Voltage Matters – Flexibility

17th April 2026

Agenda

10:00 – 10:05 Fundamentals & EA – Welcome (5 minutes)

10:05 – 10:10 Threepwood – Richard Parke – Update (5 minutes)

10:10 – 10:25 Smart Grid Consultancy Ltd – Gary Swandells, Director – Keynote: *DSO Regulation & Voltage Regulation* (15 minutes including Q&A)

10:25 – 10:45 National Energy System Operator (NESO) - Julian Leslie, Director of Strategic Energy Planning and Chief Engineer – *Voltage Management in a Low Carbon Future* (20 minutes including Q&A)

10:45 – 11:05 geo – James Harrow, Head of Flex and Innovation, and **EDF Energy UK R&D** - **Olayinka Ayo**, Lead Research Engineer – *Project SOLVE – Solving Voltage Challenges with LCT Driven Flex Forecasting and Smart meter data* (20 minutes including Q&A)

11:05 – 11:25 SP Electricity North West - **Andy Howard**, Innovation Programme Manager – *QUEST Network Innovation Competition (NIC) Project – Summary Findings* (20 minutes including Q&A)

11:25 – 11:30 Fundamentals & EA – Closing remarks and next steps (5 minutes)

Welcome and Updates

Voltage continues to ascend the priority list

Fundamentals acquired by EA Technology in January

Fully committed to Voltage Matters

Thanks to Threepwood for their support

Introducing EA's Ian Cooper

Ian Cooper

Head of Consulting
EA Technology

ian.cooper@eatechnology.com

Richard Parke, Threepwood

Voltage Matters – a briefing to date

Richard Parke

17.04.26

Threepwood Consulting

www.threepwoodconsulting.com

Classification: Commercial In Confidence

Text

- 4 Webinars, 1 in-person event since January 2025
- 15+ speakers
- Wide breadth of organisations represented
  - DNOs and IDNOs
  - Regulator (Ofgem)
  - Standards bodies and trade associations (IET, ENA, BEAMA)
  - Technology providers, Innovators, System Thinker

Classification: Commercial In Confidence

Key Themes Covered

Voltage is a System Constraint

- EV Charging affected
- Rooftop PV rollout affect
- Flexibility participation affected

Legacy Approaches are under pressure

- Traditional planning assumptions were designed for static demand systems

Visibility below HV is critical

- Limited real-time insight at LV remains a common challenge

Standards, Regulation and Policy must evolve

- ESQCR voltage
- BS 7671

Opportunities Highlighted

- **Smarter voltage management can**
  - Increase capacity
  - Reduce curtailment of DERs
  - Avoid EMC issues
- **Making Innovation business-as-usual**
  - Excellent solutions have been proven and are in development
  - But the sector suffers from ‘pilotitis’, and sometimes silos hinder solution rollout
  - There is opportunity to collaborate better and accelerate rollout of proven solutions
- **Better outcomes for customers**
  - Fewer nuisance trips (e.g. EV charging)
  - Improved quality of supply
  - Potential for energy saving through CVR

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Gary Swandells, Director, Smart Grid Consultancy Ltd

Keynote: *DSO Regulation & Voltage Regulation*

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Voltage Matters

Gary Swandells

DSO Regulation & Voltage Regulation

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Personal Intro

SGC overview summary & Ofgem responsibilities

Background

• Joined the industry about 16 years ago without any specific engineering experience.

• Very much a commercial guy with a focus on economics and most notably the establishment of Flexibility as a tool for system operation.

• More recently by networks for locational capacity issues.

Ofgem / DSO role

• Position on the DSO Performance Panel, for the annual performance assessment of the DSOs for the ED2 period.

• A panel of 5 Ofgem appointed industry representatives.

• Employed as part of the annual governance process that ultimately makes up a key part of their annual financial settlement.

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Ofgem Performance Panel Members

The panel is made up of 3 Independent Experts, plus 2 stakeholders, and is chaired this year by Jack Presley Abbott.

3 Independent Experts

- **Gary Swandells**

- **Jacopo Torriti** is a Professor of Energy Economics and Policy in the School of the Built Environment, University of Reading.

- **Jason Brogden** – Director at Jason Brogden Consulting and probably best known for his work on Market Wide ½ Hourly Assessment and his leadership on the Open Networks Project for its first 4½ years, helping to set the common foundations for DSO across the network operators.

2 Stakeholders

- **Andy Manning** - Principal Economic Regulation Specialist, Citizens Advice, leading work on energy networks and systems to ensure network services deliver value for consumers.

- **Gemma Stanley** Grid Policy Specialist, Octopus Energy, serving on the Panel as ADE's stakeholder representative.

Chair

- **Jack Presley Abbott**, Ofgem Deputy Director for Strategic Planning and Connections, with a background in flexibility regulation, market design and demand response.

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Why Ofgem did not switch on metrics in ED2

What changed in ED2

• Ofgem originally intended the DSO incentive to include hard performance metrics.

• It decided not to switch them on during ED2 because the data and methodologies were not yet mature enough to set robust targets with confidence.

• The current regime leans more heavily on the stakeholder survey and the Performance Panel, with the metrics used more to build the evidence base than to drive direct scoring.

Why that matters

• That is part of the reason the panel matters, and part of the reason stakeholder submissions matter too.

• The panel does not assess performance solely on what the networks say about themselves.

• Ofgem also runs a formal call for stakeholder evidence, and that input is summarised for the panel and can be followed up where clarification is needed.

Likely to evolve into ED3, where Ofgem has already pointed to a stronger focus on wider DSO outcomes including DER integration, operational efficiency, voltage management and losses.

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Performance Panel categories and sub-categories

Ahead of this year's written submissions, the official scoring is broken down to 5 key sections.

Category	Weighting	Sub-categories
Delivery of DSO benefits	30%	Level of ambition Benefits realisation
Data and information provision	20%	Scope, granularity and accuracy of data Accessibility of data
Flexibility market development	20%	Design of distribution flexibility products, contracts and processes Facilitation of market access
Options assessment and conflict of interest mitigation	20%	Assessment of network options Management of conflicts of interest
Distributed energy resources (DER) dispatch decision-making framework	10%	DER visibility and dispatch

The panel scoring scale is out of 10 for each criterion.

Stakeholder Survey Topics

- Coordination with other network and system operators
- Data and information provision
- Support for flexibility market development
- DSO decision-making performance
- Approach to network planning

Stakeholder Survey Results represent 50% of the DSO Final Scoring.

Details of how to make contact with each DSO

DSO	Stakeholder route / wording already provided
UK Power Networks (UKPN)	DSO sign-up form or use the DSO contact page. The sign-up form is for “latest news and updates” across DSO topics, and the contact page invites people to share questions and ideas. (UKPN DSO)
Scottish and Southern Electricity Networks (SSEN)	Register as a stakeholder via SSEN’s dedicated engagement portal. SSEN’s stakeholder page explicitly says “You can register as a Stakeholder” and gives the stakeholder engagement email as a backup. (SSEN)
National Grid Electricity Distribution (NGED)	DSO mailing list form. It is specifically for people interested in DSO work and lets them choose topics such as Flex, Network planning, Net zero planning, and Data request. A general feedback form is the backup route. (Distribution System Operator (DSO))
Electricity North West (ENWL)	Stakeholder distribution list for newsletters, webinars and events; for specifically DSO/flex stakeholders, the Flexibility get in touch form is better because it also offers mailing-list sign-up and meeting requests. (enwl.co.uk)
SP Energy Networks (SPEN)	Register as a Stakeholder on SPEN’s engagement portal. SPEN says stakeholders can register there and take part in workshops, surveys, meetings and other opportunities. The registration page is currently open through the end of 2026. (SPEnergyNetworks)
Northern Powergrid (NPg)	For professional / industry stakeholders, use the Engage stakeholder portal. Northern Powergrid says this is its dedicated stakeholder portal for engagement events and channels. For homeowners or small businesses, it separately points people to Northern Powergrid Connect. (northernpowergrid.com)

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Completed and Live Operational Voltage Projects

Project	Network	Description	Current Status
CLASS	Electricity North West	Real-time voltage reduction at primary substations to manage demand/frequency.	BaU (ENWL Only); broader rollout under regulatory debate.
Smart Street	Electricity North West	Integrated use of On-load Tap Changers (OLTC) and automated switching to lower voltage safely (CVR).	BaU Rollout; latest public materials indicate now benefiting around 100K+ households, rollout ambition of 250K by 2028
Respond	Electricity North West	Used an Intelligent Mitigation Device to manage voltage and fault levels dynamically.	Completed; findings integrated into ENWL's operational toolkit.
NExT	UK Power Networks	Retrofitting transformers with power electronics for real-time phase and voltage control.	Live Trial (started Feb 2026).
LV-ACT	National Grid Electricity Distribution	Real-time active power control to balance voltage and load between two separate feeders.	Trial completed - prototype design approved and prototype/test setup is being assembled ahead of testing. duration runs to May 2026
D-Suite	SP Energy Networks	Deploying D-STATCOMs to low-voltage grids for high-speed reactive power injection.	Live (Beta Phase); developing operational blueprints.
Voltage Reduction Analysis (VRA)	National Grid Electricity Distribution	Monitored real-time consumption reaction to voltage drops to derive benefits for customers.	Completed; analysis used to update national voltage reduction policies.

Julian Leslie, Director of Strategic Energy Planning and Chief Engineer, NESO

Voltage Management in a Low Carbon Future

Public

Voltage Management in a Low Carbon Future

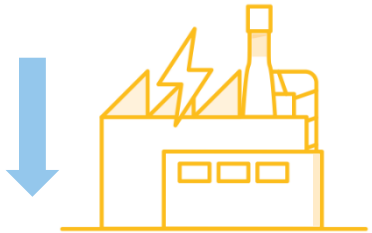
J Leslie

Director Strategic Energy Planning and Chief Engineer

NESO
National Energy System Operator

7 Engineering Challenges

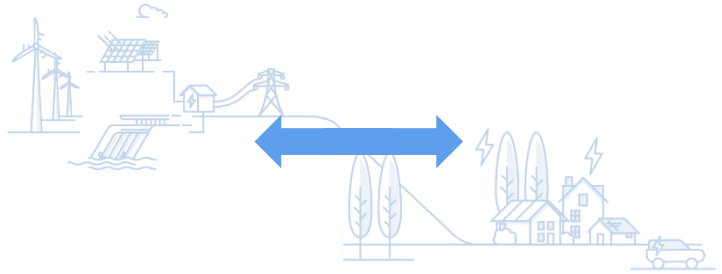
Decarbonisation of the GB power system has resulted in changes in four key areas:



Less dispatchable generation

More variable sources of generation

More asynchronous generation



Generation moving to different areas.

Each of these changes brings about new engineering challenges which have to be resolved to operate a zero carbon network.

- **Frequency** - As more non-synchronous generation connects, system inertia lowers requiring faster acting response. More variability in the system requires fast acting reserves. Large and small loss sizes require services which respond dynamically to the frequency.
- **Stability** - More non-synchronous generation is reducing the levels of stability capability provided to the network. To ensure the system is stable for faults on the network services to provide inertia and short circuit levels need to be procured.
- **Voltage** - Less dispatchable generation and changes to network flows brought about by generation moving away from demand is increasing the requirements to absorb reactive power on the GB network.
- **Thermal** – More variable sources of generation combined with generation moving to different areas are creating more thermal constraints on the network requiring more innovative solutions to manage congestion prior to network build
- **Resource Adequacy –** the right generation mix, flexible demand and storage
- **Flexibility -** what, where and when can we leverage flexibility
- **System Restoration –** how do you restart a renewable dominated system

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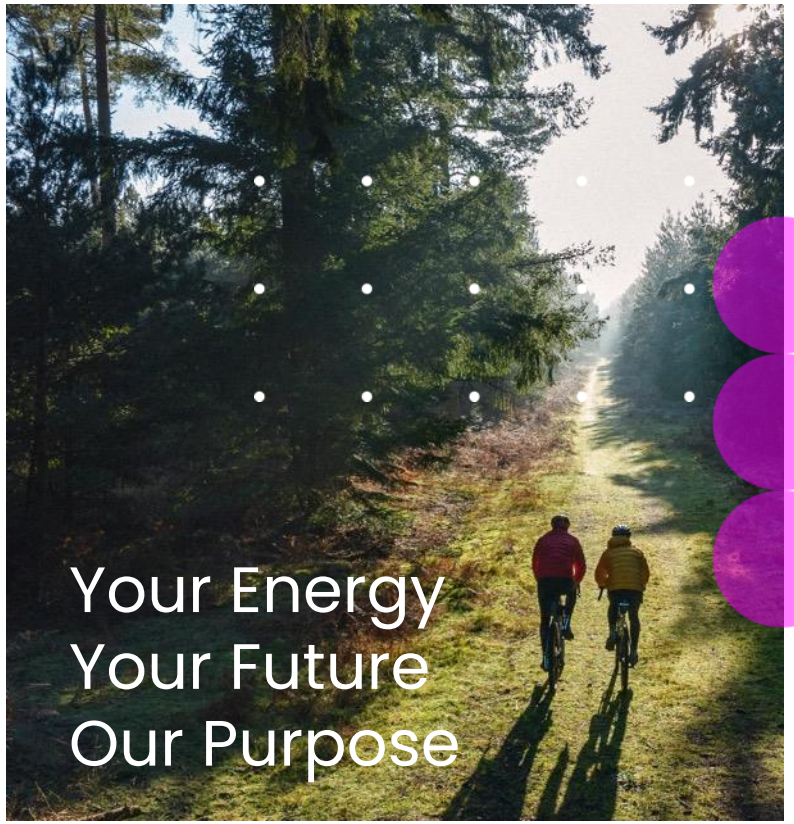
Voltage

- Much more dynamic
- Switch from low volts to high volts
- Large swings in power flow
- Cabling of connections
- Invertors powered overnight
- Change in lighting technology/ use



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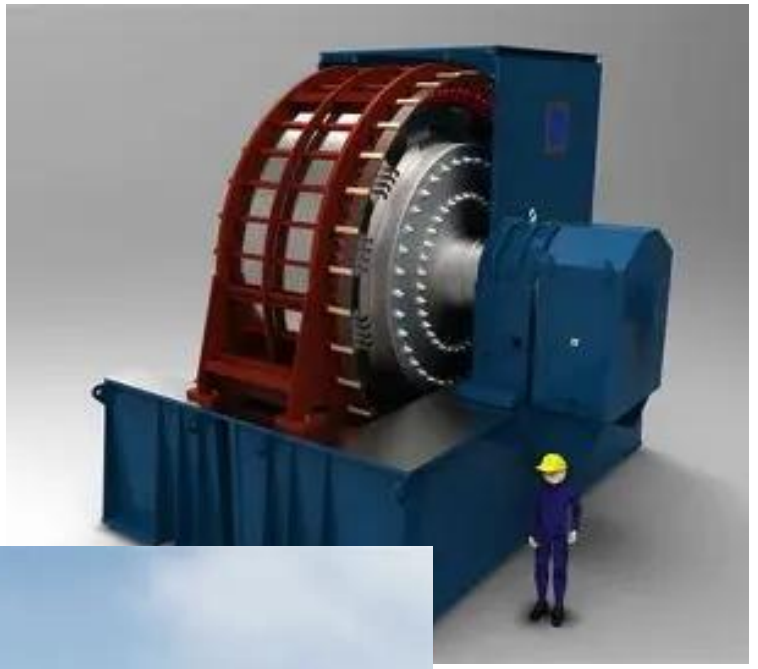
What are we doing?

- Pathfinders
- Reactive control equipment
- Voltage control circuits
- Network configuration
- Network investment
- Modelling and understanding of drivers

- DNO/DSO opportunities
  - Embedded generation
  - Voltage control
  - Network configuration



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https://www.neso.energy/

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NESO
National Energy System Operator

James Harrow, geo, Head of Flex and Innovation, and Olayinka Ayo, EDF Energy UK R&D, Lead Research Engineer

Project SOLVE – Solving Voltage Challenges with LCT Driven Flex Forecasting and Smart meter data

SOLVE

Smart Open Load Visibility Exchange

Project SOLVE – Solving Voltage Challenges with LCT-Driven Flex Forecasting and Smart meter data

Voltage Matters Webinar (17th April 2026)

James Harrow (geo)

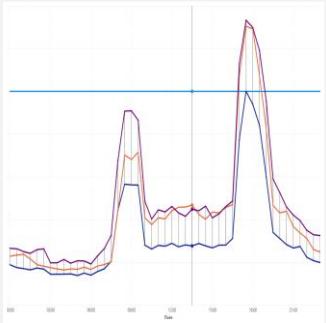
Dr Olayinka Ayo (EDF Energy R&D UK)

SOLVE

Real-time hi-res in-home voltage & power monitoring using **customer broadband**

Dynamic adjustment of Primary Substation voltage

Voltage Management using new Flex services



Flex Forecasts at substation level

Obtaining flex forecast data using open standards from Energy Smart Appliances (Matter and OpenADR)

Classification: Commercial In Confidence

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Consumers will adopt LCT assets…

- EV charging
  - Produces new peaks based on cheap overnight pricing
  - Early adopters take advantage of cheap overnight charging
    - Home battery and heat water (15kW peak load!)
  - Excess load causes “under voltage” conditions

- Solar
  - Produces “over voltage” conditions
  - EV chargers get upset
    - (could be fixed by switching on Hot water and EV charging!)

- Heat pumps… in winter…
  - Simultaneous operation – but options for some flexibility if orchestrated

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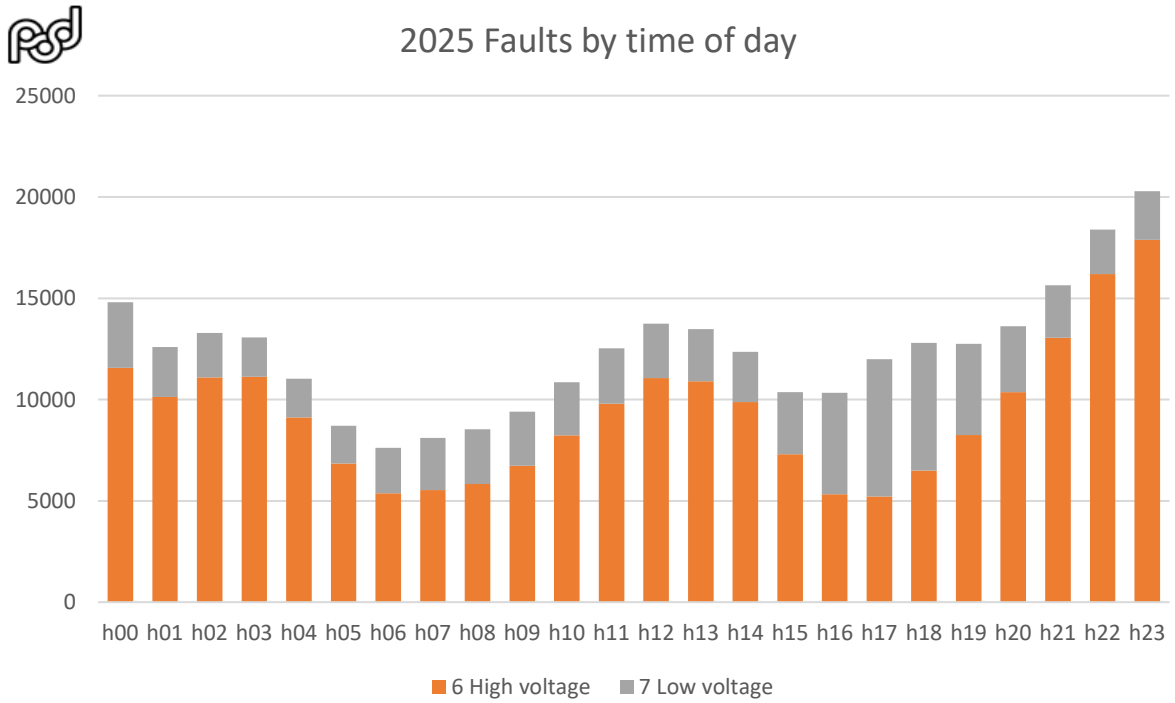
Key findings

- DNOs are starting to see voltage issues
  - Biggest impact: EV chargers
  - Cause: High load causes voltage drop along feeder cables
    - **Not enough load also causes voltage too be** too high
    - EV chargers are sensitive to voltage limits (BS7671 regulations)



Estimate: 28,290-61,500 EV charger owners complain about voltage issues per year across GB

Each investigation could cost DNOs as much as £1000 (needing 2 site visits + analysis time)

Cost to taxpayers between £25-65M per year

Problem is likely to get worse with LCT adoption

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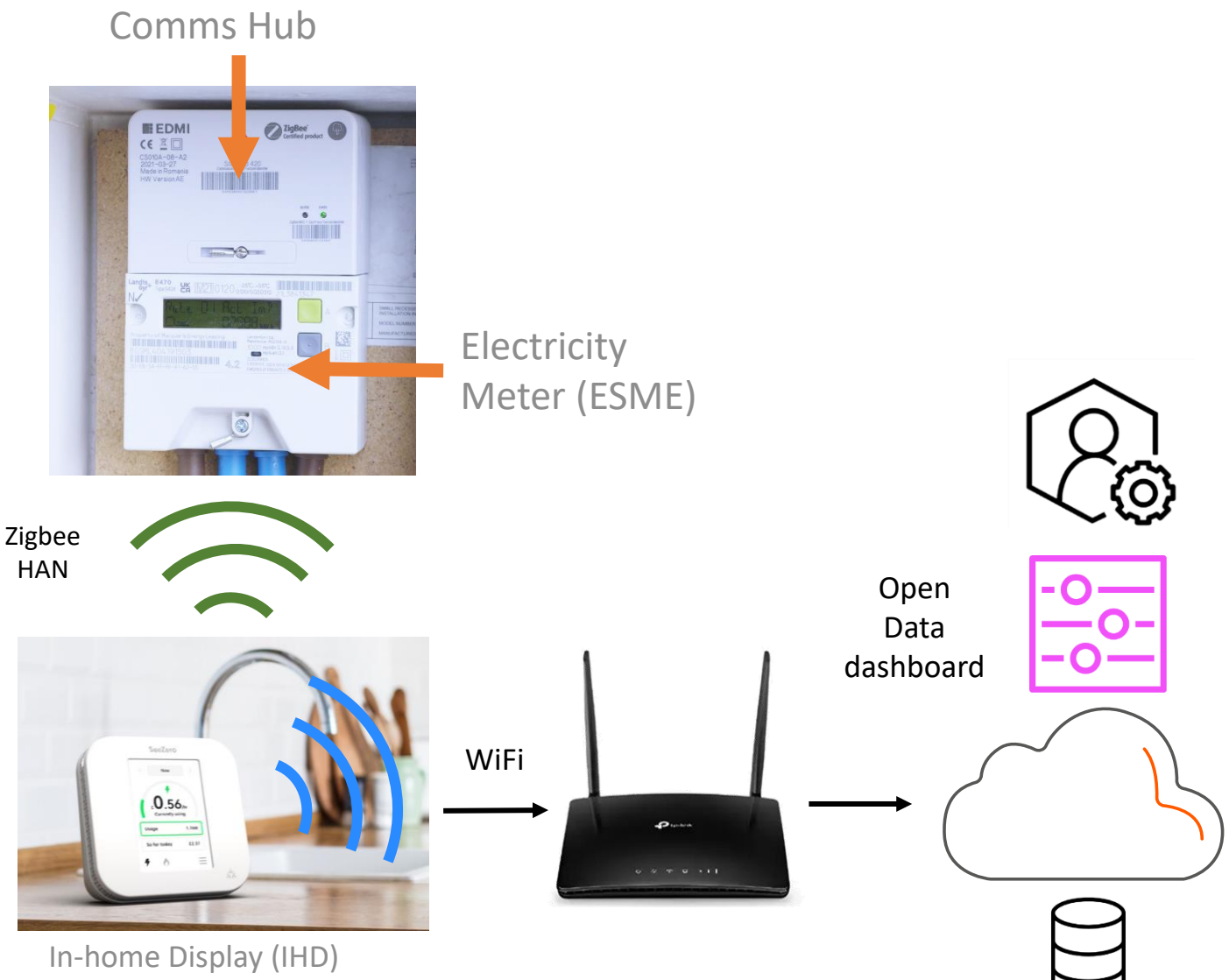


Discovery phase

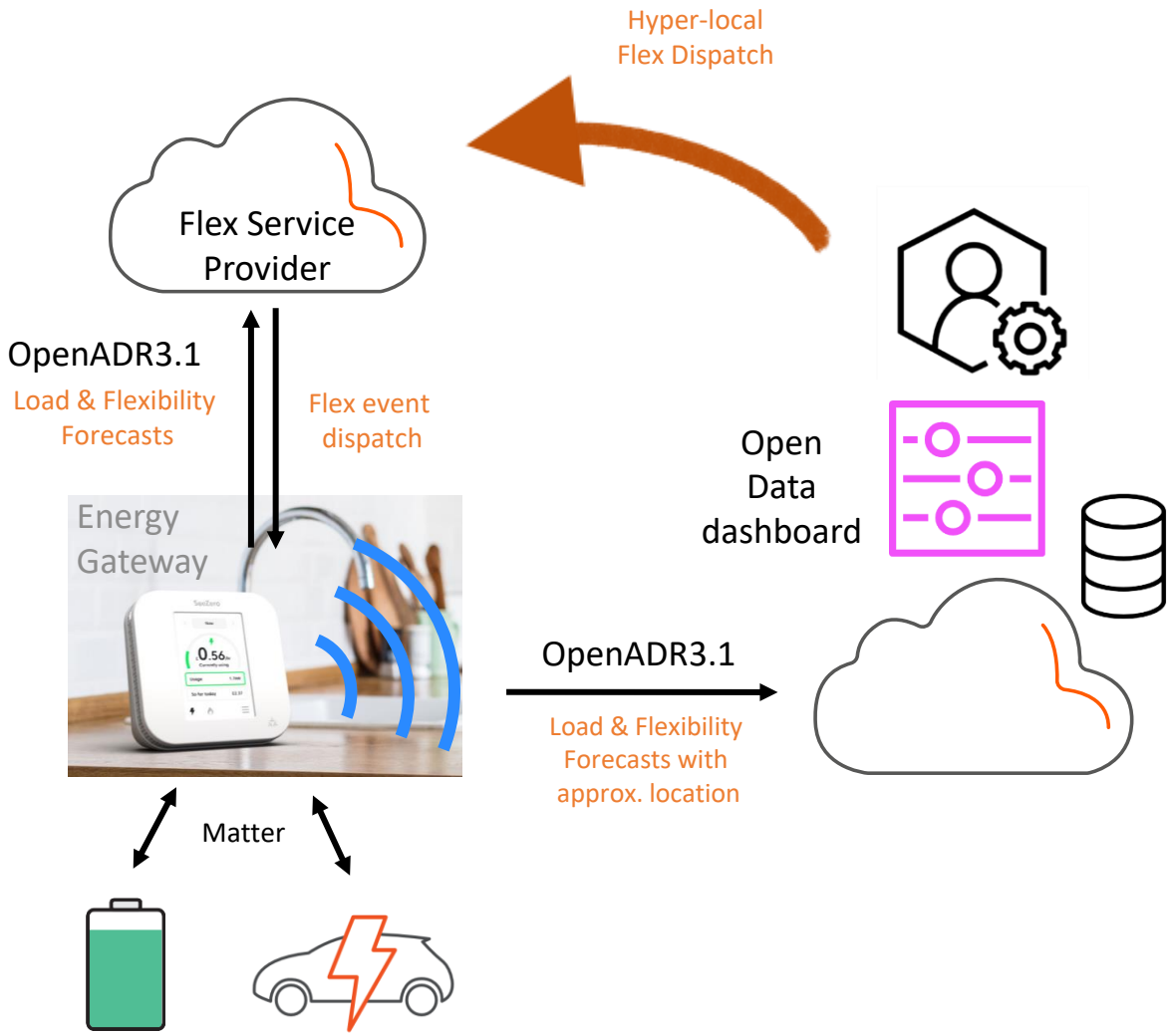
- Lab demo: Smart Meter and IHD modification to enable real-time data:
  - Voltage
  - Reactive/Active power
  - Current
  - Power factor etc
- Devices like geo's SeeZero IHD can collect that data and send it over WiFi to a cloud for aggregation / anonymisation
- No change to DCC or Comms Hub etc

Classification: [illegible] Confidence

SOLVE

OpenADR 3.1 data exchange

- Energy smart appliances can share their forecast load information (and flexibility) via Matter 1.4 to an Energy Gateway
- Energy Gateway will be connected to a FSP using OpenADR 3.1 for routine dispatch of flex services
- Optional 2nd OpenADR connection shares real-time predicted load forecasts for home to an Open Data Set service (with location information)
  - Centralised view from a range of homes (not one specific FSP)
  - Ensures market neutrality & avoids conflict of interest from FSP
  - Enables market impact assessment (has enough flex been procured?)
  - Regional data sets show where flexibility is available



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Project SOLVE data insights enhance key Ofgem's RIIO ODI for **DNOs,** while minimising inconveniences for **consumers** & creating opportunities for **Energy suppliers** & **Flexibility Service Providers**

SOLVE Capability	**Avoided DNO Cost Driver**	**Relevant ODI (Output Delivery Incentive)**
Near real-time voltage visibility	Complaints handling & site visits ↓	Complaints Metric
Early LV Voltage fault diagnosis and Proactive voltage management	Network intervention costs ↓	DSO – Network Operation
Load forecasting and Anticipatory constraint visibility	Mis-targeted DNO contracted customer flexibility ↓	DSO – Planning
Asset forecasts	Curtailment & reinforcement ↓	DSO – Planning
Standardised protocols (OpenADR & Matter)	Market inefficiency ↓	DSO – Market Facilitation
Unlocking Voltage response services from LV assets	DNO contracted customer flexibility ↑	DSO – Market Facilitation

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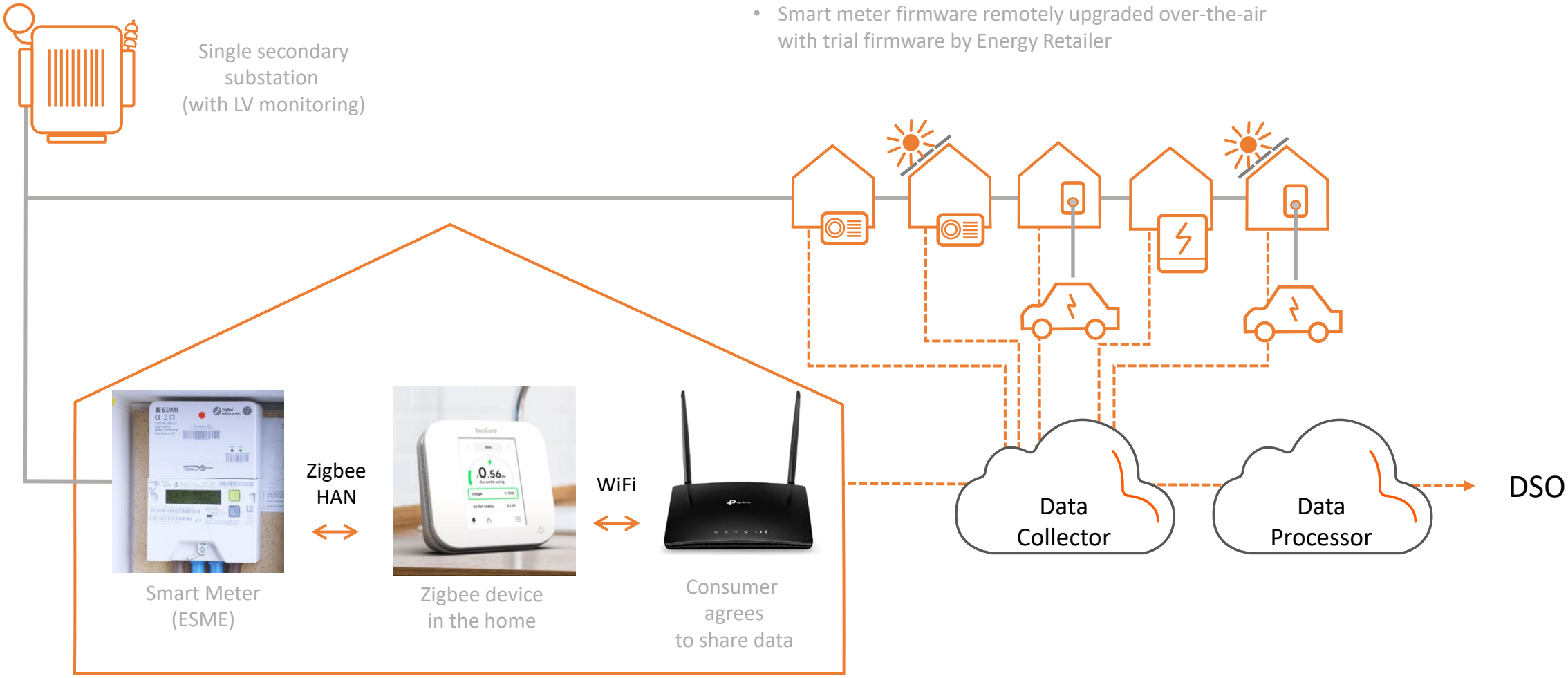
Next steps – Voltage monitoring trial

SOLVE

- Multiple homes around substation recruited and given updated IHD
- Smart meter firmware remotely upgraded over-the-air with trial firmware by Energy Retailer



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SOLVE Stakeholder Takeaways

DNO

- Near real-time voltage data from inside homes
- Faster fault diagnosis, fewer site visits, fewer repeated complaints
- Enables proactive interventions
- Enables Hyper-local Flexibility services
- Supports ED2/3
  - Complaints
  - DSO incentive
  - Reinforcement deferral
  - LV Network digitalisation

Energy Supplier

- Fewer angry calls, better tariffs, higher customer retention
  - Voltage faults appear to customers as supplier failure
  - EV tariffs break when chargers don't start
  - Suppliers already own:
    - Smart meter
    - IHD estate
    - Consumer consent journeys
- New Flexibility & Data Revenue streams

Ofgem

- Enable flexibility instead of reinforcement
- Aligns with:
  - SIF funding objectives
  - Clean Flexibility Roadmap
  - ED3 DSO evolution
- Demonstrates **standards-based, consumer-consented LV visibility**
- Provides evidence to shape:
  - LV flexibility market design
  - Voltage standards reform
  - DNO data incentives

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SOLVE

Summary

- Project SOLVE has shown that **LV visibility** and **hyper-local flexibility** can be delivered using current technology standards.
- The solution helps reduce costs now, limits future reinforcement requirements, and supports the development of a flexible, net-zero electricity system.
- Want to learn more – please get in touch:
  - james.harrow@geotogether.com

SOLVE - Show & Tell

Weds 6th May
10:00-11:30am

Classification: Commercial In Confidence


Q&A

Andy Howard, Innovation Programme Manager, SP Electricity North West

QUEST Network Innovation Competition (NIC) Project – Summary Findings

SP Electricity North West

SP Electricity North West

QUEST Voltage Matters April 26

SP ENW Website

All the projects' outputs are published at:
https://www.enwl.co.uk/future-energy/innovation/key-projects/quest/

QUEST Explained

QUEST - £7.95m NIC project awarded November 2020.
Due to run April 2021 to April 2025 but delayed (December 2025).

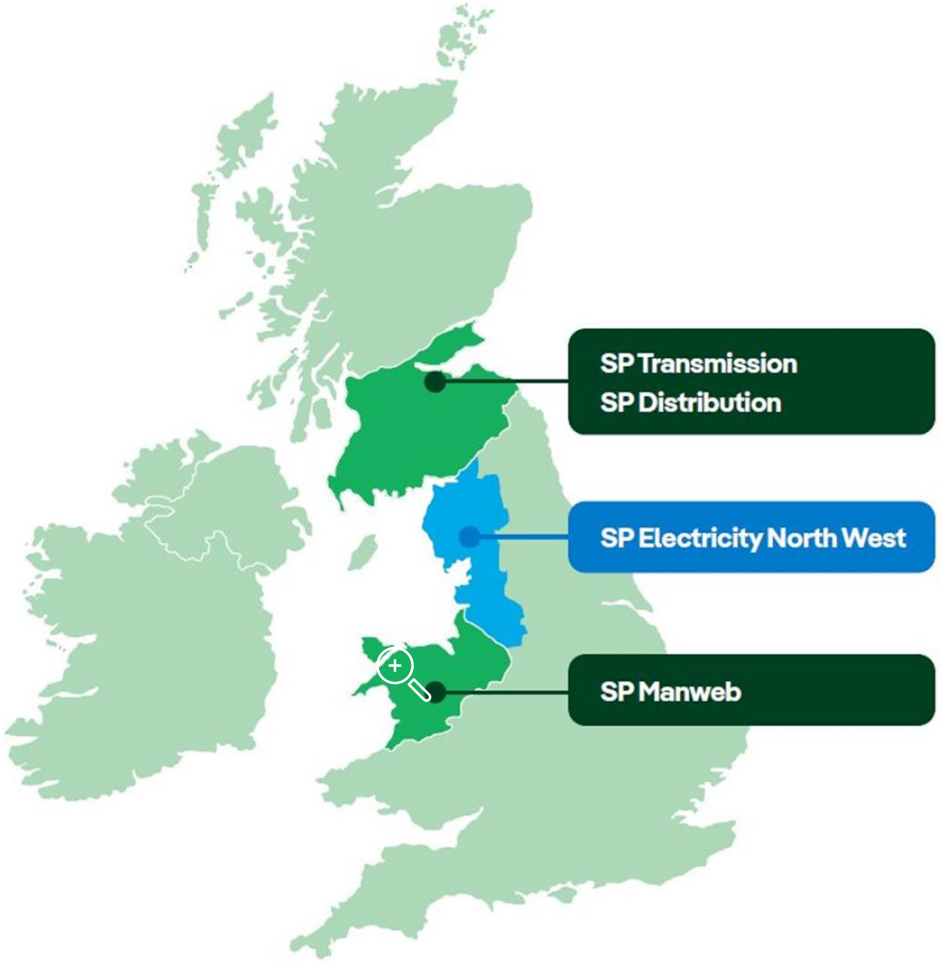
QUEST is a whole-system voltage optimisation system, comprising software held centrally within a network management system, alongside intelligent devices fitted in substations.

QUEST will co-ordinate the actions of multiple voltage control and optimisation techniques, including CLASS, Smart Street and Active Network Management (ANM), holistically across the whole system to optimise their use and facilitate the increased use of Low Carbon Technologies (LCTs).

Why is QUEST Needed?

QUEST demonstrates active Voltage Control across all of the DNO network voltages can be optimised to maximise the use of the existing network and allow for the increased uptake of LCTs and the subsequent increase in demand on the network.

DNOs have deployed several discrete voltage management techniques to manage the networks. QUEST will address their inherent limitations by fully coordinating their use.



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The Project

Innovation Funded
Now Business as Usual

SMART STREET

Innovation Funded
Now Business as Usual

CLASS

New Innovation
132/33 kV QUEST element

QUEST

- New Distribution OLTC Install (Smart St standard) & access to existing units
- Additional CLASS response steps
- Upgrade to 33/HV Voltage Control systems
- Application of enhanced 33/HV solution to 132/33 system
  - First time functionality at this Voltage level
- ICCP Integration to two ANM “3rd Party” systems
- New QUEST Overarching Control System software
  - Full Control at all Voltage levels below Whitegate Grid Supply Point
  - Optimise / maximise voltage control at each voltage level
  - Interface with other elements of Network Management e.g. ANM, Emergency situations
  - Development of Digital twin – to inform and corroborate results

OVERARCHING CONTROL SYSTEM
QUEST

Project ANM Systems

DeCentralised
&
Cloud

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SP Electricity North West

QUEST – It does what it says on the tin !

QUEST can control voltage at all Network Levels

QUEST can optimise voltage across all levels based on priorities set

QUEST will maximise benefits, once all priorities have been met

QUEST can integrate with 3rd party customer systems and modify their operation

QUEST benefits can be verified against modelling with a digital twin model

QUEST can do this using standard SP ENW network equipment

SP ENW customers did not notice the extreme voltage manipulation

OVERARCHING CONTROL SYSTEM
QUEST

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Key takeaways

- SP ENW expect to implement QUEST as BAU in ED3
  - Subject to internal business case and ED3 outcomes
- QUEST creates the best mix of Voltage interventions across the network, to meet the set priorities required at that time
  - It does not set the priority, That remains a business / Industry requirement
  - Mandating a particular set of benefits, will reduce the flexibility QUEST can provide
- There is a limit to how much voltage control is possible in the existing network
  - QUEST identified some additional benefit from its optimisation, but we may now be at limit within existing ESQCR
- Conservation Voltage Reduction
  - Remains real and measurable, however early project output includes a review on how and why it may reduce with time
- Customers didn't notice the management of voltage to ESQCR extremes
  - This was proven by Customer engagement, rather than measured data
- All DNOs are not the same
  - History, Equipment Specifications, Installed Assets, business strategy will all impact ability to replicate

Classification: Commercial In Confidence

SP Electricity North West

Thank You

Classification: Commercial In Confidence

Next Steps

Voltage Matters Calendar:

- In person event 2nd July – details TBC
- Webinar 16th October
- Details coming soon – contact us if you are keen to speak, email or via our LinkedIn community page

Meet us sooner at these events:

- Utility Week Live in Birmingham 19-20 May – Stand H2
- Eurelectric Power Summit in Helsinki 3–4 June

EA are hosting a UK roadshow to showcase both the EA and Fundamentals portfolios. If you're interested in having us visit your office by 30 April, please get in touch.