



Keele Smart Energy Network Demonstrator:

A national R&D facility to deliver UK
comparative advantage in global smart energy
markets



Aim 5 Environmental Sustainability



- Improve environmental sustainability
- World-leading research in environmental sustainability
- Education on environmental issues, strategies and practice
- Leadership in application and implementation of environmental sustainability
- Sector-leading in environmental education and engagement with business, external organisations and communities



The opportunity:

Europe's first at scale multi-energy smart demonstrator



Keele University can deliver:

- A self contained and privately owned network of energy assets (electricity, gas, heat, water, waste);
- Real world energy demands covering domestic, commercial and industrial users, at the scale of a small town;
- Potential to support and manage multiple energy vectors: electricity, gas, heat, storage and transport;
- Space and capacity to facilitate supply of both small and large scale distributed energy resources (DER) on one site;
- Research, development and commercialisation capability coupled with significant investment in business engagement;
- Part of a wider local investment strategy enshrined in the City Deal to build local comparative economic advantage.





University

- 600 acre site (largest UK university campus)
- 341 buildings in total on the site
- 61 Academic and related buildings (96,300m²)
- 153 student residential buildings (73,400m²)
- 190 staff flats and houses (19,900m²)
- 6 Science Park commercial and industrial buildings (15,900m²)
- 204,000m² of built environment
- New Development Site 80,000m²
- >10,000 staff and students per day
- Major public transport destination
- One of the largest local employers



Keele: 'at scale' demonstrator

>16km of surface and foul water drainage

>16km of mains water network

>10km of underground gas network

6 primary metering points (MP/LP)

>18km of electrical network (cable)

12 sub-stations (HV/LV)

>28km of fibre-optic cabling

Refurbishment/extension of 6km district heating

>94km of cable and pipe work

Funding Profile

What is needed to create the SMART Energy R&D facility?

- **Capital investment**

- Meters
- Home controllers
- Commercial/industrial controllers
- Direct Generation Controllers
- Storage controllers
- Feeder Automation Devices
- Protection Devices
- Automated substations
- Field communication devices
- Construction/implementation

- Distributed Energy Resources

- **Source of Funds**

£9.2m

Department for Business, Innovation & Skills (£4.6m)

European Regional Development Fund (£4.7m)

Private Sector (£5m)

- **Revenue investment**

- Technical operator expertise
- Academic-business collaboration
26PhDs
- Business engagement programmes
- Academic research programme

£5.7m

European Regional Development Fund (£4.3m)

Keele University (£1.4m)

R&D Capability



Strategic Academic Value

Supporting academic leadership, research,
and industry partnerships



- Research Facilities
 - The creation of a unique (both EU & N. America) “living laboratory” research facility of national importance
- Academic Positions
 - Director of Send – offer made to Internationally recognised Smart Energy Expert
 - Prof-in-Practice – discussions with 2 high profile industry experts
- Research / Teaching
 - Doctoral training centre in Smart Energy
 - 26 PhD studentships to undertake collaborative RD&I with industry
 - 10 at Keele 16 utilising SEND as laboratory linked to other UK universities
- Industry Partnerships
 - Leverage additional research investment e.g. HyDeploy

R&D capabilities of the value packs:

Underpinning new product development

Technical capability	R&D capability delivered	New commercial products / services
Basic information management	As is energy usage, energy supply and usage data, inputs for modelling	New data based services
Basic Demand Side Management	Integration of smart meter and home network, appliance level load control	New products / services to support DSM
Advanced metering infrastructure and heat load analysis	Integration of power, gas, heat supply and usage for whole system modelling	Development of new services to enable balancing across energy vectors
Integrated Energy Systems, Leveraging Advanced Information Management	Enables renewable energy and storage balancing across whole system	New renewable energy solutions across energy vectors
Realising Micro-grids through advanced DER management	Enables scheduling / dispatching of renewable DER to balance micro-grid	New companies/services to enable localised energy markets to operate efficiently.
Unlocking low carbon transport potential	Enable charging and storage and “vehicle-2-grid” capability	New products / services to support the growth of alternative fuel vehicles.
Introduce self-healing network characteristics	Management of energy network to overcome congestion points & reduce/delay upgrade investment	New companies/services to deliver congestion management services to network operators.

Outline Implementation Plan

Month (assumes start in Oct 16)	2015	2016					2017					2018					2019					2020					2021																																		
		jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Detailed Design Feasibility																																																													
Submission of FBC to BIS																																																													
ERDF Outline Approval																																																													
Match Funding confirmed from BIS																																																													
Submission of ERDF Full Bid																																																													
Recruitment of Academic Director																																																													
Confirmation of ERDF Funding																																																													
Recruitment of Project Staff																																																													
Preparation of OJEU																																																													
Invitation to Bid																																																													
Submission and Selection of Bids																																																													
Evaluation of bids																																																													
Award of Contract																																																													
Value pack 1 Basic information management																																																													
Capability																																																													
Roll Out																																																													
Value pack 2 Basic Demand Side Management																																																													
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Value pack 4 Integrated Energy Systems, Leveraging Advanced Information Management																																																													
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Value pack 5 Realising Micro-grids through advanced DER management																																																													
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Roll Out																																																													
Value pack 6 Unlocking low carbon transport potential																																																													
Capability																																																													
Roll Out																																																													
Value pack 7 Introduce self-healing network characteristics																																																													
Capability																																																													
Roll Out																																																													
Deliver supply chain development																																																													
Plan collaborative RD&I projects																																																													
Deliver collaborative RD&I projects																																																													
Cohort 1																																																													
Cohort 2																																																													
Prepare Final reports																																																													

Collaborative R&D with business:

How the R&D facility could be used



- First prototype vertical axis wind turbine installed 2012.
 - Self-starting
 - Self-feathering
 - Bird and bat friendly
 - Vibration free and virtually silent
 - Radar benign



nationalgrid

- Evaluation of hydrogen produced by electrolysis injected into gas supply
- Feasibility, economics, impact on assets, impact on end use devices

UPS↑DE

- Supply of services to electricity balancing market



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