

Climate Resilient Infrastructure: Preparing for a Changing Climate

Summary Document



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Increasing infrastructure's resilience to the impacts of climate change is a priority for this Government, to help protect the economy and its future growth.

This document has been produced as a response to calls from industry – infrastructure owners, investors and insurers – for Government policy on adapting infrastructure.

Climate Resilient Infrastructure outlines the importance of adapting infrastructure to the impacts of climate change; the potential opportunities to business; and the challenges and barriers to be overcome. Its aim is for:

An infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate.

The focus is energy, ICT, transport and water infrastructure. These infrastructure sectors are a set of interconnected networks on which other infrastructure sectors and parts of the economy and society rely on to function. They are central in the drive to support the transition to a low carbon, climate resilient economy.

Over the next 18 months, Government will work with industry – infrastructure owners, operators, investors and engineers – to take forward the report, and the actions set out in it. Government will report on progress made, and what further actions might be required, in the UK Government's first Adaptation Programme at the end of 2012.

Overcoming Challenges

The Government's Adapting to Climate Change Programme has prioritised the need to address the climate resilience of infrastructure. In 2009, a two-year Infrastructure & Adaptation project¹ was set-up to examine how to improve the climate resilience of infrastructure.

The project's four independent studies and extensive collaboration with industry and infrastructure experts identified a number of challenges and barriers to action.

Headline challenges

- 1. How Government can facilitate progress in adapting infrastructure to the impacts of climate change.*
- 2. How to set out the challenge of adapting to climate change in economic regulatory models.*
- 3. How the planning system for nationally significant infrastructure can guide applicants on the need to adapt new infrastructure to the impacts of climate change.*
- 4. How to reduce the risk, that climate change impacts present to infrastructure interdependencies, increasing the vulnerability of infrastructure sectors.*
- 5. How to increase the adaptive capacity in infrastructure companies and others (e.g. investors) to enable robust and cost effective climate change adaptation decisions to be made.*
- 6. How to improve the way investment decisions incorporate the impacts of climate change.*
- 7. How to improve access by industry to specific climate information and research through better information sharing, disclosure of risk and evidence.*
- 8. How to monitor progress made in adapting infrastructure to climate change.*
- 9. How to realise the potential economic opportunities that adapting infrastructure to climate change presents.*

¹ <http://www.defra.gov.uk/environment/climate/sectors/infrastructure-companies/>

Implementing Action

Government has an important role to play in addressing these challenges. By assisting others through policy, regulatory frameworks, information and support, Government can help boost the climate resilience of infrastructure.

But it is action by others – investors, owners, operators and engineering and construction sectors – that will be essential to implementing adaptation action.

| Potential actions to adapting infrastructure to climate change | |
|--|--|
| Investors | <ul style="list-style-type: none">• Incorporate climate change impacts in 'due diligence' processes.• Demand greater disclosure of climate risk and adaptation action by infrastructure organisations. |
| Infrastructure owners and operators | <ul style="list-style-type: none">• Embed adaptation in the organisation and its decision-making.• Integrate adaptation into existing infrastructure maintenance regimes.• Consider climate change impacts in design, build and operation of new infrastructure. |
| Regulators | <ul style="list-style-type: none">• Balance current and future consumer interests by aligning climate resilience alongside short-term objectives of efficiency and value for money. |
| Insurers | <ul style="list-style-type: none">• Work with clients to improve current and future climate resilience to reduce exposure to weather events. |
| Engineers | <ul style="list-style-type: none">• Develop new ways to design and build climate resilient infrastructure.• Develop new skills and expertise in adapting infrastructure to create marketable skills and solutions. |

Impacts of Climate Change on Infrastructure

The Cabinet Office's *Guide to Natural Hazards & Infrastructure*² provides advice on building resilience to natural hazard events. *Climate Resilient Infrastructure* looks at addressing the challenges and the potential opportunities to preparing infrastructure for a changing climate.

Climate change is one of the biggest challenges the world faces. Tackling climate change is a top priority for this Government – at home and internationally.

The UK Climate Projections³ show that past, current and future greenhouse gas emissions will influence our climate for decades. As a result, the UK's climate will continue to change with hotter, drier summers and warmer, wetter winters, potentially leading to an increase in extreme weather events such as heatwaves.

2 <http://www.cabinetoffice.gov.uk/infrastructure-resilience>

3 <http://ukclimateprojections.defra.gov.uk/>

Responding to climate change requires two kinds of action:

1. We need to **mitigate climate change** by reducing greenhouse gas emissions.
2. We need to **adapt to climate change** due to past, current and future greenhouse gas emissions.

Both require the UK to develop a strong and sustainable green, low carbon economy, resilient to climate change.

Climate change could have significant implications for infrastructure. As infrastructure assets have long operational lifetimes, they are sensitive not only to the existing climate at the time of their construction, but also to climate variations over the decades of their use.

For example, a substantial proportion of infrastructure built in the next five years will still be in use long after 2030.

Climate change will affect infrastructure

- **Existing infrastructure** has been engineered and built for a past or current climate and may not be resilient to the future climate.
- **New infrastructure** will often have a life of 50 to 100 years (or more). To ensure its viability over its lifetime, it needs to be resilient to a climate that could be significantly different than today.

How the impacts of climate change may affect infrastructure

- Increased flood risk to fossil and nuclear power sites and electricity substations.
- Reduced availability of cooling water for inland power stations.
- Reduced quality of wireless service from increased temperatures and intense rainfall.
- Increased flood risk to all transport sectors.
- Increased scour of bridges from intense rainfall/flooding.
- Reduced security of water supply from changing rainfall patterns.
- Increased flood risk to wastewater infrastructure.

Achieving more climate resilient infrastructure, requires the impacts of climate change to be a key consideration in the way that significant pieces of infrastructure in the energy, ICT, transport and water sectors are planned and commissioned, designed, built and maintained.

Adapting Infrastructure to a Changing Climate

The impact of climate change on infrastructure is an important economic, environmental and social issue, recognised by the Government's National Infrastructure Plan⁴. Recent impacts from flooding and severe weather highlight the risks infrastructure could face and the significant economic damage these types of events bring.

Effective, reliable infrastructure underpins economic activity, and failure to adapt, increases the possibility of service disruption and adverse economic impacts. That is why Defra's Business Plan⁵ has a priority to *support a strong and sustainable green economy resilient to climate change*; adapting infrastructure forms a key part to realising this.

To reduce the risk infrastructure faces from climate change planned, but flexible, adaptation actions are required.

4 http://www.hmtreasury.gov.uk/ppp_infrastructureuk.htm

5 <http://www.defra.gov.uk/c/orate/about/what/documents/defra-businessplan-101108.pdf>

Therefore, it is about putting in place measures that enable the cost effective management of climate impacts to reduce the risk that climate change presents to infrastructure. This includes integrating the impacts of climate change into decision making for new infrastructure and maintenance of existing infrastructure.

It is not about eliminating all risks from climate change or extreme weather.

Potential Opportunities

In a low carbon, climate resilient world, investment in climate resilient infrastructure will help enhance the attractiveness of the UK for inward investment, benefitting the economy, business and Government. Modelling by the OECD⁶ suggests that each £1 spent on climate change adaptation delivers four times its value in terms of potential damage avoided.

Adapting infrastructure to climate change presents opportunities if early action is taken and expertise developed. This includes new skills and technologies as well as additional adaptation capacity to enable infrastructure to be adapted, such as new engineering practices or IT-based technology.

All countries will need to increase their investment in their infrastructure to adjust to a more challenging climate. This is a potential opportunity; by developing adaptation expertise now, businesses should be well-placed to capitalise on opportunities in domestic and global markets.

Potential economic opportunities

- Development of new technologies and skills to be used domestically and exported.
- Engineering and planning consultancy benefits, if we do this sooner and better than other countries, our engineering and consultancy organisations can be market leaders in adapting infrastructure.
- Development of new ICT-based technologies to aid climate resilient infrastructure.
- Investment and insurance sector can promote climate resilience, reducing the risk of damage and securing rates of return.

Successful Adaptation Options

A successful approach to adapt infrastructure to the impacts of climate change should be⁷:

- **Effective:** the decision should reduce vulnerability to climate change.
- **Efficient:** the benefits of adaptation should outweigh the costs.
- **Equitable:** the distributional consequences should be taken into account.
- **Evidence-based:** the decision should be informed by latest research, data and practical experience.

While this approach will not eliminate all risk from climate change, it should enable a flexible risk-based approach to adapting infrastructure. It will reduce the risk of delayed action, or conversely, of over-investment in adaptation.

Benefits of adapting infrastructure

- Service delivery is able to adapt to meet future needs under a changing climate.
- Service delivery can adapt to increased risk of disruption from the weather.
- The viability of existing infrastructure is not compromised.
- The risks associated with investment in new long-term infrastructure are reduced.

6 de Bruin, K., R. Dellink and S. Agrawala (2009), "Economic Aspects of Adaptation to Climate Change: Integrated Assessment Modelling of Adaptation Costs and Benefits", OECD Environment Working Papers, No. 6, OECD publishing, © OECD.

7 From Adapting to Climate Change: Analysing the Role of Government, 2010 – <http://www.defra.gov.uk/environment/climate/documents/analysing-role-government.pdf>

Challenges & Barriers

The studies commissioned by the *Infrastructure & Adaptation* project identified a number of challenges and barriers that can prevent timely adaptation planning and action.

1. Information gaps: improving specific climate information and research to industry.

Work by PwC⁸ found that while there is growing awareness of climate change based on Government funded information, more specific climate information tailored to specific infrastructure sectors is required. As a result:

- Infrastructure operators could undertake further information gathering and research to allow them to identify and model their own context specific risks.
- Sector specific led research can allow information gaps, such as operational thresholds, to be addressed.

2. Managing uncertainties: anticipating a range of future climates as part of infrastructure decision making.

There is overwhelming evidence that the world is warming and will continue to warm further. There remain though uncertainties about the scale, timing and nature of exactly how the climate might change. This uncertainty can prevent adaptation action.

However, uncertainty should not be a reason for not acting. It is about examining the potential risks and taking proportionate adaptation action depending on the infrastructure asset.

Appropriate adaptation responses

| Asset type | Adaptation decision for existing asset | Adaptation decision for new asset |
|---|--|--|
| Long-life span (20 years+), e.g. power plants, reservoirs and transport structures. | Identify risks from climate change and appropriate responses. Incorporate adaptation measures into maintenance regime. | Identify risks from climate change and appropriate responses. Incorporate adaptation into investment decision. Adaptation measures identified and developed as part of planning application process. |
| Short/medium life span (up to 20 years), e.g. road surfaces, data centres, overhead lines and long-life assets nearing end of life. | Identify risks from climate change and appropriate responses. Incorporate adaptation measures into maintenance regime. | Identify risks from climate change and appropriate responses. Incorporate adaptation into investment decision. Adaptation measures identified and developed as part of planning application process. |

⁸ <http://archive.defra.gov.uk/environment/climate/documents/infrastructure-pwc-full.pdf>

3. Balancing priorities: increasing the profile of adaptation.

Due to the long-term nature of climate change and uncertainties related to the specific impacts, adaptation action can be delayed and not seen as a priority. This is a risk as, while the changing climate is a long-term challenge, the scale of infrastructure investment and existing infrastructure's vulnerability to present day climate variability means that adaptation action is required now.

As a first step, adaptation should be fully integrated into the business planning and operation of infrastructure companies.

4. Short-term regulatory focus: long-term pressures, including climate change impacts, adequately set out in economic regulation.

Regulation, rightly, has a strong emphasis on short-term value for money. While climate change adaptation is not explicitly prescribed as a statutory duty for economic regulators, it is embodied within economic regulators' wider mandates. In particular, the protection of short and long-term consumer interest, security of supply and service delivery.

To address the short-term vs long-term trade-off, it is important that economic regulators and infrastructure companies work together to plan strategically how to adapt at the right replacement cycle and right price review. This will help reduce the risk of 'over-adapting'.

5. Climate risk to infrastructure interdependencies: improving collaboration across sectors.

A modern, efficient, networked infrastructure creates interdependencies within and between infrastructure in the energy, ICT, transport and water sectors. Each sector depends to some extent on resilient in the other sector. These interdependencies need to be understood and managed.

The impacts of climate change will mean interdependencies and vulnerabilities will be more evident, e.g. availability of cooling water for an inland power station may be reduced, affecting its ability to generate electricity. Combined with a lower understanding and/or lack of co-ordination between infrastructure sectors, it can undermine the ability to adapt infrastructure successfully.

This risk merits particular attention and improved cross-sector collaboration is required.

Actions to Prepare Infrastructure for a Changing Climate

The full report includes actions to improve the climate resilience of infrastructure to enable the aim of *an infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate* to be met.

To take forward the actions within *Climate Resilient Infrastructure*, Government will work with infrastructure owners and operators, investors and insurers, regulators, engineers and others to realise the opportunities identified.

The UK Government will publish its first Adaptation Programme in late 2012. This will include an update on progress made in taking forward the actions and meeting its aim for climate resilient infrastructure, as well as what additional actions may be required.

We welcome the views of industry and others on the actions and challenges/opportunities identified in *Climate Resilient Infrastructure*. If you wish to contribute and/or work with Government on adapting infrastructure to the impacts of climate change, please contact the infrastructure team within the Adapting to Climate Change Programme in Defra at ACCInfrastructure@defra.gsi.gov.uk

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