

## Delivering zero carbon electricity



Richard Smith  
Future Transmission Networks Manager

BIEE – 22<sup>nd</sup> September 2011

**Is the future  
electric?**

Is the future  
electric?

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**Significantly**  
*(but not entirely)*

**Is the Grid ready  
to invest?**

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to invest?**

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**YES**

*(but that's not  
the right question )*

# 2050: where will our energy come from?

**~50% from electricity  
at ~15g CO<sub>2</sub>(e) / kWh**

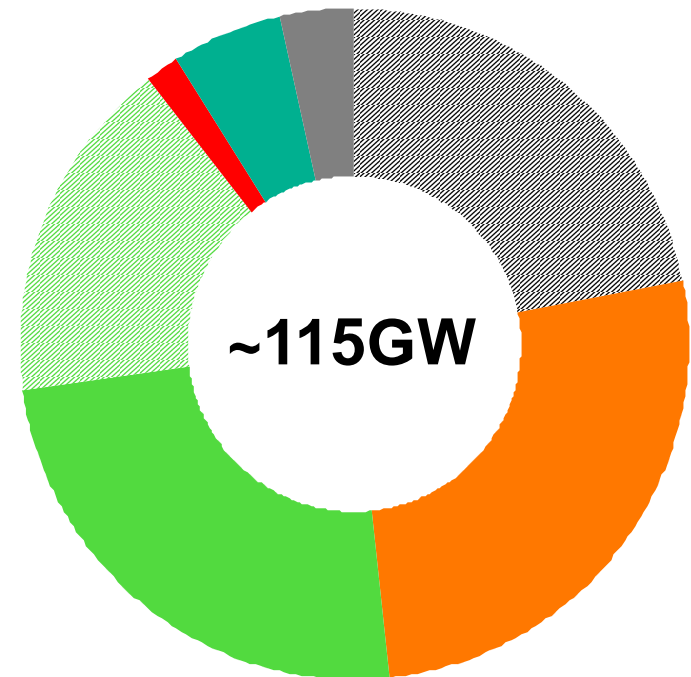
- Wind, nuclear & CCS dominant at ~25GW – 30GW each
- ~20GW other renewables
- ~15GW interconnection
- ~20GW embedded generation

**~35% from gas  
at ~185g CO<sub>2</sub>(e) / kWh**

- LNG & continental imports
- Bio-methane

**~15% from oil  
at ~245g CO<sub>2</sub>(e) / kWh**

## Generation capacity mix



# 2020: where will our energy come from?

**~20% energy from electricity  
at ~200g CO<sub>2</sub>(e) / kWh**

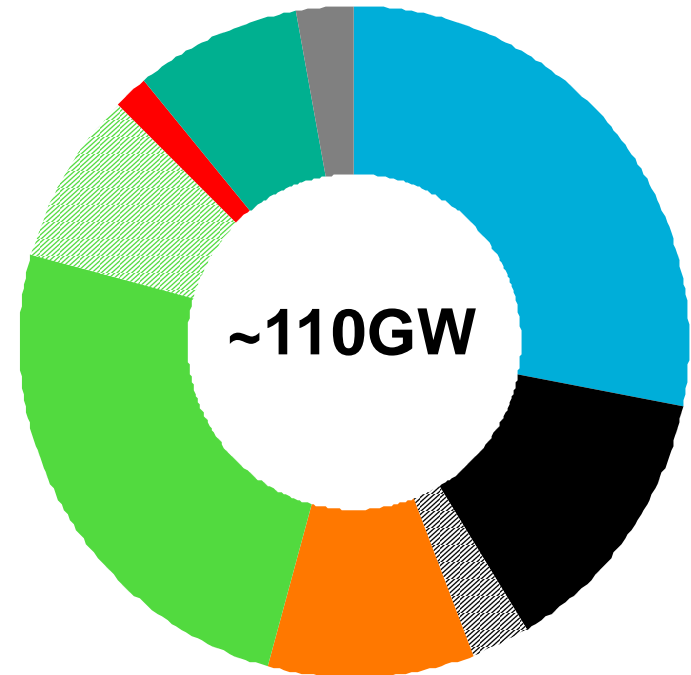
- Wind, gas dominant at ~30GW each
- ~11GW nuclear
- Some unabated coal
- ~10GW interconnection
- ~14GW embedded generation

**~40% from gas  
at ~185g CO<sub>2</sub>(e) / kWh**

- LNG & continental imports increase
- UKCS & Norwegian gas decline

**~40% from oil  
at ~245g CO<sub>2</sub>(e) / kWh**

## Generation capacity mix



- Gas CCGT
- Nuclear
- Interconnector
- Coal
- Wind
- CHP
- CCS
- Renewable
- Other

# Key policy debate: the balance between gas and electricity

## Electricity demand

**~1,000 GWh / day**

(avg. November day)



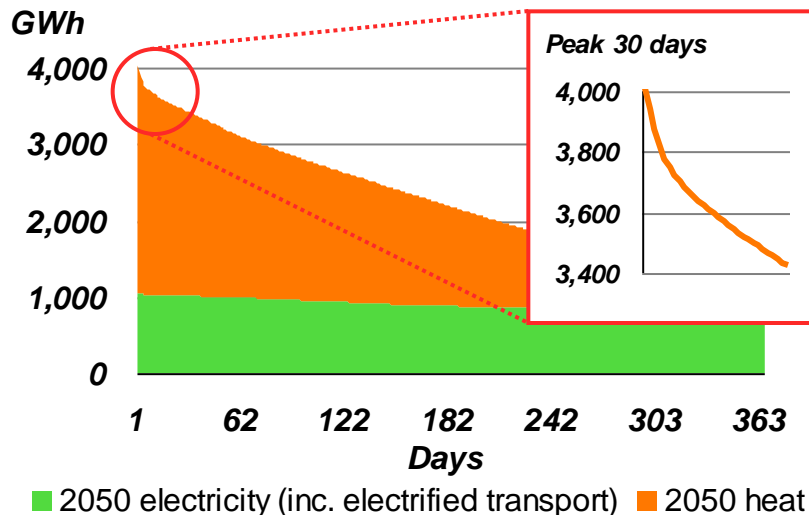
## Gas demand

**~4,000 GWh / day**

(avg. November day)



## Energy use is 'peaky' ...



## Full electrification of heat: what you have to believe...

**~150 GW of heat electrified =**

Nuclear?	~45 sites at 3.3GW / site
Renewables?	~30,000 wind turbines at 5MW / turbine
CCS?	~75 sites at 2GW / site
Solar PV?	~40m homes at 17m <sup>2</sup> / home
Inter-connectors?	~150 BritNed's at 1GW each

**...even after significant energy efficiency**



# The transmission delivery challenge

## Heat pumps in 2020

**~1,200,000**      **~1–4GW**  
In homes              peak demand

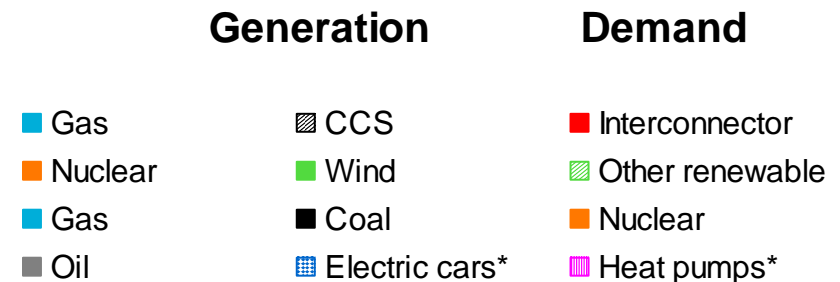
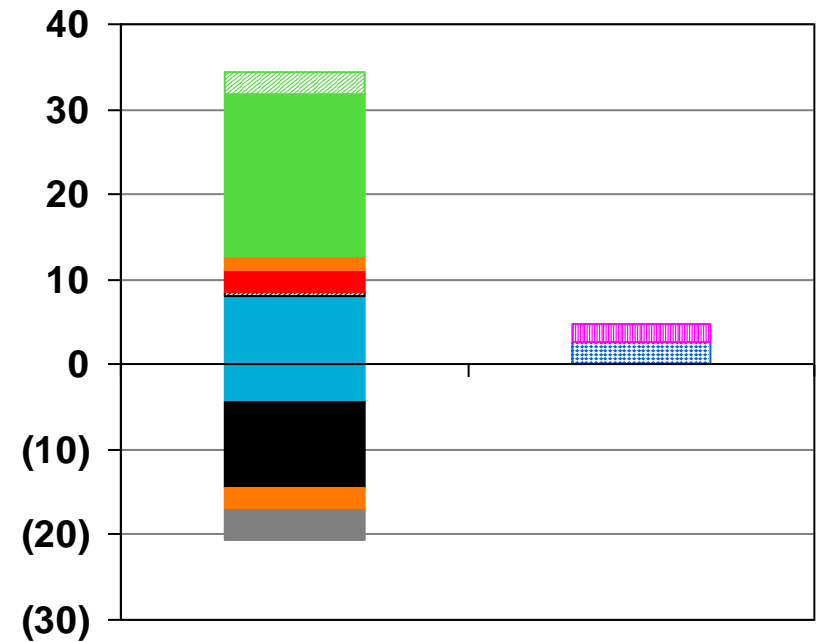
- Properties insulated for efficiency
- ‘Hot-spots’ of demand will emerge
- Evening peak impact mid-decade
- Time of use tariffs & smart metering enable peak management by 2020

## Electric vehicles in 2020

**~1,700,000**      **~1–5GW**  
on the road              peak demand

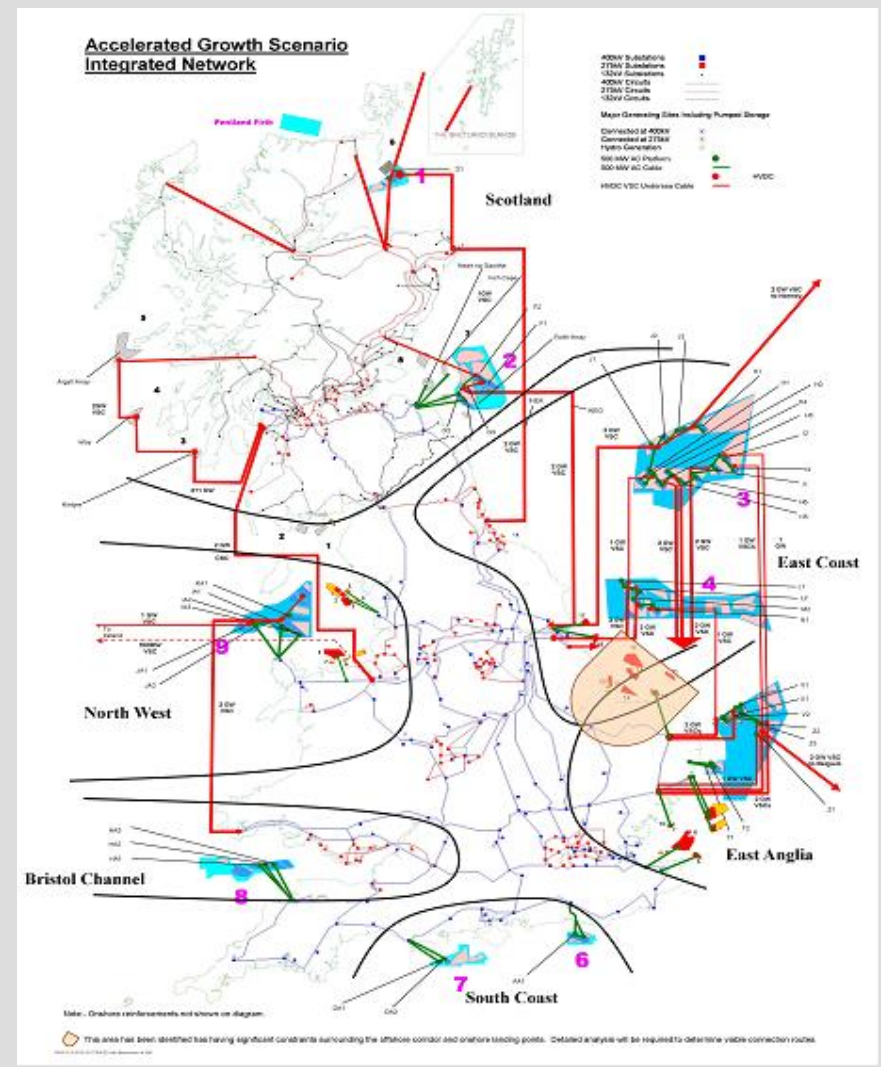
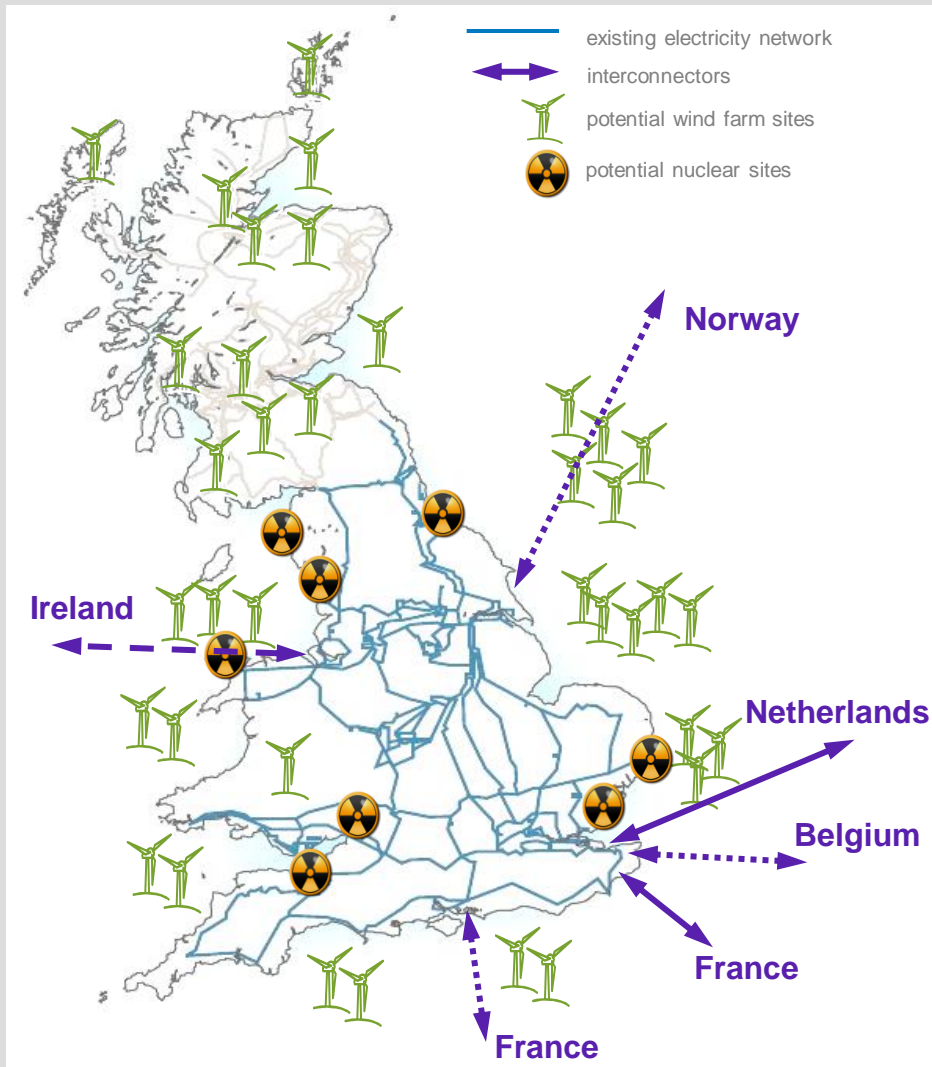
- 13A plug-in home charge dominant
- ‘Hot-spots’ of demand will emerge
- Evening peak impact mid-decade
- Time of use tariffs & smart metering enable peak management by 2020

Change 2010 to 2020 (GW)



\* Electric vehicle and heat pump at mid-range peak demand.

# The transmission delivery challenge



# The distribution delivery challenge

## Peak electricity demand in the home increases significantly

- ~2.5kW peak appliance demand for an average house in 2010
  - ~3kW charge for an electric car
  - ~3.5kW demand for a heat pump
- 
- ~9kW potential total demand



## Distribution networks will need to double their capacity

	2010	2030	2050
Household demand*	~2.5kW	~4.7kW	~7kW
Embedded generation	~8GW	~15GW	~20GW
Network loading (kW/km)	~75	~170	~300
<b>Network scale</b>		<b>X2.3</b>	<b>X4.0</b>

\* After diversity average peak demand

Network scale vs 2010 levels

**The real  
question is...**

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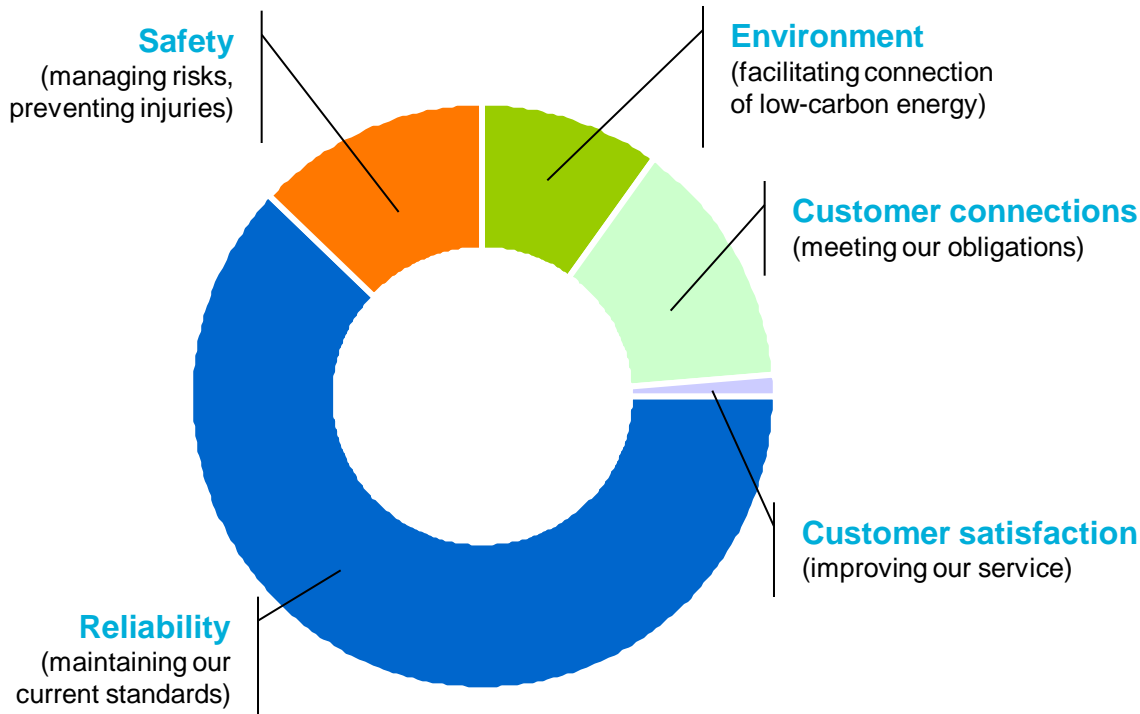
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**What do our  
customers want  
from grids?**

# RIIO: stakeholder engagement and value for money...



## Our plan to 2020/21: £16.8bn totex\*



\* Capex + opex between 2013/14 and 2020/21, in 2009/10 prices

## We will:

- Expand and renew the transmission network
- Find and develop enough people with the right skill sets
- Innovate the way we work and deliver outputs
- Upgrade critical IT systems
- Secure planning permission to deliver the required major infrastructure projects
- Manage commodity volatility
- Support the development of the regulatory and legal framework