



Department
for Environment
Food & Rural Affairs

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Climate resilient infrastructure: Preparing for a changing climate

Progress update report

July 2013

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This document/publication is also available on our website at:

<https://www.gov.uk/government/publications/climate-resilient-infrastructure-preparing-for-a-changing-climate>

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This document sets out an update on progress made in taking forward the actions in the report *Climate Resilient Infrastructure: Preparing for a changing climate* (May 2011).¹ It should be read in conjunction with the first report on the National Adaptation Programme published on 1 July 2013.²

Actions	Current activity
<h2 style="text-align: center;">Challenges to Adapting National Infrastructure</h2>	
<p>How government can facilitate progress in adapting national infrastructure to the impacts of climate change. To help overcome the challenge, government will assist others by:</p>	
<p>Engaging infrastructure organisations to enable them to influence the development of the first UK government Adaptation Programme and future adaptation policy.</p>	<ul style="list-style-type: none"> • Infrastructure organisations have contributed significantly to the development of the National Adaptation Programme (NAP) as set out in the report on the NAP (July 2013). The Environment Agency has established the Infrastructure Operators Adaptation Forum in order to: influence national and local government policy and action on infrastructure and adaptation; discuss and share information between asset owners; explore a more consistent approach for the application of climate science to infrastructure planning; and provide an interface with the research community in this area. • The government is also implementing a second round of the Adaptation Reporting Power which will seek an update on actions set out in the reports produced by infrastructure operators in the first round.
<p>Publishing the first UK government Adaptation Programme by the end of 2012, which will include an update on progress made in implementing the actions from <i>Climate Resilient Infrastructure</i>.</p>	<ul style="list-style-type: none"> • The National Adaptation Programme report was published in July 2013.

¹ <https://www.gov.uk/government/publications/climate-resilient-infrastructure-preparing-for-a-changing-climate>.

² <https://www.gov.uk/government/policies/adapting-to-climate-change/supporting-pages/national-adaptation-programme>.

Actions	Current activity
<p>Continuing to set out the importance of adapting to climate change, through:</p> <ul style="list-style-type: none"> - the Roadmap to a Green Economy. - the National Infrastructure Plan - the Water White Paper. - Energy, Transport and Water National Policy Statements. 	<ul style="list-style-type: none"> • ‘Enabling the Transition to a Green Economy, Government and Business Working Together’³ published in 2011, sets out how a green economy will maximise value and growth across the whole economy, while managing natural assets sustainability. It sets out a range of policy tools government is using to support the transition, including around increased resilience. • The government’s National Infrastructure Plan (NIP) was published in November 2011 and encouraged the need for some £250bn of infrastructure in the planning pipeline to adapt to climate change. It outlines that climate change risk assessment is critical to managing future risk of disruption to supply chains, safeguarding access to resources, operations and demand patterns, and thereby benefiting growth. • The Water White Paper was published in December 2011 and included a number of recommendations to ensure that future water supply and quality operations and infrastructure will tackle climate resilience. For example: developing a customer focussed water industry, encouraging more efficient use of water, promoting the use and benefits of Sustainable Drainage Systems and ensuring that the regulatory process provides for a longer term view. • Climate resilience is embedded in the National Policy Statements (NPSs) published to date. On outstanding NPSs to be consulted on or published, Defra is ensuring that relevant policy teams address climate resilience. Transport’s National Networks NPS was put on hold while the Department for Transport’s Roads Reform took place. The Command Paper, Action for Roads: A network for the 21st century was published on 16 July 2013.
<p>Influencing EU policy on climate change adaptation and specific energy, transport and water policy and regulations.</p>	<ul style="list-style-type: none"> • The European Commission published its non-binding EU Climate Change Adaptation Strategy in April 2013. It addresses potential adverse impacts on the environment primarily by embedding adaptation into EU policy instruments and promoting information sharing across the EU. The government has supported the inclusion of sustainability criteria and promoting greater interconnection for low carbon energy sources in Trans-European Networks for energy (TEN-E) and sought consideration of climate resilience in Trans-European Networks for transport (TEN-T).
<p>Supporting the building of</p>	<ul style="list-style-type: none"> • Defra and the Cabinet Office aim to strengthen existing links between the National Adaptation Programme and central government preparations for civil emergencies emanating from natural hazards,

³ <http://webarchive.nationalarchives.gov.uk/20120823131012/http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1096705244&type=ONEOFFPAGE>

Actions	Current activity
resilience to today's natural hazards, through the work of the Cabinet Office.	<p>accidents or malicious threats. One option currently under consideration is for government departments to incorporate longer term climate resilience into their future Sector Resilience Plans. These Plans annually assess the resilience of the UK's most important infrastructure to disruption from civil emergencies over the next five years.</p> <ul style="list-style-type: none"> • Water companies and energy generation and network providers (among others) work directly with central government on preparations for civil emergencies.
<p>How to set out the challenge of adapting to climate change in economic regulatory models. To help overcome the challenge, government will assist others by:</p>	
Using its Principles of Economic Regulation to inform the design of regulatory frameworks, ensuring the system remains coherent, predictable and appropriately focused.	<ul style="list-style-type: none"> • The government published its Principles of Economic Regulation in April 2011, with a specific commitment to strongly encourage the Joint Regulators Group to adopt a more systematic approach to issues of cross-sector coherence and best practice.
Applying the Principles, lead government departments will produce detailed sector application of them later in 2011.	<ul style="list-style-type: none"> • Lead government departments are applying the principles in their regulatory policies. For example, Defra is making reference to the principles in its Strategic Policy Statement to Ofwat: that incorporates Social and Environmental Guidance to Ofwat. • DfT aviation policy used the Principles for the Civil Aviation Act published in 2012 and the CAA use the guide for their approach to economic regulation of NATS and airports
Using the findings from the first round of the Adaptation Reporting Power to examine how economic regulators are currently approaching adaptation.	<p>Evidence from the Adaptation Reporting Power reports suggests that regulatory processes are becoming more robust in encouraging climate change adaptation :</p> <ul style="list-style-type: none"> • OFGEM is developing opportunities for greater climate resilience: e.g. enhancing the price control review to reflect longer asset life spans, and encouraging a focus on longer run issues and better management of uncertainties by energy network providers when they submit business plans to OFGEM. • The new Price Control Review process known as Revenue = Incentives+Innovation+Outputs (RIIO) has strong incentives on network reliability which encourages a greater focus on climate resilience in

Actions	Current activity
	<p>electricity networks. OFGEM is also embedding climate resilience and long term planning into its internal decision making.</p> <ul style="list-style-type: none"> • OFWAT is developing a framework for the next price review (PR14) that will incentivise water and sewage companies to take more ownership of the delivery of climate resilience within their business plans, by moving to an outcomes based approach that provides an improved scope for innovation in terms of both capital and operational solutions that will benefit customers. To support sector resilience work Ofwat commissioned and published collaborative guidance on resilience principles to further encourage longer term thinking. • OFCOM's Report set out areas where climate change could affect the sector in the future and the mechanisms that already exist to consider such developments. • Rail is regulated by government and the Office of Rail Regulation (ORR). DfT has incorporated adaptation in the High Level Output Specification process and ORR is embedding adaptation in existing obligations and duties.
<p>How the planning system for nationally significant infrastructure can guide applicants on the need to adapt new infrastructure to the impacts of climate change. To help overcome the challenge, government will assist others by:</p>	
<p>Including adaptation within each National Policy Statement to set out how applicants should consider the impacts of climate change in their application.</p>	<ul style="list-style-type: none"> • All designated National Policy Statements (NPS) include the requirement that nationally significant infrastructure projects should be resilient to climate change over the lifetime of their assets. • Of the transport NPSs not yet consulted on, the Aviation NPS was replaced with the Aviation Policy Framework which was consulted on in late 2012 and published in March 2013. The Aviation Policy Framework highlighted the need to manage the risks associated with climate change as essential for the successful long-term resilience of the UK's aviation industry and its contribution to supporting economic growth and competitiveness. The National Networks NPS was on hold while DfT drafted the Roads Reform Command Paper which was published on 16 July 2013 and will be consulted on later in the year. • Of the Water and Waste water related NPSs, the Waste Water NPS has been designated, but there are no current plans for a Water Supply NPS. • The Environment Agency is working with the Planning Inspectorate to agree how they will assess

Actions	Current activity
	Nationally Significant Infrastructure Project applicants' consideration of climate risks in line with NPS requirements.
<p>How to reduce the risk that climate change impacts presents to infrastructure interdependencies – increasing the vulnerability of infrastructure sectors. To help overcome the challenge, government will assist others by:</p>	
Using the Infrastructure UK led Engineering & Interdependencies Group to explore issues of interdependency:	<ul style="list-style-type: none"> • Government, the research community and engineering institutions are working to explore issues of interdependencies. Infrastructure UK (IUK) is leading on a project to better understand the benefits of dual use infrastructure. An evidence based programme by the Infrastructure Transitions Research Consortium (ITRC – see below) is supporting this work. • A project known as Infrastructure Interdependencies Timelines, led by the Engineering the Future consortium of engineering professional bodies and published on 15 July 2013 has scanned across various government policy areas and used case studies to explore sub-groups of interlinked policies.⁴ It shows the relationships and benefits of an interlinked policy approach, whilst understanding scenarios where multi-departmental delivery is optimal or not.
How climate risks can exacerbate interdependency vulnerabilities.	<ul style="list-style-type: none"> • The £5.9 million Infrastructure Transitions Research Consortium (ITRC) has piloted methodology for analysing the role of interdependence in exacerbating climate risks to infrastructure systems. • Given the levels of complexity of the hazard and infrastructure networks, there are several factors that affect the failure probabilities and consequence, which include interdependencies that are vulnerable to climate change. Therefore the research will also explore how climate risks may exacerbate these vulnerabilities. • The Infrastructure Operators Adaptation Forum is encouraging knowledge sharing on interdependency risk management, enabling representatives of different sectors to engage.

⁴ http://www.engineeringthefuture.co.uk/government/pdf/EtF_Infrastructure_Interdependencies_Report.pdf

Actions	Current activity
<p>How engineering e.g. systems thinking and dual-use infrastructure, can reduce the risk from climate impacts</p>	<ul style="list-style-type: none"> • Activity on systems thinking is emerging within IUK's programme of work on the role of infrastructure to support long term growth. • Current activity is concentrating on how exploiting the opportunities that arise from dual use of infrastructure corridors can increase resilience of networks at a systems level. This is not aimed at any particular threats, but climate change risks are implicitly included. • At a more direct level, IUK's work is investigating the pros and cons of dual use approaches; e.g. rail corridors that also carry electricity networks or also offer community flood management benefits. IUK is proposing a number of interdependencies pilot studies to consider these ideas further. • This programme of work will test the hypothesis that a single corridor with multiple services is likely in many cases to be easier and cheaper to protect against climate risks (and other risks) than multiple parallel corridors for individual infrastructure elements.
<p>How co-ordination and information sharing of cross-sectoral adaptation measures can be improved.</p>	<ul style="list-style-type: none"> • IUK aims to share its findings across sectors and stakeholders and encourage dialogue on interdependency risks. • IUK also recognises that the collection of geographic information on both infrastructure assets, local interests and pressures, will increase understanding of these issues and will enhance the capacity of organisations or systems to manage climate resilience. • A number of science initiatives are already underway to better understand the spatial relationships and dependencies with respect to the Climate Change Risk Assessment risks: e.g. ITRC programme development of an infrastructure assets GIS database and similar work by the Cabinet Office is also identifying resilience risks from cascade failures between different infrastructure services in close proximity.
<p>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. To help overcome the challenge, government will assist others by:</p>	
<p>Using the results of the first round of the Adaptation Reporting Power to raise the</p>	<ul style="list-style-type: none"> • The first round of the Adaptation Reporting Power (ARP) has led to 91 published reports from infrastructure providers, regulators and others. Defra published a summary of findings in March 2012. • To exchange knowledge, the ARP Summary of findings has been circulated to members of the

Actions	Current activity
profile of adaptation in infrastructure companies.	<p>Infrastructure Operators Adaptation Forum (IOAF), whose membership includes a cross section of infrastructure owners and operators.</p> <ul style="list-style-type: none"> Defra will request, as part of the next ARP round, that infrastructure operators produce updates on the actions set out in their first round adaptation reports
Using the Command Paper document to engage the investment community.	<ul style="list-style-type: none"> The government has worked with the Carbon Disclosure Project to develop questions on adaptation for its annual questionnaire to companies listed under FTSE100 index. This has elicited useful information on how well organisations are adapting to climate change. The Business theme of the National Adaptation Programme reflects how banks and insurers are addressing climate change adaptation in their decision making and due diligence processes.
<p>How to improve the way investment decisions incorporate the impacts of climate change. To help overcome the challenge, government will assist others by:</p>	
Leading by example by integrating adaptation requirements when investing in and/or procuring new infrastructure projects and using the Adaptation Supplement to the Green Book.	<ul style="list-style-type: none"> The government is planning to make revisions to its Treasury Green Book Supplementary guidance on climate change adaptation. In particular the new guidance is aiming to: <ul style="list-style-type: none"> lay out the principles to build climate resilience into economic analysis of capital projects explain the need to address critical thresholds where tipping points in levels of service might arise due to a changing climate provide guidance on the impacts and uncertainties that lie around these impacts apply to all public sector infrastructure investment. The transport infrastructure sector uses infrastructure design and maintenance standards which are being revised to include consideration of long term climate implications. Department for Transport is including adaptation in its new Transport and Roads Strategies to ensure consideration of climate change in investments and projects.
Using high profile examples (e.g. Crossrail) to demonstrate how climate change adaptation can be integrated into new infrastructure	<ul style="list-style-type: none"> The Environment Agency, in providing support to the Infrastructure Operators Adaptation Forum, is developing a knowledge sharing and show-casing website to be launched by the end of 2013, which will provide examples and approaches to highlight and share best practice on climate change adaptation in infrastructure decision making. Examples include: National Grid; Thames Tunnel; Yorkshire Water; CrossRail; HS2; Gatwick Airport; Network Rail; and Port of Felixstowe.

Actions	Current activity
projects.	
Continuing to set out in the National Infrastructure Plan that adapting to climate change is a strategic, economic risk to the country, infrastructure operators and Investors.	<ul style="list-style-type: none"> • The 2011 National Infrastructure Plan highlighted the following activities: <ul style="list-style-type: none"> - Encourage the sector towards design and engineering changes to increase climate resilience and encouraging dual-use infrastructure. - A two-year design competition in 2012 run by Defra and TSB to support climate resilient infrastructure.
Integrating adaptation into the investment decision making of the proposed Green Investment Bank.	<ul style="list-style-type: none"> • The Green Investment Bank is incorporating climate change resilience into its sustainability and green impact policies, and considering climate resilience in its investment decision making as part of its standard technical and green risk assessment processes. Where appropriate the bank will commission external assessment of the scale and nature of the extreme weather and climate risks associated with proposed investments.
Increasing engagement with the investment community to raise the profile of adaptation	<ul style="list-style-type: none"> • UKTI has identified key global markets where opportunities exist for UK businesses based on the requirement for adaptation good and services, the availability of funding, the ease of doing business, and where the UK has the skills to provide the necessary adaptation solutions. UKTI will be helping UK businesses maximise these opportunities through its support such as trade missions and trade shows.
<p>How to improve access by industry to specific climate information and research through better information sharing, disclosure of risk and evidence. To help overcome the challenge, government will assist others by:</p>	
Continuing to invest in the work of the Hadley Centre to support its world-class climate science and further develop understanding of climate impacts.	<ul style="list-style-type: none"> • The government is continuing to invest in the work of the Hadley Centre, which is developing evidence that will be of use to a wide range of stakeholders.

Actions	Current activity
Using the results from the first round of the Adaptation Reporting Power to share good adaptation practice and help address interdependencies.	<ul style="list-style-type: none"> • Results from the first round of the ARP relating to interdependencies have been shared and discussed at the Infrastructure Operators Adaptation Forum.
Using the results from the first UK Climate Change Risk Assessment to improve understanding of the risk the UK faces from climate change	<ul style="list-style-type: none"> • This has been integral to the collaborative development of the National Adaptation Programme.
In each lead infrastructure department (e.g. DECC for energy infrastructure) considering with their industry partners whether their evidence base for adapting their infrastructure is sufficient.	<ul style="list-style-type: none"> • Transport: research projects are underway to improve the evidence base for climate adaptation e.g. rail - TRaCCA, FutureNet; roads - FutureNet. The Rail Safety and Standards Board has set up a Rail Climate Change Adaptation Knowledge Portal to facilitate the sharing of information about rail climate change adaptation research between railway organisations, research bodies, universities and other stakeholders. (http://extranet.rssb.co.uk/Pages/Welcome.aspx). • Energy: the Adaptation Reporting Power reports from the energy sector contain views about the sufficiency of the evidence base and indicate where the sector would like better evidence. DECC and energy sector organisations attend the Infrastructure Operators Adaptation Forum, which provides a mechanism for the exchange of information on assessing risks from climate change. • The evidence base for adapting water infrastructure to future climate change pressures is considered within an objective in Defra's water evidence strategy to develop policy options that support water companies promoting resilience in the water sector. • Defra plans to continue developing the evidence to support a strategic approach to drainage planning and standards, to enhance resilience against surface water flood risks.
Raising awareness of climate resilient infrastructure to investors and insurers, e.g. through increased disclosure	<ul style="list-style-type: none"> • The Carbon Disclosure Project published a report for government entitled: <i>Insights into Climate Change Adaptation by UK Companies</i> in March 2012.

Actions	Current activity
of risk via the Adaptation Reporting Power and Carbon Disclosure Project.	
Learning from, and sharing, adaptation experience on infrastructure from other countries, in particular G20 countries.	<ul style="list-style-type: none"> • The government is in close contact with EU member states to share knowledge and approaches to adaptation. For example, the government supported development of the EU Climate Change Adaptation Strategy which, amongst other objectives, promotes information sharing and gathering across the EU using the 'Climate Adapt' tool maintained by the European Environment Agency. • Defra has also presented the approach to the National Adaptation Programme to the Vietnamese, South Korean and Taiwanese governments, and the EA's Climate Ready Service is reviewing lessons learned from comparing French and German National Adaptation Programmes. • The <i>Adaptation and Resilience to a Changing Climate Coordination Network (ARCC CN)</i> was established in 2009 and has evolved into a knowledge exchange network engaging more than 25 multi-disciplinary research teams representing 35 academic institutions and over 200 UK policy and practitioner stakeholders. ARCC CN is learning from and sharing adaptation experience internationally as follows: <ul style="list-style-type: none"> - Engagement of experts during ARCC CN events e.g. 2011 (USA, the Netherlands) and 2012 (Canada) conferences and participation at related international conferences: e.g. Arizona Adaptation Futures (2012), Second Nordic International Conference on Adaptation to Climate Change (2012) and European Conference on Climate Adaptation (2013). - Building working partnerships with infrastructure research communities and their stakeholders in Europe, Canada, USA and Australia.
<p>How to monitor progress made in adapting national infrastructure to climate change. To help overcome the challenge, government will assist others by:</p>	
Asking the Adaptation Sub-Committee to include an assessment of progress on adapting infrastructure as part	<ul style="list-style-type: none"> • In its 2012 report: '<i>Climate change – is the UK preparing for flooding and water scarcity?</i>', the Adaptation Sub Committee published its assessment of the water supply demand balance and recommended measures to address future impacts. • In its 2014 report, the ASC will produce an assessment of the resilience of energy, transport, ICT and

Actions	Current activity
of their annual report on the UK's preparedness for climate change.	water infrastructure, and consider the role of green infrastructure as a cooling measure. It will also consider water use by the industry and energy sectors to add to the assessments that have been made for public water supply (2012) and water use in agriculture (2013).
The ASC will regularly assess progress across the key sectors (energy, ICT, transport and water), looking at each one in-depth periodically.	<ul style="list-style-type: none"> The ASC is considering infrastructure related to different sectors in each of its preparedness reports, leading up to its statutory report on the implementation of the National Adaptation Programme in 2015.
<h2>Opportunities and future areas of work</h2>	
<h3>How to realise the potential economic opportunities that adapting national infrastructure to climate change presents. To help overcome the challenge, government will assist others by:</h3>	
Integrating adaptation into the government's Green Economy work.	<ul style="list-style-type: none"> The UK's low carbon and environmental sector has continued to grow. The government is working to ensure that the Green Economy brings forward efficiency and resilience, for example, through consumer choice on energy and water demand, and in take-up of remote /household energy generation and conservation , which supports wider resilience of infrastructure Cost reduction task forces have been set up by government for offshore wind and carbon capture and storage technology with climate resilience being a consideration in terms of wind and water availability risks in relation to rivers and marine environments.
Considering whether further work is needed to identify the opportunities for business and professional bodies.	<ul style="list-style-type: none"> The National Adaptation Programme Business and Infrastructure themes are considering further evidence to identify opportunities for businesses and professional bodies to consider climate resilience, e.g. through projects that sign post best practice and through the use of knowledge sharing. Professional bodies and academia are considering climate resilience further through the Institution of Engineering and Technology and Institution of Civil Engineers involvement in the Infrastructure Operators Adaptation Forum, and in developing understanding and promoting expertise in managing interdependency risks through research such as ITRC.

Actions	Current activity
Working through UKTI, with FCO and BIS, to promote and facilitate international commercial opportunities for UK infrastructure companies with adaptation expertise.	<ul style="list-style-type: none"> UK Trade and Investments (UKTI) promotes UK companies' capabilities to overseas markets, in areas contributing to adaptation to climate change including infrastructure, the built environment and agriculture. Examples include flood defences, insurance products related to climate risks and agricultural advice.
<p>Examine how climate change may affect waste infrastructure. To achieve this, government will:</p>	
Undertake a study on the risks waste infrastructure faces from the impacts of climate change and how the industry can adapt.	<ul style="list-style-type: none"> Defra has undertaken a study into the risks that waste infrastructure faces from climate change and is liaising with relevant government departments and agencies.
<p>Consider how the international impacts of climate change may affect national infrastructure. To help overcome the challenge, government will assist others by:</p>	
Considering the findings from the Foresight International Dimensions of Climate Change (IDCC) study and whether further work is needed	<ul style="list-style-type: none"> International threats and opportunities of climate change have been considered in a recent report to Defra.⁵ On infrastructure the study explored energy supply vulnerabilities and provided commentary on the level of risks posed going forward, e.g. whether countries that currently supply energy (oil and gas) are themselves highly adaptive to a changing climate.

⁵ <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18348>

