

Electrification of Transport Research for Net Zero

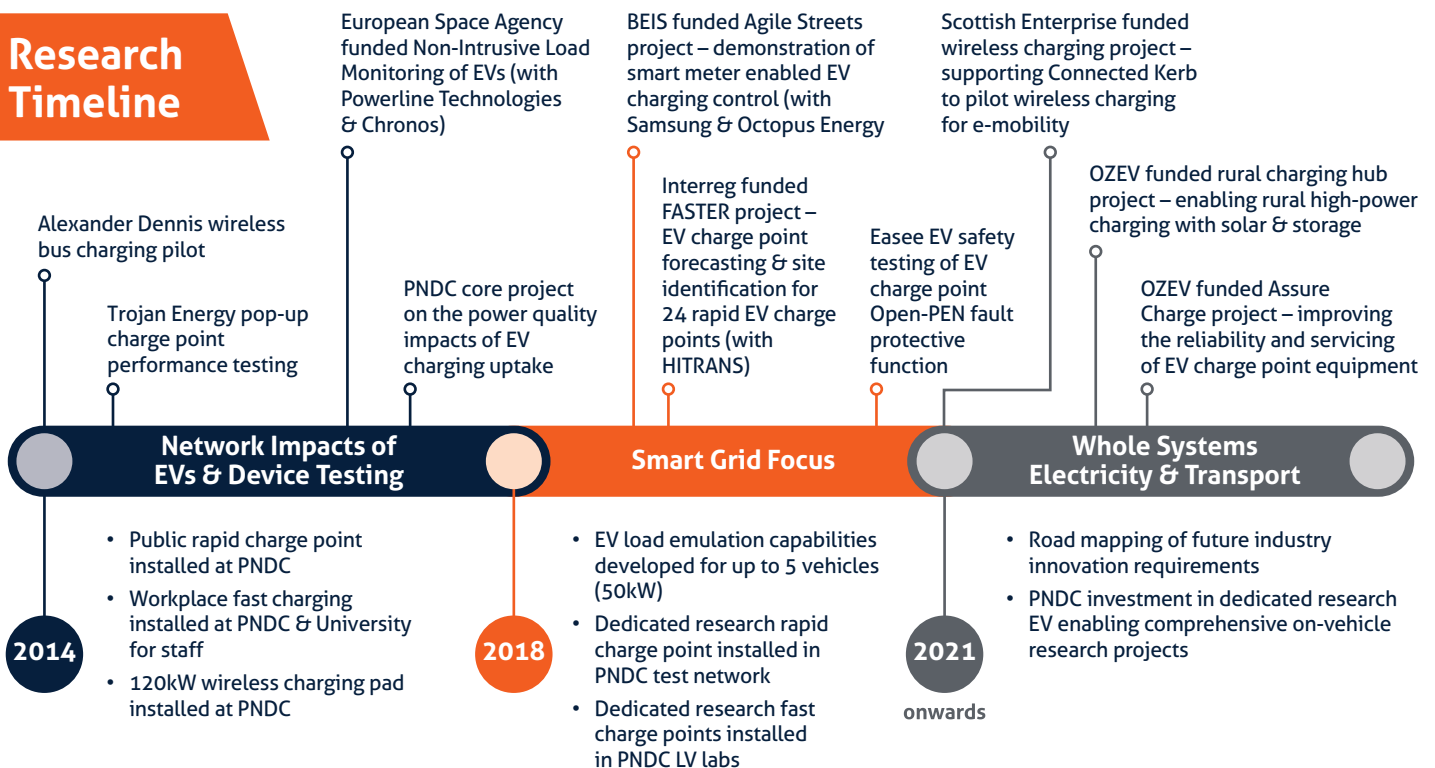
Transforming the future of transport and energy

PNDC is developing and de-risking the technologies, planning and operational processes, and finance models required to enable the transition to zero emission vehicles at the lowest cost to consumers in a timescale compatible with net zero targets.

We do this through:

- ▶ Coordinating energy network and transport industry stakeholders to collaborate on innovation and infrastructure deployment.
- ▶ Physical and virtual test environment for industry partners to create integrated systems for electric and other alternative fuel vehicles.
- ▶ Providing academia-industry collaboration and knowledge exchange of best practice and state-of-the-art.
- ▶ Coordinate energy network forward investment and infrastructure coordination.
- ▶ Digitalisation, data and tools to enable flexibility, grid services and smart charging strategies for electrified transport and decarbonised energy.

Research Timeline



Transport Test Assets and Capabilities

A Whole Systems Innovation Environment

- ▶ 50kW rapid charger (DC: CCS & CHAdeMO Mode 4 outlets, and AC: Type 2/Mode 3 outlets)
- ▶ 22kW rapid charger (DC: CCS & CHAdeMO Mode 4 outlets, and AC: Type 2/Mode 3 outlets)
- ▶ 7kW fast charger post (2x AC: Type 2/Mode 3 outlets)
- ▶ Wireless electric vehicle charger bay (Inductive: 100kW, 20kHz)
- ▶ High-power dynamic EV load emulation for DC charge point testing (CCS, CHAdeMO)
- ▶ Multiple low power dynamic EV load emulators for testing AC charge points & smart charging
- ▶ Charge Point Management System (CPMS) for smart charging and communications testing
- ▶ Indoor vehicle bay (for passenger and light-duty vehicles)
- ▶ Operation of PNDC HV/LV network in grid-connected or off-grid modes (45Hz – 62Hz, and 9.5kV - 13kV)
- ▶ Motor-Generator set (1MW/5MVA) with a 24MVA fault level
- ▶ 11kV configurable overhead (60km equivalent) distribution network
- ▶ 11kV configurable underground cable (3.4km equivalent) distribution network
- ▶ 400V configurable underground cable secondary distribution network
- ▶ 10 x 11kV/400V secondary substations (capacity ranging 50 to 500kVA)
- ▶ AC and DC compatible electrical network test buses for integration and operation of EV-hub designs with collocated EV charging, storage and on-site generation
- ▶ Indoor 400V LV test bays to integrate and test renewable, energy conversion, and storage
- ▶ Outdoor 400V LV test bays to integrate and test large sized energy resources
- ▶ High-fidelity data acquisition system(s) capable of sampling and logging electrical network parameters at rates up to 100kHz
- ▶ Real-time digital simulator (RTDS) capable of modelling national and facility scale energy networks with energy resource device models
- ▶ 540kVA bi-directional power converter capable of high-fidelity emulation of AC and DC voltage and current supplies - compatible with real-time digital simulator for power hardware-in-the-loop (PHIL) applications
- ▶ Energy storage and energy conversion systems emulation, e.g. grid scale and distributed li-ion, fuel-cells, flow-batteries
- ▶ Renewable generation emulation and profiles, e.g. distributed solar, wind, hydro
- ▶ 600kVA of low voltage load banks with load profile control (resistive & inductive)
- ▶ Solar PV array emulators (2x DC controllable supplies: 600V, 8.5A up to 5kW)
- ▶ Array of 5 controllable solar PV inverters (ranging 3 to 10kW) to test co-location of renewables with charge points
- ▶ HV and LV phase-to-phase and phase-to-earth fault capability to test protection and contingency schemes
- ▶ Smart grid monitoring and control systems, including full supervisory control and data acquisition (SCADA) system
- ▶ Smart grid communication networks: e.g. Ethernet, fibre, GSM, satellite, LoRaWAN
- ▶ Smart grid communication protocol test harnesses: E.g. Modbus, DNP 3.0, IEC61850
- ▶ High-fidelity data acquisition system(s) capable of sampling and logging electrical network parameters at rates up to 100kHz
- ▶ Electronics fabrication and machine shop

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