Vision for The Future

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Tom King
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Grid of The Future
CIGRE 2013 Symposium
Boston, MA October 21, 2013

CIGRE US 2013 - Boston, MA
Grid of The Future Symposium

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Our Future is built from our History

- **Learning & Collaborating**
- **Exchanging Valuable Information from World Practices**
- **Developing Power Engineers today and into the Future**

CIGRE Vision: "Joining Forces for The Power System of Today and Tomorrow" – truly aligns to National Grid's promise to:

- **Partner to work better together,**
- **Connect with our Customers today, and be trusted to help them meet their energy needs tomorrow**

National Grid Owns and Operates Large-scale International Energy Transport Networks

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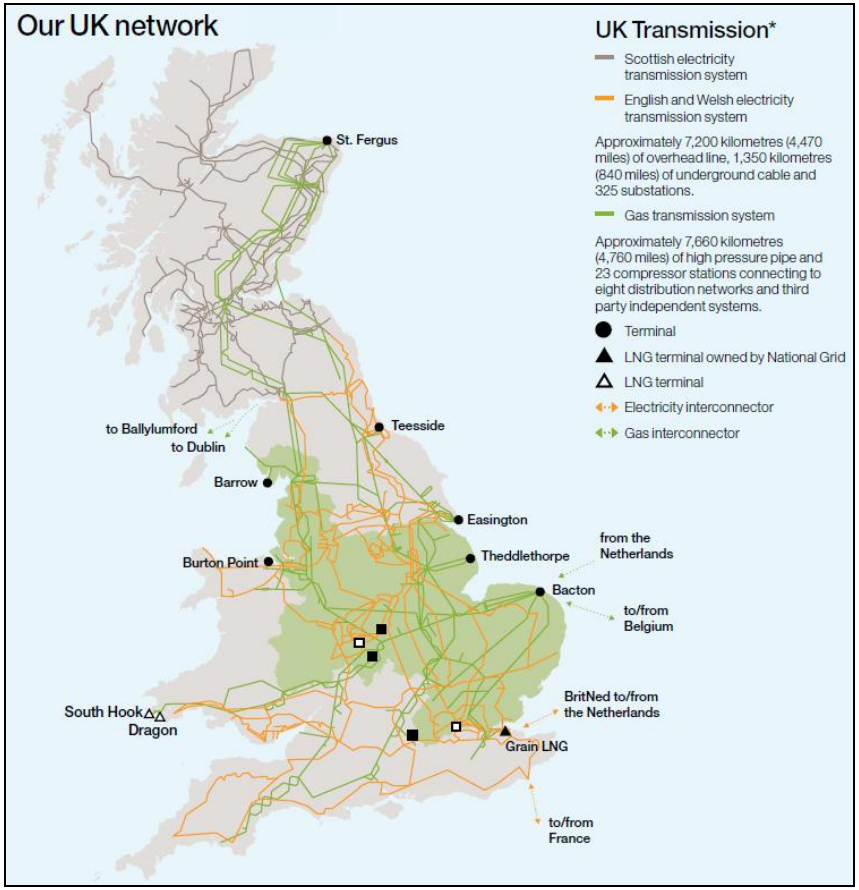

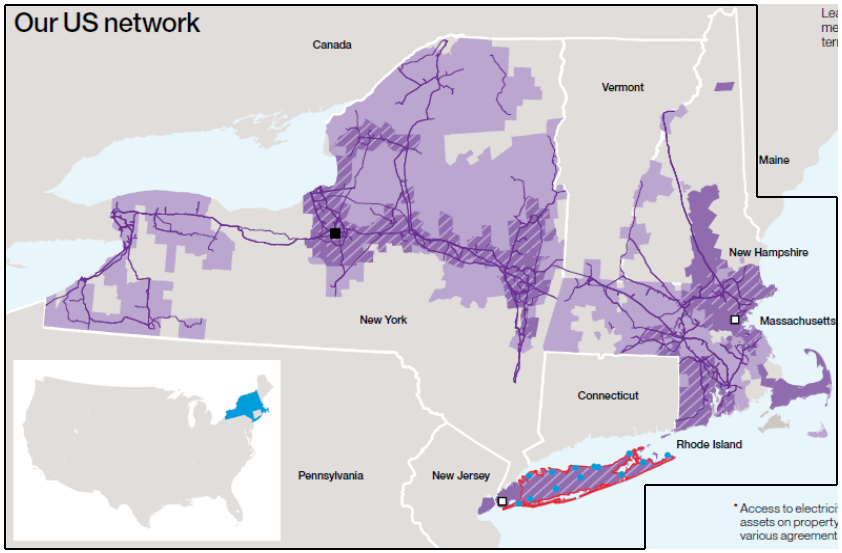

- We aim to build on core UK and US electricity and gas regulated businesses to deliver superior customer services.

Energy Policy Drives Grid Vitality

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- **In the UK,** energy policy continues to evolve from the Climate Change Act of 2008 - Commits UK government to reducing greenhouse gas emissions to a level at least 80% lower than 1990 baseline by 2050.
- **In the US,** energy policy is influenced by both federal actions and state actions. In the northeast state energy policy has been very influential.
  - **Federal** policy has been driven primarily through federal agency regulations and Presidential executive orders.
  - **State** energy policies are focused on promoting energy efficiency and renewable technologies and focused on reducing greenhouse gas emissions.
  - **Regional** policy in the northeast includes the Regional Greenhouse Gas Initiative in which 9 states participate to reduce power plant CO_2 emissions.

Energy Policy Development Considerations

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- **The Customer:**
  Concern for cost, reliability, impact on the environment
- **Available Energy Sources:**
  Environmentally sustainable, accessible, economical
  (e.g., natural gas, renewable resources)
- **Delivery System Technology:**
  Multidirectional, resilient, able to accommodate varied energy sources (e.g., solar, wind, combined heat and power)
- **Recognize and Reward Technology Innovation**
- **Promote Education in Energy:**
  Businesses / Government / Academic partnerships
- **Federal, Regional, & State Requirements:**
  Concern for cost, reliability, impact on the environment

Policy and technology advances are pressuring the current electric infrastructure system.

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Policy Driving Shifts

- Federal, state & local policy and community initiatives.
- Aggressive renewable portfolio standards and incentives.
- New investments in electric generation ($1.3 Trillion* by 2035) are changing where generation is located – more local and more distributed.
- New investments in gas infrastructure ($400 Billion* by 2035).

Infrastructure Delivery

- Electric delivery sector is in need of major reinvestment ($1.0 Trillion* by 2035) driven by asset modernization (replacement, cyber-security).
- Climate change is causing more frequent and severe weather events and a need for more resilient infrastructure.
- Critical information for optimization and prioritization to enable policy for market demands.

Technology & Customers Driving Shifts

- Customers are dependent on energy to enable their daily lives and businesses.
- Customers are accustomed to getting more and seeking more value. Affordability and reliability are expected.
- More diverse customers with evolving needs. Technology is reshaping and playing a major role in their lives.

Utility 2.0 – Accountability for policy, resilient infrastructure, and enabling markets.

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Utility 2.0 - the heart of a clean energy future

Policy Drivers

- **Resiliency and Reliability**
- **Cost Efficiency**
- **Efficient Consumption**
- **Greenhouse Gas Emissions**
- **CAFE standards – Alt Fuels**
- **Oil to Gas Conversions**

- ***Resilient Backbone*** – prevents and reduces impact of outages while integrating clean, central and distributed resources
- ***Market Enabler*** - facilitates and sends the right price signals to customers and 3rd parties
- ***Customized Solutions*** – provides utility-customized solutions that can stimulate the market

Customer & Market Drivers

- **Energy Efficiency**
- **Demand Response**
- **Distributed Generation**
- **Electric Vehicles**
- **Information**
- **Combined Heat & Power**
- **Energy Storage**

- ***Optimizes*** **value for** ***<u>all</u>*** **customers**
- **Meets policy objectives and Enables policy drivers to facilitate market solutions**
- ***Centralizes*** **information to prioritize & optimize solutions**
- ***Creates <u>accountability</u>*** **to deliver policy drivers**
- ***Accelerates*** **market expansion to meet policy objectives**

Energy Productivity & Efficiency

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- An Alliance to Save Energy paper with policy recommendations to double U.S. economic productivity of energy by 2030
- Spans all sectors of the economy – buildings, transportation, industry, energy sector
- Recommendations:

Invest in energy productivity in all sectors of the economy.

Modernize U.S. infrastructure, buildings, transportation, and equipment.

Educate consumers, business leaders and policy makers to encourage smarter energy use.

Our Industry Must Lead by Example

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- Partner with Regulators, Communities, Customers, Vendors, Manufacturers and Solution Providers
- Be Creative in the Approach
- Explore and Apply Advanced Technologies
- Learn to Secure our Future Together
- Share & Shape Policy and Technical Solutions through Education and Examples

Small Scale Renewables & Smart Grid

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- Largest smart grid in Massachusetts
- Installing smart meters for up to 15,000 customers in Worcester
- Features both customer and grid-facing technology
- Drives customer choice and real-time information sharing
- Enables Distributed Generation
- Enables better storm response

America's energy future: A smart grid city

Worcester, MA smart grid pilot

Offshore Wind Will Play a Role

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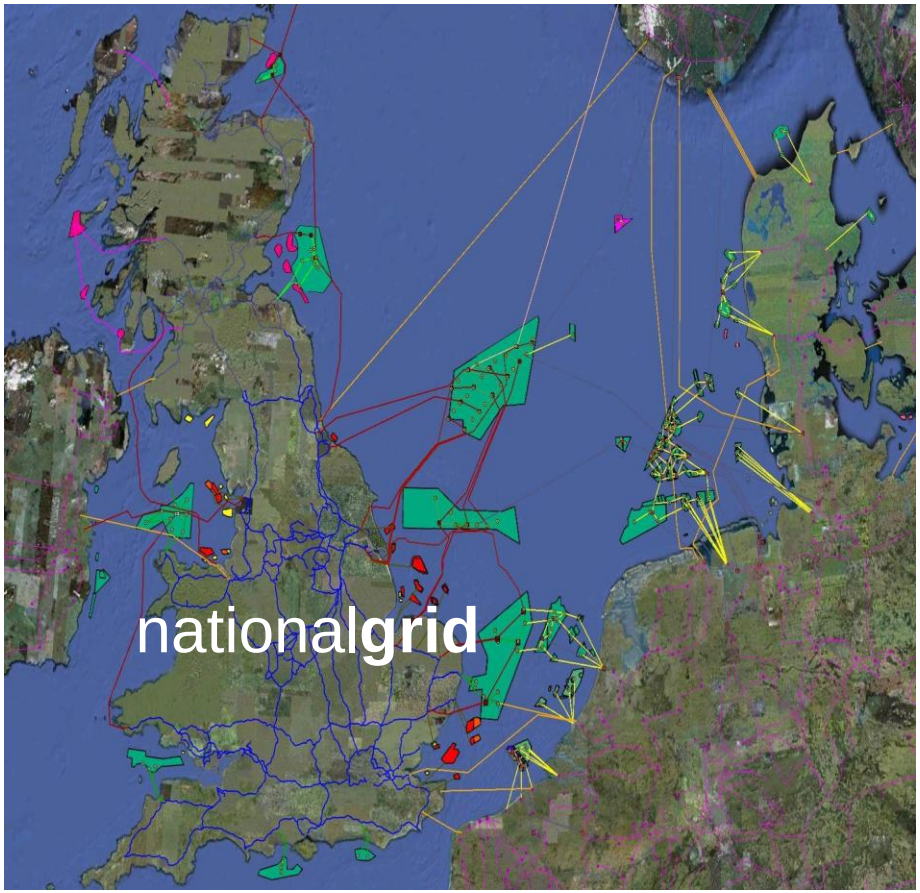
- UK has 3.3 GW of offshore wind installed to date
  - London Array project 630 MW is largest offshore development in world
- New England development
  - Cape Wind 468 MW
  - Deepwater 30 MW
- Mid-Atlantic states exploring legislative and regulatory mechanisms for offshore wind
- Interconnections via undersea transmission cables and improvements to on-shore transmission networks



Summary:
The US Electricity Future

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- We are moving toward cleaner generation, improved energy networks, and additional customer-side choices and services
- Energy policies will impact how well we are able to achieve a reliable, sustainable, and affordable energy future
- A clear and coordinated set of national and regional energy policies will expedite progress:
  - Energy Efficiency, New and Integrated Technologies
  - Renewable Energy policies
  - Electric Transmission planning, siting, and investment policies
  - Environmental policies (influencing generation mix)