EQUİNOX

How the largest domestic heat pump flexibility project is developing new commercial arrangements to benefit customers and networks

Ryan Huxtable
Innovation Programme Lead

Rois Smith
Innovation and Deployment Engineer

nationalgrid

nationalgrid.co.uk

EQUİNOX

1

Background to the project

nationalgrid

nationalgrid.co.uk

EQUINOX

Equitable Novel Flexibility Exchange (EQUINOX) overview

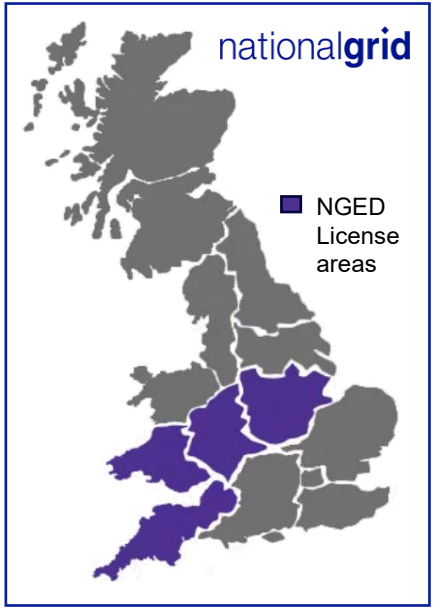
What is EQUINOX? An innovation project testing new commercial and technical arrangements to reward households with heat pumps for participating in flexibility by temporarily altering their heating choices without compromising on comfort.

Who is it funded by? Ofgem via the Network Innovation Competition (NIC).

Who is it led by? National Grid Electricity Distribution (NGED).

What is EQUINOX's goal? Aims to demonstrate the potential of heat pump flexibility as a solution for managing a rise in heat pump uptake in the UK. If proven, heat pump flexibility could save consumers money by lowering energy bills and mitigating costly network upgrades, while contributing to a more resilient and equitable low-carbon energy system.

Who else is involved? The project is undertaken in collaboration with Octopus Energy, ScottishPower, Sero, Passiv UK, West Midlands Combined Authority, Welsh Government, National Energy Action, SP Energy Networks, and Guidehouse.



EQUINOX

EQUINOX overview

The problem

- The increase in heat pumps connected to the distribution network will **contribute to** the need for network reinforcement.
- There are currently limited proven solutions for Distribution Network Operators (DNOs) to unlock flexibility from domestic heating in a cost effective and equitable way.

The project

- Testing commercial and technical arrangements to **reward households with heat pumps** for temporarily altering their heating choices without compromising on comfort.
- Aims to show **how heat pumps can engage in flexibility**, which stands to mitigate costly system upgrades and save consumers money by lowering energy bills, while contributing to a more equitable low-carbon energy system.

EQUINOX

Trial two overview

- **Over 1000 participating households**
- **72 hours of EQUINOX events**
- **2-hour turndown periods**
- **0-3 events per week**

Trial design approach

- Crossover Randomised Control Trial (RCT) enabled robust statistical analysis

3 commercial arrangements

- **M1 –** higher per kWh utilisation payment, varies by notice period
- **M2 –** lower per kWh utilisation payment, varies by notice period
- **M3 –** advance availability payment for accepting automated heating control. Also medium per kWh utilisation payment

3 notice periods

- Day ahead
- Morning ahead
- 2 hours ahead

3 event timings

- 4-6pm
- 5-7pm
- 6-8pm

3 heat pump control methods

- Manual customer control
- Remote customer control
- Automated supplier **control**

EQUINOX

Trial three overview

- **Over 900 participating households**
- **Series of mini trials**
- **Designed to answer remaining questions for BAU implementation**
- **Manual and remote customer control methods**

Demand turn up flexibility

- 2 hours per day
- Series of Heat Pump only and whole home events

Morning peak flexibility

- 2 hours per day
- Carried out between 8am and 10pm

Longer flexibility events

- Events of 2-4 hours per day
- Carried out between 4pm and 8pm

Daily flexibility

- Monday to Friday for 8-11 weeks
- Range of 2-4 hour events
- Carried out in the morning and evening peak time

EQUINOX

2

Learning from Trials 2 & 3

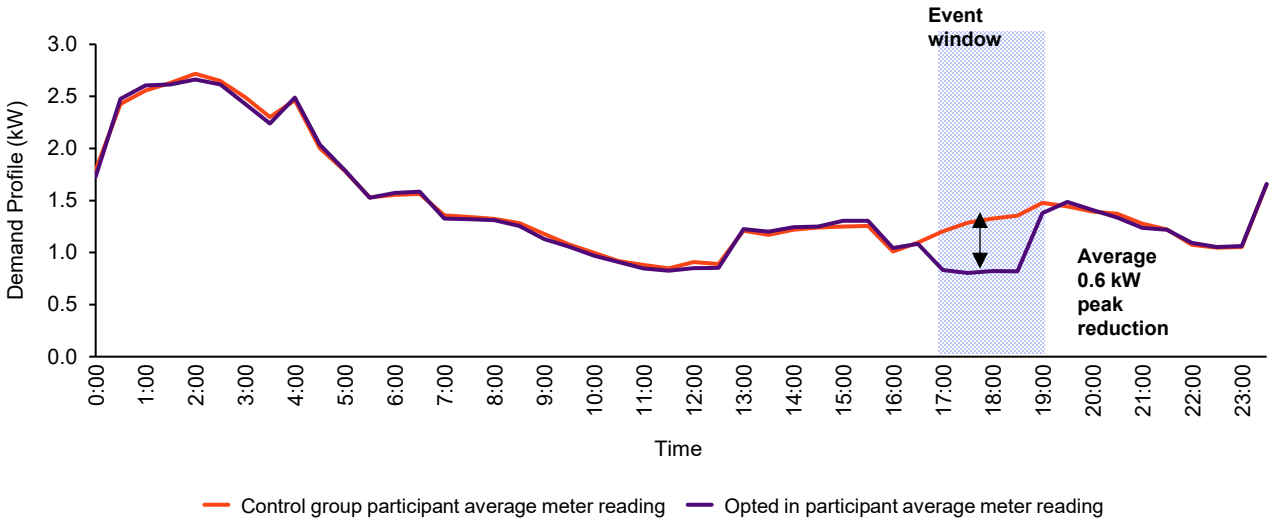
nationalgrid

nationalgrid.co.uk

EQUINOX

Finding 1: Heat pump behavioural change provides meaningful demand shifting out of the evening peak period

Average demand profile of EQUINOX trial two participants across all events held between 5-7pm[1]

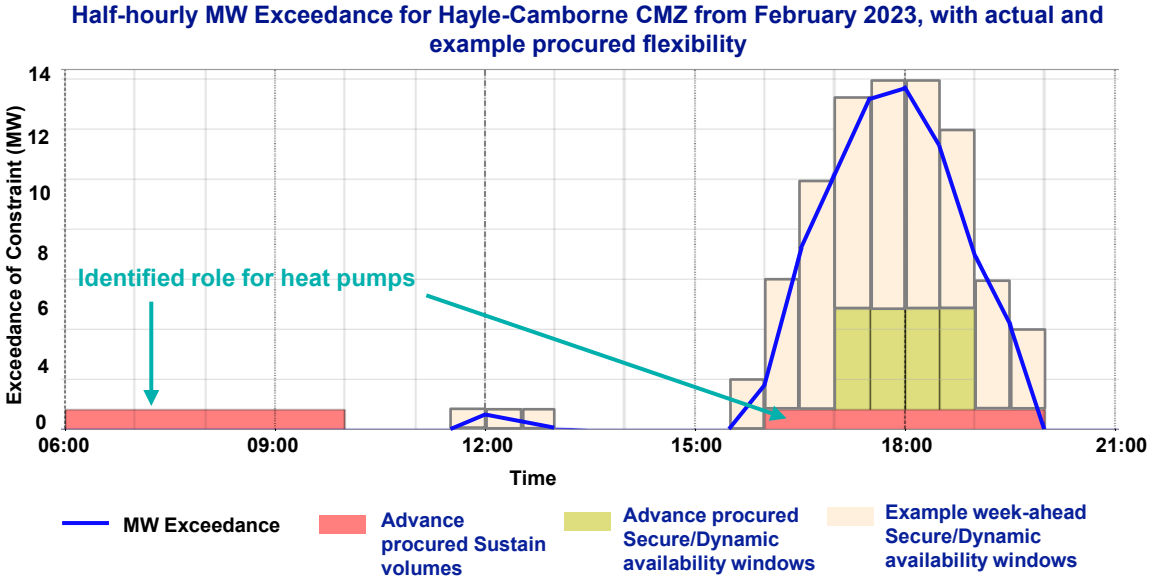


- Opted in participants provided an average measurable demand response of 0.6 kW (1.2 kWh) per event.
- This is a 48% reduction in the average participating home's peak load.
- Participants provided statistically significant demand response.
- 47% of participants opted into and turned down for an average event.

[1]There was negligible difference in the demand profile of participants for events held at 4-6pm and 6-8pm – the peak reduction window was simply shifted backwards or forwards from the 5-7pm chart.

EQUINOX

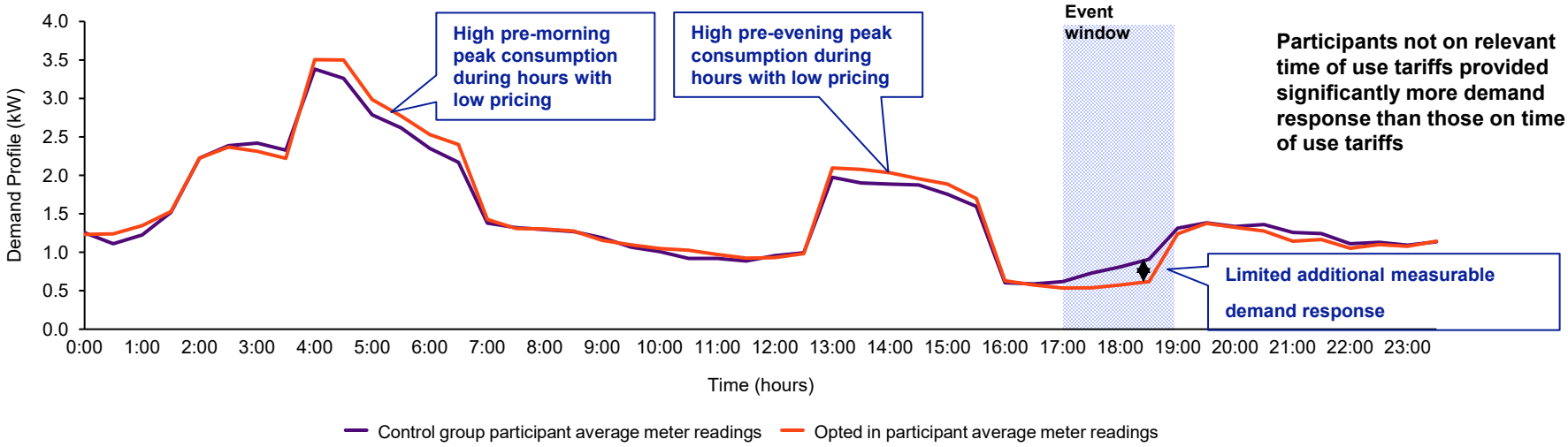
Finding 1: Heat pump flexibility can help to resolve distribution network Constraint Managed Zones if combined with other assets



- The average trial two demand response per heat pump was scaled up across several scenarios for NGED's Hayle-Camborne Constraint Managed Zone (CMZ).
- Analysis indicated heat pumps could mitigate 20% of the CMZ's projected peak demand in 2028.
- Demonstrates heat pumps could be a valuable option for advanced dispatch, though additional assets would be required for shorter periods to mitigate total peak demand.

Finding 2: A key driver of demand response was whether a participant's electricity tariff was already incentivising load shifting

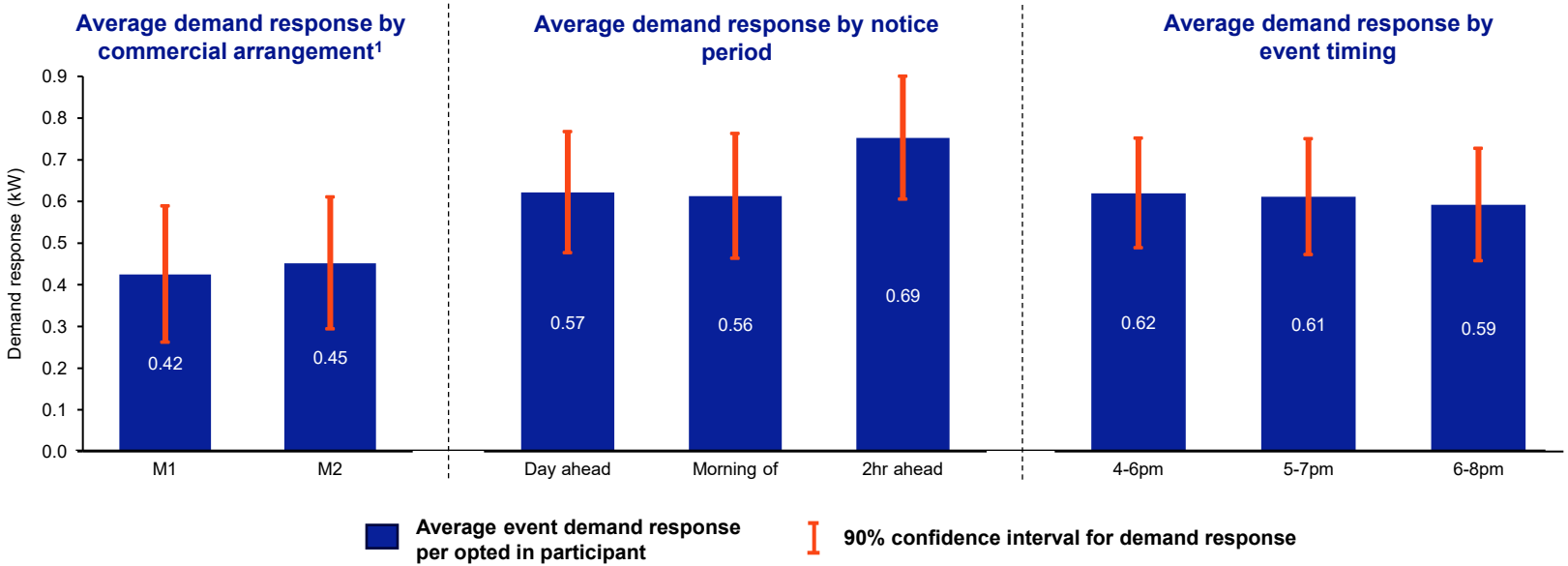
Average demand profile of Trial two participants with tariffs offering different unit rates during the day, solely for events held 5-7pm[1]



[1]There was negligible difference in the demand profile of participants for events held at 4-6pm and 6-8pm – the peak reduction window was simply shifted backwards or forwards from the 5-7pm chart.

EQUINOX

Finding 3: Demand response was consistent across commercial arrangements, notice periods and event times

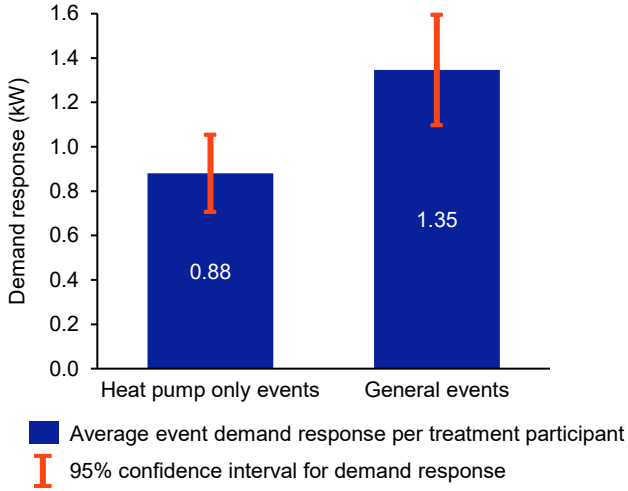


[1]Commercial arrangement opt in rate was measured slightly differently from notice period and event timing. This is why comparatively lower demand response values were recorded. M1 paid 50% more than M2 £/kWh (M2 customers topped up after trial 2).

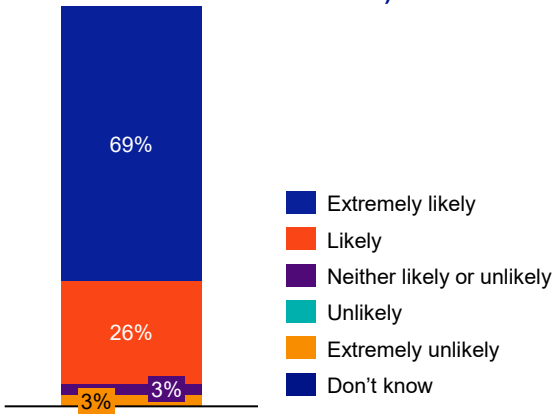
EQUINOX

Finding 4: Participants can provide demand turn up during the middle of the day via their heat pump

Average demand turn up per treatment participant by event type



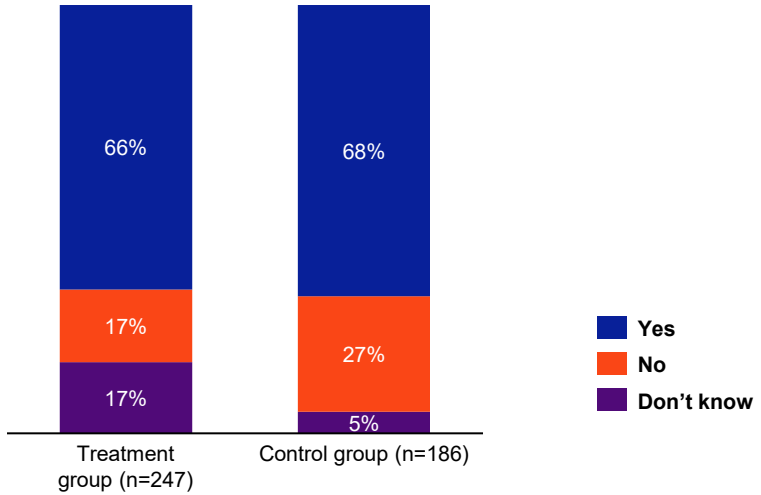
Treatment participants willing to participate in an ongoing turn up product (number of customers=33)



Finding 5: Participants successfully stacked Daily Evening Flex with NESO's Demand Flexibility Service

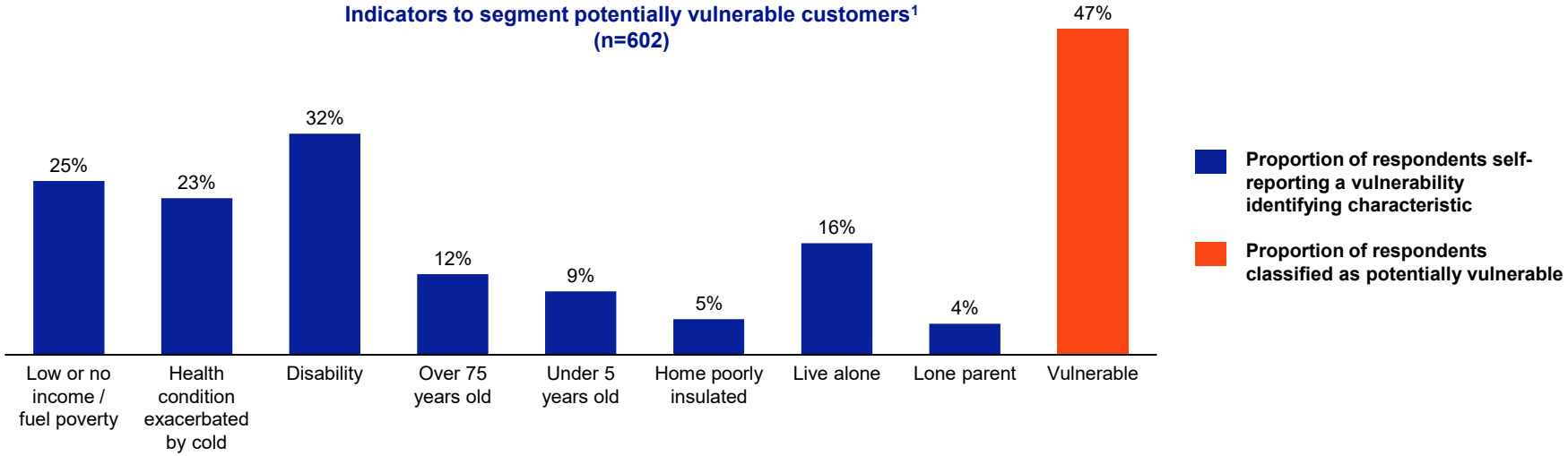
- **Treatment Participants earned a total of £96 in aggregate, when participating in DFS events and EQUINOX events at the same time: e.g. stacked events.**

Did you participate in Octoplus Saving Sessions during the EQUINOX sustain trial?



Finding 6: Vulnerability demographics of customers in trial three

In trial three we developed and implemented an Equitable Participation Framework (EPF) to refine how vulnerability was assessed. This resulted in eight vulnerability indicators being selected to segment for potentially vulnerable customers. **47% of participants being considered potentially vulnerable.**



[1]Participants could select more than one answer

EQUINOX

4

Next steps

nationalgrid

nationalgrid.co.uk

EQUINOX

EQUINOX Trials have now all concluded

We are now preparing our BAU transition report on what's next for the learning and outcomes from EQUINOX:

Category	Learning Points for BAU Implementation
1. **Future Flexibility Procurement**	• Heat pump behavioural change can deliver meaningful demand reduction (typically 2 hrs/day; but for some customers 3–4 hrs). • Turndown magnitude increases as temperature falls; participation rate marginally reduces. • Turn-up flexibility is also achievable. • Current market incentives and TOU tariff rates are sufficient to drive engagement. • Inviting heat pumps to participate in daily flexibility services in a baseload capacity provides most value to networks.
2. **Customer Outcomes**	• High customer satisfaction can be expected engaging customers with heat pumps, along with minimal comfort impact. • Potentially vulnerable customers should be invited to participate and permitted to do so if they express an interest.
3. **Technical Integration**	• Customers with automated, manual, and remote heat pump control methods can all participate in flexibility. • Automated control may be most reliable, though participation is expected from TOU tariffs not flexibility services. • Existing DNO → Aggregator → Customer interaction models remain suitable for procurement of flexibility.
4. **Stacking**	• There is strong customer appetite for participating in stacked DNO/NESO flexibility services, indicating appetite for more advanced participation models/ service offerings.
5. **Informed Forecasting / Network Design**	• DNOs may assume a portion of heat pump homes will act flexibly – in line with EQUINOX results. • These insights enable more accurate forecasting and network planning as uptake grows.

EQUINOX

If you would like to know more, use the links or QR code below!

Full research findings for trial two are available:

- Learning from trialling novel commercial methods
- Trial two customer engagement report

If you have any additional questions, please feel free to contact us at:

NGED.Innovation@nationalgrid.co.uk

We welcome feedback and questions at our stand or in the Q&A

Scan this QR code for easy access to our trial two findings

nationalgrid