

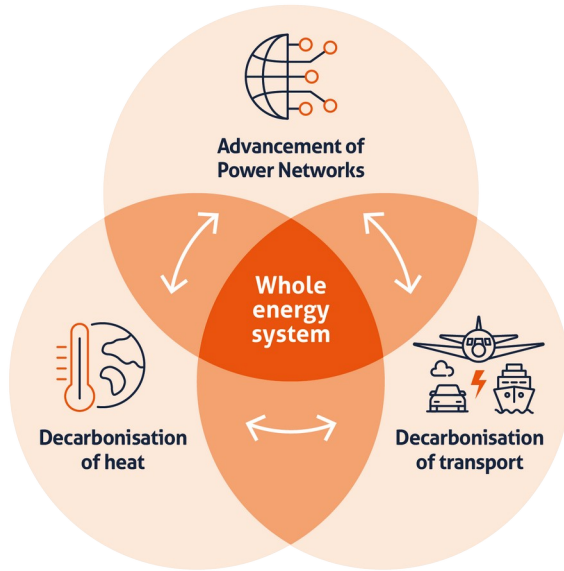
Powering Networks: Innovation, Collaboration & Scale

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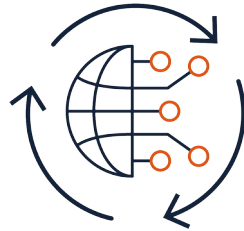
Energy x 2023 Scotland: 27th April 2023



PNDC – A Whole Systems Approach



Advancement of Power Networks



- ▶ Asset Management
- ▶ Digitisation
- ▶ Informatics
- ▶ Comms & Cyber Security
- ▶ Power Hardware in the Loop (PHiL)
- ▶ LV and 11kV network validation

Decarbonisation of Heat



- ▶ Heat sources, e.g. heat pumps
- ▶ Heat storage
- ▶ Heat networks
- ▶ Cooling systems
- ▶ Hydrogen for heat

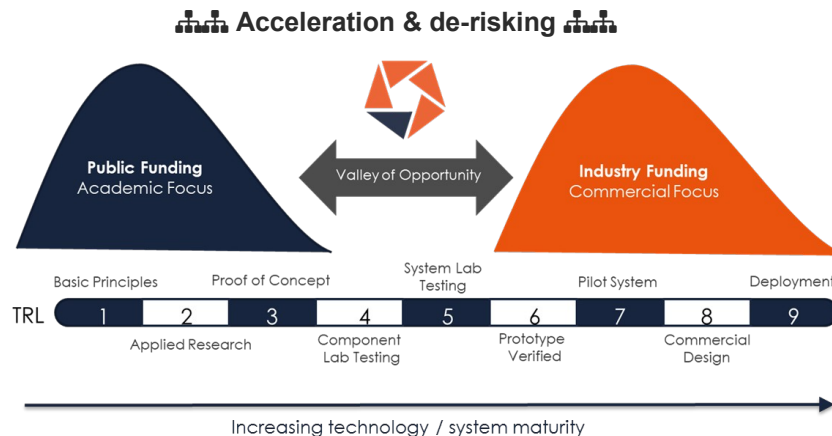
Decarbonisation of Transport



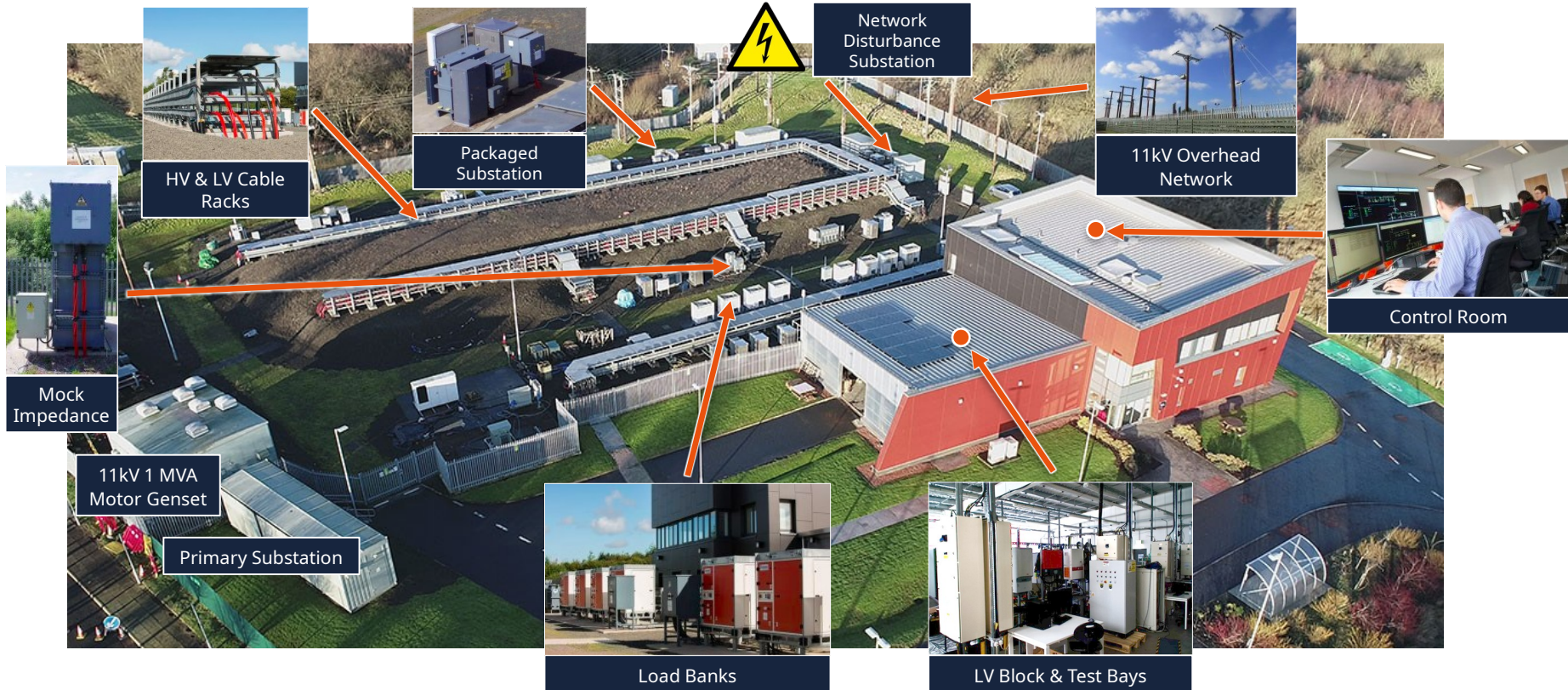
- ▶ HGV, marine, aero and rail systems
- ▶ Power electronics convertors
- ▶ LVA and LVDC systems
- ▶ Drive trains
- ▶ Electrification infrastructure

PNDC Overview

- ❖ University of Strathclyde industry-facing innovation centre opened in 2013 and currently celebrating a **decade of innovation** throughout 2023.
- ❖ Focussed on accelerating the development and deployment of novel energy, heat and transport technologies supporting net zero initiatives.
- ❖ Multiple engagement models; Open access
- ❖ Dedicated expert team (~ 50 staff)
- ❖ New cutting-edge whole systems facility due in 2024

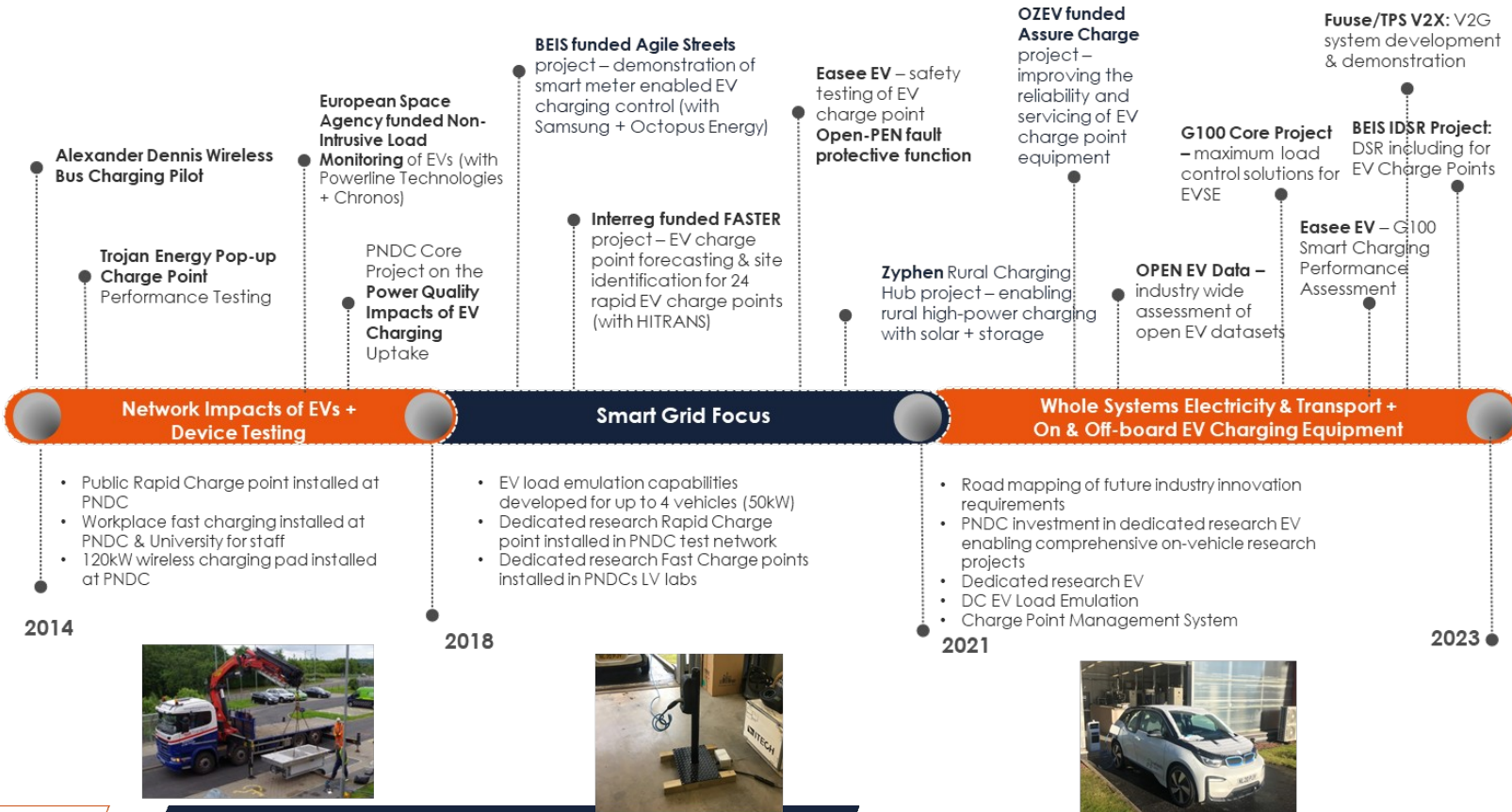


Existing Facilities (Wardpark)



Innovation

PNDC EV Infrastructure



HV Systems project



Project Objective:

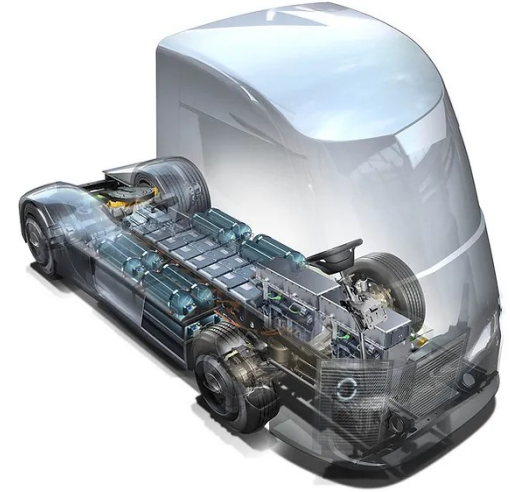
This project supports the development and test the UK's first ground-up Hydrogen Fuel Cell Electric Heavy Goods Vehicle and is the flagship project for the £4.8m DER-IC – Scotland equipment enabling MW-scale testing of power electronics, electrical machines and drives.

PNDC Role:

Accelerating route to market, whole vehicle power system development and supplier validation through the following:

1. Power Hardware modelling
2. Subsystem Testing and Analysis
3. HGV testing and analysis

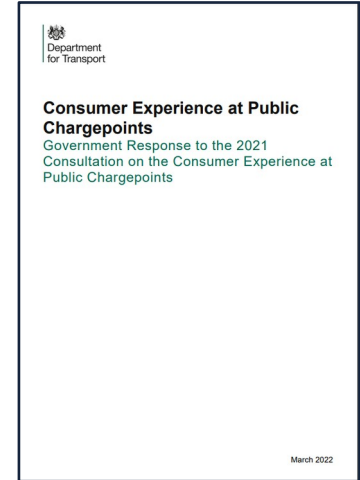
Status : HV-Systems battery system now onsite for testing, ongoing support of control system development



Scale

Assure Charge: Project Motivation

- Anecdotal user experience suggests that **public charging reliability is key concern of EV drivers**
- UK Government, Consumer Experience at Public Charge Points, March '22
 - *"It's essential that the public ChargePoint network is maintained and that faults are repaired quickly to **ensure a minimum 99% reliability** across the charging infrastructure"*
- Yotta Survey on Charging Network Growth, Feb '22
 - *"**Under half of respondents (47%) say they currently identify faults or issues with devices/charge points automatically** by remote device management software."*

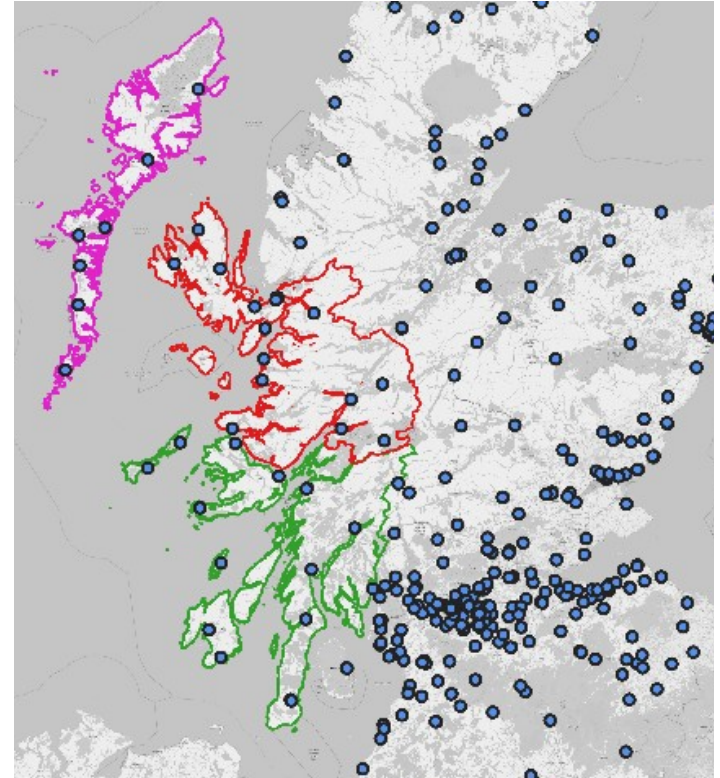


Project Objective:

- Install 72 'journey' (50kW) charge points across:
 - Northern Ireland,
 - Border counties of Ireland, and,
 - Western Scotland
- €6.4 million EU INTERREG V funded project.
- ***Deliver 24 'journey' charge points in Scotland across council regions of: Argyll and Bute, the Western Isles and Highland (Skye, Lochaber & Lochalsh).***

PNDC Role:

- Provide an evidence-based approach to site identification.
- Managed DNO connections applications for project portfolio.
- Procurement and technical support.

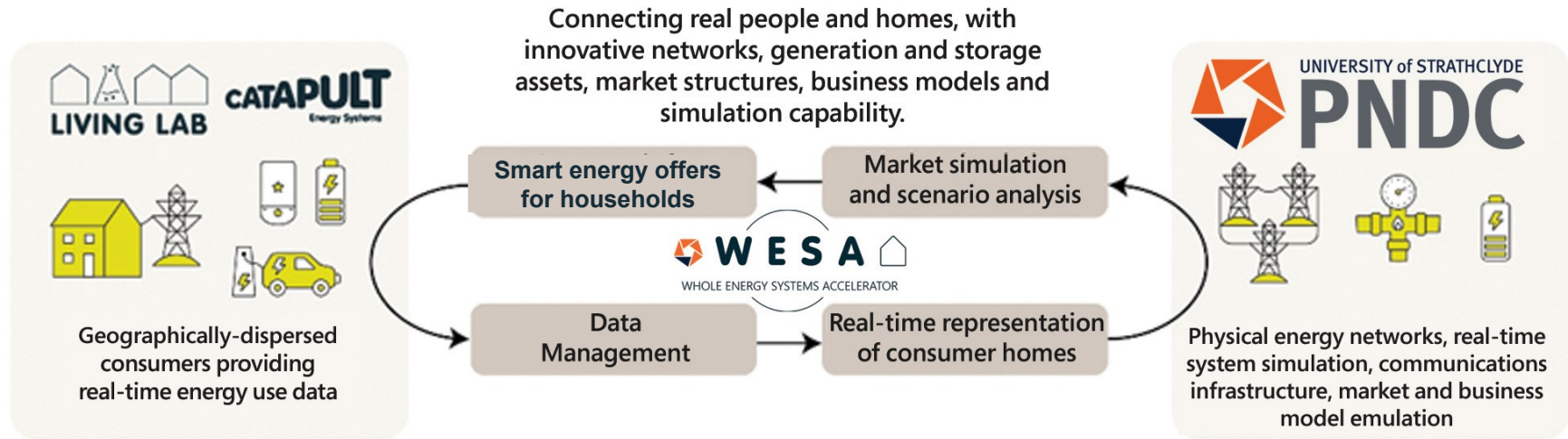


Scotland FASTER region and existing 'journey' EV infrastructure

Collaboration

Whole Energy Systems Accelerator (WESA)

Collaboration with Energy Systems Catapult



A unique national collaboration facility...
providing space for industry, government & academia **to test & demonstrate new technologies, products, services, business models, policies & regulation** under **simulated in-market arrangements** with **real consumers & real network infrastructure**

Neighbourhood Green (Feb 2022 – July 2023)

❖ **Aim:** Assess future normal domestic loads and After Diversity Maximum Demand (ADMD) and its impact on the grid

❖ **Approach:**

- ❖ Gather historic data/insight from Living lab homes and other trials
- ❖ Real world trial at 60 homes with at least one form of LCT to monitor energy usage over time
- ❖ Virtual clustering of living lab homes and assessing the impacts in different weather conditions including extreme scenarios at PNDC

Partnering organisations



Energy suppliers



Low carbon technology providers



Consumer advocates



Network Operators

EXTEND: Longer Duration Energy Storage Demonstration (Feb 2023 – Apr 2024)

❖ **Aim: Develop, build and trial EXTEND solution in 100 homes across the UK evaluating the effects of a fleet of such storage systems on electricity network**

❖ **Approach:**

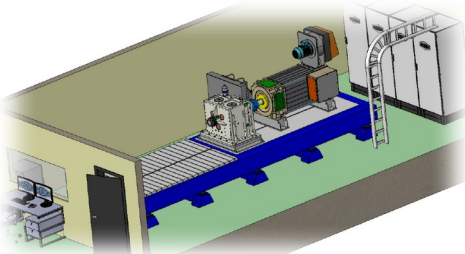
- ❖ Thermal modelling of reference case and prototype energy storage system.
- ❖ Scenario development (networks, buildings, max demand...)
- ❖ WESA Interface build and initial testing.
- ❖ Testing of agreed scenarios.



Expansion Facility – New Technical Capabilities

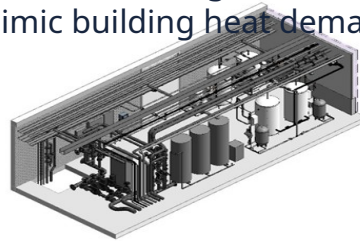
Electrical equipment (in procurement)

- ❖ 11kV distribution network
- ❖ 2.5MVA s/stn & LV network
- ❖ 1MVA DC power supply
- ❖ 1MVA AC power supply
- ❖ Real-time digital simulation
- ❖ 2 x 1MW dynamometers



Thermal facility (awaiting funding decision)

- ❖ For low carbon heating, cooling, thermal storage and heat recovery system testing and validation
- ❖ Scalable up to ~750kW, 5-90°C flow temp, system ΔT 5-40°C
- ❖ Heat and cooling emulators to mimic building heat demand



Hydrogen facility (existing + to be upgraded)

- ❖ Existing facility - 80 kg H₂ storage, 12 bar supply pressure, 9kg/hr max flowrate
- ❖ Upgraded facility - 160 kg H₂ storage, 20 bar supply pressure, 30kg/hr max flowrate



← Whole system capability →

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