National Grid ESO

GB transition from fossil fuel to a zero carbon grid

James Greenhalgh

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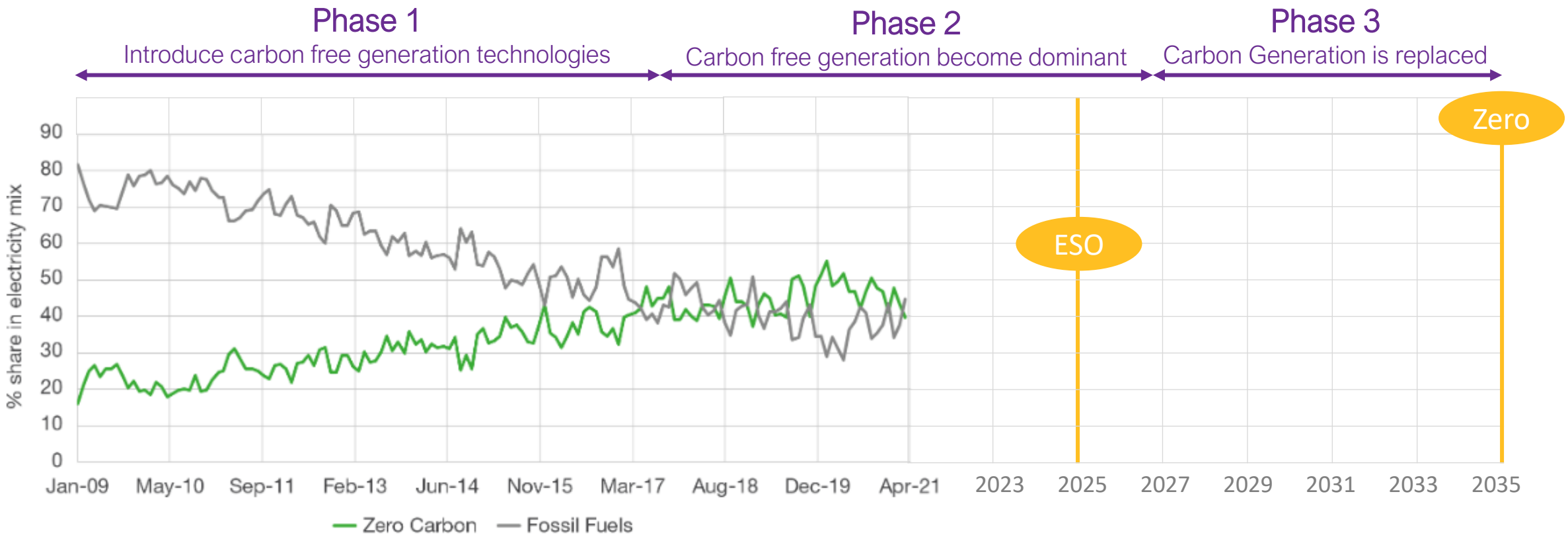
“Decarbonise the UK’s electricity system by 2035”

The Journey



By 2025 the ESO has a target to operate the Transmission network carbon free for short periods

By 2035 the electricity network needs to operate carbon free all year round

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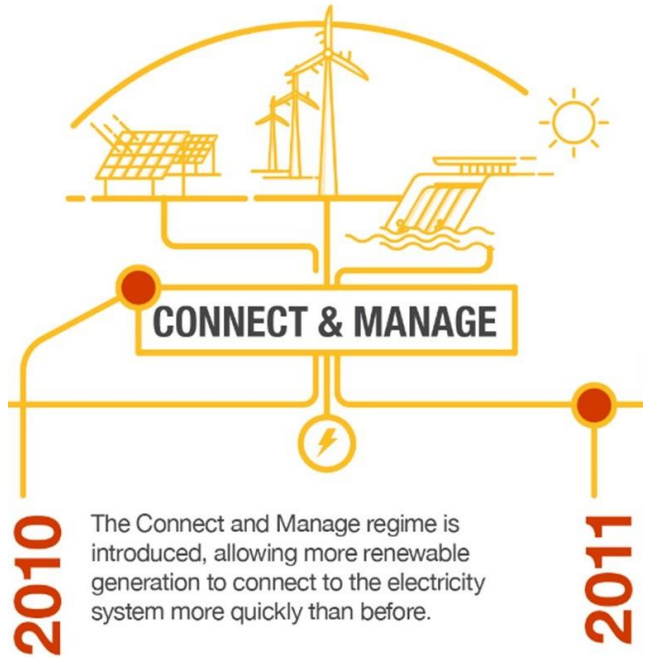
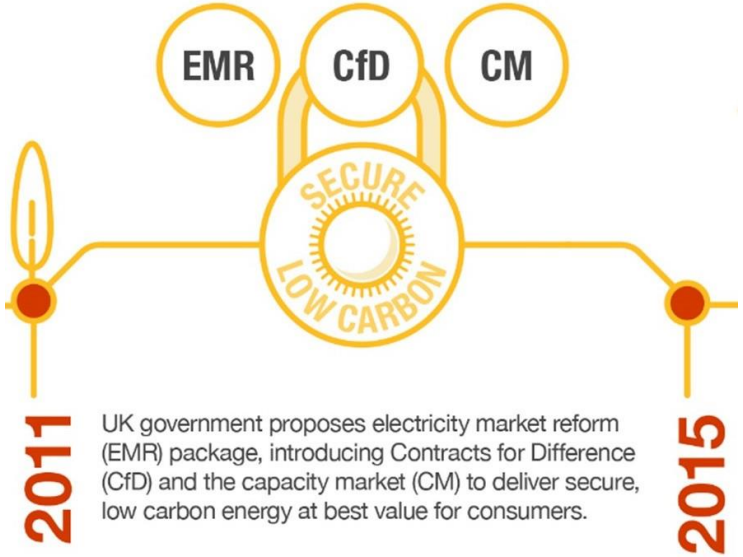
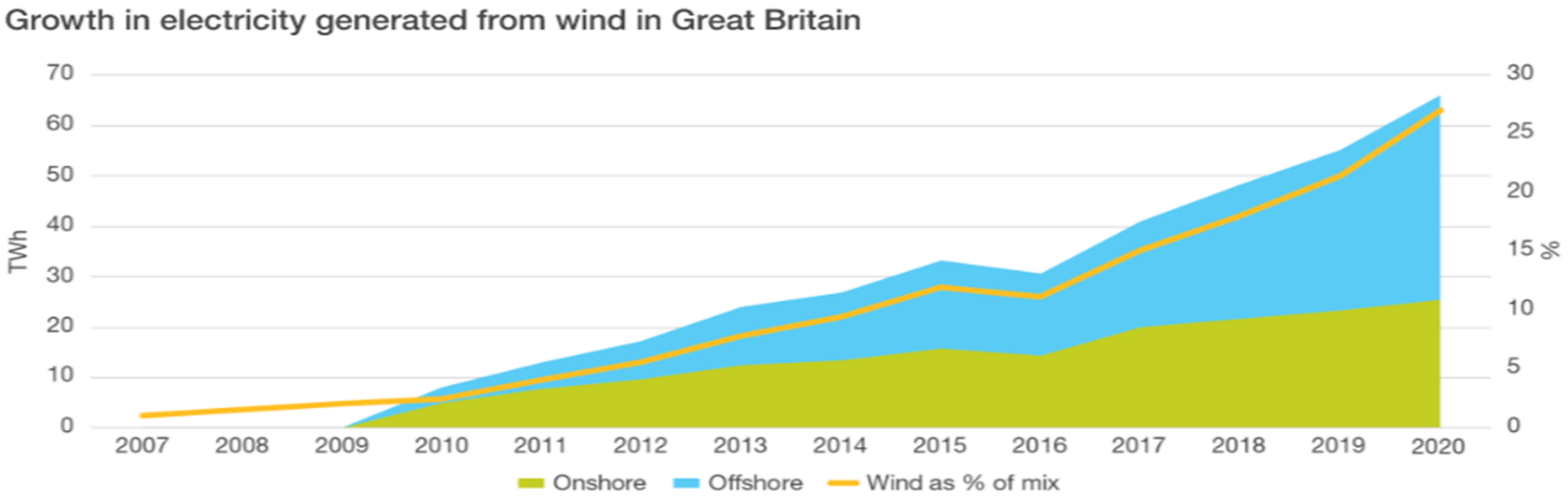
[Road to Zero Carbon in numbers | National Grid ESO]

Phase 1 – Changes to Policies, Regulation & Markets

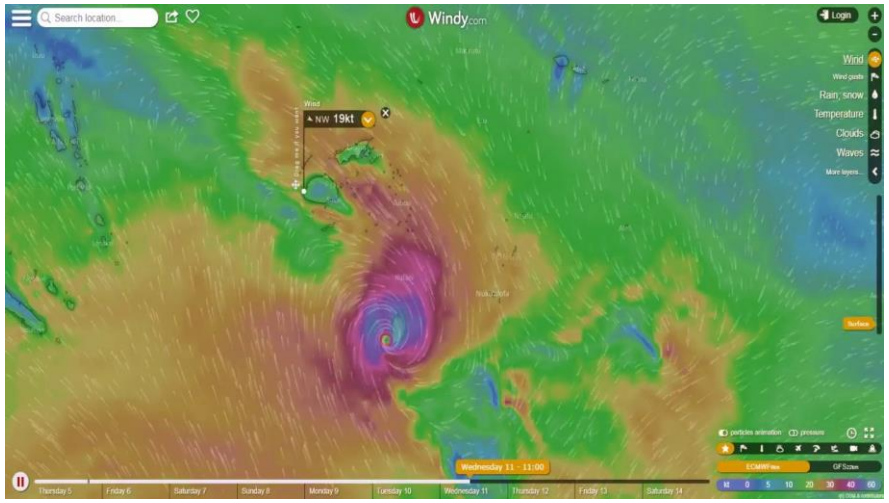




Phase 1: Developments in wind and solar energy



The challenges of using it……



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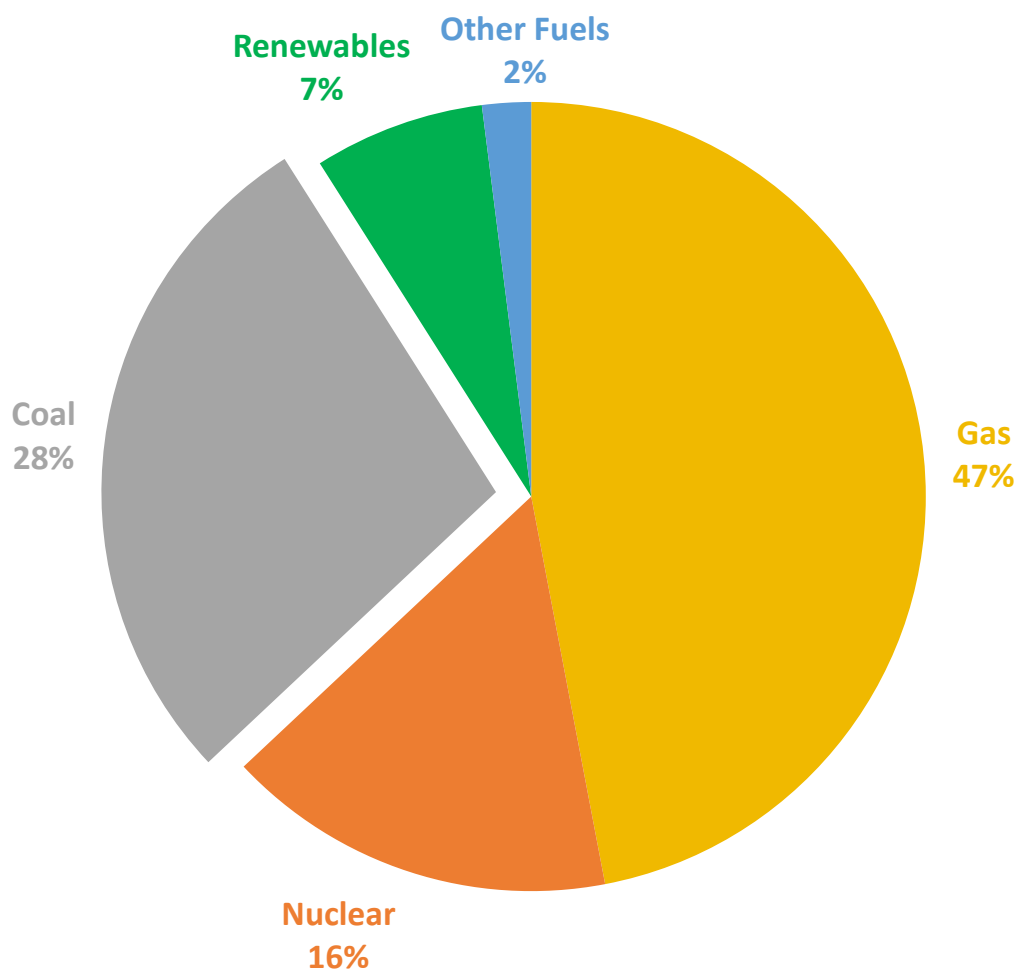
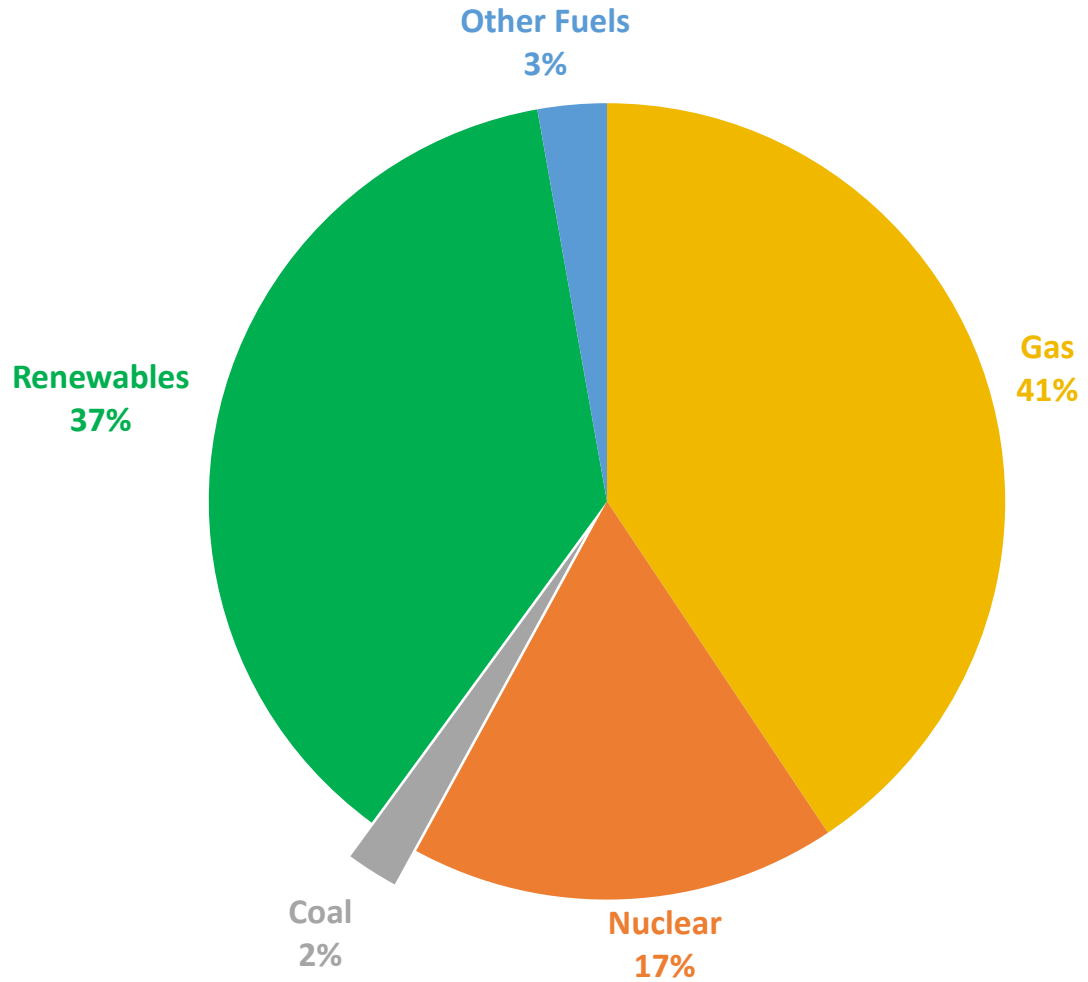
Progression, but further to go…

UK ELECTRICITY 2010

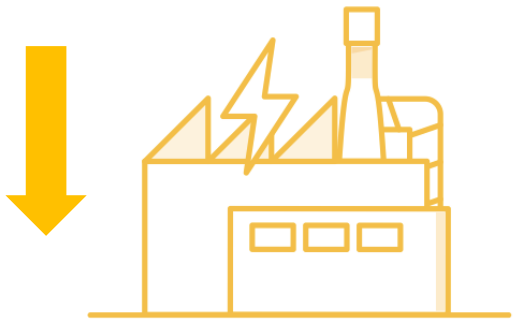


UK ELECTRICITY 2019



Phase 2 – Feeling the change

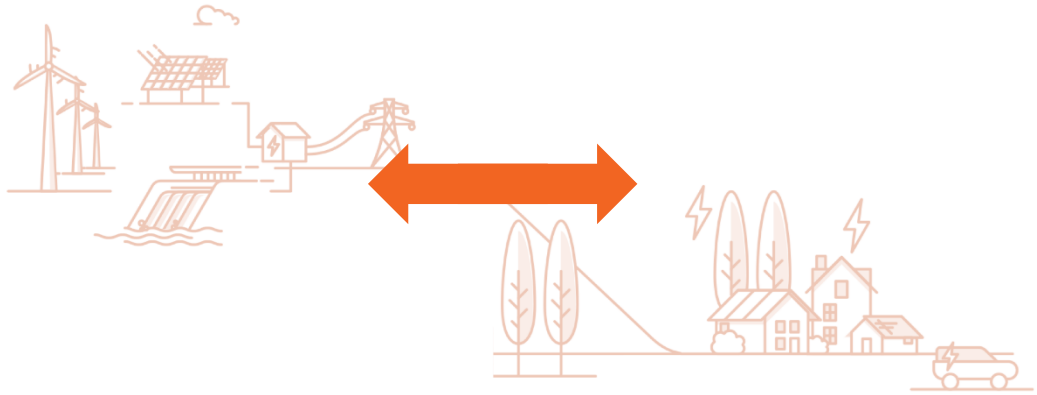
Increased amounts of decarbonisation of the electricity system has resulted in changes in four key areas:



Less dispatchable generation

More variable sources of generation

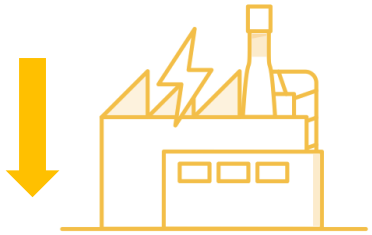
More asynchronous generation



Generation moving to different areas.

Engineering Challenges of running zero carbon

Decarbonisation of the GB power system has driven in changes in four key areas……



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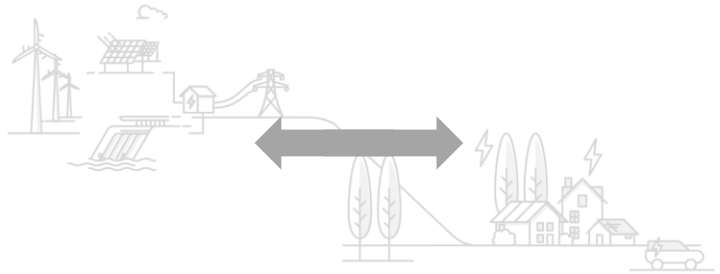


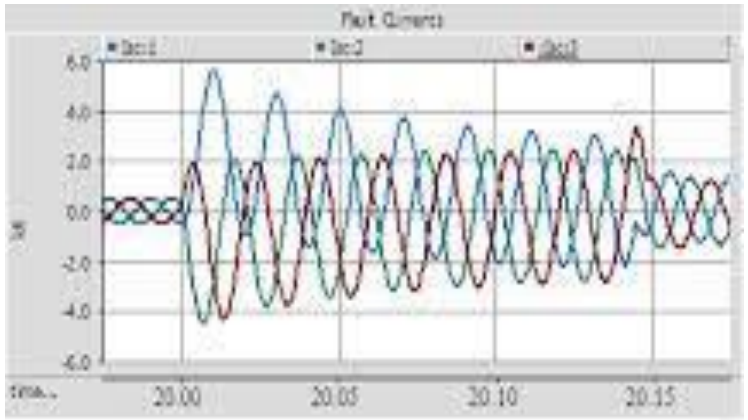
Generation moving to different areas.

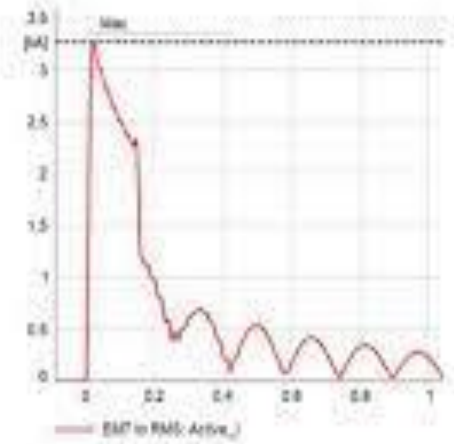
……. Resulting in 5 core engineering & operational challenges:

- *Frequency management*
  - *Stability & Inertia*
    - *Voltage Control*
      - *Thermal Limits*
        - *Restoration Capability*

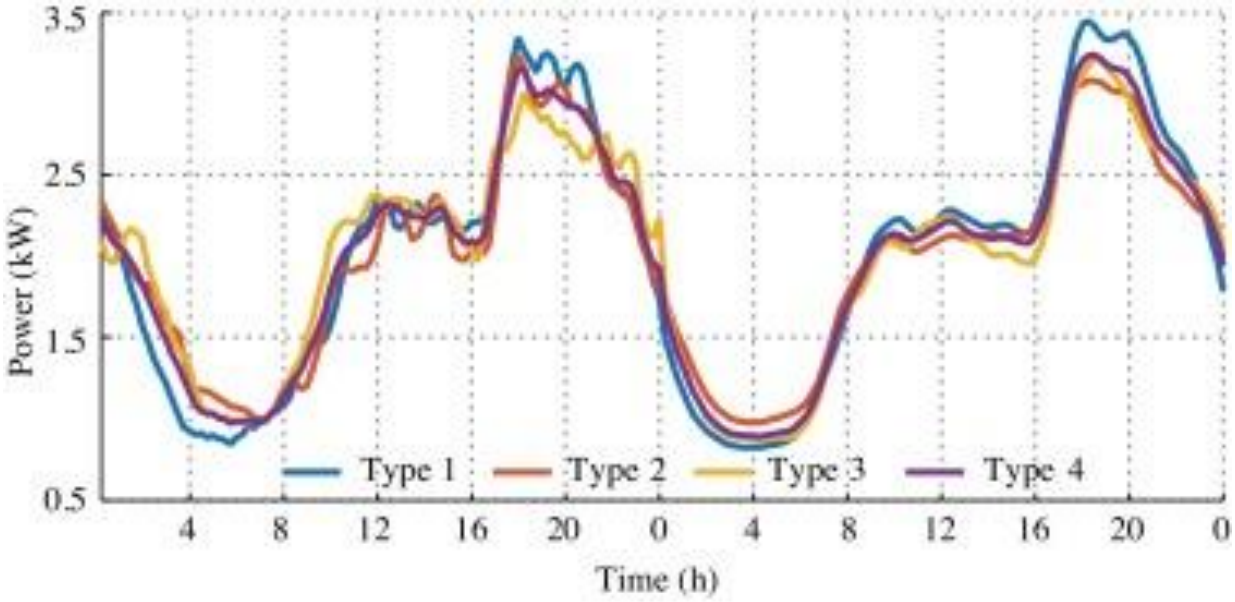
- New products & services – e.g., buying inertia
- New paradigms – restoration from distributed resources
- Advanced technology – real time inertia measurement
- New tools and training in Control Room

Frequency, Stability & Inertia

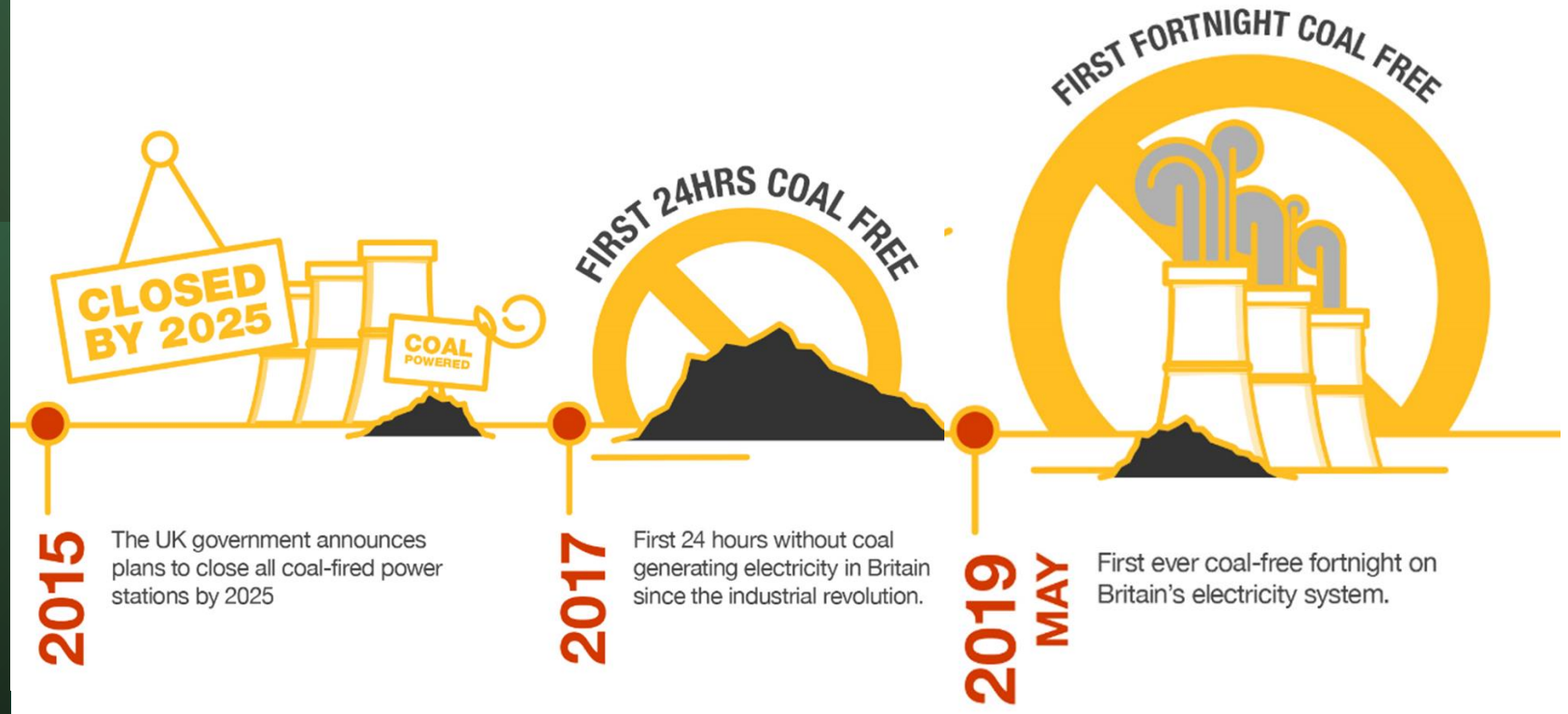




Thermal limits and Voltage control



Commitments that deliver results

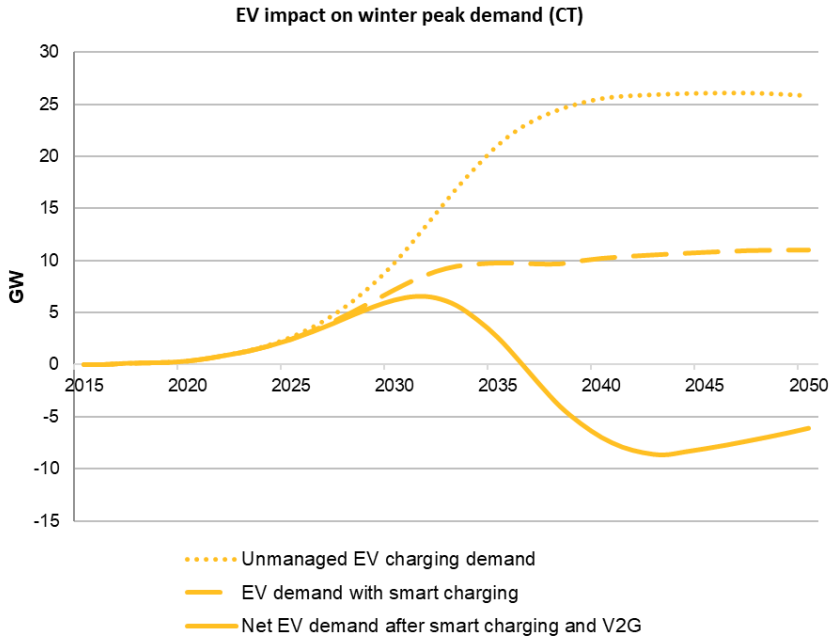


Phase 3 – Flexibility

Flexibility is about moving things around in day to keep the system balanced

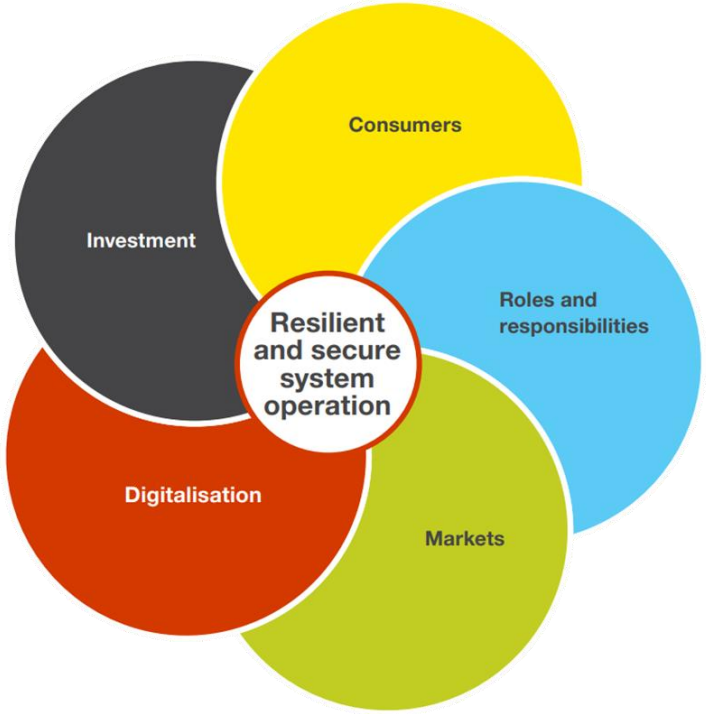
Problems

- How do you move solar energy to when it is needed?
- How do you reduce peak demand by shifting negotiable demand away from the peaks?
- How do you smooth out changes in demand and generation to reduce system stress?



Solutions

- Consumer Flexibility from negotiable demand
- Interconnectors
- Storage



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Reflections

- Great progress, but the easy stuff has been done
- Net zero commitment makes everything clearer
- Electrify everything, or nearly everything…
- Wind and solar will be the main technologies
- Flexibility is fundamental and hard/expensive
- We should be building grids with that in mind – start with 2050 and work backwards
- Markets need to be overhauled to deliver capacity and investor certainty – what got us here won't get us there

Thank you for listening,

Questions?

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