



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

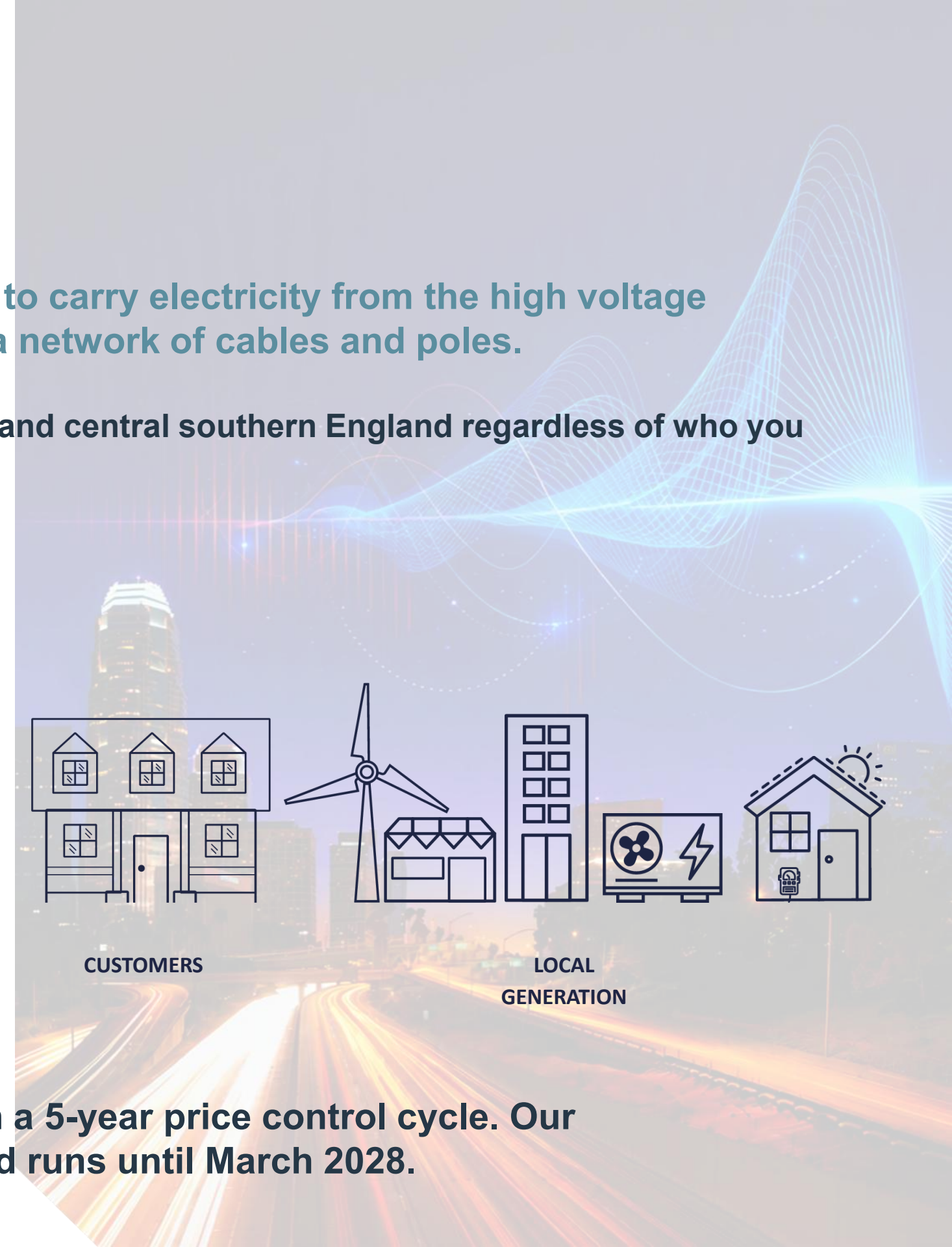
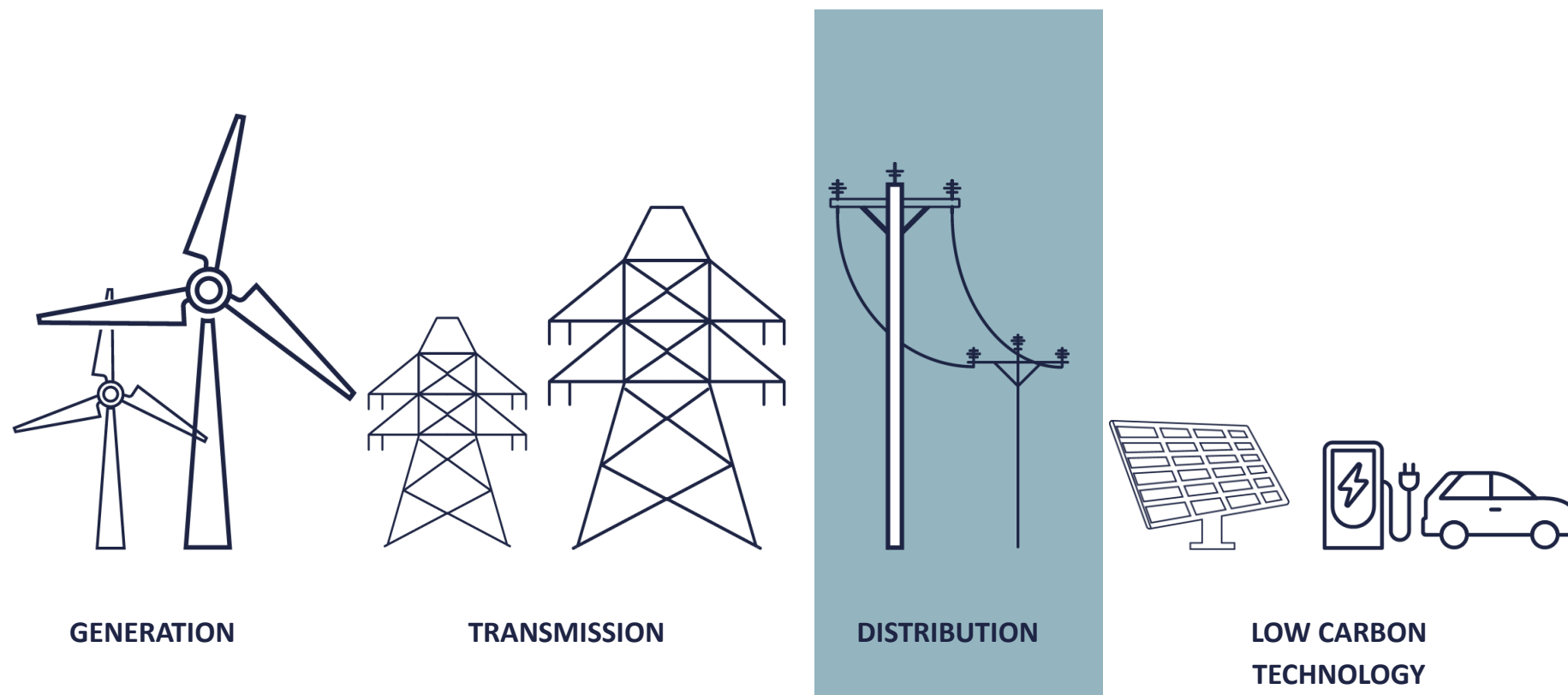




OUR ROLE IN THE ENERGY SYSTEM

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 RIIO-ED2, began in April 2023 and runs until March 2028.



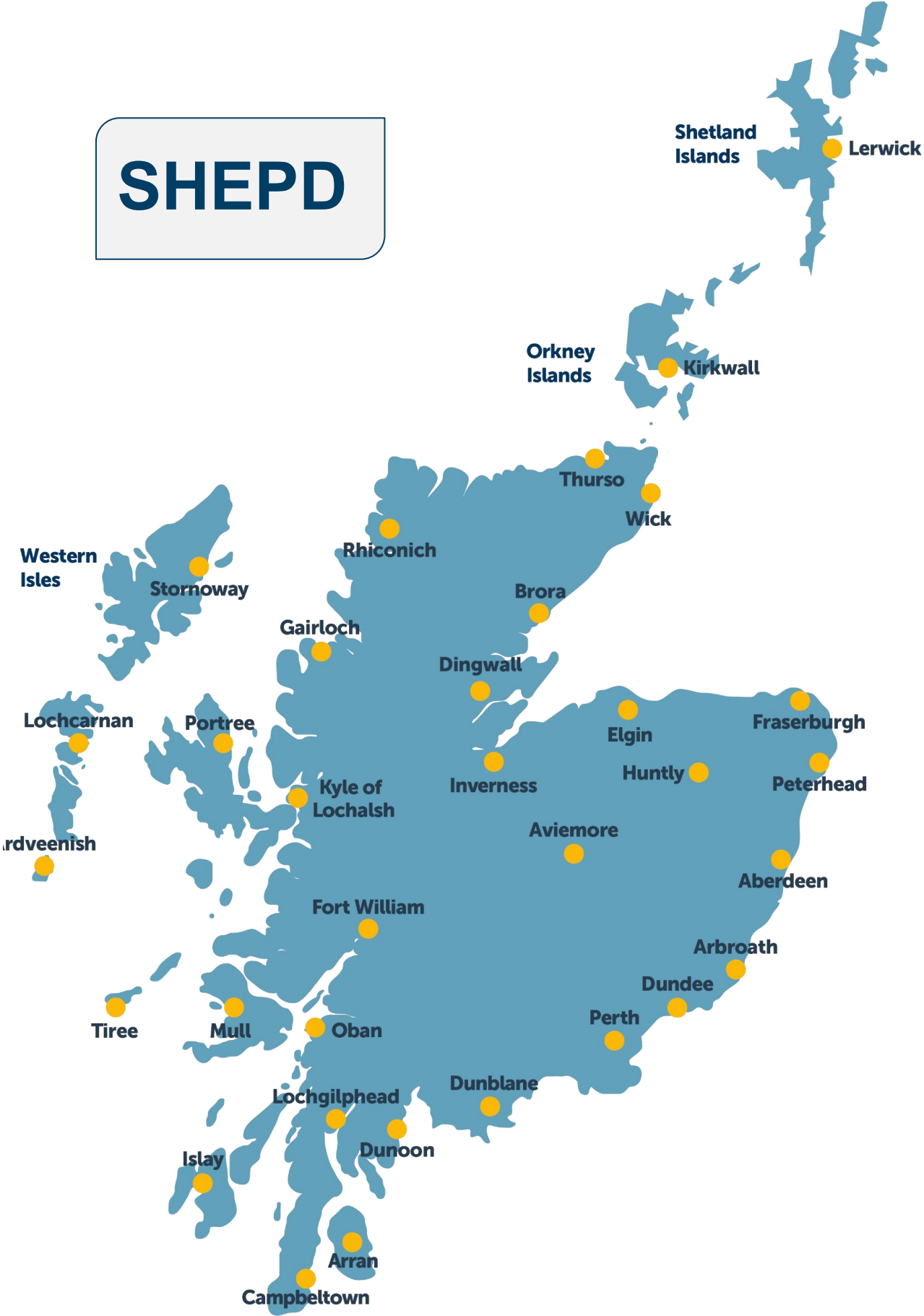
SEPD



SEPD North

SEPD South

SHEPD



SHEPD North

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POWERING OHMS

SIF Discovery



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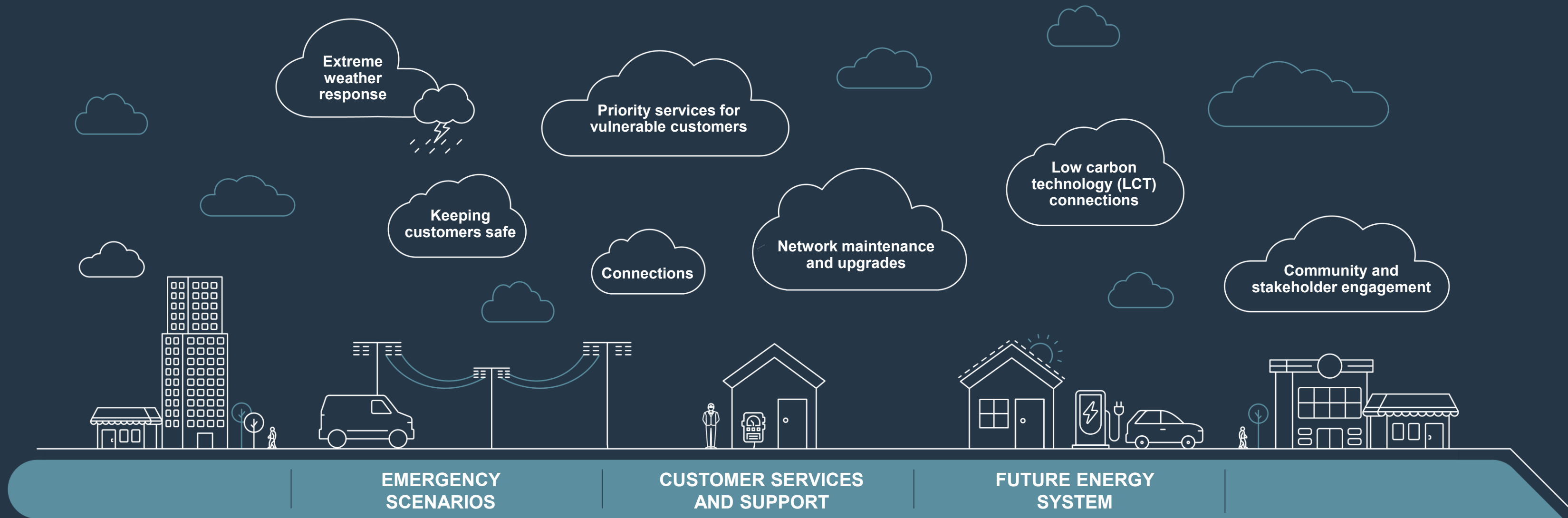
WELCOME AND INTRODUCTIONS



PROJECT EVOLUTION & DELIVERABLES



POWERING CUSTOMERS AND COMMUNITIES



●●●● BACKGROUND

The aim of Powering Ohms is to look at smarter ways to upgrade local electricity networks so they can support more electric vehicles, heat pumps, and other low-carbon technologies.

01 COMPACT VOLTAGE TRANSFORMATION APPROACHES

to develop compact pavement substations and larger capacity pole-mounted solutions – reducing need for land acquisition and prolonged disruption, enabling more consumer-centric grid expansion.

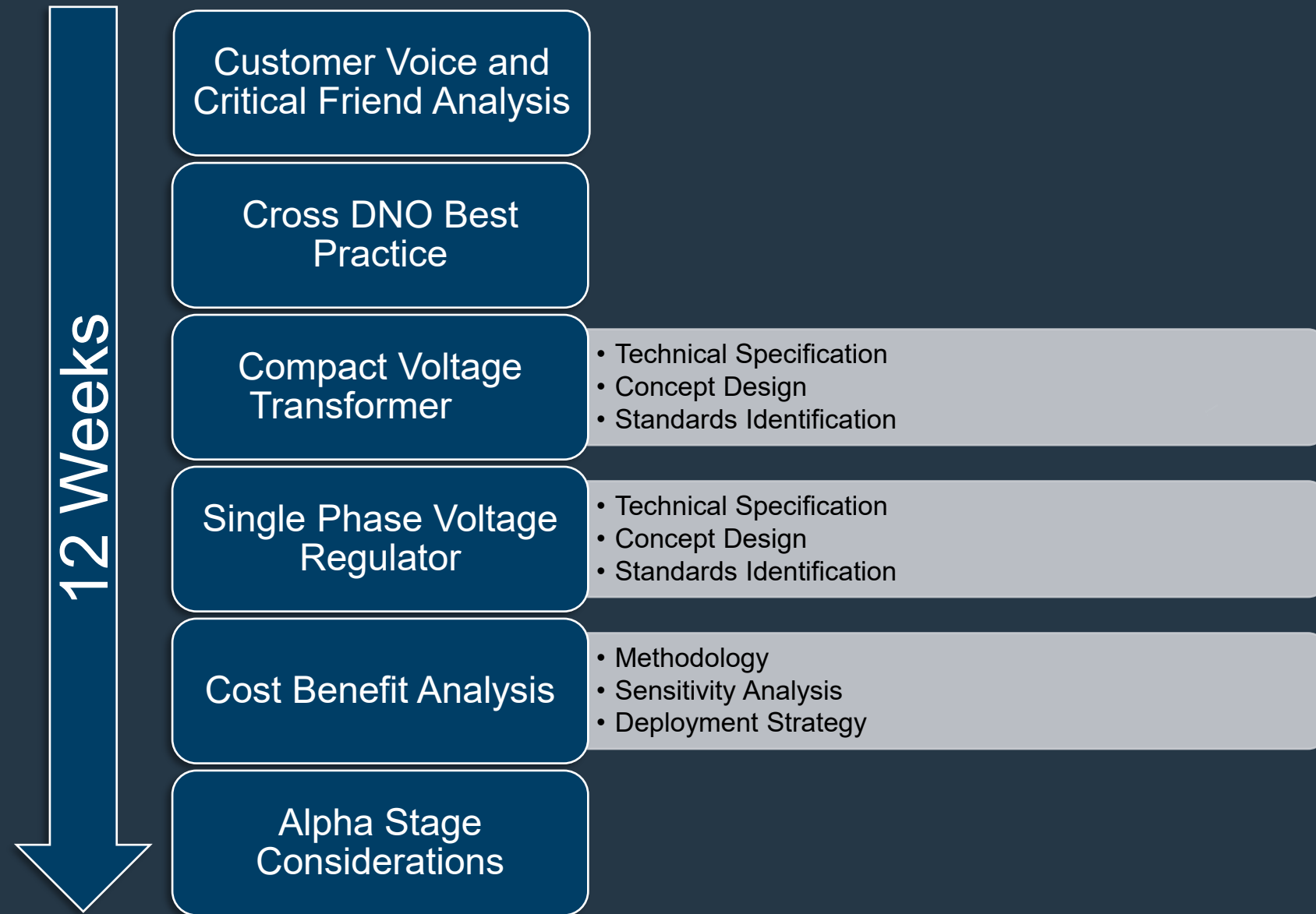
02 DEVICES AT CUSTOMER POINT OF CONNECTION

to improve voltage control. Improved network-side utilisation of existing LV assets, enabling capacity to be released in a more targeted and proportionate way. This supports faster responses to localised demand growth without defaulting to large-scale reinforcement and customer disruption.





DELIVERABLES





CONSUMER VOICE & WHOLE SYSTEM ENGAGEMENT

Why this report matters

WP2 brings together network practice, barriers and consumer voice to shape Alpha.



D2.1 Consumer Voice & Critical Friend

Customer-facing feedback on acceptability, vulnerability, accessibility and communication.

- Safety, planning, public realm impact, reliability and expected asset life were identified as key topics for consumer consideration
- Local highways added an authority input, discussing sightlines and physical protection

D2.2 Cross-DNO Best Practice & Barriers

Current DNO approaches, limitations, adoption barriers and solution evidence needs.

- Cable reinforcement, Network alterations, transformer upgrades and new secondary substations were identified as the current best practice
- Cost, delivery time, space, land availability and access constraints were identified as limitations of the current practice

D2.3 Alpha Consumer Engagement

Practical recommendations for trial design, communication, access and safeguards.

- The report helped us to gather valuable information that can shape any future technology from the ground up
- Desirables from the survey helped us to add an element of future proofing to the project



Consumer impact: the same issues, different lenses

DNOs, housing and highways stakeholders broadly agree on the themes, but approach them differently.

DNO lens

- Network delivery
- Safety and compliance
- Service continuity
- Operational risk
- Maintenance and monitoring

Housing / resident lens

- Access to homes
- Resident disruption
- Landlord / tenant routes
- Home user guides
- Practical acceptability

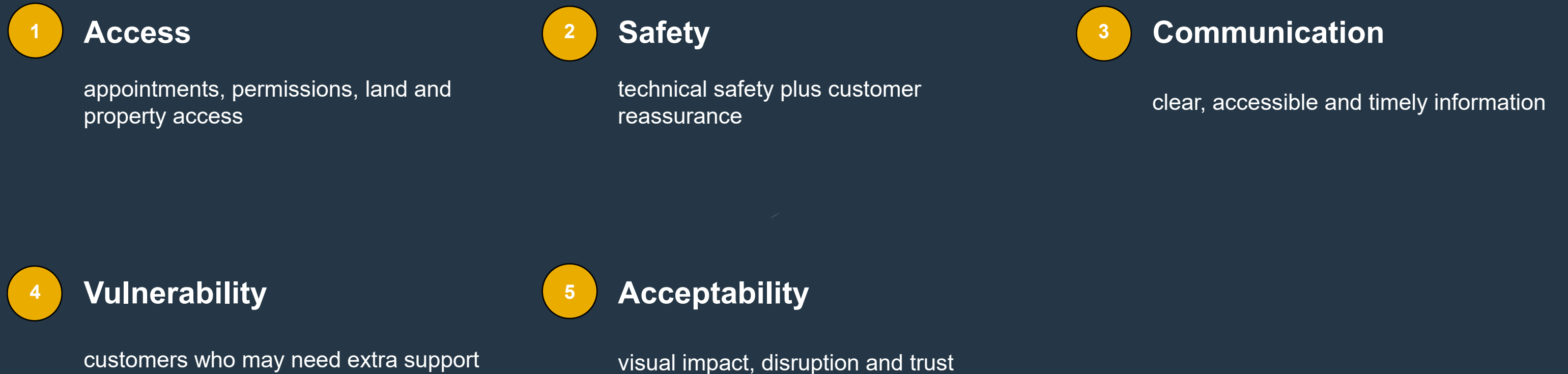
Highways / public realm lens

- Siting and sightlines
- Footway / verge space
- Cabinet clutter
- Damage / tampering
- Local Highway Authority input



Where the evidence aligns

Five themes recur across the DNO and consumer-centric evidence streams.



Shared conclusion: All participating parties agreed that technical validation needs to happen alongside customer engagement and delivery planning.



COMPACT VOLTAGE TRANSFORMER

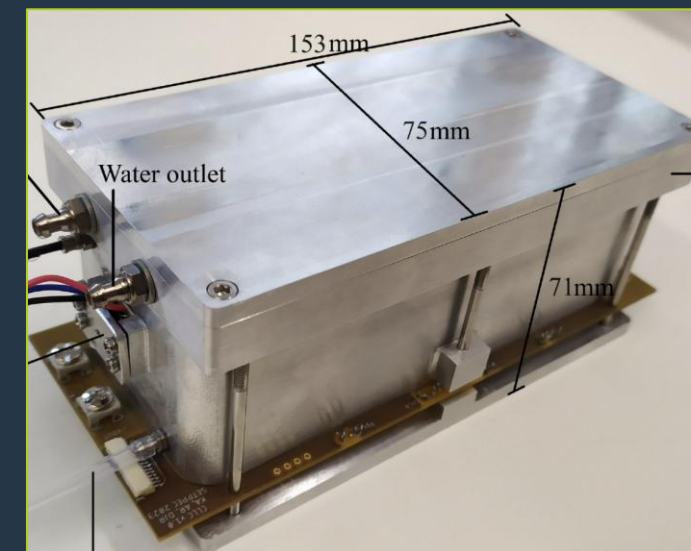
TECHNICALLY FEASIBLE

The Powering Ohms – Compact Pavement Substation study concludes that a Compact Pavement Substation (CPS), based on a modular Solid-State Transformer (SST), is technically feasible as a compact alternative to conventional 11kV/400V distribution substations in space-constrained urban environments.



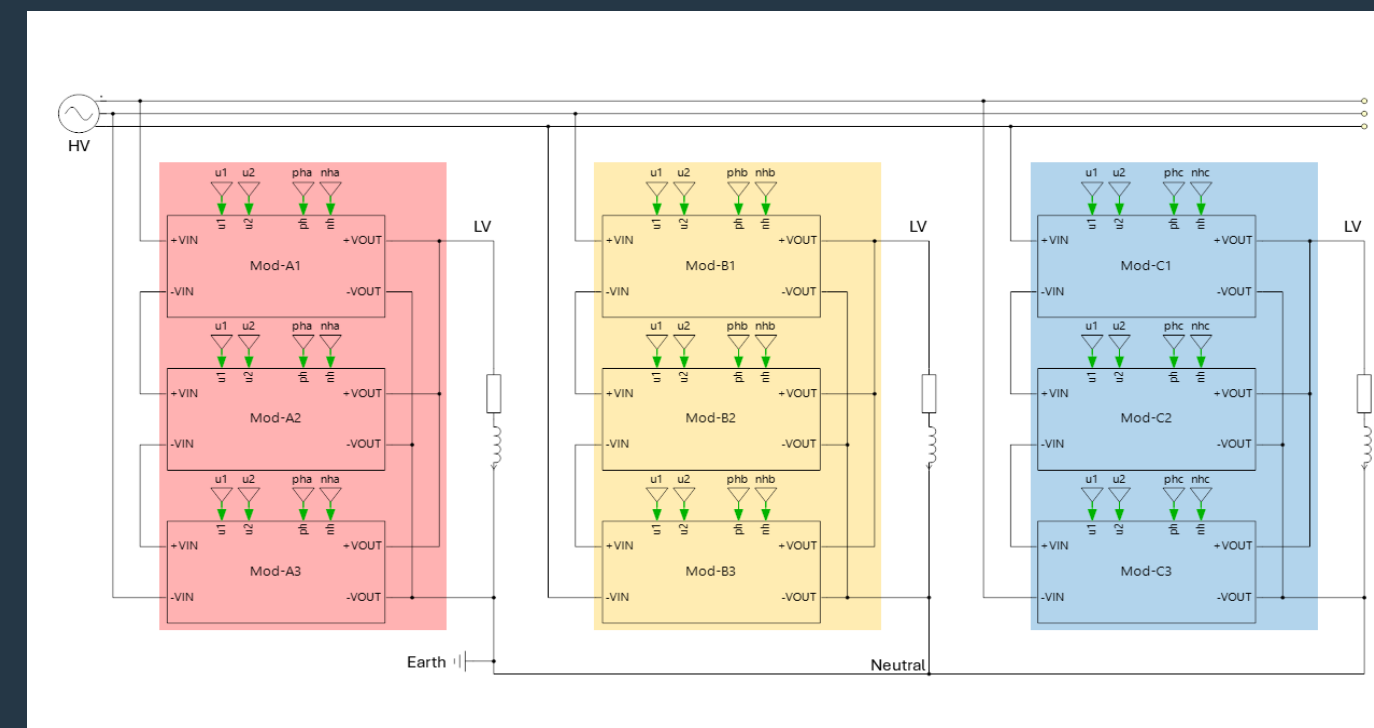
VALIDATION REQUIRED

The study found no fundamental technical barriers to deploying the CPS concept. However, successful progression requires further validation of protection coordination, insulation performance, thermal packaging, module reliability, and system integration before full-scale network deployment can be justified.



COMPACT 350 kVA CONCEPT

The concept aims to deliver 350kVA capacity within a street-furniture-sized enclosure, helping address growing electricity demand driven by heat and transport electrification while reducing the need for land acquisition, planning approvals, and disruptive civil works.





COMPACT VOLTAGE TRANSFORMER – NEXT STEPS

De-risk the critical technology challenges:

Validate protection coordination, insulation performance, thermal management, voltage/current sharing, and long-term reliability to demonstrate the SST can operate safely and effectively on an LV network.

Progress through a staged prototype programme:

Develop and test a single module, then a series-connected phase string, before building a full 350 kVA three-phase prototype to prove performance under real operating conditions.

Build the commercial business case:

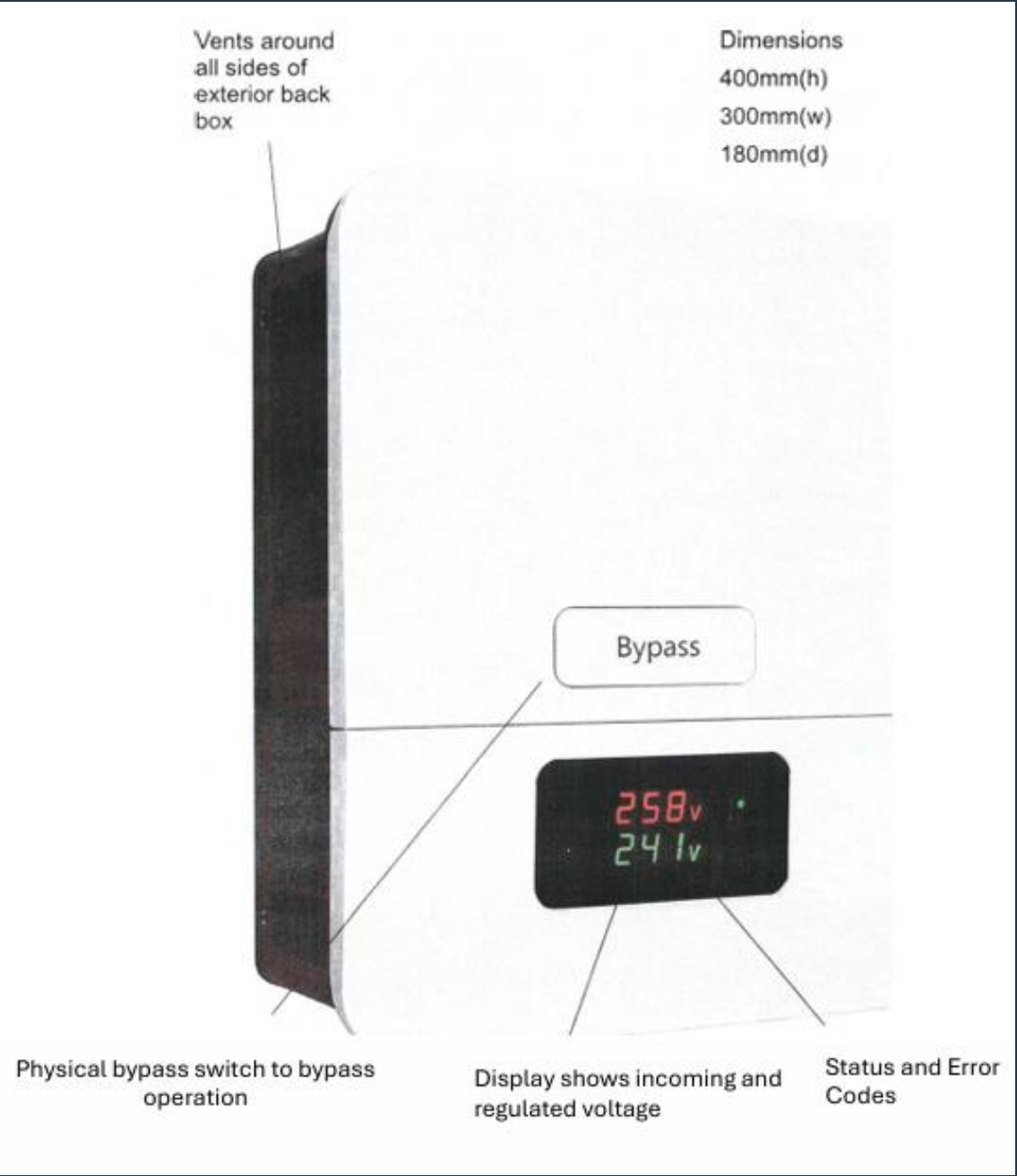
Quantify the benefits versus conventional reinforcement by demonstrating reduced land requirements, lower civil works costs, faster installation, and reduced customer disruption in constrained urban locations.

Achieve asset approval and network deployment readiness:

Develop the compliance, safety, maintenance, and operational framework required for SSE approval, leading to field trials and potential deployment as an ED3 reinforcement solution.



CUSTOMER POINT OF CONNECTION VOLTAGE CONTROL



AREAS CONFIRMED AS FEASIBLE:

DEVICE & CONNECTION

- Device can be constructed to a small enough form factor to make prototyping viable
- Device can control both up and down voltage requirements
- Connection possible under current guidance

PROTOTYPE & CONTROL

- Clear success criteria for prototype created
- Schemes of work for prototype testing understood
- Impacted British Standards highlighted
- Modes of operation and Dead Bands quantified

OPERATING MODES AND DEADBANDS

Input Grid Voltage (AC)	Mode of Operation	Output voltage
230.0	Bypass	230.0
240.0	Bypass	240.0
250.0	Bypass	250.0
252.9	Active	240.3
253.0	Active	240.4
255.0	Active	242.3
260.0	Active	247.0
265.0	Active	250.4
266.3	Active	250.4
267.0 (upper limit)	Active	250.4



SINGLE PHASE VOLTAGE REGULATOR – NEXT STEPS

De-risk the critical technology challenges:

Placing additional equipment into the customers homes will come with challenges, as has been evidenced by the Smart Meter roll out. Safety will form a cornerstone of any further development of the product.

Progress through a staged prototype programme:

Engaged with labs and testing house to create an appropriate testing regime to test and explore the devices capabilities, including levels of voltage correction, capacity, thermal limits and performance.

Build the commercial business case:

Seek to build on and incorporate the potential functions of the SPVR into a full deployment strategy that will seek to assist SSEN with its voltage strategies. Direct intervention could prove more lucrative and practical than large scale reinforcement.

Achieve asset approval and network deployment readiness:

Develop the compliance, safety, maintenance, and operational framework required for SSE approval, leading to field trials and potential deployment as an ED3 reinforcement solution.

Both Powering Ohms devices make a case against a conventional overlay, on a conservative set of assumptions, across all three sensitivities tested within plausible ranges.

POSITIVE VALUE CASE

Both devices have positive Financial and Societal benefits, with some Environmental costs due to losses, and a positive NPV overall.

NPV RESILIENCE

The NPV is positive under all sensitivities tested (unit cost against service life, SPVR fleet size, and VoLL exposure all the way down to zero).

BREAK-EVEN HEADROOM

54% **33%**

SPVR

**Compact
substation**

Break-even unit costs for both SPVR and CS sit well above the partners' estimated prices, 54% headroom for SPVR and 33% for CS at their assumed service lives.

WHERE EACH WINS

SPVR has an advantage for financial benefits, particularly as a small number of SPVRs cost substantially less in total than the overlay they replace. CS has advantages of societal benefits, with one CS resolving every complaint on the feeder very quickly, addressing lost load and complaints efficiently.

This gives the two devices different strengths for different situations: SPVR suits a feeder with a handful of affected customers, Compact Substation suits a feeder where the whole customer base is affected.



BAU AND COMMERCIALISATION

FINANCIAL BENEFIT

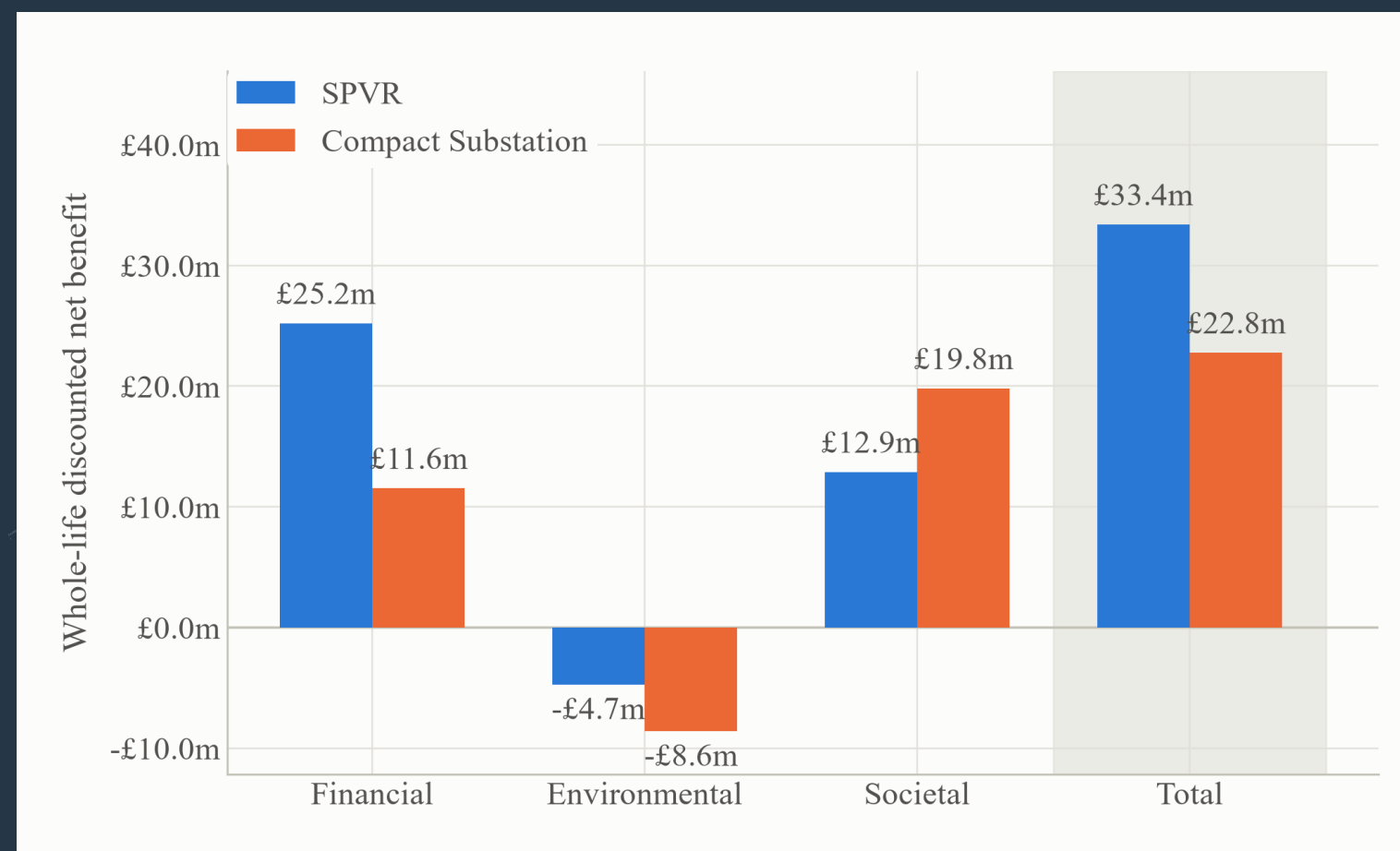
SPVR shows the larger Financial benefit (CAPEX and OPEX). Buying and installing all ten units assumed for one feeder still costs less in total than either the overlay it replaces or a single CS.

ENVIRONMENTAL COST

CS costs more on Environmental (losses) than SPVR does. A CS carries the whole feeder's power continuously, so it continuously loses some energy as heat. Each SPVR unit regulates only one property and bypasses when that property doesn't need regulating. SPVR's additional losses are further mitigated by benefits of Conservation Voltage Reduction (CVR).

SOCIETAL BENEFIT

CS shows the larger Societal benefit (VoLL), because once it arrives it resolves every customer's complaint on the feeder at the same time. SPVR resolves complaints one at a time, installing a new unit only when that specific customer complains, so clearing the whole feeder's backlog (i.e., growing value of Energy Not Supplied) takes longer.



£2.78k

SPVR's Discounted Net Benefit per unit

£19k

CS's Discounted Net Benefit per unit



NEXT STEPS



NEXT STEPS



FOUR SIGNALS SUPPORT PROGRESSION



BOTH PROJECTS SHOWED POTENTIAL FOR PROGRESSION



CBA IS POSITIVE IN BOTH CASES



POSITIVE IMPACT FOR CUSTOMERS



TECHNICALLY VIABLE



THANK YOU



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AUDIENCE Q&A ?



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