



HF-PQ NET & POWERING OHMS

SIF Show and Tell



Scottish & Southern
Electricity Networks



HOUSEKEEPING

- Please feel free to ask questions throughout the session in the Teams chat.
- Today's session will be recorded and will be made available after the event. The recording will stop for the Q&A session.



Video/webcams off
Please only turn your video on for the discussion in break-out rooms



Mics on mute
Please stay on mute unless you are asking a question



Technical queries
If you have any technical questions let us know

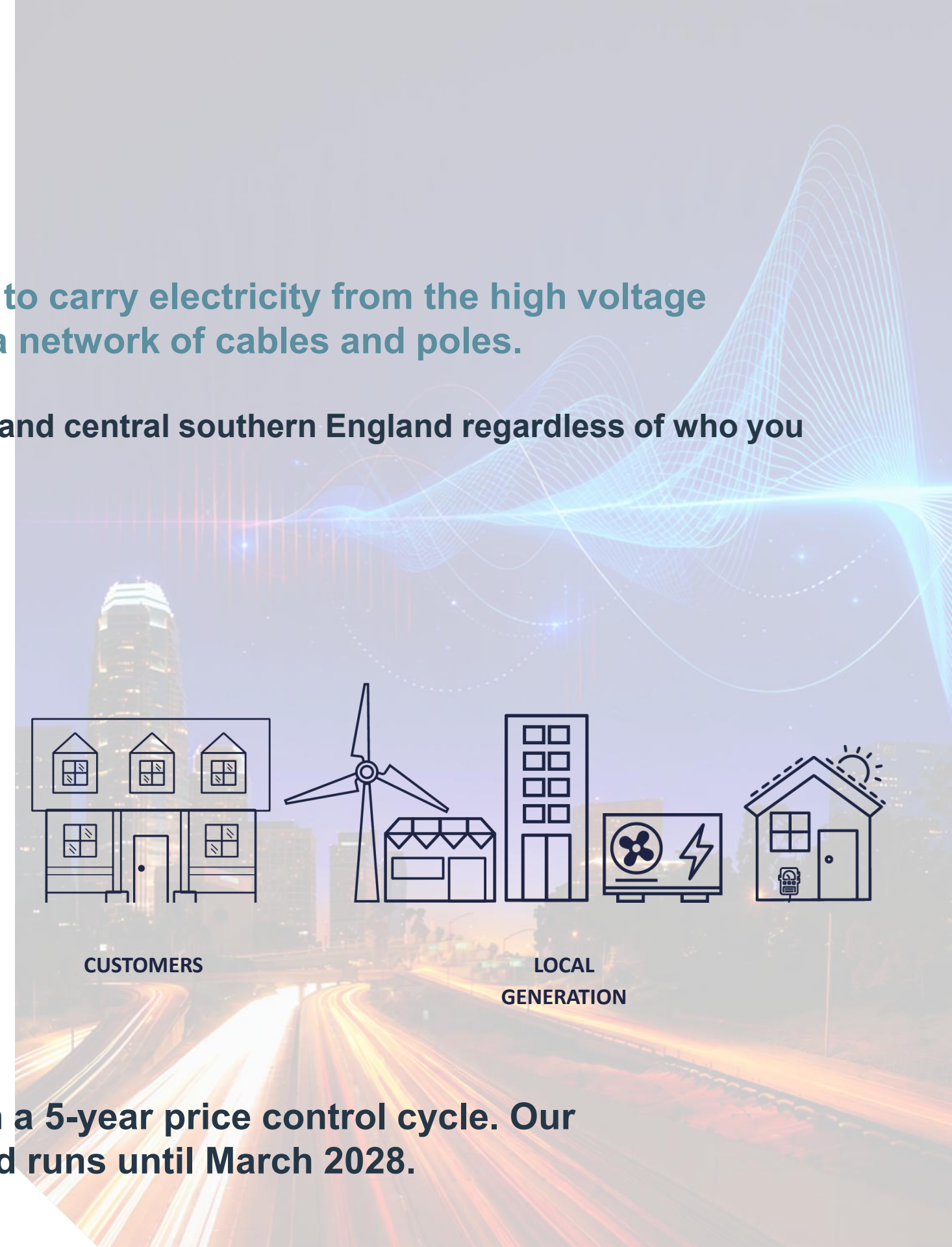
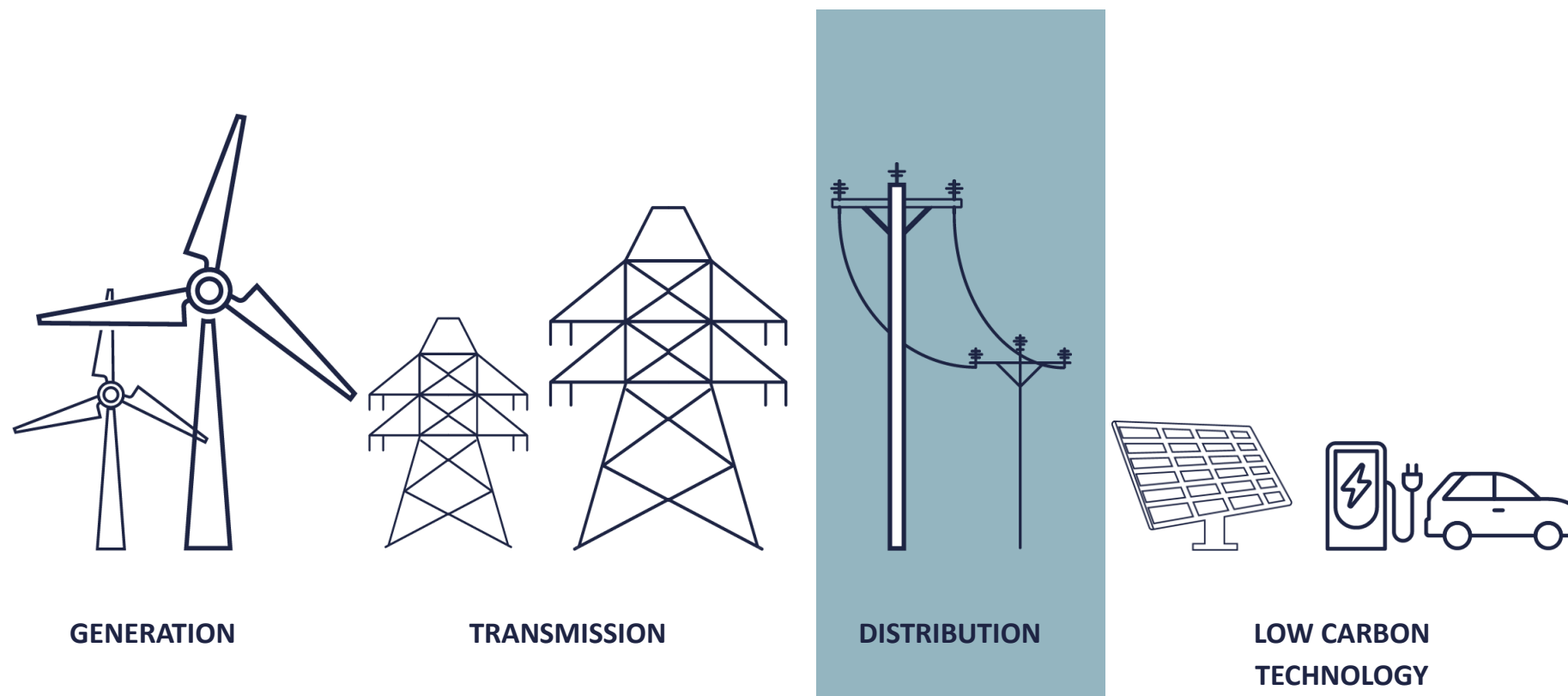




OUR ROLE IN THE ENERGY SYSTEM

As a Distribution Network Operator, our role in the energy system is to carry electricity from the high voltage transmission grid to industrial, commercial and domestic users via a network of cables and poles.

We provide this service for every home and business in the north of Scotland and central southern England regardless of who you pay your energy bills to.



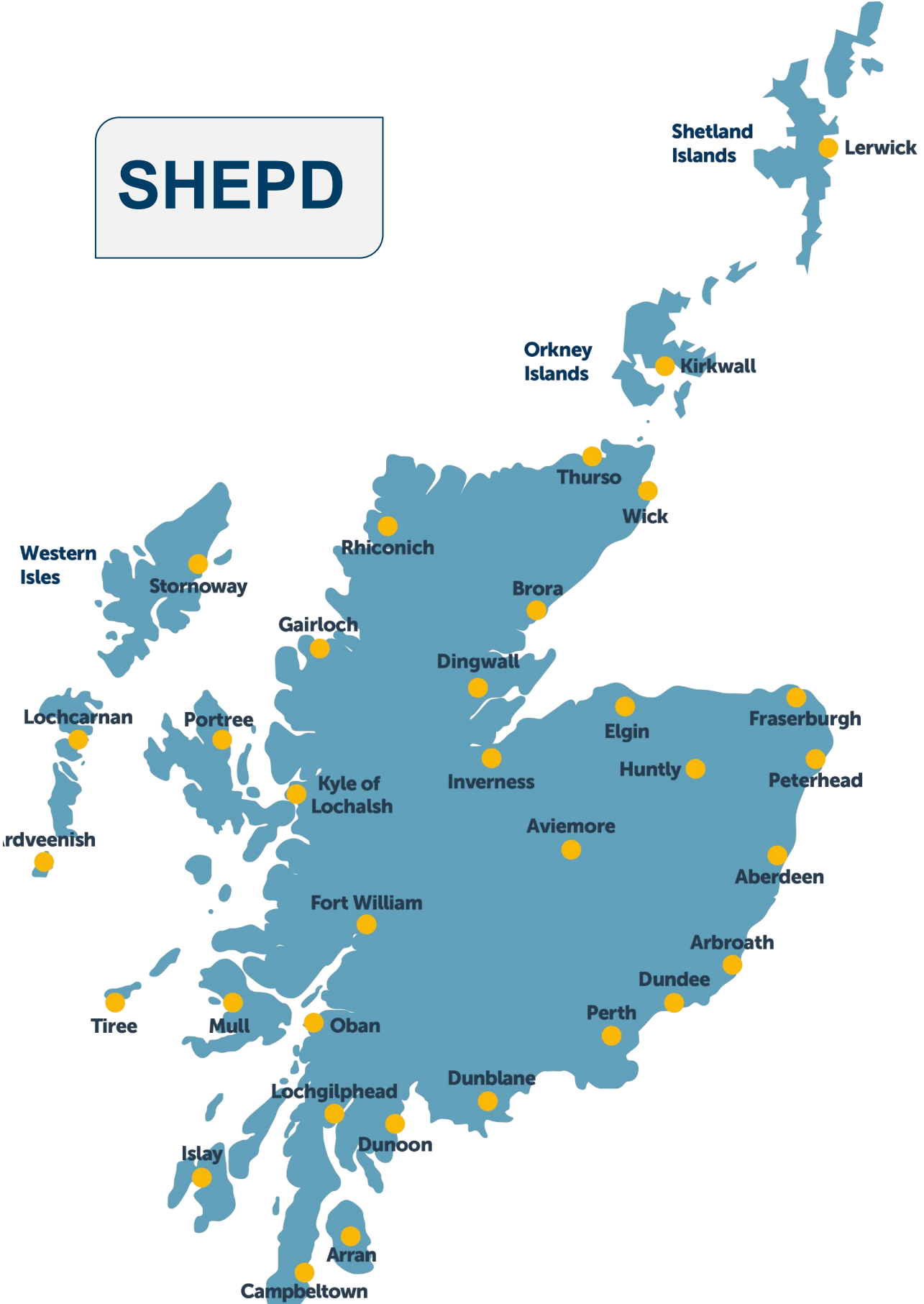
We are regulated by Ofgem, the energy regulator, through a 5-year price control cycle. Our latest business plan, for RII0-ED2, began in April 2023 and runs until March 2028.



SEPD



SHEPD





HF-PQ NET

(HIGH FREQUENCY POWER QUALITY FOR LCT NETWORKS)

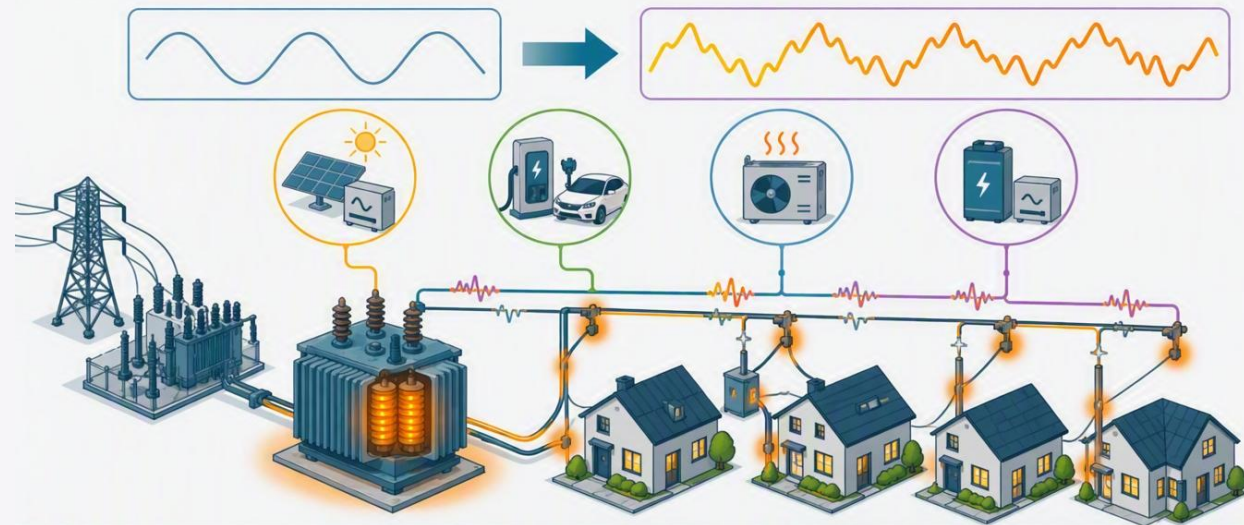
Show and Tell Webinar

8th October



HF-PQ NET : PROBLEM STATEMENT

WHAT IS SUPRAHARMONICS?



Supraharmonics

High frequency voltage or current distortion in the 2 kHz to 150 kHz range.

More power electronic converters = more potential high frequency emissions on LV networks.

KEY INDUSTRY CHALLENGES

Limited Visibility & Uncertainty



Difficult to detect across LV networks, and limited evidence leads to higher uncertainty in planning and connection decisions

No Common Monitoring Specification



Lack of consistent measurement method to monitor high frequency emissions above 5 kHz

Additional Heating & Asset Impact



Possible overheating may lead to insulation stress, network losses, ageing and reduced asset life

Customer Impact & Effect

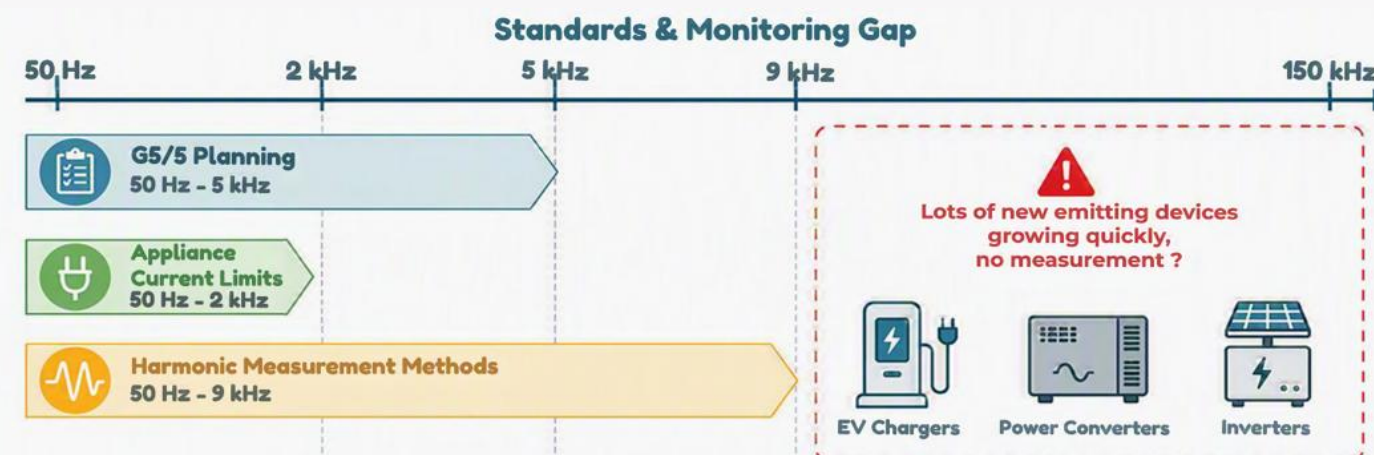


Equipment malfunction, performance issues and more power quality complaints

WHY EXISTING MONITORING STANDARD FALLS SHORT?

Standards & Monitoring Gap

Existing standards and monitoring focus mainly up to ~5 kHz, leaving much of the Supraharmonics range with limited visibility.





HF-PQ NET: AIM AND OBJECTIVES

Develop a consistent high frequency monitoring framework that defines operator needs, equipment specifications, data integration and industry guidance.

KEY OBJECTIVES



Characterise High-Frequency Disturbances

Existing knowledge, challenges and impacts of high-frequency and Supraharmonics distortion



Define Monitoring Equipment Specifications

Bandwidth, sampling, accuracy, installation and reporting



Access Availability of Monitoring Instruments

Supplier capability, limitations, roadmaps and deployment



Data Interface & Architecture

Collection, storage, processing, sharing and integration



Review Existing Best Practice

DNO, industry and international monitoring approaches



Standards, Policy & Procurement

Turn learning into standards, policy and procurement guidance

OBJECTIVES CONVERGE INTO

Combined evidence and requirements

A consistent framework for Supraharmonics monitoring, data and network decisions



Emission Sources



Network Susceptibility



Customer Impacts



High Frequency Distortion Risk Heat Map

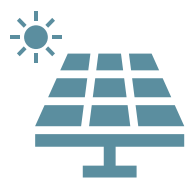
+ practical measurement methods



DISCOVERY FINDINGS - LITERATURE REVIEW

Reviewed the state of the art on the sources, impacts, measurement methods, and regulatory framework for emissions in the 2 kHz to 150 kHz frequency range.

What equipment can cause the distortion ?



PV and batteries

Equipment which generates in DC and needs to convert to AC



EV charging both AC and DC

Loads which need to convert from AC to DC with high power

Which parts of the network are sensitive to the distortion?



Primary substation impedance

Necessary to measure a frequency dependent network impedance



Distance between primary and secondary substation

DNO, industry and international monitoring approaches

Potential Network Impacts



Heating

Additional heating in transformers and cables, create wear and tear



Customer Complaints

Methods to determine if customer complaints already align with distortion

Why does this matter?

As more electric vehicles, heat pumps and renewable energy systems connect to the electricity network, they can create high-frequency electrical "noise" that is not routinely monitored today.

Key findings

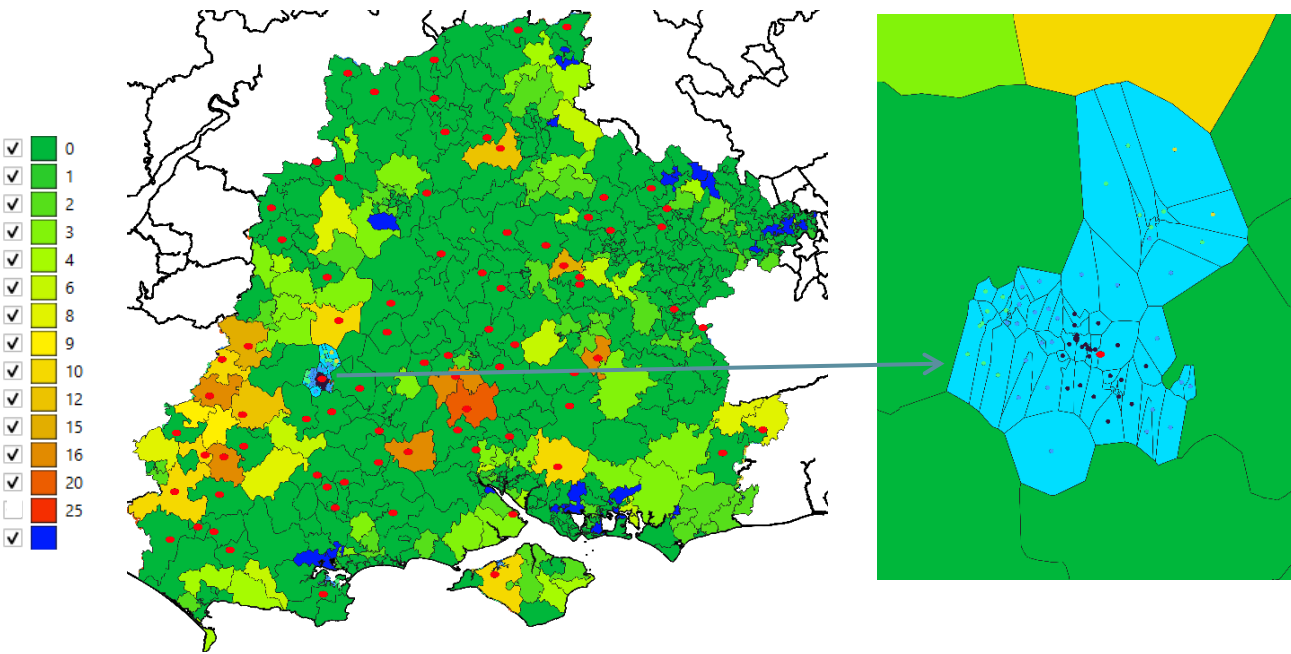
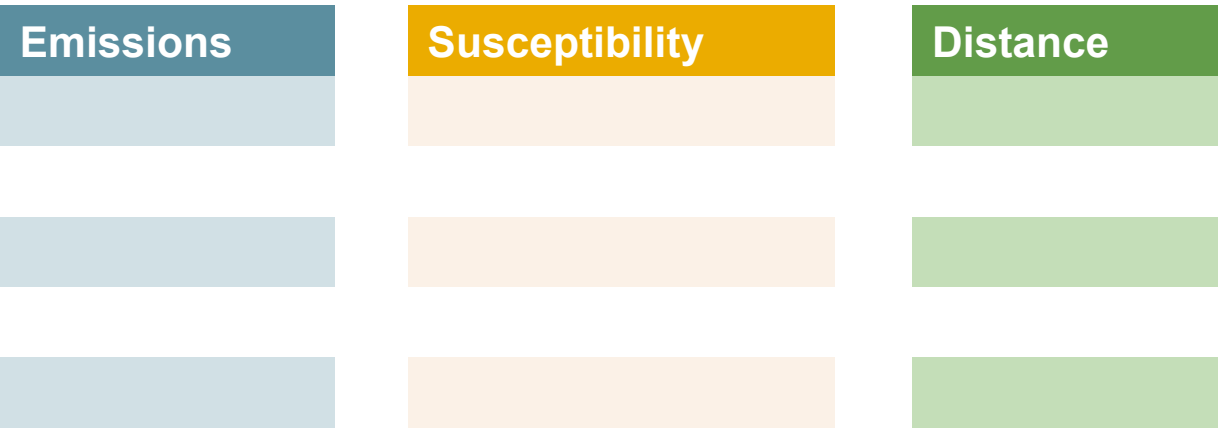
- EV chargers, solar panels and other modern technologies are the main sources of this electrical noise.
- The amount of disturbance varies from place to place depending on local network conditions.
- High levels can affect equipment performance, increase energy losses and interfere with some communication systems.
- Measuring these disturbances is difficult because most existing monitoring equipment was not designed for these frequencies.



DISCOVERY FINDINGS - HEATMAP

Network prioritisation methodology was applied to produce a heat map of primary and secondary substations.

Quantified the available data



Map potential sites

Combined network datasets to identify candidate measurement locations.

Rank the locations

Applied a simple score to flag sites more likely to experience higher disturbance levels.

Assess key influences

Reviewed the local network, renewable and power-electronic generation, and EV/heat-pump uptake.

Compare sites

Selected varied sites, including nearby and distant substations, to see how disturbances change across the network.

Key result

Discovery has identified **Potential measurement sites** for the Alpha phase.

482

Primary substations reviewed

12

Primary substations

24

Secondary substations



CHOOSING FIELD-MONITORING EQUIPMENT

We checked current standards and available products to see what can capture high-frequency electrical disturbances.

WHAT WE LEARNED

- 01

Define the need
The monitor must detect high-frequency electrical disturbances from 2–150 kHz.
- 02

Check the market
Several products meet many of the requirements and could support the Alpha and Beta trials.
- 03

Recognise the gap
Because standards have recently changed, no current product meets every latest requirement.

SUITABLE OPTIONS FOR FUTURE FIELD TRIALS:

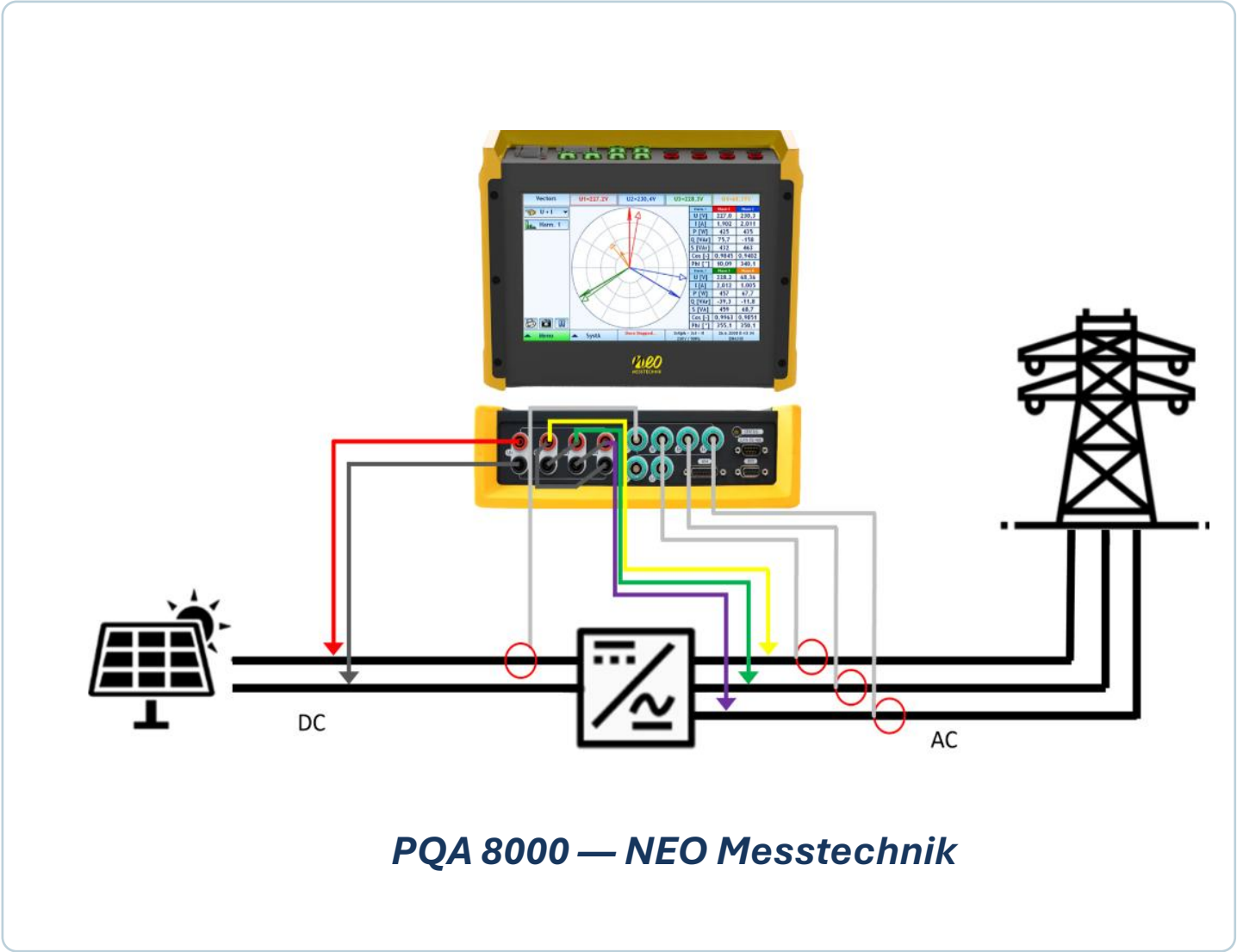
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PQ monitoring instruments reviewed

3

hardware-ready PQ monitoring instruments identified

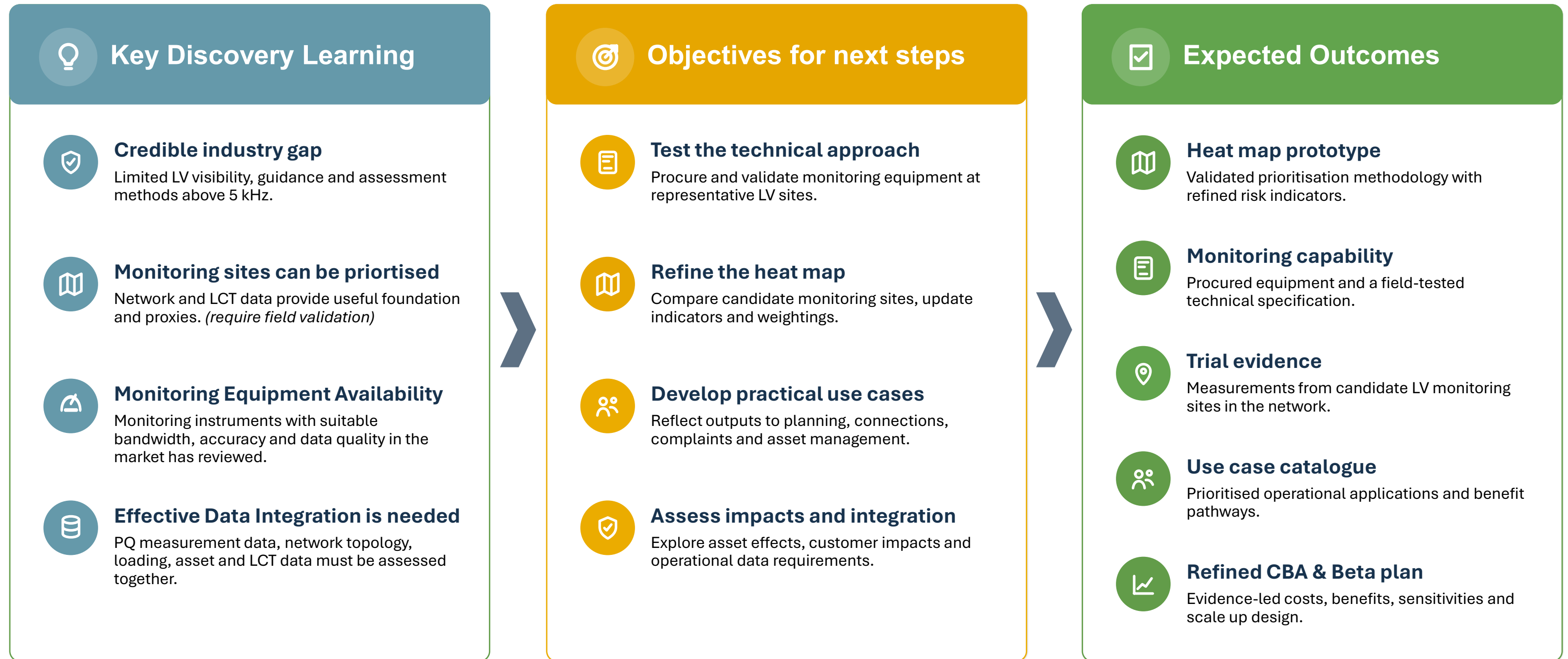
EXAMPLE OPTION:





From Discovery to Future Development

Literature review and candidate listings into focused field testing and practical use cases





THANK YOU

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