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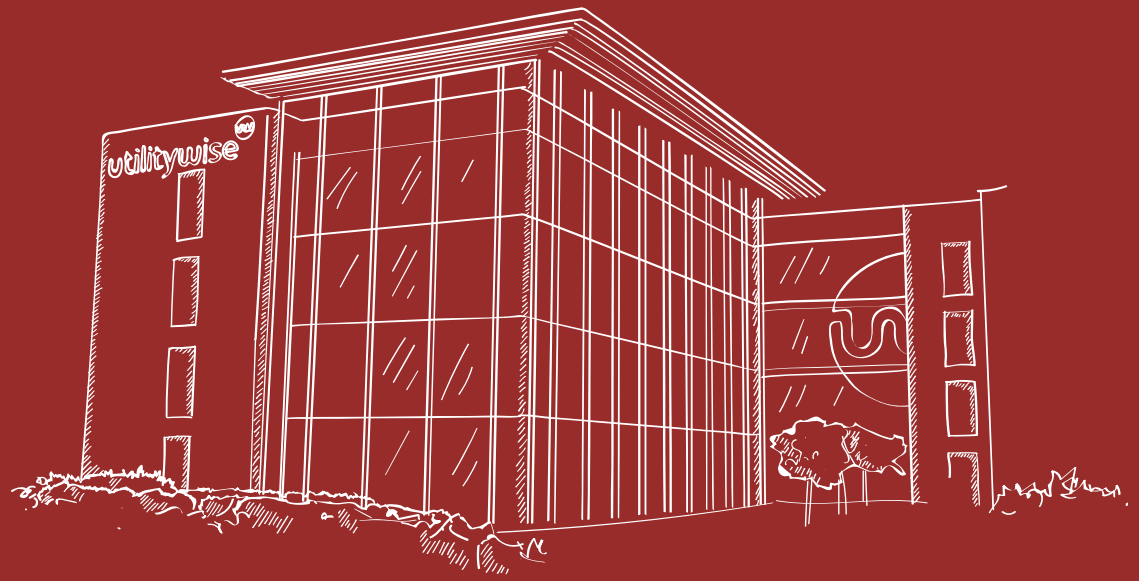
# 8th Smart Grids Cleanpower 2017 Markets

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# 20th Century Energy Policy

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Business | Your Money | Market Data | Markets | Companies | Economy

## UK using less energy despite growing economy, report finds

By Roger Harrabin
BBC environment analyst

18 December 2014 | Business | Share

**People in the UK are using less energy even though the economy is growing, new figures confirm.**

Increased wealth typically leads to increased energy use - but this link appears to have been broken by technology and government policy.

New analysis of government statistics for BBC News shows that the average person in the UK is using 10% less electricity than five years ago.

## Shale gas – an inconvenient truth for the anti-fracking lobby

Andrea Leadsom, Minister of State, 23 September 2015 — Shale gas

Energy strategy in Britain has three big goals; keeping the lights on, keeping the bills down, and moving to a clean energy future.

We need to meet the UK's ~~rising~~ demand for energy, using clean and low carbon energy sources if we are to continue to combat climate change and grow the economy – a point emphasised in the recent report from the independent Task Force on Shale Gas.

This isn't something which will simply happen overnight, it will take time as we start to move to more renewable and low carbon energy sources. There is a big challenge in how we get from where we are today – dependent on coal and gas for over 50% of our energy – to a low carbon future. Moving from coal to gas would make a huge contribution to reducing our carbon footprint, and is the 'bridge' we need for many years to come.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/573269/ECUK_November_2016.pdf

https://decc.blog.gov.uk/2015/09/23/shale-gas-an-inconvenient-truth-for-the-anti-fracking-lobby/

# Conscious Decoupling

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In addition to weather factors, domestic fuel consumption is dominated by a number of other factors;

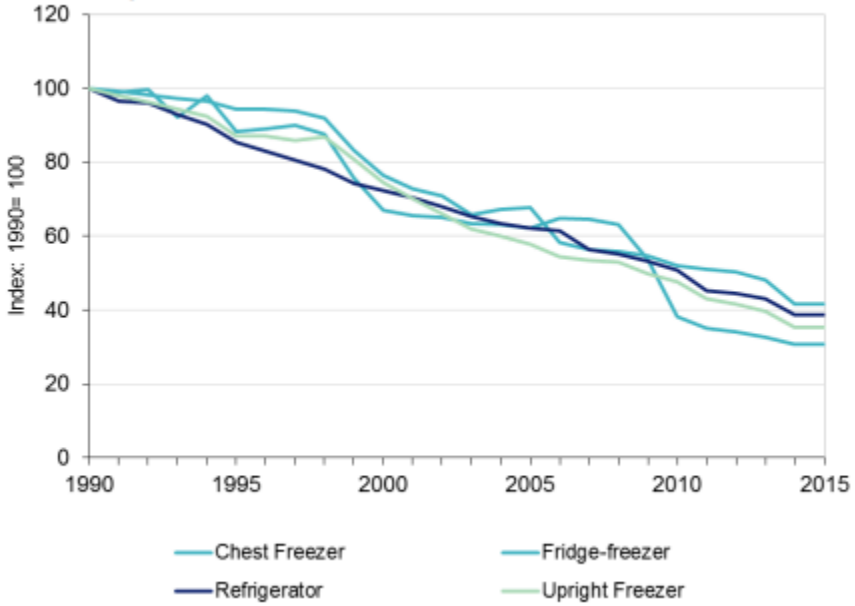
- Household characteristics; the number of households, disposable income and energy prices
- Efficiency measures such as installing a more efficient boiler and improving home insulation (for example adding cavity wall insulation, and double glazing), and the age of the housing stock (older homes tend to have poorer insulation properties)
- In the case of electricity consumption, the number and usage of appliances along with appliance efficiencies

On a temperature corrected basis (only available from 2002) final energy consumption has fallen steadily; from 52,229 ktoe in 2002 to 42,328 ktoe in 2015, a fall of 19 per cent. This effect is likely to be due to a combination of all the above factors and the following section discusses each one in turn.

◆ Consumption (RHA)

*Source; BEIS ECUK table 3.01*

**Chart 3.05: Average energy consumption of new cold appliances 1990 to 2015 (index 1990)**




*Source; BEIS ECUK Table 3.09*

*Unadjusted laboratory fuel economy figures, weighted 55% city and 45% highway.
Source: Office of Transportation and Air Quality, EPA

Bloomberg

https://www.bloomberg.com/news/features/2017-05-17/america-s-cars-are-all-fast-and-furious-these-days

# *Where is the market?*

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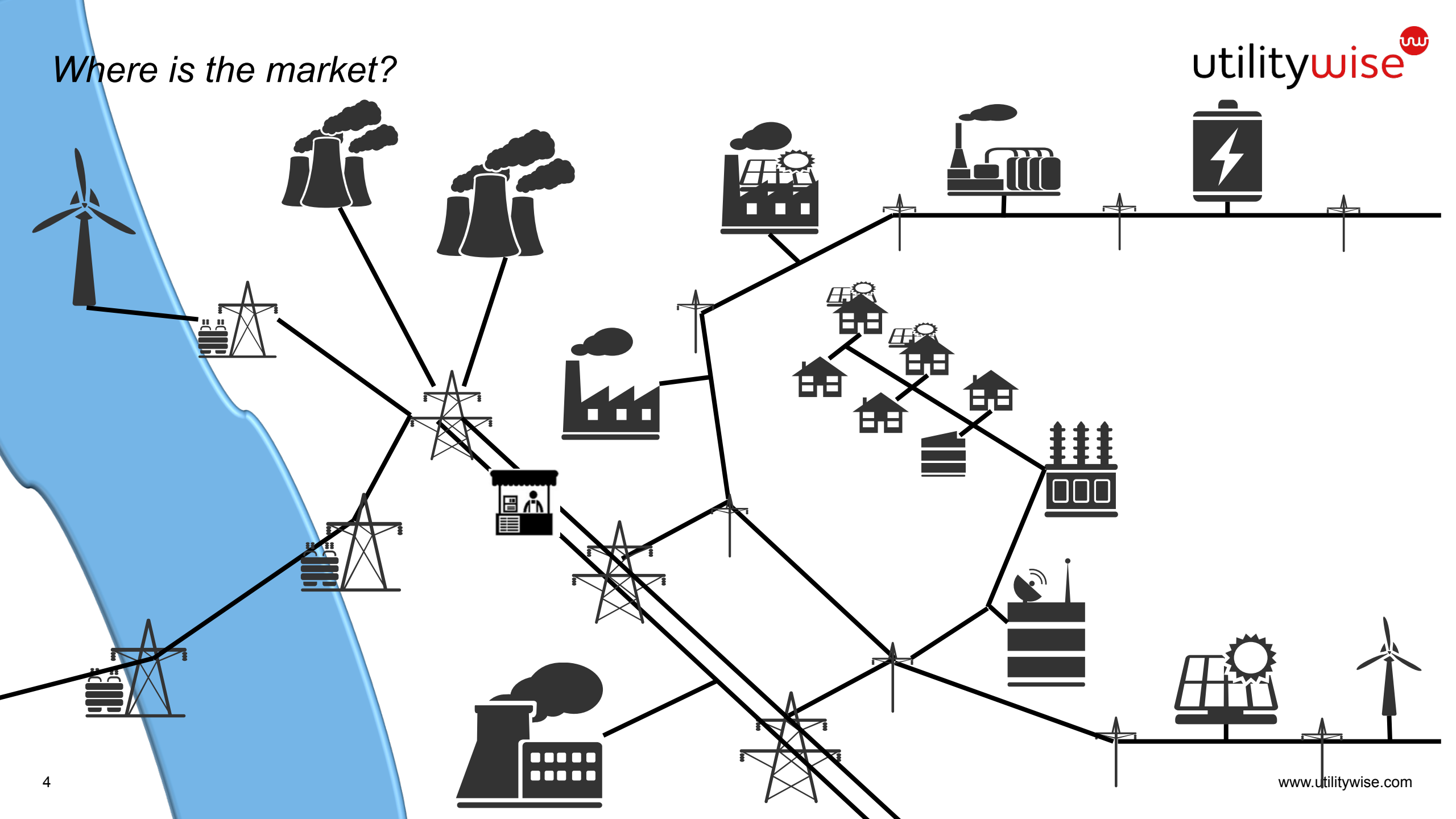
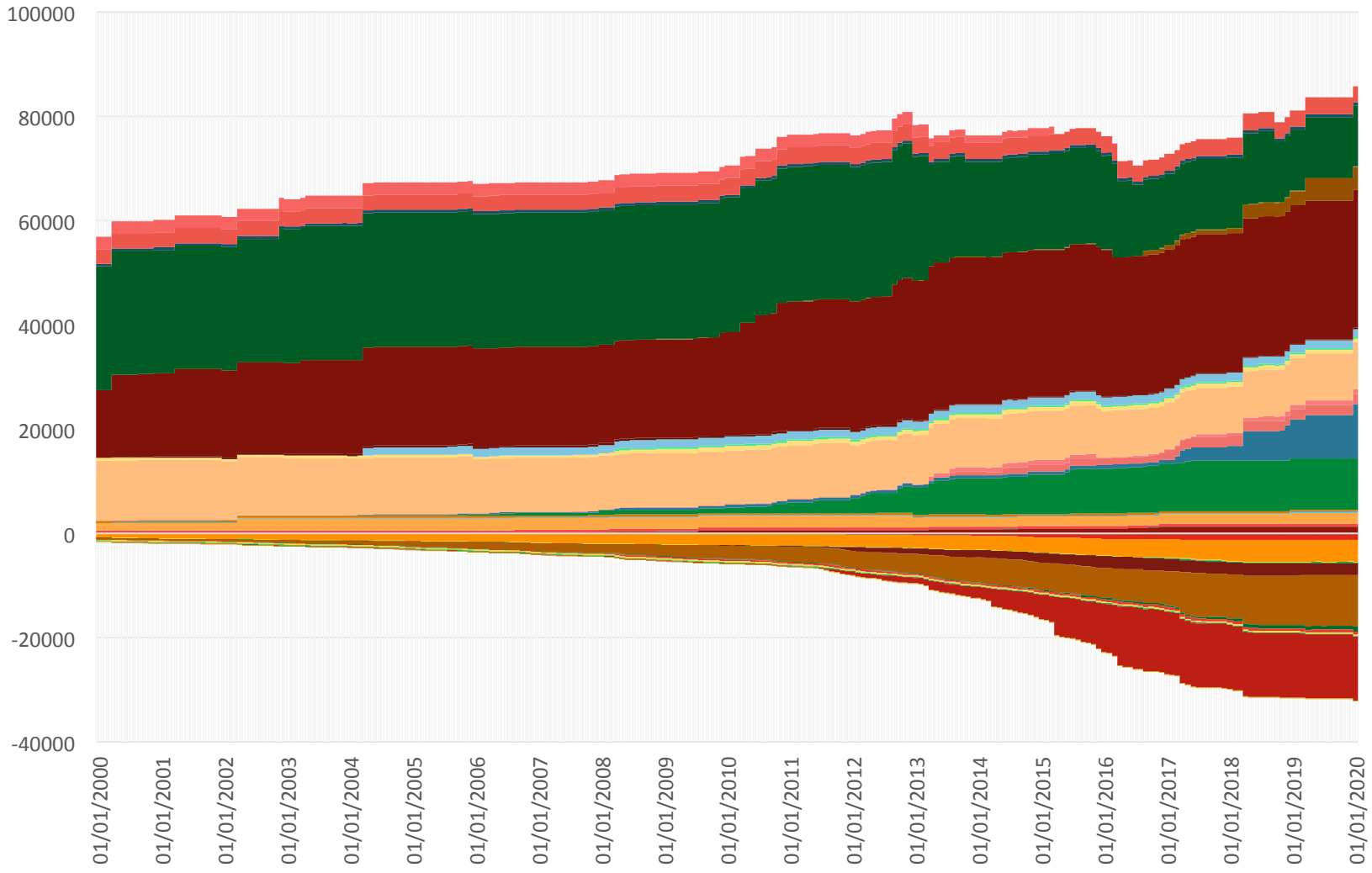
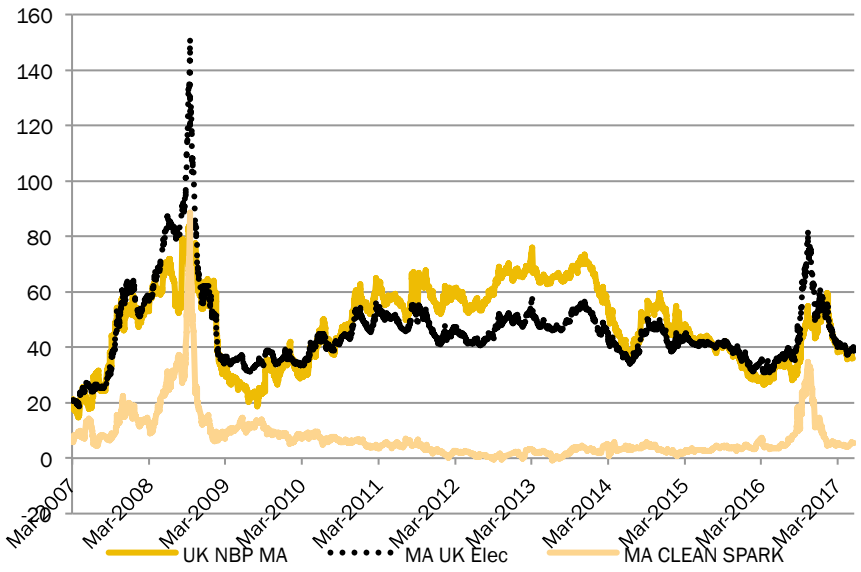
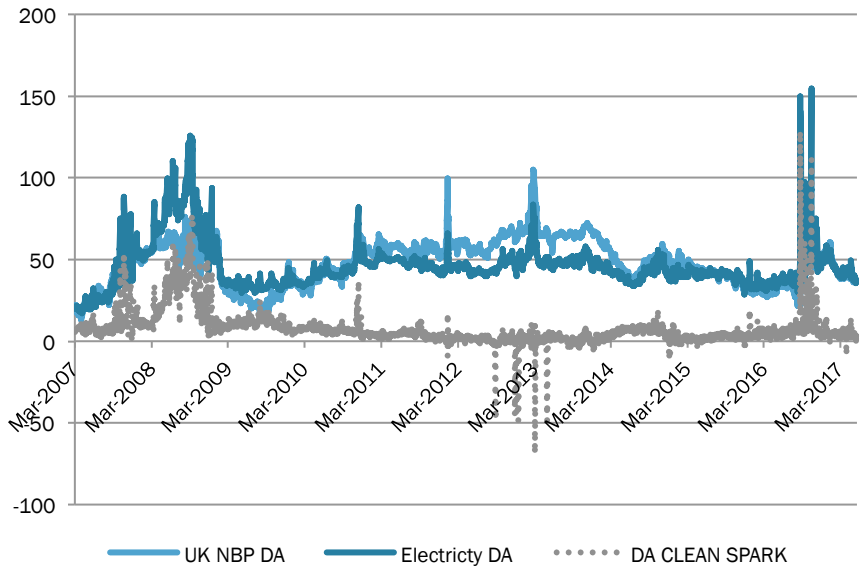


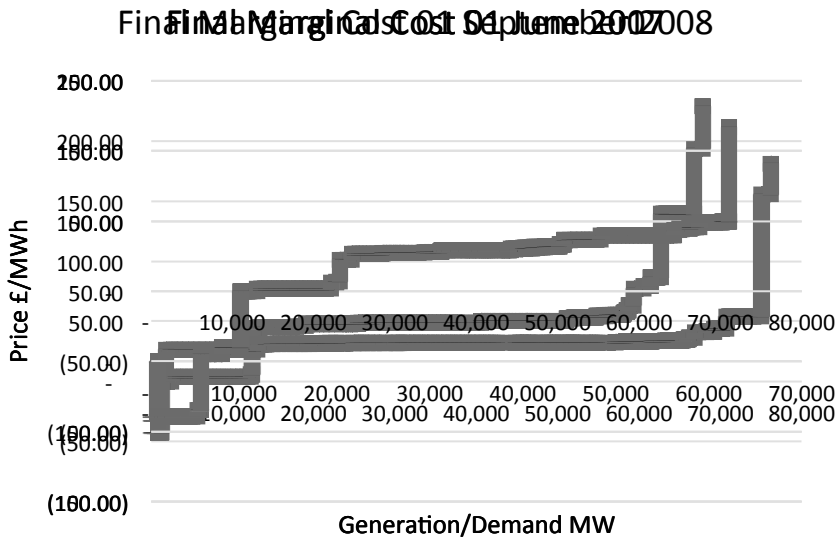
# Distributed Generation & Changing Generation Mix



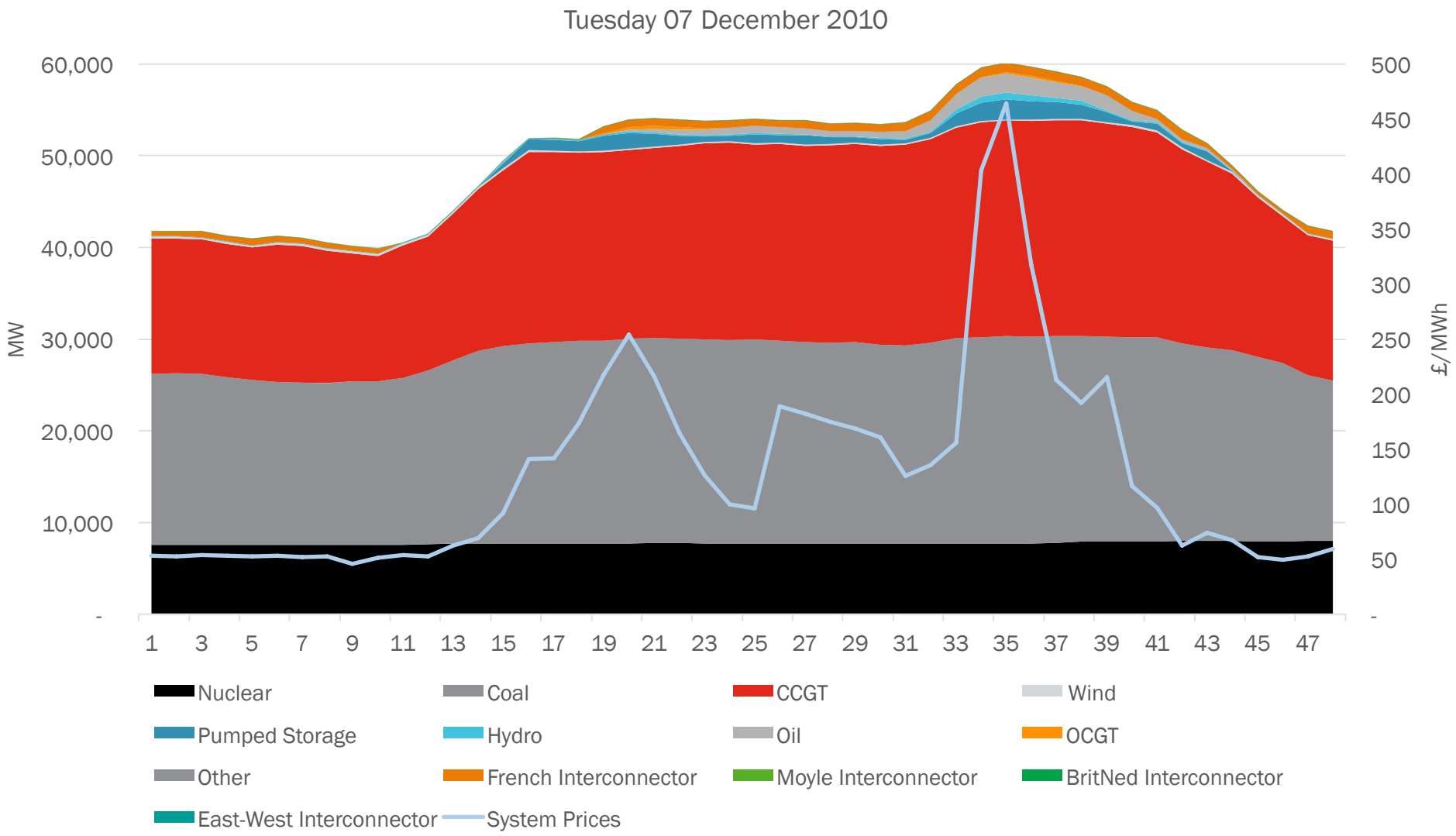
# What drives electricity prices?



# TRIAD demand and generation



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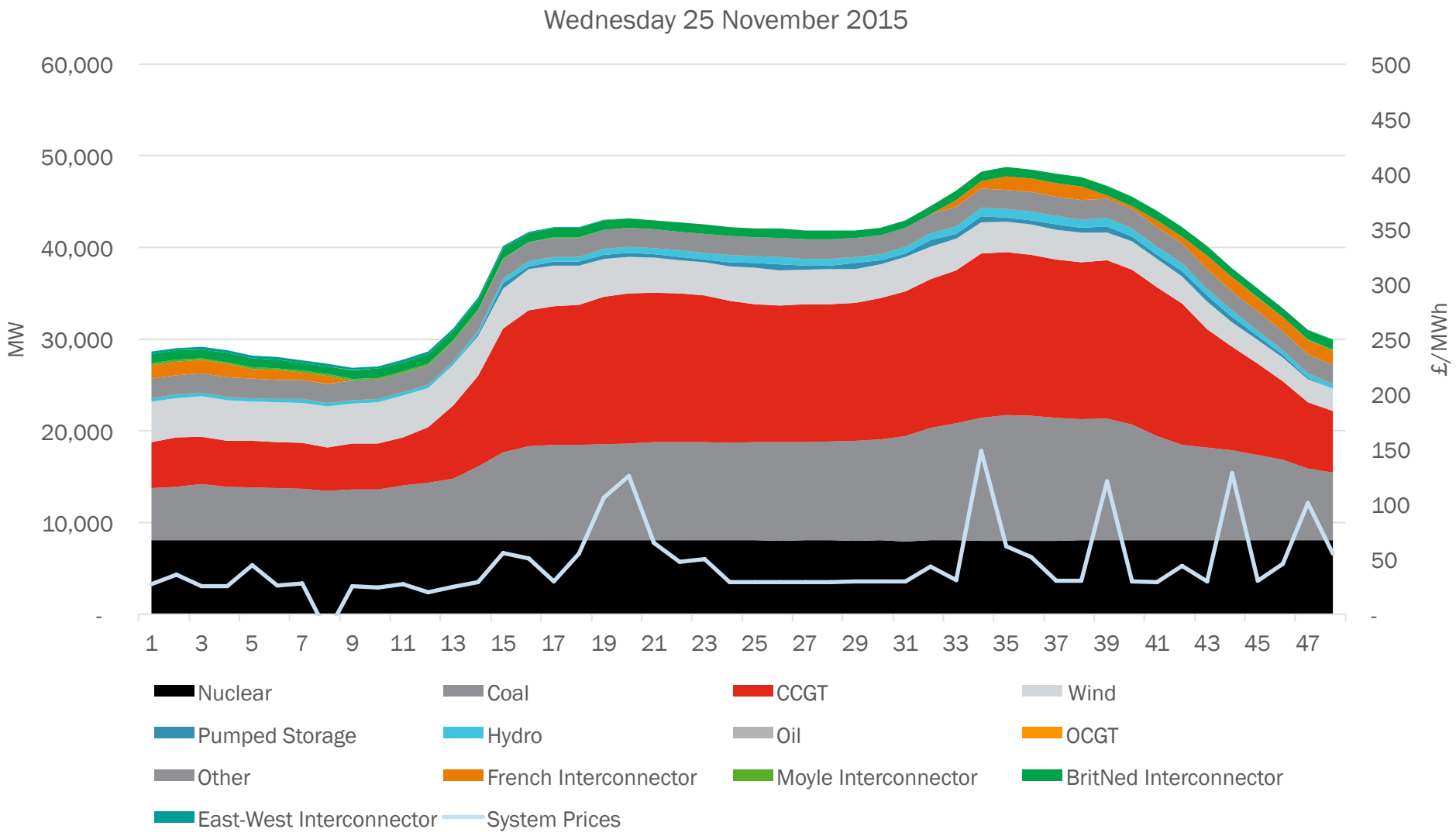

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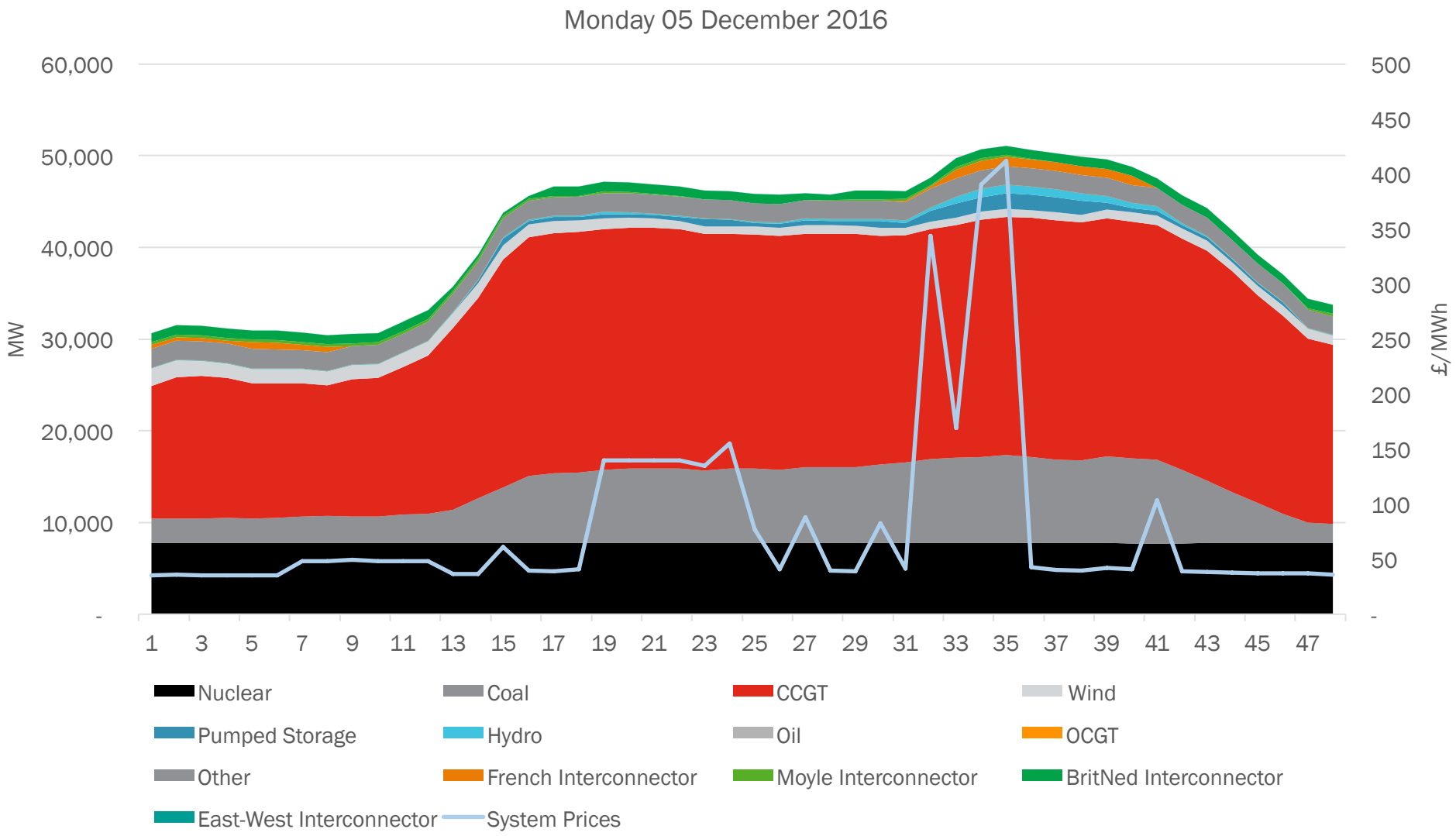
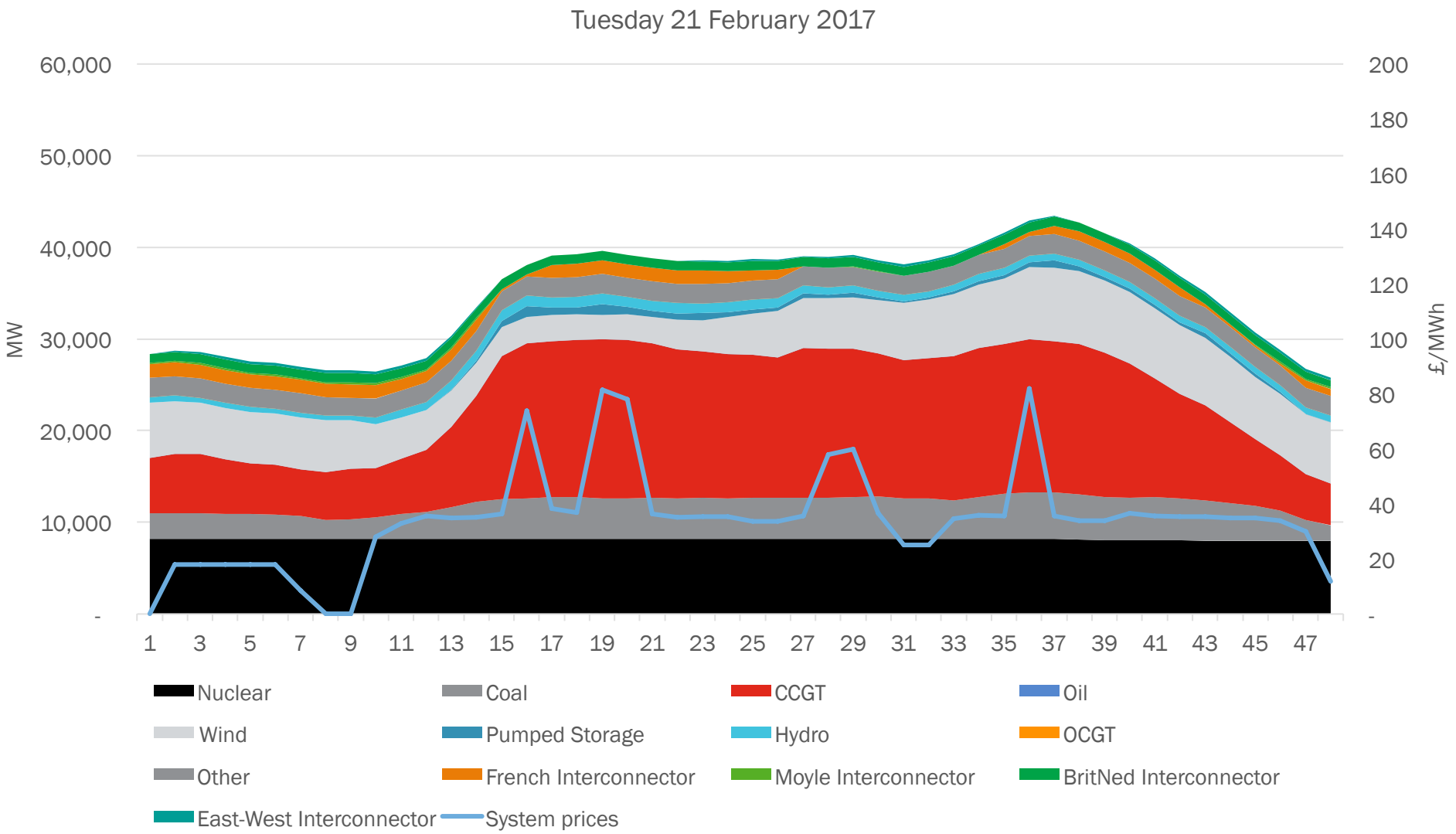
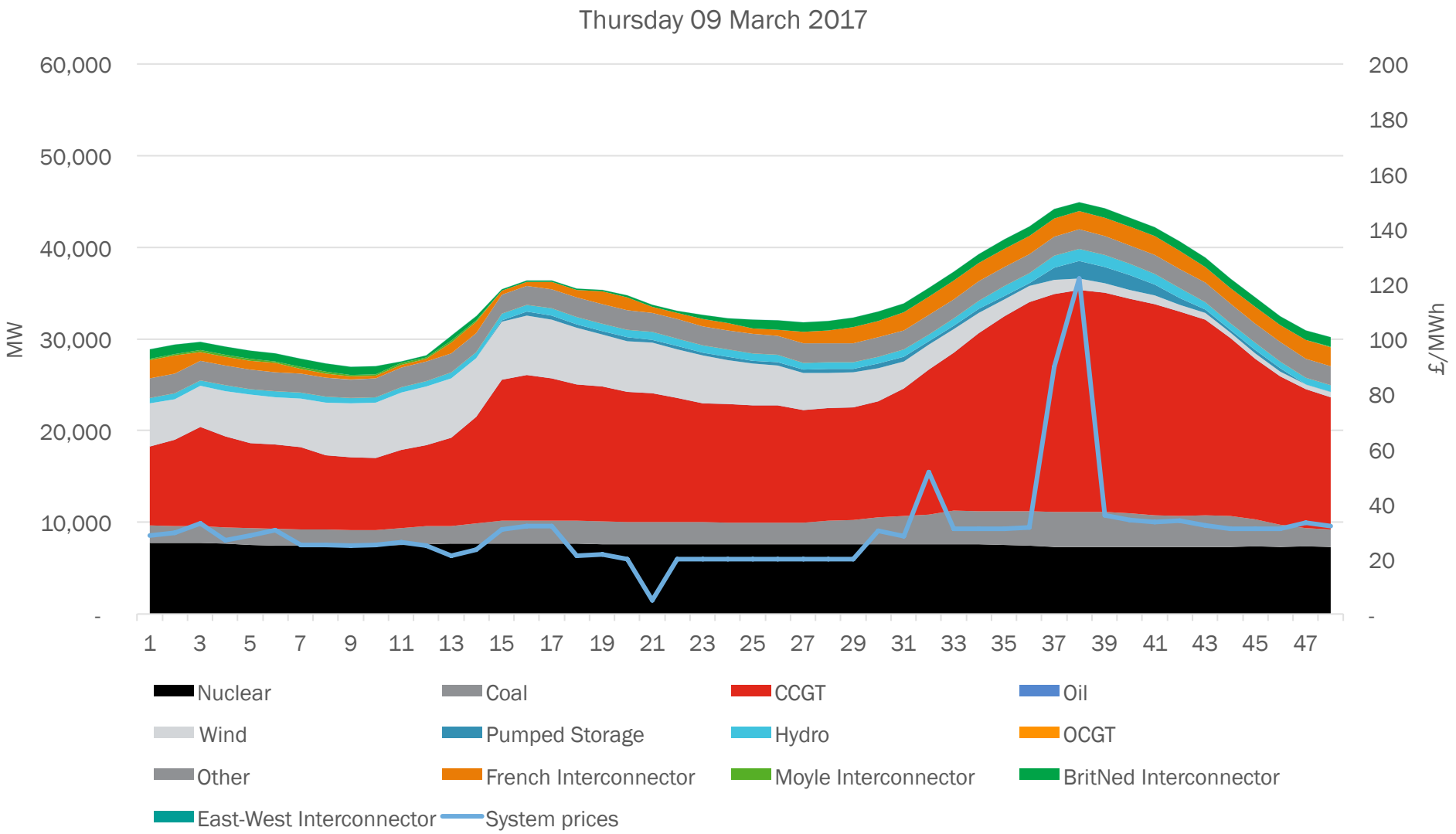


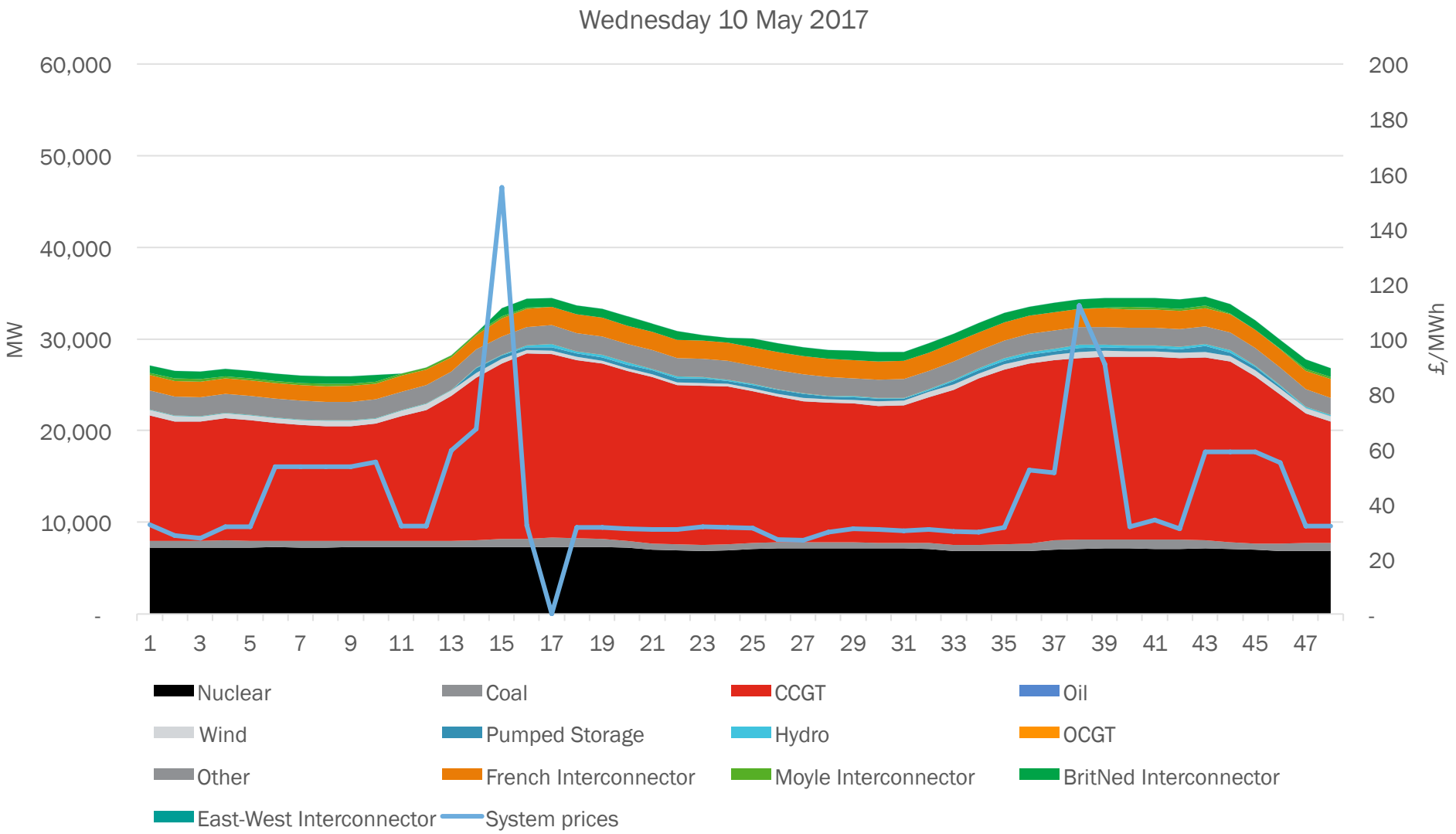
# Demand and generation – 0-8am Wind Ramp Down



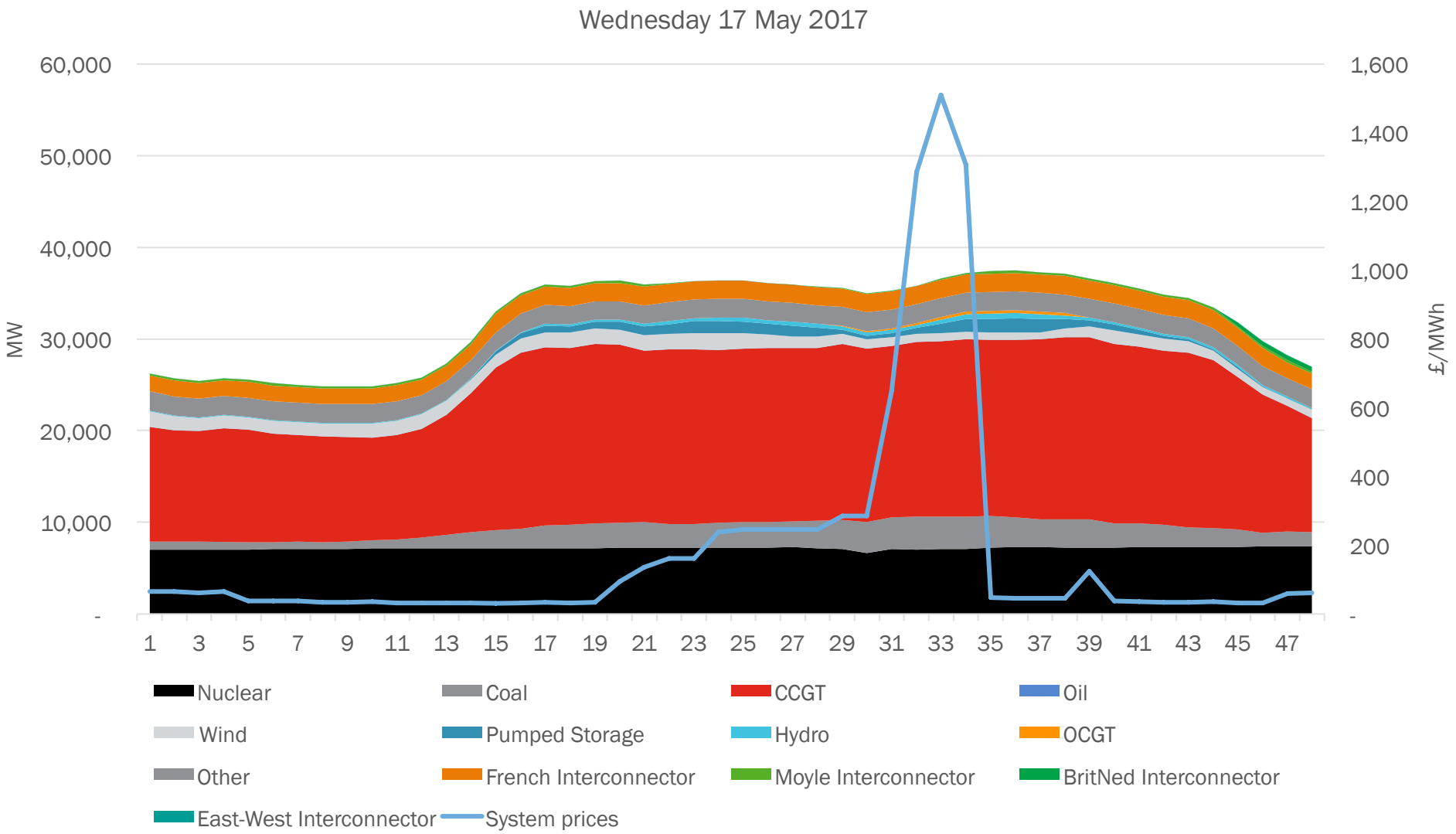
# Demand and generation – 8am-4pm Wind Ramp down



# Summer demand and generation – High Solar



# *Summer demand and generation – Low Solar*



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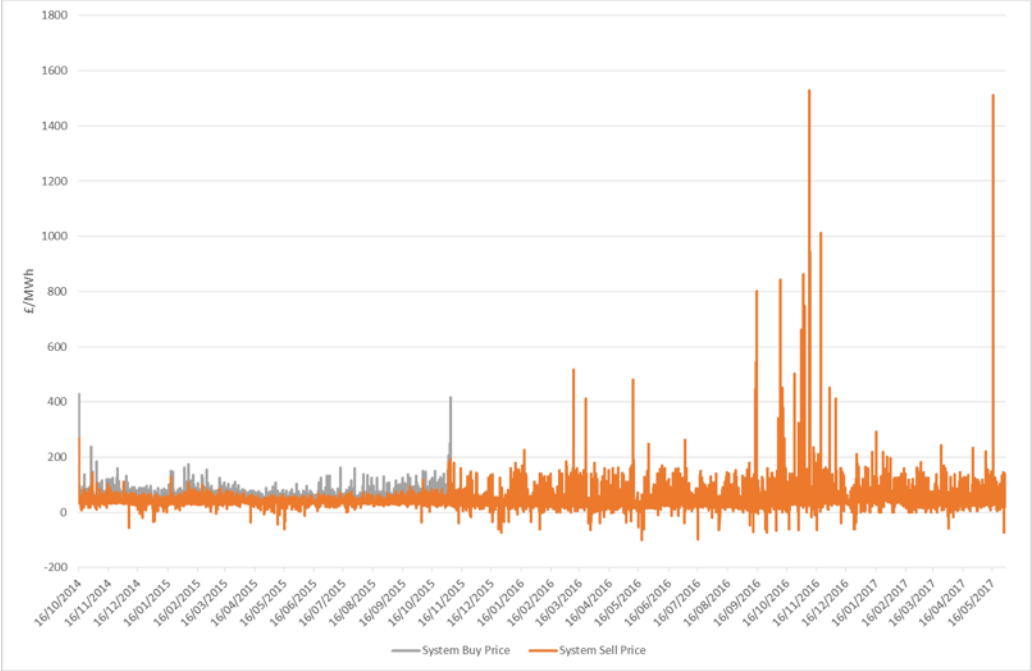
**The modification proposal**

Modification proposal P305[7] (P305 Proposed) was raised by NGET (the Proposer) on 30 May 2014. It proposes the following changes to the cash-out calculation:

- 'Reducing PAR': the introduction of a marginal cash-out price, starting by reducing the Price Average Reference Volume (PAR)[8] from 500MWh (PAR500) to 50MWh (PAR50) on 5 November 2015, before reducing it to 1MWh (PAR1) on 1 November 2018[9];
- 'A single cash-out price': the introduction of a single cash-out price;
- 'VoLL pricing': the inclusion of a cost for disconnections and voltage reduction into the cash-out price calculation based on an administrative Value of Lost Load (VoLL), and a process for correcting parties imbalance volumes in these events, starting with a VoLL price of £3,000/MWh on 5 November 2015 before moving to £6,000/MWh on 1 November 2018;
- 'RSP': pricing Short Term Operating Reserve (STOR)[10] actions into cash-out using a Reserve Scarcity Pricing (RSP) function[11], starting with a 'static' RSP function on 1 November 2015 before moving to a 'dynamic' RSP function on 1 November 2018[12].



# Balancing Costs

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## Balancing demand 'could cost National Grid £2bn'

share

National Grid already spends just over £1bn a year on "balancing services" CREDIT: ALAMY

By **Emily Gosden**, ENERGY EDITOR

27 JUNE 2016 • 12:24AM

The costs of managing the UK's electricity supplies could double to £2bn a year within five years due to the growth of renewable technologies, a senior National Grid official has forecast.

**Demand side flexibility –** reduces the need for new conventional generation and network infrastructure.

### Why do we need demand side flexibility?

There is growing recognition of the important role that demand side flexibility can, and will, play in electricity markets.

- **It reduces the need for new conventional generation and network infrastructure.**
- **It supports the integration of growing intermittent renewable generation.**
- **It helps suppliers to manage market risk.**

[1] National Infrastructure Commision (March 2016) *Smart Power*
[2] Association for Decentralised Energy (July 2016) Flexibility on demand: Giving customers control to secure our electricity system.

**£8bn**

**Demand side flexibility –** could save consumers up to £8bn a year by 2030 according to the National Infrastructure Commission[1].

### Growth of demand side flexibility

The scale and value of demand side flexibility is likely to grow significantly in the future as part of a smarter system and with technological advances.

- **Interconnection, storage and flexible demand – could save consumers up to £8bn a year by 2030 according to the National Infrastructure Commission[1].**
- **National Grid estimates that increasing flexibility (interconnection, storage and DSR) could deliver up to £2bn of consumer value per year by 2030.**
- **National Grid has set an aspiration for 30–50% of balancing capability from demand side sources by 2020.**
- **The Association for Decentralised Energy (ADE) estimates potential for demand side response of 9.8GW by 2020[2].**

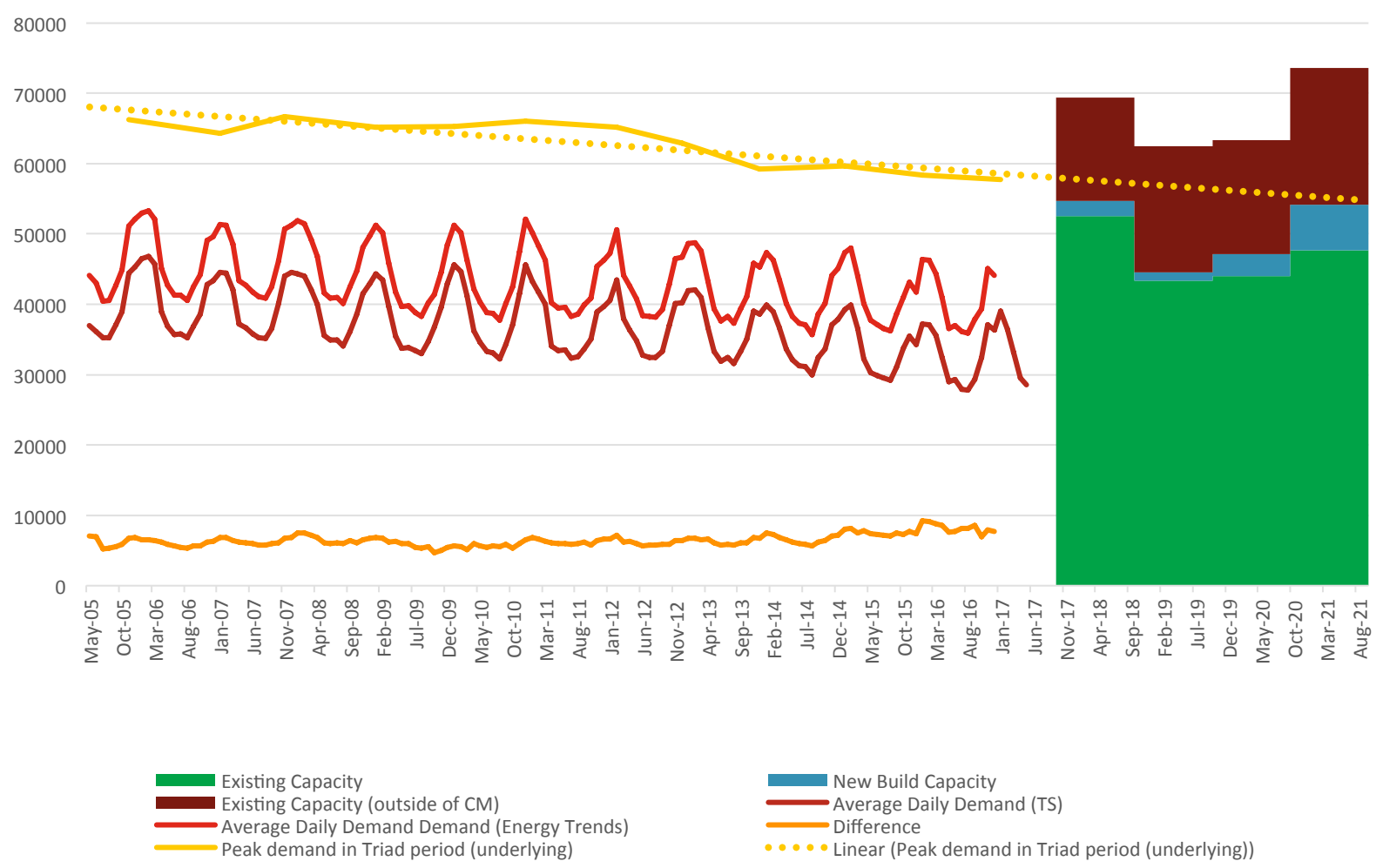
**Power Responsive year 2 focus –** deeper and broader customer engagement, simpler products and evolution of the flexibility market.

### Power Responsive year 2

In year 2 of the Power Responsive programme there will be key areas of focus.

- **Deeper and broader customer engagement.**
- **Simplification of products and services, refresh of the Shared Services Framework, and provision of support to the ADE code of conduct for demand side providers.**
- **Evolution of flexibility markets, including what success looks like for demand side flexibility, and boundaries and intersects for networks and markets.**

# Capacity Market




Jon Ferris, strategy director at Utilitywise, which manages energy supplies for businesses, said the main problem facing the UK power system was not shortage of capacity but rather an increase in volatility as growth in intermittent wind and solar generation makes supplies less predictable.

Last year was the first in which the UK generated more electricity from wind turbines than from burning coal. During windy periods last spring and summer, Britain had extended periods when all its coal power stations were idle. Yet, at cold and windless times this winter coal has been back up to 20 per cent of the energy mix.

“The auction system is like using a hammer to crack a nut,” said Mr Ferris. “We don’t have a capacity problem, we have a flexibility problem.”

# *Total System Cost*

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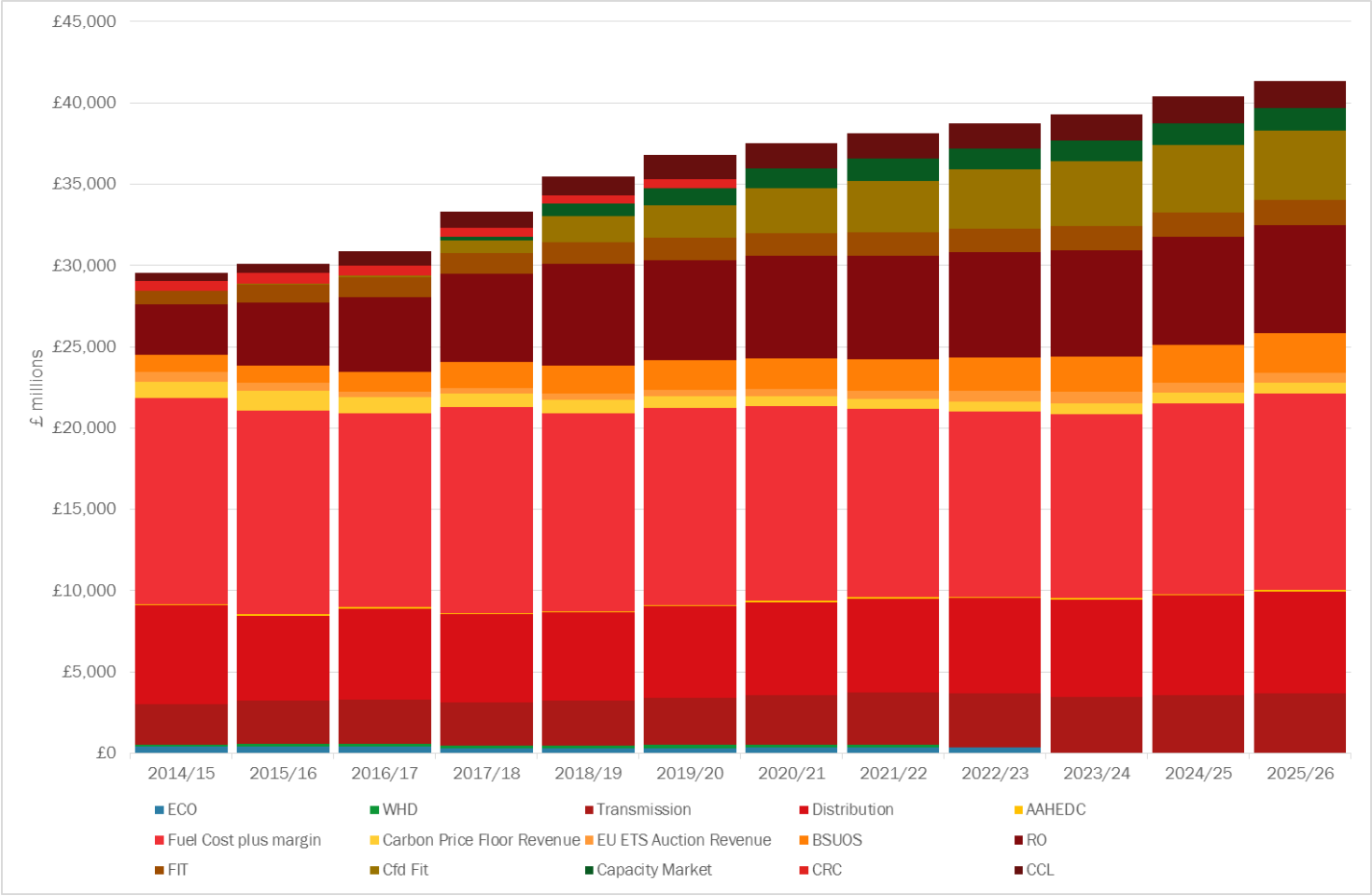
- Share of wholesale costs in decline
- Masks LVOE
  - Flexible generators get more value from market
- Rise in generator revenue outside market
  - Ancillary Services
  - Renewable support
  - Capacity Market
- Balancing flexibility more valuable than Baseload generation?



# Role of Retailers

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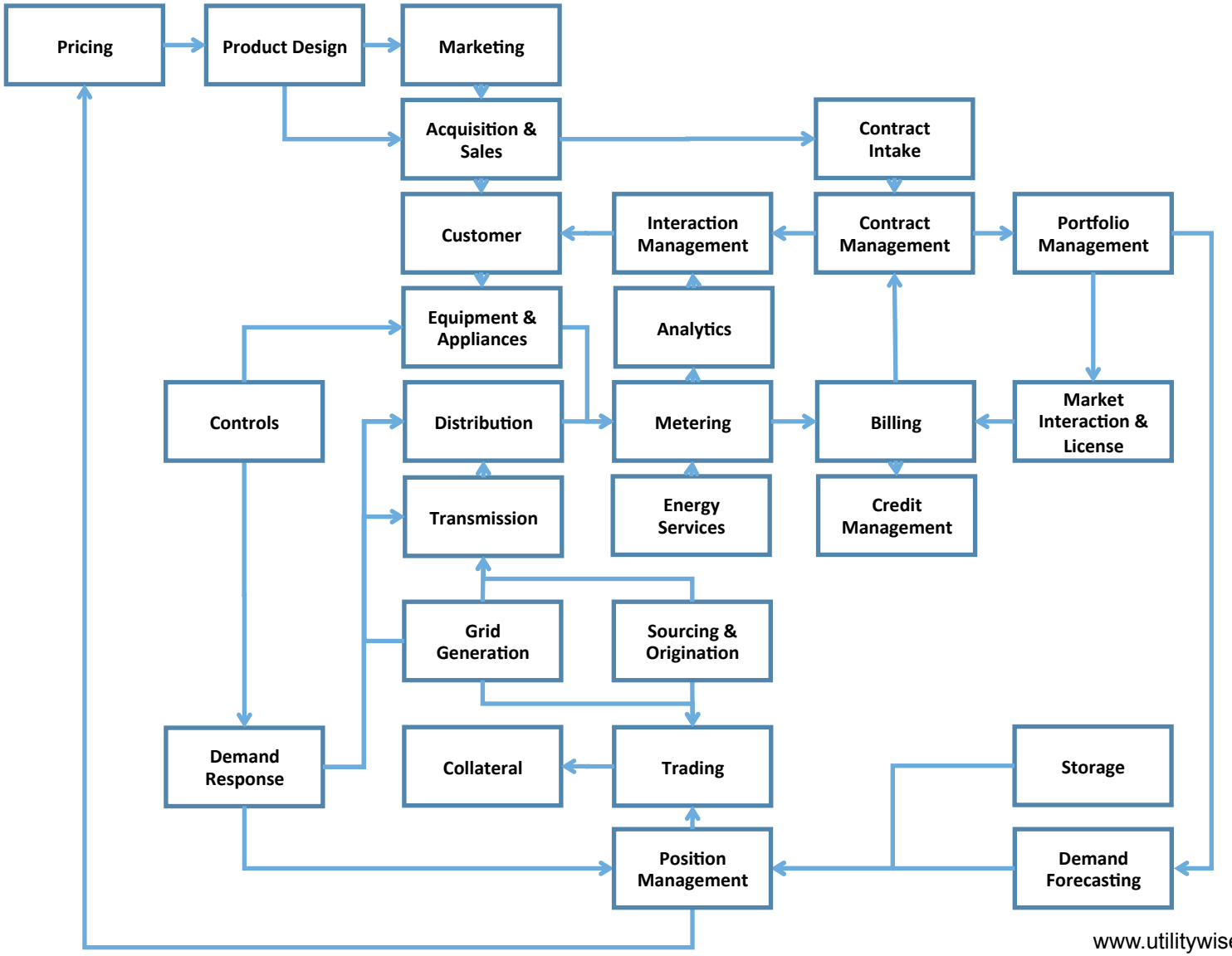
- Broking
- Balancing
- Billing

- Tariff structures
  - Cost reflective pricing
    - ToU
  - Risk reflective pricing
    - Dynamic



# *Demand Side changing the market*

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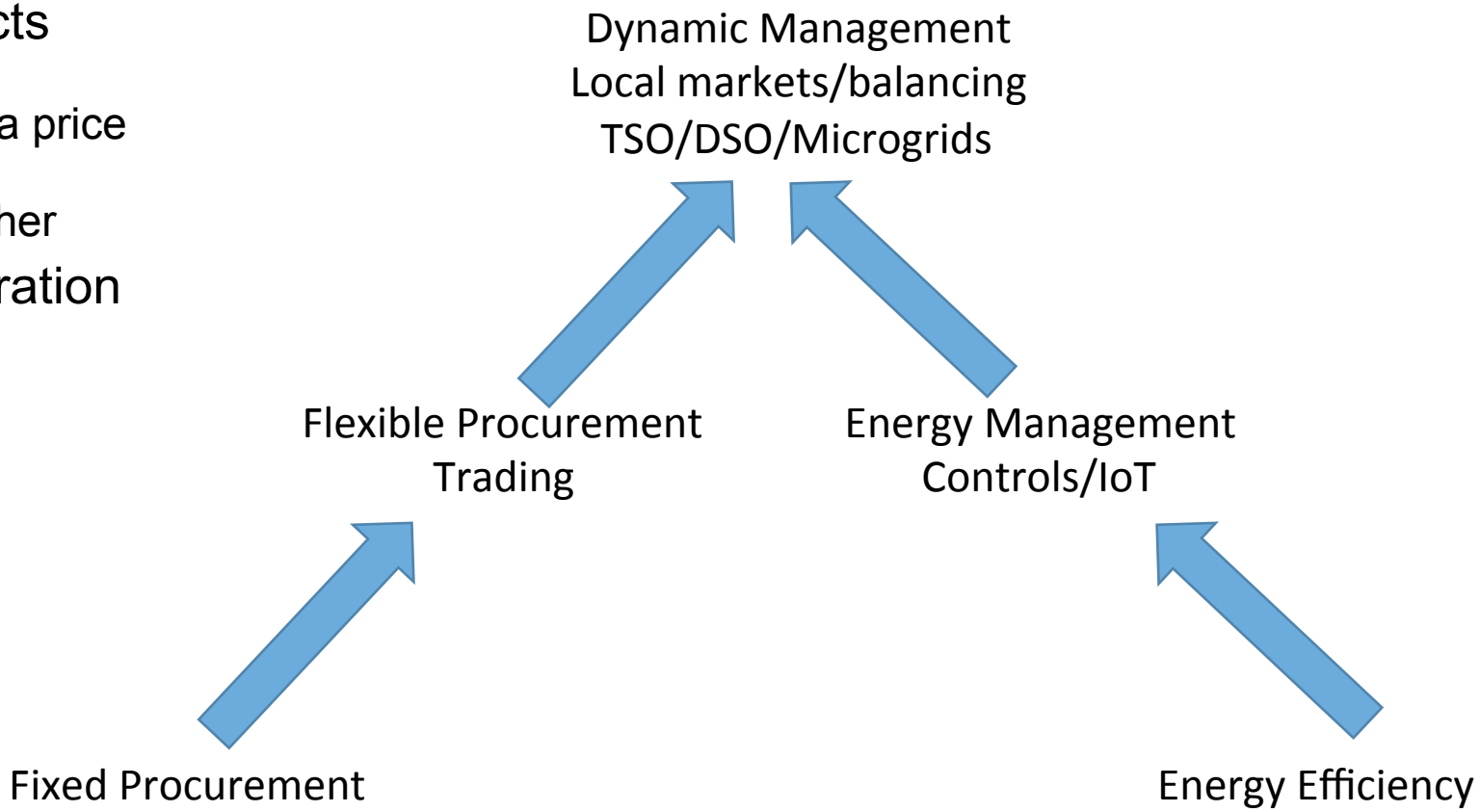
- Risk bearing supply contracts
  - Difference between:
  - contracted consumption at a price and
  - actual consumption at another
- Advantage of Vertical Integration
  - Arbitrage
  - Aggregation

- Demand side generation
- Demand reduction
- Demand management
- Demand flexibility



# *Is Demand Response the answer?*

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- Market engagement
- Perception of control
- What about operational costs?

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**Examples industry sectors with DR potential**

| Industry | Demand Response Potential | Process example |
|---|---|---|
| Iron & steel | Melting process | Furnaces |
| Non-ferrous metals | Melting processes | Furnaces |
| Chemical & petrochemical | Various processes | |
| Non-metallic minerals | Milling processes | Raw mill Cement mill |
| Pulp, paper & print | Fabrication processes | |
| Wood & wood products | Fabrication processes | |
| Food | Food processing & refrigeration | Refrigerated warehouse |
| Waste water treatment & distribution | Treatment & storage | Pump station |
| Plastic | Moulding | Injection moulding |

8

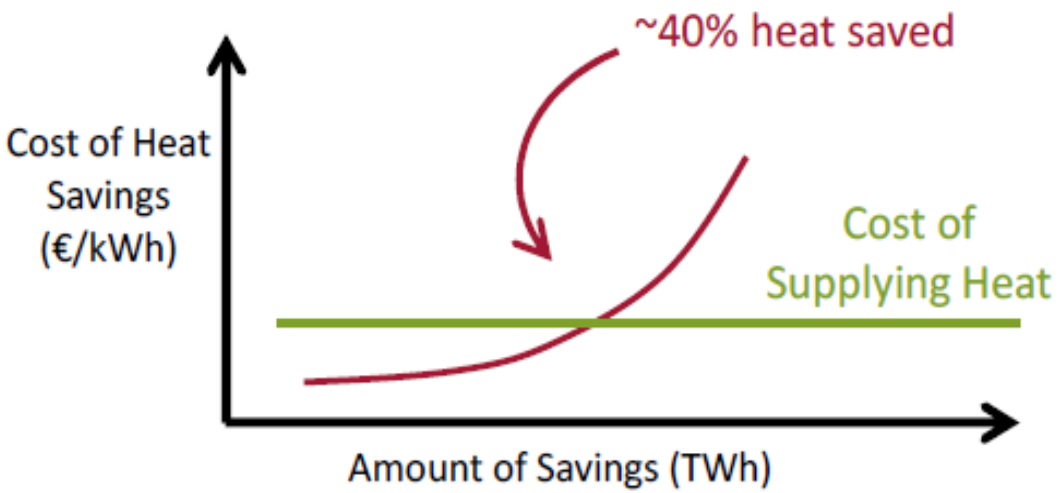
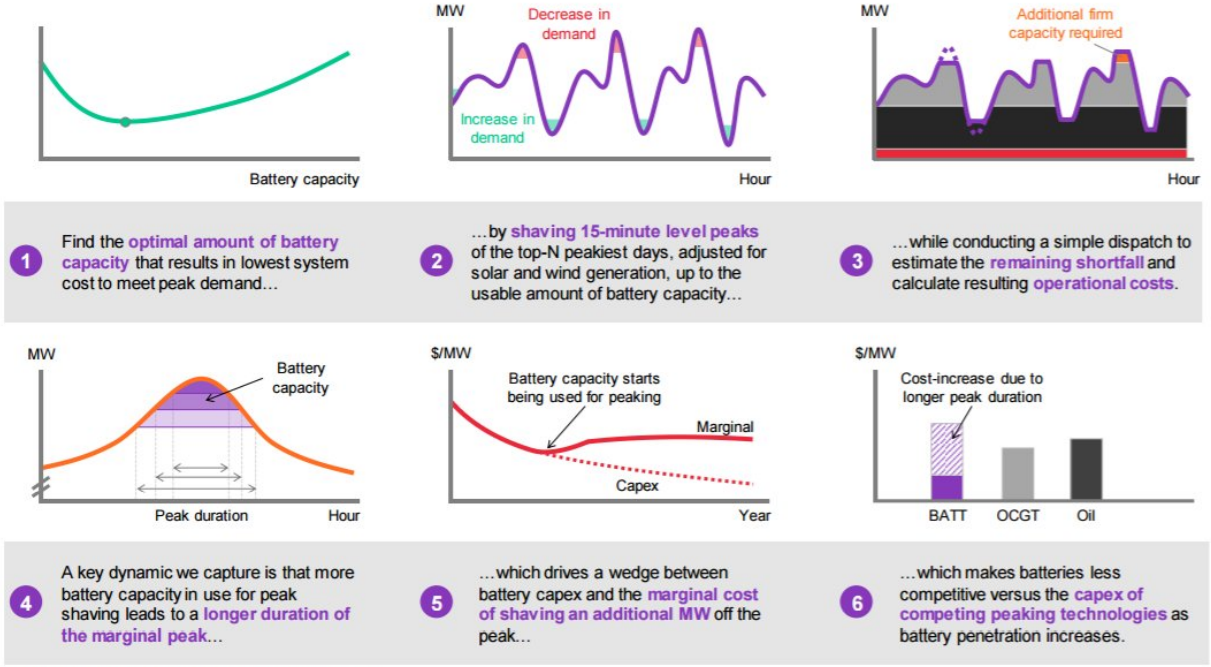



*Figure 3: Simplified diagram which shows that energy renovations should only be invested in until the point in which the cost of supplying heat to the building is cheaper than further renovations. In the Danish building stock ~40 of heat demand per square metre should be saved in existing buildings*

# Storage

- Limits to storage
  - Diminishing returns
  - Diurnal vs seasonal
- Classification
  - EU Winter Package – Equal treatment of generation, demand response and storage - at which location?
- Storage-like assets
  - Rooftop solar
  - Batteries
  - EV
  - Curtailment
  - Flexible generation

**Figure 91: Energy storage peaking capacity methodology**




*Source: Bloomberg New Energy Finance*

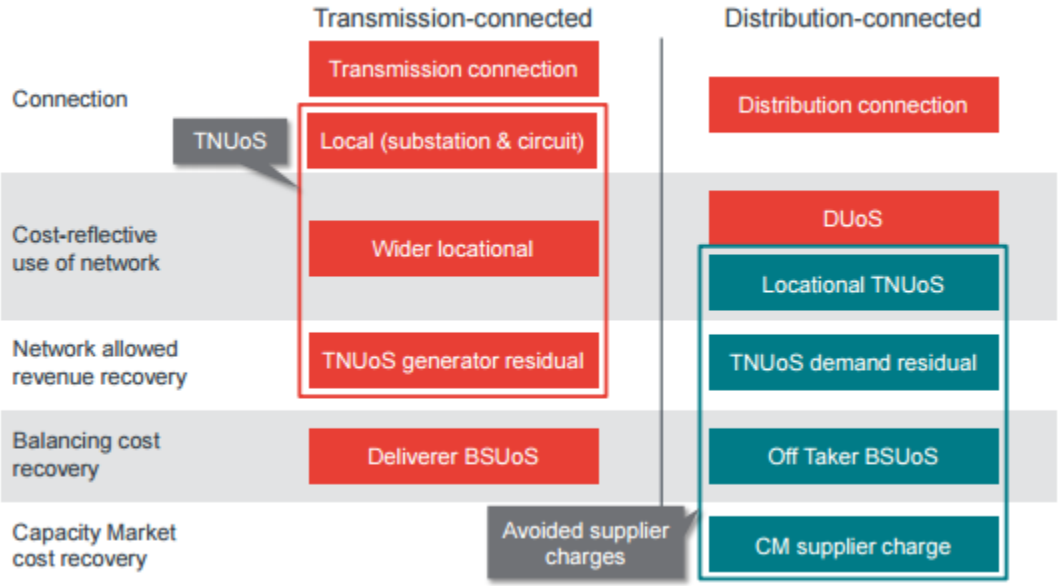
# Network Charging

- Ofgem Targeted Charging Review
  - Forward looking charges – marginal costs
  - Residual charges – recovery of sunk costs
    - 80% of Transmission
    - 50% of Distribution
  - Recent changes
    - Embedded benefits
    - DCP228
    - Excess Capacity
    - Storage classification

- Use (PAYG) vs Access (availability)

- Bi-directional grid
  - Consumer vs user
    - Who should pay for network use when there is an excess of supply?
  - Assumption that consumer pays to take power from grid
    - Demand turn-up

**Figure 1 Overview of current charging framework**




*Source: Frontier/LCP*

# *Network Competition*

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- Rate based returns
  - RIIO 10% return
  - 2 way flows on grid not designed for it
- Natural monopolies?
  - Private wire
  - Behind the meter generation and storage
- Grid Defection?

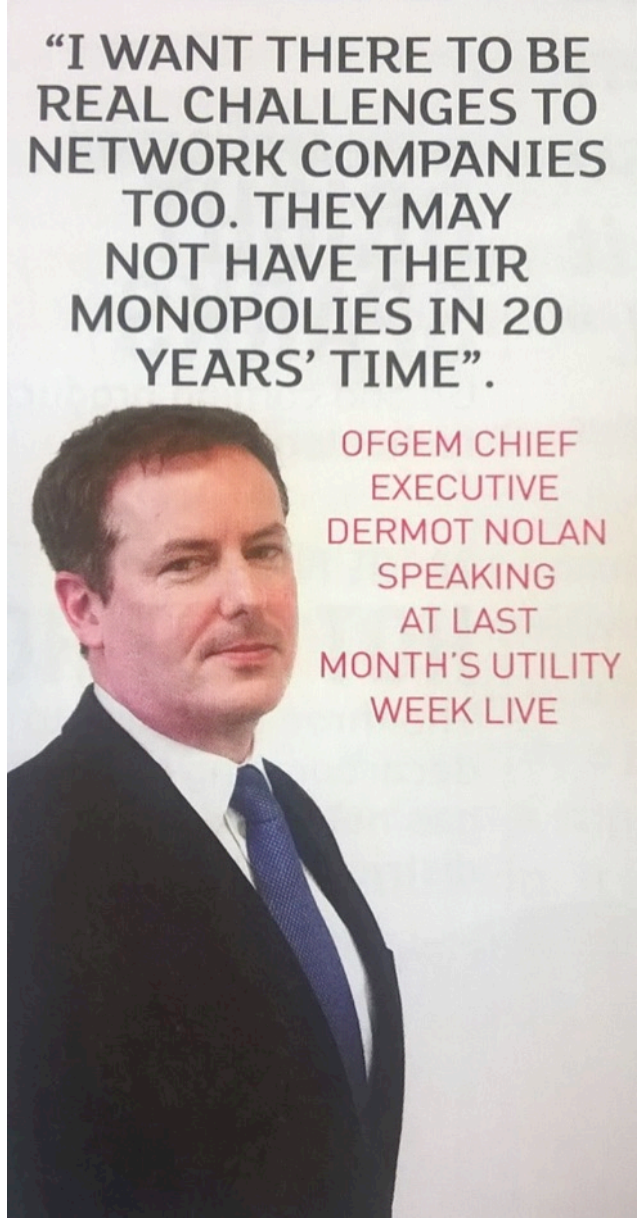
PERSPECTIVE

## OPINION: Energy networks are making too much profit

by New Power • April 18, 2017 • 0 Comments

**Morgan Wild, senior policy researcher at Citizens Advice, thinks it is time for Ofgem to re-examine its assumptions. Market comparisons justify lower returns and reduced cost allowances in the next RIIO period**

Energy networks are making bumper profits. Ofgem's RIIO reports recently revealed they are, on average, earning a 10% return. This matters partly because energy networks are regulated monopolies – it's the job of the regulator to decide how much profit they can earn. And it matters because energy networks represent about a quarter of consumers' bills. At a time when energy bills are rising and real incomes stagnating, it is crucial to answer whether these profits



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- Enabling more efficient use of existing infrastructure
  - Telecoms – IP, compression
    - How much copper do we need?
    - Do we need landlines at all?
  - Transportation – autonomous vehicles
    - How many cars do we need?
    - How much parking do we need?
  - Smart grid
    - How much generation do we need?
    - How much grid capacity do we need?

  - Asset as a Service
    - New services – VoD, MMRPG, cloud computing, augmented reality

# *P2P – Transactive Grid*

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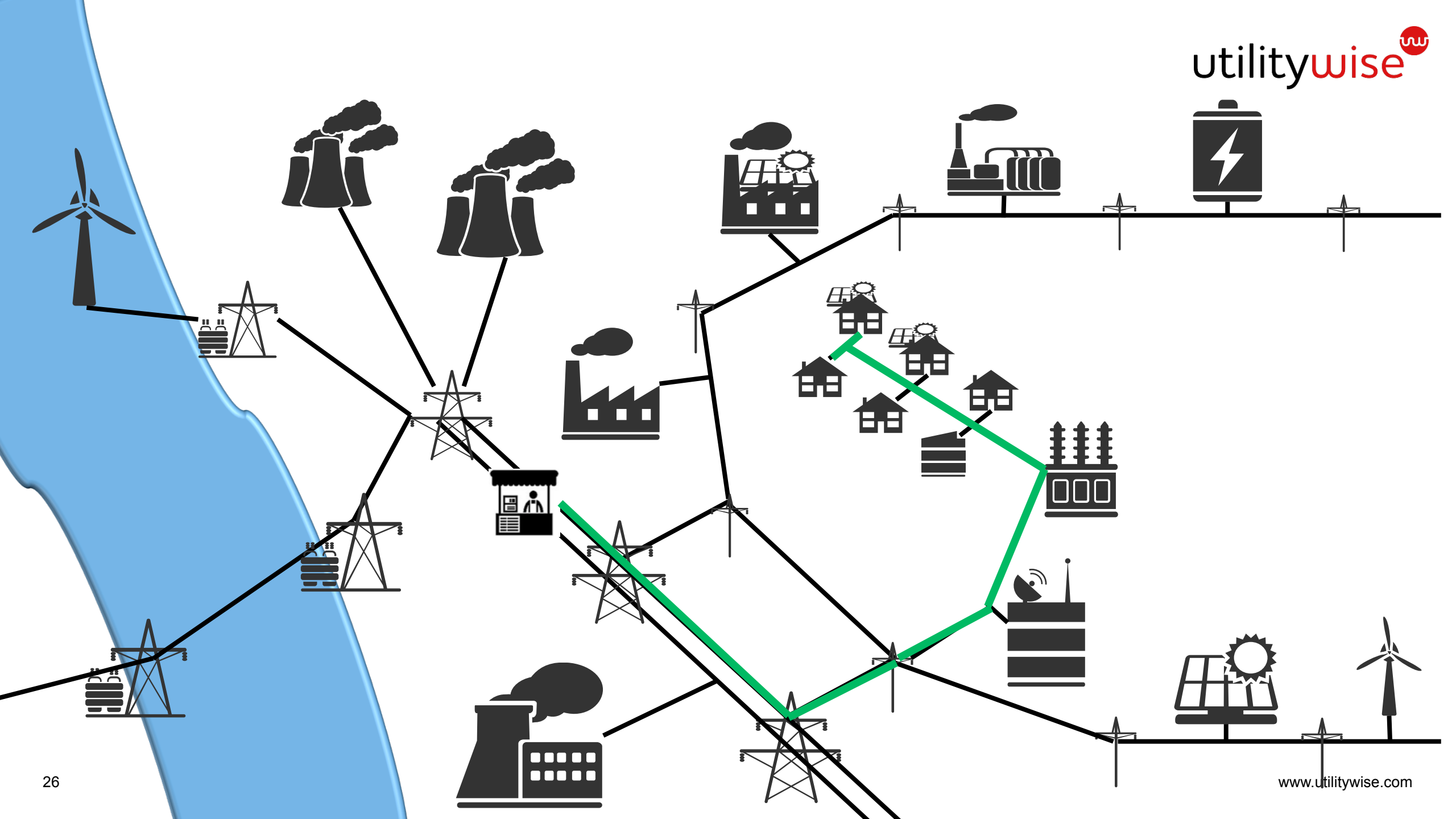
- Local markets/matching generation and consumption
  - LO3
  - Open Utility
- Blockchain
  - Micro-transactions
  - Trustless settlement

- The Uberisation of energy?
  - Excess solar
    - Solarcoin
  - Breaking the rules
    - Disconnect between flow of electrons and flow of money

The Australian Solar Council and Energy Storage Council call on all Governments to implement six key measures:

- Establish a plan for the orderly closure of coal-fired power stations;
- Make action on climate change a key objective of the National Electricity Market;
- Commit to at least 50 per cent renewables by 2030;
- Introduce a 5-minute settlement rule;
- Enable markets in peer to peer trading and demand response; and
- Replace the Australian Energy Regulator and Australian Energy Market Commission with a new combined energy rule maker and regulator.

The energy market is changing rapidly and will be completely transformed within the next decade by the combination of distributed and large-scale solar, energy storage, demand response, energy efficiency



# *Why blockchain isn't enough for P2P energy trading*

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- Cost reduction, or cost avoidance?
  - Variable costs
    - Wholesale
  - Fixed Costs
    - FiT/CfD/RO, CM
  - Network monopolies and asset cost recovery
    - TNUoS, DUoS, BSUoS
- Local markets
  - Collateral
  - Liquidity
- Scalability
- Centralisation of governance

# *Blockchain Transformation*

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- Interstitial tissue, not layer on current arrangements
- Data sharing
  - Distributed ledger – where is it beneficial?
- Trusted Third Parties
- Taking the meter off the wall
  - Ubitricity
  - Blockcharge

# *Fractal Grid*

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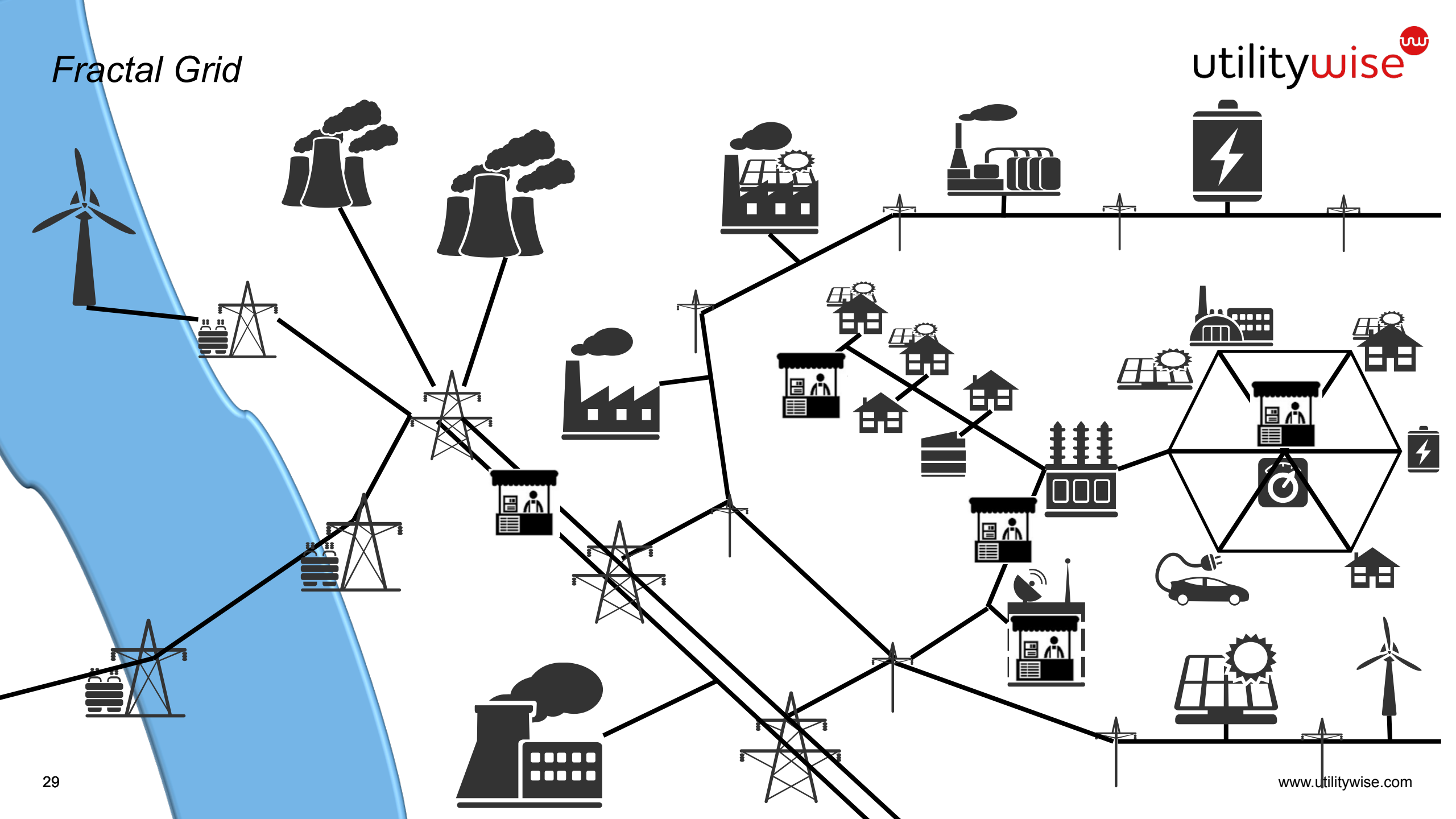

# *Two Tier Grid – Dark Side of Flexibility*

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- Asset-rich
  - Generation, storage islanding, grid services, efficient and smart appliances – lower network costs, resilience and payments for ancillary services
- Energy-poor
  - Disproportionate exposure to grid costs and centralised generation, lower energy productivity

- Goran Strbac – by 2030 flexible rates will be half of inflexible
  - Exacerbating inequality – haves vs have nots

# 21st Century Policy Challenges

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- Need for investment
  - Centralised generation and networks

    or
  - Bi-directional networks and distributed generation
  - Electrification of heating and transport
- New forces driving change
  - Demand side alternatives
  - Climate change
  - New entrants & business models
  - Local markets
  - Technology
- World is moving faster than regulatory paradigm
  - FIT rates
  - Net metering
  - Storage
  - Dumb Smart meters
  - Negative prices
  - But – REV, Ofgem Innovation
- Higher cost of getting policy wrong
- Stuck between tweaking imperfect existing regulation and transformation

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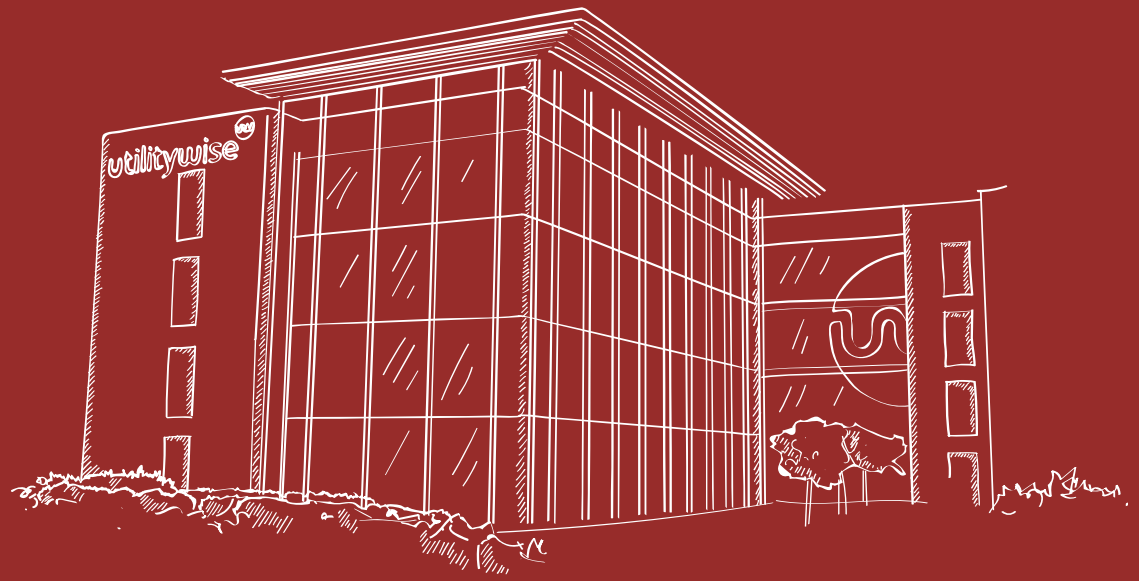
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