

# Local Network Management and Distributed Generation Curtailment Avoidance through Domestic Demand Response



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**CIGRE UK Post Session Technical Conference**  
**Birmingham**

26/11/2024

# Who We are

We are part of Iberdrola, a global energy company with more than 35,000 employees and supplying energy to almost 100 million people in dozens of countries including Spain, the UK, the US, Brazil, Mexico, Germany, Portugal, Italy and France.

We own and operate two distribution networks, SP Distribution plc (SPD) and SP Manweb plc (SPM). We are the only DNO group to operate across all three nations of GB – Scotland, England and Wales.

We also own and operate one transmission network in Central and Southern Scotland, SP Transmission plc (SPT).

**Our business is crucial to the delivery of the UK's Net Zero targets and the transition to a more sustainable future.**

**We are committed to making this happen at pace, with engineering plans of £3.0 billion for SPD and SPM in the next 5 years.**

### Key facts

**>7m people served**

across 3.5 million homes and businesses



**30,000**

substations across our distribution network areas



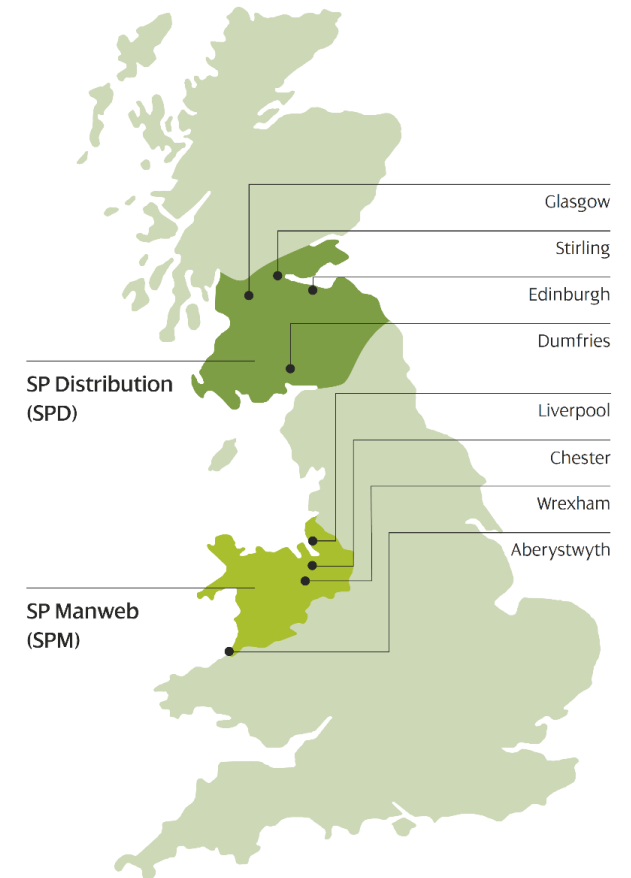
**>2,400 employees**

across our distribution business

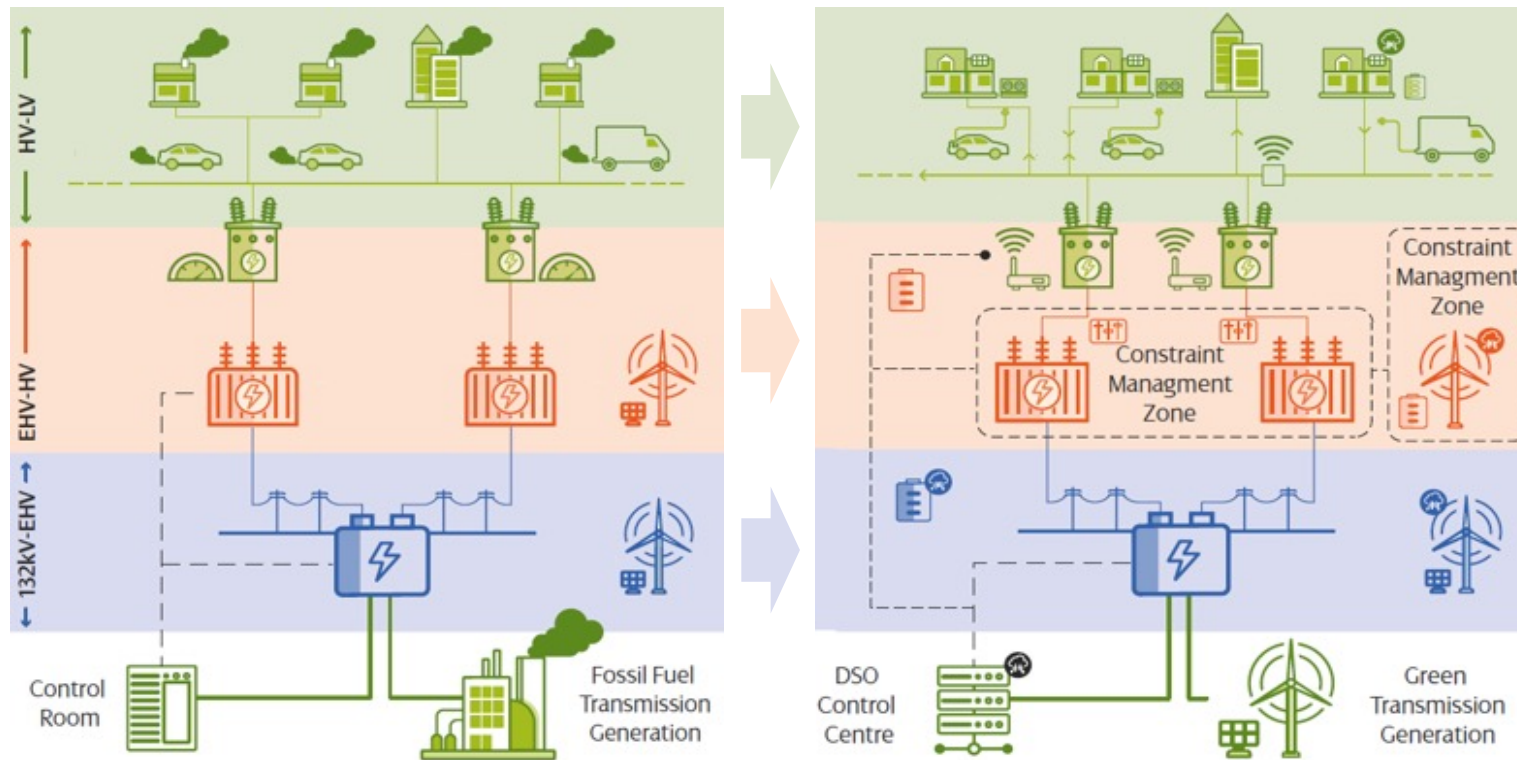


**>100,000km**

of cables and overhead lines, enough to wrap 2.5x around the world

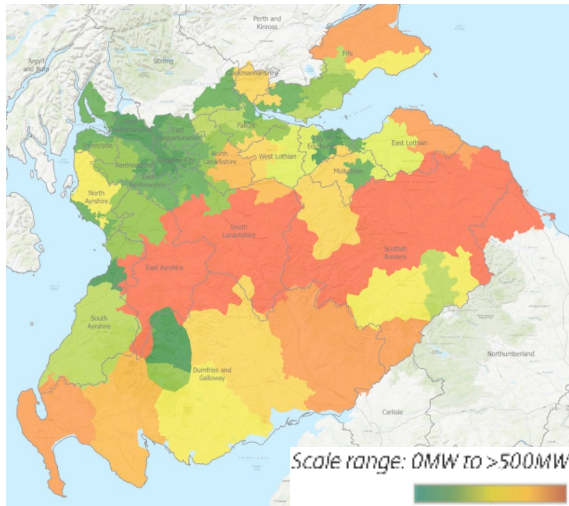


# Developing the System of the Future

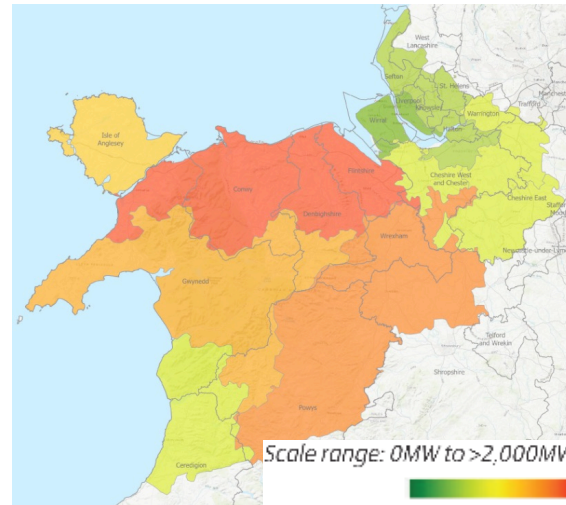


Increasing DER, complexity of planning & operation and whole system interactivity

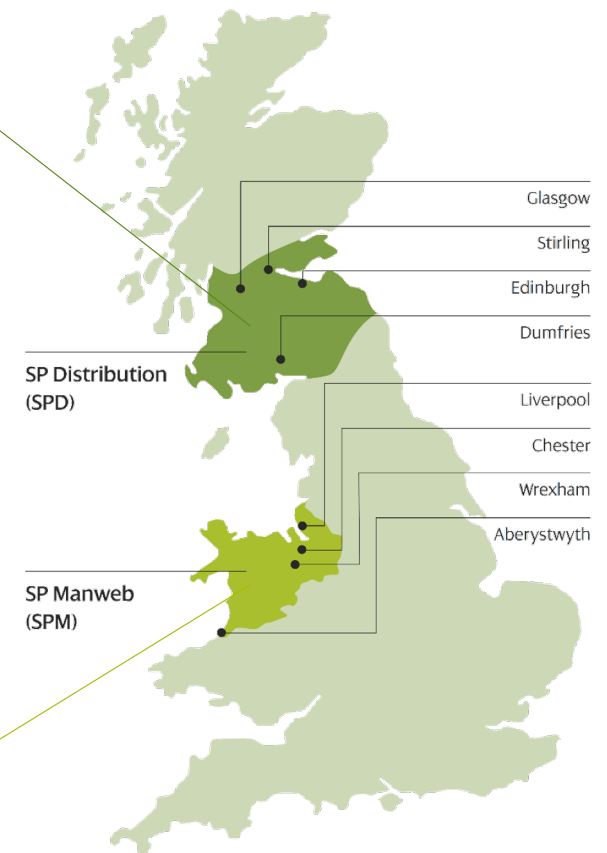
# DER Penetration and Growth



In the next ten years, the generation and storage capacity on our network is likely to triple and by 2050 we anticipate a five-fold increase in generation. **Given that wind and solar PV generation output is weather-dependent, it is unlikely to always occur at the same time as periods of high demand.**



The level of renewable generation curtailed across GB in 2020 due to network constraints was a total of 3.5TWh with curtailment cost of ~£299m. **As renewable capacity penetration increases, the cost of curtailment is also set to increase and the consumers in Scotland and England may face an extra cost which is estimated to be over £1 billion per year through curtailment payments.**

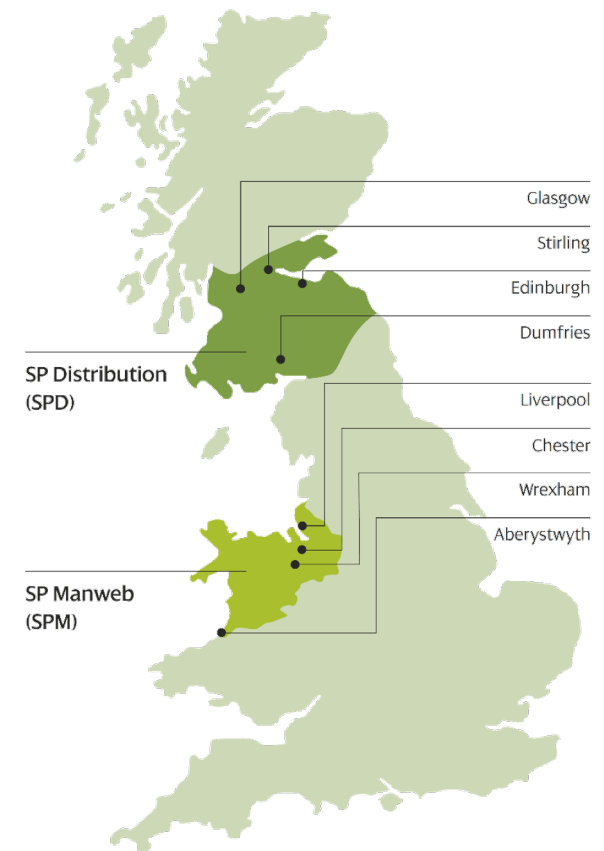


# Proposed Solution – Demand Shift

In association with Octopus Energy, we reached out to customers in the Dumfries & Galloway and Ayrshire region and sought interest who were willing to participate in the trial.

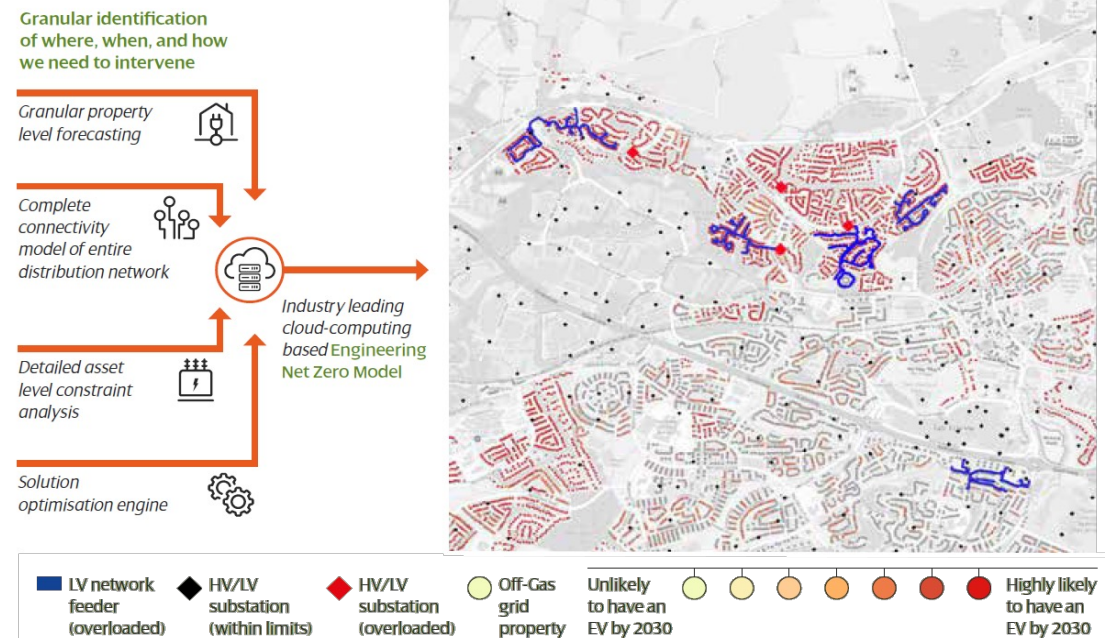
Trial area has **over 3GW connected and contracted DER** against a local **demand of around 500MW**. The cumulative firm capacity of Gird Supply Points (GSPs) in the region is around 1.8GW due to which significant proportion of generation capacity would need to be curtailed during certain network operating scenarios.

<b>Customers in trial</b>	8,692
<b>Affected 11kV/400V substations</b>	2,011
<b>Affected 33kV substations</b>	62
<b>Total customers supplied within study area</b>	212,278
<b>Total demand shift commitment (MW)</b>	10.6



## We are revolutionising our modelling capability to deliver Net Zero.

- **Industry leading model** developed of the **entire network** to assess **forecast demand on every asset**.
- These models require **Microsoft Azure** servers to analyse **over 175k iterations** per network asset.
- Models need to be **integrated with network monitoring** and **corporate systems** to replace ‘paper-based’ design.
- This **precise knowledge** meant we could reach out to our domestic customers to **enable demand side flexibility for every constraint**.

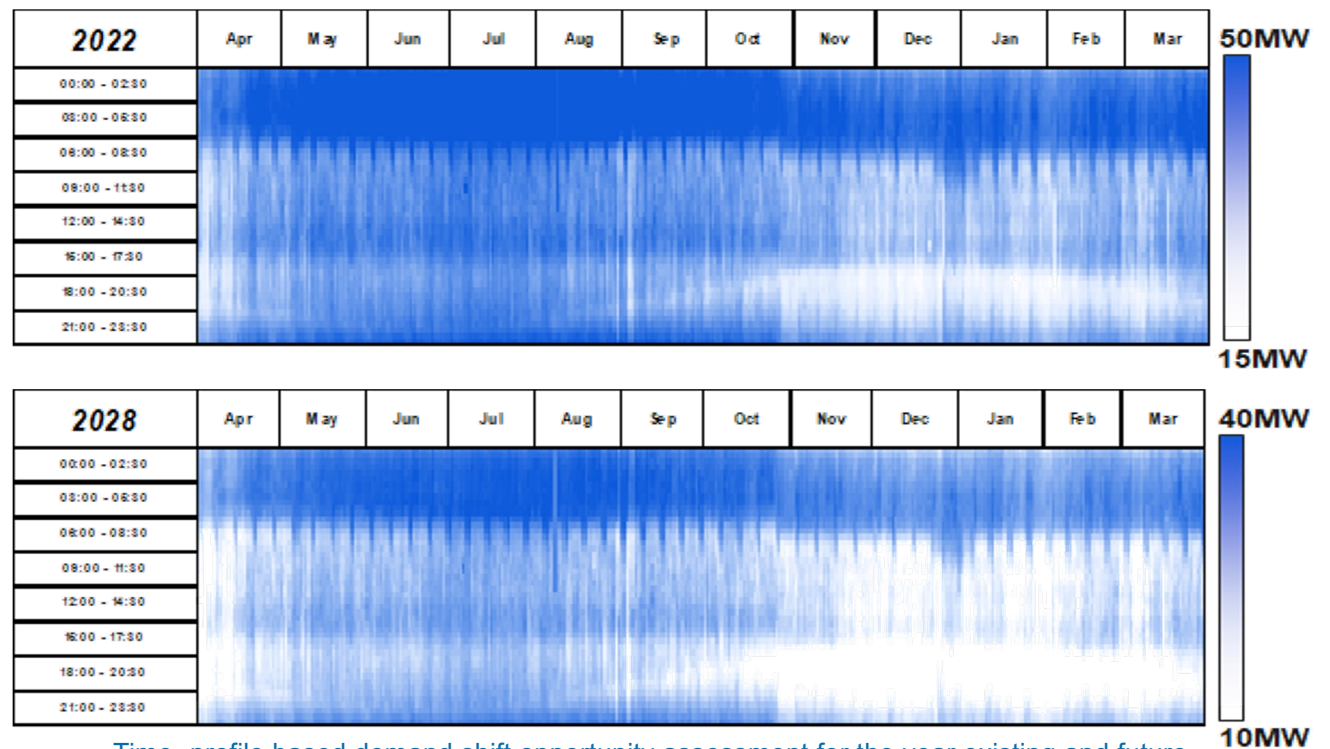


# Impact Assessment

Detailed sensitivity studies considering **time profile based half-hourly data and 17,520 simulations** were performed.

The **demand shift opportunity ranges between 15-50MW for the existing network** without triggering a network constraint.

**Demand shift capacity reduces by 10MW with forecast uptake in electric vehicle (EV) and heat pump (HP) by end of regulatory price control period 2028.**



Time -profile based demand shift opportunity assessment for the year existing and future network operating conditions

# Demand Shift Trial

With extensive engagement with Octopus Energy, we developed six separate events that lasted for two hours between either:

- 5:30 am – 7:30 am (high generation, low demand) or
- 7:30 pm – 9:30 pm (low generation, high demand)

These events covered weekdays and weekends.

The dates for the trial were determined based on consumer behaviour and their usual trends.

## Pre-Event:

Octopus Energy emailed participating customers in the trial area with the trial information and an opt-in request. The customers, both smart and non-smart customers, who accepted the opt-in request became part of the “trial group”.



## Event: In each of the six events the process was as follows:

- Our control room identified the day-ahead network needs.
- Once confirmed there are no constraints, we informed Octopus Energy of the viability of the event.
- Octopus Energy sent a day-ahead reminder email to all trial customers with their turn up target.

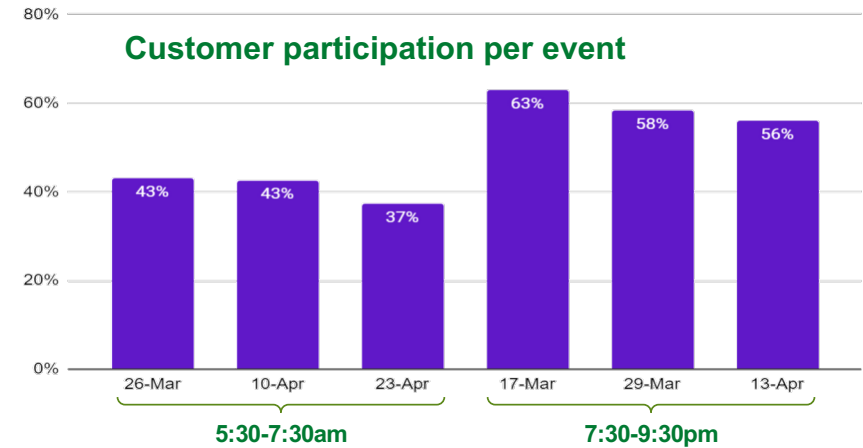
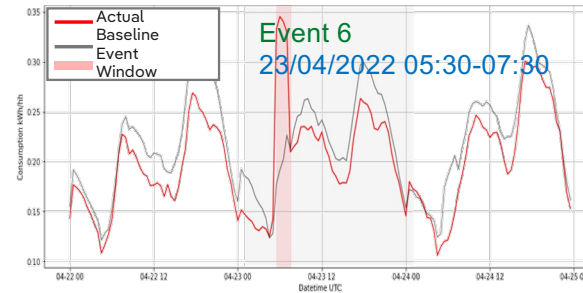
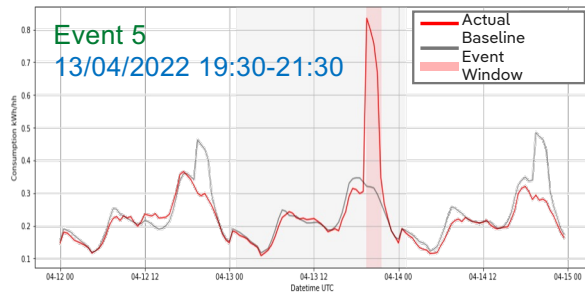
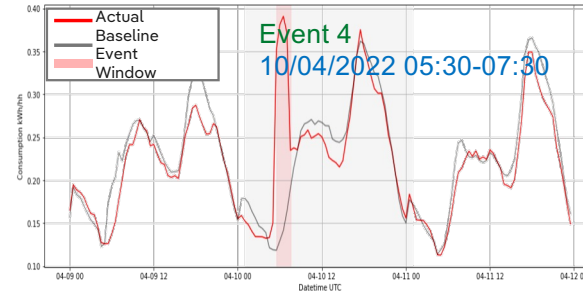
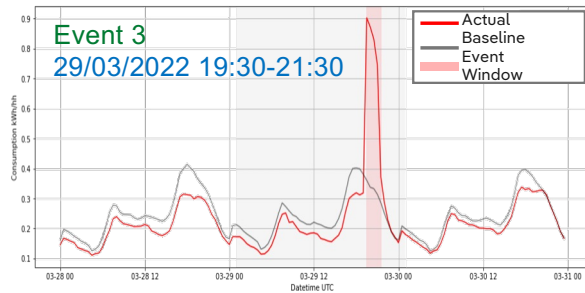
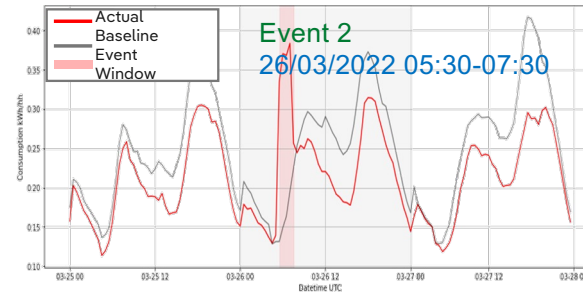
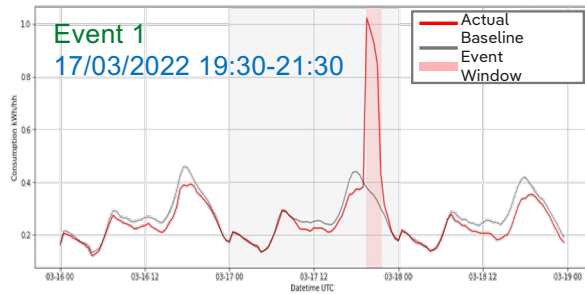


## Post-Event:

Octopus Energy calculated the demand shift response as the difference between the actual and forecasted demand. Customers who successfully reached the 10% increase target were deemed to have participated in the trial and were rewarded with free electricity / double the credit.



# Results and Observations



Households used more energy when requested to do so to help balance generation. **A total of 20MWh demand response** was secured with **a max turn-up per event recorded at 2.84MW** and an **average turn-up being 1.7MW**.

**Participation was higher in the evening, ~20% more than in early morning.** Hence, it is key to know when the best moment is for demand shifts.

Also, survey conducted indicated that 98% of customers were satisfied with the trial, with >46% wanting to participate 5 days a week.

## Conclusion

**Renewable energy capacity in the UK is set to grow by 26GW.** As renewable capacity increases, **the cost of curtailment** is also set to increase with **over £1 billion per year** of curtailment payments estimated. **Demand-side flexibility could provide an alternative to curtailment.**

Customers across Dumfries & Galloway and Ayrshire participated in a six-week trial. **Customers were instructed to power up their usage when green energy supply was highest.** Trials concluded that **a total of 20MWh demand response was secured** with max response per event recorded at 2.84MW and an average turn up per even being 1.7MW.

Domestic flexibility methods like this trial will support the move towards a greener energy system – **balancing the grid and bringing down costs for everyone by reducing the need for expensive grid rebalancing interventions.**



# Thank You



26/11/2024