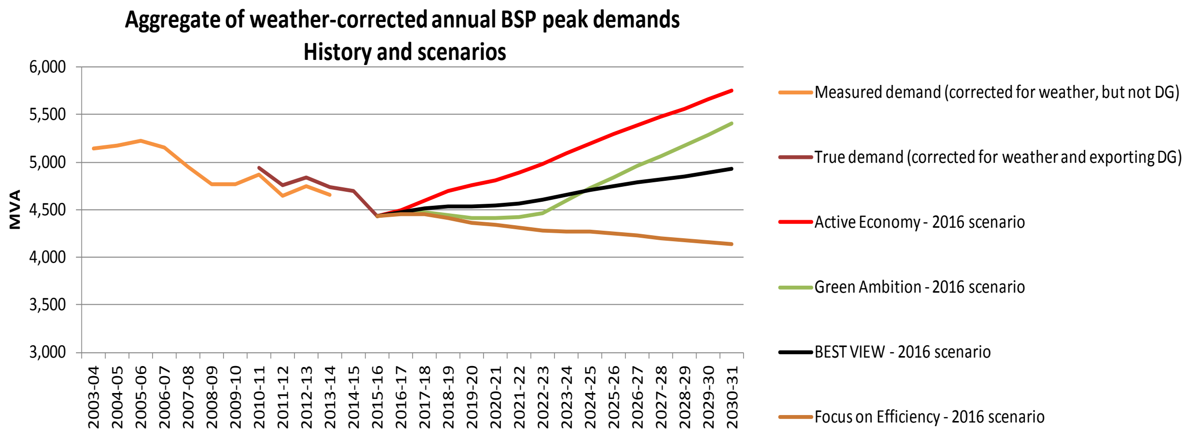
The 2016 update to our peak demand scenarios

Each year, we produce scenarios of annual peak demand for each primary, BSP and GSP – this is part of ensuring we plan for sufficient capacity on our network, and meet our reporting obligations to Ofgem, National Grid and our customers.

We have just completed updating our scenarios for winter peak demands. The scenarios use the latest baseline loading data for the financial year 2015/16, and benefit from improvements in inputs and methodology developed in our innovation projects.

Our best-view of the future of peak electricity demand is slow growth to 2030, but still not returning to 2005 levels by 2030. This is shown by the black line on the graph below, which indicates the sum of measured peak demands at all Bulk Supply Points, adjusted both for the effects of large metered generators which export to the local network, and for 'average cold spell' weather conditions.



The aggregate view above is the sum of the detailed scenarios produced for each substation, reflecting the local mix of domestic versus non-domestic customers, economic activity levels, and the likely uptake of electric vehicles and heat pumps in each area – so demand growth can differ significantly by area and by asset, growing more quickly in some areas than others eg Manchester and Ribble versus Cumbria. This means local interventions to add network capacity may be justified even with low growth in peak demand overall.

Although we have a best-view of peak demand out to 2030/31, there are multiple reasons for significant uncertainty about the future. So instead of one forecast, we create a set of plausible peak demand scenarios to reflect that uncertainty, as shown in the graph above.

BEST VIEW – Underlying growth in customers' energy demand at peak is based on interpretation by our consultants of the Office of Budget Responsibility's central long-run economic growth rate (2%, March 2016), and expected changes in demographics and energy efficiency. We combined this with latest baseline load data, recent local trends in peak demands for each substation. This underlying demand trend is relatively flat, with a slight rise in demand in the next few years, followed by a slow fall to 100 MW below current levels by 2030. We then add an incremental component associated with new technologies, based on the Low view from DECC/Ofgem of uptake of electric vehicles and of non-domestic heat pumps for our area, plus new analysis we commissioned of likely domestic heat pump uptake, and latest data on the load profiles of electric vehicles and heat pumps. These new technologies are expected to add 600 MW of peak load by 2030 (200 MW from electric vehicles and 400 MW from heat pumps), with most of this occurring after 2023. The net effect is an overall increase in load of 500MW above current levels by 2030.

Active Economy – As for BEST VIEW, but with a consistently higher economic growth rate above 3%, and minimal increases in energy efficiency. An extreme upper view.

Focus on Efficiency – As for BEST VIEW, but assuming increased government, commercial and consumer focus on energy efficiency, combined with a low scenario of domestic heat pump uptake.

Green Ambition – As for Focus on Efficiency, but instead with DECC/Ofgem's High views of uptake of electric vehicles and heat pumps.

Our judgement of the approximate likelihood of the best-view scenarios is 65%, with 5%, 15% and 15% respectively for the others, acknowledging that the true outcome will be somewhere in between, and not a smooth trend.

Uptake assumptions for Electric Vehicles and Heat Pumps

	Low Carbon Technology	2022	2030	Source of uptake level
BEST VIEW	Electric Vehicles	49,000	252,000	DECC/Ofgem Scenario 4 'Low'
	Non-domestic heat pumps	6,000	11,000	
	Domestic heat pumps	56,000	182,000	DELTA EE scenario
GREEN AMBITION	Electric Vehicles	148,000	593,000	DECC/Ofgem Scenario 1 (medium EV, high HP)
	Non-domestic heat pumps	7,000	16,000	
	Domestic heat pumps	74,000	587,000	

Similarities to the 2015 peak scenarios

- The background component reflects economic, demographic and efficiency factors, including local variations. We continue to use the underlying demand scenarios developed for us by the consultancy CEPA in 2015, reflecting differences in electricity demand by local authority and between domestic and non-domestic customers.
- We add additional demand from heat pumps and electric vehicles.
- We consider 'true' demand, adjusting measured demand for the output of large generators which export to our network. The contribution of generators to capacity is considered separately outside the demand forecast.
- As in last year's scenarios, we have approximately weather-corrected all the scenarios by adjusting peak demands using National Grid's national 'Average Cold Spell' factor. So there is additional weather-related uncertainty in peaks of ± 4%.
- For the incremental component, we continue to use DECC/Ofgem's scenarios from the end of 2014 for uptake of electric vehicle and non-domestic heat pumps.

Changes for the 2016 peak scenarios

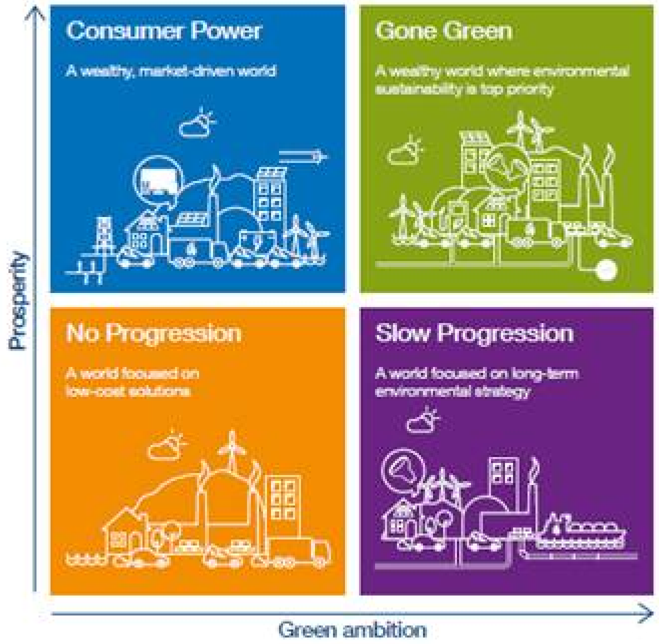
- Updates for latest substation loading and units distributed data (from 14/15 to 15/16)
- Switch in our best-view scenario the underlying demand from using CEPA's Central Scenario to Stalled Economy scenario, due to the downward revision of the OBR's GDP forecast from 2.5 to 2%
- Revised assumptions for domestic heat pump uptake, types and incremental load at 6pm based on work in our 'Demand Scenarios' NIA project with DELTA EE, recognising that there are multiple types of domestic heat pump. At BSP or primary level by 2030, the scale of increased heat pump load is similar whether considering an average winter peak or an exceptionally cold winter peak; in sub-zero temperatures, hybrid heat pumps switch to gas, but air source heat pumps and their resistive electrical lead to significant increases in local load serving those types of heat pump. This study indicated that at high uptakes in an extremely cold winter, heat pump load could increase winter peaks by 3.5 GW by 2050.
- Revised assumptions for electric vehicle incremental load at 6pm based on the 'My Electric Avenue' project, but with electric vehicle uptake scenarios still based on last year's DECC/Ofgem numbers for our region.

Upcoming changes for the 2017 scenarios (related to our 'ATLAS' NIA project)

- Consider not just peaks, but year-round half-hourly loading including minima
- Consider incremental load from EV and HP not just at time of the existing evening peak, but take account of the variation in load over the day and night.
- Consider not just active power flows, but also leading the industry in developing views of reactive power flows on a DNO network and at our boundary with National Grid.
- Improving our view of true demand to take account of all generator types
- Developing weather-correction of demand around the year.
- Developing DG scenarios to understand how measured demand may change i.e. the effective combination of true demand and the effect of generation.

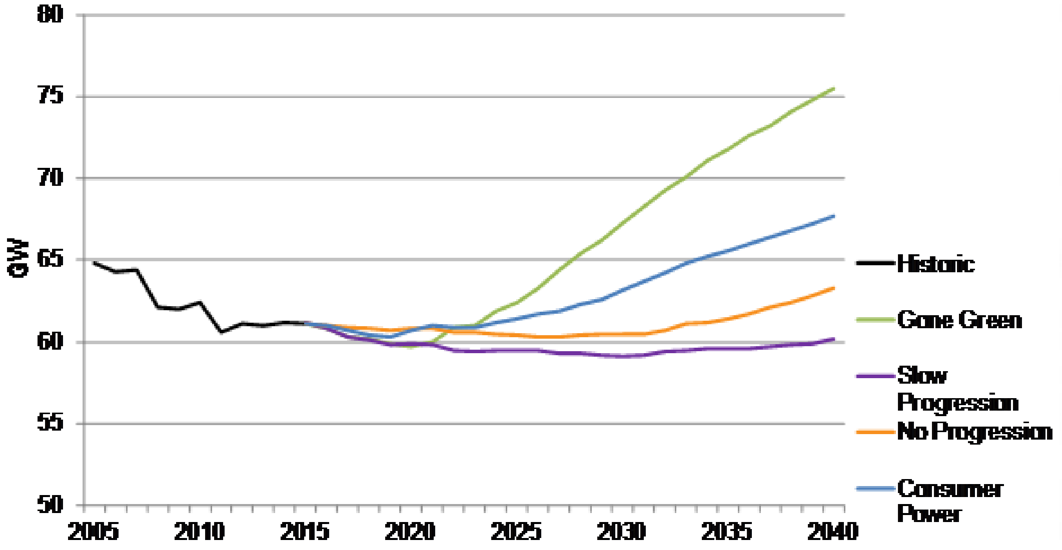
Comparison with National Grid's Future Energy Scenarios 2016

Since we produced our scenarios in June 2016, National Grid has published their own analysis of 'credible and plausible' long-term pathways or scenarios for electricity and gas in Great Britain. Their four scenarios cover a mix of prosperity and environmental ambition as shown below.



A key output for us is their view of (true) winter peak demand – weather corrected and not suppressed by distributed generation so comparable to true demand on our network but including demand at extra high voltages and transmissions. **National Grid's analysis suggests little change in peak demand by the end of ED1 (2023) across GB, but further growth after that in all scenarios except Slow Progression**. NB. This hides significant local and regional variation, which our scenarios capture.

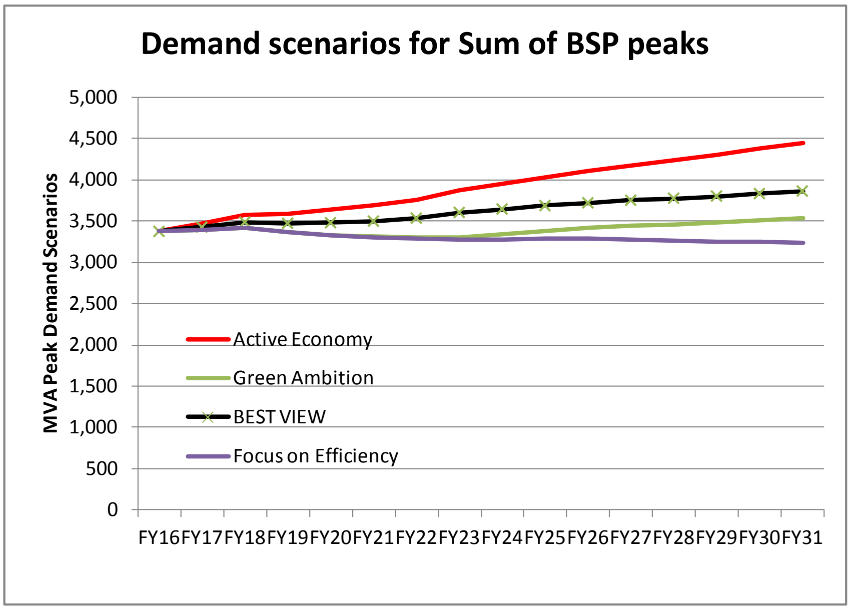
Electricity: Average cold spell peak demand for Great Britain



National Grid do not comment on the likelihood of their scenarios. However we consider our own best-view peak scenario is consistent with a view between No Progression and Consumer Power – both in terms of the underlying assumptions on economic growth and environmental ambition. **This is a good sense check that our own scenario work and best-view are credible.**

Addition of summer peak scenarios

To complement our winter peak scenarios, we have now produced summer peak scenarios for all of our BSP and Primary substations. This is the first time we have separately identified summer peaks. We will use the summer peak scenarios to assess which is the season of most onerous demand relative to capacity, but recognising the significant uncertainty in future scenarios.

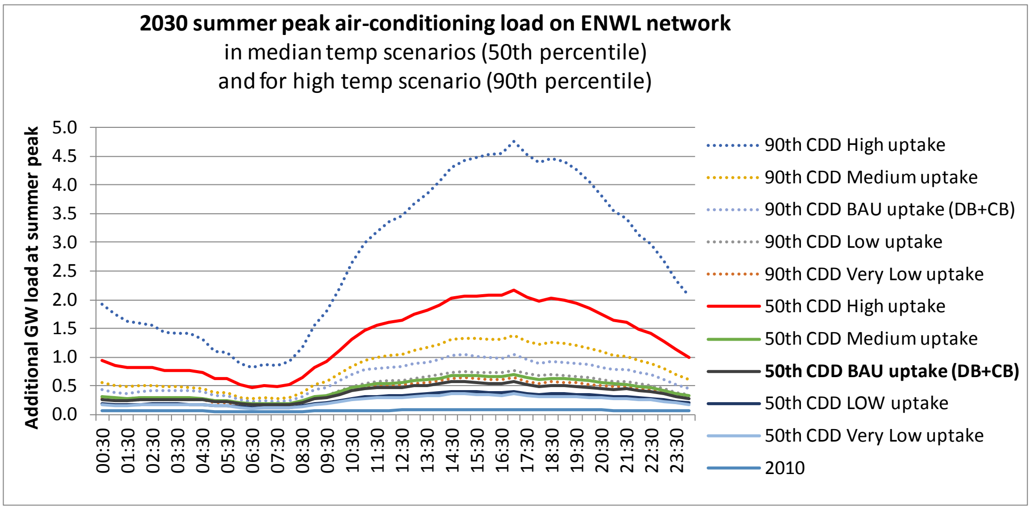


In terms of underlying demand trends, these are similar to the CEPA demand trends, but removing our assumption that smart metering is reducing domestic peak demand, given the smaller domestic peak in summer. We also updated using Ofgem data on the scale of PV in our network area which is operating but where we do not receive data on its output – we expect this to suppress peak demand.

In terms of the incremental component of demand, the key change is to remove heat pump load and replace with air conditioning load. For our **Active Economy** and **Best-View** scenario we chose to reflect a modest uptake scenario informed which corresponds to 2.6% of domestic customers and 29% of commercial floor-space being air conditioned by 2030, and the likely usage profile based on median cooling requirements in our region at 6pm in the summer peak in 2030. As in the winter case, these incremental components add around 600MW of load, with a third of the addition being electric vehicle load, and the remaining being additional air conditioning load. In our **Green Ambition** and **Focus on Efficiency** scenarios, we assume no growth in air conditioning demand, assuming that cooling needs are addressed in other ways. So these incremental scenarios reflect the difference between low and high scenarios for electric vehicles only.

One of the key issues with summer peaks is time of day; we identified that the vast majority of evening peaks are around 5.30-6pm, but in comparison there is a wide spread of the time of day of summer peaks, with many peaking in daytime or overnight. Additional loads from electric vehicle, electric heating loads and air conditioning are also significant at this time, but they do not follow the profile of existing loads. This shows the importance of our future scenario work in our new approach to demand scenarios – in the ATLAS project - which addresses the full half-hourly load behaviour, rather than an arbitrary choice of peak time of day. We will be better able to reflect the shift in timing of additional load. All but one of our bulk supply points has winter peaks at present, there is greater variety in the time of year and day peaks for primaries – both in summer and in winter - we expect this situation to become more complex over time.

Our air conditioning scenarios are informed by work this year with the University of Manchester on air conditioning – this has completed a review of the evidence base, and demonstrated the significant uncertainty around the scale of future air conditioning demand, its variability by time and location across our network particularly amongst non-domestic customers with very diverse cooling needs. There is also potential for much higher uptakes and much higher additions to summer peak demands if climate change brings much raised temperatures. In credible but unlikely scenarios, additional air conditioning load in summer could be several GW e.g. if social practices and costs meant significant deployment. We will feed this into our future work.



2030 summer peak air-conditioning load on ENWL network
in median temp scenarios (50th percentile)
and for high temp scenario (90th percentile)
Additional GW load at summer peak
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
00:30
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18:30
19:30
20:30
21:30
22:30
23:30
90th CDD High uptake
90th CDD Medium uptake
90th CDD BAU uptake (DB+CB)
90th CDD Low uptake
90th CDD Very Low uptake
50th CDD High uptake
50th CDD Medium uptake
50th CDD BAU uptake (DB+CB)
50th CDD LOW uptake
50th CDD Very Low uptake
2010