

Climate Resilient Infrastructure:

Embedding climate resilience in DFID programme design

Introduction

DFID’s Economic Development Strategy (2017) recognises climate change as ‘the biggest global threat to sustained economic development’. Climate resilient infrastructure can accommodate the shocks and stresses posed by extreme weather events and climate change, while supporting economies and communities (particularly the poor and vulnerable) to survive, adapt and thrive in the face of these challenges.

DFID can play a transformative role in supporting government and private investors to invest in climate resilient infrastructure. This note sets out key considerations for integrating climate resilience in DFID infrastructure programmes, including suggested steps at each stage of the programme cycle. Figure 1 demonstrates how successfully building climate resilience into infrastructure programmes encompasses **both the resilience of the assets themselves, and enhancing the resilience of communities, cities and economies.**

DFID staff and programming partners must consider very different drivers to those in developed countries and markets (refer to Briefing Note 1 in this series), which themselves may be country or context specific. These are summarised below.

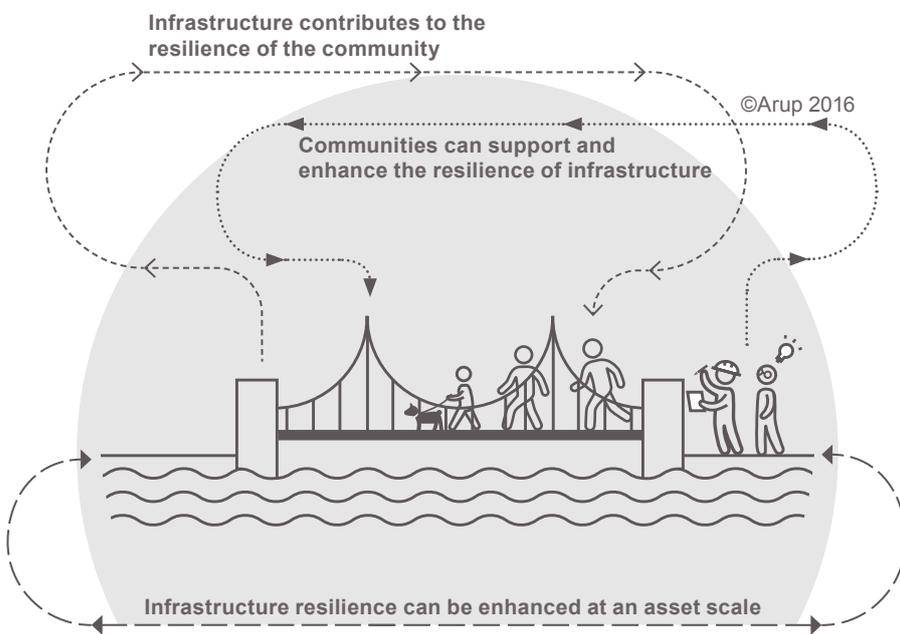


Figure 1: Infrastructure and community resilience



“Must do”

For DFID and its programme partners, the ‘must do drivers’ relate to compliance with relevant climate safeguards and policy.

These include:

- DFID Smart Rules i.e. ‘avoiding doing harm’ and ‘ensure sustainability and resilience’.
- National, regional or urban policy and regulation on climate change adaptation and resilience (this does not exist in many countries DFID operates in).



“Should do”

The ‘should do drivers’ are incentives or targets to build infrastructure resilience.

These include:

- National, regional or urban climate change adaptation and resilience strategies (these do exist in many countries DFID operates in).
- Enhancing value for money (VFM) through no-cost or low-cost resilience ‘value add’ for infrastructure investment.
- International finance including DFID Country Office International Climate Fund (ICF) Targets.



“Could do”

The ‘could do’ drivers are voluntary actions undertaken by infrastructure owners, operators and financiers to enhance climate resilience, taking into account interdependencies with other systems and benefits for other stakeholders. These include:

- Piloting innovative new approaches
- Enhancing co-benefits for poor and vulnerable communities
- Investing in relevant national policy and capacity.

Key steps in programme design

This section outlines key steps and considerations for integrating climate resilience in DFID infrastructure programming. Aligning with programme design, these steps are intended to be iterative. A best-practice approach for integrating climate resilience will be inclusive and evidence-based, looking to enhance resilience outcomes beyond the project 'footprint' - particularly for poor and vulnerable communities.



Scoping and developing options

Objective: develop an understanding of climate resilience needs and opportunities to inform option development.

- **Review lessons learned** from climate resilience components of previous programmes (DFID and others) which are relevant to the local area and/or sector.
- **Review national or local climate change challenges** that may be addressed, considering:
 1. What are the key climate-driven shocks (sudden onset events or disasters) and stresses (chronic long-term impacts) experienced by infrastructure, communities and the economy historically?
 2. What will be the frequency and severity of these shocks and stresses in the future?
 3. Which key stakeholders are impacted by the shocks and stresses? Who might benefit from climate resilient infrastructure investment? (e.g. vulnerable communities, small business owners, asset operators, government ministries).
- **Consult with identified stakeholders** to better understand how infrastructure investment might enhance resilience outcomes.
- **Identify options to enhance resilience of infrastructure and communities**, considering:
 1. Is there an opportunity to deliver infrastructure specifically to address identified gaps or vulnerabilities?
 2. What are the requirements or opportunities to ensure the proposed infrastructure is resilient to the identified climate-driven shocks and stresses?
 3. What opportunities exist to create resilience benefits beyond the footprint of the infrastructure through improved planning, design, construction, operation and maintenance, or governance? Of these opportunities, are there any 'no cost' or 'no regrets' options, such as retaining flexibility in design to allow easy future upgrade in response to future climate change?



Reviewing risks, vulnerabilities and interdependencies

Objective: employ robust data in options selection and business case design, in order to guide climate resilience investment decision, and enhance positive impact and VFM.

This step may be undertaken as an iterative process - in greater detail for the preferred option once selected.

- **Obtain up-to-date information to inform decision-making.** This may include: data for historic climate impacts and projected future climate change, hazard maps, economic assessments of climate change impacts for relevant sectors, and level of uncertainty associated with future trends and impacts.
- **Consult further with relevant stakeholders**, including local communities and government disaster management authorities, to better understand climate related impacts, priorities, and opportunities at a local level.
- **Evaluate the level of uncertainty** associated with future trends (e.g. climate change, demographic change, economic growth or technology shift), considering what level of uncertainty is acceptable.
- **Assess vulnerabilities and risks (including opportunities) related to climate impact** for all options, including the infrastructure itself and potential outcomes for the environment, communities and the economy. This may require climate modelling and/or a multi-hazard risk assessment.
- **Evaluate existing and potential interdependencies**, both within the infrastructure system, and critical dependencies upon other systems (e.g. energy, human resources, emergency plans).



Options appraisal

Objective: consider and prioritise climate resilience opportunities in investment decisions.

- **Undertake appraisal.** Use appropriate economic and options appraisal techniques to prioritise climate resilience spending, including consideration of climate resilience benefits for infrastructure performance over its lifetime, and more broadly for beneficiary communities or the wider economy. Incorporate elements of robustness and flexibility where uncertainty around impacts is high. Refer to Briefing Note 2 in this series: *Getting the economics of infrastructure resilience right*.
- **Ensure options selection takes into account climate resilience benefits,** both for the infrastructure itself and for wider communities.
- **Ensure that climate resilience solutions are incorporated from the outset** rather than being considered in isolation once the project is underway.
- **Ensure all ‘no regrets’ resilience opportunities are captured** in the preferred option to maximise development benefits and achieve early VFM.



Confirming objectives

Objective: clearly establish climate resilience objectives and requirements.

- **Define the preferred ‘resilience strategy’** ranging from providing resilience through resistance and robustness (high CAPEX), to managed adaptation or organisational measures (higher OPEX).
- **Clearly set out climate resilience objectives, outputs and indicators in the business case and results framework.** This should include performance objectives for the asset, and/or climate resilience objectives for the community or broader stakeholders.
- **Identify performance requirements,** to be further developed in project mobilisation and Terms of Reference. For example, the time to achieve 90% operability, following a shock event, could be a performance requirement.



Delivery planning

Objective: integrate climate resilience objectives and requirements in delivery planning.

- **Identify roles, responsibilities and stakeholders** relevant to climate resilience objectives, and set these out in the delivery plan; for example community-based organisations, service providers and government agencies such as emergency management authorities.
- **Consider opportunities to involve community and other key resilience stakeholders in delivery,** in order to improve ownership, capacity and awareness of resilience. For example, training to local labourers on resilient construction techniques can ensure skills are replicated beyond the project.
- **Ensure the delivery timeline allows for adequate engagement and coordination** with stakeholders on climate resilience objectives.

Identifying climate resilient infrastructure opportunities

The infographic below provides questions to support review of climate resilience opportunities for DFID programmes.

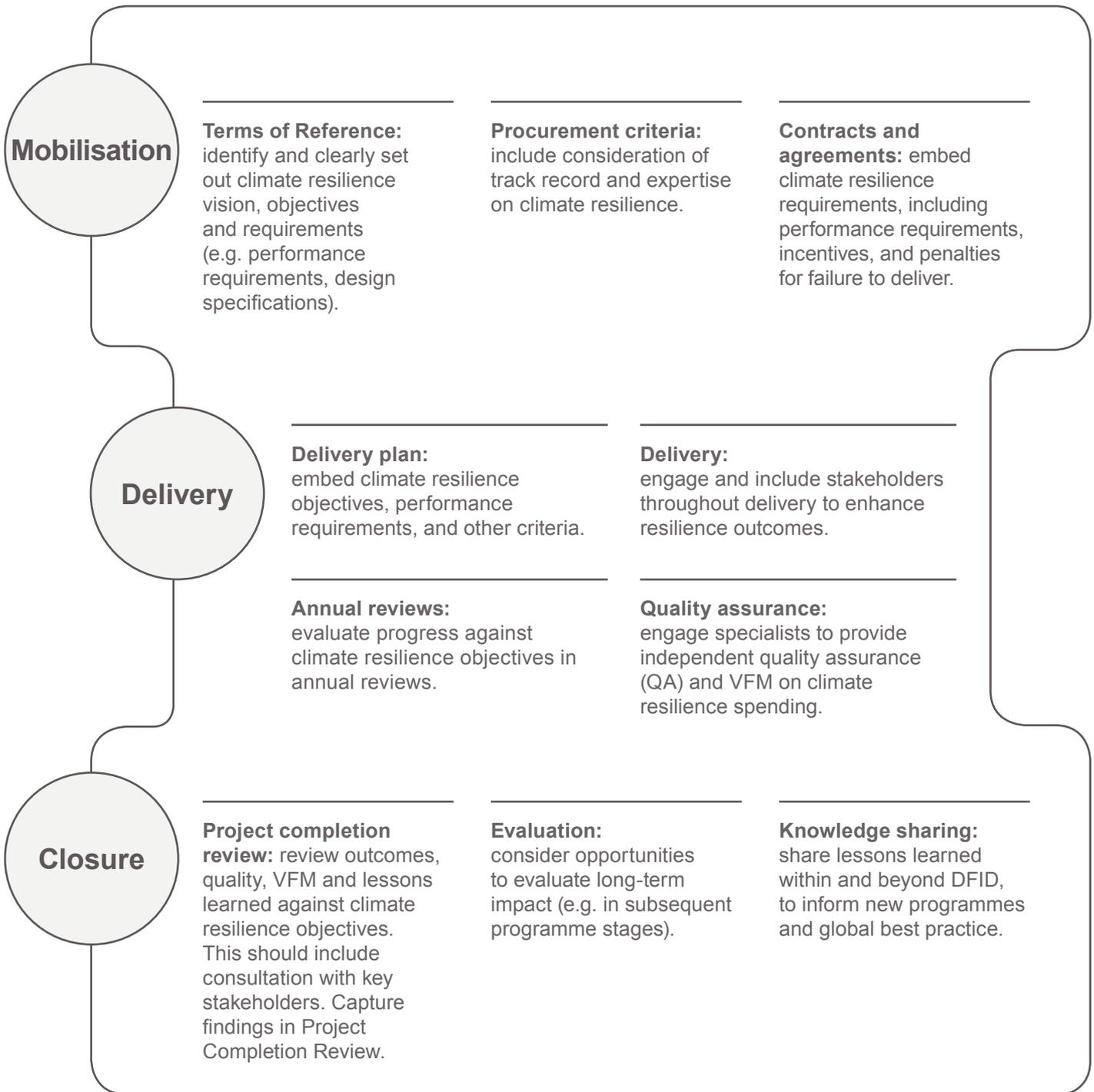
TYPES OF INTERVENTION

WHO BENEFITS

<p>Resilient infrastructure planning, design or construction: technical assistance (TA) or capital expenditure (CAPEX)</p> 	<p>Asset financiers, owners, operators and users benefit when infrastructure assets and systems can remain functional, recover quickly, and adapt or transform when climatic shocks and stresses occur.</p> <p>Key question for programme design: what performance is required from the infrastructure when climate-driven shocks and stresses occur?</p> 	<p>Broader stakeholders (communities, cities, economy) benefit when infrastructure supports or enhances their ability to cope, adapt and thrive when climatic shocks and stresses occur.</p> <p>Key question for programme design: how might infrastructure support the resilience of communities and other stakeholders to current and future climate shocks and stresses?</p> 
<p>Resilient infrastructure operation and maintenance: Operational expenditure (OPEX) or TA</p> 	<p>For example: designing major community buildings with back-up systems, first aid and contingency supplies to ensure they can operate as shelters during an emergency. Or, designing a new highway using an elevated profile and robust materials to resist certain flood levels or temperatures.</p> <p>For example: developing operation and maintenance plans that identify emergency access and nearby contingency supplies in case of damage. Up-skilling a local community or workforce to ensure assets can be readily repaired following major damage and seasonal wear and tear.</p>	<p>For example: a new dam intended for flood protection might also provide water supply to manage drought and wildfires during the dry season, and clean drinking water and irrigation year round. This requires both hard and soft measures such as investment in physical infrastructure, water supply facilities, community engagement/ training, and inter-agency coordination (e.g. between water company/ forestry/ fire service).</p> <p>For example: involving community in testing of water quality, and/ or providing training/ awareness raising on how to cope if quality falls below acceptable levels (boiling, chlorinating, or using other sources).</p>
<p>Resilient infrastructure: organisational and institutional TA</p> 	<p>For example: supporting government to adapt global standards for seismic resilience to suit local vernacular construction and materials to ensure uptake and enforcement is realistic.</p>	<p>For example: supporting effective government engagement with communities on resilience gaps and opportunities.</p>

Next steps

Beyond programme design, suggestions for key steps to ensure climate resilience objectives are realised throughout the programme cycle are summarised below.



Further reading

GUIDANCE

- **Arup / Lloyd's (2017), Future Cities: Building Infrastructure Resilience** – Practical advice for asset owners, operators, designers and insurers to enhance infrastructure resilience: www.lloyds.com/cityresilience
- **Gallego-Lopez, C.; Essex, J. (2016), Infrastructure resilience resources. Evidence on Demand, UK** – A series of three infrastructure resilience resources developed for DFID, focusing on design, understanding risk and resilient investment, and mainstreaming in development planning: <https://goo.gl/okMAkG>
<https://goo.gl/Y9vNCB>
<https://goo.gl/4X2aN1>
- **IIED (2013), A framework for mainstreaming climate resilience into development planning** – Identifies progress and shares learning in Asian and African countries to achieve climate resilient societies and economies: <https://goo.gl/mi7Pjz>
- **Ranger (2013), Decision-making under uncertainty** – How to address uncertainty in decision-making and potential use of decision tools in this context: <https://goo.gl/FHEebP>
- **Watkiss, Hunt and Savage (2014), Early VfM Adaptation Toolkit** – Delivering Value for Money Adaptation with Iterative Frameworks and Low-Regret Options: <https://goo.gl/Egb45j>

DATA SOURCES

- **CCWorldWeatherGen (Climate Change World Weather File Generator for World-Wide Weather Data)** – Allows for generation of climate change weather files for world-wide locations ready for use in building performance simulation programs: <https://goo.gl/orSgby>
- **Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report** – An update of knowledge on the scientific, technical and socio-economic aspects of climate change: <https://goo.gl/yAQqu5>
- **Think Hazard** – Online tool which highlights the likelihood of different natural hazards affecting project areas, provides guidance on how to reduce the impact of these hazards, and where to find more information: <http://thinkhazard.org/en/>
- **UNEP / UNISDR Global Risk Data Platform** – A multiple agencies effort to share spatial data information on global risk from natural hazards, allowing visualisation and extraction of data on past hazardous events: <http://preview.grid.unep.ch/>
- **WeatherShift** – Online tool using data from global climate change modelling to produce data files for use in simulating building energy requirements, adjusted for changing climate conditions: www.weather-shift.com/

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Infrastructure and Cities for Economic Development ("ICED") is a project funded by the UK's Department for International Development ("DFID") and is led and administered by PricewaterhouseCoopers LLP, working with organisations including Adam Smith International, Arup, Engineers Against Poverty, International Institute for Environment and Development, MDY Legal and Social Development Direct.