

## DEVELOPING FUTURE POWER NETWORKS

Energy Storage for Distribution Networks

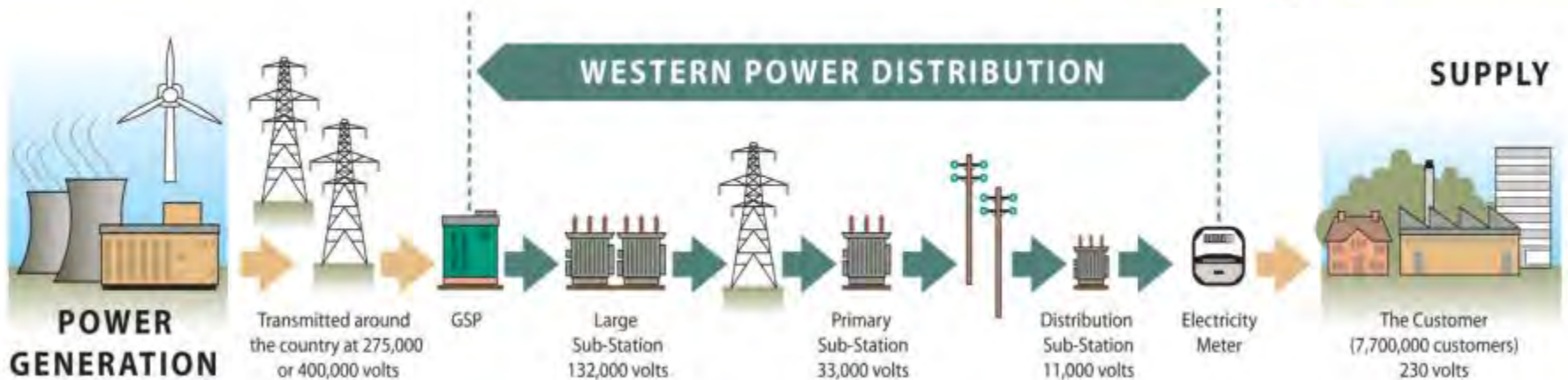
**Ben Godfrey**

Innovation & Low Carbon Networks Engineer

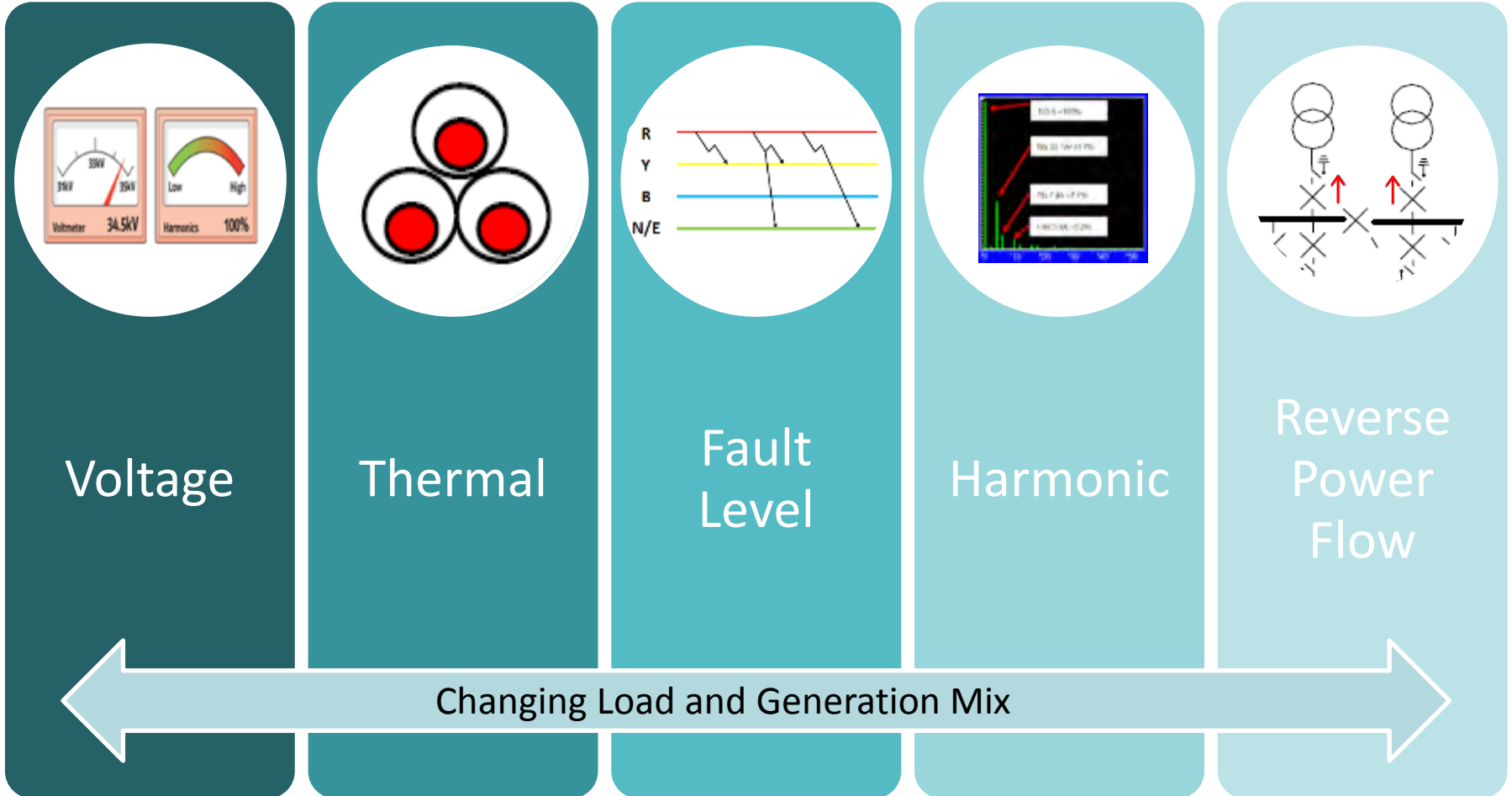


## Who Are We?

- 7.7 Million customers over a 55,500 sq kms service area
- Our network consists of 221,000 kms of overhead lines and underground cables, and 185,000 substations
- LV to 132kV Network ownership



# Distribution Network Challenges



# Flexible Approaches to Low Carbon Optimised Networks

**What is Project Falcon?**

- Dynamic Asset Rating
- Automated Load Transfer
- Meshed Networks
- Battery Storage
- Control Demand
- Distributed Generation
- Conventional Reinforcement

**New Demand Requirements**

- Electric Vehicles
- Wind
- ?
- Solar PV

**PLANNER**

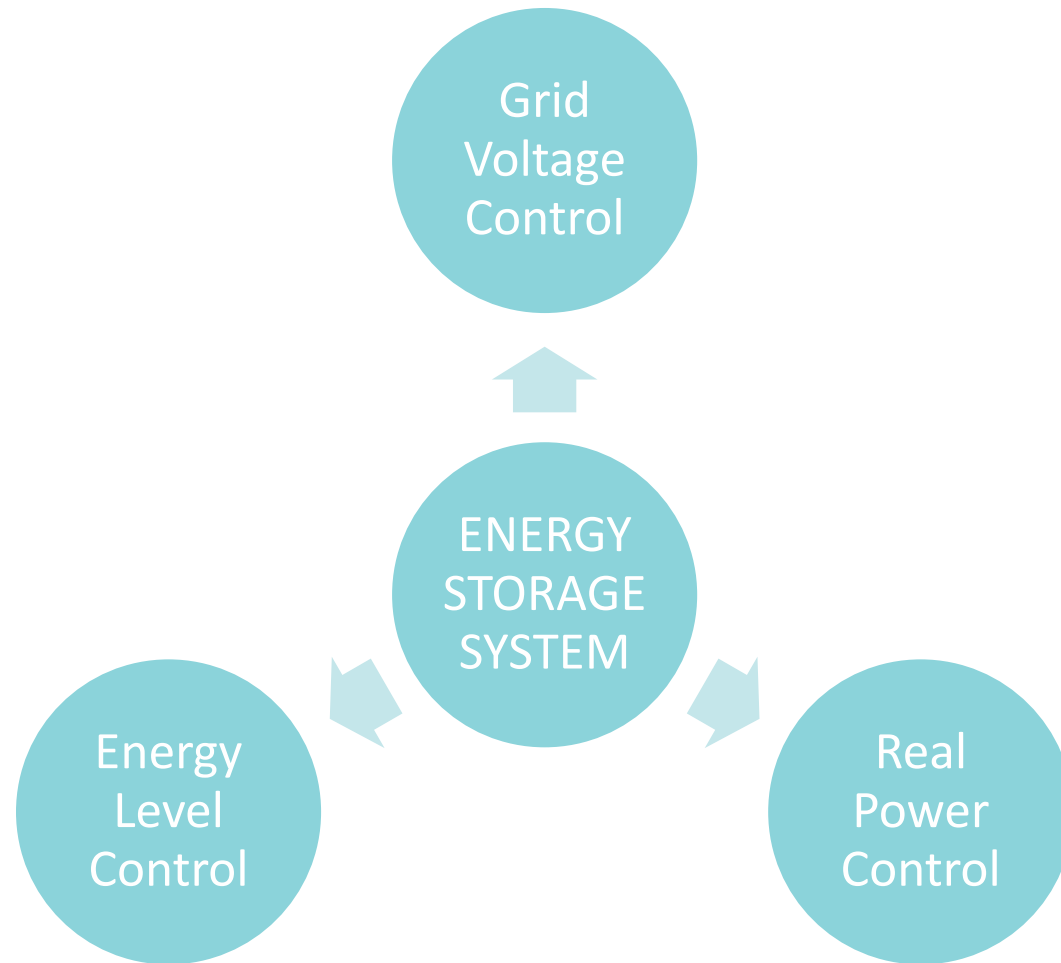
**Solution**

**SIM**

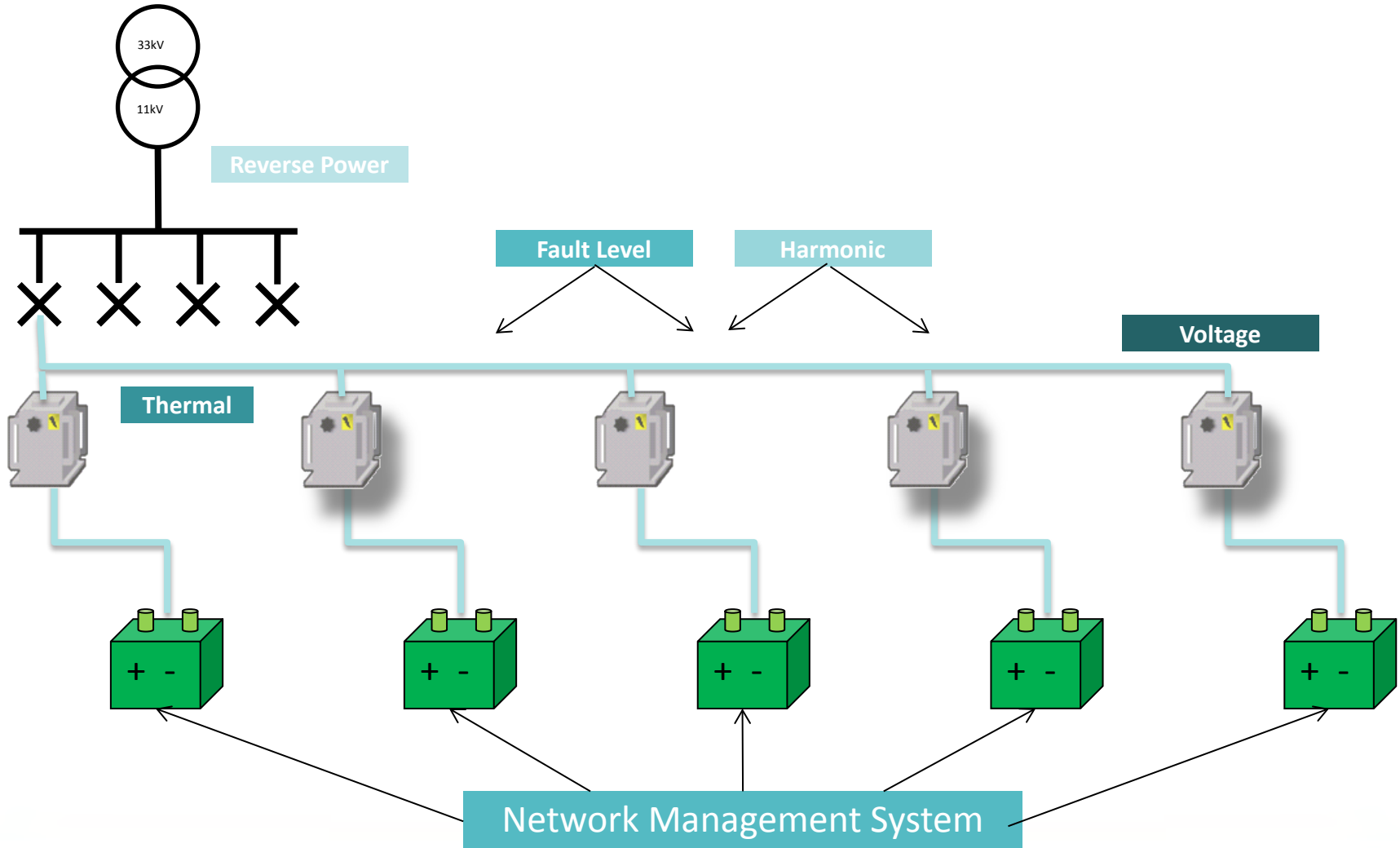
The illustration depicts a workflow where a human planner interacts with a simulation. The planner, wearing a yellow hard hat and sitting in a director's chair, is positioned in front of a large screen displaying various network optimization options. To the right, a robot-like simulator character stands next to a screen titled 'New Demand Requirements', which lists 'Electric Vehicles', 'Wind', a question mark, and 'Solar PV'. The simulator is holding a document labeled 'Solution' that lists 'Production', 'Transmission', and 'Distribution'.

# Benefits of Energy Storage Systems

Voltage
Thermal
Fault Level
Harmonic
Reverse Power



# Collaborative Energy Storage Systems



## Equipment Deployed

100 kWh  
Base Unit



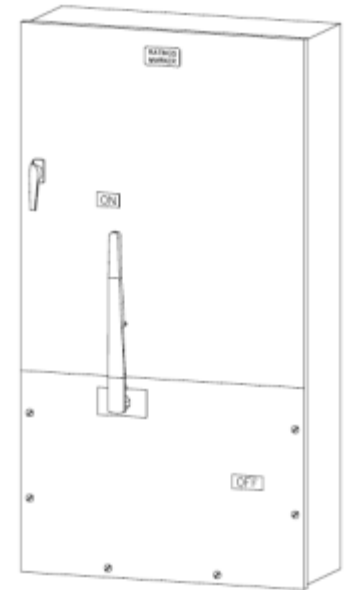
50(100) kW  
Inverter



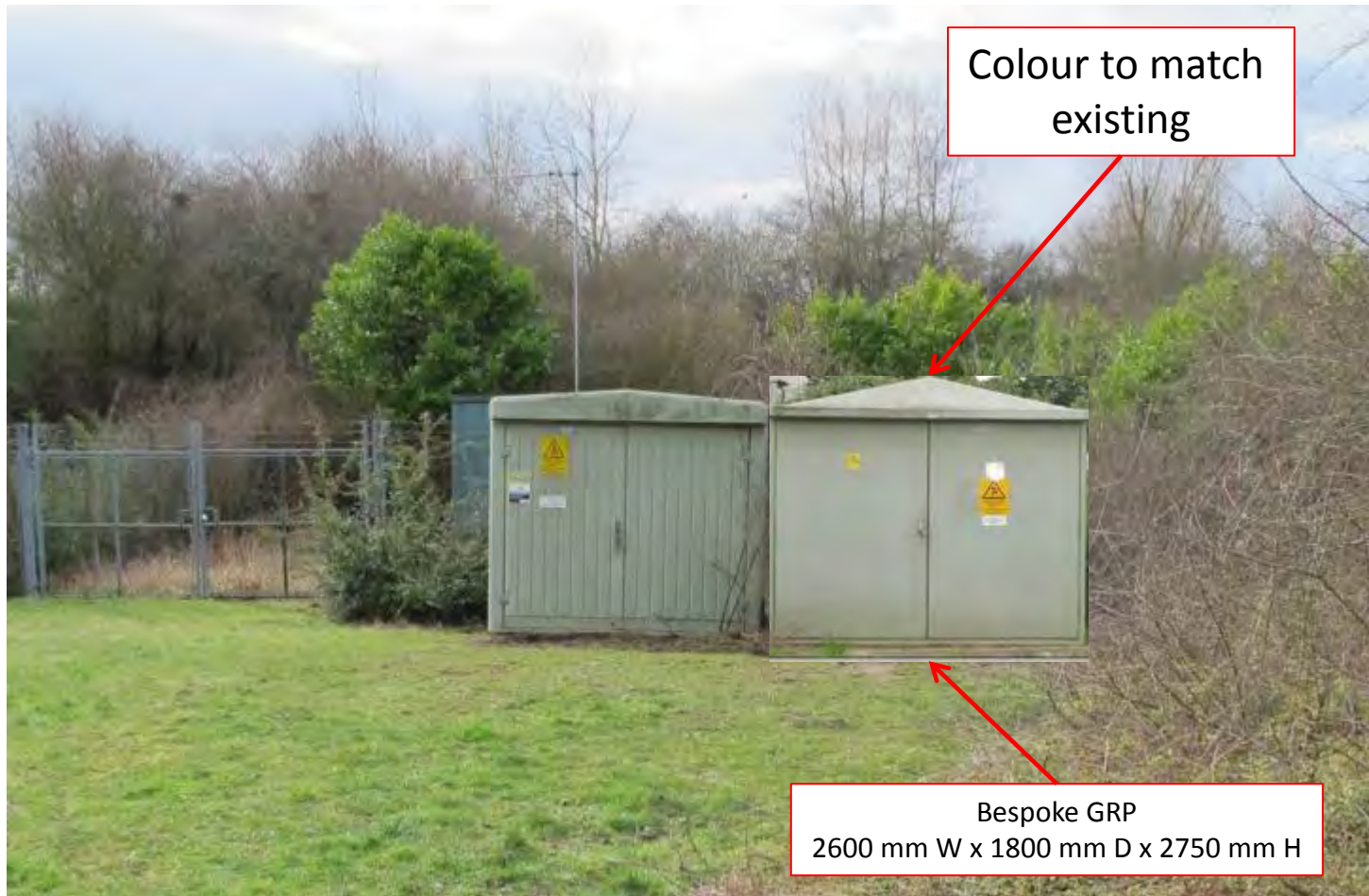
Site Controller



DC Switchgear



## Existing Distribution Sites





## Installed Layout



## Installed Layout



# Installed Layout



## Physical Installation Challenges



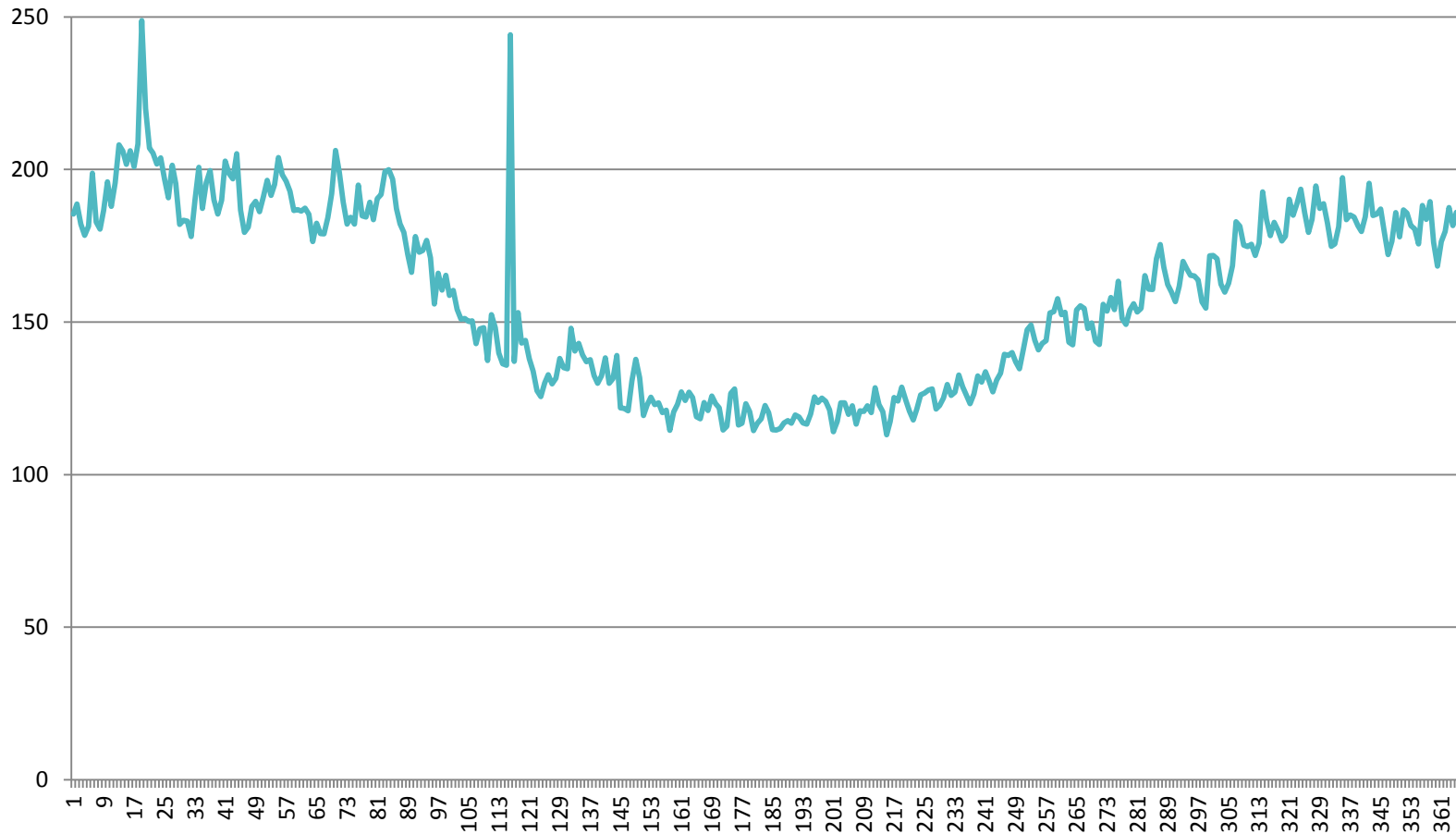
- Large Form Factor
- Difficult to manoeuvre
- DC wiring knowledge gaps
- Fan Noise
- Switching Frequency Noise
- Environmental Conditions
- Heat Dissipation
- Electrical Protection (G59)
- Modes of Failure
- Harmonic Content

## Replication



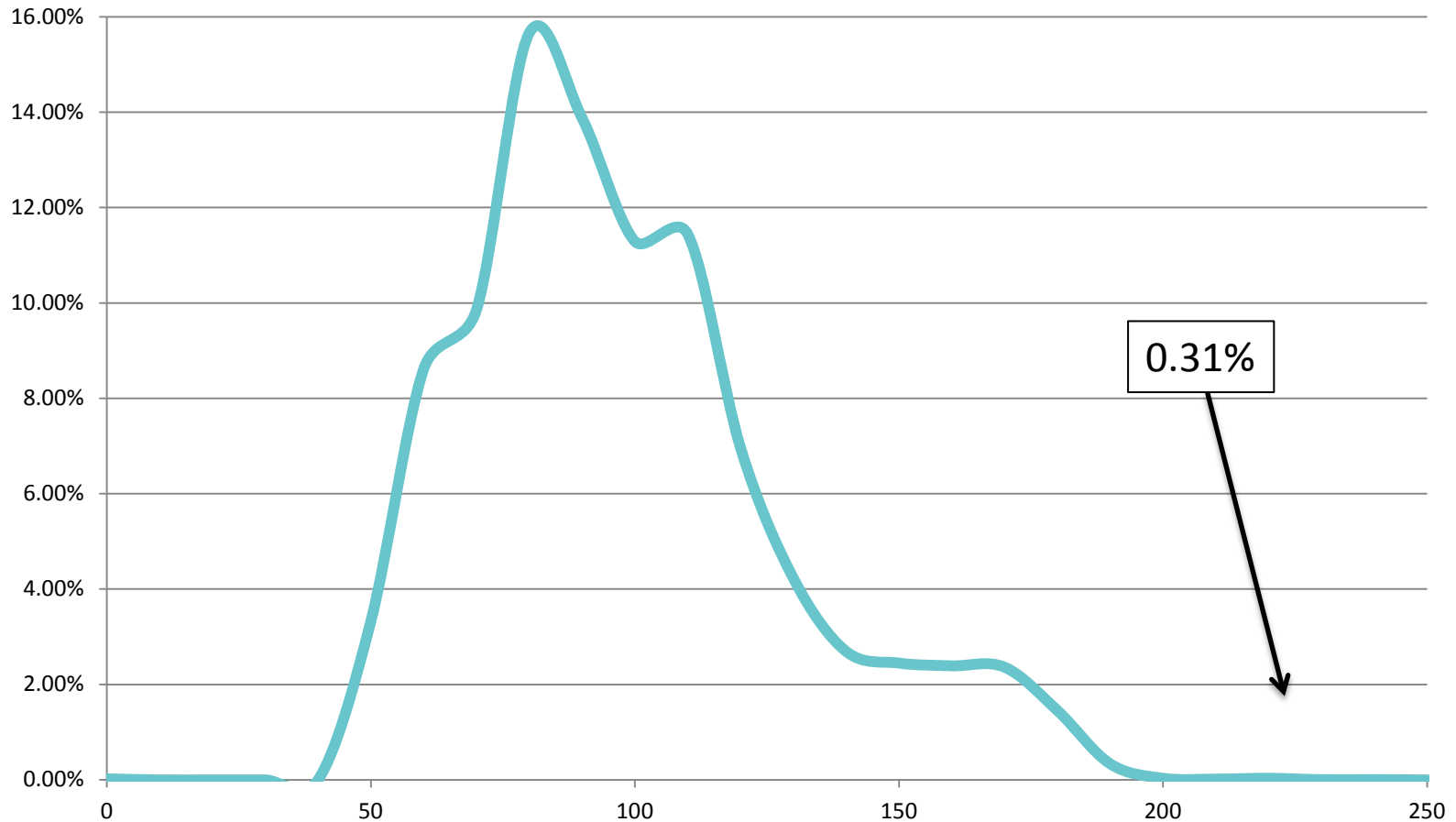
# DNO Usage Profile

## 250A Circuit

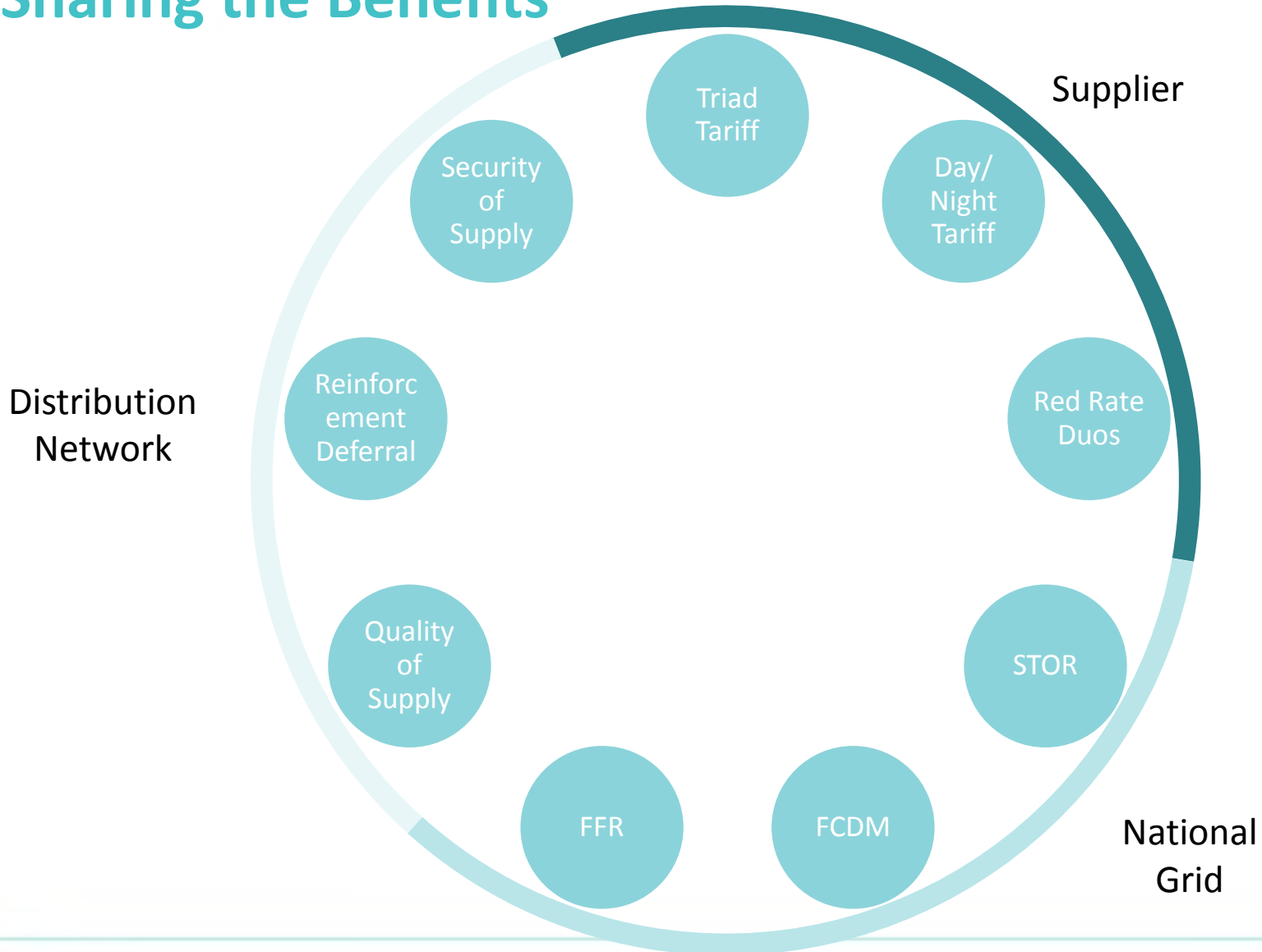


# DNO Usage Profile

## 250A Circuit



# Sharing the Benefits





## Project Learning

- Optimum charge and discharge windows
- Available triggers for charging regime
- DNO connection requirements for ancillary grid service operation
- Multiple set collaboration across an HV feeder or network
- Best placement of storage on the system
- How power electronic devices can be used to address power quality issues
- Lifespan of battery versus running operation
- Integration of ESSs with existing control environments
- Improvements for equipment specifications

## Project Benefits

- Carbon offsetting through storage systems
- Reduction in I<sup>2</sup>R system losses
- Improvement in system efficiency
- Voltage support
- Reinforcement deferral
- Reduced risks of stranded assets as deployment of battery storage gives options to delay reinforcement investment until demand trends are established
- Power quality improvements
- Facilitation of more Low Carbon Technologies

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*Serving the Midlands, South West and Wales*

**LCN Fund**  
Low Carbon Networks

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## The UK has a bold target to reduce carbon dioxide emissions by 80% by 2050

### Our Low Carbon Future

The UK has a bold target to reduce carbon dioxide emissions by 80% by 2050. Meeting this target will require widespread changes in the way we generate and use electricity.

Electricity networks are a key facilitator of this low carbon energy future and we need to make sure we have an electricity network that is value for money and provides the best solution for consumers.

The role of electricity networks is already changing and they are central to our energy future whether that energy is produced centrally or locally. We are beginning to see the transformation that will be required as we move towards a low carbon energy world. We want to help lead this change.

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**THANKS FOR LISTENING**

