nationalgrid

Connected, secure, two-way grid assets



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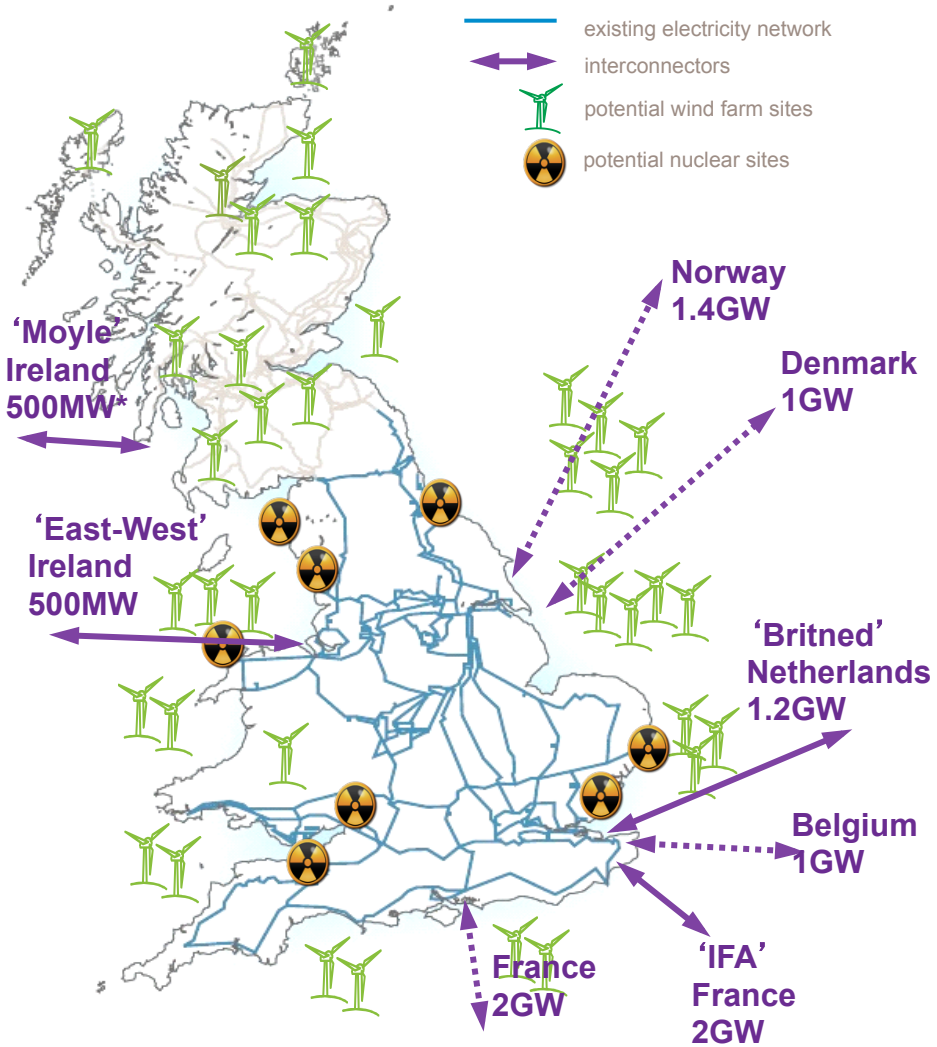
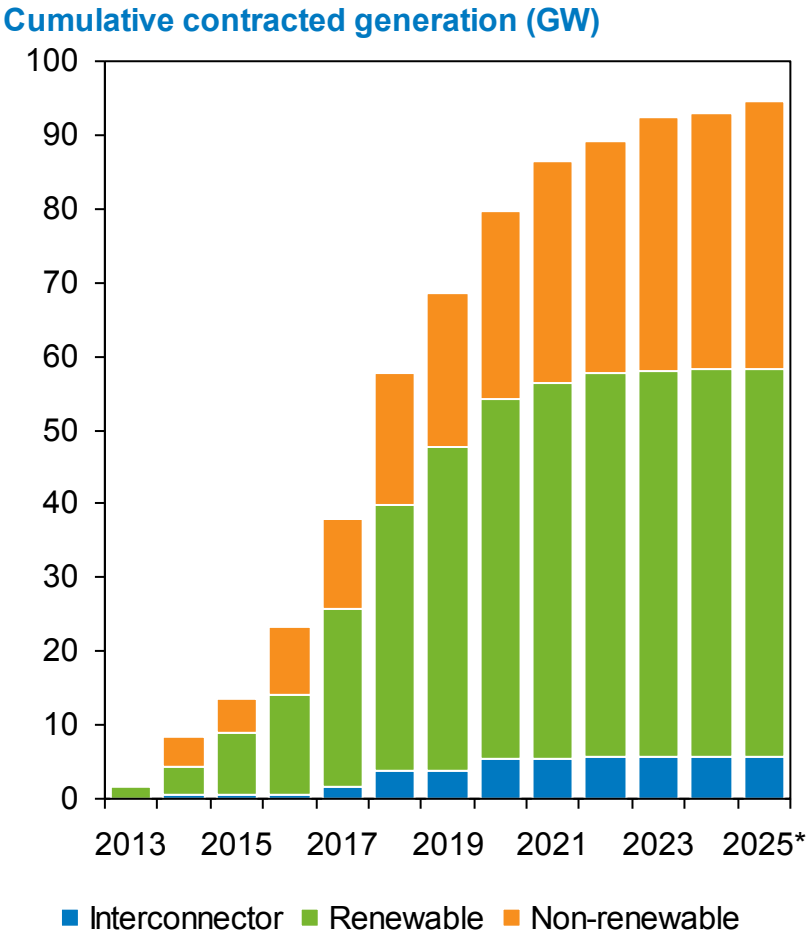
www.cir-strategy.com/events/cleanpower

The changing grid

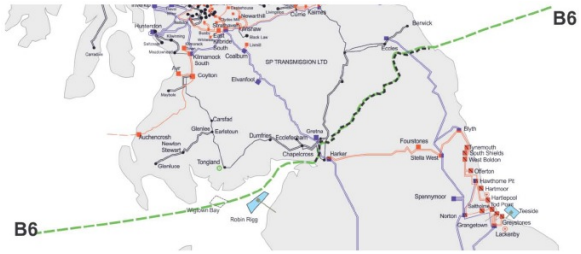


Arrows are illustrative and do not show connection points.



Source: National Grid TNQCU – March 2013.
* No new contracted generation after 2025.
Renewable fuel types: Biomass, Hydro, Tidal, Wave, Wind

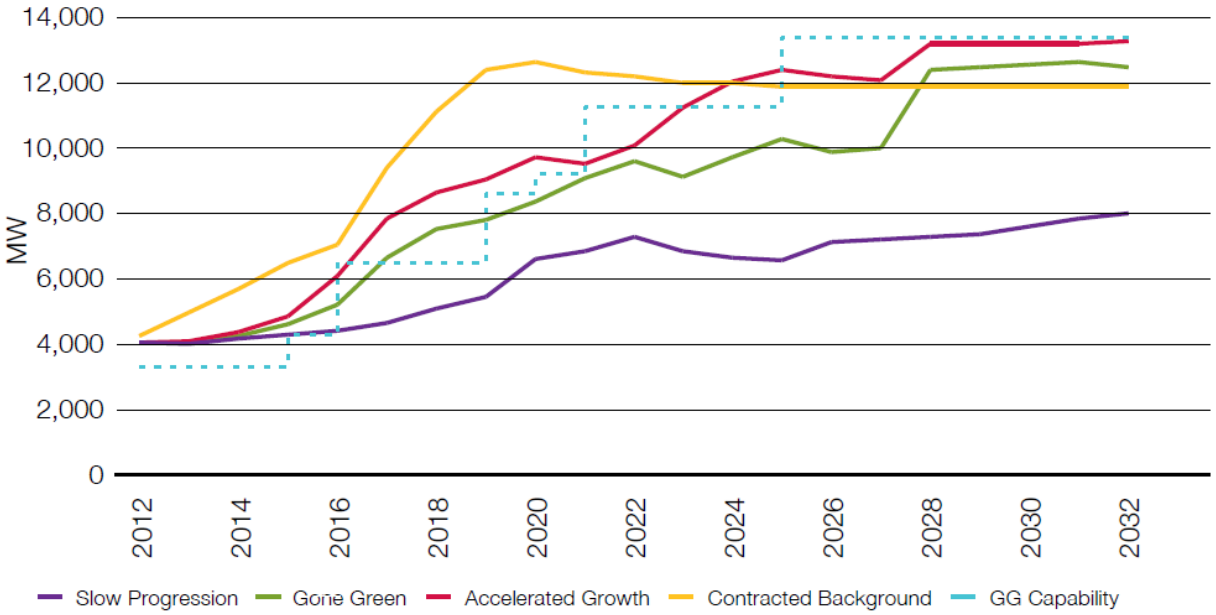
The need for a smarter system: B6 boundary example



Boundary B6 is the boundary between SP transmission and NGET.

Scotland typically contains an excess of generation leading to mostly north-south power flows as the most likely stress condition.

Current capability is limited to around 3.3GW



Source: National Grid Electricity Ten Year Statement – November 2012.

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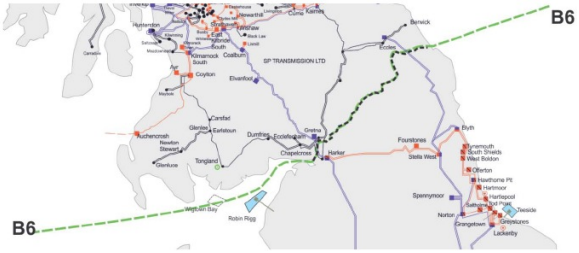

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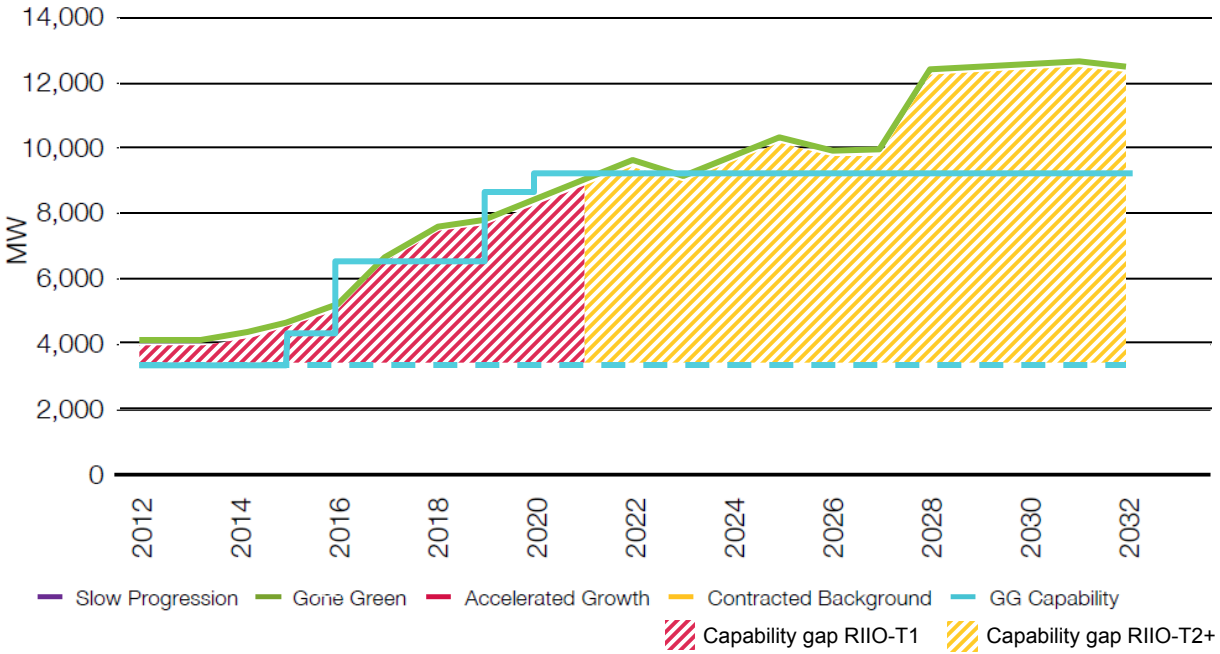

Solutions:

- Invest in primary assets to deliver physical capability eg:
  - Harker–Hutton, Eccles–Stella West and Strathaven–Harker series compensation.
  - 2.4GW Western HVDC link (submarine HVDC cable route from Deeside to Hunterston).
  - ~2 GW Eastern HVDC link (submarine HVDC cable route from Peterhead to Hawthorn Pit via Torness.
  - Harker–Strathaven reconductoring and series compensation

Source: National Grid Electricity Ten Year Statement – November 2012.

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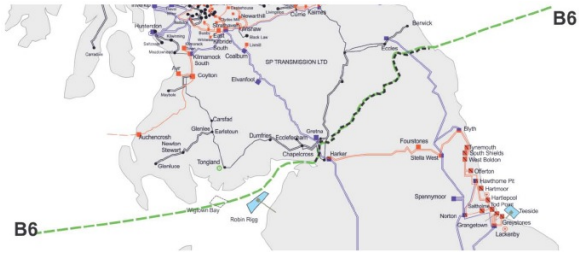

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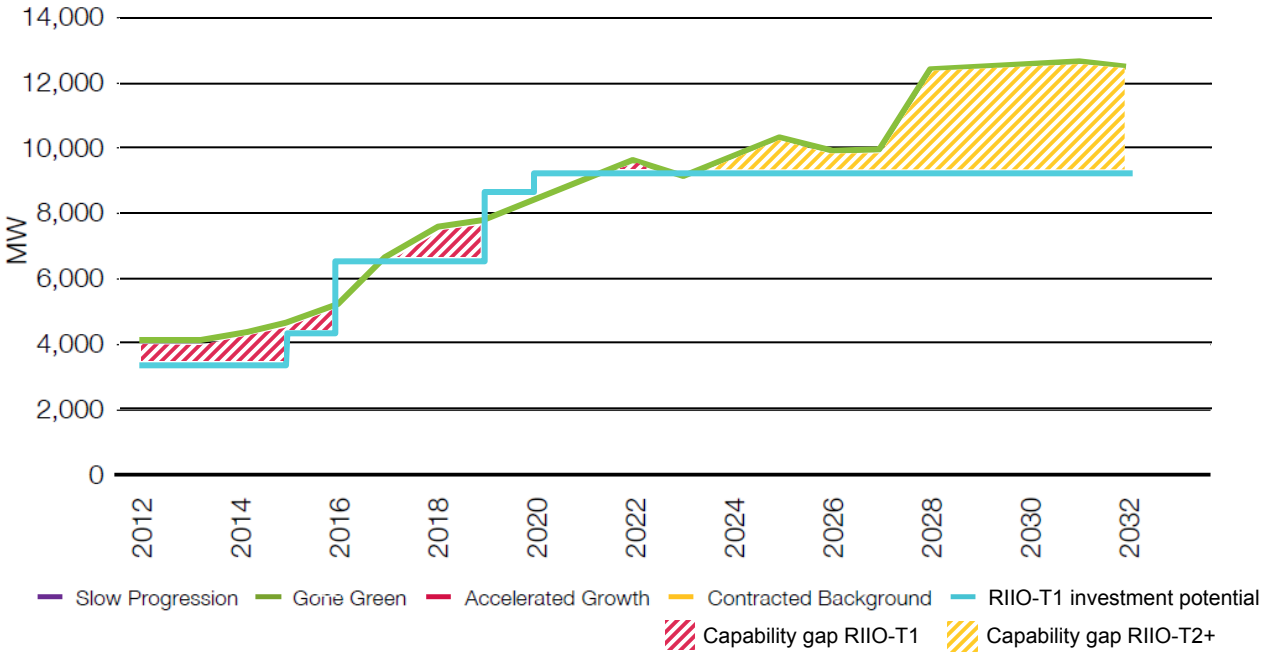

Solutions:

- Invest in primary assets to deliver physical capability
- Invest in secondary assets to enhance capability eg:
  - Circuit rating enhancement
  - Risk management
  - Condition monitoring
  - Remote asset management and monitoring

Source: National Grid Electricity Ten Year Statement – November 2012.

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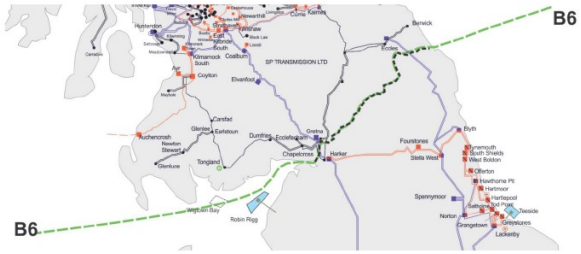

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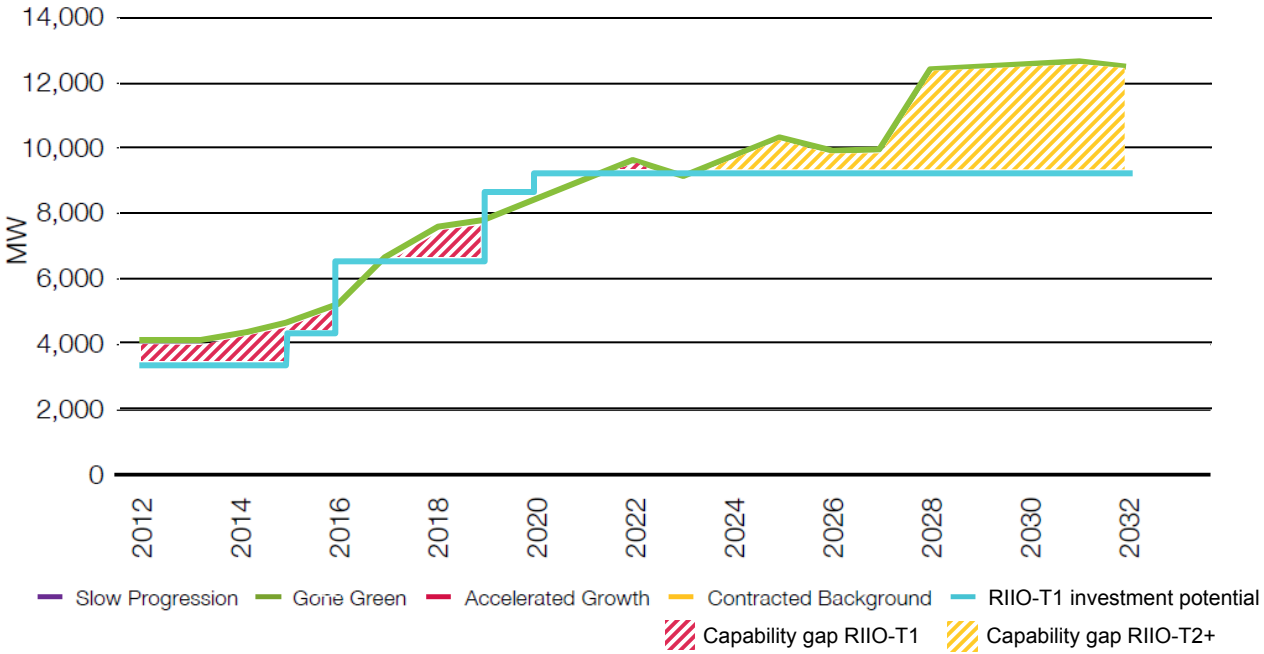


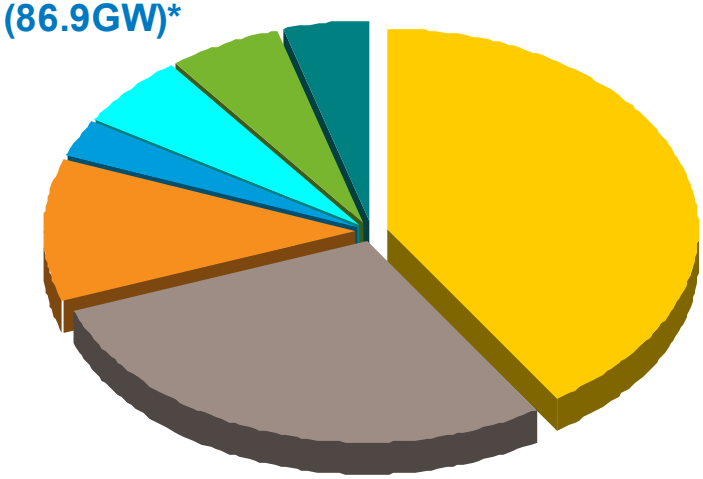
Solutions:

- Invest in primary assets to deliver physical capability
- Invest in secondary assets to enhance capability
- Invest in commercial solutions:
  - Flex generation
  - Interconnection
  - Storage
  - Demand management

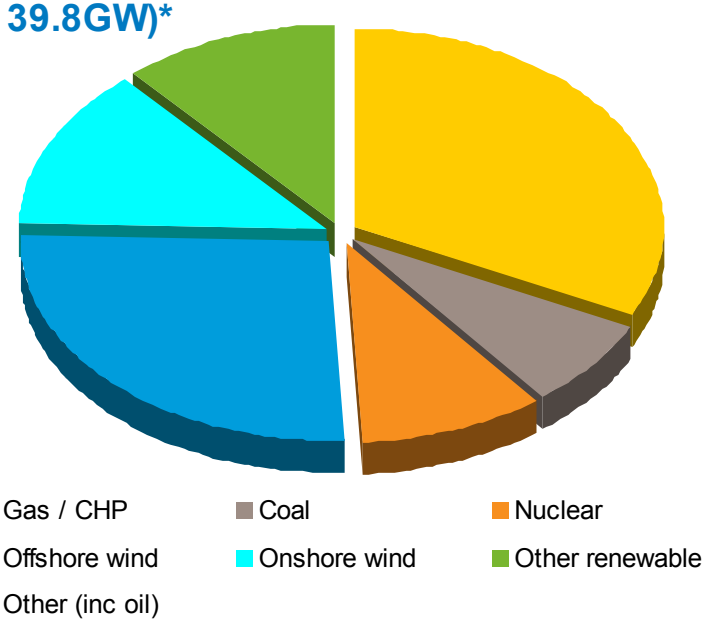
Source: National Grid Electricity Ten Year Statement – November 2012.

Flex generation

2012 generation capacity (86.9GW)*



2030 generation capacity (139.8GW)*



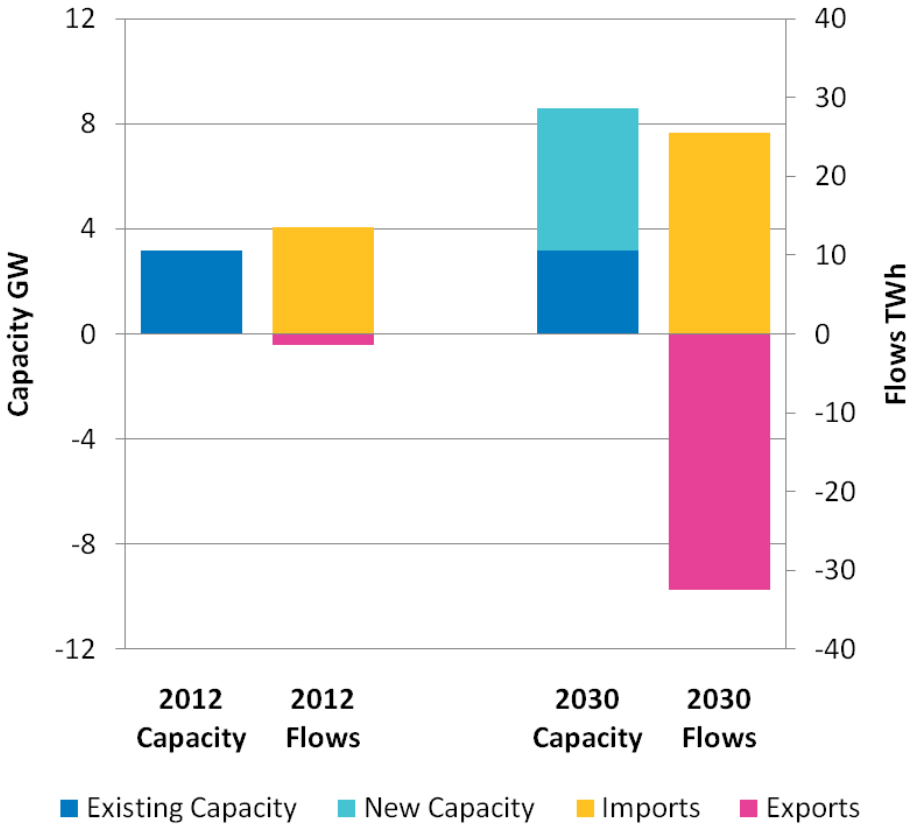
~75% flexible thermal

~40% flexible thermal

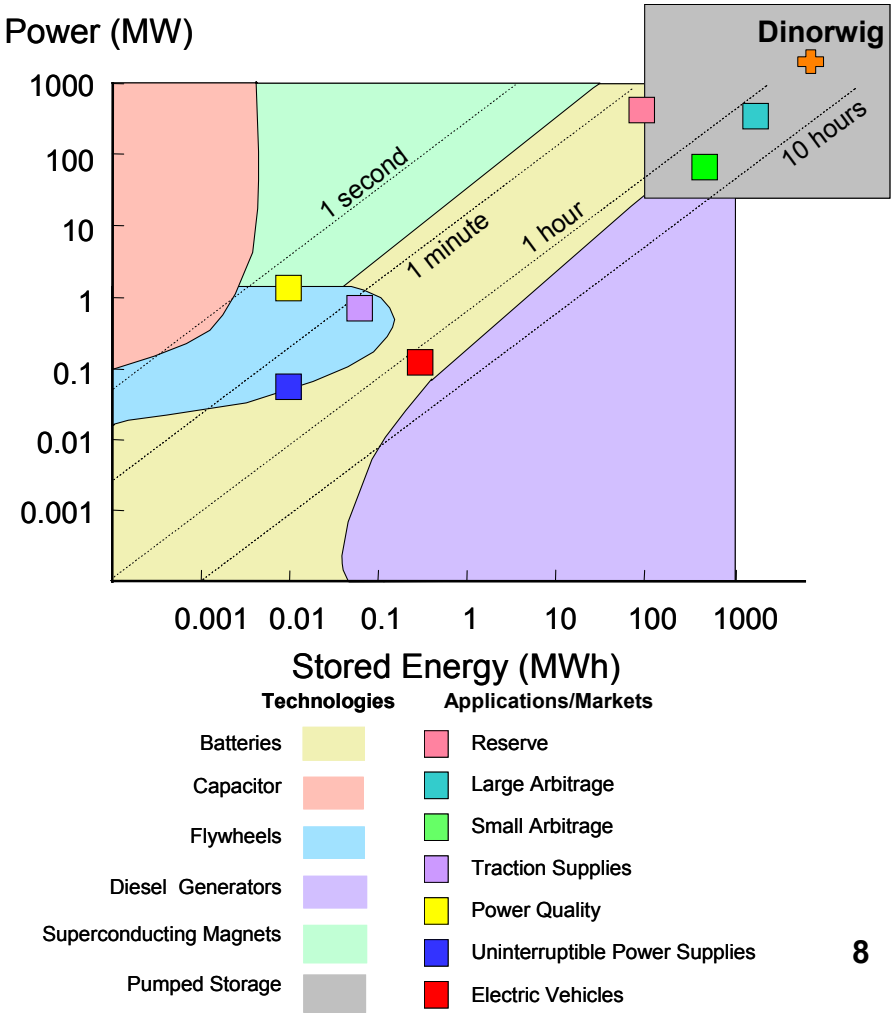
Source: National Grid Gone Green 2012 scenario.
* Excludes interconnection & pumped storage.

Interconnection & storage (grid scale)

Interconnectors



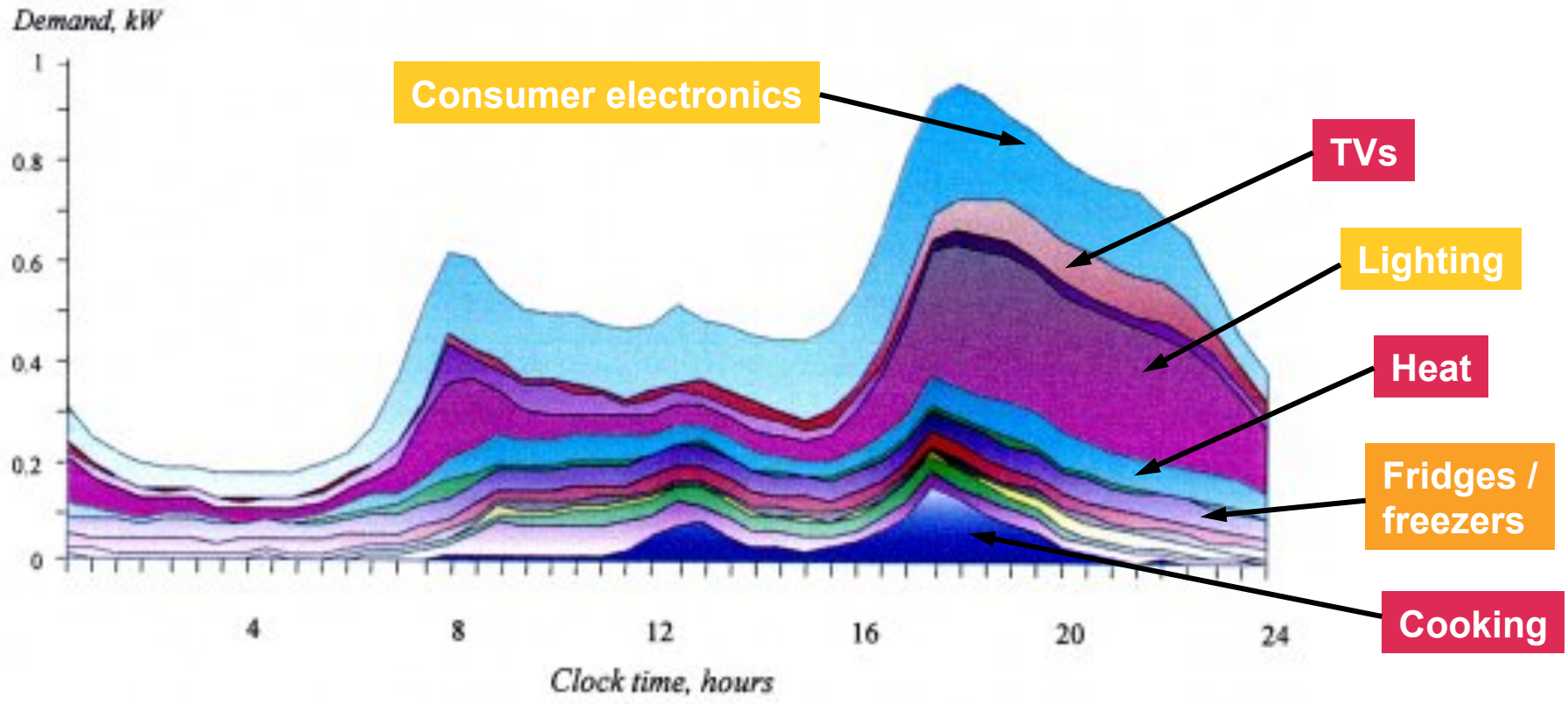
Storage



Source: National Grid Gone Green scenario analysis.

Demand management

Average consumer demand profile for winter peak ~2010



Heat pumps and electric vehicles will dominate the demand profile in 2030
Time of Use Tariffs should increase variability between users and days

Source: Load Research Limited (excluding Economy 7 demand).

Heat – where networks meet…

Key 'technical' challenge:

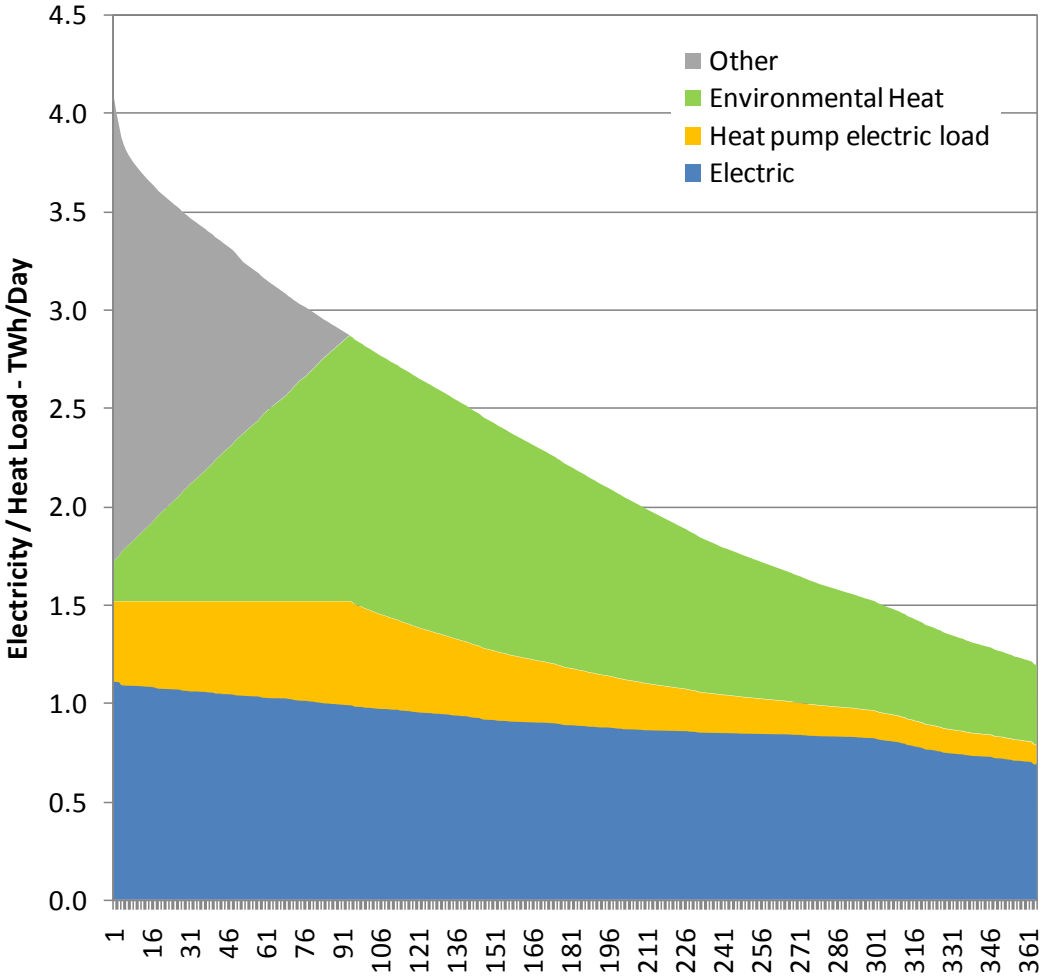
HEAT DEMAND IS HIGHLY VARIABLE

- Seasonality drives heat demand:
  - Summer minimum of ~500GWh/day
  - Winter maximum of ~3,000GWh/day
- Heat pump efficiency reduces significantly with colder external temperatures (coefficient of performance range: 1.5 to 5)

Key policy considerations:

GAS HAS AN IMPORTANT ROLE TO PLAY

- Full electrification will be highly costly (100GW – 150GW new electricity capacity required, at low load factors)
- Hybrid solutions including gas, heat networks & electrification can decarbonise heat economically
- Increased insulation is essential in all cases



Incremental electrification will use 'dirtier' marginal power stations

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At the heart of the energy transformation…