EQUİNOX

Enabling domestic low carbon heat flexibility without leaving anyone behind

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29th October 2024

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Agenda

1. Introduction to EQUINOX
2. Trial two overview
3. Research findings
4. Next steps

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Introduction to EQUINOX

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Equitable Novel Heat Exchange (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.
- Aiming to mitigate costly system upgrades and save consumers money by lowering energy bills, while contributing to a more resilient and equitable low-carbon energy system.

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Trial two overview

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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

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Research findings

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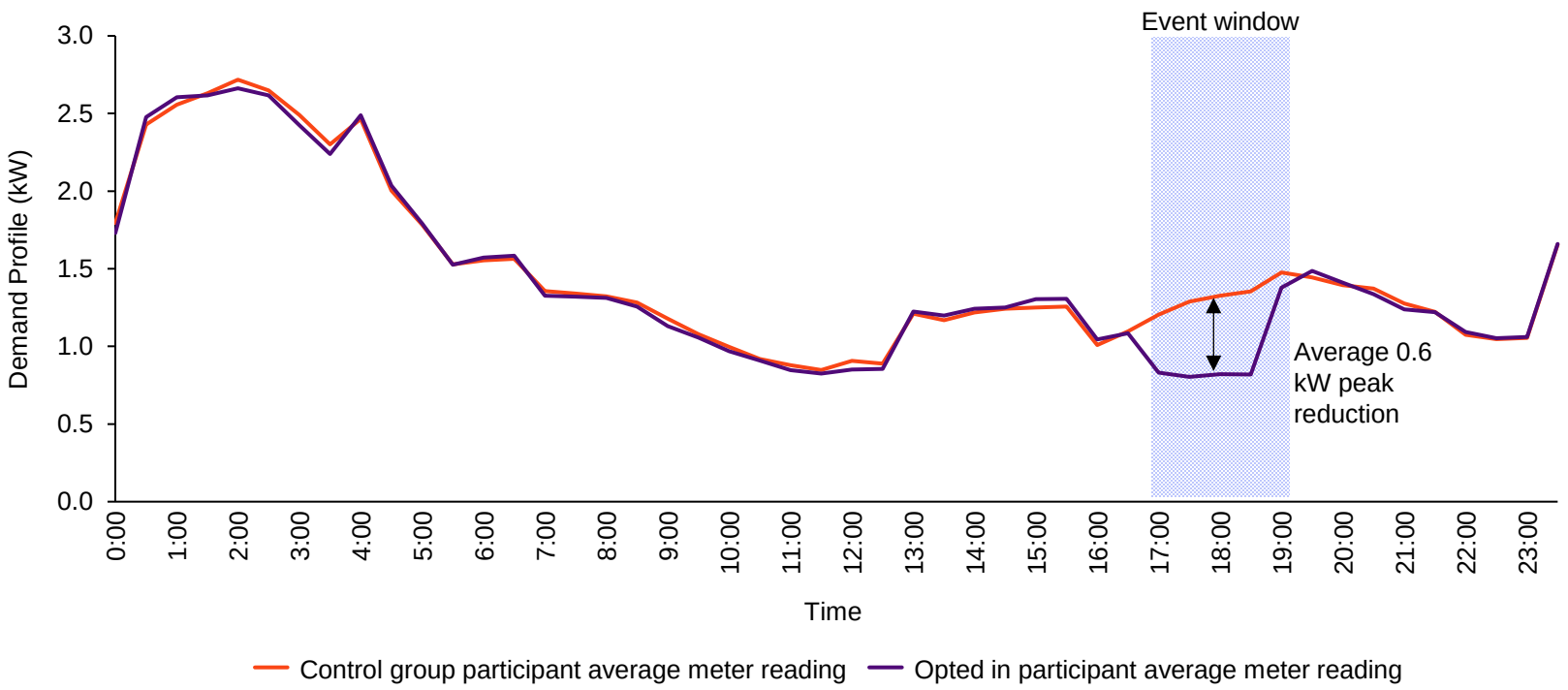
1. Heat pump behavioral change provides meaningful demand shifting out of the evening peak period

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.

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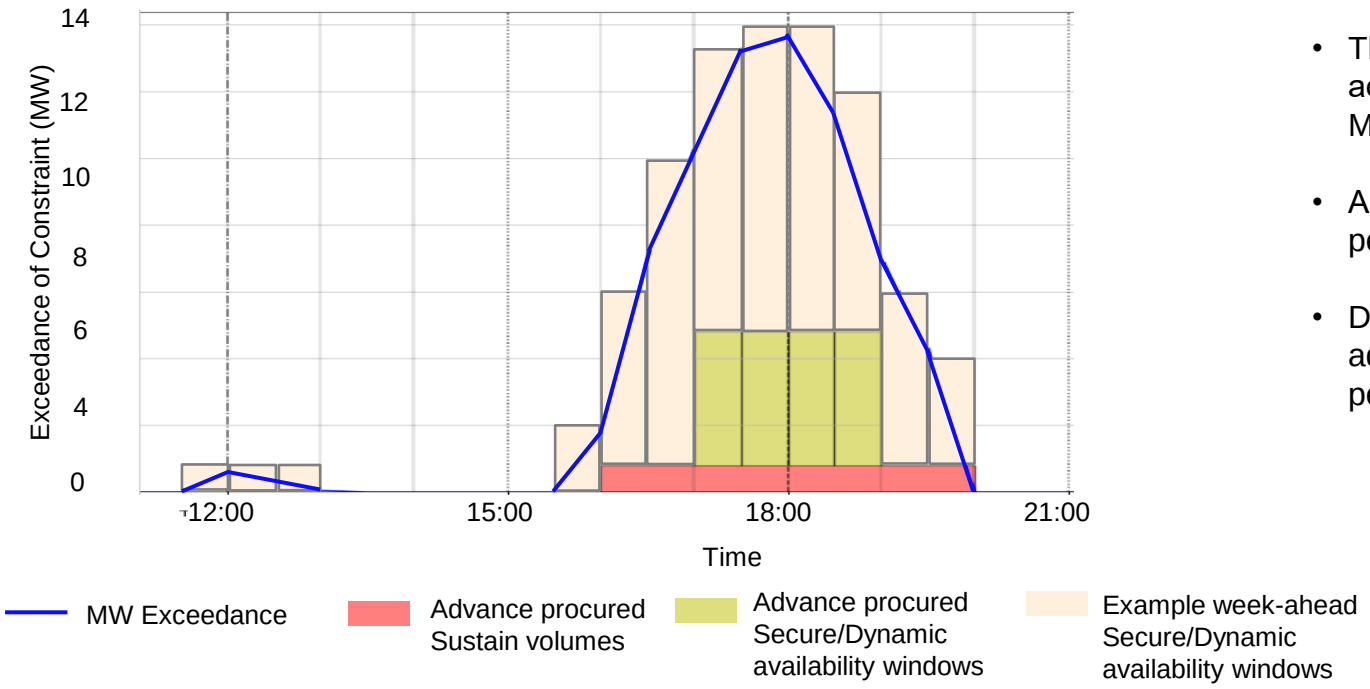
2. Heat pump flexibility can help to resolve distribution network Constraint Managed Zones if combined with other assets

Half-hourly MW Exceedance for Hayle-Camborne CMZ from February 2023, with actual and example procured flexibility



- 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 form part of a dispatch group, though additional assets would be required for shorter periods to mitigate total peak demand.

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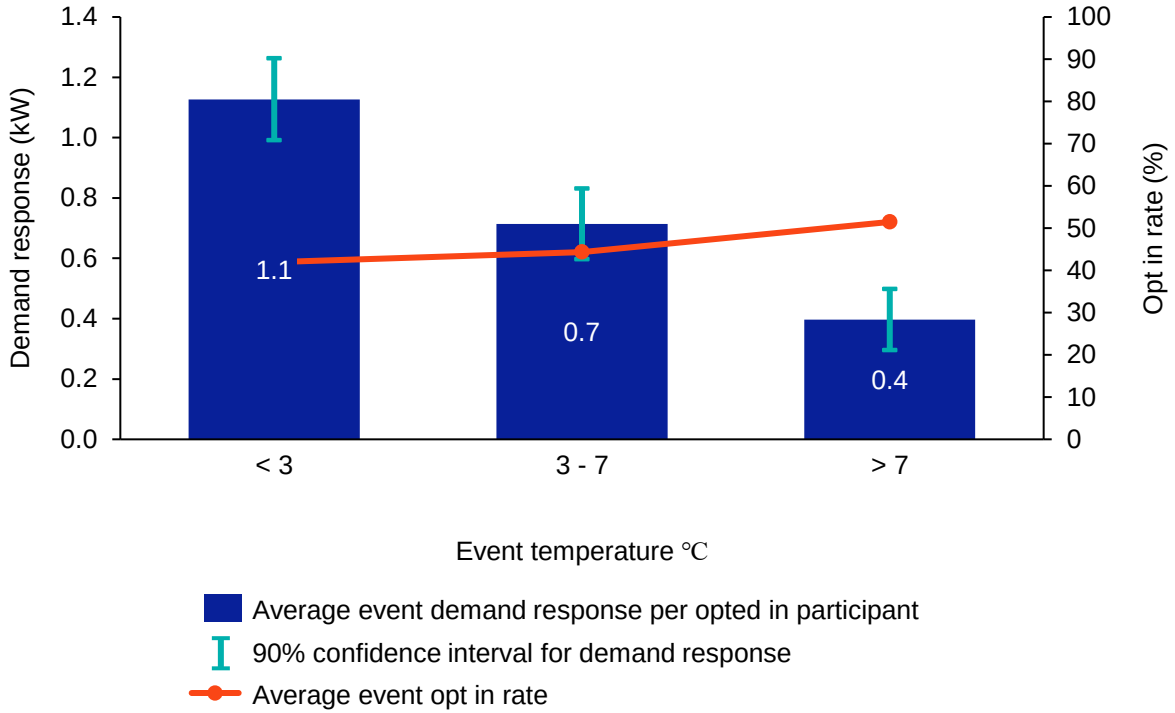
3. External temperature was a strong driver of demand response

Trial 2 average demand response grouped by temperature ranges[1]



- Average event temperature ranged from -1.4°C to 12.5°C
- Opt in rate was slightly (10%) higher for the warmest events (>7°C) than the coldest events (<3°C).
- This suggests greater demand response per heat pump household can be procured when the weather is coldest, despite slightly fewer households opting in.

[1] Average event temperatures across customers ranged from -1.4°C to 12.5°C.

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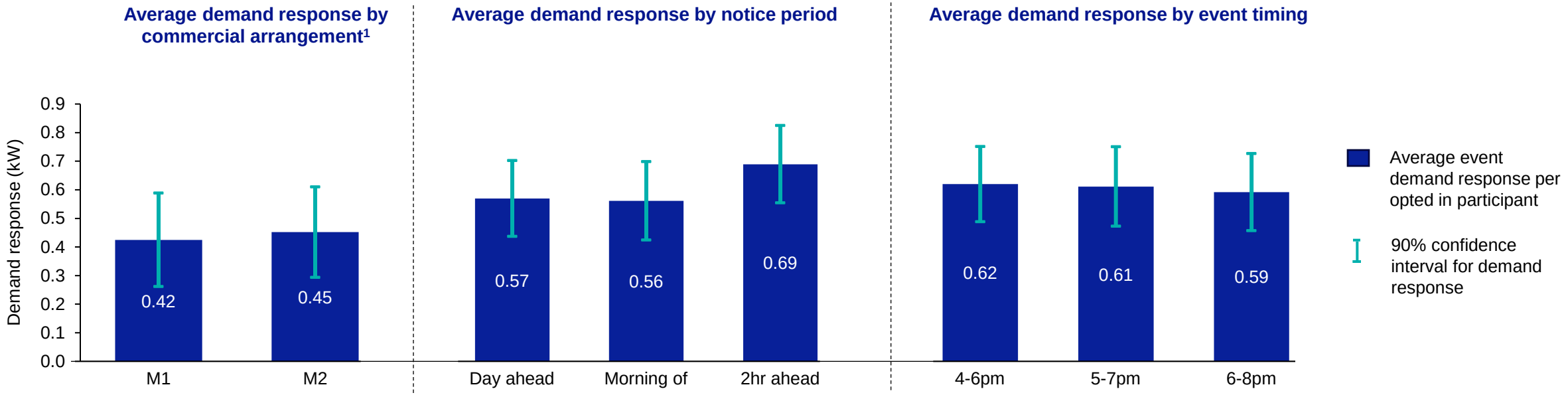
4. Demand response was consistent across commercial arrangements, notice periods and event times



[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).

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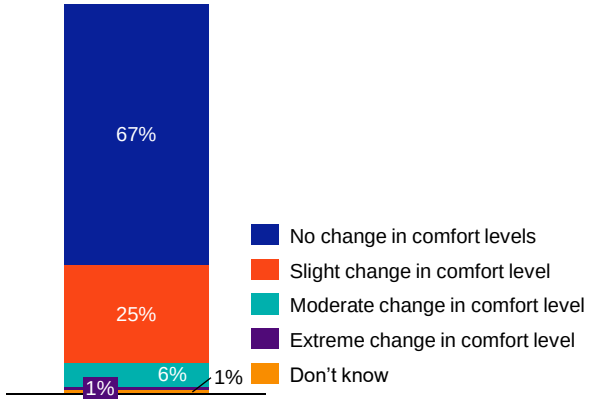
5. Minimal impact on thermal comfort was reported by EQUINOX participants

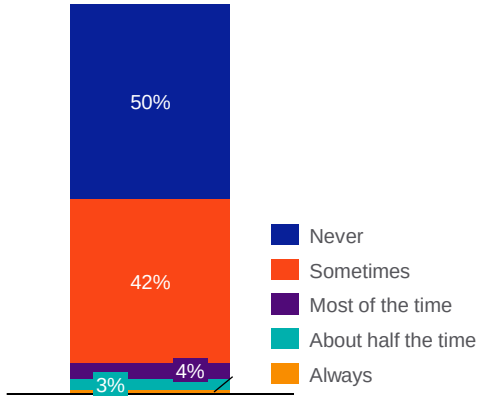
Post-event surveys: Even when surveyed after the coldest events (< 3°C), 85% of participants reported either no change or a slight change in comfort. This increases to 92% across all event temperatures

End of trial survey: When re-surveyed at the end of winter, customers who recalled any discomfort during the trial overwhelmingly report that it was mild.

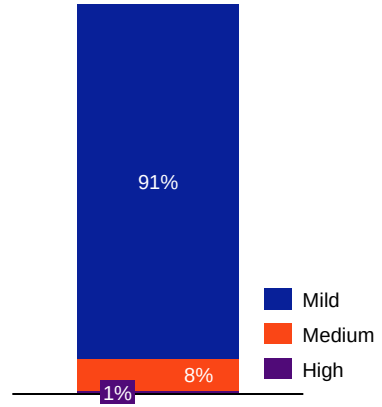
How much did the event impact comfort levels inside your home?



How frequently did participating in EQUINOX events cause any discomfort for you or someone else in the household?



If you felt discomfort, what level of discomfort have you felt from participating in EQUINOX events? [1]



[1]Customers were only asked this question if they selected sometimes, most of the time, about half the time, and always when asked "how frequently did participating in EQUINOX events cause any discomfort for your or someone else in your household?"

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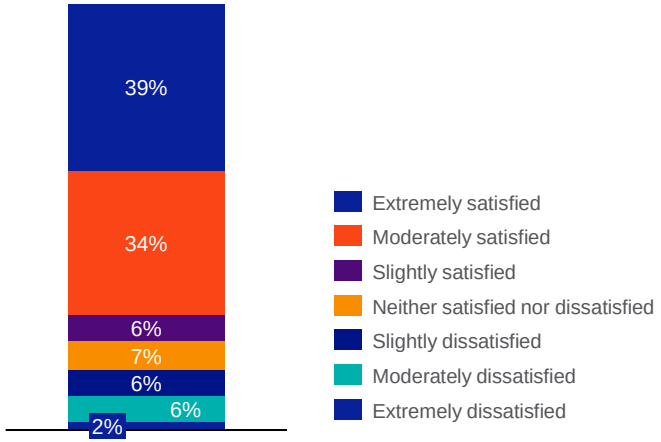
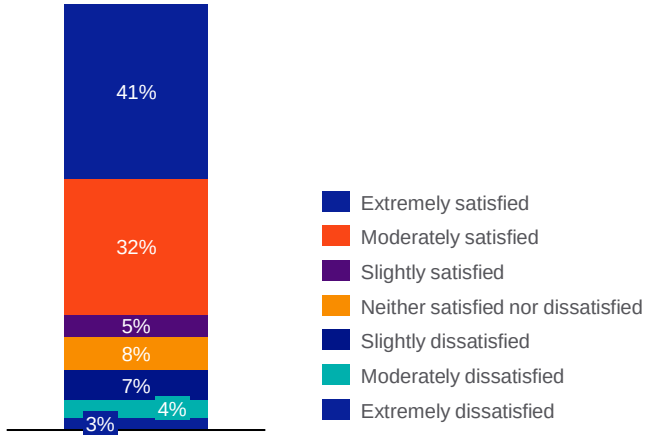
6. Heat pump flexibility is open to all households, including those with potential vulnerabilities

Non-vulnerable participants: How satisfied are you with the overall EQUINOX trial? (n=489)



Potentially vulnerable participants: How satisfied are you with the overall EQUINOX trial? (n=147)



Customers with potential vulnerabilities reported similar preferences and experiences compared to non-vulnerable participants across trial satisfaction, participation and trial design.

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Next steps

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Trial three will begin soon

Recruitment for trial three is underway. Trial three will be similar to previous trials, with some new features:

	Trial 3 will…	To confirm whether...
	Onboard SPEN[1] to trial EQUINOX events in other license areas.	The events trialled in EQUINOX are suitable for other parts of GB.
	Implement turn up flexibility events.	Domestic heat pumps can help reduce curtailment by using surplus electricity.
	Implement longer flexibility events lasting >2 hours.	Domestic heat pumps can cover a greater part of DNOs required flexibility window.
	Implement morning peak events between 8-10am.	Domestic heat pumps can help reduce the morning peak.
	Implement sustain-type events lasting multiple weeks during peak hours.	Domestic heat pumps can provide long-term peak reduction in support of DNOs.
	Stack EQUINOX events with other events.	Domestic heat pumps can support and be rewarded by both DNOs and other parts of the industry.
	Implement an equitable participation framework.	Customers, particularly those who are potentially vulnerable or fuel poor, can equitably navigate and participate in heat pump flexibility.

[1]Scottish Power Energy Networks (SPEN)

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

Full research findings for trial two are available:

- Learning from trialing novel commercial methods: https://www.nationalgrid.co.uk/downloads-view-reciteme/672211
- Trial two customer engagement report: https://www.nationalgrid.co.uk/downloads-view-reciteme/671038

If you have any additional questions, please feel free to contact us at:
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Scan this QR code for easy access to our trial two findings

Question and answer

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Month YEAR. Reference Number