Gas Demand Forecasting

GDN Project – Delta EE

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LCNI 2018

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Introduction to Wales & West Utilities

- Gas System Operator & emergency service for Wales & south west of England
- Peak capacity just under 500 GWh per day, 58 GWh of storage deployed each day
- £2m invested each week into our future low-cost, green gas & H_2- ready network
- Varied innovation programme for today and tomorrow's customers
- Projects are carried out within and outside the NIA funding arrangements
- Our innovation approach is highly collaborative and projects are business led

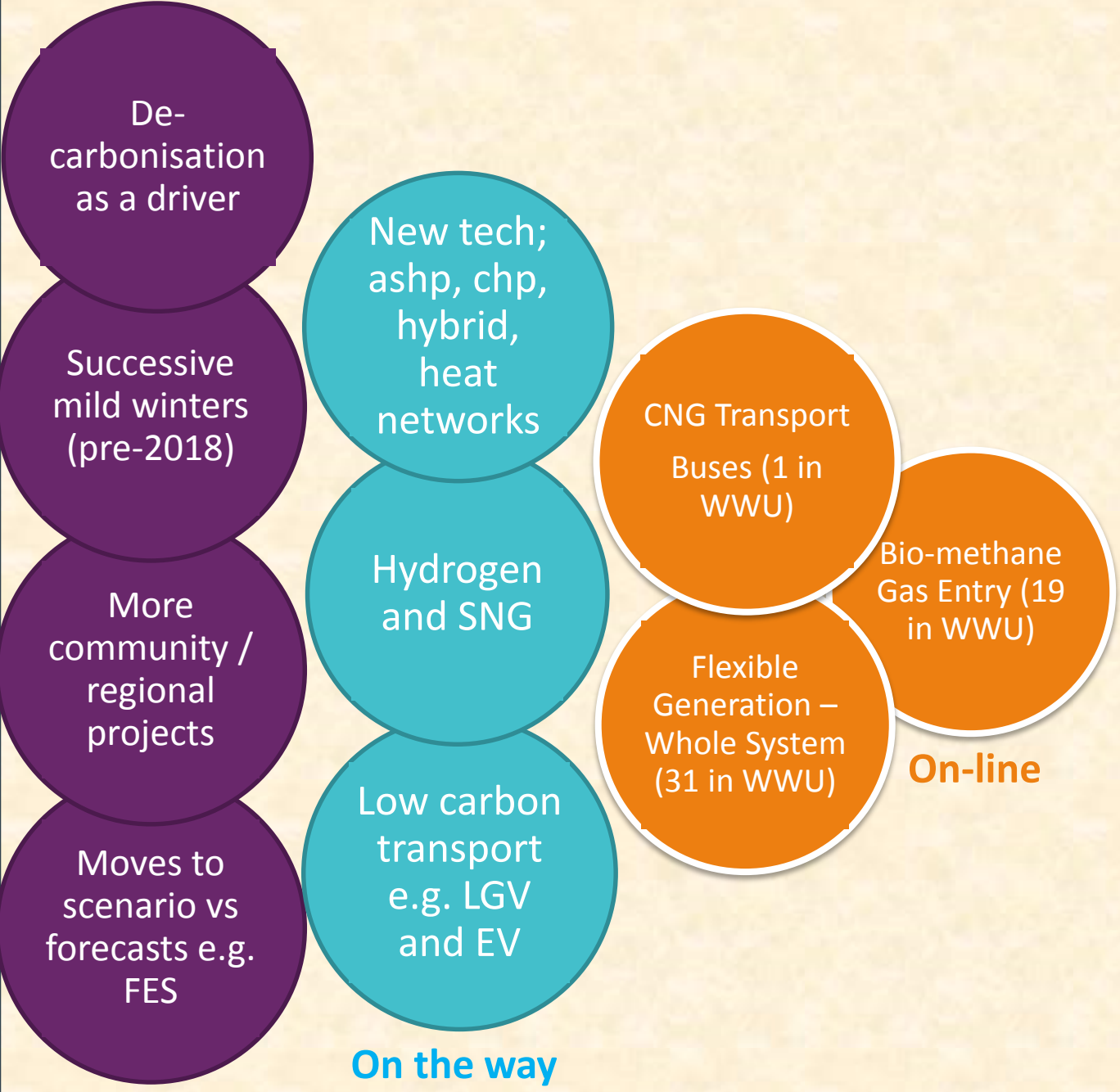
Long Term Forecasting Background:

Legacy processes assumed gas would continue to be used by similar customers for similar processes

- Temperature as a key driver for gas usage
- Sites forecast together based on size
- Forecast GDP used as a driver for growth
- Peak Daily Gas Demand derived from annuals

Process served us well:

- Well understood
- Consistent
- Representative of reality



A requirement for more certainty and a general review of approaches

New models for investment and whole network analysis - requiring new inputs

Aspiration for shared learning across all GDNs as part of any project

Gas Demand Forecasting - Proposal

Background:

- The quantity and type of future customer energy usage across GB is uncertain and difficult to predict. This means that the gas network will need to be prepared to provide a flexible service in terms of customer demands. Some examples of this include:
  - Increased use of gas power stations responding to intermittency of renewable generation
  - New gas usage in homes using hybrid heating systems
  - Use of gas for vehicles
  - Connections of CHP's

Proposal:

- To undertake a 3 stage project to review and improve our long term forecasting processes to support both existing needs and data for our new investment model. Stage 1 for WWU only & we will seek full network collaboration for stages 2 & 3.

Benefits:

1. A strategic forecasting framework that can accommodate changes in gas demands arising from decentralisation and decarbonisation of the gas system to allow us to make the best investment decisions, on our network, for our customers.

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Gas Demand Forecasting Phase 1

- Considered a large number of areas for improvement
- Provided high level forecasts of the potential impacts on networks, capacity and storage
- Set recommendations for areas to consider in more detail in future phases

Project Registration

Project Title		Project Reference
Gas Demand Forecasting		NIA_WWU_044
Project Licensee(s)	**Project Start Date**	**Project Duration**
Wales and West Utilities	October 2017	0 years and 2 months
Nominated Project Contact(s)		**Project Budget**
Bethan Winter - Bethan.Winter@wwutilities.co.uk		£36,667

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Gas Demand Forecasting Phase 2

- Focussed on key gaps identified in phase 1
- Covered work originally proposed as gaps 2 and 3

Project Registration

Project Title	Project Reference
Gas demand forecasting – Phase 2	NIA_ WWU_047

Project Licensee(s)	Project Start Date	Project Duration
Cadent, Northern Gas Networks, SGN and Wales and West Utilities	June 2018	0 years and 4 months

Nominated Project Contact(s)	Project Budget
Wales & West Utilities – Bethan Winter Cadent – Lorna Millington NGN – Chris Hogg SGN – Alex Webb	£208,667

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Cadent Your Gas Network

SGN

Northern Gas Networks

DELTA Energy & Environment

Key gaps considered in Phase 2

- 1. Consolidation of domestic measures ★
- 2. Locational impacts of demand
- 3. Electric and Gas Vehicles
- 4. Combined impact of Electric Vehicles and Heat Pumps ★
- 5. Review of annual to peak relationship
- 6. Future generation mix scenarios
- 7. Green gas injection
- 8. What if' analysis on policy
- 9. Commercial / industrial analysis
- 10. Emerging technologies and business models

★ Look at as an example

Key Outputs

- Demand change by component by year
  - Impacts on capacity investment incl. storage and compression
    - Peak, Storage and Annual
    - For a range of geographies
- Information on profiling within day for new load types e.g. Electric Vehicles
- Linkage between vectors e.g.
  - Gas Boiler -> Air Source Heat Pump -> Gas Fired Power Station
- Robust higher confidence forecasts in the short term ~ 10 years
- Consideration of sensitivities and scenarios for the longer term

RESIDENTIAL HEATING

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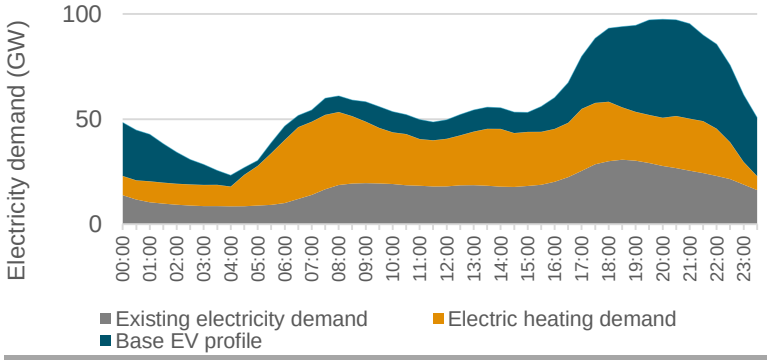
Heat pump and EV impact on peak demand

Key messages

- The combined impact from EVs and HPs can be mitigated by introducing flexible solutions. Coordination is required to avoid new peaks occurring from moving loads around in isolation.
- Residential peak electricity demand is expected to be between 57 and 93 GW, most likely around 70 GW. This is an increase of 48 GW from 2017 levels

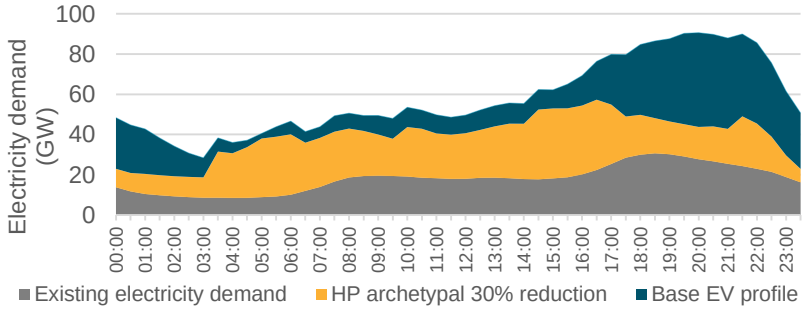
Base scenario – no flexible electric heating; uncontrolled EV charging

- Peak demand occurs at **8:30 pm**



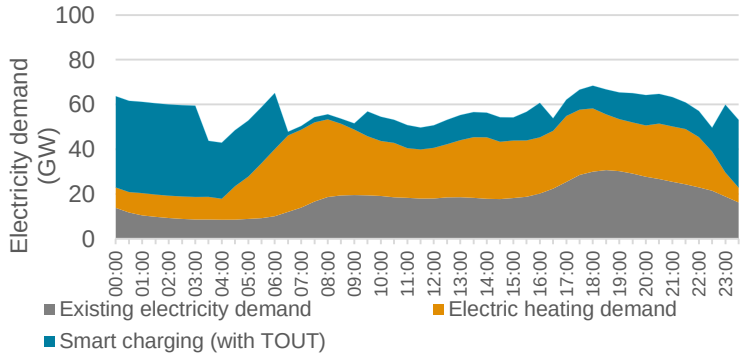
Heat Pump flexibility scenario

- Peak demand now occurs at **8:00 pm**.



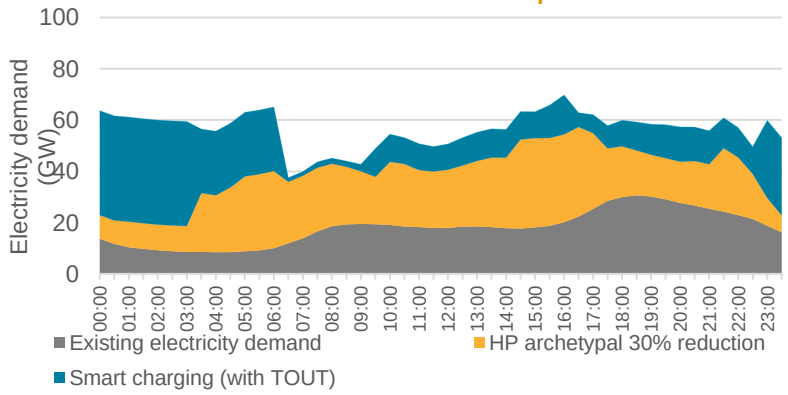
EV flexibility scenario

- Peak demand now occurs at **6:00 pm**.



Combined flexibility scenario

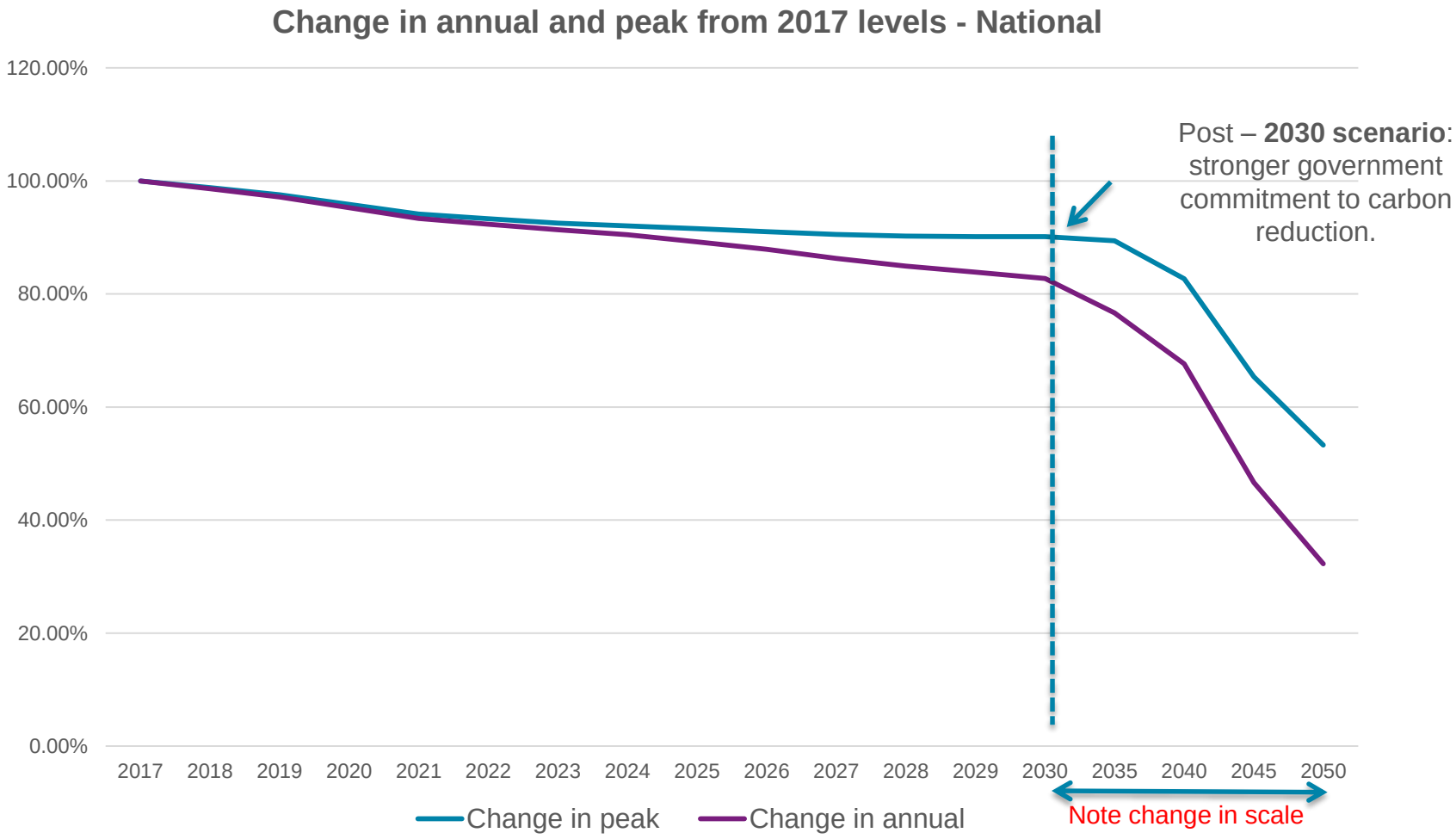
- Peak demand now occurs at **4:00 pm**.



Sources: Northern Powergrid

**A diversity factor of 36% is applied to account for the likelihood of home chargers to be charging their cars at the same time.*

Residential gas demand results



Gap 1 sensitivity testing: Scenario assumptions

1a. Stronger regulation to favour 'electrification of heat'

- These sensitivities see a faster decline in gas demand. We will test this via two sensitivities
  - Assuming all gas appliances are banned from 2025 in new builds instead of 2030
  - Assuming the above and that gas boilers in retrofit are banned from 2030 rather than 2040

1b. Higher energy costs

- These sensitivities test changes in energy price assumptions compared to the base case
  - BEIS 'high price' scenario: both gas and electricity prices increase, but spark spread remains constant
  - High electricity price: electricity prices only increase by 30% compared to base case assumptions, causing gas appliances to be favored from an economic perspective

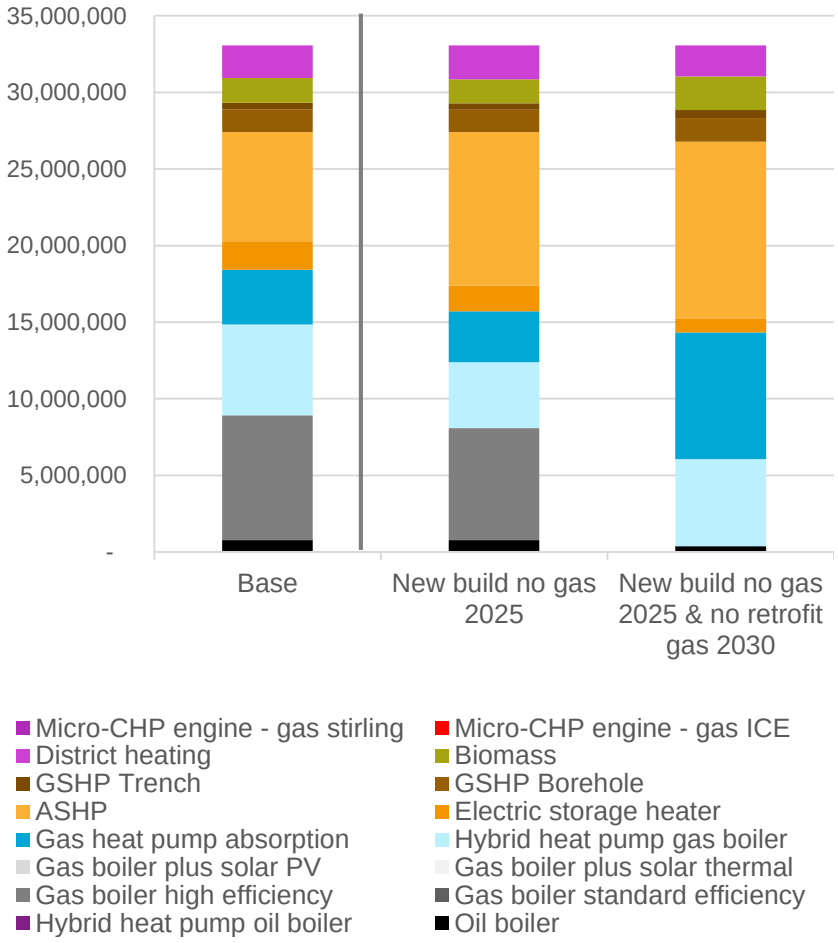
1c. Low carbon support

- Government support increases so that 2050 energy targets can be achieved. Three scenarios are tested:
  - Subsidies for ASHPs, GSHPs and hybrid systems are present to 2050, remaining at 2018 tariff levels
  - Subsidies for the above technologies and additionally gas absorption heat pumps are present to 2050.
  - Insulation rates improve so that 5% of properties are being insulated per year from 2020 compared to 3% in the base case

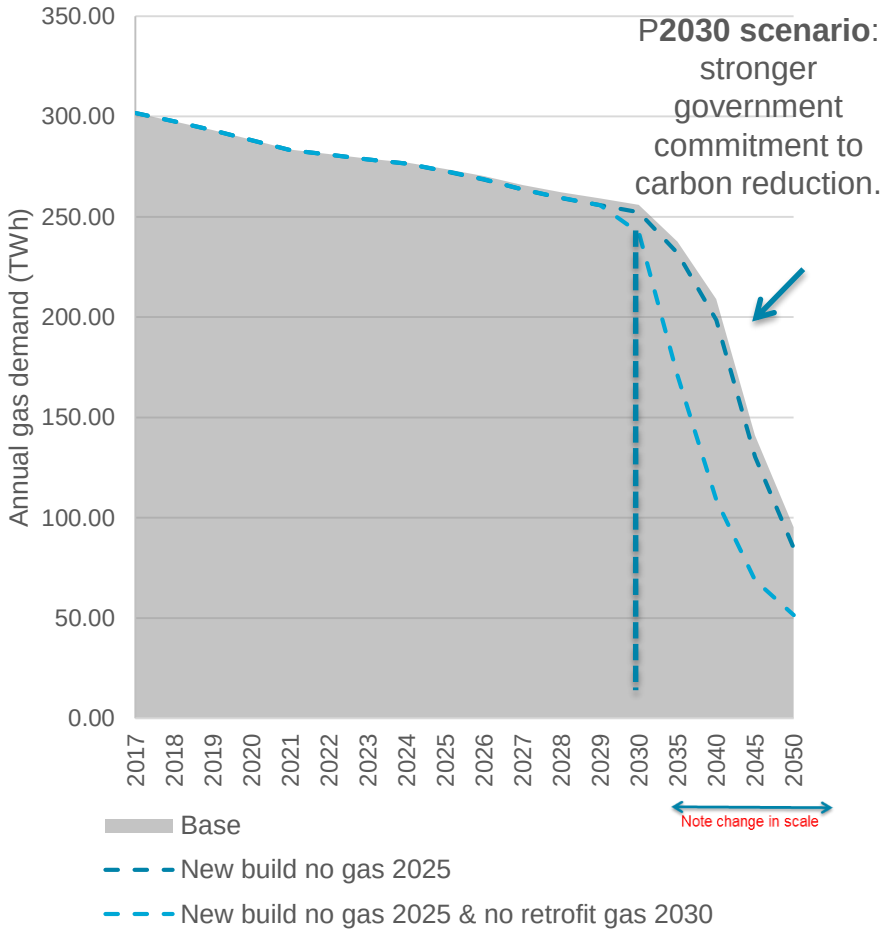
Residential gas demand sensitivities

1a. Stronger regulations to favour 'electrification of heat'

Installed base of heating appliances in 2050



Comparison of total annual gas demand



COMBINED IMPACT OF AIR SOURCE HEAT PUMP AND EVS

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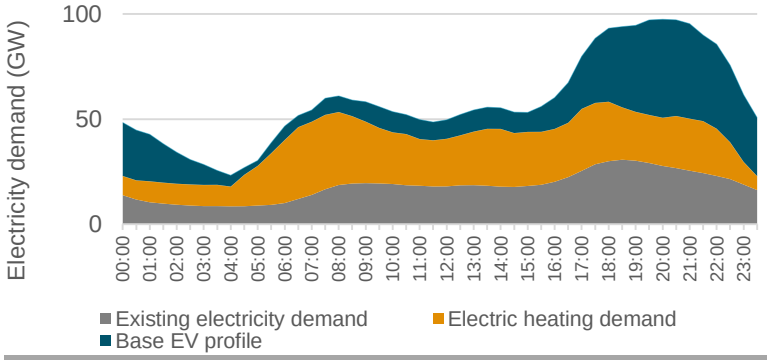

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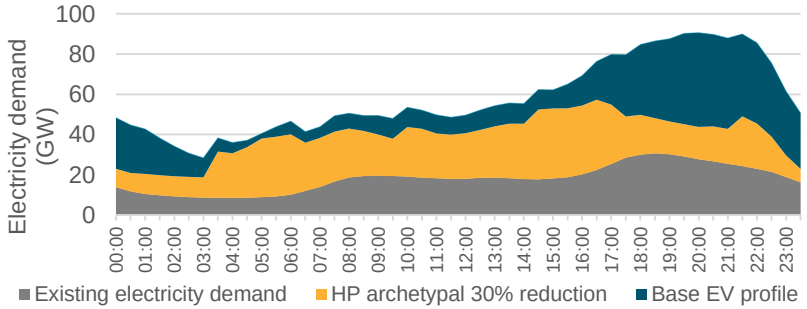

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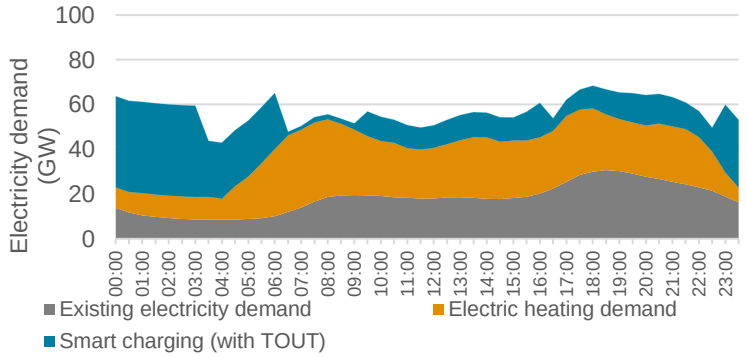

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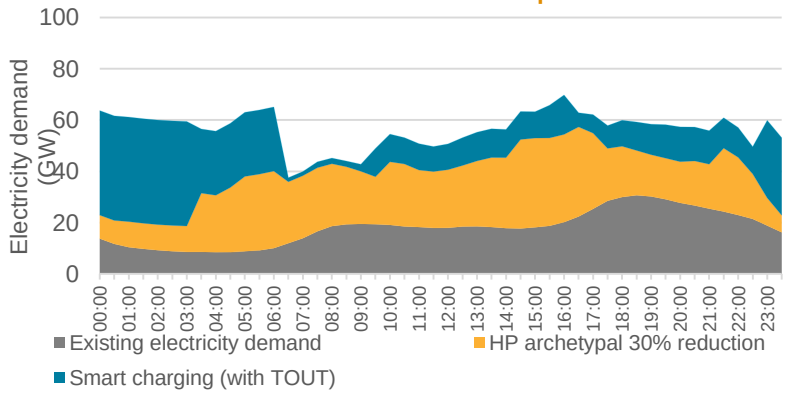

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What went well:

- A huge range of experience within the team
  - Over 150 years gas distribution experience
  - Wider technology insight and analytics from the Delta EE team
  - History of working together (GDNs, WWU & Delta)
- Common goals
  - To look at new ways of forecasting loads by type
  - To gain information that can be easily used in existing models
  - To forecast peak capacity requirements from base principles
  - To improve knowledge and understanding within the team
- Regular update t-cons, input from all parties
- Learnt ‘even more’ about other areas we need to consider
- Increased understanding of data requirements and availability

Recommendations

- Review of data availability and sharing
  - More use of granular data by hour and location would improve results
- Better understand impacts on / limitations resulting from electricity network.
  - C&I grid connection constraints – could drive more CHP uptake?
  - Opportunity for collaborative piece of work on this? As a minimum share this study with DNOs?
- Generation mix - still uncertain – what can be done here?
  - What mix of generation needed to support the residential scenario? / C&I scenarios?
- Calculate Carbon impact

Next steps:

- Final report
- Share learning
- Use of data in current and new processes

- If you would like to discuss further:
  - Bethan.Winter@wwutilities.co.uk