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INTEGRATING CLIMATE RESILIENCE THROUGH THE INFRASTRUCTURE LIFECYCLE

CFA BRIEF



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KEY MESSAGES

- Ensuring the resilience of critical infrastructure is imperative to maintaining sustainable economic growth in a future affected by climate change, particularly for emerging markets and populations most vulnerable to climate change.
- Infrastructure assets can both be resilient themselves and contribute to the resilience of the populations they serve.
- Making infrastructure resilient benefits a range of stakeholders. Among them, users benefit from more reliable services, lenders benefit from a greater likelihood of repayment, and public planners, owners, and operators benefit from lower costs and enhanced asset values.
- To ensure resilience, climate considerations must be integrated throughout the infrastructure lifecycle, including the enabling environment, upstream, and downstream stages.
- All stakeholders across the infrastructure cycle have a role to play in enabling the planning and construction of climate-resilient infrastructure.

Climate Finance Advisor's mission is to accelerate sustainable, climate-aligned investment to the benefit of society, the economy, and the global environment. Established in 2015 as a Benefit LLC, CFA is a women-owned consulting and advisory firm specializing in helping our clients develop climate finance strategies, appraise and structure climate-aligned investments, channel public and private capital to sustainable investment, and integrate climate considerations into investment decisions, financial products and services, and policies. To engage with CFA on this issue, please contact us at info@climate-fa.com.

Introduction

Infrastructure is the cornerstone of economic and social development. It provides communities across the world with clean drinking water, safe and efficient transportation, and energy to power businesses and homes.

By some estimates, \$97 trillion in infrastructure investment is needed by 2040 globally, and of that amount, there exists a gap of more than \$15 trillion in the funding and financing available to provide such infrastructure (Global Infrastructure Hub, 2021, github.org). This gap, sometimes called the “infrastructure deficit”, requires investment from both public and private capital, each of which can play a significant role in the sustainability and resilience of infrastructure investments. Infrastructure assets are long-lived, and in many parts of the world, infrastructure is an asset class often developed as part of a public-private collaboration involving not only a combination of public and private capital, but also a regulatory, policy and legal enabling environment conducive to attracting investment.

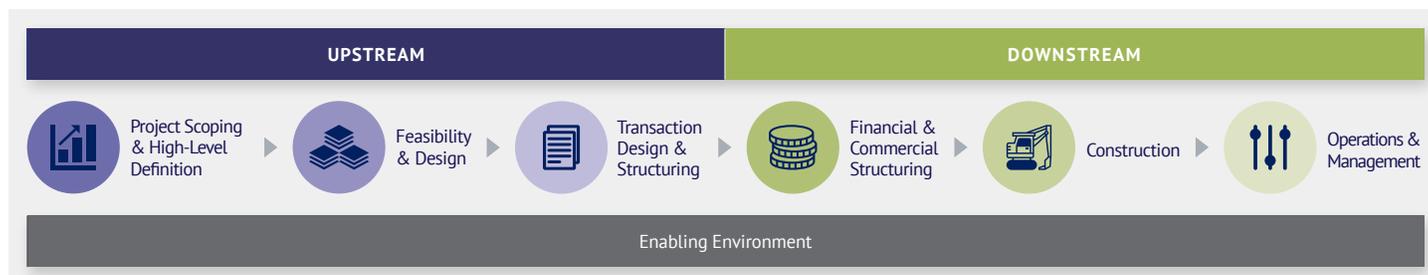
Today, bridging this gap and addressing this deficit needs to account for the realities of a changing climate. Incorporating measures of climate resilience into infrastructure planning, procurement, design, and financing benefits many stakeholders, including:



However, enhancing infrastructure resilience to climate change requires a comprehensive approach throughout the “infrastructure project lifecycle” which ensures the right incentives are present across all stages. In an enabling environment, a well-planned and systematic pipeline of climate-resilient investments is developed by public and private developers, and preconditions are present that ensure resilience is embedded in the financing of construction, operating, and managing infrastructure once developed. Building from a paradigm followed by the Global Infrastructure Facility and others, this brief provides a suggested set of actions across each stage that help integrate climate-resilience into infrastructure development.

Integrating Resilience into the Infrastructure Lifecycle

The infrastructure lifecycle has six component stages as illustrated in Figure 1, which includes two main elements: an Upstream Phase, and a Downstream Phase, each with sub-components.* The enabling environment is an important component of the infrastructure lifecycle. This section discusses practical approaches on how to integrate climate resilience considerations in each component of the infrastructure lifecycle (e.g. Enabling Environment, Upstream, and Downstream phases).



Sources: World Bank Group, *Resilience Rating System: Summary of Methodology and Guidance*. 2020.

FIGURE 1.
Infrastructure Lifecycle

*The checklist is part of research undertaken by CFA for the [Global Infrastructure Facility](https://www.gif.org/) (GIF), and benefits from input and review from GIF staff.

Enabling Environment

The policy, legal and regulatory “enabling environment” is often an important consideration by project developers and investors when deciding to develop infrastructure projects.

A country’s enabling environment typically includes the policies, regulations, incentives, and institutional capacity that underpin the entire infrastructure life cycle.

The enabling environment can not only help to reduce risks (real and perceived) that can dissuade investors, it can also help ensure that climate risks are addressed upfront in infrastructure planning and at all stages of an infrastructure project’s “lifecycle”, thereby creating the conditions for resilient infrastructure investments.

Checklist for Integrating Climate Considerations in the Enabling Environment

The following are practical ways to integrate climate resilience considerations into a country’s enabling environment.

HOW:

KEY PRINCIPLES FOR ENSURING A COUNTRY’S ENABLING ENVIRONMENT PRIORITIZES RESILIENCE IN INFRASTRUCTURE INCLUDE:

- a. Well-articulated climate goals over meaningful short-, medium- and long-term time horizons.
- b. Sector level reforms that align with the country’s overall sustainable development, climate, and economic growth goals, with roadmap(s) for implementation.
- c. Economic incentives that align with investment in resilience.

✓	Integrate Climate Resilience into real sector policies (e.g., water, transport, energy, etc.)	Ensure that sector reform includes adopting standards and metrics that set a high bar for adaptation and resilience, and that such reforms have mechanisms to improve standards over time (updating mechanisms) so that sector standards stay consistent with overall adaptation needs. Such mechanisms can be tied to warming or impact trends.
✓	Build sector-specific pipeline of resilience/resilient infrastructure projects	Align pipeline of climate-resilient projects with the country’s infrastructure service goals, NDC, and climate adaptation plans over time horizons aligned with infrastructure lifecycle(s) and a country’s sustainability goals.
✓	Incorporate climate-related risk assessments into initial strategic assessment of infrastructure	Assess economic and financial costs of climate-related risks to infrastructure, including demand for and supply of services.
✓	Climate Risk Assessments for all public budget (spending) and financial sector	Require that all financial actors (public financing mechanisms, private finance) integrate climate risk assessment into their funding/investment decisions and give preference to those projects where climate-related risks are well-managed.
✓	Employ fiscal and economic incentives for climate resilience	Develop fiscal and economic incentives (e.g., tax breaks, public financing mechanisms/funds, or banks), which, <i>by design</i> , provide incentives for developers and other investors to prioritize the provision of resilience benefits.
✓	Ensure climate resilience is a goal of all public procurement, particularly for infrastructure	Update existing procurement policies to integrate climate-related risk and resilience as a key component of procurement and public-private partnership (PPP) laws.
✓	Build climate risk and resilience capacity across government agencies	Build teams within government to support the enabling environment for resilient infrastructure, including building pipeline, creating and applying economic incentives.

Infrastructure Lifecycle

UPSTREAM PHASE

This phase includes (i) project scoping and definition, (ii) feasibility and design, and (iii) transaction design and structuring. An infrastructure asset's resilience is determined by the type of infrastructure chosen, where it is built, and its relation to the broader infrastructure system. Many of these parameters are determined upstream in the planning process and are driven by policymakers and public planners, whether they are developing resilient infrastructure through a systems-based approach or sector-based planning. Integrating climate resilience into upstream planning improves the quality of pipeline projects, ultimately creating a stronger basis for dealing with the impacts of climate change.

Checklist for Integrating Climate Considerations in the Project Scoping/High-Level Definition

The following are practical ways to integrate climate resilience considerations into the **Project Scoping and High-Level Definition** step in the Upstream phase of the infrastructure lifecycle.

HOW:



A. COUNTRY NEEDS AND OPTIONS ASSESSMENTS		
	Climate risk analysis (country, sector)	Assess the country/sector-based impacts in an integrated/systemic manner expected from climate change over several time horizons (short, 1-5 years; medium, 6-15 years; long, 15+ years).
	Integrate climate risk analysis into the country's national climate plans	Including its Nationally Determined Contributions (NDC) and National Adaptation Plans (NAPs), and build the opportunity set sector by sector to address climate risk/build-in resilience measures.
	Integrate climate-related risk and resilience measures into broad sectoral policies and time horizons that align with country strategies	Ensure measures consider short (1-3), medium (3-5), and long term (5+) time horizons, as well as the life of infrastructure assets.
	Develop an indicative pipeline of infrastructure investments to deliver on climate and other goals	Use climate risk assessments to inform the pipeline of resilient infrastructure.
B. DEFINE "RESILIENT" INVESTMENT AND INVESTMENT IN "RESILIENCE"		
	Integrate resilience concepts into pre-feasibility analyses on potential infrastructure investments	Viability gap analysis, cost-benefit analysis, Value for Money analysis, and high-level financial/economic modeling should all reflect climate resilience considerations.
	Ensure market readiness assessments integrate resilience measures in the enabling environment where possible	Ensure project pipeline considers the impact of enabling environments with regards to climate considerations.

C. ENSURE "OPTIONS ANALYSIS" FOR PUBLIC FINANCE PRIORITIZES AND SUPPORTS DIFFERENT SECTOR-BASED CLIMATE-RESILIENT INVESTMENT PIPELINES

	<p>Ensure that fiscal and budgetary analysis includes economic (quantified) impacts of climate-related risks and an assessment of cost-savings</p>	<p>Including analysis from "building-in" resilience measures into critical infrastructure assets and services (e.g., reduction of disaster costs; increase(s) in economic productivity from the benefits of adaptation).</p>
	<p>Integrate climate-related considerations (e.g., valorization of costs and benefits) into strategic fiscal/budgetary allocation to prioritize/accelerate resilient infrastructure</p>	<p>Allocate public funding strategically where public funding is better suited (e.g., infrastructure with low(er) ability to attract private capital) and enable public funding for those projects which may have a higher potential to attract private capital given high-level economic assessment to be utilized to mobilize such capital.</p>
	<p>Ensure all option analysis recognizes and accounts for operations and maintenance costs (O&M) associated with resilient infrastructure and includes (where needed) plans to ensure long-term coverage of such costs</p>	<p>This is particularly important where revenue streams are low (e.g., Nature-based Solutions, or NbS) and fiscal sustainability analysis requires ongoing public support to ensure resilience measures are maintained.</p>

Checklist for Integrating Climate Considerations in Feasibility and Design

The following are practical ways to integrate climate resilience considerations into the **Feasibility and Design** step in the Upstream phase of the infrastructure lifecycle.

HOW:



A. FULL FEASIBILITY STUDIES (PROJECT SPECIFIC)

	<p>Ensure that technical, economic, and other feasibility studies of specific infrastructure projects integrate climate-related risks/hazards that will, directly and indirectly, impact the asset</p>	<p>This includes ensuring a Cost-benefit and Value-for-Money assessment² that integrates climate-related costs and benefits over (i) varying time horizons and (ii) quantified in terms of their impacts on revenues, assets, and costs.</p>
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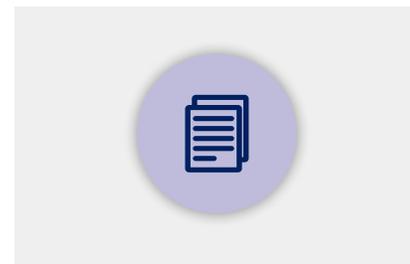
B. FULL ENGINEERING AND DESIGN OF PROJECT

	<p>Use climate-informed feasibility studies to ensure projects are designed and engineered to address anticipated climate-related risks (e.g., water scarcity, increased storm intensity, heat impacts) over various time horizons</p>	<p>Ensure they are consistent with existing climate-related taxonomies and metrics, and are designed to minimize impacts of disasters and other acute/chronic climate-related impacts.</p>
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Checklist for Integrating Climate Considerations in Project/Transaction Design

The following are practical ways to integrate climate resilience considerations into the **Project and Transaction Design** step in the Upstream phase of the infrastructure lifecycle.

HOW: ACTIVITY 3: PROJECT AND TRANSACTION DESIGN, FINANCIAL STRUCTURING AND BIDDING



A. PROJECT AND TRANSACTION DESIGN



Ensure that climate-related risk assessments undertaken in the feasibility studies are used to help design the financial transaction

Integrate into the financial structure approaches to appropriate risk-sharing by different public and private entities (e.g., government, financial institutions, development finance institutions) aligned with different forms of capital.

B. PPP STRUCTURING: BIDDING, TENDERING, CONCESSIONS



Ensure government bidding, tendering or concession documents clearly outline the resilience goals for the infrastructure asset

This can enable developers/private financiers to ensure the climate resilience and sustainability aspects are explicitly integrated into design and transaction structuring.



Ensure transparent scoring methodologies for public procurement of resilient infrastructure

Including ensuring that scoring prioritizes climate resilience and sustainability measures, and that best-value/value-for-money approaches do not penalize incremental costs for resilience measures (if applicable).



Ensure PPP structures identify obligations

Particularly of the public/government support and the owner/operator of the asset in ensuring the long-term climate-resilience goals of the asset.



Ensure project proponent's existing procurement policies integrate climate-related risk and resilience as key factors

Where project developers themselves procure for public infrastructure development, ensure procurement prioritizes resilience and sustainability measures.

DOWNSTREAM PHASE

Once a project has gone through planning stages in the Upstream Phase, it enters the more operational Downstream Phase, where it goes through the following steps: (i) financial close, (ii) construction, and finally (iii) operation and maintenance, which occurs during its lifetime. Integrating climate resilience throughout these three stages ensures that the project helps build resilience and mitigates climate risks through to its decommissioning

Checklist for Integrating Climate Considerations in Financial/Commercial Structuring

The following are practical ways to integrate climate resilience considerations into the **Financial and Commercial Structuring** step in the Downstream phase of the infrastructure lifecycle.

HOW:



A. COUNTRY NEEDS AND OPTIONS ASSESSMENTS



Ensure that climate-related risk data is integrated into project specific financial models and projections

Specifically, as they relate to:

- ✓ a. All revenues, costs, and asset values.
- ✓ b. Capital costs for overall resilience measures (if additional).
- ✓ c. Additional potential financing costs (e.g. insurance cost projections, financing terms).
- ✓ d. Operation and maintenance (O&M) costs to maintain resilience measures and/or enhance over time.



Ensure benefit-cost analysis captures estimates of avoided costs as a result of resilience measures

Specifically, ensure the financial modeling captures the estimated savings in losses, damages, and other savings resulting from enhancements made.

B. RISK ALLOCATION AND STRUCTURING



Ensure contracts related to engineering, procurement, construction (EPC), and O&M, such as with the general EPC contractor and operator, adequately identify and articulate climate-resilience requirements

including:

- ✓ a. **Procurement:** ensure that the EPC contractor procurement policies are aligned with the project's resilience/sustainability goals.
- ✓ b. **Performance (both EPC and Operator):** ensure contract provisions and performance metrics tied to the resilience outcomes anticipated by the asset are included.



Ensure financing documents incorporate resilience measures as part of an overall risk management strategy of the asset

Encourage, and where possible ensure, financing costs to reflect reduction in riskiness resulting from resilience measures.



Where applicable, ensure that insurance is procured, which helps to manage the costs of potential climate-related risks, should they occur

Ensure that insurance costs also reflect the benefits from resilience measures.



Ensure government's role in the impact of disasters on infrastructure that has integrated resilience measures

Seek to identify (where possible) in public concessions, bidding documents, and other support for the project government obligations to address, accept, manage, and/or reduce climate-related risks, particularly in cases of extreme climate events.

Checklist for Integrating Climate Considerations in Construction

The following are practical ways to integrate climate resilience considerations into the **Construction** step in the Downstream phase of the infrastructure lifecycle.

HOW:



✓	Ensure construction fully applies resilience design specifications	Where relevant include contractual levers (milestones, disbursement conditions, etc.) to ensure construction contractors meet climate-resilient design specifications and standards.
✓	Monitor and track the implementation of resilience measures	Specifically, monitor and track costs of resilience measures as implemented during construction.
✓	Ensure climate considerations are part of overall construction, and that contractors manage climate impacts on the health and safety of workers in the construction phase	Specifically related to climate-hazards such as extreme heat, and other climate-risks present during construction.

Checklist for Integrating Climate Considerations in Operations and Maintenance

The following are practical ways to integrate climate resilience considerations into the **Operations and Maintenance** step in the Downstream phase of the infrastructure lifecycle.

HOW:



A. OPERATIONS AND MAINTENANCE		
✓	Monitor and track climate-related performance of operational assets through enhanced monitoring & evaluation	Include approaches to assess, quantify, and measure climate-related cost benefits, including realized savings from enhanced resilience.
✓	Adjust maintenance schedules to reflect evolving resilience needs as needed	Specifically, monitor and track costs of resilience measures as implemented during construction.
✓	Ensure climate considerations are part of overall construction, and that contractors manage climate impacts on the health and safety of workers in the construction phase	Specifically related to climate-hazards such as extreme heat, and other climate-risks present during construction.
B. RE-FINANCING, IF APPLICABLE		
✓	Where possible, seek to have the asset's credit rating (or other creditworthiness assessments) reflect resilience measures	
✓	Ensure financing documents consider resilience measures as part of an overall risk assessment	Encourage financing costs to reflect such measures.
✓	Where applicable, ensure that insurance is maintained at a sufficient level to help manage the costs of potential climate-related risks	Should they occur.