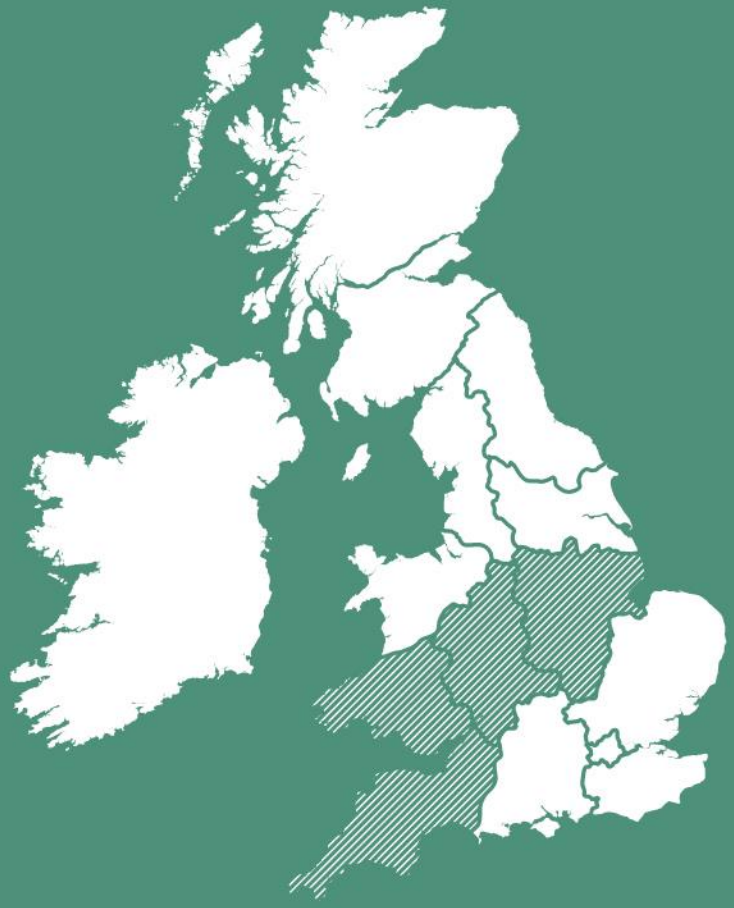
WESTERN POWER DISTRIBUTION

INNOVATION

NEXT GENERATION NETWORKS



# CarConnect

**Balancing Act Conference**

**Thursday 8th September 2016**

**Ben Godfrey**

**Innovation and Low Carbon Networks Engineer**

**Western Power Distribution**

WESTERN POWER DISTRIBUTION
INNOVATION

WESTERN POWER DISTRIBUTION PROTEUS NEW
WESTERN POWER DISTRIBUTION FLEXDGRID
WESTERN POWER DISTRIBUTION PLUGS AND SOCKETS
WESTERN POWER DISTRIBUTION SOLA BRISTOL
WESTERN POWER DISTRIBUTION LOW CARBON HUB
WESTERN POWER DISTRIBUTION OPEN LV NEW
WESTERN POWER DISTRIBUTION NETWORK EQUILIBRIUM
WESTERN POWER DISTRIBUTION SMART ENERGY ISLES
WESTERN POWER DISTRIBUTION NETWORK TEMPLATES
WESTERN POWER DISTRIBUTION FALCON

# Future Networks Programme

## Assets

- Telemetry
- Decision support
- Improved assets
- New assets
- Flexibility
- Automation
- Incident response

## Customers

- New connections
- Upgrades
- Information
- Self Serve
- Products/Service
- Tariffs
- Communities

## Operations

- Reliability
- Forecasting
- DSO
- DSR
- GBSO Interface
- Efficiency
- SHE and Security

## Network and Customer Data

- Airborne Inspections
- AIRSTART[1]
- Telecoms Templates
- Superconducting Cable
- SF6 Alternatives
- MVDC Test Lab
- Smart Energy Laboratory
- Statistical Ratings
- Primary Network Power Quality Analysis

- Hybrid Heat Pump Demonstration
- Hydrogen Heat & Fleet
- Carbon Tracing
- HV Voltage Control
- Solar Storage
- LV Connect and Manage
- Sunshine Tariff
- CarConnect
- Industrial & Commercial Storage

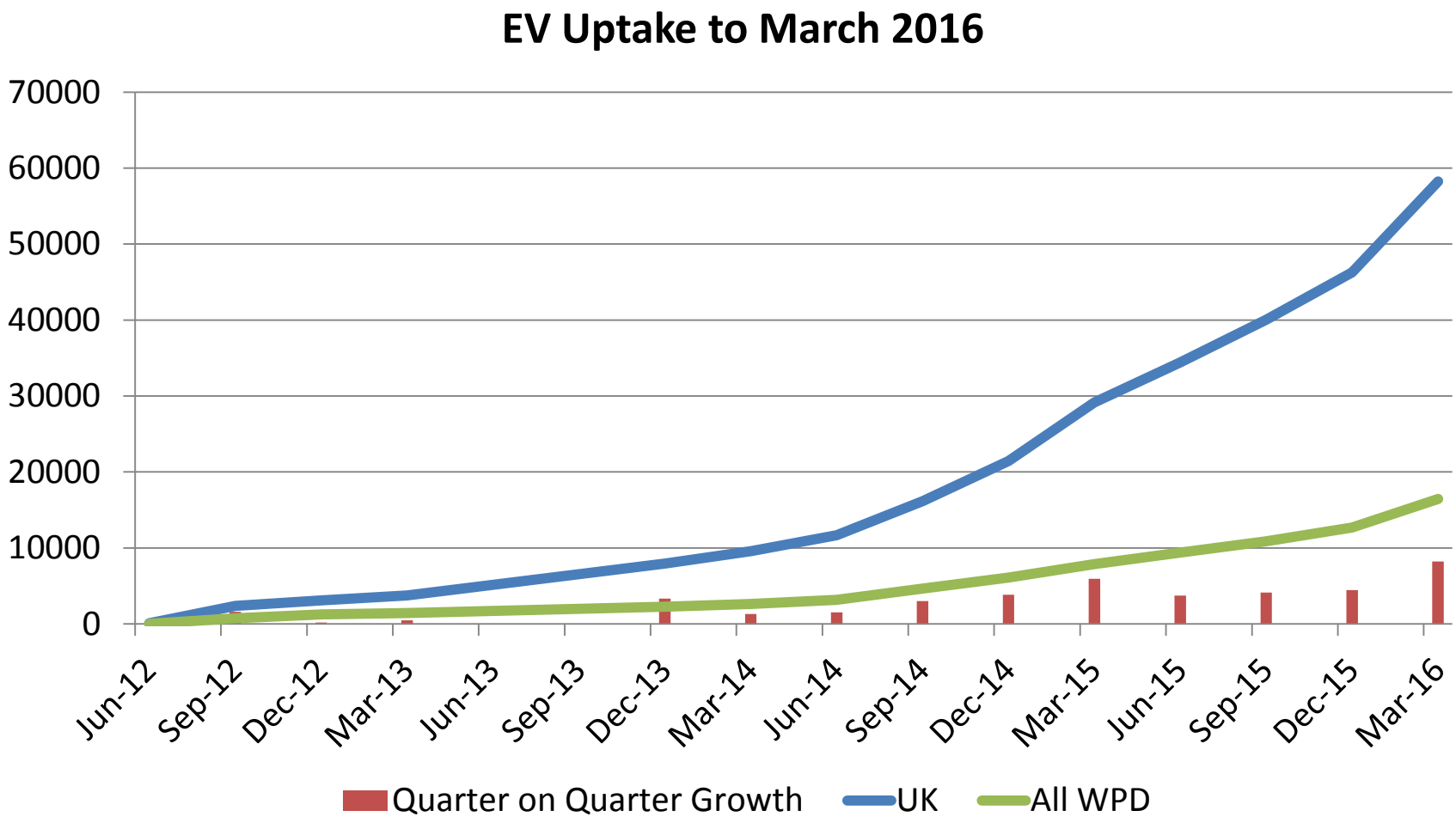
- DSO/SO Shared Services
- Project Sync
- Project Entire: Flexible Power
- Integrated Network Model
- Smart Meter Exploitation
- Distribution Operability Framework
- Data Analytics
- Voltage Level Assessment
- LV Connectivity
- Smart Systems and Heat[2]

Note: 1 – Funded by Aerospace Technology Institution; Note 2 – Funded by the Energy Systems Catapult

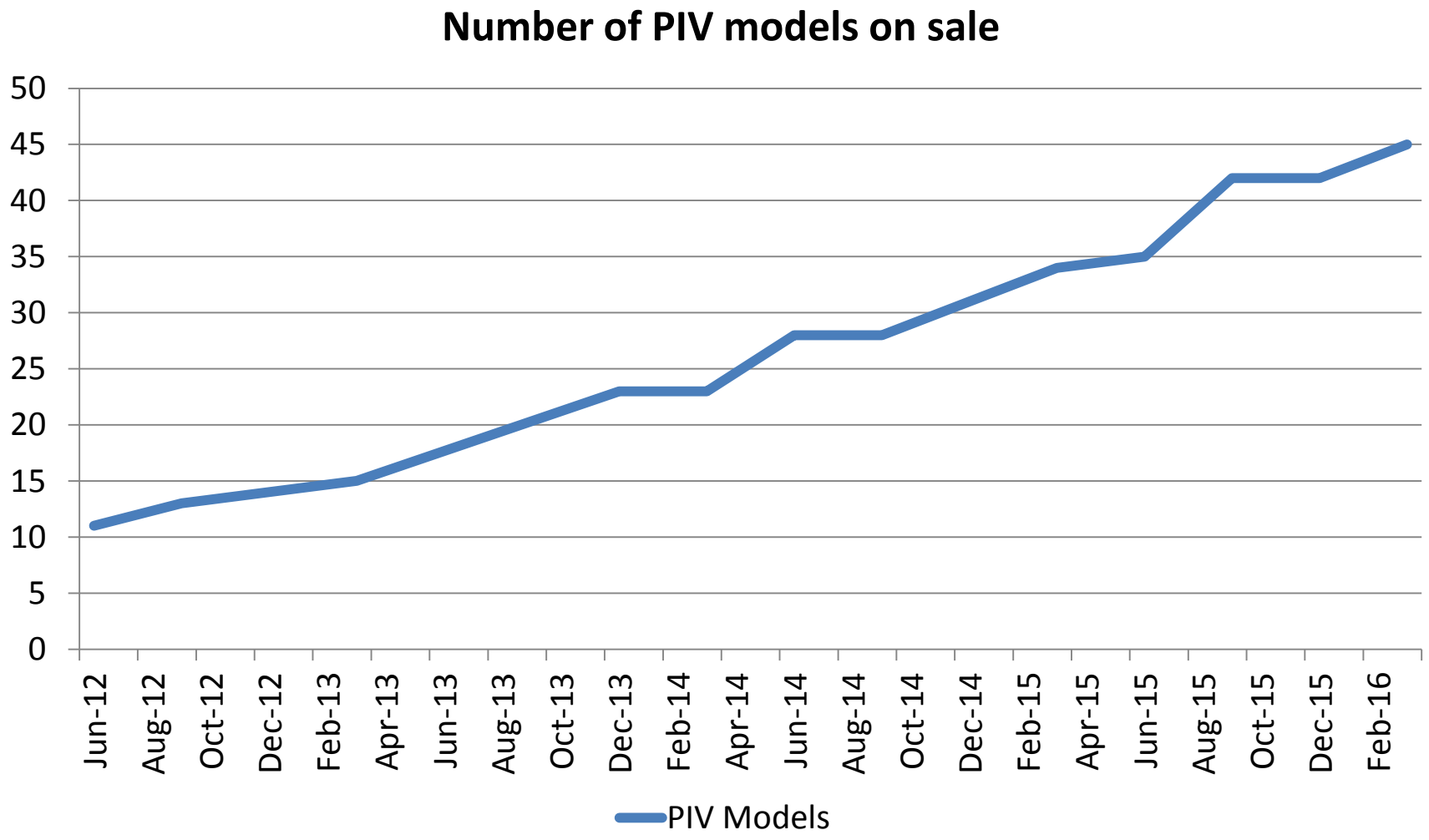
# Electric Vehicles – A network challenge

- 15-fold increase in EVs on UK roads between 2013 and 2015
- Some forecasts predict over 1m EVs on the roads by 2020
- An EV covering 10,000 miles/annum charged at home will consume around 3300kWh
- Average domestic annual consumption is 3200kWh

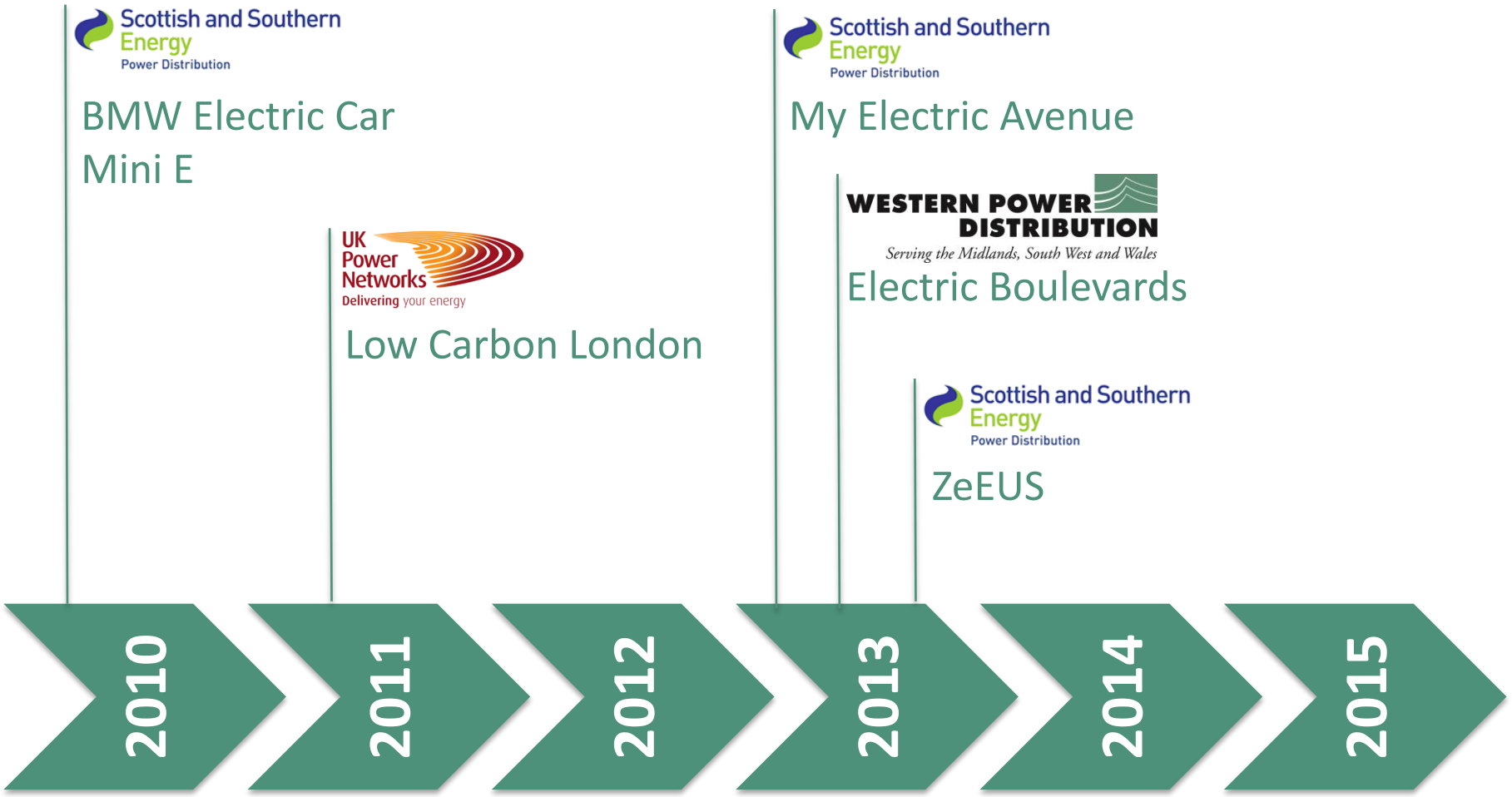
# Electric Vehicles – A network challenge



# Electric Vehicles – A network challenge

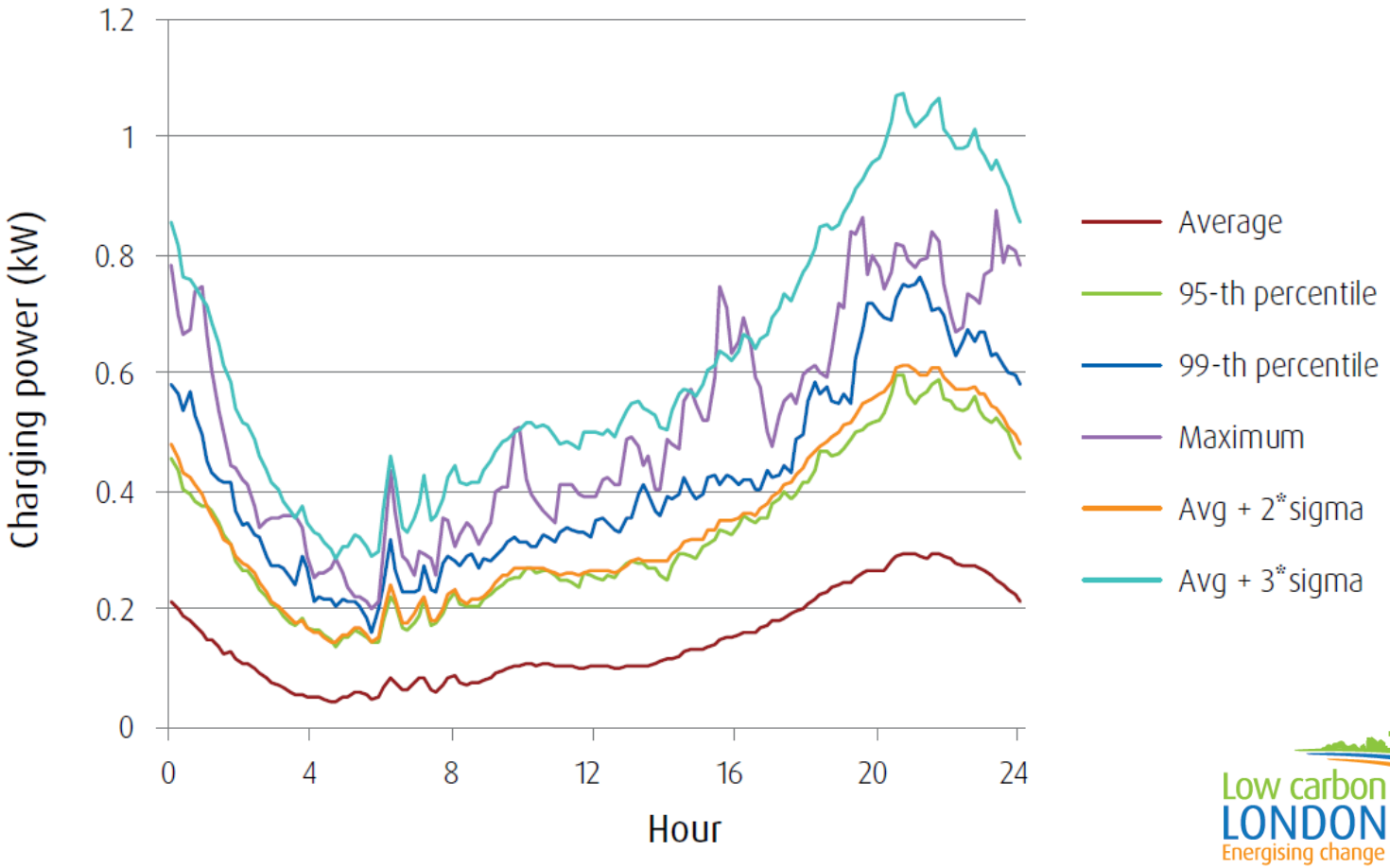


# Electric Vehicles – Building on learning from IFI/LCNF



# Electric Vehicles – What have we learnt?

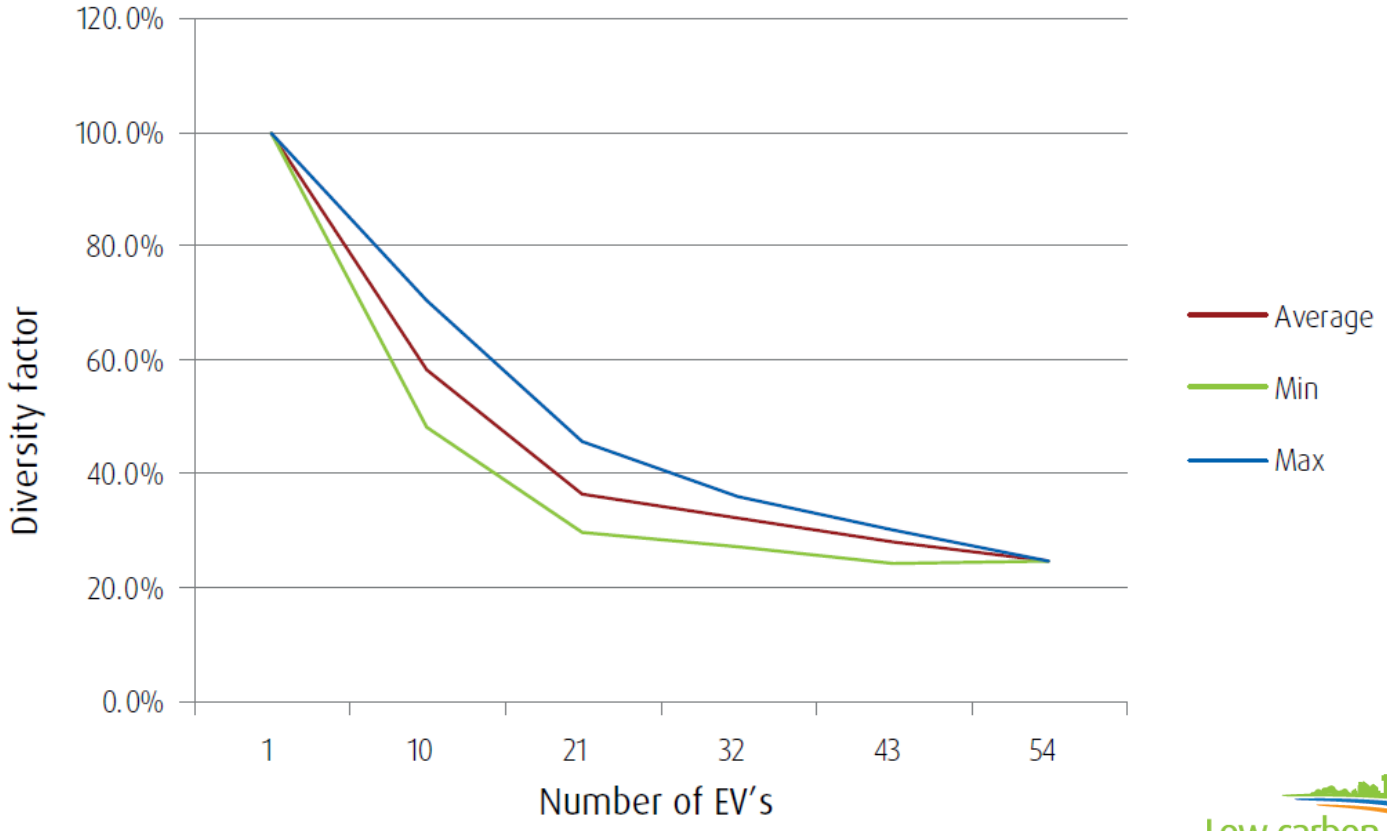
## Figure 13: Maximum expected charging profiles per EV for different probability levels.




Low carbon LONDON
Energising change

# Electric Vehicles – What have we learnt?

## Figure 14: Diversity factor for different subsample sizes of the residential EV data

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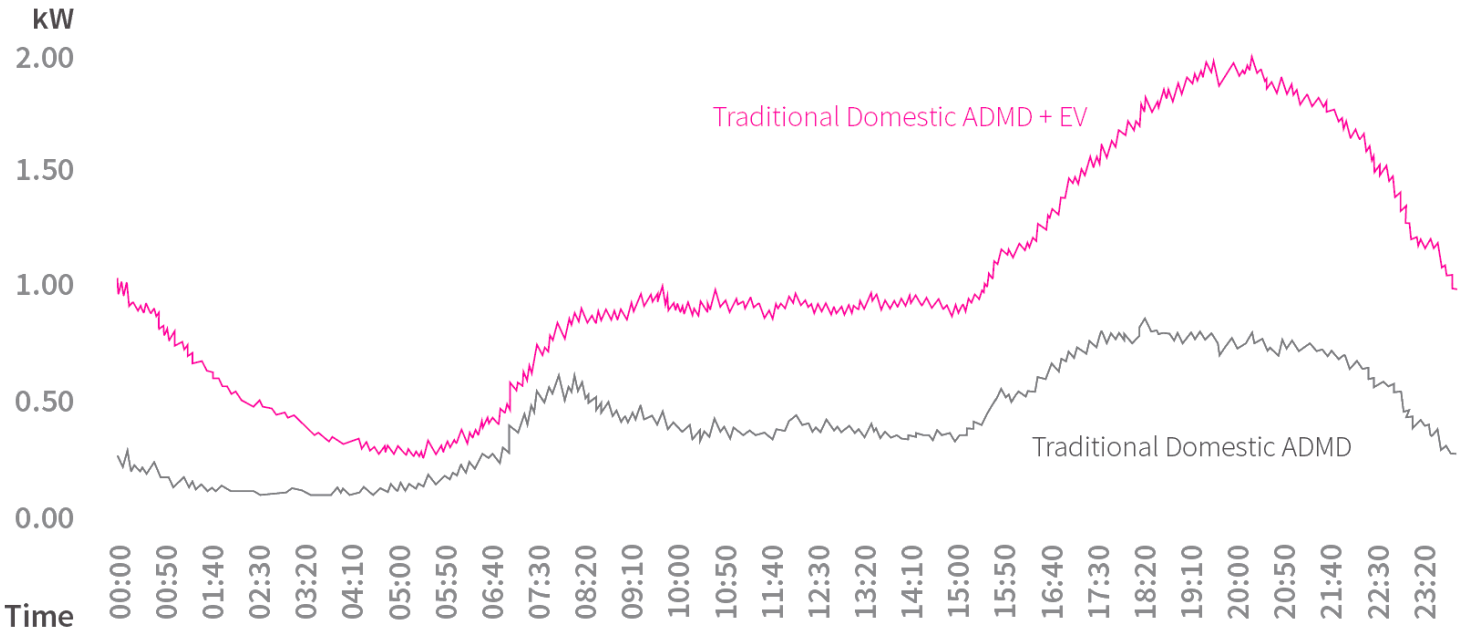
Energising change

# Electric Vehicles – What have we learnt?

## DOUBLING THE LOAD

THE AFTER-DIVERSITY-MAXIMUM-DEMAND (ADMD) TRADITIONALLY USED FOR DOMESTIC PROPERTIES IS 1KW; WITH THE INCLUSION OF AN EV THIS NEEDS INCREASING TO 2KW.




MY ELECTRIC AVENUE

# Electric Vehicles – What have we learnt?

- My Electric Avenue predicts reinforcement required when 40-70% of vehicles are electric, with a cost of £2.2bn by 2050.
- Low Carbon London estimates a quadrupling of current LV network reinforcement spend during high EV uptake conditions
- Reinforcement will be needed across the whole network, causing disruption to customers whilst the work is carried out.
- Market is already moving towards faster charging with larger capacity batteries which may increase the reinforcement costs.

# Electric Vehicles – What do we still need to learn?

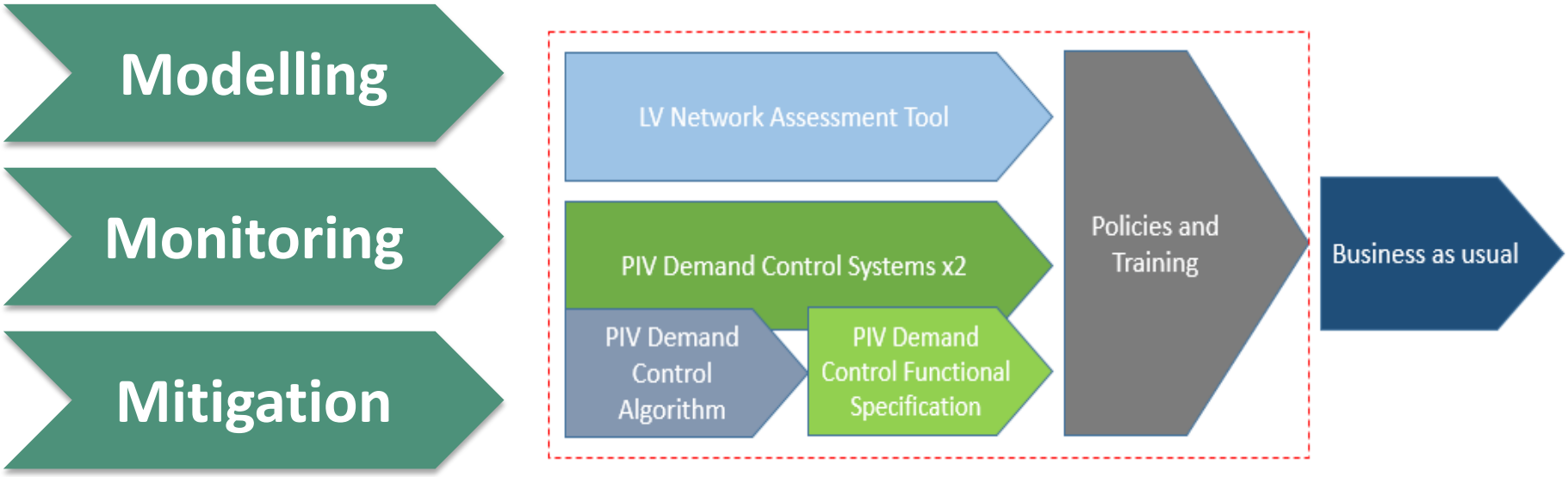
- Location, Location, Location
  - Where these vehicles are deployed will be key
- Improved industry training and tools
  - How to model connections quicker
  - Rules for the materiality of connections
- How smart?
  - Smart technologies can only provide a marginal uplift
  - Most rely on controlling the load which may not be acceptable

# Electric Vehicles – What do we still need to learn?

- How quickly?
  - The level of uptake will define the reinforcement plans
- Improvements in technology
  - Accessibility of public infrastructure will affect charging patterns
  - Bigger batteries and faster charging will also have effects
- Dealing with clustering
  - How will we know that clusters are forming?
  - What can we do to limit their effects?

# CarConnect NIA Project

- £5.8m project to develop all the tools required for DNOs to manage EV uptake
- World's largest Plug-in Vehicle Trial – up to 700 vehicles
- Using a market-led range of EV manufacturers and models
- Charge rates of up to 32A and test bed development of V2G



# CarConnect NIA Project

**Modelling** | Monitoring | Mitigation

- Data from the 700 participant electric vehicle trial will inform new planning assumptions to be developed within a distribution network modelling tool
- This will build upon work from Low Carbon London and My Electric Avenue
- The tool will be trained out to WPD network planners to assess future reinforcement schemes

# CarConnect NIA Project

Modelling | **Monitoring** | Mitigation

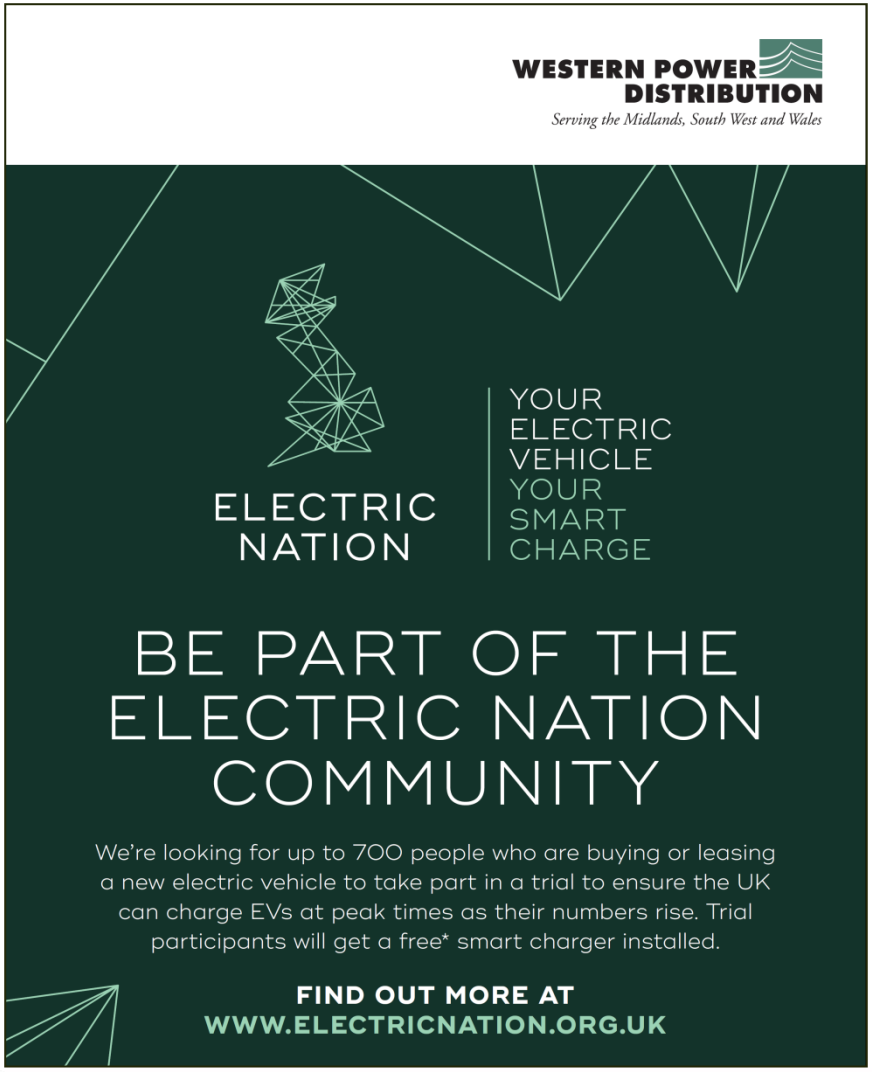
- 30 substation monitoring units will be installed at potential cluster locations around the WPD network
- An algorithm will be developed to detect electric vehicle charging signatures, allowing further visibility of electric vehicle penetration levels
- By more accurately understanding actual clustering effects at LV network pinchpoints, we can use all available headroom and potentially further defer reinforcement

# CarConnect NIA Project

Modelling → Monitoring → **Mitigation**

- This project will also develop and trial the use of demand side response as a mitigation technique for load peaks caused by widespread electric vehicle charging
- Smart chargers will allow the charging level to be controlled by a third party
- WPD will contract with the third party to provide this demand flexibility and trial the effectiveness and reliability of EV DSR on a commercial basis

# CarConnect – Introducing Electric Nation




- Customers in WPD regions will be recruited to the trial under the customer facing brand – Electric Nation
- Trial participants will be offered a free smart charger for their property
- Data gathered will inform future network planning
- Smart chargers will be able to throttle charging and we can pilot DSR commercial arrangements for customers

# CarConnect – Integration of EVs

**Modelling**

Planners will be able to accurately plan future reinforcement for electric vehicles

**Monitoring**

Enhanced visibility of distribution and saturation of electric vehicles on the network

**Mitigation**

Technical and commercial mechanisms to control electric vehicle charging to benefit the network

# CarConnect – Q & A

# THANKS FOR LISTENING

WESTERN POWER DISTRIBUTION

*Serving the Midlands, South West and Wales*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