

## Adapting to climate change, managing the risks – National Grid

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### Background to National Grid

National Grid owns and operates the high voltage electricity transmission system in England and Wales and, as Great Britain System Operator (GBSO), it operates the Scottish high voltage transmission system. National Grid also owns and operates the gas transmission system throughout Great Britain and through its low pressure gas distribution business it distributes gas in the heart of England to approximately eleven million offices, schools and homes. In addition National Grid owns and operates significant electricity and gas assets in the US, operating in New England and New York.

In the UK, National Grid's primary duties under the Electricity and Gas Acts are to develop and maintain efficient networks and also facilitate competition in the generation and supply of electricity and the supply of gas. Our activities include the residual balancing in close to real time of the electricity and gas markets.

Through its subsidiaries, National Grid also own and maintain around 18 million domestic and commercial meters, the electricity inter-connector between England and France, and a Liquid Natural Gas importation terminal at the Isle of Grain.

### Management of climate change risks within the business

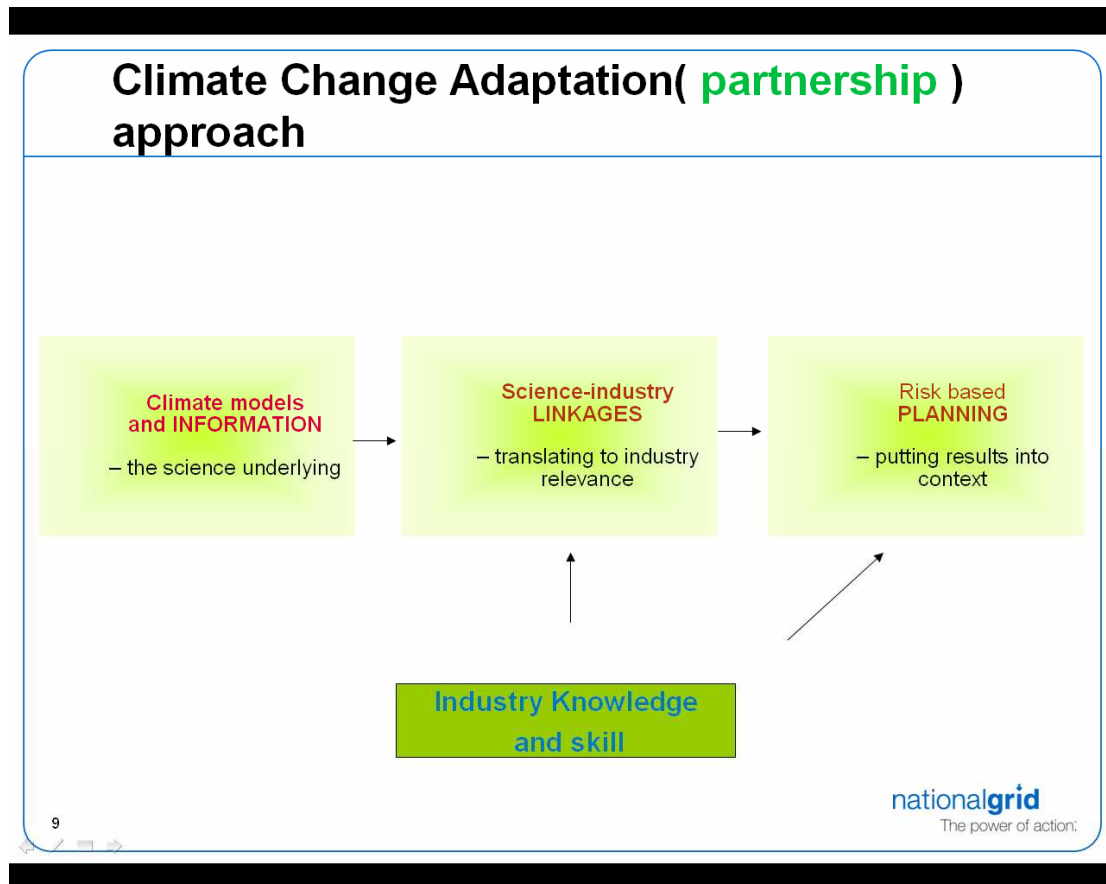
National Grid's attitude to risk management helps focus its attention on business-critical activities to bring in increased consistency to all its operations. In this way where a risk is common to all its operations, such as climate change, the corporate centre sets out the strategy to respond to the risk while the business units tailor the guidance to meet their operational requirements

Their Annual Report and Accounts 2008/09 included the following risk factor: "**We are increasingly subject to regulation in relation to climate change.** We commit significant expenditure toward complying with these laws and regulations and to meeting our obligations under negotiated settlements. If additional requirements are imposed or our ability to recover these costs changes, this could have a material impact on our businesses and our results of operations and financial position".

## Climate change risk - Adapting for the climate of the future

In 2008, alongside other energy companies and the Met Office, National Grid completed a groundbreaking study to consider the effects of climate change on the energy industry.

The 14-month project called 'Energy project 2' (EP2) set out to establish what effect climate change will have on the industry's infrastructure and business. EP2 project was carried out with Industry experts (working in partnership, **see the diagram below**) with the view to bring the science very close to practical business application for planning purposes.



It is vital for the industry because it needs to be able to forecast 15 to 40 years ahead for any asset investment now. The EP2 project has given the energy industry some of the tools it needs for future planning. Energy infrastructure is costly and can have a lifespan of 40 or more years, therefore the energy industry took the expert advice of the Met Office Hadley Centre. This will help anticipate the potential impacts of climate change and allow the industry to future-proof what it builds in the coming years.

EP2 investigated a number of issues including soil conditions and their impact on cables; how the urban heat island might change so the industry can plan city infrastructure; the relationship between electricity network resilience and weather; a tool to predict sea surges at sites of interest (e.g. LNG sites), and climate models and wind projections.

Potential changes in demand are another key factor as higher temperatures could increase electricity requirements during the summer, as air conditioning units become more widely used. However, this is balanced by lower demand in the winter. The findings of the next 10 years climate data is being considered by the Energy Companies to use in their future Energy supply/demand planning process.

### Key findings from the EP2 project were:

- With a few exceptions, such as the thermal ratings of equipment and apparatus, there is currently no evidence to support adjusting network design standards. For example existing design standards for overhead line conductors do not require change.
- The risk profile for transformers will be affected. Design thresholds of temperature will be exceeded more often and there will be more hot nights in cities. (see example below)
- Soil conditions will change: higher temperatures and seasonal differences in soil moisture are expected. Future conditions could be included in cable rating studies by increasing average summer soil temperatures in the models by approximately 0.5°C per decade. Increased winter rainfall may increase landslide threats to National Grid's Gas pipelines (and other linear infrastructure) and increased shrink/swell movement ranges may affect equipment foundation performance and hence equipment stress states, possibly necessitating mitigation measures.
- The output of thermal power stations (and in particular Combined Cycle Gas Turbines) could be suppressed with higher air temperature meaning lower air density and, in turn, lower mass flow. The same effect reduces gas compressor performance and reduces flow rate in the gas pipeline network. Conditions at each location should be considered, especially during re-design or new build and, if appropriate, adaptation planned.
- Historical climatologies are no longer valid because climate is not stationary. The new climatologies that take account of climate change are already being adopted and will improve demand forecasting and planning out to 10 years ahead.
- Wind resource is uncertain and understanding future resource represents a significant challenge. Although we don't yet have the answers, this project has highlighted possible strategies for improving industry knowledge.

## Result – an example- Urban Infrastructure



- ◆ For number of hot nights other effects critical
- ◆ **The risk profile for transformers will be affected**
- ◆ Design thresholds of temperature will be exceeded more often
- ◆ **More hot nights in cities – 42 days per 90 day summer season**

#### What are we doing about the above:-

- ◆ More scenarios studies and advance planning/warning in the areas of hot spots i.e. London
- ◆ Correlate transformer and power line loading with the load demand data in order to understand the extreme weather risk.

### Strategy following the 2007 floods

Following the 2007 floods and damage to some electricity substations the energy industry undertook a review to map electricity sites vulnerable to flooding. Energy Networks Association (ENA) led the review, under the Energy Emergencies Executive Committee framework reporting in March 2008. It involved representatives from all electricity network operators, DECC, Ofgem, Environment Agency, Scottish Environment Protection Agency, Met Office and the Pitt Team.

### Output from the report

- Impact of flooding on the UK electricity supply system and risks for society.
- Flood risk information including the need for climate adaptation.
- Flood defences and planning requirements.
- Systematic approach to flood risk assessment and protection including the establishment of Flood Risk Assessments for each substation; identification of the Flooding Impact for each particular site: establishing if a site will be protected by a flood protection scheme and where necessary, identifying the most appropriate flood protection system for each site.
- Levels of acceptable flood risk and implications for investment including a Cost/Benefit assessment that takes into account societal risk.
- Work Programmes for implementation of substation flooding resilience and associated funding requirements. A number of immediate measures have been taken by electricity network operators to reduce the flood risk to substations including:-
- The purchase of relocatable flood defence systems.
- Development of improved methods of flood warning with the Environment Agency and support for the Flood Forecasting Centre initiative.

National Grid is currently participating in a Project RP913 'Flood resilience and resistance for critical infrastructure' which was originated by CIRIA (construction industry research and information association) in response to the disruption to essential services caused by widespread flooding which occurred in the summer of 2007. The project aims to build on the recommendations made in Sir Michael Pitt's Review of 2007 floods.

### **Acknowledgement:**

This information was mainly sourced from National Grid's response in September 2009 to Defra's consultation on the Adaptation Reporting Power in the Climate Change Act 2008.