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Interoperable Demand Side Response

Performance Testing in Settings Indicative of the Real World

Department for Energy Security & Net Zero

The IDSR programme is part of the up to £65m Flexibility Innovation Programme within the Department for Energy Security and Net Zero's £1 billion Net Zero Innovation Portfolio

Resillion Introduction

Quality Assurance and Testing

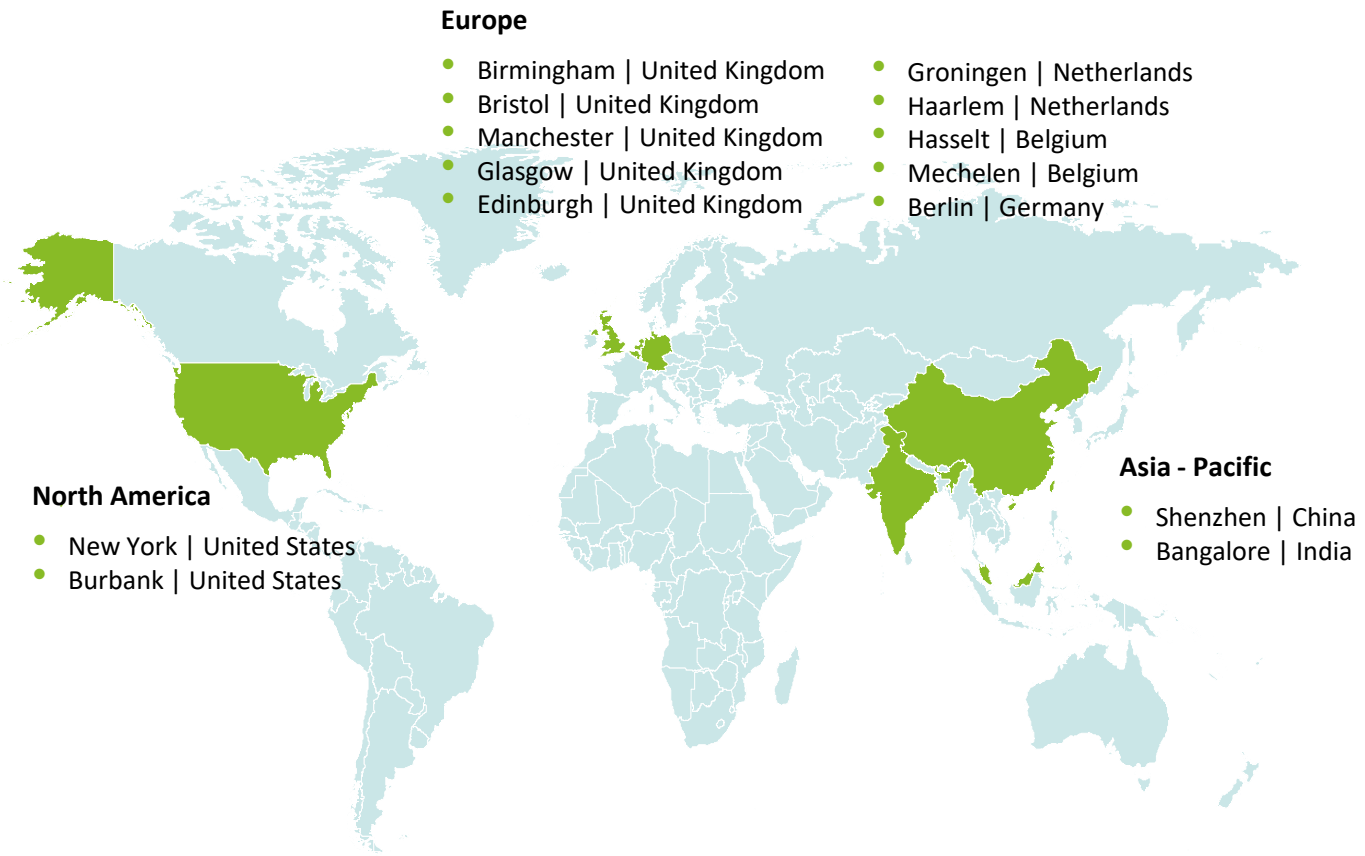
Systems

Devices

Cyber Security

Content

Global Presence



Europe

- Birmingham | United Kingdom
- Bristol | United Kingdom
- Manchester | United Kingdom
- Glasgow | United Kingdom
- Edinburgh | United Kingdom
- Groningen | Netherlands
- Haarlem | Netherlands
- Hasselt | Belgium
- Mechelen | Belgium
- Berlin | Germany

North America

- New York | United States
- Burbank | United States

Asia - Pacific

- Shenzhen | China
- Bangalore | India

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Project Overview

Interoperable Demand Side Response - Performance Testing in Settings Indicative of the Real World

Objectives:

- The Interoperable Demand Side (IDSR) Programme aims to support the development and demonstration of energy smart appliances

Scope:

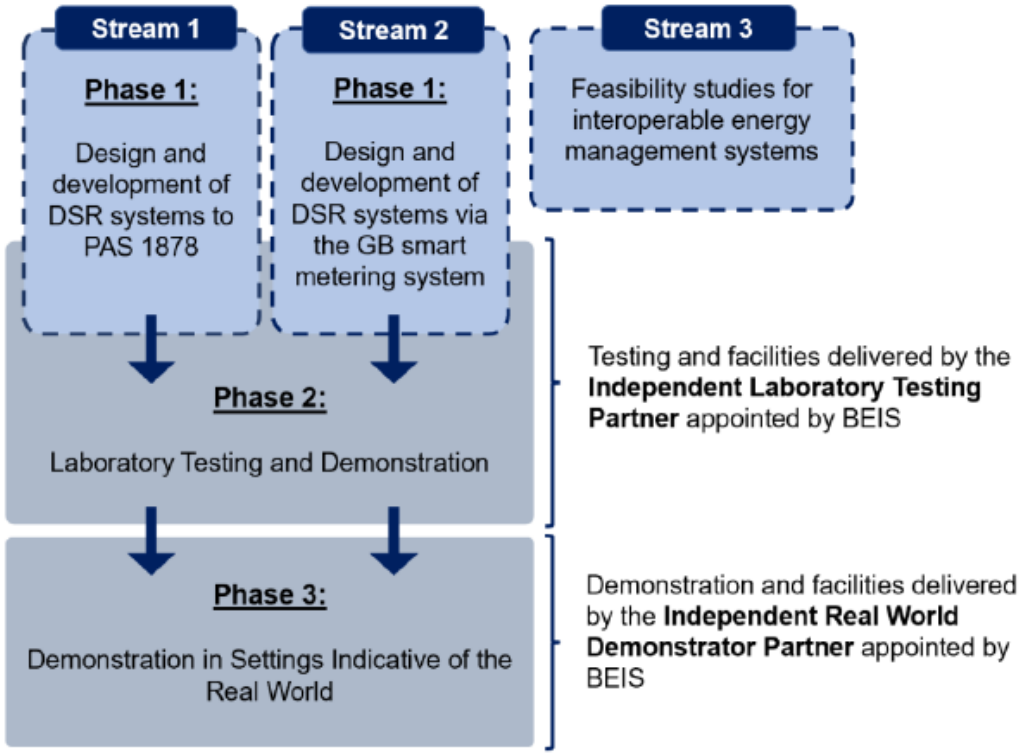
- DSR based on PAS 1878/1879 (with OpenADR) and on the GB Smart Meter System
- Test a mix of ‘energy smart appliances’ (EV chargers, heat pumps, battery storage… up to 20 in each project) and DSRSP platforms
- Measure performance in delivering a range of DSR services (reduce, increase, delay, or ‘smooth’ energy demand)
- Demos and showcase presentations

Timeline:

- Jan 2023-Apr 2024: Design and develop test schemes and lab
- May 2024-Sep 2024: Testing projects and reporting

Context

IDSR programme has 2 test phases



Phase 2 / Lot 1 Testing

- Individual products: ESA, DSRSP
- Validate compliance with specifications and standards
- Basic interoperability

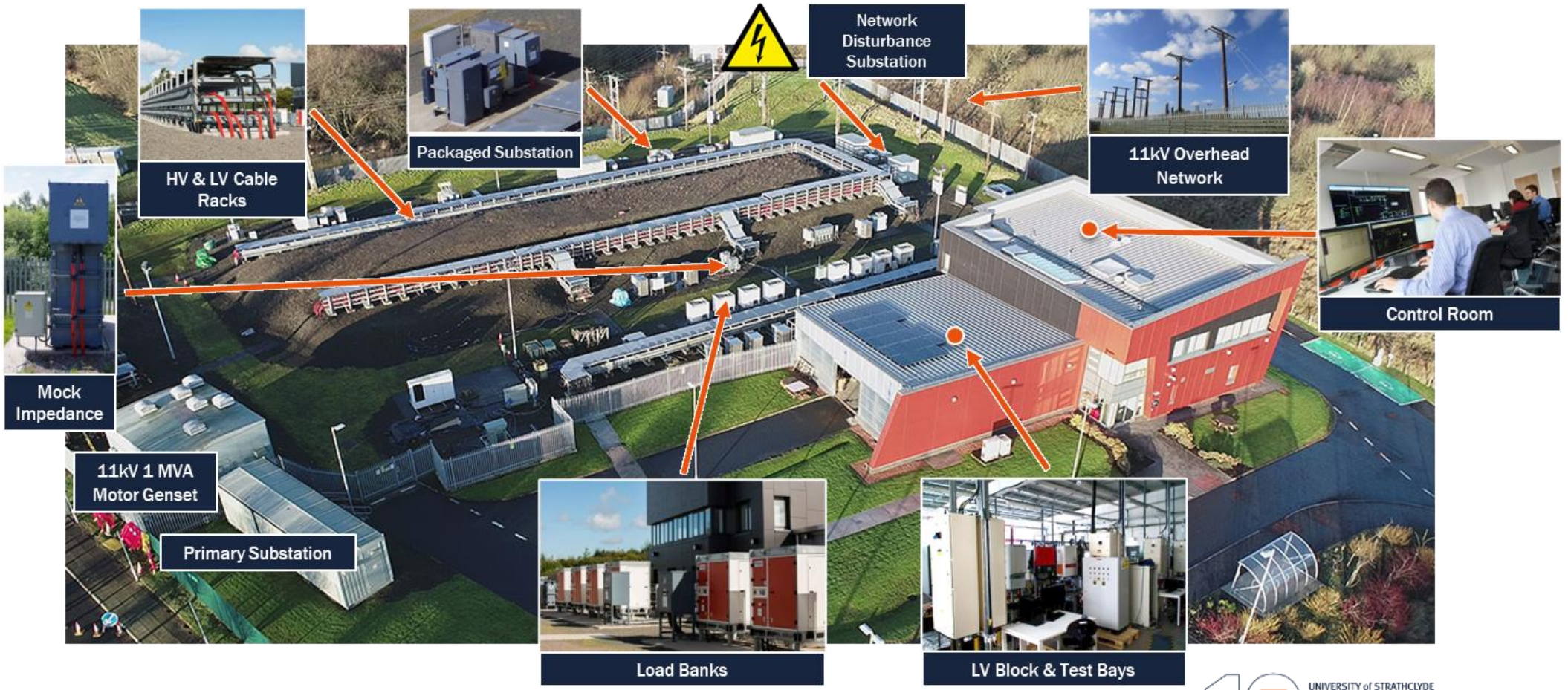
Unit Testing, Integration Testing

Phase 3 / Lot 2 Testing

- Multiple ESAs
- Larger interoperability groups
- System-level scenarios and use cases

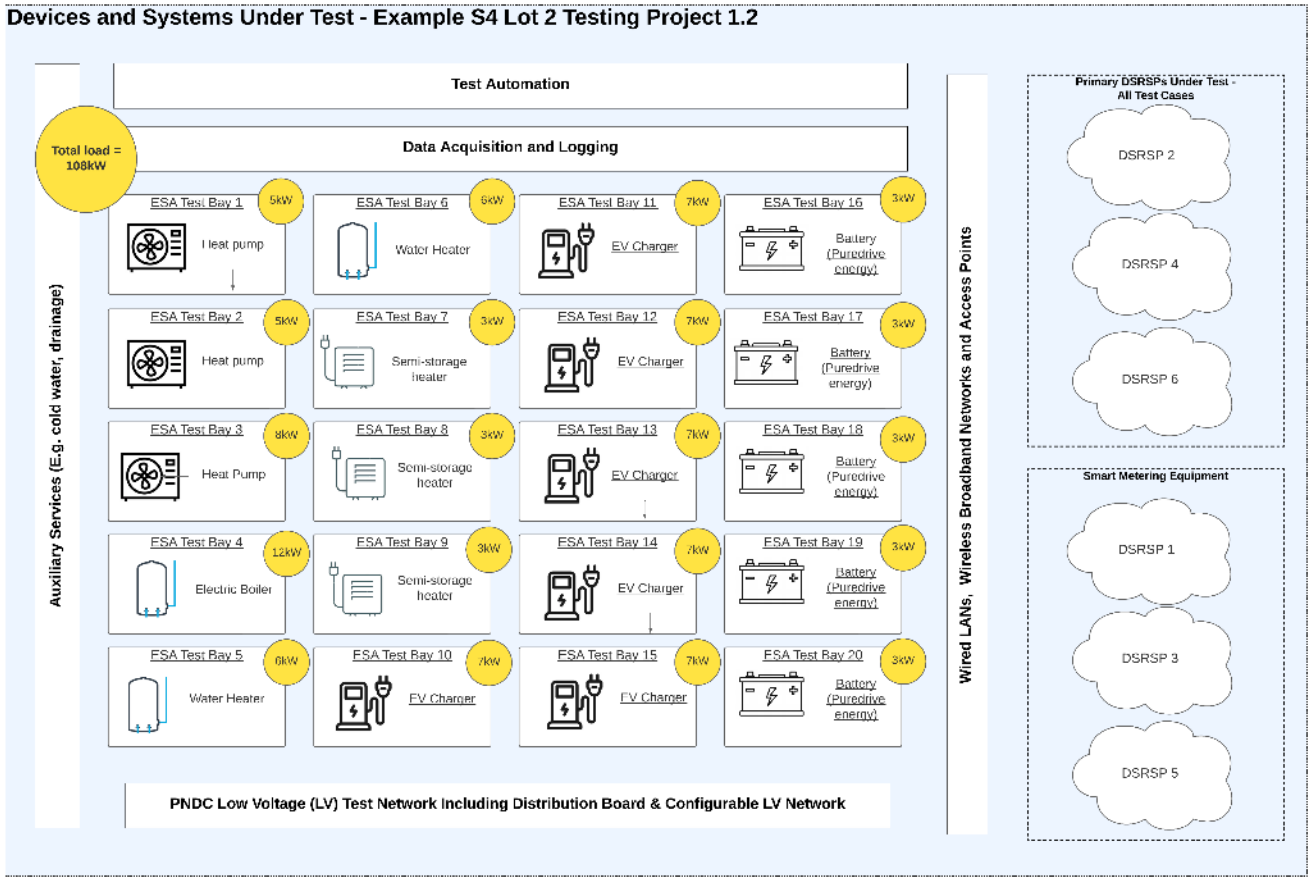
System Testing, Performance Testing

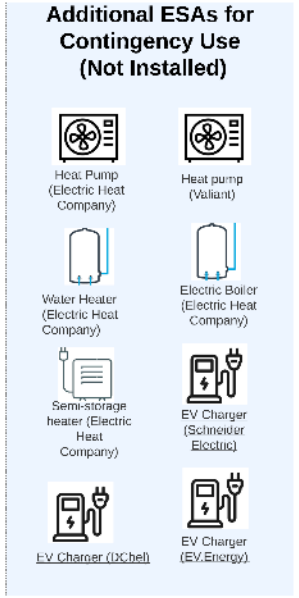
Settings Indicative of the Real World?



Settings Indicative of the Real World

IDSR Lab at PNDC





- Groups of Energy Smart Appliances (ESA) representing multiple premises connected to a common substation
- ESA test bays configured with electrical, communication, and auxiliary services (hot/cold water service & drainage) required to fully test all device types in a real-world environment
- Test loads and load emulation for Smart EV Charge Point, and Electric HVAC device types
- Time-synchronized power quality monitoring and data logging equipment to enable accurate performance assessment of all DSR services, including sub-second frequency response

Measurements and Data Collection

Exploratory performance testing and demonstrations, not Pass/Fail

Power and environmental measurements

- Background grid conditions (frequency, voltage)
- Net electrical power flow at a simulated domestic site
- Electrical power flow at ESAs
- ESA performance (heat power output / consumption, battery SoC, appliance cycles…)
- Background operational environmental conditions (temperature, humidity)

Data logging from devices and systems

- Logging of user settings, preferences and mid-test interventions
- Logging of DSR settings, registration, DSR service participation
- Logging of optimisation or scheduling inputs – eg. variable ToU tariffs
- Logging of external control triggers (eg. setpoint driven events – timestamped)

All measurements and data are time-synchronised throughout the duration of each test run

Performance Testing Scheme

Use cases define testing scenarios

IDSR Programme Use Cases	
A	Consumer registering DSR appliance with CEM (where not integrated)
B	Consumer registering with the appointed DSRSP
C	Consumer defining DSR preferences
D	Routine DSR mode of operation based on preferences tariff (ToU)
E	Sending power profiles from ESA to CEM and to DSRSP
F	Response DSR mode of operation
G	Consumer over-ride of DSR response mode and routine mode
H	DSRSP maintaining DSR service delivery despite availability changes
I	Consumer de-registers ESA from CEM and DSRSP
J	Change of incentive information
K	Consumer changes DSRSP

Grid Objective use cases (PAS 1878 / 1879)

- Match the short-term availability of intermittent renewable energy generation sources such as wind and solar
- Decrease the peak load on the electrical transmission and distribution networks to alleviate the need for network upgrades to handle new domestic appliance types
- Allow the offset of short-term market imbalances by controlling flexible load on the network
- Allow control of electricity network characteristics such as line frequency, system inertia and network voltage, and help prevent network and generation outages

Example Test Scenario

DSR intervention to reduce or defer demand

Primary use cases covered

- Offset short term market imbalance (unavoidable shortfall in generation capacity relative to expected demand)
- ESA Response Mode (execute flexibility offer)

Starting conditions

- ESAs under test are commissioned and registered with a DSRSP platform
- ESAs have provided flexibility offers to the DSRSP
- Demand under ESA ‘Routine Mode’ is known/predictable

Test initiation

- A DSR Service Request is submitted to the DSRSP, specifying a reduction or deferral of demand appropriate for the ESAs under test and the starting conditions

Direct measurements and data collected

- Timed measurements of energy flow at simulated premises and at individual ESAs
- Actual energy consumption reported by ESAs
- ESA device level data that might impact performance - eg battery State-of-Charge

Inferred performance measure

- How accurately does the DSR system as a whole deliver the required DSR service?

Target Outcomes

In support of accelerated adoption of domestic DSR

- Encourage industry adoption by demonstrating the effectiveness of domestic DSR
- Help to prove a set of products (ESA, CEM, DSRSP) to ‘seed’ the market
- Data from the study will be available to extrapolate to larger scale and inform design work on future energy networks
- Contribute to lessons learned, for continuing standards development

Limitations and Risks

This is indicative of the real world, not actually real…

Test groups containing up to 20 ESAs

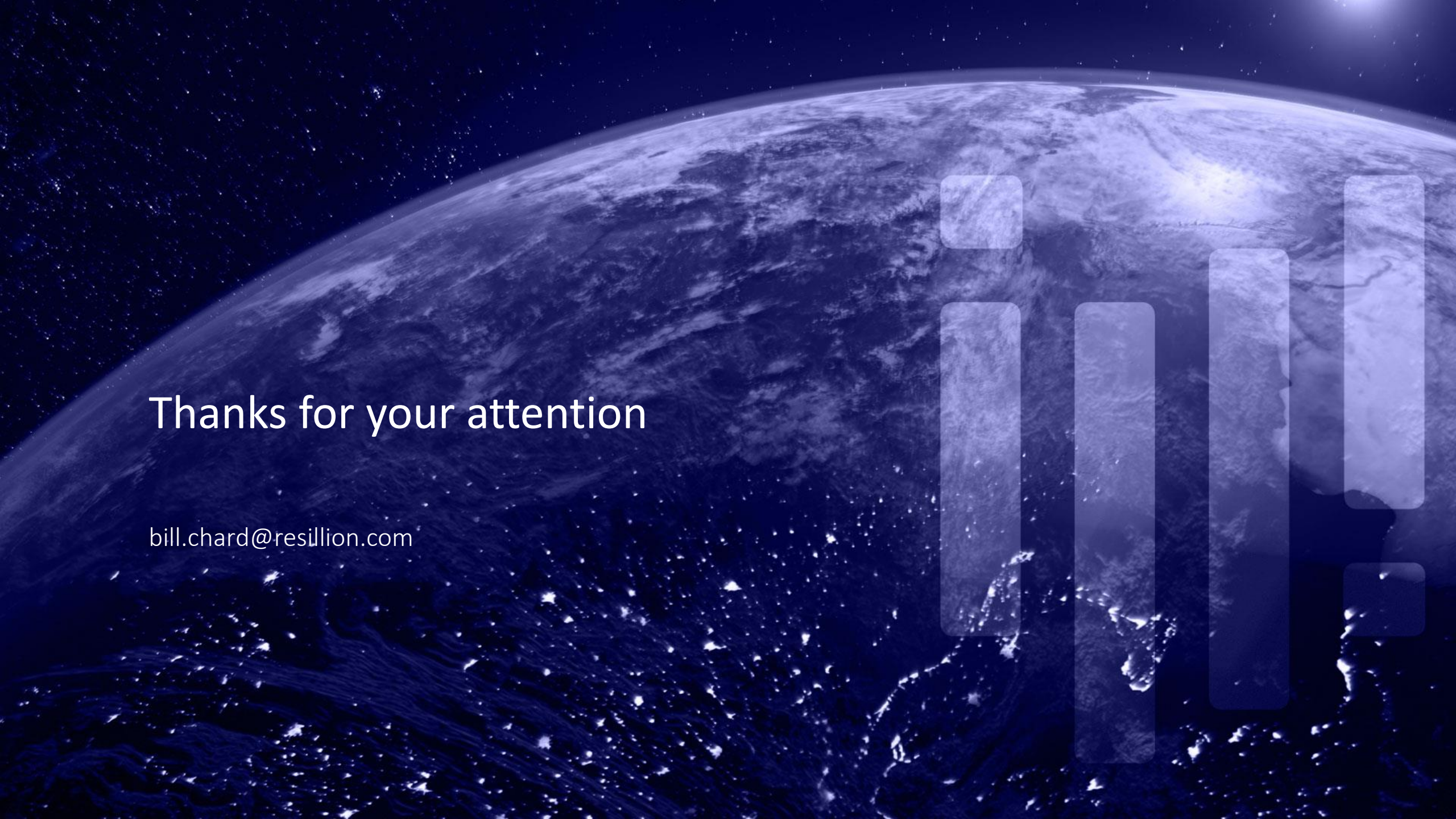
- Expect real-world deployments to manage millions of devices
- DSRSP logic and flexibility offers must be artificially set to accommodate test scenarios at small scale

Data communications

- Comms failure use cases are out of scope
- Some comms via test networks (DCC Boxed)

Interoperability

- PAS 1878 is a new standard (although OpenADR is well established)
- Interoperability is critical for this testing project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