WORLD BANK GROUP
THE WORLD BANK IBRD • IDA
IFC International Finance Corporation
PPIAF Enabling Infrastructure Investment
Global Infrastructure Facility
A G20 INITIATIVE

Climate Toolkits

for Infrastructure PPPs

GRID ENGINEERS

1818 H Street NW, Washington, DC 20433

Telephone: 202-473-1000; Internet: www.worldbank.org

Cover photo: Frame Stock Footage/Shutterstock

ACKNOWLEDGMENTS

This toolkit was jointly prepared by a World Bank Group team led by Philippe Neves and Jade Shu Yu Wong composed of Guillermo Diaz Fanas, Carmel Lev, Christina Paul, Gisele Saralegui, and Khafi Weekes as well as GRID Engineers led by Rallis Kourkoulis and Fani Gelagoti with contributions from Konstantinos Kotoulas, Leon Kapetas, Elena Bouzoni, Antonios Mantakas, Agamemnon Giannakopoulos, and Diana Gkouzelou.

The team would like to thank Bernice Van Bronkhorst, Caren Grown, John Gregory Graham, Ezgi Canpolat, Veronique Morin Floissac, Sohee Gu, Jennifer Solotaroff, Carolina Monsalve, Jun Rentschler, Jyoti Bisbey, Edgar Saravia, Alvina Elisabeth Erman, Catiana Garcia-Kilroy, Elif Kiratli, Fiona Elizabeth Stewart, Irina Likhachova, Juan Samos Tie, Mariana Silva Zuniga, Paolo Avner, Rob Pilkington, Steven Louis Rubinyi, and Laurence Carter for their contributions and valuable peer review inputs.

The team is grateful to Fatouma Toure Ibrahima, Jason Zhengrong Lu, Jemima Sy, Imad Fakhoury, and Emmanuel Nyirinkindi for their support and guidance. Charissa Sayson, Paula Garcia, Rose Mary Escano, and Luningning Loyola Pablo provided excellent administrative support.

The task team wishes to acknowledge the generous funding provided for this report by the Public-Private Infrastructure Advisory Facility (PPIAF) through the Climate Resilience and Environmental Sustainability Technical Advisory (CREST) funded by the Swedish International Development Cooperation Agency (SIDA), and by the Global Infrastructure Facility (GIF).

About PPIAF

PPIAF helps developing-country governments strengthen policy, regulations, and institutions that enable sustainable infrastructure with private-sector participation. As part of these efforts, PPIAF promotes knowledge-transfer by capturing lessons while funding research and tools; builds capacity to scale infrastructure delivery; and assists sub-national entities in accessing financing without sovereign guarantees. Donor-supported and housed within the World Bank, PPIAF's work helps generate hundreds of millions in infrastructure investment. While many initiatives focus on structuring and financing infrastructure projects with private participation, PPIAF sets the stage to make this possible.

About the GIF

The Global Infrastructure Facility, a G20 initiative, has the overarching goals of increasing private investment in sustainable infrastructure across emerging markets and developing economies and improving services that contribute to poverty reduction and equitable growth aligned with the SDGs. The GIF provides funding and hands-on technical support to client governments and multilateral development bank partners to build pipelines of bankable sustainable infrastructure. The GIF enables collective action among a wide range of partners – including donors, development finance institutions, country governments, together with inputs of private sector investors and financiers – to leverage both resources and knowledge to find solutions to sustainable infrastructure financing challenges.

About CTA

IFC's PPP Transaction Advisory (CTA) advises governments on designing and implementing PPP projects that provide or expand much needed access to and/or improved delivery of high-quality infrastructure services – such as power, transportation, health, water and sanitation – to people while being affordable for governments. In doing so, CTA assists on both the technical, financial, contractual, and procurement aspects of PPP transactions. To date, CTA has signed over 400 projects in 87 countries, mobilizing over $30 billion of private investment in infrastructure, and demonstrating that well-structured PPPs can produce significant development gains even in challenging environments.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF BOXES

List of Abbreviations and Acronyms

ACCF	Africa Climate Change Fund
ADB	Asian Development Bank
AF	Adaptation Fund
AFD	Agence Française de Développement (French development agency
AfDB	African Development Bank
AFPCN	French Association for Disaster Risk Reduction
AFTWR	Africa Water Resources Unit (World Bank)
AR5	Assessment Report 5
AREI	African Renewable Energy Initiative
ASAP	Adaptation for Smallholder Agriculture Program
ATP	Adaptation tipping point
BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh's Climate Change Strategy and Action Plan
BCP	Business continuity plan
BEIS	Department for Business, Energy and Industrial Strategy
BGI	(UK)Blue-green infrastructure
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry of Economic Cooperation and Development, Germany)
BOT	Build-operate-transfer
BS	British standard
BTO	Build-transfer-operate
C3	Consultative Council on Climate Change (Mexico)
CAB	Climate Adaptation Bond
CAFI	Central African Forest Initiative
CAPEX	Capital expenses / capital expenditure
Casa Civil	Executive Office of the Presidency of the Republic (Brazil)
CAT	Climate Action Tracker
Cat DDOs	Catastrophe drawdown options
CAW	Central Arkansas Water
CBA	Cost-benefit analysis
CBD	Convention on Biological Diversity
CBFF	Congo Basin Forest Fund (hosted by AfDB)
CBI	Climate Bonds Initiative
CCA	Climate change adaptation
CCA	Climate contingency account
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CEN	European Committee for Standardization (Centre Européen de Normalisation)
CER	Certified emission reduction
CGMC	General Coordination for Global Climate Change (Brazil)
CICC	Inter-Ministerial Commission on Climate Change (Mexico)
CIDA	Climate informed decision analysis
CIDA	Canadian International Development Agency

CIF	Climate Investment Funds
CIM	Inter-Ministerial Committee on Climate Change (Brazil)
CIMGC	Inter-Ministerial Commission on Global Climate Change (Brazil)
CMIP	Coupled Model Intercomparison Project
COP	Conference of the parties
CPTEC	Center for Weather Forecasting and Climate Studies (Brazil)
CRA	Climate risk analysis
CTF	Clean Technology Fund Development
DAC	Assistance Committee
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DFAT	Department of Foreign Affairs and Trade (Australia)
DFC	United States International Development Finance Corporation
DFI	Development finance institution
DFID	Department for International Development (UK)
DMDU	Decision making under deep uncertainty
DNSH	Do-no-significant-harm
DRM	Disaster risk management
DRR	Disaster risk reduction
DSCR	Debt service coverage factor
DSP	Digital signal processor
DSRA	Debt service reserve account
DtP	Decision to proceed
E&S	Environmental & social
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECA	Export credit agencies
EIA	Environmental impact assessment
EIB	European Investment Bank
eIRR	Expected internal rate of return
EMAS	Eco-Management and Audit Scheme (EU)
EMDE	Emerging market and developing economy
eNPV	Expected net present value
EOA	Engineering options analysis
EPC	Engineering procurement and construction
EPs	Equator Principles
ESF	Environmental and social framework
ESG	Environmental, social, and governance
EU	European Union
Ex-Im	Export-Import Bank of the United States
FAO	Food and Agriculture Organization of the United Nations
FBMC	Brazilian Forum on Climate Change (Brazil)
FCPF	Forest Carbon Partnership Facility
FFEM	Fonds Français pour l'Environnement Mondial (French global environment facility)
FIP	Forest Investment Program
FM	Force majeure
GBP	Green Bond Principles

GCCA	Global Climate Change Alliance
GCCI	Global Climate Change Initiative (US)
GCF	Green Climate Fund
GCM	General Climate Model
GCPF	Global Climate Partnership Fund (Germany, UK and Denmark)
GEEREF	Global Energy Efficiency and Renewable Energy Fund (EIB)
GEF	Global Environment Facility
GEx	Executive Group on Climate Change (Brazil)
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse gas
GIB	Global Infrastructure Basel
GIF	Global Infrastructure Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GLP	Green Loan Principles
GRI	Grantham Research Institute
HLPW	High Level Panel on Water (UN)
IAPH	International Association of Ports and Harbors
IBRD	International Bank for Reconstruction and Development
ICF	International Climate Finance (UK)
ICMA	International Capital Market Association
ICT	Information and communications technology
IDA	International Development Association
IDB	Inter-American Development Bank
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IISD	International Institute for Sustainable Development
IKI	Internationale Klimaschutzinitiative (international climate initiative, Germany)
INECC	National Institute of Ecology and Climate Change (Mexico)
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal rate of return
IsDB	Islamic Development Bank
ISI	Institute for Sustainable Infrastructure
ISO	International Standards Organization
IUCN	International Union for Conservation of Nature
JBIC	Japan Bank of International Cooperation
JI	Joint implementation
JICA	Japan International Cooperation Agency
JR	Japanese Railways
KfW	Kreditanstalt für Wiederaufbau (German development bank)
KPIs	Key performance indicators
LCA	Life-cycle analysis
LDCF	Least Developed Countries FundLeast
LDCs	Developed Countries
LEED	Leadership in Energy and Environmental Design

LMA	Loan Market Association
LTS	Long-term strategy
MCA	Multi-criteria analysis
MCTI	Ministry of Science and Technology and Innovation (Brazil)
MDBs	Multilateral development banks
MDG-F	MDG Achievement Fund
MEA	Multilateral Environmental Agreements
MEAT	Most economically advantageous tender
MIES	Mission Interministérielle de l'Effet de Serre (inter-ministerial taskforce on climate change, France)
MIGA	Multilateral Investment Guarantee Agency
MMA	Ministry of Environment (Brazil)
MOFA	Ministry of Foreign Affairs (Japan)
MPTF	Multi-Partner Trust Fund (UNDP)
MRA	Maintenance reserve account
MRV	Monitoring, reporting, and verification
N/A	Not applicable
NAMA	Facility Nationally Appropriate Mitigation Action facility (UK, Germany, Denmark, and the EC)
NAP	National Adaptation Plan
NAPA	National Adaptation Program of Action
NAS	National Adaptation Strategy
NBS	Nature-based solutions
NCEA	Netherlands Commission for Environmental Assessment
NDBs	National development banks
NDCs	Nationally Determined Contributions
NDVs	National Development Visions
NGOs	Non-governmental organizations
NICFI	Norway's International Climate Forest Initiative
NMFA	Norwegian Ministry of Foreign Affairs
NORAD	Norwegian Agency for Development CooperationNet
NPV	present value
O&M	Operations & management
ODA	Overseas development assistance
OECD	Organization for Economic Co-operation and Development
OPEX	Operational expenses / Operational expenditure
PA	Paris Agreement
PBCs	Performance-based contracts
PBMC	Brazil Panel on Climate Change (Brazil)
PCBA	Participatory cost-benefit analysis
PML	Probable maximum loss
PMR	Partnership for Market Readiness
PPCR	Pilot Program on Climate Resilience
PPI	Private participation in infrastructure
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public-private partnership
Project Co	Project company

Q&A	Question & answer
RC	Reinforced concrete
RCM	Regional climate modeling
RCP	Representative concentration pathway
RDM	Robust decision making
Rede	Brazilian Research Network on Global Climate Change (Brazil)
Clima	Request for proposals
RFP	Request for
RFQ	qualificationsReal-
ROA	options analysis
RTD	Regional Transportation
RWS	DistrictRijkswaterstaat
SCCF	Special Climate Change Fund
SCF	Strategic Climate Fund
SDG	Sustainable Development
SEP	GoalSelf-evaluating platform
SEPED	Secretariat for Research and Development Policies and Programs
SINACC	(Brazil)National System on Climate Change (Mexico)
SLLP	Sustainability-linked loan principles
SPTs	Sustainability performance targets
SREP	Scaling Up Renewable Energy Program for Low Income
SuRe	Countries Standard for Sustainable and Resilient Infrastructure
SSA	Sub-Saharan Africa
TCFD	Task Force on Climate-related Financial Disclosures
TEG	Technical Expert Group (EU)
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD Program	United Nations Collaborative Program on Reducing Emissions from Deforestation and forest degradation
US	United States
USAID	United States Agency for International Development
USGBC	United States Green Building Council
VCS	Verified Carbon Standard Voluntary
VER	emission reduction
VfM	Value for money
WB	World Bank
WBG	World Bank Group
WBG CCKP	World Bank Group's Climate Change Knowledge Portal
WEAP	Water Evaluation and Planning System
WPSP	World Ports Sustainability Program
WRI	World Resources Institute
WWAP	World Water Assessment Program (UNESCO)

Foreword

The time for action to build a better future and green recovery has never been stronger as we navigate the uncertainty of a world attempting to manage its way out of a triple crisis: debt sustainability, climate change, and pandemic. The fiscal constraints of governments across the globe open the door to new opportunities and challenges to crowd in private sector solutions, innovation, and finance to create new solutions and pathways to meet Paris Agreement goals on climate change. Participation of the private sector in climate-smart investments and infrastructure is critical and public-private partnerships (PPPs) are among the key solutions. PPPs are critical because the public sector alone will not be able to fill in the infrastructure gap without mobilizing private sector expertise, innovative thinking, investment capacity, and finance. PPPs can be a challenge though, because climate change creates uncertainty—and it is hard to play with uncertain moving pieces within the framework of PPPs, which require a certain degree of predictability to attract investment and finance.

This toolkit aims to address this precise challenge by embed- ding a climate lens and approach into upstream PPP advisory work and structuring. If structured correctly, PPPs can increase climate resilience offering innovative solutions to address bothmitigation and adaptation challenges. PPPs are able to provide well-informed and well-balanced risk allocation between partners—offering long-term visibility and stability for the duration of a contract (often 25 or 30 years, sometimes even more), compensating climate change uncertainty through contractual predictability.

Here are some of the questions this toolkit helps answer:

- *How do we make the most out of PPPs and private sector participation while helping with climate change mitigation and adaptation?*
- *How can we innovate to allow for optimal risk allocation and contractual predictability in an environment marked by uncertainty and the need for resilience to unpredictable scenarios?*

The Public Private Infrastructure Advisory Facility (PPIAF), The Global Infrastructure Facility (GIF), and (International Finance Corporation Public-Private Partnership (IFC PPP) Transaction and Advisory Services have joined forces to build upon best practice on a topic at the cross-roads of climate change, infrastructure, and private sector participation. It is a field in development with nascent expertise, in which there will be a great deal of testing and innovation ahead of us.

Building awareness and shifting mindsets are needed. Currently an insufficient focus is given to considering climate change in the framework of public-private partnerships (PPPs). For instance, the PPP tender selection criteria are currently ultimately based on the least cost approach, which may promote assets not resilient enough to withstand climate impacts. This may in turn even result in total asset loss with devastating effects on the economy and society. We need to help change this mindset and send the right signals for the private sector to innovate and participate in delivering climate smart solutions. This toolkit is indeed about providing solutions to public officials and their advisors on how to better align interests and incentives towards climate-smart investments and tap into the tremendous private sector financing capacity.

> This toolkit is ultimately a call for action for decision makers, to push for bold initiatives so that infrastructure investments become a critical and steady pathway to achieve Paris Agreement and SDG commitments.

Emmanuel B. Nyirinkindi
Vice President, Cross-Cutting Solutions,
International Finance Corporation

Imad Najib Ayed Fakhoury
Global Director, Infrastructure Finance,
PPPs and Guarantees Global Practice,
World Bank

INTRODUCTION

CALL FOR CLIMATE ACTION THROUGH PPPs:
INVESTING IN CLIMATE MITIGATION, ADAPTATION AND RESILIENCE

The global impact of climate change has never been more present

with devastation seen across the globe from melting polar ice to fires, floods, droughts, hurricanes, and beyond—loss of life and destruction seen in their wake. The Intergovernmental Panel on Climate Change (IPCC) report issued a dire warning this year with climate catastrophe looming unless we all act together to avert global warming beyond the 2 degrees target. The cascading impact on the global economy, affecting business productivity, development, and employment, will grow unless action is taken. Climate change—as a global phenomenon affecting all parts of the developed and developing world—requires immediate global coordination to limit its impacts. In response to this global imperative, the UN's Conference of the parties adopted in 2015 the Paris Agreement, which has been signed by 196 nations and whose goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

The Paris Agreement is now complemented by several initiatives to include climate mitigation, adaptation, and resilience provisions in national and international policies. The World Bank Group (WBG) has stepped up its commitment this year with the new Climate Change Action Plan, including a commitment to Paris alignment reinforcing a focus on embedding climate action in infrastructure as described in Module 1.1 and in the Introductory Phase.

Joining Forces through Public-Private Investment in Infrastructure

Private sector participation in climate-smart solutions will be critical to fostering climate mitigation and adaptation by catalyzing mobilization of innovation, competition, and leveraging financing opportunities as well as mainstreaming these solutions. Within a rapidly evolving global landscape, private sector actors are themselves making bold new commitments to achieve net-zero emissions and build climate adaptations driven by their shareholders and new regulatory pressures. The COVID-19 green recovery and public sector fiscal constraints are also driving new opportunities and demands for the private sector to step in and provide solutions through public-private partnerships (PPPs). Building viable and bankable pipelines of climate-smart PPP solutions will be critical to ensuring the trillions of investments and finance needed to deliver on the Paris Agreement commitments. Hence, it is—now more than ever—to the mutual benefit of the public and the private sectors to work together on ambitious climate-smart infrastructure projects. Guidance on incentivizing private sector participation is provided in Phase 3.

Failure to timely invest in mitigation may resultin the need for disproportionate spending in adaptation in the not-so-distant future.

The time to act is now: the need for mitigation

In order to meet the goals of the Paris Agreement and limit global warming, we will need to mitigate greenhouse gases (GHGs) and find new pathways to decarbonization. Governments will need to step up their commitments as part of the latest 5-year cycle of ramping up Paris Agreement Nationally Determined Contributions (NDCs) to prioritize mitigation. Translating their NDC commitments into pipelines of investments are critical next steps for achieving GHG emissions reduction in infrastructure and beyond. Climate-friendly construction, resource efficiencies, sustainable operation, and maintenance optimization using climate data analytics are among the mitigation aspects that should be considered in the preparation, planning, and contract drafting phases, as explained in Modules 1.2 and 2.1.

The time to act is now: the need for adaptation

Building adaptation and resilience into infrastructure investment will be critical to ensure that assets are resilient to climate impact and avoid the worst outcomes from total loss of investment and assets while maintaining operational performance. In light of increasing climatic hazards, infrastructure projects need to be shielded against these potential impacts to ensure their integrity and ability to provide the level of service required for the local communities.
Guidance on the identification and selection of climate adaptation options is provided in Modules 1.2 and 2.2.

Resilience of/through infrastructure

Given the unprecedented extreme climate-related events occurring now more frequently than ever, opting for infrastructure's ability to absorb, withstand, and recover from shocks—including sudden changes in demand—is the only viable strategy to ensure economic continuity for the community and economy. At the same time, infrastructure should not be treated independently from the broader context within which it operates and should rather be considered an intrinsic part of the systemic safeguards for community resilience to climate hazards, as explained in Module 1.2.

Climate vs affordability

The challenge of evaluating cost and savings in PPP investments with climate mitigation and resilience will need to be managed. Government and other stakeholders may question the choice of investing in climate action as being too risky for the projects' affordability due to the potential for increased costs, without fully understanding potential savings and implications for total asset loss without including climate considerations. The reality is that infrastructure is based on long-term assets, which are highly likely to be exposed to the effects of climate change over that life. In an era of continued urbanization, communities cannot afford infrastructure failures and losses due to climate change. Moreover, a failure to address climate resilience in PPPs may make these projects non-bankable, as regulators and financiers scrutinize these risks more closely in their decision-making. Guidance on calculating the benefits of climate action over the whole life-cycle of PPP projects, duly accounting for non-monetary benefits, is provided in Modules 1.3 and 2.3.

Green financing: an opportunity to accelerate climate action

As the world is rapidly shifting towards sustainable infrastructure, institutions and authorities at an international level and even local level are developing new instruments in the form of green financing opportunities to support the climate transition. There is a rapidly growing new market for climate and sustainable finance. Green and sustainable linked bonds and loans, climate derivatives, and other instruments are being developed and offered by banks, multilateral development banks (MDBs), governments, and development agencies to accelerate the uptake of sustainable climate action. Guidance on eligibility criteria and on preparing projects to tap into such liquidity pools is provided in Module 3.2.

From theory to application: including climate action in tendering/contracts

Building the new generation of PPP infrastructure to last should include clear messaging in all phases of the tender and award process. Procuring agencies need to bolster climate action by including relevant provisions in tender documents (requests for proposals (RFPs), requests for quotes (RFQs)) and key performance indicators (KPIs) and ensure these are enforced through the proper supervision process. Additionally, market sounding early on PPP advisory is expected to assist in producing the proper terms of reference and attracting high-quality bidders. Guidance on sustainability indicators and performance criteria for the construction and operation of PPP infrastructure projects is provided in Modules 3.3 and 4.1, while specific KPIs and provisions for bidders are available in the sector-specific toolkits.

NEW QUESTIONS AND UNTESTED APPROACHES ARE EVOLVING
IT IS A WORK IN PROGRESS

Dealing with climate uncertainty

One of the major challenges in structuring PPPs and designing projects for climate change is our inability to predict the actual evolution of climate stressors. Decision-makers will often find themselves swinging between the lower-cost optimistic scenarios and their costlier, higher-risk counterparts, which call for adopting more adverse climatic projections. In the absence of reliable data, decision making under deep uncertainty (DMDU) may need to be promoted to enable the assessment of several scenarios along with their costs and benefits. Guidance on incorporating DMDU in the decision-making duringproject preparation is provided in Modules 2.1 and 2.2.

Adaptive planning as an alternative to high up-front adaptation costs

Responding to climate uncertainty considerations, the scientific community has proposed the concept of adaptive planning for the design and construction of long-lifespan assets. The concept calls for designing the projects for a mild scenario at the present time to minimize upfront costs, while allowing for adaptation to more adverse scenarios based on relevant indicators that may appear in the future. What is more, adaptive planning may lay the ground for incentivizing all stakeholders to maintain an active role in the full life-cycle of projects. Guidance on applying adaptive planning in the preparation of PPP investments is provided in Modules 2.2 and 2.3.

The need for contract flexibility to accommodate uncertainty

Unavoidably, inclusion of uncertainty and adaptive planning into the equation will negatively impact the long-term visibility required by investors. To re-establish equilibrium, the tender and award processes will need to allow for proper stakeholder engagement and dialogue as well as objective indicators and appropriate guarantees that will allow for flexible terms in contracts without compromising investors' appetite. Guidance on forming flexible contracts to promote climate action is described in Module 3.2.

Flexible contracts will necessitate innovative financial structures

As defined above, funding and financing of adaptive planning may challenge investors and impact bankability unless proper schemes are designed. Public and private stakeholders together may be encouraged to consider new innovative approaches such as reserve accounts—possibly in the form of a climate contingency account (CCA)—that will be used to finance adaptive works in the future in case these are required or to repay shareholders if not. Guidance on setting up a CCA and its associated benefits and challenges is provided in Module 2.3 and 3.1.

UNTESTED APPROACHES

Unexpected events: Force majeure and blending insurance with financial tools

Climate change may be associated with the risks of more frequent service disruptions or failure due to extreme events. As with all risks, these will need to be properly assessed and allocated to the party more suitable to bear them. However, as awareness regarding the magnitude of potential losses increases, insurance availability may become scarce while guarantee requirements may rise. Conventional force majeure (FM) provisions may be revisited in order to structure potential new FM approaches, which will simultaneously incentivize adaptation and resilience. In such approaches, FM may be triggered only when a hazard exceeds a certain level, with the private party assuming potential risks below that threshold level. In this context, climate-smart PPPs should devise and benefit from novel risk transfer solutions such as blending insurance with contingent financing tools. Guidance on force majeure and potential blended schemes and insights on mobilizing insurance is provided in Module 3.1.

The need for modern, greener solutions with respect to biodiversity

Modern infrastructure is expected to fulfill environmental sustainability criteria, including the protection of biodiversity and pollution reduction. Sustainable infrastructure should also promote nature-based solutions (NBS) and ecosystem-based adaptation. NBS solutions may form part of the critical pathways for building climate resilience and providecost-effective solutions. The use of recyclable, repairable, reusable, and recoverable materials in construction will reduce CO_2 emissions during their operations and contribute to saving natural resources during the production of raw materials, helping to build a circular economy. Applications of NBS and green solutions in infrastructure projects are described in Modules 1.1 and 1.2.

FOSTERING AWARENESS
IN A RAPIDLY CHANGING WORLD WITH CLIMATE CHANGE

Ownership of simple solutions

The role of public sector procuring authorities in enforcing climate action is crucial. As part of their role as coordinators of the preparation, appraisal, and tender process, PPP units and other public sector entities need to possess an understanding of climate policies, risks, and opportunities, and all respective funding, financing, and risk-sharing mechanisms. The present toolkit is intended to support this process and provide the means for non-experts to conduct a high-level screening of the climate impact for project planning, including climate mitigation for GHG emissions and hazard and risk mapping to build resilience. This is fundamental for the preliminary identification of the necessary adaptation and mitigation measures and, ultimately, allows PPP units to take ownership over climate considerations, resulting in better and deeper engagement. Detailed guidance on this process is provided in the accompanying sector-specific toolkits, while high-level guidance is also offered in Phase 1 of the high-level toolkit.

Understanding shifting scenariosand context

As with every change, transition to the new era of climate-smart infrastructure through PPPs needs to overcome the hurdles of well-established practices. Climate action requires an in-depth understanding of the implications of climate change and the threats it may impose on infrastructure, including indirect impacts due to externalities (i.e., revenue loss posed by the failure of interconnected infrastructure or loss of users due to climate-induced migration). As climate change is rapidly changing, threats that do not exist at present could become catastrophic in the future. The benefits of mitigation and adaptation will need to be assessed during the life-cycle of the process. Guidance on how to recognize interconnections and evaluate adaptation and mitigation measures is provided in Modules 2.1 and 2.2.

Tackling climate change through early engagement

Climate change mitigation and adaptation is not an add-on to existing practices or a compliance checklist. It requires knowledge of the global and national landscape and consideration of all requirements at a very upstream stage to ensure that the climate-related aspects of the project are identified and properly accounted for in subsequent stages. This will include the project's alignment with the Paris Agreement and NDCs together with a growing body of international standards or taxonomies. At a community level, procurers will need to secure stakeholder engagement, identify user-satisfaction criteria, and optimize social/gender inclusion practices. Guidance on crucial early actions is provided in Modules 3.3 and 4.1.

Bringing together the proper team

Technical, financial, and legal consultants advising on the structuring of climate-smart PPPs will need to coordinate their efforts to integrate novel mitigation and adaptation solutions that do not risk the bankability of projects, and use the ideal mix of adaptation works and financing tools to optimize theallocation of climate-change-induced risks. Market sounding is essential for testing the waters and primary mapping of the private sector investor and financing appetite. Guidance on identifying the necessary advisory services is provided in the sector-specific toolkits.

GENDER & CLIMATE

IN SUSTAINABLE INFRASTRUCTURE PPPs

It takes two to tango

Sustainable infrastructure for men and women, boys and girls

Conventional infrastructure can hardly be climate- or gender-neutral: design, construction, and operation of infrastructure projects - from highways to dams, and from power production to digital and information and communications technology (ICT) infrastructure - comes with environmental costs and impacts to the affected population. It goes without saying that the quest of counterbalancing climate costs with benefits would be meaningless if the beneficiaries themselves were not properly included in the equation: maximizing the benefits is intertwined with maximizing the beneficiaries, i.e., ensuring that no one is left behind. The burden of climate risks often falls disproportionately upon vulnerable groups (e.g., people with disabilities, Indigenous people, etc.) who tend to be more severely impacted by shocks or stressors—in terms of mortality, livelihood impacts, food and water security, migration, threats to cultural identity, among others. Climate-smart infrastructure will need to be equally accessible, provide the same service levels, and create equal opportunities for men and women, boys and girls. Where gender gaps are evident—be it a consequence of accessibility, skills, income level, time poverty, safety, or any sort of socio-economic factor—sustainability is inhibited. For there is no point aiming at sustainable infrastructure in non-sustainable communities. In this context, as a pioneer in the global race towards eliminating gender gaps, the World Bank Group focuses on the principle that one should not have to choose between investing in climate or closing the gender gaps. To this end, the present high-level climate-smart toolkit is accompanied by a separate gender-smart toolkit providing guidance on incorporating gender considerations in PPP infrastructure projects. The two products may be used independently; however, each one provides entry points to the other, while it is expected that users should be able to consult them both in the preparation of PPP transactions in infrastructure.

GENDER & CLIMATE

Climate change as a gendered risk

Women and girls face higher risks and greater burdens from changes in climate, especially in situations of poverty. In fact, of the 1.3 billion people living in conditions of poverty, 70% are women who are highly dependent on local natural resources for their livelihood, particularly in rural areas where they shoulder the major responsibility for household water supply and energy for cooking and heating, as well as for food security[1]. Hence, as environmental conditions and weather-related phenomena become harsher due to climate change, chances for women to develop skills and embark on employment opportunities will reduce. This will leave less time for women to access training and education, develop skills or earn income. This is further exacerbated by the fact that women may be underrepresented in decision-making and have limited access to resources. Additionally, cultural norms may hinder women from reacting (i.e., abandoning homes or seeking refuge) during natural disasters in several regions, thereby drastically increasing their exposure to such events.

Infrastructure as a catalyst for women

Across the world, gender inequalities are evident in all facets of employment: labor share, leadership, and wages. In most societies, working women find themselves balancing between work obligations and family care, while in several cases, regulatory or cultural constraints may further reduce equal employment opportunities. Properly designed infrastructure may drastically help reduce such inequalities.

Providing better water and sanitation services, for example, can reduce the time women and girls spend fetching water, freeing their time for educational or economic pursuits[2].

Studies have shown that access to electricity may contribute to raising female employment by saving time from housekeeping activities and providing the means to set up home-based manufacturing. It is also well known that safe and reliable transportation infrastructure will greatly impact women's ability to physically access the labor market while saving time from other family care-related activities. At the same time, digital infrastructure could open immense windows of opportunities for participating in new markets and developing new skills.

However, infrastructure investments alone will not be adequate if proactive measures are not in place to ensure that women equally benefit from them. In fact, unequal access (e.g., due to lower income) to infrastructure could even deepen gender and social inequalities. Thus, gender-responsive measures should be in place during the planning, design, implementation, and monitoring of projects to help ensure that infrastructure indeed has a positive impact. The design of these measures could greatly benefit from a strong female participation in the decision-making bodies, while it is also a good practice to include proper indicators in all stages of infrastructure projects to allow monitoring of the actual gains for under-represented populations and ensure equitable services are provided to everyone.

[1] https://www.un.org/en/chronicle/article/womenin-shadow-climate-change

[2] Evidence comes from a World Bank rural water supply and sanitation project in Morocco. After project completion, time spent fetching water by women and girls was reduced by 50 to 90 percent. With more time and better health, female primary-school attendance in the project area increased by 21 percent. World Bank. ICR Review. Report number: ICRR11535.

GENDER & CLIMATE

We need to act early on

Sustainable PPP infrastructure projects of the future are expected to be both climate-smart and inclusive to guarantee resilience throughout their long lifespans. To this end, their design has to be able to respond to the needs and priorities of all users, accounting for and addressing the different impacts they may have on women and men, boys and girls. Land or water usage rights could, in some cases, be a burden for under-represented populations to access infrastructure if not resolved early on. Similarly, the cultural context within which the infrastructure will be operating as well as the income levels of all intended users/beneficiaries, will need to be studied at the onset of the respective design to ensure that the actual socio-economic landscape is not impeding inclusivity.

Indeed, infrastructure projects can further jeopardize women's access to and use of land. Women in rural areas can be disproportionately impacted by such changes as they often rely on common property such as land. These investments can decrease the land available for agriculture and interfere with existing land uses (e.g., subsistence agriculture, livestock grazing), which can hamper women's income-generating opportunities as womenare heavily reliant on agricultural work.

In some cases, maximizing resilience through climate-smart PPP projects may involve challenging the existing status quo by designing the proper strategies to limit their potential negative impacts while boosting the positive ones. Guidance on addressing risks and impacts on disadvantaged and vulnerable groups is provided in the World Bank's Environmental and Social Framework and IFC's Environmental and Social Performance Standards.

Echoing the voices of men and women, boys and girls

In the quest to achieve the goals outlined in the previous paragraph, decisions made at the preparation phase will have to be based on surveys equitably representing the needs and concerns of different genders, cultures, and Indigenous populations. Where gender gaps are identified, it is essential that the appropriate stakeholders are present in interviews and consultations aiming to address them. It is important to understand that accounting for women's needs and concerns during the selection, preparation, building, and operation of PPP projects will not only result in boosting the benefits of infrastructure to the community but will also generate opportunities for women to enhance their professional and leadership skills and increase their chances of being employed in the jobs which will be created.

GENDER & CLIMATE

Private sector participation does count

The private sector increasingly recognizes that closing gender gaps in employment and leadership means better talent, more productivity, more diverse leadership, more customers, and a stronger bottom line. More firms in the private sector are changing business practices, developing PPPs and committing resources to achieve gender equality. Such business transformation will not only result in a reduction of gaps between men and women in the economy but can also lead to increased firm productivity and help private companies innovate, grow, and perform better[3].

PPPs as an opportunity to accelerate equity

According to the World Bank Group's Primer on Gender Equality, Infrastructure and PPPs, private investors often rely on the government to consider and address issues relevant to ensuring that a project is gender-inclusive. The government often relies on the private sector to address these issues as fundamental to service the delivery of the project. A PPP project provides an opportunity to join public and private capacities to focus on issues relevant to women. PPP projects must be commercially and financially viable. If governments need private investors to provide additional support or services to meet the needs of women, they may need to provide additional incentives. For example, PPP payments can be linked to performance and services for women. Likewise, if the private partner performs poorly, financial penalties within the PPP contract may apply.

© Flore de Preneuf/World Bank. Further permission required for reuse.

[3] World Bank Group Gender Strategy (FY16–23), Gender Equality, Poverty Reduction and Inclusive Growth, World Bank Group, 2016

TOOLKIT USER GUIDE

Scope of the toolkits and intended users

What they are

The present high-level toolkit outlines a framework and describes specific actions to support emerging market and developing economy (EMDE) governments, development partners (multilateral development banks (MDBs) and development finance institutions (DFIs)), and other stakeholders working on advisory services in incorporating climate actions in the up- and mid-stream phases of PPI projects. The toolkit is accompanied by a set of sector-specific toolkits providing specific instructions on "how" to implement the actions described in the present high-level document in specific infrastructure sectors.

Who can use them

The toolkits are meant to be used by government officials, PPP practitioners in MDBs and project sponsors in the preparation stages of PPI infrastructure projects. They are also meant to assist advisors by defining a concrete framework to outline the steps to incorporate climate considerations in their services. As the toolkits cover the entire PPP process, each one of them is not intended to be used by the same person in its entirety. Users could instead benefit from one or more relevant sections of the toolkits depending on their background, the nature of the project, and the phase of project implementation within the PPP cycle. Entry points to the toolkits are discussed below.

Shape and structure

High-level toolkit: what and why

The toolkit is structured in phases, following the traditional phases of the PPP preparation cycle. Each phase includes modules of varying degrees of detail describing the actions foreseen to incorporate climate considerations in PPPs properly. In that sense, the high-level toolkit is to be treated as the reference document providing guidance on what should be done at each step and why it should be done. This is complemented by links to relevant tools and online resources and further reading recommendations to reinforce users' understanding. Phases and modules have been structured to be self-standing, allowing users to browse them independently.

Sector-specific toolkits: how

Following the logical order described in the high-level toolkit, the sector-specific toolkits intend to provide actionable instructions on how to implement each principle, taking account of the different nature of each sector/subsector and the different approaches, tools, and methodologies that are relevant to it. In this context, sector-specific toolkits contain two main parts. The first part covers in a practical way the Phase 1 of the PPP cycle, including simplified versions of tools that PPP units may use to perform initial assessments in-house. The second defines minimum requirements and qualifications that the PPP unit will have to request from consulting services to properly incorporate and evaluate climate adaptation, mitigation, and resilience characteristics in projects.

TOOLKIT USER GUIDE

Entering the toolkits and navigating through them

High-level toolkit navigator

As described above, the high-level toolkit is a reference document. Hence, it is recommended that users take advantage of the toolkit navigator/executive summary, which is intended to be used as an index allowing easy access to the proper module depending on the user's needs. The navigator is itself structured in phases, which are further broken down into modules and steps. It contains brief descriptions of each process's scope, contents, and intended outcomes, thereby offering a preview of the different parts of the toolkit and allowing users to immediately jump to the section(s) most relevant to their need(s) using hyperlinks.

Sector-specific toolkits

Sector-specific toolkits are separate documents that have the form of step-by-step instructions, frequently referring to specific parts of the present high-level toolkit. These toolkits provide detailed guidance for the entire up- and mid-stream stages of the PPP process through actionable items that are relevant to and applicable in specific infrastructure sectors. Their scope is to support PPP units performing specific actions during the very early (upstream) steps of the process and propose climate-related provisions to be included in the terms of reference (ToRs) for advisory services.

EXECUTIVE SUMMARY

A MULTI-PHASE MODULAR APPROACH

The signature of the Paris Agreement in 2015 and the increasing pressure from civil society for solid governmental climate actions have recentered the global economy towards a climate-sensitive pathway. Recently, the 2021 United Nations Climate Change Conference (COP26) in Glasgow reconfirmed the global commitment to accelerate action towards achieving climate goals. If properly prepared and managed, new infrastructure investments can play a key role in fostering this vision. Still today there is little guidance on how to translate the global imperative into specific actions that could be delivered at a project level due to several challenges:

Challenges and Pressing Issues

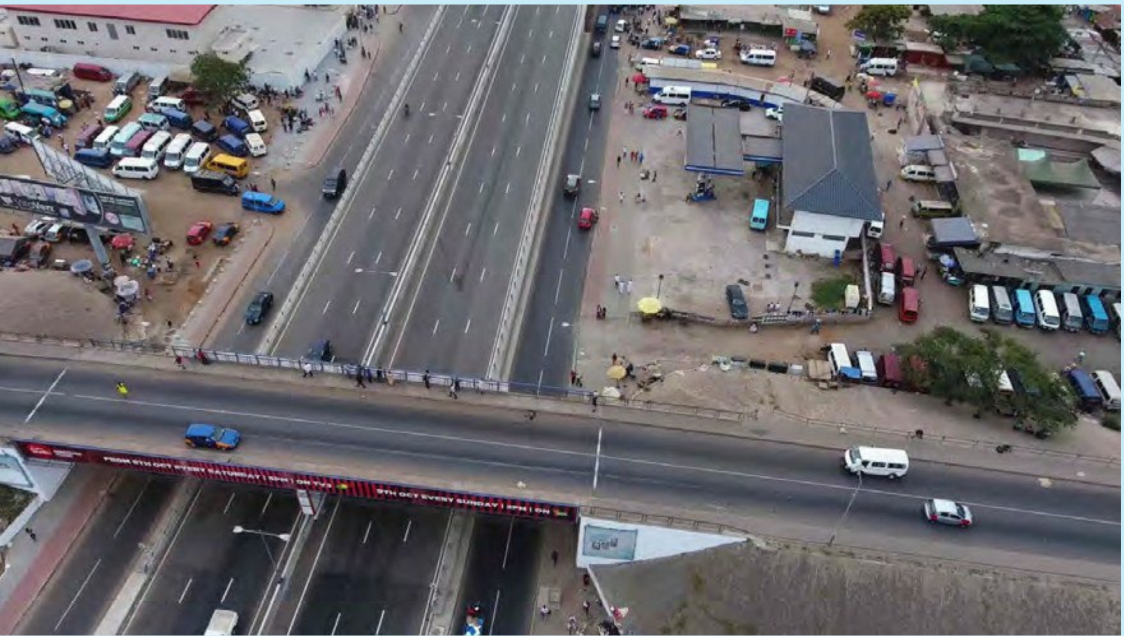
- Decision-makers need to ensure that investments can offer benefits across the agendas of sustainable development, climate mitigation, and adaptation without risking the affordability and the bankability ofthe project.
- New infrastructure projects should be technically robust to absorb, withstand, and recover fromunprecedented climate threats and other shocks—including sudden changes in demand.
- All infrastructure projects invariably should be structured and delivered within a climate-sensitive framework that provides quantitative evidence of the impact of the infrastructure on the climate objectives, systematically monitors climate performance, and incentivizes the integration of innovationand good practices at all stages of the development.
- For PPP projects in particular, there is the additional challenge of dealing with the lock-in effect of long- duration contracts, which increases the pressure of adequately assessing the cost and benefits of climate investments over the whole life-cycle of the project while simultaneously managing climate uncertainty.

Services in and out of the Port of Vancouver have experienced severe capacity restrictions following flooding throughout theMetro Vancouver and Fraser Valley regions.

Responding to these challenges, the present toolkit emphasizes the need for taking a holistic, systematic, and integrated approach to support the inception, selection, design, preparation, and management of sustainable long-lived investments. The toolkit describes a coherent flow that runs smoothly along the PPP process cycle, discusses interactions and trade-offs among technical, economic, financial, and contractual decisions of a PPP project, and provides guidance on pressing questions.

Spotlight Areas of Guidance

- How the decisions on climate mitigation aspects of a project made during the early stages of Phase 1 may impact the long-term sustainability of the investment (tested during the Project Appraisal – Phase 2)
- How to translate these climate mitigation decisions into project requirements and technical specifications to be integrated within the contractual structure and the tender documents of the project (Phases 3 and 4)
- How to design for climate uncertainty (i.e., proposing adjustments in the technical feasibility of Phase 2), and what are the recommended tools and methodologies to incorporate this uncertainty into the project appraisal (e.g., by evaluating the project performance under multiple scenarios representing a variety of climatic futures)
- Which are the recommended methodologies, standards, and frameworks for assessing climate risks and GHGemissions and designing adaptation and mitigation measures
- What are the means to finance climate adaptation and mitigation works (including green bonds, green and sustainability-linked loans), and how the PPP projects may benefit from blending innovative funding/financing sources into their traditional project finance (explored during Phase 3)
- How the climate-risk assessments (of Phase 2) can inform the risk-allocation decisions of Phase 3



Building climate-resilient infrastructure in Ghana.

TOOLKIT NAVIGATOR

PHASES, MODULES & AREAS OF GUIDANCE

INTRODUCTORY PHASE

Module 0.1 Climate Policies Digest

Module 0.2 National Governance Framework on Climate Change

This phase introduces the enabling environment of climate-smart investments, providing a quick overview of the global climate landscape and its national policies and instruments. The phase includes:

- A description of the climate goals and principles of the Paris Agreement and other major international frameworks, and the role of national instruments (i.e., NDCs and National Adaptation Plans (NAPs)) in addressing global climate change at a national scale
- A description of the national governance framework on climate change (i.e., the legislation system and the domestic governance) highlighting institutional capacities and synergies

AREAS OF GUIDANCE

MODULE 0.1

Climate Policies Digest

STEP 1

Understand the international climate policy landscape

STEP 2

Comprehend the national climate policy framework

STEP 3

Review country's commitments

Overview of the international climate policy landscape. A timeline of events that led to the 2015 Paris Agreement; description of intra-governmental commitments; a brief introduction on the IPCC (2014) assessment report and the current state of knowledge in climate change

National instruments for the implementation of the Paris Agreement. Understanding the complementary role of NDCs, NAPs, and long-term strategies (LTS); determining their implementation status by reviewing their comprehensives, ambition, timeliness, equity, and their alignment with the Paris Agreement and the domestic climate legislation; screening NDCs and NAPs to identify specific targets and country-specific action plans (e.g., GHG target and peaking year, non-GHG targets, NDC coverage, and specific sector commitments, measures for enhancing climate adaptation and resilience at a country level; gender-equity provisions)

MODULE 0.2

National Governance Framework on Climate Change

STEP 1

Review climate legislation

STEP 2

Review institutional capacity

Paris Agreement compatibility check of domestic legislation. Current status of climate legislation and its relevance to the NDC pledges; performing a sector-wide and subnational screening of climate legislation; reviewing existing and (anticipated) national and sub-national policy frameworks, instruments, development plans, and sectoral programs, as well as recognizing implications for new infrastructure investments

Institutional capacity on climate change. Scanning the domestic institutional framework; mapping key actors in the decision-making process on climate matters, including entities that oversee the implementation of NDCs and NAPs; understanding the devolution of climate change policies and the role of states/municipalities in forming and implementing the climate agenda; understanding the horizontal organization/coordination of ministries/agencies and their role in planning, developing, and monitoring of climate actions

PHASE 1 - PROJECT SELECTION

Module 1.1 Project Alignment with Climate Policies

Module 1.2 Climate Considerations in Project Selection

Module 1.3 Value of Investment Accounting for Climate Actions

Phase 1 describes how climate change affects the decisions that the PPP unit will make when screening and selecting a new project. Being the most upstream phase ofthe toolkit, it includes considerations on:

- Assessing and enhancing projects' alignment with national and international climate policies and goals
- Performing a preliminary screening of climate risks that could affect the project directly or indirectly (externalities) as well as of adaptation measures to alleviate them
- Identifying GHG emissions of a project and potential measures to mitigate them
- Preliminarily assessing the value of investment in qualitative terms accounting for costs and benefits of climate mitigation and adaptation

This phase includes three modules, each of which is broken down into steps as outlined below.

MODULE 1.1

Project Alignment with Climate Policies

STEP 1

Map the Global and National/Subnational Climate Policies

STEP 2

Assess Project's Alignment with Climate Policies

AREAS OF GUIDANCE

Overview of climate policies. A snapshot of the landscape of climate policies at global, national, sub-national, and/or regional level and description of climate goal and targets; mapping of stakeholders, authorities, and entities responsible for their implementation

Climate-related specifications for new projects. Understanding how Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) can accelerate the decarbonization and energy efficiency of new projects and reinforce their ability to combat the adverse effects of climate change

Climate alignment of new projects. Checking the alignment of the project with the global and national climate-change agenda; unlocking green financing and funding sources through better alignment; high-level recommendations to enhance the project's alignment with climate policies

MODULE 1.2

Climate Considerations in Project Selection

STEP 1

Assess Climate Risks

STEP 2

Assess GHG Emissions Qualitatively

STEP 3

Review Adaptation and Resilience Strategies

STEP 4

Review Small-Scale Mitigation Measures

STEP 5

Prioritize Climate Strategies

AREAS OF GUIDANCE

Climate risk screening. Defining climate risk and understanding its main components (hazard, exposure, vulnerability) and methodologies to assess it; understanding the impacts of climate-related phenomena and the difference between physical and indirect risks; recognizing the difference between internal risks and externalities

Climate uncertainty. Exploring the roots of uncertainty; the role of climate scenarios in describing the future climatic conditions, and how the projections of future greenhouse gas (GHG) emissions are affecting risk assessment

Reduction of climate risks through adaptation. Increasing the adaptive capacity and reducing the sensitivity of assets; conceptualizing adaptation and resilience; maximizing the resilience of the project to natural hazards and resilience through the project of its beneficiaries and the local economy

Small-scale mitigation in projects. Describing schemes and mechanisms to increase the mitigation potential of projects that are not primarily tagged as “climate mitigation”, combining the benefits of mitigation and adaptation by implementing nature-based solutions

Cost and benefits of adaptation and mitigation. Employing environmental and social frameworks and “do no significant harm” principles further to appraise trade-offs of alternative climate adaptation and mitigation strategies; assessing the cost of climate interventions; understanding the multiple benefits of climate actions, including the potential savings in the project’s life-cycle as well as non-monetary gains (e.g., social, gender, empowerment of local population and economy)

MODULE 1.3

Value of Investment Accounting for Climate Actions

STEP 1

Include Climate Considerations in Cost-Benefit Analysis (CBA)

STEP 2

Check Project's Affordability

STEP 3

Check Project's Suitability as a PPP

AREAS OF GUIDANCE

Climate considerations on the project's economics. Developing a preliminary understanding of how climate change may affect (positively or negatively) the overall economic value of the project and its affordability considering different viewpoints and perspectives, estimating the cost of climate investment considering liabilities and revenues

Costs and benefits of climate actions. Estimating the factors affecting the value of the investment and which are directly impacting the net present value of the project (e.g., cost of mitigation and adaptation, cost of recovery, cost of maintenance, loss reduction, tax reductions related to GHG emission reduction, etc.); realizing how co-benefits of mitigation/adaptation can offset some of the initial investment cost (e.g., by fostering productivity, inclusion and resilience, thereby improving access to markets, jobs, education, health, and other services)

Climate change considerations in the PPP suitability assessment. Defining the role of the private sector in mobilizing innovation and competition, and leveraging financing opportunities; appraising suitability in due consideration of the level of climate-induced costs, the potential of climate-risk allocation in a PPP scheme, the availability of risk protection measures (i.e., insurances and guarantees), and overall financing and bankability concerns

PHASE 2 - PREPARATION

Module 2.1 Interactions between Climate and PPPs

Module 2.2 Climate Considerations on Technical Feasibility

Module 2.3 Climate Considerations on Commercial Feasibility and Bankability

Phase 2 describes the project preparation phase and hence, in the context of the high-level toolkit, refers to the incorporation of climate actions in the assessment of the project's technical and commercial feasibility. It therefore provides guidance on the following:

- Assessing climate-related risks accounting for both internal and external risk factors
- Selecting adaptation options, including for cases of decision making under deep uncertainty
- Assessing GHG emissions due to the project and identifying applicable climate mitigation options
- Maximizing resilience of and through the project
- Promoting the use of "green" construction solutions for adaptation and mitigation
- Assessing costs and associated benefits of climate action and including them in the project without compromising its commercial feasibility and bankability

MODULE 2.1

Interactions between Climate and PPPs

STEP 1
Climate Hazard Analysis

STEP 2
Characterization of Internal Risks

STEP 3
Landscape Mapping and Identification of External Risks

STEP 4
Towards Low-Carbon Infrastructure

AREAS OF GUIDANCE

Climate hazards projections. Extrapolating future climate hazards using global and regional climate models (GCMs and RCMs); defining future climatic conditions based on representative concentration pathways (RCPs)

Climate risk modeling. Incorporating climate uncertainty in hazard analysis by introducing three key sources of uncertainty: (i) model, (ii) emission scenario, and (iii) internal variability; calculating exposure and vulnerability of the projects to climatic stressors distinguishing between chronic and acute risks, that may lead to direct and indirect losses onthe project

Climate externalities. Recognizing external risks (externalities), defined as the dependencies of the project with associated infrastructure, other social and physical systems, technological developments, and policy decisions that might be driven by climate change and might increase/decrease the project's overall risk

Life-cycle assessment of project's carbon footprint. Assessing the project's GHG emissions over its entire life- cycle, including the contribution of all activities performed during construction, operation, and maintenance of the infrastructure; tracking down opportunities for reducing the life-cycle GHG emissions by optimizing the operation and maintenance processes

Applicability of small-scale mitigation options. Exploring nature-based-solutions (NBS), ecosystem-based adaptation, blue-green or green-gray infrastructure; using renewable, repairable and recyclable sources and materials

MODULE 2.2

Climate Considerations on Technical Feasibility

STEP 1

Feasibility of Small-Scale Mitigation

STEP 2

Assess the Feasibility of Adaptation Strategies

STEP 3

Manage Uncertainty in Adaptation Plan

AREAS OF GUIDANCE

Decision-making under uncertainty. Recognizing how climate variability and uncertainty is impacting technical and financial decisions; the pitfalls of traditional decision making; introduction to decision making under uncertainty (DMUU) methodologies

Categories of adaptation measures. Thinking of adaptation as a combination of prevention, preparation, and recovery measures; calculating risk reduction potential of adaptation alternatives; resilience of/through the project

Base and adaptive plans. Introducing the concepts of base and adaptive planning where "base" refers to a project plan in which all capital expenses associated with adaptation and resilience measures are disbursable upfront, and "adaptive" refers to a project plan in which adaptation and resilience expenses are disbursable throughout the project depending on specific climate-related performance indicators; discussion on pros and cons of each approach

Definition of "base plan" using decision making under deep uncertainty (DMDU) approaches. Recognizing robustness as the main attribute of a base plan (defined as the ability of the plan to perform acceptably over a range of climate scenarios); exploring the applicability of robust decision making (RDM), information-gap decision theory, Climate Risk Informed Decision Analysis (CRIDA), to decide on the technical design of the base plan; setting the proper performance indicators and thresholds when assessing robustness

Definition of "adaptive plan" using DMDU approaches. Recognizing flexibility as the main attribute of an "adaptive plan" (defined as the ability of the plan to adjust over time to the changing climate conditions; developing technical designs with different planning horizons (short, medium, and long-term); identifying tipping points that signpost the need for a plan re-adjustment (i.e., implementation of additional contingencies); familiarizing with prevailing adaptive planning methodologies

Evaluation of costs and benefits. Introducing methods such as cost-benefit analysis (CBA) under uncertainty, DMUU, and multi-criteria analysis (MCA) to properly assess feasibility under multiple climate evolution scenarios while incorporating monetary and non-monetary benefits

MODULE 2.3

Climate Considerations on Commercial Feasibility & Bankability

STEP 1

Update and Refine CBA, VfM and Affordability

STEP 2

Bankability and Commercial Feasibility

AREAS OF GUIDANCE

Introduction of climate cost and benefits in CBA. Updating cost calculations to explicitly account for the cost of climate mitigation and adaptation (refined after the technical feasibility), the cost of impact and the costs of recovery; calculating savings associated with avoidance of operational disruptions due to climate hazards; calculating benefits of risk reduction and their indirect benefits to the broader ecosystem or socio-economic system; estimating the benefits of GHG emission reduction; evaluating changes in the residual value of the project

Value for money (VfM) of climate-smart projects. Assessing the implications of climate actions on the VfM of the project; evaluating the merits of the project as a PPP from an overall cost perspective; confirming whether PPP procurement enhances private sector innovation and optimizes risk allocation

VfM of climate-smart projects. Updating the VfM based on new cost estimates, but also on other implications of the proposed technical solutions; evaluating the merits of the project as a PPP from an overall cost to the government perspective; confirming whether the project includes PPP benefits such as private sector innovation, risk transfer, and performance-based structures

Affordability of climate-smart projects. Revisiting project affordability accounting for the additional cost to the project company (which frequently translates into increased availability payments by the grantor or higher user fees) and the potential reduction of the grantor's contingent liabilities when the climate-change-induced risks are transferred to the project company

Commercial feasibility of climate-smart projects. Assessing commercial feasibility from the perspectives of different stakeholders (grantor, investor, lender); incorporating climate mitigation and adaptation in the PPP structure without risking the commercial feasibility of the project; performing a high-level risk allocation screening to illustrate different strategies, actions, and risk-sharing instruments so that bankability is not threatened

PHASE 3 - STRUCTURING CONSIDERATIONS

Module 3.1 Climate Considerations on Risk Allocation

Module 3.2 Climate Considerations on the Financial Structure

Module 3.3 Integration of Climate Requirements into the Procurement Process

Phase 3, which evolves during the contract structuring phase of the PPP cycle, intends to provide guidance on the following:

- Describing the climate risk profile of the project and preparing a clear risk allocation structure and management plan that specifies and nuances climate risk events, including hedging mechanisms and force majeure exceptions
- Prescribing climate provisions on the payment mechanism that would enforce incorporation of climate mitigation and adaptation requirements in the project
- Exploring innovative financing instruments for climate projects beyond the traditional financial support, thus safeguarding their bankability and investability, and enhancing the projects' eligibility to receive financing from such sources
- Defining a coherent set of requirements (key performance indicators or KPIs) for inclusion in the tender documents in order to ensure compliance with climate-related performance objectives during the design, construction, and operation of the project
- Providing climate-related recommendations for inclusion in the tender documents

MODULE 3.1

Climate Considerations on Risk Allocation

STEP 1

Understand Climate Risk in PPPs from a Contractual Viewpoint

STEP 2

Structure & Allocate Climate Risk

STEP 3

Insurance Coverage against Climate-Change Risks

AREAS OF GUIDANCE

Risk categories from a contractual standpoint. Distinguishing between "internal" risks, i.e., those directly affecting the project causing physical damage and/or downtime for inspection or repairs, and "external" risks, i.e., those posed by the project due to failures of the interconnected infrastructure or changes in the broader socio- economic environment including transition risks

Predictable and unpredictable risks. Distinguishing risks as predictable (i.e., generated by events that may be anticipated based on the climate modeling and for which adaptation and resilience works should be designed and implemented) and unpredictable (caused by extremely rare events for which adaptation measures cannot be designed); further distinguishing unpredictable risks as "insurable" (when there are available insurance mechanisms to cover them) and "uninsurable" events which are commonly treated as force majeure

Climate risk appetite of different stakeholders. Recognizing the different risk allocation rationales among PPP actors and their main concerns (grantor, project company, lenders, insurers)

Risk transfer mechanisms for climate risks. Identifying different risk transfer mechanisms for different risk categories; understanding the limitations of traditional catastrophe risk insurance and guarantee mechanisms to deal with climate change uncertainty; introducing hybrid risk transfer solutions blending innovative insurance instruments with financial options including index-based products (e.g., weather derivatives), Catastrophe Drawdown Options (Cat DDOs), and state guarantees

MODULE 3.2

Climate Considerations on the Financial Structure

STEP 1

Include Climate Provisions in the Payment Mechanism

STEP 2

Consider Availability of Concessional Funds

MODULE 3.3

Integration of Climate Requirements into the Procurement Process

STEP 1

Include Climate Requirements in the Design

STEP 2

Include Climate Requirements in Technical Specification and Output Indicators

STEP 3

Include Climate Requirements in Operational Procedures

AREAS OF GUIDANCE

Flexible payment mechanisms. Introducing flexibility to the payment mechanism to meet the capital expenditure (CAPEX) requirements of climate adaptation, distinguishing between availability-based and user-pays PPPs, balancing between incentives for climate innovation and penalties for failure in the contract structure

Green funding. Exploring opportunities, criteria, and requirements for applying for multilateral and bilateral financing mechanisms; coordinating grant application with PPP project preparation

Technical guidance on sustainability and climate change. Familiarizing with code/standards/guidelines that include climate provisions; acknowledging the role of sustainability rating tools (e.g., LEED, EDGE, SuRe, etc.) in the technical design and delivery of climate-smart PPPs through illustrative examples; introducing the Finance to Accelerate the Sustainable Transition-Infrastructure (FAST-Infra) labeling system for sustainable infrastructure assets

KPIs for climate-smart projects. Defining output specifications that comply with the climate-resilient objective of the project; introducing KPIs that correlate hazard intensity with acceptable performance levels; analyzing sustainabilitymetrics and indices for constructions and operations

Prevention and management of climate disasters. Embedding climate requirements in the operational procedures of the project; revisiting environmental impact assessments to incorporate climate change considerations; involving the private sector in disaster prevention and planning activities, describing requirements and specifications for emergency response plans to combat climate hazards

PHASE 4 - TENDER PROCESS

Module 4.1 Drafting Climate-Smart Tender Documents

This phase covers the period from the completion of the project structuring (where the key design/performance specifications and the financial and risk structure of the project have been decided) to the official launch of the tender. It, therefore, provides guidance on the following:

- Specifying a set of climate-related qualification / evaluation criteria for the bidders that are consistent with the characteristics of the project
- Structuring and designing of a clear and transparent RFP package that outlines proposal requirements and informs bidders on the climate aspects of the tender/selection process and timing
- Drafting of the contract, detailing in a clear and enforceable manner the role of the public and private parties and key climate-related provisions (output of Phase 3)

MODULE 4.1

Drafting Climate-Smart Tender Documents

STEP 1

Define Climate-Smart Criteria for the RFQ/RFP

STEP 2

Include Climate-Smart Considerations in the PPP Agreement

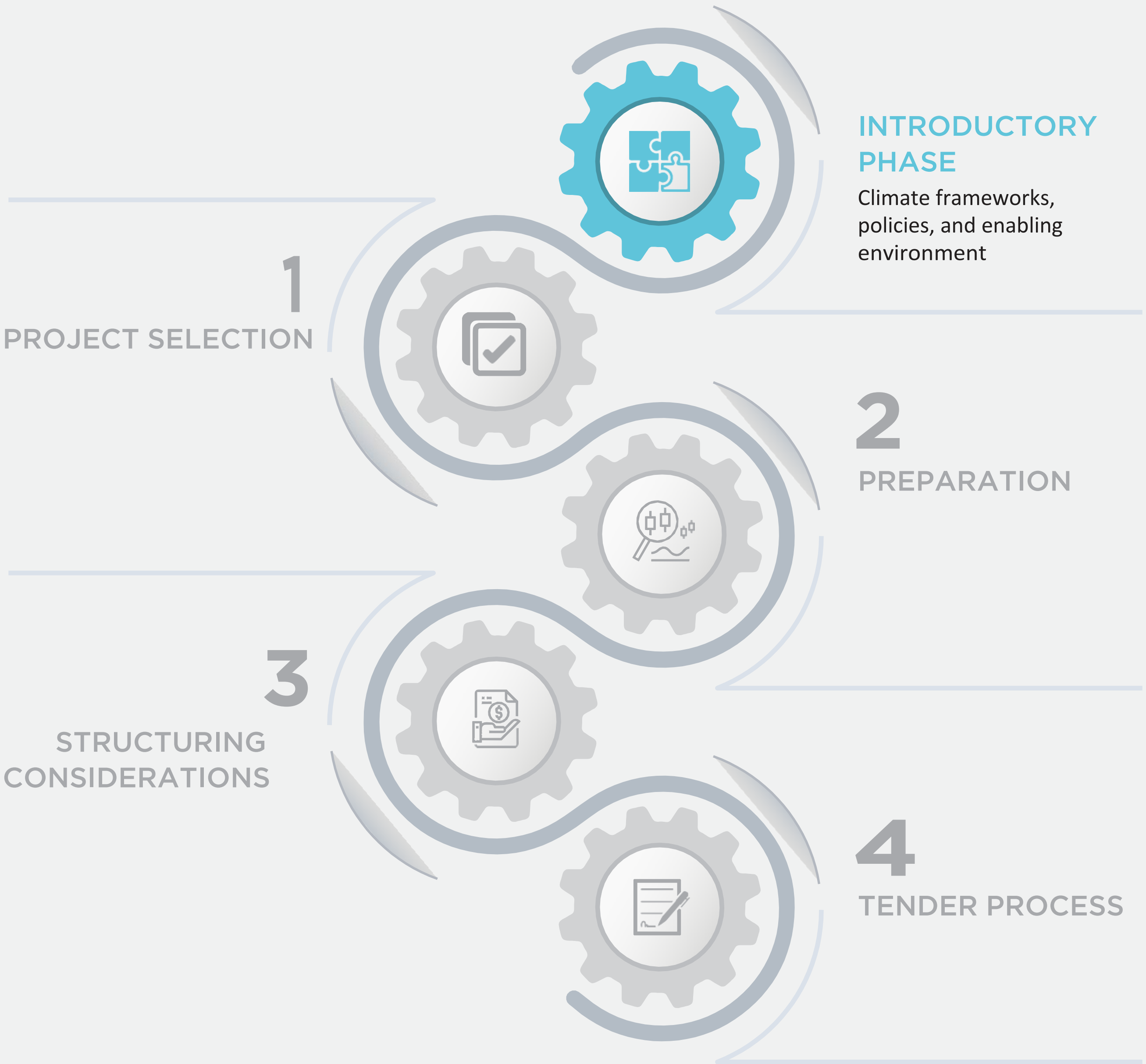
AREAS OF GUIDANCE

Climate specifications for PPPs. Defining technical and operational standards, analyzing examples of including low-carbon incentives and risk mitigation strategies in the procurement documents; example RFQ and RFP provisions relevant to climate mitigation/adaptation projects

Evaluation of bidders. Defining proper sets of qualification/evaluation criteria for the selection of bidders measuring sustainability and climate resilience practices, innovation, technical excellence, demonstrated experience, and social inclusivity

Evaluation of proposals. Demonstrating alternatives to theleast cost bid evaluation; integrating climate-smart criteria into the evaluation process; understanding the benefits of price and quality evaluations; introducing the concept of life cycle assessment of proposals

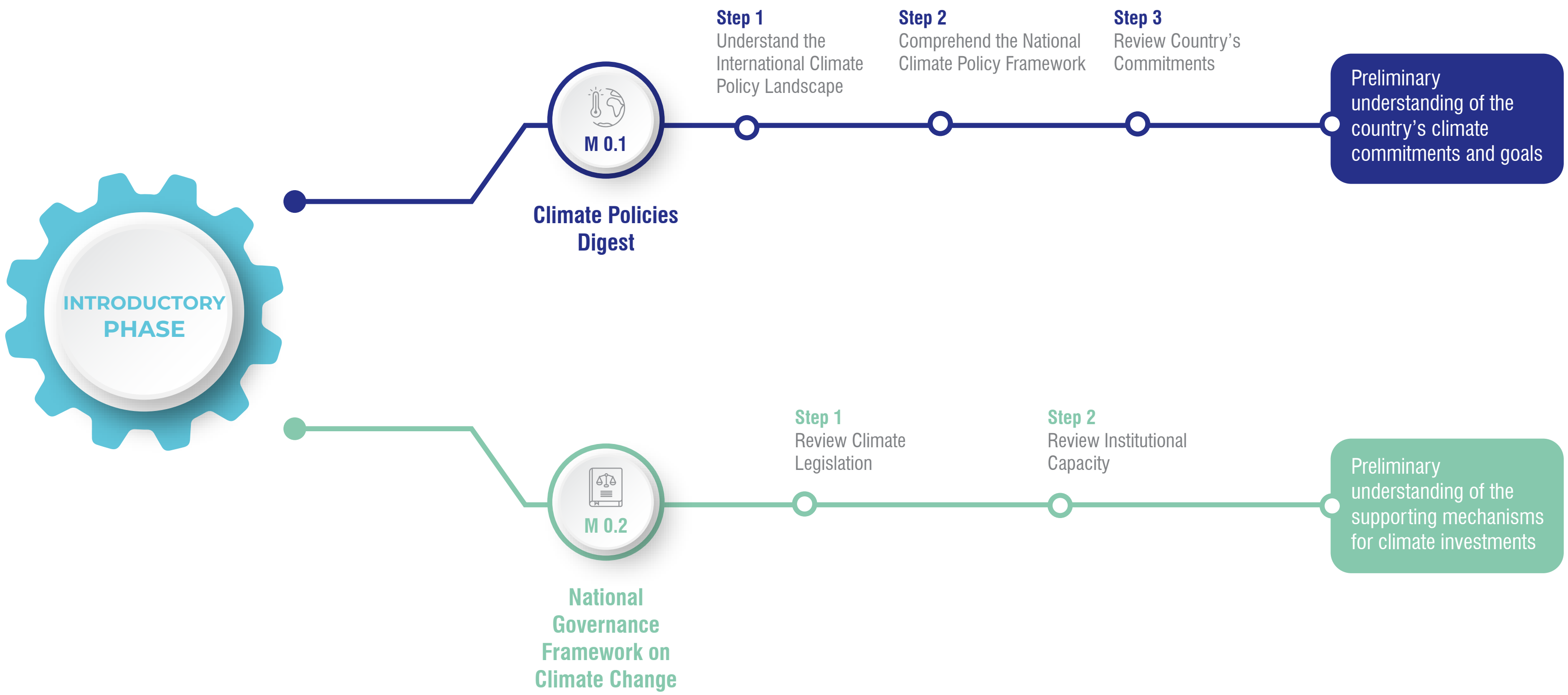
INTRODUCTORY PHASE



Introductory Phase

Major international frameworks and their adaptation in the form of national policies and regulations define climate-related goals for each country at the national or regional level. Aligning the development of climate-smart investments with these norms/targets/processes will decisively contribute towards meeting emission reduction targets and national commitments while accelerating adaptation and resilience efforts to combat climate change. Therefore, this introductory phase is meant to assist government officials and their advisors in acquainting themselves with what constitutes the enabling environment for climate-smart PPPs and understand how the alignment of current legislation with the Paris Agreement and other climate change and sector-specific policies underpins investments in low carbon and climate-resilient infrastructure.

Obtaining a clear understanding of the domestic administrative structure—be it the legislation system or the domestic governance—that oversees and coordinates the climate planning and development activities is also essential for moving from abstract concepts and wishful intentions to tangible climate investments. It is noted that the structure of administrative mechanisms differs among different countries, both in terms of the bodies/authorities responsible for developing and implementing climate policies, as well as in terms of the interactions among them. Readers who are already familiar with the enabling environment may proceed to the main body of the toolkit.


INTRODUCTORY PHASE
M 0.1
Climate Policies Digest
Step 1
Understand the International Climate Policy Landscape
Step 2
Comprehend the National Climate Policy Framework
Step 3
Review Country's Commitments
Preliminary understanding of the country's climate commitments and goals
M 0.2
National Governance Framework on Climate Change
Step 1
Review Climate Legislation
Step 2
Review Institutional Capacity
Preliminary understanding of the supporting mechanisms for climate investments

Introductory Phase

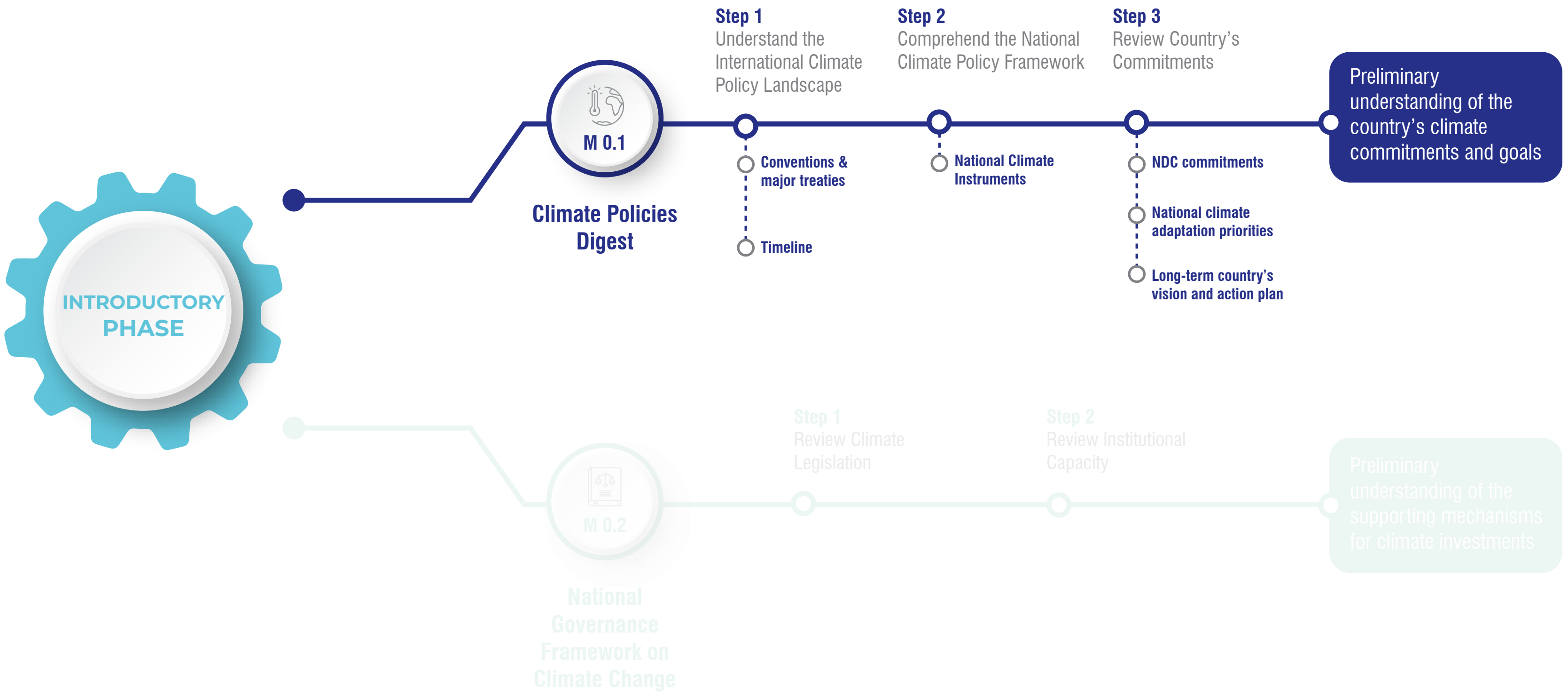
Outline

This preparatory phase comprises two modules:

Module 01 – Climate Policies Digest is intended for use by government officials and their advisors and provides an overview of existing climate change policies, describing general norms and highlighting some country-specific features. It includes:

- a brief presentation of the Paris Agreement and the major international policy frameworks that are the key drivers for low carbon and climate-resilient transition
- a detailed description of NDCs and their relevance to long-term strategies (LTSs)
- an overview of National Adaptation Plans (NAPs)
- a description of the many interlinkages of gender equality and climate change within policy dialogues and climate action policies and plans.

Module 02 – National Governance Framework on Climate Change focuses on the national regulatory framework that oversees climate policy planning and proposes a stepwise review process to help government advisors unravel its regional characteristics (e.g., existing structures/policies, jurisdictions, responsibilities, and synergies among institutions).



INTRODUCTORY PHASE
M 0.1
Climate Policies Digest
Step 1
Understand the International Climate Policy Landscape
Conventions & major treaties
Timeline
Step 2
Comprehend the National Climate Policy Framework
National Climate Instruments
Step 3
Review Country's Commitments
NDC commitments
National climate adaptation priorities
Long-term country's vision and action plan
Preliminary understanding of the country's climate commitments and goals
M 0.2
National Governance Framework on Climate Change
Step 1
Review Climate Legislation
Step 2
Review Institutional Capacity
Preliminary understanding of the supporting mechanisms for climate investments

0.1 Climate Policies Digest

The first module of this phase serves as a first-level navigator of the international climate-related policies landscape. It commences with the description of major frameworks such as the Paris Agreement and concludes with a country-specific screening of the implementation of climate policies.

STRUCTURE OF THE MODULE

Module 0.1 is structured in three steps:

- **Step 1** is intended to provide an overview of the major international frameworks defining climate policies and which form the basis for national climate-related legislation and norms.
- **Step 2** provides an overview of the national climate instruments (NDCs, NAPs, LTSs)and discusses their commitments, interactions and key differences in their implementation.
- **Step 3** introduces a high-level review of NDCs, NAPs, and LTSs to help users assess the country's achievements in climate aspects, recognize specific economy-wide and sector-specific targets/commitments, and identify country-specific implementation mechanisms.

01 UNDERSTAND THE INTERNATIONAL CLIMATE POLICY LANDSCAPE

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental agreement that was signed in June 1992 in Rio de Janeiro and entered into force in 1994. Today, 197 countries have ratified the convention with the main objective to stabilize greenhouse gas (GHG) concentrations to a level that would prevent dangerous anthropogenic interference with the climate system. Formal Conferences of parties (COP) have been held every year since 1995 and comprise the supreme decision-making body of the convention. The aim of the COPs is to discuss progress and update existing or set new goals regarding climate change under the UN climate-change framework. The first major implementation of the UNFCCC measures entered into force through the Kyoto Protocol (see Insight 0.1) in 2005 and was superseded by the Paris Agreement, which sets the current framework of international climate policy. COP decisions are scientifically-backed by the Intergovernmental Panel on Climate Change (IPCC) – an independent body founded in 1988 under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) – to provide policymakers with regular scientific assessments on the current state of knowledge about climate change. Parties to the UNFCCC have recognized the importance of involving women and girls, as well as men and boys equally in UNFCCC processes and have therefore established a dedicated agenda item under the convention, addressing issues of gender and climate change.

THE URGENCY OF ACTION

With the last decade having been confirmed as the warmest on record, the urgency to address both the causes and impacts of climate change is now clearer than ever. According to the latest Assessment Report (AR5)[1] by the IPCC, the "point of no return" (i.e., a 1.5° Celsius increase in global temperatures that is expected to result in severe food shortages, coastal inundations, and the displacement of tens of millions of people) is now predicted to arrive as early as 2030, unless significant steps are taken before. With the threat so apparent, national leaders increasingly recognize that inaction is not an option and have been convinced to commit to ambitious national pledges outlined in the 2015 Paris Agreement, setting the goal for a global transition to net zero emissions by 2050.

PARIS AGREEMENT: A MAJOR SHIFT IN THE INTERNATIONAL POLICY LANDSCAPE

Global climate governance is a highly iterative and evolving process that has progressed significantly since the signing of UNFCCC in 1992. The main benchmarks and contributions of this process are presented in the timeline of Figure 0.1. The last major milestone was reached at COP21 in Paris on 12 December 2015, when parties achieved an international climate

[1] IPCC, 2014: Fifth Assessment Report

agreement that forms the current landscape to combat climate change and accelerates and intensifies the actions and investments needed for a sustainable, low carbon future. The agreement entered into force and became legally binding in April 2016 after ratification by 55 parties that accounted for an estimated 55% of total GHG emissions. It was adopted by 196 parties (including the European Union (EU) that comprises 28 member countries).

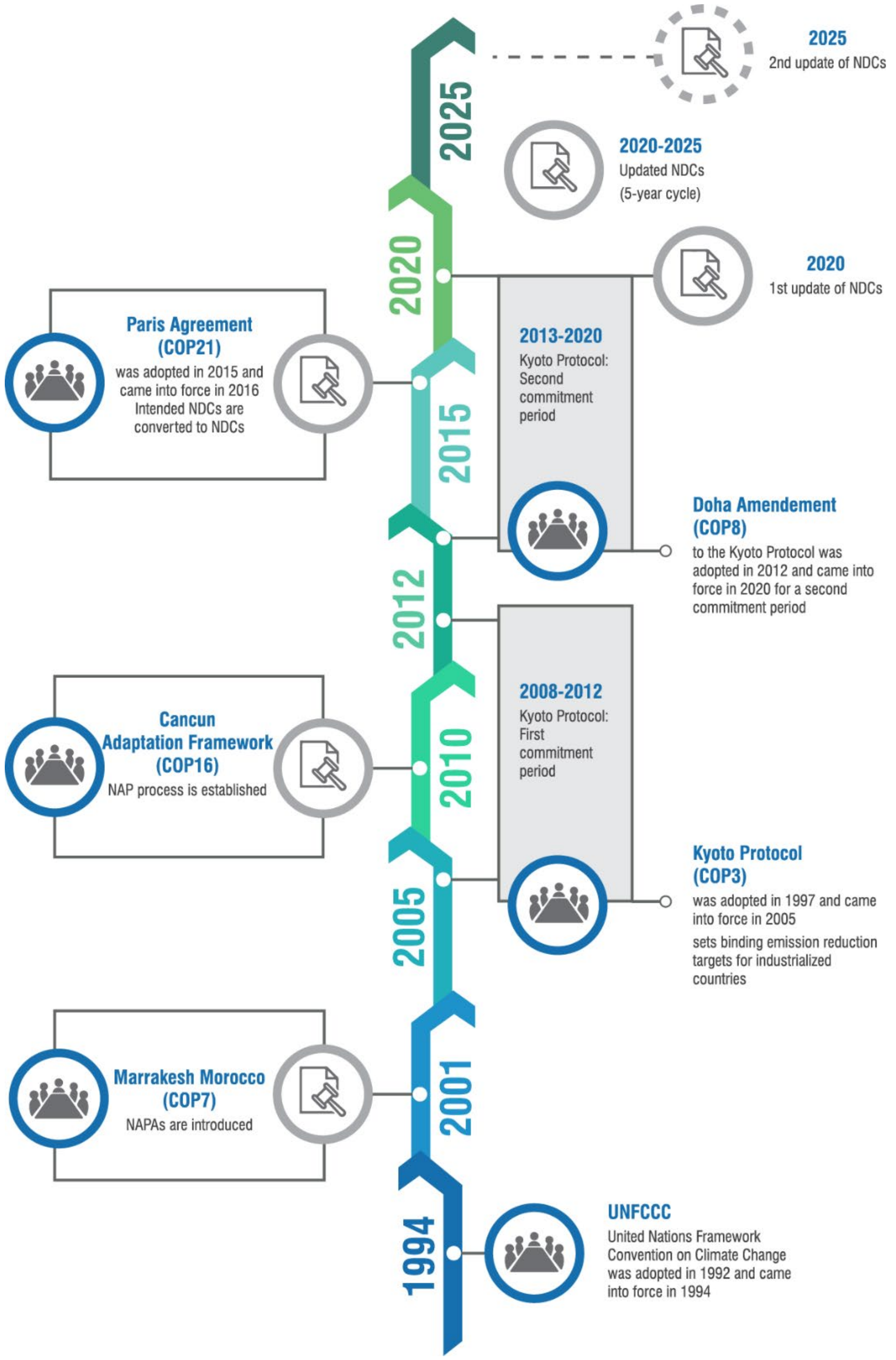


FIGURE 0.1 Timeline of major milestones of international climate-change considerations

The Paris Agreement achieved a major shift in the international climate policy landscape by bringing for the first time all nations under one umbrella into a common cause to mitigate climate change and adapt to its effects with additional support to less developed countries to do so as well. The goal of the Agreement is to keep the global average temperature rise to well below 2°C above pre-industrial levels and to pursue efforts to limit the rise to 1.5°C as well as to achieve net-zero emissions in the second half of the current century. In addition, the Agreement aims to increase the resilience and adaptation capacity of countries to deal with climate change risks that may emerge in the near future. Aiming to reach these goals, new financial instruments, technological frameworks, and funding opportunities were put into action to support countries (especially the least developed and developing parties that belong to the Agreement). To this end, developed countries and international organizations were prompted to take the lead in providing financial assistance to more vulnerable countries and in proposing innovative climate finance for large-scale carbon-emission reduction and climate adaptation investments. An overview of global climate frameworks that, together with the Paris Agreement, are supporting the vision for sustainable and climate-sensitive growth is provided in Insights 0.1 and 0.2.

02 COMPREHEND THE NATIONAL CLIMATE POLICY FRAMEWORK

NDCs, LTSs, and NAPs are the three main instruments for the implementation of the Paris Agreement by each country. These instruments, despite their distinctive characteristics, go hand in hand and reinforce each other into pursuing climate resilience and GHG emission targets.

NATIONALLY DETERMINED CONTRIBUTIONS (NDCs)

The NDCs are the most important instruments for the implementation of the Paris Agreement at the national level, serving as the vehicle to put the global efforts towards reducing emissions and adapting to the impacts of climate change into a national policy. As of today, 196 countries have ratified the Paris Agreement, and 192[2] have committed to and implemented NDCs, outlining **short and mid-term** climate action plans that are to be regularly updated. Indeed, following the NDC cycle, all parties were requested to submit new or updated NDCs by 2020 and then update them every five years thereafter (2025, 2030, etc.). To facilitate clarity, transparency, and understanding, parties shall submit their NDC for each cycle at least 9 to 12 months in advance of the relevant session[3].

[2] Eritrea has submitted its first NDC but has not yet become a party to the Paris Agreement.
[3] https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/nationally-determined-contributions-ndcs

LONG-TERM STRATEGIES (LTSs)

The UN also invited countries to submit their LTSs for achieving their climate change goals. Unlike the NDCs, these plans are mandatory. This is the role of the second instrument provided by the Paris Agreement, the LTS. As of June 2021, 29 parties, representing 42 countries, have submitted an LTS document, but only 11 of them include a quantified vision for emissions in 2050. The latter comes in various formats, either as a percentage reduction with respect to the emissions of a reference year (i.e., "base year goals") or fixed-level goals (stating what emissions level will be achieved in 2050).

NDCs and LTS in a nutshell

What do they include?

NDCs	LTSs
Quantifiable short and mid-term emission reduction targets (incl. implementation timeframes and sector coverage) and adaptation objectives	Long-term strategies for reducing greenhouse emissions that will form the basis for the implementation of more ambitious NDCs
Coherent and transparent reporting and monitoring framework	A roadmap for action to steer national climate change mitigation policy in the long-term (incl. actions to financially strengthen investment to deliver long-term NDC targets)
Institutional arrangements in legislation and measures to support the implementation of commitments	Guidelines to enable the transition to a low carbon economy across all sectors of activity (avoiding locking in carbon-intensive infrastructure)
May include instances of climate adaptation priorities and plans	A vision for the country's future that focuses on a sustainable development trajectory

FIGURE 0.2 Schematic illustration of the main characteristics of NDCs and LTSs

NATIONAL ADAPTATION PLAN (NAP) AND NATIONAL ADAPTATION PROGRAM OF ACTION (NAPA)

The third major UN instrument is the NAP, which is the main planning tool introduced in 2010 during the COP16 in Cancun, Mexico. Originally meant to be a special instrument for least developed countries (LDCs), it has since then been increasingly promoted to all countries, having as its main objective to provide a clear and robust framework and specific action plans that will:

- reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience
- facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programs, and activities—in particular, development planning processes and strategies—within all relevant sectors and at different levels, as appropriate
- integrate a gender perspective within the national adaptation strategy that aims to address gender gaps (Insight 0.3).

The NAPs have progressed the preliminary work of the NAPA process—that focused on the design of urgent win-win measures for LDCs to combat increased levels of climate-change vulnerability—into a comprehensive and regularly updated framework that integrates climate change adaptation into national planning. An example of a NAP development process is presented in Box 0.1.

WHAT IS INCLUDED IN A NAP?

The Least Developed Country Expert Group, on behalf of the UNFCCC, developed Technical Guidelines for the National Adaptation Plan Process. These guidelines, although not prescriptive, outline the key elements and phases for implementing a coherent NAP process that focuses on medium- and long-term adaptation needs and priorities. These include:

- a national stock-take (e.g., mapping of actors, identification of capacity gaps and urgent needs)
- climate-risk assessments
- an implementation phase, outlining the (long-term) NAS (including prioritization of climate change adaptation options and plans to enhance capacity building and promote coordination among actors)
- a reporting, monitoring, and review phase that specifies key milestones and expected outputs over time.

A brief explanation of how NAPs, NDCs, and climate frameworks support sustainable development is provided in Insight 0.4.

BOX 0.1 EXAMPLE OF THE NAP DEVELOPMENT PROCESS IN KENYA

Kenya was among the first countries to submit a NAP in the registry of the UNFCCC. Kenya's NAP is an example of successful implementation because it clearly defines the country's climate vision, articulates specific objectives to achieve it, and describes strategies/actions/tools to facilitate implementation. In brief:

VISION

The vision of the Kenyan NAP is enhanced climate resilience towards the attainment of Kenya's 2030 development vision.

GOALS

- Strong economic growth, resilient ecosystems, and sustainable livelihoods for Kenyans
- Reduced climate-induced loss and damage and mainstreamed risk reduction approaches in various sectors
- Reduced costs of humanitarian aid and improved knowledge and learning for adaptation and the future protection of the country

SPECIFIC OBJECTIVES

- Highlight the importance of adaptation and resilience-building actions in development
- Integrate climate change adaptation into national and country-level development planning and budgeting processes
- Enhance the resilience of public and private sector investment in the national transformation and the resilience of the economic and social pillars of Vision 2030 to climate shocks
- Enhance synergies between adaptation and mitigation actions in order to attain a low carbon, climate-resilient economy
- Enhance the resilience of vulnerable populations to climate shocks through adaptation and disaster risk reduction strategies

IMPLEMENTATION STRATEGIES

- Seek participation from civil society
- Clearly define institutional arrangements, roles, and responsibilities
- Perform risk and vulnerability analysis
- Include sector-specific implementation plans and budgets at the national and subnational level
- Establish a monitoring and evaluation system
- Include a gender-specific implementation plan

Source: Kenya National Adaptation Plan 2015-2030:
https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Kenya_NAP_Final.pdf

03 REVIEW NATIONAL CLIMATE POLICIES

As national circumstances and priorities for climate action differ from country to country, in this step, government officials and their advisors are encouraged to review the NDC and NAP documents of their country and identify specific commitments that are described in them. Figure 0.3 outlines the **five principles of the high-level screening** process: timeliness, comprehensiveness, ambition, alignment, and equity— followed by specific questions pertinent to each category. The review process may be facilitated by using the high-level screening questionnaire provided below.

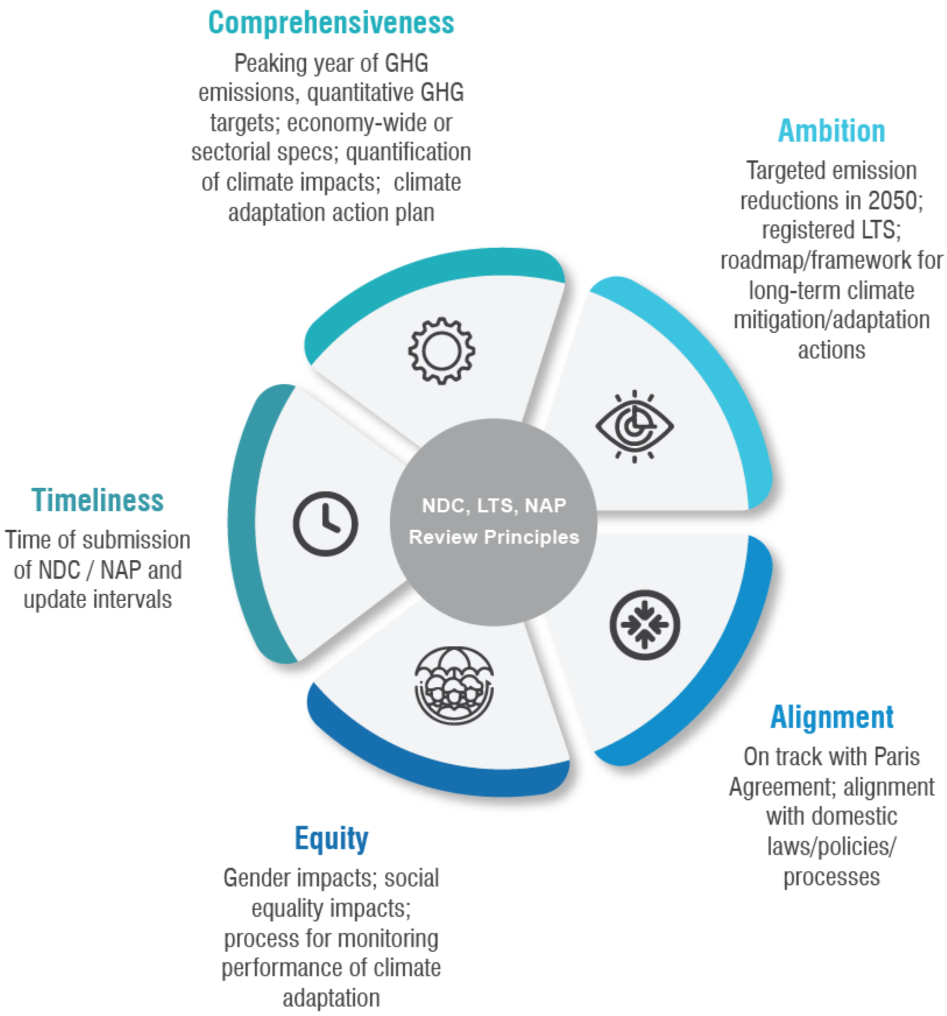


FIGURE 0.3 Five principles for high-level screening of NDCs, LTSs, and NAPs

HIGH-LEVEL SCREENING QUESTIONNAIRE OF NDCs, NAPs and LTSs

NDC TIMELINESS

- Has the country submitted an updated NDC?

NAP TIMELINESS

- Does the country have a NAP?
- If not, is a **NAP process** currently underway in the country?
- What is the **time interval** for reviewing the NAP process?

EXTERNAL ALIGNMENT

- How does the NDC target perform with respect to the goal of holding global warming below 2° C?
  (Users may refer to the rating provided by the Climate Action Tracker in the Resources.)

INTERNAL ALIGNMENT

- How do the NDC and NAP align with **domestic laws** and policies?
- Do the NDC and NAP specify an **implementation** process through national entities/bodies?

NDC COMPREHENSIVENESS

- Does the NDC provide a **peaking year** of GHG emissions?
- What is the quantitative unconditional **GHG target** described in the NDC?
- What is the **NDC coverage**? Is it economy-wide or does it have sectoral content?
- Does the NDC cover **non-GHG targets** as well?
  (For example, in the energy sector a non-GHG target would be to establish quantitative targets to increase the capacity and/or generation of renewable energy.)
- Does the NDC specify detailed sector commitments for GHG reduction targets?
- Does the NDC cover climate adaptation aspects?

NAP COMPREHENSIVENESS

- Does the NAP (if available) include quantitative assessments of the projected climate impacts (e.g., impact analysis, vulnerability assessments)?
- What data and knowledge have been used to assess current and future climate risks?
- Does the NAP specify current and near-term planning and actions? What is their time horizon?

NDC AMBITION

- Does the NDC include a **quantitative vision** for emission reductions in 2050?
- How is the NDC's ambition level rated (according to Climate Action Tracker and/or Climate Change Performance Index)?
- Does the NDC provide a tentative **roadmap** for implementation including timelines and milestones (e.g., a renewable energy roadmap)?
- Is this supported by preliminary information on the costs and benefits of implementing it?

NAP AMBITION

- Does the NAP clearly define national **long-term goals** or vision?
- Does the NAP include specific provisions for monitoring and evaluating performance?

OVERALL AMBITION

- Has the country communicated an **LTS** to UNFCCC?
- Does the NAP or NDC include information on **gaps and barriers** forimplementing the climate policy?
- Do they propose an **action plan** to improve future performance?
- Do they include **recommendations** on what information and metrics are needed to improve performance?

EQUITY PROVISIONS IN NDC

- Does the NDC predict the possible impact of mid-term and long-term mitigation actions on **gender equity**?
- Are **social equity impacts** properly addressed?
- Does the NDC prescribe measures to manage **low-carbon transition** for workers and communities that were traditionally relying on GHG-intensive activities?

EQUITY PROVISIONS IN NAP

- Do the NAP activities consider the disproportionate impacts of climate change on women (e.g., does it include a **gender analysis**)?
- Does the NAP propose a process of monitoring/evaluation **integration of gender considerations** into climate adaptation?

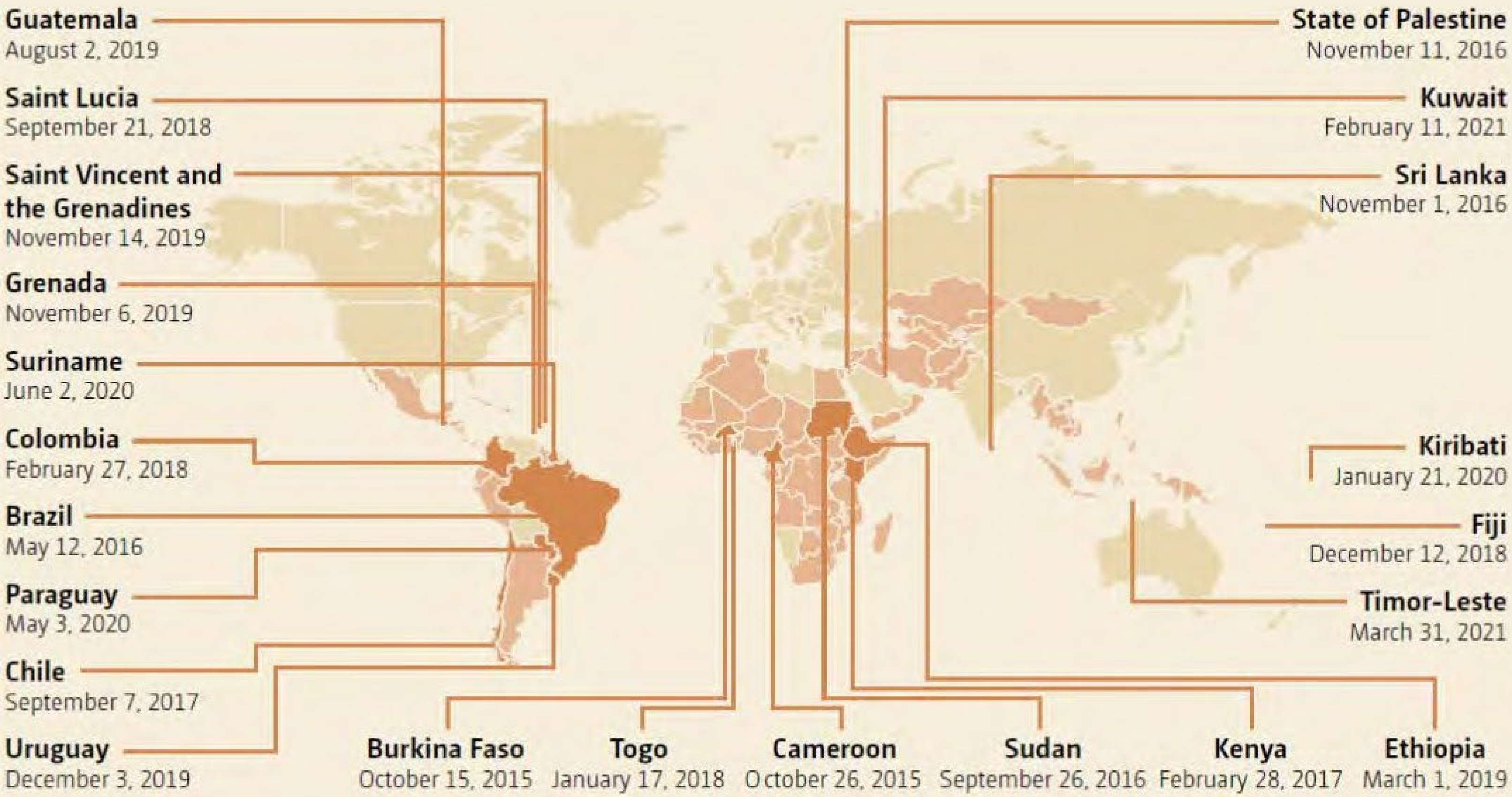


FIGURE 0.4 Information on National Adaptation Plans in developing countries as of 31 March 2021. Darker shades are those countries with a NAP, while the lighter shades are those that started the process. Those without shades are developing countries with no information on whether they have initiated the process. [Source: UNFCCC| National Adaptation Plans]

Step Output

By completing the first module, toolkit users should have formulated a solid background on the progress of climate policies in their country, as this is manifested through the NDCs, NAPs and LTSs. Before embarking on the next module, users are prompted to compile the information gathered above (following the stepwise process) into a coherent matrix that outlines key findings. A sample matrix is provided below.

Checklist	Example answers
A. Climate Policy Status	
Paris Agreement party	yes/no
Last NDC submission	year
Registered NAP process - (year of submission)	yes/no - (year or in progress)
Update interval of NAP	e.g., every 10 years / not specified
B. NDC screening	
Peaking year of GHG emissions	year
Quantitative GHG 2030 target	e.g., reduce GHG emissions by x%
NDC coverage	economy-wide or sectoral
NDC includes adaptation	yes/no
On track with current policies	yes/no
LTS communicated to UNFCCC	yes/no
Quantitative vision for emission reductions	reduce GHG emissions by x% by 2050
C. NAP screening	
Near- and mid-term planning actions	list of actions (or not set)
Priority adaptation sectors	list sectors
On track with current policies	yes/no

KEY TAKEAWAYS

- The current international climate policy landscape has been shaped by a long history of complex interactions among multiple global institutions, international organizations, alliances of countries, and public pressure.
- The major international climate frameworks have driven the development by the UN of the National Determined Contributions (NDCs), the National Adaptation Plans (NAPs) and the long-term strategies (LTSs), the three main instruments for the implementation of climate-change policies and the translation of global climate goals into national targets.
- Getting acquainted with the development and the implementation mechanisms of the climate policies in the global and national agenda is a necessary step to understand the national circumstances and priorities for climate action.
- The course, timing, and level of development of climate policies differ from country to country. The national and subnational climate frameworks can be screened through the lens of five high-level principles: timeliness, alignment with the international climate agenda and domestic laws, comprehensiveness, ambition, and inclusion of gender equity provisions

INSIGHTS

INSIGHT #0.1

KYOTO PROTOCOL:

THE FIRST IMPORTANT STEP FORWARD IN THE EFFORT TO TACKLE GLOBAL WARMING

THE ROAD TO KYOTO

The Kyoto Protocol is an international treaty adopted on 11 December 1997 which, due to its complexity, entered into force in 2005. Currently, 192 parties have ratified the Kyoto Protocol and are committed to the regulations and responsibilities of the agreement. In short, the Kyoto Protocol puts into practice the UNFCCC framework by committing **industrialized countries to reduce G H G emissions** to "a level that would prevent dangerous anthropogenic interference with the climate system" and in accordance with individual targets of eachparty.

During the first commitment period (2008-2012), 37 industrialized countries and economies in transition and the European Community committed to reduce GHG emissions to an average of 5 percent against 1990 levels. In 2012, the Doha amendment to the Kyoto Protocol was adopted, committing parties to reduce GHG emissions by at least 18 percent below 1990 levels (second commitment period starting in 2013 and ending in 2020). However, the agreement only came into force in 2020 after achieving the threshold for parties depositing their instrument of acceptance (144 instruments).

Binding commitments
regarding GHG reduction for 37 developed countries

Flexible market mechanisms
In the form of carbon emission offsetting mechanisms and trading options

New Supporting Mechanisms
- International emissions trading
- Clean development mechanism (CDM)
- Joint implementation (JI)

Climate resilient Future
Recognized the urgency to assist countries in adapting to the adverse effects of climate change and aims to lead to a climate resilient future

Financial Tools for climate adaptation
to promote the development of technologies and solutions that pave the way for a climate-friendly, sustainable future.

Establishment of the Adaptation Fund to finance adaptation projects and programs in developing countries

FIGURE 0.5 Summary of Kyoto Protocol's main innovations and mechanisms

Three Global Frameworks

that drive sustainable development in climate change

INSIGHT #0.2

The Paris Agreement: What is the progress so far?

According to UNFCC, although climate change action needs to be massively increased to achieve the goals of the Paris Agreement, the years since its entry into force have already sparked low-carbon solutions and new markets. More and more countries, regions, cities, and companies are establishing carbon neutrality targets. Zero- carbon solutions are becoming competitive across economic sectors representing 25% of emissions. This trend is most noticeable in the power and transport sectors and has created many new business opportunities for early movers. By 2030, zero-carbon solutions could be competitive in sectors representing over 70% of global emissions.

Text source: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
Paris Agreement (full document - EN): https://unfccc.int/sites/default/files/english_paris_agreement.pdf

The Sendai Framework for The Paris Agreement (DRR) 2015-2030 is the first major agreement that aims to provide member parties with robust action plans and solid procedures towards the prevention and reduction of future and existing disaster risks, respectively. The framework works hand in hand with other climate-related agreements, including the major Paris Agreement of COP21 and the Sustainable Development Goals (SDGs). It comprises four main priority pillars: understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster reduction for resilience, and enhancing disaster preparedness.

The Sendai Framework for Disaster Risk Reduction 2015-2030:
https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

The Sustainable Development Goals (SDGs) or Global Goals are 17 complementary goals with the general target to achieve prosperity and a better and sustainable future for all countries. They were adopted by all United Nations member states in 2015 as part of the 2030 Agenda for Sustainable Development. The SDGs are to be implemented side-by-side with the Sendai framework and the UNFCCC climate-related policies (the Paris Agreement). Specifically, climate actions and disaster risk reduction are the purpose of Goal 13 (combat climate change and its impacts) and Goal 11 (make cities inclusive, safe, resilient, and sustainable), respectively.

A detailed description of the 17 goals and the SDG framework is provided in the following link:
https://sdgs.un.org/goals

INSIGHT #0.3

INTEGRATING A GENDER PERSPECTIVE INTO THE NAP PROCESS

Modern societies have come to a point of understanding that women and girls shouldn't be identified as a "climate-vulnerable group," but rather as "active agents" of climate adaptation in societies. Their understanding of their immediate environment, their skills in managing natural resources to provide for their families, and their customary involvement in climate-sensitive activities, such as farming and fisheries, should be harnessed in climate mitigation and adaptation planning.

The international community has recognized the role of women as effective climate-change agents. COP21 calls for an approach that addresses gender gaps when accounting for climate vulnerabilities and integrating climate mitigation and adaptation measures into relevant social, economic, and environmental policies. Building on this, the Technical Guidelines for the National Adaptation Plan process for Least Developed Countries by UNFCCC propose the implementation of a holistic approach that stretches across all four phases of climate adaptation - from planning and vulnerability assessments to implementation strategies and monitoring of performance - and proposes specific activities that should be implemented in that respect. This will help ensure that there is equal participation of men and women in the decision-making processes, that the adaptation measures will not exacerbate gender inequalities, and that implementation strategies and action plans are responsive to the needs of women and children (e.g., by including operating procedures that bridge gender gaps and promote a balanced gender representation).

INSIGHT #0.3

Gender Considerations in Fiji's NAP

Fiji's NAP is a well-thought-of example of how gender issues can be smoothly and efficiently integrated into the NAP process. Specific considerations include:

Gender perspectives when framing the scope and vision of the NAP process

The aspirational goal of Fiji's NAP is the promotion of "ecosystem-based" and "gender and human rights-based" approaches to adaptation.

Organization of a large and inclusive multi-stakeholder National Consultation Workshop prior to embarking with the NAP process

This included national and subnational government representatives, industry experts and specialists (including those focusing on gender issues), and independent reviewers by international organizations.

Prioritization criteria for closing gender gaps

Gender-related criteria for selecting among different adaption those options that equitably benefit low-income and otherwise disadvantaged groups.

Engage tools/perspectives into the NAP process that address gender considerations.

Apply standard operating procedures that close gender gaps; use sex- and age-disaggregated data and responsive reporting in vulnerability assessments; introduce gender analysis and multi-criteria analysis into decision-making processes regarding climate change adaptation and disaster management; think of women and children when performing needs assessments and proposing action plans which place particular focus on low-income and, especially women and children; apply participatory and gender-responsive budgeting.

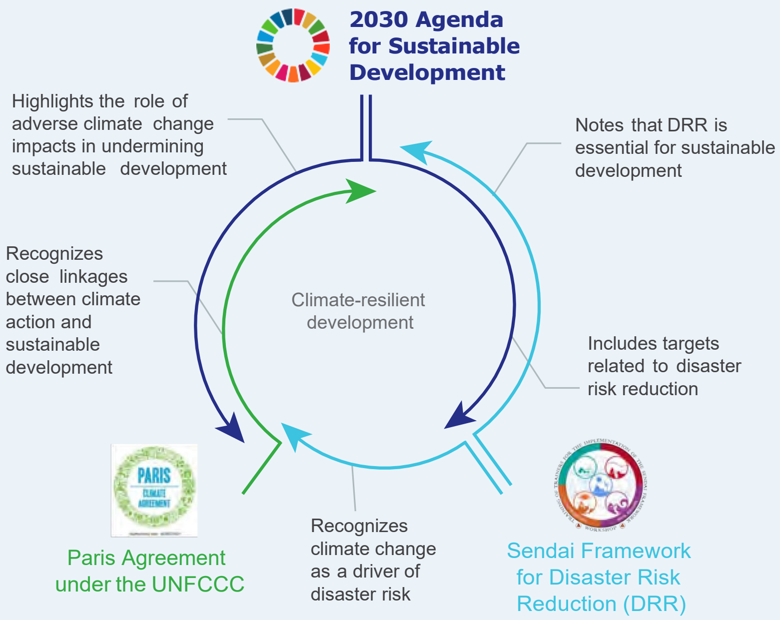
INSIGHT #0.4

HOW IS SUSTAINABLE DEVELOPMENT SUPPORTED BY THE PARIS AGREEMENT, THE SENDAI FRAMEWORK, AND THE GLOBAL SUSTAINABLE GOALS?

Sustainable development is underpinned by three global agendas, the Paris Agreement on Climate Change Adaptation (CCA), the Sendai Framework for Disaster Risk Reduction (DRR), and the SDGs. The mutually supporting nature of these agendas is clear: from a policy perspective, SDGs establish a strong mandate for investing in infrastructure that contributes to sustainability targets, while CCA, the Paris Agreement and the Sendai Framework for DRR provide the normative framework for guiding climate mitigation and adaptation plans at a country-level (as laid out in NDCs and NAPs). In practical terms, investments in low-emission, climate-resilient infrastructure will help countries achieve their SDGs and reduce exposure to climate hazards. The adaptation vision, goals, and priority activities of NAPs should reflect, as appropriate, the country's SDG targets (IISD, 2015)[1].

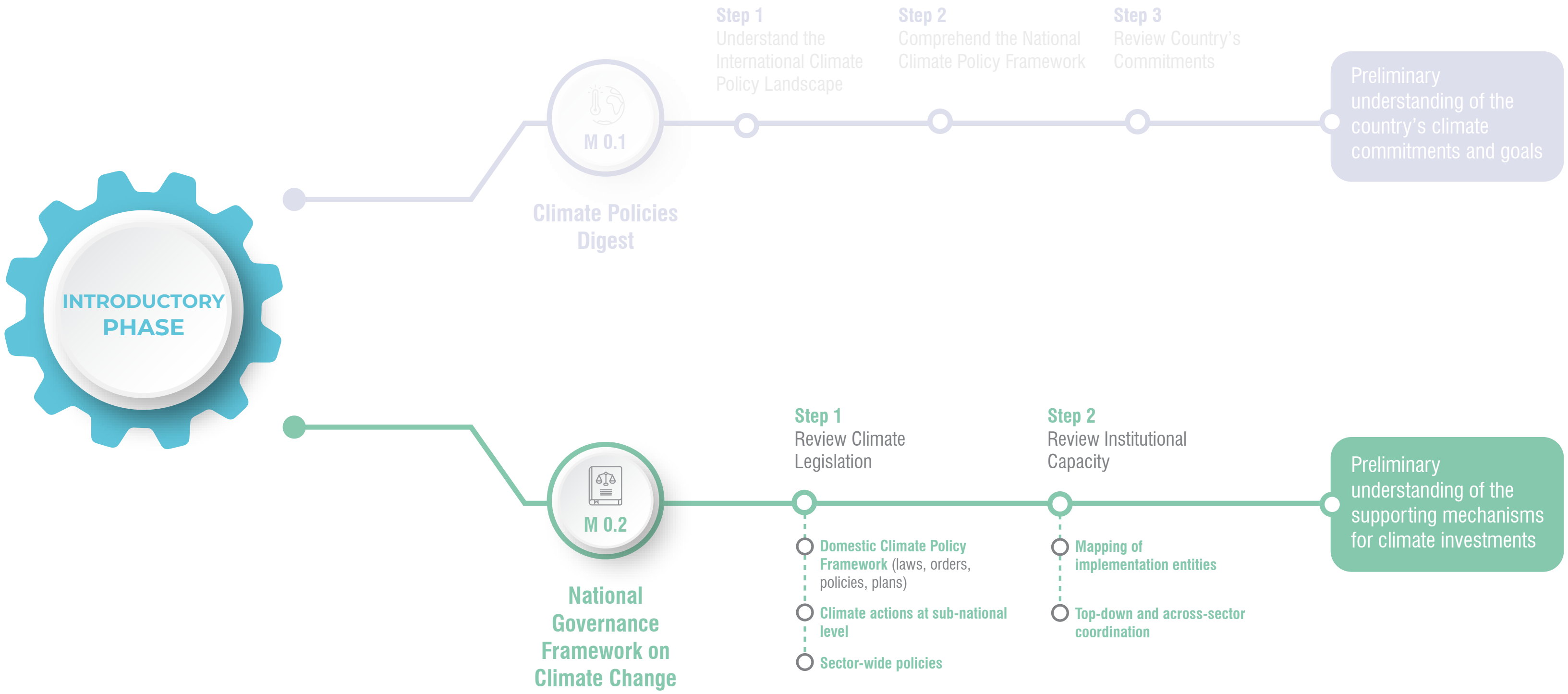
It is therefore important to understand that aligning CCA and DRR agendas with global SDGs is not like sailing on two boats. Investment in infrastructure should contribute towards making cities and human settlements inclusive, safe, resilient, and sustainable (SDG 11) while combating climate-change impacts (SDG 13).

[1] IISD,2015: sNAPshot: Initiating sector integration ofadaptation considerations: Overview Brief, NAP Global Network



Aligning NAP priorities with SDGs

- For Cameroon, agriculture is a priority climate-sensitive sector. This is acknowledged by the country's NAP document (2015), which emphasizes the need to promote climate-resilient agricultural practices. Investment in this direction is entirely compatible with SDG target 2.4 that calls for implementation of resilient agricultural practices to ensure sustainable food production systems.
- For Sri Lanka, the coastal sector in general and the protection of fisheries in particular is a national adaptation priority (Sri Lanka's NAP/NDC (2016)). Hence investing in the protection of the coastal ecosystems is not only climate-responsible, but it is also completely aligned with SDG 14 on the conservation and sustainable use of marine resources.



INTRODUCTORY PHASE
M 0.1
Climate Policies Digest
Step 1
Understand the International Climate Policy Landscape
Step 2
Comprehend the National Climate Policy Framework
Step 3
Review Country's Commitments
Preliminary understanding of the country's climate commitments and goals
M 0.2
National Governance Framework on Climate Change
Step 1
Review Climate Legislation
Domestic Climate Policy Framework (laws, orders, policies, plans)
Climate actions at sub-national level
Sector-wide policies
Step 2
Review Institutional Capacity
Mapping of implementation entities
Top-down and across-sector coordination
Preliminary understanding of the supporting mechanisms for climate investments

0.2 National Governance Framework on Climate Change

While parties are legally obligated to submit an NDC and commit to it, the application of the NDC is not legally binding. Successful implementation of the Paris Agreement requires that targets pledged internationally through the NDCs are fully integrated into domestic frameworks and policies. As a result, climate and environmental laws have grown consistently over the last two decades, as countries have come to understand that immediate action is needed to move away from the irreversible effects of climate change, and many more countries are entering the loop looking to develop new policies or strengthen their existing climate laws and policies. The numbers speak for themselves: as of 30 September 2018, there were 1,500 national laws and executive acts addressing aspects directly relevant to climate change, when at the time of the adoption of the Kyoto Protocol (in 1997), there were only about 70 such laws and policies around the world—a twenty-fold increase in 20 years. [4]

It goes without saying that different countries having different legislative cultures may approach climate policymaking in different ways. Some adopt legislation through parliaments or national assemblies, while others rely on executive orders implemented through sector-specific plans or strategies at the national or subnational level.[5] The policymaking process is also regulated by the existing institutional capacity and the mechanism of coordination across national and subnational levels of governance. In that respect, some countries adopt centralized policies directly enforced by the national government, while others advocate for a more devolved administration with significant actions/initiatives taking place at a subnational or state level.

[4] GRI, 2018: Policy Brief Global trends in climate change legislation and litigation: 2018 snapshot (based on Climate Change Laws of the World database)
[5] Alina Averchenkova, 2019: Legislating for a low carbon and climate resilient transition: learning from international experiences, Elcano Policy Paper

STRUCTURE OF THE MODULE

Module 0.2 is designed to help users (mainly government advisors) navigate the dynamically evolving national climate policy landscape and review instruments, plans, processes, and institutions (always relevant to the country-specific context). The module is structured in twosteps as described below:

Step 1 performs a Paris Agreement compatibility check of domestic climate change-related laws, policies, and instruments. (This might include general acts, national or subnational laws on climate change, as well as climate policies and sector-specific plans and instruments (e.g., water-management plans, flood plans, etc.) addressing climate change mitigation, adaptation, resilience, and/or disaster risk management aspects).

Step 2 reviews institutional capacity (i.e., national, regional, and subnational institutions/authorities that are responsible for developing/implementing climate change policies) and existing mechanisms for the coordination of implementation of climate initiatives.

Upon completion of Module 0.2, the users will have obtained a sense of:

- How (if at all) is the Paris Agreement reflected in domestic legislation?
- What is the level of complexity of the institutional framework on climate change?
- What are the main entities that are involved in the decision-making process on climate matters, and how do they interact with the (existing) PPP legislation framework?
- Which entities oversee the implementation of NAPs and NDCs? How do they interact with the other government and subnational planning entities?

01 REVIEW CLIMATE LEGISLATION

The screening process covers **four thematic areas** initiating with a high-level screening of the national climate laws (or executive acts) and gradually focusing on sector-wide policies (Figure 0.6). For each area, a list of sample questions is provided to act as a guide for a comprehensive climate change policy review.

01. CLIMATE LEGISLATION

- Has the country adopted national framework legislation on climate change?
- If not, is the country working on developing frameworks or a new climate law? When is it anticipated?
- Is there a sector-wide law (e.g., Energy Transition Law)?

02. NATIONAL TARGETS AND RELEVANCE TO NDC PLEDGES

- How does the level of the emission reduction targets specified in the national legislation compare to that included in the NDC? Is it the same, or is it less ambitious?
- Does the law/act include economy-wide, multi-year statutory targets?
- Does it specify a net zero emissions target?
- Does the law specify sector-wide targets (e.g., clean energy targets)?
- Does the law promote the development of green infrastructure?

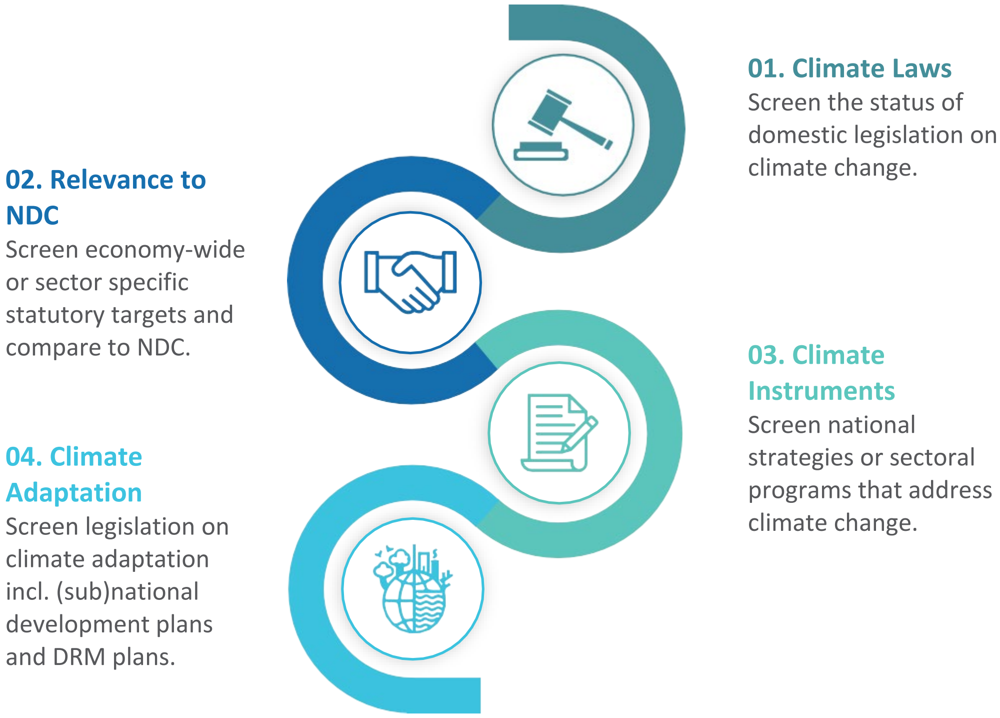


FIGURE 0.6 The four main thematic areas for screening the domestic climate laws and policies

03. CLIMATE POLICY PLANNING AND INSTRUMENTS

- What are the main implementation instruments that address policy areas related to climate change (e.g., National Program for Sustainable Energy)? What is their planning horizon? What is their specific purpose?
- Is there a national strategy on climate change?
- Are there low carbon development plans for specific sectors?
- Are there sectoral programs that address climate mitigation/adaptation?
- Are there specific policy instruments to promote compliance with (sub)sector-specific emission standards or acquisition of climate-related certificates (e.g., clean-energy certificate, or intelligent electrical networks, etc.)?
- How do subnational or state policies complement national climate policies (e.g., implementation of state-specific emission reduction targets)?

- Does the domestic PPP law make a special mention of climate-smart / sustainable infrastructure? Does it prescribe specific requirements? Is there a mention of climate-change risks?

04. CLIMATE ADAPTATION AND DISASTER MANAGEMENT

- Is climate adaptation incorporated into domestic climate legislation? How is this supported by subnational policies in areas of devolved competence?
- Is there in place a national disaster risk management policy? Does it prescribe actions to enhance resilience against climate-induced impacts?
- How do the current policy frameworks mainstream adaptation into existing planning processes?
- Is climate adaptation incorporated into development plans of specific sectors (e.g., water resources)?

Step Output

At this point, toolkit users should be aware of the climate legislation framework (general law and sector-wide laws if applicable) and how it is distilled into specific principles/action plans relevant to the country context. A summary of the key findings may be included in a table similar to the sample provided below:

Checklist	Name of Climate Law
Year passed / (year of decree)	
Emission reduction targets to 2030 (and 2050 if applicable)	
Emission peak	
Clean energy targets	
State-specific reduction targets	
Policy instruments (e.g., National Program for Sustainable Energy)	
Low carbon development plans for specific sectors	
Reference to PPP law (if existing)	

02 REVIEW INSTITUTIONAL CAPACITY

This step is intended for use by advisors of government officials. It turns the focus on assessing the institutional capacity and establishing a preliminary understanding of the key governance functions for executing climate-change policies. The questions listed below (clustered in three groups) are intended to guide users on how to delineate the vertical (across national and subnational levels of governance) and horizontal organizational structure (among ministries and sectors) and recognize the existing provisions for keeping the government accountable for the implementation of its climate targets.

The screening may be initially conducted as part of a desk study, and if deemed necessary, more detailed research may follow, including interviews and consultations with actively involved stakeholders covering all dimensions of climate policymaking.

SUPREME AUTHORITY

The climate law most probably establishes a supreme authority that defines the overall duties and powers of the government with respect to climate change policy, advises on the climate policies, and oversees the country's accountability with respect to international commitments. This may be an independent non-governmental public body (e.g., the Climate Change Commission established bythe UK's Climate Change Act of 2008 or the new Expert Committee for the Energy Transition established by the Energy Transition for Green Growth Law of 2015 in France) or a government-based entity (e.g., the Ministry of Environment), or even a synthetic instrument coordinating actions among existing national or subnational entities (e.g., the National System on Climate Change (SINACC) in Mexico, which includes the Inter-Ministerial Commission on Climate Change (CICC), the Consultative Council on Climate Change (C3), and the National Institute of Ecology and Climate Change (INECC)).

First Level Screening

- According to the climate law, which authority is responsible for advising on/overseeing the national climate change strategy? Is it an independent advisory body or a governmental body?
- Which institution is responsible for the implementation of a NAP process?
- Which institution oversees/ updates/ monitors the alignment of national policies to NDCs?
- What is the established institutional infrastructure that coordinates the implementation of climate objectives/plans/policies?
- Which ministries/entities/agencies/public bodies are responsible for the implementation of climate change mitigation targets? Is there a thematic focus?
- Which entities/agencies/public bodies are responsible for addressing climate adaptation?

DEVOLUTION OF CLIMATE CHANGE RESPONSIBILITIES

Countries differ in their approach of devolving authority and responsibilities for the development and implementation of national climate targets and policies to subnational levels. Traditionally, most countries adopt a top-down process for the implementation of policies (e.g., Germany, China, France) where the central government sets the national target that is then allocated downwards to provinces/states/subnational administration. There are cases, however, where the subnational or state initiatives on climate change become the major drivers of action, substituting for the lack of federal laws and policies (e.g., the case of the United States).[6]

Vertical Screening

- Is climate policy implemented at the national or subnational/state/provincial or city level?
- How are the activities across national and subnational levels of governance coordinated? Is there an entity to oversee accountability at the subnational level?
- Does the climate law/executive order mandate devolved administrations to develop their own laws/policies (e.g., the cases of Scotland and Wales in the UK)? Which are the most relevant (subnational policies), and how do they interact with the central climate change law?
- Have the states/municipalities committed to sector-specific provisions/targets (e.g., regional energy efficiency programs)?

HORIZONTAL ORGANIZATION

Horizontally coordination between agencies is yet another essential feature of any robust institutional framework. Setting smooth horizontal coordination requires proper allocation of responsibilities and the establishment of an uninterrupted communication channel among ministries. It also calls for the development of procedures and mechanisms to engage participation from independent advisory bodies and relevant stakeholders (within or outside the government structure).

Horizontal Screening

- What are the ministries that have already developed sectoral mitigation/adaptation programs or low carbon development plans?
- Which ministries are responsible for the implementation of sector-wide laws (e.g., energy transition laws)? Is it a responsibility of a single ministry, or are several ministries involved?
- What are the mechanisms in place to support coordination between governmental entities and other stakeholders? Does the regulatory framework promote the inception of multi-stakeholder forums to encourage an open exchange of views among all interested parties?

[6] Between 2005-2016, 17 states and territories joined the US Climate Alliance, a partnership of governors that decided not to align with the (at the time) federal decision to breach the Paris Agreement, and committed to reduce greenhouse gas emissions.

PHASE 0

M 0.2

National Governance Framework on Climate Change

Step 1
Review Climate Legislation

Step 2
Review Institutional Capacity

- Is there a body to provide independent advice to ministries? What is its composition? How is it involved in climate policy planning? Does it advise on climate adaptation matters as well?
- Is there an independent scientific body in place to promote research and development and build capacities in the scientific community? How is this body involved in decision planning?
- Is there an agency in place to assist the government in crafting PPP projects? If the answer is positive, how does this agency interact with other ministries or the supreme authority to promote climate change mitigation/adaptation/ resilience in PPP projects?

Step Output

The output of this step is a list of entities and relevant stakeholders actively involved in the climate planning/development/implementation process. Independent institutions that oversee/advise on the process should also be identified. Results may be presented in the form of a responsibility map or in asimpler table format as in the example below:

Institution/ Organization				
	Ministry of Energy	**Ministry of Agriculture**	**National Institute of Science**	**...**
Actor type	Government	...	...	
Policy document	Law on renewable energy (2016)	...	...	
Jurisdiction	National	...	...	
Role/responsibilities	Shaping the national energy strategy	...	...	
Contact person (if available)	...	...	...	

KEY TAKEAWAYS

- The national governance framework on climate change is evolving dynamically with the development of new or existing instruments, plans, processes, and implementing institutions or agencies.
- Screening the status of domestic climate-related laws in combination with the national alignment to the Paris Agreement or other climate- related international frameworks while focusing on sector-specific development plans will enable a wide understanding of the national climate- related policy environment.
- The key implementing authorities and the overall national institutional capacity on climate change developments can be assessed in a vertical way (across national and subnational levels of governance) and in a horizontal organizational structure (among ministries and sectors) in order to recognize the existing entities for keeping the government accountable for the implementation of its climate targets. Usually, a supreme authority oversees and advises on the national climate policies and their implementation.

PHASE 0

Resources

[NDC PARTNERSHIP – KNOWLEDGE PORTAL]

The knowledge portal provides quick and easy access to data, tools, guidance, good practice, and funding opportunities. Applicable resources for both reducing emissions and adapting to the impacts of climate change.

Developed by: NDC Partnership - Hosted by: World Resources Institute (WRI) and UN Climate Change

[CLIMATE ACTION TRACKER]

An independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aims. It also contains country-specific information on: pledges/targets; policy projections; and sector-specific goals/activities

Developed by: Climate Analytics and New Climate Institute

[CLIMATE WATCH]

An online platform designed to empower policymakers and other stakeholders with the open climate data, visualizations, and resources they need to gather insights on national and global progress on climate change. Users can analyze and compare NDCsunder the Paris Agreement, access historical emissions data, and discover howcountries can leverage their climate goals to achieve their sustainable development objectives

Developed by: World Resources Institute (WRI) - Powered by: Resource Watch

[RESOURCE WATCH]

A dynamic platform featuring hundreds of data sets covering different aspects of sustainability and climate change

Developed by: World Resources Institute (WRI)

[CLIMATE CHANGE LAWS OF THE WORLD]

An open database that contains climate and climate-related laws/policies promotinglow carbon transitions

Developed by: Grantham Research Institute on Climate Change and the Environmentand Sabin Center for Climate Change Law

NATIONAL FRAMEWORKS FOR CLIMATE SERVICES (NFCS)

Multi-stakeholder user interface platforms enabling the development and delivery of climate services at the country level focusing on five priority areas: agriculture and food security, disaster risk reduction, energy, health, and water. The NFCS platforms facilitate users to assess baselines on climate services capacities at the national level, to identify key stakeholders, map existing services and establish capacities

Developed by: Global Framework for Climate Services under the auspices of WMO

WORLD BANK NDC PLATFORM

A useful set of tools that include a detailed adaptation/mitigation database, a content visualization tool, and summary country briefs

Developed by: World Bank Group, 2016

NATIONAL ADAPTATION PLANS TECHNICAL GUIDELINES FOR THE NATIONAL ADAPTATION PLAN PROCESS

The technical guidelines have been developed by the LEG, with input and feedback from theGlobal Environment Facility and its agencies to support the NAP process

Developed by: UNFCCC, 2012

PHASE 1

1

PROJECT SELECTION

Pipeline and Project scope

Identify candidates and select project

Assess economically the project and screen it as PPP

2

PREPARATION

3

STRUCTURING CONSIDERATIONS

4

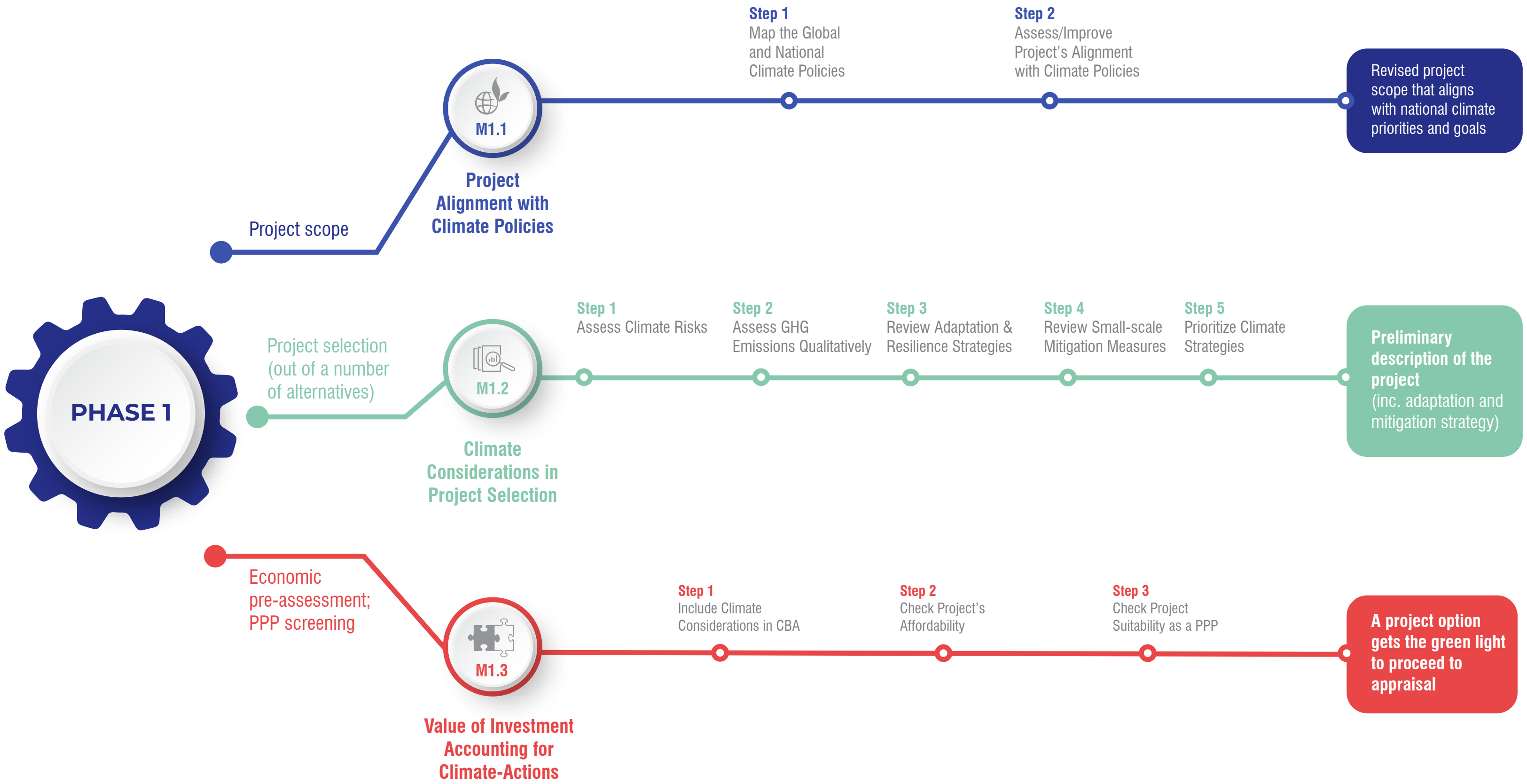
TENDER PROCESS

Phase 1

The first phase of the toolkit evolves along the first phase of the PPP cycle, namely the PPP screening and identification of a project. The goal of this phase is to create a viable pipeline of PPPs that advance climate change goals. This phase will focus on exploring options for climate mitigation and embedding climate resilience of investments.

Alongside this process, the toolkit intends to guide the preliminary assessment of the climate hazard environment and the evaluation of the overall climate-risk level of the project, to identify and appraise adaptation, resilience, and low carbon/mitigation solutions, and to guide public entities on whether the additional risks or opportunities prompted by climate change render PPPs or other forms for private participation less or more attractive as procurement methods. Identification of risks and appraisal of risk reduction methods early in the process will allow for better-informed decisions and proper risk allocation to avoid the possibility of having to revise the project scope at a later stage when commitments may have already been in place.

Early-stage assessments made at this phase are primarily based on qualitative data, while detailed quantitative re-evaluations will follow in subsequent phases as more data will become available.


PHASE 1
Project scope
M1.1
Project Alignment with Climate Policies
Step 1
Map the Global and National Climate Policies
Step 2
Assess/Improve Project's Alignment with Climate Policies
Revised project scope that aligns with national climate priorities and goals
Project selection (out of a number of alternatives)
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate Risks
Step 2
Assess GHG Emissions Qualitatively
Step 3
Review Adaptation & Resilience Strategies
Step 4
Review Small-scale Mitigation Measures
Step 5
Prioritize Climate Strategies
Preliminary description of the project
(inc. adaptation and mitigation strategy)
Economic pre-assessment; PPP screening
M1.3
Value of Investment Accounting for Climate-Actions
Step 1
Include Climate Considerations in CBA
Step 2
Check Project's Affordability
Step 3
Check Project Suitability as a PPP
A project option gets the green light to proceed to appraisal

Phase 1

Outline

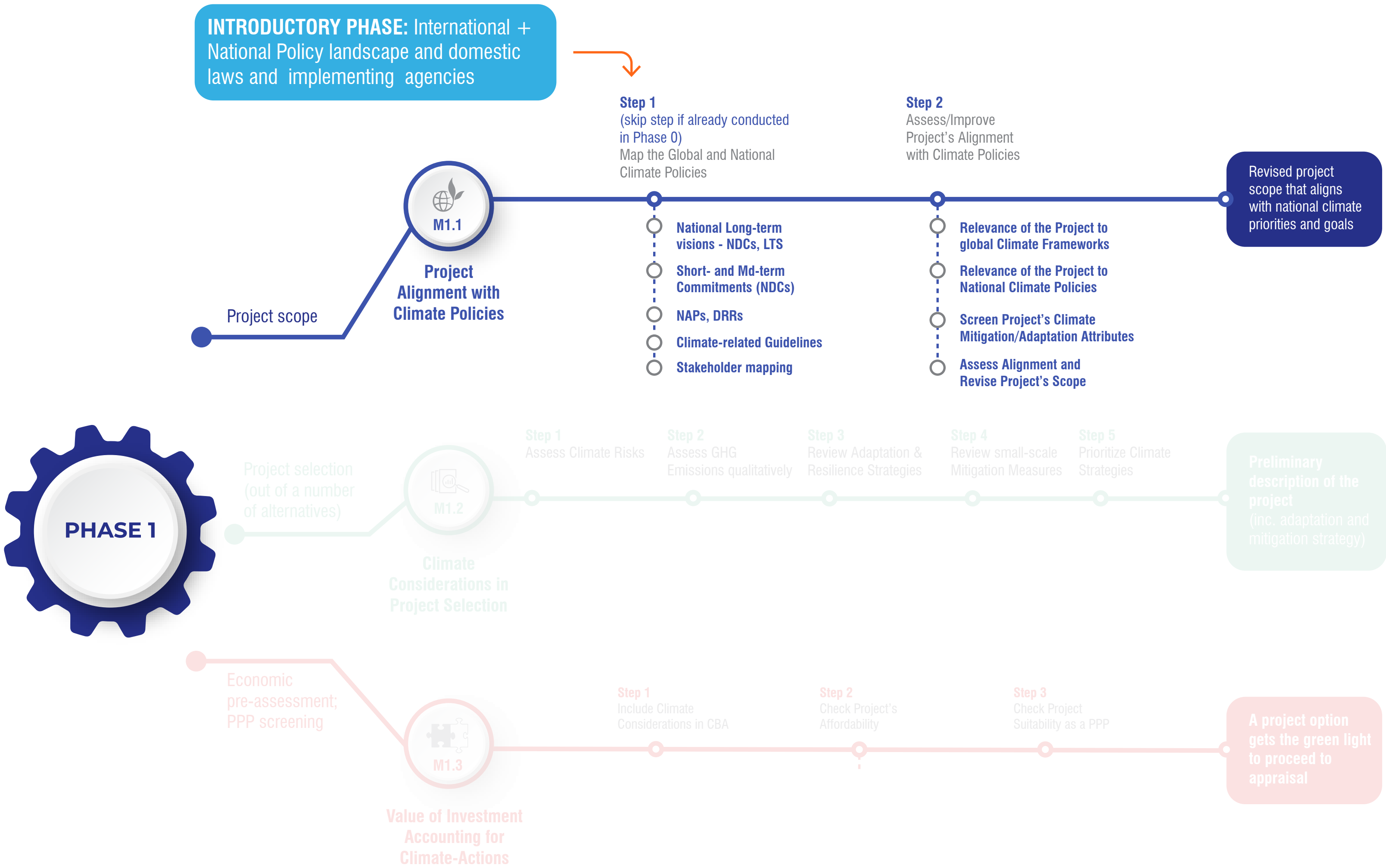
Phase 1 comprises three modules:

Module 1.1 – Project Alignment with Climate Policies aims to ensure compliance of the project scope with climate policies and goals, identify the relevant enabling environment, and propose climate considerations to be included in the project scope and description.

Module 1.2 – Climate-Change Risk Pre-assessment provides guidance on how to qualitatively assess climate-change-induced risks on the project and appraise adaptation/resilience and low carbon/mitigation measures.

Module 1.3 – Preliminary Value for Money (VfM) and PPP Suitability outlines processes to incorporate the previously identified risks and opportunities in the preliminary value for money assessment of project alternative options and examines the suitability of a PPP as a procurement method after the project has incorporated all climate-related costs and potential savings.

It is understood that various agencies (across countries or within the same country) may apply different processes in this upstream project selection phase. Hence, the guidance provided in the present document suggests good practices and provides reference tools that may vary in degree of sophistication while at the same time recommending minimum requirements to be used as inputs in the subsequent phases.



INTRODUCTORY PHASE: International + National Policy landscape and domestic laws and implementing agencies
PHASE 1
Project scope
M1.1
Project Alignment with Climate Policies
Step 1
(skip step if already conducted in Phase 0)
Map the Global and National Climate Policies
National Long-term visions - NDCs, LTS
Short- and Md-term Commitments (NDCs)
NAPs, DRRs
Climate-related Guidelines
Stakeholder mapping
Step 2
Assess/Improve Project's Alignment with Climate Policies
Relevance of the Project to global Climate Frameworks
Relevance of the Project to National Climate Policies
Screen Project's Climate Mitigation/Adaptation Attributes
Assess Alignment and Revise Project's Scope
Revised project scope that aligns with national climate priorities and goals
Project selection (out of a number of alternatives)
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate Risks
Step 2
Assess GHG Emissions qualitatively
Step 3
Review Adaptation & Resilience Strategies
Step 4
Review small-scale Mitigation Measures
Step 5
Prioritize Climate Strategies
Preliminary description of the project
(inc. adaptation and mitigation strategy)
Economic pre-assessment; PPP screening
M1.3
Value of Investment Accounting for Climate-Actions
Step 1
Include Climate Considerations in CBA
Step 2
Check Project's Affordability
Step 3
Check Project Suitability as a PPP
A project option gets the green light to proceed to appraisal

1.1 Project Alignment with Climate Policies

The scope of the first module is to ensure compliance of the project with climate policies and goals, identify the relevant enabling environment, and propose low carbon options contributing to climate-change mitigation to be included in the project.

Alignment of projects with such frameworks shall allow them to contribute towards meeting national and international goals to combat climate change and to provide access to funding and/or innovative financing instruments, including tapping into a growing market for green and sustainable finance. Fiscal instruments, such as fees, taxation, and subsidies, can also be tailored to encourage actions that reduce climate risk and discourage activities that are maladaptive. After completing this module, the initial project scope may need to be revised to comply with the climate policy priorities in terms of climate change mitigation and the PPP investment to be tagged as climate-smart (see Box 1.1).

STRUCTURE OF THE MODULE

The relevant processes included in this module follow two consecutive steps:

- **Step 1**[1] outlines the information that needs to be gathered to describe the country's climate-related national and international framework.
- **Step 2** examines the project scope vis-à-vis the mapped climate policies and the country's national development goals in order to identify potential weak links or gaps. Building on this, it evaluates whether the project scope is compliant and aligned with climate targets in the country's NDCs or whether a change of scope may be warranted.

[1] In case the process described in the introductory phase has been completed prior to entering Phase 1, its output will be adequate to inform the present step.

BOX 1.1 CLIMATE-SMART INVESTMENTS: 3 HIGH-LEVEL PRINCIPLES

At present, the definition of climate-smart has been used for a variety of economic sectors ranging from agriculture to infrastructure without a unique high-level definition. For the purposes of this toolkit, investment is to be defined as "climate-smart" if the policies and plans governing its identification, preparation, design, and assessment combine the following attributes:

1. Align with countries' adopted climate targets and policies (e.g., NAPs, NASs, NDCs)
2. Contribute to global **mitigation** goals (e.g., Paris Agreement) for reducing CO_2 emissions
3. Build in **resilience** to the risks of climate change projected during its lifetime
4. Adopt responses/principles to build in **adaptation** to climate change

Climate-smart PPP projects should aim to exhaust the possibility of including the above attributes (always in accord with applicable national and international goals and regulations) to the maximum extent and deliver infrastructure that is designed to better withstand and adapt to the impacts of climate change (including extreme climate events) while at the same time contributing to the combat against climate change.

01 MAP THE GLOBAL AND NATIONAL/SUBNATIONAL CLIMATE POLICIES

The "**Introductory Phase"** of the present toolkit provides a detailed description of the global climate policy landscape and its implementation into specific national policy documents. It also proposes a climate-policy navigation tool for tracking actors and national policies/processes in a clear and structured manner and identifying linkages, synergies, and complementarities among them.

The process of mapping the national and international climate policies has been described in detail in the Introductory phase. While such a mapping exercise is useful for all projects--regardless of procurement method, the current (first) step of the toolkit aims to *briefly outline the type of information* that needs to be available in order to proceed with the evaluation of the investment's alignment with national and international climate goals. If the entire mapping process described in the Introductory phase has been performed, toolkit users may proceed to the next step of the present module.

Otherwise, in order to initiate the project's alignment check, it is helpful to first map out the relationships between the global agendas and the national climate policies by identifying the country's development pathways that pre-existed or have emerged in response to the global

PHASE 1

M1.1

Project Alignment with Climate Policies

Step 1
Map the Global and National Climate Policies

Step 2
Assess Project's Alignment with Climate Policies

climate developments (Figure 1.1). In this process, it is essential to recognize that the degree of alignment is country-specific, ranging from informal to systematic, depending on its level of commitment, international collaborations, and country-specific context. In any case, this is a valuable starting point for integrating climate mitigation goals and adaptation processes into greenfield climate-smart investments as well as into pre-existing projects in the case of contract adjustments/renegotiations.

The mapping exercise is a desk study performed in collaboration with respective government stakeholders (e.g., line ministries, agencies, etc.) comprising the collection and review of relevant existing or developing national policies and strategic documents, including[2]:

- **National Development Visions** (NDVs) and **long-term strategies** that outline the overarching ambitions for country development processes and identify the role that different sectors need to play in reaching these goals. These may have been in place before the 2030 Agenda for Sustainable Development was established and may or may not include climate considerations.

- **National commitments to international agendas** that establish concrete targets for countries to achieve. These include national SDG targets, NDCs, and national commitments to the Sendai Framework targets.

- **National/subnational plans & strategies** that elaborate on how national commitments will be achieved. These include overarching development plans, as well as NAPs, NASs, and national disaster risk reduction strategies. Plans developed for specific sectors or by subnational authorities may also contain valuable guidance for targeted action and should therefore be reviewed.

- **Good practices** and **climate-related guides** that describe opportunities and entry points for integrating green attributes in projects. Such documents may include applications of green practices in the reference country or the neighboring ones as well as reference material at the international level. Climate-related guides are gaining momentum around the world and contain insightful knowledge that should be reviewed and applied in the project if possible

GENDER CONSIDERATIONS

At this stage, it is strongly recommended to look into potential interactions between climate change and gender at the country level. The analysis may reveal gender gaps in health, education, income, availability of infrastructure, and access to data and technology. In addition, inequalities may be applied by regulations and regional policies as well as discriminatory laws that disproportionately affect women/girls. Users are advised to consult the Gender Action Plan, agreed in COP25 which sets out objectives and activities under five priority areas that aim to advance knowledge and understanding of gender-responsive climate action.

This is also the time for users to identify whether a country specific climate-change Gender Action Plan (ccGAP) exists that aims to provide a methodology for training and building the capacity of women and women's organizations on the linkages between gender and climate change.

The global agenda on climate change and genderis rapidly growing and users are strongly encouraged to follow it and incorporate gender considerations during the present project selection phase of the process.

[2] IISD, 2019: Alignment to Advance Climate-resilient Development: Overview Brief 2, NAP Global Network

PHASE 1

M1.1

Project Alignment with Climate Policies

Step 1
Map the Global and National Climate Policies

Step 2
Assess Project's Alignment with Climate Policies

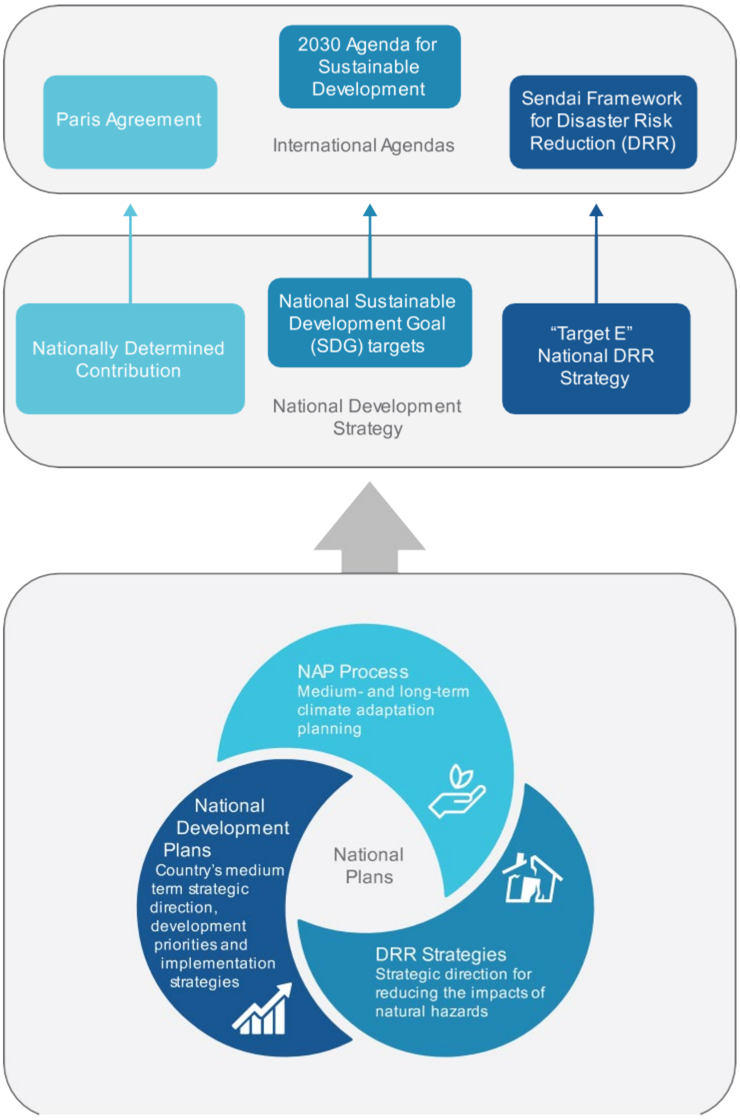


FIGURE 1.1 International agreements and national strategies/policies/plans that drive investments in climate-smart infrastructure

Step Output

Identification of global climate frameworks and their priorities

02 ASSESS PROJECT’S ALIGNMENT WITH CLIMATE POLICIES

This step involves the examination of the project scope vis-à-vis the country's national development goals and strategies with an emphasis on how the specific project objectives and the planned activities align with the Paris Agreement framework, that is:

- result in negative, zero, or very low carbon emissions and are consistent with a fully decarbonized economy that contributes to climate-change mitigation
- contribute to the transition towards a decarbonized economy[3] e.g., energy efficient construction, manufacturing of low-carbon technologies/materials
- contribute to increasing adaptation and resilience and reduce the cost of adaptation actions to long-term climate change effects
- build resilience against the impacts of natural hazards, which are increasing in frequency and intensity due to climate change
- promote the sustainable use and management of ecosystems
- adopt nature-based solutions to address climate-change mitigation goals
- tackle poverty, gender discrimination, and inequality while supporting the capacity of developing countries to promote equity and implement inclusive and people-centered infrastructure

SCREEN THE CLIMATE ATTRIBUTES OF THE PROJECT

The screening process proposed herein comprises a **set of four key questions** to consider that aim to evaluate the alignment of the intended project (or projects pipeline) to the overarching goals of international agreements, national climate targets/priorities, and the broader national strategies and action plans. Based on the evaluation results, actions for possible improvement may be possible. It is noted that the proposed questionnaire-based screening may be further enhanced to employ more detailed research depending on the degree of analysis required by the state authorities at this stage.

[3] avoiding locking in carbon-intensive assets undermining the long-term decarbonization goal

Q1 DOES THE PROJECT'S SCOPE ALIGN WITH THE FRAMEWORK OF THE SUSTAINABLE DEVELOPMENT GOALS AND THE PARIS AGREEMENT?

The project-specific strategic and climate-related goals and objectives need to be clearly defined and benchmarked against the country's national climate strategy (including its compliance with international climate frameworks) and specific climate mitigation and climate adaptation and resilience objectives.

Climate mitigation objectives promote activities that encompass the following characteristics: serve long-term decarbonization targets; support emerging technologies with significant climate mitigation potential; meet global high-performance standards or high-efficiency benchmarks or significantly exceed national/regional/sectoral energy-performance standards. These may include implementing energy-efficiency measures, developing carbon-capture and renewable energy projects, supporting sustainable mobility projects/technologies, protecting biodiversity, promoting green and sustainable construction methods and materials, and nature-based solutions, etc.

Climate adaptation and resilience objectives promote projects designed to withstand today's climate (and related hazards) while enhancing the resilience and adaptation capacity to better cope with the as-yet-unknown adverse effects of climate change, including extreme weather and chronic (slow onset) events. They also recognize the role of sustainable development in reducing the risk of loss and damage and in combating climate change.

Solely promoting climate-resilient development pathways without considering the main national development goals and priorities might waste crucial resources or lead decision-makers away from addressing basic needs and primary targets that safeguard lives, prosperity, and overall social development. For example, a resource-demanding green solution should be tested against a conventional solution that delivers

GENDER CONSIDERATIONS

The climate toolkit should identify projects and project attributes that tackle gender inequalities and help minimize discrimination between men/boys and women/girls. For example, a country may have high levels of gender inequality and experience regular flooding (which reinforces gender inequality by causing disruptions that are relatively more harmful for women/girls). In such a situation, how can climate-resilient and adaptive infrastructure be made more gender responsive?

Users are advised to consider whether gendered risks and opportunities can be mainstreamed in the three high-level principles of climate-smart infrastructure: mitigation, resilience, and adaptation. The goal would be to address gender gaps by minimizing risks to women and other vulnerable groups and increase opportunities for their inclusion in climate-smart projects.

Among others, the Gender Tagging Tool (created by the WBG's Gender Group in 2018) can be used to identify project attributes that are likely to reduce gender gaps in a particular country's context.

electricity to more people. It is, therefore, essential to ensure that principal goals or emerging targets are not overlooked during project selection, as the harm of neglecting such priorities may outweigh the benefit of prioritizing climate considerations. The project's alignment and compliance with climate-change frameworks may also unlock green financing and funding sources (Insight 1.1).

A detailed screening of the project's role towards climate mitigation and adaptation follows in the following sections.

Q2 DOES THE PROJECT'S SCOPE ALIGN WITH THE NATIONAL AGENDA ON CLIMATE CHANGE (NDCs, NAPs CLIMATE LAWS)?

For a project to be considered aligned with the country's low-carbon, climate-resilient development pathways, the following conditions should be met:

- The project's sector is among the priority sectors described in the national climate policies (i.e., NDCs and/or NAPs, etc.).
- The project complies with the sector-specific criteria and provisions on climate change and sustainable development.
- The project invests in the infrastructure sector(s) where collaborative action has been agreed through the country's bilateral, multilateral, or international partnerships (e.g., Africa-EU Energy Partnership) if such partnerships or collaborations are in place for the reference country.
- The project's sector is not highlighted as "vulnerable to climate change," or in case it is, the project explicitly addresses the relevant climate-change risks. For example, a hydropower project that meets climate-change mitigation criteria may be considered incompatible with the country's resilient development pathway if it does not adequately contribute to long-term energy security (e.g., lack of risk reduction measures). An example of an NDC prioritized sector is briefly described in Box 1.2.

BOX 1.2 EXAMPLE OF A PRIORITIZED SECTOR IN NDC

According to the latest submission of Kenya's NDC (2020), investing in the energy sector, particularly in renewable energy, is considered a national priority underpinning the country's vision for "increasing renewables in the electricity generation mix of the national grid." This also aligns with the strategic energy-related goals agreed among the Africa-EU Energy Partnership for promoting sustainable energy investments in the region. Moreover, energy sector- specific provisions in the NDC promote the use of advanced design methodologies and risk management policies for climate-proofing the greenfield energy investment against the uncertain impacts of climate change.

Source: Republic of Kenya - Ministry of Environment and Forestry, 2020 Submission of Kenya's Updated Nationally Determined Contribution

Q3 DOES THE PROJECT INCORPORATE MITIGATION FEATURES THAT CONTRIBUTE TO THE TRANSITION TOWARDS A NET-ZERO FUTURE?

The project should be analyzed through the lens of decarbonization and climate change mitigation by evaluating its lifecycle carbon footprint with respect to the GHG reduction goals as outlined in the country's sector-specific plans on climate mitigation. Relevant climate mitigation tracking methodologies may be used, e.g., Joint MDB Methodology,[4] Climate Bond Taxonomy - CBI, recommendations of the Task Force on Climate-related Financial Disclosures, Green Bond Principles, EU Taxonomy, etc. (see Insight 1.2). The screening process should at least:

- Identify eligible sectors/activities/processes
- Calculate GHG emissions of the proposed solutions (for example, gCO2 e/unit of production) and identify the key elements that contribute to these emissions
- Identify entry points where GHG reduction measures/mitigation options could be incorporated. For example, the use of solar power for infrastructure lighting or implementation of carbon capture and storage technology in a large CO2 point source infrastructure (such as a cement factory or a biomass power plant)
- Consider introducing nature-based solutions that protect biodiversity and reduce GHG emissions. Consider entry points for blue-green Infrastructure,[5] sustainable alternatives, and good practices such as replacement of high embedded-emissions[6] materials with eco-friendly materials, coastal mangrove protection, green roofs, rammed earth, reclaimed wood, etc.
- Consider the broader chain in which the project is dependent or interconnected: for example, an electric bus project also needs to take into account charging stations and the origin of the electricity provided
- Identify entry points for engaging with circular economy approaches, such as the use of construction techniques that reuse/recycle/repurpose end-of-life materials and infrastructure components to promote efficient material utilization

Q4 DOES THE PROJECT INCORPORATE A SPECIFIC STRATEGY FOR ADAPTING TO CLIMATE CHANGE?

The importance of climate adaptation is emphasized within the text of the Paris Agreement itself, which includes a call for all countries to engage in National Adaptation Planning to identify, address, and review their evolving adaptation needs through a country-driven, participatory

[4] Joint Report on Multilateral Development Banks' Climate Finance, 2020

[5] Blue-green Infrastructure refers to the combination of water elements (e.g., channels, ponds, canals) with natural green elements (e.g., vegetation) in a common network attempting to deliver a wide range of ecosystem services

[6] Embedded emissions of a product refer to all the GHGs that have been produced in the process of bringing the product to market

approach taking into consideration vulnerable groups, communities, and ecosystems. Project alignment to the NAP should therefore screen components/elements/approaches that:

- Reduce the project's exposure/vulnerability to the impacts of climate change
- Take into consideration the effects of a changing climate in the planning/design of the infrastructure
- Enhance climate resilience or build adaptation capacity
- Embed climate resilience in design, construction, and operations
- Promote/facilitate the integration of programs/activities/strategies that support adaptive management in a changing climate through integrated observation/monitoring and decision support tools
- Incorporate disaster risk reduction technologies/systems/plans and decision making under deep uncertainty (DMDU)[7]
- Enhance the climate adaption/resilience within the broader ecosystem
- Protect women and vulnerable populations from the impacts of climate change and mainstream gender concerns in their programs and activities
- Protect or do not threaten biodiversity and the natural environment
- Incorporate nature-based solutions

[7] DMDU is elaborated in Phase 2.

How to perform the project's alignment screening?

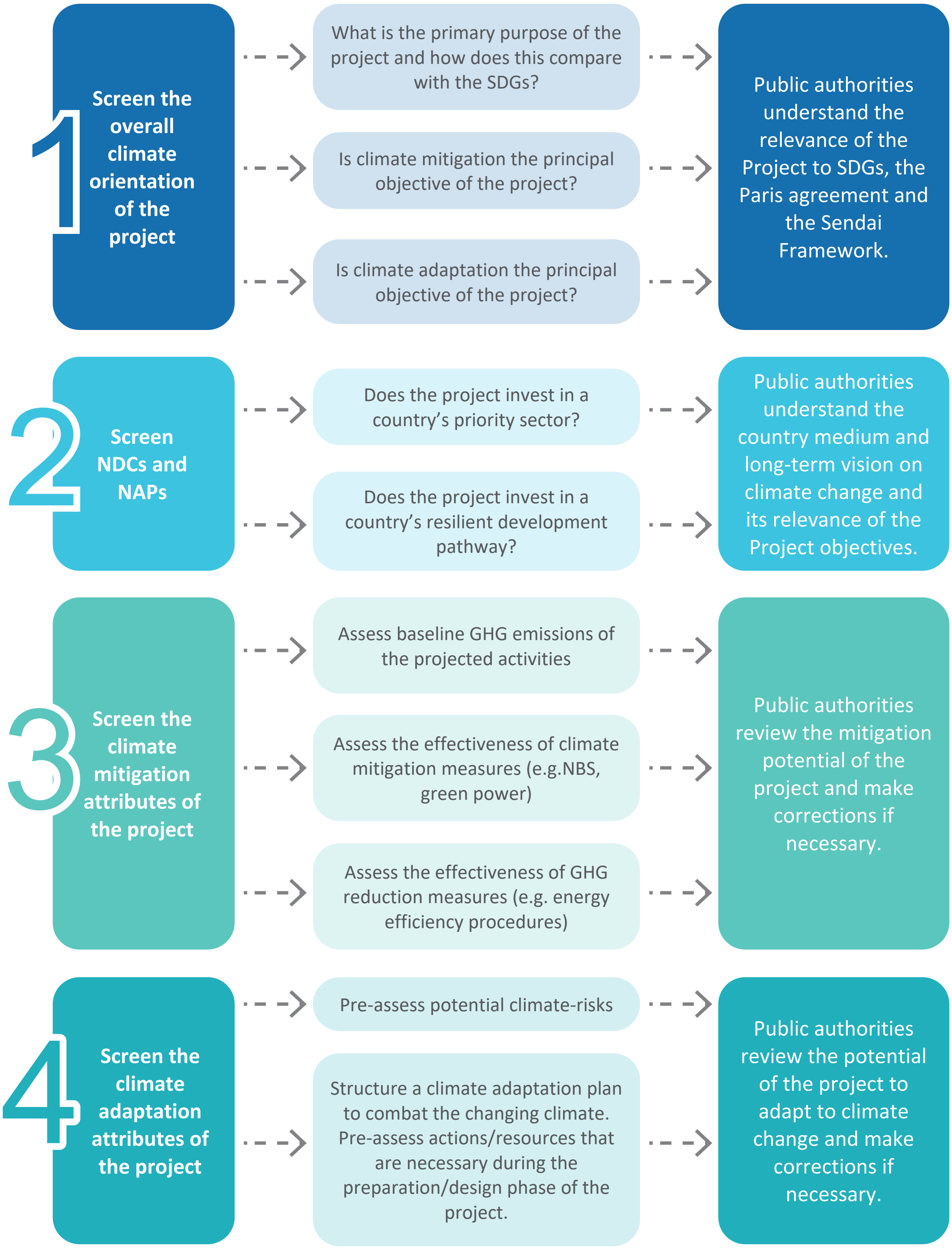


FIGURE 1.2 Indicative instructions on performing the project's alignment with international and national framework screening

PHASE 1

M1.1

Project Alignment with Climate Policies

Step 1
Map the Global and National Climate Policies

Step 2
Assess Project's Alignment with Climate Policies

DECIDE ON PROJECT'S ALIGNMENT AND REVISE SCOPE

In order to evaluate the project's alignment[8] with the Paris Agreement and NDCs, the project should be assessed as to its ability to address the climate policy-related criteria presented above efficiently. At a high level, this may be materialized by answering the questions listed in the previous section. Depending on the answers, it will be possible to derive a conclusion as per the level of its alignment. Sector-specific guidance on how to perform the alignment assessment is provided in the respective sector-specific toolkits.

This is a fundamental exercise—to be performed as early as possible in the process of project selection—that will provide the necessary data to decision-makers to understand how the project responds to the country's climate-resilient development pathway. A decision may then be made on whether it is necessary to revise the project's scope or if it is possible to enhance its scope and design in order to ensure that it properly and adequately accounts for the desired climate-change considerations. After the integration of such actions in the planning process by the structuring team, the project's alignment may be reassessed and revised again until the desired alignment level is reached. It is noted that the alignment exercise may need to be repeated once more data regarding the climate actions on the project will become available.

Step Output

A decision on the level of alignment for the project (or project options, if available) and an action plan to improvealignment if possible.

[8] In the Climate Change Action Plan 2021-25, the WBG committed to aligning all new operations to the goals of the Paris Agreement and preparing rigorous methodologies to assess alignment. To ensure that there is no confusion, it is noted that on projects where the WBG, or other MDBs, are involved and provide financing,all bank-specific climate change assessment frameworks and other policies would still apply in their entirety and the MDB would execute its due diligence.

KEY TAKEAWAYS

- Climate policies apply at global, national, subnational and/or regional leveland include goals and targets the project fits with. Inventory of the overall climate policy landscape should therefore be performed while focus should be given on the project's type- and sector-specific provisions.

- The climate policy mapping should be accompanied by the identification ofthe associated stakeholders responsible for the implementation of these climate policies.

- Climate-related specifications, GHG mitigation methodologies, and adaptation measures as described in climate policies and guidelines should be linked with the project.

- The key elements identified in the climate policy inventory should be incorporated in the project's scope as well as its climate mitigation, adaptation and resilience objectives.

- The project should exhaust all options to increase its alignment with international and national climate policies and guidelines in order to benefit to the greatest extent possible not only by contributing to reaching climate-related goals but also because this may unlock access to additional liquidity pools.

INSIGHTS

Insight #1.1

Unlocking Finance Mechanisms for Climate-Smart Investments

Insight #1.2

Green Taxonomies

INSIGHT #1.1

Unlocking Finance Mechanisms
for Climate-Smart Investments

In response to the global need for financing of climate-smart investments, several innovative mechanisms and instruments have emerged ready to provide the necessary financing to projects that are aligned with climate adaptation policies and support the achievement of mitigation goals and alignwith the SDGs.

1/ *International Funds under the UNFCCC*

To facilitate the alignment of infrastructure activities and investments with the global climate agenda, the UNFCCC established a financial mechanism to provide funds to developing and LDCs. The operation of the mechanism is entrusted to the Global Environment Facility (GEF). At COP16, UNFCCC parties established the Green Climate Fund (GCF) as an additional Financial Mechanism for climate change. In addition, parties have established special funds that aim to support projects that align with the global climate agenda and current framework: Special Climate Change Fund (SCCF), Least Developed Countries Fund (LDCF), Adaptation Fund (AF).

2/ *National Funds*

National climate change funds have been established to create a financial vehicle through which climate-related finance (domestic and/or international) can be channeled, programmed, disbursed, and monitored. Examples include the Indonesia Climate Change Trust Fund and the Mali Climate Fund. The Philippines' People's Survival Fund is also an example of a fund financed on an annual basis solely through domestic sources.

3/ *Bilateral and Multilateral Funding*

The Paris Agreement states that the developed country parties may also provide financial resources to developing nations and LDCs for the financing of activities and infrastructure related to the implementation of the UNFCCC framework through bilateral, regional, and other multilateral channels. A number of MDBs provide financing as well as professional advice to enhance sustainable development that aligns with global targets to combat climate change.

4/ *Other Green Financing Opportunities*

Projects aligned with the global climate frameworks and the SDGs may be funded by other available financing instruments such as green and sustainable loans and green bonds. According to the International Capital Markets Association (ICMA), green bonds are any type of bond instrument (debt security) where the proceeds will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible green projects, or support climate-related or environmental projects. In 2014, a group of banks initiated the development of the Green Bond Principles (GBP), a set of voluntary guidelines framing the issuance of green bonds under the targets of the Paris Agreement. The Green Bond Principles have become the leading framework globally for the issuance of green, social, and sustainability bonds.

Green projects that contribute to climate-change mitigation may also benefit from the issuance of carbon credits (or carbon offsets). Under the Clean Development Mechanism (CDM) carbon offset scheme that was defined by the Kyoto Protocol, developed countries are allowed to fund GHG emissions-reducing projects in developing countries and LDCs and claim the saved emissions as part of their effort to comply with their obligations to meet climate-change mitigation targets. The mechanism essentially constitutes another way to fund climate-change mitigation projects in low-income countries and comprises another reason for a project to align with the global climate agenda.

INSIGHT #1.2

Green Taxonomies

The need for standards

What is needed is a clearly defined, transparent, and structured green taxonomy broadly accepted to support informed decision-making and contribute towards investment opportunities that aim to achieve national environmental/climate-change mitigation and adaptation objectives.

What is a taxonomy?

According to the ICMA, a green taxonomy is a classification system for identifying activities or investments that will move a country toward meeting specific targets related to priority environmental objectives. In that respect, definitions for "climate-aligned", "green" or "sustainable" assets are key for safeguarding the market from the risk of "greenwashing", supporting governments in targeting their actions against climate change and enabling financial market players to know which investments to focus on if they are to get onto the sustainable finance playing field.
The main actors/users of the taxonomy are, therefore, governments that aim to prioritize climate-change mitigation and green development activities, financial institutions that target investments in sustainable projects, financial regulators, and investors. The overall aim of a taxonomy would be to:

- provide a uniform and harmonized classification system for low-emission activities and low-carbon assets
- set GHG emissions reduction criteria for meeting climate-mitigation goals
- ensure that investors remain engaged with sustainable investments and green financing
- provide the basis for further policy action
- provide a framework for reporting on climate mitigation and resilience

---

Sources:
Joint Group of Multilateral Development Banks, 2019: Joint Report on Multilateral Development Banks' Climate Finance - 2019
CBI, 2021: Climate Bonds Taxonomy
CBI, 2019: Growing green bond markets: The development of taxonomies to identify green assets
EU TEG on Sustainable Finance, 2020: Taxonomy: Final report of the Technical Expert Group on Sustainable Finance
World Bank Group, 2020: Developing a National Green Taxonomy - A World Bank Guide

Green Taxonomy Examples

INSIGHT #1.2

Joint Report on Multilateral Development Banks’ Climate Finance (2019)

The Joint MDB Methodology for Climate Mitigation FinanceTracking comprises definitions, regulations, and a list of eligible activities that facilitate consistency in accounting and reporting of climate activities. The eligible activities, as identified by the MDB methodology, should: (i) result in negative, zero, or very low carbon emissions and be consistent with a fully decarbonized economy; (ii) contribute to the transition towards a decarbonized economy; (iii) contribute to enabling very-low-carbon performance or a substantial reduction of GHG emissions in other activities. The list of eligible activities is regularly renewed aiming to ensure that technology developments and innovative low-carbon solutions are taken into consideration.

The CBI Taxonomy

The Climate Bonds Initiative (CBI) is an international organization aiming to mobilize the largest green bond market capital towards the development of climate change solutions. The CBI has developed a strong green taxonomy system, namely the Climate Bonds Taxonomy, that is a guide to climate-aligned assets and projects. It is a tool for issuers, investors, governments, and municipalities to help them identify and prioritize key investments that will deliver a low carbon economy. Criteria have been developed for the following key infrastructure sectors identified within the CBI taxonomy: energy; transport; water; buildings; land use & marine resources; industry, waste & pollution control; ICT.

The EU Taxonomy for Sustainable Finance

The EU Taxonomy is a tool to help governments, investors, companies, bond issuers, and financiers lead the transition to a low-carbon, resilient and resource-efficient economy. The taxonomy sets performance criteria (referred to as "technical screening criteria") to six environmental objectives for environmentally sustainable economic activities: climate change mitigation; climate change adaptation, sustainable use and protection of water and marine resources; transition to a circular economy, waste prevention, and recycling; pollution prevention and control; and protection of healthy ecosystems. Eligible projects contribute substantially to one of the above six activities; do no significant harm to the five others; and meet minimum safeguards.

INSIGHT #1.2

THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

The TCFD was created in 2015 by the Basel-based Financial Stability Board (FSB) whose role, since its establishment in 2009 after the global financial crisis, is to promote international financial stability. The TCFD's focus is reporting on the impact an organization has on the global climate.

The overarching goal of the TCFD is "to help identify climate related information required by investors, lenders, and insurance underwriters to appropriately assess and price climate-related risks and opportunities aiming to provide a universally adoptable framework on company financial disclosures concerning climate change". In this context, the task team has developed recommendations on how to monitor climate actions, which is a key element of assessing a project's contribution to negative, zero, or very low GHG emissions.

The recommendations of the TCFD were published in 2017 along with additional supporting material to assist entities with the implementation of climate-related financial disclosure. In general, recommendations and guidance of the TCFD is provided around four key thematic areas that represent major organization operation elements:

GOVERNANCE
Disclose the organization's governance around climate-related risks and opportunities

STRATEGY
Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material

RISK MANAGEMENT
Disclose how the organization identifies, assesses, and manages climate-related risks

METRICS & TARGETS
Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material

Source: TCFD, 2017: Recommendations of the Task Force on Climate-Related Financial Disclosures

MODULE 1.1 Resources

NDC REGISTRY (INTERIM)

A UNFCCC public registry where all communicated NDCs are registered and available

Developed by: UNFCCC

UNFCCC NAP CENTRAL

A platform for the management of NAPs submitted by developing countries

Developed by: UNFCCC

APEX: AN INVESTMENT PLANNING APP FOR CITIES

A tool to assist identification of investments suitable for green financing and climate-resilient long-term planning

Developed by: IFC

NATURAL CLIMATE SOLUTIONS (NCS) WORLD ATLAS

This online tool demonstrates opportunities for countries around the world to view how natural climate solutions, alongside emission reduction strategies, can help them reduce their net GHG emissions. NCS are effectively a subset of nature-based solutions geared toward climate change mitigation

Developed by: Nature4Climate

FUND — CLIMATE FRAMEWORK FOR UNCERTAINTY, NEGOTIATION, AND DISTRIBUTION, VERSION 3.9, 2014

A tool to perform cost-benefit and cost-effectiveness analyses of GHG emission reduction policies, to study equity of climate change and climate policy, and to support game-theoretic investigations into international environmental agreements

Developed by: Anthoff D, Tol RSJ, 2014

JICA CLIMATE FINANCE IMPACT TOOL: CLIMATE FIT (MITIGATION), JAPAN INTERNATIONAL COOPERATION AGENCY (DRAFT VER. 3.0)

Guidelines for methodologies to quantitatively evaluate carbon sequestration and reduction in GHG emissions for different sectors

Developed by: Japan International Cooperation Agency, 2019

GREENHOUSE GAS PROTOCOL

GHG Protocol establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains, and mitigation actions. GHG Protocol includes multiple calculation tools

Developed by: WRI & WBCSD

NATIONAL ADAPTATION PLANS: TECHNICAL GUIDELINES FOR THE NATIONAL ADAPTATION PLAN PROCESS

Technical guidance and support to the NAP process

Developed by: UNFCCC - LDC Expert Group, 2012

NAP ALIGN: RECOMMENDATIONS FOR ALIGNING NATIONAL ADAPTATION PLAN PROCESSES WITH DEVELOPMENT AND BUDGET PLANNING

An analysis tool to help countries align their NAP with their overall national development goals

Developed by: GIZ, 2014

ENGAGING THE PRIVATE SECTOR IN NATIONAL ADAPTATION PLANNING PROCESSES

This study aims to offer guidance to governments and their partners on how to engage the private sector in the NAP process

Developed by: BAP Global Network, GIZ, 2019

PATHWAY FOR INCREASING NATURE-BASED SOLUTIONS IN NDCS

A seven-step approach for governments to identify potential NBS with the aim of enhancing their climate mitigation and adaptation action in a cost-effective manner and with multiple co-benefits

Developed by: United Nations Development Program (UNDP), 2019

ACCELERATING CLIMATE AMBITION AND IMPACT: TOOLKIT FOR MAINSTREAMING NATURE BASED SOLUTIONS INTO NATIONALLY DETERMINED CONTRIBUTIONS

This toolkit offers key information, methodologies, and guidance for national authorities related to climate change, environmental management, forests, other land-use sectors, as well as other sectors related to the NDCs. This toolkit also provides information relevant for sub-national governments seeking to align theircommitments and actions with the NDCs

Developed by: United Nations Environment Program, 2019

CBI TAXONOMY

A guide to climate-aligned assets and projects for a low carbon economy addressed to issuers, investors, governments, and municipalities

Developed by: Climate Bonds Initiative, 2021

GROWING GREEN BOND MARKETS: THE DEVELOPMENT OF TAXONOMIES TO IDENTIFY GREEN ASSETS

Green bond guidelines in selecting and reporting on eligible green and sustainable projects. The briefing explores the role of such guidelines in steering capital towards investments in climate-aligned assets

Developed by: Climate Bonds Initiative, 2019

EU TAXONOMY: FINAL REPORT OF THE TECHNICAL EXPERT GROUP ON SUSTAINABLE FINANCE

The EU Taxonomy is a tool to help investors, companies, issuers, and project promoters navigate the transition to a low-carbon, resilient, and resource-efficient economy by setting technical screening criteria for sustainable economic activities

Developed by: TEG, 2020

DEVELOPING A NATIONAL GREEN TAXONOMY - A WORLD BANK GUIDE

The guide recommends the principles and methodology for developing a well-defined and structured taxonomy of environmentally sustainable activities. It addresses the need among financial market participants for clarity and transparency in what is understood and what qualifies as green

Developed by: World Bank Group, 2020

CLIMATE-RESILIENT INFRASTRUCTURE: GETTING THE POLICIES RIGHT - OECD ENVIRONMENT WORKING PAPERS NO. 121

This paper provides a framework for action aimed at national policymakers in Organization for Economic Co-operation and Development (OECD) countries to help them ensure new and existing infrastructure is resilient to climate change. It examines national governments' actions in OECD countries and provides recent insights from professional and industry associations, development banks, and other financial institutions on how to make infrastructure more resilient to climate change

Developed by: OECD, 2017

ADAPTATION PRINCIPLES: A GUIDE FOR DESIGNING STRATEGIES FOR CLIMATE CHANGE ADAPTATION AND RESILIENCE

The report lays out six universal Principles of Adaptation and Resilience

Developed by: World Bank Group, 2020

IMPROVING CLIMATE RESILIENCE IN PUBLIC PRIVATE PARTNERSHIPS IN JAMAICA

The tool identifies several instruments and tools already used to address climate change issues in the context of Jamaica's infrastructure production

Developed by: Frisari, G.L., Mills, A., Silva, Z. M. C., Donadi, E., Ham, M.S.C., Pohl, I., Climate Change Division – IADB, 2020

Module 1.1 - Further Reading

NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

The NDCs at a glance on the UN Climate Change website

Developed by: United Nations Climate Change

2020 EDITION POCKET GUIDE TO NDCS UNDER THE UNFCCC

A guide to understanding the framework of NDCs under the UNFCCC through a set of answers to key questions

Developed by: ECBI, 2020

NATIONAL ADAPTATION PLANS (NAPS)

The NAPs at a glance on the UN Climate Change website

Developed by: United Nations Climate Change

THE NATIONAL ADAPTATION PLAN PROCESS: A BRIEF OVERVIEW

A brief overview of the NAP process

Developed by: UNFCCC - LDC Expert Group, 2012

THE ROLE OF THE NAP PROCESS IN TRANSLATING NDC ADAPTATION GOALS INTO ACTION: LINKINGNAP PROCESSES AND NDCS

A study that aims to enhance the understanding of NDCs and how they can be linked to the NAP process for implementing adaptation goals

Developed by: GIZ, 2017

2019 JOINT REPORT ON MULTILATERAL DEVELOPMENT BANKS' CLIMATE FINANCE

Collaborative effort to make MDB climate finance figures in developing countries and emerging economies public on an annual basis

Developed by: African Development Bank; Asian Development Bank; Asian Infrastructure Investment Bank; European Bank for Reconstruction and Development; European Investment Bank; Inter American Development Bank; Islamic Development Bank; World Bank, 2019

CLIMATE-RESILIENT INFRASTRUCTURE: POLICY PERSPECTIVES, OECD ENVIRONMENT POLICY PAPER No 14

The report highlights emerging good practices and remaining challenges across OECD and G20 countries. It provides non-prescriptive guidance to countries as they seek to enhance resilience in line with their national circumstances and priorities

Developed by: OECD, 2018

THE WORLD BANK GROUP ACTION PLAN ON CLIMATE CHANGE ADAPTATION AND RESILIENCE:MANAGING RISKS FOR A MORE RESILIENT FUTURE

The action plan lays out the WB's strategy to boost efforts on adaptation and resilience

Developed by: World Bank Group, 2019

ACTION PLAN: FINANCING SUSTAINABLE GROWTH

The action plan proposes a unified classification system for sustainable activities and creates standards and labels for green financial products

Developed by: European Commission, 2018

ADAPT NOW: A GLOBAL CALL FOR LEADERSHIP ON CLIMATE RESILIENCE

The report focuses on making a case for climate adaptation, designed to inspire action among decision-makers

Developed by: Global Commission on Adaptation, 2019

LIFELINES: THE RESILIENT INFRASTRUCTURE OPPORTUNITY

The report lays out a framework for understanding infrastructure resilience and makes an economic case for building more resilient infrastructure

Developed by: World Bank Group, 2019

INFRASTRUCTURE UNDERPINNING SUSTAINABLE DEVELOPMENT

The report presents and explains the ability for infrastructure to influence all 17 SDGs

Developed by: UNOPS, 2018

EMERGING TRENDS IN MAINSTREAMING CLIMATE RESILIENCE IN LARGE SCALE, MULTI-SECTOR INFRASTRUCTURE PPPS

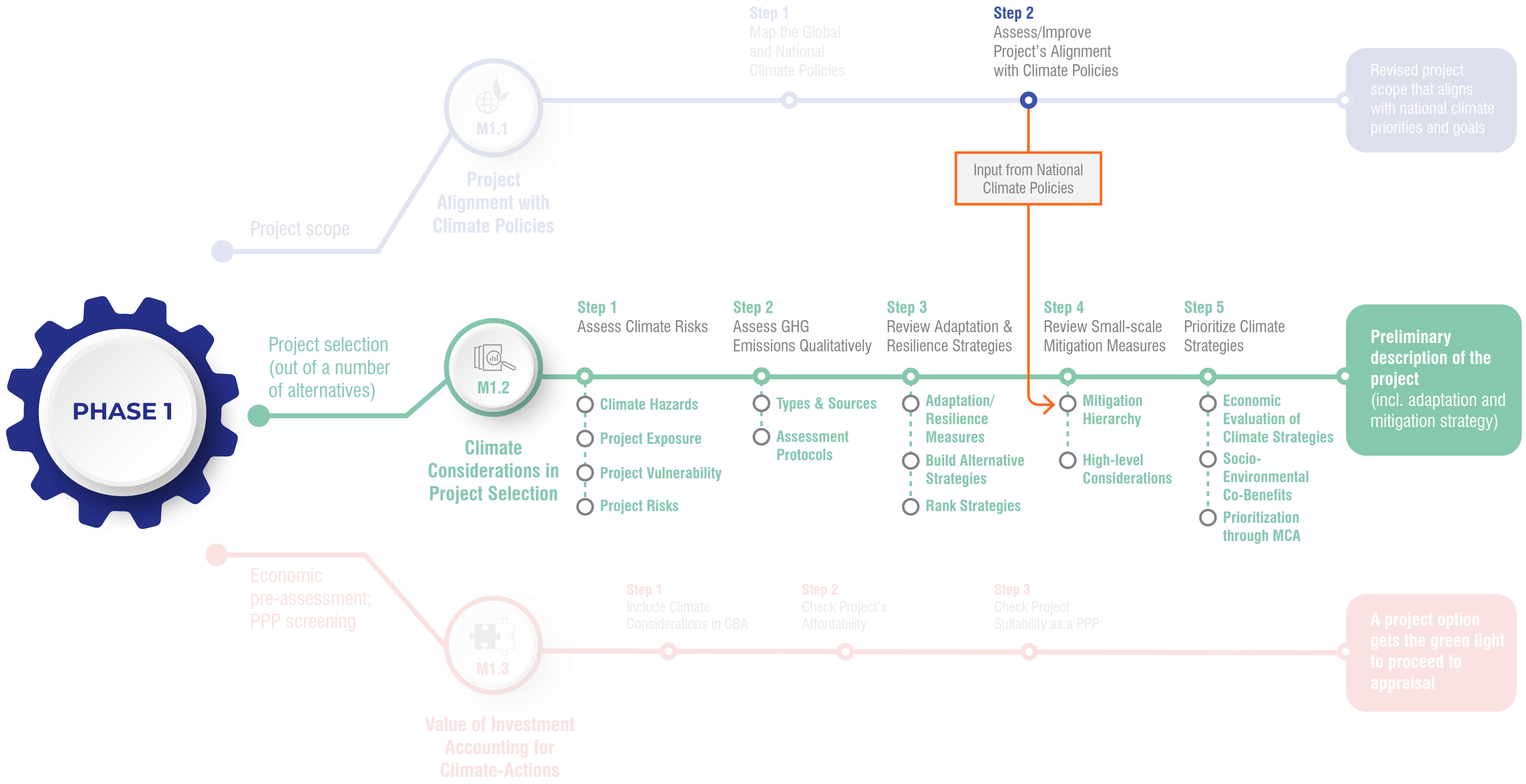
This report is produced as part of the initiative to develop global knowledge that provides practical information on how to mainstream climate resilience into PPP frameworks in the context of multisector investment planning and implementation in developing countries

Developed by: WB Group, PPIAF, 2016

PPPLRC CLIMATE-SMART PPPS WEBSITE

This section of the Public-Private Partnership Legal Resource Center (PPPLRC) website provides links to policies, legislation, project documents, and other resources that are relevant to the legal and regulatory framework of climate-smart PPPs

Developed by: PPPLRC, World Bank



PHASE 1
Project scope
M1.1
Project Alignment with Climate Policies
Step 1
Map the Global and National Climate Policies
Step 2
Assess/Improve Project's Alignment with Climate Policies
Revised project scope that aligns with national climate priorities and goals
Input from National Climate Policies
Project selection (out of a number of alternatives)
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate Risks
Climate Hazards
Project Exposure
Project Vulnerability
Project Risks
Step 2
Assess GHG Emissions Qualitatively
Types & Sources
Assessment Protocols
Step 3
Review Adaptation & Resilience Strategies
Adaptation/ Resilience Measures
Build Alternative Strategies
Rank Strategies
Step 4
Review Small-scale Mitigation Measures
Mitigation Hierarchy
High-level Considerations
Step 5
Prioritize Climate Strategies
Economic Evaluation of Climate Strategies
Socio-Environmental Co-Benefits
Prioritization through MCA
Preliminary description of the project
(incl. adaptation and mitigation strategy)
Economic pre-assessment; PPP screening
M1.3
Value of Investment Accounting for Climate-Actions
Step 1
Include Climate Considerations in CBA
Step 2
Check Project's Affordability
Step 3
Check Project Suitability as a PPP
A project option gets the green light to proceed to appraisal

1.2 Climate Considerations in Project Selection

A major item in the planning, structuring, and awarding of climate-smart PPP infrastructure is to ensure its ability to withstand climate-change-related stressing. Given the usually long duration of PPP contracts, it is possible that climate-change effects may manifest themselves several years after the financial close of the project bringing unforeseen harm to the contract. They, therefore, constitute a type of risk on the project that attracts growing attention from all stakeholders and needs to be estimated, assessed, addressed, and properly shared between the private and the public parties in order to ensure that the project contract will evolve smoothly and to the best benefit of its beneficiaries.

On the other hand, the project itself poses a risk to the environment due to GHG emissions attributable to the project directly due to its construction and operation process or indirectly as a consequence of the production of construction materials. As the alleviation of such impacts is obviously an international priority and a global imperative, it is necessary that GHG emissions are estimated at the project planning phase so that appropriate mitigation measures can be proposed.

Combating climate change involves the incorporation of climate mitigation options and proper design of adaptation and resilience measures to cope with the associated risks. In this context, Module 1.2 aims to navigate users through the preliminary review of technical solutions that could not only ensure adaptation and resilience of the project to the climate hazards it is (or may in the future be) exposed to, but that could also contribute (to a greater or lesser extent) to the country's climate mitigation goals.

As such, the concept of double materiality

PHASE 1

M1.2

Climate Considerations in Project Selection

Step 1
Assess Climate-Change Risks

Step 2
Assess GHG Emissions Qualitatively

Step 3
Review Adaptation & Resilience Strategies

Step 4
Review Small-Scale Mitigation Measures

Step 5
Prioritize Climate Strategies

(captured through the definitions of "resilience *of*" and "resilience *through*" introduced in the WBG's Resilience Rating System[1]) is herein further extended to account for the potentially dual purpose of climate-smart PPP infrastructure: avoid direct and indirect loss through adaptation and resilience while contributing to climate mitigation and broader social benefits. The overarching goal of the present module is to outline a process that will allow users to ensure that the project options that will be brought forward for the value for money assessment (Module 1.3) have incorporated climate actions (including the estimation of the proper climate mitigation, adaptation, and resilience measures as well as their associated cost levels and potentialbenefits). Assessments performed at this stage are mainly qualitative; detailed GHG and climate risk analyses are described later in this toolkit as part of Phase 2, while sector- specific guidance is provided in the accompanying sector-specific toolkits.

SCREENING DIFFERENT PROJECT OPTIONS

During the selection phase, the structuring team may examine more than one option for a project.[2] Different project options could be exposed differently to the same hazard and result in different levels of risk. Subsequently, these may be associated with different costs (both upfront capital and operational expenses), and therefore, climate risk screening should be performed for each project option.

STRUCTURE OF THE MODULE

The module comprises five steps:

- **Step 1** identifies all climate hazards that may potentially affect the project and qualitatively assesses the influence of climate change on each one of them. It subsequently investigates the project exposure & project vulnerability at a high level in order to estimate the overall climate risk
- **Step 2** performs an early-stage screening of the project's GHG emissions
- **Step 3** identifies potential adaptation and resilience measures to reduce the project-specific climate risks
- **Step 4** proposes mitigation measures to partially compensate for the project's GHG emissions
- **Step 5** prioritizes climate (adaptation and mitigation) strategies considering costs, benefits, and potential trade-offs

[1] World Bank Group, 2021: Resilience Rating System: A Methodology for Building and Tracking Resilience to Climate Change

[2] The terms "project option" and "project" are thus used interchangeably in the present toolkit

01 PRE-ASSESS CLIMATE RISKS

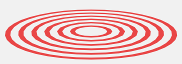
Climate-change risks are associated with climate hazards that are experienced already or may appear in the future (e.g., sea-level rise, flooding in an area that is flood-proof today) as a consequence of climate change and may challenge the technical design of the project and hence its revenues or its availability. In engineering practice, climate risks are estimated as a function of the hazard level and the project's exposure and vulnerability (see Box 1.3). Schematically, the risk is estimated using the following formula:

Risk = **Hazard** x **Exposure** x **Vulnerability** (Eq. 1.2.1)

Although more detailed analyses will follow in the subsequent phases, risk calculations are expected to be performed in qualitative terms in the current stage. To this end, the following sections aim to describe the process of estimating these three risk components at a high level.

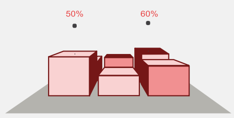
BOX 1.3 INTRODUCTION TO RISK ASSESSMENT

Risk assessment is a broad and sometimes complex scientific field. In its most simplified form, the risk may be defined as a function of:

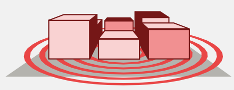


Hazard is the type of stressor, i.e., the natural phenomenon (e.g., wind, flood, high temperatures) that may potentially threaten the infrastructure. **Likelihood** defines the probability of the specific hazard occurring at a certain intensity.

Exposure is an index of the plausibility of the hazard actually affecting the infrastructure (it may also be thought of as proximity of the project to the hazard source).



Vulnerability defines the sensitivity of the infrastructure to a specific type of threat.



Risk is the probability of harmful consequences or expected loss (physical damage, disruption of economic activity) resulting from the interaction of a hazard with the built environment. Risk is therefore considered as the combination of the severity and associated likelihood of a hazard (where the higher the severity of the hazard, the lower the likelihood of occurrence), the assets' exposure to the hazard, and their vulnerability to damage.

Illustrations adapted from UNISDR, 2019: Words into Action Guidelines - National Disaster Risk Assessment: Governance System, Methodologies and Use of Results

Quantitative assessment of the above components may require significant expertise and hence, the involvement of skilled technical staff. The present high-level toolkit provides instructions on performing a qualitative assessment of these components based on simplified, readily available (online) tools. Users are encouraged to seek updated resources and risk assessment tools that may be suitable for the region/sector of interest and which may become available in the future.

CLIMATE HAZARDS

Climate hazard is one of the main parameters that needs to be assessed to enable the identification of risks. To this end, users are prompted to examine the natural and built environment around the project and identify climate hazard sources that could damage the infrastructure or threaten its operations. For this task, users may be assisted by resources such as Think Hazard!, United States Agency for International Development's (USAID's) climate links, and the World Bank's Screening Tools and Climate Change Knowledge Base (Box 1.4), which are meant to provide information on hazards affecting the project's location or broader area. Additional resources are listed at the end of this module.

BOX 1.4 CLIMATE HAZARD ANALYSIS TOOLS

In order to evaluate each hazard's characteristics, a study on climate-related data at the location of interest needs to be performed. Current and future climatic data are available by the national meteorological authorities of the country of interest (or those of neighboring countries) and within international sources that provide climate information on the appropriate scale. Some additional useful hazard and climate data sources are the following:

- **Climate Change Knowledge Portal** (World Bank Group): A knowledge portal that provides historical climate data (for temperature and rainfall) and future projections of climate data for various climate stressors and variables for each RCP
- **Think Hazard!** (GFDRR - World Bank Group): A web tool that provides high-level hazard maps per country, including also smaller scale (district level) hazard detail
- **Climate links** (USAID): A global knowledge portal for climate and development practitioners that also includes climate risks per country or broad regions (Regional & Country Risk Profiles and GHG Emissions Fact Sheets)

The severity—or even the very existence—of each hazard type will vary depending on the actual evolution of climatic conditions. However, the latter cannot be predicted at the present time due to the uncertainty stirred by climate change. As such, multiple scenarios may need to be explored to account for future uncertainty. Although more advanced methodologies for decision-making under uncertainty exist (and are further discussed in the next steps and in Phase 2 of the toolkit), these may be too resource-demanding to be employed at such an upstream stage of the process. It is therefore deemed preferable to perform the present early-stage screening considering a few plausible climatic evolution scenarios for each hazard type based on the Representative Concentration Pathway (RCP) evolution index—an index to describe the different growth rates of GHG and other climate-forcing emissions (for a more detailed description of RCP see Insight 1.3). Different RCPs describe different emission scenarios of the future corresponding to different intensities and frequencies of climate hazards. (i.e., rainfall, temperature, sea level, floods/droughts, etc.). At a high level, this may be performed using future projections from sources such as the World Bank Group's Climate Change Knowledge Portal referred to previously. The goal at this upstream phase is to qualitatively estimate (using input from the portal or any other available source) hazards and intensity levels (e.g., low, medium, high) and assess whether such intensities are expected to increase due to climate change. Sector-specific instructions on how to perform this type of assessment are provided in the respective sector-specific toolkits.

> It is important to recognize that climate change might affect each hazard differently. Hence, a climate hazard that would not constitute a risk to the project at present might become a threat in the future as climate change unfolds and its impacts become visible. To this end, the identified climate hazards should include every potential threat that the project might face not only under current climatic circumstances but also throughout its lifecycle.

PROJECT EXPOSURE

Proximity to the hazard source (or its zone of influence) is usually the main parameter determining a project's exposure to it. To estimate exposure, users will need to consider factors that are inherent to the project (e.g., a significant distance from the coast will offer protection from coastal erosion), or extrinsic (e.g., the present existence of a breakwater wall), which are not part of the project, but do protect the project from the hazard impacts.

The preliminary estimation of the project exposure may be based on regional impact maps (if available) by examining whether the project location (or alignment) is included within the geographical spread of the hazard (i.e., assets within the impact zone will be affected while those outside not). If such information is not available, past experience and data from historical performance may be used to perform initial crude estimates of whether the project may be falling within a hazard's zone of influence.

PROJECT VULNERABILITY

The definition of vulnerability encompasses two main dimensions: the sensitivity or susceptibility to harm and the lack of capacity to cope and adapt. When users evaluate the sensitivity or susceptibility of a project option to a given hazard, they need to consider project features such as structural type and technical integrity, bearing capacities and thresholds, robustness of the infrastructural components, weak points in the project's structural system, dependencies between the project assets or project modules, etc. To evaluate the project's capacity to cope and adapt, users also need to consider non- structural features such as emergency management, disaster policy development, evacuation plans, reconstruction ability in relation to service disruption duration, availability of alternative temporary substitutes, etc. The consideration of such factors will guide the qualitative evaluation of the overall project vulnerability to specific hazards for every project option.

PROJECT RISK

Two main climate risk typologies are identified (Figure 1.3):

Internal risks originating from hazards that are posed directly on the project and could damage the infrastructure itself or/and affect its availability (e.g., extreme flooding destroying dikes and suspending the service of infrastructure). Internal risks may have two types of impact: **direct impacts** defined as the loss due to damage on the physical infrastructure, and **indirect** impacts defined as the loss of revenue due to the unavailability of the infrastructure (applicable both to government payments and user-pays PPPs).

External risks originating from hazards affecting the broader socioeconomic system (i.e., green-economy transition risks) and surrounding infrastructure with which the PPP project is interlinked. This category is exclusively associated with potential indirect impacts (e.g., revenue loss due to reduced demand, loss of the project's revenue base, or loss of access to the infrastructure due to failure of the interconnected network).

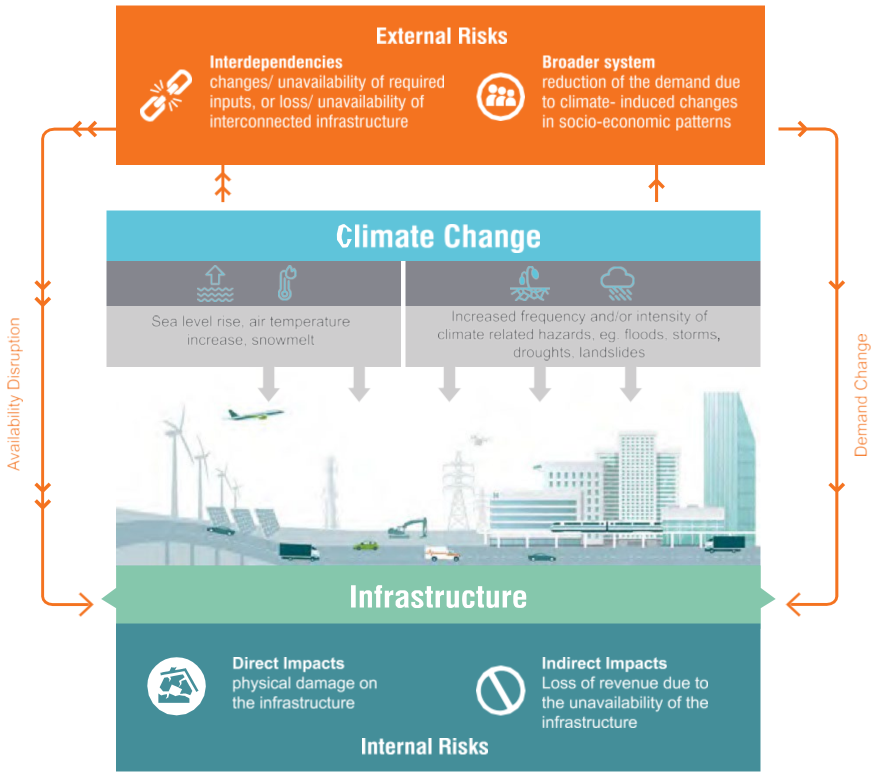


FIGURE 1.3 Climate change may pose internal and external risks to the infrastructure

Internal risk assessment is possible at a high level using the generalized formula presented in Eq. 1.2.1. Understandably, to properly assess the vulnerability of an infrastructure project, it is necessary to know the specific design characteristics of its assets; when this is the case, the involvement of expert consultants will be essential for this task. However, in most cases, the technical design is unknown at the present upstream phase. Thus, in the absence of any better

PHASE 1
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate-Change Risks
Step 2
Assess GHG Emissions Qualitatively
Step 3
Review Adaptation & Resilience Strategies
Step 4
Review Small-Scale Mitigation Measures
Step 5
Prioritize Climate Strategies

data or methodologies, it is recommended that the risk is preliminarily calculated as a function of the hazard and the project's exposure only.

Unlike internal risks, which can be alleviated through the appropriate adaptation measures, **external risks** depend on factors beyond the control of the project's stakeholders. Additionally, different project options may be differently exposed to external risks. Therefore, it is important that external risk factors be identified early in the project selection process since they could alone—in the most extreme case—be a reason to abandon a specific option.[3] To this end, users are encouraged to hold consultations with multiple stakeholders aiming to identify factors such as imminent policy changes, demographic patterns, and uncertainty sources in the supply or demand side of the infrastructure, in order to decide whether such risks can be mitigated.

Detailed guidance on how to perform a qualitative risk assessment at a high level for several infrastructure sectors is provided in the respective sector-specific toolkits.

Step Output

1. A qualitative characterization of the internal climate risk of the project (or project options) per hazard type (low, medium, high)
2. List of external climate risks and contingencies

[3] A recent example of such a case comes from the feasibility study of a photovoltaic plant in Southeast Asia: the projecthad to be abandoned although the internal risks were covered and sunlight was granted due to a projected water shortage in the region that would hinder the panels' cleaning operations in case of increased dust coverage.

PHASE 1

M1.2

Climate Considerations in Project Selection

Step 1
Assess Climate-Change Risks

Step 2
Assess GHG Emissions Qualitatively

Step 3
Review Adaptation & Resilience Strategies

Step 4
Review Small-Scale Mitigation Measures

Step 5
Prioritize Climate Strategies

02 PRE-ASSESS GHG EMISSIONS QUALITATIVELY

The broader infrastructure sector is considered to be (directly or indirectly) responsible for almost 70% of the globally emitted[4] greenhouse gases. This includes the emissions attributable to the construction, operation, and waste disposal. Indicatively, the construction industry itself may be accountable for as much as 25% of global GHG emissions (including building and demolition). It is thus essential that action is taken to reduce the carbon footprint of any type of infrastructure. The current step intends to define the principles and outline the process of assessing GHG emissions of a project at a high level so that appropriate mitigation measures can be explored to help reduce them.

GHG TYPES AND SOURCES

GHGs are produced either naturally or due to human activity. This toolkit refers to GHGs produced due to the process of burning fossil fuels for the production of energy, manufacturing, and transportation. When released in the atmosphere, GHGs trap heat, therebycontributing to global warming. Hence, the consequence of an uncontrolled increase in the GHGs would be accelerating global warming and subsequently of the effects of climate change.

Several types of GHGs are produced during the aforementioned activities, depending on the process, the technologies involved, the raw materials, and several other factors. According to the IPCC, every GHG is characterized by its global warming potential (GWP), which indicates how much heat the GHG can trap within the atmosphere or if stated otherwise, how much it may contribute to climate change. In order to be able to quantify and compare GHGs characterized by different GWPs in a single unit, the global community is currently using the carbon dioxide equivalent (CO2e) as the reference quantifier. This allows all GHGs to be expressed in relation to carbon dioxide, which is considered to have a GWP of 1. Carbon dioxide is hence used as the reference GHG that all other gases get compared to.

GHG ASSESSMENT PROTOCOLS

In order to estimate the CO2e of an infrastructure project, it will be necessary to be able to identify all emissions generated during the construction process and also to acquire an indication of the emissions to be produced during its operations (either directly, e.g., due to its operations in case of a power plant, or indirectly, e.g., due to car emissions in case of a highway project). This is a resource-demanding exercise requiring significant expertise that may not be available at the project selection phase. In case users are already skilled in the field or can gain access to relevant expertise, they are encouraged to review available tools to assess the GHG emissions at several levels (tiers).

---

[4] According to the IPCC (https://www.ipcc.ch/report/ar5/wg3/) the combined contribution of energy production and transportation is 50%. The actual contribution reaches approximately 70% of the globally emitted GHGs when considering all infrastructure sectors.

Among them, the Greenhouse Gas Protocol, a partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), has created online tools that help practitioners perform reliable GHG emissions assessments per sector. Also, the United States Environmental Protection Agency (EPA) has created an online tool allowing users to calculate CO2e in a simplified manner.

Sector-specific guidance on how to perform the assessment is provided in the respective sector-specific toolkits. For a preliminary high-level screening of the GHG emissions of various options and activities (to be considered at the current step), users are advised to consult sources such as the IPCC's Guide "Climate Change 2014 Mitigation of Climate Change," which includes detailed information for several infrastructure sectors.

Step Output

A gross estimation of the baseline GHGs of the project (assuming that no climate mitigation measures are taken)

03 REVIEW ADAPTATION AND RESILIENCE STRATEGIES TO REDUCE CLIMATE RISKS

In this step, users are guided on how to perform a preliminary screening of adaptation and resilience measures to reduce the climate risk of the project.

Adaptation refers to measures aiming at preparing for and preventing the impacts of climate-induced risks on the project and could include technical solutions, adjustments in the project management practices or operational strategies, infrastructural modifications, or policy adjustments and additions.

Resilience of a project refers to design attributes that will allow the project to resist a shock, absorb its impacts, and rapidly recover functionality after the end of the event. At the same time, the community may benefit from increased resilience through the project, as explained in Box 1.5. It is important to note that while all projects must achieve resilience against climate risks (resilience *of*), it is not mandatory and perhaps not always applicable that all projects' outcomes contribute to community resilience (resilience *through*).

In the ensuing text, "resilience" usually refers to endurance and recovery from acute disastrous events, while "adaptation" relates to chronic, slowly evolving processes (see also Insight 1.4). In this context, risk reduction strategies are expected to contain a combination of adaptation and resilience options.

In some instances, climate adaptation and resilience measures can offer additional benefits to the broader project environment. These are typically termed as co-benefits and could include additional socioeconomic benefits (e.g., addressing gender gaps, minority inclusion, job creation, technology promotion, etc.) as well as enhanced contribution to climate mitigation. This is particularly the case for nature-based solutions that can be combined with or replace the conventional "gray" infrastructure (Box 1.6). Therefore, it is advisable that these are thoroughly reviewed at this step as they could contribute significantly to the decision in favor (or against) a specific option.

BOX 1.5 THE NEW ERA OF RESILIENCE: ENSURING COMMUNITY CONTINUITY, NOT JUST LOSS AVOIDANCE

Aiming to monitor adaptation and resilience-related actions, the World Bank's Action Plan on Climate Change and Resilience has developed a Resilience Rating System (RRS) to encourage climate policy-aligned development and to track climate-related finance methodologies. When referring to project resilience, we may refer to different plans to react to climate change that the project incorporates throughout its lifecycle. As defined by the WBG's Resilience Rating System report, project resilience includes two different dimensions, namely the *resilience of* the project and the *resilience through* the project. The latter characterizes the extent to which projects explicitly contribute to the resilience of the infrastructure's broader environment that may include the beneficiaries, asset networks, regions, or even countries. To this extent, such projects are intentionally designed with the objective or sub-objective of improving the climate-change resilience of a community and not just of their assets.

Hence, a new era of resilience is born where community continuity and protection from natural disasters and the detrimental impacts of climate change are prioritized. Through this dimension, investments that support transformation towards resilient development pathways are promoted, as they relate to current and long-term climate impacts, and not just loss avoidance directly connected with the project itself. The ultimate aim is to pass from project-only resilience to building overall community resilience.

Resilience *of* the project

Consider climate and disaster risks in project design and incorporate measures to absorb them and quickly bounce back.

Example: opting for redundancies in the design of a power generation facility will allow it to quickly resume operations following an extreme weather event, even if it has been partially damaged by it.

Resilience *through* the project

Design interventions to enhance sector's and beneficiaries' climate resilience

Example: incorporating flood protection measures for a road network could simultaneously offer enhanced endurance to flooding to a community located downstream.

Sources:
World Bank Group, 2021: Resilience Rating System: A Methodology for Building and Tracking Resilience to Climate Change
World Bank, 2019: The World Bank Group's Action Plan on Climate Change Adaptation and Resilience

PHASE 1
M1.2
Climate Considerations in Project Selection
Step 1 Assess Climate-Change Risks
Step 2 Assess GHG Emissions Qualitatively
Step 3 Review Adaptation & Resilience Strategies
Step 4 Review Small-Scale Mitigation Measures
Step 5 Prioritize Climate Strategies

BOX 1.6 GREEN INFRASTRUCTURE AND NATURE-BASED SOLUTIONS

Natural systems such as forests, floodplains, and soils can contribute to clean, reliable water supply and protect against floods and drought. In many circumstances, this type of "green infrastructure" (alone or in combination with traditional "gray infrastructure") may also be used to protect systems such as dams, levees, reservoirs, treatment systems, and pipes.

Solutions inspired and supported by nature termed "nature-based solutions" may be used as climate adaptation measures that can simultaneously deliver environmental, social, and economic benefits and help build resilience. The United Nations World Water Development Report 2018 highlighted how nature-based solutions can help meet the 2030 SDGs (WWAP 2018). Similarly, the High-Level Panel on Water (HLP 2018) convened by the United Nations and World Bank concluded that green infrastructure could "help address some of the most pressing water challenges, particularly if planned in harmony with gray infrastructure."

Sources:
WB-WRI, 2021: Integrating Green and Gray: Creating Next Generation Infrastructure
https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en

CLIMATE RISK REDUCTION: ADAPTATION & RESILIENCE MEASURES

After assessing climate risks, users are prompted to identify adaptation options to address them effectively. Adaptation measures may be broadly categorized in the following three classes (Figure 1.4):

Prevention includes all measures that can lead to reducing the likelihood of the consequences of the risk once a hazard materializes.

Preparation includes all measures that can lead to reducing the consequences of the risk once a hazard materializes.

Finally, **recovery** includes measures that will allow the project to resume operations in a timely way following the occurrence of an event.

Depending on the project's details, the prevailing hazards in the location site, and the results of the risk assessment (as well as the country, local experience, available technology, and capacity), different adaptation options may apply. To identify adaptation measures that are relevant to the project's context, users should think of measures that reduce the two main contributors of risk: exposure and vulnerability. Regarding project *exposure*, transferring the proposed project's location to areas of reduced hazard levels could be one way to reduce risk. Other exposure reduction measures may include infrastructure side projects that are currently under development or are planned to be developed or upgraded in the near future and may serve as protection measures for the project site.[5] Smaller-scale side infrastructure projects that are not in the core of the project but can become part of its environment and are designed to provide climate change adaptation to the project site can also be considered as potential risk reduction measures.

[5] It is not recommended to rely on side-projects whose realization may be questionable. However, when the state entity procuring the PPP infrastructure is also responsible for the side projects, it is advisable to act towards securing mutual benefits for both.

Adaptation and Resilience measures

Prevention Measures

reduce the likelihood of the consequences of the risk once a hazard is realized. Examples include the addition of structural components such as sea walls and coastal protection structures, sewage works, improved drainage, the introduction of firebreaks against wildfires, etc. Technology measures such as remote sensing and monitoring of climate/weather conditions and hazard and vulnerability mapping may also be included in this classification.

Preparation Measures

reduce the severity of consequences once a hazard is realized, with the adopted measures aiming to protect the infrastructure and/or its users from the detrimental effects of the hazardous phenomenon. Such measures should explicitly consider gender and may include early warning systems, emergency evacuation plans as well as frequent training and awareness of the infrastructure operator's staff. Structural methods such as increasing the robustness of the construction in order to withstand acute climate events could also be considered as a preparation measure.

Recovery Measures

comprise all measures that can lead to efficient recovery of the infrastructure itself and its closely dependent human and natural environment from the impacts of climate hazards. Insurance coverage, emergency accommodation measures, quick recovery, and reconstruction measures while addressing potential gender gaps are a few examples of such actions. Another important aspect that falls under this category is the infrastructure's ability to maintain or quickly regain its capacity (at full or partially) in the aftermath of an acute hazard. Relevant examples would include the provision of alternative bypassing routes in major motorway networks, the provision of emergency power redundancies, etc.

FIGURE 1.4 Categories of adaptation and resilience measures and examples

With regards to *vulnerability* reduction, two types of measures are proposed:

(a) those that **reduce the sensitivity** of the project to the hazard, typically of a structural nature

(b) those that **increase the capacity of the project to cope** with the stressing without compromising its operation, typically of a non-structural nature.

For example, both the choice of a different structural type for the project infrastructure and the development of early warning systems can lead to increased resilience and, by extension, reduced risk.

> Users are also advised to identify and assess the potential of adopting technology-related adaptation measures or climate innovations that may be applicable to the project and seek support from the corresponding implementing agencies or othercountries that are already advanced in this field (Box 1.7).

Then for each applicable adaptation measure, the user is called to estimate its risk-reduction potential, i.e., how much this measure is expected to reduce the risk. While performing this task, two considerations are worth noting: (i) an adaptation measure can have a reducing effect on multiple risks while on the other hand, a combination of measures may be necessary to achieve a reduction of a single risk to an acceptable level; (ii) an adaptation measure may be combined with a green strategy (e.g., blue-green infrastructure) to deliver additional climate mitigation benefits. The process of identifying adaptation measures is summarized in Figure 1.5.

It should be noted that the in-depth assessment of the adequacy and effectiveness of adaptation and resilience measures requires significant expertise. Therefore, it is desirable that users are supported by technical consultants experienced in the design of similar hazard-resisting projects in the region considered. Sector-specific guidance on how to preliminarily select such measures is provided in the respective sector-specific toolkits.

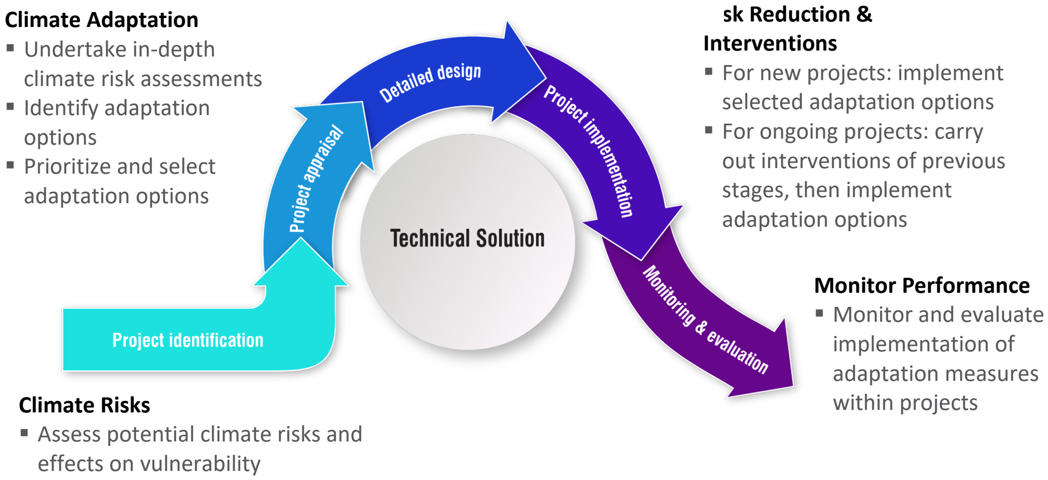


FIGURE 1.5 The identification of adaptation measures starts within the project selection phase when the climate risk profile of the project is assessed. During the project appraisal, the adaptation measures are tested as per their technical feasibility and their economic value.

BOX 1.7 TECHNOLOGY-RELATED ADAPTATION MEASURES

Technological advancements related to climate change may provide original ideas and innovative solutions regarding climate change mitigation and/or adaptation opportunities. Even though technological inventions can significantly contribute to the battle against climate change and can notably accelerate climate change adaptation across societies, innovation remains concentrated within a limited number of countries, mainly in the Global North (WB/IBRD, 2020). Providing, therefore, broad access to emerging digital innovations and transferring technological knowledge across all countries and especially the ones that present the highest vulnerabilities, could enhance and connect the heterogeneous climate actions across the globe in a coherent and transparent way, providing in this way a cooperative technological approach that will enable and support new generation climate markets (WB/IBRD, 2018).

Towards this direction, technological advancements and digital innovations allow embodying in climate action the high functional complexity required for this transition. **Smart contracts** that incorporate the transparency and robustness of decentralized registries that blockchain technology offers, **collaborative governance systems** that enable holistic development of monitoring, reporting, and verification (MRV) systems or regulatory standards, **smart meters,** and other devices associated with the Internet of Things (IoT), combined with big data analytics and automated data flows, **new irrigation systems**, **advanced weather forecasting tools,** and innovative **more-resilient crop varieties**are only some of the potential tools that technology currently offers. Keeping up to date with the latest technological advancements and the business environments that they create may be critical for the race against climate change.

Sources:
WB/IBRD, 2020: Invention and Global Diffusion of Technologies for Climate Change Adaptation: A Patent Analysis
WB/IBRD, 2018: Blockchain and Emerging Digital Technologies for Enhancing Post-2020 Climate Markets

CHOOSING ADAPTATION & RESILIENCE STRATEGIES

At the end of this step, users are expected to perform a qualitative ranking of candidate adaptation and resilience measures to decide those that will be forwarded to the next step for a preliminary cost analysis.

When prioritizing adaptation and resilience strategies, it is recommended that criteria such as feasibility and ease of implementation, local capacity, additional costs, social impact, etc., are considered by the decision-maker. An overview of suggested criteria is also provided in the "do-no-significant-harm" (DNSH) framework,[6] which aims to outline the considerations that need to be accounted for when reviewing resilience plans.

[6] The framework is available in the following link: https://ec.europa.eu/info/sites/default/files/c2021_1054_en.pdf

Participatory decision-making is recommended in order to ensure that all stakeholders and beneficiaries concerned are properly represented in the process. Moreover, the integration of gender considerations in this process is a key element to achieving a meaningful reflection of society's needs in the required decision. Although this decision is to be made at a high level, it is desirable that the technical evaluation of applicable adaptation and mitigation measures be made by skilled technical experts who will be able to provide decision-makers with the necessary background to make an informed decision.

04 REVIEW SMALL-SCALE MITIGATION MEASURES

Exhausting the potential of climate mitigation through infrastructure is an international imperative. According to recent World Bank data,[7] climate change has not slowed down, and its connection with human wellbeing and poverty is increasingly visible. Unchecked, it will push 132 million people into poverty over the next ten years, undoing hard-won development gains. As a response to this imperative, it is recommended that even projects whose primary scope is not climate mitigation attempt to incorporate small-scale mitigation actions aiming to reduce their carbon footprint and support the vision of a safer future. In this context, the **mitigation hierarchy** (Box 1.8) is a crucial consideration for infrastructure projects aiming to contribute to a net positive approach. Even when GHG emissions cannot be avoided, it is essential that GHG minimization options are considered prior to offset alternatives.

BOX 1.8 MITIGATION HIERARCHY

Mitigation hierarchies for measures and actions have been widely used for over a century in risk management within various fields such as natural resource management, waste hierarchy (Lansink's Ladder), biodiversity and wildlife management (e.g., IFC Performance Standard 6), and progressively in climate-action frameworks as well (e.g., UNFCC REDD+, Kyoto Protocol emissions trading mechanism).

The basic concept of mitigation hierarchy includes different variations of the **Avoid – Minimize – Offset** principle and aims to achieve the reduction of potential adverse impacts of risks to acceptable levels via structured and prioritized steps. Following the same principle, the World Bank's Environmental and Social Framework (ESF) explicitly incorporates the concept of mitigation hierarchy by proposing that projects, first and foremost should strive to **avoid** adverse impacts. If avoidance is not feasible, the project should be designed to minimize or **reduce** adverse effects on people and the environment. Where residual impacts remain, projects should **compensate** affected communities or **offset** adverse impacts. Within this context of the World Bank's mandate, ESF converts the aspiration of the mitigation hierarchy into practical, project-level applications.

Sources:
World Bank, 2016: Factsheet Environmental and Social Standard 1
WWF, 2020: Discussion Paper: Mitigation Hierarchies - First Things First: Avoid, Reduce and only after that– Compensate

[7] World Bank | Understanding Poverty | Climate Change | Overview: https://www.worldbank.org/en/topic/climatechange/overview (last visited on July 1, 2021)

As part of the preparation of climate-smart PPP infrastructure, it is recommended that several mitigation solutions are examined early on during the preliminary technical design. Such solutions generally fall into the following **categories**: *renewable energy production*, *energy efficiency initiatives*, *circular economy,* and *sustainable materials* (Figure 1.6).

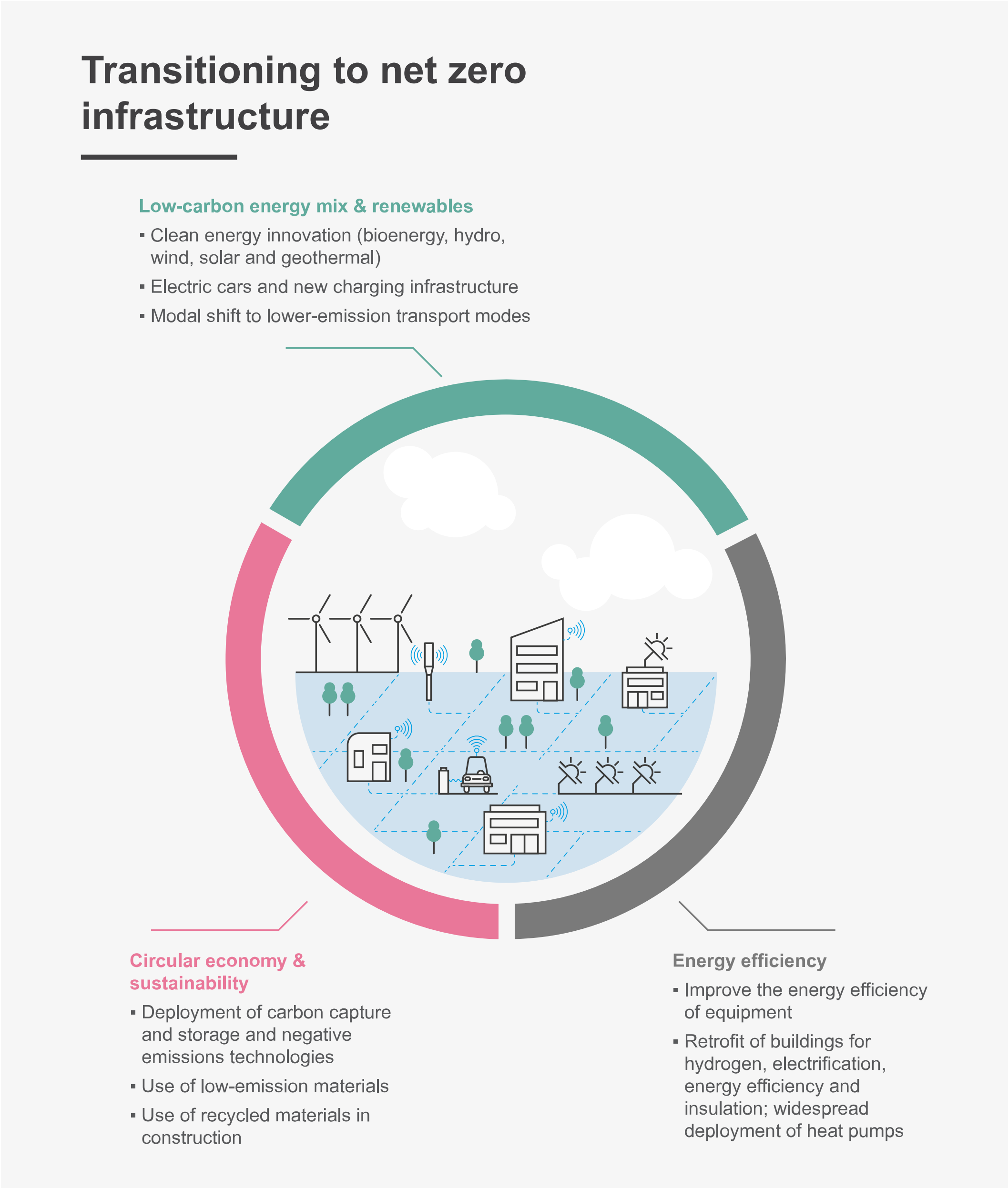


FIGURE 1.6 Cross-sectoral climate mitigation strategies supporting the vision for net- zero infrastructure

Moreover, synergies between mitigation and adaptation may be produced through the incorporation of technically and commercially feasible green infrastructure options—such as nature-based solutions, ecosystem-based adaptation, and blue-green or green-gray infrastructure. Examples of such options are provided in Insight 1.5. Their use is expected to grow as more scientific evidence regarding their merit and ways to incorporate them in the design will become available. On the other hand, implementation of nature-based solutions may have to overcome specific challenges, as indicatively illustrated in Figure 1.7.

FIGURE 1.7 Benefits and challenges of investing in nature-based solutions [Source: WBG -WRI, 2019: Integrating green and gray: creating next generation infrastructure]

CHOOSING A CLIMATE MITIGATION STRATEGY

Even at a very preliminary level, the selection of small-scale mitigation options greatly depends on the infrastructure sector and the region in which the project is to be located. In all cases, attention should be paid to ensuring that the incorporation of climate mitigation measures in the project does have a measurable net-positive impact without compromising the affordability of the project or risking discouraging private sector participation. In other words, the cost and ease of application (or overall feasibility) of proposed measures need to be justifiable in terms of achieved emissions reduction. Although there is no cross-sectoral approach to selecting such options, users should try in principle to answer the following high-level questions:

- Which solutions exist for the specific sector or sub/sector and how efficient are they?
- What are the expected emission reductions when compared to the business as usual or do-nothing solutions?
- Is the necessary technology available, tested, and proven to provide reliable results?
- Is there enough expertise from the side of potential bidders to apply such solutions?
- What is the envisioned cost of construction, utilization, and maintenance?

PHASE 1

M1.2

Climate Considerations in Project Selection

Step 1
Assess Climate-Change Risks

Step 2
Assess GHG Emissions Qualitatively

Step 3
Review Adaptation & Resilience Strategies

Step 4
Review Small-Scale Mitigation Measures

Step 5
Prioritize Climate Strategies

Users are also advised to consult relevant resources (see also the "resources" section at the end of this module) in order to be able to keep pace with developments relevant to the project under consideration. Detailed guidance on available small-scale mitigation options for a number of sectors is provided in the respective sector-specific toolkits.

Particular attention should be paid to ensuring that the climate mitigation strategy will not hinder the social dimension of the infrastructure. The most vulnerable population groups are often disproportionally impacted by the costs of addressing climate change. According to recent WBG data,[8] *"In the absence of well-designed and inclusive policies, climate change mitigation measures can place a higher financial burden on poor households. For example, policies that expand public transport or carbon pricing may lead to higher public transport fares which can impact poorer households more."*

Step Output

Outline of a climate mitigation strategy and preliminary estimation of the cost of implementation and the associated benefits

05 PRIORITIZE CLIMATE STRATEGIES

The last step of the module is devoted to the economic evaluation and—based on that—the prioritization of climate strategies.

According to a recent World Bank report, every dollar invested in resilient infrastructure generates four dollars in benefits.[9] The economic case is clear: making infrastructure more resilient yields significant economic benefits. This becomes more evident when considering the actual loss associated with natural disasters, which averages around $18 billion a year in low and middle-income countries due to damage to power generation and transport infrastructure alone. When added to the loss due to disruptions in households and businesses, the figure soars to at least $390 billion a year.[4] Unfortunately, the loss is disproportionately higher when considering the most vulnerable regions or populations among those affected.

[8] World Bank | Understanding Poverty | Topics | Social Dimensions of Climate Change: https://www.worldbank.org/en/topic/social-dimensions-of-climate-change#1 (last visited on July 1st 2021)
[9] World Bank, 2019: Lifelines: The Resilient Infrastructure Opportunity

Therefore, the economic evaluation of climate actions should properly assess all their costs and benefits duly considering the multiple sources of the latter (see Box 1.9). These include the principal benefit of loss reduction (throughout the lifecycle of the project), but also several additional (social, economic, and environmental) co-benefits, the value of which may be very significant. Indeed, opting for the proper mitigation and adaptation investments can unlock immediate, short-term benefits (e.g., in the form of boosting employment of empoweringlocal communities, and strengthening the skills and knowledge of the local population). Itmay also ensure long-term benefits for the beneficiaries in the form of a safer planet, decarbonized future, sustainable economic growth, and resilience against climate-related shocks.

BOX 1.9 APPRAISING PROJECT'S ECONOMIC VALUE

The ***economic costs of the project are not the same as its financial costs*** — externalities and environmental impacts should be considered. Externalities (positive or negative) are economic impacts that affect persons who are not necessarily part of the project scope. The ***economic benefits are a measure of the value the project will deliver to society as a whole***. The revenue a project will generate is usually a lower-bound estimate of its economic benefits; however, benefits can be much higher than revenues. For example, the benefits from improved transportation for drivers can far exceed the tolls paid on a highway — faster connections, reduced vehicle maintenance, lower accident rates may be significant factors. In addition, the project may enhance regional economic activity and quality of life for the people living in the vicinity of the project. Similarly, the value of education at a high school should be measured by the enhancement in the lives and prospects of the children who attend that school, even if no school fees are charged.

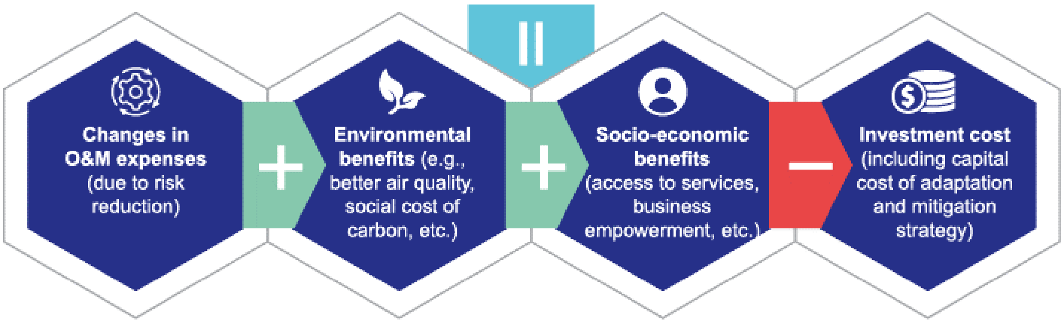
Source: PPP Knowledge Lab | PPP Reference Guide: Assessing Project Feasibility and Economic Viability

ECONOMIC EVALUATION OF CLIMATE ACTIONS

As evidenced by the preceding discussion, in most cases, increasing spending in adaptation and resilience measures (usually constituting CAPEX) shall result in reduced losses during the lifetime of the project (OPEX). The ability to correctly capture all costs and benefits during the economic appraisal of the project (the process of which is described in Module 1.3 and analyzed in detail in Module 2.3) will determine the future of infrastructure and the affected population. Therefore, it is recommended that a high-level assessment be performed early on during the project selection phase using the simplified generalized formula below.[10]

[10] World Bank, 2005: A framework for the economic evaluation of transport projects, Transport Note No. TRN-5, 25pp, Washington D.C., USA

OVERALL ECONOMIC IMPACT OF CLIMATE ACTIONS



Clearly, the outcomes of this formula and any variations thereof shall depend on the accuracy and availability of data and on the appropriateness of the methodology to convert non-monetary data to compatible, quantifiable terms. Although this assessment will be conducted in more detail during the project preparation phase, a simplified approach—in the form of a participatory decision process—is considered appropriate for the requirements of the current step. Instructions on how to prioritize projects based on such a high-level economic evaluation are provided in the next section.

BOX 1.10 OPTING FOR SOCIO-ENVIRONMENTAL CO-BENEFITS

Consistent with the broader World Bank Group's climate strategy, it is recommended that synergies are sought between actions to address climate change and other local and regional environmental priorities, and proper merit is given in trying to maximize benefits generated as a result of climate actions. Such co-benefits could include: addressing gender gaps, serving national strategic priorities, protecting populations from risks, etc., using clean energy, protecting biodiversity, restoring landscapes and protecting the broader natural environment, reducing gender gaps, achieving easier access to funding, serving national-security purposes, enhancing social and political acceptance. Consultations with stakeholders and participatory decision-making are highly recommended (if not essential) to ensure that all voices are equitably heard and reflected on the project selection, which will, in turn, simultaneously endow the project with additional public support.

PRIORITIZATION OF CLIMATE STRATEGIES: A SIMPLIFIED APPROACH

As already explained, project structuring teams are in need of a solid decision-making process that will allow them to prioritize climate strategies based on their costs and benefits at an early stage. Depending on the nature of such options, the benefits may or may not be quantifiable in monetary terms (Box 1.10). This—in combination with the uncertainties associated with climate risks and the lack of quantifiable data—could render traditional cost-benefit analysis inapplicable for this upstream stage. Hence, a qualitative prioritization approach is introduced, allowing the evaluation of multiple criteria without employing advanced resource-demanding analyses. The proposed approach enables the inclusion of several significant environmental, socio-economic and gender-related co-benefits in the technical and financial appraisal of the project and may be used as a method to prioritize climate strategies at a high level.

The method builds on the concept of multi-criteria-analysis (MCA),[11] and can be used when non-monetary factors such as ecological, social, cultural, gender, environmental, political, or other considerations are important for the decisions. After having identified the potential adaptation and resilience strategies, their prioritization process involves the following steps (Figure 1.8):

1. **Select evaluation criteria** to be applied. To ensure agreement and shared understanding among all parties, each criterion must be clearly described and agreed upon among all participating stakeholders. Criteria may include not only the effectiveness or the monetary benefit of the option (similar to cost-effectiveness and cost-benefit analyses), but also other important factors such as urgency, no-regret attributes, ease of implementation, social acceptance, mitigation co-benefits, etc.
2. **Assess the importance of each criterion** by assigning weight factors. Each criterion receives a weight value between 0 and 1 (assuming that the sum of the weights of all criteria is equal to unity (1))
3. **List strategies and score each strategy's performance** for each criterion. The score should be a numerical value between 0 and 1, where 0 reveals bad and 1 excellent performance
4. For each strategy, calculate its **partial scores per criterion** by multiplying the score per criterion (from step c) with the respective criterion's weight (step b); then add partial scores to calculate the total score of the strategy
5. **Prioritize strategies** by ranking them in descending total score order

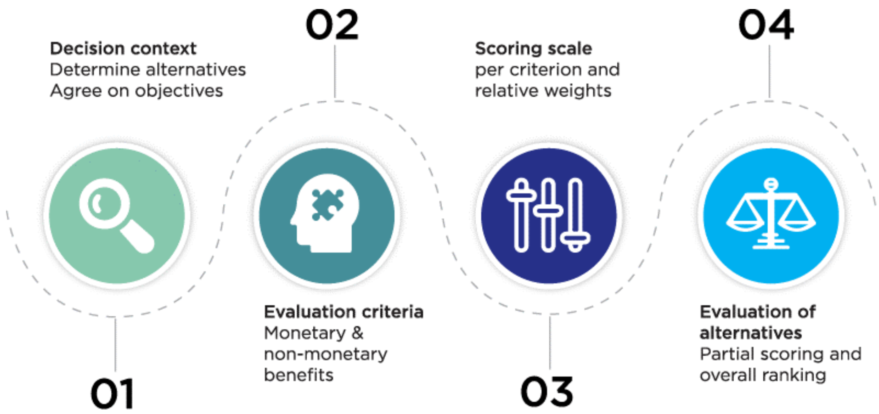


FIGURE 1.8 Schematic of the simplified prioritization approach

An example application of this type of analysis in an actual project in Rwanda is provided in Box 1.11. Given that this ranking is based on qualitative score estimates, it is recommended that the criteria, their weights, and the scores corresponding to each one of them are assigned following a participatory approach enabling a productive dialogue among all stakeholders involved. This will endow the process with reliability and objectivity and allow the proper representation of all stakeholders in the decision-making. An indicative list of scoreable criteria is provided in Table 1.1.

[11] More details may be found in the following resources: UNFCCC, 2011: Assessing the costs and benefits of adaptation options - An overview of approaches ; USAID, 2013: Analyzing Climate Change Adaptation Options Using Multi-Criteria Analysis

PHASE 1
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate-Change Risks
Step 2
Assess GHG Emissions Qualitatively
Step 3
Review Adaptation & Resilience Strategies
Step 4
Review Small-Scale Mitigation Measures
Step 5
Prioritize Climate Strategies

Users are advised to update this list using region, sector, and context-specific criteria in order to tailor the process to the needs of any specific project. Detailed guidance in a sector- specific context is also provided in the sector-specific toolkits.

TABLE 1.1 Indicative criteria for assessing climate actions

Efficiency	Is the option achieving the desired goal in the most economical way?
Irreversibility	Are the negative impacts of the option reversible?
Feasibility of implementation	How feasible is the option from an economic, social, technological, and environmental perspective?
Urgency of action	How urgent is the implementation of the option?
Cost	How much does the design and implementation of the option cost?
Climate-sensitivity	Will the option achieve the desired objectives if climate conditions change?
Flexibility	Can the option be adjusted/modified/upgraded if the impacts of climate change are higher than expected?
Overall contribution	Is the option contributing to sustainable development (e.g., poverty reduction, etc.), and is it relevant to strategic national development goals?
Social and political acceptance	Is the option widely accepted socially and politically?

BOX 1.11 PRIORITIZING CLIMATE ACTIONS USING MCA: EXAMPLES

During the preparation of Rwanda's NAPA, 11 different adaptation options for combating the impacts of climate change were identified as most relevant to the country's context. Yet, the government decided to proceed with the most urgent and immediate needs due to limited capacities and resources. The latter was determined using a well-structured and transparent MCA approach that evaluated: the impact of the option to vulnerable groups and resources; the contributions of the option to the sustainable development; the synergies with Multilateral Environment Agreements (MEAs); the effectiveness of the option in reducing climate risks; and cost efficiency. Each criterion was assigned a weight factor (i.e., reflecting its importance for the decision-makers), and subsequently, the total weights.

	CRITERIA					TOTAL WEIGHTED SCORE
	#1	#2	#3	#4	#5	
Weight	**0.333**	**0.222**	**0.111**	**0.222**	**0.111**	**1.000**
Intensive agriculture and animal husbandry	1	0.50	0.57	1	0.33	**0.765**
Introduction of drought resistant species	1	0.50	0	1	0.66	**0.739**
Integrated water resource management	1	1	0.14	1	1	**0.903***
Information systems, early warning & rapid response mechanisms	1	0.50	1	1	0.33	**0.813**
Development of sources of energy alternative to firewood	1	0.50	0.57	0.66	0.66	**0.726**
Promotion of non-agricultural activities	1	1	0.57	0.66	0.33	**0.800**

Example: The total score of the first ranked option ("Integrated water resource management") is calculated as follows: Total score = 1*0.333 + 1*0.222 + 0.14*0.111 + 1*0.222 + 1*0.111 = 0.903
Example adopted from Republic of Rwanda, 2016: NAPA-Rwanda

Another example of a multi-criteria framework applied in a decision support tool for governments has been developed by Marcelo et al. (2016) in the World Bank's Policy Research Working Paper: Prioritizing Infrastructure Investment. Within this MCA framework, projects are prioritized based on project outcomes considered along two combined dimensions: social-environmental and financial-economic

Source: Marcelo, Mandri-Perrott, House, Schwartz, 2016: Prioritizing Infrastructure Investment: A Framework for Government Decision Making. Policy Research Working Paper No 7674. World Bank

Step Output

A ranked list of adaptation and mitigation strategies

KEY TAKEAWAYS

- Climate change and its devastating effects may manifest themselves several years after the financial close of the project bringing unforeseen harm to the contract. Hence climate-change risks need to be assessed and timely addressed already at an early stage in the PPP process.
- Risk comprises three components: hazard – exposure – vulnerability. These components need to be assessed from a climate-change perspective for all project options to ensure that climate-change risks are addressable and can be borne.
- Several tools are available online to allow a preliminary high-level assessment of climate hazards and their future evolution trends.
- A preliminary climate risk screening of the technical solution, location, operations, and revenue streams will avoid unpleasant dead ends that could possibly be revealed at a later stage.
- Potential adaptation and resilience strategies that could be implemented in the project should be identified to ensure that the project-specific climate risks can be addressed and that climate change will not threaten the project's viability throughout its life-cycle.
- Additional complementary measures that contribute to climate-change mitigation, protection of biodiversity and broader natural environment and socioeconomic development (including closing the gender gaps) should also be incorporated and evaluated based on environmental & social frameworks and "do-no-significant-harm" principles to facilitate and further support the decision for the pre-selection of project options.
- Nature-based solutions, ecosystem-based adaptation, and blue-green or green-gray infrastructure are proposed as technically feasible plans that promote climate-smart solutions and climate mitigation.
- Climate actions may be prioritized on the basis of an evaluation of their multiple benefits, which are not necessarily expressed in monetary terms, using a simplified approach.

INSIGHTS

Insight #1.3
Climate Scenarios – The Case of RCPs

Insight #1.4
Chronic and Acute Risks

Insight #1.5
Nature-based Solutions and Blue Green Infrastructure Application Examples

CLIMATE SCENARIOS

THE CASE OF RCPs

INSIGHT #1.3

Climate scenarios are used extensively within climate models adopted in climate science, as well as in engineering practice, to simulate changes in climatic variables (e.g., temperature, precipitation) that are expected to occur in the future (i.e., climate projections). Theinformation presented in a climate scenario is derived from a set of assumptions, including socio-economic and technological future developments that may or may not be realized in the future. Given the wide variety of possibleassumptions that can be made for the future, multiple possible climate scenarios can be defined. Such conditions make it difficult for theinternational climate community to speak the same language when it comes to climate outputs without having a globally accepted consistent framework. To address this need for consistency in the usage of climate scenarios, and subsequently, their climate outputs, four Representative concentration pathways (RCPs), namely the RCP2.6, RCP4.5, RCP6, and RCP8.5, were selected by IPCC Assessment Report 5 (AR5) to comprise the standard set of climate scenarios. The four RCPs are considered representative in the sense that each one represents a broad range of other climate scenarios (with different starting assumptions) that are possible to lead to the same climate characteristics via different trajectories.

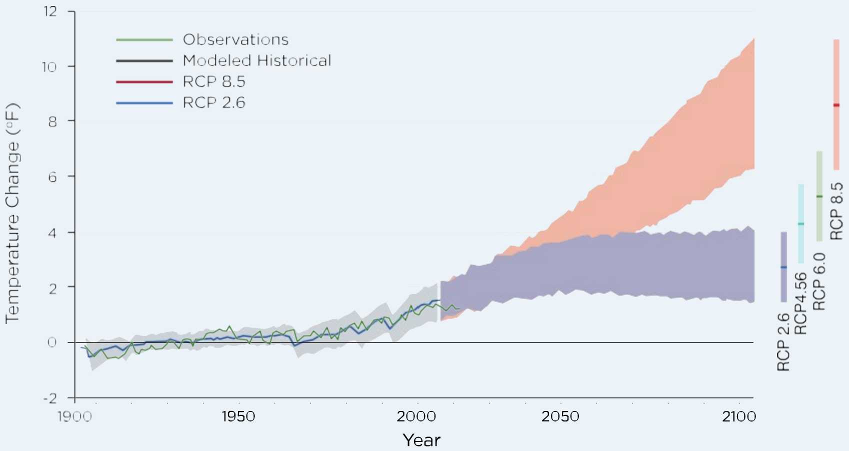


FIGURE 1.9 The 4 IPCC RPCs describing the range of plausible climate futures [Adapted from: CDKN, 2015 The impact of climate change on the achievement ofthe post-2015 sustainable development goals, Technical Report]

4 SCENARIOS

In particular, RCP2.6 represents various scenarios that aim to keep global warming likely below 2°C above pre-industrial temperatures. RCP2.6 corresponds to a scenario where very high mitigation measures have been considered in combination with a limited climate change. RCP4.5 and RCP6.0 represent intermediate scenarios, while RCP8.5 is the highest GHG emissions scenario when no additional efforts to constrain emissions are considered (also termed a “business as usual” scenario) and climate change is assumed to be extreme. In RCP8.5, the global temperature increase is projected to be beyond 4°C in comparison to pre-industrial temperatures (Figure 1.9 above).

INSIGHT #1.4

CHRONIC AND ACUTE RISKS

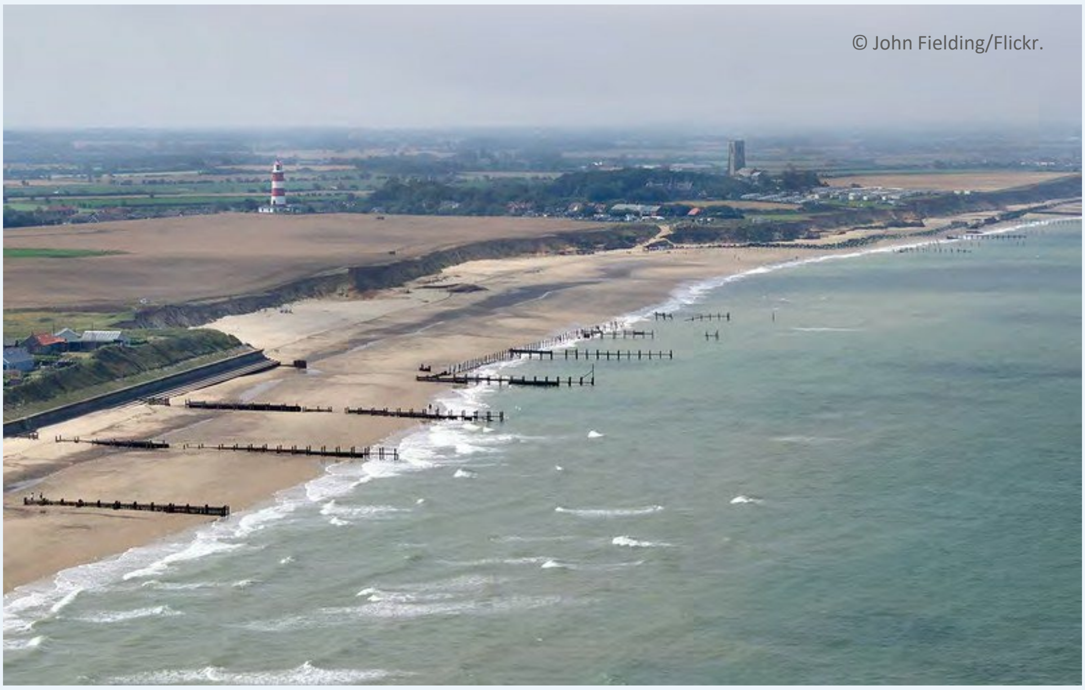
The Earth's climate system may be considered as a set of complex interdependent climatic procedures that lie within a dynamic equilibrium in which weather events are expressed. Within this system, the global climate is characterized by major climatic constants (e.g., sea level, mean temperatures, weather patterns, seasons, permafrost, glacial retreat, etc.), and at the same time, it shapes the range and scale in which extreme weather events (e.g., heat waves, hurricanes, storm surges, extreme temperatures, etc.) may—or may not—occur in different parts of the world.

As climate change unfolds, shifting trends in the evolution of climatic constants become more and more evident. This evolution materializes gradually and becomes apparent only when examining mean values and measurements over an extended period of time. Such chronic climatic shifts alter the dynamic equilibrium of the global climate system, causing significant climatic impacts around the world that may potentially result in devastating consequences.

Definitions

These potential incremental future climatic impacts, and their subsequent potential consequences, comprise the **chronic risks** of climate change. The time of occurrence, the severity, and the pace of these possible impacts are unknown and cannot be predicted (not even probabilistically); thus, chronic risks inherently entail uncertainty.

Concurrently, when focusing on a smaller scale in time, it is already obvious that more frequent and more intense weather events are being experienced around the world. Such extreme or acute weather expressions are causing immediate physical impacts on both natural and man-made systems. Risks that are imposed from the noticeable increase (or decrease) in the frequency and/or intensity of extreme weather phenomena constitute the second type of climate-change risk, **acute risks**. Similarly, acute risks encompass high uncertainty as the frequency and intensity of extreme weather events cannot be determined given their dependency on a climate that is currently evolving in an unpredictable way.

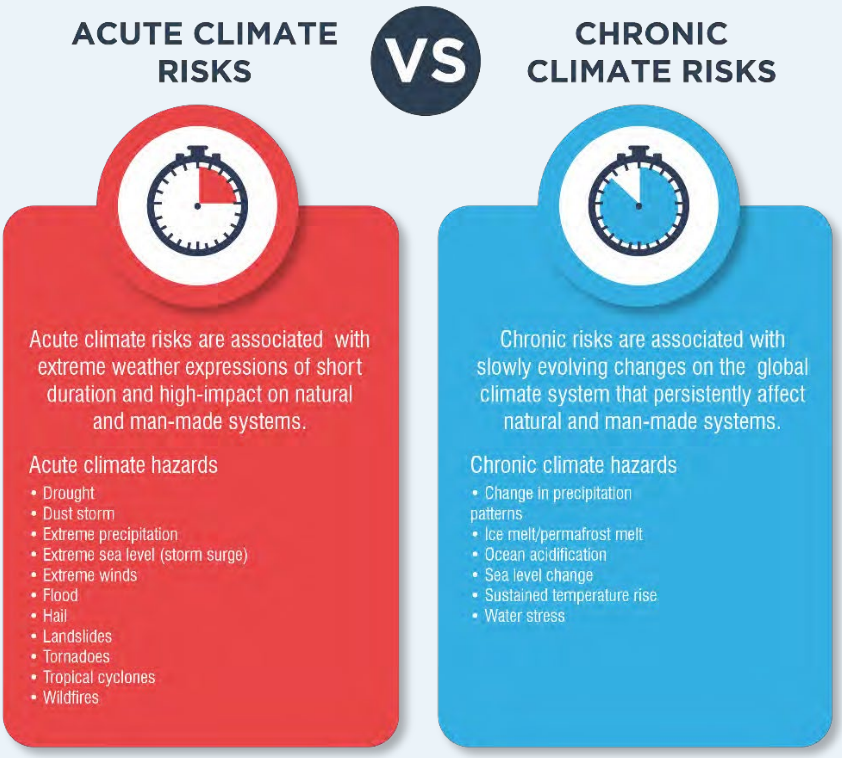


INSIGHT #1.4

IMPLICATIONS FOR THE PPP

Chronic and acute hazards may have both **direct and indirect impacts** on investments and projects, either in the form of physical damages or in the form of service disruptions. For example, if extreme temperaturesexceed the threshold of asphalt, the surface of paved roads may start melting. Similarly, a chronic hazard such as average temperature rise may cause disruptions in the production of geothermal energy because of cooling water shortages.

Chronic and acute risks have different characteristics in terms of their pace of realization (quick/gradual), their duration (short/long), their time of expected occurrence (present/future) as well as their impacts on losses (CAPEX/OPEX). As such, investors may approach chronic and acute risks differently in respect to **risk management strategies**. For example, insurance practices may be implemented to control losses that are associated with acute risks, which are mainly experienced as shocks given their short duration. On the other hand, chronic risks seem to be more suitable to be covered by financial products and long-term strategic plans.



Source: WRI, 2021: Assessing Physical Risks from Climate Change: Do Companies and Financial Organizations Have Sufficient Guidance?

NATURE-BASED SOLUTIONS & BLUE-GREEN INFRASTRUCTURE APPLICATION EXAMPLES

INSIGHT #1.5

► Sand Dams to Combat Drought, Somalia

Somalia is a low-income country that suffers from a very dry, highly variable climate, low precipitation, and extreme weather conditions that could significantly deteriorate due to climate change. Traditional water management mechanisms, especially in rural areas, are often obsolete and lack the capacity to sustain water supply during prolonged dry periods. These conditions make rural communities extremely vulnerable to climate stresses and shocks.

In response to this challenge, the Water for Agro-Pastoral Livelihoods Pilot Project has financedthe construction of several sand dams and subsurface dams across Somalia. The infrastructure was intended to improve the availability of water resources during long dry seasonsby increasing soil moisture, retaining a higher water table throughout seasons, and minimizing water losses due to evaporation and runoff. A similar project was approved by the Somalia Emergency Drought Response and Recovery Project in 2017, continuing investments in sand dams in 15 priority areas around Somalia.

INSIGHT #1.5

► Sand Nourishment for Coastal Protection, Netherlands

To protect the Delfland Coast from erosion and potential flooding, the Dutch government advocated for the implementation of a nature-based strategy avoiding the construction of gray infrastructure (such as concrete levees and wave breakers). In 2011 the government proceeded with a nearly $100 million investment to deposit a 21.5 million cubic meters volume of sand (all at once) and let the sand naturally distribute itself across the coastline and replenish the natural sand dunes. Initial findings are encouraging indicating that the shoreline has indeed grown beyond the original deposit, although the dunes have grown more slowly than expected.

© Rijkswaterstaat/Flickr.

► Combining Green and Gray Infrastructure for Flood Risk Management, Poland

The government of Poland and the World Bank introduced the Odra and Vistula River basins hybrid nature-based solution projects aiming to mitigate flooding in the aftermath of the great river floods in 1997, 2006, and 2010. The project came as part of the strategy to invest in flood protection measures of the population and economic centers of the country. To this end, the existing gray infrastructure was combined with natural features: the river floodplain was enlarged by restoring dikes and repairing existing levee systems and drainage canals, improving flood retention capacity, and helping the protection of local communities. This is another example of efficient interaction between nature-based solutions and traditional gray solutions as a means to reduce climate risk while contributing towards a resilient and low-carbon future.

MODULE 1.2 Resources

[CLIMATE CHANGE KNOWLEDGE PORTAL]

CCKP provides global data on historical and future climate vulnerabilities and impacts

Developed by: World Bank Group

[THINK HAZARD!]

Webtool that provides high-level hazard maps per country, including also smaller scale (district level) hazard detail

Developed by: Global Facility for Disaster Reduction and Recovery (GFDRR) - World Bank Group

[REGIONAL & COUNTRY RISK PROFILES AND GHG EMISSIONS FACT SHEETS]

Climate risk profiles summarize key climate stressors and risks most relevant to a mission's objectives. GHG emissions fact sheets provide information that may be useful in identifying climate change mitigation opportunities

Developed by: United States Agency for International Development (USAID)

[CLIMATE & DISASTER RISK SCREENING TOOLS]

A proactive approach to considering short- and long-term climate and disaster risks in project and national/sector planning processes

Developed by: World Bank Group

[LAC RISK PROFILE VIEWER]

An online tool to inform users of the available risk-studies and their appropriate uses for countries in the Latin America and the Caribbean region, and also to allow the investigation of key risk-study results across multiple countries

Developed by: World Bank Group

[CLIMATE CHANGE ADAPTATION TOOLKIT: WEADAPT]

This toolkit is a combination guidance document and worksheet that assists organizations in outlining a process for identifying, exploring, and evaluating adaptation options to assist organizations in prioritizing actions

Developed by: RMIT University, Net Balance Foundation, City of Greater Geelong

[CLIMATE RISK SCREENING AND MANAGEMENT TOOL FOR PROJECT DESIGN]

This tool guides USAID project planners and support staff through the process of assessing and addressing climate-related risks. This process will help to ensure the effectiveness and sustainability of strategic objectives in the face of climate variability and change

Developed by: USAID, 2017

THE ADAPTATION SUPPORT TOOL: CLIMATE ADAPT

The Adaptation Support Tool is a web tool within the European Climate Adaptation Platform Climate-ADAPT that aims to assist policymakers and coordinators on the national level in developing, implementing, monitoring, and evaluating climate change adaptation strategies and plans

Developed by: European Commission, European Environment Agency

DISASTER AND CLIMATE CHANGE RISK ASSESSMENT METHODOLOGY FOR IDB PROJECTS: A TECHNICAL REFERENCE DOCUMENT FOR IDB PROJECT TEAMS

This methodology provides practical support to project teams in different sectors on how to integrate disaster and climate change risk considerations into project preparation and implementation, where relevant

Developed by: IDB, 2019

JICA CLIMATE FINANCE IMPACT TOOL: CLIMATE FIT (ADAPTATION)

Guidelines for methodologies to assess climate risks and examine adaptation measures for different sectors

Developed by: Japan International Cooperation Agency, 2019

DESIGNING CLIMATE CHANGE ADAPTATION INITIATIVES: A TOOLKIT FOR PRACTITIONERS

The toolkit is a step-by-step guide on how to develop adaptation initiatives in developing countries. The guide helps to understand how to differentiate between a climate change “adaptation” and a traditional development initiative and what key elements must be considered when developing and designing an adaptation initiative

Developed by: UNDP, 2010

BOOKLET ON CLIMATE SCREENING AND ADAPTATION AND REVIEW EVALUATION PROCEDURES

The booklet includes a set of decision-making tools and guides that enable screening projects in vulnerable sectors for climate change risks and identify appropriate adaptation measures to reduce vulnerability

Developed by: African Development Bank (AfDB), 2011

RESILIENCE RATING SYSTEM: A METHODOLOGY FOR BUILDING AND TRACKING RESILIENCE TO CLIMATE CHANGE

The RRS evaluates the resilience of the project design and, through project outcomes, aims to achieve better monitoring of adaptation and resilience-related action. It also includes guidance on ways to incorporate appropriate risk reduction measures into project design

Developed by: World Bank Group, 2021

Module 1.2 - Further Reading

SPECIAL REPORT: MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION

This special report explores the challenge of understanding and managing the risks of climate extremes to advance climate change adaptation

Developed by: IPCC, 2012

AR5 SYNTHESIS REPORT: CLIMATE CHANGE 2014

The most comprehensive assessment of climate change published thus far *by the IPCC.* The AR6 Synthesis Report is due for release in 2022

Developed by: IPCC, 2014

SPECIAL REPORT: GLOBAL WARMING OF 1.5°C

An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global GHG emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

Developed by: IPCC, 2019

INTEGRATING GREEN AND GRAY: CREATING NEXT GENERATION INFRASTRUCTURE

This report guides developing country service providers and their partners on how to integrate nature into mainstream infrastructure systems

Developed by: World Bank Group – World Resources Institute, 2019

INFRASTRUCTURE FOR GENDER EQUALITY AND THE EMPOWERMENT OF WOMEN

The report provides a series of methodologies and tools based on the evidence-based infrastructure approach, helping governments assess and improve their capacity to plan, deliver and manage infrastructure systems. This includes identifying actions to mainstream gender in infrastructure projects,understanding priority areas for intervention, and assessing the level of sustainability, efficiency, and resilience of existing infrastructure assets and systems

Developed by: UNOPS, 2020

LEVERAGING CO-BENEFITS BETWEEN GENDER EQUALITY AND CLIMATE ACTION FOR SUSTAINABLE DEVELOPMENT: MAINSTREAMING GENDER CONSIDERATIONS IN CLIMATE CHANGE PROJECTS

The report provides methodologies and tools to mainstream gender in climate project design and implementation.

Developed by: UN Women, 2016

GENDER DIMENSIONS OF DISASTER RISK AND RESILIENCE: EXISTING EVIDENCE

This report reviews existing evidence and data on how men and women, boys and girls, are impacted by, prepare for, and cope with disasters

Developed by: World Bank Group, 2021

GENDER AND CLIMATE CHANGE: OVERVIEW OF LINKAGES BETWEEN GENDER AND CLIMATE CHANGE

UNDP presents updated versions of 12 training modules and issue briefs on gender dimensions of climate change, covering a range of themes and sectors. These knowledge products are designed to build capacity in member countries with respect to gender and climate change within the context of sustainable development

Developed by: UNDP, 2016

WORLD BANK GROUP GENDER STRATEGY (FY16-23): GENDER EQUALITY, POVERTY REDUCTION AND INCLUSIVE GROWTH

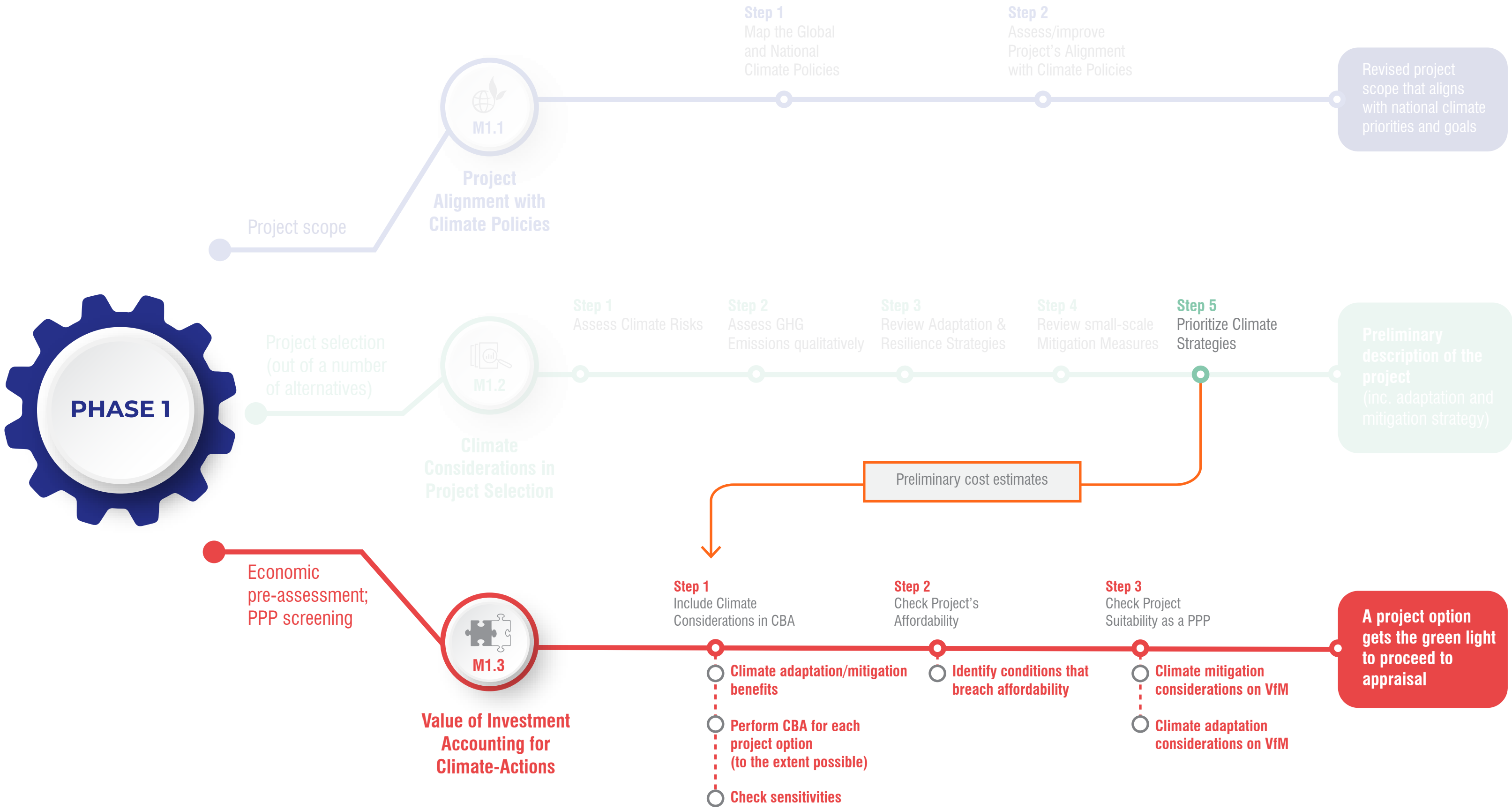
The World Bank Group's new gender strategy delineates the support provided to client countries and companies to achieve greater gender equality. This strategy builds on past achievements and raises the bar on gender equality by focusing on how the World Bank Group can move beyond mainstreaming to an approach that identifies outcomes and monitors results of WBG supported interventions in client countries

Developed by: World Bank Group, 2016

GENDER EQUALITY, INFRASTRUCTURE AND PPPS

The report points out that best practices at the intersection of gender equality and infrastructure PPPs are still evolving

Developed by: Schwartz, J., Damian, B., Nyirinkindi, E., IBRD, World Bank, 2019



Step 1
Map the Global and National Climate Policies
Step 2
Assess/improve Project's Alignment with Climate Policies
Revised project scope that aligns with national climate priorities and goals
M1.1
Project Alignment with Climate Policies
Project scope
PHASE 1
Project selection (out of a number of alternatives)
M1.2
Climate Considerations in Project Selection
Step 1
Assess Climate Risks
Step 2
Assess GHG Emissions qualitatively
Step 3
Review Adaptation & Resilience Strategies
Step 4
Review small-scale Mitigation Measures
Step 5
Prioritize Climate Strategies
Preliminary description of the project
(inc. adaptation and mitigation strategy)
Preliminary cost estimates
Economic pre-assessment; PPP screening
M1.3
Value of Investment Accounting for Climate-Actions
Step 1
Include Climate Considerations in CBA
Climate adaptation/mitigation benefits
Perform CBA for each project option (to the extent possible)
Check sensitivities
Step 2
Check Project's Affordability
Identify conditions that breach affordability
Step 3
Check Project Suitability as a PPP
Climate mitigation considerations on VfM
Climate adaptation considerations on VfM
A project option gets the green light to proceed to appraisal

1.3 Value of Investment Accounting for Climate-Actions

The scope of this third module of Phase 1 is to investigate whether one or more project options may be potentially subjected to climate change-induced risks that could question their technical or financial viability and hence, exclude them from further analysis. As part of this high-level evaluation, the following financial pre-assessment analyses will be performed:

1. Preliminary cost-benefit analysis (CBA), affordability, and value for money (VfM) analysis for each project option brought forward from Module 1.2.
2. Assessment of suitability of the project for PPP procurement and identification of the project option with the highest benefit to the government. Projects failing to pass the selected criterion are excluded from further consideration.

At this stage, the following, mainly qualitative, information is available based on the outputs of the preceding modules:

- the project's risk to climate change
- the cost levels of the direct and indirect losses of such events on the infrastructure
- the costs and benefits of adaptation and resilience measures
- the costs and benefits of climate mitigation[1]

The module intends to guide users in incorporating these outputs into the financial pre-assessment analyses and to outline the considerations that will need to be addressed in each case.

[1] This may refer either to the cost and benefits of alarge-scale mitigation project, or to the cost and benefits introduced by the adoption of small-scale mitigation within projects whose primary scope is not climate mitigation.

STRUCTURE OF THE MODULE

The module is structured in three consecutive steps:

- **Step 1** provides guidance for a high-level cost-benefit analysis (CBA) which aims to identify solutions that maximize the benefits-cost difference.
- **Step 2** tests the affordability of each project option both at the level of the government's fiscal resources and at the level of assessing the impact of tariffs on users. Assessment refers to the project's whole life-cycle, accounting for the special characteristics of its climate mitigation attributes and under the prism of climate-change-induced costs that may occur in the future.
- **Step 3** helps the user decide on the suitability of a project that has been assessed for potential future climate risk and has passed the preliminary CBA and affordability checks to be procured within a PPP framework.

BOX 1.12 ASSUMPTIONS INCLUDED IN THE MODULE

For the purposes of the guidance of this module, certain assumptions are made upfront in order to allow flexibility and adaptability of this part of the toolkit and to avoid its noncompliance when project evaluation processes followed by public authorities are not aligned with the typical PPP cycle. These assumptions are as follows:

- The country in which the project is located can accommodate PPP structures from a regulatory perspective.
- There is a government budget with transparent investment allocations and short, medium, and long-term timelines.
- There is private investment in the country and a banking system that can support international transactions.
- For the right project structure, there are EPC and O&M companies[2] capable of undertaking the contracts (international or national companies that are allowed to operate in the project's country).
- The country is not at war and/or in any other unresolved form of force majeure status (e.g., riots, earthquake disaster, ongoing fires, pandemics, etc.).
- Affordability, CBA, and VfM analyses are not conclusive at this stage and are conducted simultaneously (and updated as more information becomes available during the project evaluation and preparation phases) in order to serve as decision support tools within the boundaries of the state's budget and access to liquidity.

01 INCLUDE CLIMATE CONSIDERATIONS IN CBA

As CBA aims to identify the technical solution that maximizes the benefits minus costs positive difference, any increase in costs would have to be matched or exceeded by increases in benefits. Otherwise, the attractiveness of the technical solution would decrease. Direct and indirect costs are generally more straightforward to identify and quantify; therefore, the following process of incorporating the previous module's outputs in the CBA analysis starts withthe costs part of the equation.

CBA COSTS

Costs associated with climate actions fall into three main categories:

- **Cost impact estimates** of the identified climate hazards: (i) what is the cost impact to the project due to operational disruption, which may or may not include structural damage (i.e., direct and indirect losses as defined previously) and (ii) what is the cost to recover from such disruption back to full operations, adjusted for the probability of occurrence and the timing of such occurrence
- **Cost of the climate mitigation options and of adaptation measures** to reduce climate impacts, e.g., the cost of structural capital works that protect from the hazard
- **Indirect costs** ("externalities") associated with operational disruption due to climate hazard (e.g., business disruption due to people not being able to travel a given road, suspension of industrial production because of power shortages for extended time periods due to power grid unavailability because of extreme weather conditions). Such costs should be adjusted for the probability of the associated events occurring throughout the life-cycle of the project

Once costs have been identified and adjusted for shadow prices and opportunity costs as per the standard CBA analysis, they are input into the financial model and added to the total costs of the project. Associated benefits, over and above the benefits that the project otherwise offers, should then be identified and, to the extent possible, quantified.

CBA BENEFITS

Recapping the description of Module 1.2, for projects including climate mitigation and adaptation plans, such benefits are:

- **Risk reduction** which shall be reflected in all subsequent considerations as well as in the financing[3] terms of the project
- **Socio-environmental co-benefits** including resilience *through* the project, whereby the climate-related measures also lead to protection of the wider or adjacent ecosystem or lead to wider economic benefits, e.g., uninterrupted travel to and from work without frequent interruptions, growth of nearby land value, which is also likely to benefit from such measures, the safety of users, no power shortages, etc.
- **Socio-economic benefits** including impacts on food and nutrition security, health, human settlements, biodiversity, and the natural environment, poverty, unemployment ratio, water supply, electricity costs. Such impacts may unfold during the full life-cycle of the project (including decommissioning) and not just during the validity period of the PPP contract
- **GHG emission** reduction and de-carbonization (which in turn contribute towards achieving national CO_2-related targets)
- Potential access to **"green" liquidity pools**
- Increase of the **residual value of the project**. Especially as climate hazards most likely cover the full life-cycle of the project and, in fact, may be expected to intensify in the long term, a project that is protected from such hazards will have a higher valuation at the end of its life-cycle. For example, a power generating facility may have its life extended, through upgrades and turbine replacement, without the need to relocate because of climate difficulties or uncertainties. The same applies to a transportation network that, with some adjustments, will continue to serve its purpose without the need for alternative transport means due to frequent floods.

Understandably, climate-related benefits should be considered supplementary to the first and foremost benefit of the project, which should be its ability to provide service of higher quality to the end beneficiaries. Such benefits also need to be updated accordingly in the financial model and adjusted for market imperfections. Sensitivities are then assessed, primarily on the costs, which are easier to quantify.

[3] While "funding" is defined as the capital provided by the government or grantor, "financing" refers to the capital that may be raised by the project company from the private sector (e.g., commercial banks). The latter will introduce climate-related terms that need to be met in order to unlock eligibility or to reduce the cost of access to such capital. For example, a commercial bank is highly likely to request guarantees or increased interest rates to finance the project if the climate-related risks appear high or not adequately addressed; other institutions are limited by their mandates to only finance specific climate-mitigation activities.

CBA SCENARIOS

CBA is intended to inform the decision-makers on:

- the level of increase in climate-related costs that are required for total costs to match or exceed benefits
- The level of maximum tolerance of climate-related costs that leads to a breach of affordability.

By identifying such boundaries, it can be determined whether a project that is already positive from a CBA perspective can tolerate climate-related costs, whether they are associated with mitigation or adaptation expenses, and at what level without compromising its overall positive net effect on society, the environment,[4] and the state.

To the extent information for any of the above is not available, it remains an open item to be determined in the later phases. In any case, it is expected that the CBA is constantly updated and information within it refined as project assessment and selection advances in the next stages. In case information is already available, users may refer to Module 2.3 for further guidance on how to perform the CBA in quantitative terms.

It is worth noting that what may be considered a high cost for adaptation measures can ultimately be significantly lower than the costs associated with the risk of disruptions due to climate hazards. The cost of externalities must be carefully assessed in order to compare a project alternative with limited climate hazard risk, against a project alternative with no adaptation but with costs associated with operational disruption.

Step Output

The impact that climate hazard-associated costs, be it disruption costs, adaptation costs, or both, have on the cost-benefit balance and the level of such costs that the project alternatives can tolerate before they are considered net unbeneficial.

[4] When considering climate mitigation projects (e.g., renewable energy, waste to energy), socio-economic benefits are, by default, enriched given the direct link between the project's purpose and, primarily, GHG emission reduction. This direct link is not necessarily the case, when considering projects with climate mitigation adjustments (e.g., highway lighting by renewables), whose primary purpose is not to reduce GHG emissions, but rather climate mitigation is a positive "byproduct."

02 CHECK PROJECT'S AFFORDABILITY

Affordability has to be ensured on the basis of the whole lifecycle costs of each project, with project options that breach affordability levels --regardless of the procurement method used -- being dropped. In the context of this analysis, a preliminary assessment has to be conducted to evaluate whether the additional costs to the project, either from climate events occurring or from the required adaptation and/or mitigation works, impact affordability. Of course, both liabilities and revenues from user-pays projects and taxes have to be considered while ensuring that the net result is in line with budgetary limits, constraints, and other concurrent investment plans of the public authority or the state. Similarly, the impact of tariffs on users needs to be properly assessed and ensure it is acceptable.

Affordability analysis is viewed as a continuous assessment as more data becomes available and project structures are determined. However, what is important at this stage is the likelihood of climate hazard-associated costs or of costs in relation to climate mitigation requirements impacting affordability.

For example, for projects where climate-related costs are a relatively small percentage of the total capital costs, affordability is unlikely to be affected. On the other hand, if such costs (or the contingency costs in case of no adaptation or resilience plans) are a significant percentage of total capital costs, then affordability becomes questionable (this applies to both availability-based and user-pays based concessions whereby the government would have to take steps to fill any viability gap given the high risk and associated costs). In such cases, the project would have to be rejected or re-assessed since its potential for passing PPP suitability and VfM will decrease significantly, as described in the next step.

Step Output

A preliminary high-level assessment of the impact that climate-related costs have on the project's affordability and whether the level of such additional costs renders a project unaffordable for the public authority, regardless of the procurement method and the project structure.

03 CHECK PROJECT'S SUITABILITY AS A PPP AND PRELIMINARY VFM

Entering this step, the project options are assumed to (i) have been assessed for climate-change risk and have not been rejected due to high non-addressable risk, (ii) have passed the preliminary CBA test, whereby their net socio-economic benefits exceed total costs and the strategic climate objectives of the government authorities are being met, and (iii) are likely to be within the government's affordability levels when incorporating costs associated with climate actions.

These project options will next be assessed for their suitability to be procured as PPPs (see also Insight 1.6). In other words, whether and to what extent do climate mitigation or climate risks and their associated reduction costs impact a project's suitability for a PPP. Understandably, given that climate hazard scenarios essentially translate into risk and cost at varying levels in each case, it is important to identify the parts of a PPP suitability assessment that may be affected. Table 1.2 outlines these areas demonstrating the relevant risk and cost considerations, which are explained in detail below.

Similar to CBA, climate mitigation projects (e.g., wind farms, photovoltaic plants, etc.) will, in most cases, satisfy some of a project's PPP suitability considerations more easily. For example, finance availability is, in fact, significantly enhanced as there are several liquidity pools globally and by multiple sources (commercial banks, development and multilateral institutions, government grants) with clear and transparent eligibility criteria for such funding. There is also a substantial market appetite for such projects, given the relevant strategic direction of many private sector infrastructure investors.

VfM at a program level

To the extent that a government or public authority intends to undertake a VfM analysis to determine the most beneficial procurement method for a project (in this case, PPP versus traditional procurement[5]), VfM can also be done at a program level, especially if it relates to projects with a series of common characteristics. This may also be applicable in the case of a list of project options if the climate risk requirements and characteristics are of a similar level and the impacts to all projects are of similar nature and size.

[5] It is noted that frequently project grantors view a PPP solution as the only solution in procuring a project that would otherwise not be procured at all. In these cases VfM analysis is not undertaken.

TABLE 1.2 Impacts of climate change on PPP suitability

VfM Driver	PPP Suitability: Climate Considerations	Conditions	Impact on PPP Suitability
Project size	Is the project too big for the market? Is the project too complex to be delivered as a PPP?	Expensive adaptation costs may materially impact the project size over and above the levels that justify a tender, or that active contractors can take on, or that can be financed	**Negative**
		Including climate risk potentially requires more data and expertise, additional studies and adjustments to standard documentation, increasing preparation time and budget	**Negative**
Market appetite	Would there be investor market appetite?	New climate risks (that haven't been identified before in the country or region) will have a negative impact on private investor appetite	**Negative**
		Proper identification of adaptation cost will maintain private sector appetite	**Positive**
Precedent projects	Are there precedent transactions already developed as PPPs for this type of project in thecountry/region or similar countries?	Existing PPP program or pipeline in the country would allow more flexibility in introducing new risks tothe project structure	**Positive**
Risk allocation	Are there any significant climate risks within the project that are not manageable by a private partner?	The capability (or appetite) of the private sector to undertake unmitigated climate-induced risks is questionable	**Negative**
		Uncertainty on the level of adaptation costs and of their time of occurrence compromises PPP suitability	**Mostly Negative** (unless specific measures to decrease uncertainty are taken)
	Are there circumstances where climate risks can be better by the private party?	The private sector's capital and skills bring higher efficiency in disaster response and recovery. Also, insurance coverage increases the capability of the private party to assume a certain level of climate risks	**Positive**

VfM Driver	PPP Suitability: Climate Considerations	Conditions	Impact on PPP Suitability
	Is there a risk of non-availability of the land/right of way and land acquisition cost overrun?	Geophysical hazards (landslide, subsidence, etc.) may be intensified by climate change	**Mostly Negative** (unless recognized and proper measures are structured)
Certainty of offtake/ supply	Is it possible that the project will experience a change in demand due to climate change?	Climate-related disruption on demand/offtake/supply of a project climate compromises certainty of investment	**Negative**
Project Quality	Will the project quality increase if the project is developed through a PPP scheme?	PPP structure gives room to the concessionaire to think about the most efficient and effective way to deal with climate risk, e.g., for mitigation measures, rebuilding	**Mostly Positive** (provided that the methods used are tested)
		Pressure from private financiers brings higher construction quality and stimulates high performance in order to ensure repayment/ returns	**Positive**
Output-based contracting	Is it possible to define clear output requirements for road performance in climateevents?	Output-based contracting linked with financial incentives (or penalties) may stimulate better climate risk mitigation and preparation as well as quicker and higher quality response and repairs	**Mostly Positive**
Finance availability	Are there any significant climate risks that may harm the availability of financing?	Unmitigated climate risk would challenge financing availability. Certainty of adaptation costs and their timeline (if not performed upfront) is required to ensure the finance availability for a PPP structure	**Negative** (unless recognized and proper measures are structured)
Legal or regulatory framework	Has the country adopted a national framework legislation on climate change (e.g., a Climate Act)	Project implementation will be facilitated if there is an enabling legal/regulatory framework for green investments (defining among other subsidies and incentives for private partner participation)	**Mostly Positive**

Given the qualitative assessments of this stage, it may be quite beneficial for project preparation teams to consider conducting an early-stage market-soundness testing in order to evaluate the extent to which their assumptions are valid and receive non-binding feedback not only from potential bidders but also from several other categories of potential beneficiaries of the project.

PHASE 1

M1.3

Value of Investment Accounting for Climate-Actions

Step 1
Include climate Considerations in CBA

Step 2
Check Project Affordability

Step 3
Check Project Suitability as a PPP

KEY CONSIDERATIONS WHEN PERFORMING VFM

Assuming that the preliminary VfM analysis is at this stage undertaken primarily on a qualitative basis (see Box 1.13), the following considerations should be made with regards to incorporating climate actions in the project's structure:

- Include the cost of climate adaptation and resilience measures when calculating the public sector comparator (i.e., what would it cost the government or the public authority to procure the project through traditional means). Admittedly, at this qualitative level of the VfM assessment, it will be essential to make assumptions regarding such costs; however, a high-level review of potential costs and likelihood can be determined.
- Incorporate the cost of climate adaptation and resilience measures in the PPP preliminary model. Again, assumptions have to be used at this early stage; however, substantial differences as compared to the output of **Step 1** may surface, thereby indicating that a PPP may be more beneficial than traditional procurement.
- Similarly, include climate mitigation costs when calculating the public sector comparator and the PPP preliminary model.
- Identify the benefits of procuring via PPP related to climate risk and adaptation measures, such as the innovation that the private party may introduce in this sector, the competitive tension to keep costs low and performance high, efficiencies, etc.
- Ensure that the potential benefits regarding mitigation characteristics that could be brought by PPP procurement are adequately considered, assuming equal quality of service between PPP and traditional procurement.

Detailed VfM analysis will be undertaken in the next phase, as details regarding costs and project structure under a PPP contract evolve. At this stage, the project option with the highest potential net value to the government should be taken forward to the next phase for more detailed analysis and structuring.

Step Output

For each project option:

- (Optional) The likelihood of passing the CBA test
- A decision whether the climate costs maintain or breach affordability
- A preliminary decision on whether an option can be structured as a PPP in a way that is more valuable to the government as opposed to traditional procurement considering climate evolution, its risks, and the required adaptation measures

BOX 1.13 RULE OF THUMB FOR ASSESSING THE IMPACT OF CLIMATE RISK INCORPORATION ON A PROJECT'S PPP SUITABILITY

A project alternative that is otherwise considered to be suitable for a PPP is assessed based on the following questions:

01 Level of climate risk
Is the risk low enough and its impact controllable within the context of a project's operational and financial performance (e.g. a flood on a road once a year for a few days is very different to sea level rising and water covering parts of the road permanently)?

02 Climate risk protection
Can the risk be mitigated either via resilience / adaptation measures (or uncostly recovery), or can insurance be bought at a reasonable price against such risks?

03 Availability of financing
If the costs are considerable to eliminate such risk, are there potential ways that such costs can be funded separately or incorporated in the project economics in a manner that does not compromise the project economics?

04 Bankability considerations
Will potential lenders be willing to accept risk on the project company, on the basis that the appropriate solutions will be pursued (insurance and/or adaptation)?

05 Other benefits
Are there any potential benefits to including climate risk and adaptation provisions in a contract structure?

06 Regulatory framework
Does the PPP regulatory framework allow for bespoke treatment of climate hazards (i.e., definition of risks that may be mitigated versus those that cannot)?

If the answer is yes to all the above questions, then PPP suitability is not likely to be affected by incorporating climate risk provisions and measures in a project structure. This depends on the nature of the project, the level of impact, and the actual level of costs for addressing the risk.

KEY TAKEAWAYS

- The high-level CBA should incorporate climate considerations including cost impact estimates of the identified climate hazards and the costs of recovery, the cost of climate mitigation options and climate adaptation and resilience measures, indirect costs associated with operational disruptions due to climate hazards together with the benefits of risk reduction and their indirect benefits to the broader ecosystem or socioeconomic system, GHG emission reduction, potential access to green financing sources, and the residual value of the project throughout the whole life-cycle.

- An important factor to consider for the need of a climate-inclusive CBA analysis is that what may be considered a high cost for adaptation measures can ultimately be significantly lower than the costs associated with the risk of disruptions due to climate hazards.

- The additional costs to the project, either from climate events occurring or from the required adaptation and/or mitigation work affect affordability. Both liabilities and revenues, from user-pays projects and tax, have to be considered, while ensuring that the net result is in line with budgetary limits, constraints, and other concurrent investment plans of the public authority or the state.

- Climate change considerations should be also incorporated within the PPP suitability assessment by taking into account the level of climate-related (adaptation and mitigation) costs in a traditional vs. PPP procurement method comparison, the potential climate-risk allocation in a PPP scheme, the availability of risk protection measures (i.e., insurances and guarantees) and the financing and bankability concerns related to climate risks supplemented by the project's co-benefits.

- Building on the findings of this phase to conduct an early-stage market soundness testing of the project, emphasizing potential climate action could provide valuable insights from multiple stakeholders thereby providing valuable input for the forthcoming preparation phase.

INSIGHTS

Insight #1.6

How May Climate Risk Impact the PPP Suitability of a Project?

INSIGHT #1.6

HOW MAY CLIMATE RISK IMPACT THE PPP SUITABILITY OF A PROJECT?

Climate and climate change introduce additional risks to the PPP that, if not properly assessed, addressed, transferred, or shared among parties, may compromise the project VfM and the overall PPP suitability. Listed below are conditions that should be considered during project preparation and structuring.

1 Project size/cost of adaptation ratio

Project size plays an important role in the sense that a small percentage (upto 10%) increase in the total project costs in order to implement adaptation measures and mitigate climate risk should not impact a project's PPP suitability. If, on the other hand, such costs represent a significant percentage of total project costs, therefore requiring larger funding by the private sector, then some form of cost or risk-sharing with the governmentor structured solutions would be required to maintain PPP suitability.

2 Climate-induced disruption

The impact of climate hazard risk on availability, for availability projects, or supply and offtake, for user-pays concessions, has to be considered, particularly when such risk severely affects interdependent infrastructure. In most cases, the project company would have to be ring-fenced from such risks. For example, failure of the grid given an adverse climate scenario should not be the risk of a power plant concession, and similarly, flooding of a road should not be the risk of an adjacent toll road. To the extent that climate hazards compromise this relative certainty of availability and offtake/supply, PPP suitability is also impacted.

3 Local market appetite

The market's appetite for PPP projects is another factor to be considered in order to understand how a bidding process will be impacted (number of bidders, quality of bidders) and how climate risk will be effectively introduced in the bidding documents/provisions. If a PPP pipeline already exists, it may be more straightforward to incorporate new provisions in contracts without affecting the market appetite for new projects. In cases where PPPs are a new way of procuring infrastructure, consultations should take place in order to assess the market's appetite for a PPP with climate provisions and perhaps to initiate thinking about ways that such provisions can represent a benefit and an incentive for market players.

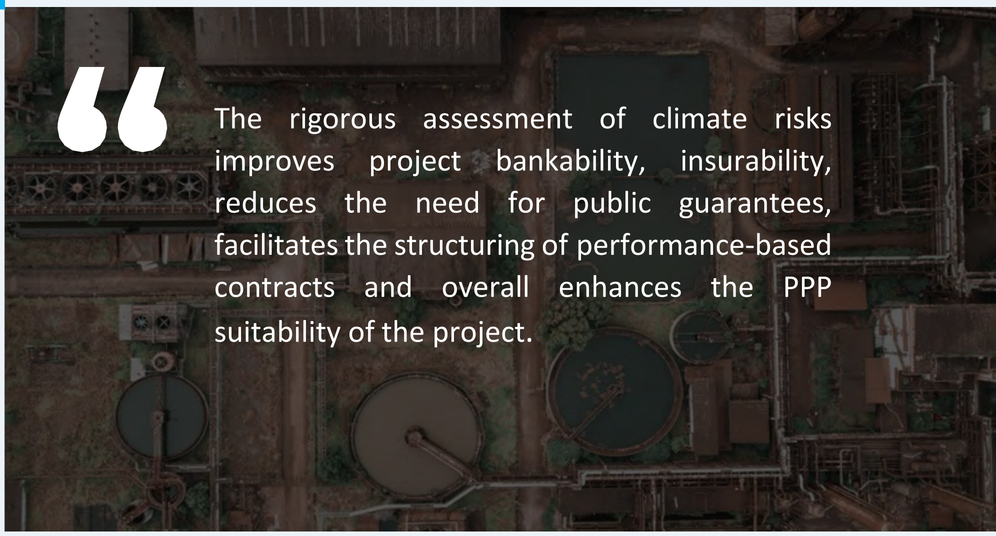
INSIGHT #1.6

4 Measurability of climate impacts

On the basis that a PPP structure would not accommodate provisions with uncertain outcomes and uncertain responsibilities, it is essential to assess whether climate-induced disruptions have a measurable impact on a project's performance. If yes, climate risk will be explicitly introduced in the PPP agreement (i.e., performance metrics can be structured and embedded in the payment mechanism, insurance provisions, etc.). If the risk is not measurable, then it is likely that a PPP structure without significant protections and cover by the government or other agencies will face difficulties in being executed.

5 Availability of financing

Climate risk provisions in a PPP structure may improve the project's eligibility for additional liquidity sources under the provision that there are no significant uncertainties in a project's cash flow waterfall and/or there are reserve accounts to account for contingencies. Lenders would require guarantees and cover if climate uncertainties are not accommodated adequately within the financing plan.



> "The rigorous assessment of climate risks improves project bankability, insurability, reduces the need for public guarantees, facilitates the structuring of performance-based contracts and overall enhances the PPP suitability of the project.

6 Affordability implications

Climate risk costs (disruption or adaptation) that are significant or not addressable may severely impact the capability of the private sector to sustain payments. Public sector intervention would be necessary to fill the viability gap (in user-pays concessions) or to provide the required guarantees. One counter to that is whether a project that otherwise becomes unaffordable by the inclusion of climate risk provisions or measures would provide benefits/synergies/innovative solutions if procured via a PPP that would make it more affordable.

MODULE 1.3 Resources

[VALUE-FOR-MONEY ANALYSIS: PRACTICES AND CHALLENGES]

Presents lessons from countries that have relatively well-developed approaches and tools for VfM analysis: with respect to how this analysishas evolved, what are the ongoing and new challenges, and how the approaches might apply in countries with less well-established PPP programs

Developed by: WBI - PPIAF, 2013

[ASSESSING THE COSTS AND BENEFITS OF ADAPTATION OPTIONS. ANOVERVIEW OF APPROACHES]

This publication provides an introduction to a range of different assessment approaches and methodologies of assessing the costs and benefits of adaptation options and shares best practices and lessons learned

Developed by: UNFCCC, 2011

Module 1.3 – Further Reading

[INVESTING IN A TIME OF CLIMATE CHANGE]

This study provides information on risk and opportunity priorities to incorporate when building investment portfolios. It outlines a methodology that will allow investors to be better informed to identify, assess, and act on climate change within the investment process. The approach incorporates four climate scenarios and four climate risk factors to estimate the impact on returns for portfolios, asset classes, and industry sectors between 2015 and 2050. The report also provides sector-based details

Developed by: Mercer, 2015

[ECONOMIC ANALYSIS OF CLIMATE-PROOFING INVESTMENT PROJECTS]

How the economic analysis of climate-proofing measures informs the design ofinvestments

Developed by: Asian Development Bank, 2015

PHASE 2

1
PROJECT SELECTION

2
PREPARATION

Refine project scope and preliminary design

Assess technical feasibility

Refine socio-economic feasibility

Assess PPP commercial feasibility and affordability

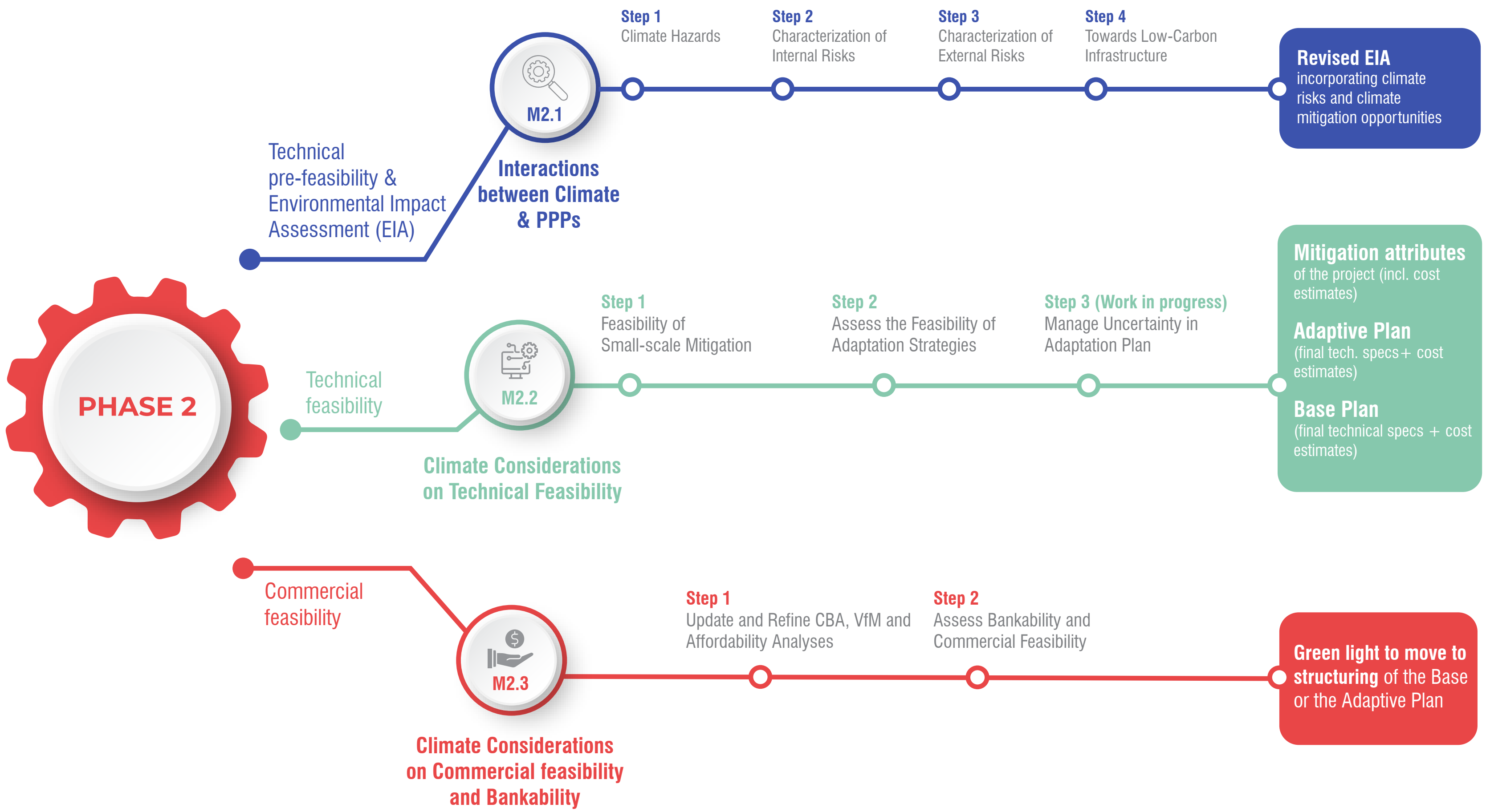
3
STRUCTURING CONSIDERATIONS

4
TENDER PROCESS

Phase 2

Climate considerations should play an instrumental role during the second phase of the PPP cycle, which typically includes the project's scope refinement and the assessment of its technical and commercial feasibility. Therefore, it is essential that the assessment of any climate-related risks and the design of climate mitigation options and adaptation and resilience measures are properly and accurately accounted for at this stage to include climate-related considerations in the project appraisal correctly.

In this context, Phase 2 of the climate toolkit is devoted to guiding users on how to conduct detailed assessments of GHG emissions and climate risks (including advanced climate hazard modeling) while accounting for both internal and external risk factors, followed by a thorough review of considerations on the design of climate mitigation and adaptation plans under deep uncertainty (including provisions for promoting the use of "green" construction solutions). Costs and associated benefits of climate considerations are subsequently assessed, and guidance is provided on how to include them in the project without compromising its commercial feasibility and bankability.


PHASE 2
Technical pre-feasibility & Environmental Impact Assessment (EIA)
M2.1
Interactions between Climate & PPPs
Step 1
Climate Hazards
Step 2
Characterization of Internal Risks
Step 3
Characterization of External Risks
Step 4
Towards Low-Carbon Infrastructure
Revised EIA incorporating climate risks and climate mitigation opportunities
Technical feasibility
M2.2
Climate Considerations on Technical Feasibility
Step 1
Feasibility of Small-scale Mitigation
Step 2
Assess the Feasibility of Adaptation Strategies
Step 3 (Work in progress)
Manage Uncertainty in Adaptation Plan
Mitigation attributes of the project (incl. cost estimates)
Adaptive Plan (final tech. specs+ cost estimates)
Base Plan (final technical specs + cost estimates)
Commercial feasibility
M2.3
Climate Considerations on Commercial feasibility and Bankability
Step 1
Update and Refine CBA, VfM and Affordability Analyses
Step 2
Assess Bankability and Commercial Feasibility
Green light to move to structuring of the Base or the Adaptive Plan

Phase 2

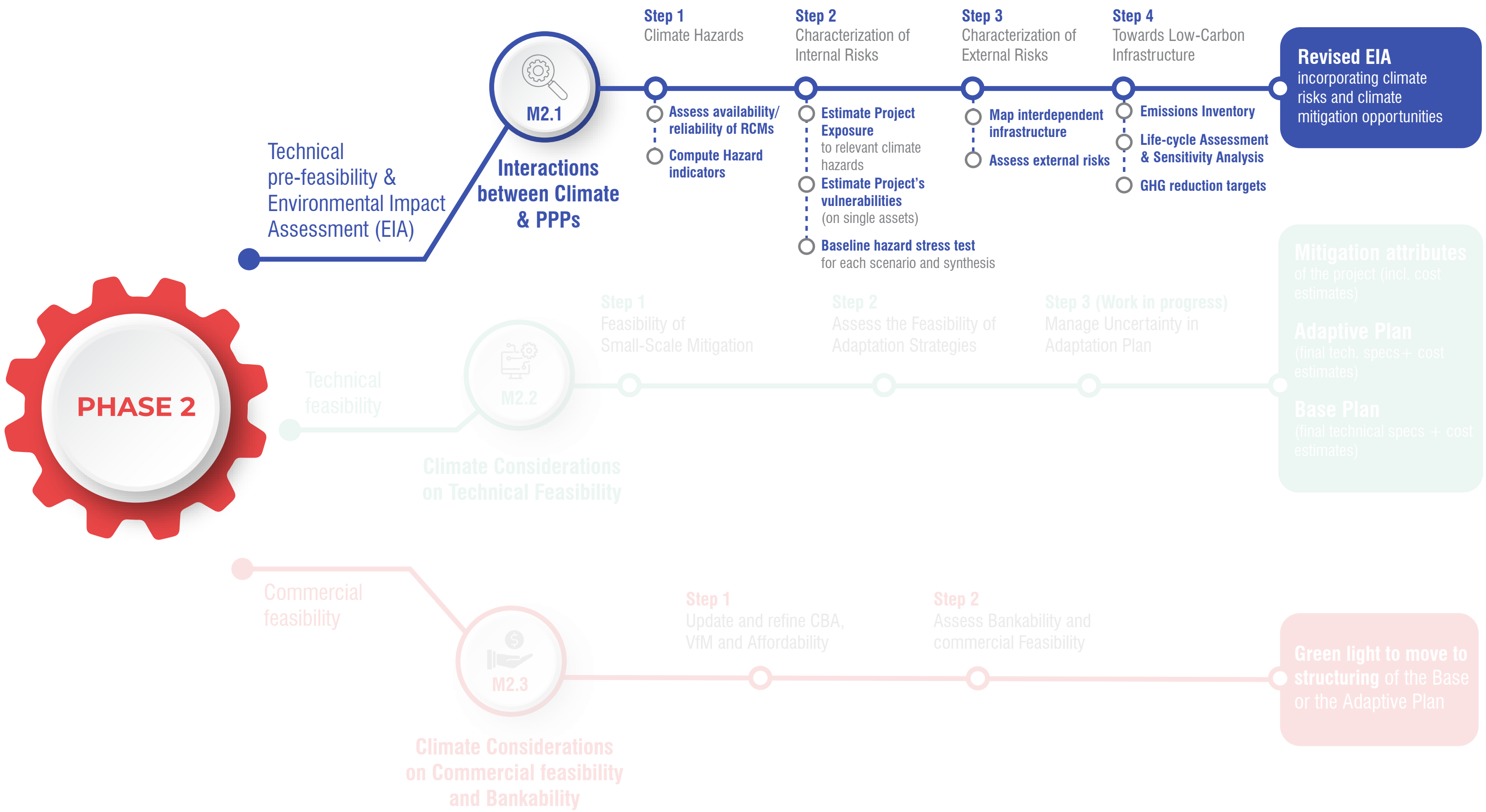
Outline

Phase 2 comprises three modules:

Module 2.1 – Interactions between Climate and PPPs outlines the impacts of climate on the project and the impact of the infrastructure on climate change. It involves future mapping, climate change, and risk modeling and intends to provide guidance on assessing adaptation measures and measures to enhance projects' contribution to carbon neutrality.

Module 2.2 – Climate Considerations on Technical Feasibility Assessment provides guidance on how to review technical solutions while evaluating non-monetary benefits of climate mitigation options and describes the methodology to include climate adaptation and resilience options in the technical feasibility of the project, which may be performed under conditions of deep uncertainty regarding climate scenarios.

Module 2.3 – Climate Considerations on Commercial Feasibility Assessment provides detailed instructions on how to update cost-benefit, value for money, and affordability analyses of the PPP project and to ensure that bankability and commercial feasibility are not compromised after incorporation of climate-related measures.



PHASE 2
Technical pre-feasibility & Environmental Impact Assessment (EIA)
M2.1
Interactions between Climate & PPPs
Step 1
Climate Hazards
Assess availability/ reliability of RCMs
Compute Hazard indicators
Step 2
Characterization of Internal Risks
Estimate Project Exposure to relevant climate hazards
Estimate Project's vulnerabilities (on single assets)
Baseline hazard stress test for each scenario and synthesis
Step 3
Characterization of External Risks
Map interdependent infrastructure
Assess external risks
Step 4
Towards Low-Carbon Infrastructure
Emissions Inventory
Life-cycle Assessment & Sensitivity Analysis
GHG reduction targets
Revised EIA incorporating climate risks and climate mitigation opportunities
Technical feasibility
M2.2
Climate Considerations on Technical Feasibility
Step 1
Feasibility of Small-Scale Mitigation
Step 2
Assess the Feasibility of Adaptation Strategies
Step 3 (Work in progress)
Manage Uncertainty in Adaptation Plan
Mitigation attributes of the project (incl. cost estimates)
Adaptive Plan (final tech. specs+ cost estimates)
Base Plan (final technical specs + cost estimates)
Commercial feasibility
M2.3
Climate Considerations on Commercial feasibility and Bankability
Step 1
Update and refine CBA, VfM and Affordability
Step 2
Assess Bankability and commercial Feasibility
Green light to move to structuring of the Base or the Adaptive Plan

2.1 Interactions between Climate and PPPs

While understanding the impacts of climate on infrastructure is of paramount importance, it is equally critical to understand the infrastructure's contribution to future climate. Therefore, the present module aims to support users, firstly, with developing climate risk assessments that will subsequently inform adaptation measures and, secondly, with assessing the potential contribution of the infrastructure to a carbon-neutral future.

In the project preparation phase of the PPP cycle, a more comprehensive climate risk assessment is performed for the selected project. This module aims to guide users in conducting a quantitative hazard analysis and assessing both internal and external risks posed on the project through its interaction with the broader environment. As part of understanding the broader environment, users are prompted to explore dependencies on associated infrastructure (e.g., energy, transport, water), which are themselves likely subjected to climate-induced impacts. Additional climate-related considerations are also studied as part of this module through a future landscape mapping activity.

Climate risk assessment at this stage is expected to be data-driven and computationally demanding. While the intention is to develop a thorough quantitative analysis, the time demanded for such an assessment, or the lack of available information might lead users to a more rudimentary approach. In either case, this tool is designed to be used by a multidisciplinary team that incorporates advanced climate and risk analysis expertise, in-depth sectoral knowledge, and a solid understanding of the project's dependencies on the surrounding socioeconomic systems, natural and built environment (Box 2.1).

Finally, this module supports users in assessing the infrastructure's carbon emissions throughout its life cycle as well as the emissions associated with the infrastructure's service. This assessment is key to identifying the contribution to climate mitigation through the development of low-carbon infrastructure.

BOX 2.1 NECESSITY OF AND RESOURCES FOR CLIMATE MODELING

Climate change modeling can be a very scientific task requiring skilled personnel and advanced tools. Mobilizing such resources during the early upstream phases of the PPP project may be challenging— especially in cases where project funding has not yet been secured. On the other hand—and as will be shown in several parts of the present toolkit—neglecting climate impacts due to poor assessments may provoke losses whose scale can be orders of magnitude larger than the cost of even the most advanced modeling efforts.

Therefore, it is recommended that a small-scale expert's assessment is performed during the identification stages of Phase 1 to evaluate the potential climate impacts on the project and vice-versa and subsequently define the types and level of analyses that would be essential for the present preparation Phase 2.

This would enable planning of the advisory resources to be included in Phase 2 and identification of the type of consulting activities and the required level of detail.

It is recommended that such an expert's assessment be based on the guidance provided by the toolkit in order to propose qualifications of advisors to be included in the terms of reference of the relevant consulting requests for proposals. It should also be able to assess the cost of obtaining such services so that these are adequately accounted for by therelevant PPP units.

Although many resources are available online that allow preliminary high-level identification of climate impacts, it is not recommended to rely on such information only for the assessments described in the present Phase 2 of this toolkit.

STRUCTURE OF THE MODULE

This module consists of the following four steps:

- **Step 1** provides guidance on performing a detailed climate hazard analysis for the project under consideration, including direct and subsequent hazards while accounting for climate uncertainty.
- **Step 2** navigates users through the characterization and quantification of internal risks (i.e., those potentially producing physical damage on the project or downtime), including guidance on how to assess exposure and vulnerability of the assets to each hazard.
- **Step 3** maps the interdependencies of the project with existing infrastructure and hence identifies external risks to the project (i.e., those impacting the operation of the project due to climate-related damage on or failure of its interconnections with the broader ecosystem).
- **Step 4** guides users on analyzing the emissions associated with the infrastructure and identifies potential mitigation measures.

01 CLIMATE HAZARDS

In this step, users identify the hazards potentially threatening the project. The characterization of these hazards will support the risk assessment of steps 2 and 3. Users should aim to answer in an adequate manner the following key questions:

Project-specific characteristics: Which are the project's assets under risk evaluation?

Climate hazards: Which climate scenarios are taken into account in the climate risk assessment? What are the exact metrics of each hazard related to the project for the examined climate scenarios? This information is brought forward from step 1 but can be adapted if needed.

A detailed analysis of climate hazard evolution over future periods of interest is performed for selected climate scenarios. The minimum timeframe for assessing climate hazards shall be the PPP life cycle. However, the public party may want to extend the timeframe for the study, given that the life cycle of the infrastructure may be longer than the duration of the PPP contract. Both direct (e.g., extreme temperatures) and subsequent hazards should be explored (e.g., fire hazards due to excessive heat). Climate expert advice is recommended in handling climate models and modeling outputs. Experts should first select and then evaluate driving parent ensembles of Global Climate Models (GCMs) and Regional Climate Models (RCMs) (Box 2.2). Climate sensitivity analysis is performed for the explored models, and ultimately the interpretation of results takes place with respect to the project's risks.

Climate projections are assessed against a reference period of analysis to identify change. The existence and use of historical observation is deemed extremely valuable to evaluate RCM's reliability (and possibly reject its use) and apply bias correction to modeled results, i.e., to account for systematic errors and improve their fitting to observations. Modeling areas with scarce observations naturally limits the modelers' ability to reduce uncertainty (Box 2.3).

RCM results are becoming increasingly available, thus covering most areas of the globe. Ongoing research activities have developed high-resolution models, albeit they are computationally intensive and have not been mainstreamed in infrastructure projects. If RCM data is unavailable for a region or is still too coarse, users can explore statistical downscaling. Once the above process is completed, a set of climatic variables will become available on which indicators of interest can be readily applied.

BOX 2.2 CLIMATE MODELING

To assess present and future hazards, climate scientists make use of climate models. Simply put, these are numerical representations of the climate system based on the biophysical properties of its components, their interactions, and feedback processes. The following two types of models are typically used to produce climate projections:

- **Global Climate Models** (GCMs): simulating the climate at a global scale
- **Regional Climate Models** (RCMs): simulating the climate for a region

GCMs cover the globe in a three-dimensional grid. Current and future climate can be described in each grid cell. GCMs typically have horizontal spatial resolution ranging from 150 - 200 km, while vertical layers can be up to 30. Running GCMs requires large computational power and time. The low resolution suggests that these models cannot predict future climate for local impact studies, i.e., at the scales of PPP projects. To overcome this limitation, downscaling methods are applied to obtain local climate information. Downscaling can be dynamic or statistical. Dynamic downscaling uses Regional Climate Models (RCMs) to increase the resolution of climate projections (Figure 2.1). RCMs are able to simulate mesoscale processes in a level of detail that a GCM cannot. Useful resources for accessing downscaled information are included at the end of this module.

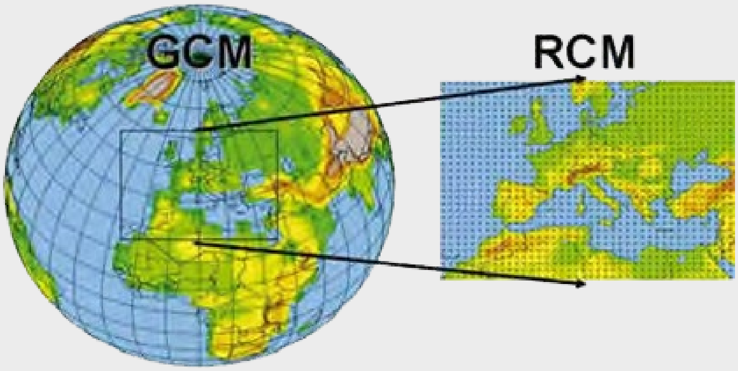


FIGURE 2.1 An RCM domain embedded in a GCM grid [Source: F. Giorgi, 2008: WMO Bulletin 52(2) - April 2008, page 86]

BOX 2.3 MAKING SENSE OF FUTURE UNCERTAINTY

How the future climate will unfold is not known. To explore possible alternative futures, climate scientists use models to project climate under different emission scenarios. Different intensities and frequencies of future climate hazards and risks on PPPs are expected for these different scenarios. To plan for adaptation, it is useful to understand the spread of possible future hazards, i.e., the level of uncertainty in the effort to predict the future. Three key typologies of uncertainty are introduced, namely:

- **model uncertainty**, stemming from the imperfect knowledge and representation of climate in climate models
- **emission scenario associated uncertainty**, due to the imperfect knowledge of socioeconomic and technological developments in the future, resulting in different levels of emissions of GHGs
- **internal variability-related uncertainty**[1] due to natural climate variability.

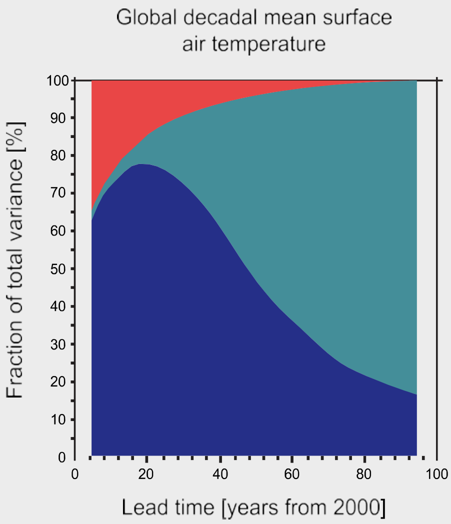


FIGURE 2.2 Fractional contribution of different uncertainty sources (model configuration in blue; scenario uncertainty in green; internal variability in orange) for global temperature as a function of lead projection time obtained from the CMIP3 ensemble.

Figure 2.2 shows uncertainty contribution to the projected global surface air temperature. Co-assessing the influence of the above three sources of uncertainty suggests that their relative contribution changes over projection lead time, i.e., uncertainty is dynamic. Its absolute value will tend to increase, e.g.,natural variability will not decrease with time, but it tends to contribute less to theoverall uncertainty. Model configurationand internal variability dominate near- term projections while, as expected, scenario uncertainty is low. Scenario uncertainty becomes dominant for the long term, end of century projections

Source: Hawkins, Sutton, 2009: The potential to narrow uncertainty in regional climate predictions. Bull. Amer. Meteor. Soc., 90, 1095 - 1107]

Step Output

A quantitative analysis of climate hazards likely to affect the project

[1] Internal variability is the natural variability of the climate system that occurs in the absence of external forcing and includes processes intrinsic to the atmosphere, the ocean, and the coupled ocean-atmosphere system.

02 CHARACTERIZATION OF INTERNAL RISKS

Following the hazard analysis of step 1, the present step focuses on analyzing the project exposure and vulnerability. On this basis, it aims to characterize internal risks through the analysis and synthesis of risk components under the climatic scenarios of interest. Users should attempt to answer the following key questions adequately:

Project Exposure: Which assets of the project are in direct contact with the hazardous event?

Project Vulnerability: If a hazardous event occurs and the project is exposed, what is the project's overall susceptibility and recovery capability to the hazard?

Climate Risk: What is the overall climate risk of the project for the investigated hazards? What is the associated uncertainty in the calculations, e.g., is the influence of different climate models and scenarios significant?

Already in Phase 1, users have identified whether the project location will experience a hazardous event. Now that the project's masterplan has been selected, users can assess if the project's infrastructure is anticipated to experience any climatic stress or any change in the project environment during or after the hazardous event. Making use of the indicators defined in the previous step, it is possible to assess the project's exposure per hazard. To compute the degree of the project exposure, it would be necessary to perform modeling analysis. The selection of modeling application should reflect the project's needs and level of detail required and is subject to expert opinion, thus balancing between time constraints, computational ability, and data availability. For example (see also Box 2.4), hydrological flood models may be used to characterize hazard exposure for the project's assets under different flood scenarios (return period events). It is noted that similar to hazards, exposure can also be dynamic as the surrounding environment of the project experiences changes (see external risk). In cases where modeling is not possible (or not preferred by the user), well-informed estimations or empirical approaches can also determine the level of exposure.

With respect to vulnerability, users assess factors that contribute to the project's ability to withstand the impact of a hazard it is exposed to. Such factors can be inherent characteristics of the infrastructure (e.g., the capacity of structural materials) or systemic characteristics (e.g., early warning system). The two components of vulnerability, namely the sensitivity and lack of capacity to cope or adapt to the hazard, have already been explored in Phase 1. In the present phase, users need to elaborate further on the identified contributing factors to the vulnerability components for the base plan. The assessment is performed for the hazard indicators and scenarios of step 1. Ultimately, the integration of all vulnerability factors per hazard will lead to the overall degree of vulnerability of the project for each hazard. This integration could be supported by applying weights[2] on the different vulnerability factors based on technical knowledge or based on empirical estimations regarding the merit of each factor to the overall vulnerability.

Once the above individual risk components have been assessed, they are consolidated under a baseline hazard **stress test** for each scenario. The series of stress tests produce the ensemble of risk synthesis, which essentially constitutes the envelope of potential risks that may affect the project. In some instances, risks might interact between them, and this should be taken into account. For instance, following the previous example, forest fire risk can increase future flood hazard exposure as it will change the rainfall-runoff response of the catchment as well as erosion characteristics.

Modules 2.2 and 2.3 elaborate on measures aimed to reduce the identified risks and minimize their cost implications.

Gender Considerations

When conducting a climate hazard assessment,[1] estimation of climate stressors and potential disruption should account for gender. As a plethora of literature shows, women and children are more vulnerable to climate change due to gender norms and division of labor. For instance, during times of flooding and other natural disasters, women are often the last to evacuate their homes because of their caregiving responsibilities or because they lack permission from male members in the family. Moreover, women are also likely to suffer during post-disaster rehabilitation. They struggle more in the labor market and are more vulnerable to domestic violence and sex trafficking in shelters. In addition to these considerations, other vulnerable groups particularly in the context of natural disasters should be focused on including persons with disabilities. Similarly, changes in land use (e.g., through a renewable energy project) can particularly hit indigenous populations who have inalienable rights to ownership of land.

[[1] Source: International Federation of Red Cross and Red Crescent Societies IFRC, 2010- A practical guide to gender-sensitive approaches for disaster management]

Step Output

Climate risk synthesis and production of an evidence base for improved planning and decision-making

[2] i.e., importance factors

BOX 2.4 FROM CLIMATE MODELS AND IMPACT MODELS THROUGH TO ECONOMIC ASSESSMENT MODELS

Climate models provide useful evolution information on specific variables. On this basis, an impact model is used to calculate specific impacts relevant to the context of the study at hand. These models will account for exposure and vulnerability. This information is then utilized in the subsequent modules (i) to develop technical solutions that reduce climate impacts and (ii) to understand the economic implications of climate change on the project. These two components are typically seen in conjunction. Careful consideration of each model's limitations and an understanding of the propagation of uncertainty among models is necessary.

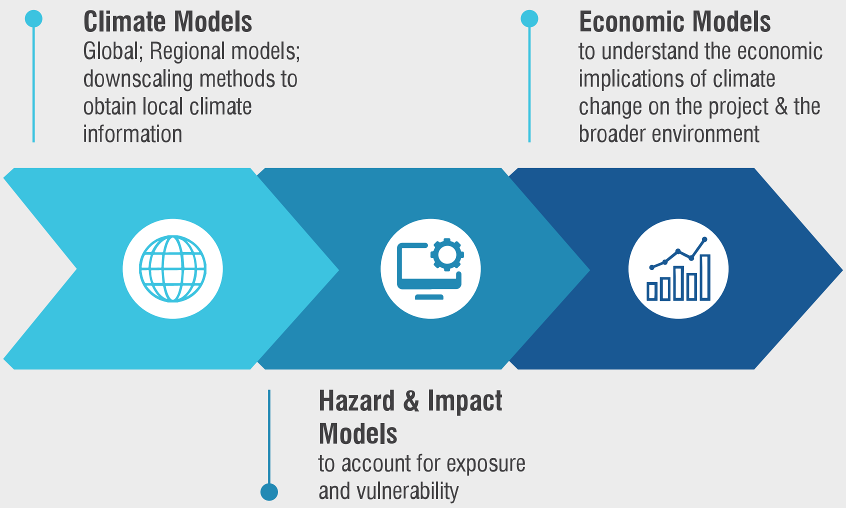


FIGURE 2.3 Model interlinkages to translate climate risk to financial risk

An example for the hydropower sector

In the case of a hydropower project (whether existing or new), climate change is expected to alter the hydrology of the catchment where the project is found. For instance, indicators derived from climate models can show changes in annual precipitation levels, snowmelt, intra-annual precipitation distribution, and evapotranspiration, all of which can contribute to changes in hydrology. Through the use of hydrological modeling (i.e., the impact model, see Figure 2.3), these changes will be translated to changes in river flows and, by extension, on storage volumes at the reservoir, i.e., changes in the form of intra- and inter-annual storage variations. These variations have significant design and economic implications for the reservoir. As such, this analysis shall inform the capacity design and turbine selection and provide a better understanding of the expected revenue (when and how much energy will be produced). Ultimately, climate scenarios can be used to provide a better understanding of the range of economic performance of the planned infrastructure, i.e., provide uncertainty bounds on the investment's returns.

03 LANDSCAPE MAPPING AND IDENTIFICATION OF EXTERNAL RISKS

This step aims to motivate users to become climate-conscious by guiding them to imagine future landscapes where the project becomes externally exposed to hazards during its life-cycle, i.e., potential external risks are identified (see Box 2.5). In these future scenarios, exposure, vulnerability, and demand for the infrastructure might be affected. The timeframe to be examined shall include at least the duration of the PPP contract or preferably extended to the whole life cycle of the infrastructure (i.e., beyond decommission). Users should aim to answer in an adequate manner the following fundamental question:

Future Landscapes: What is the project's interdependent infrastructure and which factors that comprise the socioeconomic system will interact with the project's climate risk?

As such, users are prompted to:

(a) **Identify dependencies with associated infrastructure** which themselves may be exposed to climate risks. Notwithstanding, the hazards associated with internal and external risks are not necessarily the same. In addition, where relevant, risk interactions need to be considered. In this case, the resilience of the associated infrastructure should be strengthened. This requires consultation with relevant stakeholders and guarantees the necessary action will be taken. When this is not possible, alternative ways to reduce dependencies should be explored.

(b) **Assess the relationship to other social and physical systems**, technological developments, and policy decisions that might be driven by climate change or might increase/decrease climate risk.

In most cases, this analysis builds upon information the project has already collected to establish a cost-benefit analysis and non-climate risk assessment. These changes can be co-assessed in the climate risk assessments. Table 2.1 describes typologies of factors that can interact with climate risk, while Box 2.6 provides a relevant example for the water sector.

BOX 2.5 THE MULTIPLE PROJECT THREATS OF EXTERNAL RISKS

In the conceptual example of Figure 2.4 below, flood (internal) risk can cause direct damage to the project's assets and/or lead to availability disruptions. Even in cases where robust design helps minimize internal risk, threats can arise from the project's interaction with the broader environment, such as:

(i) **Associated infrastructure**, not part of the project, such as upstream flood risk reduction measures, might fail to prevent unexpected flooding.

(ii) **Other socioeconomic systems that interact** with the project can also increase risk over time. For instance, urban densification over the project's lifecycle can increase runoff generation, and by extension, flood risk or transition to green economy can impose legal or operational changes related to flooding risks.

The former risk contribution suggests the project should explore the system-wide resilience of infrastructure. The latter interaction constitutes a slow onset risk which can be dealt with using appropriate spatial planning instruments.

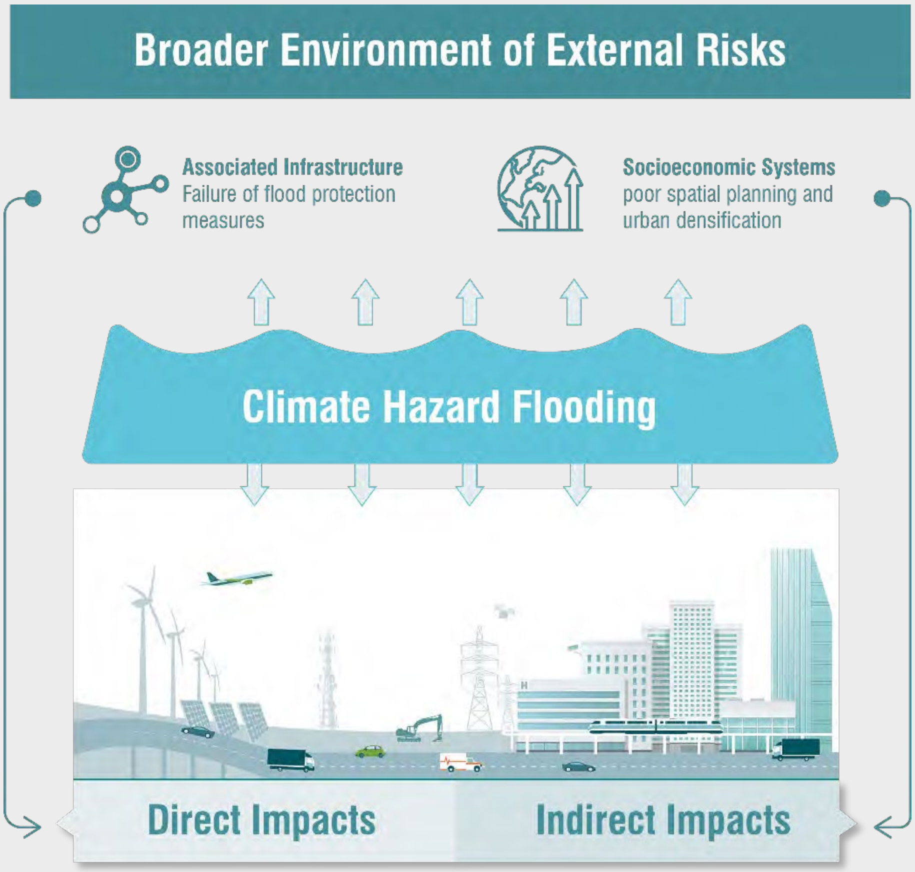


FIGURE 2.4 Conceptual example of external risks and their impacts

TABLE 2.1 Indicative list of transitions and examples of potential impacts

Transitions that might influence future scenarios	Potential impact /examples
Land-use changes: land area conversion from one use to another, e.g., from natural to build environment, from forest to agricultural land, etc.	Change of land use can affect runoff generation. In combination with an expected increase in extreme precipitation events due to climate change, flooding mayoccur more frequently
Technological changes: invention and practice of new technologies and innovative fields that may disrupt (in a positive or negative manner) the regular operation of the project	Change of technologies may provide opportunities for the project to adopt innovative techniques and adapt to climate change as for example, real-time control measures, water-saving irrigation measures, etc.
Demographic changes: changes in human population characteristics and population segments. These may refer to population distribution, age, marital status, occupation, income, education level, and other statistical measures that may influence the project	Different segments of the population make different use of the project's service, and these uses are associated with different vulnerabilities which can increase due to climate change. Changes in annual income, or population growth, might increase demand for the infrastructure (e.g., water consumption) and, by extension, affect the climate resilience of the infrastructure. For example, Cape Town ran out of water due to a lack of adaptation of water infrastructure as the population was growing, combined with a hydrological multi-year drought
Transport changes: emerging technologies that will facilitate traveling and at the same time increase or decrease GHG emissions	Introduction of electric vehicles in combination with renewable energy production could mitigate GHG emissions of a transportation network. In this way, a road network should be able to adapt and provide the required facilities (such as electric chargers). On the other hand, autonomous cars might lead to an increase in induced travel and, as a result, increased demand for infrastructure
Policy and regulation changes: evolution of national and worldwide guidelines and regulations on sustainability and climate change	ESG considerations and carbon taxes are likely to affect the demand or viability of certain economic activities

BOX 2.6 EXAMPLE OF 'FUTURE LANDSCAPE MAPPING' IMPLEMENTATION

A representative example of the future landscape mapping exercise may be the following.

A PPP project aims to develop a new reservoir for water supply and control of downstream floods. The public authority (with the support of an external consultant) should first carry out a climate risk assessment[3] to assess potential direct and indirect climate-induced impacts. At this stage, a 'future landscape mapping' should be considered that evaluates the effects of external socioeconomic factors. This will ensure that factors contributing to climate risk (through vulnerability and exposure increase) are captured and that the project will remain future-ready within its lifecycle. For the proposed example, users could consider:

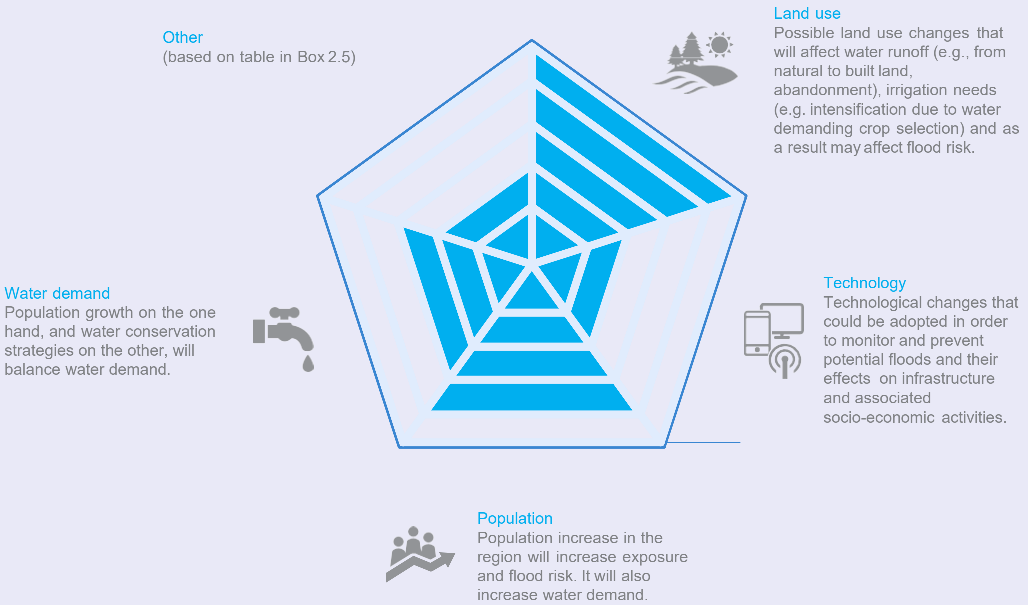


FIGURE 2.5 Example of 'future landscape mapping'

Based on these potential changes and the outcomes of a climate risk assessment, various instances of the future should be conceived and described. These will be the input of the adaptive planning step that aims to ensure the project's resilience and sustainability under conditions of uncertainty beyond climate deep uncertainty.

Future 1: Climate and land management along predictable lines from the past
Future 2: Heavier rainfall and increased use of land
Future 3: Lower rainfall and no change in the use of land
Future 4: ...

Step Output

A thorough evaluation of external risks arising from the project's interaction with the project's broader, present and future environment, which can be affected by climate change

[3] The "broader environment baseline" is used for this climate risk assessment (consistent with a robust deterministic design).

04 TOWARDS LOW-CARBON INFRASTRUCTURE

Approximately 70% of global GHG emissions are associated with the construction and operation of infrastructure (Saha, 2018)[4]. As making significant ex-post changes to an infrastructure project to reduce its emissions is not possible, the ex-ante life cycle assessment (LCA) of greenhouse emissions of an infrastructure project is of critical importance. These assessments will inform funding, design, and construction decisions.

Box 2.7 describes the typical steps of an LCA methodology used to calculate emissions. While different tools and databases are commercially available and can be used depending on the infrastructure sector or complexity of analysis, the underlying principles of the indicated steps are the same.

Firstly, users performing the assessment should draw a clear scope definition. Upon this, they can establish which are the main activities and components throughout the PPP life cycle that contribute (negatively or positively) to the **emissions inventory**. The **i**nventory shall analyze all environmental inputs and outputs to the processes, services, and products used in the project with the ultimate aim to quantify net emissions. In some cases, these will be associated with direct emissions (e.g., emissions related to vehicle traffic during construction), while in other instances, emissions will be embodied (e.g., the carbon embodied in cement production). A robust LCA can be performed on the basis of a comprehensive inventory. Expert judgment is used to exclude specific components with a negligible contribution to the net emissions assessment over the project's life cycle. This can significantly reduce the complexity of the analysis.

Expert judgment is required to draw the boundaries of analysis (Box 2.7); this refers to the spatial and temporal boundaries and those of associated activities. For instance, a housing project may require the development of supporting infrastructure (e.g., water, transport, energy, schools). Similarly, a transportation project can result in additional travel utilization of other networks. Such considerations are likely included in the project formulation and its CBA. The LCA and CBA should make consistent use of data and assumptions.

Upon completion and interpretation of the LCA, users can identify opportunities for reducing emissions. These opportunities might relate to selecting infrastructure options (preliminarily assessed in Phase 1) or to specific material flows and activities during construction and operation. For instance, opportunities can arise by following circular economy principles (e.g., water recycling, circular construction that turns waste into resources) and the adoption of renewable energy technologies where suitable.

[4] Saha, 2018: Low-carbon infrastructure: an essential solution to climate change? World Bank Blogs

BOX 2.7 LIFE CYCLE ASSESSMENT FOR INFRASTRUCTURE PROJECTS

The shift towards net-zero PPP infrastructure requires the development of an evidence base to inform the respective funding, construction, and operation decisions. To this end, a lifecycle assessment methodology can be used to calculate GHG emissions associated with the project. The methodology consists of the application of the following steps: 1. Goal and Scope Definition, 2. Inventory Analysis, 3. Impact assessment, 4. Interpretation (Figure 2.6).

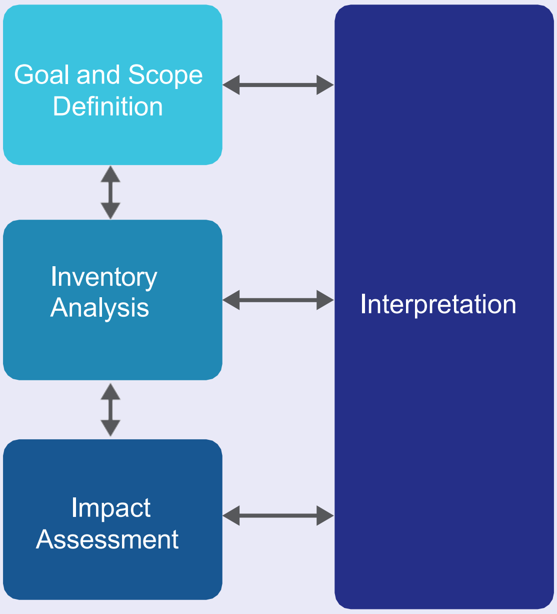


FIGURE 2.6 Schematization of lifecycle assessment [Source: Life Cycle Assessment Methodology, International Organization for Standardization (ISO) 14040)]

The methodology was originally conceived to account for diverse environmental impacts, including carbon emissions. It is recommended that potential adverse effects on other parameters are also explored when applicable, in particular when trade-offs exist between emissions and other environmental impacts.

Upon the completion of the analysis, the user can explore possible entry points for technological and process innovation, including the integration of (i) circular economy models in the construction and maintenance, (ii) renewable energy sources, and (iii) nature-based solutions, which offer mitigation opportunities to the project.

It is recommended that life cycle assessments (LCAs) are carried out in conjunction with life cycle cost (LCC) analysis to obtain a comprehensive picture of the implications of different decisions and options. Where relevant, a comprehensive LCA can form the basis for the accounting and reporting of scope 1 (direct emissions from owned and controlled sources), scope 2 (indirect emissions from the generation of purchased energy), and scope 3 (all other indirect emissions occurring along the PPP's value chain) related activities.

An LCA that uses deterministic value inputs and reports single value outputs might conceal the impact of multiple drivers of uncertainty on the projected emissions of a project. It is recommended that users perform an uncertainty analysis as a QA/QC process—within their resource constraints—to elucidate the sensitivity of results to these drivers, e.g., the definition of functional units, system boundaries, geographical context, scale, material lifetime, etc. For more information, Saxe et al.[5] provide a taxonomy of uncertainty in environmental LCA of infrastructure projects.

Gendered Climate Risks

The fundamental point that should be taken into account at this stage is that risks associated with climate change may be gendered, and therefore, the climate risk assessment tool needs to allow for gender-sensitive evaluation of the impact of climate stressors. Data collection relating to past experience with natural disasters must include an adequate sample from underrepresented communities. Social differences including ethnicity, race, Indigenous identity, disability status, and age are intertwined and can result in overlapping forms of disadvantages.Hence, semi-structured interviews, focus groups and surveys can be important methods in collecting representative data. A methodology of collecting gender-disaggregated data and involving women in infrastructure planning should be put in place at an early stage of the PPP process aiming to ensure that gender gaps concerning the impacts of climate change are suitably addressed.

Step Output

Apply fit-for-purpose lifecycle assessment methodologies to assess GHG emissions resulting from the construction, operation, and maintenance of the infrastructure, as well as those emissions ing from the use of the provided service. This will serve as input to the design of mitigation measures and assess their technical and commercial feasibility in the subsequent modules.

[5] Saxe, S., Guven, G., Pereira, L., Arrigoni, A., Opher, T., Roy, A., Arceo, A., Raesfeld, S.S.V., Duhamel, M., McCabe, B., Panesar, D.K., MacLean, H.L., Posen, I.D., 2020: Taxonomy of uncertainty in environmental lifecycle assessment of infrastructure projects. Environ. Res. Lett. 15, 083003.

KEY TAKEAWAYS

- A life cycle assessment (LCA) may be performed to calculate emissions due to construction, operation and maintenance of the infrastructure. Upon completion and interpretation of the LCA, users can identify opportunities for reducing emissions, e.g., by using alternative materials, minimizing consumption, selecting clean energy sources, benefitting from technological advancements, incorporating nature-based solutions, etc.

- A detailed climate hazard evaluation and evolution over the future periods may be performed by utilizing Global and Regional Climate Models (GCMs and RCMs, respectively) to identify the potential trends of climatic stressors that may affect the project.

- Assessment of internal climate-change induced risks on the project should be performed using advanced modeling techniques on the basis of the expected intensity of hazard, and the project's exposure and its vulnerability to the specific hazard type.

- Climate-change impacts, in the form of chronic and acute climate risks, that may lead to direct and indirect losses on the infrastructure should be identified and evaluated.

- External risks are defined as dependencies with associated infrastructure, other social and physical systems, technological developments, and policy decisions that might be driven by climate change and increase / decrease climate risk. Possible future landscape should be reviewedand risk-mitigation options identified.

MODULE 2.1

Resources

CLIMATE CHANGE KNOWLEDGE PORTAL

CCKP provides global data on historical and future climate vulnerabilities and impacts

Developed by: World Bank Group

CLIMATE ANALYSIS TOOL

The Climate Analysis Tool of the CCKP provides a visualization of global downscaled climate models with daily data at a 0.5° scale (approximately 50 km x 50 km)

Developed by: World Bank's CCKP, powered by Climate Wizard

WCRP CORDEX

The Coordinated Regional Climate Downscaling Experiment, a framework aimed at addressing climate information needs at the regional level

Developed by: World Climate Research Program

VULNERABILITY ASSESSMENT SCORING TOOL (VAST)

A spreadsheet-based tool that guides the user through conducting a quantitative, indicator-based vulnerability screening of transportation networks against climate stress

Developed by: ICF International, 2015

RCP DATABASE (VERSION 2.0)

The RCP database aims at documenting the emissions, concentrations, and land-cover change projections of the Representative Concentration Pathways

Developed by: International Institute for Applied Systems Analysis (IIASA)

SSP PUBLIC DATABASE (VERSION 2.0)

The SSP database provides quantitative projections of the so-called Shared Socioeconomic Pathways (SSPs) and related Integrated Assessment scenarios

Developed by: International Institute for Applied Systems Analysis (IIASA)

JICA CLIMATE FINANCE IMPACT TOOL: CLIMATE FIT (MITIGATION), JAPAN INTERNATIONAL COOPERATION AGENCY (DRAFT VER. 3.0)

Guidelines for methodologies to quantitatively evaluate carbon sequestration and reduction in GHG emissions for different sectors

Developed by: Japan International Cooperation Agency, 2019

GREENHOUSE GAS PROTOCOL

GHG Protocol establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains, and mitigation actions. GHG Protocol includes multiple calculation tools

Developed by: WRI & WBCSD

CLIMATE RISKS AND ADAPTATION PATHWAYS FOR COASTAL TRANSPORT INFRASTRUCTURE

These guidelines were prepared to provide coastal transport infrastructure authorities and organizations with targeted information about climate risks for both assets and operations.The guidelines also contain practical information pertaining to strategies and measures for building resilience and undertaking adaptation planning

Developed by: Fisk, G.W, National Climate Change Adaptation Research Facility, Gold Coast, 2017

CONFRONTING CLIMATE UNCERTAINTY IN WATER RESOURCES PLANNING AND PROJECT DESIGN: THE DECISION TREE FRAMEWORK

The Decision Tree Framework described in this book provides resource-limited project planners and program managers with a cost-effective and effort-efficient, scientifically defensible, repeatable, and clear method for demonstrating the robustness of a project to climate change

Developed by: World Bank, 2015

ENHANCING THE CLIMATE RESILIENCE OF AFRICA'S TRANSPORT INFRASTRUCTURE

The report introduces a three-step approach that allows policymakers to manage the risk imposed by extreme climate change events on roads and bridges in Sub-Saharan Africa

Developed by: Cervigni, R. et al., 2016

Module 2.1 - Further Reading

[ASSESSING THE REAL COST OF DISASTERS]

This report provides reliable, comprehensive, and comparable data on the economic impact of disasters as well as on public spending on disaster management and risk prevention, which are essential for developing effective disaster risk management policies

Developed by: OECD, 2018

[INDICATORS TO ASSESS THE EFFECTIVENESS OF CLIMATE CHANGE PROJECTS]

The objective of this document is to discuss SMART (specific, measurable, achievable, realistic and timely) indicators that can be used for assessing the impact of climate change projects, including those that seek to adapt to the expected impacts of climate change and those that promote low carbon emissions growth strategies to mitigate GHGs

Developed by: Inter-American Development Bank (IDB), 2012

[INTEGRATING GREEN AND GRAY: CREATING NEXT-GENERATION INFRASTRUCTURE]

This report guides developing country service providers and their partners on integrating nature into mainstream infrastructure systems

Developed by: World Bank Group – World Resources Institute, 2019

[IMPROVING CLIMATE RESILIENCE IN PUBLIC PRIVATE PARTNERSHIPS IN JAMAICA]

The tool identifies several instruments and tools already used to address climate change issues in the context of Jamaica's infrastructure production

Developed by: Frisari, G.L., Mills, A., Silva, Z. M. C., Donadi, E., Ham, M.S.C., Pohl, I., Climate Change Division – IADB, 2020

[LIFELINES: THE RESILIENT INFRASTRUCTURE OPPORTUNITY. RESILIENT INFRASTRUCTURE FOR THRIVING FIRMS: A REVIEW OF THE EVIDENCE]

This review examines the literature on the role of infrastructure in determining the productivity and competitiveness of firms

Developed by: Braese, Johannes, Rentschler, Jun, Hallegatte, Stephane – World Bank, 2019

[OVERVIEW OF ENGINEERING OPTIONS FOR INCREASING INFRASTRUCTURE RESILIENCE: FINAL REPORT (ENGLISH)]

This report summarizes the findings of investigating the vulnerability of key infrastructure, mitigation/improvement measures, and the costs that are associated with such improvements

Developed by: World Bank Group, 2019

[OVERVIEW OF ENGINEERING OPTIONS FOR INCREASING INFRASTRUCTURE RESILIENCE (VOL. 2): TECHNICAL ANNEX (ENGLISH)]

This background document presents a more detailed treatment of the topic (see above) and provides background information and supporting data

Developed by: World Bank Group, 2019

[INVESTMENT DECISION MAKING UNDER DEEP UNCERTAINTY - APPLICATION TO CLIMATE CHANGE]

This paper summarizes the additional uncertainty created by climate change and reviews the tools available to project climate change (including downscaling techniques) and to assess and quantify the corresponding uncertainty

Developed by: Hallegatte, S., Shah, A., Lempert, R., Brown, C., Gill, S. – World Bank, 2012

[PPPLRC CLIMATE-SMART PPPS WEBSITE]

This section of the PPPLRC website provides links to policies, legislation, project documents, and other resources for climate-smart PPP projects relevant to the whole PPP cycle, including the project preparation stage

Developed by: PPPLRC, World Bank

[INTEGRATING GENDER EQUALITY IN CLIMATE-SMART DEVELOPMENT]

A framework to support the integration of gender into the operationalization of the climate policy

Developed by: Netherlands Commission for Environmental Assessment, 2014

[WORLD BANK GROUP GENDER STRATEGY (FY16-23): GENDER EQUALITY, POVERTY REDUCTION AND INCLUSIVE GROWTH]

The World Bank Group's new gender strategy delineates the support that the group provides to client countries and companies to achieve greater gender equality. This strategy builds on past achievements and raises the bar on gender equality by focusing on how the WBG can move beyond mainstreaming to an approach that identifies outcomes and monitors results of WBG-supported interventions in client countries

Developed by: World Bank Group, 2016

[GENDER EQUALITY, INFRASTRUCTURE AND PPPs]

The primer consists of four key sections that show PPP practitioners how gender considerations can be incorporated into infrastructure PPPs

Developed by: World Bank Group, 2019

[GENDER TOOLKIT: TRANSPORT]

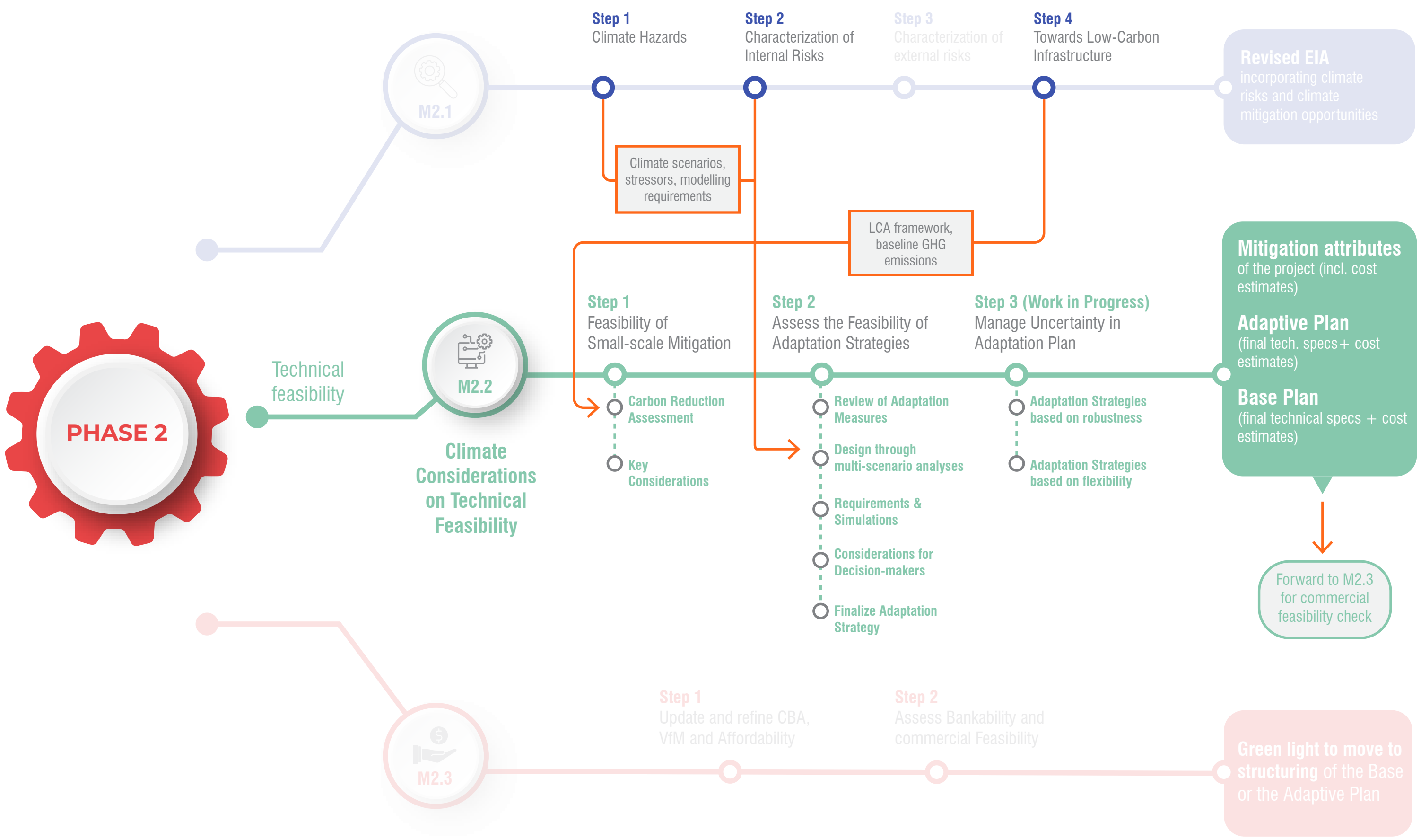
Provides users with a set of tools and case study examples to help design transport projects that aregender-responsive and inclusive

Developed by: Asian Development Bank (ADB), 2013

[TOOLKIT FOR MAINSTREAMING GENDER IN WATER OPERATIONS]

The toolkit provides guidance on how to improve gender mainstreaming in project design,implementation, and evaluation

Developed by: World Bank Group, 2016


PHASE 2
Technical feasibility
M2.1
Step 1
Climate Hazards
Step 2
Characterization of Internal Risks
Step 3
Characterization of external risks
Step 4
Towards Low-Carbon Infrastructure
Revised EIA
incorporating climate risks and climate mitigation opportunities
Climate scenarios, stressors, modelling requirements
LCA framework, baseline GHG emissions
M2.2
Climate Considerations on Technical Feasibility
Step 1
Feasibility of Small-scale Mitigation
Carbon Reduction Assessment
Key Considerations
Step 2
Assess the Feasibility of Adaptation Strategies
Review of Adaptation Measures
Design through multi-scenario analyses
Requirements & Simulations
Considerations for Decision-makers
Finalize Adaptation Strategy
Step 3 (Work in Progress)
Manage Uncertainty in Adaptation Plan
Adaptation Strategies based on robustness
Adaptation Strategies based on flexibility
Mitigation attributes
of the project (incl. cost estimates)
Adaptive Plan
(final tech. specs+ cost estimates)
Base Plan
(final technical specs + cost estimates)
Forward to M2.3 for commercial feasibility check
M2.3
Step 1
Update and refine CBA, VfM and Affordability
Step 2
Assess Bankability and commercial Feasibility
Green light to move to structuring of the Base or the Adaptive Plan

2.2 Climate Considerations on Technical Feasibility

The scope of the present module is to identify and assess climate mitigation and adaptation strategies that could be incorporated into the project to reduce its carbon footprint and protect it from climate risks. The underlying principle that should be governing both categories of measures is the understanding that—despite its complexity and uncertainties —climate change can be hampered through feasible climate actions. It is shown that, in fact, every project can and should contribute to a sustainable and resilient future through proper considerations, without the need to necessarily deviate from conventional design practices. The design of simple solutions may be possible in many cases, provided that the impacts of climate can be correctly recognized and that uncertainties can be bypassed by examining several scenarios. On the other hand, more advanced models and approachesare there and can be employed to offer technically feasible design even under complex climate conditions.

STRUCTURE OF THE MODULE

The proposed process includes the following consecutive steps:

Step 1 outlines the process to assess the feasibility of small-scale mitigation measures to be incorporated in projects following a proper GHG emissions analysis.

Step 2 provides instructions for the design and technical feasibility analysis of adaptation strategies that will be able to optimize resilience and protection against climate risks that may materialize under several plausible climate evolution scenarios.

Step 3 includes considerations for the design of climate actions under conditions of deep uncertainty, including advanced modeling approaches. Step 3 is characterized as a **"work in progress"** in the sense that it contains methods that have not yet been mainstreamed across infrastructure sectors.

01 FEASIBILITY OF SMALL-SCALE MITIGATION

This step intends to provide guidance on incorporating (small-scale) mitigation attributes in projects whose primary scope is not climate mitigation (e.g., renewables). By entering this step, users are supposed to (i) have performed a baseline GHG emissions assessment of the project (i.e., prior to the incorporation of the climate-mitigation measures) and (ii) have completed the climate alignment screening (Module 1.1), which highlighted climate mitigation opportunities that can be integrated into the project to enhance its contribution to climate goals. The scope of this step is to propose **a tangible climate mitigation strategy** comprising technically feasible measures to reach specific short- and long-term GHG reduction emission targets.

The assessments of this step are building on the life cycle assessment (LCA) of greenhouse gas emissions of Module 2.1 and should be therefore performed using the same methodology, tools, boundaries, and timeframe.[1] As before, assessments at this stage are expected to be data-driven and computationally demanding. Therefore, it is advisable to undertake the step by a team of sustainability experts who possess in-depth sectoral knowledge and a solid understanding of the project's dependencies on the surrounding natural and built environment.

CARBON REDUCTION ASSESSMENT

A carbon reduction assessment (CRA) should clearly define the reduction target and the means to achieve it (including technical requirements, supporting systems, and operational adjustments). It should also outline any important risks in the process and propose contingencies for mitigating them. The final outcome should be a lifecycle cost comparison of alternative mitigation strategies including financial figures (i.e., capital, operating, maintenance, and disposal expenses) and socio-environmental costs and benefits (e.g., monetized societal costs due to environmental pollutants) to build a case on the worthiness of the investment.

At this point, it should be understood that the CRA is sector and project-sensitive. The "best" strategy to reach any carbon reduction metric will differ for each specific project (even within the same sector), owner, and site. It is also expected that the CRA will dynamically progress with evolving technologies and industry understanding. Hence it is beyond the scope of this toolkit to prescribe in detail its various components. Instead, the toolkit is shortlisting below some key considerations that are common for most CRAs, to help the users understand what to expect and look for. Users may also refer to Insight 2.1 to obtain an overview of the variety of mitigation opportunities and their differences among sectors. A detailed description of sector-specific climate-mitigation entry points is provided in the respective sector-specific toolkits.

[1] The minimum timeframe of assessing climate hazards shall be the PPP life cycle, however, the public party may want to extend the timeframe for the study given that the life cycle of the infrastructure may be longer than the duration of the PPP contract.

KEY COMPONENTS OF A CARBON REDUCTION ASSESSMENT

1 Scope of the Assessment

The user should frame the scope of the study by answering the following key questions:

- What is the short-term GHG reduction target (in the region/sector), and what is the horizon for accomplishing it (according to current policies)?
- Is there a net zero emissions (NZE) decarbonization target, and what is the planning horizon?
- What are the boundaries of the assessment? Does it cover direct GHG emissions from fossil fuel consumption within the project site? Does it include net indirect emissions from energy imports and exports or embodied emissions in the production of materials?
- Will the strategy be focusing on the construction, or operation emissions, or both?
- What are the boundaries of the decarbonization strategy? Does it allow projects to produce or procure clean, renewable energy beyond the boundaries of the project site?

2 Opportunities for Reduction

Measures and design strategies that are likely to create significant efficiency and energy gains may be sought within the following *four broad categories* that are more or less common across sectors. (Although it is possible that some sectors rely more on a particular category than on the others.)

Reduce energy and material demand through a range of actions including energy efficiency, behavioral, and process changes and the application of circular economy principles.

Direct use of renewable energy (RE)* to provide energy requirements. Depending on the project specifics this may include options for on-site RE generation, off-site RE purchase, or off-site RE generation.

Direct use of renewable heat and biomass including the use of solar, geothermal, and sustainable biomass for heat, and the production and use of biofuels. This may also include the combination of bioenergy with carbon capture and storage (BECCS).

Reduce fossil fuels by replacing equipment with zero-emission alternatives, or by creating incentives/policies that promote low-carbon activities.

**The cost for renewable energy generation and storage technologies has fallen considerably, and renewables are increasingly able to compete economically with conventional grid energy, making them an attractive option.*

3 Climate Mitigation Strategies

Different climate mitigation strategies may be assembled by combining measures from the above categories. In cases where the combination of measures is not enough to reach the GHG reduction target, *carbon offsets*[2] may be used to compensate for the balance of emissions. Such offsets should preferably be able to prove *additionality*[3] and should be used to invest in energy efficiency or carbon-free renewable energy projects, preferably within the same region. The emissions reduction benefits must be claimed through a credible mechanism such as carbon credits or a local carbon credit fund (see Module 3.2).

4 Future Projections

It is recommended that the feasibility assessment of the climate mitigation strategies reflects both current and projected conditions representing changes in the state of knowledge of enabling technologies, changes in climatic conditions, and changes in the policy framework. For example, developments in battery technologies (i.e., energy storage) may further assist the uptake of renewables, making them a more credible and affordable option. On the other hand, changes in stationary weather patterns may impact the long-term energy usage of the infrastructure and hence the level of the interventions needed to achieve a prescribed performance standard. For example, a warmer climate will increase electricity use (associated with cooling, lighting, fans, pumps, and other electrical loads), thus increasing the requirements for the installed capacity of renewable energy.

5 Requirements and Supporting Systems

The feasibility study should also clearly describe any requirements/supporting systems essential for implementing the strategy. This may include installation of supporting infrastructure, power supply requirements, or even changes in the operational workflow of the infrastructure with respect to the established status quo (e.g., charging time requirements of machinery may impact the logistics of a port infrastructure).

6 Risk and Contingencies

The newness of the technologies and the lack of standardization may also generate risks that should be properly identified and managed during the technical feasibility assessment. Risks may include proprietary technology constraints associated with the choice of a particular technology or a manufacturer (that may not be supported in the future), service reliability risks (e.g., delays, power outages, etc.), supply risks, and others. For these risks, specific contingencies may apply (e.g., a resilience/business continuity plan to guide operations during a power outage).

7 Implementation Plan

A well-thought-out timeline of implementation may be as important as the implementation itself. It is generally considered good practice to avoid committing upfront to unnecessary large investments and rather make the necessary arrangements to facilitate the smooth

[2] The term "carbon offset" refers to using the reduction in GHG emissions in one location/project to compensate for emissions that occur elsewhere. Please refer to Phase 3 of the present toolkit

[3] Additionality of an activity refers to net GHG emissions reduction that would not have happened in the absence of this activity (i.e., the offset or the project).

implementation of the strategy when the time is ripe. For example, rather than investing today in large capacity high-efficiency cooling equipment, invest in smaller and more economical equipment, but include provisions in the design to accommodate larger equipment when (and if) needed.

EQUITY THROUGH DECARBONIZATION

In certain cases, the implementation plan may create additional opportunities other than the decarbonization goal. For example, prioritizing zero-emission routes in areas that have both poor air quality, and hence populations with a relatively high prevalence of health issues, creates a unique opportunity to enhance social equity.

8 Life cycle Cost (LCC)

The final step in the feasibility analysis is the comparative analysis of life cycle costs(LCC) of any alternative strategies to select the one that is more cost-efficient while generating broader co-benefits[4] (e.g., reduced pollution, equity enhancement, etc.). The LCC assessment should always be accompanied by sensitivity (stress) tests to properly account for the effect of forecasting costs, inflation, and price fluctuations for volatile commodities over the multi-decade time frame. Expert assessment is required to determine costs (especially those related to new technologies for which limited information is available), set the boundaries of the sensitivity analyses, and assist in the interpretation of results.

The cost and benefits of the preferred climate mitigation strategy will be combined with the cost and benefits of the adaptation strategy (described in the follow-up steps) to ultimately inform the economic appraisal of the project and the bankability considerations (performed in Module 2.3).

Step Output

A climate mitigation strategy, a plan for implementation, descriptionof cost, savings, and benefits

[4] For example, it is possible to explicitly include the social cost of carbon (SCC) ($/per unit metric ton of carbon dioxide) to implicitly estimate the economic damage that would result from emitting one ton of carbon dioxide into the atmosphere.

02 ASSESS THE FEASIBILITY OF ADAPTATION STRATEGIES

The next step towards preparing a climate-smart PPP project is to design cost-efficient adaptation and resilience measures to combat the climate-induced risks (recognized and rigorously assessed in Module 2.1). The assessments at this stage are expected to require the engagement of external consultants with experience in risk analysis of engineering systems.

The scope is to develop adaptation strategies that are climate-proof (i.e., they perform well or at least satisfactorily) over a range of climate conditions. "*Adaptation strategy*" is a term meant to include any combination of individual adaptation and resilience measures that aim to reduce the damage, loss, and potentially disastrous consequences generated by the climate stressing on the infrastructure. Following the definitions of Module 1.2, there are three different classes of adaptation and resilience measures (Figure 2.7):

- **Preparation measures**, aiming at increasing robustness (or decreasing the sensitivity) of the infrastructure or a critical component of it
- **Prevention measures**, aiming at reducing the exposure of the project to the hazard
- **Preparedness measures** aiming at supporting the quick recovery of the infrastructure in the aftermath of extreme climate events.

In addition to the above definitions, adaptation measures may also be characterized as “soft” or “no-regret” options when they improve performance without substantially changing the technical design of the infrastructure (e.g., improving water management approaches, installing early warning systems, etc.). Most commonly, however, adaptation measures will require significant modifications of the infrastructure dimensions/technical design to bear the increased climate-induced stressing (e.g., add scouring protection at bridge piers, elevate critical infrastructure components, etc.), or may even include construction of additional infrastructure (e.g., flood defenses for the protection of a coastal highway against the risk of sea-level rise). In more extreme cases, adaptation solutions may also include changes in the project's design capacity (e.g., the capacity of a hydropower plant). In all cases, it is important to analyze, understand and build on local knowledge and practices of local communities that, in many cases, may have rich traditional knowledge and practices that they have been using to help their communities adapt to climate shocks.

PHASE 2
M2.2
Climate Considerations on Technical Feasibility
Step 1
Feasibility of Small-scale Mitigation
Step 2
Assess the Feasibility of Adaptation Strategies
Step 3
Manage Uncertainty in Adaptation Plans

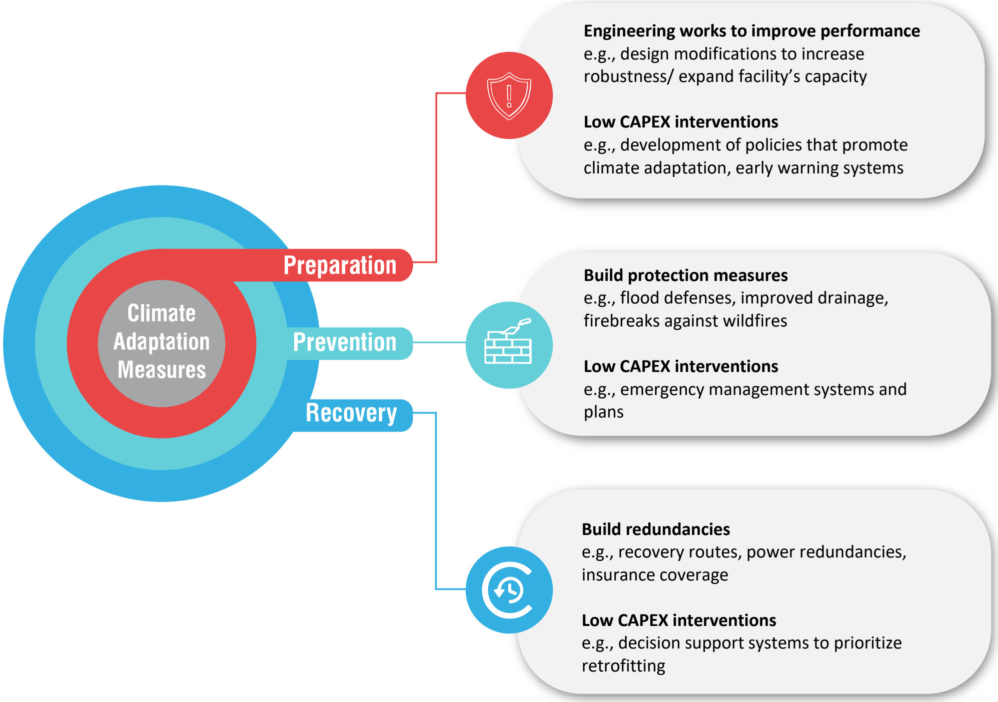


FIGURE 2.7 Categories of climate risk reduction strategies and example adaptation measures (pertinent to each category)

DESIGN OF ADAPTATION AND RESILIENCE MEASURES: THE NEED TO CONSIDER SEVERAL SCENARIOS

Almost all of today's infrastructure has been designed using climatic design values calculated from historical climate data, assuming that the average and extreme conditions of the past will represent conditions over the future lifespan of the project. Yet, as the climate changes, the climatic stressors will also change,[5] and so will the infrastructure design (i.e., to withstand the increased stressing of the future and avoid failure). For example, it is possible that today's design values (e.g., a flood event that is assumed to occur on average every 100 years) will correspond to a more frequent event (e.g., occurring every 20 years) in the years to come. This also implies that the stressing imposed on the infrastructure by the 100-year return period event (in future terms) could be equivalent to the stressing introduced by a considerably more extreme event when converted to current design values (e.g., say that of a 200-year return period event).

This peculiarity and the fact that there is no certainty on the precise impact of climate change on the future intensity of the climatic stressors (and their probability of occurrence) complicates the technical design of the infrastructure (and the adaptation measures). As a result, traditional engineering (Figure 2.8)—targeting at a minimum allowable level of performance (i.e., known as "life safety" in the technical terminology) when experiencing an event of low (but known) probability—cannot work when the probability of the event is not known (as is the case with climate change).

A generally accepted good practice is to examine climate projections associated with a range of emissions scenarios and simulate the performance of the infrastructure across these scenarios

[5] Although the pattern and the magnitude of change is highly uncertain and thus very difficult to predict.

(associated with different levels of climate stressing). The output will be in the form of vulnerabilities and losses (direct and indirect) computed over an ensemble of possible futures.[6] This way, decision-makers, rather than relying on a single climate scenario (as was the standard practice so far), are better informed on the level of protection offered by the adaptation strategy across scenarios[7] and are thus better prepared to make adaptation decisions that will last.

DESIGN FOR CLIMATE CHANGE

To combat the climate uncertainty, engineers assess the technical performance of protection measures over possible and less possible futures and discard the designs that do not provide the required level of protection.

The selection of an adaptation strategy is then a matter of a technical and economic decision: the incremental protection that is offered by an increase in the capacity of an adaptation measure should be able to justify its incremental cost increase. For example, if the cost differential for using the next larger standard size for a drainage pipeline represents only a small increase in total costs yet would perform better over a range of scenarios, the agency may decide that the extra investment is warranted. The follow-up step (**Step 3**) further expands on this subject, describing state-of-the-art methodologies and tools that are meant to be used by highly skilled experts to assist agencies in selecting an adaptation strategy that will perform "best"[8] over the range of possible future scenarios. These approaches, known by the term decision making under deep uncertainty (DMDU), are being frequently used in the design of green infrastructure and flood management systems over the last years, while there are few pilot applications in transportation projects as well.

[6] These scenarios are generally described by the Representative Concentration Pathway (RCP) index, discussed already in Insight 1.3 of the previous phase.
[7] The level of protection can be high when considering optimistic climate estimates, but may substantially drop if the highest emission scenario takes place.
[8] The term "best" is used schematically, as it doesn't refer to an optimum strategy, but to a strategy that is less likely to fail in the future.

PHASE 2
M2.2
Climate Considerations on Technical Feasibility
Step 1
Feasibility of Small-scale Mitigation
Step 2
Assess the Feasibility of Adaptation Strategies
Step 3
Manage Uncertainty in Adaptation Plans

CLIMATE-PROOF

VERSUS

TRADITIONAL

CHOOSING THE RIGHT DESIGN

Climate-proof		Traditional
Future climate conditions are unknown	Underlying Assumption	Climate conditions of the past may represent future conditions also
Design of projects that experience medium-high climate risk	Application Domain	Design of climate-insensitive projects
A plan (or planning sequence) that will perform acceptably under varying climate conditions	Objective	Design of an optimal plan to withstand today's climate
Technical performance; Loss estimates (direct + indirect)	Assessment Milestones	Technical performance; Standard codified process
Expert consultants' engagement is necessary	Required Experience	Expert involvement is not deemed necessary
Necessary; different stakeholders may have different attitude towards climate risk	Stakeholders' Engagement	Not necessary

FIGURE 2.8 Traditional versus climate-proof design: assumptions, limitations, and resources required

TECHNICAL PERFORMANCE OF THE ADAPTATION STRATEGY

The assessments performed in this step are highly technical, and hence the involvement of skilled consultants should be considered essential throughout the process.[9] It is beyond the scope of the toolkit to go into the details of performing a multi-scenario risk analysis. Besides, this is a sector- and hazard-specific exercise. Instead, the step briefly outlines some key considerations that are important from a design perspective.

[9] Sector-specific guidance on the required expertise is provided in the sector-specific toolkits.

Computational Model

The model should be comprehensive enough to describe characteristics and processes that may affect the cost-benefit performance of the infrastructure (in due consideration of the overall objective of the investment plan) but simplified enough to be appropriate for multi-scenario analysis. For example, if the objective of investing in a new highway system in a rural area is to improve farmers' access to markets[10] and the considered hazard is the flood, the computational model should include a function to describe (at a low-approximation level) the physical loss (e.g., damage of flooded roads), a function for estimating the cost of disruption caused by the closure of a traffic link (e.g., performing a simplified network analysis), and a function to describe the benefits of adaptation (that can be as simple as a static correlation between the reduction of transport cost and the expansion of farmers' market).

Development of Scenarios

Key in the multi-scenario analysis is, by definition, the selection of representative scenarios. The intention of an experienced modeler is to select scenarios that adequately describe (to the best of today's knowledge) the plausible range of climate changes relevant to the project's economic life. The scenarios should combine climatic and non-climatic variables (as described in Module 2.1). The climatic variables represent different intensities of the examined climate stressor (e.g., river discharge[11] during a frequent, moderate, and extreme flood) corresponding to different IPCC storylines (as expressed by the RCP scenarios).

Depending on the specifics of the analysis performed, the minimum required number of scenarios may vary. For most common engineering assessments, a handful of scenarios would be sufficient to describe the boundaries of the performance (upper-bound and low-bound estimates). On the other extreme are some very computationally intensive assessments (described in Step 3) for which hundreds or thousands of scenarios are analyzed to describe in detail the full spectrum of variables (climatic and not) that may affect the performance of an adaptation strategy.

Interpretation of Results

The outcome of a multi-scenario assessment is an expanded risk matrix (developed for every adaptation strategy, in case more than one are being examined) that correlates the severity of a climate stressor (associated with a specific climate scenario) with a potential impact (typically expressed in terms of direct and indirect losses). Depending on the level of detail of the analysis, the output of this multi-scenario approach may inform agencies' decisions in several ways:

- **Engineering design** decisions (e.g., need to adjust the design limits based on updated precipitation intensity and frequency projections)
- **Economic evaluation** (that will be performed in Module 2.3) with data on: (i) the capital cost of the adaptation; (ii) projections on the O&M cost and savings (calculated as annual

[10] Espinet, Rozenberg, Rao, Ogita, 2018: Piloting the Use of Network Analysis and Decision-Making under Uncertainty in Transport Operations Preparation and Appraisal of a Rural Roads Project in Mozambique under Changing Flood Risk and Other Deep Uncertainties, Policy Research Working Paper No 8490, World Bank Group

[11] River discharge describes the volume of water that streams past a point in the river's course every second

loss estimates); (iii) benefits of adaption (i.e., as loss reduction/avoidance); (iv) the cost of externalities. For all these estimates, mean and variance values can be provided.

- **The direction of climate change** (for which greater certainty exists than the exact magnitude and timing of the change). Knowledge of the expected broader direction of change (e.g., increasing or decreasing precipitation) may be sufficient for some decisions. For instance, based on the knowledge that debris and water flows are expected to increase as the climate changes, Norway installed debris deflectors or screens to keep debris out of drainage systems and energy dissipators in channels and culverts to reduce increased water velocities.[12]
- **Need for a more flexible adaptation design**. When there is significant uncertainty on the climate projection of the future, agencies may choose to proceed with flexible strategies that allow for changing course during the project lifetime. A detailed description of such strategies is provided in the next step under the "Adaptive Plan" section.
- **The necessity of O&M and emergency management plan**, for which specific requirements will be prepared during contract preparation (Phase 3) and drafting of RFP documents (Phase 4).

CONSIDERATIONS FOR DECISION MAKING

Upon completion of the assessments, climate strategies will have been evaluated as to their **technical performance under a number of possible climatic scenarios** (in terms of costs, losses, benefits, technical requirements or any other variable that has been included in the model). In cases where the response is not particularly sensitive to the changing climate, uncertainty should not be considered critical. In the opposite case, strategy selection decisions will have to be made depending on the risk appetite of decision-makers and the actual risks of the project. For example, when risk-aversion is prioritized over cost savings, decisions will likely be driven by the more conservative scenarios.

In order to facilitate decisions on adaptation strategy, this section proposes two alternative planning options that build on the idea that instead of designing a plan that will perform well for a highly-anticipated future (but it will most probably fail if a more adverse scenario takes place), it may be possible to conceive a plan that is "reliable" (i.e., has relatively low vulnerability) over a wide range of plausible futures. A plan may be characterized as "reliable" if it is either **robust** (i.e., fail-safe for several possible future scenarios) or **flexible** (i.e., can be adjusted dynamically as the future unfolds and uncertainty decreases). These competing attributes are associated with two distinctively different planning philosophies for combating climate uncertainty. The first, robust planning, aims to conceive today (with the best available information about the future conditions) a robust static plan – named herein **base plan**. The second one, termed **adaptive plan**, consists of an initial plan that will be implemented today (and will perform acceptably for some years, provided that the climate will not change dramatically in the near future) accompanied by adaptive measures that could be activated if climate conditions demand it. (Figure 2.9).

[12] FHWA, 2017. Transportation Infrastructure Resiliency: A Review of Best Practices in Denmark, the Netherlands and Norway. https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/gbp_june_2017/index.cfm,

Climate Adaptation Plans

Base and Adaptive

Base plan (All CAPEX disbursable upfront)	Adaptive plan (CAPEX disbursable throughout the project's lifetime based on climate indicators)
Seeks robust adaptation plans that perform acceptably under a wide range of climate scenarios	Seeks for flexible/expandable adaptation plans that can change over time when climate circumstances are different than anticipated
General applicability	Conditional applicability (as it is not always technically possible to design flexible adaptation solutions)
Implemented once	Implemented sequentially (may require 2-3 interventions during the infrastructure lifetime)
Multi-scenario risk assessment & DMDU	Multi-scenario risk assessment, RCP-dependent dynamic adaptation plans; monitoring methodology
Higher life cycle cost	Lower life cycle cost
Preferable for risk-avert decision makers	Risk appetite: neutral

FIGURE 2.9 Two different options to implement an adaptation strategy: "Base Plan" and "Adaptive Plan"

Implementing adaptation via a base plan

The base plan is defined as a plan in which all capital expenses associated with adaptation and resilience measures are meant to be disbursed upfront. From a contractual perspective, this is the most straightforward way of procuring new projects; all significant capital expenses are known and fixed at the time of the signature. The challenge for engineers and decision-makers is to commit today to an adaptation plan that will not change in the future and will remain robust (will not fail) for the years to come.

- **Implementing adaptation via an adaptive plan**

Adaptive planning proposes a conceptually different methodological framework for dealing with uncertainty in decision-making. Instead of committing today to resource-demanding plans, decision-makers are encouraged to design dynamic plans that can be updated in due time (in light of new climatic conditions). In the context of this toolkit, the adaptive plan is therefore defined as a strategy in which climate-related CAPEX *is not disbursed upfront but is rather spread throughout the project's lifespan* based on certain climate-dependent indicators. Such an approach, although cost-efficient, introduces two sets of challenges when procuring new projects:

- First, there is the technical challenge to conceive and design adaptation solutions that can be modular and/or expandable to allow for future interventions. This condition cannot always be met.
- Second, there is the challenge of preparing a contract and financial structure that has the necessary flexibility and provisions to support this type of planning. Discussion on these challenges is included in Phase 3 of the toolkit.

Following the definitions presented above, it is easy to understand that the "base" plan could coincide with the current state of practice in cases when the code-compliant design (if available) is able to guarantee acceptable levels of robustness. In cases when risk-aversion dominates decision making, the "base" plan will correspond to a more pessimistic climate-change outlook (i.e., a rather conservative approach).

However, in cases where the discrepancies among scenarios are significant or where the existence of too many scenarios does not allow users to compare them directly, advanced methodologies to support decision making under deep uncertainty may be employed. An introduction to the technical characteristics and potential applications of such methods is offered in Step 3, duly noting that the methodologies presented are not prescriptive and that the choice on if and which to apply should be based on technically sound justifications by relevant experts.

MAINSTREAMING FLEXIBILITY IN THE DESIGN

It is important to note that "adaptive" planning may as well, in several cases, consist of simple options without necessitating significant deviations from conventional practice. (Example: the adaptive design of climate control via a geothermal system for a hospital procured via a PPP could include installation of all piping systems upfront while allowing the procurement and installation of additional heat pumps to be performed at a later stage in case temperature rises. This will decrease the upfront capital expenses while allowing – if the temperature rises—for seamless upgrading of the system in the future without affecting the facility's operations.)

FINALIZE THE TECHNICAL FEASIBILITY OF ADAPTATION STRATEGY

When the adaptation plan is decided, the final task is to perform a detailed technical feasibility assessment following standard PPP procedures in order to: **(1)** assess in detail the structural competence of the infrastructure (validate dimensions and perform basic structural calculations); **(2)** verify that the plan can be constructed within the proposed schedule and budget; **(3)** provide construction specifications; **(4)** confirm construction cost estimates; **(5)** conduct a detailed environmental impact assessment (EIA) for the duration of construction/operation of the project.

The process for assessing the technical feasibility of the base and the adaptive plan is outlined in Figures 2.10 and 2.11.

FIGURE 2.10 Technical feasibility assessment of adaptation works implemented via a base plan. Step 5 is optional.

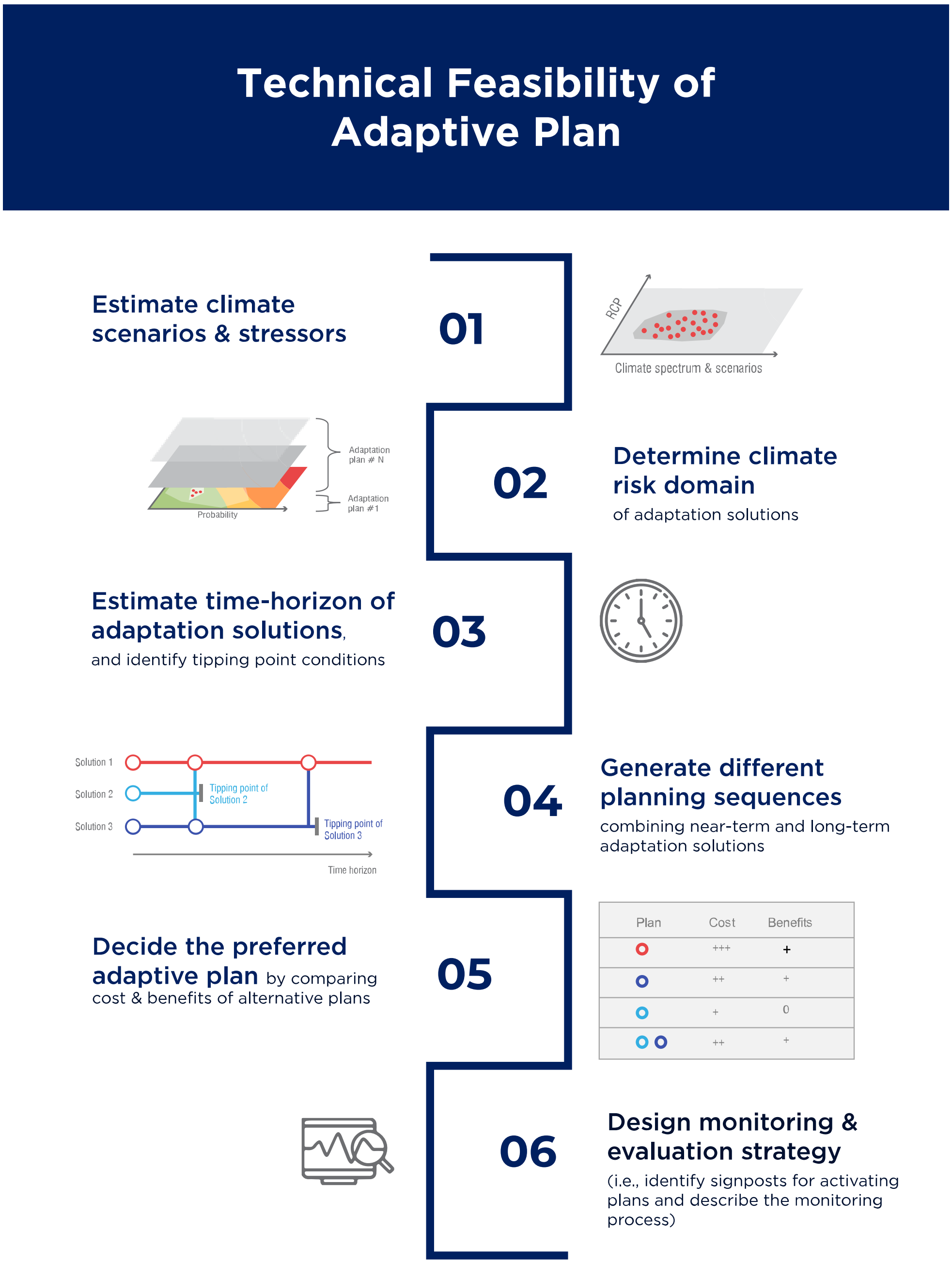


FIGURE 2.11 The six main steps of the technical feasibility assessment for the adaptive plan

PHASE 2

M2.2

Climate Considerations on Technical Feasibility

Step 1
Feasibility of Small-scale Mitigation

Step 2
Assess the Feasibility of Adaptation Strategies

Step 3
Manage Uncertainty in Adaptation Plans

03 MANAGE UNCERTAINTY IN ADAPTATION PLANS

WORK IN PROGRESS

The methods presented in this step are innovative and have not—at the time of writing—been mainstreamed across sectors. While some sectors have already incorporated their use in routine operations, some others have only applied them in pilot applications.[13] Users are thus encouraged to review the methodologies in order to obtain an understanding of their capacities, considering the fact that as more models are developed, the use of such methodologies will be gaining popularity among consultants and may be preferable to conventional approaches (due to their advanced modeling capabilities). The selection of the appropriate method and the design suitable for it should be based on relevant expertise and performed by experts.

Upon entering this step, users are expected to have pre-qualified a list of candidate adaptation and resilience strategies. Depending on the problem details, the decision on the "best" strategy may not be straightforward. For example, an increase in the capital expenses for adaptation may provide increased protection against losses from a climate hazard, but the hazard itself may be a very extreme (i.e., very low probability) event, thereby questioning the justification of the investment. Similarly, an ecosystem-based adaptation option may be able to offer protection up to a level of hazard but unable to protect against more adverse scenarios where a more conventional approach could work better. In such cases, where decisions are hindered by the uncertainty regarding the realization of one scenario or another, decision making under deep uncertainty (DMDU) methodologies provide a framework to support how decision-makers prioritize their options in an informed way by simultaneously considering multiple criteria.

Although several types of methods may be found in the literature, the present toolkit focuses on two categories of decision making under deep uncertainty approaches, broadly corresponding to the two types of adaptation plans described previously. It is a matter of experience and preference of the consultant to select the most appropriate approach for the problem under consideration (in view of requirements and resource limitations).

[13] For example, the World Bank Group supported in 2018 the Preparation and Appraisal of a Rural Roads Project in Mozambique under Changing Flood Risk and Other Deep Uncertainties. The study included advanced analyses aiming at piloting the use of decision-making under uncertainty in transport operations.

STRATEGIES BASED ON ROBUSTNESS

This type of approach shall be more appropriate for the design of "base" plans, with their aim being to identify among several strategies the one that maximizes robustness over a variety of scenarios. A list of popular approaches could indicatively include the following:

- *Robust Decision Making (RDM)* analysis, which measures the performance of alternatives and seeks an alternative that satisfies a predefined performance criterion (i.e., an indicator of success) over the majority of scenarios analyzed
- *Information Gap Decision Theory,*[14] which uses nested uncertainty increments to evaluate the robustness of a candidate adaptation option
- *Climate Informed Decision Making (CIDA)*, which identifies alternatives whose good performance is insensitive to the most significant uncertainties (Insight 2.2)

Despite their technical differences, the basic structure of all methods includes the following steps:

(1) Define performance indicators and thresholds

Describe the climate-related objectives of the base plan in due consideration of current and potential constraints in future conditions. The result will be a definition of success (mathematically described in the form of performance indicators) that the decision-makers require or aspire to achieve by implementing the specific infrastructure. Depending on the infrastructure sector and the specific investment objectives, success may be described by means of a variety of indicators. A non-exhaustive list would include:

- Technical performance indicators (e.g., expected physical damage over life-span less than a threshold percentage of the initial investment, loss of network redundancies)
- Loss indicators (e.g., expected annual losses below a certain threshold)
- Risk reduction indicators for the infrastructure or the broader ecosystem
- Economic indicators (e.g., benefit-cost ratio, total net benefits) or violation of performance thresholds (e.g., levelized cost of regret)
- Indicators of the overall environmental impact of a plan (e.g., protecting/risking biodiversity, air/water quality, etc.
- Social equity indicators (e.g., efficiency in addressing gender gaps)
- Multi-objective indicators[15] that integrate monetized and non-monetized criteria into one indicator.

(2) Perform stress tests

Model the system performance in the widest possible range of the future landscape to identify vulnerabilities (i.e., conditions of unacceptable performance) of each plan.

[14] Info-Gap Decision Theory - 2nd Edition (elsevier.com)

[15] Kasprzyk, Nataraj, Reed, Lempert, 2013: Many objective Robust Decision Making for complex environmental systems undergoing change, Environmental Modelling & Software, Volume 42, Pages 55-71, ISSN 1364-8152

(3) Test the robustness

Measure the performance of each plan (i.e., using one or more of the indicators described above) under different instances of the future. Apply **scenario discovery methods** to identify the conditions that lead a strategy to fail to meet its objectives (Bryant and Lempert 2010). The description of these conditions helps to focus decision makers' attention on the riskiest future conditions and to discuss the acceptability of the risks of the various available options.

An example of the application of a robust-based DMDU for the design of a hydropower project in Sub-Saharan Africa is provided in Box 2.8 (a,b).

BOX 2.8a ROBUST DECISION MAKING FOR THE DESIGN OF A HYDROPOWER PROJECT IN SUB-SAHARAN AFRICA

SETTING THE STAGE

This is an illustrative example to describe how robust decision-making can be incorporated into the design of a new hydropower facility. The introductory questions are meant to describe the dilemma the decision-maker faces before getting into the details of the application of the RDM approach.

1. **What should be the capacity of the hydropower plant considering climate change** given that the projected precipitation rates for the future may vary between two extremes (a low and a high)?

If the nominal capacity is too low—i.e., complying with the lower-limit of the precipitation estimates—there is a risk of procuring a project that may not be able to satisfy the potential increasing demand of the future (e.g., due to increased business activity, or population growth that may be boosted by potential changes in the climatic conditions). On the other hand, if the capacity is too high—i.e., assuming higher precipitation—there is a risk of under-exploitation in case water supply proves to be low (e.g., due to decrease in rainfalls and increased evaporation).

2. **What is an "optimum" design?**

Evidently, the right design is a matter of balancing between the cost of building and operating the power plant over the amount of money that must be charged per unit of energy to break even. If average annual precipitation exceeds a certain threshold, the preferred design would be larger to best utilize the increased available streamflow. If, on the other hand, average annual precipitation is below a threshold, a smaller hydropower design capacity would be the most efficient.

3. **What is the metric for an "optimum" design?**

Depending on the risk appetite of the decision-maker, there are different descriptors to measure this trade-off (and hence optimize investment), resulting in different "optimum" designs:

- A conservative decision-maker would feel more comfortable with a design that *minimizes the cost of regret*, which is the cost difference between a chosen design and the cost of the best alternative for that particular future. Hence when the minimization of regret is the driving motivation for new investments, lower nominal capacity hydropowers will be preferred.
- On the other hand, from a riskier decision maker's perspective, an "optimum" design is associated with *maximum benefits*. Hence, when maximization of net benefits is the goal, a larger nominal capacity will be preferred.

BOX 2.8b ROBUST DECISION MAKING FOR THE DESIGN OF A HYDROPOWER PROJECT IN SUB-SAHARAN AFRICA - NUMERICAL EXAMPLE

Hydropower alternatives: 12 alternative design capacities are examined: 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, and 51 m^3 /s

Future Climate: The mean annual temperature in the region is expected to increase by 1.5° C - 2° C by 2040 (having a median at 22.0° C), and precipitation ranges from 650 to 1,325 mm/year.

Computational model: Analyses are performed with the WEAP hydrological model (by Stockholm Environment Institute).

Results: The performance of the 12 design alternatives when subjected to the different climate scenarios is summarized in Figure 2.12. Following the previous discussion, the comparison is performed using two alternative indicators: **the levelized cost of regret** expressed in $/ GWh (left graph) and the **forgone profit** expressed in $/year (right graph).

It is worth noting that designs in the low-middle range (design Nos. 3-4) demonstrate minimum levelized cost of regret and small variance in the predictions over the range of climate scenarios,at the expense, however, of a foregone profit on the order of $4/year. On the other side of the spectrum lies design No. 12, which minimizes the forgone profit if accepting a (non-trivial) cost of regret on the order of $400/ GWh. The final decision lies with the decision-maker.

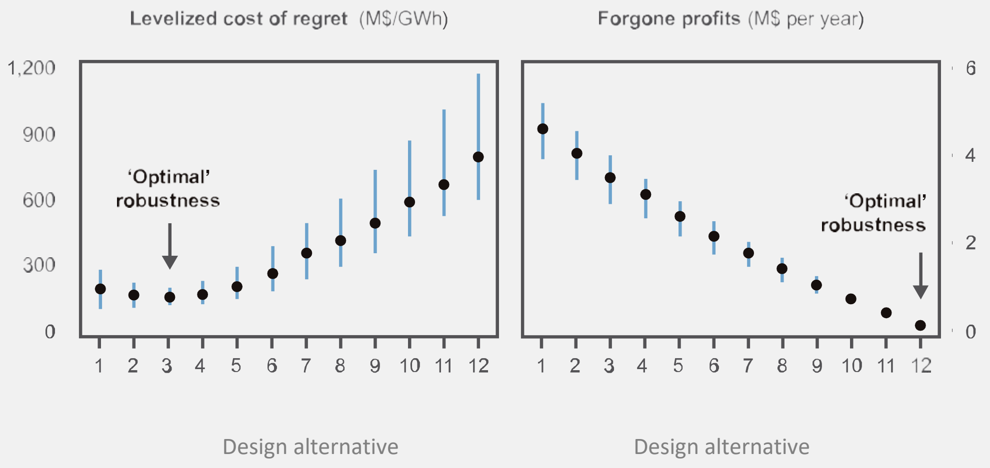


FIGURE 2.12 Mean levelized cost of regret, left, and net benefit of regret (i.e., forgone profit), right, of the 12 alternative solutions over the range of climate scenarios (M$: million dollars, GWh: Gigawatt hours)

Source: World Bank Group, 2015: Confronting Climate Uncertainty in Water Resources Planning and ProjectDesign

STRATEGIES BASED ON FLEXIBILITY

This type of approach shall be more appropriate for the design of "adaptive" plans and, in general, aim to handle uncertainty by planning different types of actions that may be activated, if and when necessary, based on trigger points. Alternative instances of the method are summarized in Box 2.9. Their main components of "adaptive planning" are illustratively presented in Figure 2.13 and summarized below:

The procedure commences with an in-depth analysis of existing conditions and vulnerabilities. Next, the objectives of the adaptation are determined, and proper indicators of success are specified. Based on this, a conceptual design of a base plan is conceived (i.e., a plan that is appropriate to meet the adaptation goals assuming that the climate conditions will not change), supported by "adaptation add-ons" (that offer increased levels of protection against more severe climate conditions). By combining the base plan with the different adaptation add-ons, alternative strategies are generated and assessed over a large ensemble of climate scenarios to estimate vulnerabilities and losses. It is understood that different strategies may have a different window of effectiveness, beyond which a strategy can no longer meet the desired objectives and new strategies need be followed. Central in the idea of adaptation planning is the implementation of a monitoring system with related contingency actions to keep the adaptation plan on track. An example of the implementation of an adaptive planning approach for flood protection is provided in Box 2.10.

FIGURE 2.13 The eight steps of adaptive planning

PHASE 2

M2.2

Climate Considerations on Technical Feasibility

Step 1 Feasibility of Small-scale Mitigation

Step 2 Assess the Feasibility of Adaptation Strategies

Step 3 Manage Uncertainty in Adaptation Plans

BOX 2.9 ADAPTIVE PLANNING METHODOLOGIES

A new paradigm for adaptive planning under conditions of deep uncertainty has emerged in the literature, and several methodologies have been developed in that response. Despite their differences, the methodologies listed below describe a framework for developing dynamic adaptive plans that contain a strategic vision of the future, commit to short-term actions, and establish a procedure to guide future actions.

Adaptive Policymaking (Kwakkel et al., 2010) provides a stepwise approach for developing a basic plan and contingency planning to adapt the basic plan to new information over time. Once the basic plan has been designed and near-term actions are implemented, a monitoring system is established to signpost the implementation of contingencies (i.e., when a trigger event occurs or a threshold has been reached).

Adaptation Pathways provide insight into the sequencing of actions over time, potential lock-ins, and path dependencies. Central to the methodology are adaption tipping points (Haasnoot et al., 2012; Kwadijk et al., 2010), which are the conditions under which an action no longer meets the clearly specified objectives. The approach uses computational scenario approaches to assess the distribution of the sell-by date of several actions across a large ensemble of transient scenarios.

Dynamic Adaptive Policy Pathways (Haasnoot et al., 2013)**,** which is a combination of Adaptive Policymaking and Adaptation Pathways. The methodology explicitly includes decision making over time by constructing a dynamic, robust plan as a set of actions or interventions that are decided dynamically in time whenever a tipping point (i.e., a future time instance at which decisions for actions have to be made) is reached within a monitoring system. After identifying the key objectives, constraints, and uncertainties, a variety of plausible futures is generated. For each future, system performance is examined with respect to the objectives and potential actions, or interventions are identified whenever the system fails to meet the objectives. This assessment is performed either through simulation-based techniques or optimization-based techniques.

Sources:

Kwakkel, Walker, Marchau, 2010: Adaptive airport strategic planning, European Journal of Transport and Infrastructure Research, https://doi.org/10.18757/ejtir.2010.10.3.2891

Kwadijk, Haasnoot, Mulder, Hoogvliet, Jeuken, Krogt, Oostrom, Schelfhout, Velzen, Waveren, Wit, 2010: Using Adaptation Tipping Points to prepare for climate change and sea-level rise: A case study in the Netherlands, Wiley Interdisciplinary Reviews: Climate Change 1, https://doi.org/10.1002/wcc.64

Haasnoot, Middelkoop, Offermans, van Beek, van Deursen, 2012: Exploring pathways for sustainable water management in river deltas in a changing environment, Climatic Change 11, https://doi.org/10.1007/s10584-012-0444-2

Ranger, Reeder, and Lowe, 2013: Addressing 'deep' uncertainty over long-term climate in major infrastructure projects: four innovations of the Thames Estuary 2100 Project, EURO Journal on Decision Process 1, https://doi.org/10.1007/s40070-013-0014-5

Haasnoot, Kwakkel, Walker, ter Maat, 2013: Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world, Global Environmental Change 23, https://doi.org/10.1016/j.gloenvcha.2012.12.006

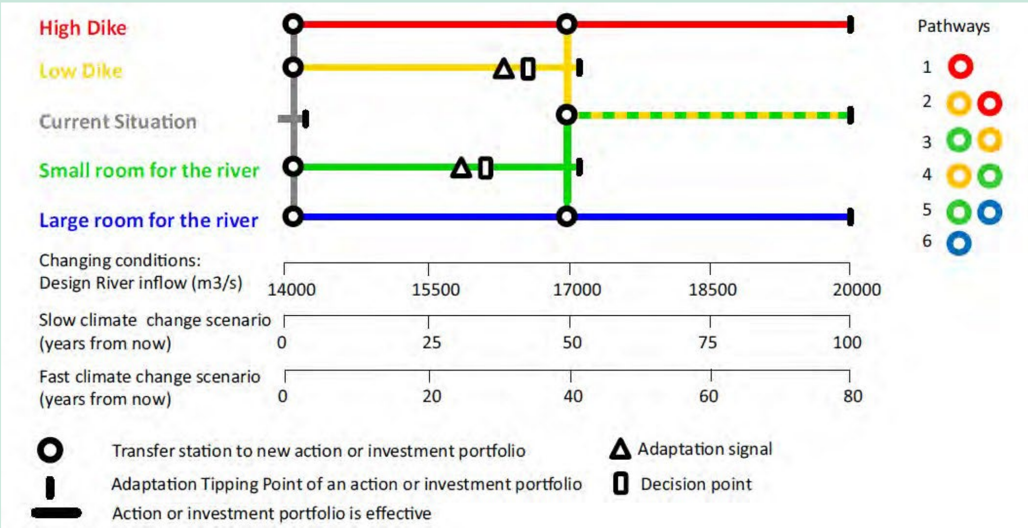
BOX 2.10 AN EXAMPLE OF ADAPTIVE PLANNING Haansoot et al. (2020)

The example refers to a fictitious case based on the Waal River in the Netherlands. The river banks are protected by levees, and the regions in proximity to the river experience flooding when the river flow reaches and exceeds design conditions (approx. 14,000 m^3/s). Due to climate change, increased river inflow is anticipated. Four alternative adaptation strategies are considered: (i) raising the dike with 0.5 m (low dike), (ii) raising the dike further by 1 m (high dike), (iii) providing more room for the river by widening the riverbed at a small scale, or (iv) at large scale.

As illustrated in the figure below, these actions may be combined in various paths and, as such, generate six pathways comprised of four starting points and two possible transfer stations (denoted by circles). Depending on the rate of evolution of the future climate (i.e., fast evolution responsible for a rapid increase in river inflow, or slow representing a later onset of climate change), the adaptation tipping point is expected to take place between years 40 and 50.

Until that point, any of the low-investment solutions (yellow or green) may be implemented. Beyond that point, higher adaptation is required, which may be implemented either by increasing the height of the dike (red line) or by expanding the trenches of the river (blue line), or by combining the low-dike solution with creating some additional room for the river.

Among the alternatives, the preferred strategy is the one that maximizes the net present value and brings additional co-benefits.



Source:

Haasnoot, M., van Aalst, M., Rozenberg, J., et al. Investments under non-stationarity: economic evaluation of adaptation pathways. Climatic Change 161, 451–463 (2020). https://doi.org/10.1007/s10584-019-02409-6

KEY TAKEAWAYS

- A carbon reduction assessment is necessary to define GHG-reduction targets and the means to achieve it (including technical requirements, supporting systems, and operational adjustments).
- Based on a life cycle cost assessment, it is possible to compare alternative mitigation strategies to select the one that is more cost-efficient while generating broader co-benefits[1] (e.g., reduced pollution, promotion of equity, etc.).
- "Adaptation strategy" is a term meant to include any combination of individual adaptation and resilience measures, that is aiming to reduce the damage, loss, and potential disastrous consequences generated by the climate stressing on the infrastructure.
- Adaptation and resilience measures should be identified at this stage. These may be divided in three categories: (i) prevention measures that reduce the likelihood of the consequences of the risk once a hazard is realized, (ii) preparation measures that reduce the severity of consequences once a hazard is realized, and (iii) recovery measures that comprise all measures that can lead to efficient recovery of the infrastructure itself and its closely dependent human and natural environment from the impacts of climate hazards.
- It is generally accepted good practice to examine climate projections associated with a range of emissions scenarios and simulate the performance of the infrastructure across these scenarios (associated with different levels of climate stressing). This way, decision-makers are better informed on the level of protection offered by the adaptation strategy across scenarios and are better prepared to make adaptation decisions.
- In order to allow design of adaptation measures under uncertainty, two potential planning options have been defined: "Base" plan, i.e., a project plan in which all capital expenses associated with adaptation and resilience measures are disbursable upfront and "adaptive" plan, i.e., a project plan in which adaptation and resilience expenses are disbursable throughout the project depending on specific climate-related performance indicators.
- In cases where decisions are hindered by the uncertainty regarding the climate scenarios, decision making under deep uncertainty methodologies provide a framework to help decision-makers prioritize their options in an informed way simultaneously considering multiple criteria.

INSIGHTS

Insight #2.1
Small-scale Mitigation Options

Insight #2.2
Climate Informed Decision Analysis

SMALL-SCALE MITIGATION OPTIONS

INSIGHT #2.1

Infrastructure projects should aim to appropriately plan and design construction and operation procedures in such a way that GHG emissions are explicitly measured and climate mitigation methods are incorporated within the project solution alternatives. The latter may be adopted either as core solutions for the project or, if not possible, as add-ons to traditional gray infrastructure with the aim to reduce the carbon footprint of the project and at least do no significant harm to the natural environment biodiversity and regional ecosystem.

Below are examples of climate-change mitigation options that can either be introduced to conventional infrastructure projects **whose primary purpose is not climate mitigation** to reduce GHG emissions and hence align the project with the international and national / regional agendas on climate change. Adoption of such options may unlock a pool of green funding mechanisms that could support the implementation of the project and optimize its bankability.

Road Networks

The construction of road networks represents a significant amount of the total GHG emissions produced by the transportation sector. Aiming to reduce the carbon footprint and emissions within the life cycle of the project and consequently contribute to climate change mitigation, the main factors to be taken into consideration while planning and designing a road construction are the smart use of materials, their efficient transportation on-site, as well as the optimization in construction techniques. To this end, the re-use or recycling of existing materials during the construction of a motorway network (e.g., the use of materials from old roadways that can be recycled on-site) and the optimization of earthworks to reduce haul distances may lead to a significant impact on the total carbon emissions of the network. In addition, the contractor may consider the use of climate-smart materials, such as porous asphalt that allows water to flow naturally into the soil beneath (hence preserving the ecosystem without generating significant disruptions), the vegetation of embankments as a carbon-capturing method, and gabion walls as an alternative to concrete walls that can reduce CO_2 emissions by 80% compared to traditional reinforced concrete (RC) walls (ref). The infrastructure required for zero direct emissions transport (e.g., electric charging points, electricity grid connection upgrades, hydrogen fueling stations) and infrastructure that is predominantly used for low-carbon transportation (e.g., bicycle and running tracks) may be regarded as indirect measures to assist in climate change mitigation within the life cycle of the network.

INSIGHT #2.1

Green Buildings

Climate change mitigation strategies for buildings could be mainly focused on the promotion of energy efficiency and energy saving mechanisms, the appropriate selection of materials and resources, the use of renewable energy for their operation needs, proper waste management, the efficient use of water, and finally the integration of vegetation that may work as a carbon capture mechanism.

Specifically, through careful and appropriate planning, a building may integrate innovative implementations such as passive design for energy conservation (through the use of efficient materials), maximum harvest of daylight to reduce heating requirements, appropriate location and design of the building openings in order to minimize energy losses, and innovative ventilation systems and smart air conditioning that lead to reduction of energy consumption. In addition, production of renewable energy may be incorporated through the introduction of solar panels at the façade and/or roof of the structure that may cover entirely the energy needs of the building itself. Landscaped garden areas and the introduction of green/vegetated façades and roofs may provide a natural, efficient and inexpensive carbon capture mechanism while at the same time enhance the design and esthetics of the building. Efficient water management could minimize the use of water during construction and provide a systematic mechanism to decrease the water footprint of the building (e.g., through the adoption of blue roofs that harvest and store rainwater).

Another significant aspect of what is defined as a green, sustainable, and bioclimatic building that mitigates climate change is the incorporation of key elements and technologies that facilitate the use of eco-friendly transport (e.g., the installation of charging stations for electric vehicles and parking spaces for bicycles).

Aiming to support sustainability and climate change mitigation within design, construction, and operation of buildings, green certifications/rating systems have been introduced and have gained popularity within the last decades (e.g., LEED, EDGE by IFC).

INSIGHT #2.1

Ports and Maritime Infrastructure

Port projects may facilitate reduction of CO_2 emissions from shipping, port facilities, and landside operations. The development of ports can also contribute to climate change mitigation by accelerating the energy transition, improving the air quality, and by implementing circular economy principles throughout the port's life cycle. All these can be achieved by setting a clear green vision that adopts low carbon development strategies and other mitigation approaches.

A complete supply chain operating on zero emissions can be achieved by setting targets for zero tailpipe emissions from cargo handling equipment and trucks, promoting hydrogen fuel cell electric trucks for freight operations and overall electrification of maritime mobility. Optimization of the port's own fleet by investing in energy-efficient ships and alternative fuels (hydrogen, bio-fuels, etc.), installation of rapid charging stations, and hydrogen refill tanks may support the port's emission targets.

Development of onshore high voltage power supply for container vessels or cruise ships that can connect at berth and access CO_2-neutral electricity from the power grid instead of keeping their engines running and producing emissions of sulfur dioxide, nitric oxide or other air pollutants will not only offer a quieter port environment but also cut substantially such emissions. Carbon capture and storage (CCS) is widely regarded as a key component in the transition of the global energy system. Developing carbon capture infrastructure such as capture plants or transporting pipelines to support CCS projects will not only contribute to climate change combat but also enable new business areas at the port. Improving or compensating for the health of ecosystems, like implementation of large-scale plantation projects (e.g., eelgrass), or maximizing the low carbon energy recovery of wastewater and reducing the overall environmental impact of wastewater treatment can also contribute substantially to climate change mitigation.

In addition, the introduction of emission-free stipulations within the procurement system for port development and operation projects is another way to incorporate mitigation in ports. The port authorities could demand from the prospective contractors throughout the life cycle of the port that a certain proportion of the equipment, work process, construction materials, or energy consumption should be emission-free.

INSIGHT #2.2

CLIMATE INFORMED DECISION ANALYSIS

Climate informed decision analysis (CIDA) is an innovative methodology as it links the insights provided by bottom-up analyses with the information from climate models and informs decisions and risk assessment. Originally developed for water-management systems, the approach is usually conducted via the following steps:

01 KEY CONCERNS & DECISION THRESHOLDS

The first stage of the analysis identifies the climate conditions that cause risks and/or favor a particular decision to be preferred over another. An additional aim of the discussions is to identify thresholds of performance indicators that, when exceeded, signify the need for adaptive actions.

02 MODELLING THE RESPONSE

After characterizing the key climate concerns, the next step is to build a model that simulates system performance as a function of climate inputs. The assessment initiates with a sensitivity analysis using a large input series that samples a wide variety (even remotely plausible) of climate conditions. The result is a set of climate stressors and performance indicators.

03 DECISION MAP

A decision map is produced, identifying each decision's performance under different climate possibilities, as well as the best decision for a given future climate. A decision map, including which decision options are optimal under which groups of climate conditions, can be constructed.

04 RELATIVE PROBABILITIES

The final step in the process is the allocation of probabilities that characterize the relative likelihood of the defined climate groups. Using climate models (i.e., global climate models (GCMs)), stochastic modeling,or expert judgment, a probability is assigned to each climate group. The decision is then based on the application of decision-to-climate performance to relative climate probabilities.

Sources:
Climate Risk Assessment of Niger Basin Investment Program, 2010, AFTWR
Brown, Ghile, Laverty, Li. 2012: Decision Scaling: Linking Bottom-up Vulnerability Analysis with Climate Projections in the Water Sector

INSIGHT #2.2

CLIMATE INFORMED DECISION ANALYSIS

ADVANTANGES	DISADVANTAGES
Identifies vulnerabilities without relying on uncertain global climate models	The quality of the stakeholder process determines the relevance and efficacy of the entire decision process.
Vulnerability analysis is decoupled from climate projections, thus can be easily updated when new GCMs become available.	CIDA relies on subjective judgment to determine important scenarios
Applies the GCM late in the process, reducing the impacts of GCM uncertainties on the decision	Time and computationally intensive

MODULE 2.2
Resources

RESILIENCE BOOSTER TOOL

The Resilience Booster is an interactive, step-by-step tool for development practitioners who are designing or working on climate resilient projects. It helps teams to think through, specify, and design project activities that build resilience by integrating relevant attributes

Developed by: World Bank, 2021

ADAPTATION KNOWLEDGE PORTAL

The portal is an online resource of the UNFCCC Knowledge-to-Action Hub for Climate Adaptation and Resilience (also called the Nairobi work program (NWP)). The portal provides free and open access to relevant knowledge resources

Developed by: UNFCCC

THE ADAPTATION SUPPORT TOOL: CLIMATE ADAPT

A web tool within the European Climate Adaptation Platform Climate-ADAPT that aims to assist the development, implementation, monitoring, and evaluation of climate change strategies and plans

Developed by: European Commission - European Environment Agency

ECONOMIC APPROACHES FOR ASSESSING CLIMATE CHANGE ADAPTATION OPTIONS UNDER UNCERTAINTY

Methodologies for the economic assessment of climate change options considering uncertainty. Prototype Microsoft Excel-based tools for CBA and MCA

Developed by: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

RESILIENCE RATING SYSTEM: A METHODOLOGY FOR BUILDING AND TRACKING RESILIENCE TO CLIMATE CHANGE

RRS complements existing methodologies on tracking climate-related finance

Developed by: World Bank Group, 2021

PILOTING THE USE OF NETWORK ANALYSIS AND DECISION-MAKING UNDER UNCERTAINTY IN TRANSPORT OPERATIONS: PREPARATION AND APPRAISAL OF A RURAL ROADS PROJECT IN MOZAMBIQUE UNDER CHANGING FLOOD RISK AND OTHER DEEP UNCERTAINTIES

This paper presents a methodology to identify key priority areas for transport investments. The methodology uses a geospatial data-driven approach and then proposes an innovative economic analysis for project appraisal under uncertainty

Developed by: World Bank, 2018

ADAPTATION PRINCIPLES: A GUIDE FOR DESIGNING STRATEGIES FOR CLIMATE CHANGE ADAPTATION AND RESILIENCE

The report lays out six universal principles

Developed by: World Bank Group, 2020

ASSESSING THE COSTS AND BENEFITS OF ADAPTATION OPTIONS: AN OVERVIEW OF APPROACHES

This publication aims to elaborate on the role and purpose of assessing the costs and benefits of risk reduction options; introduce a range of key methodological issues; explain the most commonly used assessment approaches; describe lessons learned and good practices; provide a glossary of the most commonly used terms; provide a bibliography of useful resources and references. A diverse range of case studies is presented throughout this publication to illustrate available assessment methods and options

Developed by: UNFCCC - United Nations Framework Convention on Climate Change,2016

ASCE/COS 73. STANDARD REQUIREMENTS FOR SUSTAINABLE INFRASTRUCTURE

Standards providing guidance on sustainable infrastructure development through the entire lifecycle process. The standards outline how leadership shall encourage transformative development of the infrastructure solution at the earliest stages; consider and analyze all reasonable alternatives; and consider natural, no- construction, and constructed project solutions

Developed by: ASCE, 2020

Module 2.2 - Further Reading

DYNAMIC ADAPTIVE POLICY PATHWAYS: A METHOD FOR CRAFTING ROBUST DECISIONS FOR A DEEPLY UNCERTAIN WORLD

A scientific paper proposing a method for decision-making under uncertain global and regionalchanges

Developed by: Haasnoot, M., et al., 2013, Global Environmental Change 23, 2013, 485–498

ADAPTATION PATHWAYS IN PLANNING FOR UNCERTAIN CLIMATE CHANGE: APPLICATIONS IN PORTUGAL, THE CZECH REPUBLIC, AND THE NETHERLANDS

The paper compares the application of the methodology in four planning practices

Developed by: Zandvoort, M., et al., 2017, Environmental Science & Policy Vol. (78)

INVESTMENTS UNDER NON-STATIONARITY: ECONOMIC EVALUATION OF ADAPTATION PATHWAYS

A scientific paper proposing an economic evaluation framework of the methodology

Developed by: Haasnoot, M., et al., 2020, Climatic Change 161: 451–463

CLIMATIC COST-BENEFIT-ANALYSIS UNDER UNCERTAINTY AND LEARNING ON CLIMATE SENSITIVITY AND DAMAGES

A scientific paper presenting a methodology to consider parametric uncertainty on climate sensitivity and damages

Developed by: T. Ekholm, 2018, "Ecological Economics," Vol. (154)

ADAPTING INFRASTRUCTURE AND CIVIL ENGINEERING PRACTICE TO A CHANGING CLIMATE

This report identifies the technical requirements and civil engineering challenges raised by a changing climate

Developed by: ASCE, Committee on Adaptation to a Changing Climate; Edited by J. Rolf Olsen, 2015

2.3 Climate Considerations on Commercial Feasibility and Bankability

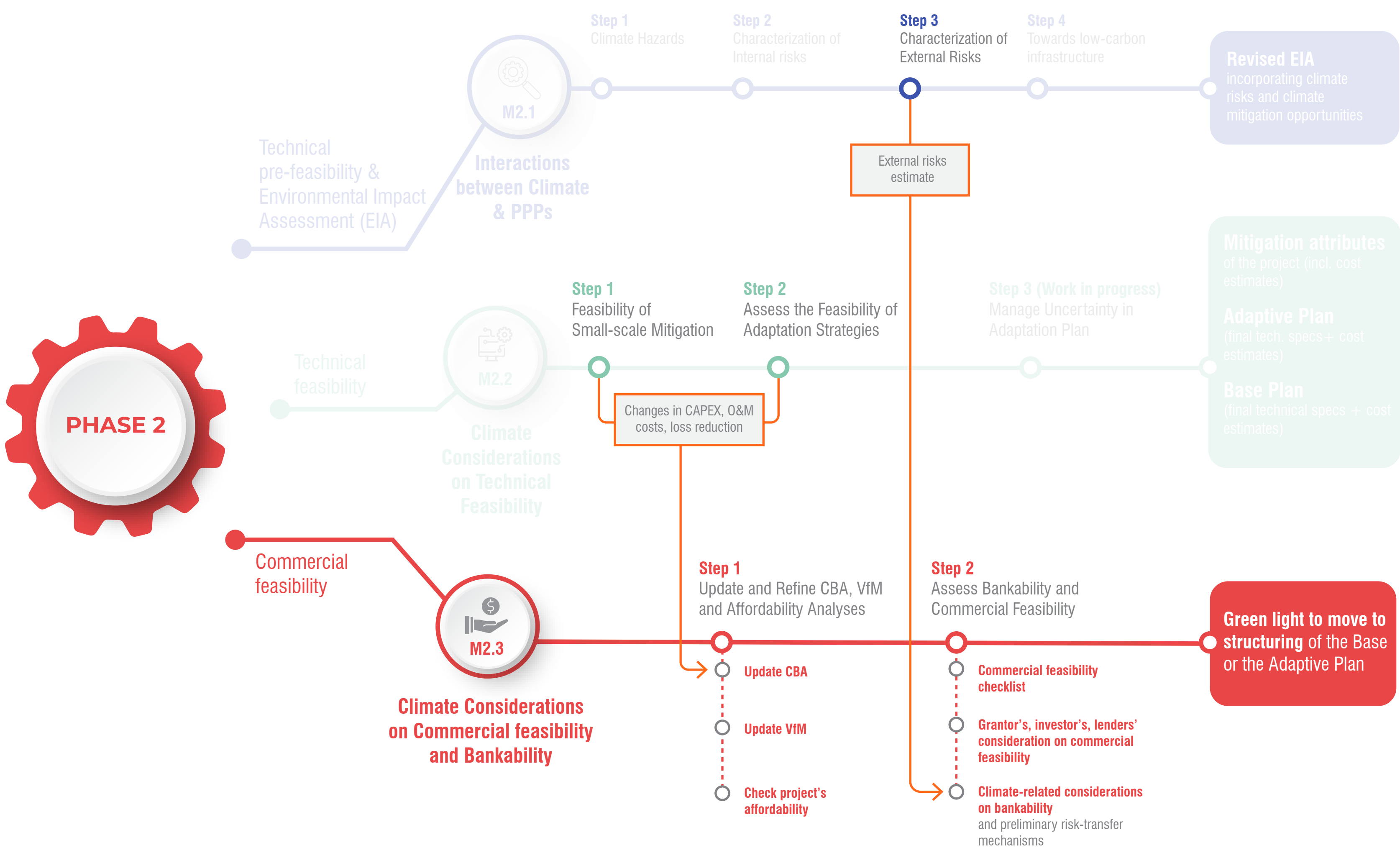
When entering the present module, users are supposed to have completed the review of climate actions to be incorporated in the project and the assessment of their technical feasibility. On the basis that the PPP route has already been chosen, the impact of such technical solutions on the PPP project's commercial feasibility is assessed in the following sections in order to ensure it is ultimately structured as a commercially viable and bankable project.

At first, given that the project has entered the PPP preparation and appraisal phase, it is essential to perform the underlying supporting analysis (CBA, VfM, and affordability).

The pre-assessments of Phase 1 are now updated and scrutinized as detailed, quantified data are currently available to evaluate whether there are climate scenarios and solutions that (i) tip the balance of costs versus benefits (i.e., updated costs exceed quantitative and qualitative benefits), (ii) render traditional procurement more valuable than PPP, and (iii) make the project unaffordable, in which cases alternative project plans would have to be considered and reassessed.

Next, bankability considerations due to incorporating climate mitigation or adaptation measures in the project's structure are identified, key questions for the structuring team are presented, and possible solutions to enhance bankability are briefly discussed.

The resulting output of this section should be a project that can incorporate within a PPP structure technical solutions that address climate risks; result in negative, zero, or very low carbon emissions; or at least contribute to the transition towards a decarbonized economy. Involvement of appropriate technical and financial consultants is essential throughout the module.



Step 1
Climate Hazards
Step 2
Characterization of Internal risks
Step 3
Characterization of External Risks
Step 4
Towards low-carbon infrastructure
Revised EIA
incorporating climate risks and climate mitigation opportunities
M2.1
Technical pre-feasibility & Environmental Impact Assessment (EIA)
Interactions between Climate & PPPs
External risks estimate
Mitigation attributes
of the project (incl. cost estimates)
Adaptive Plan
(final tech. specs + cost estimates)
Base Plan
(final technical specs + cost estimates)
Step 1
Feasibility of Small-scale Mitigation
Step 2
Assess the Feasibility of Adaptation Strategies
Step 3 (Work in progress)
Manage Uncertainty in Adaptation Plan
Technical feasibility
M2.2
Changes in CAPEX, O&M costs, loss reduction
Climate Considerations on Technical Feasibility
PHASE 2
Commercial feasibility
M2.3
Climate Considerations on Commercial feasibility and Bankability
Step 1
Update and Refine CBA, VfM and Affordability Analyses
Step 2
Assess Bankability and Commercial Feasibility
Green light to move to structuring of the Base or the Adaptive Plan
Update CBA
Update VfM
Check project's affordability
Commercial feasibility checklist
Grantor's, investor's, lenders' consideration on commercial feasibility
Climate-related considerations on bankability
and preliminary risk-transfer mechanisms

STRUCTURE OF THE MODULE

The module includes the following consecutive steps:

- **Step 1** provides guidance on updating and refining the CBA, VfM, and affordability assessment of the project that has been already checked as to its technical feasibility.
- This is followed by **Step 2,** which presents the criteria that need to be met so that the project solution is commercially feasible and bankable.

01 UPDATE AND REFINE CBA, VFM, AND AFFORDABILITY ANALYSES

Performing a thorough cost-benefit analysis and properly estimating the value for money and affordability of the project are perhaps the most critical steps towards the decision on the commercial feasibility of the project. The analysis at this stage is expected to be considerably more advanced compared to the early assessments of Phase 1, since users are expected to have acquired (as part of the preceding modules) updated and quantified information on:

- **Climate risk scenarios**, which provide an indication of potential exposure of the project to costs, either due to operational disruption or due to physical damage
- the costs and benefits of **risk-reduction plans** against identified scenarios
- the costs and benefits of **climate mitigation strategies**
- the **underlying uncertainty** and whether such uncertainty can be addressed in part or in full, as well as the impact of such uncertainty in a project's technical feasibility

The following sections outline how such data can be used to rigorously assess CBA, VfM, and affordability in order to estimate whether the incorporation of climate actions in the PPP project remains justifiable from a commercial perspective.

COST-BENEFIT ANALYSIS (CBA)

Upon initiation of the process, all categories of costs and benefits related to climate actions (presented previously as part of Module 1.3) will need to be diligently quantified. Thus, in the current step, the preliminary estimates of Phase 1 need to be updated in light of the new data listed above. Table 2.2 illustrates the steps of the traditional CBA process, which will need to be updated to incorporate the costs and benefits of climate actions.

TABLE 2.2 Incorporating climate-related considerations in the CBA process (APMG guide)

CBA process outline	CBA sub-steps	Incorporating climate toolkit outputs
Projecting Financial Data with Conversion/ Adjustment	Tax adjustment	• Only relevant to the extent there are tax incentives to a project when incorporating wider social benefit parameters
	Shadow prices and opportunity costs adjustment	• Adjust costs and benefits as would otherwise be done, but with including any probabilistic analysis of costs and uncertainties about climate hazardrisks and/ or costs of adaptation
	Construction of the model	• Reflect on the cost estimates and the steps above in the model
	Defining term and residual value	• Residual value requires adjustment as an asset that is unprotected by climate hazards that are worsening in the long term will decline in value, while an asset that incorporates protection mechanisms (adaptation) will retain higher residual value
Adding Externalities	Defining a list of externalities	• In the case of costs, externalities may be significant, especially in cases of essential infrastructure. These need to be carefully thought of, especially when assessing project alternatives without adaptation (e.g., in the case of a carbon emission reduction project, a social price of carbon may be applied) • In the case of benefits, externalities should be assessed and reflected (e.g., user safety, the certainty of availability, and of revenue)
Adding (Other) Socio-economic Benefits	Monetizing/ inferring value for relevant benefits	• Reducing and managing the risk of climate disruptions increases private investment confidence (business, entrepreneurship, property). These gains need to be reflected and, to the extent possible, quantified
	Considering/ qualifying other unvalued benefits	• Resilience through the project has to be reflected (e.g., the prevention of flood or other short or mid-term disruptions to an area that an infrastructure asset covers will undoubtedly have significant impacts on the surrounding ecosystem and biodiversity) • Alignment with strategic climate objectives
Relative Price Adjustments and Bias/Risks Adjustments	Market imperfection	• Apply as would otherwise have been done
	Other opportunity cost adjustments	• Consider cases whereby the cost of adaptation leads a project alternative to become more expensive than an alternative that was rejected as too costly but did not suffer from the same climate risks • In addition, consider alternative uses of the land and space that climate measures cover, if any, and apply such costs
	Taxes	• Same as above, apply only to the extent that tax advantages are applicable when a project exceeds its purpose in social benefits • Consider the tax income gained from steady uninterrupted operations
Defining Base Case, Defining and Calculating EIRR	Discount rate definition and calculation of expected net Present Value – eNPV and Internal Rate of Return - eIRR	• Consider adjusting discount rate for valuation depending on levels of certainty of cash flows (in case a project alternative has adaptation measures) and uncertainty of cash flows (in case a project has no adaptation measures). This needs to be aligned with the probabilistic analysis of events occurring to avoid "hurting" a project with uncertainty twice (one with a high probability of costs occurring and one with a high discount rate because of the uncertainty of cash flows)
Incorporating Uncertainty: Sensitivities	Test the strength of the proposed business plan and present the effect of variations	• As would otherwise be conducted
Closing the Analysis and Reporting	Include the assumptions and results in the screening report	• As would otherwise be conducted, however, highlighting in the report that climate mitigation (if applicable) and resilience has been considered as one of the main criteria

CBA Considerations for Base and Adaptive Plans

As explained in detail in Module 2.2, adaptation works may either be implemented at the project's onset (base plan) or at any other time during the project lifetime (adaptive plan). Depending on the planning horizon of the adaptation strategy, the cost and benefits of the CBA may be impacted differently (Tables 2.3 and 2.4).

TABLE 2.3 CBA cost elements for base and adaptive plans

CBA Element	Adjustments for a **Base Plan**	Adjustments for an **Adaptive Plan**
	COST ELEMENTS	
Capital Cost	Increase of project's capital cost	Increase of project's long term cost profile
Cost Projections	▪ Reduction of the probabilistic adjusted cost[1] ▪ Mitigation of contingent costs[2]	▪ Reduction of the probabilistic adjusted cost ▪ Mitigation of contingent costs
Contingent Liabilities by the state	Decrease. Risk transfers to the project company	Decrease. Risk transfers to the project company
Contract Mechanism	N/A	Required (to oversee climate indicators and trigger for adaptive works)
Coordination Costs	N/A	May increase in case inputs from an increased number of parties will be required
Procurement Cost	May increase. Technical advisors' scope is widened and environmental (and other) advisors will have to be engaged	May increase. Technical advisors' scope is widened and environmental (and other) advisors will have to be engaged

[1] There are two ways to account for such risks: (i) by adding a cost line adjusted for its probability of occurrence or (ii) by adding a risk premium to the discount rate of the valuation model.
[2] Although there is always a probability of an unexpected disruption if a technical solution does not fully protect upfront.

TABLE 2.4 CBA benefit elements for base and adaptive plans

CBA Benefit Elements for **Base Plans**	CBA Benefit Elements for **Adaptive Plans**
▪ Straightforward procurement contract as all is dealt with at the EPC contract level ▪ Less frequent interruptions of operations, be they due to adverse climate events or for adaptive works ▪ Potential access to liquidity pools that are relevant to climate action ▪ Certainty of flow (supply or offtake) for interdependent infrastructure ▪ No requirement for government guarantees	▪ Continuous innovation by the private sector (when adaptive works are required, better, cheaper solutions may have been developed) ▪ Potential access to liquidity pools that are relevant to climate action ▪ Higher certainty of operations in case of most climate-induced disruptions without a high upfront cost ▪ Limited requirement for government guarantees (it is expected that for climate events that do not abide by the expected timing and severity of the underlying risks that the adaptive plan is based on, would still require some form of government protection depending, of course, on the availability of relevant insurances)

It is generally good practice to meticulously establish the range of cost impacts for all solutions considered (i.e., adaptation and mitigation measures) in order to assess whether there are cases whereby total costs start exceeding total benefits. For these cases, an assessment by the grantor will have to be made on whether:

- the underlying strategic objectives or the qualitative benefits of the project overall "exceed" the additional costs, and therefore the project should proceed even if such solutions are costly (assuming it does not breach affordability, of course)
- Cost-efficient solutions may offer sufficient protection[3] against climate risks, and therefore the costlier solutions against severe and less likely events should remain outside the scope of the project; or
- Other adaptation measures (i.e., outside the scope of the project under consideration) could be pursued[4]

[3] This is a qualitative decision based on the relevant specialist advice and specific circumstances in each case. At a high level and only as an indication, a less costly technical solution that still leaves some contingent liability may have a very low probability of occurrence, therefore minimizing its impact in the CBA, or that probability may be considered to be near zero, and therefore irrelevant, as there are other government mechanisms in place to address severe climate events. It goes without saying, however, that any such exposure would have to be guaranteed by the government under a PPP structure in case it remains an open risk.

[4] There may be cases where a project to protect other assets or projects can be pursued independently.

INCORPORATING CLIMATE UNCERTAINTY IN CBA

The discussion in the preceding modules has highlighted the fact that climate-related uncertainties impact the project risks and thus the selection of adaptation and resilience plans. This is expected to also be reflected in the costs and benefits of climate actions that could render the traditional CBA approach inadequate. In such cases, uncertainty may be incorporated in the analysis either by conducting CBA under risk or by employing the more demanding approach of CBA under uncertainty, as outlined below. On the other hand, when the effect of different scenarios on the technical effectiveness of climate strategies has been proven to be insignificant (on the basis of climate analyses), traditional CBA is appropriate.

Although the guidance below attempts to highlight the main advantages and disadvantages of the two approaches (which should not be considered as mutually exclusive) and the conditions under which each one may be applicable, the decision to embark on the analysis should be made on the basis of project-specific factors including the criticality of climate considerations, availability of data, capacity and priorities of the structuring team, availability of advisors, etc.

- **CBA under risk**

The approach may be used to account for the risk of unknown climate-related quantities in the same way it would be employed in order to account for any other non-stationary variable (e.g., uncertainty regarding future traffic volumes in case of a highway PPP). It is performed in cases when it is meaningful to attach distributions to the variables entering the cost-benefit analysis (and net present value equation). Thus, it is appropriate in cases where probabilities may be assigned in the climate scenarios for the region under consideration (and hence reflected in the values of costs and benefits to be fed into the model). The analysis method may be described as a probability-weighted sensitivity analysis using Monte Carlo simulations. The output of this type of analysis shall provide the climate actions' net present value (NPV) with its corresponding standard deviation as well as the probability that the expected NPV is negative.

- **CBA under uncertainty**

This approach is applicable in cases of significant uncertainty, where it is not possible to accompany scenarios with probabilities, and requires conducting multiple CBA analyses (i.e., one per considered scenario) and deriving the NPV of climate actions in each scenario. A simple metric may be defined as the number of scenarios in which the NPV is positive. The conditions under which the NPV is not positive can also be analyzed to identify the vulnerabilities of the investment. To do so, a scenario discovery method may be applied for identifying conditions that characterize the vulnerabilities of the proposed investment options. The description of these conditions helps focus decision makers' attention on the most important uncertain future conditions to the problem at stake and discuss the acceptability of the risks involved given the various options available.

In essence, CBA under uncertainty follows the same principles as any methodology for **decision-making under uncertainty**, such as those discussed in Module 2.2. In fact, in their most advanced instances, DMDU models may incorporate both technical and financial parameters simultaneously (e.g., by using them to select options that optimize the NPV of climate actions). It is worth mentioning that, despite their merit, such "fully coupled" approaches are computationally demanding and require significant expertise.

VALUE FOR MONEY (VFM) ANALYSIS

The next action is the refinement of the VfM analysis, which has been conducted in the early stages of project selection (as described in Phase 1). The scope of the updated VfM analysis is to assess whether the proposed technical solutions under the various climate scenarios and associated costs maintain the merits of a PPP, both from an overall cost to the government perspective and the potential qualitative benefits and considerations associated with such a procurement option, such as private sector innovation, risk transfer, and performance-based structures.

At this stage, given the updated specific information from Modules 2.1 and 2.2, the VfM will have to be revised, primarily in view of the updated cost estimates and other implications of the proposed technical solutions. The underlying assumption is that PPP suitability and affordability are (and should be) maintained with as few implications as possible on the requirements for government or other forms of guarantees and cover. For example, any technical solution that materially and significantly alters the project's cost and risk profile would likely have to be reassessed for its overall PPP suitability and affordability, to the extent that:

1) The government would need to provide significant guarantees or
2) Interest from the private sector would be reduced or
3) Any additional costs would require significantly larger debt amounts and capacity payments by the government

In such cases, it is suggested that the technical solution is rejected or reconsidered to mitigate its impact on PPP suitability and/or affordability. This is likely to be more relevant for projects subjected to medium/high climate risks, having significantly higher associated costs, whether for development of relevant technical works or insurance for any of the remaining risks, or for reinstatement costs.[5]

[5] The level of costs of a technical solution that may derail the VfM analysis by impacting PPP suitability or affordability really is decided on a case-by-case basis. In certain projects it may because the technical solution is rather complicated representing a significant percentage of overall project costs, and therefore requiring higher availability payments by the state or user charges by the public—deeming it unaffordable. Alternatively, the complication of the technical solution may require the involvement of bidders and EPC contractors that are not experts in the sector of the underlying project, therefore reducing the project's attractiveness given the challenges to form appropriate consortia. In other projects, the technical solution may still require insurances that are too expensive or not available.

The VfM should not be looked at in isolation but rather has to follow, or happen in combination with, the updating of the affordability analysis.

Key Considerations for VfM

The main parameters to consider when updating the VfM analysis at this stage, both from a quantitative and qualitative assessment perspective (Box 2.11), are the following:

1) The **range of costs** under each climate scenario and technical solution, which will lead to a range of values under both procurement options. It is important to note that the cost implications are seemingly the same for both the traditional procurement and PPP model. Thus they are not impacting the overall conclusion and, in fact, they further support the case for a PPP as the latter would lead to alleviation of certain such costs (assuming, of course, that a PPP is already preferred to traditional procurement from Phase 1). Yet, there will be cases where such costs may lead to challenging affordability and PPP suitability. Although such cases are likely to occur as a project risk moves from the medium to high probability and from medium to high impact scales, the impact on affordability and PPP suitability should be considered as well if there is a net loss of value.

2) The **high-level qualitative benefits** of a PPP with climate measures have already been considered in Phase 1. However, they must, at this stage, be further refined (Figure 2.14). For instance, under an adaptive plan scenario, a PPP will allow for innovative solutions to be put forward by the private sector to keep costs low and the underlying competitive tension may push required returns lower. In certain cases, perhaps a PPP will allow for the private sector to suggest and propose technical solutions for climate mitigation or adaptation, rather than the government having to conclude on a solution upfront. Also, the technical solution is best managed (developed, proposed, and executed) through a performance-based PPP contract whereby the expected innovation and life-cycle approach by the project will materially enhance the value.

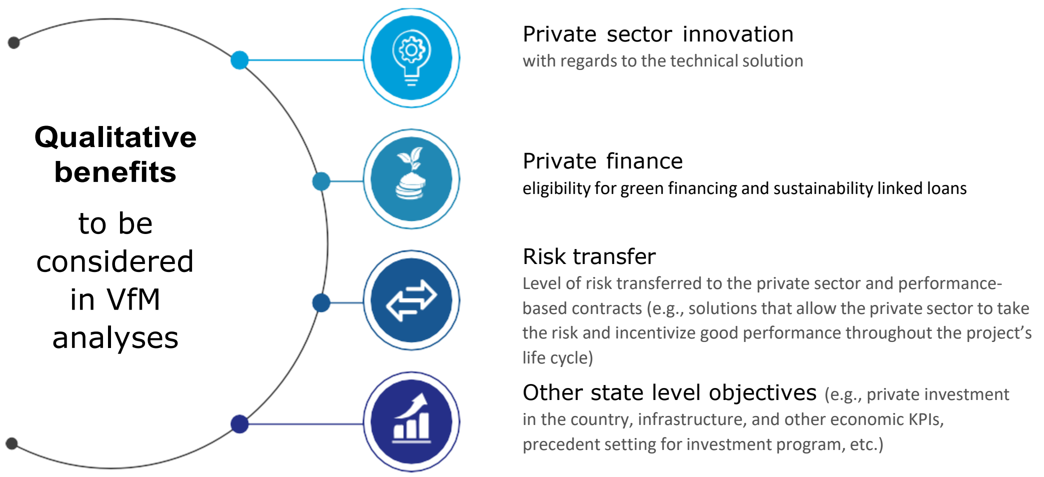


FIGURE 2.14 Qualitative benefits for procuring climate-smart projects via the PPP route

It remains at the discretion of the grantor whether quantitative or qualitative assessment approaches shall be used, either to complement or to be used instead of each other, in order to complete the VfM exercise depending in each case on the impact level of each risk and its likelihood of occurrence. There may be cases when a qualitative assessment can maintain the preference for a PPP approach, even when the quantitative assessment suggests otherwise. Additionally, in cases where suitability or affordability are questioned, the qualitative assessment may provide the necessary incentives to the grantor to develop deliverable and affordable PPP solutions.[6]

So while it is considered unlikely that the balance in a VfM analysis will change due to the incorporation of more specific and refined climate action plans in a project, both the quantitative and qualitative elements should be refined and updated in this phase, as there may be cases where the technical solution proposed for each climate scenario may be delivered more effectively and efficiently under a PPP structure or, in certain cases, compromise the suitability or affordability of a PPP project and, in such cases, the qualitative assessment may well counter such quantitative value loss.

BOX 2.11 THE IMPORTANCE OF QUALITATIVE ASSESSMENT

The importance of the qualitative assessment, regardless of the outcome of the quantitative assessment, is twofold. Firstly, it serves to complete the VfM analysis by highlighting all those PPP-related qualitative benefits that are increasingly important to governments, and secondly, it may well be that, in cases whereby the quantitative analysis is not negative, the qualitative assessment benefits may outweigh the costs and therefore still maintain the preference for a PPP approach. Even in cases whereby the grantor may be in a position to challenge a project's PPP suitability or affordability (due to large cost increases, or risk remaining uncovered or performance cannot be measured), the qualitative benefits can serve to improve such a position, especially when considering a PPP project's whole life cycle and impact on the society.

PHASE 2 AFFORDABILITY

The analysis is meant to assess whether the incorporation of climate mitigation and resilience provisions compromises the affordability of the PPP project. To this end, the grantor's total economic exposure to the project company and to the project, either directly because of periodic availability payments and users paying fees or indirectly because of contingent liabilities, has to be determined and assessed against government short- and long-term budgets and the relevant populations' income levels. Affordability assessments should also verify that the implementation of the adaptation and mitigation actions will not compromise the government's

[6] For example, a substantially higher total cost for the grantor due to climate considerations and measures that would otherwise question the project's affordability may be countered by the fact that the qualitative assessment part of the VfM indicates that social and other government objectives (e.g., private sector investment, new jobs, local private finance, etc.) do ultimately lead to a net benefit to the grantor, therefore countering affordability. In other words the very fact that a project is procured by a PPP addresses what otherwise would have probably been unaffordable.

capability to pay the project company, including for cases when there are unforeseen events or risks that the government has assumed as part of the PPP contract or the financing agreements.

As explained above, the incorporation of climate strategies may impact a project's affordability in two competing ways

1) increases the additional cost to the project company, which frequently translates into increased availability payments by the grantor or higher user fees[7]
2) reduces the grantor's contingent liabilities when the climate change-induced risks are transferred to the project company.

Therefore, when reviewing affordability in the context of a PPP project with climate mitigation and adaptation provisions, the following considerations would have to be addressed depending on the payment option deployed for the PPP project:

For availability-based concessions

- Does the extra cost to the project company for including mitigation options and for incorporating adaptation/resilience plans (including the need for acquiring relevant insurances) lead to an increase in the level of availability payments that is unaffordable over the long term to the government?
- Are there any additional guarantees required by the government, given the underlying climate hazard, that increase contingent liabilities at an unsustainable level for the state?
- What is the level of reduction to the state's contingent liabilities by transferring this risk to the private sector? This is expected to mitigate the impact of any cost increases from the two previous questions.

For demand-based concessions

- What is the resulting increase in the user paying fees over what would otherwise be the case before incorporating climate mitigation and adaptation plans in the project?
- Can such increase be tolerated by the users in terms of their income levels, and, if not, would the state be required to provide a form of subsidy (either directly on the price of the user charge or on the basis of assumed guaranteed usage levels)? Can such a subsidy be afforded?
- What is the level of reduction to the state's contingent liabilities by transferring this risk to the private sector? This is expected to mitigate the impact of any cost increases from the previous question.

If the net impact of the above calculations does not harm affordability—and in many cases, perhaps it may even improve it—then no further considerations should be made on this front other than what the respective grantor would routinely do.

[7] Such increases are not proportionate to the project cost increase given that most of the time there are innovative structures proposed and executed via a PPP that would mitigate the level of the increase.

Step Output

- A project (incorporating climate mitigation and adaptation provisions) that is affordable and suitable for PPP procurement.
- If the above condition cannot be met, the project should be reconsidered or restructured.

02 BANKABILITY AND COMMERCIAL FEASIBILITY

There are two possible scenarios resulting from the updating of the CBA, VfM, and affordability analyses of Step 1:

- There are technical solutions (i.e., adaptation and mitigation measures) that can be accommodated within a PPP structure, with required adjustments in many cases
- PPP suitability or affordability are breached when incorporating such technical solutions and risks in the project's structure; therefore, the solutions are rejected.

In the latter of these two cases, if the remaining alternative technical solutions do not suffice to manage, share, or be insured against the risks, the project will have to be reassessed, and, perhaps, a different procurement method should be sought if that is available.

The next sections address the considerations associated with incorporating climate actions and climate risk within a PPP procurement to ensure that commercial feasibility and bankability are achieved and enhanced. The main considerations of the primary stakeholders are outlined for the various levels of risk and extent that these can be addressed by the technical solutions, while high-level options are proposed to accommodate the extra cost and risk within the PPP contract.

HIGH-LEVEL CONSIDERATIONS ON COMMERCIAL FEASIBILITY AND BANKABILITY

The following checklist outlines the initial questions that the grantor should attempt to address in order to safeguard commercial feasibility and bankability (Box 2.12).

- Does the level of risk and cost associated with a technical solution impact the appetite of the investors[8] to bid for a project, and how does this change depending on the type of PPP structure?
- If high risk diminishes interest in the project, what countermeasures can be considered to mitigate such risk (incentives, unlocking financing pools, credit support by multilateral development banks, etc.), other than asking the grantor to assume all risks and provide state support?[9]
- At what level of risk do such measures become relevant?
- Does a high level of risk require upfront addressing early in the concession? Can medium risk be treated with more gradual adjustments?
- To what extent do the lenders consider this, and what would they expect in terms of commercial structure and protection mechanisms to preserve the project's bankability (see Box 2.12)?
- Do mitigation costs deem the project not viable from a returns perspective?
- What countermeasures can be put in place in terms of commercial structure in order to reduce the adverse impact of such increased costs?
- Can such costs be funded by separate pools of funds (green bonds, climate financing, multilateral cover)? For example, the incorporation of nature-based solutions in the project design may unlock additional liquidity pools or even generate additional revenues to the project (see Figure 2.15).
- Can the developers or investors claim other benefits from assuming such cost within the project company (e.g., carbon credits)?
- To what extent is the "climate adaptation" attribute of a project officially accepted by international organizations (e.g., to what extent does it officially count towards a participant company's public climate metrics, and under what authority – similar to "Equator Principles" Box 2.13)?

ADAPTIVE PLANNING MAY BREACH BANKABILITY

The whole idea of implementing climate adaptation measures through adaptive planning is to avoid high upfront capital for adaptation works when there is little consensus on their necessity. Such a strategy may provide a good cost-benefit ratio, but may challenge the financial structure and the payment mechanism of the project. A safe practice is to explore the possibility of adaptive planning only as a last resort (i.e., if it is the only economically viable solution). In all cases, decisions on the bankability of adaptive planning and selection of the appropriate financing method will require involvement of expert consultants. Details on the project financing of adaptive plans are provided in Module 3.2.

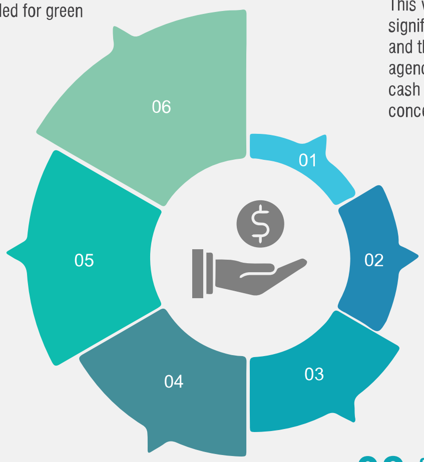
---

[8] The list of market players, whether investors, developers, or lenders, that are interested in demand-based concessions such as toll roads, airports, and certain utilities, are very different to those that are interested in availability-based concessions such as free roads, utilities with fixed offtake contracts and prices, and social infrastructure.

[9] State support of a PPP project can take many forms. It can be in the form of a direct debt guarantee, a guaranteed payment to the project company regardless of asset availability, a debt guarantee only during the construction period, etc.

BOX 2.12 GENERAL BANKABILITY CONSIDERATIONS FOR A PPP PROJECT WITH CLIMATE CONSIDERATIONS

There are certain considerations that commercial lenders will particularly be interested in when assessing their participation in a PPP project that incorporates climate risk considerations. While lenders, in general, are by default likely to require approved environmental impact assessments and Equator Principles confirmations in most cases, climate change-induced risks add certain considerations that the lenders would be more comfortable if properly and timely addressed as early as possible in the preparation of PPP contract provisions. These include but are not limited to:



01 Co-participation of multilateral, development or export credit agencies
This will provide comfort to commercial lenders that a significant level of due diligence has been exercised and that the project benefits from the support of agencies that are unlikely to let a project fail if it faces cash flow difficulties at some point during the concession term.

02 Maintenance of debt service coverage ratios (DSCRs) at levels comfortably above default covenants when either payments for adaptive plans are due (if planned in advance) or when the payment mechanism is adjusted to reflect such costs as and when they occur.

03 Clear understanding of the reliability and sufficiency of climate adaptation plans and breach conditions.

04 Robust reinstatement mechanisms in case of disruptive events and provisions for debt service coverage in case of Project Company income loss (e.g., first claim to insurance proceeds; state or other form of guarantees).

05 Financial model robustness under multiple negative scenario sensitivities.

06 The categorization of the project as “green” even if its purpose is not to facilitate climate mitigation but to adapt to climate change. This may allow tapping into lenders’ liquidity pools that are intended for green projects.

BOX 2.13 EQUATOR PRINCIPLES

The Equator Principles are a risk management framework for environmental and social risks that apply to projects globally across all industry sectors. Their framework includes ten major principles consisting of sets of guidelines to provide a minimum standard for due diligence and monitoring to support decision-makers on socially and environmentally responsible risk management. They are based on the World Bank Group's International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, that were first introduced in 2003 by ten financial institutions together with the IFC, after growing pressure from the public and various NGOs for social and environmental inclusion in project financing and development. Currently, the financial institutions that have adopted the Equator Principles (EPFIs) cover most of the international project finance debt within developed and emerging markets. All EPFIs have committed not to support the financing of projects that do not intend, or are not able, to comply with the latest update of the Equator Principles (EP4). The framework for financial institutions, together with other respective original frameworks developed by multilateral development financial organizations such as the World Bank Group (Environmental Social Framework) and the Export Credit Agencies of OECD member countries (environmental and social due diligence) or other international organizations such as United Nations (UNEP environmental, social and sustainability framework) are all trying to respond to the overarching need of environmental and social awareness within the projects. Similarly, the inclusion of climate change incorporation in projects has also become a prominentneed.

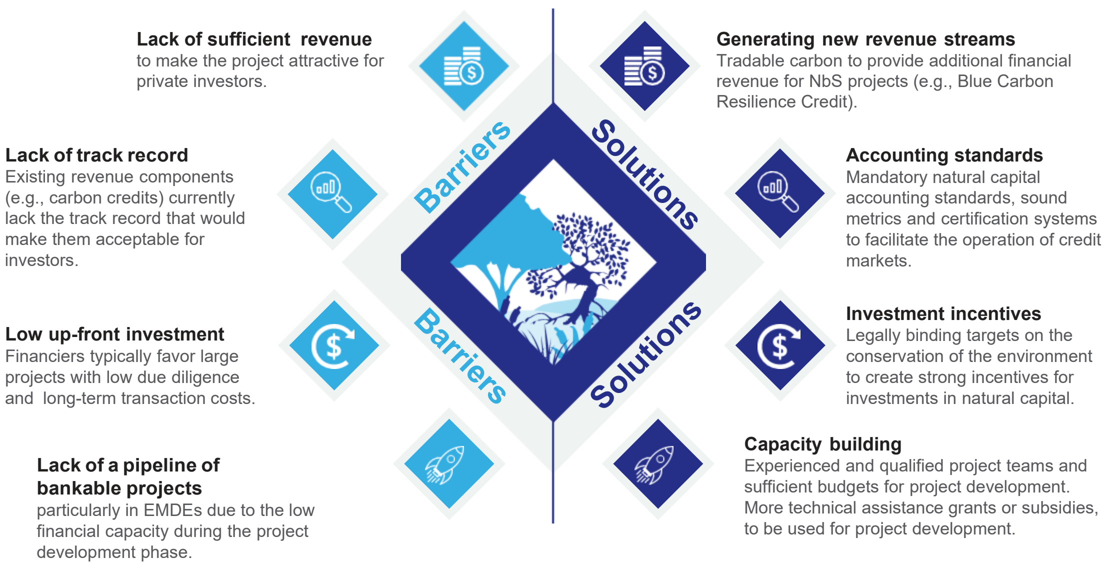


FIGURE 2.15 The incorporation of nature-based solutions in the design may (under circumstances) enhance the bankability of the project. [Source: Ecoshape (2021), "Paving the way for scaling up investment in nature-based solutions along coasts and rivers"]

GRANTOR, INVESTOR, AND LENDER CONSIDERATIONS ON COMMERCIAL FEASIBILITY

The section highlights what the main stakeholders - grantor, investor, lender - would **expect to see and achieve** in the structure of a PPP project that includes climate actions to help them address the high-level questions (described above).

GRANTOR

RESPONSIBILITIES

- Incorporation of the climate plan in the project's scope without the need for state guarantees or alternatively with limited government or multilateralsupport
- Communication of the approach to the market and managing feedback and expectations effectively, in order to develop and maintain market interest and competition
- Development of the tender documentation (RfP, project documents and contract, technical specs, etc.) that are clear in terms of requirements, risk allocation, and qualification criteria
- Maintaining competitive tension through a well-timed and disciplined process
- Having the capacity to evaluate and monitor the implementation of anadaptive plan (if applicable).

INVESTOR

RESPONSIBILITIES

- To convey to the grantor and government positions and views in relation to climaterisk impact on a project and climate adaptation approaches that would be deliverable as part of the project scope

REQUIREMENTS

- Clarity and robustness of contractual structure in relation to climate-related requirements and risk allocation
- Impact of climate related requirements on investment returns and risk allocation, such as:
  - the impact on total capital cost
  - the frequency of capital injections
  - which party bears the risk of events occurring at different than expected timeframes
- The complexity of technical works associated with climate action that may require use of technologies and approaches that cannot be delivered by local contractors
- The project's bankability and the extent that it is affected, positively or negatively, by climate risk and risk reduction plans
- Availability of additional sources of liquidity over and above bank debt (e.g., green bonds) and flexibility of project documentation so qualifying conditions can be met
- Enforceability of climate risk and climate adaptation clauses in the project documentation.

LENDER

RESPONSIBILITIES

- Consultations whereby high-level views are communicated in relation to the necessary risk allocations and project structures and ways to not compromise bankability. This can be done by the grantor's financial advisor or, if not yet engaged, by the grantor's finance team which may administer such consultations, to the extent that relationships exist

CONSIDERATIONS AND REQUIREMENTS

- During the project's construction period, the primary concerns are:
  - construction delays
  - construction budgets (to the extent it is not a turnkey lump sum arrangement)
  - the quality of the construction (e.g., poor construction may cause operational issues in the long term).

  If climate risks are faced during the construction period, then risk allocation (i.e., who compensates for the resulting delays and recovery costs) during this time becomes critical for the lenders. If climate risks are relevant for after the construction period, then the only concern for the lenders is whether the construction allows for efficient and cost-effective future climate adaptation works.
- During operations, the main concerns are:
  - operational disruption and therefore disruption to the steady and predictable cashflows of the project company
  - the size of the climate adaptation cost and the timeframe within which it will be complete.
- The lenders will have different considerations and requirements in case of:
  - Operational disruption due to a climate event, with no new or minor capital/ repair works required
  - Operational disruption due to climate event requiring significant repair and reinstatement works
  - Project company revenue disruption in "user-pays" projects, due to limited or no asset utilization by its intended users.
- Mitigation measures, such as contingency or reserve accounts, for all the above will be sought for and required in most cases.

ALIGNED UNDERSTANDING

The intention of all the above steps is to ensure a position whereby, before the structuring phase of the PPP contract, the main stakeholders are aligned in their understanding of the climate risk, the required measures, the project structure necessary, and the availability of any bankability or risk "enhancers" that would allow all parties to participate and support.

PHASE 2

M2.3

Climate Considerations on Commercial Feasibility and Bankability

Step 1
Update and Refine CBA, VFM and Affordability Analyses

Step 2
Bankability and Commercial Feasibility

INCORPORATING CLIMATE MITIGATION AND ADAPTATION PLANS IN PPP STRUCTURE: BANKABILITY CONSIDERATIONS

Climate-related risks may impact the project's bankability, and as such, lenders need to be covered against them. To this end, the current section utilizes results from Modules 2.1 (identification of direct and indirect risks) and 2.2 (climate risk reduction strategies) to evaluate the impacts of including such risks on bankability and to highlight actions and potential instruments that need to be considered. Such impacts and especially the identification, evaluation, and description of the actions and instruments in place to optimize the risk-sharing will be analyzed in detail in the subsequent Phase 3 of the toolkit.

A high-level guide is presented in the ensuing tabulated format (Tables 2.5 – 2.6) to describe requirements and potential for risk allocation to the private sector without impacting bankability, for varying levels of risk and varying levels of addressability by a technical solution.

Understandably risk level will depend on the climate scenario and, as such, cannot be represented by a unique value for the project. In this sense, it is possible that parties may employ different strategies/actions/instruments to share different portions of risk depending on the intensity and the likelihood of each hazard occurring (e.g., low-impact risks borne directly by the project company with high impact risks covered by insurance). Such allocation, including the categorization of events as force majeure, will be further defined as part of Phase 3.

Step Output

- High-level consideration of the project's commercial feasibility and bankability that will be refined during structuring
- Green light to move to structuring

TABLE 2.5 Level of risk transfer and impact on bankability based on low climate risk as assessed in Module 2.1

Level of risk	Is the risk addressable? [10]	Event impact level	Level of risk transfer to project company	Bankability
Low	Yes	Low	Project company will likely accept the risk and cost of adaptation, especially as associated costs can be incorporated in reserve and contingency accounts.	As long as the risks that the project company takes are clearly identified, adaptation works are seen to fully protect against them and, assuming a clear adaptation work plan, then bankability should not be impacted.[11]
		High	Project company will likely accept the risk up to a certain pre-agreed level of reinstatement costs, especially if there are benefits in doing so, such as unlocking liquidity pools (green financing) or receiving carbon credits.	Lenders would require comfort that reinstatement costs will not breach DSCR levels. Guarantees above certain levels of costs may be required. Even if there is a risk-sharing scenario between project company and grantor, the lenders would want some level of cover or insurance above certain levels of reinstatement costs and timing implications.[12]
	No	Low	Project company is unlikely to accept the risk in full. However, shared risk approaches could be considered, especially if there are other benefits in doing so, such as more sources of finance, cost-sharing in case of adverse events up to a certain degree or pre-agreed level.	Lenders are unlikely to accept any structure without a sponsor (assuming a strong credit rating) or grantor guarantees that would keep them whole in any case.
		High[19]	Project company is unlikely to accept the risk. Incentives could be considered.[13]	Lenders would expect guarantees from the grantor.

[10] Addressable risk means that the technical solution can mitigate significantly or protect fully against such risk. Also that the cost of such works is a small percentage of the overall capital costs and that they can be scheduled with a certain degree of certainty during the time of the concession. Another mitigating factor would be other non-project related works undertaken by the government to protect against such risks.

[11] This will be treated as an extra construction feature of the project—as long as there is enough cash to complete the capital works when these are due (possibly via a reserve account) and maintain Debt Service Coverage Ratios (DSCRs).

[12] A high-impact incident may be expected to come under force majeure protection clauses. In addition, if there is insurance or credit cover against such events, then it is likely that the project company and lenders can accept the risk.

[13] These could include loan guarantee facilities or similar instruments.

TABLE 2.6 Level of risk transfer and impact on bankability based on medium climate risk as assessed in Module 2.1

Level of risk	Is the risk addressable?	Event impact level	Level of risk transfer to project company	Bankability
Medium	Yes	Low	Project company will likely accept the risk and cost of adaptation, especially as associated costs can be incorporated in reserve and contingency accounts.	As long as the risks that the project company takes are clearly identified, adaptation works are seen to fully protect against them and assuming a clear adaptation work plan, then bankability should not be impacted.[14]
		High	Project company will require some level of risk-sharing above certain levels of disruption, such as that the government covers costs over and above a pre-agreed reserve account level.	Lenders would require some form of protection against such events, probably via direct guarantees from the sponsors (assuming strong credit rating), covered by DFI/ ECAs[15], or the grantor. A reserve account[16] may ease such protections.
	No	Low	Project company will likely accept the risk up to a certain pre-agreed level of reinstatement costs, especially if there are benefits in doing so, such as unlocking liquidity pools (green financing) or receiving carbon credits.	Lenders are unlikely to accept any structure without sponsor or grantor guarantees that would keep them whole in any case.
		High[17]	Project company is unlikely to accept the risk	Lenders would expect guarantees from the grantor for a part of the capital.

[14] Provided of course that DCSR levels remain healthy in case of such events. If there is a risk that DSCR levels are breached, then lenders may require reserve accounts to be in place.

[15] DFIs: Development Finance Institutions, ECAs: Export Credit Agencies

[16] The reserve account will be kept at certain levels constantly in the project company to be utilized for such events and to be released as dividend towards the end of the concession.

[17] Although currently such cases would be most often classified as force majeure, it is the intention of this toolkit to provide guidance on limiting the portion of risk that would be deemed force majeure, also accounting for the fact that the frequency of severe events is increasing precisely due to climate change.

TABLE 2.7 Level of risk transfer and impact on bankability based on high climate risk as assessed in Module 2.1

Level of risk	Is the risk addressable?	Event impact level	Level of risk transfer to project company	Bankability[18]
High	Yes	Low	Project company will likely accept the risk and cost of adaptation, especially as associated costs can be incorporated in reserve and contingency accounts.	Lenders would require sufficient reserve and contingency accounts as well as reduced debt-to-equity levels.
		High	Project company will require some level of risk-sharing above certain levels of disruption, such as that the grantor covers costs over and above a pre-agreed reserve account level. Incentives (e.g., financing, credits) will also be important in accepting any level of risk here.	Lenders would require sufficient reserve and contingency accounts as well as reduced leverage debt-to-equity levels, insurance, or cover by DFIs/ ECAs. Protection by the state in case the project company cannot meet its debt payments because of climate disruptions may also be required.
	No	Low	Other than keeping a reserve account for any such disruptions, and provided there are other indirect incentives for doing so (e.g., financing, credits), the project company is unlikely to assume the risk for such events.	Lenders would require protection by the grantor in case the project company cannot meet its debt payments because of climate disruptions. To the extent available, insurance may also be required with first claims.
		High[19]	Project company is unlikely to accept the risk.	Lenders would expect guarantees from the grantor for part of the capital.

[18] In all cases whereby climate risk is high, the lenders are likely to require completion guarantees to the extent that (i) construction schedules may be impacted with delays and additional costs and (ii) that the risk is imminent and not in the medium to long term.

[19] As above, although currently such cases would be most often classified as force majeure, it is the intention of this toolkit to provide guidance on limiting the portion of risk that would be deemed force majeure, also accounting for the fact that the frequency of severe events is increasing precisely due to climate change.

KEY TAKEAWAYS

- The project's CBA, VfM, and affordability analyses need to be refined based on the updated data regarding climate risk scenarios as well as the feasible technical solutions that have been identified to address them.

- When uncertainty about the future evolution of climate influences the projected costs and benefits of climate actions, CBA under risk or under uncertainty may be necessary.

- The VfM needs to be updated given the redefined cost but also other implications of the proposed technical solutions in order to conclude whether the project maintains the merits of a PPP both from an overall cost to the government perspective and the potential qualitative benefits and considerations associated with such a procurement option, such as private sector innovation, risk transfer, and performance-based structures.

- The incorporation of climate mitigation, adaptation, and resilience provisions in the project includes two major implications for the affordability of the project: (i) the additional cost to the project company, which frequently translates into increased availability payments by the grantor or higher user fees and (ii) the reduction of the grantor's contingent liabilities when the climate change-induced risks are transferred to the project company.

- To ensure that commercial feasibility and bankability are achieved, certain high-level considerations related to climate change risks should be outlined and addressed by the grantor at this stage of the PPP process. Such considerations are dependent on the infrastructure sub-sector, but also on the type of PPP project that is envisaged.

- Climate-related goals and concerns of the main stakeholders (grantor, investor, lender) need to be understood and respected in order to ensure a common understanding of risks.

- Climate-related risks may impact the project's bankability and as such, lenders need to be covered against them. Parties may employ different strategies/actions/instruments to share different portions of risk.

MODULE 2.3
Resources

RISK STRESS TEST TOOL (RIST)

RiST is an Excel-based tool developed to help conduct the stress testing analysis described in the methodological note Integrating Climate Change and Natural Disasters in the Economic Analysis of Projects: A disaster and climate risk stress methodology.
RiST is directly linked to the World Bank's Resilience Rating System (RRS) and provides an approach to obtain an A rating for the resilience of a project

Developed by: World Bank, 2021

INTEGRATING CLIMATE CHANGE AND NATURAL DISASTERS IN THE ECONOMIC ANALYSIS OF PROJECTS: A DISASTER AND CLIMATE RISK STRESS TEST METHODOLOGY

This guidance note proposes a simple methodology to ensure that all project appraisaland assessment processes, including economic analyses, properly consider all climate change and disaster risks

Developed by: World Bank, 2021

ENABLING PRIVATE INVESTMENT IN CLIMATE ADAPTATION AND RESILIENCE: CURRENT STATUS, BARRIERS TO INVESTMENT AND BLUEPRINT FOR ACTION

This report provides an overview of the current state of private sector investment in adaptation and resilience and the known barriers to such investment, then proposes a pragmatic Blueprint for Action for public and private stakeholders. It identifies five key entry points as well as ways to create an enabling environment and illustrates each point with case studies

Developed by: World Bank, 2021

THE ECONOMICS OF CLIMATE CHANGE ADAPTATION: INSIGHTS INTO ECONOMIC ASSESSMENT METHODS, ECONADAPT DELIVERABLE 10.2

This guide has been developed as part of the ECONADAPT project, funded by the European Commission under the Seventh Framework Program. The objectives of the project are to build the knowledge base on the economics of adaptation to climate change and to convert this into practical information for decision-makers in order to help support adaptation planning

Developed by: Tröltzsch, J., Rouillard, J., Tarpey, J., Lago, M., Watkiss, P., Hunt, A.,2016

Module 2.3 - Further Reading

2002–H1 2017 INVESTMENT IN LOW-CARBON INFRASTRUCTURE

This report presents records from the Private Participation in Infrastructure Database reflecting the investment commitments for infrastructure projects in low- and middle-income countries globally atthe time of financial closure

Developed by: World Bank Group, 2017

BETTER GROWTH, BETTER CLIMATE. THE NEW CLIMATE ECONOMY REPORT. THE GLOBAL REPORT

This report examines whether it is possible to achieve lasting economic growth while also tackling the risks of climate change

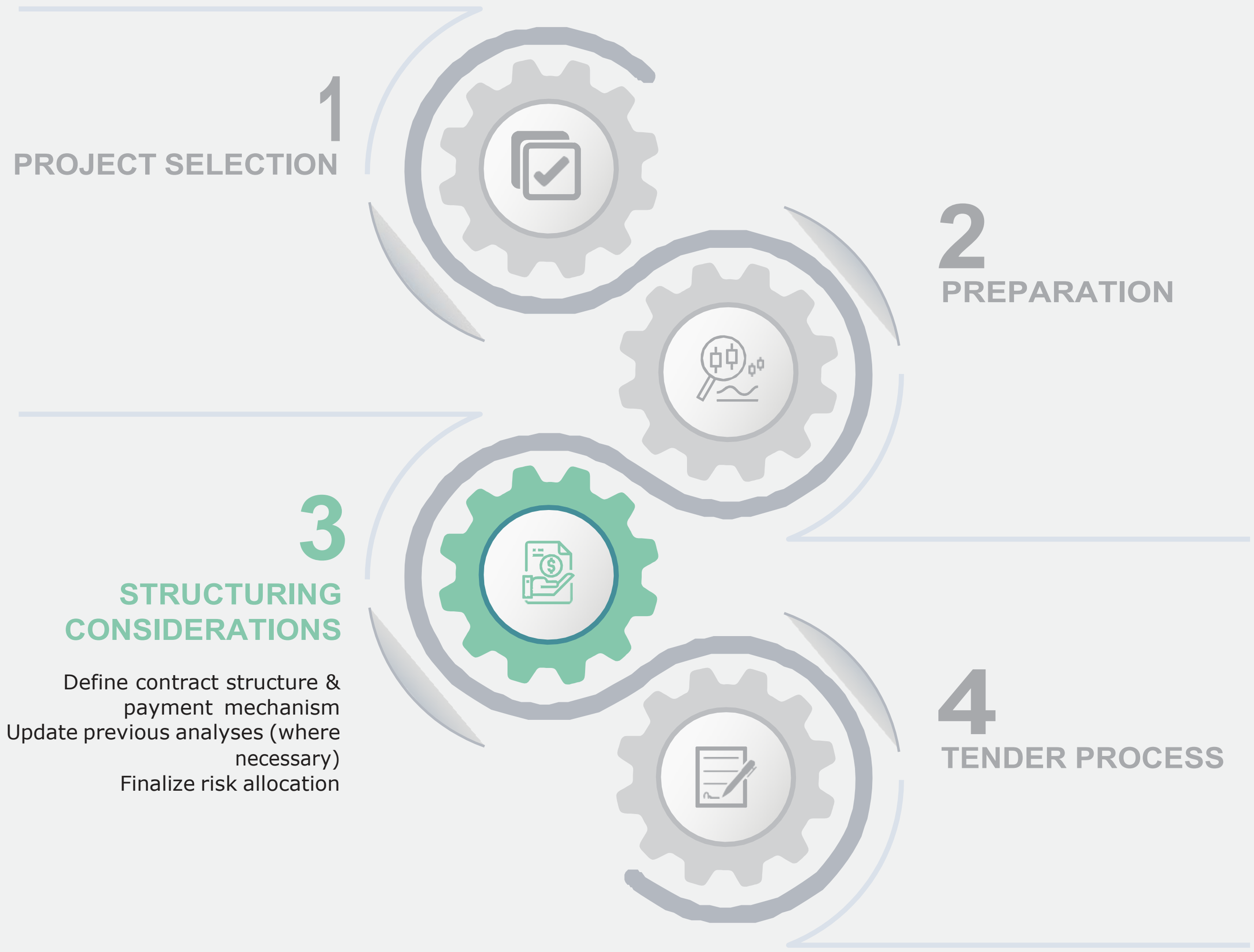
Developed by: Global Commission on the Economy and Climate, 2014

INVESTMENT DECISION MAKING UNDER DEEP UNCERTAINTY: APPLICATION TO CLIMATE CHANGE

This paper summarizes the additional uncertainty that is created by climate change and reviews the tools that are available to project climate change (including downscaling techniques) and to assess and quantify the corresponding uncertainty

Developed by: World Bank, 2012

PHASE 3


1
PROJECT SELECTION
2
PREPARATION
3
STRUCTURING CONSIDERATIONS
Define contract structure & payment mechanism
Update previous analyses (where necessary)
Finalize risk allocation
4
TENDER PROCESS

Phase 3

Incorporation of climate mitigation and adaptation into the structuring phase of a PPP introduces a new set of considerations that should be rigorously understood, assessed, and managed by the procuring authority to ensure and maximize the project's attractiveness. In this context, the objectives of Phase 3, which evolves during the contract structuring phase ofthe PPP cycle are:

(1) to rigorously describe the climate risk profile of the project and prepare a clear risk allocation structure and management plan that specifies and nuances climate risk events (i.e., use of intensity levels/benchmarks and impact ceilings to restrict unreasonable claims), including hedging mechanisms and force majeure exceptions

(2) to prescribe climate provisions on the financial structure that would enforce incorporation of climate mitigation and adaptation requirements in the project

(3) to explore innovative financing instruments for climate projects beyond the traditional financial support, thus safeguarding their bankability and investability, and to enhance the projects' eligibility to receive financing from such sources

(4) to define a coherent set of requirements (KPIs) for inclusion in the tender documents in order to enhance compliance with climate-related performance objectives during the design, construction, and operation of the project

(5) to provide climate-related recommendations for inclusion in the tender documents

Phase 3

Position in the PPP Process Cycle

At this stage, the project has been successfully appraised, which means that all necessary technical due diligence studies have been completed, and the project's risk profile (accounting for the varying climate conditions) has been assessed. A preliminary technical design has been undertaken (including climate mitigation and adaptation measures), commercial feasibility and affordability analyses have been carried out (identifying potential public co-financing and other means of support), and a preliminary project structure (basic payment and risk structure) has been outlined.

The main objective of Phase 3 is to **finalize the structuring of the PPP project contract,** which includes the financial structure (i.e., how the private party will be compensated for the works and services); the risk structure (i.e., which portion of risk is borne by each party and to what extent) and the project documentation (that outlines technical requirements and the overall obligations of the project company to which the development and management of the infrastructure will be delegated).

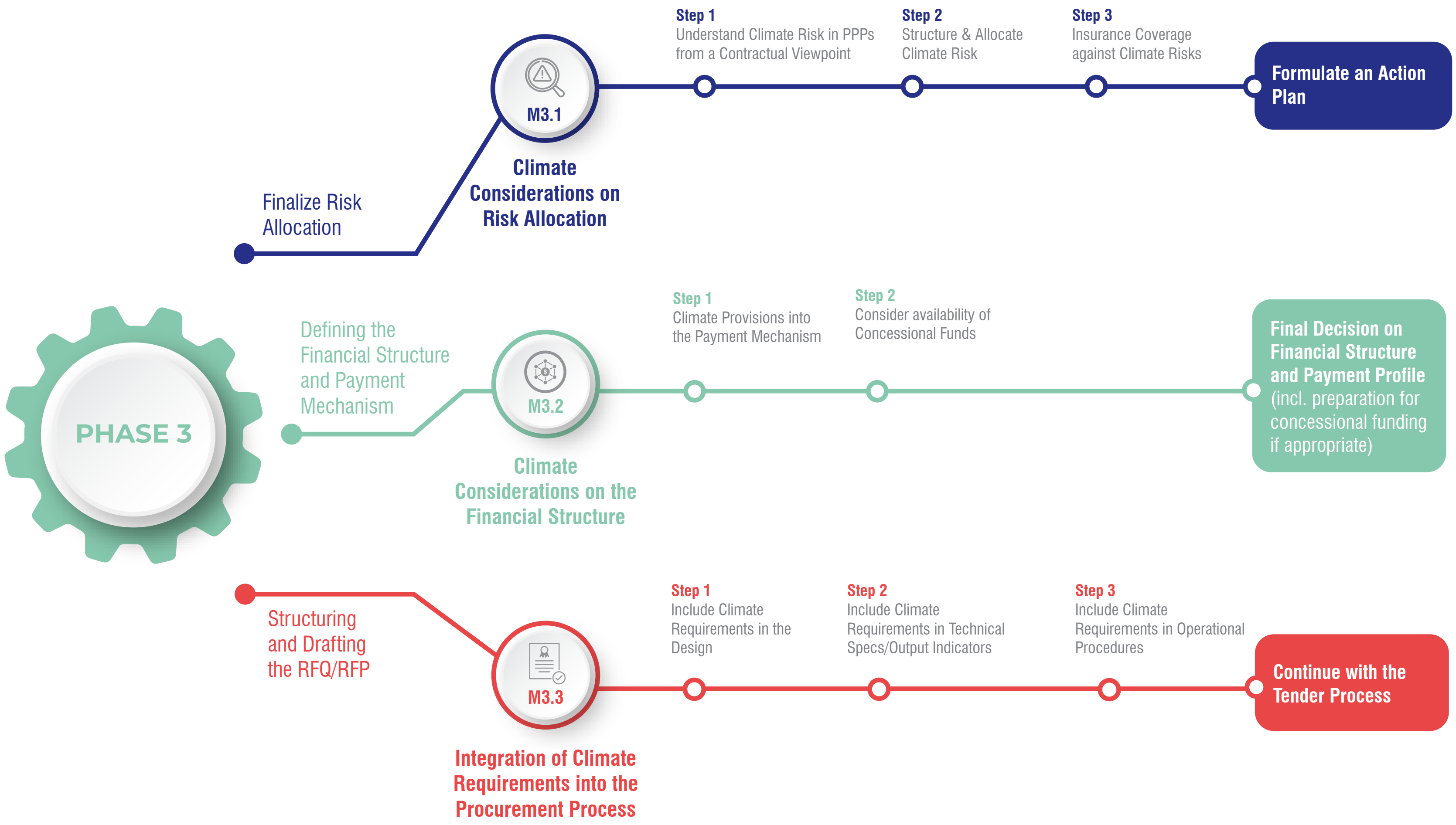
Outline

Phase 3 comprises three modules:

Module 3.1 – Climate Considerations on Risk Allocation provides an overview of the climate risk typologies (from a contractual perspective); outlines how climate change impacts the risk-allocation mechanism; and proposes measures, procedures, and instruments for enhanced climate risk management and climate mitigation.

Module 3.2 – Climate Considerations on the Financial Structure discusses the implications of climate change on the payment mechanism of PPPs and proposes measures/instruments to be included in the financial model. It also provides guidance to the procuring authorities on innovative tools (green bonds, carbon credits, grants and loans from MDBs, etc.) that could be considered as options to support the financing of climate mitigation and resilience and outlines general criteria for projects to be considered eligible for this type of financing.

Module 3.3 Integration of Climate Requirements into the Project Structure outlines climate-related options to facilitate the preparation of the project documents and describes a set of requirements (climate-related KPIs, design standards) to be embedded in the RFQ and RFP to ensure that the project will deliver its climate objectives.


PHASE 3
Finalize Risk Allocation
M3.1
Climate Considerations on Risk Allocation
Step 1
Understand Climate Risk in PPPs from a Contractual Viewpoint
Step 2
Structure & Allocate Climate Risk
Step 3
Insurance Coverage against Climate Risks
Formulate an Action Plan
Defining the Financial Structure and Payment Mechanism
M3.2
Climate Considerations on the Financial Structure
Step 1
Climate Provisions into the Payment Mechanism
Step 2
Consider availability of Concessional Funds
Final Decision on Financial Structure and Payment Profile (incl. preparation for concessional funding if appropriate)
Structuring and Drafting the RFQ/RFP
M3.3
Integration of Climate Requirements into the Procurement Process
Step 1
Include Climate Requirements in the Design
Step 2
Include Climate Requirements in Technical Specs/Output Indicators
Step 3
Include Climate Requirements in Operational Procedures
Continue with the Tender Process

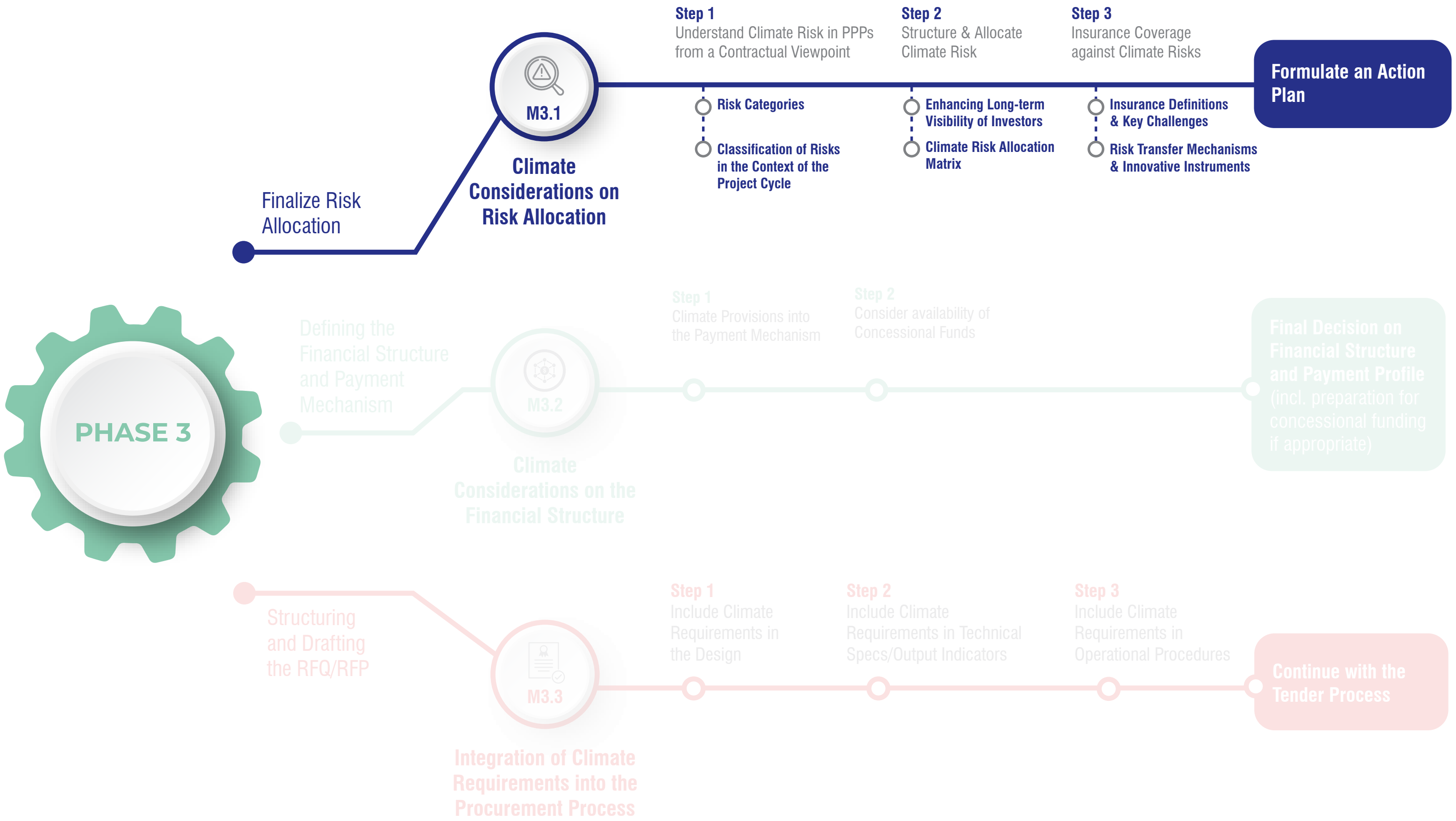
3.1 Climate Considerations on Risk Allocation

The underlying principle of risk allocation in a PPP transaction is that risks should be allocated to the party that is better placed to carry them (this includes the ability to prevent the risks from happening and the ability to manage impacts and consequences better if they do occur).

Although this principle is widely known and accepted, operationalizing it in a detailed PPP contract is a complex task.[1] From a contracting authority perspective, this will require an experienced team of advisors combining analytical tools with deep knowledge of everyday practice and precedents to carefully assess and quantify possible sources of risks across the different stages of the PPP project (planning, design, construction, operation, and maintenance). In general terms, the contracting authority should retain the risks that cannot be adequately assessed or efficiently priced by the market or those risks that the contracting authority can manage and price more efficiently. From the private party's perspective, risk will be managed primarily by reallocating it to the main subcontractors, i.e., the construction and the operations and maintenance contractor. The availability of insurance or hedging will also be a key consideration. The private partner may be required to place specific insurances by its lenders, the grantor, and the contracting authority.

In this risk allocation context, climate change may be seen as an additional exogenous stressor that introduces some new risks into the PPP process and complicates the efficient management of traditional risks. Therefore, this module attempts to provide contracting authorities with an overview of the different nuances of climate risks and their interactions with the project, provide non-prescriptive guidance on the allocation exercise, and highlight some high-level grantor considerations in the process.

[1] Global Infrastructure Hub, PPP Risk AllocationTool 2019 Edition


PHASE 3
Finalize Risk Allocation
M3.1
Climate Considerations on Risk Allocation
Step 1
Understand Climate Risk in PPPs from a Contractual Viewpoint
Risk Categories
Classification of Risks in the Context of the Project Cycle
Step 2
Structure & Allocate Climate Risk
Enhancing Long-term Visibility of Investors
Climate Risk Allocation Matrix
Step 3
Insurance Coverage against Climate Risks
Insurance Definitions & Key Challenges
Risk Transfer Mechanisms & Innovative Instruments
Formulate an Action Plan
Defining the Financial Structure and Payment Mechanism
M3.2
Climate Considerations on the Financial Structure
Step 1
Climate Provisions into the Payment Mechanism
Step 2
Consider availability of Concessional Funds
Final Decision on Financial Structure and Payment Profile (incl. preparation for concessional funding if appropriate)
Structuring and Drafting the RFQ/RFP
M3.3
Integration of Climate Requirements into the Procurement Process
Step 1
Include Climate Requirements in the Design
Step 2
Include Climate Requirements in Technical Specs/Output Indicators
Step 3
Include Climate Requirements in Operational Procedures
Continue with the Tender Process

STRUCTURE OF THE MODULE

The module comprises two steps:

- **Step 1** describes climate risks from a contractual perspective and provides a high-level overview of the risk appetite and key considerations of the stakeholders involved: the public authority, the private party, the financiers, and the insurers.
- **Step 2** proposes a climate risk allocation matrix (that is meant to be as general as possible to cover different sectors, projects, and jurisdictions) that the contracting authority may use as high-level guidance for allocating climate risks before embarking into negotiations with the private investor counterpart.

01 UNDERSTAND CLIMATE RISK IN PPPS FROM A CONTRACTUAL VIEWPOINT

Climate risks may affect any stage of the PPP project—planning, land acquisitions, construction, and O&M. To avoid disputes over additional costs and maximize the VfM of the project, it is recommended that detailed risk allocation agreements are in place specifying the level (i.e., impact and/or probability) of climate-related events, the range, and types of appropriate compensation and the procedures to react in case of any potential damage. They may also provide guidelines on the use of insurance to cover extreme events.

A detailed description of the different types of climate risks has been provided in Phase 2 (Module 2.1), along with a methodology to assess and quantify them. The scope of this stage is to revisit the two broad risk categories—internal and external—(defined in Phase 2) from a contractual standpoint as explained below (Figure 3.1):

Internal Risks (i.e., those directly affecting the project causing physical damage and/or downtime for inspection or repairs) may either materialize in the form of more frequently occurring or extreme events depending on the intensity of the climatic hazard. Of course, there is a wider spectrum of climate impact and events which will be dependent on whether global Paris Agreement goals of keeping global warming below 1.5 degrees are achieved or not. Here we simply include two main options; in reality it is more complex.

- ***More frequently occurring events*** include the events that may be more readily forecast based on the climate modeling described in Phase 2 and for which adaptation and resilience works ideally would be designed and implemented. In these cases, although the imposed stressing on the infrastructure is meant to be within the design capacity of the adaptation measures, loss (or reduced performance) is still possible due to climate-related supply changes that were not captured correctly in the initial design (e.g., lower solar energy potential at the location of a photovoltaic plant), insufficient maintenance, structural defects, human error, or even as part of the technical design itself.[2] These risks may either occur during construction (causing delays) or during the operation phase of the PPP. What is more, in case of insufficient adaptation works (e.g., due to inadequate climate modeling/design or low-quality construction), the infrastructure will experience increased needs for replacements and rehabilitation, prolonged downtime as well as increased maintenance costs that may even trigger an early contract termination.

- In this context, these events define the *adaptation risk*, i.e., the portion of climate risk that would be addressed through the proper design and construction of the appropriate adaptation and resilience works, as explained in Phase 2. Hence, the project company, which controls the design and O&M of adaptation measures, usually bears these risks. More details on risk allocation are provided in the risk allocation matrix presented in the ensuing (see also examples in Box 3.1 and Box 3.2).
- On the other hand, ***extreme events*** refer to significant stresses such as those associated with natural disasters and are supposed to be so rare that they cannot serve as the basis of any technical design for adaptation measures. If they materialize, such events may be responsible for large-scale physical damage or total loss to the infrastructure and the broader environment, having long-term impacts on the operation and availability of the project (or even early termination of the contract). Although the scope of adaptation and resilience planning is to avoid severe damage and associated losses, extreme, unpredictable climate events may drive the respective works beyond their capacity. In this sense, these events define the **excess risk**, i.e., the portion of climate risk that exceeds the respective provisions (which the design of adaptation/resilience plans would have adhered to and efficiently addressed).

Depending on the level of their potential loss, these excess climate risk events may be classified as "insurable" (when there are available insurance mechanisms to cover them, and therefore the private contractor is likely to be required to bear the cost of the disaster through insurance) and "uninsurable" events which would commonly be treated as force majeure, explained below.

External Climate Risks (i.e., those impacting the project due to failures of the interconnected infrastructure or changes in the broader socioeconomic environment interacting with the infrastructure): this category includes risks that may or may not be relevant today but could emerge in the future because of climate change, such as:

- **Transition (and other) risks,** defined as the risks accompanying the transition to greener and less carbon-dependent economies that challenge the traditional legislative and investment framework and drive technological innovation in every aspect of life
- **Risks of climate-induced failure of interconnected infrastructure,** which is not part of the project itself but interacts with it (e.g., loss of the grid in a power generation

[2] Depending on the intensity of stressing (i.e., the climate event) modern standards may even accept some repairable physical damage in view of a cost-efficient technical design.

project or reduction of ridership in a highway project due to gradual desertification of the areas it is serving).

In most cases, external risks stem from events that cannot be controlled or mitigated by the private party but do have the potential to harm the revenues or availability of the project. Therefore, it is essential to recognize them early in the planning process and take the necessary preventive actions to alleviate them.

BOX 3.1 COLOMBIA'S 4TH GENERATION ROAD CONCESSION PPP

The La Niña floods of 2010-2011 led to economic losses estimated at $6 billion, of which 38% arose from damage to infrastructure. Roads under concession suffered damage of $88 million, leading to disputes between road concessionaires and the government about which parties bore responsibility for covering these damages. In response to this, the national infrastructure agency enhanced and clarified insurance requirements with technical support from the World Bank. The contract for the latest tranche of new roads allocates climate risks to the concessionaires since they will be best placed to manage those risks. Concessionaires have to hold sufficient insurance to cover their expected probable maximum loss. The risk of insurance premiums increasing in the future due to climate change rests with the private sector.

Sources:
CEPAL and BID, 2012: Valoración de daños y pérdidas: Ola invernal en Colombia 2010-2011,
IDB - WBG, 2016: Colombia: 4th Generation Toll Road Program

BOX 3.2 PUBLIC AND PRIVATE COLLABORATION IN INSURANCE AGAINST CLIMATE RISKS

- **In France**, the insurance industry's contribution to extreme weather risk management is fairly well integrated, addressing risk transfer, disaster risk reduction financing, and data sharing for better governance. The public and private sectors have long-standing cooperation, put in place by the non-profit French Association for Disaster Risk Reduction (AFPCN) in 2001. The AFPCN is supported by government departments and brings together the disaster risk reduction community to promote a coordinated approach. Its activities include stakeholder dialogue, exchange of good practice, and research.
- **In Denmark**, the Storm Council provides flood insurance provisions. This body brings stakeholders together and shapes their interaction within the framework of a single common goal (i.e., the condition of storm surge and fluvial flood insurance). In recent years the Storm Council has benefitted from the greater involvement of private-sector insurers.
- **In the United Kingdom**, the universal provision of flood insurance is characterized by a series of negotiations between the British government and the insurance industry and the respective roles of the two.

Source:
European Union, 2018: Using insurance in adaptation to climate change

The most extreme cases of either category are commonly defined as **force majeure**, and may consist of internal and external unforeseen events beyond the control of either party construed or represented by a law, policy, or contract. While catastrophic climate events have typically been considered force majeure events, incorporating climate change-induced risks and mechanisms to mitigate such risks within a PPP structure may require revisiting the definition of force majeure. Specifically, as more data regarding climatic evolution scenarios become available, it is in the interest of all parties to try and limit the cases to be characterized as force majeure and instead attempt to consider such risks through alternative routes. This will also enhance the comfort of commercial lenders whose awareness regarding climate change is growing and, therefore, tend to increasingly require insurance coverage or other forms of reliable guarantees. A good practice example, describing the evolution of risk-sharing and force majeure provisions in PPPs in Japan, is provided in Box 3.3.

CLASSIFICATION OF RISKS IN THE CONTEXT OF THE PROJECT CYCLE

Internal and external risks, as categorized above, are included in the risk classes that should be considered during the various phases of the project as follows:

Design and Construction Phase including risk classes relevant to *site selection, environmental, design, work delays, construction standards,* and *social environment*

Operation and Maintenance Phase including risk classes relevant to *revenue risk in user-pays PPPs, climate risks in availability-based PPPs, maintenance costs and standards, financing adaptive planning, changes in legal frameworks*

The climate risk allocation matrix presented in the subsequent step explains each type of internal and external risk attributes while providing a tabulated summary of some high-level risk-sharing principles pertaining to each of them.

RISK ALLOCATION

INTERNAL RISKS		EXTERNAL RISKS
Damage of the Infrastructure	Root Cause	Damage of interconnected infrastructure
Physical damage and service disruption	Causes of Losses	Service disruptions (causing loss of revenue in user-pays PPPs)
The private party assumes the larger portion (with or no participation from the public)	Risk Allocation	Primarily borne by the public
Commercial insurance or Credit enhancer from MDBs (common for availability- and user-pays PPPs)	Risk sharing mechanisms	Public pays (availability payments or shadow minimum compensation based on average usage numbers for user-pays PPPs)

FIGURE 3.1 Internal vs. External Risks on a PPP project

BOX 3.3 RISK-SHARING BETWEEN PUBLIC AND PRIVATE SECTORS IN AVAILABILITY-BASED PPPS

Because Japan is prone to natural disasters, the public sector has typically borne the disaster risks, partly contributing to the development of PPP markets in Japan. Under the traditional public procurement in Japan, the costs of force majeure risks were 99 percent borne by the public sector. Japan's PPP projects of the first generation—mainly build-transfer-operate projects with availability payments (governments pay unitary charges to operators)—adopted the same risk-sharing as in the traditional procurement. However, as both the public and private entities accumulate PPP experience, disaster risks that the private sector can reasonably manage have been transferred to the private sector depending on the project type and characteristics. For example, Sendai City PPPs were mostly build-operate-transfer projects that transferred ownership of the assets to the private sector and elaborated upon the definition of force majeure to share risks with the private sector if the private sector can bear these risks.

Project Type	Characteristics	Scope of Force Majeure and Risk Allocation (Small ← Natural disaster risks → Large)
BTO (availabilit ypayment)	• Samples of force majeure are identified. • Force majeure risk will be mainly borne by the	Force Majeure; Private; Public
BOT (availabilit ypayment)	• Provides more clarity on definition of force majeurethan the above. • Private party owns facilities and bears a part of natural disaster risks in some cases.	Force Majeure; Private →; Public
BOT (user payment andhigh profitability)	• Force majeure risks will be borne by the private partyunder a project with high	Force Majeure; Private; Public

Note: BOT = build-operate-transfer. BTO = build-transfer-operate. PPP = public-private partnership. "Availability payment" refers to government payment of unitary charges to operators. "User payment" refers to payment to operators from user fees.

FIGURE 3.2 Transfer of natural disaster risks in PPP projects, by project and payment type

Step Output

A common understanding among stakeholders on the climate-induced risks and their nuances

02 STRUCTURE & ALLOCATE CLIMATE RISK

A preliminary risk assessment has already been conducted in Phase 2 – Appraisal Phase identifying the main categories of climate risks relevant to the particular project. A decision has been made on overall risk allocation and the possible impacts on the project's bankability (Module 2.3). During the present step, the risk structure is refined: climate change risks are revisited while risks allocation decisions are further detailed and structured. They specify the form and extent to which each party assumes the identified risks; how compensation and relief events will be treated; relevant support measures for the private/public partner (in the form of securities, subsidies, guarantees, etc.). This is materialized by employing a risk allocation matrix presented in the ensuing.

ENHANCING LONG-TERM VISIBILITY OF INVESTORS

Long-term visibility of investors is primarily defined by the certainty of cash flows to ensure both returns to investors and capacity to service debt. Including upfront climate resilience and mitigation requirements in the financial modeling will be key, including stress testing. Designing and constructing the concession with climate mitigation and resilience will also be key together with longer term requirements of additional maintenance or even CAPEX works to ensure ongoing resilience. To this end, life-cycle expenses for climate adaptations and mitigation requirements under extreme climate-related events have to be clearly defined and provisioned for—including in the project and concession agreements. The goal is to attempt to manage risks and their impacts in the contracts to minimize cash-flow disruptions. These provisions may also include innovative financial schemes, such as the climate contingency account described below and other schemes that have been duly tested with the market to ensure investment appetite and bankability.

What should underlie all cases and scenarios is a common understanding of the climate risk, its potential impact, and the sufficiency of the adaptive works to protect against it or the level of protection that such adaptive works provide. How such an assessment evolves over time is also critical; therefore a periodic review would have to be provisioned for in order to assess whether climate indicators have been developing as planned or if adjustments are required. The concession agreements should provide for such review and the resulting adjustments that may need to be made and specify who bears the risk for costlier or more frequent adaptive works. As per the principles of project finance, the risk allocation should also be clearly defined and determined within the project documents in a manner that addresses any uncertainty. To the extent that uncertainty remains, the grantor would have to offer some form of cover, especially in relation to the debt financing, and subject always to the available insurance coverage and its associated costs.

The next sections aim to provide the necessary background for selecting the proper risk transfer mechanisms.

NEW INNOVATIVE SCHEMES: THE CLIMATE CONTINGENCY ACCOUNT (CCA)

The idea of a climate contingency account (CCA) is one method to be explored as a way to provide for the adaptive works or to cover climate-related costs (or loss of revenue). However, this concept is new and as of yet not market tested.

The concept of a CCA derives from the reserve accounts commonly used in PPP projects, which reserve amounts from the project's cash flows for future expenditures. Such reserve accounts are mainly used to reserve funds for periodic heavy maintenance works (i.e., a maintenance reserve account, known as an MRA) without causing major cash flow fluctuations in those years. Similar to these reserve accounts, a CCA may be applied in case of adaptive planning to reserve funds from the beginning of the PPP concession up to certain pre-agreed levels in order to pay for periodic adaptive works that are planned in advance as part of the project structure in line with certain climatic scenarios and gradual risk exposure increase. (See also the example in Insight 3.1)

The cash flow certainty it provides will have to be balanced against the cost to the project company for maintaining such an account or captured in the financial modeling and payment schemes. Another way, whether complementary or supplementary to a CCA, would be to have provisions in place whereby the grantor steps in to cover the adaptive costs or to compensate the project company for climate-related disruptions. Or in other cases, the project company enjoys certain tax breaks to mitigate the impact of lower cash flows on equity returns.

BOX 3.4 EXAMPLE OF ALLOCATING CLIMATE-INDUCED RISK IN USER-PAYS PPPS

The project.[3] Toll road PPP: Project company pays annual fees to the state[4] in exchange for constructing, operating, maintaining, and financing the asset. Project company's income source is the toll charges, which are regulated and increase only with inflation.

Climate risk. Medium risk of flooding due to rising sea level. It is expected that this may cause disruptions after year 10 of the concession. For the purposes of this example, disruptions are assumed to be the equivalent of one to two months' income from tolls.

Adaptation plan. Every five years the sea level is measured and if certain predetermined metrics are exceeded, works should take place to protect the asset from inundation. This plan has been costed upfront and included in the financial model and tariff.

PPP Agreement

- The project company assumes flood risk by being responsible for designing and constructing adaptation works and periodic maintenance or upgrades
- A third party is responsible for monitoring and validating the sufficiency of such works and sea level rise
- Grantor and project company should agree on the sufficiency of protection
- Insurance should be sought in relation to any flooding occurrence regardless of the adaptive works. In cases whereby such insurance cannot be procured, the state would have to provide some form of assurance, perhaps with the support of MDBs

Investability

Sponsors would expect some or a combination of the following:

- Availability of insurance or state protection for the remaining outstanding risk
- A cost-sharing mechanism if adaptive works are required sooner than anticipated and
- that any reserve funds (i.e., such as the contingency account concept presented above) can be released if not utilized, even if in certain cases there may be sharing of such gain (e.g., 50:50 sharing of released cash with the grantor)
- Risk of traffic volume losses due to issues with interdependent assets to be taken by the grantor or other relevant support institutions, i.e., if flooding in adjacent infrastructure prevents traffic on the toll road. In such cases, the project company would expect some form of compensation by the grantor to avoid default and maintain some level of return
- An acceptable clear and transparent monitoring mechanism
- Any support that the grantor can provide in relation to certifications that would increase the project's eligibility for green financing liquidity pools

Bankability

Commercial lenders would expect[5] all or a combination of the following:

- The asset is designed and constructed in a way to boost climate resilience and properly insured against risks
- Enough cash at the project company level to cover the cost of the adaptive works as and when these are due to occur, perhaps through a reserve account
- Enough cash balances in a DSRA account that can cover debt repayments during a period of disruption
- Adjustments to the payment mechanism to cover for part of the cost required to develop the adaptive solution as and when required
- Sponsor's ability to access credit facilities to fund adaptive works as and when required, either through an ongoing working capital facility or letters of credit (the project company will prefer the latter) as well as provide additional equity support if needed and as structured in loan documents or financing documents
- Protection against any flooding risk that remains regardless of the works (lenders would have first right to any insurance proceeds)
- Robust financial models covering different climate scenarios (i.e., stress testing the financial model)

---

[3] Fictional project

[4] The winning bidder is the one with the highest NPV of annual payments to the state (assuming a process whereby all proposed technical solutions are acceptable therefore the financial proposal determines the winning bidder).

[5] The list is in relation to what lenders would expect in relation to climate considerations. It is assumed that traffic volume and other typical risks are dealt with separately.

CLIMATE RISK ALLOCATION MATRIX

This section introduces a non-exhaustive list of **climate risk classes** that generally apply to climate-smart PPPs and that are commonly identified in different guides and protocols. Risk allocation comprises two elements: (i) public versus private (practically referring to risk structuring), and (ii) debt versus equity (i.e., how the private sector manages risk). In PPPs, it is generally recognized that risk should be allocated to the party capable of managing it from an efficiency perspective. Although the experience has shown that this principle often may be overlooked, it is essential to recognize that inadequate protection from climate-change risks (potentially stemming from the inability of the party bearing the risk to handle it properly) could threaten the entire project and negatively impact all parties. The purpose of the climate risk allocation matrix presented herein is to describe risk classes originating from climate change, proposing a rationale for each class's allocation strategy.

As a general rule, it is recommended to try and share climate risk between public and private sectors to ensure every party is involved in the risk-handling process. The private sector will thus be incentivized to manage and innovate around climate risks, while the grantor should be able to put a "cap" on the amount of cost and/or post-completion project impact. Following this principle, it is possible to achieve private sector innovation around the issue while also enhancing bankability that will engage lenders – which will, in turn, provide better terms for financing (debt) and will improve the project's financial feasibility.

The risk allocation table presented below is meant to provide an indicative and **"in-principle" perspective** of risk distributions among stakeholders, although there may be cases where such distribution must be reconsidered depending on the project's nature, size, and location. The type of PPP structure also affects ultimate risk allocation; however, primarily, the project's characteristics and requirements will indicate the proper PPP structure. Moreover, the provisions outlined herein are not meant to be representative of all possible case studies, as different countries may have various risk-sharing clauses and standards.[6]

Climate risk considerations and their allocation are better determined on a project-by-project basis and depending on the project's needs and risk exposure rather than on the type of PPP structure.

[6] For example, the standard private finance initiative contract in the United Kingdom specifies that a private contractor takes on most natural disaster risks to incentivize private contractors to handle such risks better, while the World Bank's Guidance on PPP Contractual Provisions 2019 Edition assumes that natural disaster risks (force majeure) are better managed by the public sector.

A. Climate Risks Related to the Design and Construction Phase

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Risk Mitigation Measures
	Public	Shared	Private		
A1. Site Selection e.g., the risk associated with selecting land suitable for the project; risk of hidden geotechnical risks (that may be exacerbated by climate events) that were not adequately identified and assessed during due diligence studies. Climate-change induced risks, e.g., inundation of the project area, scarcity of resources required for the project's operations (e.g., inability to guarantee cleaning of solar panels due to projected water shortage)		☑		The **risk that the land is not suitable** is typically shared as the contracting authority may be able to secure the availability of the corridor. Still, the suitability of the corridor may be dependent on the private party's design and construction plan.	It is recommended that both parties implement detailed geotechnical, geological, and subsoil surveys. The surveys should focus on parameters that may be particularly affected by climate change effects such as flooding, erosion, fires, sea level risk, soil/water contamination, changes in settlement patterns due to changes in subsoil water, risk of landslide and erosion, etc. Site selection through a climate lens will be a critical first step to reducing risks.
	☑			The contracting authority usually undertakes detailed geotechnical and ground/soil surveys during the feasibility stage and shares this information with the private partner during the tender process and should therefore bear the **risk of not providing accurate geotechnical data**.	
	☑	☑		Suppose it is not possible to perform surveys before the tender. In that case, **the risk for unsurveyed land** will be allocated to the contracting authority (e.g., as a compensation event) or may be shared by the private partner (e.g., as a relief event).	
			☑	In case of projects involving significant underground works (e.g., tunnels), the private partner should assess geotechnical risks.	
A2. Environmental Risk e.g., risks associated with pre-existing conditions; conditions caused by the project; compliance with environmental laws	☑	☑		**Pre-existing pollution** is typically the contracting authority's risk unless it was known to and priced by the private party.	The private partner should develop sound environmental and social risk management plans echoing the most updated international standards provisions such as the WBG's Performance Standards and/or the Equator Principles. (A detailed description is provided in Module 3.3.)
			☑	The private party typically bears the **risk of obtaining all environmental licenses and environmental authorizations** after the contract signature. (For exceptions, readers may refer to World Bank's Guidance on PPP Contractual Provisions, 2019 Edition.)	
			☑	The private party bears the **risk of complying with all environmental licenses** and environmental laws applicable to the project. Exceptions may apply in the case of "changes in law" (as described in the transition risk category).	
			☑	The private party bears the **risk of environmental events caused during the project construction**. (i.e., unrestricted GHG emissions, contamination, destruction of biodiversity, noise, etc.)	It is advisable that (depending on the project's specific characteristics) relevant environmental KPIs are introduced in the contract and monitored by the contracting authority. (A detailed description is provided in Module 3.3.)

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Risk Mitigation Measures
	Public	Shared	Private		
A3. Design Risk The risk that the project design is not contributing towards climate mitigation and the proposed adaptation measures are not adequately addressing climate change impacts			☑	Typically, the private party will be primarily responsible for the technical design's adequacy and **compliance with the standards/output specifications** that the contracting authority has set.	The contracting authority will define the performance standards in the tender documents (e.g., design and output specifications; provisions on the technical expertise of the design team; guidance on the preferred methodological procedure[7]). (A detailed description is provided in Module 3.3.)
		☑		In circumstances where the contracting authority provides the basic design, the private party bidders will be only responsible for **non-compliance issues** unless proven that the revised design offers added value to the project compared to the basic design (i.e., increases robustness and resilience at a reasonable incremental cost).	
A4. Work Delays (due to climate events)		☑	☑	The private party typically assumes the **risk of delays to the extent they are not caused by force majeure or events due to grantor non-compliance or failure** (relief and or compensation events).	Enforcement of construction deadlines subjected to extensions for specific events/types of works (either in the form of scheduled completion date or in the form of expected construction period). If force majeure provisions are applicable, relief and compensation events may include: ▪ Delivery date extension to suppress late charges ▪ Changes in the payment schedule (i.e., an extension of the payment due date for compensation of services and/or rate revisionsto cover increased costs)
		☑	☑	Exceptions may also include **work delays caused by the unavailability of input** (e.g., interruptions in the supply of utilities) due to adverse climatic impacts on the broader project environment (outside of the private partner).	
A5. Construction Standards (mitigation and adaptation works) The risk of non-compliance with regulatory construction standards		☑	☑	**Meeting relevant quality standards** will be a private party risk. Exceptions may apply in case of "changes in law/standards" after the project signature (as described in the "transition risk" category). It will however be critical for the contracting authority to include and incentivize the use of standards both in the contract and RFP/RFQ stage (e.g., including a requirement for green building certification – EDGE or LEED)	▪ **Design standards**, sustainability/resilience ratings, and climate mitigation KPIs should be clearly outlined in the tender documents. The procuring authority bears the responsibility of selecting a competent bidder that has proven experience in relevant projects. ▪ Upon completion of construction (including mitigation/adaptation works), there might be provisions for **reliability testing**[8] whereby the

[7] This may be a particularly important requirement (but at the same time difficult to meet) recognizing the scarcity of specific guidance on climate-adaptation design.

[8] An agreement between all involved stakeholders (and their technical environmental and legal advisors) on the sufficiency of the planned works, as well as their completion according to the planned requirements and their fitness for purpose. The agreement will mark the point where the project transitions from being "under construction" to "operational."

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Risk Mitigation Measures
	Public	Shared	Private		
					lenders and insurers will sign off on the sufficiency of the infrastructure developed. ▪ The contracting authority may **seek parent company guarantees** directly from the private party and its sub-contractors regarding certain contractual (or tender) obligations (in the form of bid bonds, completion bonds, performance bonds, and guarantees). ▪ **New mechanisms not yet tested in the market may include cash reserving mechanisms,** which could be maintained during the contract's lifetime to act as security/guarantee in case of performance failure by the private party.
A6. Social Risk The risk associated with the project impact on the affected population (including the risk of widening gender gaps)	☑	☑		During the feasibility stage, it is expected that the contracting authority would have assessed the impact of the project on the broader socio-economic environment and, in particular, the **effects of climate change on the already vulnerable population** and take actions to minimize any negative impact. It is also expected that projects that widen the gender gaps would have been excluded from consideration as inappropriate. In that respect, the contracting authority will bear this risk except to the extent the private party is responsible for implementing any social management measures.	▪ Adopt internationally recognized social and environmental standards and practices for the project to manage social risk ▪ Introduce specific social KPIs in the tender documents ▪ Request a rigorous environmental and social impact assessment (prepared by the private sector) that should include a gender impact analysis and a coherent gender action plan ▪ Investors and lenders may expect to see a plan addressing social impacts, including the execution of necessary contractual arrangements.
A7. Changes in Law (and overall climate transition risks) The risk of potential loss or potential impacts of the value		☑		Regarding climate-change policies, **changes in applicable legislation** can neither be foreseen nor managed by either party. The policy landscape is currently transitioning, adding uncertainty to any investment across all economic sectors. To effectively handle such risks without hindering the investment appetite, it may be good practice to establish risk-sharing mechanisms in the contract to absorb any transitioning impacts towards a greener economy.	▪ As part of the transition to a greener economy, states may set ambitious climate goals including—but not limited to—increased taxation of GHG emissions. ▪ In order to alleviate the impacts of such changes, parties are encouraged to negotiate

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Risk Mitigation Measures
	Public	Shared	Private		
of investments that may be triggered from changes - or new implementations - in the policy frameworks, the legislation system, or government strategies, as well as the transformation of traditional operations in primary sectors due to the effects of climate change.					positive countermeasures such as competitive financing of climate mitigation actions. ▪ Transition risk insurance is currently an emerging market of the insurance industry that may be used to offer coverage (up to a mutually defined cap).
A8. Unavailability of Insurance		☑		The private party typically bears the responsibility for acquiring insurances and the cost of doing so. However, if **insurance becomes unavailable** (in the international insurance market from reputable insurers), **or the premiums are prohibitively high** (beyond the control of any party), the private party will be eligible for pricing in reasonable contingency. For a detailed description of the unavailability of insurance, refer to World Bank's Guidance on PPP Contractual Provisions (2019 Edition).	▪ As part of the appraisal, the contracting authority should consider what insurances are necessary and **available at a reasonable premium** and whether insurance might become unavailable (or too expensive) for the project as a result of climate change. ▪ In cases of unavailability, the private party is typically relieved of its obligation to take out the required insurance. ▪ The contracting authority could under circumstances act as the **insurer of last resort.** ▪ Multilateral agencies could also explore the option of serving as **credit enhancers**.

BOX 3.5 THE CASE OF AICHI ROAD CONCESSION PROJECT: RISK SHARING POLICY BY CIRCUMSTANCE

Force majeure may include events such as a storm, torrential rain, flood, high tide, landslide, fall of ground, a strike of lightning, earthquake, fire, other natural disasters, or uprising, riot, disturbance, an act of war, epidemic, or other human-made disasters—where the cause is not attributable to either the government or the concessionaire (Table 3.1).

TABLE 3.1 Examples of force majeure events

Disaster type	Events for which additional costs are borne by the public sector
Earthquake	Damage based on normal social conventions
Heavy rain	Maximum rainfall of 80 millimeters or more in 24 hours Even if the rainfall is below the above standard, it is considered heavy rain if the hourly rainfall is significant (20 millimeters or more), provided that the hourly rainfall is observed at the nearest weather observation station (managed by the public corporation) from the damaged place
Storm	Maximum wind speed of 15 meters per second or more (average in 10 minutes)
High tide, storm surge, tsunami	Extraordinary high tide, storm surge, or tsunami caused by a storm or its aftermath with relatively non-minor damage

The public sector shall bear the cost if the concessionaire either cannot foresee the risk or should not be expected to establish measures to prevent additional costs. More precisely, additional costs resulting from natural disasters that fall under force majeure would be borne by the public sector if (i) the disaster recovery project is in accordance with the National Government Defrayment Act for Reconstruction of Disaster Stricken Public Facilities, and (ii) the public sector agrees that there were no reasonable measures that the concessionaire could have taken to prevent the additional costs from being incurred because the event was unforeseeable.

Source:
World Bank, 2017: Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement—The Case of Japan

Step Output

1. Include climate risks within the risk matrix
2. Prepare force majeure clauses for climate-induced events

B. Climate Risks during the Operation and Maintenance Phase

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Mitigation Measures
	Public	Shared	Private		
B1. Revenue Risk in User-pays PPPs The risk of reduced revenues caused by more frequent climate events that obscure ridership and/or availability of service (e.g., reduced aircraft arrival/departure flow rates in airports due to prolonged periods of fog, decreased energy production due to climate-related supply changes)			☑	**Case 1. Internal climate risks (excluding cases of extreme events)** Given that the project has been adequately designed and appraised against those risks (i.e., the necessary adaptation works have been constructed), the risk of revenue loss should be low and primarily borne by the private party	▪ The private partner must obtain and maintain **insurance policies** for potential revenue loss due to climate events. These policies should cover the losses up to a minimum amount prescribed in the contract. The government is indirectly protected by the insurance package,[9] as the amount received under the insurance policy will be offset from the compensation payable by the government in respect of such an event ▪ Purchase of **weather derivates** by the private party to compensate for liquidity problems (due to short-term revenue loss) caused by low-impact weather events. (A detailed description is provided in Module 3.3.) ▪ The establishment of insurance against climate risks provides comfort to the lenders that revenue loss and potential repairs or rebuilding costs will not breach DSCR levels ▪ Contractual mechanisms such as guarantees of minimum traffic/revenue or other similar mechanisms
		☑		**Case 2. Internal climate risks caused by extreme but predictable events** (exceeding the design limits of adaptation works) This is the case of rare but high-impact climate events (e.g., storm, torrential rain, flood, high tide, lightning strike, a landslide caused by extreme or prolonged rainfall periods, etc.) that cause significant physical damage and prolonged disruptions to the project. The predictability of the event is a crucial differentiator in terms of risk allocation; events for which historic experience exists are usually considered insurable, and hence such risk is assumed by the private party (at the cost of an insurance premium[10])	
	☑			**Case 3. Internal climate risks caused by extreme and unpredictable events** (overly exceeding the design limits of adaptation works) It is essential to understand that what classifies as an unpredictable event—beyond any insurable extremes—isa matter of negotiation between the public and the private party based on the experience of past disasters. Unforeseen events are typically treated under the provisions of force majeure. It is also not uncommon to prescribe a benchmark intensity level above which the climate event is considered force majeure. Depending on the PPP law of the country of origin, different risk allocation practices may be applicable for force majeure	▪ If commercial insurance is hindered for any reason, an option would be to explore whether multilateral agencies could act as guarantors for financiers, which would also act as a **credit enhancer** ▪ State guarantees ▪ **Cat DDOs** (see definition and examples in Module 3.3) ▪ Other mechanisms/compensation arrangements as described in force majeure provisions. (See, for example, force majeure definitions in the PFI Act of Japan, Box 3.5)

[9] The prescription for a minimum insurance package is common practice in all PPP contracts.
[10] If the cost of insurance is significant, it may be covered though (user or availability) payment increases.

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Mitigation Measures
	Public	Shared	Private		
		☑		**Case 4. External climate risks.** Depending on the severity of the event and the level of revenue loss, there might be an established threshold/cap above which the contracting authority will bear/share the risk, and the private partner will be entitled to compensation	A **shadow minimum compensation** by the state based on average usage numbers, similar to a take-or-pay arrangement. This could take the form of direct compensation, or it may be reflected in the payment mechanism
B2. Climate Risk in Government-pays PPPs The risk of events affecting pre-determined performance and quality standards.			☑	**Case 1. Internal climate risks** (excluding cases of outstanding climate risk). The private partner bears the risk of meeting the performance specifications under the contract (i.e., by ensuring that the works and the operational performance are of the necessary quality and level)	▪ In availability-based payment structures, the private partner's payment may be subject to a reduction if availability criteria and performance-based standards are not met (e.g., when the restoration time to the pre-event performance levels exceeds a predetermined duration).[11] This would have to be weighed on a project to project basis
			☑	**Case 2. Internal climate risks caused by extreme but predictable events.** As in the respective B1 case above, the private party should obtain commercial insurance against such risks. If the cost of insurance is high, it may be covered through availability payment increases	▪ **Insurance coverage** against extreme weather events. ▪ **Public guarantees** and/or guarantee facilities by MDBs (whenever commercial insurance is not available)
	☑			**Case 3. Internal climate risks caused by extreme and unpredictable events.** As in the respective B1 case, these cases are typically covered under force majeure provisions, which means that the public sector primarily assumes the risk	▪ Mechanisms/ compensation arrangements described in the **force majeure provisions**
		☑	☑	**Case 4. External climate risks.** They refer to cases where a climate event has disrupted the availability of a significant resource/utility, thus ultimately impacting the availability of the project itself. The private party bears the principal risk and responsibility of ensuring an uninterrupted supply of resources and providing redundancies when necessary. However, depending on the	▪ **Contractual provisions** to specify conditions of non-performance and compensation procedures (see Module 3.3)

[11] The Spopark Matsumori Accident Response and Investigation Committee, which was established in 2005 after a ceiling collapsed in the Sendai Health Facility Project in Japan, made several proposals to management to minimize the impacts of future accidents. One of the proposed measures includes the restructuring of the payment mechanism that considers reduction in the availability payment when the specifications of the services were not achieved. A point of consideration is whether the scope for reducing the availability payment should only include the payment for the maintenance cost or if it should be applied to the unitary payment as well (to incentivize the private sector to perform to a high standard). Source: World Bank, 2017: Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement-The Case of Japan

Risk Class	Indicative Risk Allocation: Public	Indicative Risk Allocation: Shared	Indicative Risk Allocation: Private	Indicative Relevant Risk Items and Rationale	Mitigation Measures
				event's severity, there may be instances where the risk needs to be shared among parties.	
B3. Maintenance Cost and Standards The risk of increased maintenance costs (beyond modeled costs), potentially exacerbated by climate-change effects; the risk of non-compliance with the maintenance standards			☑	The private party will bear the principal risk of meeting the appropriate maintenance standards as set out in the performance specification. The system remains robust and is handed back in the expected condition. The private party should also assume the cost of increased maintenance (assuming that the impacts of increased maintenance due to climate change should be already included in the bidder pricing)	▪ **Contractual provisions** describing in detail output specifications, including minimum requirements for day-to-day routine maintenance as well as life-cycle maintenance and replacement of particular assets (for a detailed description on maintenance provisions, refer to Module 3.3)
B4. Finance Risk of Adaptation Works (applicable to adaptive plans only) The risk of meeting the financing requirements for the additional adaptation work at the time of the intervention		☑		Although the initial decision for implementing an adaptive plan (i.e., periodic climate adaptation works that are planned in advance following specific climatic scenarios) lies with the public authority, the public sector has reviewed and validated the rigorousness of the technical design and the project structure. From this standpoint, the risk of financing additional adaptation beyond those originally planned should be shared among parties	▪ The original design and construction would have included climate mitigation and resilience measures together with ongoing requisite maintenance or additional CAPEX. Together these would have been included in the financial model and payment scheme for the concession. Other newer schemes which have not yet gained wide market approval such as the climate contingency reserve account may provide additional solutions. By introducing the CCA in the PPP structure, the grantor manages to pass a significant portion of the risk to the private sector, protects the project's bankability by introducing a buffer mechanism for adverse events, and limits the requirements for upfront government guarantees or insurance from other multilateral agencies (see example in Box 3.3)
B5. Force Majeure (Acts of God) The risk posed to the project by unprecedented climate events (such as hurricanes, storms, etc.) with potential extraordinary impacts on the asset performance		☑		Force majeure is a complex legal issue, as it differs between the civil code countries (where it is a legally defined concept, thus limiting the freedom of the parties to derogate from the legal concept), and those with common law jurisdictions where there is freedom between the parties to agree on the terms of the contract. Consequently, in civil code countries, a recommended practice is to define a non-exhaustive list of events in addition to a "catch-all definition" that ensures that the term includes all events that fall within the legally defined concept. In general law countries, it is common to include an exhaustive list of events that will be classified as force majeure in the contract	▪ **Narrowing down the definition of events** that may qualify as force majeure specifying intensity levels (e.g., rainfall per hour) and/or output thresholds (i.e., level of damage to the asset and the surrounding environment, duration/ persistence of consequences, etc.) Such a rationale has been adopted by the PFI Act of Japan, which defines force majeure conditions using both quantitative and qualitative criteria. To this end, numerical intensity thresholds are specified, coupled with a description of the level of damage to the surrounding environment (see Box 3.4)

Risk Class	Indicative Risk Allocation			Indicative Relevant Risk Items and Rationale	Mitigation Measures
	Public	Shared	Private		
				The common ground in all cases, is that force majeure is typically treated as a shared risk where neither party is better placed than the other to manage the risk or its consequences. The final definition of force majeure should not be confirmed until both public and private entities agree. As climate change becomes the norm and the severity of climate events is increasing, it is in the interest of all parties to try and limit the cases that can be characterized as force majeure and rather attempt to consider such risks through alternative routes (e.g., through insurance or other financial tools)	In other examples, an event may only qualify as force majeure if it has existed for a particular length of time. In such circumstances, the risk is allocated to the private partner and/ or shared for the first few months and subsequently becomes a shared risk or a contracting authority risk (with entitlement to terminate if the force majeure event continues for more than a defined time period, e.g., 6 – 12 months)[12] ▪ **Objective measurement of the event intensity.** The above force majeure definition rationale may be facilitated by the implementation of local measurements and sensing equipment (managed by the private party under the supervision of the public authority) providing some sort of objective measurements on the intensity of the event (although there are still open regulatory and legal uncertainties regarding the representativeness and accountability of measurements)
B6. Disruptive Technology Risk The risk that a new emerging technology unexpectedly displaces an established technology, impacting the business model and/or the modeled cost (e.g., new equipment for maintenance having a high upfront cost or cost of purchasing satellite material for weather forecasts, etc.).		☑	☑	Responsibility for **disruptive technology risk depends** on the project circumstances. From a strict contractual standpoint, the private partner is responsible for meeting the output specifications (regardless of whether this is done with state-of-the-art or technologically obsolete resources). However, given the rapid climate-related technological advances, it is in the project's best interest to incorporate contractual provisions for the integration of new technologies and other foreseeable developments (e.g., projected uptake of electric and automated cars). The parties should also agree to a cost-sharing mechanism for such technological upgrades	▪ Precise output specifications that cover both current and projected needs (e.g., locations of electricity charging points) ▪ A project-specific cost-sharing mechanism (e.g., for adjustments of the infrastructure to accommodate or comply with the new technologies) that provides the necessary flexibility for future improvements ▪ Contractual provisions to incentivize the private party towards integrating disruptive technologies (as soon as they become available) that have a clear environmental and public benefit

[12] Source: Global Infrastructure Hub, PPP Risk Allocation Tool 2019 Edition.

03 INSURANCE COVERAGE AGAINST CLIMATE-CHANGE RISKS

As evidenced by the preceding steps, a common pre-requisite for the private sector to assume climate risks, and at the same time satisfy bankability and investor parameters, would be the availability of and **access to adequate insurance**. Financiers require to know how debt repayments will be made if a disruptive event occurs. Hence, from a commercial lender's perspective, a party with an appropriate balance sheet would have to step in and make those repayments. That party can be either the state (which is not the preferred route), the sponsors via a corporate guarantee (which is not uncommon in PPPs but breaches the principle of non-recourse financing[13]), or the insurer whose proceeds will be used to make debt repayments.

Therefore, this step is devoted to providing guidance on the factors governing climate risk transfer decisions. In this sense, it intends to illustrate the beneficial role of insurance options and to highlight (i) the challenges accompanying infrastructure insurance against climate change-induced risks given their inherent uncertainty and (ii) ways to address them by presenting potential hybrid solutions where conventional insurance options may be blended with other financial instruments. The ultimate goal is to ensure that all risks—to the extent possible—are addressable, and hence the project's bankability and investment appeal are not called into question.

INSURANCE DEFINITIONS AND KEY CHALLENGES

Insurance is traditionally used to cover risks of catastrophic events such as earthquakes, extreme floods, hurricanes, and volcano eruptions. **Catastrophe risk insurance** hence refers to the process of transferring the risk of potential loss due to a catastrophic event from the project company to the insurer for the cost of an annual fee. The latter is termed **premium** and is estimated by the insurer and mutually agreed with the project company depending on the project's expected **loss** in case of a catastrophic event (which depends on its exposure and vulnerability to the considered hazard's level). The loss limit, i.e., the maximum amount that the insurance could have to pay to the project company, is termed **probable maximum loss** (**PML**).

Hence, with an insurance contract in place, in case of a catastrophic event, the insurer shall pay the loss (caused either due to direct damage to the infrastructure or due to downtime) up to the PML limit. Any **excess** amount is not covered. There is also a portion of the loss (indicatively on the order of 5%-10% of the PML) corresponding to minor events that shall be payable by the project company if such events occur; this is termed the **deductible** amount.

Investments that enhance the climate resilience of the PPP infrastructure would reduce the project's vulnerability against climate risks (as it would against any type of risk) and would

[13] Therefore, this is also not a frequently preferred route although a sponsor may wish to do so.

therefore enhance its insurability.[14] On the other hand, the uncertainty that climate change introduces is impacting the risk transfer procedure in many aspects:

- First and foremost, investors may be reluctant to exert efforts and resources in ensuring long-term resilience against low-probability and highly uncertain climate change-related hazards.
- PML amounts are usually relatively high and concentrated on a single location (i.e., that of the asset) which contradicts insurers' will for portfolio geographic diversification (in other words, insurers themselves wish to reduce their risk exposure by diversifying the risks they are underwriting). This may then reduce the availability of insurance options in the market—especially in higher-value projects.
- As low-impact events tend to become more frequent due to climate change, the deductible amounts may rise to allow insurance companies to reduce their exposure to high-likelihood events and secure funds to cover their clients against extreme events.
- High-impact, low-probability climate events (which by definition encompass a higher degree of uncertainty) cannot be assessed adequately by existing insurance models and are therefore not properly covered in traditional insurance contracts; in these cases, innovative mechanisms (such as those described in the next section) may be required.

RISK TRANSFER MECHANISMS & INNOVATIVE INSTRUMENTS[15]

Aiming to address the challenges identified in the previous section, which cannot be covered by traditional insurance alone, the present toolkit proposes a combination of options outlined in the next section and schematically presented in Figure 3.3.

> Although the necessity for transcending the boundaries of traditional risk transfer instruments is unquestionable, it is worth mentioning that some of the mechanisms presented herein have not yet become mainstream in the market as readily available options.

[14] Any risk mitigation measure included in the technical design apparently reduces risks but cannot mathematically eliminate it. As such, insurance of any project would be essential to cover the amount of potential losses in case of an extreme event possibly surpassing the design level of mitigation measures.

[15] Exploratory field: innovative risk transfer mechanisms such as those presented herein are currently under development and market testing and have not yet been extensively deployed.

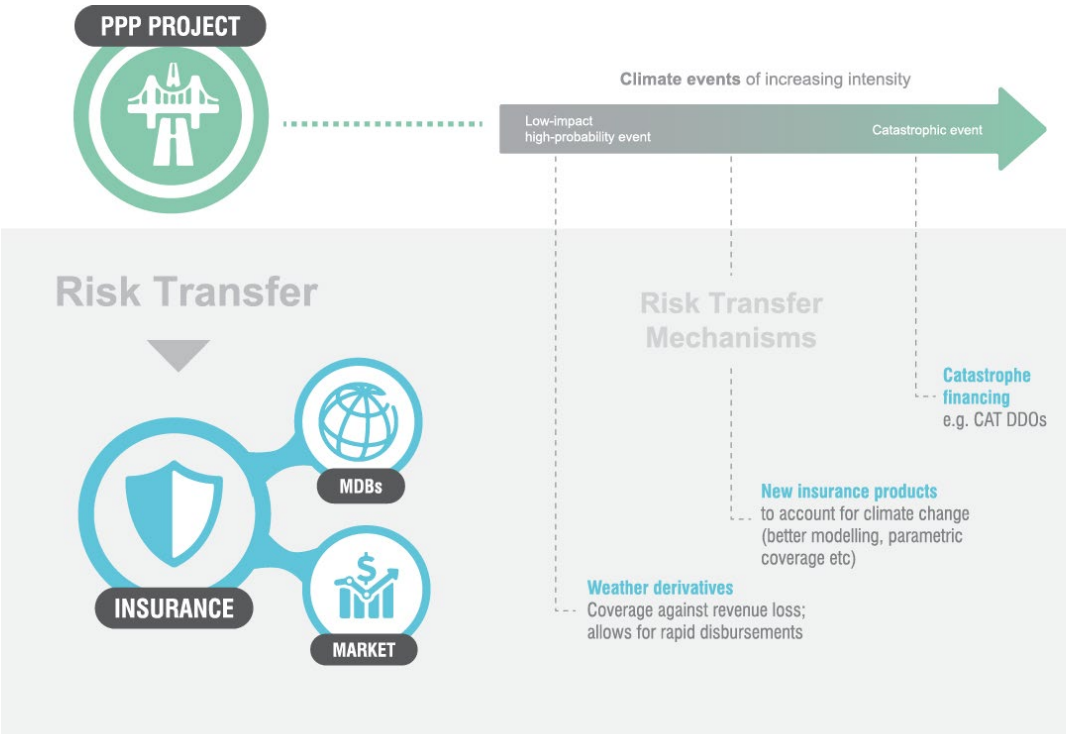


FIGURE 3.3 Innovative risk transfer mechanisms for PPP infrastructure. On the left side of the risk spectrum are the weather derivates to compensate for low impact but high-probability events (e.g., a temperature increase in the coming year above the annual average); on the right side are products to provide finance in the aftermath of extreme catastrophic events (CAT DDOs: Catastrophe Deferred Drawdown Options).

Incentives for new insurance instruments

In order to enhance insurability of climate risks and exceed the limits of traditional insurance, it is recommended that countries attempt to provide market incentives, e.g., by applying appropriate policies or modifying legislation for insurance companies to introduce new products which:

- Require the use of accurate, region-specific models to correctly assess catastrophe risks and hence are able to price them better
- Incentivize investments in resilience as a means to enhance insurability and better pricing of insurance plans
- Encourage risk-transferring from insurers to investors (especially the ones with high-risk appetite)

Financial Tools

To reduce the effects of climate-change-induced uncertainty in the quantification of both the upper bound of probable loss (due to extreme, acute events) and the frequency of occurrence of lower-magnitude losses (due to low-impact events), traditional insurance could be combined with financing options such as:

Index-based products (e.g., weather derivatives) that may be activated as a means to hedge the risk of more frequent weather-related losses:

An index-based weather derivative[16] is a financial instrument used by companies or other entities to hedge against the risk of weather-related losses. This financial instrument is typically based on a weather-related index that is designed to reflect losses due to adverse climatic events such as excessive or insufficient rainfall, extreme temperature, tropical storms, hurricanes, cyclones, and typhoons. To this end, an entity that needs to hedge a specific weather risk may purchase a derivative contract by paying a premium upfront. The seller/issuer of the contract accepts this weather risk and works similarly to an insurer. In case the weather index crosses a specific pre-determined threshold, the derivative holder receives the agreed payout (see also Box 3.6).

Catastrophe Drawdown Options (Cat DDOs) that could be potentially used to provide coverage in case of an extreme event in excess of the maximum insured loss:

Cat DDOs act as a source of bridge financing until other post-disaster financing sources (e.g., concessional funding, bilateral aid, reconstruction loans, etc.) become available or while they are being mobilized. Cat DDOs provide a similar type of protection to a catastrophe bond (insurance - reinsurance like) with the difference that, once triggered, the contingent financing facility opens a loan or line of credit to the World Bank that does have to be repaid, albeit at attractive terms. Drawdown may become available only after specific criteria linked to the catastrophe are met. Typically, the pre-specified drawdown trigger is the country's declaration of a state of emergency. Cat DDOs (see also Box 3.7) may be tailored to a country's specific needs and apply to middle-income and low-income countries eligible for the World Bank's IBRD and IDA concessional funding (IBRD Cat DDO[17] and IDA Cat DDO[18]).

State Guarantees

An already existing option, state guarantees may be provided not only as part of the regular bankability considerations but also as a means to enhance the insurability of the project or the investability in the country's catastrophe risk through the issuance of catastrophe bonds.

[16] World Bank,2015: Index-Based Weather Derivative Product Note
[17] World Bank, 2018a: IBRD Catastrophe Deferred Drawdown Option (Cat DDO) Product Note
[18] World Bank, 2018b: IDA Catastrophe Deferred Drawdown (Cat DDO) Product Note

BOX 3.6 WEATHER DERIVATIVES

Unlike traditional insurance schemes, index-based weather derivatives allow for rapid disbursements as there is no need for an assessment of loss incurred. Once the index threshold value is reached, the buyer receives the payout. As such, weather derivatives will play a significant role in hedging the risk of extreme natural hazards that may increase in frequency and magnitude in the future due to the effects of climate change.

The Malawi Example

Malawi, a country in Southern Africa, is highly vulnerable to climate change and extreme weather conditions, and especially to drought. The country is heavily based on agriculture, although rainfall is not guaranteed, and precipitation levels are expected to decrease in the future. Given this, the government of Malawi purchased weather derivative contracts that were structured as an option on a rainfall index. The index was related to maize production so that if precipitation within a year falls significantly below a historical average, then Malawi would receive a payout of $4.4 million. The World Bank's intermediation on index-based weather derivatives allowed Malawi to transfer weather-related risk to market counterparts.

Sources:
World Bank,2015a: Index-Based Weather Derivative
Product NoteDRFIP, 2012: Weather Derivative in Malawi
World Bank, 2015b: Case Study - Mitigating the Impact of Drought on Energy Production in Uruguay

BOX 3.7 CAT DDOS

Catastrophic events require immediate liquidity to cover expenses for relief processes, recovery operations, and reconstruction works and may pose significant financial shocks to countries. Timely preparation by securing rapid access to financing sources before a disaster strikes, is critical in preventing budget re-allocations from longer-term social and development programs (e.g., health, education) towards emergencies and achieving efficient and effective response to disasters. The Catastrophe Deferred Drawdown Option (Cat DDO) was introduced in 2008 as part of the World Bank's broader crisis management spectrum of catastrophe contingent risk financing solutions, aiming to address the urgent financial needs that appear in case of catastrophic events (natural disasters and/or health-related events) and to support long-term strategic disaster risk management policy goals and capacity building.

The fundamental requirements for a country to gain access to the Cat DDO include:

- the existence of an adequate **macroeconomic policy framework**; and
- the existence or preparation of a **satisfactory disaster risk management program** that the World Bank will monitor on a periodic basis.

Numerous countries have already benefited from funds disbursed from a contingent credit line from the World Bank after disastrous events (including the outbreak of COVID-19) triggered their Cat DDOs. One recent example is the $20 million that the World Bank disbursed to support Saint Vincent and the Grenadines' response to the crisis posed by the La Soufrière volcano eruption.

Sources:
Ijjasz-Vasquez, Escobar, 2017: Cat DDOs: More than emergency lending for disaster relief, World Bank Blogs (last visited July 15th, 2021)
Evans, 2020: World Bank CAT DDOs triggered by coronavirus, disburse almost $900M, article www.artemis.bm (last visited July 15, 2021)

Step Output

Decision on the insurance requirements for the bidders (for climate events)

KEY TAKEAWAYS

- Climate risk categories will need to be redefined from a contractual standpoint as: (i) "internal risks", i.e., those directly affecting the project causing physical damage and/or downtime for inspection or repairs, may be associated with "predictable" and "unpredictable" events and (ii) "external risks", i.e., those posed on the project due to failures of the interconnected infrastructure or changes in the broader socioeconomic environment.
- It is essential to recognize that inadequate protection from climate-change risks (potentially stemming from the inability of the party bearing the risk to handle it properly) could threaten the entire project and negatively impact all parties.
- As climate change becomes the norm and the severity of climate events is increasing, it is in the interest of all parties to try and properly assess and allocate such risks.
- Infrastructure insurance against climate change presents key challenges. Hybrid solutions should be sought for where conventional insurance options are not adequate and may be blended with other innovative financial instruments. These could include index-based products (e.g., weather derivatives), Catastrophic Drawdown Options (Cat DDOs), and state guarantees. However, it is duly noted that such options are still at an exploratory phase.
- Transition risk insurance is currently an emerging market of the insurance industry that may be used to offer coverage (up to a mutually defined cap) against potential changes in law as part of the transition to greener economies.
- As per the principles of project finance, the risk allocation should be clearly defined and determined within the project documents in a manner that addresses any uncertainty. To the extent that uncertainty remains, the grantor would have to offer some form of cover, especially in relation to the debt financing, and subject to the available insurance cover and its associated costs.

MODULE 3.1 Resources

PPP RISK ALLOCATION TOOL

2019 Edition has been designed to assist both the public and private sectors in appropriately allocating risks across a variety of infrastructure projects to improve PPP delivery, leading to more sustainable and better quality infrastructure that provides value for money and addresses the needs of the public

Developed by: Global Infrastructure Hub and Allen & Overy, 2019

Module 3.1 - Further Reading

GUIDANCE ON PPP CONTRACTUAL PROVISIONS

This document contains guidance and examples drafting provisions in relation to a number of core PPP contractual clauses, including force majeure provisions and treatment of climate risk

Developed by: World Bank Group, 2019

RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS (PPPS): CONTRACTS AND PROCUREMENT – THE CASE OF JAPAN

A guide harnessing the knowledge and expertise gained from PPP projects in selected countries to help the governments of low- and middle-income countries to prepare and structure disaster-resilient infrastructure PPPs

Developed by: World Bank Tokyo Disaster Risk Management Hub, GIF, GFDRR, 2017

RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS (PPPS): CONTRACT AND PROCUREMENT – THE CASE OF INDIA

This country brief gives an overview of the availability of insurance for PPP projects in the context of climate change in India, a country that is a crucial PPP implementer across infrastructure sectors. India's experience in PPP projects affected by natural hazards offers insights and lessons on how disaster and climate risks can be managed under PPPs in emerging markets and developing economies

Developed by: World Bank Tokyo Disaster Risk Management Hub, GIF, GFDRR, 2018

TECHNICAL BRIEF ON RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS: POLICY, CONTRACTING, AND FINANCE

This technical brief highlights key considerations and good practices for structuring resilient infrastructure PPPs through policy and legislation; contracting and disaster risk allocation; procurement, monitoring, and payment; and insurance. The brief was developed based on country case studies on Japan, India, and Kenya, as well as a literature review

Developed by: World Bank Group, 2019

SOVEREIGN CLIMATE AND DISASTER RISK POOLING

The report provides recommendations on managing the financial impact of climate and disaster risks and describes how the sovereign catastrophe risk pools are now operating. It examines potential gaps and identifies possible opportunities for new sovereign pools

Developed by: World Bank Group, 2017

A WORKSHOP ON DISASTER RISK REDUCTION AND RISK TRANSFER: TOWARD CONCRETE ACTION INSOUTH ASIA AND EAST ASIA AND THE PACIFIC

This is a summary report of the South Asia Region and the East Asia Pacific regions training workshopfrom April 28-30, 2008, on the importance of disaster risk reduction and risk transfer, including major concepts, models, and various applications of disaster risk reduction around the globe

Developed by: World Bank, 2008

INSURANCE OF WEATHER AND CLIMATE-RELATED DISASTER RISK: INVENTORY AND ANALYSIS OF MECHANISMS TO SUPPORT DAMAGE PREVENTION IN THE EU

The study builds on the EU Adaptation Strategy and the accompanying Green Paper. It addresses the objective of encouraging the use of insurance to manage weather and climate-related disaster risk

Developed by: European Commission, 2017

MITIGATING THE IMPACT OF DROUGHT ON ENERGY PRODUCTION IN URUGUAY

This document refers to a case study brief in Uruguay. The World Bank executed a $450 million weather and oil price insurance transaction for the state-owned electric utility. This milestone transaction createsan important fiscal buffer which is part of the wider risk management strategy

Developed by: World Bank, 2015

PRODUCT NOTE - INDEX-BASED WEATHER DERIVATIVES

A brief overview of the World Bank's index-based weather derivatives as part of a broad spectrum of disaster risk financing instruments, designed to assist member countries in planning efficient responses to natural disasters

Developed by: World Bank, 2015

WEATHER DERIVATIVE IN MALAWI

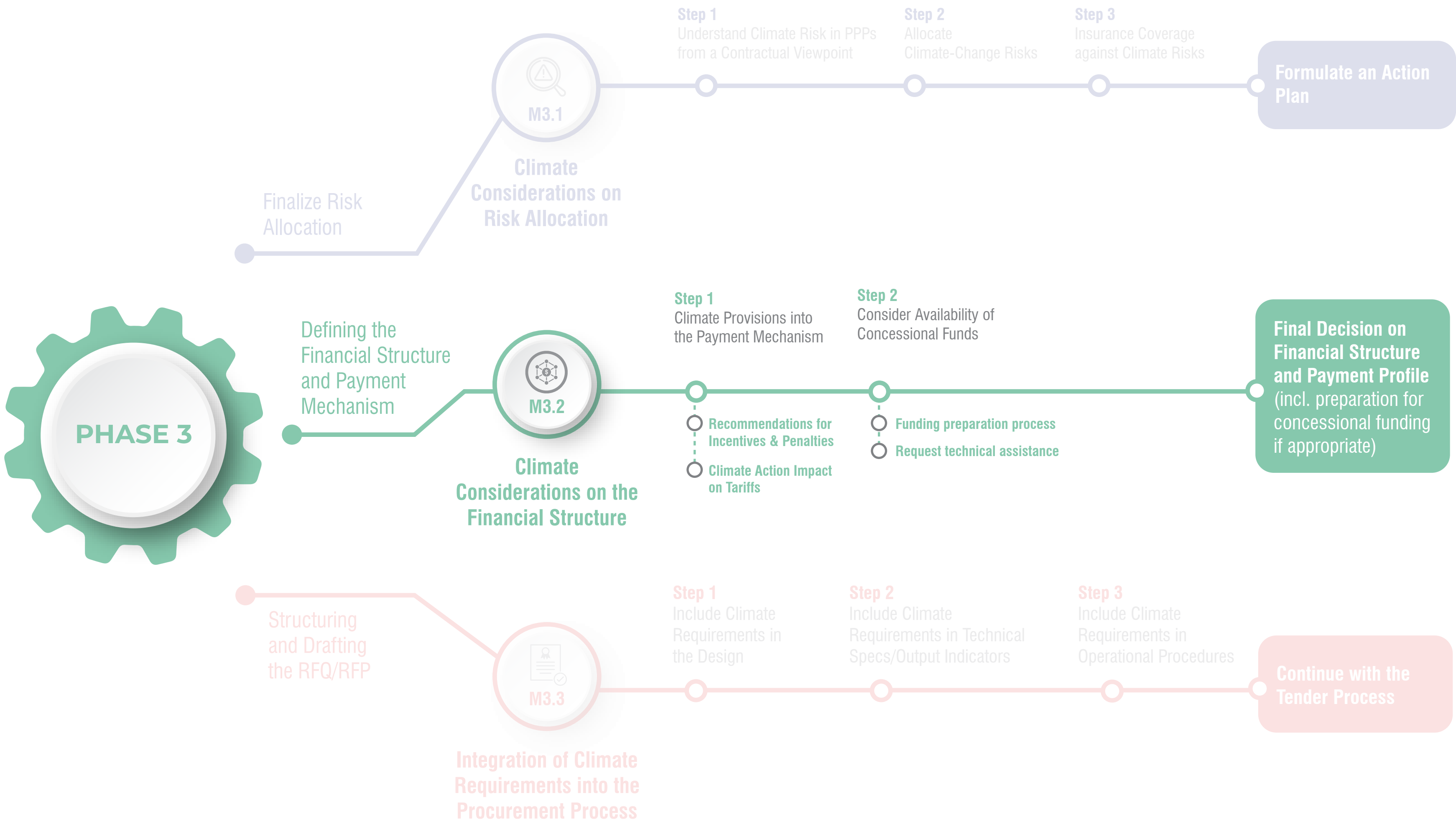
The index-based weather derivatives allowed Malawi to access the financial markets and transfer weather-related risk to market counterparts. This weather derivative was the first time that the World Bank offered a financial risk management tool to a low-income country

Developed by: Disaster Risk Financing and Insurance Program (DRFIP), 2012

PPPLRC CLIMATE-SMART PPPS WEBSITE

This section of the PPPLRC website provides links to policies, legislation, project documents, and other relevant resources for developing, procuring, and contracting climate-smart PPP projects and insuring climate-change risks

Developed by: PPPLRC, World Bank


Step 1
Understand Climate Risk in PPPs from a Contractual Viewpoint
Step 2
Allocate Climate-Change Risks
Step 3
Insurance Coverage against Climate Risks
Formulate an Action Plan
M3.1
Climate Considerations on Risk Allocation
Finalize Risk Allocation
PHASE 3
Defining the Financial Structure and Payment Mechanism
M3.2
Climate Considerations on the Financial Structure
Step 1
Climate Provisions into the Payment Mechanism
Recommendations for Incentives & Penalties
Climate Action Impact on Tariffs
Step 2
Consider Availability of Concessional Funds
Funding preparation process
Request technical assistance
Final Decision on Financial Structure and Payment Profile (incl. preparation for concessional funding if appropriate)
Structuring and Drafting the RFQ/RFP
M3.3
Integration of Climate Requirements into the Procurement Process
Step 1
Include Climate Requirements in the Design
Step 2
Include Climate Requirements in Technical Specs/Output Indicators
Step 3
Include Climate Requirements in Operational Procedures
Continue with the Tender Process

3.2 Climate Considerations on the Financial Structure

When it comes to structuring a PPP, a critical decision for the procuring authority is to decide upon an appropriate financing mix to leverage the risk and return profile of the project making it a bankable and attractive investment. As described in the previous sections, the uncertainty related to climate change renders the risks posed on the project quite unpredictable. Extreme climatic phenomena may occur more often than before while moderate events could be characterized by augmented intensities thereby impacting the project. Moreover, as insurers and financiers are becoming increasingly aware of this climate change landscape, failure to address the climate risks could jeopardize the bankability of the project. In this context, it becomes evident that neglecting climate in the structuring of such projects is not an option. The long-term viability of the traditional least cost approach will need to evolve. Including climate mitigation and resilience measures into the structuring and financial modeling of PPPs is becoming ever more important.

Hence, the aim of this module is to embed a climate lens into project structures by attempting to prepare a predictable reaction to unpredictable events, in what is uncharted territory. Therefore, it is essential to note that several concepts among those presented in the next sections are still at a developing stage and have not been fully market-tested and validated. However, early planning for climate resilience is critical for the bankability of the investment. And in fact, provided that such planning is performed on a timely basis, it may provide opportunities for the projects to tap into additional liquidity pools and new forms of financing. In such circumstances, the procuring authority may need to consider and prepare financing structures that include **institutional support**[1] (multilateral or supra-national development banks (NDBs) and other financial agencies). There are also new climate finance emerging sources of debt and equity financing. This may include green lending and bonds as well as sustainable finance-linked debt, among others. This a burgeoning financial market that requires adherence to several global principles and taxonomies (compatible with the CBI[2] or the GBP[3] guidelines/criteria) and is briefly explained in Appendix 2.

[1] In the form of non-revolving public grants and concessional loans[1] (towards the public authority or the project company).

[2] Climate Bond Initiative

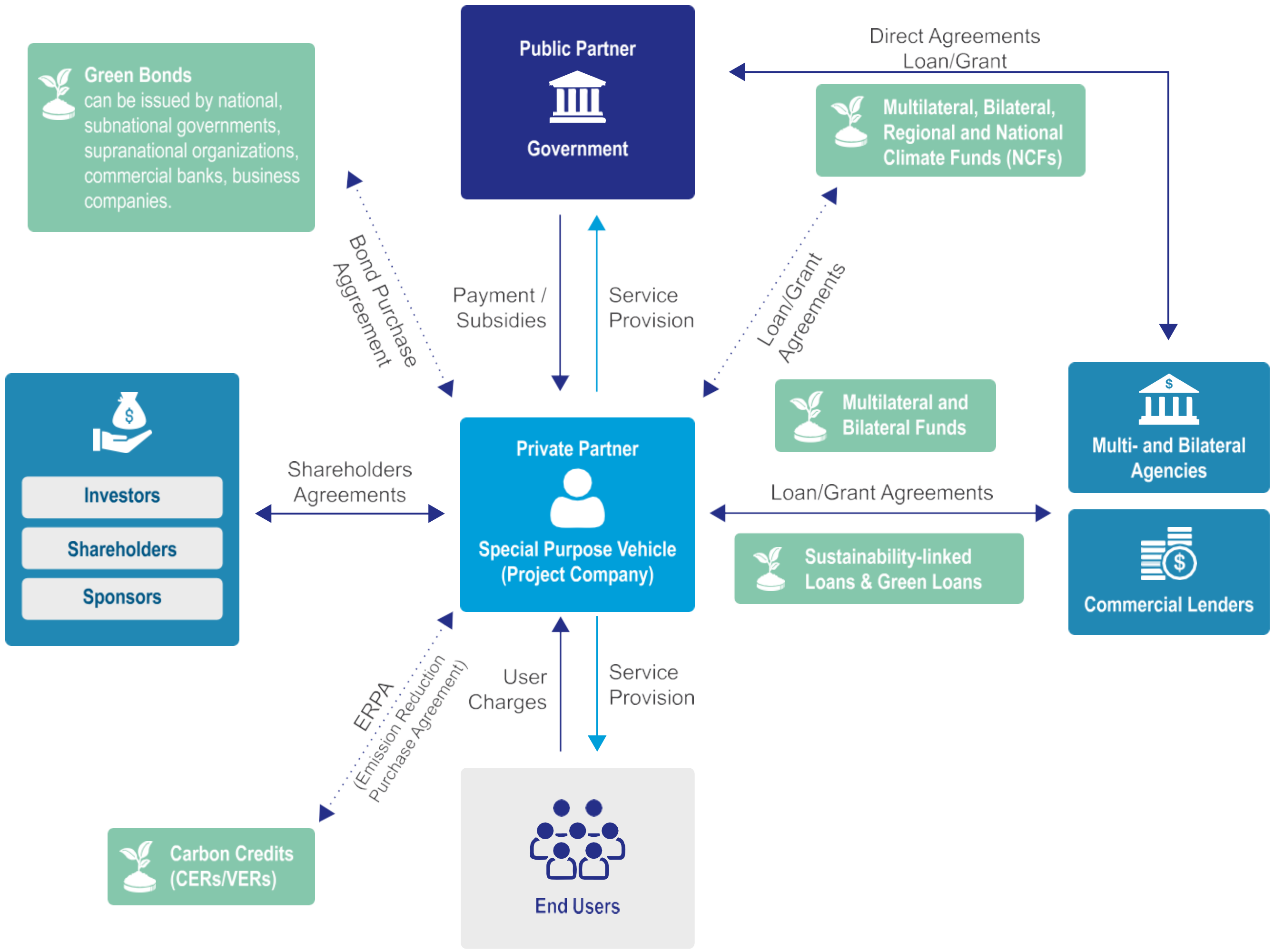
[3] Green Bond Principles (GBP)

STRUCTURE OF THE MODULE

The scope of this module is to provide high-level guidance on these aspects and outline specific considerations and opportunities relevant to the financial structure of the project. The basic financial structure has been defined in Phase 2 during the assessment of the project's commercial feasibility, affordability, and VfM. In the current module, the financial structure will have to be refined further. This includes: (i) finalizing the payment or revenue mechanism and (ii) deciding on the level of engagement of public compensation/support instruments (e.g., direct or indirect financial support, credit enhancement mechanisms, etc.).

While it is not strictly related to the financial structuring performed during the pre-tender stage (it is the winning bidder/investor's responsibility to obtain the means necessary to finance the project), it is relevant to explore the project's eligibility for innovative sources of climate financing, as it can trigger the need to embed in the overall contract structure some provisions that facilitate the project's attractiveness to such financing sources. This would enhance the project's eligibility for innovative sources of climate financing. A schematic overview of different grants as well as concessional and commercial financing sources (traditional and innovative) that may be relevant for a climate-smart PPP project is provided in Appendices 1 and 2.

FIGURE 3.4 Schematic summarizing the potential flows of funds between various stakeholders within the complex interaction landscape of potential solutions for funding and financing climate actions in PPP projects. Not all options may be available or applicable in every project (in particular the ones shown with dotted arrows are used in very specific cases only).



The module comprises two steps:

- **Step 1** focuses on the options for integrating climate provisions in the payment mechanism of PPP projects and discusses the differences between availability-based and user-pays PPPs to meet the CAPEX requirements of climate adaptation.
- **Step 2** does not constitute a part of the conventional PPP process cycle. It is included in the toolkit as an informative section aiming to introduce users to the benefits of and process to apply concessional funding. For the reader interested in innovative financial instruments (such as sustainable linked and green loans), which are products that may or may not be applicable to a given project, more information is provided in Appendix 2.

01 INCLUDE CLIMATE PROVISIONS INTO THE PAYMENT MECHANISM

It is good practice in PPPs to structure a payment mechanism based on explicit and clear performance standards that incentivize the project company to deliver its obligations or penalize it through deductions when underperforming. Depending on the nature of the project, availability-based or user-pays, the payment mechanism is adjusted accordingly to include various elements, such as the fixed availability payment, pain-gain sharing, bonuses, penalties, claims, etc.

The step focuses on how a payment mechanism may be impacted by incorporating climate considerations in a PPP structure and discusses schemes relevant to base or adaptive plans, the two alternative planning approaches introduced in Module 2.2 to design climate adaptation measures under uncertainty.

It is reminded that both plans constitute a means of responding to climate uncertainty that makes it hard to predict the intensity of climate phenomena for which the adaptation measures will have to be designed. The result of a base plan would be a robust adaptation strategy, i.e., a strategy that would respond satisfactorily under most scenarios. On the other hand, an adaptive plan treats the design of adaptation measures in a staged manner. It thus proposes that adaptation measures are designed and evaluated upfront for different climate scenarios but they are materialized only after specific climate-related indicators exceed certain thresholds. It therefore aims to avoid high upfront capital that could question the financial viability of the project by disbursing capital expenses sequentially based on pre-defined trigger points that are evaluated at specific time intervals.

When applied into project finance structures, the latter approach raises investment and bankability challenges. While a critical step is to build a relevant form of adaptation upfront, it may not be sufficient over the life of the project—hence triggering the questions of contract stability and cashflow visibility for the project company. Without built-in adaptation, the project may neither attract investors and lenders nor be insurable. But building flexibility over time in a PPP contract constitutes a challenge: the example of the highway PPP sector is quite illustrative given the gap that can exist between initial traffic projections and the reality of traffic volumes (and sometimes the need to expand the road in advance of initial forecasts). It is only through a case-by-case analysis that this can be dealt with:

- *Would alternatives such as letters of credit or a stand-by financing instrument be viable?*
- *Is the risk insurable?*
- *What about the capacity and need for the grantor to step in, eventually providing a funding account?*
- *Which climate risks can be addressed and committed upon from the beginning and which ones may require a review clause?*
- *In terms of funding, what are the mechanisms that trigger price adjustments, how, and how to ensure those remain acceptable for the user payer?*

When climate mitigation and adaptation plans are in place, the payment mechanism can act as the platform upon which any relevant inflows or outflows will be reflected, especially as monitoring climate risk and the protection against it will be continuous and ongoing throughout the life of the PPP. There are several cases where this can be applicable and relevant as follows:

Availability-based PPPs – In this case, the payment entails the total payment required by the project company, incorporating any additional cost associated with climate adaptation and mitigation measures during the construction and concession period. It remains to the bidders' discretion how to integrate these aspects into the design of the project. Climate-related CAPEX needs to be built upfront as much as possible. If an adaptive plan is in place for climate risk-reduction works, how eventual future works are funded and financed needs to be agreed upfront, to allow the PPP contract to give the necessary cashflow visibility to investors, despite of the climate change uncertainty around the infrastructure asset.

WORK IN PROGRESS: FINANCING ADAPTIVE PLANNING

The concepts presented in this step are innovative and have not—at the time of writing—been mainstreamed across sectors. While some sectors have already incorporated adaptive planning in routine operations, others have applied them only in pilot applications,[4] and the use of such approaches in PPPs is nascent and will require testing, with trial-and-error. Users are thus encouraged to review the financing options discussed while recognizing that the landscape is still evolving and that the concepts presented herein may require further validation prior to being widely applicable. Decisions on the bankability of adaptive planning and selection of the appropriate financing method will require involvement of expert consultants.

[4] For example, the World Bank Group supported in 2018 the Preparation and Appraisal of a Rural Roads Project in Mozambique under Changing Flood Risk and Other Deep Uncertainties. The study included advanced analyses aiming at piloting the use of decision-making under uncertainty in transport operations.

Let's assume a fictitious project, including only climate adaptation measures on a base or adaptive structure. The cost of adaptation is assumed to be reflected only in the increase of availability payment (upfront or after a trigger condition has been reached), neglecting any other sources of funds. In case a base plan is in place, the cost of adaptation will materialize in the form of a constant increase of availability payments (compared to the theoretical "no adaptation" case). In a project finance structure, this approach is strongly preferred and recommended. In case of an adaptive plan, the cost of adaptation will be initially lower and may increase after certain trigger points only in case the climate indicators suggest that additional adaptation measures will need to be taken (and hence paid for). Such an approach triggers bankability questions that need to be discussed and agreed upon from the beginning to ensure the feasibility and acceptability of the approach by private sector stakeholders under project finance schemes.

For user-pays concessions, cashflows are based on user charges and traffic or usage volumes. As is the case in many projects, there may be some revenue-sharing provisions if usage exceeds certain levels. Therefore, an additional way to account for the extra cost of climate considerations is to net it out of the grantor's share. An additional way could be to introduce a fixed element in the project company's revenue, either directly through a periodic fee or a charge per user (or even through tax discounts in each toll fee paid), or by guaranteeing part of the traffic (therefore indirectly improving the credit quality of the project). Social acceptance of tariff amounts and adjustments is a critical risk to manage (through effective stakeholder engagement, affordability and willingness-to-pay analyses, proactive and strategic communication plans, etc.), making it sensitive to transfer climate risk payments to the final user (which puts additional pressure on the fiscal affordability of the project by the public authority).

Penalties – Proper maintenance of climate mitigation and adaptation works is critical and should be linked with the payment mechanism. To this end, penalties should be in place in case of insufficient maintenance or negligence to enforce the proper application of the relevant technical design and maximize the environmental benefit. Special care is recommended when projects involve specific classes of nature-based solutions (e.g., mangroves) whose performance depends significantly on diligent maintenance.

CONSENSUS ON RISK REDUCTION PLANS

It is noted that risk-reduction plans must be agreed at commercial and financial close by all stakeholders (grantor, project company, and lenders) for them to be sufficient without state guarantees. It is equally important to ensure (by including relevant penalty provisions) proper updating of such risk-reduction plans once additional climate-related data become available or if technological advances allow more efficient treatment of climate-related considerations without impacting the costs.

Incentives could be included in the payment mechanism to incentivize the private sector to assume climate risks. For example, incentives could include a shadow toll-based payment for traffic that would have otherwise been lost due to an adverse event if not for the protective measures in place (i.e., via a temporary tax break, netting it out of any revenue sharing in place, or by reducing any annual lease payment due to the public authority). Another class of incentives could be to endow the project with characteristics that enhance its eligibility for concessional financing or its ability to tap additional liquidity pools to finance climate actions. Such instruments are analyzed in the ensuing sections.

CLIMATE ACTION IMPACT ON TARIFFS

Assuming tariffs, in this section of the toolkit, refer to the payments made by the grantor to the project company, an increase in tariffs to reflect the additional risk and cost related to climate action would by default occur, either directly or indirectly. On the basis that bankability and investor returns have to be viable and maintained over a project's life-cycle, such an increase in tariffs may be upfront or with step-up mechanisms depending on the timeline of delivery of the adaptation works. However, there are ways to mitigate tariff increases or even minimize the need for such increases altogether (Box 3.8). Such ways are not mutually exclusive and can be thought of in various combinations:

- The tariff is split into (i) a base facility charge to cover the capital costs, the operating costs, and the returns to debt and equity, and (ii) a climate charge to cover climate action - related costs. In order to mitigate the increase caused by the climate charge, instead of it being charged, the project company can enjoy equivalent tax breaks, or alternatively be able to access certain forms of beneficial green/development/grant financing based on that charge.
- The additional cost, as expressed in this case by the climate charge, will be shared by the government and the project company, with some other form of indirect compensation to the project company or its shareholders, such as tax reliefs, grants, ESG target meeting support, concession benefits (such as extension options), insurance support, etc.
- The climate charge element of the total tariff is guaranteed by the grantor under all cases, therefore increasing the certainty of the revenues and improving the credit rating of the project company.
- The project companies are asked to retain in total the additional required cost and therefore bid for the project as a whole without separating climate action elements.

> There are different ways to share climate-related costs depending on the market, bidder commitment to climate action, and grantor objectives. This requires structuring and thinking from the CBA and VfM stages of a project.

BOX 3.8 TARIFF MITIGATION EXAMPLE

In the case of a demand-based concession, i.e., a toll road, there may be an element in the toll charge that is climate action related. For instance, a toll charge totaling $2 per car is the sum of $1.75 for infrastructure development, maintenance and operation, and $0.25 for climate adaptation works. In order to not pass or limit passing the cost to the end-user, the project company is asked to keep the toll charge at $1.75 and apply a shadow charge, which can then be recovered indirectly by mechanisms such as (i) equivalent tax breaks at the project company level (i.e., the equivalent of forfeiting the $0.25 charge), or (ii) access to green grants of equivalent amounts.

Step Output

Climate provisions in the payment mechanism:

- Incentives/penalties associated with a good or bad performance during a climate event
- Tariff adjustments (and tariff mitigation mechanism) to accommodate for the financing of climate actions that take place during the course of the project

02 CONSIDER AVAILABILITY OF CONCESSIONAL FUNDS

Mobilizing concessional funding /financing is not a compulsory part of the PPP cycle; it is however included in the toolkit as concessional funds may prove a very useful source of financing climate action. According to the World Bank Group:[5] *"Concessional finance is below market rate finance provided by major financial institutions, such as development banks and multilateral funds, to developing countries to accelerate development objectives. The term concessional finance does not represent a single mechanism or type of financial support but comprises a range of below market rate products used to accelerate a climate or development objective."* Concessional finance constitutes an innovative source of financing climate actions in challenging environments and should not yet be regarded as a mature and readily accessible financing pool. While acknowledging this fact, this step attempts to navigate users through the complex and constantly evolving concessional funding landscape by presenting key instruments, agencies, and interactions. It also provides guidance on how to rapidly screen eligible sources (for the foreseen PPP investment) in order to provide a preliminary source of information for the procuring authority on how to prepare projects to be able to benefit from concessional funds.

[5] https://www.worldbank.org/en/news/feature/2021/09/16/what-you-need-to-know-about-concessional-finance-for-climate-action

BOX 3.9 HOW A PPP PROJECT CAN BENEFIT FROM CONCESSIONAL FUNDS

From the perspective of a procuring authority seeking to deliver a project as PPP, the use of public/concessional funds can significantly strengthen PPP delivery by providing access to necessary funding that would be unavailable from other traditional sources. Indeed, in case commercial lenders or investors do not have the appetite to provide financing to the project, concessional funds may prove a valuable funding source endowing the project with the following benefits:

- They reduce the national funding resources that the project will require to bridge the viability gap in hardly viable projects
- They reduce the level of financing that needs to be raised, thus increasing the commercial feasibility of (a viable) project by reducing the risk that the winning bidder may not be able to raise the required funds
- They reduce the level of user charges and improve the overall structure of the PPP by supporting components of the project that may not be attractive for private sector financing
- They promote the delivery of a more affordable project for the procuring authority and/or for the users.

Securing concessional funding/financing could be a demanding task, which starts from identifying the funding opportunity, continues with the preparation of the financing application, and culminates in the reception of the funding and the implementation of the project. During this process, the procuring authority is faced with some crucial decisions regarding the selection and structuring of the funding and the role and level of engagement of key stakeholders/entities and expert advisors. The process of preparing for concessional financing can be either performed as part of Phase 3 (i.e., when the financial structure of the PPP is finalized), or it can run parallel to the PPP process cycle and be constantly revisited as information becomes available (Figure 3.5).

Preliminary Screening of grants and concessional finance (may have been performed during Phase 1)

When concessional funding/financing is intended to be mobilized, at a preliminary stage, the procuring authority is expected to:

- **Confirm the eligible project expenditure**, which includes reviewing the project scope and the intended use of the financial support; pre-screening of funds that support the intended investment activities; checking funding size requirement. Detailed guidance on these aspects is provided in Section 2.
- **Contact the national entities** that are responsible for financially supporting the climate initiatives. (Users may wish to refer to Phase 0 for additional guidance on the domestic administrative structure that oversees climate activities.)
- **Coordinate with the National Climate Funds (NCFs),** if established,[6] on the type of activities that are considered national priorities and for which funding from national and multilateral

[6] Obviously setting up an NCF may not be a viable option for all countries due to capacity and other constraints.

sources is available. For a detailed description of the role of NCFs in supporting green infrastructure projects, users may refer to Insight 3.2.

- **Seek technical support** for the preparation of the financing or grant.

Grant Preparation (may have been performed during Phase 2)

When grants are mobilized, at preparation stage, the procuring authority is expected to:

- Perform the preparatory work that is important for application submission. This will include much of the already conducted financial assessment (i.e., cost-benefit analysis, bankability check, and VfM) to support the justification of the financing amount (funding gap, eligible costs). See also general evaluation principles of Climate Funds in Appendix 1.
- Where specific technical guidance is needed (on any of the aforementioned tasks), the procuring authority may consider publishing terms of reference to request advisory services for the preparation of financing or grant. High-level guidance on these aspects may be provided by any of the agencies/entities described in the ensuing.
- Decide on beneficiary (i.e., whether it will be the public or the private party). This decision will be determined based on the financial structure of the PPP. Should, for example, the procuring authority decide that the PPP will involve availability payments, then it may wish to designate itself as the beneficiary to control the payment of the grant proceeds in line with performance-based payments. In a different context, it is possible for the private partner to assume the role of the beneficiary, provided that this is in line with the procuring authority's desire and that the private partner agrees to undertake the corresponding obligations and responsibilities (e.g., regular reporting, administration of payment, proof of eligible expenditure, etc.).
- Decide on the timing of the application (i.e., whether the application will be submitted before or after the completion of the PPP procurement process) and allocate the necessary resources to support that decision. The choice will depend, among other criteria, on the expected level of the bidder's interest, the thoroughness of the project preparation, the procuring authority's capacity to run parallel processes, and the flexibility of the project's timeline. In general, it is considered good practice to start the application process before financial close to speed up the overall process, reduce the risk of committing to a funding level that may not materialize, and provide bidders with data on the blended finance structure early enough. This will allow them to prepare their bids accordingly and mitigate the risk of losing bidders since the grant availability and conditions will be clear up-front.
- Depending on the schedule decided, the procuring authority may wish to seek conditional grant approval. This is generally a good practice to avoid unnecessary delays between commercial and financial close. For example, lenders will require evidence of grant approval to enable financing to be drawn down.

Submission of Application and Implementation (typically performed during Phase 3)

At this stage, the procuring authority is expected to:

- Make the final decisions on the choice of the payment mechanism and timing of disbursement of financing. The nature of the PPP will determine if the financing will be disbursed as a direct contribution towards capital costs (reducing future user charges or availability payments) or used as a contribution towards future availability payments, linking payment to long-term performance. In any case, the decision made should be reflected in the financial plan submitted to the granting authority for evaluation.

- Finalize the application submission, monitor the progress of evaluation, and respond to any further request raised by the granting authority. Often, delays in grant approvals are caused due to such requests rather than by the application and decision process itself.
- In case of grant approval, the procuring authority should coordinate with the private partner's legal advisors (and other technical advisors involved in the procedure) to manage the necessary **administrative work for initiating the grant reimbursement** (which includes receiving certification from the granting authority, finalizing the decision on the beneficiary, managing reporting and audit obligations, etc.).
- In case the public authority is acting as the grant beneficiary, it is the authority's responsibility to regularly monitor the project's performance and take the appropriate action according to the grant agreement. This may also include handling contract modifications/ disputes, disbursement requests, and meeting reporting and audit obligations.

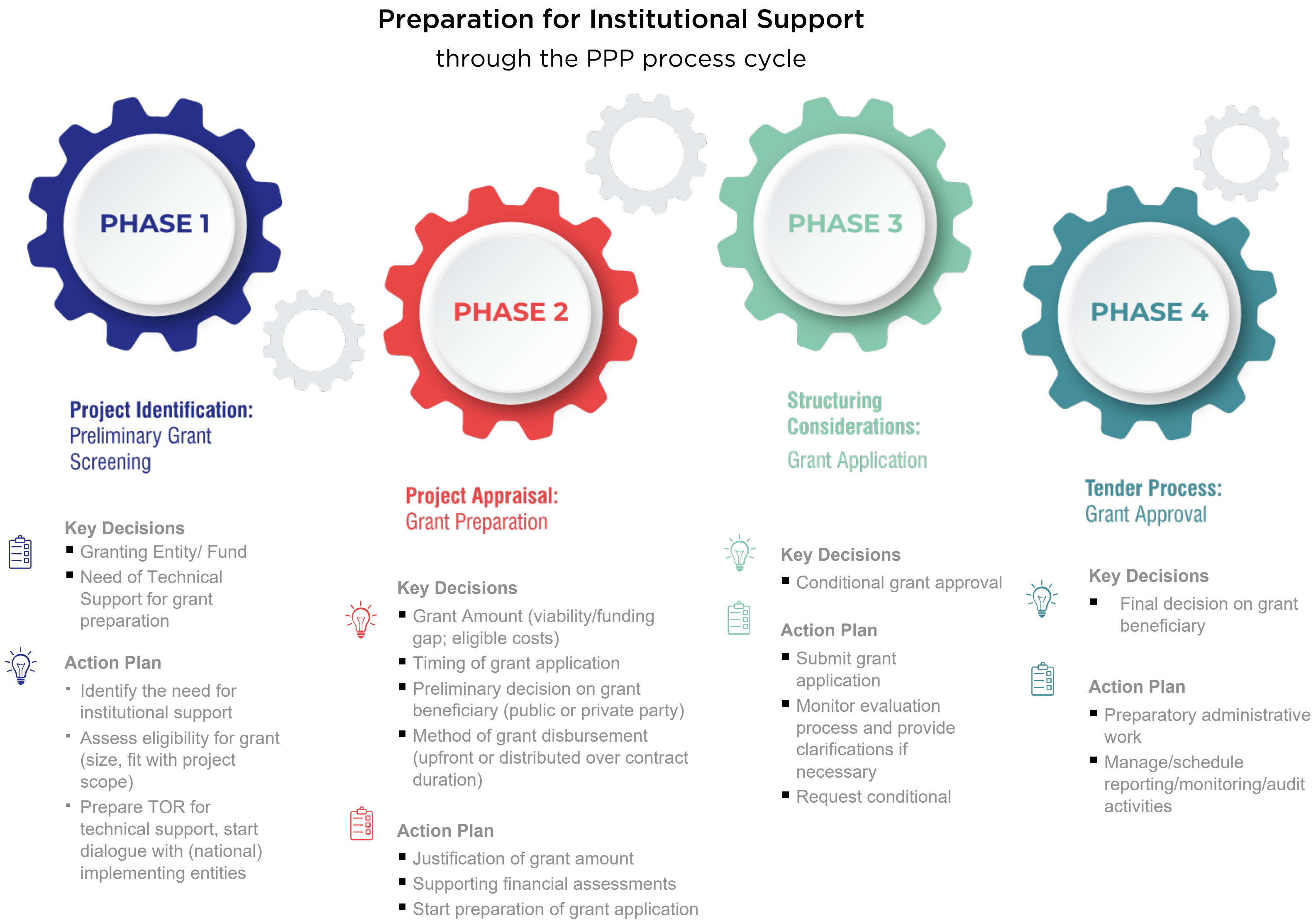


FIGURE 3.5 Decisions and actions to prepare for concessional support during Phases 1-4 of the PPP cycle for the projects that benefit from concessional support (this being neither systematic nor compulsory)

TECHNICAL ASSISTANCE ON CONCESSIONAL FINANCING

Last but not least, as previously discussed, depending on the financial model and the specific characteristics of the PPP project, the process of securing institutional support can be complicated, requiring expert advice in several technical aspects. Public authorities may request technical assistance (or high-level guidance on the preparation/submission of terms of reference) from:

- **National implementing entities,** which can be ministries that supervise and manage fundraising from different funding sources (UNFCCC and non-UNFCCC funds) and the technical committees of national climate funds. (Details on the designated role of NCFs in supporting the development of green infrastructure are provided in Insight 3.2)
- **Fund accredited entities or national designated authorities (NDAs)** of specific funds (private, public, or non-governmental institutions) carry out a range of activities, including developing funding proposals and management/monitoring of projects and programs. For example, JASPERS (Joint Assistance to Support Projects in European Regions) supports national implementing entities in beneficiary countries in preparing PPP projects for grant applications using ESI (European Structural Investment) funds
- **Advisory services departments** of regional and multilateral implementing entities and DFIs
- **Consulting firms with proven experience** in the area and knowledge of the country's local context

Step Output (Optional)

Action plan for requesting a concessional fund

KEY TAKEAWAYS

- Climate change-related investments need to be embedded upfront and integrated in the initial design as much as possible, to be funded through the revenues or the availability payments of the project.
- Prediction of the intensity of climate-related phenomena is hindered due to climate change. Hence, investing in adaptation to tackle the most adverse scenario may question the bankability of the project (while under-investment would question its long-term viability). One challenge will consist of the need to reconcile eventual adaptive planning (to avoid veryhigh upfront costs of adaptation works) with the difficulty to finance such an approach. In this context, adaptation actions may be designed and included in the financial model for several scenarios with the actual investments being deferred for later when more data would be available. This is an innovative approach that still needs to be explored and tested, and for which bankability will have to be ensured through tailor-made structuring in each project, mobilizing the appropriate funding measures (such as an increase in the amount of availability payments) and financing instruments, to the extent possible.
- The cost of long-term adaptation actions (in case of adaptive planning) can be partially funded via an increase to the availability payment (when it is required) or by introducing a fixed element in the project company's revenues (i.e., periodic fee, a charge per) or by guaranteeing part of the usage (therefore indirectly improving the credit quality of the project) in user-pays PPPs.
- The payment structure of adaptive PPPs should include provisions for continuous monitoringof cashflow variations due to climate-induced impacts.
- Penalties should be in place in case of insufficient maintenance or negligence to enforce the proper application of the relevant technical design and maximize the environmental benefit of the project. Payment incentives (e.g., shadow-toll payments for traffic, temporary tax breaks, etc.) should be included to encourage the private sector to consider climate risk in design, operation, and maintenance.
- In some PPP projects, the use of concessional funds is possible and alleviates the financing pressure. When it applies, concessional funding/financing may be mobilized through a competitive selection process. PPP procuring authorities should, therefore, carefully identify funding opportunities and perform the necessary technical analyses for justifying the funding necessity. The preparation for funding may run in parallel with the PPP cycle. This is a quite demanding process and chances for success may be low.
- Projects incorporating environmental, climate, and or social benefits may tap into liquidity pools from green, social, sustainability, and sustainability-linked bonds—a fast-growing market sector with nearly $600 billion of bonds issued across these four formats in 2020.

INSIGHTS

Insight #3.1
Exploring Adaptive Solutions such as Climate ChangeAccount

Insight #3.2
National Climate Funds

Insight #3.3
Financing for Climate Resilience and Adaptation

Insight #3.4
Exploring Financing Concepts
for projects having a strong adaptation component

INSIGHT #3.1

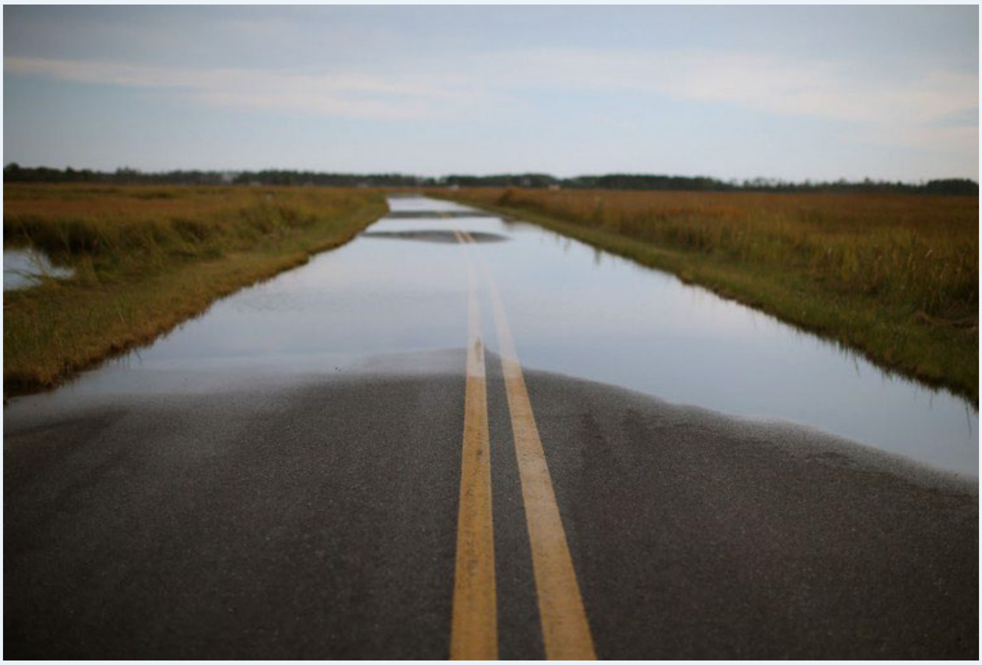
EXPLORING ADAPTIVE SOLUTIONS SUCH AS THE CLIMATE CHANGE ACCOUNT

The Problem

Assume a project that is affordable, passes the CBA assessment as per the government's requirements and objectives, and delivers value for money if procured through a PPP structure. The project is exposed to climate change-induced risks that can be mitigated via an adaptive plan that requires structural adjustments periodically depending on the levels of certain climate indicators (e.g., if sea level, drought, or frequency and level of floods exceed certain levels). The cost of such structural adjustments depends on the rate of worsening of such indicators, i.e., if indicators do not worsen at the expected rate, less expense will be required for such structural adjustments.

Grantor's and Project Company's Considerations

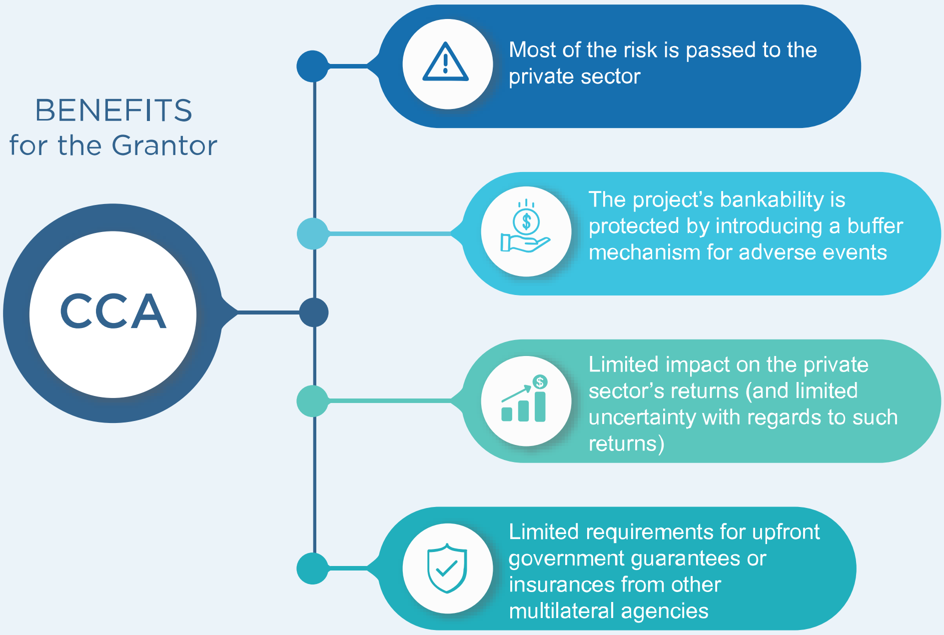
The project grantor wishes to mitigate/eliminate such risks to the project to ensure consistent operational continuity and prefers to include such structural adjustments in the technical requirements of the project and pass on the associated cost to the project company. Among the possible alternatives, the grantor can separately procure protective works outside the PPP project's scope, which could be conceptually unsatisfactory if one objective is to maximize a PPP project's capacity to provide climate resilient solutions.



INSIGHT #3.1

A possible solution – to be tested

One possible solution – whose cost implication would have to be discussed and agreed among partners – could rely on introducing the concept of a climate change account (CCA), to which the project company has to periodically contribute funds up to the level required to cover the costs of some adaptive works when expected. The level and timing will have to be pre-agreed based on the due diligence and consultations during the procurement phase.



NATIONAL CLIMATE FUNDS

National climate funds (NCFs) are domestic financing mechanisms designed to help countries assess mitigation/adaptation funding from the ever-growing pool of global financing mechanisms into green infrastructure projects that are considered a national priority. In particular, their mission is to:[7]

- Collect sources of funds and direct them towards climate change activities thatpromote national priorities
- Blend finance from public, private, multilateral, and bilateral sources to further catalyze resources supporting climate change action
- Coordinate country-wide climate change activities to ensure that climate change priorities are effectively implemented

Typically, the NCF structure comprises funding sources, governing bodies, a trustee, and implementers**.** Funding sources provide funds to the NCF, governing bodies make decisions about the fund's operations, the trustee manages the flow of financing towards and from the NCF's account, and implementers receive funds and ensure activities are undertaken. The financial flows (that may come in grants, equity investment, low-cost entrusted loans, financing guarantees) should follow specific fiduciary arrangements and standards.[8]

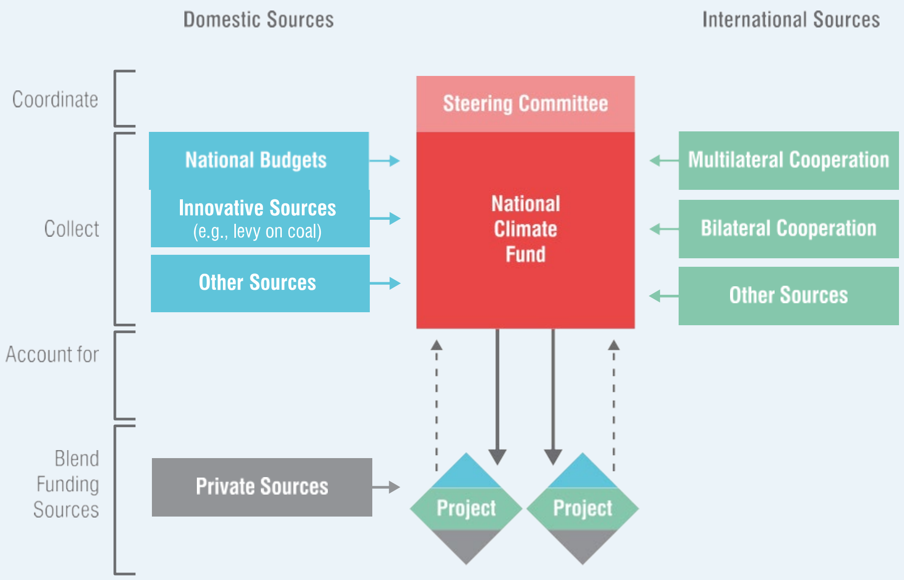


FIGURE 3.6 The mechanism of supporting the development of projects through blended financing (national and international funding sources) [Source: UNDP, 2011: Blending Climate Finance Through National Climate Funds]

[7] UNDP, 2011: Blending Climate Finance Through National Climate Funds

[8] Some funds have set out homogeneous fiduciary standards that every implementer must apply to be eligible for funding. Other NCFs apply different fiduciary standards for different types of implementers and projects (e.g., different standards between multilateral and private sector implementers, and between large-size and smaller-size projects).

How can PPP investments benefit from NCFs?

NCFs provide access to multiple funding resources

Through the NCF mechanism, projects may benefit from a rich financing blend including among other international financing flows from UNFCCC entrusted financial mechanisms (i.e., GEF, GCF, AF, LDCF, SCCF) from non-UNFCCCC financial mechanisms provided by multilateral financial institutions (e.g., WB, Asian Development Bank (ADB); AfDB, etc.) and bilateral development agencies, as well as domestic funds and innovative sources.

NCFs support the long-term climate vision

Although NCFs are consistent with the Paris Agreement, they have their roots in the national context. NCF objectives and priorities are therefore fully aligned with national climate change strategies and plans (NAPAs, NAPs, etc.) to promote, support, and coordinate investments in country-driven climate change priorities based on national circumstances and reality.

NCFs may target specific sectors and/or activities

Some NCFs have a broader funding agenda covering both climate mitigation and adaptation projects, while others focus on specific sectors and activities. For example, the Ecuador Yasuni ITT Trust Fund supports activities/programs that specifically address forestry, watershed and river management, energy, social development, research, science, technology, and innovation (as described in the Ecuadorian National Development Plan). The Bangladesh Climate Change Resilience Fund (BCCRF) provides financing for climate adaptation activities that combat the changing agricultural conditions and protect vulnerable populations.

NCFs provide flexibility in fundraising

An NCF provides the additional mechanism to attract a diverse variety of sources of climate financing, including public, private, multilateral and bilateral funds, as well as innovative financing sources (e.g., carbon taxation, etc.) at a project level. This provides greater flexibility in transactions when compared to traditional UNFCCC supported mechanisms.

NCFs have access to innovative financing

Innovative financing mechanisms such as levies on coal production, fees from polluting companies, or proceeds from carbon markets may also provide capital for an NCF. Of course, this may only be possible under the assumption that complementary structures are already in place to ensure the efficient collection and delivery of funds. For example, the Brazil National Fund on Climate Change collects funds from revenue from the oil production industry and channels them toward climate change mitigation and adaptation activities.

NCFs may have access to direct funding

Some NCFs support a “direct access” modality, in which domestic entities can readily attract funding through the Adaptation Fund, the Green Climate Fund, and other funds for implementing their climate change programs and projects.

INSIGHT #3.3

FINANCING FOR CLIMATE RESILIENCE AND ADAPTATION

01. THE CONTEXT

As climate adaptation and resilience establish their place high on the global climate agenda reaching levels of attention and focus similar to climate mitigation, considerations regarding the financing of such initiatives and projects are being identified. In particular, grantors and lenders to such projects are contemplating how to increase and optimize the allocation of funds to projects with climate adaptation and resilience mechanisms, especially as these gradually become integral parts of project structures and requirements. Especially in developing markets and economies, where investor and lender appetite are already limited or require significant support in state grants, loans, guarantees, and insurances, adding another layer of cost and risk may further complicate matters.

Assuming that the additional cost of climate adaptation and/or resilience against climate- related disruptive events is primarily borne by the project company, at least up to a certain level, the sources of funds of the project will need to incorporate such additional costs and accept the risk allocation from a bankability perspective. In certain cases, the level of such costs or the project's exposure to climate-related disruptions will be too high, thereby compromising the project's feasibility, in which case alternate project solutions or project locations will be sought and developed. Yet, for the purposes of this thinking trail, the cost of adaptation and resilience is assumed to be reasonable and the resulting protection against disruptions sufficient (primarily through the project's structural adjustments but also via insurance or a combination to the extent required - the primary objectives are to avoid disruptions to the public service without burdening the project company with losses or the risk of losses, and without having the state to step-in with guarantees in every case).

What is essentially defined herein is a PPP project that is required as part of the RFP, apart from its primary role to manage the infrastructure and deliver the public service according to specific criteria and standards, to include mechanisms and structures that protect it against climate-related events and disruptions without compromising the project's bankability and feasibility.

> From a financing perspective, this implies a requirement for:
>
> - additional finance to cover the capital cost of adaptation
> - insurance availability for such climate-related risks at an acceptable cost to the project company

02. CHALLENGE AND OPPORTUNITY

As a significant part of the financing for PPP projects in developing economies comes from multilateral (increasingly also national) development banks and agencies, the same institutions are in a premium position to lead the way in structuring solutions for the additional cost of climate adaptation. However, what seems an additional funding requirement may unlock new liquidity pools, ones that are explicitly focused on climate adaptation and which individual projects with climate adaptation mechanisms can tap into. For instance, instead of including climate adaptation within the Green Bond Principles, develop a capital market instrument specifically focused on climate adaptation for projectswith such characteristics. By all means, this implies that the climate adaptation elements and costs of a project will have to be identified and quantified and that the fund allocationpolicies at the MDB level will have to be set out in advance.

> What seems, however, like an additional funding requirement, **may actually unlock new liquidity pools**, ones that are explicitly focused on climate adaptation and which individual projects with climate adaptation mechanisms can tap into.

INSIGHT #3.4

POTENTIAL FINANCING CONCEPTS

FOR PPPS HAVING A STRONG ADAPTATION COMPONENT

Below are examples of financing mechanisms that either include **climate adaptation** or can be used to form new independent solutions. These examples constitute innovative ideas that are currently at an exploratory phase and have not yet been verified as being able to become mainstream. The underlying aim isto unlock pools of funding and direct them to projects in developing economies.

1 Climate Adaptation Bond (CAB) by MDBs/NDBs

Like the green bonds, issuance of CABs by MDBs or NDBs (perhaps even in local currencies) could contribute to either supporting projects that incorporate climate adaptation or funding a project's specific climate adaptation mechanism. The latter case may be an instrument that is insured against backdrops or failures of the adaptation infrastructure to protect against the identified climate risks, either through additional insurance by the respective agency or by cover in the financing documentation (similar to ECA covers) whereby the project company does not default in case of inability to repay loans due to climate-related disruptions. Given the increasing interest by the investor community for green bonds or other environmentally related bonds, the likelihood is that interest for such instruments, initially for ones bythe MDBs and gradually for ones by NDBs, will also be developed alongside the growing importance of and focus on climate adaptation.

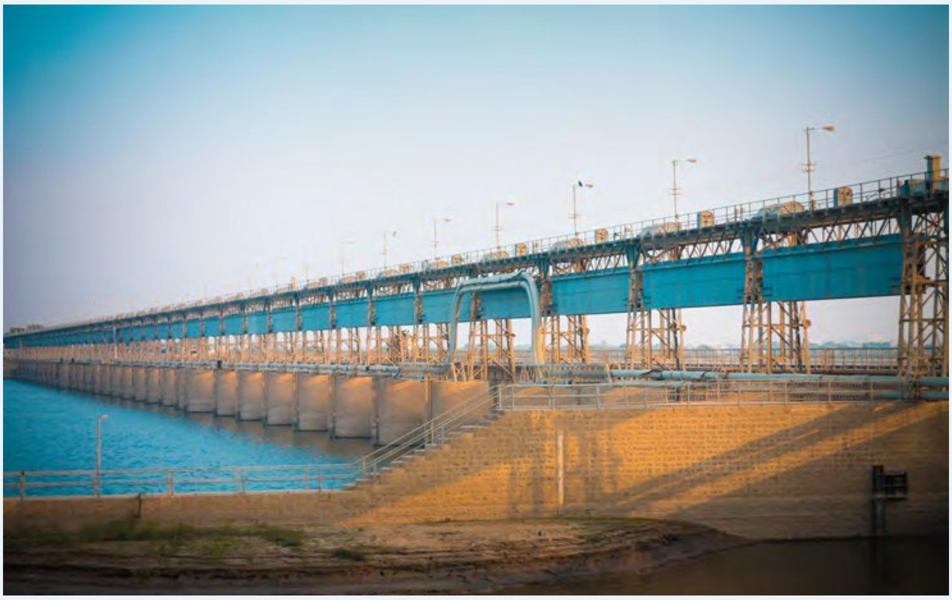
2 Project CAB (PCAB)

Essentially project-specific bonds that carry a CAB certification. Like CABs above, the PCAB can be raised either as additional financing to the project with adaptation mechanisms alongside the other financing tranches or as a finance pool specifically funding the cost of adaptation. In this case, several considerations will have to be addressed, such as the credit rating of such bonds and their coordination with other lenders and currencies. However, provided there is appropriate support in the form of cover, it could enhance available liquidity. One example of support could be that the MDB would insure the bond against the project company failing to repay the bondholders because of the inability of infrastructure to protect against pre-identified climate risks. This would also improve the project's credit rating, although EMDE countries' credit ratings may limit such improvements.

INSIGHT #3.4

3 Credit Support

Let’s assume a public authority aims to raise private bank financing to finance the cost of climate adaptation assets such as a wall against rising sea level, anti-flooding measures, or required materials against extreme temperatures. Such tranches of financing, within an infrastructure project, could benefit from some form of credit support, depending on the country's credit quality and the project, as well as the level of existing private financing activity in the country. Such credit support may include: (i) guarantees in case of inability by the project company to repay the loan, (ii) seniority of such tranches in the cashwaterfall, (iii) security over the project's assets, (iv) restrictive covenants until such loan is repaid, or a combination of the above. Especially if supporting climate mitigation goes alongside receiving some form of certification (a "scout" badge), such financing by commercial lenders will likely be strategically aligned with the growing importance of the climate-related objectives and agenda.



4 Adaptation Levy

Introduce a levy on the businesses that benefit from the project to cover the cost of adaptation. This may have political implications and may be unrealistic to suggest in developing economies. Therefore, only businesses that can sustain such a levy should be considered in any case. Such levies have widely been used in developed economies, generally without political controversy, given that the benefits for the business far outweigh the cost of protection and, most importantly, the cost of business disruption.

> Perhaps the question is not about new financing instruments but how to optimize and expand existing ideas, make them more focused and targeted, and engage with sovereigns early in the process to support them in delivering such solutions.

5 Tax Incentives

Indirectly finance the extra cost of adaptation through specific tax incentives (e.g., tax breaks equivalent to the amount spent on climate adaptation) given to the project company, whether at the company or the holding level or even in capital repatriation. The project company will then be responsible for covering the cost of adaptation measures within their existing budget and proposal, assuming that the adaptation measures are sufficient and to the required standards, limiting the likelihood of climate-related disruptions, and consequently the impact on such risk allocation.

6 Climate Adaptation Credits

Incorporate climate adaptation in guidelines or policies, whereby a sponsor that develops projects with climate adaptation is eligible for climate adaptation credits—attributed a value—thereby incentivizing the private sector to participate in and complete such projects regardless of location. To the extent that such credits can be quantified and have a commercial value, they can fund part of the project's capital costs.

There is no "one model fits all" solution, therefore each of the above will have to be further refined to reflect country- specific considerations and project-specific elements depending on its nature, size, and type of climate risks. The suggestions above serve to form a basis for further discussion and elaboration on the viability, constraints, and applicability of each option. It is expected that, as climate adaptation gains ground in the international socioeconomic and political agenda, so will the requirements and incentives for such characteristics in public infrastructure with financing availability being the main catalyst.

MODULE 3.2
Resources

CARBON PRICING DASHBOARD

Launched in May 2017, the Carbon Pricing Dashboard is an interactive online platform that provides up-to-date information on existing and emerging carbon pricing initiatives worldwide

Developed by: World Bank Group

CDM REGISTRY

An electronic database that ensures the accurate accounting of the issuance, holding, and acquisition of certified emissions reductions (CERs)

Developed by: UNFCCC

CLIMATE FUNDS UPDATE/THE FUNDS

An independent website that provides information and data on the growing number of multilateral climate finance initiatives designed to help developing countries address the challenges of climate change

Developed by: Heinrich Böll Foundation/Overseas Development Initiative

MULTI-PARTNER TRUST FUND OFFICE/TOOLS

The MPTF Office, housed within the UNDP, assists the UN system and national governments in establishing and administering pooled financing mechanisms — multi-donor trust funds and joint programs — to collect and allocate funding froma diversity of financial contributors to a wide range of implementing entities in a coordinated manner. MPTF website provides five tools where users can navigate among various funds and relevant documents

Developed by: UNDP

Module 3.2 - Further Reading

WHAT ARE GREEN BONDS?

A green bond toolkit for those interested in better understanding the nature of green bonds. The content aims to distinguish green bonds from other traditional financial instruments and provideinsight into the potential of green bonds to mobilize new sources of climate finance

Developed by: World Bank Group, 2015

THE WORLD BANK GREEN BOND PROCESS IMPLEMENTATION GUIDELINES

High-level guidelines on the implementation of the World Bank's Green Bond Program Developed by: World Bank, 2018

GREEN BOND PROCEEDS MANAGEMENT AND REPORTING

The objective of this guide is to clarify the processes issuers in the public sector can follow to meet two of the four elements of the Green Bond Principles (GBP): proceeds management and reporting

Developed by: World Bank, 2018

THE WORLD BANK GREEN BOND IMPACT REPORT 2019

The intention of impact reporting is to help investors develop a more detailed understanding of the climate and environmental impacts that can be expected or projected from green bond projects

Developed by: World Bank, 2019

THE WORLD BANK IMPACT REPORT 2020 SUSTAINABLE DEVELOPMENT BONDS AND GREEN BONDS

The 2020 report is focused on the IBRD-financed projects supported by sustainable development bonds and green bonds. It presents results highlights, issuance, commitment, and allocation figures,followed by examples of the new projects added to the respective project portfolios in FY20

Developed by: World Bank, 2020

CLIMATE BONDS TAXONOMY

The Climate Bonds Taxonomy is a guide to climate-aligned assets and projects. It is a tool for issuers, investors, governments, and municipalities to help them understand the critical investments that will deliver a low carbon economy

Developed by: CBI, 2021

GREEN BOND PRINCIPLES - VOLUNTARY PROCESS GUIDELINES FOR ISSUING GREEN BONDS

The principles outline best practices when issuing bonds serving social and/or environmental purposes through global guidelines and recommendations that promote transparency and disclosure, thereby underpinning the market's integrity. The GBPs seek to support issuers in financing environmentally sound and sustainable projects that foster a net-zero emissions economy and protect the environment

Developed by: ICMA, 2021

THE EU TAXONOMY

The EU Taxonomy is a tool to help investors, companies, issuers, and project promoters navigate the transition to a low-carbon, resilient and resource-efficient economy

Developed by: EU TEG on Sustainable Finance, 2020

[THE EU GREEN BOND STANDARD]

The report proposes that the commission create a voluntary EU Green Bond Standard to enhance the green bond market's effectiveness, transparency, comparability, and credibility and encourage the market participants to issue and invest in EU green bonds. The proposal builds on best market practices

Developed by: EU TEG on Sustainable Finance, 2019

[USABILITY GUIDE FOR THE EU GREEN BOND STANDARD]

This guide offers market actors guidance on using the proposed standard and the set-up of a market-based registration scheme for external verifiers. The usability guide contains an updated proposal fora green bond standard (annex 1)

Developed by: EU TEG on Sustainable Finance, 2020

[GREEN BONDS IN PUBLIC-PRIVATE PARTNERSHIPS]

This paper proposes green project bonds as an alternative way to finance green PPPs by engaging capital markets. For procurers to effectively include green bonds in their current tendering activities, they need to understand both the opportunities and underlying risks stemming from the inclusion of this type of securities as a financing tool

Developed by: The International Institute for Sustainable Development, 2015

[SUSTAINABILITY LINKED LOAN PRINCIPLES - SUPPORTING ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE ECONOMIC ACTIVITY]

Sustainability linked loans aim to facilitate and support environmentally and socially sustainable economic activity and growth. The Sustainability Linked Loan Principles (SLLP) have been developed by an experienced working party, consisting of representatives from leading financial institutions active in the global syndicated loan markets

Developed by: Loan Market Association, Asia Pacific Loan Market Association, Loan Syndications & Trading Association, 2021

[GREEN LOAN PRINCIPLES - SUPPORTING ENVIRONMENTALLY SUSTAINABLE ECONOMIC ACTIVITY]

The green loan market aims to facilitate and support environmentally sustainable economic activity. The Green Loan Principles (GLP) have been developed by an experienced working party, consisting of representatives from leading financial institutions active in the global syndicated loan markets, to promote the development and integrity of the green loan product

Developed by: Loan Market Association, Asia Pacific Loan Market Association, Loan Syndications & Trading Association, 2021

THE CLEAN DEVELOPMENT MECHANISM: A USER'S GUIDE

This manual is designed as a tool to help diverse stakeholders put the Clean Development Mechanism into action and to implement projects efficiently and equitably in a variety of national and sectoral contexts

Developed by: UNDP, 2003

[STATE AND TRENDS OF CARBON PRICING 2020]

This report provides an up-to-date overview of existing and emerging carbon pricing instruments worldwide, including international, national, and subnational initiatives. It also investigates trends surrounding the development and implementation of carbon pricing instruments and how they could accelerate the delivery of long-term mitigation goals

Developed by: World Bank, 2020

STORIES FROM THE FIELD - A LOOK AT WORLD BANK CARBON FINANCE PROJECTS IN AFRICA

A list of examples that illustrates the benefits of choosing a low carbon development path and how carbon finance can help finance projects

Developed by: World Bank

A BLUEPRINT FOR SCALING VOLUNTARY CARBON MARKETS TO MEET THE CLIMATE CHALLENGE

The trading of carbon credits can help companies — and the world — meet ambitious goals for reducing greenhouse-gas emissions. This article deals with what it would take to strengthen voluntary carbon markets to support climate action on a large scale

Developed by: McKinsey, 2021

HOW THE VOLUNTARY CARBON MARKET CAN HELP ADDRESS CLIMATE CHANGE

This article deals with how the voluntary carbon market is gaining momentum and plays anincreasingly important role in limiting climate change

Developed by: McKinsey, 2020

CARBON PRICING: SETTING AN INTERNAL PRICE ON CARBON

This series of articles aims to clarify how carbon is valued, taking into account the different projects and approaches

Developed by: Gold Standard

THE STATE OF INTERNAL CARBON PRICING

This article deals with the pricing thresholds of internal carbon charges implemented by companies

Developed by: McKinsey, 2021

NATIONAL CLIMATE FUNDS: LEARNING FROM THE EXPERIENCE OF ASIA-PACIFIC COUNTRIES

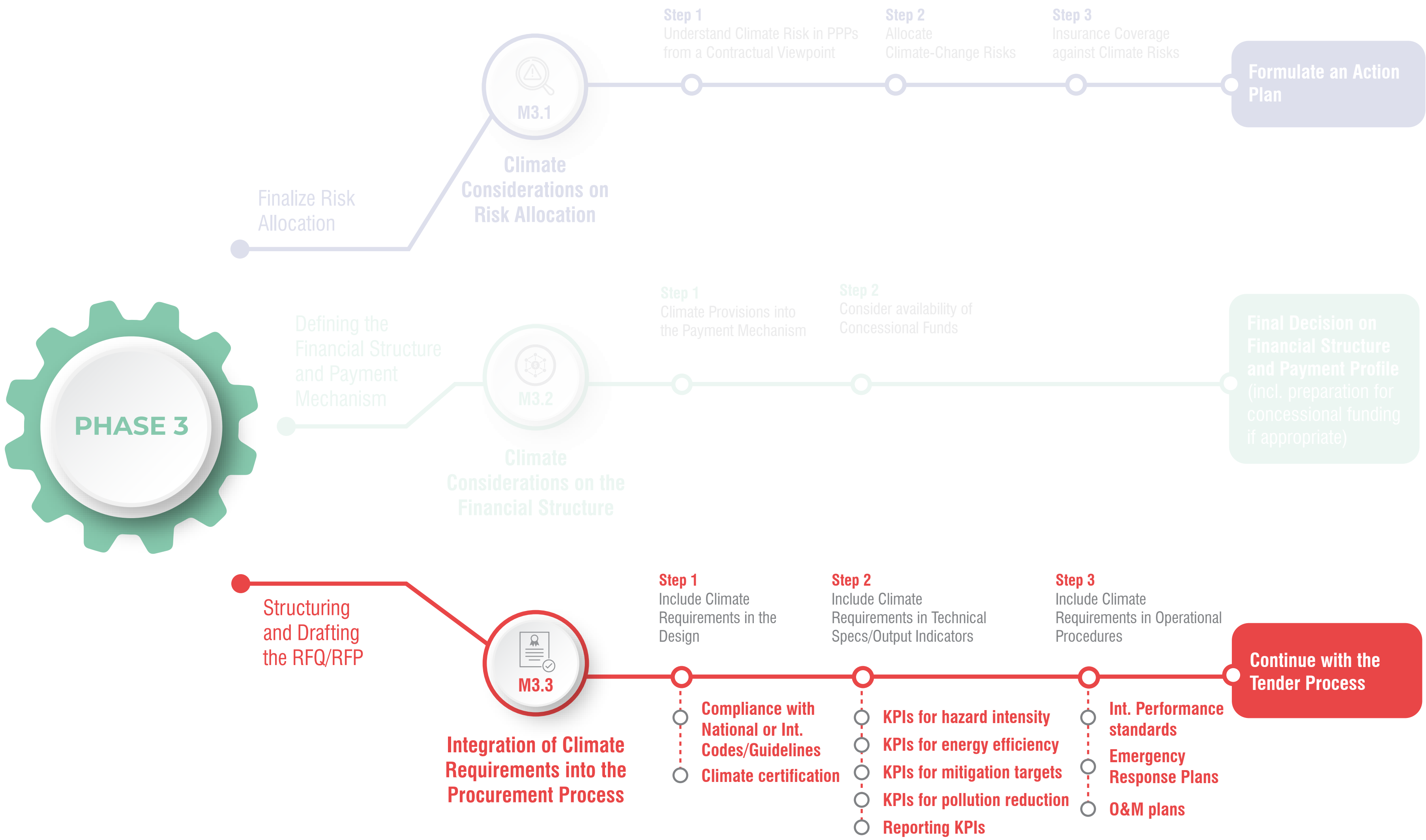
An analysis document based on the consolidated information from E-discussions, regional clinics, and case studies with contributions from over 250 practitioners across Asia-Pacific

Developed by: UNDP, 2012

BLENDING CLIMATE FINANCE THROUGH NATIONAL CLIMATE FUNDS

A guidebook for the design and establishment of national funds to achieve climate change priorities

Developed by: UNDP, 2011


PHASE 3
Finalize Risk Allocation
M3.1
Climate Considerations on Risk Allocation
Step 1
Understand Climate Risk in PPPs from a Contractual Viewpoint
Step 2
Allocate Climate-Change Risks
Step 3
Insurance Coverage against Climate Risks
Formulate an Action Plan
Defining the Financial Structure and Payment Mechanism
M3.2
Climate Considerations on the Financial Structure
Step 1
Climate Provisions into the Payment Mechanism
Step 2
Consider availability of Concessional Funds
Final Decision on Financial Structure and Payment Profile (incl. preparation for concessional funding if appropriate)
Structuring and Drafting the RFQ/RFP
M3.3
Integration of Climate Requirements into the Procurement Process
Step 1
Include Climate Requirements in the Design
Compliance with National or Int. Codes/Guidelines
Climate certification
Step 2
Include Climate Requirements in Technical Specs/Output Indicators
KPIs for hazard intensity
KPIs for energy efficiency
KPIs for mitigation targets
KPIs for pollution reduction
Reporting KPIs
Step 3
Include Climate Requirements in Operational Procedures
Int. Performance standards
Emergency Response Plans
O&M plans
Continue with the Tender Process

3.3 Integration of Climate Requirements into the Procurement Process

Once all assessments are finalized and the financial and risk-sharing structure of the project is decided (and following review by the procuring authority), they should be reflected in the final project documents and the drafting of request for qualifications (RFQs) and request for proposals (RFPs).

The purpose of this module is to facilitate procuring authorities in preparing the relevant documentation of climate-smart PPPs. The latter should also include specific climate objectives to be met during the design, construction, and operation of the project and climate-smart KPIs to measure the achievement of pre-determined climate mitigation/adaptation goals and levels of service.

At this stage, it is also recommended that market sounding is performed to ensure the proposed PPP structure will draw both investor appetite and is bankable. Market sounding has to be managed with transparency and care to allow interested bidders and financial institutions to provide input and set out their concerns on the project's scope and proposed structure.

STRUCTURE OF THE MODULE

The module includes three steps:

- **Step 1** provides an overview of climate considerations included in relevant standards, codes, and guidance documents and discusses available rating systems and frameworks to evaluate the sustainability and resilience of infrastructure projects.
- **Step 2** outlines operational procedures and standards that are essential for combating the effect of climate change during the construction and operation of the infrastructure.
- **Step 3** describes how public authorities can leverage output specifications to incentivize mitigation and adaptation innovations during the project's life-cycle.

01 INCLUDE CLIMATE CONSIDERATIONS IN THE DESIGN

Designing infrastructure to withstand the unknown climate conditions of the future is neither a simple nor a standardized procedure. As explained in detail in Module 2.2, at the design stage, bidders will be requested to assess the impact of climate risks on their project and design adaptation measures that address climate-induced vulnerabilities across a range of climate futures. They may also need to assess whether their projects (and the foreseen construction/operation procedures) will contribute (and to what extent) to GHG reduction. Aiming to perform these tasks in a coherent, reliable, and high-quality manner, it is recommended that all implemented procedures and methodologies will comply with modern climate standards, guidance documents, and rating systems. This will also provide a common ground of reference that will substantially facilitate the review process of the technical proposals by the procuring authority.

Authorities may wish to request in the relevant RFPs that the design will:

- **Comply with climate provisions included in national or international codes/guidelines** (e.g., ISO 14080:2018[1]; International Green Construction Code - IGCC[2]). More documents are expected to be available over the coming years as national governments and international standardization organizations are stepping up efforts to update and strengthen their technical standards to promote climate resilience. According to UNFCCC, five countries (Australia, Canada, Denmark, Germany, and Korea[3]) have already incorporated revisions to their standards. Moreover, two major international standardization organizations, the European Committee for Standardization (CEN, Centre Européen de Normalisation) and International Standards Organization (ISO), are reviewing existing standards to address climate risk better.[4] The CEN is amending and extending the scope of Eurocodes[5] to account for climate change (with a focus on transport and energy infrastructure, as well as building and construction). The ISO is working through its Adaptation Task Force to develop standards for vulnerability assessment, adaptation planning, and adaptation monitoring and evaluation (ISO 14090:2019 on Adaptation to Climate Change).
- **Ensure a minimum climate certification level as prescribed by sustainability rating tools and frameworks.** Highly rated assets/projects are expected to benefit from increased performance, reduced costs, and marketing advantages. Therefore, it is recommended

---

[1] ISO 14080:2018
[2] International Green Construction Code (IGCC)
[3] The Korea Expressway Corporation has strengthened the design requirements for drainage capacity, bridge design, and embankment slopes to prevent potential technical failures stemming from the increased frequency and intensity of projected rainfalls.
[4] OECD, 2014: Environment Policy Paper No 14 – Climate-resilient Infrastructure
[5] Eurocodes: The European Design Codes

that RFPs and tender documents include relevant requirements. Indicative examples include:

- LEED certification (Leadership in Energy and Environmental Design) developed bythe United States Green Building Council (USGBC)[6]: a rating system for green buildings (e.g., hospitals, schools, and data centers). More information on the LEED system is offered in Box 3.9
- EDGE (Excellence in Design for Greater Efficiencies) developed by IFC[7]: a green certification for buildings that demonstrate resource efficiency in energy, water, and embodied energy in materials SuRe (GIB)[8] and Envision (ISI, 2015)[9]: rating systems developed to integrate sustainability and resilience metrics throughout the life-cycle of infrastructure projects. More information on the EDGE system is offered in Box 3.11
- FAST-Infra Sustainable Infrastructure Label developed by the Climate Policy Initiative (CPI) is a globally applicable label for projects demonstrating positive sustainability performance (see Insight 3.5)
- The Resilience Rating System (WBG, 2021)[10]: a methodology for building and tracking resilience of infrastructure projects to climate change
- CEEQUAL (BRE)[11]: evidence-based sustainability assessment, rating, and awards scheme for civil engineering, infrastructure, landscaping, and public realm projects

---

[6] U.S. Green Building Council (USGBC): http://leed.usgbc.org/leed
[7] International Finance Corporation (IFC), EDGE: https://edgebuildings.com/
[8] Global Infrastructure Basel (GIB): https://sure-standard.org/
[9] ISI, 2015: Envision Rating System for Sustainable Infrastructure
[10] WBG, 2021: Resilience Rating System: A methodology for building and tracking resilience to climate change
[11] BRE: https://www.ceequal.com/

BOX 3.10 SUSTAINABLE BUILDINGS: THE LEED RATING SYSTEM

Green building rating systems and programs were introduced in the 1990s to support and promote sustainability within buildings' design, construction, and operation. One of the most globally recognized and currently used green certification systems for buildings is the Leadership in Energy and Environmental Design (LEED) rating system. The LEED certification, developed by the U.S. Green Building Council (USGBC) in 1993, is applicable for the performance management of all building types and phases and neighborhoods, cities, and communities. The LEED rating (LEED v4.1) scores the performance of buildings in energy efficiency, water conservation, site selection, material selection, daylighting, and waste reduction and provides an appropriate certification level; the Platinum, the Gold, the Silver, and the Certified.

A challenging yet successful application example of a LEED-certified building is the World Bank's office in Juba in South Sudan which received the Gold LEED certification back in 2013. Lack of electricity supply at the site location, minimal access to local materials as well as the scarcity of the project's team, and limited local capacity were just some of the aspects composing the challenging environment that the project had to face. Through careful design, detailed planning, and innovative implementations such as passive design for energy conservation, maximum harvest of daylight, solar energy, innovative air conditioning and ventilation systems, extended usage of recycled materials, on-site wastewater treatment and water recycling, enhanced indoor environmental quality and landscaped garden areas and vegetation, the two-story building managed to receive the precious Gold rating and became an inspiring example for sustainable buildings in Central Africa.

Sources:
World Bank, 2013: Feature Story - The World Bank's Country Office in Juba wins Top Environmental Award for Sustainability
Crea, 2014: USGBC article - The little LEED building that could: South Sudan's first LEED-certified building

PHASE 3

M3.3

Integration of Climate Requirements into the Procurement Process

Step 1
Include Climate Considerations in the Design

Step 2
Include Climate Requirements in Technical Specs/Output Indicators

Step 3
Include Climate Requirements in Operational Procedures

BOX 3.11 SUSTAINABLE BUILDINGS: THE EDGE CERTIFICATION SYSTEM

EDGE (Excellence in Design for Greater Efficiencies) is an independent, non-competitive in nature, green building certification that was developed in 2014 by IFC. The main aim of EDGE is to mainstream green buildings and contribute to the fight against climate change while simultaneously helping to boost prosperity through increased building efficiency. The EDGE certification applies only to building projects and is available in more than 170 countries included in the EDGE software. The rating system works on a pass/no pass basis where the project must save 20% or more in each of the three resource activities: energy, water, and materials to be classified as “EDGE certified.” In addition to that, the “EDGE Advanced” buildings need to achieve at least 40% energy savings while the “EDGE zero-net carbon” buildings need to achieve 100% renewables on-site or off-site or purchased carbon offsets to top off at 100%. At the design stage, a preliminary certificate is provided, while the final EDGE certification is granted after completion of the project by an authorized service provider with independent auditing provided by a licensed EDGE Auditor. The EDGE software has also been broadened beyond new buildings to support existing buildings and buildings undergoing renovation by checking their level of saving against a baseline. The certification providers in each country set the pricing for the certification, which is calculated according to the project’s number of buildings, floor area, and type of building.

There are numerous featured EDGE-certified projects that successfully followed the EDGE process. For the Antananarivo International Airport in Madagascar, for example, the predicted project savings reach 33% in energy consumption, 49% in water resources, and 37% in construction materials, while the expected CO2 reduction reaches 393.6 tCO2/year. In this project, various efficient technical solutions were adopted in the design, such as roof insulation systems, water-efficient toilets, medium-weight hollow concrete blocks, and many more. Another successful example is the ALP North logistics park located in north Nairobi, Kenya. By including sustainable roof construction, solar panels and water-efficient facets (among others), the building is predicted to achieve around $16,000 in monthly savings from utility bills. In this project, the predicted savings reach 41% in energy, 52% in water, and 50% in materials, while the expected CO2 reduction is 645 tCO2/year. Solid dense concrete blocks for internal walls, dual flush for water closets, water-efficient landscaping, reduced window to wall ratio reflective paint, and tiles for energy efficiency, are just a few of the innovative solutions that were introduced in the project design.

Sources:
https://edgebuildings.com/
Antananarivo International Airport: https://edgebuildings.com/project-studies/antananarivo-international-airport/
ALP North: https://www.edgebuildings.com/project-studies/alp-north/

02 INCLUDE CLIMATE REQUIREMENTS IN TECHNICAL SPECIFICATION AND OUTPUT INDICATORS (KPIs)

Output specifications should be defined early in the project lifecycle and should be supported by clear and well-managed reporting standards that regulate the supervision processes (between the grantor and the investee) throughout the project life-cycle. By clearly outlining output specifications, the public authorities can take advantage of the expertise and innovation skills of the private sector. A consistent way for the tenderers to monitor and bidders to demonstrate compliance with sustainability and climate-resilient objectives is by measuring the output of key performance indicators (KPIs).[12] KPIs are commonly categorized as physical or operational. Physical KPIs may include physical quantities referring to the hazard (e.g., flood level, temperature, rainfall) or the infrastructure itself (e.g., scouring, drainage blockages, corrosion, IT failures, damage to networks, etc.). Operational KPIs refer to measurable parameters describing the serviceability of the infrastructure (such as traffic, downtime, accessibility, etc.). The exact types and characteristics of KPIs would be infrastructure-specific. However, an indicative high-level list of climate-relevant KPIs for inclusion in the relevant documents should include:

- **KPIs correlating hazard intensity** (described by specific quantitative standards) **with acceptable performance level** (i.e., availability reduction, recovery period, construction delays). When specific hazard metrics are prescribed (e.g., rainfall above a certain level, etc.), it is also common to define (in consultation with the private party) where measurements will take place and whether the measurements will be managed by the public or the private party or a mutually agreed third party (Figure 3.7). It is also important to take into account the interdependencies of infrastructure assets as part of the climate impact may be indirect through interconnection with a grid for example in a power project. The KPIs will need to distinguish direct and indirect impacts and expectations around the ability to get an asset back into operation.

[12] A useful rule when developing output requirements is that they should be SMART— specific, measurable, achievable, realistic, and timely. This is common for both user-pays and availability-based PPPs.

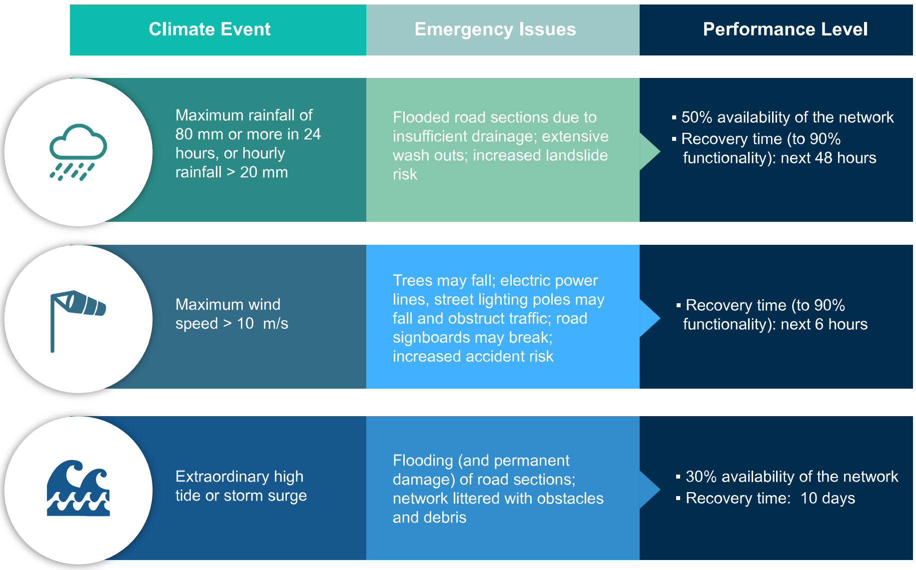


FIGURE 3.7 Example use of KPIs correlating hazard level intensity with the level of service on a fictitious highway system (mm: millimeters, m/s: meters per second)

- **KPIs for measuring energy efficiency/conservation in projects and their associated activities** (typically expressed as reductions relevant to some benchmark consumption). This can serve as an indirect incentive for the private sector to use renewable energy sources and adopt innovative green strategies during construction and operation of otherwise energy-intensive projects (e.g., by the installation of intelligent power distribution systems, new fuel-friendly engines, etc.); see also the example in Insight 3.6.
- **KPIs measuring emissions** (i.e., GHG emissions that are typically expressed as the equivalent of metric tons of CO2 or a percentile reduction thereof[13]). The latter may be produced either by the operations of the infrastructure (and are therefore termed direct) or indirectly from the emissions produced by the supply chain (e.g., purchased electricity). Depending on the project objectives, additional emission metrics may also be relevant (e.g., emission of dust and particles, metal emissions to air, etc.). Tender documents should clearly define the scope of the measurement and the calculation methodology. For example, GHG emissions assessment may be requested to follow accounting standards such as the GHG Protocol.[14]

---

[13] It is recommended that the measurement protocols comply with Environmental Management Systems (i.e., ISO14001, EMAS and BS8555)

[14] WRI & WBCSD's Greenhouse Gas Protocol: https://ghgprotocol.org/

- **KPIs measuring emissions to water/land** (e.g., nutrients and organic pollutants/waste pesticides, etc.). Different KPI targets are foreseen for the construction and the operation period of the PPP.
- **KPIs reporting obligations and inspection rights** (e.g., periodic updates of O&M and emergency response plans that address climate risks).
- **KPIs for usage of resources** (or enhanced usage of resources) expressed in the form of a targeted reduction, which may include activities performed during both the construction and the operation of the infrastructure. For example, usage of secondary and recycled aggregates (e.g., construction and demolition waste) should be prescribed when possible to further reduce the impact on natural resources.

GENDER-SENSITIVE KPIs

Tenderers should encourage the private sector to consider gender-related issues during construction, operation and maintenance of the PPP project. This can be done by including relevant KPIs within the PPP specifications and RFQ/RFP documents, describing the ratio of women/men employed during construction, the target increases in the percentage of local women's employment as a consequence of the project, the benefits of local women/girls from the development of the infrastructure, etc. Gender related KPIs will incentivize the private sector to seriously consider gender equality within the project solution and will help to raise awareness about the issue.

03 INCLUDE CLIMATE REQUIREMENTS IN OPERATIONAL PROCEDURES

The benefit of procuring projects as PPPs is that it enables the contracting authority to maximize VfM by encouraging private operators to exercise their own ideas and efforts and to implement methods for efficient, effective facility construction and project operation. The same way of thinking applies to any operational procedure that may be affected by the changing climate or may affect (positively or negatively) the environment in general, covering a wide spectrum of activities over which the private sector has substantial control—from the overall sustainable business strategy to specific business components such as identification of climate risks and impacts; efficient disaster risk management and emergency response to extreme weather effects; and establishment of preventive maintenance and monitoring protocols.

A procuring authority willing to embed climate considerations in the operational procedures of the project may prescribe a minimum set of **performance standards** while inviting the private sector to include climate risk in their **O&M plans,** and develop innovative **emergency response plans** to be activated when disasters occur. Such requirements should be included in the RFP and RFQ documents and are briefly outlined in the next sections. Prior to issuing these documents, it is advisable to also conduct market soundness testing aiming to investigate the market's appetite for the project and, if necessary, attempt to modify its terms to increase such appetite. A brief guide to such testing is provided in the last section of this step.

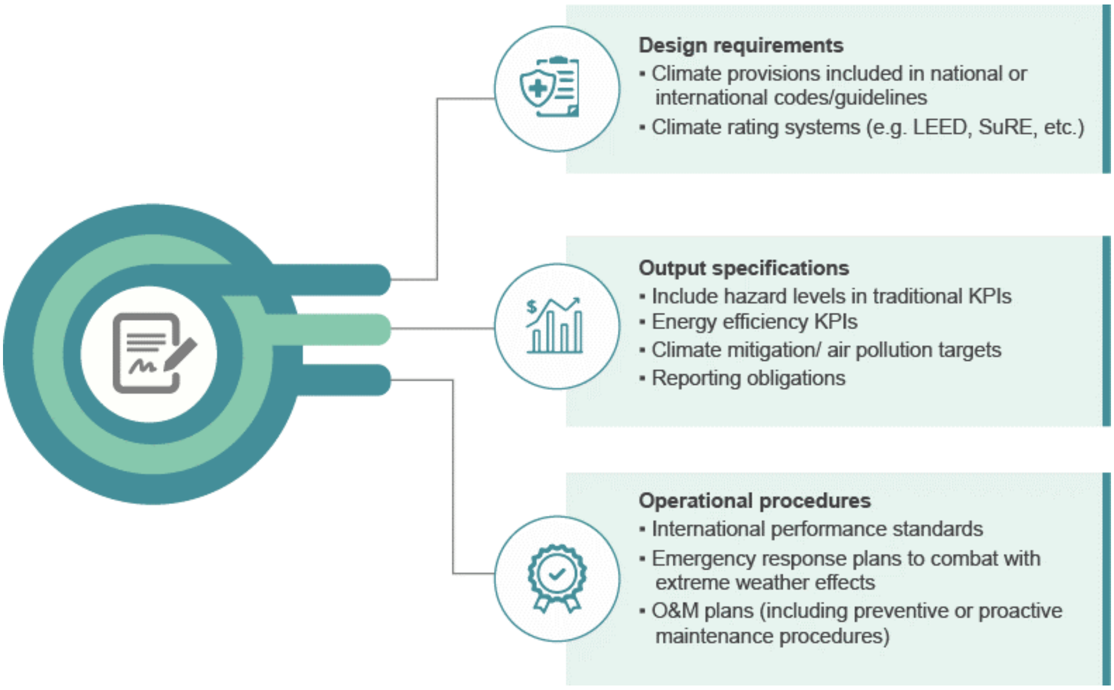


FIGURE 3.8 Key considerations for the procuring authority when preparing the KPIs for operational procedures

PHASE 3

M3.3

Integration of Climate Requirements into the Procurement Process

Step 1
Include Climate Considerations in the Design

Step 2
Include Climate Requirements in Technical Specs/Output Indicators

Step 3
Include Climate Requirements in Operational Procedures

BOX 3.12 CONCESSIONAIRE SCREENING USING DRM EVALUATION CRITERIA IN AIRPORT PPP PROJECTS

Examples of how DRM evaluation criteria can be explicitly incorporated in the bidding process of PPPs are provided below. Both examples refer to major airport projects in Japan: the Kansai International Airport and the Sendai Airport.

Kansai International Airport

For the prequalification of the candidate operators of the Kansai International Airport, positive evaluation points were given to participants that ensured reliable and regular operation of the airport by allocating appropriate resources for DRM methods. In addition, points were given to participants that introduced preventive maintenance and monitoring in a systematic manner that prioritized safe and secure operation of the airport. Points worth up to 10 percent of the total maximum score were added to operators that adopted an appropriate emergency/safety control plan and a business continuity plan.

Sendai Airport

During the prequalification process of the Sendai Airport, positive evaluation points were given to operators that provided a detailed, proactive management DRM plan that would prevent damage and accidents and would allow the project to obtain insurance. Due to the substantial exposure of the location to earthquakes, DRM was a prerequisite in order to obtain project insurance. The winning bidder also included within the proposal a specialized airport operation center that included aviation security, guards, DRM, and facility management that would lead to stable operation of the airport and consequently, provided the bid with additional positive evaluation points.

Source: World Bank, 2017: Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement-The Case of Japan

INTERNATIONAL PERFORMANCE STANDARDS

Public authorities are encouraged to align (and, if necessary, complement their domestic regulations) with any of the well-established international benchmarks for identifying and managing environmental and social risks, irrespective of the financing scheme of the project. This will guarantee a good level of performance in all relevant aspects of the business. Such an example is the IFC Performance Standards (compulsory for IFC-financed activities), including good sustainability practices to improve life-cycle project performance. The standards also provide specific guidance and performance indicators for a number of cross-cutting issues, including climate change, gender, human rights, and water— which may not be thoroughly addressed by domestic regulations.

Characteristic provisions of the IFC-performance standards (relevant to climate-change effects) are listed below:

- Environmental impact assessments should be revisited to include a risk and impact identification process associated with the changing climate and adaptation opportunities. It should also consider the emissions of greenhouse gases in the project area as well as potential transboundary effects (i.e., pollution of air or pollution of international waterways)
- In projects posing potentially significant adverse impacts or where technically complex issues are involved, clients may be required to involve external experts to assist in the risks and impacts identification process
- In high-risk circumstances, it may be appropriate to complement the environmental and social risks and impacts identification process with specific human rights due diligence as relevant to the particular business
- Projects should adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and—where residual impacts remain—compensate/offset for risks and impacts to workers, affected communities, and the environment
- For projects that are expected to produce more than 25,000 tons of CO_2, it is recommended that all emissions (both directly from the facilities owned or controlled within the physical project boundary and indirectly associated with the off-site production of energy used by the project) are properly quantified. Quantification will be conducted by the client annually in accordance with internationally recognized methodologies and good practice[15]
- The private party is expected to implement technically and financially feasible and cost-effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs—with a focus on areas that are considered core business activities. Where benchmarking data are available, the client will make a comparison to establish the relative level of efficiency
- The project shall adopt measures to avoid or reduce water usage (e.g., water conservation measures, use of alternative water supplies, water consumption offsets, etc.)
- Include provisions to avoid the generation of hazardous and non-hazardous waste materials, or at least reduce the generation of waste, and recover and reuse waste in a manner that is safe for human health and the environment

EMERGENCY RESPONSE PLANS (ERPS)

Efficient and effective handling of climate risks (that can neither be transferred nor mitigated) by private operators also improves the project's VfM. Public authorities wishing to leverage the ability, experience, and creativity of the private sector to respond promptly to such disastrous events may use the procurement process (RFPs/RFQs) to incentivize the development of innovative response plans.[16] This step describes methods to motivate private partners to submit ERPs, outlines a minimum set of requirements that a successful ERP should contain, and provides examples of good practices.

---

[15] Estimation methodologies are provided by the Intergovernmental Panel on Climate Change, various international organizations, and relevant host country agencies.

[16] Efforts can be made to strengthen DRP by private operators through monitoring and payment mechanisms.

ERP specifications

- The Emergency Response Plan is a key element for incorporating climate considerations (Figure 3.9) while conforming to existing laws and regulations on public works and the country's disaster risk management standards (federal or local DRM plans).

FIGURE 3.9 Five key principles for the implementation of a robust emergency response plan

- The ERP should consider gender gaps and aim to address gender inequalities that may occur during an emergency

- Depending on the in-country procurement procedures and the specific project objectives and risk profile, different conditions may apply to develop the ERP. For example, the ERP may be:
  - (i) the sole responsibility of the government (i.e., in case the government has already a strong disaster risk management plan, or if it does not wish to complicate the transaction process)
  - (ii) the sole responsibility of the private sector (i.e., when the government believes that the private sector can offer significant creativity)
  - (iii) a shared responsibility between parties

- Moreover, the submission of the ERP by the private sector may either be requested during the procurement phase (in order to be evaluated[17]) or after the selection of the preferred bidder
- The level of involvement and responsibilities of the private party should be clearly defined and mutually accepted by both parties in the contract. Before permanent commitments are made, the public authority should adequately communicate the level of risk (for which the private party will be responsible) to ensure that the appropriate measures and investments will be activated
- It is equally important that the envisaged level of service is reasonable and based on communication between the contracting authority and private entities (i.e., during competitive dialogues and Q&A sessions of the procurement stage). Setting too high specifications may act as a barrier for the private sector's participation (because of the increased cost implications), leading eventually to the deterioration of the project's attractiveness

MONITORING PERFORMANCE

The contracting authority should be responsible for monitoring the implementation of the disaster plans. In case the monitoring indicates that services are not at the level agreed (as outlined in the proposals submitted by the private operators), penalties may be enforced (e.g., reduction in the availability payment) to encourage better conforming with the agreed service level. (See also the example in Box 3.12.)

[17] Refer to Module 4.2 for details on the evaluation of the ERPs.

BOX 3.13 THE ROLE OF EMERGENCY RESPONSE PLANS IN AVAILABILITY-BASED PPPS

Monitoring and evaluation mechanisms are set up to record and verify that the predetermined and planned actions related to public services during or after a disaster have been performed by the private operator and have met the required quality standards and levels agreed between the public and private party. In cases where services are not adequately provided, the public entity may proceed with an availability payment reduction. Availability payment reductions methods may be applied either directly when obligations are not met or through penalty point systems where the availability payment is reduced after reaching a specific level of points and/or a recovery point system based on which the private operator is rewarded when delivering higher quality services. In a PPP contract, not only the minimum obligations and level of performance should be described, but also the procedures for improvement and further development for the cases that the default obligations are ascertained. Such procedures may be clearly defined but shall encompass adequate freedom to respect the independence, originality, and ingenuity of private entities.

An example that demonstrates the applicability of such provisions in practice is the School Meal Supply Center at Sendai, which was restored more than two months faster than other similar facilities that were operated by public authorities. This achievement was made possible due to the independent actions and initiatives of the private operator that had the motivation (availability payment reduction) and the flexibility (following its own supply network) to act and perform while bypassing time-consuming administrative procedures that the equivalent public operators had to face and along with the other affected infrastructure that they had to manage at the same time causing extra delays for the publicly operated facilities.

Source:
World Bank, 2017: Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement-The Case of Japan

OPERATION AND MAINTENANCE (O&M) PLANS

While the emergency response plans deal with the acute weather events exacerbated by climate change, there is also a need to effectively manage the chronic exposure of infrastructure to the gradually increasing temperatures and precipitation levels. Although not responsible for disastrous incidents, the latter directly impact the aging process of construction materials (e.g., steel, concrete, asphalt, etc.), resulting in increased O&M expenses. If not promptly addressed, the aging of materials may also trigger high-impact events (e.g., accidents or extensive rehabilitation).

These changing trends introduce the need for tender documents requesting modernized O&M plans that incorporate: (i) preventive or proactive maintenance procedures (Box 3.14); (ii) dynamic planning and timing of the maintenance protocols to keep pace with the increased needs; (iii) wide sensing and monitoring systems to measure the performance of KPIs and update maintenance strategies if needed. Insight 3.7 provides an exciting overview of how climate change is transforming infrastructure maintenance approaches.

CHRONIC CLIMATE IMPACTS ON ROADS

Studies demonstrate that U.S. roads may experience accelerated rutting, cracking, and erosion of their pavements (due to changing weather conditions), and this increase in the deterioration pattern is estimated to cost $2.8 billion in adaptation costs in 2050 relative to 2010 expenses. (Chinowsky et al., 2013).[18]

BOX 3.14 PREVENTIVE MAINTENANCE EXAMPLES IN PPP CONTRACTS

Example 1

Japanese Railways (JR), Japan: Extreme heat can cause railroad tracks to buckle, as heat causes steel to expand, putting stress on ties, ballasts, and rail anchors that keep the tracks fixed to the ground. To achieve zero accidents due to track buckling, JR has raised the standard for estimated maximum performance temperature of its railroads from 60°C to 65°C to guide future investments. JR has also developed maintenance vehicles that detect potential joint openings.

Example 2

Attica Tollway (Attiki Odos), Greece: Located in the greater Athens area, Attiki Odos is one of the most modern roadways in Greece and has been constructed by incorporating resilience and adaptation measures to climate-related hazards. The managing company adopts effective climate change adaptation measures against the potential asphalt melting, thermal expansion of bridge joints, landslides, and structural damage that are projected due to climate alterations within the area of the motorway. Preventive maintenance currently includes pavement maintenance, installation, and operation of environmental (e.g., meteorological) monitoring stations and proactive management. Meteorological stations are installed along the motorway network and provide real-time data on weather conditions, environmental conditions, and keep a record of extreme events. Therefore, the condition and current state of the roadway is evaluated regularly, especially after an extreme event (e.g., flood, earthquake, etc.). The overarching goal is to develop a climate-change resilient road through preventive maintenance and retrofitting of structural components and equipment at an early stage that will minimize the plausible detrimental effects of the projected climate change futures.

Sources:

OECD, 2014: Environment Policy Paper No 14 – Climate-resilient Infrastructure

European Commission, 2018: Climate change adaptation of major infrastructure projects

[18] Chinowsky et al., 2013: Assessment of Climate Change Adaptation costs for the U.S. road network, Global Environmental Change

MARKET SOUNDING

Climate-smart PPPs constitute a relatively new type of investment that naturally comes with both risks and opportunities. It is strongly recommended to clearly communicate this to potential investors and financial institutions prior to the tendering phase when more data is available (making sure that there is still some flexibility in the procurement process to allow updating some of the terms of the project based on the feedback received).

Climate considerations in the market sounding would not alter the regular format of the process. Hence, it is expected that the exercise could include meetings with companies, contractors, investors, banks, etc., either in person or in writing. The scope of these meetings would be to present the project structure, potentially even draft RFQs and RFPs, capture the market reactions, test investment appetite, and ensure bankability of the project.

It is necessary to ensure that the climate-risk landscape is communicated while at the same time stressing the fact that innovation in adaptation and resilience is not only sought for but would also be incentivized using all means that would have been identified as applicable. Similarly, it is essential to focus on the importance of climate mitigation through positive messaging. References to innovative financing mechanisms would enable tapping into additional financing options. Throughout this exercise, it is important to understand and efficiently communicate to the stakeholders the changing global landscape that favors green investments—moving away from traditional GHG-emitting infrastructure.

If successfully executed, this exercise will have the dual impact of raising the market's awareness and appetite for the project while at the same time informing the procuring authority about potential blind spots in the intended tender process that need to be revisited.

KEY TAKEAWAYS

- Aiming to include climate requirements in the design of a PPP, authorities may request in the RFP that the design complies with climate provisions included in national or international codes/guidelines (e.g., ISO 14080:2018; International Green Construction Code - IGCC). Additional international standards and documents that will help in mainstreaming climate adaptation and mitigation within the design process are expected to become publicly available soon.

- It is proposed that the project technical characteristics comply with sustainability rating tools and frameworks (e.g., LEED, EDGE, SuRe, etc.), that will add value to the project due to marketing advantages and provide benefits from increased performance and cost minimization.

- Climate relevant key performance indicators (KPIs) need to be included in the technical specifications of the project, providing a clear output of the project's performance during its life-cycle.

- The procuring authority may require the embedding of climate requirements in the operational procedures of the project by including them within the RFP and RFQ documents. As such, it is proposed that bidders include climate risk in their O&M plans as well as emergency response plans.

INSIGHTS

Insight #3.5

Sustainable Infrastructure Frameworks

Insight #3.6

Energy-Efficiency and Sustainability Practices in Modern Port Facilities

Insight #3.7

How Climate Change is Transforming Infrastructure Maintenance Approaches

INSIGHT #3.5

SUSTAINABLE INFRASTRUCTURE FRAMEWORKS AND TAXONOMIES

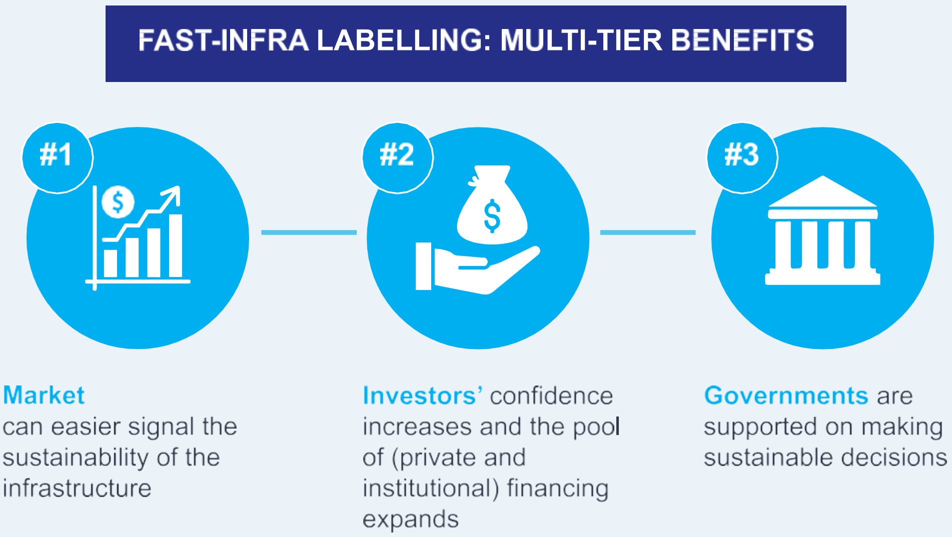
► FAST-Infra: a tool to label sustainable infrastructure assets and enhance their bankability

BACKGROUND

FAST-Infra, the "Finance to Accelerate the Sustainable Transition-Infrastructure" initiative, aims to close the trillion-dollar sustainable infrastructure investment gap, with urgency, by transforming sustainable infrastructure into a mainstream, liquid asset class. The platform proposes practical and inclusive solutions while embedding sustainability across the life-cycle of projects and expanding the pipeline of bankable projects. FAST-Infra is also working on four market mechanisms with the potential to mobilize private capital.

SOLUTION

FAST-Infra proposes to establish a consistent, globally applicable labeling system for sustainable infrastructure assets. Such a system will allow the market to easily signal the sustainability of the asset. Investors can trust that their money is going to projects that meet environmental, social, resiliency, and governance needs and contribute to the SDGs. A sustainable infrastructure label will also ensure that governments and project developers embed high environmental, social, governance, and resiliency standards into new infrastructure at the design and pre-construction phases, on the grounds that only assets incorporating such standards will obtain the label. The label will also attract private finance at the construction stage and new institutional investors at the post-construction phase. Alongside the labeling work, FAST-Infra is developing financial mechanisms to mobilize private investment at scale for the financing of labeled projects.



Sources:
World Bank | PPLRC | FAST-Infra website (last visited 30.07.2021)
Climate Policy Initiative | FAST-Infra website (last visited 30.07.2021)

INSIGHT #3.5

▶SuRe: a global infrastructure standard for sustainability and resilience

The Standard for Sustainable and Resilient Infrastructure (SuRe) – developed by the Global Infrastructure Basel Foundation (GIB), introduced at COP21 in 2015 and officially launched as certifiable at COP23 in 2017 – is a voluntary global standard applicable to new (greenfield) or existing (brownfield) infrastructure projects that wish to be certified for their performance in sustainability and resilience through 61 environmental, social, and governance (ESG) criteria, clustered in 14 themes. The SuRe standard has been developed with the purpose to contribute to the objectives of international frameworks (SDGs, UNFCCC, Sendai framework, UN Universal Declaration on Human Rights, and many others) and to complement the Equator Principles (see Box 2.13) by serving as a guide for the development of infrastructure that is environmentally sound, socially inclusive, economically viable, and able to withstand impacts and recover quickly from shocks and stresses.

Public offices, project developers, as well as infrastructure investors and financiers may follow the SuRe standard and benefit from the acquisition of the certification for their infrastructure projects through a 7-step process. The certification assessment is possible at any project phase (i.e., planning and design, construction, commissioning, operation, upgrade) and is verified through audits by third-party, independent, accredited bodies. Annual surveillance audits are carried out after the initial certification. The duration of the validity of the certification is five years, while recertification may be applied in the fourth year. The SuRe standard describes certain minimum requirements for gaining the prestigious certification and distinguishes three performance levels based on specific thresholds of the overall points: Bronze (>60%), Silver (>75%), Gold (>90%). The current publicly available latest version of the SuRe standard is ST01 Version 1.1. However, **Version 2.0** is expected to be released soon. A simplified version of the SuRe goes by the name of Smartscan, built as a self-assessment tool suitable for projects that are planning to be certified in the future and wish to be evaluated in advance.

Source: https://sure-standard.org/

INSIGHT #3.6

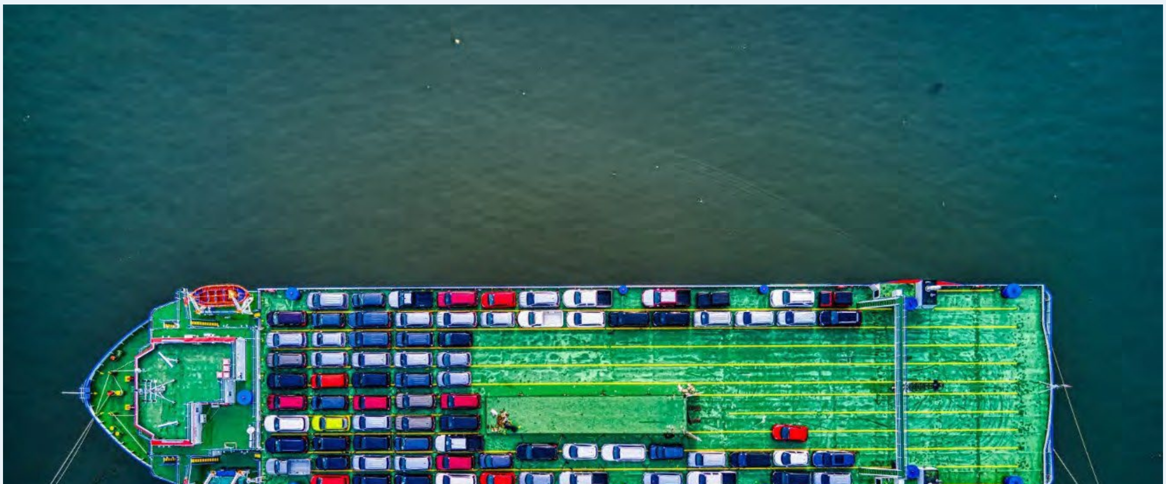
EXAMPLE: ENERGY-EFFICIENCY AND SUSTAINABILITY PRACTICES IN MODERN PORT FACILITIES

▶ A new era for ports

Ports are undoubtedly a major gear of the global economy as they mobilize numerous business lines and workforces in various fields (transportation, cargo distribution, logistics, tourism, etc.) and create significant economic and social value. The evolution of ports throughout history has led to the transformation of modern ports into international and local hubs of multiple business activities with complex interactions and interlinks. Due to this concentrated activity, ports have always been responsible for a significant amount of greenhouse gas emissions that accelerate climate change. At the same time, though, and dueto their location, ports are directly experiencing the effects of extreme weather events or longer-term climate impacts caused by climate change. Modern port facilities need to contribute not only to making the port industry cleaner in order to combat climate change but also to protect all business activities and infrastructure from all acute and chronic risks linked to climate change. Following the international trends in responsible development, there is significant progress in technological port advancements and port facilities and operations developments towards energy efficiency, sustainability, resilience, and environmental soundness.

In support of this vision, the World Ports Sustainability Program (WPSP), launched in 2018 by the International Association of Ports and Harbors (IAPH), is mandated to enhance and coordinate the sustainability efforts of the global port stage. The program is directly linked to the UN's 17 SDGs by covering potential topics within five major themes (resilient infrastructure, climate and energy, community outreach and port city dialogue, safety and security, governance and ethics). WPSP provides active sharing of knowledgevia a global online library of best practices, a portal for sustainable port-related projects and initiatives, and a think-tank platform that aims to connect and inspire international and national port community actors. WPSP also reports on the global sustainability progress within the port and maritime sector (World Ports Sustainability Report 2020).

Sources:
Imam, 2019: Climate Change Impact for Bridges Subjected to Scour and Corrosion, Climate Adaptation Engineering, Elsevier
Nasr, Kjellström, Björnsson, Honfi, Ivanov, Johansson, 2020: Bridges in a changing climate: a study of the potential impacts of climate change on bridges and their possible adaptations, Structure and Infrastructure Engineering
United Nations, 2018: The World's Cities in 2018



INSIGHT #3.6

The Port of Rotterdam, Netherlands

The Port of Rotterdam, Europe's largest seaport, is an example of sustainable port development and clean transition realization. The port has already implemented and is continuously planning and researching many innovative applications for its infrastructure assets and operational activities. Numerous projects, such as the Heat Alliance that distributes residual port heat to greenhouses, local industries and households or the four blockchain prototytpes of Blocklab for heat supply administration, wind energy pricing, energy data exchange, and smart electricity meters, contribute towards building a sustainable port and set the path towards the ambitious target of building a 100% green port cluster.

►Sustainable Practices in Port Facilities

- Smart flood risk management strategies
- Air quality improvements
- Emissions monitoring and management (e.g., through carbon capture and storage in empty gas fields)
- Application of circular economy principles
- Incentives for clean shipping (e.g., discounts for clean ships or bans of ships not complying with international environmental standards)
- Protection/ recovery of biodiversity at the port and the surrounding nature
- Wind and solar power production at the port area
- Wide usage of LED lighting and eco-friendly land transportation (electric or hydropower cars, public buses, and industrial trucks)

Sources:

Woetzel et al., 2020: Will infrastructure bend or break under climate stress?

Shtayat, Moridpour, Best, Shroff, Raol, 2020: A review of monitoring systems of pavement condition in paved and unpaved roads. Journal of Traffic and Transportation Engineering https://doi.org/10.1016/j.jtte.2020.03.004

INSIGHT #3.7

HOW CLIMATE CHANGE IS TRANSFORMING INFRASTRUCTURE MAINTENANCE APPROACHES

The challenge

Climate change is a substantial factor of infrastructure material deterioration, while long- term changes in climatic conditions might lead to an increased rate of corrosion of materials, including concrete, steel, and asphalt. Regions currently experiencing freeze-thaw cycles mayexperience fewer cycles in the future, and regions currently experiencing deep seasonal or even permafrost conditions may experience thawing. Variation of the average temperature, a rise of precipitation and relative humidity, as well as air pollution and higher carbon concentrations in the atmosphere are already predicted by the scientific community and their potential impact on material deterioration has been evaluated by various researchers (Imam, 2019; Nasr et al., 2020; Yoon et al., 2007). At the same time, the rapid expansion of urbanized regions is unavoidably followed by the need to enlarge the capacity and resilience of existing infrastructure (the population of people in urbanized regions will rise from 55% now to nearly 68% in 2050, United Nations, 2018) at a time when the world strives to secure infrastructure maintenance funding. The future of our infrastructure appears to be uncertain, and societies must act immediately to avoid unforeseen financial oreven human loss.

The opportunity

To this end, climate-resilience and adaptation have the potential to increase asset life and reliability of services and consequently protect asset returns. Apart from undertaking structural retrofitting measures that directly increase the capacity of the infrastructure system, climate resilience may involve preventive maintenance and monitoring techniques that could potentially reduce the vulnerability of structural components and enhance their defenses against plausible pessimistic climate-change scenarios. These measures may comprise a package of simple management (non- structural) decisions, such as modification of maintenance schedules to adjust to changing circumstances over the asset's life-cycle and inclusion of adaptive management that considers climate change uncertainty. Another methodology is the introduction of structural health monitoring and detection technologies that aim to identify potential faults in infrastructure and, as such, prevent deterioration at an early stage. Those technologies include systems that can detect cracks along with infrastructure networks (highway pavements, railway networks) and sensors to identify whether a structural system (e.g., a bridge) has developed increased vulnerabilities.

The Role of Technology

As technology becomes more accessible and advanced analytics are introduced in decision making processes, sensors that measure key climate change metrics may be introduced at the location of the infrastructure. By collecting such data from several locations of the infrastructure (e.g., measurements of humidity, temperature variation, precipitation etc.) deterioration prediction algorithms may be used that will provide an estimation of structural health decay within the time domain, considering the effects of climate change. Preparing for climate change at this stage can avoid the need for costly rehabilitation and reduce the risk of infrastructure components becoming prematurely obsolete.

INSIGHT #3.7

Wide Sensing

Install sensors to measure key environmental/climatic data (e.g., humidity, temperature variation, precipitation levels, carbon dioxide concentration, chloride concentration, etc.) that may be used for structural deterioration predictions

Infrastructure Health Monitoring (IHM)

Measure structural response and deterioration rate to enable effective asset management and prioritize maintenance strategies. Measuring methodologies include crack detection sensors, steel corrosion measurements, accelerometers, wireless sensors, thermal sensors, optical fiber sensors, strain gauge sensors, etc.

UAV technologies

Complement in-person maintenance and traditional datacollection with frequent, low-cost, high-performance UAVinspections supported by digital image processing (DIP) applications

Increased frequency of traditional inspections

Early detection of signs of structural deterioration to avoid increased replacement rehabilitation in the long run

MODULE 3.3 Resources

[SUSTAINABLE INFRASTRUCTURE TOOL NAVIGATOR]

Navigation to 90+ rating systems, high-level principles, and guidelines. By developing this tool, GIZ's Emerging Markets Sustainability Dialogues (EMSD) aim to bring clarity to the infrastructure sustainability arena and thereby increase uptake of innovative infrastructure solutions that meet sustainability principles

Developed by: GIZ

[EDGE GREEN-BUILDING CERTIFICATION SYSTEM – THE EDGE APPLICATION]

A free online tool to assist in designing resource-efficient and zero-carbon buildings. EDGE includes a cloud-based platform to calculate the cost of going green and utility savings. The state-of-the-art engine has a sophisticated set of city-based climate and cost data, consumption patterns, and algorithms for predicting the most accurate performance results. (More details on EDGE certification system: https://edgebuildings.com/)

Developed by: IFC, 2015

[GREENHOUSE GAS PROTOCOL]

GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains, and mitigation actions. GHG Protocol includes multiple calculation tools

Developed by: WRI & WBCSD

Module 3.3 - Further Reading

[REFERENCE GUIDE ON OUTPUT SPECIFICATIONS FOR QUALITY INFRASTRUCTURE]

Practical guidance with a focus on PPPs and other long-term contracts

Developed by: Global Infrastructure Hub, 2019

[PPP KNOWLEDGE LAB | PERFORMANCE REQUIREMENTS]

The PPP Knowledge Lab brings together the most relevant and authoritative resources on PPP in one location to empower governments and their advisors to design and deliver best-in-class infrastructure projects. The Performance Requirements section provides information on what is expected from the private party in terms of the quality and quantity of the assets and services to be provided.

Developed by: World Bank Group

RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS (PPPS): CONTRACTS AND PROCUREMENT – THE CASE OF JAPAN

A guide harnessing the knowledge and expertise gained from PPP projects in selected countries to help the governments of low- and middle-income countries to prepare and structure disaster-resilient infrastructure PPPs.

Developed by: World Bank Tokyo Disaster Risk Management Hub, GIF, GFDRR, 2017

RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS (PPPS): CONTRACT AND PROCUREMENT– THE CASE OF INDIA

This country brief gives an overview of the availability of insurance for PPP projects in the context of climate change in India, a country that is a key PPP implementer across infrastructure sectors. India's experience in PPP projects affected by natural hazards offers insights and lessons on how disaster and climate risks can be managed under PPPs in emerging markets and developing economies.

Developed by: World Bank Tokyo Disaster Risk Management Hub, GIF, GFDRR, 2018

TECHNICAL BRIEF ON RESILIENT INFRASTRUCTURE PUBLIC-PRIVATE PARTNERSHIPS: POLICY, CONTRACTING, AND FINANCE

This technical brief highlights key considerations and good practices for structuring resilient infrastructure PPPs through Policy and Legislation; Contracting and Disaster Risk Allocation; Procurement, Monitoring, and Payment; and Insurance. The brief was developed based on country case studies on Japan, India, and Kenya, as well as a literature review.

Developed by: World Bank, 2019

PPPLRC CLIMATE-SMART PPPS WEBSITE

This section of the PPPLRC website provides links to policies, legislation, project documents, and other resources that are relevant for developing, structuring, and implementing climate-smart PPP projects.

Developed by: PPPLRC, World Bank

PHASE 4


1
PROJECT SELECTION
2
PREPARATION
3
STRUCTURING CONSIDERATIONS
4
TENDER PROCESS
Structure and draft RFQ/ RFP
Launch the tender
Evaluate bidders
Award the contract

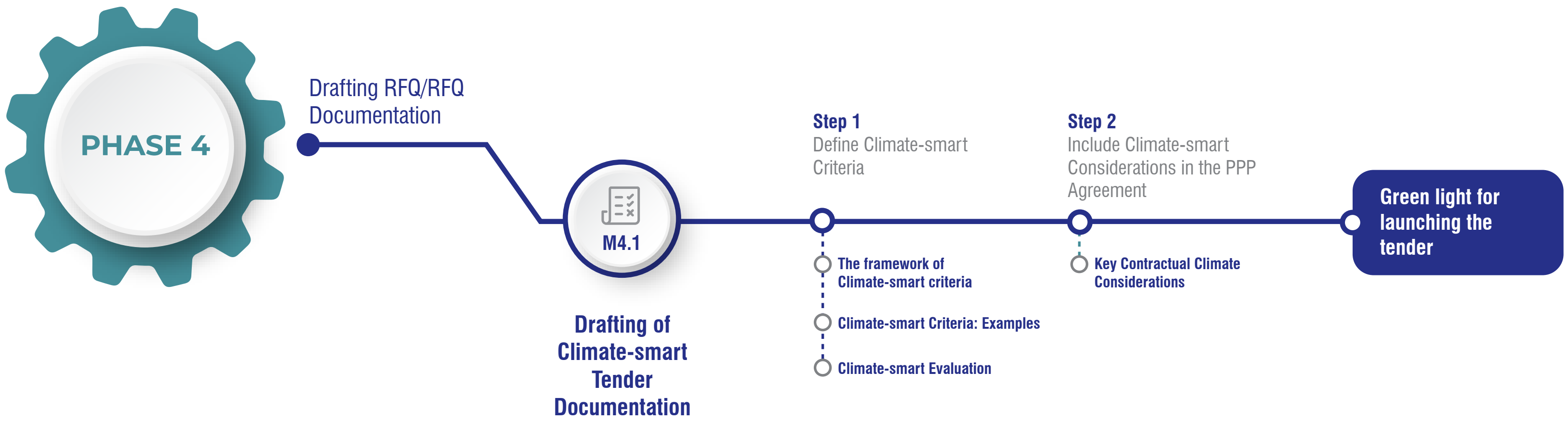
Phase 4

This phase covers the period from the completion of project structuring (where the fundamental design/performance specifications and the financial and risk structure of the project have been decided) to the official launch of the tender. This essentially includes:

(i) designing/drafting the RFP and RFQ. That is, specifying a set of climate-related qualification/evaluation criteria for the bidders that are consistent with the characteristics of the project. It also includes the structuring and designing of a clear and transparent RFP package that outlines proposal requirements and informs bidders on the climate aspects of the tender/selection process and timing.

(ii) drafting of the contract, detailing in a clear and enforceable manner the role of the public and private parties and key climate-related provisions (output of Phase 3).

The scope of Phase 4 is to support users include elements and procedures applicable to climate-smart PPPs in the drafting of the tender documents.


PHASE 4
Drafting RFQ/RFQ Documentation
M4.1
Drafting of Climate-smart Tender Documentation
Step 1
Define Climate-smart Criteria
The framework of Climate-smart criteria
Climate-smart Criteria: Examples
Climate-smart Evaluation
Step 2
Include Climate-smart Considerations in the PPP Agreement
Key Contractual Climate Considerations
Green light for launching the tender

4.1 Drafting of Climate-smart Tender Documentation

STRUCTURE OF THE MODULE

Phase 4 comprises a single **Module 4.1** '**Drafting of Climate-smart Tender Documentation'**, which is broken down into the following steps:

- **Step 1** aims to integrate 'climate-smart' criteria and processes into the preparation of the RFQ and RFP documentation.
- **Step 2** summarizes some key climate considerations/ components (described in detail in the previous Phases of this toolkit) to be included in the contract draft.

01 DEFINE CLIMATE-SMART CRITERIA FOR THE RFQ/RFP

Regardless of the precise outline of the tender process, and whether the RFQ will be a separate phase or integrated within the RFP, the definition of clear qualification/evaluation criteria is essential for the selection of high-quality bidders. Due to the diversity of partnerships, it is challenging to identify criteria that can be universally applied across the range of climate-smart PPPs. Instead, the focus of this step is to describe a generic framework that will assist procuring authorities in defining their own sets of criteria that pertain to the complexity and nature of each project. This step also provides climate-smart examples and discusses different evaluation processes.

THE FRAMEWORK OF CLIMATE-SMART CRITERIA

Climate-smart criteria shall be used to evaluate the technical capability of the private party to deliver high-quality infrastructure that is designed, built, and operated in a way that anticipates, prepares for, and adapts to changing climate conditions while promoting the transition to a decarbonization pathway. As with traditional qualification/evaluation criteria, climate-smart criteria are also project-specific and should be decided when the project structure is finalized, and the project scope and associated risks are well understood. The climate-smart criteria should reflect and be compatible with:

- the **design standards** of the project (described in Module 3.3 - Step 1). The proposed design must be consistent with relevant standards, and bidders should be able to provide evidence of technical competence in assessing the impact of climate risks and designing adaptation measures while implementing the standards and methodologies described in the project agreement. Depending on the format of the PPP (i.e., whether a preliminary technical design is requested in the bidding process), the design's quality and innovation may also be evaluated. In such cases, it is recommended that the evaluation considers how the design improves the project's climate resilience and the methodology's environmental footprint (i.e., LCA of the use of natural resources, raw materials extraction, etc.)
- the **operational standards** of the project (described in Module 3.3 - Step 3). Bidders will be requested to propose an adequate design and provide evidence of previous or ongoing experience in operating/maintaining similar infrastructure (in terms of size, technical features, complexity, and volume/number of users). In line with the operational specifications described in Module 3.3, bidders should demonstrate:

i) experience in managing climate, environmental and social risks following international standards (including GHG emissions calculations, implementation of 'mitigation hierarchy' protocols in construction and operational processes; energy-efficiency practices; conservation of natural resources and reduced generation of waste) – see examples in Box 4.1

ii) previous or ongoing experience in implementing modern operation and maintenance procedures (incl. state-of-the-art preventive maintenance protocols). Submission of (preliminary) O&M plans may also be requested to assist the evaluation of bidders.

BOX 4.1 EXAMPLE OF INCLUDING LOW-CARBON INCENTIVES IN THE PROCUREMENT PROCESS

Port Facility in Timor Leste

The Tibar Bay port is one of the most significant private investments in Timor Leste and the country's first PPP project. The project was designed as a world-class container terminal port encompassing several sustainable and energy-efficiency strategies such as: developing the Port to avoid/minimize the loss of blue carbon sinks (mangroves, seagrasses, and salt flats); incorporating best-practice energy efficiency solutions for lighting, buildings, and facilities; using renewable energy to supply at least part of the Port's electricity needs (e.g., solar photovoltaic panels and solar water heaters mounted on Port buildings); and requiring all ships using the Port to comply with MARPOL (International Convention for the Prevention of Pollution from Ships) Annex VI.

Source:

Republica Democratica de Timor-Leste, 2013: Tibar Bay Port Summary of Environment and Social Scoping Study

- **technical/construction standards** (described in Module 3.3 - Step 1). Bidders may be requested to provide evidence of past or ongoing experience in constructing projects of a similar scale (in terms of size and complexity), having similar climate-resilient and/or green characteristics. For example, this could include demonstrating experience in sustainable building practices or expertise on green building rating systems (e.g., LEED, EDGE).
- the **overall project risk profile**. Bidders will be requested to demonstrate a specific strategy, including tools, processes, and policies, to manage and address the most prominent climate risks identified in the structure of the project (outlined in Module 3.1 - Step 2). These may include:

  (i) Construction experience in dealing with problematic site conditions that are particular to the project under consideration (e.g., specialized excavation techniques; ground-stabilization techniques)

  (ii) Procedures for dealing with environmental risks (e.g., projects with pre-existing pollution conditions or in proximity to environmentally protected areas requiring sensitive and skilled management, etc.)

  (iii) Experience in designing and implementing emergency response plans for the efficient management of extreme-climate events supported by a good track record in relevant circumstances (i.e., similar in scale projects impacted by the same kind and intensity of weather events) – see example in Box 4.2.

  (iv) Methods for designing projects in a gender-responsive manner that may create positive changes in women's lives. In the case of projects delivered in regions with identified gender inequalities that the impacts of climate change may further exacerbate, it is good to request a draft gender action plan (to be evaluated during bidding).

  (v) Access to insurance mechanisms or other financial instruments to provide coverage in case of extreme events that may disrupt operations and impact in any way the availability of the asset. Although it is not necessary to sort out insurance until contract signature, it is considered good practice to request evidence of the policies/insurance being available.

- the **output specifications** of the project (as described in Module 3.1 - Step 2). Bidders will be requested to propose methods and practices to achieve a particular performance level of the infrastructure when facing a climate event of pre-determined intensity. The procuring authority should then assess whether the means and methods proposed by bidders are realistic and sufficient to meet the expectations. Any relevant innovation that may improve performance further may be positively evaluated and encouraged through incentives. There will of course need to be a balance between innovation and bankability that will have to be explored.

RIGHT BALANCE OF CLIMATE CRITERIA

Procuring authorities need to be mindful of the fact that introducing too many specifications may function as a disincentive for more bidders (perhaps including local firms) to participate in the tender. It is therefore recommended that such requirements are optimized so as not to threaten the competitive process. One approach would be to differentiate between essential needs and desired ones (that would add value to the bidder but would not remove marks if absent).

BOX 4.2 PRIVATE OPERATOR EVALUATION CRITERIA ON DRM FROM JAPANESE PPP PROJECTS

In the **Sendai School Meal Supply Center Project**, the bidding documents emphasized and explicitly evaluated (1) the capacity of the bidder to ensure the structural and non-structural competence of the facility; (2) the comprehensiveness of the maintenance system and recovery plans.

In the **Aichi Toll Road Project**, the emphasis was placed on the Crisis Management Plan and particularly on the feasibility of the communication systems and the capacity of the plan to effectively address climate incidents (e.g., snowfall, torrential rain, etc.)

Kansai International Airport

In the **Kansai International Airport**, private operators that allocated sufficient funding for DRM and presented business continuity plans were positively evaluated. Additional points were given to bidders that proposed maintenance and renovation investment in a preventive and systematic manner.

Source:
The World Bank (2017): Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement, The case of Japan

CLIMATE-SMART CRITERIA: EXAMPLES

In line with the definition and the purpose of climate-smart infrastructure, the criteria provided below would be able to nuance the technical capacity of the private party to deliver structures and services sustainably, to promote climate-resilience of and through the project, and to integrate climate-related technological innovations in a meaningful and forward-thinking way. Evaluation should also consider the bidding team's qualifications and the engagement of external experts in performing complex due-diligence studies requested by the RFP. A schematic view of the five principles of climate-smart evaluation is depicted in Figure 4.1.

The traditional evaluation[1] process divides the criteria into three broad categories: construction, operation and maintenance, and environmental and social aspects. An indicative list of climate-smart qualification/evaluation criteria pertinent to the above categories is providedin Tables 4.1 - 4.3.

FIGURE 4.1 Criteria to be considered by the procuring authority when evaluating proposals (ESMP: Environmental and Social Management Plan)

[1] Although there is no universal approach for the organization of the criteria, it is customary to bundle criteria into several broader categories and assign a specific weighting factor to reflecting their relative importance in the total score.

TABLE 4.1 Indicative climate-smart criteria and sub-criteria for evaluating the quality of the design and the construction procedures. The list is meant to be indicative and provide a basis for developing project-specific detailed RFQ and RFP provisions.

DESIGN & CONSTRUCTION	**RFQ**: INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Demonstrate technical capacity to develop low carbon solutions ✓ Experience in the construction of "green" structures as demonstrated by relevant certifications ✓ Experience in the use of innovative low-carbon materials (*e.g., low carbon concrete*) ▪ Demonstrate prior experience in NbS and Eco-system BasedAdaptation design ▪ Experience in GHG inventory preparation (field measurements,standardized reporting, Quality assurance and control protocols) ▪ Qualifications of climate experts (i.e., downscaling, climate modeling incl. climate stress tests and probabilistic/stochasticsimulations, etc.) ✓ Experience in relevant projects should be evaluated ▪ Technical and financial advisors with experience in DMDU procedures (if requested by the project agreement)
	RFP: INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Demonstrate the flexibility of the project to adapt to climatechange impacts ✓ Explore the option of including a base or an adaptive plan (seedefinitions in Module 2.2) ▪ Demonstrate the strategy to enhance the project's climate resilience. How does this strategy account for the quick recoveryof the asset(s) and the affected community in general?

TABLE 4.2 Indicative climate-smart criteria for evaluating the thoroughness of the maintenance procedures and the rapidness of the operations when confronting extreme climate events. Thelist is meant to be indicative and provide a basis for developing project-specific detailed RFQ and RFP provisions.

OPERATION & MAINTENACE	**RFQ:** INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Demonstrate sufficient financial and technical capacity to respond to acute weather-events ✓ State-of-the-art preventive maintenance strategies; integration of monitoring in O&M plans.
	RFP: INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Demonstrate how climate change hazards (e.g., hurricanes) are treated by the operations and maintenance plan? ✓ Include a description of cease of operations. Is an effective Business Continuity Plan (BCP) foreseen to secure the continuation of operations of facilities when incident occurs? ▪ Propose an action plan for quick emergency response and recovery in the aftermath of a disastrous climate-event ✓ Submission of a draft disaster prevention and risk response plan could be positively evaluated ✓ Early-warning systems (for extreme weather events) for effective emergency response (may include decision support platforms to assist rapid screening of assets and activation of evacuation routes). ▪ Provide sufficient insurance coverage against climate-related risks.

PHASE 4

M4.1

Drafting of Climate-Smart Tender Documentation

Step 1
Define Climate-Smart Criteria for the RFQ/RFP

Step 2
Include Climate-Smart Considerations in the PPP Agreement

TABLE 4.3 Indicative climate-smart criteria for evaluating the social and environmental footprint of the bidder. The list is meant to be indicative and provide a basis for developing project-specific detailed RFQ and RFP provisions.

SOCIAL & ENVIRONMENTAL	
	RFQ: INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Ensure that the service provider has committed to a sustainable policy for doing business. ✓ What is the CO_2 performance certification of the firm? What are the measures to be taken to limit CO_2 emissions within the routine firm operations? ▪ Demonstrate experience in implementing measures for improved efficiency in the consumption of energy, water, as well as other resources and material inputs ✓ The use of innovative construction methods will be positively evaluated *(e.g., automated construction; low-emissions machinery; methodologies to reuse construction materials)* ✓ Examples of efficient resource management in previous projects ✓ Demonstrated experience in implementing mitigation hierarchy protocols ▪ Qualifications of social experts
	RFP: INDICATIVE CRITERIA (AND SUB-CRITERIA) ▪ Provide details (including targets and achievements) of the organization's sustainability management policy. ▪ Perform an LCA of the environmental impact of the design (using methodologies/ criteria recommended by the procuring authority). ▪ Submit environmental and social management plans that take into account the climate-change impacts ✓ Include measures/actions to enhance co-existence with local communities

PHASE 4

M4.1

Drafting of Climate-Smart Tender Documentation

Step 1
Define Climate-Smart Criteria for the RFQ/RFP

Step 2
Include Climate-Smart Considerations in the PPP Agreement

CLIMATE-SMART EVALUATION

Introducing state-of-the-art climate resilience and climate-mitigation approaches in the project implementation will often entail additional upfront capital or operational expenditures with the potential for long term savings over the life of the asset beyond the concession period. Hence, providers of resilient infrastructure may find themselves in an unfavorable position (compared to less expensive bidders) if the benefits of resilience are not appropriately accounted for in the evaluation process. An option for procuring authorities to consider is to include in the evaluation criteria other than price to capture the value that the private party will bring to the delivery of the infrastructure project (including quantities expressed in non-monetary terms as described in Module 2.1). On the other hand, the contract award is often more defensible if based on the lowest price bid rather than less quantifiable factors.

Aiming to balance between these two options while safeguarding the project's VfM, the public authority is responsible for structuring an evaluation procedure that smoothly integrates climate-smart criteria with traditional (price and quality) criteria rigorously and transparently. There are many different approaches to conduct such an evaluation, and it is beyond the scope of the toolkit to promote one versus another. Indicative examples are provided below.

It is a customary and sound practice that, next to each criterion, the RFP describes a definition or explanation for transparency purposes — and even a description of the main factors that will be considered when assessing it. Qualitative criteria should be objective to the maximum extent possible and clearly defined or explained.

1. Enhanced Least Cost Evaluation

The conventional "least cost" selection method should be carefully considered, as what may seem a lower cost option upfront may ultimately lead to higher costs for the grantor if climate considerations and suitable provisions are not put in place or planned for in advance, including the potential for partial or total asset loss due to climate events. For example, the compensation that will have to be paid by the grantor to a road project company for events for which protection has not been appropriately developed or provisioned for may far exceed the surplus on the availability payments (resulting from a more expensive solution).

The least-cost selection would always have to be balanced against the quality and requirements of the infrastructure as well as against the capabilities of the consortia bidding for the concession. Assuming that quality, performance, and bidder capability are not compromised then the most economically beneficial solution for the grantor (e.g., the lower NPV of payments to the project company for availability-based concessions or the highest NPV of upfront and lease payments to the grantor for demand-based concessions), in other words the least-cost approach, is opted for.

2. Price and Quality Evaluation

The contracting authority may score the financial and technical competence of the proposal individually and endorse with additional points those bidders that can provide added value in climate mitigation and adaptation measures. At the same time, it is necessary that the authority evaluates the balance between value and price (i.e., the cost of an option will need to be justifiable in terms of the value it is adding to the project).

The classification of the criteria (in categories and sub-categories) and the weighting of each category should be done on a project basis. For example, innovative projects may be eligible for assigning higher weights to the technical design category (and the implemented innovations) than other conventional projects. Also, the level of thoroughness of the evaluation of any single criterion may differ. For example:

- In some cases, the demonstration of a draft emergency response plan may be considered enough, while in other cases, the bidders may be requested to specifically demonstrate the alignment and interaction of the proposed plan to the local disaster risk management plans, or to submit different plans for the construction and operation phases.
- Similarly, authorities may either decide to evaluate whether the proposal meets a minimum required level or incentivize bidders to submit a proposal that exceeds the minimum expectations[2].

When price or other quantitative criteria represent less than 50 percent, or when the RFP includes highly technical elements, it is alsorecommended to assemble an expert committee to oversee the evaluation process, and provide input where needed.

3. Bid Evaluation Model

The bid evaluation assesses the technical, economical, environmental, and climate (and other) benefits of the submitted proposals and selects the bid that brings the higher Value for Money to the project (that can be defined differently by different procuring entities). The bid evaluation process intends to provide a fair, transparent, and accountable method for evaluating providers' bids based on balancing sustainability and other non-financial factors with cost. The process is best applied and demonstrated using a properly constructed bid evaluation model.

More elaborate approaches may incorporate the life-cycle evaluation of the proposed design. For example, green public procurement in the Netherlands has customized the Most

[2] e.g., the tender document of the concession work for the civil airport in Sofia (Bulgaria) stated that "the bidders are required to submit an environmental and social program which shall *inter alia* include the bidder's approach to the increase of the airport's use and **production of renewable energy** and can earn extra points during evaluation in this regard"

PHASE 4

M4.1

Drafting of Climate-Smart Tender Documentation

Step 1
Define Climate-Smart Criteria for the RFQ/RFP

Step 2
Include Climate-Smart Considerations in the PPP Agreement

Economically Advantageous Tender (MEAT) approach[3] to integrate specific sustainability metrics (Box 4.3).

BOX 4.3 EVALUATION OF BIDDERS IN THE NETHERLANDS

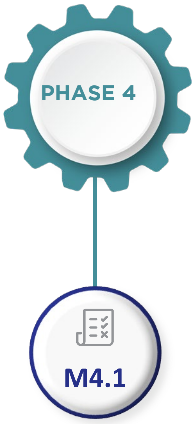
Rijkswaterstaat (RWS), the Department of Public Works of the Ministry of Infrastructure and the Environment, uses the Most Economically Advantageous Tender (MEAT) methodology, including specific sustainability criteria for infrastructure projects and services. When assessing sustainability, RWS focuses on two criteria: CO2 emissions and environmental impact. Two instruments have therefore been developed: the CO2 performance ladder and "DuboCalc", respectively. The CO2 performance ladder is a certification system with which a tenderer can show the measures to be taken to limit CO2 emissions within the company and in projects, as well as elsewhere in the supply chain. DuboCalc is a Life-Cycle Analysis (LCA) based tool that calculates the sustainability value of a specific design based on the materials to be used. Bidders use DuboCalc to compare different design options for their submissions. The DuboCalc score of the preferred design is submitted with the tender price.

Source:
OECD, 2016: Country case: Green public procurement in the Netherlands

Step Output

RFQ / RFP documents that include climate-smart criteria and climate-related technical requirements

[3] The Most Economically Advantageous Tender (MEAT) is a method of assessment that can be used as the selection procedure, allowing the contracting party to award the contract based on aspects of the tender submission other than just price (Most Economically Advantageous Tender (MEAT) - Designing Buildings Wiki)



Drafting of Climate-Smart Tender Documentation

Step 1
Define Climate-Smart Criteria for the RFQ/RFP

Step 2
Include Climate-Smart Considerations in the PPP Agreement

02 INCLUDE CLIMATE-SMART CONSIDERATIONS IN THE PPP AGREEMENT

The PPP agreement governs the obligations and rights of the parties. Although the structure and contents of the contract may vary significantly from country to country, a snapshot of the key provisions of a customary PPP agreement is summarized in Figure 4.2. The primary requirement would be a clear definition of the scope of the contract and the responsibilities of the private partner over the entire contract cycle (i.e., design and construction requirements and output targets) or KPIs, followed by provisions on the financial structure and the private party's economic rights (i.e., disbursements of payments, etc.). PPP contracts should also outline the public party's rights of oversight and control and tools/means to supervise performance (i.e., conditions of penalties, deductions from service payments, and breaches) as well as the obligations on the private party to report. Finally, the PPP agreement should describe how risks are allocated among parties, including cases of exemption from contractual obligations (i.e., definition and condition of compensation and relief events, force majeure provisions) and procedures/mechanisms to resolve disputes.

In the previous modules, the effect of climate change on the financial and risk structure of the project has been extensively discussed, highlighting the possible implications of climate change on the contractual elements defined above. This step will navigate the users through the key contents of the PPP agreement and summarize specifications/ considerations/ provisions that are pertinent to climate-smart projects **cross-referencing the relevant sections of the previous modules**.

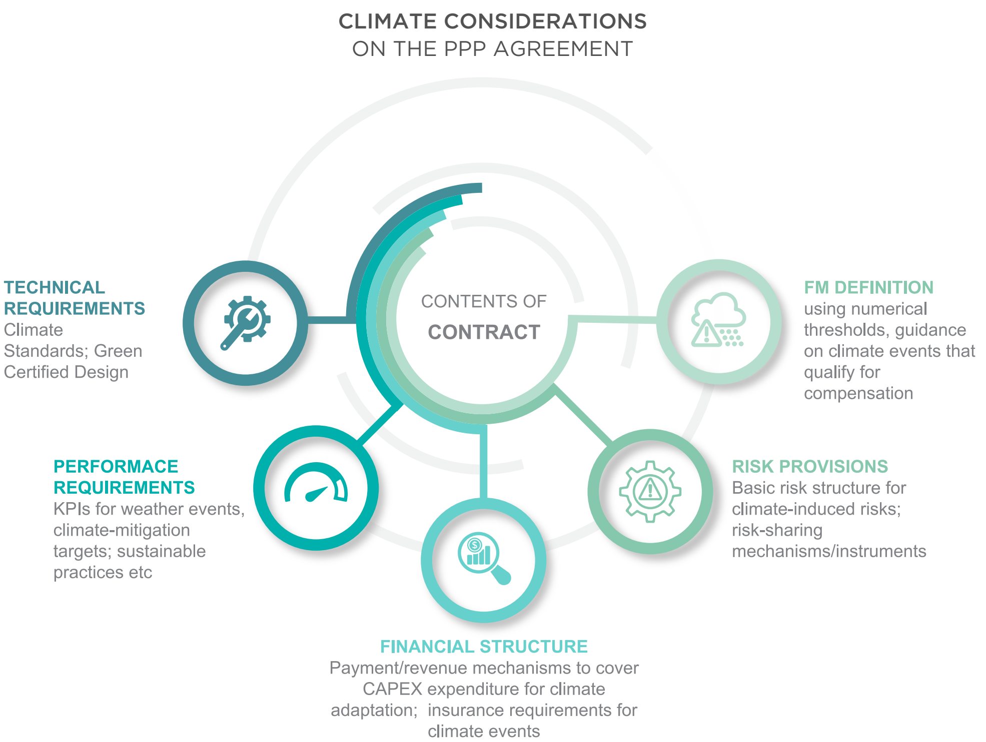


FIGURE 4.2 A schematic summary of some key climate considerations to be included in the components of a climate-smart PPP contract

KEY CONTRACTUAL CLIMATE CONSIDERATIONS

- **Technical requirements** should comply with modern climate standards (where available). They may also include a reference green certified design[4] (following an internationally recognized rating system or certification). For additional guidance, users may refer to Module 3.3 - Step 1.
- **Performance requirements** may include climate-smart KPIs correlating the level of asset service with the intensity of the weather event (as those described in Module 3.3 - Step 2). The contract may also include KPIs measuring the compliance of the service provided with specified climate mitigation targets (e.g., reduced GHG emissions, pollution, energy conservation, conservation of natural resources, etc.) and penalties to remedy the following: non-compliance in the delivery of climate adaptation works, outdated risk-reduction plans, and insufficient maintenance works. Abatement conditions are also described in Module 3.1 - Step 1.
- **Other financially related provisions** may include insurance requirements (to be obtained by the private party) and state guarantees to cover potential losses from extreme climate events, as well as reserve funds for additional climate CAPEX needs. An overview of the available insurance mechanisms and critical considerations concerning climate change are included in Module 3.1 - Step 3. In Module 2.3, the concept of the climate contingency account is introduced as an option to finance adaptation works implemented during the operational phase of the PPP. However this is untested and may impact bankability if the funding sources are allocated to the private sector.
- **Climate risk-related provisions** are described in detail in Module 3.1 - Steps 1 and 2. Climate risk events are defined and nuanced, distinguishing between "high probability low impact" events and "extreme" events that can be classified as natural disasters. This is followed by an indicative risk allocation matrix (Module 3.1 - Step 2) that can provide high-level guidance on risk structuring matters to be incorporated in the PPP agreement.
- **Compensation, relief, and force majeure events** (introduced by extreme climate events) are specified in Module 3.1 - Step 2, highlighting conditions that may qualify for compensation. The use of numerical intensity thresholds is introduced to reduce ambiguities and misinterpretations in the definition of climate events. For a comprehensive list of sector-specific KPIs, users may refer to the relevant sector-specific toolkits.
- **Financial structure**. An overview of the financial structure of climate-smart PPPs is presented in Module 3.2 - Steps 2 and 3, emphasizing the available funding and financing sources. Climate considerations on the payment mechanism are outlined in Module 3.2 - Step 1.

Step Output

Green light for tender

[4] on the basis of which bidders will prepare their technical proposals for construction

KEY TAKEAWAYS

- Definition of qualification/evaluation climate-smart criteria is essential for the selection of high-quality bidders. Climate smart criteria may be used to assess the capability of the bidder to include **climate considerations within the design** of the project and implementation of the contract. These criteria should reflect and be compatible with the design standards of the project, the operational standards/specifications, the sustainability construction standards, and the overall risk profile of the project.

- **Sustainability criteria** (e.g., low-carbon solutions), **climate resilience criteria** (e.g., capability of the project to adapt to climate hazards), **innovation criteria** (e.g., smart preventive maintenance strategies), **excellence criteria** (e.g., demonstrated ability to calculate GHG emissions and provide mitigation solutions), and **inclusivity criteria** (e.g., appropriate gender action plans) should be considered by the project authority when evaluating the bidders.

- It is recommended that the contracting authority provides an **objective methodology with measurable criteria** for assessing the value of sustainability and climate-smart factors included as part of the bidders' offers. For example, the contracting authority may evaluate separately the financial and technical competence of the proposal and provide additional marks to the bidders that provided additional climate-mitigation and adaptation measures.

- The responsibilities of the private party over the entire contract cycle should be clearly defined. Key contractual climate considerations may include **technical requirements** (e.g., green certifications, alignment with modern climate standards) and **climate-smart KPIs** correlating the level of asset service with the intensity of climatic stressors.

MODULE 4.1

Resources

[CHECKLIST FOR SUPPORTING THE IMPLEMENTATION OF OECD RECOMMENDATION OF THE COUNCIL ON PUBLIC PROCUREMENT: TRANSPARENCY]

The purpose of the checklist is to guide and support public procurement practitioners in reviewing, developing, and updating their procurement framework,according to the 12 principles of the Recommendation of the Council on Public Procurement.

Developed by: OECD, 2016

Module 4.1 - Further Reading

[GUIDE FOR ASSESSMENT OF PROCUREMENT SYSTEMS BASED ON OECD/DAC – WORLD BANK INDICATORS A PROPOSED RATING METHODOLOGY]

The objective of this guidance note is to provide a complete methodology, including scoring criteria,for the assessment of procurement systems using a set of indicators initially developed by the OECD/DAC – World Bank Working Group on Strengthening Procurement Capacities in Developing Countries.

Developed by: OECD, 2006

[A FRAMEWORK FOR DISCLOSURE IN PUBLIC PRIVATE PARTNERSHIPS]

The World Bank Group recommends a systematic structure for proactively disclosing information through this Framework for Disclosure in Public-Private Partnership Projects. The Framework is embedded in the findings of a global review of public-private partnership (PPP) disclosure frameworks and practices in transacted PPP contracts in identified jurisdictions. It suggests a holistic approach to disclosure through predefined standards, tools, and mechanisms, allowing for increased disclosure efficiency.

Developed by: World Bank Group, 2017

[GUIDANCE ON PPP CONTRACTUAL PROVISIONS]

This document contains guidance and examples of drafting provisions in relation to a number of core PPP contractual clauses.

Developed by: World Bank Group, 2019

GUIDEBOOK ON ANTI-CORRUPTION IN PUBLIC PROCUREMENT AND THE MANAGEMENT OF PUBLIC FINANCES: GOOD PRACTICES IN ENSURING COMPLIANCE WITH ARTICLE 9 OF THE UNITED NATIONS CONVENTION AGAINST CORRUPTION

This Guidebook serves as reference material for governments, international organizations, the private sector, academia, and civil society, by providing an overview of good practices in ensuring compliance with article 9 of UNCAC, which requires establishing appropriate systems of public procurement, as well as appropriate strategies in the management of public finances.

Developed by: UN, 2013

THE EPEC GUIDE TO GUIDANCE HOW TO PREPARE, PROCURE AND DELIVER PPP PROJECTS

This Guide to Guidance seeks to identify the "best of breed" guidance from PPP guidelines worldwideand selected professional publications. By providing a sourcebook of good PPP practice, it is designed to assist public officials responsible for launching and implementing PPP projects and to facilitate their understanding of the key issues and procedures involved in the procurement of PPP arrangements.

Developed by: European Investment Bank, 2011

NATIONAL PUBLIC PRIVATE PARTNERSHIP GUIDELINES VOLUME 2: PRACTITIONERS' GUIDE

Chapter 13: Bid Evaluation includes a detailed description of the criteria to apply at the bids evaluation stage.

Developed by: Australian Government | Department of Infrastructure and Regional Development, 2015

BIDDING FOR PRIVATE CONCESSIONS: THE USE OF WORLD BANK GUARANTEES

This discussion paper provides guidance on issues that need consideration before and during the bidding process. The report identifies the critical issues involved in the tendering and evaluation stages of bidding for private concessions. It draws on a survey of bidding experience in eight water and toll road projects in seven countries (China, Hungary, Mexico, Peru, Thailand, Turkey, and the United Kingdom).

Developed by: World Bank, 2010

SUSTAINABLE PROCUREMENT: AN INTRODUCTION FOR PRACTITIONERS TO SUSTAINABLE PROCUREMENT IN WORLD BANK IPF PROJECTS

This guidance is written for World Bank staff and Borrowers responsible for implementing Bank Investment Project Financing (IPF). It provides an introduction to public sector sustainable procurement. It gives practical how-to advice and supports good sustainable procurement practices. It informs practitioners how to include sustainable factors into procurement processes and provides incentives for vendors to offer more sustainable products and services. The content of this guidance is non-mandatory and is supplied as illustrating good practice only.

Developed by: World Bank, 2019

ENVIRONMENTALLY RESPONSIBLE PROCUREMENT: A REFERENCE GUIDE FOR BETTER PRACTICES

This document provides guidance to ADB staff, consultants, and executing agencies in designing and implementing environmentally sound projects.

Developed by: ADV, 2007

GOING GREEN: BEST PRACTICES FOR SUSTAINABLE PROCUREMENT

A collection of best practices has been prepared by the OECD, providing good practices for green public procurement at national and sub-national levels.

Developed by: OECD, 2015

Epilogue

THE IMPORTANCE OF CONTRACT MANAGEMENT IN CLIMATE-SMART PROJECTS

The scope of this toolkit has been to provide guidance to PPP units and their advisors on including climate mitigation and adaptation options in the up and midstream stages of structuring PPP infrastructure projects. Following their financial closure, climate-smart PPP projects will enter their final and longest stage: contract management.

According to a recent publication by the Global Infrastructure Hub, PPP contract management is one of the most important aspects of PPP delivery. If done effectively, it will support the long-term success of the project in line with the agreed contract terms. But, if managed poorly, it can seriously undermine years of project preparation and procurement and can ultimately lead to major cost implications for taxpayers and service disruptions for end users[1].

In the face of growing investment needs and constrained budgets, many governments are increasingly looking to the private sector to bring expertise and financing to infrastructure delivery, often through the use of PPPs. However, despite the growing trend among governments to consider PPPs as a procurement and financing model for infrastructure projects, the contract management of these projects through their construction and operations phases is one of the more overlooked areas of infrastructure delivery.
Indeed, as PPPs are typically long-duration contracts often referring to large-scale infrastructure projects, poor contract management could have a very detrimental impact on the quality of service.

[1]https://managingppp.gihub.org/report/overview/

This may further be exacerbated by the effects of climate change and the uncertainty associated with them. As such, efficient contract management should be regarded as a necessity - especially in the case of climate-smart PPP projects as those considered in this toolkit. Thus, the intent of this epilogue section is not to provide guidance on the supervision of climate-smart PPP contracts (which would require a separate, dedicated guidance document) but rather to emphasize on its necessity while pointing out specific climate-related elements that such supervision should consider, including:

- The need for a properly-trained **contract management team** including members experienced in monitoring climate indicators and qualitatively assessing climate risks and new options able to offer GHG emissions reduction while being able to interact efficiently with external resources (such as consultants) when necessary.

- The need for a well-structured **plan for monitoring climate-related construction and operations** including adaptation measures and GHG-reduction strategies. Assessment of the appropriateness and ability to monitor the climate-related KPIs is essential at an early stage so that any weak points are identified and corrected as soon as possible. A good practice may be to set up specific milestones in cooperation with the project company so that timeliness and objectivity is added on the monitoring process while ensuring that the public and private parties are efficiently partnering in combating the effects of climatechange.

- The need to **transparently report and abide by standards** (and consequently monitor them), adopting frameworks such as TCFD’s.

- The need for **efficient handling of renegotiations and disputes** that could be increased due to climate change. Force majeure clauses and eventual compensations related to resilience and climate change will certainly also become an even more delicate field of contract management (together with how insurance covers evolve over time). In fact, although it is generally valued as a good practice to avoid frequent renegotiations, the uncertainty regarding the evolution of climatic indicators (and hence of climate-related phenomena impacting the availability of the infrastructure) during the lifetime of the project, could challenge this principle. This may be more likely in cases when innovative instruments or structures (e.g., green financing tools, nature-based solutions, adaptive plans) are incorporated in the contracts. Given that such options may in some cases play an instrumental role for the viability of the projects, it is recommended that the contract management teams are prepared to negotiate issues such as impacts on tariffs and maintain contractual visibility over time – even though there could be uncertainty around the asset itself. At the same time, any renegotiation will need to ensure that it will not risk the benefits for the climate and the public.

Understandably, the listing above is neither thorough nor complete. While it is beyond the scope of the present document to get into the details of the contract management phase, it is necessary to remember that delivery of climate-smart PPP infrastructure is not only about adequate planning and execution. Given the challenges that climate change uncertainty is bringing to infrastructure assets, PPP contract management will become an even harder and more important task. Learning from it will certainly constitute an effective way to loop back and continue improving PPP contracts’ quality and bankability in the years ahead. And despite all the challenges, this is the only path forward for the sake of our future.

APPENDIX

APPENDIX 1
Concessional Financing Sources

APPENDIX 2
Innovative Financing Options

Appendix 1

Concessional Financing Sources

01 THE LANDSCAPE OF CLIMATE FUNDS

An overview of the global climate funding architecture with emphasis on the multilateral and bilateral funding mechanisms is provided in Figure A1. As illustrated, funds flow through multilateral channels and bilateral mechanisms to regional/national climate change financial institutions and organizations, forming another pool of funding from which low-emission and climate-resilient development can benefit.

Although a plethora of funds are available, eligibility and selection criteria may be quite hard to fulfill, while the competition to access them may be overwhelming. Additionally, the process of receiving funds through such mechanisms is quite often associated with significant managerial and reporting requirements, which in turn increase the administrative costs of handling them. Therefore, governments are advised to ensure the suitability of funds with the PPP project and the country under consideration (not all countries are eligible for all funds) before embarking on the relevant transaction process. Hence, it is recommended that a skilled team with proven experience in similar transactions is in place before initiating the process to maximize the chances of achieving an agreement with donors.

It is underlined that due to the multitude of funds and their case-specific characteristics, it is beyond the scope of this toolkit to provide an exhaustive and detailed description of all available funding sources. Instead, the intention is to provide an overview of the most significant climate funds that are currently active and summarize key features/considerations that appear to have general applicability. Tables A.1 and A.2 provide a non-exhaustive selection of available multi- and bilateral funding mechanisms covering various sectors and regions, thus allowing a first-level screening of potential options.

It is recommended that the following criteria are considered when evaluating the suitability of funds with a country and PPP project:

- Sectors, countries, and types of usually funded projects.
- Application time, cost, and administrative requirements, including reporting requirements in case of a successful application.
- Focus on the fund's priorities/requirements and the country's specific goals.

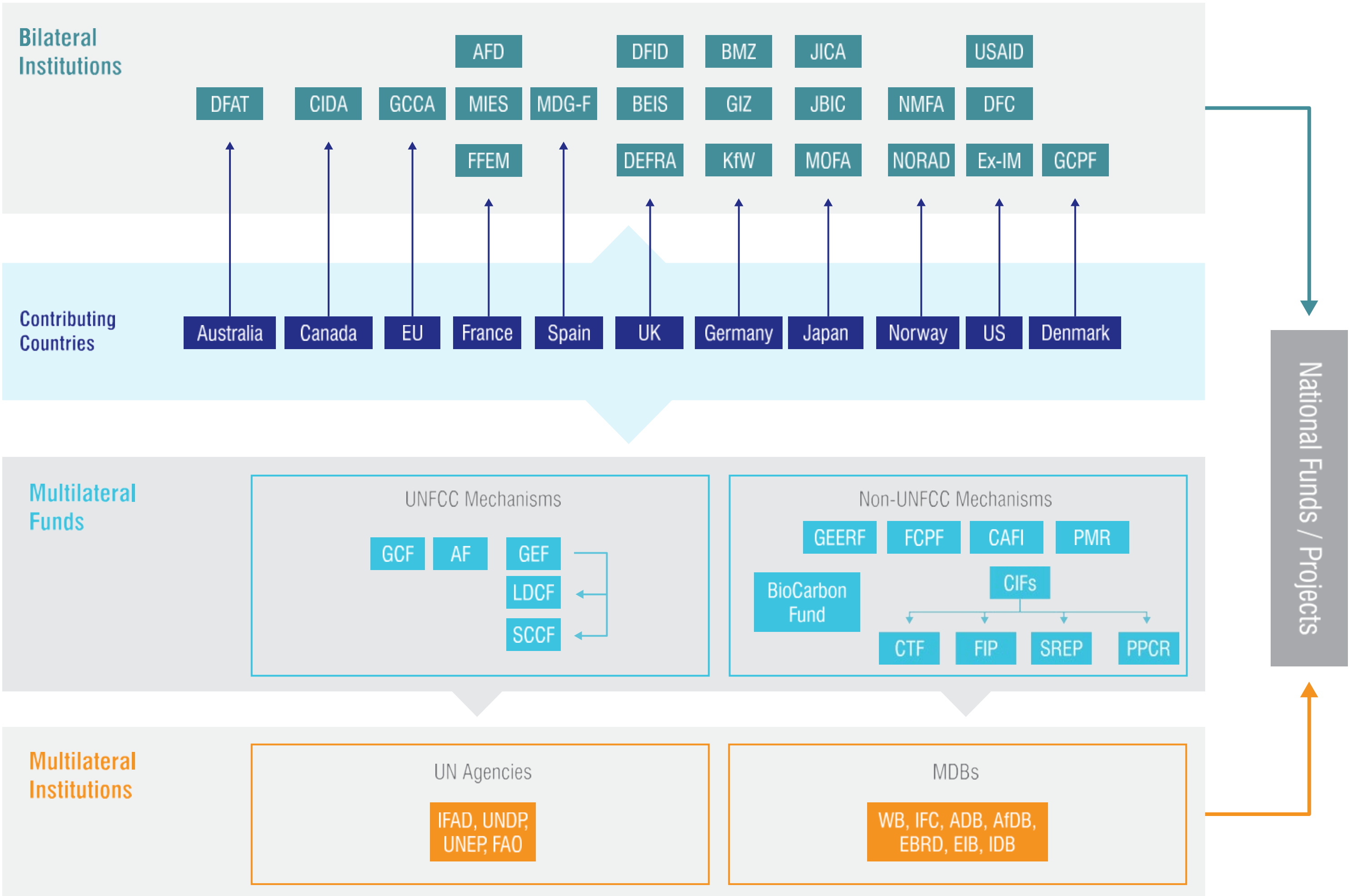


FIGURE A.1 The global climate finance architecture: indicative (non-exhaustive) list of funds and Institutions that could be considered when exploring potential sources for concessional funding sources. [Source: Climate Funds Update, 2021: The Global Climate Finance Architecture, copyright ODI and HBS].

FUNDING SELECTION CRITERIA

Once the preliminary decision to proceed has been made, it is necessary to ensure that the PPP projectmeets specific eligibility conditions that are fund-specific. Table A.1 provides vital information and hyperlinks to relevant web pages to assist toolkit users in accessing eligibility criteria specific to each fund. The figure below illustrates key selection criteria common among donors when evaluating proposals and should thus be carefully considered by the procuring authorities when preparing project applications (Figure A.2).

- Impact Potential

The purpose of this criterion is to provide the donor with the fundamental justification for the proposed project and why it is worth funding. The criterion may vary between climate mitigation and climate adaptation projects: the former should describe the emissions reductions they expect to achieve, while climate adaptation project proposals should demonstrate a reduction in loss of lives, the value of physical assets, livelihoods, and environmental or social losses.

- Urgency and Necessity

Project proposals should describe the country's financial, economic, social, and institutional needs and the barriers to accessing domestic (public), private and other international sources of climate-related finance. This is important, as most bilateral and multilateral adaptation funds will only support proposals that respond to the highest priority needs in the targeted region/country and sector.

- Efficiency and Effectiveness

Although cost-effectiveness (e.g., CO2 emission reduction per unit amount invested) is a common selection criterion for most bilateral and multilateral donors, performing quantitative measurements/comparisons in adaptation projects is not that straightforward. For the latter case, funds may ask for a justification reasoning (i.e., different financial, social and environmental costs) for choosing an adaptation solution over an alternative.

- Long-term Sustainability and Broader Impact

The proposal should demonstrate how the benefits achieved through the investments will be sustained beyond the project's lifetime. It is, therefore, possible that donors will request commitments from the national government to maintain the infrastructure and build local capacities that will enable future developments in the specific sector (e.g., upscale pilot projects and capacity-building activities).

In addition to the project's impact (that is separately scored), proposals may be requested to demonstrate **co-benefits** in the broader economy (e.g., creation of jobs, poverty alleviation, and enhancement of income and financial inclusion, especially among women); social prosperity (e.g., better access to education, cultural preservation, social inclusion, improved sanitation facilities); environment (e.g., enhanced air, water, soil quality, and biodiversity); gender empowerment (e.g., outlining how the project will address gender gaps).

- Alignment with National Climate Goals

Project proposals should clearly describe how the proposed activities align with the country's NDC and other relevant national plans.

- Organization Capacity and Experience

Another criterion, typical for most multilateral and bilateral funds, is the institutional context in which the proposed project will be implemented. Project developers should be ready to describe the organization's mandate or past work experience. Donors may also be interested to see how the project will be coordinated and how the planned investments will support the existing development activities of the targeted sector.

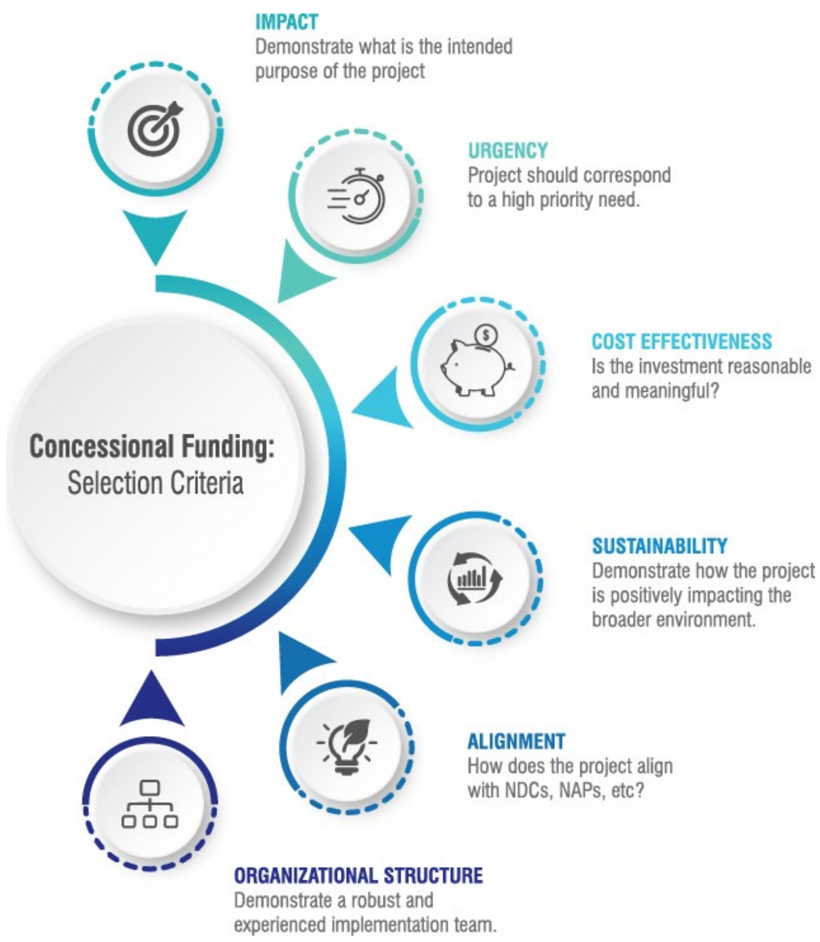


FIGURE A.2 Selection criteria for concessional funding

TABLE A.1 Multilateral Funds and Initiatives

Multilateral Funds / Initiatives	Priority Areas	Sources of Funding	Trustee	Website
Adaptation Fund (AF)	Gender ◆Agriculture ◆Coastal Zone Management ◆Disaster Risk Reduction ◆FoodSecurity ◆Forests ◆Rural Development ◆Urban Development ◆Water Management	Multi-donor trust fund (top contributors: Germany, Sweden, Italy, Spain, Belgium), 2% share of proceeds of the CER[1]	World Bank (on an interimbasis)	AF
Africa Climate Change Fund (ACCF)	The third Call for Proposals (CFP3) for the Africa Climate Change Fund (ACCF or Fund) focuses on Gender Equality and Climate Resilience (GECR).	Multi-donor trust fund (Germany, Italy, Flanders, Belgium, Global Affairs Canada, Quebec)	African Development Bank	ACCF
Climate Investment Funds (CIF)	Clean Technology Fund (CTF) ◆Forest Investment Program ◆Pilot Program Climate Resilience (PPCR) ◆Gender ◆Scaling Up Renewable Energy Program (SREP)	14 donor countries, including the US, UK, Japan, Norway, Canada, etc.	World Bank	CIF
EU Global Climate Change Alliance Plus Initiative (GCCA+)	Mainstreaming climate change into poverty reduction and development efforts ◆Increasing resilience to climate-related stresses and shock ◆Adaptation and mitigation strategies, plans, and actions.	Development Cooperation Instrument (DCI), European Development Fund (EDF), EU members	European Union	GCCA+
Green Climate Fund (GCF)	Agriculture ◆Forestry and Other Land Use ◆Buildings, Cities, industries and appliances ◆Ecosystems and ecosystem services ◆Energy ◆Health, food and water security ◆Infrastructure ◆Livelihoods of vulnerable communities ◆Transport	GCF-1 (first replenishment): 31 contributors	World Bank	GCF
Global Environment Facility (GEF) Trust Fund	Biodiversity ◆Climate Change ◆International Waters ◆Land Degradation ◆Chemicals & Waste	40 GEF donor countries	World Bank	GEF
Least Developed Countries Fund (LDCF)	Implementation of NAPAs and NAP process. Priority funding areas: agriculture and food security ◆Natural resource management Water resources ◆Disaster risk management and prevention ◆Coastal zone management ◆Climate information services ◆ Infrastructure ◆ Climate-change-induced health risks ◆NBS	Multiple countries such as Germany, United Kingdom, Sweden, Belgium, etc.	GEF, World Bank	LDCF
Special Climate Change Fund (SCCF)	Mandated to serve the Paris Agreement ◆ Acts complementary to the GEF Trust Fund ◆Climate-resilient technologies and infrastructure, climate risks, engagement of private sector for adaptationsolutions, access to finance from public sources and to markets	Multiple countries such as Germany, United States, Belgium, Norway, etc.	GEF, World Bank	SCCF
UN-REDD Programme	Supports nationally led REDD+ processes	Norway, European Union, Denmark, Switzerland, Spain, Japan, Luxemburg	UNDP Multi-Partner Trust Fund Office	UN-REDD Programme

[1] CER: Certified Emissions Reduction

TABLE A.2 Bilateral Funds. [Note that this account is not meant to be fully exhaustive; the list of all available NCFs is expected to be significantly broader]

Bilateral Funds	Priority Areas	Funding Countries	Website
Global Climate Partnership Fund (GCPF)	Renewable energy ◆Energy efficiency and low-carbon projects in developing economies	Germany, United Kingdom, Denmark	GCPF
International ClimateFinance (ICF)	Strengthening global peace ◆ Security and governance ◆Strengthening resilience and response to crises ◆Promoting global prosperity ◆Tackling extreme poverty, and helping the world's most vulnerable	United Kingdom	ICF
Internationale Klimaschutzinitiative (IKI)	Greenhouse gas emissions mitigation ◆ Adapting to the impacts of climate change ◆Conserving natural carbon sinkswith a focus on reducing emissions from deforestation and forest degradation (REDD+) ◆Conserving biological diversity	Germany (funded partly through the saleof national tradable emission certificates)	IKI
Nationally Appropriate Mitigation Action facility (NAMA Facility)	Implementation of NDCs	UK, Germany, Denmark, and the European Commission	NAMA Facility

Appendix 2

Innovative Financing Options

This appendix outlines existing innovative financing instruments to incentivize investments in green infrastructure and enhance the bankability of climate mitigation options. The list of instruments outlined in the ensuing is neither exhaustive nor binding; its scope is to raise awareness on the sort of available mechanisms and common eligibility criteria so that governments can consider them when structuring PPP projects[1].

Green, social, and sustainability-linked bonds and loans are financial instruments that were built with the very purpose to raise finance for projects with environmental, climate, and or social benefits. This is a fast-growing market sector, with nearly $600 billion of bonds issued across these four formats in 2020, representing a year- over-year increase of around 80 percent (CBI, 2021). During the first three quarters of 2021 the combined labeled issuance of such bonds had already reached $767 billion (Figure A.3).

01 BONDS TO FINANCE CLIMATE MITIGATION/ADAPTATION PROJECTS

Conventionally, bonds[2] are used by private or public companies, supranational companies (such as multilateral development banks), commercial banks, municipalities, states, and sovereign funds to finance projects and operations. PPP projects may use bonds as an alternative debt-raising mechanism. Bond proceeds can be used to finance the full project, *pre-construction* financing instrument, or *post-construction* financing. For example, it is also possible to plan for two bond issues: one for the pre-construction phase with a short maturity, followed by another bond issuance starting with the commencement of operations and maturing at the end of the project. Post-construction bonds are better received by risk-averse investors unwilling to assume the construction risk of new development (including cost overruns, construction delays, non-compliance with construction standards). Moreover, bonds can be used either to develop a single project, a collection of projects (allowing for additional diversification of the financial risk), or to support investments in a broader sector. Boxes A.1 and A.2 illustrate examples of bonds that have been used for the financing of particular projects. Table A.3 includes examples of bonds that have financed broader green developments.

[1] As awareness on climate aspects is increasing, new financing schemes may surface in the market (see for example the financing solutions described in Insights 3.3 and 3.4)

[2] A debt-capital market instrument that represents a cash flow payable during a specified time period

Although issuing a green debt (or any other type of bond) is a complex process, the primary considerations can be described by the list below[3] , which is intended to provide guidance on the general eligibility criteria for green debt financing (see, also, Figure A.4). The green bond market is governed by voluntary guidelines[4] designed to regulate all aspects of bond issuance and increase transparency. ICMA[4] defines the four main Green Bond Principles as follows:

1. **Use of Proceeds:** The issuers need to define a range of green projects they wish to support with the green bonds. The projects need to be able to demonstrate clear environmental benefits. It is strongly recommended that eligibility criteria be reviewed and rated by an external expert party. This will provide comfort to investors that the projects will meet their climate-related targets. To identify such projects, voluntary guidelines may be followed.
2. **Process for Project Evaluation and Selection:** Projects to be supported must undergo a robust review methodology. For example, all World Bank projects seeking green bond support need to undergo early screening of their processes and environmental impact.
3. **Management of Proceeds:** Allocation of funds is subsequently provided to the selected projects. Disbursements are often made over a period of a few years, depending on when project milestones are reached.
4. **Reporting:** The issuer of the bond supervises the implementation of the green bond projects. Client countries implement the development projects as per the project loan agreement. The supervision process comprises regular reports by the implementing government agency on project activities, ensuring transparency in communicating the expected/achieved impact of proceeds.

---

[3] The list is based on WBG’s IBRD green bond issuing process.

[4] The main representatives are the Green Bond Principles (GBP,2014) by ICMA (International Capital Market Association) and guidelines developed by the Climate Bonds Initiative (CBI). CBI guidelines align with the CBP but also include a standard for what would qualify as a climate bond.

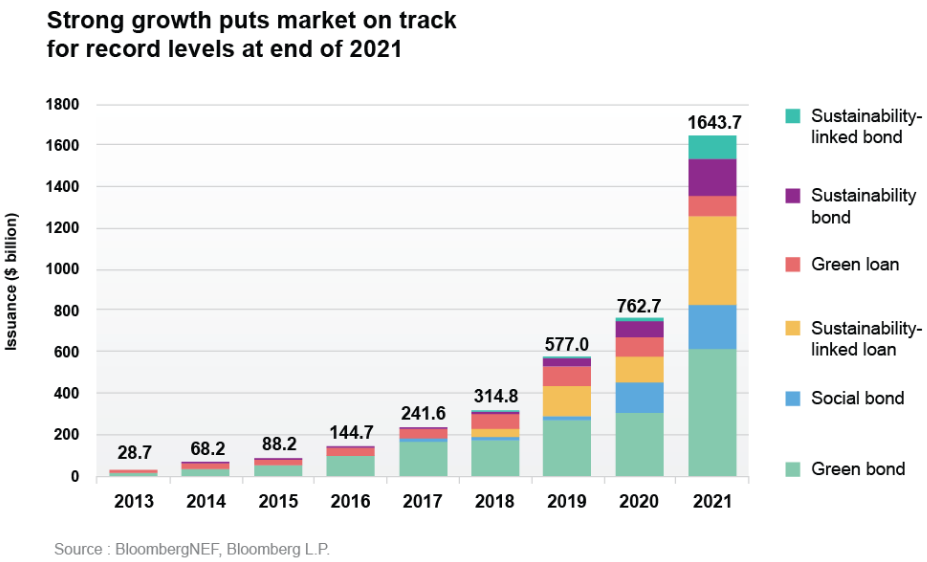


FIGURE A.3 Evolution of green, social, and sustainability linked bonds in the last years

ICMA Bond Principles

The Green Bond Principles | The Social Bond Principles | The Sustainability Bond Guidelines

Core Components:

01 **Use of Proceeds**: all proceeds from the bond issue should be utilized for green projects providing clear and quantifiable environmental benefits

02 **Process for Project Evaluation and Selection**: the process of green projects selection and eligibility criteria should be clearly communicated to investors

03 **Management of Proceeds**: financial management should be treated with high level of transparency (e.g., a third-party audit is recommended)

04 **Reporting**: Up to date information on the use of proceeds should be available by the issuers and reported at least annually

The Sustainability-Linked Bond Principles

Core Components:

01 **Selection of Key Performance Indicators (KPIs)**: selection of credible sustainability KPIs is significant to measure the issuer's performance

02 **Calibration of Sustainability Performance Targets (SPTs)**: involves calibration of one or more performance targets per KPI to be used as milestones during the project

03 **Bond characteristics**: financial and structural bond characteristics should be clearly defined

04 **Reporting**: Up to date information on the use of proceeds should be readily available by the issuers and reported at least annually

05 **Verification**: Issuers should seek independent and external verification

FIGURE A.4 Key components of green, social, and sustainability linked bonds according to ICMA

BOX A.1 EXAMPLES OF PPPS FINANCED BY GREEN BONDS

Eglinton Crosstown Light Rail Transit (LRT)

Ontario was the first government in Canada to issue green municipal bonds to finance green infrastructure projects. The green bond program was launched in 2014 with a bond issue size of $500 million and a maturity period of four years. Multiple green investors from Canada, the U.S., Europe, and Asia showed strong demand, with orders approaching $2.4 billion. Since then, the evaluation, selection, and reporting process of eligible projects were refined by incorporating stricter environmental criteria, specific category scores of LEED-rated buildings, and prioritizing particular Sustainable Development Goals (SDGs). The new Eglinton Crosstown LRT, a 30-year concession under a PPP model of $5.3 billion investment, was one of the 16 green projects selected in 2014 to receive funding from Ontario's inaugural green bond issue. The project was financed by the three subsequent green bonds issued by the province. The Eglinton Crosstown LRT is currently under construction, with scheduled completion in 2022.

Sources:
Ontario Financing Authority, 2018: Green Bond2018 Newsletter
Queen's Printer for Ontario, 2014: Strong Demandfor Ontario's First Green Bond
Aecon: Eglinton Crosstown LRT

Elazig Integrated Health Campus

In 2016 the first "green and social" project bond in Turkey was verified by a major environmental, social, and governance rating company, Vigeo Eiris. The 20-year bond, with a total bond size of 288 million euros, was the first project bond financing a hospital under a public-private partnership in Turkey. The proceeds financed the construction of the 1,000-bed Elazig Integrated Health Campus in Elazig city in eastern Turkey, including five healthcare facilities equipped with climate-friendly technologies and modern applications. IFC invested 80 million euros in the project bond supporting the next-generation healthcare facilities. At the same time, the EBRD and WB's MIGA supported the commercial tranche by an innovative joint credit enhancement scheme. Construction was completed on time, and the 28-year availability payment concession entered its operational stage in 2018.

Sources:
IFC, 2016: IFC Supports Mobilization of Long- Term Financing for Next-Generation Healthcare Facilities in Turkey
Meridiam, 2016: Closing of Elazig project
GIH, 2021: Elazig Hospital PPP

TABLE A.3 Examples of Green Project Bonds and Loans

#	Bond Issuer	Size in millions (USD)	Country	Sector	Description
1	**Denver Regional Transportation District**	834.1	USA	Transport	Regional Transportation District (Colorado) ("RTD") is issuing Green Bonds – Climate Bond Certified to refund outstanding debt used to expand and improve Denver, Colorado's regional public transportation system. RTD's efforts expedite a transition to a zero-emission transportation sector and advance regional greenhouse gas emission reduction goals.
2	**SpareBank**	1,102	Norway	Low Carbon Buildings	The issuance aims to finance and re-finance a mortgage asset pool with added environmental value, focusing on energy performance. The bond will re-finance an existing mortgage loans portfolio with residential buildings in Norway. Both new and existing Norwegian residential buildings are eligible for green bonds as they have significantly better energy standards and account for less than 15% of the residential building stock.
3	**Pet Refine Technology**	16.7	Japan	Waste Management	PET Refine Technology is issuing a green bond to finance investment in chemical recycling facility of consumed PET bottles.
4	**IEnova Corp.**	100	Mexico	Solar	IFC loan will fund the company's expansion into the solar power generation segment, including financing five solar power generation plants, thereby diversifying the country's energy supply. This is IFC's first financing in Mexico certified under the Green Loan Principles.

CONSIDERATIONS FOR ISSUING PROJECT BONDS

The way that grantors structure the project can incentivize certain types of financiers to participate in the project. While green project bonds present several merits, they are also associated with considerations that should be correctly assessed when this financing route is in place (IISD 2015). The main considerations may include:

The project risk (reflecting the project's overall risk profile). This risk may be exceptionally high for green projects (incorporating green innovations and not mature-enough technologies) or for projects requiring extended climate adaptation measures. On the other hand, this risk is compensated by the ability of green projects to accommodate future climate legislation. Therefore, the procuring authority must possess the necessary expertise to adequately evaluate the overall project and how this may affect the project bonds' proposals. Depending on the size, experience, and banking relationships, bonds' placement is not always guaranteed. Contracting authorities should specify the weight and importance of bond financing in their initial tender conditions to ensure just the right amount of competitive tension without risking losing otherwise competent bids that may not support bond financing.

The pricing volatility risk. This integrates changes in the bond pricing from the time of the financial closure to the bond issuance.

Timeline of bond issuance. Issuing a bond usually requires more time than any conventional bank lending, eventually impacting the project's starting date. Contracting authorities should therefore evaluate the suitability of bonds concerning the specific project timeline.

BOX A.2 EXAMPLE OF A PPP (RE)FINANCED BY GREEN LOAN

In 2020, ANZ and the Commonwealth Bank (CBA) supported the first certified green loan executed by a transport Public-Private Partnership in the Australian market. The loan was certified as green by the Climate Bond Initiative (CBI) under its low carbon transport criteria. With the $280 million green loan, the Canberra Metro re-financed its debt facility through which it delivered in 2019 the first stage of the Canberra Light Rail project that connects Gungahlin in the north with the Central Business District (CBD) via a 12 km track. The project will keep operating for 20 years under the design, build, operate and maintain agreement of the PPP. Over the contract term, the Australian Capital Territory (ACT government) will pay Canberra Metro for the construction costs and components of the operational costs. The Canberra Light Rail project is the largest single infrastructure project ever undertaken by the Australian Capital Territory.

Image source: Canberra Metro website

Sources:
Commonwealth Bank, 2020: CBA supports Australian-first PPP Green Loan
Canberra Metro: The Canberra Light Rail project is being delivered through a Public-Private Partnership (PPP)

02 SUSTAINABILITY-LINKED FINANCING

According to IFC[5], sustainability-linked financing aims to leverage the role of debt markets in financing and promoting sustainability. The borrower's performance is related to ESG performance targets defined by the agreement between the lender and the borrowing entity. In this context, sustainability performance targets (SPTs) are identified, which need to be ambitious, provide incentives for more action, and be linked with measurable key performance indicators, preferably benchmarked against specific metrics. A significant characteristic of sustainability-linked loans is that economic outcome is related to whether the selected predefined SPT(s) are met, which, in turn, incentivizes action on sustainability.

The Loan Market Association has developed the Sustainability Linked Loan Principles (SLLP).[6] The goal of the SLLP is to provide guidelines that identify and promote the key technical characteristics of these types of loans and, in this way, preserve the integrity of the sustainability loan financial product.

Sustainability-linked financing is a forward-looking, performance-based instrument explicitly aiming to future improvements in sustainability outcomes within a predefined timeline. it may be materialized by means of any type of instrument such as bonds, derivatives, credit facilities, etc. A significant difference between sustainability-linked financingand climate-financing instruments (e.g., green loans) is that the former would typically not impose any constraints on the use of proceeds.

03 CARBON CREDITS AND CARBON OFFSETING

A carbon credit is a coupon that allows its holder to emit a certain amount of carbon dioxide or an equivalent of another GHG. One credit permits the emission of a mass equal to one ton of carbon dioxide. Themain goal for creating carbon credits is to reduce carbon dioxide emissions and other GHGs fromindustrial activities. One way to use credits issued under carbon credit mechanisms can be as "offsets". This means that emission reductions achieved by one entity can be used to compensate for (i.e., offset) emissionsfrom another entity.[7]

In this context, investments in climate mitigation as part of a PPP project may endorse the latter with the ability to issue carbon credits up to the equivalent of GHG emission reduction corresponding to such mitigation actions. These credits may then be sold to a GHG-emitting entity as "offsets" (following the definition of mitigation hierarchy levels), thereby generating profit for the PPP project while contributing to the NDC targets of the receiving entity's country.

WBG sets the target that projects that generate carbon credits beyond the emissions mitigation benefit could also generate additional co-benefits. Carbon crediting mechanisms could be designed explicitly to support or

[5] Sustainability Linked Financings: Guidance Note for MAS IOs 1.0, IFC, 2021
[6] LMA-APLMA-LSTA, 2021a: Sustainability Linked Loan Principles
[7] World Bank, 2020: State and Trends of Carbon Pricing 2020

enhance specific co-benefits like health outcomes (e.g., from reduced indoor air pollution through the installation of improved cookstoves), biodiversity, resilience, water retention, and habitat protection.

Carbon credits are traded in two market categories:

1. **Voluntary Carbon Markets** are marketplaces allowing carbon emitters to offset emissions by exchanging them with carbon credits produced by projects which remove or reduce GHG emissions. This process is termed **voluntary emissions reduction (VER)** and is not the product of a process of compliance with legal obligations (such as obligations imposed by the Kyoto Protocol)
2. **Compliance Markets** are marketplaces intended to be used by regulated entities thereby achieving **certified emissions reduction (CER).** In this case, offsetting of a project's emissions is materialized by means of emission units (or credits) created through a regulatory framework (e.g., the UN's Clean Development Mechanism or CDM) (see also Insight 0.1 and Insight 1.5)

MECHANISMS TO BENEFIT FROM CARBON-CREDITS

PPP projects can use the carbon markets to supplement their revenue streams thereby possibly making projects more attractive. The first option to use them is to take advantage of the **Clean Development Mechanism (CDM)** that the Kyoto Protocol defined. CDM aims to assist developing countries not included in Annex I[8] and least developed countries in achieving sustainable development and at the same time to assist parties included in Annex I[25] in complying with their GHG emission limitations. To this end, industrialized countries are willing to buy certified emission reductions (CERs) and invest in emission reduction where it is cheapest globally.

This leads to investments of developed countries and businesses in climate-mitigation options and low-carbon projects taking place in EMDE countries and producing CERs. For a PPP project to be eligible for such financing, it will be necessary to demonstrate that carbon emissions are either reduced (energy efficiency measures), removed (carbon capture projects such as planting of forests), or avoided (for example, using low-carbon technologies and nature-based solutions).

The process of issuing CERs may be grouped into five steps for a PPP project, as illustrated in Figure A.6. A consulting committee is formed to conduct GHG emissions measurements for the project according to the CDM's protocol. Actions that reduce the overall project emissions are then identified and implemented to reach the desired GHG reduction target. The issue of the CERs is subsequently approved by the CDM Executive Board (CDM EB) under the guidance of the Conference of the Parties (COP/MOP) of the United Nations Framework Convention on Climate Change (UNFCCC). Detailed advice and up-to-date information on the CDM issuing process are provided on the UNFCCC CDM website[9].

Another option is the **consideration of VER carbon offsets**. Similar to CERs, these carbon credits are issued to assign a value to an offset of greenhouse gas emissions. However, in this case, carbon credits do not need to be approved by the CDM regulations but are verified by independent standards such as Gold Standard and Verified Carbon Standard (VCS). If a project meets the specified criteria – summarized in Figure A.5 – credits can be issued. The investor may then sell the credits in the voluntary market for credits in order to finance the project. The proceeds from the sale of voluntary carbon credits enable the development of carbon-reduction projects across a wide array of project types. These include renewable energy, or avoiding emissions from fossil-fuel-based alternatives; natural climate solutions (nature-based infrastructure), such as reforestation,

[8] Annex I parties include the industrialized countries that were members of the OECD in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic states, and several Central and Eastern European states.
[9] UNFCCC CDM website: https://cdm.unfccc.int/

avoided deforestation, or agroforestry; energy efficiency; and resource recovery, such as preventing methane emissions from landfills or wastewater facilities; among others.

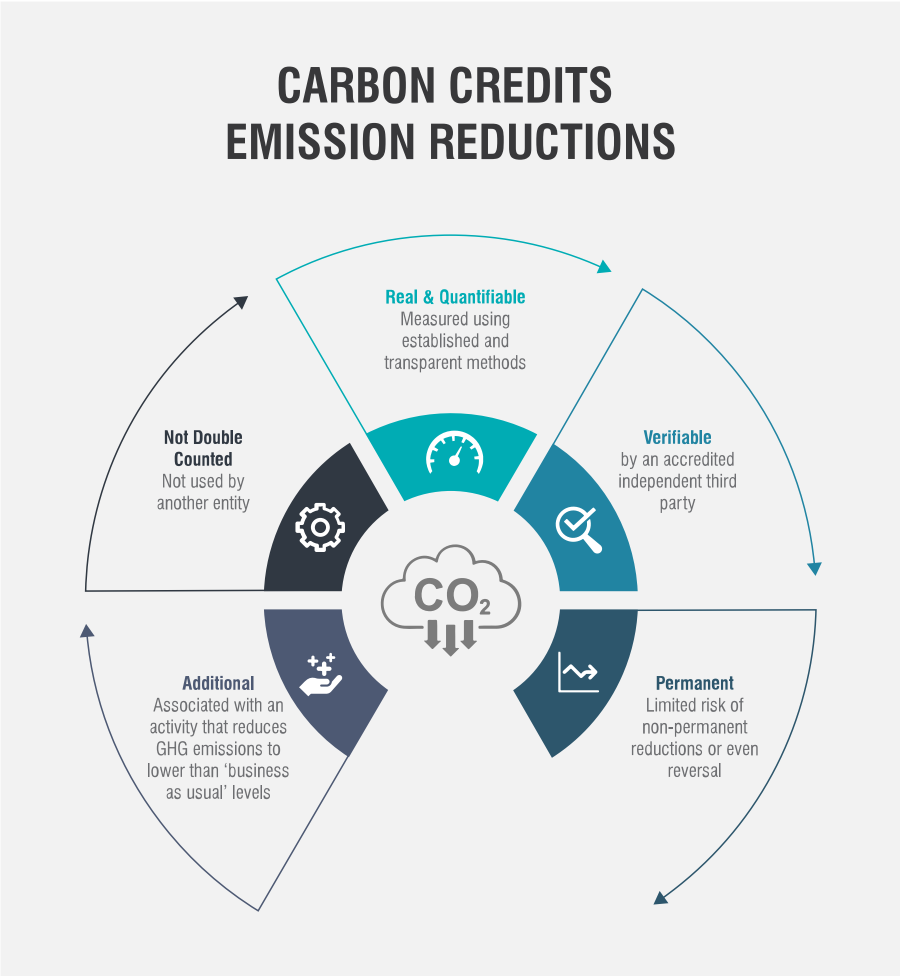


FIGURE A.5 General criteria for carbon credits

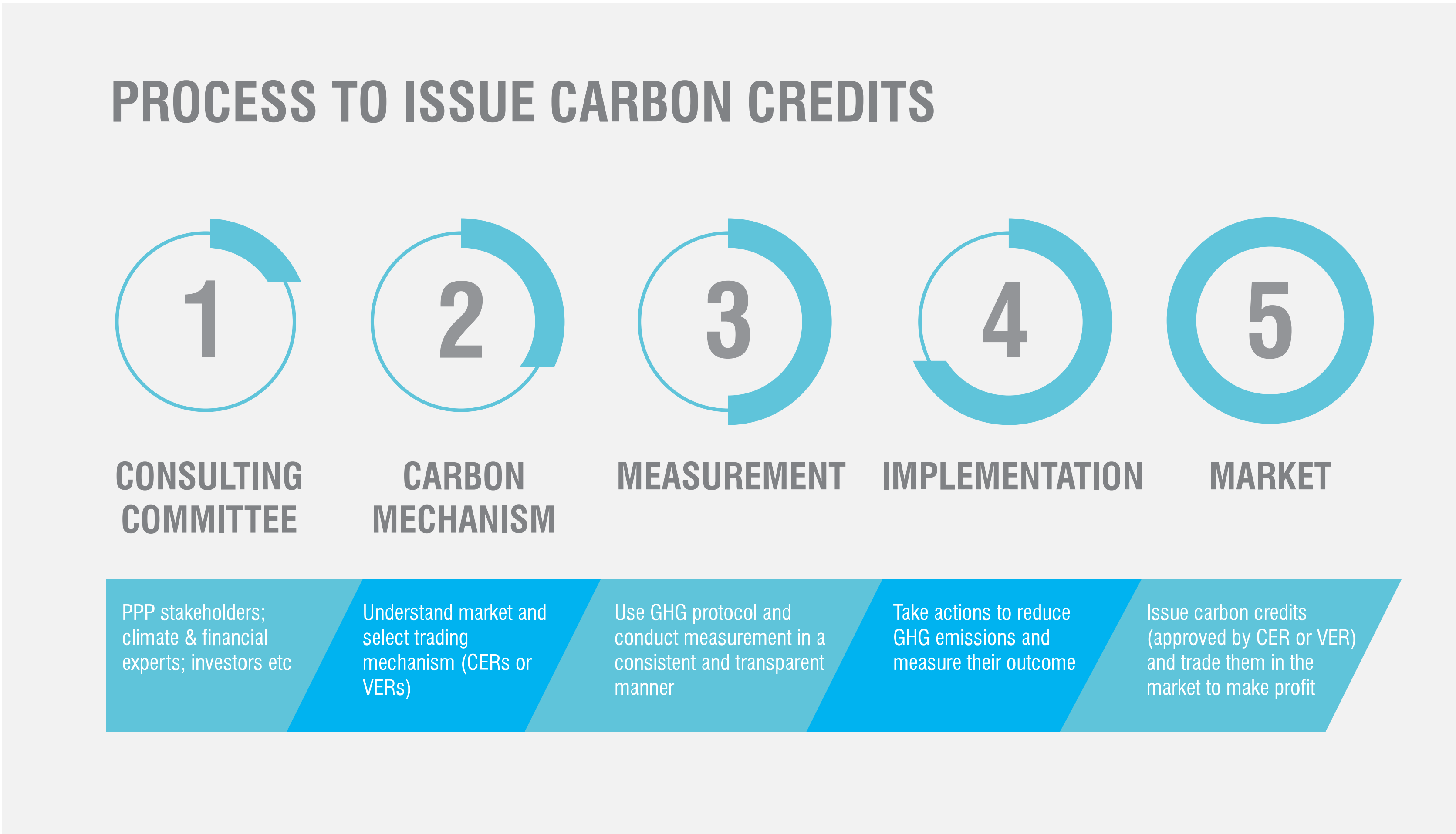


FIGURE A.6 General procedure to issue carbon credits

GLOSSARY

A

Acute climate risks
Risks which are imposed from the noticeable increase (or decrease) in the frequency and/or intensity of extreme weather phenomena. In a similar way to chronic risks, acute risks encompass high uncertainty as the frequency and intensity of extreme weather events cannot be determined given their dependency on a climate that is currently evolving in an unpredictable way

Adaptation
The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects

Adaptive plan
A project plan in which adaptation and resilience expenses are disbursable throughout the project depending on specific climate-related performance indicators. In general, an adaptive plan seeks flexible/expandable adaptation options that can change over time when climate circumstances are different than anticipated

Affordability[1]
The ability of a project to be realistically accommodated within the inter-temporal budget constraints of the government

All-risks insurance[3]
Covers losses due to physical damages to tangible property. It will respond to all perils except those specifically excluded in the insurance policy, such as war, radioactive/nuclear contamination, willful acts, defective design, etc.

Availability payment[1]
Payments made over the lifetime of a contract in return for the private party making the infrastructure available. This is defined in the contract, and it is a common form of payment in government-pays PPPs

Availability-pays PPP/Availability-based projects[4]
Projects that entitle a private partner to receive regular payments from a public sector client to the extent that the project asset is available for use in accordance with contractually agreed service levels. An availability-pays PPP is a form of government-pays PPP

B

Bankability[1]
The ability of a project to be accepted by lenders as an investment under a project finance scheme, or the ability of the project to raise a significant amount of funding by means of long-term loans under project finance, due to the creditworthiness of the project in terms of sufficiency and reliability of future cash-flows

Base plan

A project plan in which all capital expenses associated with adaptation and resilience measures are disbursable upfront. A base plan aims to conceive today (with the best available information about the future conditions) a robust static plan

Bid bond[1]

A written guarantee provided by the private party to the procuring authority. The bid bond is intended to ensure that if selected, the bidder will proceed with the contract. It is also known as a “bid submission guarantee”. The bid bond is generally returned to the successful bidder on effectiveness of the relevant contract or on financial close

Biodiversity[2]

The biological variety on earth, essentially the variety of plant and animal life in the world or in a habitat or ecosystem

Blue-Green Infrastructure (BGI)[5]

A subset of nature-based solutions that intentionally and strategically preserves, enhances, or restores elements of a natural system, such as forests, agricultural land, floodplains, riparian areas, coastal forests (such as mangroves), among others, to help produce higher-quality, more resilient, and lower-cost infrastructure services. Infrastructure service providers can integrate green infrastructure into built systems. The “blue” part refers to water elements while the “green” part refers to land elements

Business interruption insurance[3]

Insures the project company for loss of net profit and standing charges until such time as normal production or commercial operation is resumed

C

Capital expenditure (CAPEX) [1]

The initial construction costs of the infrastructure plus any expenditure on the constructed PPP asset that is not an operating expense (OPEX)

Carbon credits (or Carbon offsets)

A kind of permit that allows its holder to emit a certain amount of carbon dioxide or an equivalent of another greenhouse gases. One credit permits the emission of a mass equal to one ton of carbon dioxide. The main goal for the creation of carbon credits is the reduction of emissions of carbon dioxide and other greenhouse gases from industrial activities to reduce the effects of global warming. A carbon credit is a tradable certificate that can be sold to the carbon credit market

Catastrophe Deferred Drawdown Option (Cat-DDO)[3]

A contingency credit instrument developed in 2008 as a World Bank Development Policy Loan with a Catastrophe Deferred Drawdown Option. The Cat-DDO allows funds to be drawn upon declaration of a state of emergency or equivalent in the borrower’s territory, as a result of a natural or health-related disaster. The Cat-DDO provides critical liquidity to enable a rapid response without compromising the availability of resources for longer-term development programs. Cat-DDOs also incentivize proactive steps to reduce risk: in order to be eligible, governments must demonstrate capacity to manage the risks by strengthening the policy and financing framework for disaster risk management

Changes in law

Potential losses or potential changes in the value of investments that may be triggered from changes - or new implementations - in the policy frameworks, the legislation system, or government strategies as well as the transformation of traditional operations in primary sectors due to the effects of climate change (see also transition risks)

Chronic climate risks
Refer to potential incremental future climatic impacts, and their subsequent potential consequences. The time of occurrence, the severity and the pace of these possible impacts is unknown and cannot be predicted (not even probabilistically), thus, chronic risks inherently entail uncertainty

Civil code
Civil code is a codification of law. In civil code there is a comprehensive compilation of legal rules and statutes. In civil code countries force majeure is a legally defined concept, thus limiting the freedom of the parties to derogate from the legal concept

Climate adaptation measures
Measures that facilitate adjusting to actual or expected climate and its impacts, in order to moderate harm or exploit beneficial opportunities

Climate Contingency Account (CCA)
The concept of a CCA derives from the commonly used in PPP projects reserve accounts, which reserve amounts from the project's cash flows for future expenditures. Similar to these reserve accounts, a CCA may be applied in case of adaptive planning to reserve funds from the beginning of the PPP concession up to certain pre-agreed levels

Climate hazard[2]
The potential occurrence (or likelihood) of a climate-induced physical event or trend or physical impact that poses risk on the project

Climate mitigation measures
Low carbon or other measures that reduce GHG emissions and contribute to climate change mitigation

Climate model[2]
A numerical representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes and accounting for some of its known properties. The climate system can be represented by models of varying complexity; that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrizations are involved. Coupled atmosphere-ocean general circulation models (AOGCMs) provide a representation of the climate system that is near or at the most comprehensive end of the spectrum currently available. Climate models are typically applied as a research tool to study and simulate the climate and for operational purposes, including monthly, seasonal and interannual climate predictions

Climate resilience measures
Measures that increase the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner. This also includes the preservation, restoration, or improvement of the system's essential basic structures and functions

Climate risk[2]
The potential for consequences from climate variability and change where the project is at stake and where the outcome is uncertain. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. In this toolkit, however climate risk is defined directly from the interaction of vulnerability, exposure, and hazard - as probability cannot be explicitly computed for climate change

Climate-proof design
A design that explicitly incorporates and addresses risks that are caused by climate change

Co-benefits[2]
The positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Also referred to as ancillary benefits

Commercial feasibility[1]
Analysis conducted to check whether the project will effectively attract quality bidders, investors, and lenders, as well as highlight the main conditions that must be met to do so. Also includes "financial feasibility"

Common law[1]
Common law is generally uncodified. This means that there is no comprehensive compilation of legal rules and statutes. Although common law does rely on some scattered statutes, which are legislative decisions, it is largely based on precedent, meaning the judicial decisions that have already been made in similar cases. In common law countries there is a clear freedom between the parties to agree on the terms of the contract

Compensation events[1]
Risk events for which the private partner is entitled to receive financial compensation if the event materializes and to the extent the partner is impacted financially. This may occur in order to restore the financial equation of the project contract (the expected equity internal rate of return (IRR) and bankability) or to compensate the loss only partially (typically when an event has been nominated as a shared risk or a partial compensation event). Compensation events may be classified as full compensation events, partial compensation events, or shared-risk events

Completion bond[6]
Security provided by the construction subcontractor for performance under and completion of the construction subcontract

Concession
The agreement between the grantor and the project company for a finite period of time, typically between 25 and 40 years (with extension options for an additional 5-15 years), based on which the project company must construct, operate, and offer the required service to the public; maintain; and ultimately transfer back to the grantor the asset

Contracting authority
The unit/body/department within a government that is contracting the project (see also procuring authority)

Cost-Benefit Analysis (CBA) [1]
A type of analysis used to compare two or more options for a project or a decision based on economic flows duly adjusted, following some patterns. The CBA is primarily used to assess the socio-economic feasibility or value of the selected project or project under assessment (regardless of the method of procurement)

Credit enhancement[1]
Instruments that are structured mainly to provide a higher protection to lenders, thus increasing the credit rating of the debt. When provided by the public sector, credit enhancements are a form of public finance (in revolving mode) that may not necessarily provide soft terms, and they decrease the average cost of capital of the project directly; instead, they enable the lenders to charge lower rates of interest due to the increased credit rating. Credit enhancements can also be provided by multilateral development banks, export credit agencies, and private sector monoline institutions

D

Decarbonization
Refers to the process by which governments or other entities (or individuals) aim to achieve a low-carbon economy and reduce their consumption of carbon

Developer

A party willing to undertake / develop a project and responsible for the delivery of the project. A sponsor. Often, in some sectors, the engineering procurement and construction (EPC) contractor is also a developer

Disruptive technology risk

The risk that a new emerging technology unexpectedly displaces an established technology impacting the business model and/or the modeled cost (e.g., new equipment for maintenance having a significant upfront cost or cost of purchasing satellite material for weather forecasts, etc.)

Due diligence[1]

Review and evaluation of the project, the project contracts, and their related risks. It is carried out by project investors and lenders before deciding to participate in/lend to the project. The term may be also applied to the project preparation activities or some aspects of the preparatory works to be handled by the procuring authority before the tender launch

E

Excess risks

The portion of climate risk that exceeds the respective code provisions. The design of adaptation/resilience plans should have adhered to and be able to efficiently address the excess risks

Exposure[2]

The presence of one or more project assets in places that could be adversely affected by a hazard

External climate risks

Climate-change risks that originate from hazards affecting the broader socioeconomic system (i.e., green economy transition risks) and surrounding or associated infrastructure with which the project is interlinked. This category is exclusively associated with potential indirect impacts (e.g., revenue loss due to reduced demand or loss of access to the infrastructure due to failure of the interconnected network)

F

Force majeure [1]

External unpredictable events beyond the control of either party that are construed or defined by a law, policy or the contract. The precise scope of this term varies by jurisdiction, but it typically includes “acts of God” (natural disasters). It also often includes certain man-made events, such as war and terrorist activities

G

Government-pays PPP[6]

The government is the sole source of revenue for the private party. Government payments can depend on the asset or service being available at a contractually-defined quality (availability payments)—for example, a free highway on which the government makes periodic availability payments. They can also be volume-based payments for services delivered to users—for example, payment from hospital care effectively delivered

Grantor or **Procurer or Procuring Authority**[1]
The party that is responsible for evaluating and ultimately procuring a project. For example, the grantor may be a state entity (such as a ministry or a PPP secretariat) or local government (such as a municipality)

Gray infrastructure[5]
Built structures and mechanical equipment, such as reservoirs, embankments, pipes, pumps, water treatment plants, and canals. These engineered solutions are embedded within watersheds or coastal ecosystems whose hydrological and environmental attributes profoundly affect the performance of the gray infrastructure

Green bonds[7]
A subset of bond instrument where the proceeds are exclusively applied to finance or re-finance in part or in full new and/or existing eligible green projects and support climate-related or environmental projects

Green taxonomy[7]
A classification system for identifying activities or investments that will move a country toward meeting specific targets related to priority environmental objectives

H

Hazard frequency
A hazard attribute that describes the rate at which a hazardous event occurs (or is expected to occur) over a period of time

Hazard intensity
A hazard attribute that describes the magnitude of the hazard. The intensity might refer to the power, duration, area of coverage, or other measurable characteristics of the hazardous event

Hedging mechanisms[4]
Mechanisms or instruments that are used to limit exposure to a price or unit of value that fluctuates. These typically cover interest rate, foreign currency exchange rates or commodity prices, and/or inflation

I

Insurable events (or risks)
When there are available insurance mechanisms or instruments to cover the risks associated with these events

Insurance premium
The amount of money an individual or business pays for an insurance policy

Insurers
Entities that provide insurance to the project: mainly insurance companies

Internal climate risks
Climate-change risks that originate from hazards that are posed directly on the project and could damage the infrastructure itself or/and affect its availability (e.g., extreme flooding destroying dikes and suspending the service of infrastructure). Internal risks may have two components of impact: direct impacts defined as the loss due to damage on the physical infrastructure and indirect impacts defined as the loss of revenue due to the unavailability of the infrastructure (applicable both to government-pays and user-pays PPPs)

Investability
Potential or capacity for investment; the quality of being attractive or profitable to invest in

Investors
The shareholders of the project company. They can be EPC companies, facility management companies, financial investors, institutional investors (pension and insurance funds), state entities or the government itself

K

Key Performance Indicators (KPIs)[1]
The financial or non-financial indicators used to measure the progress or success of the private party during the operating term on critical factors relevant to the project, and which will normally vary depending on the contracted services and other attributes of the project. KPIs are often included in the contractual arrangement because they may serve as the basis for certain payments to the private party

L

Lenders
The financial institutions that provide loans to the project company in the form of senior debt, mezzanine debt or debt cover, to fund the project company on a non-recourse or limited recourse basis. Lenders can be commercial banks, multilateral institutions, development banks, export credit agencies, and infrastructure debt funds. Some types of creditors to the project company can also be bondholders, through the use of project bonds

M

Mitigation[2]

The ability of a human activity to reduce the sources or enhance the sinks of greenhouse gases. Human interventions may reduce indirectly GHG emissions by decreasing the sources of other substances that contribute indirectly to climate change

N

Natural disasters
Very low-probability extreme climate events

Nature-based solution (NbS)[5]
An umbrella term referring to actions that protect, manage, and restore natural capital in ways that address societal challenges effectively and adaptively. These include structural and nonstructural actions, ranging from ecosystem restoration to integrated resource management, green infrastructure, and more

O

Offtaker or offtake purchaser

The purchaser of the product produced by a project. The term is often used in connection with take-or-pay contracts

Operating expenditure (OPEX)[1]

Costs for operating the infrastructure asset after construction delivery

P

Parent company guarantee[1]

Guarantee from a contractor's parent company for the fulfillment of all contractual obligations. The parent company will assume responsibility for the obligations and/or provide financial compensation to the special purpose vehicle (SPV) to cover the cost of failure

Payment abatements or payment deductions/adjustments[1]

Deductions from the payments in a government-pays PPP. These are the immediate route for penalizing financially under-performance in government-pays PPPs

Performance bond/ Performance guarantee[1]

A written guarantee issued by a third-party (usually a bank or an insurance company). This is then submitted to the procuring authority and/or the special purpose vehicle (SPV). It is intended to ensure that the private partner and/or the contractor will perform all of the obligations as stated in their contracts

Physical risks

Potential damages on infrastructure or any tangible assets and service disruptions. The sources of the physical risks are climate- or weather-related events that may impact the project within its own environment. Physical risks are linked to damages and may pose financial losses for a project due to assets impairments or service interruptions

PPP contract[1]

A long-term contract between a public party and a private party for the development and/or management of a public asset or service, in which the private agent bears significant risk and management responsibility throughout the life of the contract. Remuneration is significantly linked to performance, and/or the demand or use of the asset or service

PPP pipeline[1]

A list of projects the government is considering for implementation as PPPs for a specific time frame (yearly, over 5 years, 10 years, and so on)

PPP process or PPP cycle[1]

The steps that PPP projects proceed through in order for the project to be delivered. Steps include identifying the project, appraising the PPP, structuring the PPP and designing the contract, managing the tender and award processes, and managing the contract

Private finance initiative (PFI)[1]

An alternative name introduced by the United Kingdom (UK) to refer to government-pays PPPs

Private partner[1]

The counter party of the procuring authority in the PPP contract. A private entity that has been granted the contract to construct and operate a government asset, and which is usually created under the form of a special purpose vehicle (SPV) or project company. It may also refer to the shareholder members of the SPV/project company, however these are more accurately defined as equity investors or shareholders

Private party[1]
An alternative common name to mean private partner. Private party or parties may also refer to the private agents that participate in the project (including sponsors, contractors, lenders, and investors)

Project
A plan or solution that addresses a public need and/or national goal that needs to be fulfilled or achieved. The project might be in the form of a concept or a more detailed set of operations. It might consist of an individual project or a set of multiple sub-projects. The project can be introduced with a single or multiple alternative approaches and each alternative might consist of different variants (i.e., technical solutions)

Project agreements
All the main documents that define and guide a PPP project structure, such as the offtake agreement, the engineering procurement and construction (EPC) contract and the operation and maintenance (O&M) contract

Project Company or **special purpose vehicle (SPV)**
An entity created to undertake a single task or project in order to protect the shareholders with limited liability, often used for limited or non-recourse financing

Project asset
A human, social, natural, physical, or financial resource or capital of the project

R

Re-financing risk of adaptation works (applicable to adaptive plans only)
The risk of meeting the financing requirements for the additional adaptation work at the time of the intervention

Reliability testing
Lenders and insurers sign off on the sufficiency of the developed PPP infrastructure

Relief events[1]
Risk events for which, if the risk occurs, the private partner will be excused for under-performance or even breach of obligations (that resulted from the event, but no financial compensation is granted). For example, time delays in the case of unforeseen archaeological findings

Representative concentration pathways (RCPs) [2]
Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover. Representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. Pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome

Rescheduling (or Restructuring)[8]
In relation to debt obligations, the renegotiation and agreement of revised terms of a loan facility (usually involving the spreading of interest and capital repayments over a longer period) as a result of the borrower being unable to comply with the original terms

Resilience[2]
The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure - while also maintaining the capacity for adaptation, learning and transformation

Resilience of the project[9]
Reflected in the question: "Are project assets/outputs resilient to risks from climate change and natural hazards?" Specifically, resilience of the project refers to the capacity of the project itself to achieve resilience against climate change

Resilience through the project[9]
Reflected in the question: "Is the project outcome aimed at building resilience to climate change and natural hazard risks?" Specifically, resilience through the project refers to the ability of the project outcomes to contribute to community/regional resilience

Risks of climate-induced failure of interconnected infrastructure
A type of external risk related to the associated infrastructure that is not part of the project itself but interacts with it (e.g., failure of the grid in case of a power-generation project or reduction of ridership of a highway project due to gradual desertification of the areas it is serving)

S

Security[6]
A legal right of access to value through mortgages, contracts, cash accounts, guarantees, insurances, pledges or cash flow - including licenses, concessions and other assets. Lenders can act on security rights in the event of default by the borrower. A negotiable certificate evidencing a debt or equity obligation/shareholding

Social risk
The risk associated with the project impact on affected population (including the risk of widening gender gaps)

State guarantees[10]
Agreements under which a sovereign or assimilated entity ("Government") agrees to bear some or all of the downside risks of a PPP project. A state guarantee is a secondary obligation. It legally binds the government to take on an obligation if a specified event occurs. A state guarantee constitutes a contingent liability, for which there is uncertainty as to whether the government may be required to make payments, and if so, how much and when it will be required to pay. In practice, state guarantees are used when debt providers (e.g., commercial banks, national and international financial institutions, capital markets, hedging counterparties) are unwilling to lend to a PPP company as a result of concerns over credit risk and potential loan losses. State guarantees can also be used to benefit the equity investors in a PPP company when they require protection against the investment risks they bear

Subcontract[1]
A contract between the private party and a third party, providing for performance of part of the private party's obligations under the PPP contract

Sustainability-linked loans
Key financial instruments that aim to support sustainable economic growth and investments towards a low-carbon and climate-change resilient future. They comprise any loan instrument and contingent facilities that incentivize green initiatives and actions that support sustainable economic growth

T

Tender process[1]
The process by which bids are invited from interested parties to carry out the project. A tender process uses competitive pressure among bidders to obtain the best price and terms

Third-party liability insurance

Covers third-party claims that may result from a physical injury or damage to someone else's property

Traditional design

A design that follows established norms and standards and does not account for climate uncertainty

Transition risks

A type of external risk that is not directly caused by a climate-event but is associated with the green economy transition that challenges the traditional legislative and investment framework and drives technological innovation in every aspect of life. They include the potential losses or potential changes in the value of investments that may be triggered from changes - or new implementations - in the policy frameworks, the legislation system or government strategies as well as the transformation of traditional operations in primary sectors due to the effects of climate change

U

Uninsurable events (or risks)

Events for which there are no available insurance mechanisms or instruments to cover the associated risks. They are commonly treated as force majeure

User-pays PPP[6]

The private party provides a service to users and generates revenue by charging users for the service. These fees (or tariffs, or tolls) can be supplemented by government payments, for instance, complementary payments for services provided to low-income users when the tariff is capped; or subsidies to investment at the completion of construction or specific construction milestones. The payments may be conditional on the availability or volume of the service at a defined quality level

V

Value for Money (VfM) in the PPP context[1]

The benefits relative to the costs of procuring a project using a PPP compared to other procurement options. Commonly referred by its abbreviation VfM. In a PPP context, value for money can be tested at two different points in the project cycle:

(i) during appraisal and structuring, a VfM test can determine whether the PPP alternative is a supportable procurement mechanism that is likely to provide best value to the public authority or better than the traditional procurement mechanism.

(ii) during the evaluation of bids, a VfM test can determine whether bids offer value for money against the cost of conventional procurement.

A positive VfM result or the VfM expected from the PPP option is the result of the combination of private sector efficiency and innovation, risk transfer, whole life cost, and service provided by the facility

Vulnerability[2]

The propensity or predisposition of the project to be adversely affected. Vulnerability encompasses two main concepts: (i) sensitivity or susceptibility to harm and (ii) lack of capacity to cope and adapt

W

Weather derivatives

Financial instruments used by companies or other entities to hedge against the risk of weather-related losses. This financial instrument is normally based on a weather-related index that is designed to reflect losses due to adverse climatic events such as excessive or insufficient rainfall, temperature extremes, and tropical storms, hurricanes, cyclones, and typhoons. The seller/issuer of the derivative accepts this weather risk and works in a similar way to an insurer; in case the weather index crosses a specific pre-determined threshold, the derivative holder receives the agreed payout.

Definitions based on:

1. ADB, EBRD, IDB, IsDB, and WBG, 2016: The APMG Public-Private Partnership (PPP) Certification Guide–Glossary
2. WBG CCKP, 2018: Glossary of Terms and Definitions
3. IFC, 2017: Insurance Layperson's Guide 2017
4. GIH, 2019: PPP Risk Allocation Tool 2019 Edition
5. WBG - WRI, 2019: Integrating Green and Gray: Creating Next Generation Infrastructure
6. PPP Knowledge Lab, 2021: Glossary
7. International Capital Market Association (ICMA)
8. Jeffrey Delmon, Private Sector Investment in Infrastructure, Kluwer Law International, Third Edition
9. WBG, 2021: Disaster Risk Financing (DRF) - Emerging Lessons in Financing Adaptive Social Protection
10. EPEC, 2011: State Guarantees in PPPs A Guide to Better Evaluation, Design, Implementation and Management
11. WBG, 2021: Resilience Rating System: A Methodology for Building and Tracking Resilience to Climate Change