Greenpeace 2030 UK Energy Scenario

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www.demandenergyequality.org/2030-energy-scenario.html

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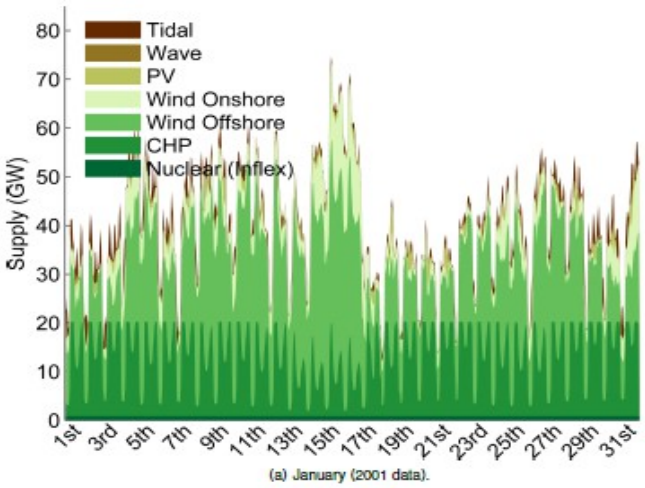
Introduction / problem definition

- Renewables produce electricity
- Electricity represents ~ 20% UK energy demand
- Electrification required simultaneously to decarbonisation
- Renewables generation variable – well known
- Electrification increases variability of demand – only recently researched
- Question – can we balance supply and demand with electrification + decarbonisation?



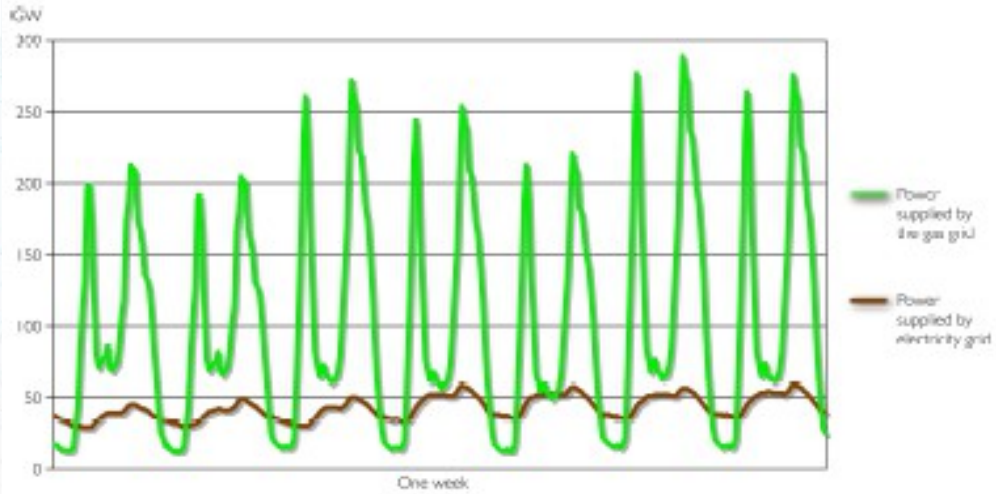


Figure 1.1: Power supplied by gas and electricity grid over one week in January. Source : Department of Energy and Climate Change (2012*b*).

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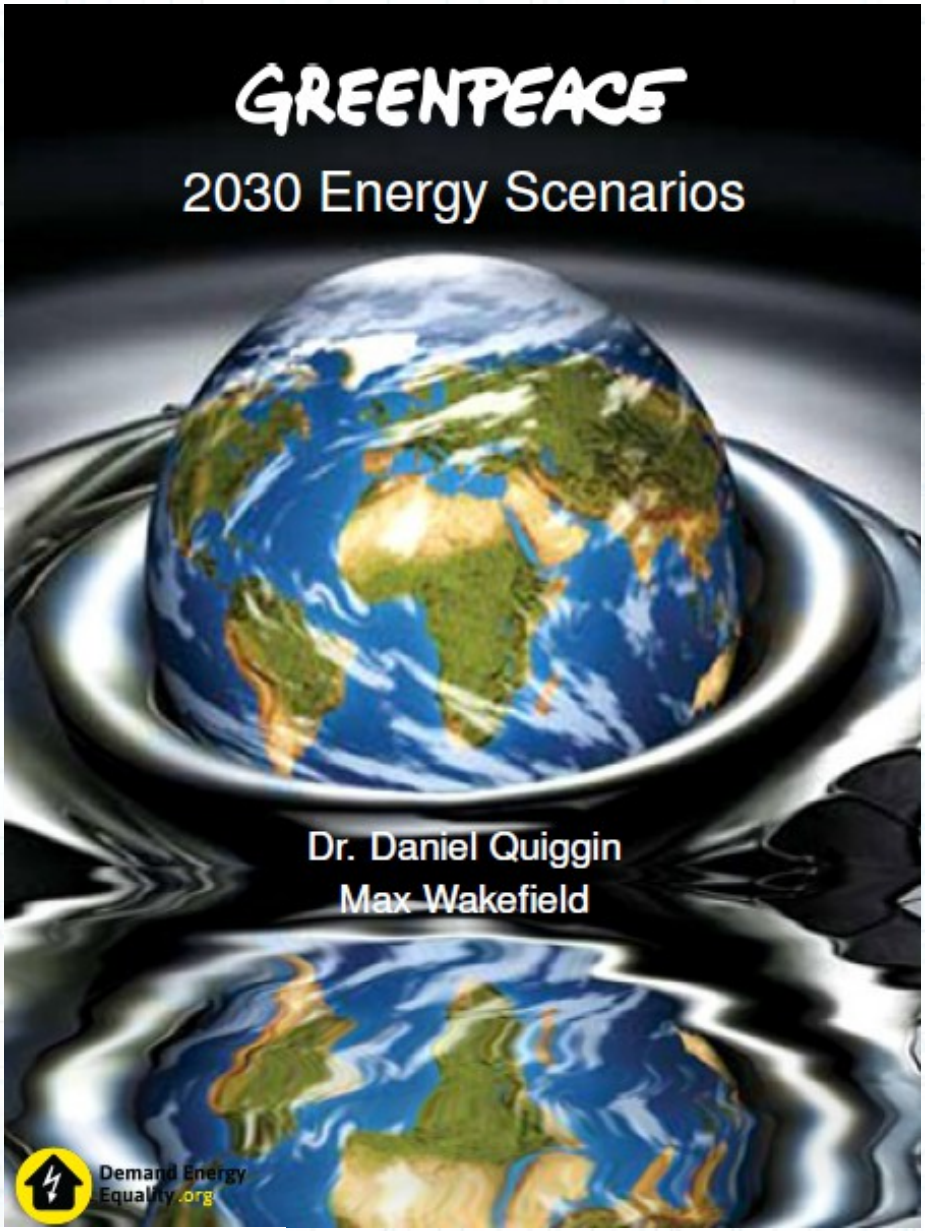

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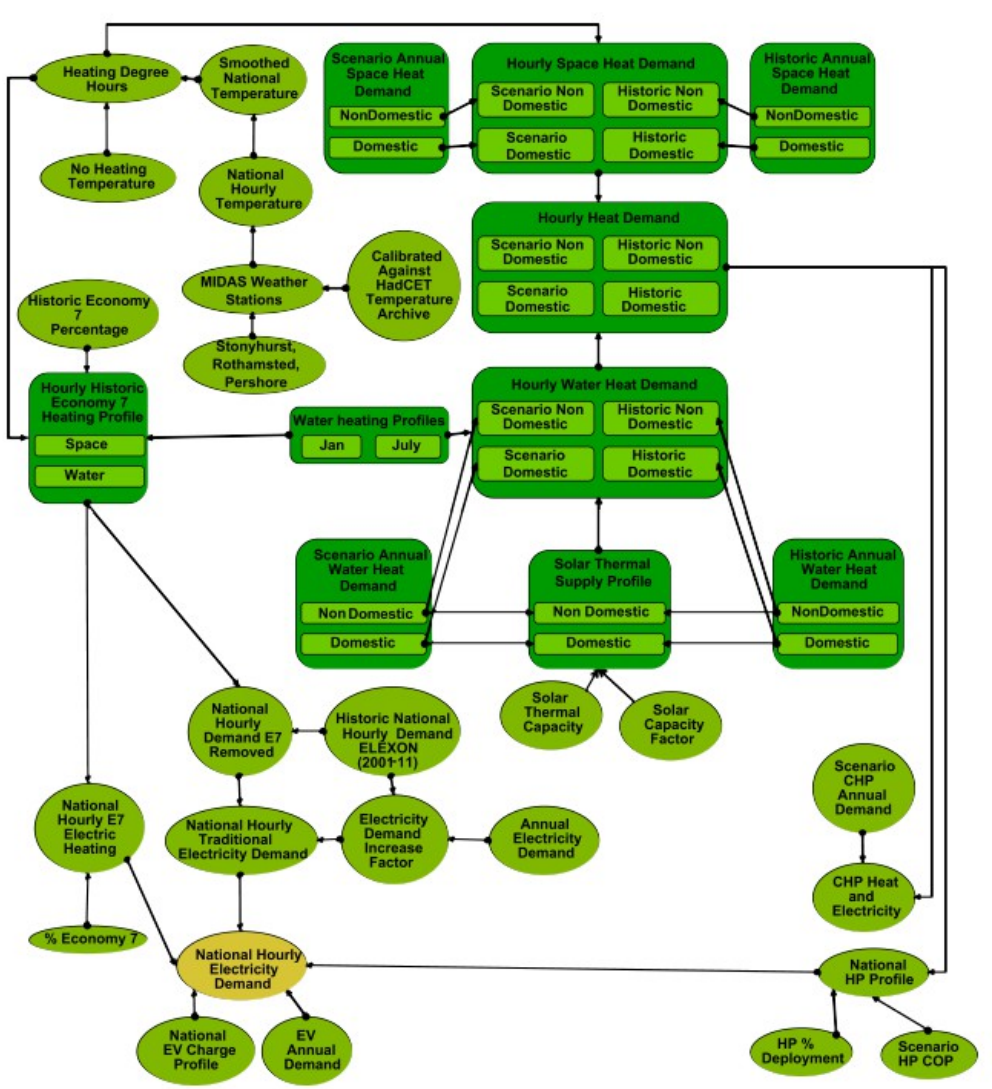
Objectives

- Greenpeace modelling criteria
  - 50 – 100 gc02/kwh by 2030
  - Ensure technically possible
  - Ensure reliability of supply – black/brown outs within historic norms
- Outputs
  - National installed generator capacities
  - National demand targets
  - Electrification technologies defined
  - DSM quantified
  - Storage and balancing mechanisms
- No-goes
  - No new nuclear, coal or CCS

Unique elements

- Treatment of demand side
- Time step & time horizon of the data
  → 11 years, hourly
- Granularity of weather data
  → hundreds of weather stations
- Heating modelling
  → hourly → cutting edge
- Above leads to ability to model decarb + electrification simultaneously
- DSM
  → national and household



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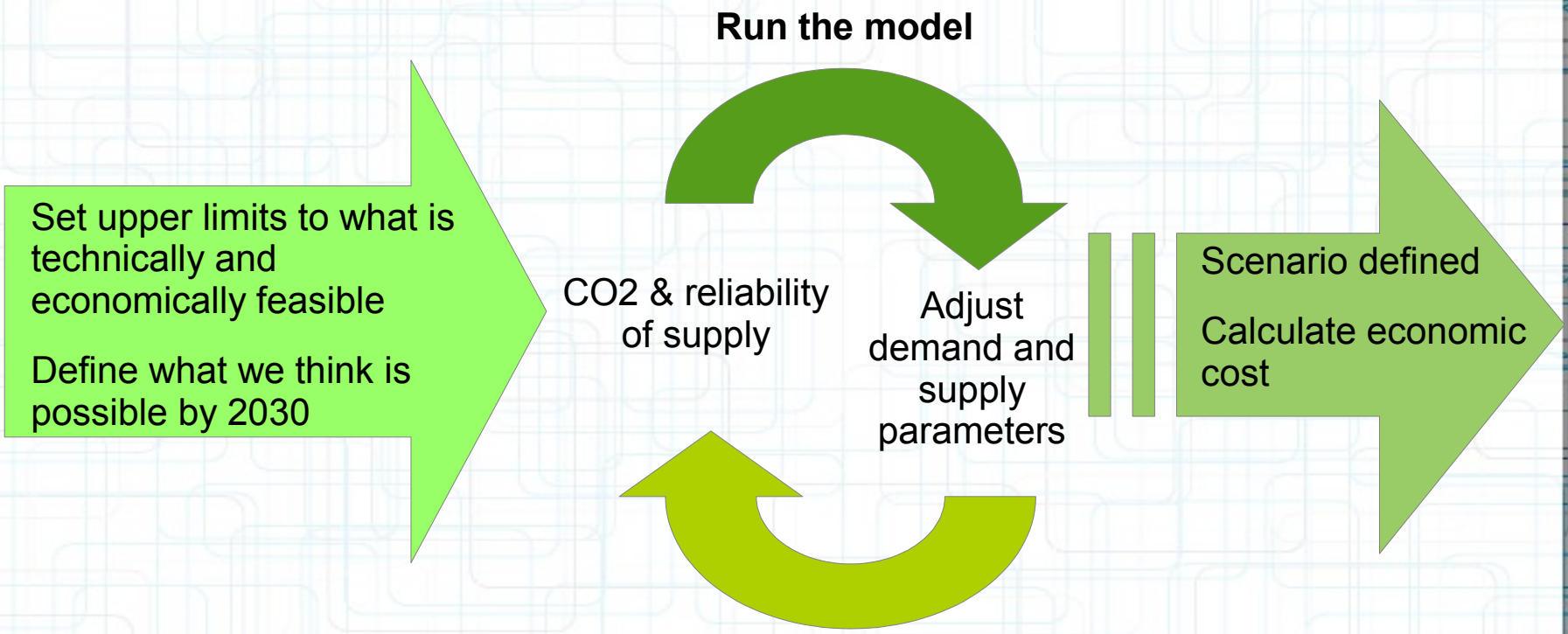
Method


Run the model
Set upper limits to what is technically and economically feasible
Define what we think is possible by 2030
CO2 & reliability of supply
Adjust demand and supply parameters
Scenario defined
Calculate economic cost

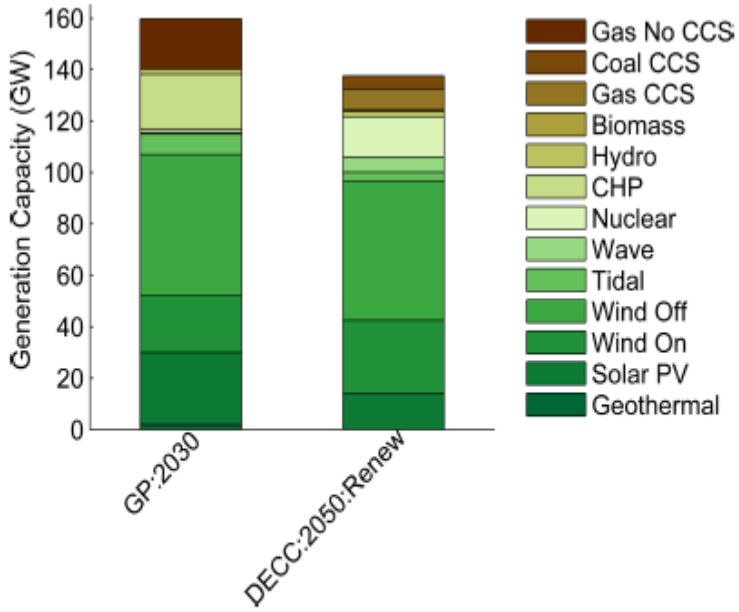
Outputs / Key outcomes

- Radical decarbonisation of the power sector in the UK is possible by 2030

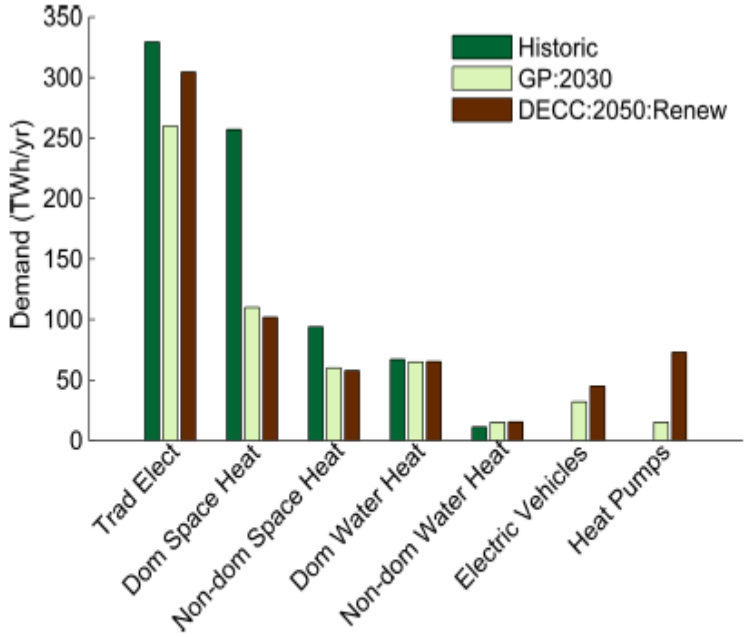
  51 - 78 gCO2/kWh

- No significant assumptions are made about the innovation of new technologies
- Electrification of substantial proportions of transport and heating is possible, while maintaining constant supply-demand balancing.
  - 12.6 m EVs, 25% heat electrified
- GP:2030 experiences no periods of deficits (blackouts of brownouts).
- Load factors on CCGTs generators are maintained.
- Ambitious domestic heating demand targets must be met → -57.2 %
- Domestic DSM plays a modest role in mitigating periods of deficit.
- Electricity costs = 8.2 – 13.8 p/kWh → generation cost
- £200 – 250 billion investment required

Outputs / Key outcomes



(a) *GP:2030* generation capacity, compared to *DECC:2050:Renew*.



(b) Demand parameters from *GP:2030* and *DECC:2050:Renew*, compared to historic demands. Annual demand in TWh/yr.

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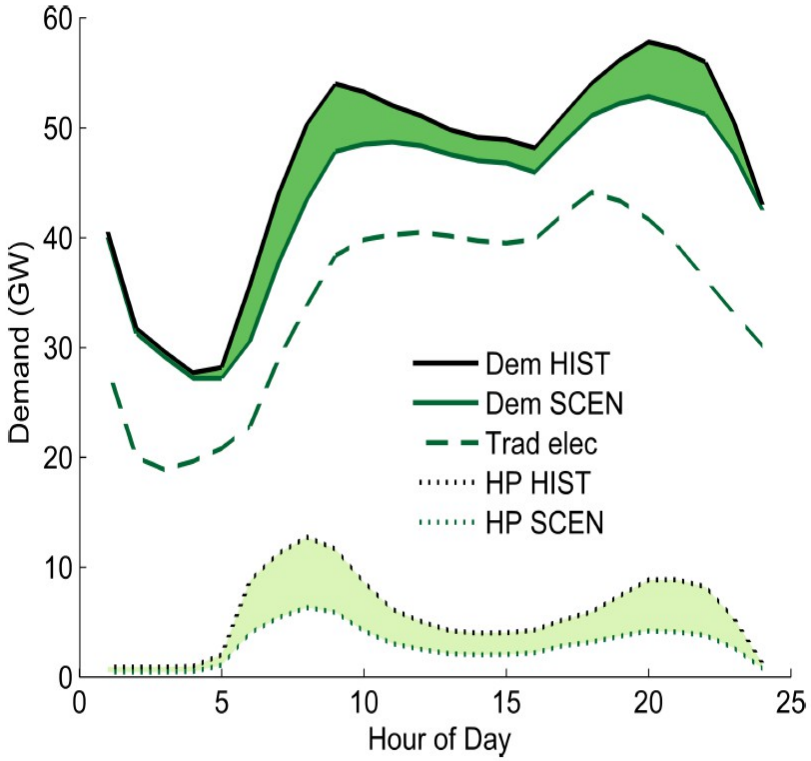
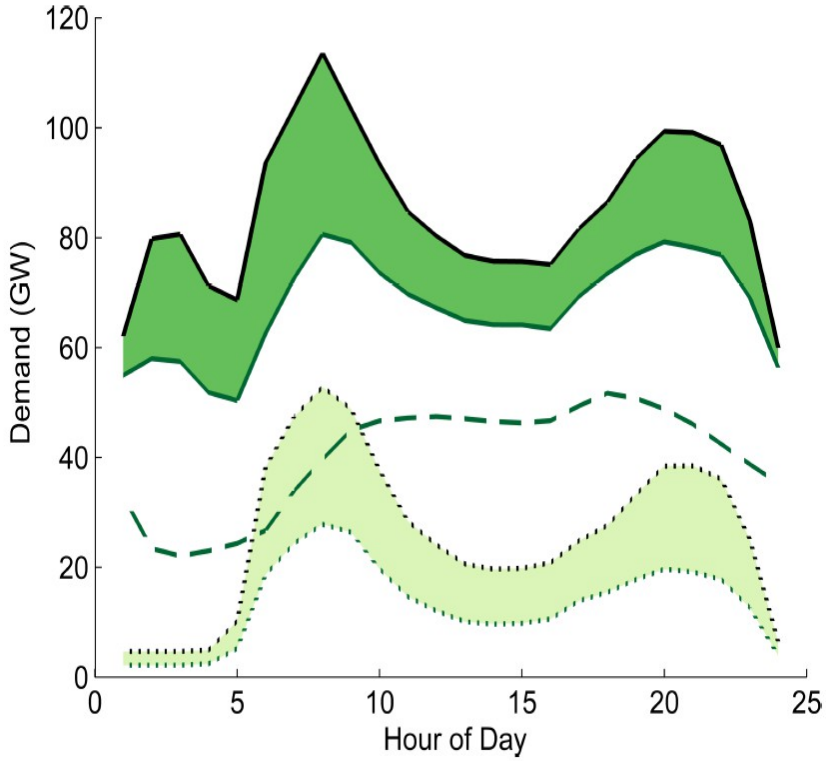
Outputs / Key outcomes



(a) Greenpeace.



(b) DECC Renewable.

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Outputs / Key outcomes

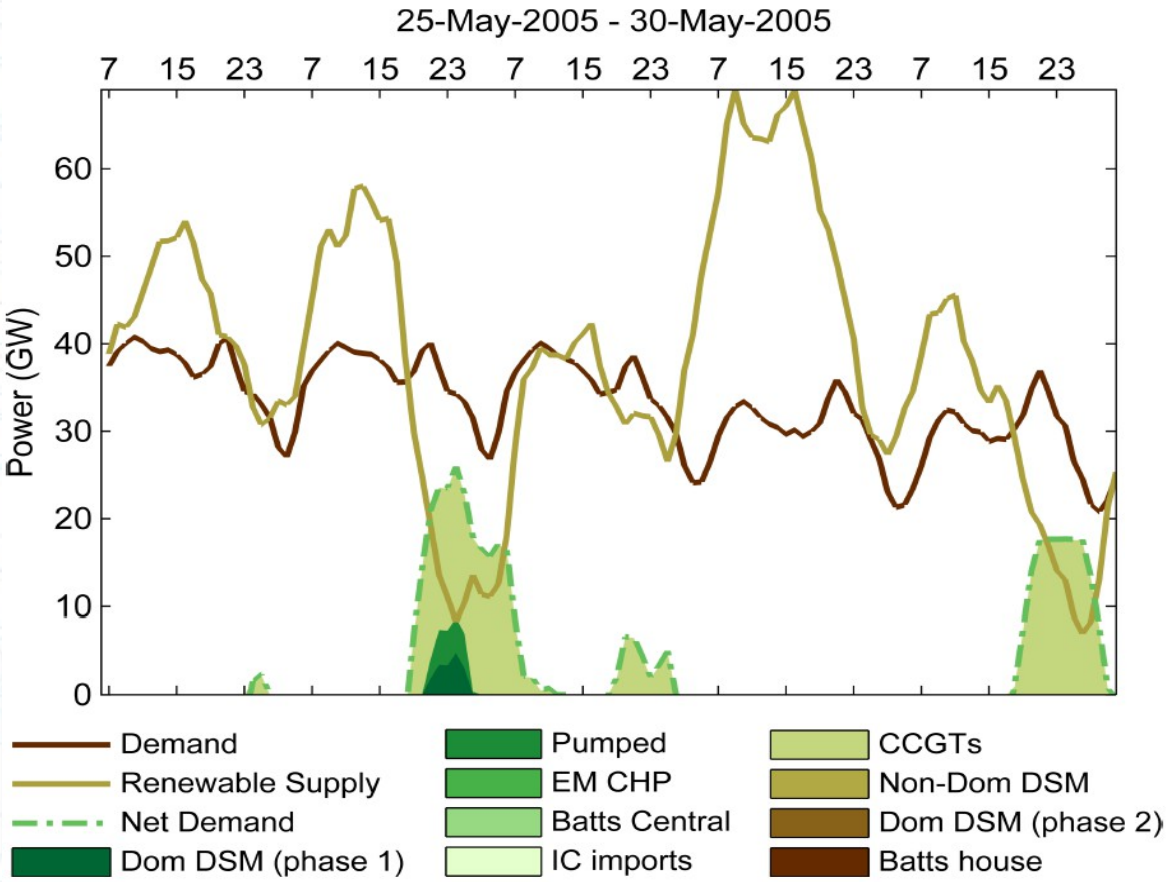

Figure 3.9: Non-dispatchable *GP:2030* net demand post renewables and the balancing mechanisms and CCGTs that fill that net demand during the summer minimum in renewable supply.

Outputs / Key outcomes

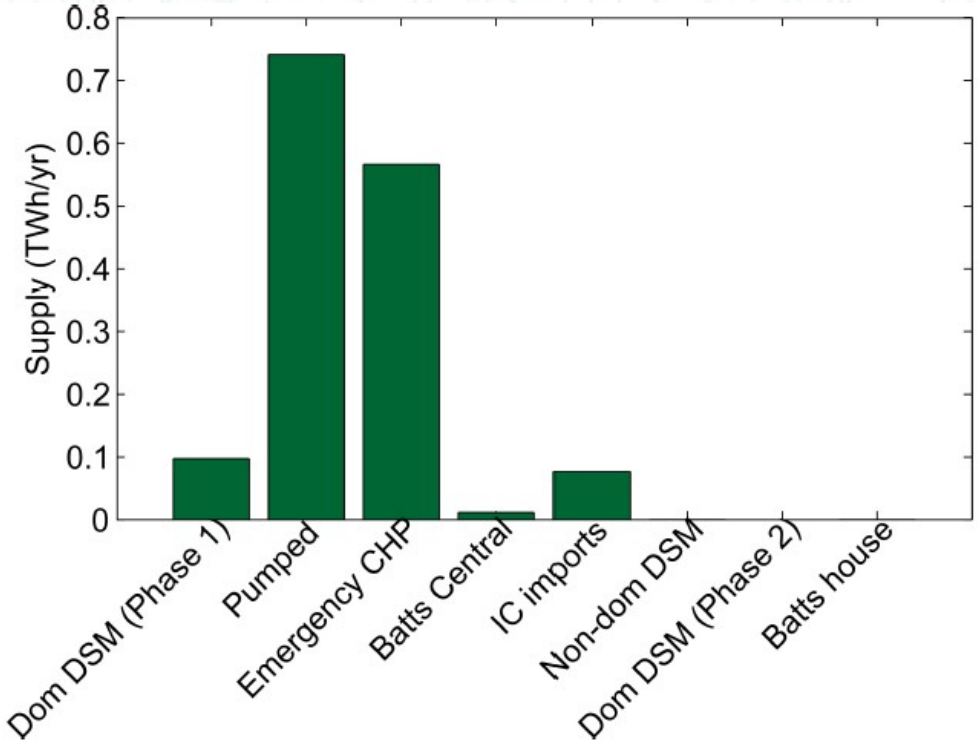

Figure 3.10: Annual average energy supply from balancing mechanisms

Outputs / Key outcomes

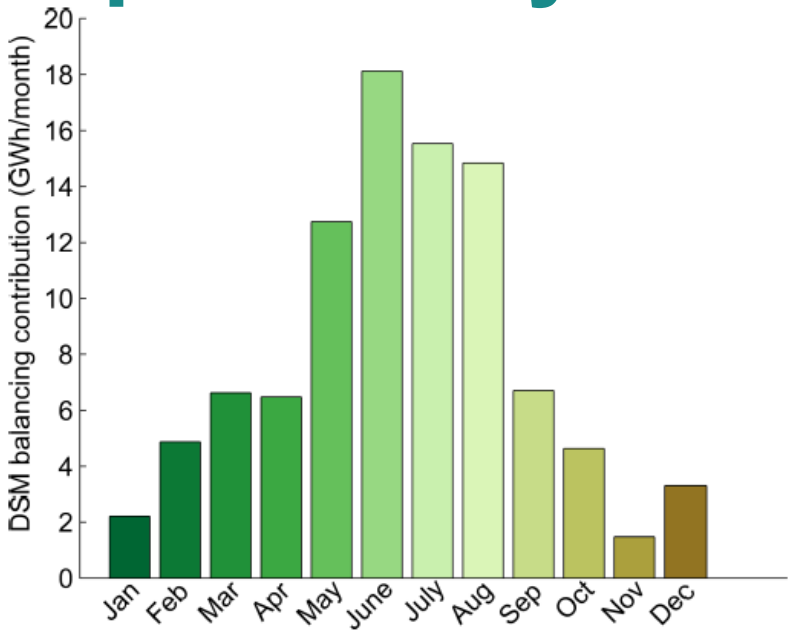

Figure 3.12: Domestic DSM contribution towards balancing per month in GWh

	Trad			HP		
	ProsSub	TypTrait	ConCirm	ProsSub	TypTrait	ConCirm
% DSM	22	23	16.2	3.9	4.1	0
% DSM≤10	17.2	16.4	10.9	3.1	3.3	0
% DSM>10	4.7	6.6	5.3	0.8	0.8	0

Table 3.3: Probability of DSM participation requirement during the evening peak (9pm - 11pm) demand periods, and of those DSM periods which are greater or less than 10% of demand for each typical household, in Jul/Aug weekdays.