InTEGReL
Integrated • Transport • Electricity • Gas • Research • Laboratory

Newcastle University

Northern Gas Networks, Newcastle University, Northern Powergrid, Northumbrian Water and Siemens have established InTEGReL (Integrated Transport Electricity Gas Research Laboratory)

InTEGReL is a fully integrated whole energy systems development and demonstration facility, providing a space for industry, academia, SMEs and government to come together to explore and test new energy technologies, strategies and processes which bring transport, electricity and gas into one place.

The initiative creates a first-of-a-kind facility exploiting, and significantly enhancing, the existing co-location of:

- an electricity distribution system
- a gas distribution hub
- a gas distribution system control room

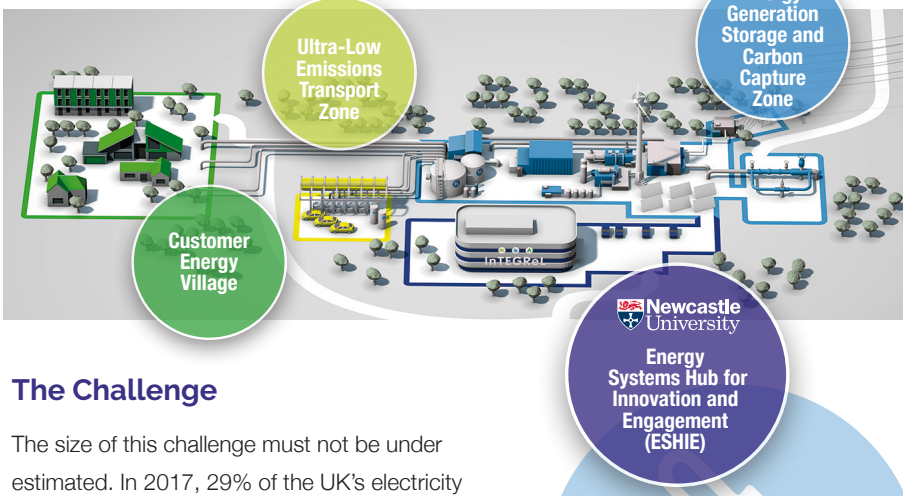
Through collaboration with industry and academia, InTEGReL is breaking down traditional barriers between gas, electricity, water and transport sectors to better utilise their assets to deliver a more secure, affordable, low carbon energy system.

The vision

For the first time, researchers will work alongside industrial practitioners to explore the transformative benefits of coupled gas, electricity, water and transportation systems. Full-scale research and demonstrations of novel approaches to integrated energy systems will be undertaken. These explorations will be facilitated through the addition of state-of-the-art facilities such as:

- digital twins
- IoT and artificial intelligence
- large-scale hydrogen electrolysers
- thermal energy storage systems
- advanced instrumentation and control systems

The InTEGReL facility will target serious challenges faced by energy systems, often referred to as the energy trilemma. It is estimated that between 2014 and 2021 £34 billion of investment across electricity networks and £7.6 billion across gas networks will be required to ensure energy demand will be met in a cost effective, clean and secure way.*



The Challenge

The size of this challenge must not be under estimated. In 2017, 29% of the UK's electricity came from renewable sources, but electricity is only ~20% of the UK's energy use. We must also decarbonise transport (~40%) and heat (~30%).

There is an emerging consensus that a 'whole-systems' approach to integrated electricity, gas and heat networks offers us the potential to rapidly deliver a resilient, low-carbon, least-cost energy system. This whole-systems approach however presents many technical, commercial, regulatory and safety research questions which must be addressed.

Source: Delivering UK Energy Investment: Networks. DECC, 2015

Northern Gas Networks · NORTHERN POWERGRID · NORTHUMBRIAN WATER living water · SIEMENS

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ESHIE research facility at InTEGReL

The Energy Systems Hub for Innovation and Engagement (ESHIE) facility will provide an open, flexible, 'whole-systems' energy research and demonstration facility at the InTEGReL site.

It will support expertise to catalyse effective energy solutions developments. It will also address the skills gap for research and innovation in energy systems integration.

The ESHIE facility is currently the subject of a funding application to Research England. If successful, the facility is expected to be operational by August 2021.

The proposed facility

The 4000m^2 two-story drive-through ESHIE facility will incorporate:

- industrial research lab space
- seminar rooms
- flexible lab space
- flexible office space for academics and industrial partners to work alongside each other
- collaboration space for SMEs to utilise the facility for research, testing and optimisation of new products and services, and how they could fit into the wider whole energy system (with adequate protection for confidential developments)
- the InTEGReL observatory allowing site-wide monitoring, testing and configuring different whole-energy systems
- a Northern Gas Networks and Northern Powergrid joint control room that is unique in allowing joint monitoring and control of the gas and electricity networks; a prerequisite for research on integration.
- a boardroom/conference room
- public event space, to engage end customers in research to optimise deployment of energy system integration
- data linkage to the Urban Observatory and the Urban Sciences Building (USB) at the Newcastle Helix campus (formerly Newcastle Science Central) for remote management, synthesis of data from multiple national sites, and further modelling, visualisation and simulation. This will allow InTEGReL to be accessible to multiple global partners and facilitate open research

Industrial research lab space

The industrial research lab will have the ability for any energy conversion equipment to plug-and-play with electricity, natural gas, hydrogen, hot heat, cold heat and compressed air.

It will contain items including but not limited to:

- an electrolyser
- vehicle to grid (V2G) Points
- fuel cell
- carbon capture system
- real time digital simulator (RTDS)
- battery energy storage system
- trigeneration unit
- compressed air energy storage system
- thermal energy storage system

Through experimentation and modelling, these technologies will all be integrated into an instrumented and controllable multi-vector energy system, including the existing full-scale gas and electrical infrastructure operated by Northern Gas Networks and Northern Powergrid.

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