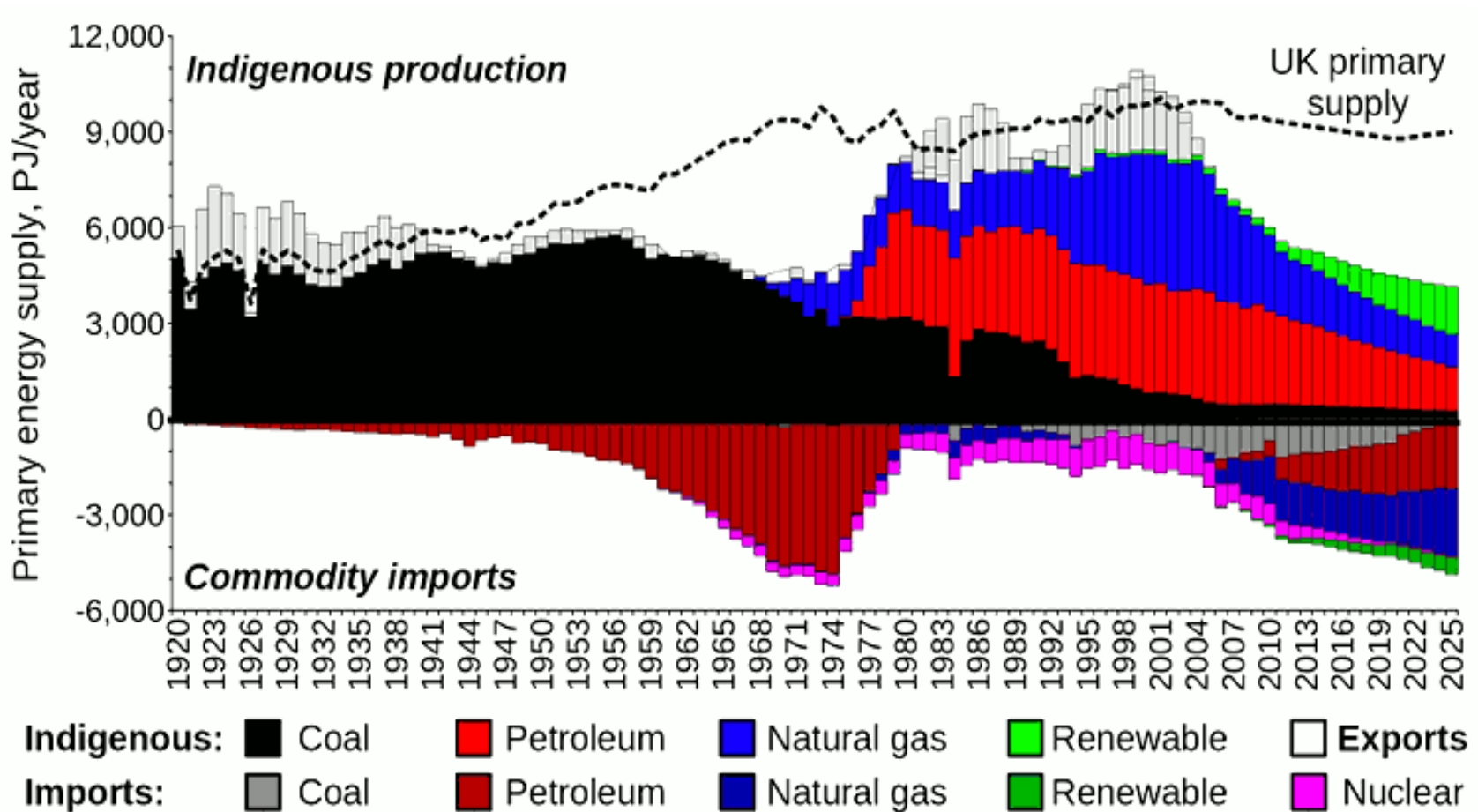


E3G

Rethinking UK Coal: the history, logic and EU context of the UK phase out

Nick Mabey, E3G and Matt Phillips,
European Climate Foundation

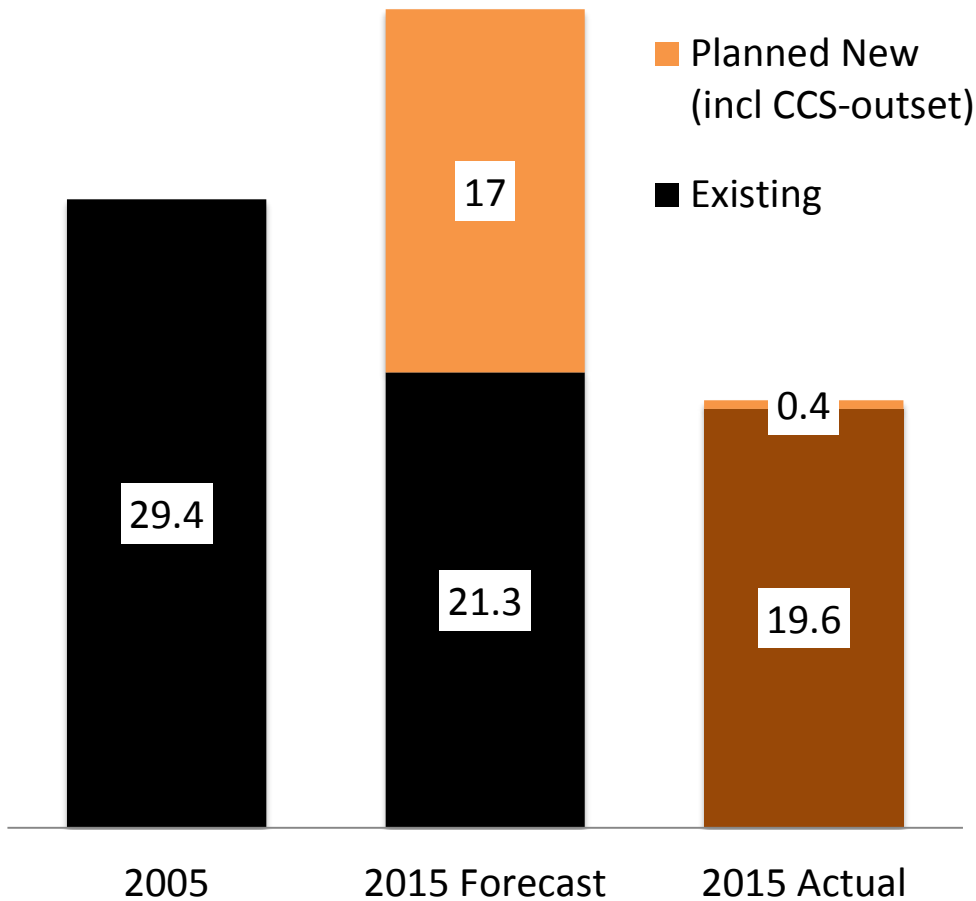
The UK was built on coal but has chosen to go clean and efficient



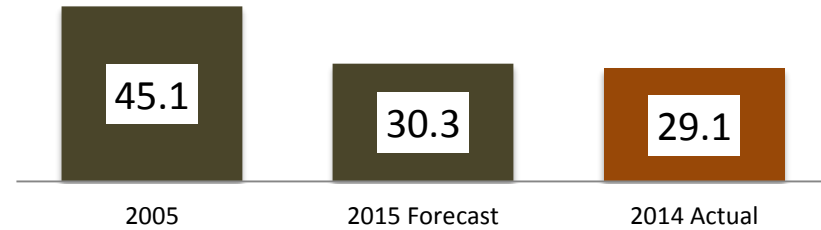
UK has gone from 95% energy from coal in 1950s to under 5%

UK coal situation 2005-2015

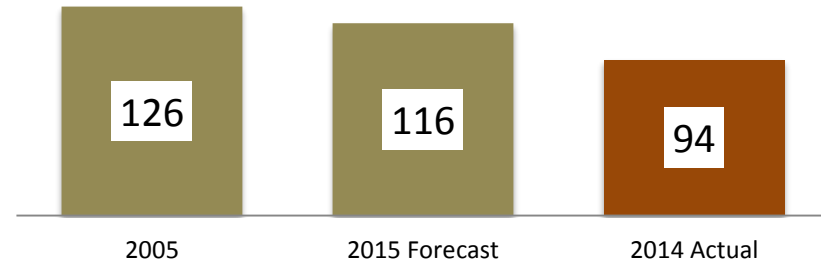
Coal capacity forecast in 2005 vs actual



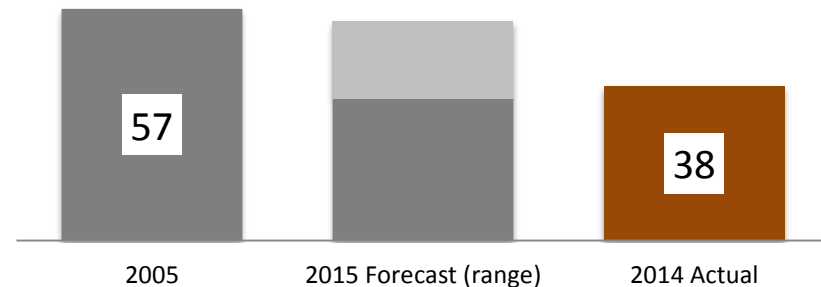
Coal % share of Generation forecast in 2005 vs actual



Coal TWh forecast in 2005 vs actual



Coal Mt forecast in 2005 vs actual



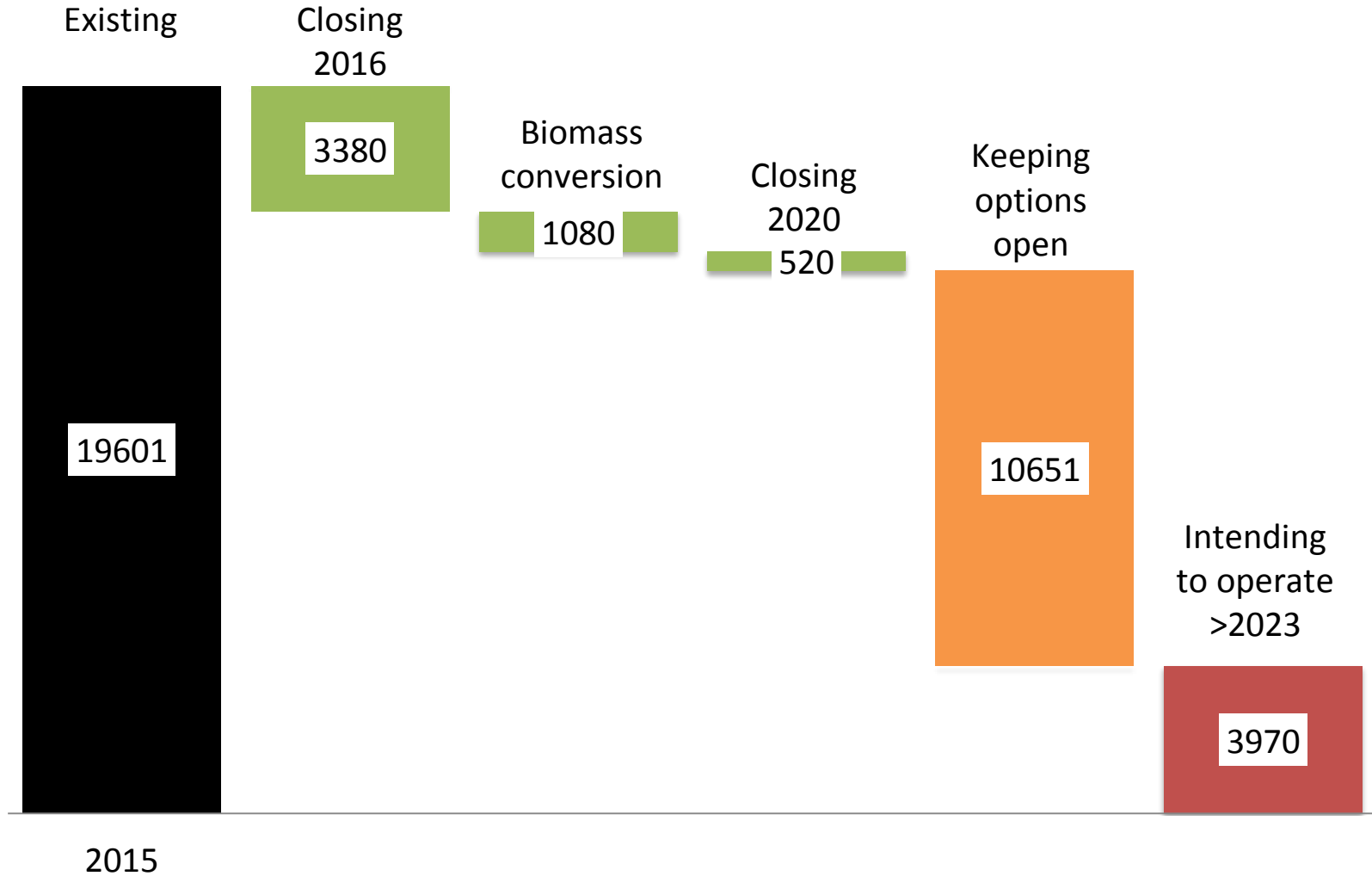
Coal re-think 2008-10



- Popular campaign against Kingsnorth coal project chilled enthusiasm of utilities and saw widespread questioning of new coal on climate grounds
- Opposition leader, David Cameron proposed ruling out new coal in 2007
- By end 2009 Labour created Department of Energy and Climate Change and coal policy changed
- All new unabated coal projects were subsequently abandoned

What is next for coal in the UK?

UK existing coal capacity MW



Coal phase out... but when?

- Just before 2015 election, Cameron committed to *“end the use of unabated coal for power generation”*
- Last UK deep mine closes in 2016. Energy security equation fundamentally changed for coal
- Plants may now be uneconomic, but propped up by capacity payments

The UK Coal Rethink

- Kingsnorth forced rethink of UK decarbonisation policy based on markets responding to carbon price
- Govt modelling of least cost pathway to 90% GHG cuts in 2050 pointed to decarbonisation of power sector by 2030
- Results driven by need to replace aging nuclear and dirty UK coal plants in next decade
- Modelling showed high cost of locking into new coal plants – even if more efficient and “CCS ready”

Analysis drove Emissions Performance Standard on new plant and Electricity Market Reform



CCC Advice to UK Government 2011

Share of total UK emissions from power generation.

28%

The carbon intensity of power will need to fall from around 500 g/kWh today to 50 g/kWh by 2030.

50
gCO₂e/kWh

97% of electricity should be generated by low-carbon sources in 2030, compared to 26% now.

97%



UK Power Decarbonisation Pathways

- In 2011 low carbon generation addition assumed to be a mixture of wind, nuclear and gas & CCS
- CCS demonstration now 5-7 years behind schedule
- Nuclear now >5 years behind schedule
- On shore and offshore wind cheaper than estimated
- 5.7 GW of solar installed by 2015 (> 1GW in 2011 plans)
- Electricity demand falling due to efficiency measures

More renewables and less nuclear than anticipated. Nuclear not needed for 2027 carbon budget

Source: CCC 4th Carbon Budget Report; DECC Statistics

Figure 6.5: MARKAL trajectory for the power sector (2010-2050)

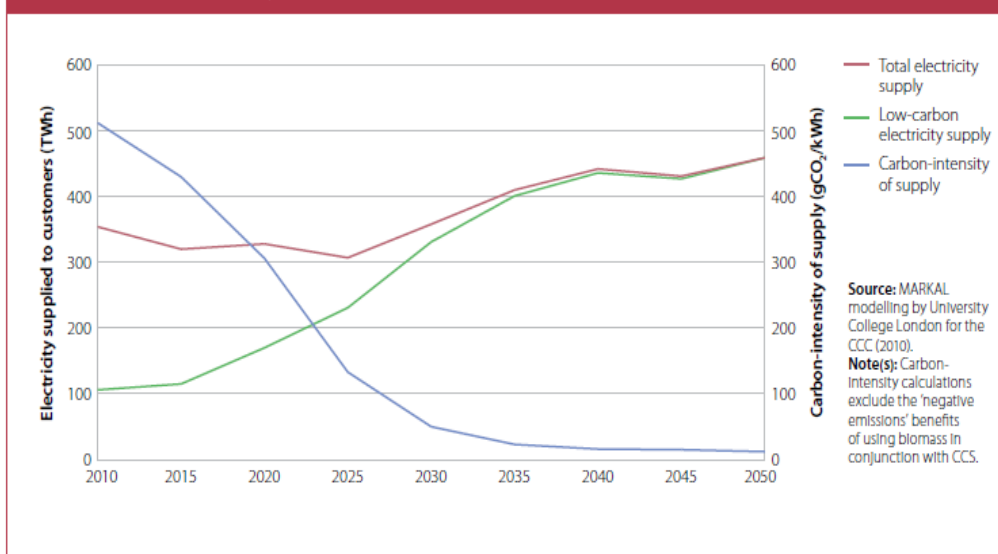
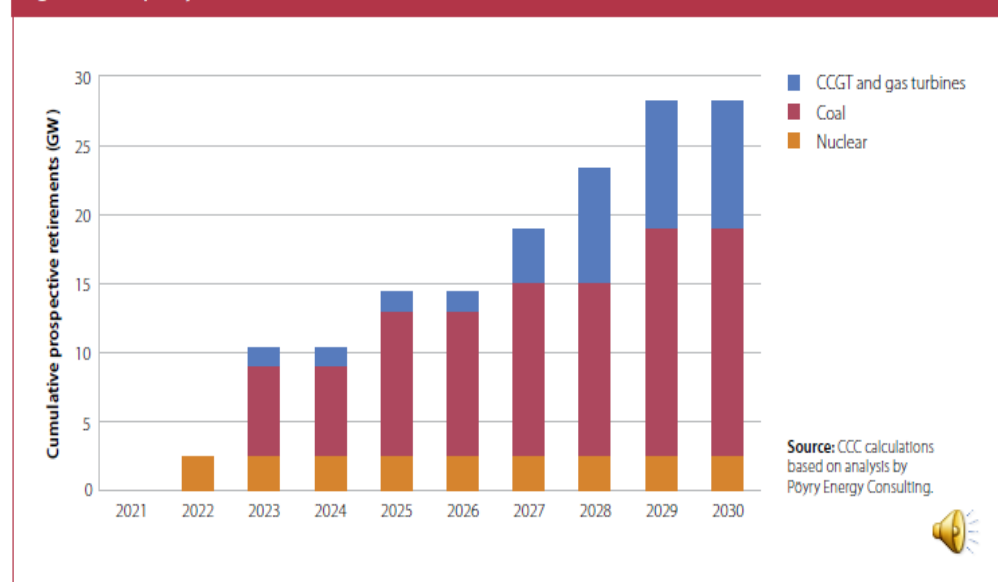
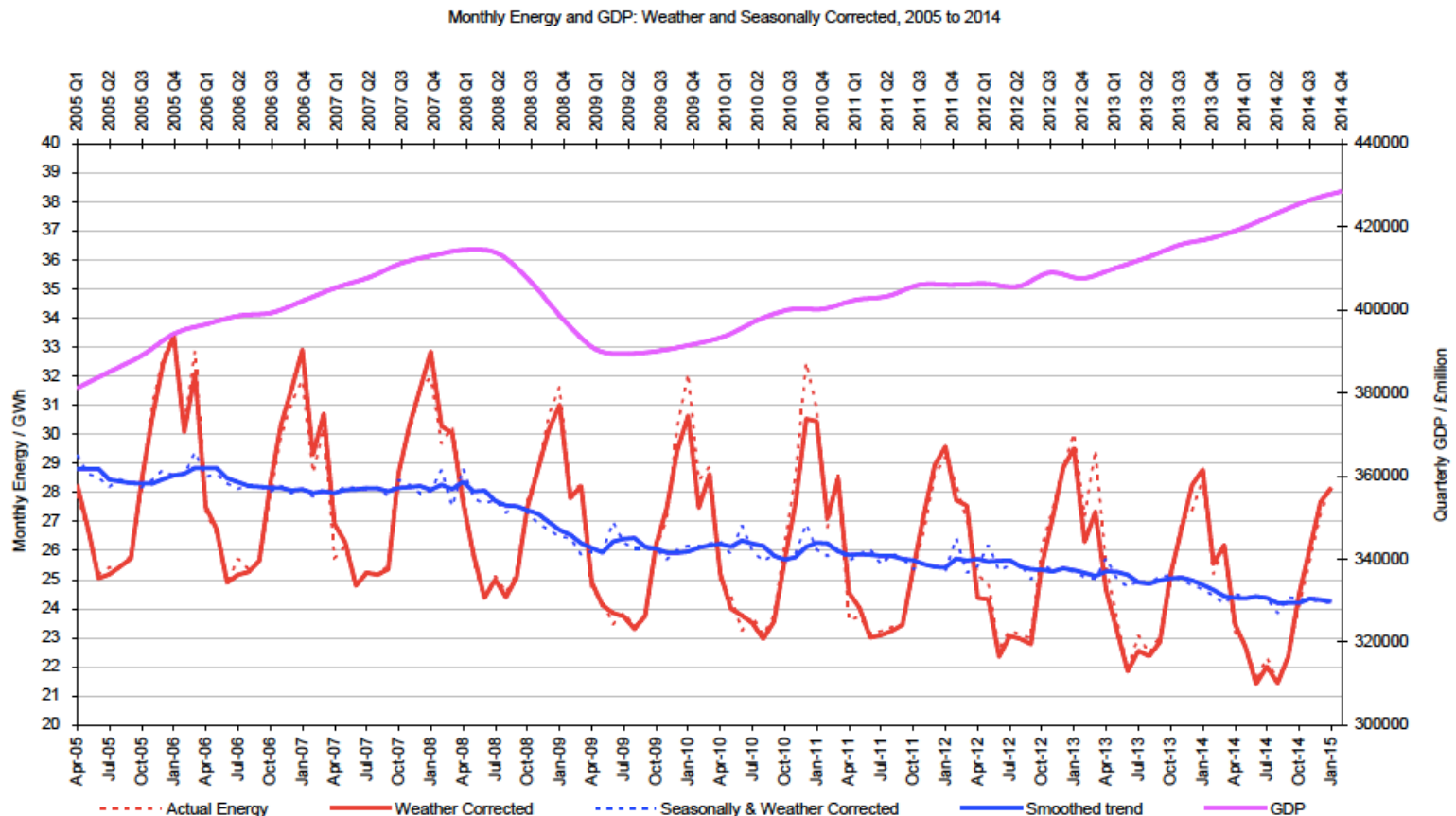


Figure 6.7: Capacity retirement (2021-2030)



UK Seeing a Power Demand Revolution

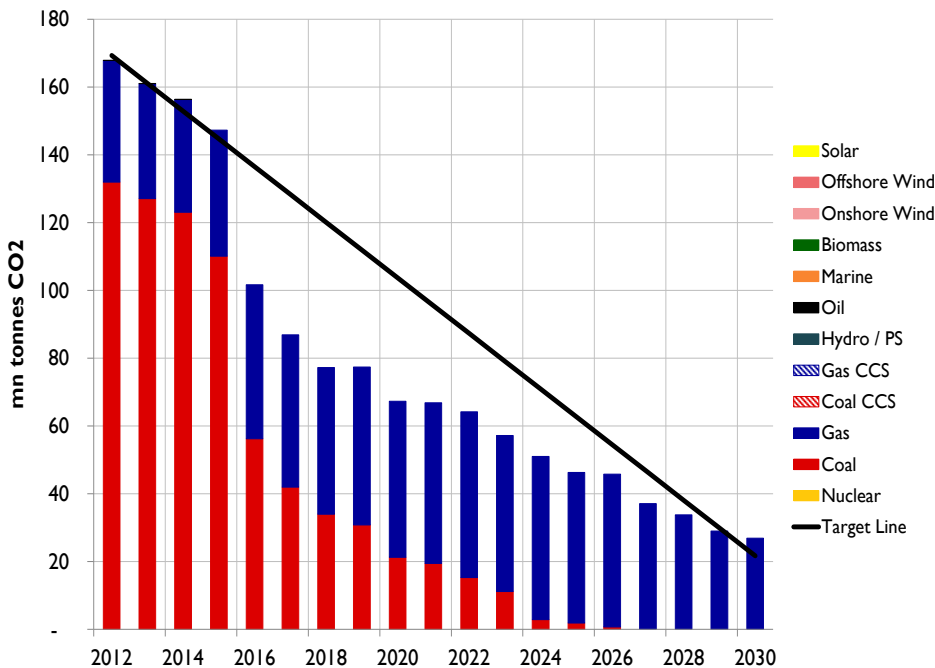
Figure 10 - Monthly energy and GDP: weather and seasonally corrected (2005 to present)



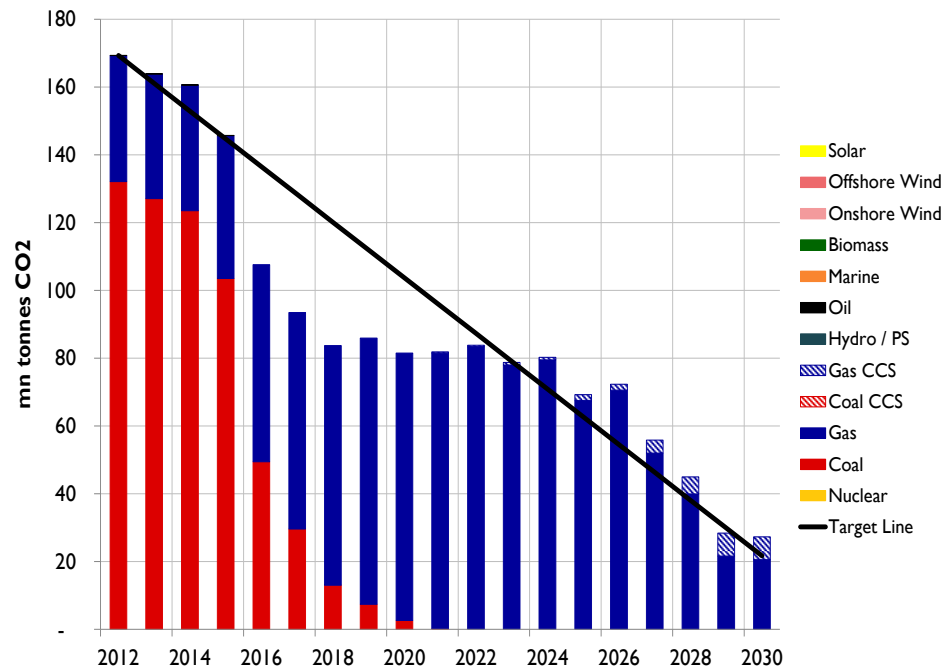
Risk Management: Carbon Price vs Emission Performance Standards

- Debate over UK Electricity Market Reform focused on whether investment should be driven by EPS & technology support policies (FiTs, CfDs etc) or an increasing carbon price.
- Carbon price driven scenarios resulted in faster coal phase out & greater gas build out
- This leads to very high price risks in 2030s if CCS is expensive/fails. **UK will use EPS and CfD auctions to drive power sector decarbonisation.**

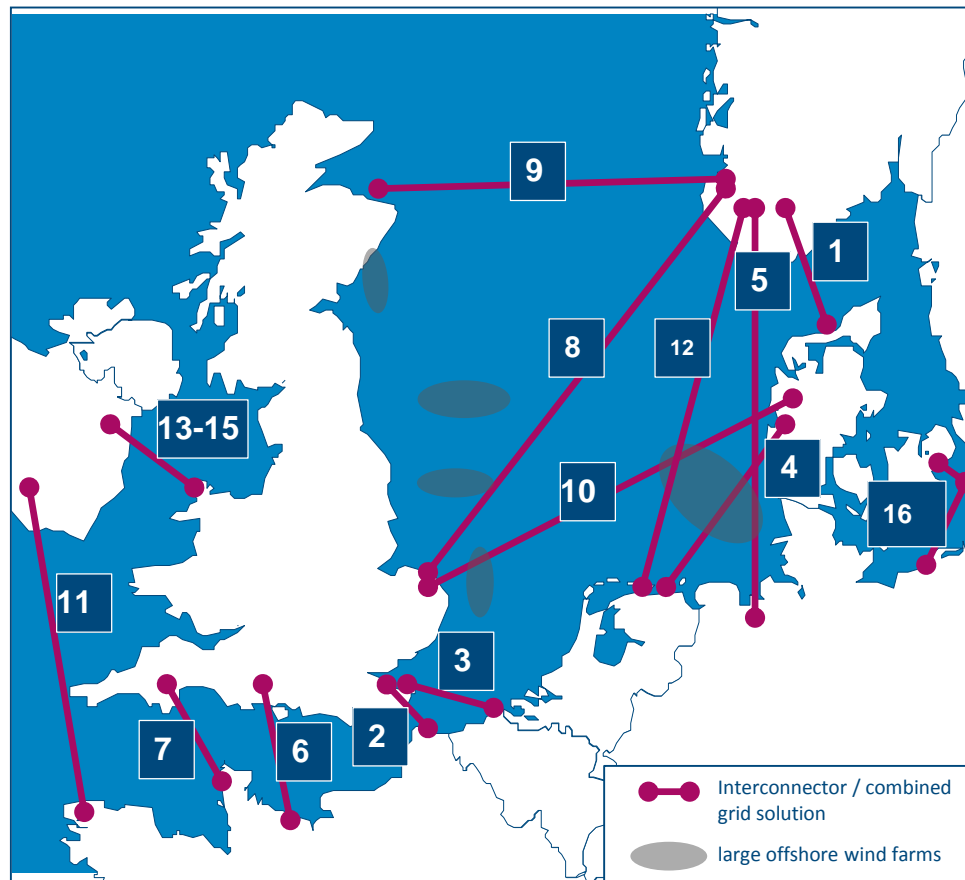
Technology Support & EPS



Carbon Price Driven



UK continuing with Power Market Reforms



- UK reformed power market to incentivise low carbon generation
- Green Investment Bank supports offshore wind and decentralised energy
- 2030 pipeline of up to 70GW of offshore wind in North Seas region
- Building regional EU market and up to 14+ GW interconnectors to ensure least-cost expansion of wind power
- UK needs demand side reforms to power market and smart grids to manage grid stability and costs

**Power decarbonisation requires new markets and infrastructure.
Reforms benefit consumers but resisted by incumbents.**



Japan compared to NW Europe



**Japan roughly similar to
NW Europe in
population, climate and
geography**

(UK, Ireland, Norway, Denmark,
Sweden, Finland, Belgium and
Netherlands)



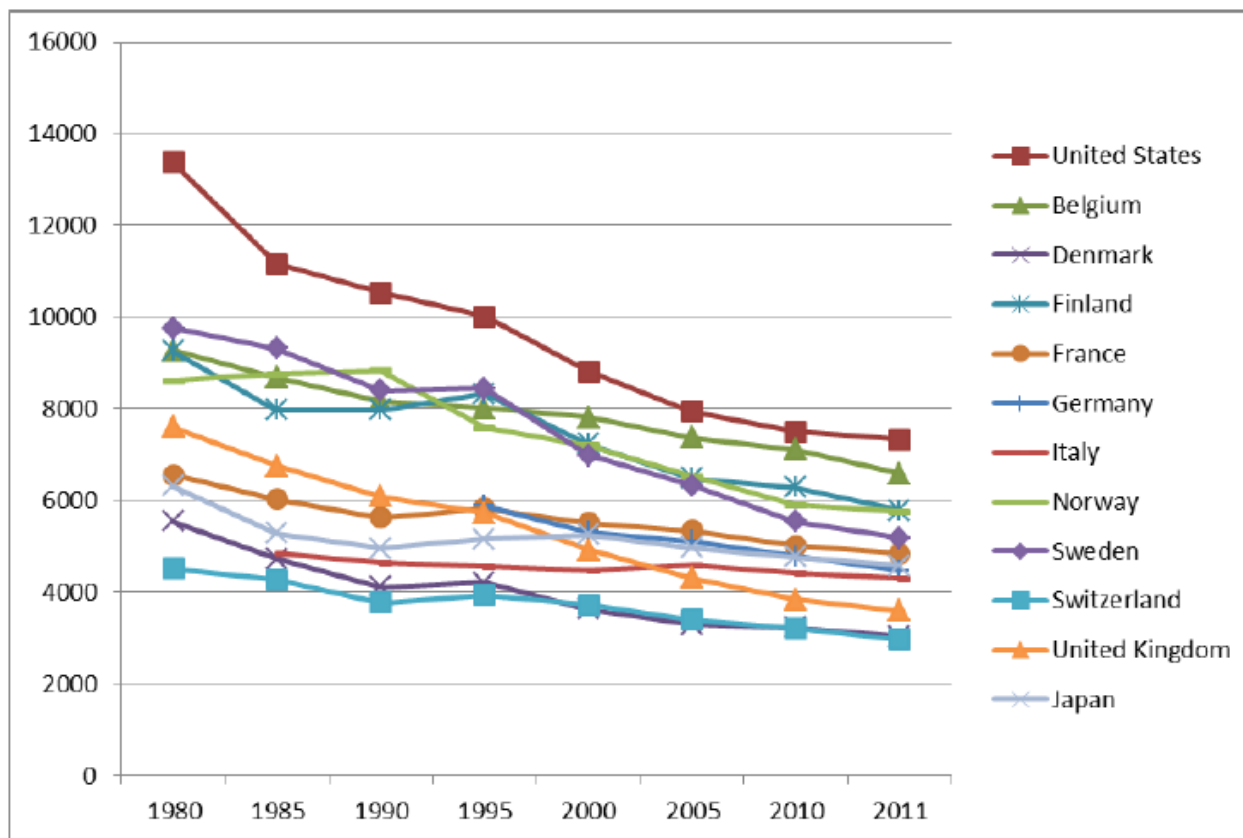
- “NW Europe” GDP is 11% higher (GDP per capita 13% higher) than Japan
- Japan produces roughly 20% more GHG emission and 18% more GHG per capita
- **UK, Belgium, Sweden, Denmark, Finland, Norway progressing coal phase out or are almost out of coal. Netherlands has ruled out new coal, is now forcing closure of 5 plants but is yet to agree phase out.**
- Energy security improves as coal is imported and region increasing interconnection, sharing of storage, efficiency of electricity use and gas in industry/heating

No new coal plants without CCS are being considered in NW Europe



Japanese Energy Productivity Improvement has Stalled compared to Competitors

Energy Consumption per dollar of GDP: 1980-2013



Source: EIA International Statistics Database 2015



Is Modelling of Japan underestimating Decarbonisation Potential?

Japan Decarb 2050

UK Decarb 2050

Figure 3. Energy Pathways, by source

3a. Primary Energy

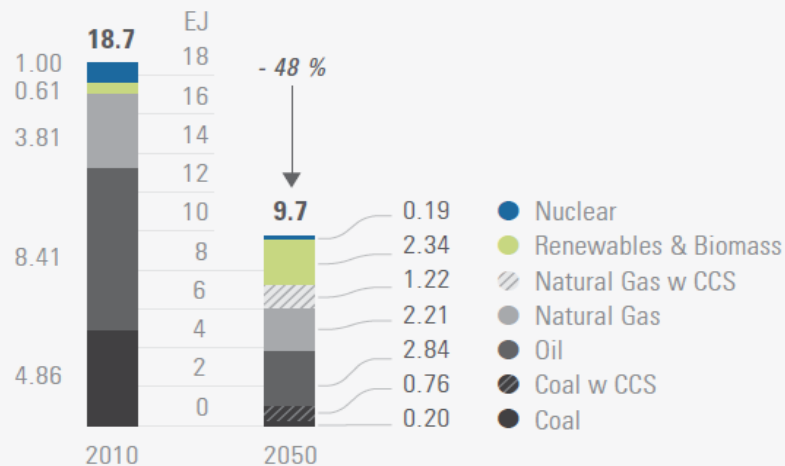
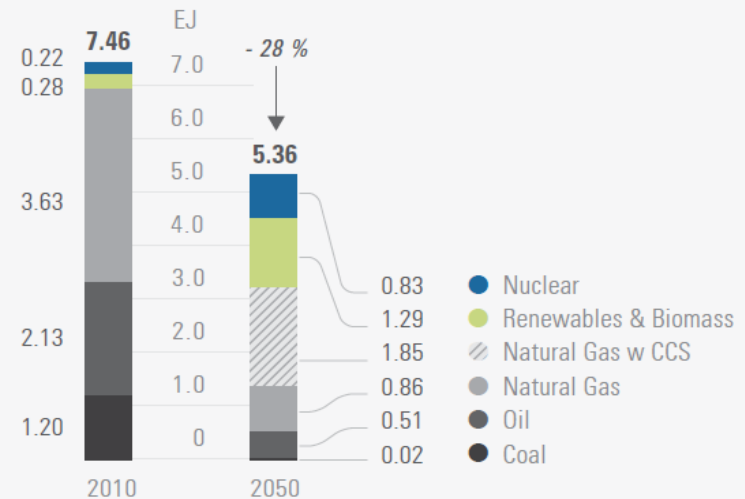


Figure 3. Energy Pathways, by source

3a. Primary Energy



- Japan's population drops to 97 million in 2050; UK grows to 77 million by 2050. Japan sees 40% decline in working population.
- Japan's Energy/GDP is forecast to remain double the UK's in 2050
- **Models suggest Japan has little structural change despite rapid population decline**



Japan is a top patent holder in key clean technologies

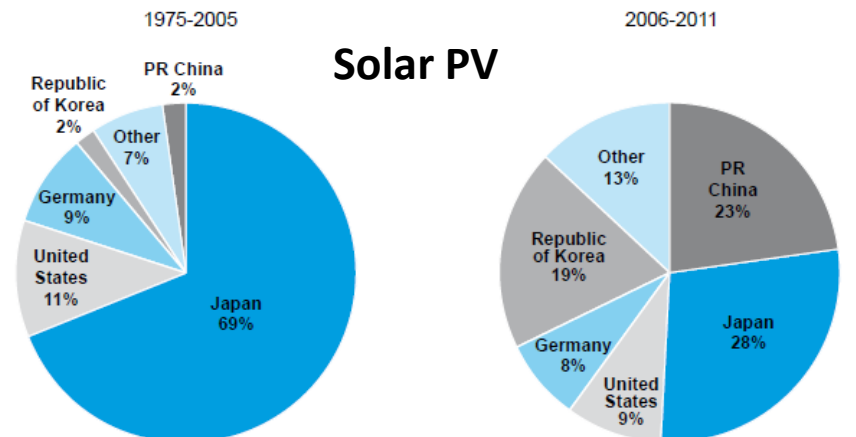
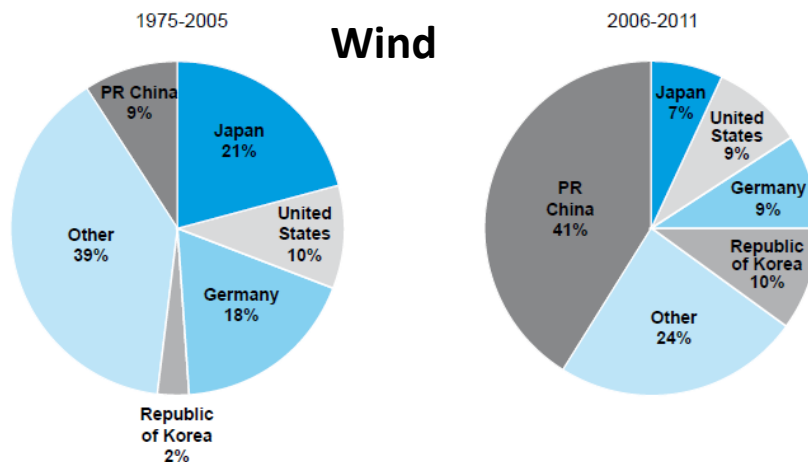
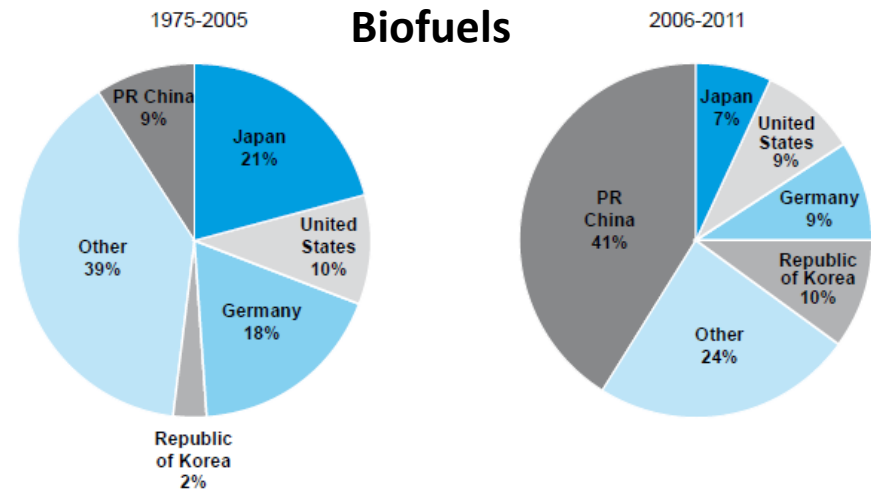
Patent holdings in Solar PV, Wind Power, Biofuels and Solar Thermal 2006-2011

Rank 2006-2011	Technology Owners	Country/Region of Company HQ	Technology Area
1	LG	Republic of Korea	SolarPV
2	Mitsubishi	Japan	SolarPV
3	General Electric	USA	Wind
4	Sharp KK	Japan	SolarPV
5	Panasonic	Japan	SolarPV
6	Samsung	Republic of Korea	SolarPV
7	Siemens AG	Germany	Wind
8	Mitsubishi	Japan	Wind
9	Kyocera Corp	Japan	SolarPV
10	Konica Minolta	Japan	SolarPV
11	Fujifilm Corp	Japan	SolarPV
12	Hitachi	Japan	SolarPV
13	Vestas Wind Sys As	Denmark	Wind
14	Hyundai	Republic of Korea	SolarPV
15	Sumitomo	Japan	SolarPV
16	Toyota	Japan	SolarPV
17	Industrial Technology Research Institute	China	SolarPV
18	Sony Corp	Japan	SolarPV
19	Dainippon Printing Co Ltd	Japan	SolarPV
20	Suzlon Energy (REpower Systems)	India (Germany)	Wind



Japanese companies see relative decline but absolute growth in opportunity

- 500% rise in clean technology patent filings since 2005
- Japan's position challenged by new entrants e.g. China with strong clean tech domestic markets
- But opportunities expanding in fast growing global \$5 trillion pa low carbon markets



Conclusions

1. UK coal phase out driven by least-cost delivery of 2050 decarbonisation goal.
2. Allowing additional coal investment would have increased price and security risks to consumers.
3. Incentivising investment in low carbon generation required market reforms and an EPS to avoid over-investment in fossil.
4. Technology and demand uncertainties means risk management is key. UK demand reduction has reduced projected new fossil plants.
5. Costs are best controlled, and security maintained, to 2030 by building interconnected grid and demand side markets.
6. Major export opportunities in new smart energy products and services; strong synergies between UK energy and industrial policy.
7. Japan has strong competitive advantages in clean technology but domestic markets and ambition falling behind similar economies



Background Material

- EU Decarbonisation

<http://e3g.org/showcase/energy-union>

<http://e3g.org/showcase/eu-2030-climate-and-energy-package>

- Power Sector Risk Management

<http://e3g.org/showcase/risk-managing-power-sector-decarbonisation>

- North Seas Grid

<http://e3g.org/showcase/North-Seas-Grid>