

Innovation, Governance and Affordability for a Sustainable and Secure Economy

Catherine Mitchell, 26th November 2014



New Thinking For Energy



Abstract

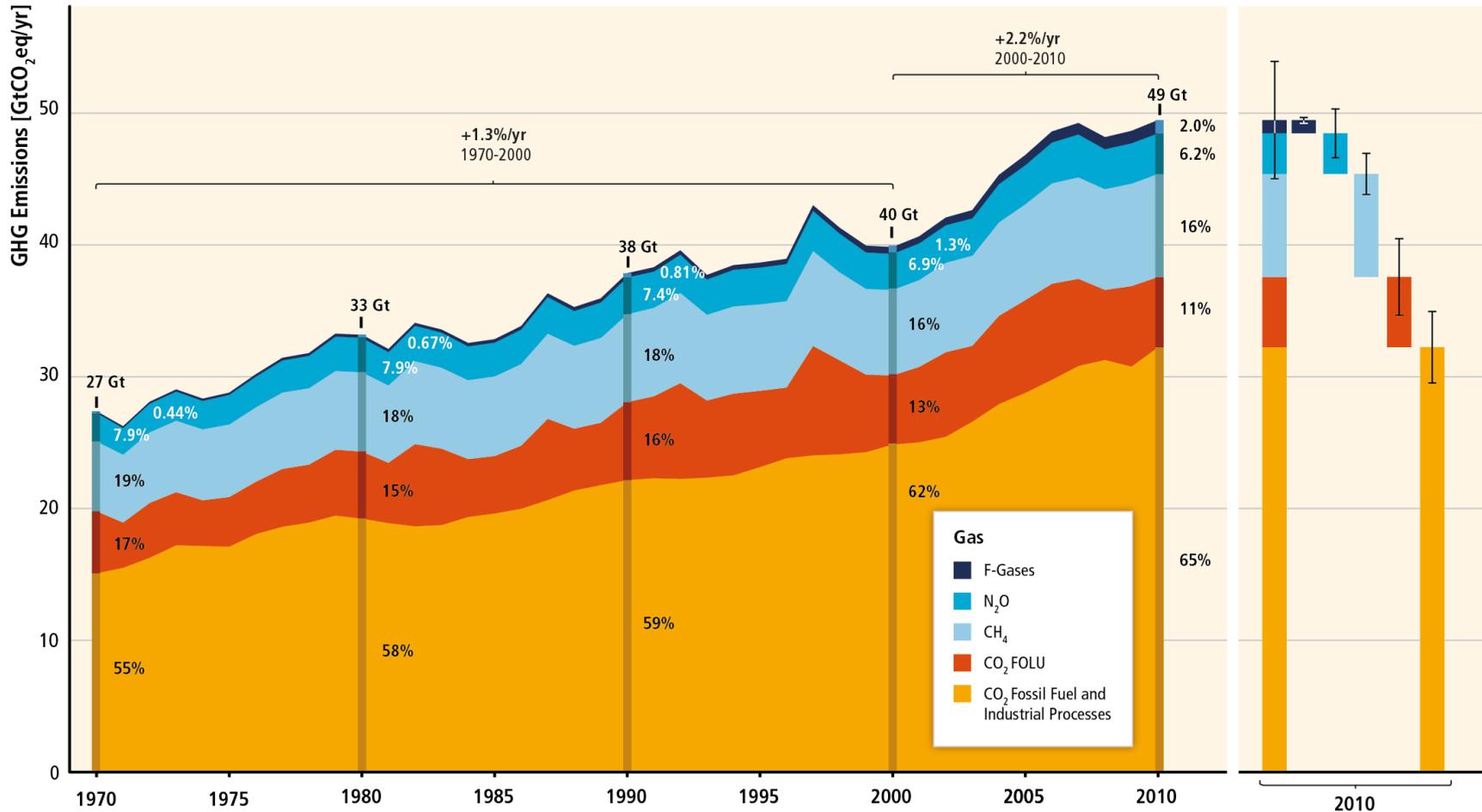
The global energy system is in a time of rapid technological change, which in turn is fundamentally altering the economics of energy. This technological change is both (1) within energy technologies, for example, rapid price falls of solar energy, but also (2) the IT revolution is enabling different ways to operate and manage the energy system - for networks and markets. This has implications for the conventional utility model, business models and customer relationships with their energy use but also for the role of regulation and Regulators. This is leading to two types of countries - those that are enabling, or at least not constraining, the change in energy systems; and those which, for various reasons, are ignoring or attempting to constrain it. While constraining change may slow it down, countries cannot stop it completely – and the question is whether by constraining change in the energy system countries are setting themselves up for a very disruptive time at some point in the future with a wider loss of innovation within their economies, as opposed to a more managed transformation.

Overview

- Why is it important to have innovation / change?
- Climate Change Policy
- Short Explanation of Energy Situation in UK
- Changing Economics of Energy
- Embracing change
- Constraining change
- Final outcomes for country, customers and citizens

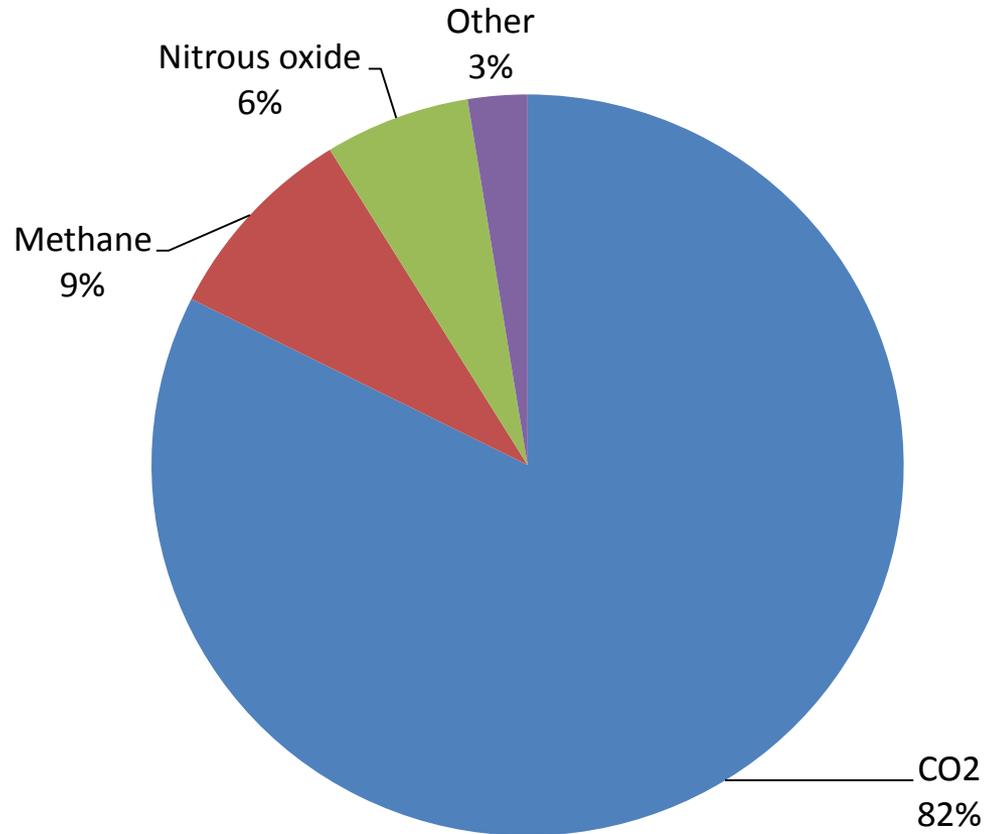
Emissions accelerate globally despite reduction efforts. Most emission growth is CO₂ from fossil fuel combustion.

Total Annual Anthropogenic GHG Emissions by Groups of Gases 1970-2010



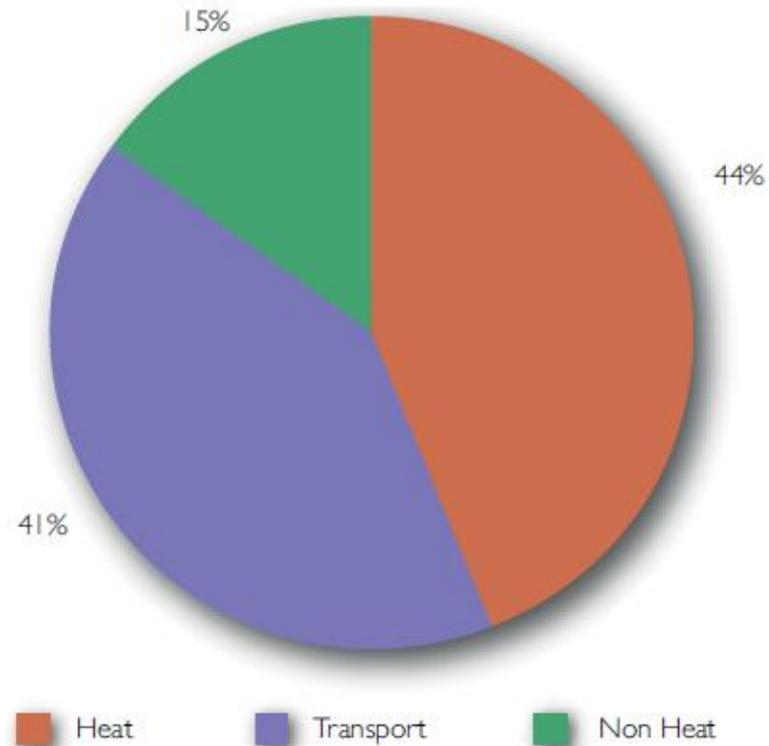
CO2 the big climate change emission

UK greenhouse gas emissions 2012 (mtCO₂e)



DECC

Chart 1: Energy Usage for Heat, Non Heat and Transport, 2011



Source: DECC

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190149/16_04-DECC-The_Future_of_Heating_Accessible-10.pdf

UK Policy: 2050 target and carbon budgets (CCC, 2010) – even this 80% cut is not sufficient reduction to maintain the 2 degrees global warming

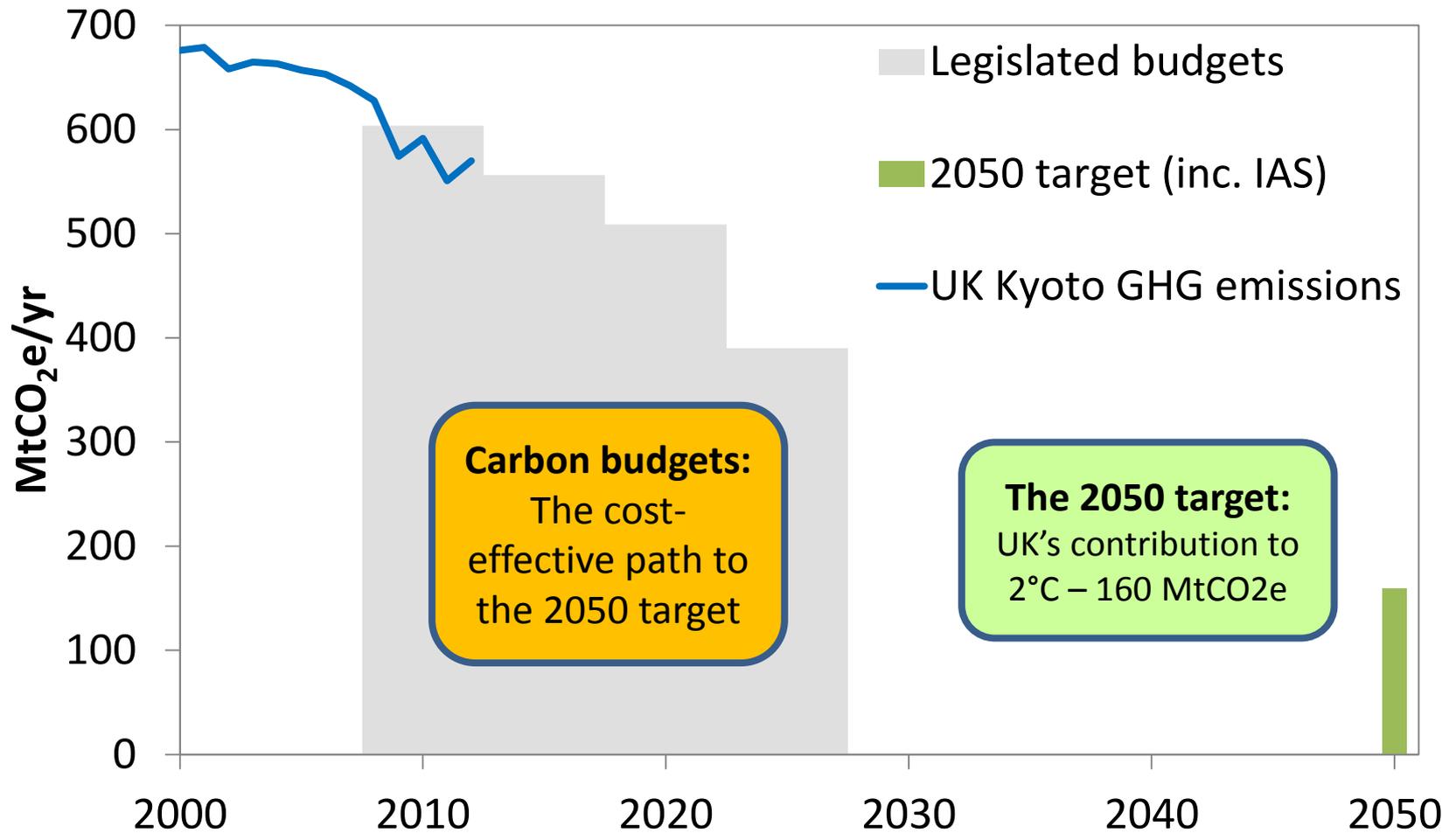
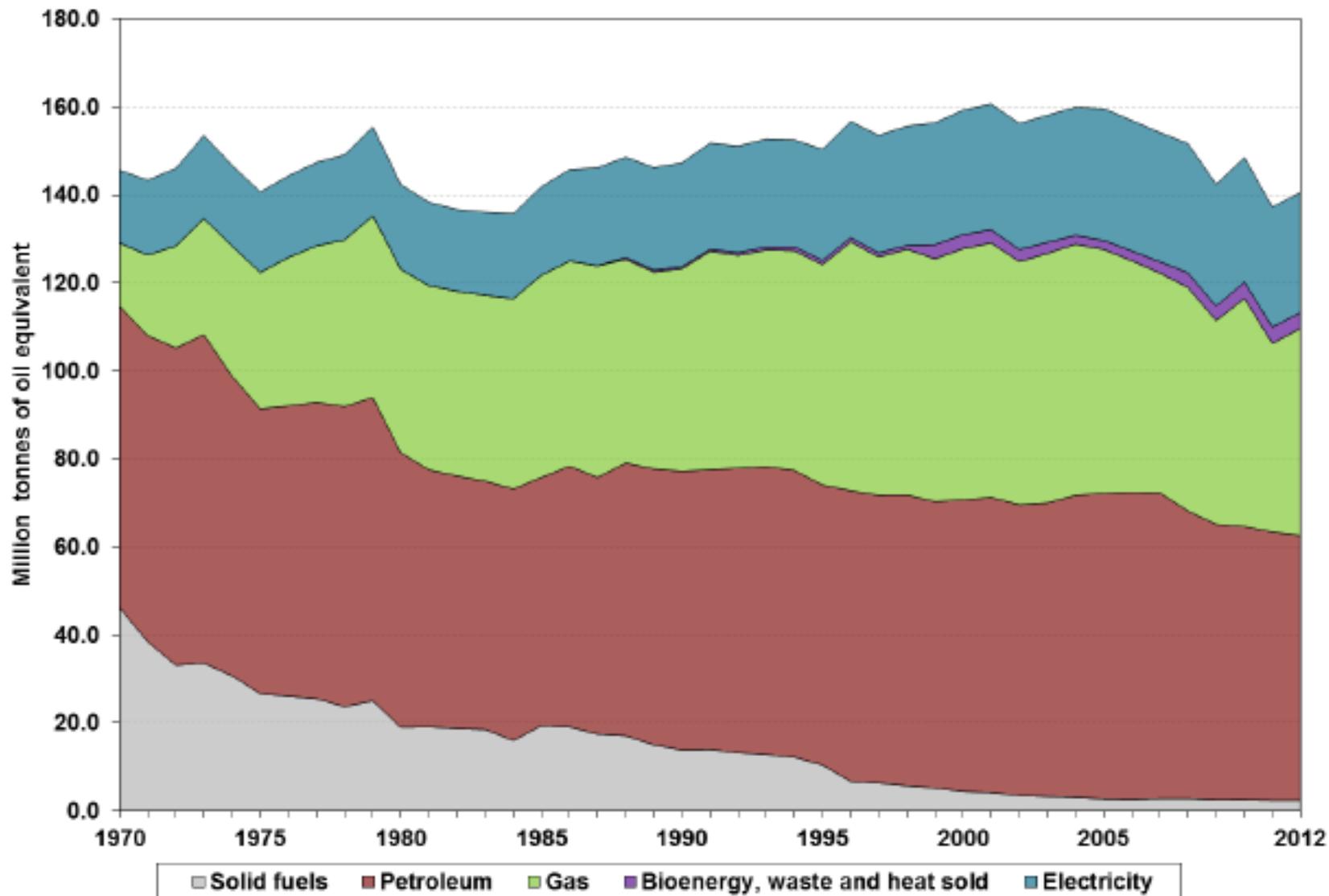


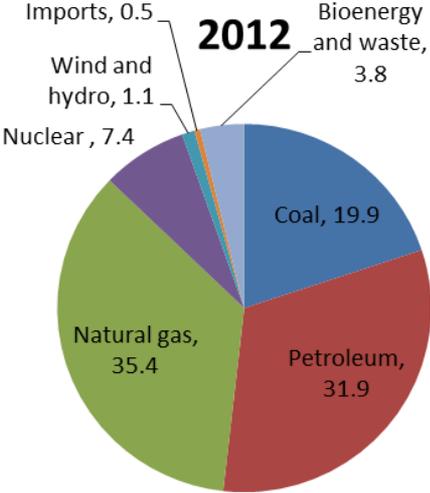
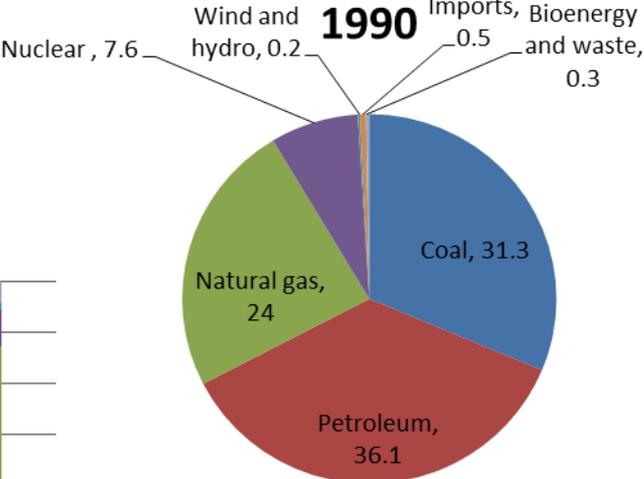
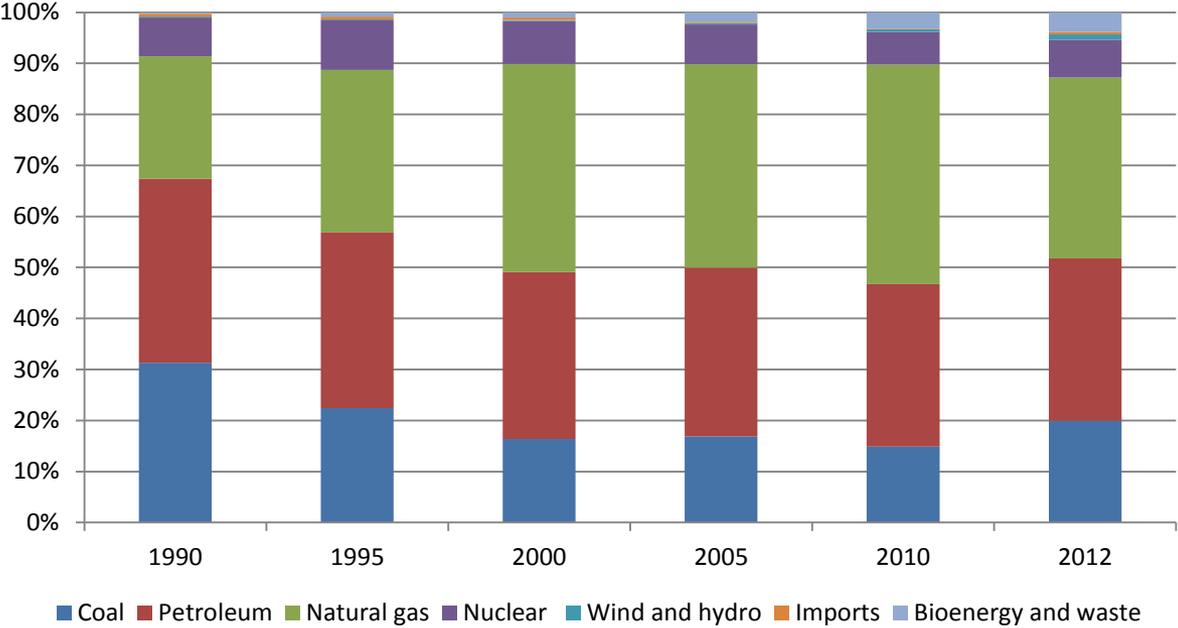
Chart 3

Final energy consumption by fuel, UK (1970 to 2012)

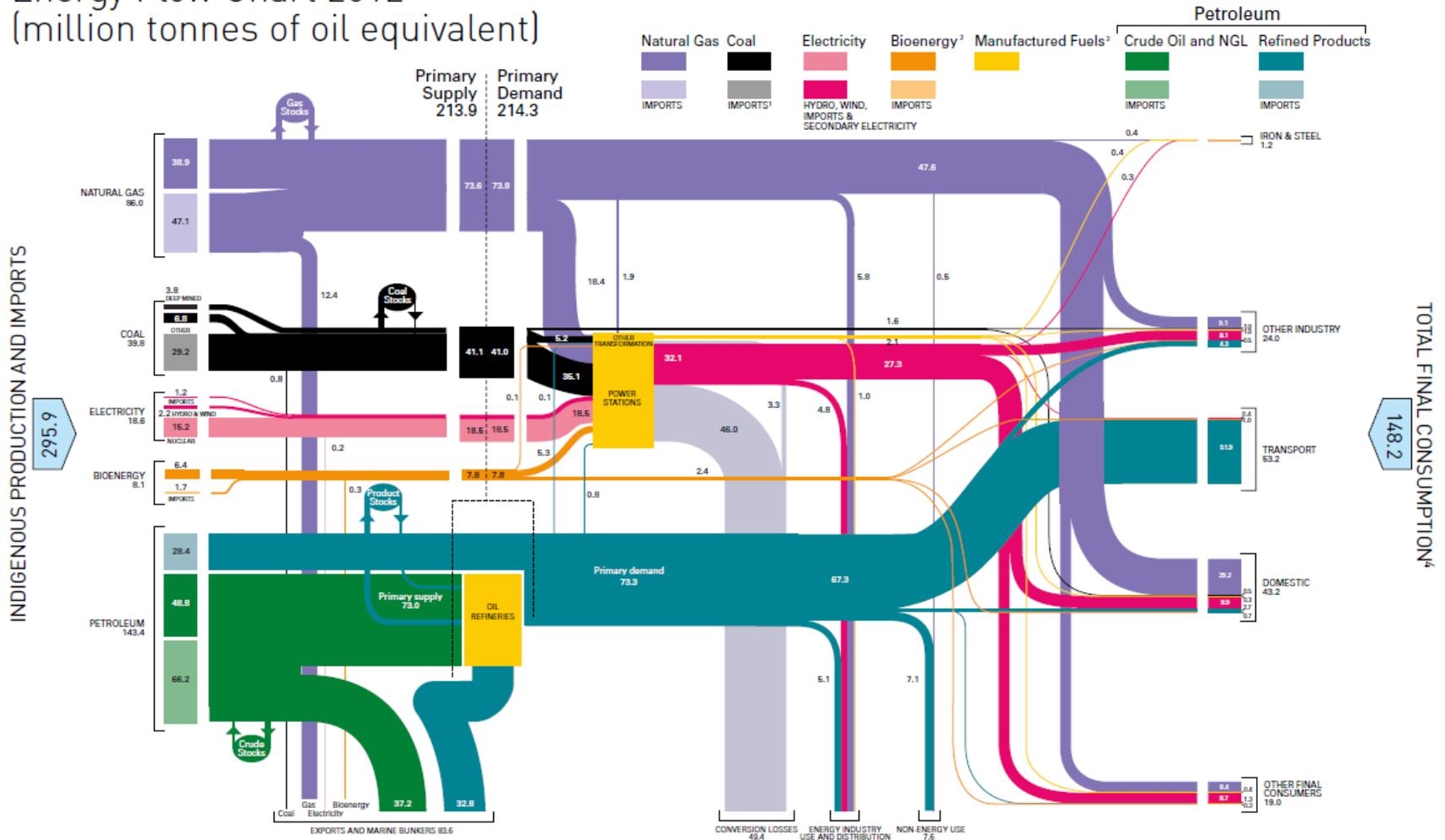


Source: DECC, ECUK Table 1.06

UK energy supplied



Energy Flow Chart 2012 (million tonnes of oil equivalent)



FOOTNOTES:
 1. Coal imports include imports of manufactured fuels, which accounted for 0.1 million tonnes of oil equivalent in 2012.
 2. Bioenergy is renewable energy made from material of recent biological origin derived from plant or animal matter, known as biomass.
 3. Includes heat sold.
 4. Includes non-energy uses.
 This flowchart has been produced using the style of balance and figures in the 2013 Digest of UK Energy Statistics, Table 1.1.

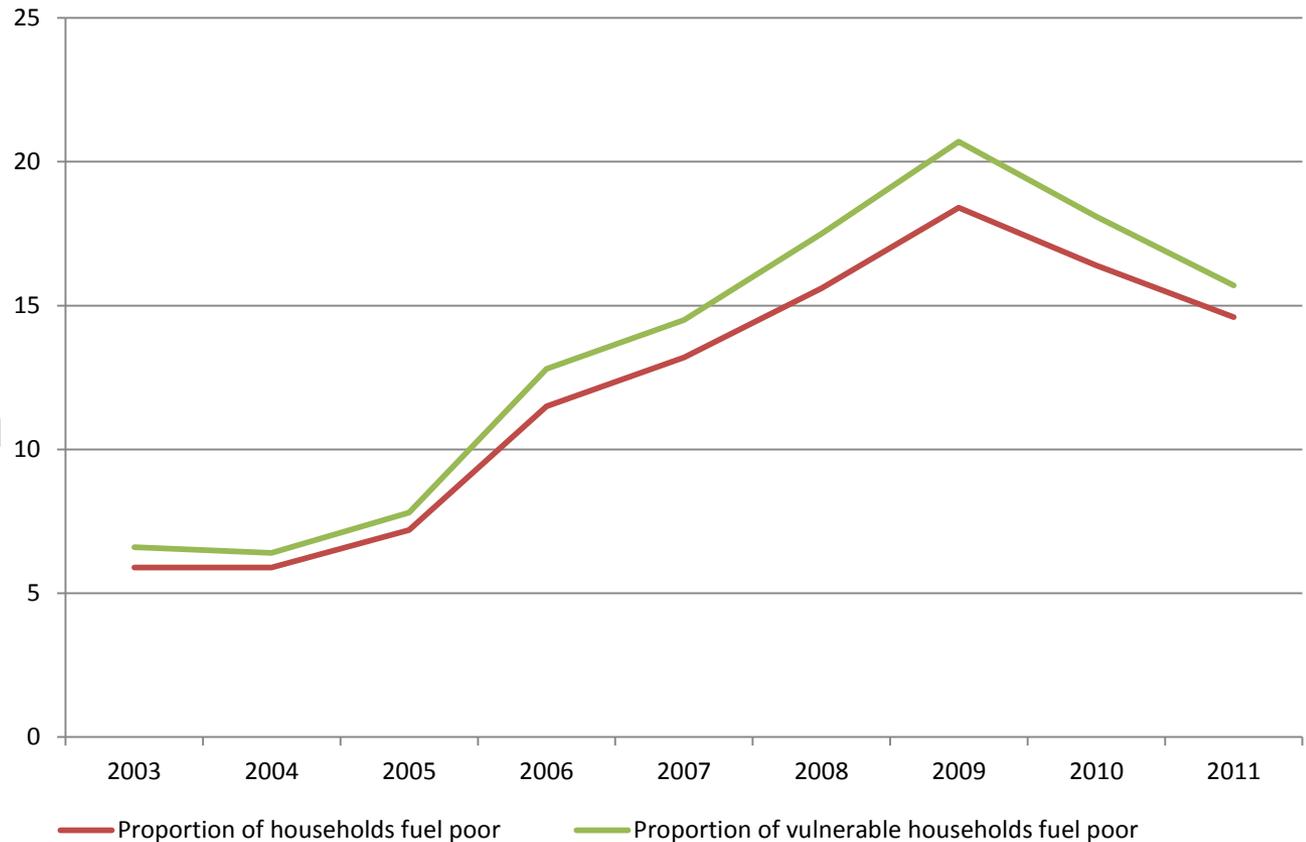


Fuel poverty rose through the 2000s despite targeted programmes – a result of poor housing stock, energy prices and income

Up until recently, 'fuel poverty' defined as those households needing to spend more than 10% of their income on fuel to maintain an adequate level of warmth (DECC 2009)

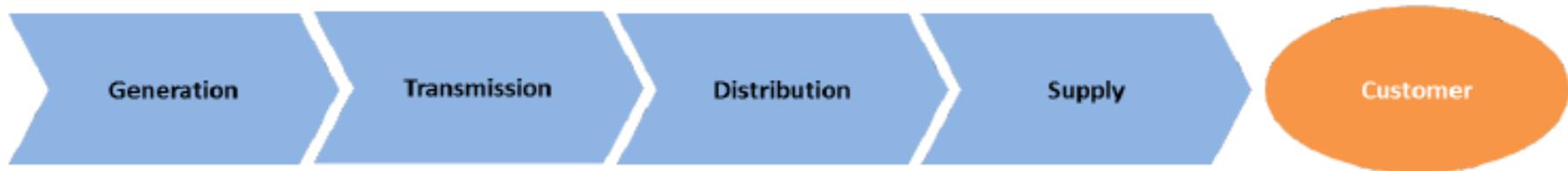
Source: DECC
Note: Uses the 10% definition

Proportion of households living in fuel poverty (%), England



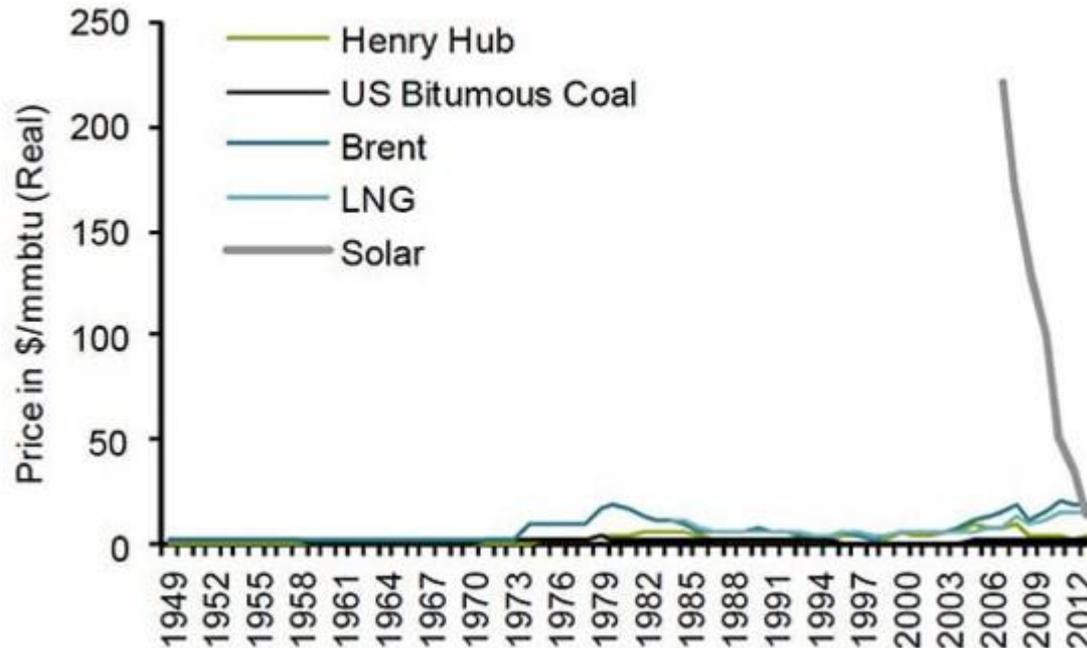
The conventional energy utility model – linear, top-down, fossil dominated

The role of utilities in the past...



US Grid Parity by 2016

Welcome to the Terrordome...

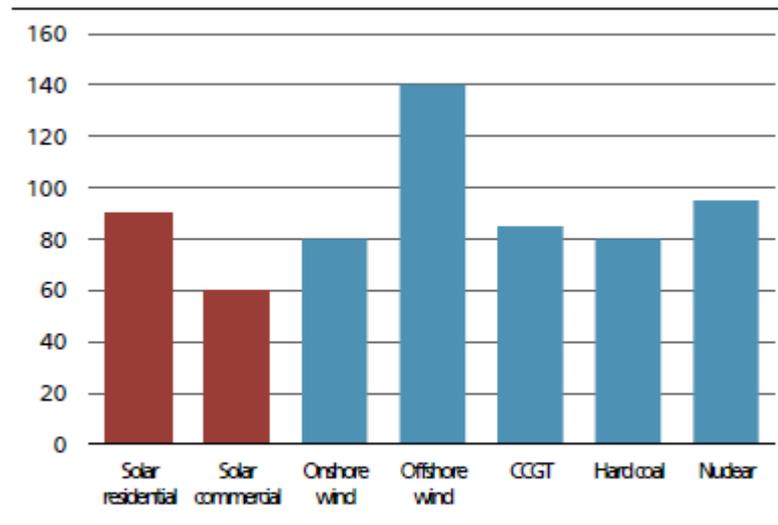


While You Were Getting Worked Up Over Oil Prices, This Just Happened to Solar:
Bloomberg 29/11/14

Chatham House | The Royal Institute of International Affairs

Changing Economics

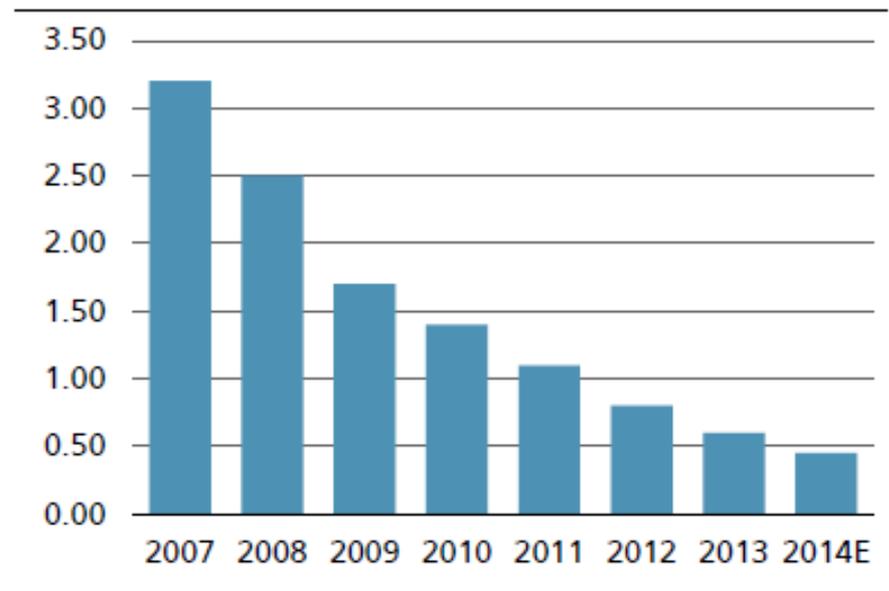
Figure 19: Solar new entrant cost (€/MWh) now competitive with conventional technologies



Source: UBS estimates

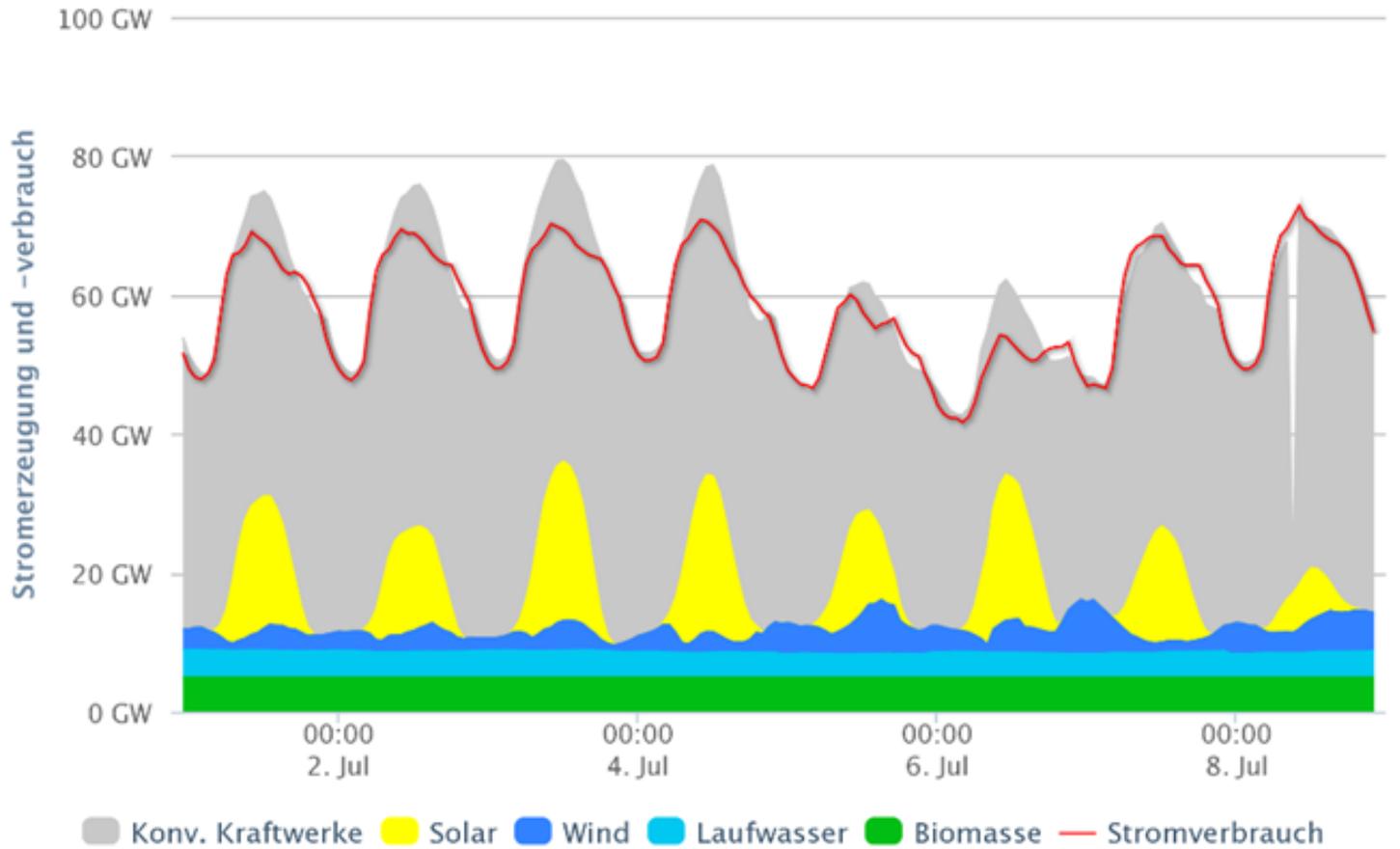
Note: Excludes cost of backup power for intermittent renewables and transmission cost for large-scale conventional plants.

Figure 18: Solar panel prices have dropped c85% since 2007 (€/W) on innovation and economies of scale



Source: UBS estimates

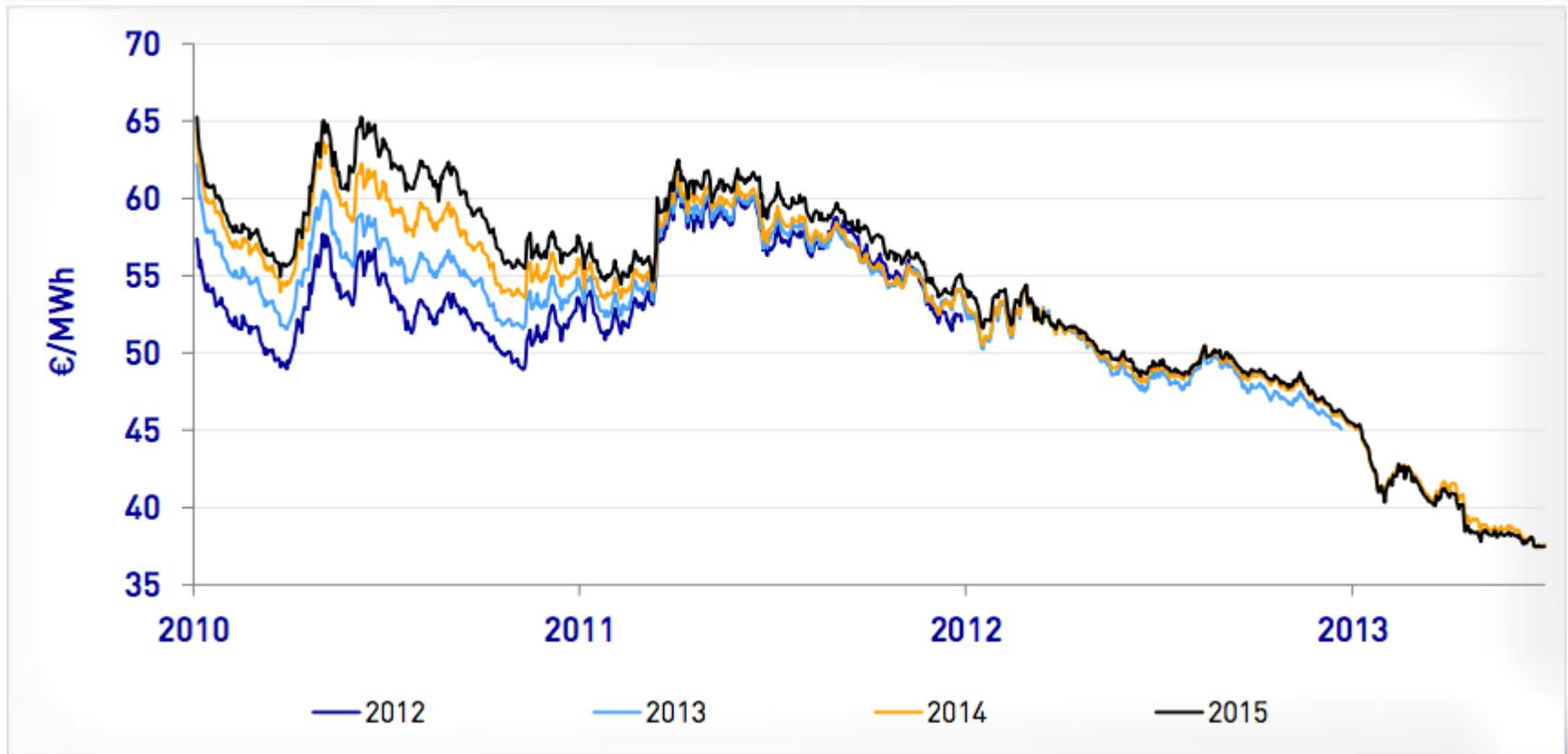
Weekly variation



Stand: 09.07.2014, 09:30

Wholesale price of electricity is falling in Germany (and Denmark) because of higher levels of ZMC RE (good for customers)

Forward price for electricity base load in Germany in €/MWh

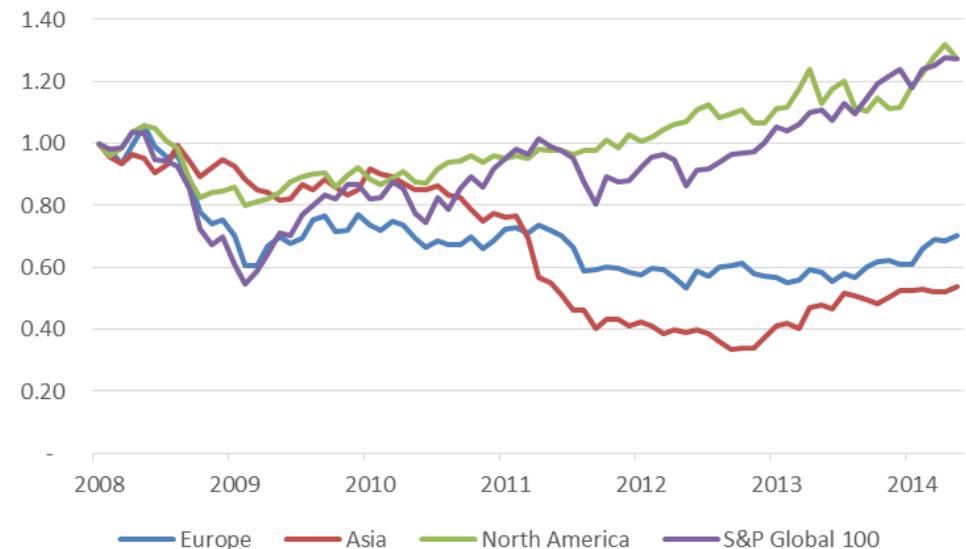


State of utilities

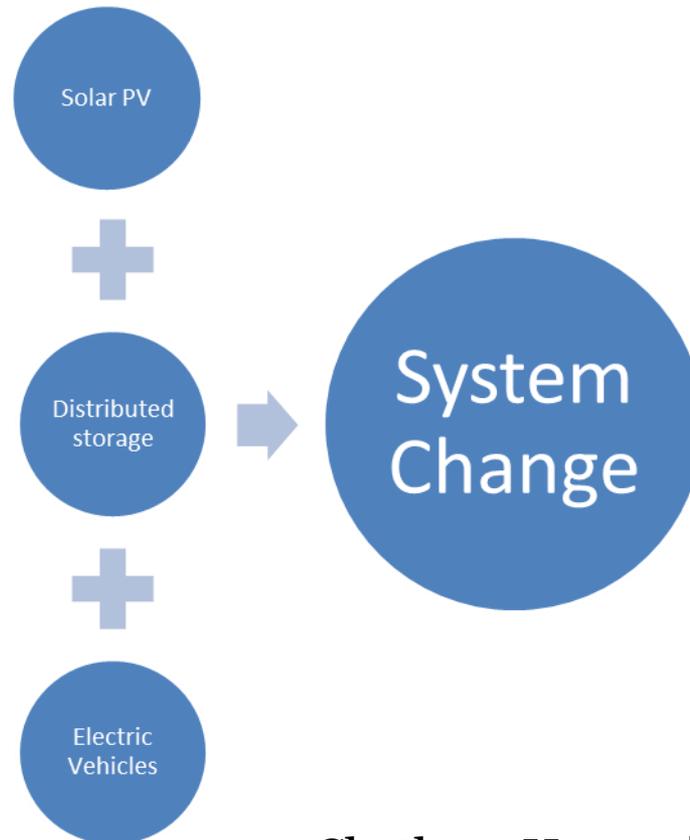
Falling revenues and debt levels

- According to Société Générale, outside the financial sector the power utility sector is the most indebted in Europe
- RWE this led to a fall in net income from a profit of €2.5 billion (US\$3.4 billion) in 2012 to a historic, first time loss in 60 years, of €2.8 billion (US\$3.8 billion) in 2013.

Changing Share Price



How far and fast will technology change ?

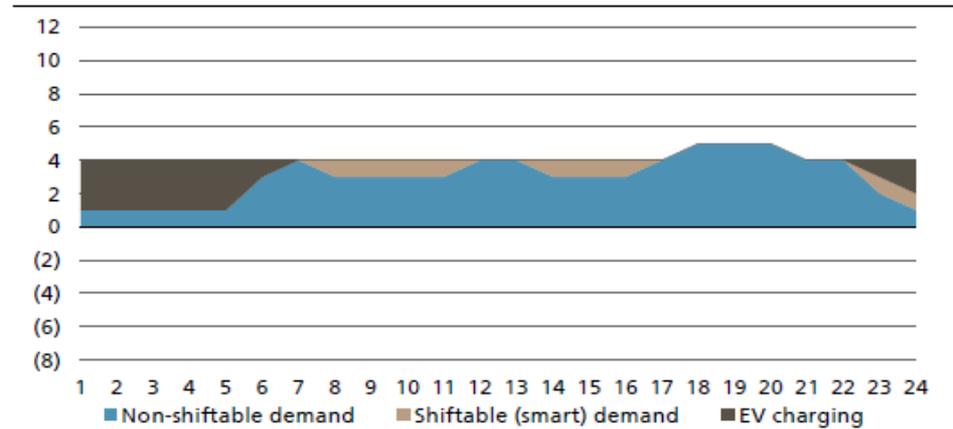


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Solar, storage, electric vehicles and ICT enable a completely different energy system

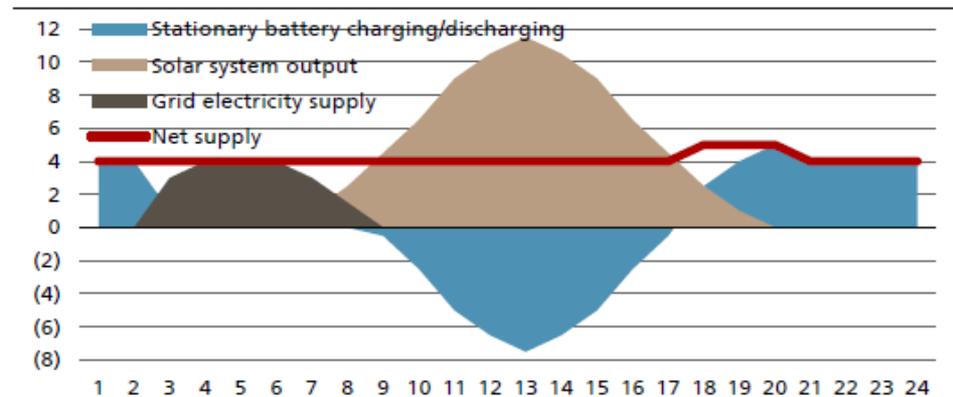
This is showing that with a combination of IT, solar and storage, total capacity requirements shrink. Thus, technologies are low carbon; total capacity required is less; and (previous slide) marked lower prices + profits.

Figure 14: Daily demand profile...



Source: UBS estimates (schematic illustration of a typical working day)

Figure 15: ...and daily supply profile can be (almost) perfectly matched



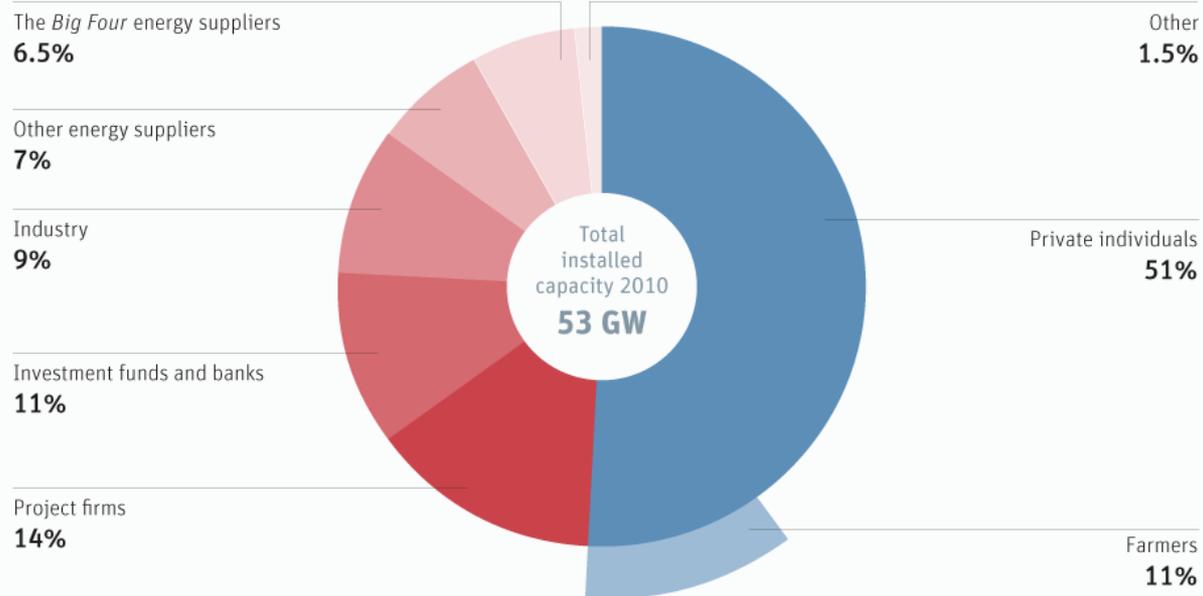
Source: UBS estimates (schematic illustration of a typical working day)

Ownership is also threatening the conventional utility model

Renewables in the hands of the people

Ownership of renewables installed capacity in Germany, 2010

Source: www.unendlich-viel-energie.de



German Energy Transition

energytransition.de



Supply Rise of New Social Enterprises – further reducing market for conventional utilities

Citizens form cooperatives to drive the energy transition

Number of energy cooperatives in Germany, 2001–2011

Source: www.unendlich-viel-energie.de



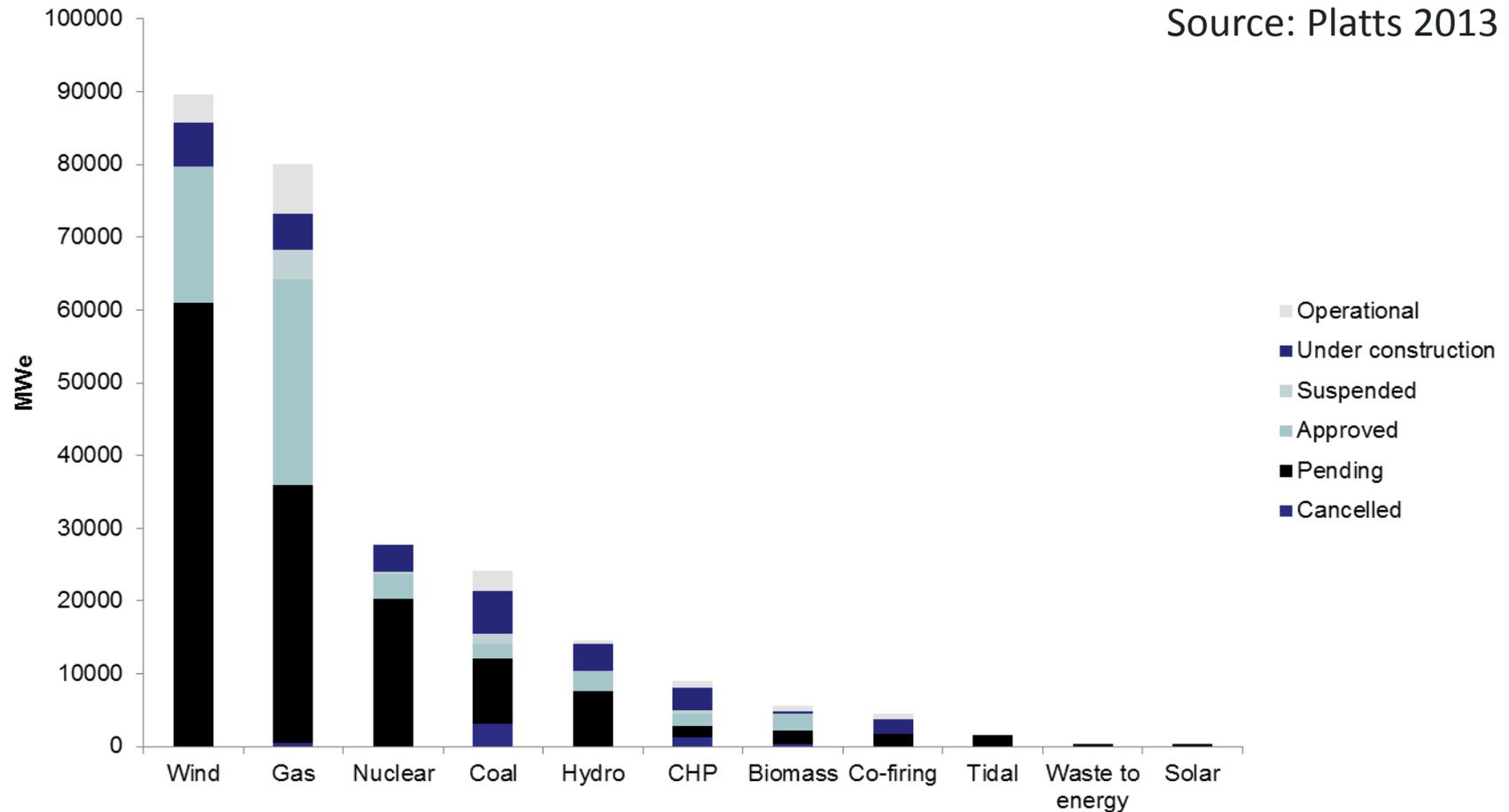
German Energy Transition

energytransition.de

CC BY SA

Status of New Western European Power Projects by Energy Type

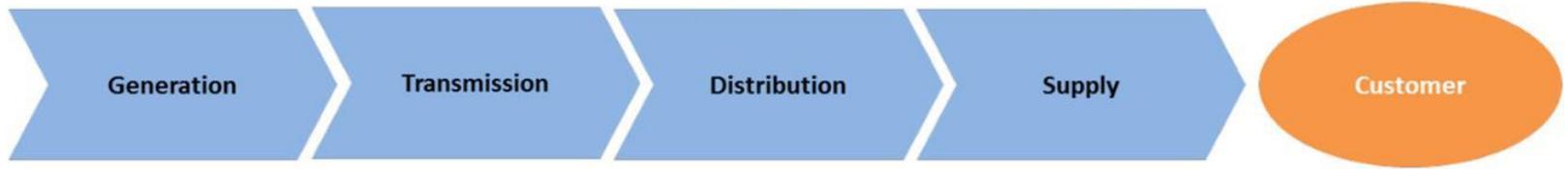
Source: Platts 2013



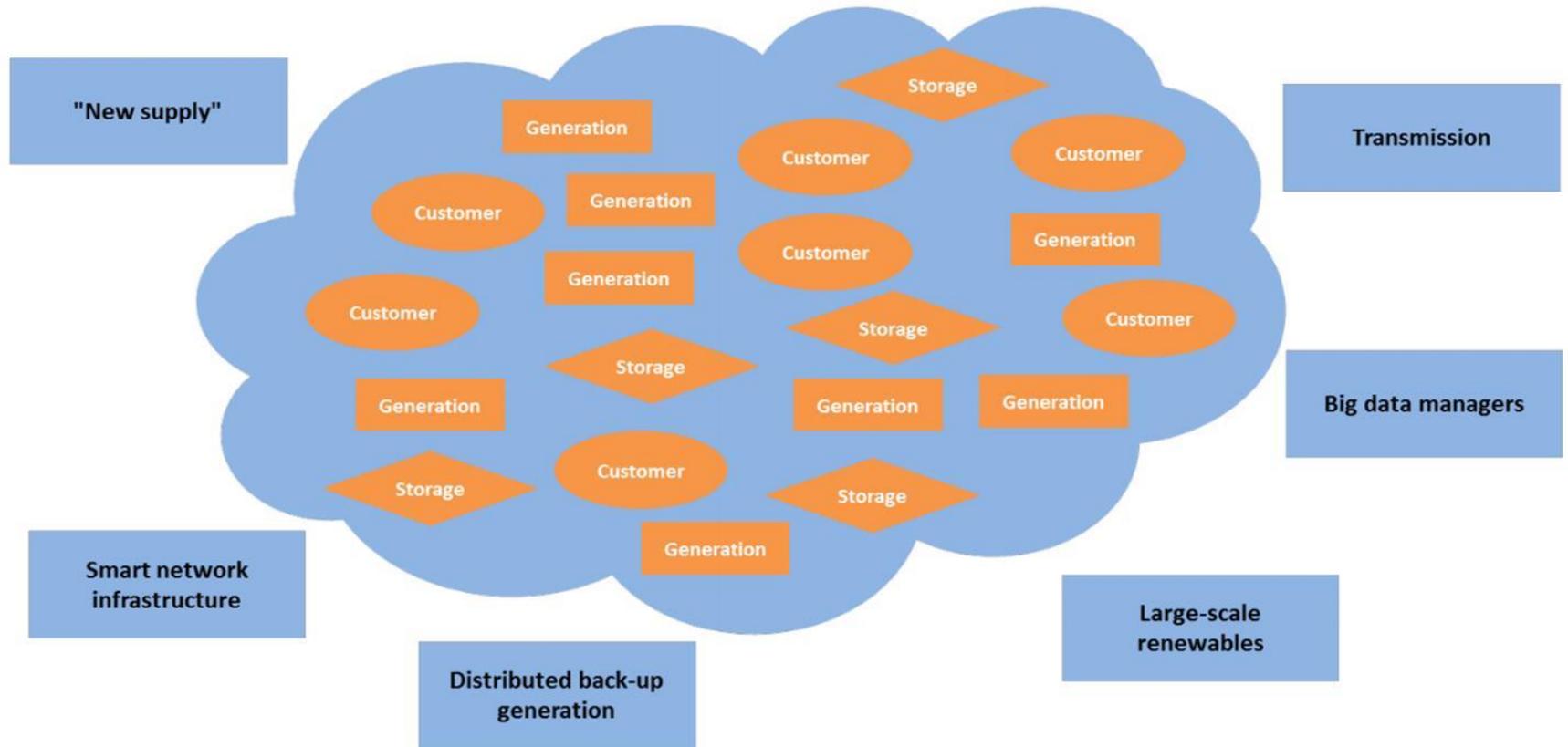
	Billion \$ 2013	Billion \$ 2012
Gross and Net Investment in R Electricity (not including hydro over 50mW)	192	234
Gross and Net Investment in Fossil capacity (upgrading existing and new)	270	309
Net Investment in Fossil capacity (new)	102	-

http://www.ren21.net/portals/0/documents/resources/gsr/2014/gsr2014_full%20report_low%20res.pdf

The role of utilities in the past...



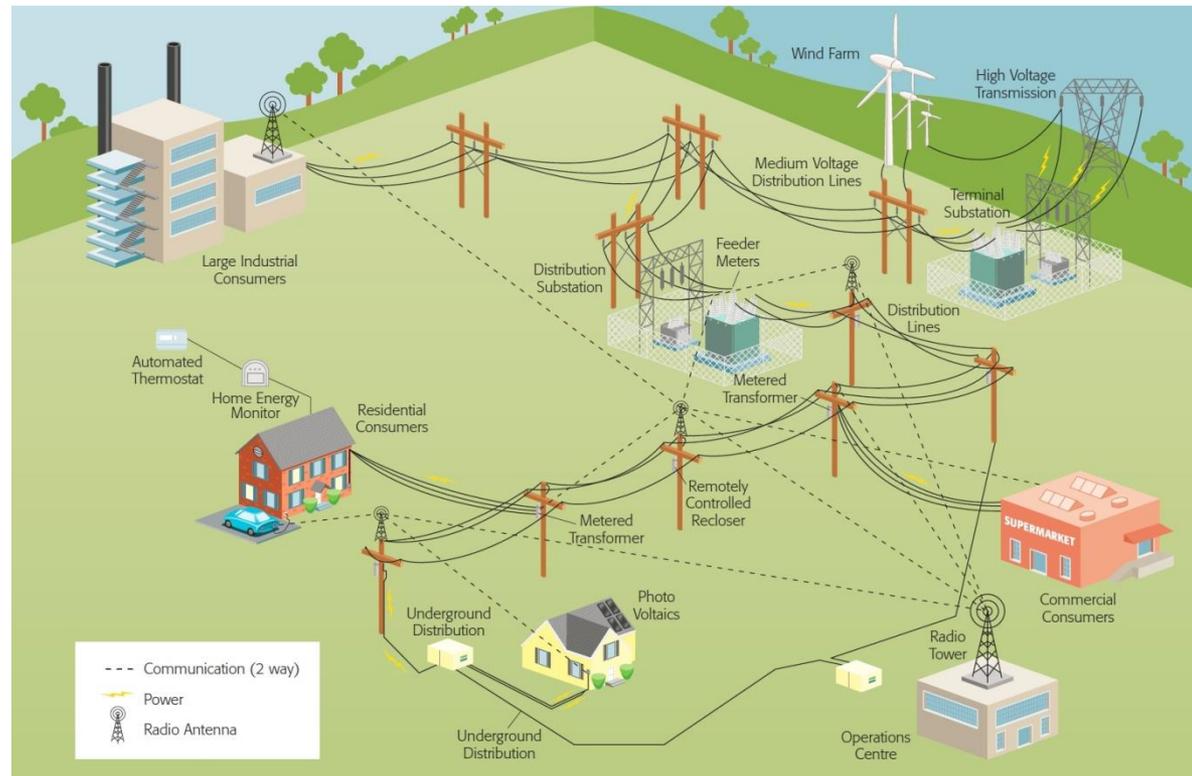
...and in the future

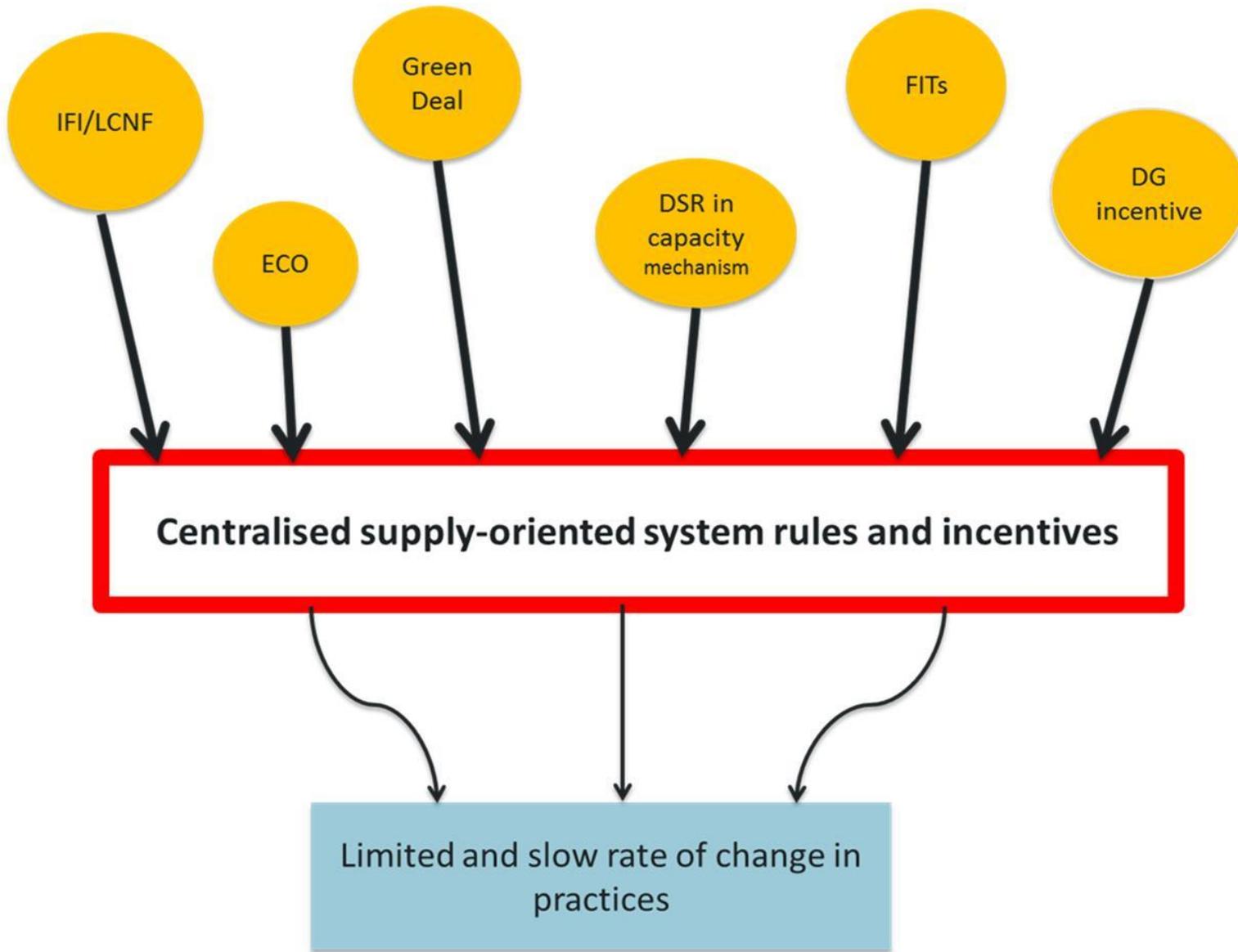


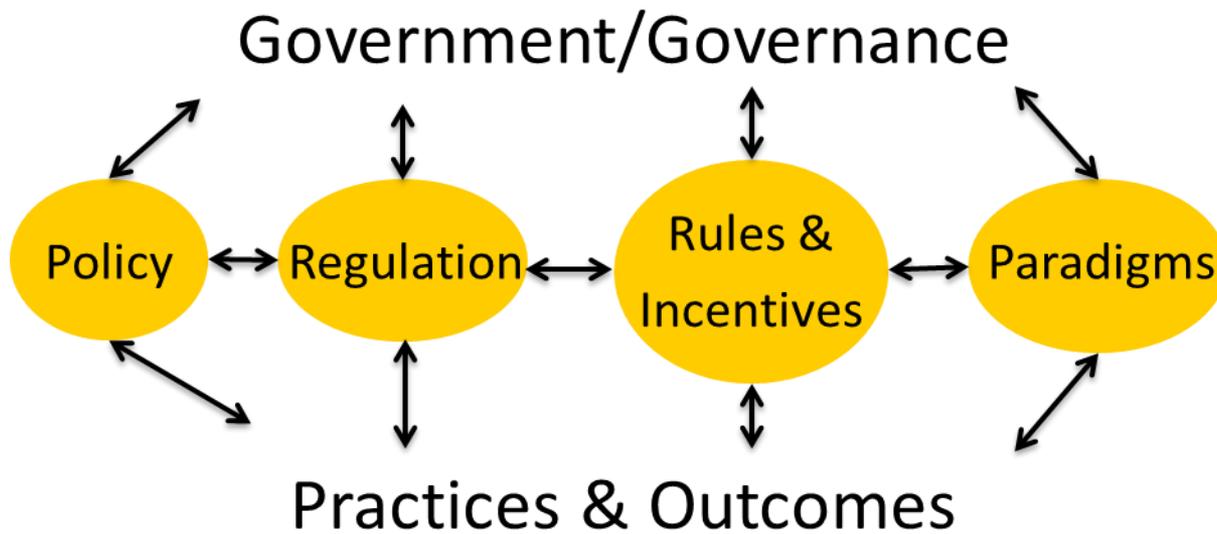
Source: UBS

Denmark is embracing change towards a more decentralised, flexible, integrated energy system.

- Top-down and one-way becomes integrated and flexible
- Active network management
- Micro-grids
- Meshed networks
- Smart storage
- Smart EV charging
- Intelligent assets
- Smart buildings and connected communities
- City and community energy
- Data management
- From distribution network operators to distribution **system** operators





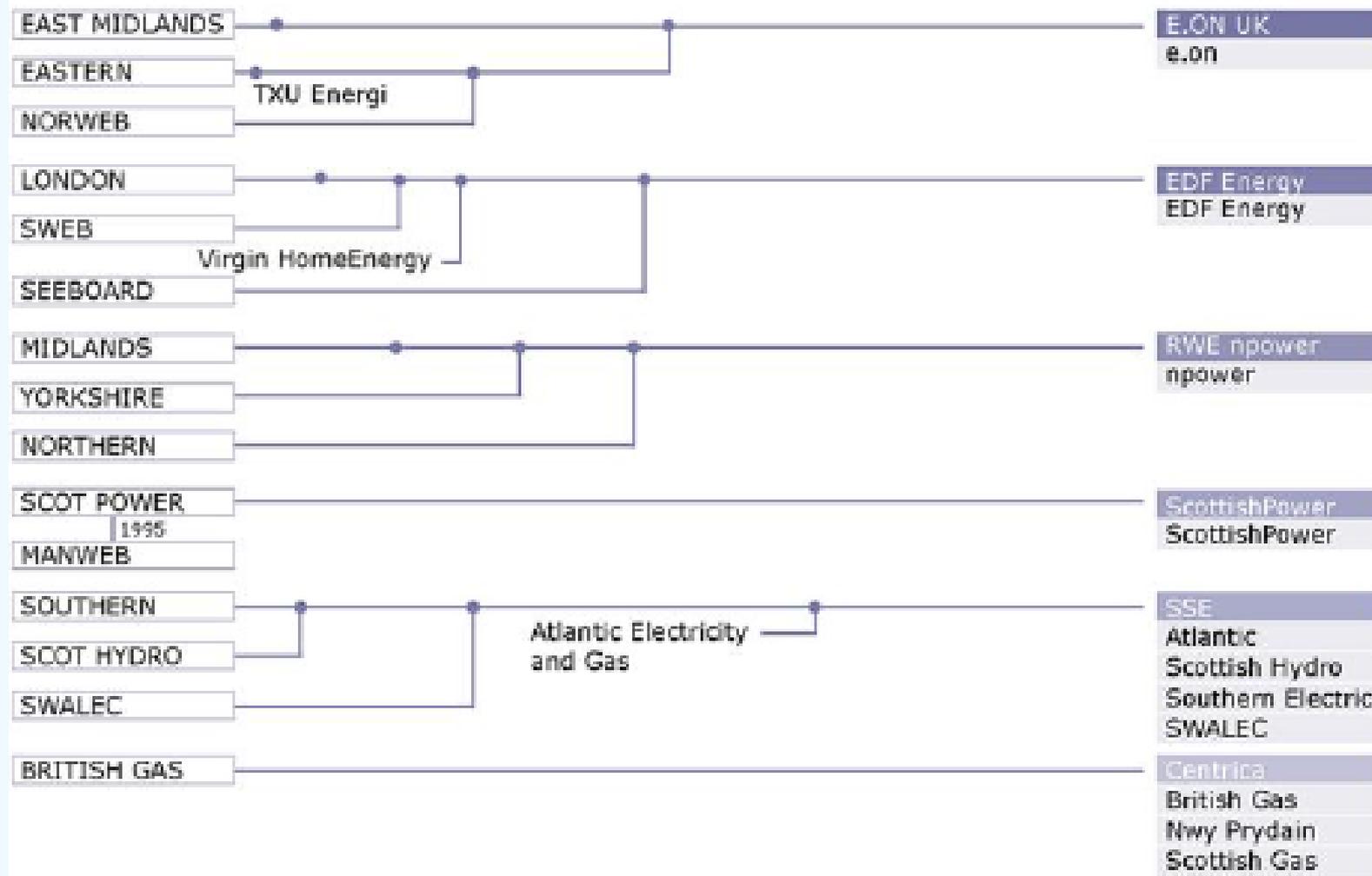


Theory

Dynamically
Inter-related

Figure 2.2: Consolidation of GB energy suppliers

Pre-liberalisation | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |



Source: Ofgem

The GB electricity system is dominated by vertically integrated 'Big 6' incumbents in all parts of the value chain and in both gas and electricity

Table 5: Different arms which make up each of the six largest vertically integrated energy companies

Company	Exploration/ production	Generation	Trading	Retail	Net- work	Gas storage	Renewables
E.ON*	X	X	X	X		X	X
EDF		X	X	X		X	X
SSE	X	X	X	X	X	X	X
Centrica/ British Gas	X	X	X	X		X	X
ScottishP ower		X	X	X	X	X	X
RWE		X	X	X			X

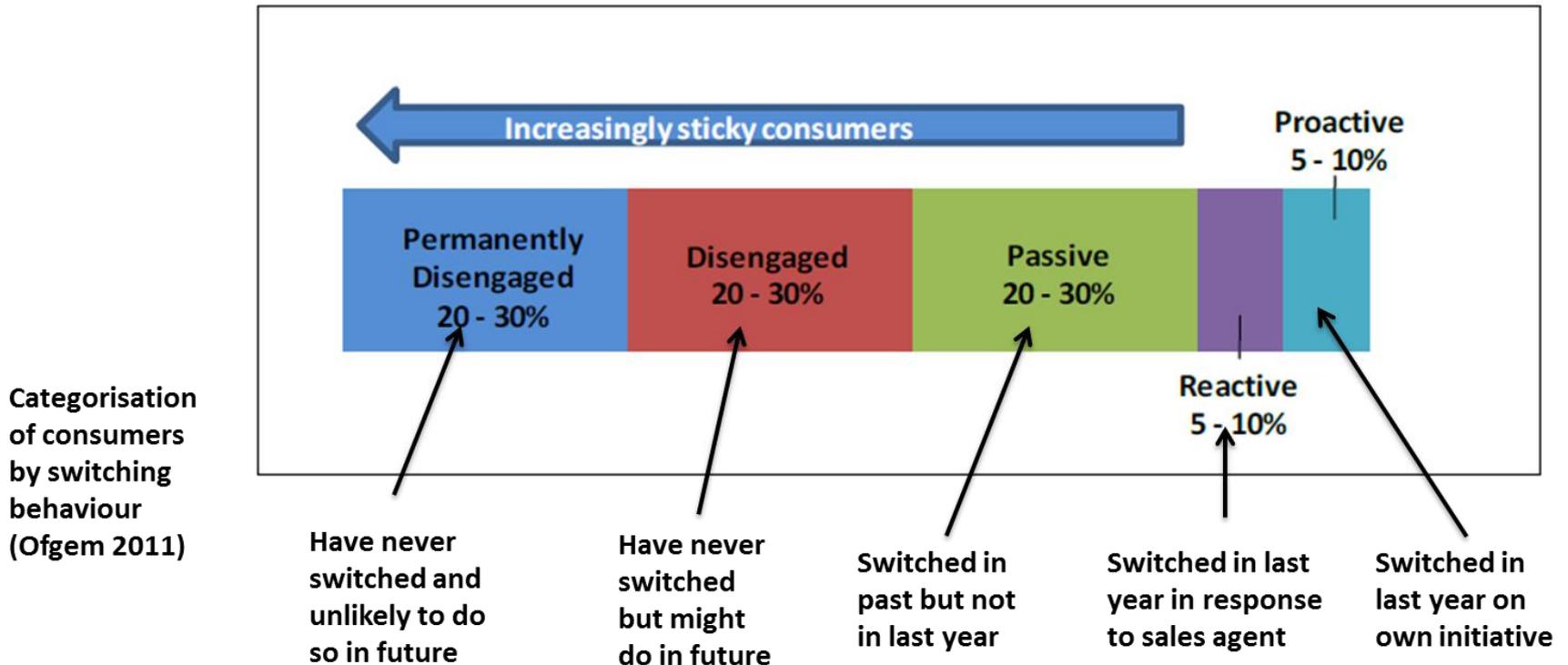
*E.ON operates each of the businesses listed (Exploration and Production, Generation, Trading, Retail, Gas Storage and Renewables) as an independent standalone business within the overall E.ON group, which must optimise its own position separately, and not on a vertically integrated basis.

Source: Q 115, Q 224

Source: Ofgem 2008

Most domestic consumers are 'sticky' (i.e. do not switch frequently) and therefore makes it difficult for new entrants to do new things

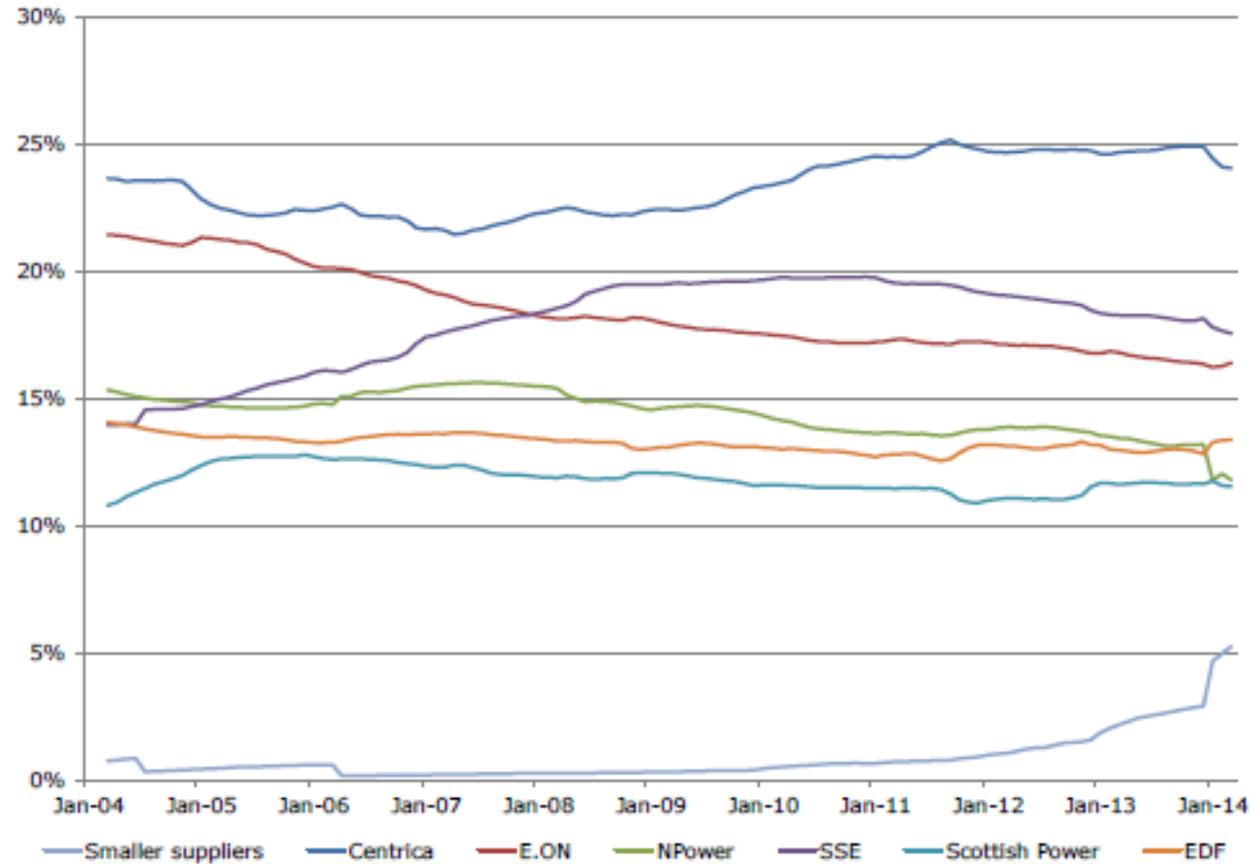
- Sticky customers help Big 6 vertically integrated suppliers manage generation risk so have no interest in encouraging switching



Non Big 6 supply increasing from end 2013 (in part stimulated by Labour Party 'reset' speech of September 2013) is now 9% of electricity, less for energy

(Figure from Ofgem OFT 2014 Market Assessment)

Figure 3: Domestic electricity supply market shares



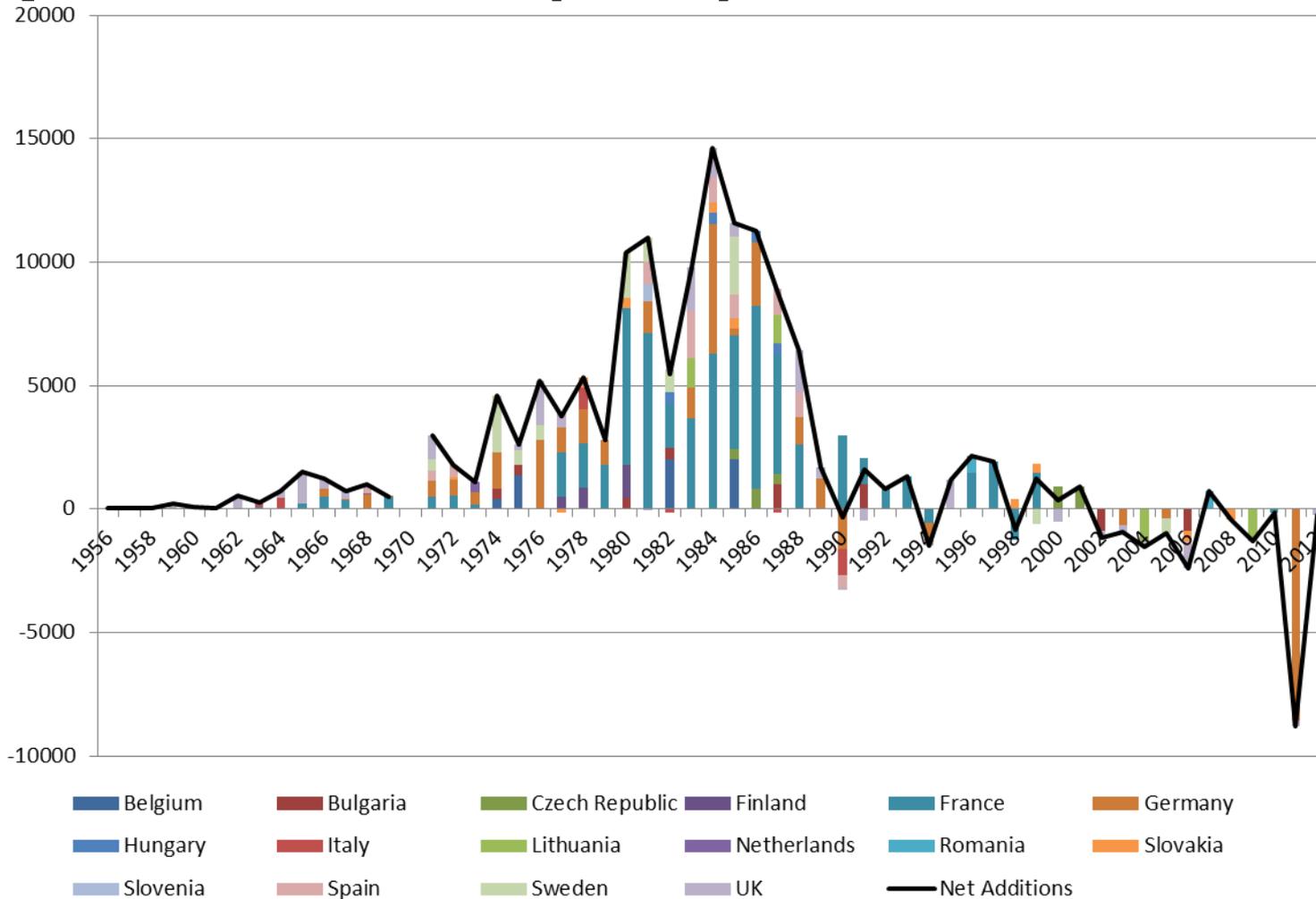
Source: Meter Point Administration Number (MPAN) data from Distribution Network Operators (DNOs)

Nuclear versus Solar Costs in GB

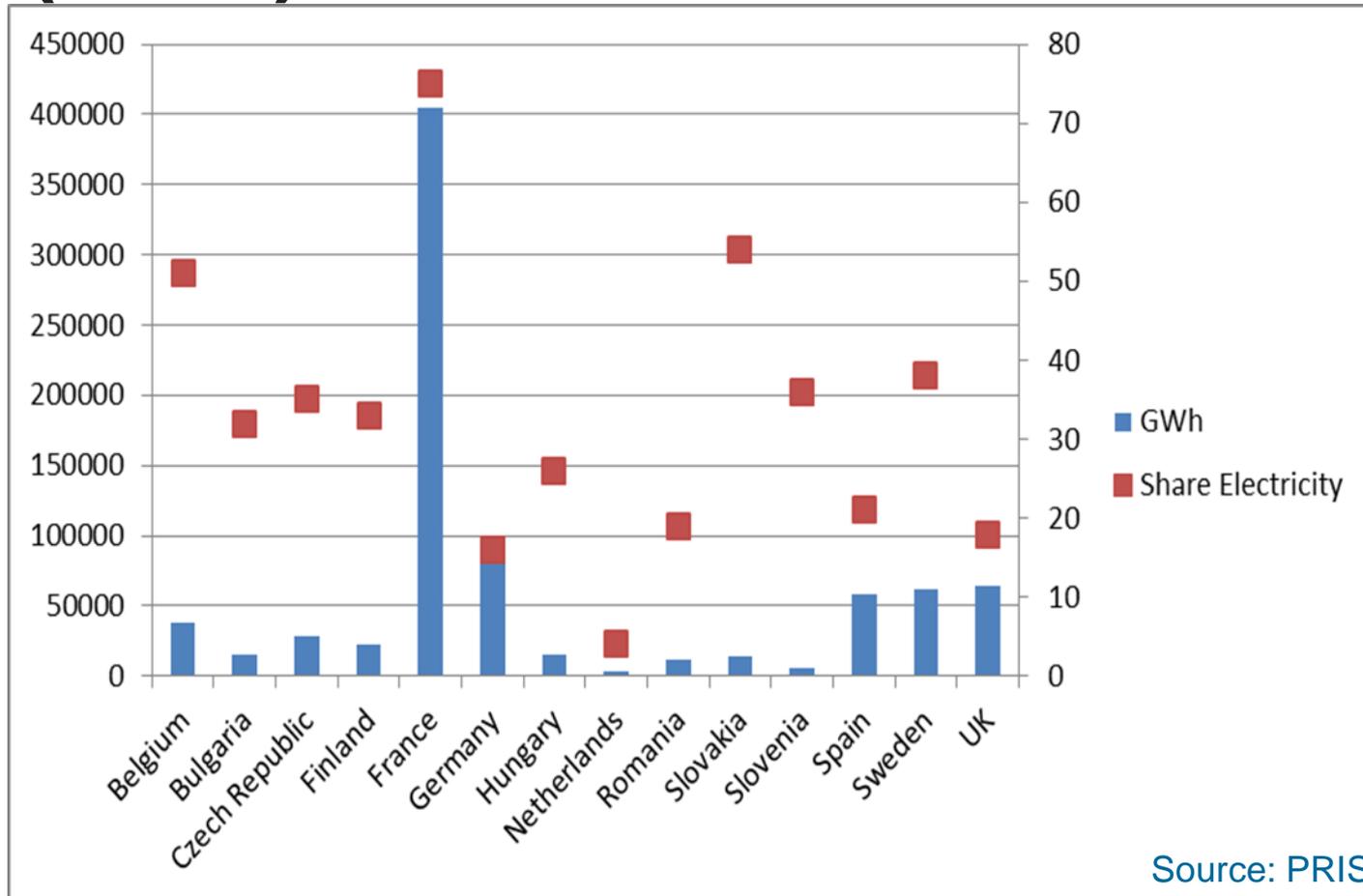


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EU Nuclear Power Start-up/Shutdown (MW)

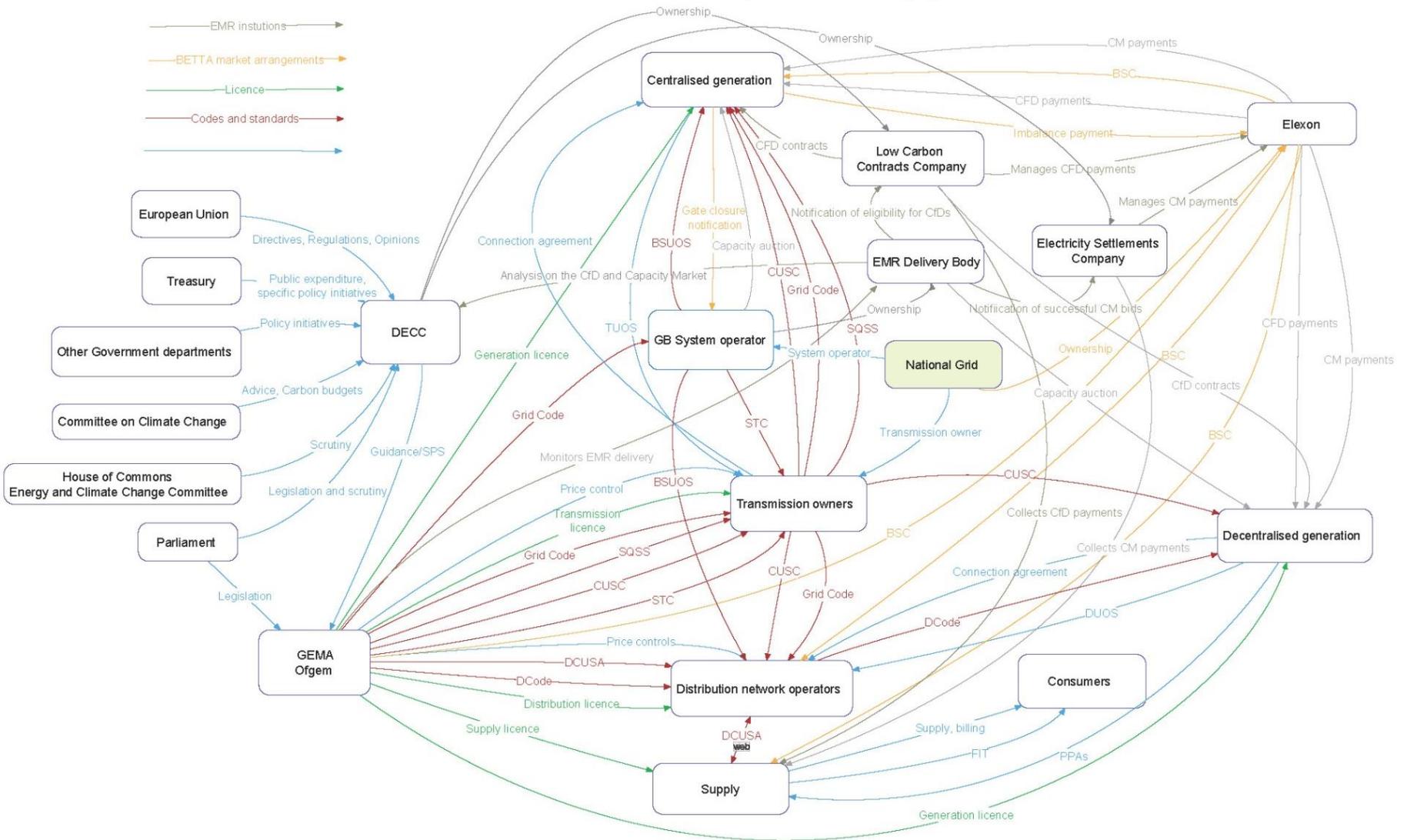


2012 Status of Nuclear Power in the EU (GWh)



- 13 Member States don't operate nuclear reactors, including Italy and Lithuania that have closed their stations

Institutional relationships in the electricity system



Practice change minimal in the UK – does this matter?

- Supporting nuclear matters for CC reduction targets if
 - insufficient nuclear is built – which is likely
 - it undermines RE or energy efficiency – certainly the former and probably the latter
- Customers end up paying more than needed for public policy – bad for affordability
- As still a fundamentally supply, top-down system, customers probably have less energy efficient homes / buildings, therefore pay more for their energy – bad for ; bad for environment; bad for security from point of view of access
- Will practice change be forced on Britain eventually?
 - If so, will it be more disruptive?
- Does lack of innovation ‘spill over’ into wider, negative economy effects?
 - Mazzucato says it does <http://projects.exeter.ac.uk/igov/book-review-the-entrepreneurial-state/>

Conclusion

- Governance matters
 - if a country wants a sustainable (XXXXX) economy, then it needs to make sure that the governance in place is encouraging that rather than encouraging inertia or continuation of the unsustainable economy

Thank you

<http://projects.exeter.ac.uk/igov/>