EPSRC

Engineering and Physical Sciences Research Council

National Centre for Energy Systems Integration

Newcastle University

Durham University

Heriot-Watt University

University of Sussex

The University of Edinburgh

EPSRC National Centre for Energy Systems Integration

EPSRC Engineering and Physical Sciences Research Council · Newcastle University · Durham University · Heriot-Watt University · University of Sussex · The University of Edinburgh

CESI National Centre for Energy Systems Integration

- £20M multi-disciplinary research centre investigating Energy Systems Integration
- Multi-vector energy systems analysis utilising Big Data and Supercomputer techniques and technology
- Funded by EPSRC, a consortium of 5 research intensive universities, Siemens and other industry partners

Address current limitations:
Uncertainty, Calibration, Behavioural dynamics, Spatial and Temporal variations, Representing interdependencies

Addressed by:
Co-evolutionary approach to supply and demand, Stochastic Programming, Agents, System of Systems, Fine Grain Data, Quantitative and Qualitative, Expert Judgement, **Multi-Disciplinarity,** soft linking between models, High Performance Computing Framework,

Some of our strategic industrial and governmental partners

Siemens – Ingenuity for life · Northern Gas Networks · centrica · Nanyang Technological University · NREL National Renewable Energy Laboratory · CenSES Centre for Sustainable Energy Studies · Skoltech Skolkovo Institute of Science and Technology · iESI International Institute for Energy Systems Integration · Northern Powergrid · nationalgrid · DTU · enzen · EPRI Electric Power Research Institute · Department for Business, Energy & Industrial Strategy · The Scottish Government · Catapult Energy Systems · UKERC UK Energy Research Centre · i-STUTE · The Alan Turing Institute · Department for Transport · ofgem · Innovate UK · Centre on Innovation and Energy Demand · ITRC mistral · CIE-MAP

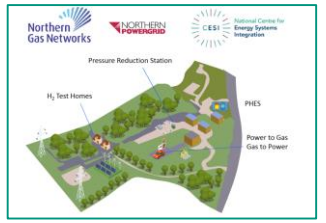
Some of our living labs and demonstrator facilities for research and validation


Newcastle Helix


Findhorn Community


Siemens Smartgrid Lab

Thames Valley Vision

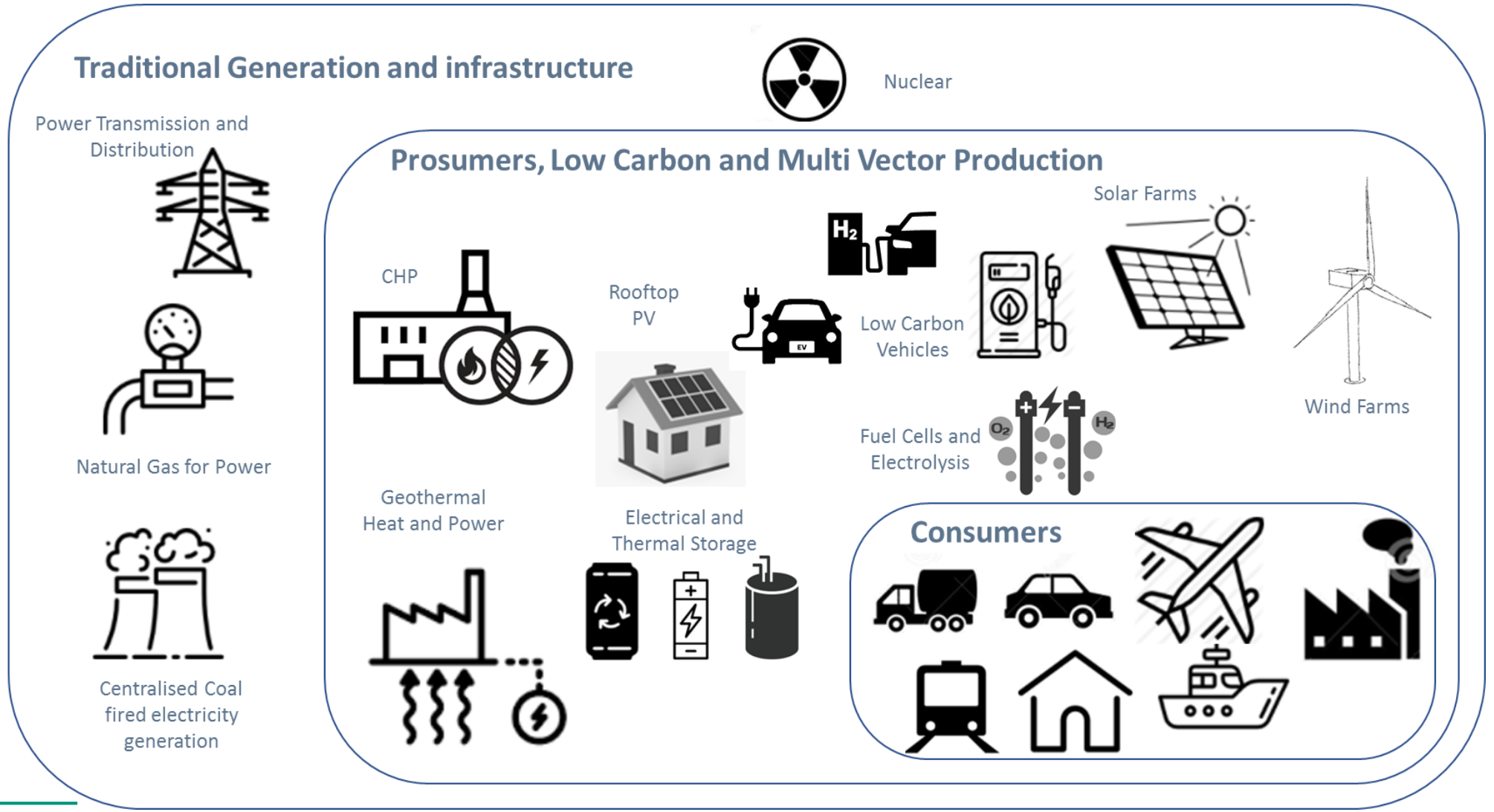


Integrel – Utility Scale Gas and Electricity Distribution Laboratory

Cockle Park Farm

National Centre for Energy Systems Integration

Whole Energy Systems for Transport, Heat and Electricity



CESI Academic Leadership

Director

Professor Phil Taylor Newcastle University

- Deputy Pro Vice Chancellor of SAgE Faculty & Head of the School of Engineering
- Siemens Professor of Energy Systems
- An internationally leading researcher and industrial expert in energy systems, electrical distribution networks, smart grids and energy storage integration and control.

Associate Directors

Professor Jon Gluyas
Dong/Ikon Chair in Geoenergy, Carbon Capture & Storage
Durham University

Dr Chris Dent
Chancellor's Fellow
School of Mathematics
University of Edinburgh

Professor Gordon Mackerron
Professor Of Science And Technology Policy
University of Sussex

Professor Tony Roskilly
Director, Sir Joseph Swan Centre for Energy Research
Newcastle University

Dr Sara Walker
Director of Expertise in Infrastructure, Engineering
Newcastle University

Professor David Flynn
Professor
Director of Smart Systems Group
Heriot Watt University

National Centre for Energy Systems Integration

CESI Research Work Package Streams

WP1 — Commercial, regulatory and policy aspects
- Energy Policy
- Sector Regulation
- Social interaction
- Commercial
- Behaviour

WP2 — Energy supply
- Multi –Vector Generation
- Interconnection
- Spatio-temporal

WP3 — Infrastructure and storage
- Systems modelling
- Storage
- Networks and Infrastructure

WP4 — Energy Demand
- Multi-vector Consumer Demand
- Buildings
- Transport
- Highly temporal

WP5 — Demonstration and Validations
- Cross-vector demonstration
- Validation within living labs
- Real-time data

WP6 — Multi-Scale Architectures
- Whole systems planning tool
- Co-evolution cycles
- Integration of models
- Stochastic optimisation

Bounded by WP7 - Impact, engagement and management

Newcastle University

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CESI Multi-disciplinary Expertise

Engineering

- Mechanical
- Electrical
- Thermal
- Transport
- Sub-surface
- Buildings
- Renewables

Science

- Mathematics
- Data
- Statistics
- Geophysics
- Computing

Social

- Economics
- Business
- Human Geography
- Anthropology
- Policy
- Energy Futures]
- Markets
- Regulation

Newcastle University

CESI Scientific Support

- brings together experts to investigate the energy network, understand and demonstrate future supply and demand for the UK
- 5 Leading Research Universities
- Leading Edge International Scientific Support

The Centres Industrial Partners

- Lead Industrial Partner

SIEMENS
Ingenuity for life

- Government Support

Department for Business, Energy & Industrial Strategy
The Scottish Government
CATAPULT Energy Systems
Cabinet Office
Department for Transport
ofgem
Innovate UK
UK Research and Innovation

- Leading Energy Industry Partners

Ørsted
centrica
nationalgrid
Scottish & Southern Electricity Networks
CREDS
gentoo
It's how you live
e·on
SCOTTISHPOWER
NORTHERN POWERGRID
triphase
Newcastle City Council
NEA
Action for Warm Homes
ecotricity
SIEMENS Gamesa
RENEWABLE ENERGY
Northern Gas Networks
redT
energy storage
NISSAN
Innovation that excites
Durham County Council

Supply | Infrastructure and Storage | Demand

Newcastle Helix

- Newcastle Helix is Newcastle's £350 million project bringing together university, business and residential buildings
- it provides a living laboratory for us to trial innovative urban technologies and experiment on the system
- The energy system of **Newcastle Helix** includes:
- 11kV smart grid throughout the site
- Combined heat and power (CHP) district heating
- Electric vehicle (EV) fuelling station
- Low carbon heating
- Building-mounted solar photovoltaic
- Solar thermal photovoltaic (PVT), producing power and hot water

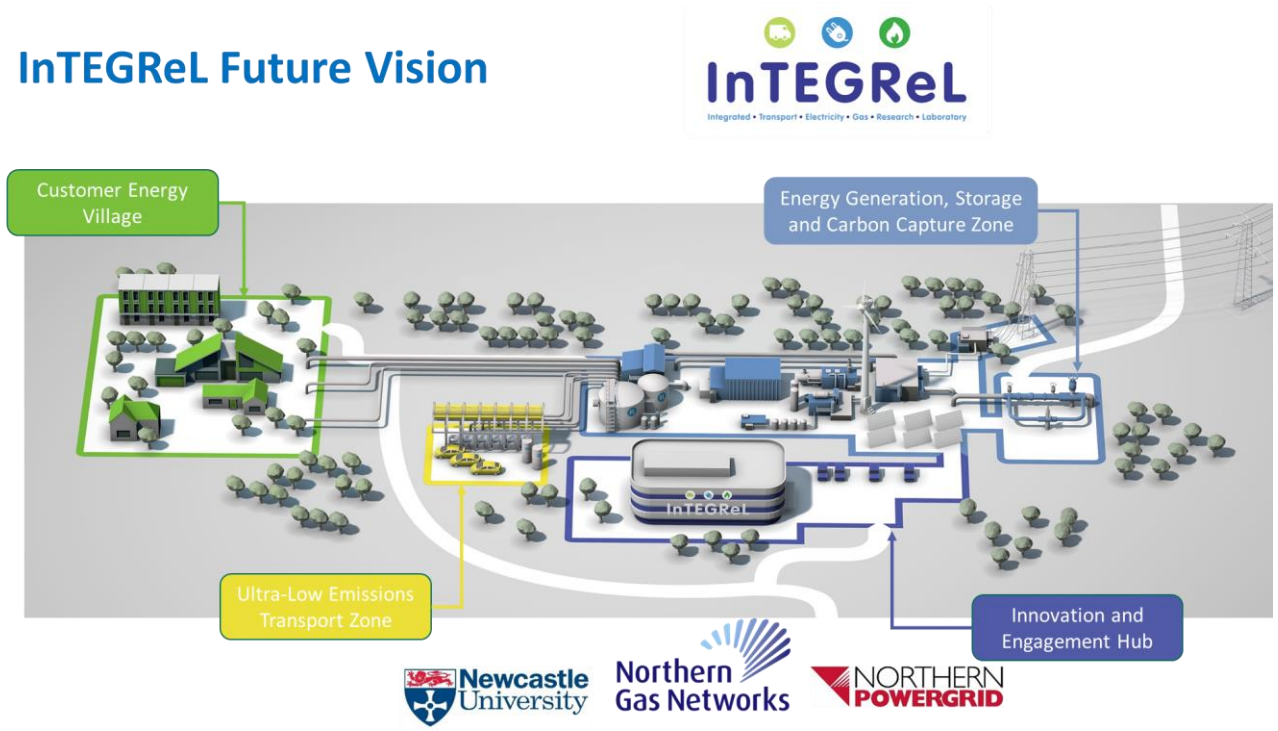
https://3d.usb.urbanobservatory.ac.uk/

£62m InTEGRel - Integrated Transport Electricity Gas Research Laboratory

- **UK's first multi-vector industrial networks research centre**
- Collaboration between CESI, Northern Powergrid and Northern Gas Networks
- Development of a world-leading **emerging sector** in Gas and Electricity Network **integration**

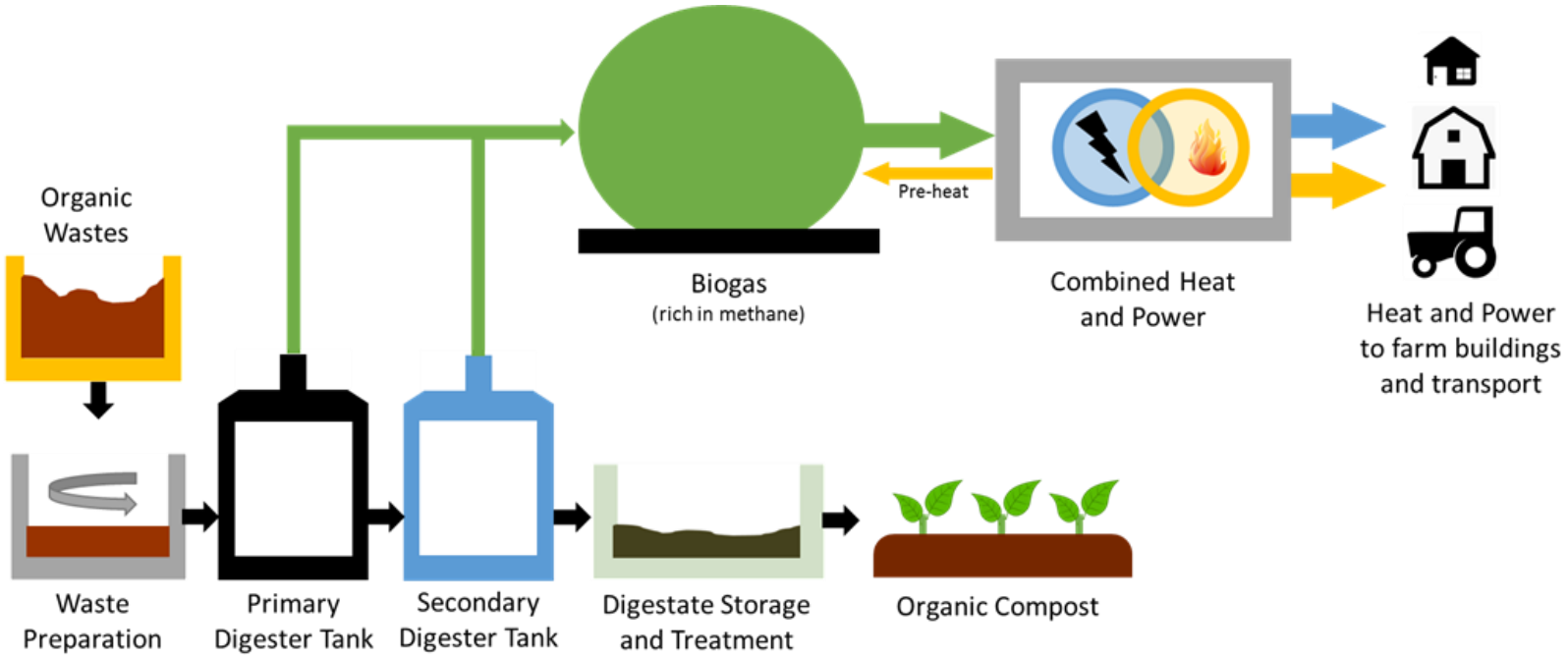
1. Customer Energy Village for testing of innovative solutions to energy challenges e.g. Hydrogen as a Heating Fuel, **Low Carbon Heating**
2. **Innovation Hub** for engagement and skills development and training
3. Energy Generation, Storage and **CCS** Zone
4. Ultra-Low Emissions Transport Zone e.g. **H_2**, V2G, **Low Carbon Freight**

https://www.ncl.ac.uk/cesi/research/demo/integrel/



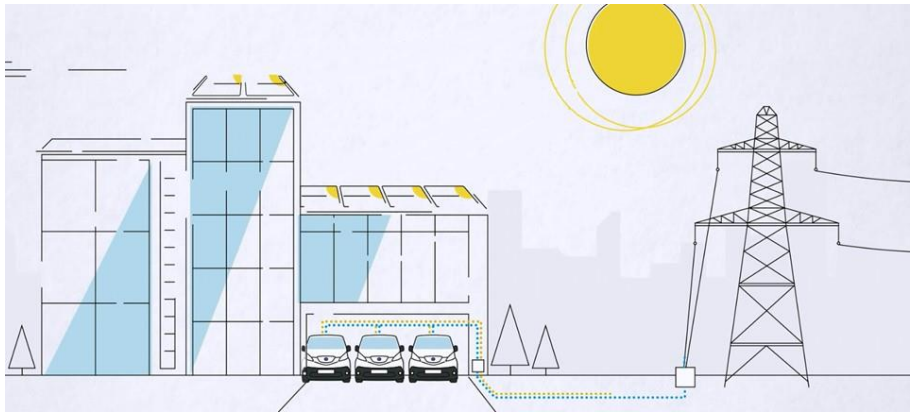
Cockle Park Farm

- Cockle Park Farm is a working 307 hectare mixed farm situated near Morpeth. The farm is owned and operated by Newcastle University
- it provides a living laboratory for us to trial innovative rural technologies and experiment on the system
- Combined farm waste fuelled AD with CHP system installed and operational



e4Future- Large Scale Demonstrator on Vehicle-to-Grid (V2G)

- a real-world £9.8M V2G trial project
- expertise from across the whole Vehicle-to-Grid value chain
- Demonstrator deployed in groups and controlled by an innovative aggregator platform stacking multiple investigating the business proposition and core technology around V2G with demonstration at large scale
- Demonstrator includes
  - private communal
  - commercial/delivery p
  - public service vehicles
  - using V2G-ready models



Co-funded by

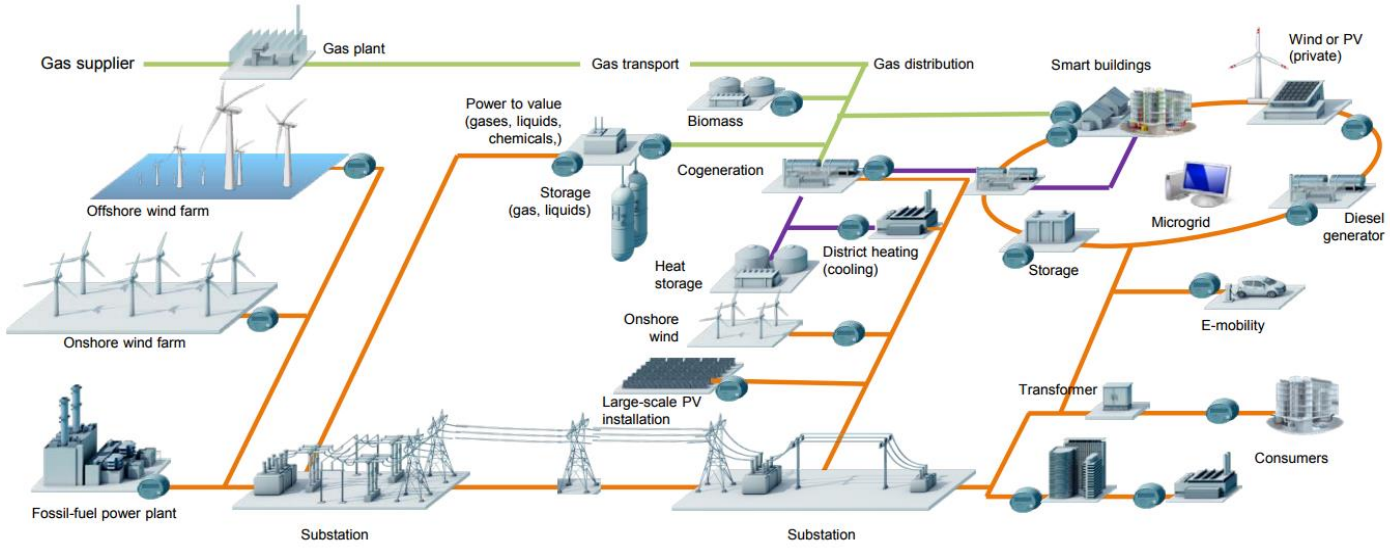
- Office for Low Emission Vehicles (OLEV) (Department for Transport)
- Department for Business Energy and Industrial Strategy (BEIS)
- In partnership with Innovate UK.

£10m SEND - Smart Energy Network Demonstrator

- **Keele University** is upgrading their campus energy system
- **Siemens Energy Management team** won the contract to deliver the infrastructure transition

- will include:
  - digitalisation of 24 substations
  - installation over 1,500 smart meters
  - 500 home controllers
  - 5 MW renewable integration package.
- Siemens utilised a whole energy systems approach in their submission
- Generation, Infrastructure and Storage and Demand
- The site will be used as a demonstrator for future research in smart energy systems
- CESI on Project Steering Board

A whole energy systems approach – Source Siemens



National Centre for Energy Systems Integration

£65m Faraday Battery Institution

- **UK's independent national battery research institute**
- Established as part of the government's £246 million investment in battery technology through the **Industrial Strategy**
- Significant investment in the important area of **battery energy storage**
- CESI Director, Professor Phil Taylor is a founding member
- Newcastle University involved in 2 of the 4 fast start projects (£42M)
  - **Extending battery life**
    - 10 university partners including

University of Cambridge, Newcastle University, WMG University of Warwick, University of Strathclyde

  - **Recycling and reuse of batteries**
    - 8 university partners including

University of Birmingham, Cardiff University, Newcastle University, The University of Edinburgh

Newcastle University

New Demonstrator Announcements

ISCF

- Partners on **£28.5m** ReFLEX (Responsive Flexibility) Orkney project (Professor Flynn, Heriot-Watt University)
  - Whole island Virtual Energy System (VES) in Orkney (transport, power and heat)
  - digitally link distributed and intermittent renewable generation to flexible demand and storage
- Partners on **£8m Energy Revolution Research Consortium - Core - EnergyREV** (Professor Taylor)
  - ISCF/UKRI collaboration on research
- Partners on **West Sussex uses a virtual power plant approach to optimise heat networks, solar & storage assets**

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Twitter	:	@cesienergy
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