Energy Storage Projects Portfolio

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Energy Storage in a Changing Climate, SFCA-ETP Meeting, St Andrews 22/3/16

Innovate UK

Briefly covering today…

- Snapshot of energy storage projects
- Energy Catalyst overview
- Other funding
- UK scale of energy storage trials
- List of energy storage projects by category
- Take-home messages

Innovate UK – who we are

Who? The UK Innovation Agency for business

Why? Innovation grows UK GDP

What?

Fund
- Open Funds
- Challenge Competitions
- De-risking

Connect
- Opportunities
- Expertise
- Growth support

Four criteria to win Innovate UK funding:

Can the UK do it?	Is there a large market opportunity?
Is the idea 'ready'?	Can we make a difference?

+ pass/fail scope for each competition

Overview: Energy Catalyst Rounds 1-3

- Started 2014 – open ended
- Objective: accelerate to commercialisation the best UK research & innovation that delivers *all* aspects of the energy trilemma in *any* market
- Scope: <Costs *and* <Emissions *and* >Resilience; *any* technology or application
- Scope: *additional* requirements for funding by EPSRC, DECC (& DFID)
- Staged, escalating support to commercialise energy technology innovations:
  - Early Stage Tech Feasibility, <1yr, <£200k academic or SME led, >50% industry
  - Mid stage CR&D, <3yrs, <£1.5m, >70% industry-led
  - Late stage CR&D, <3yrs, <£10m, >70% industry-led
- 6-monthly applications with standard Innovate UK 10-questions & assessment
- Option for portfolio balancing (not used to date)
- £49m budget, 3 Rounds: Innovate UK (£36m), EPSRC (£11m) & DECC (£2m)
- 633 applications
- £43m grants awarded to 88 projects (14% funded)

- ***Round 4 (delayed to April'16) – opportunity to prepare a bid***
- ***+ Newton, Infrastructure Systems & Open competition calls to come…***
- ***+ EIC, Shell Foundation***

Scope: The Energy Trilemma: *all 3 aspects*

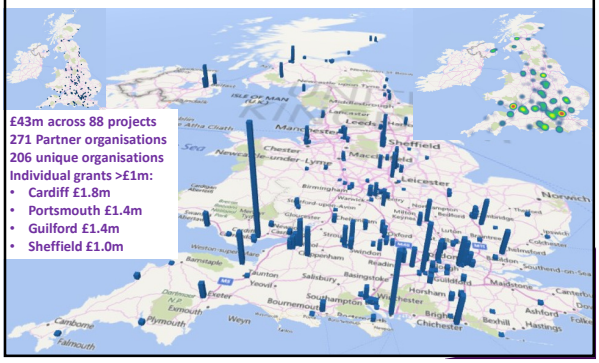
security of supply
+
affordability
+
emissions

=
…global opportunities

Technology Areas (20 sub-categories):
- Carbon Abatement
- Renewable Energy
- Nuclear Fission
- Hydrogen & Fuel Cells
- Energy networks & System Integration
- Demand Side technologies
- Enabling Technologies & Processes
- Other (any)

the Energy Trilemma issue is rapidly disrupting global energy systems & markets – creates business opportunities in UK & around world for UK organisations

Geographical distribution - 271 organisations, £43m grants



Co-Funders looking for different outcomes:

EPSRC Scope: Energy Trilemma + **Scientific Excellence**	**INNOVATE UK** Scope: Energy Trilemma + **UK GDP growth**
DECC Scope: Energy Trilemma + **UK Energy Policy**	**DFID** Scope: Energy Trilemma + **Transform Energy Access**

Energy Storage is a priority area for all funders of Energy Catalyst

Energy Storage Projects funded by Innovate UK

~£15m live grants in energy storage

- **>31 live projects, in 3 competitions**
  - Energy Catalyst
  - Smart systems
  - Localised Energy Systems
- **6 themes**
  - 12 Systems & trading models £8.7m
  - 7 Battery & flow-battery tech £2.5m
  - 5 Heat storage £1.6m
  - 3 H2 & chemical storage £0.9m
  - 3 Power Converters £0.5m
  - 1 Flywheel £0.6m

Business Models, Trading & System Integration 12 Projects, £8.7m

grid-scale
consumer scale
aggregation of distributed assets
(excl. projects on demand side flex/management)

Electricity Storage - Network operator trials

EA Technology A Good Practice Guide (GPG) on Electrical Energy Storage

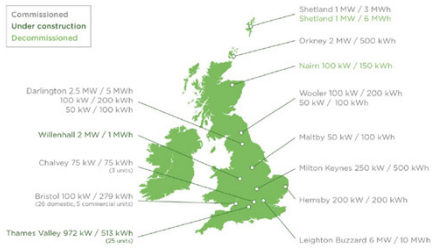
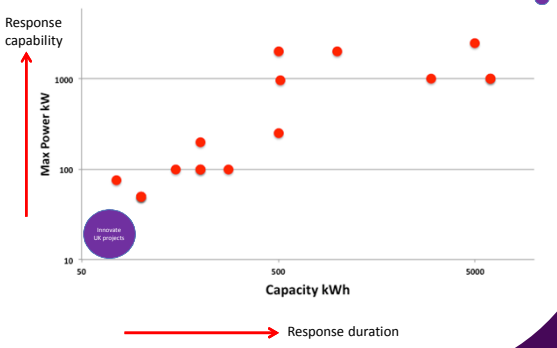


Figure 2.4: GB DNO Deployment of Electrical Energy Storage (at 1st December 2014)

Innovate UK projects + Network operator trials



Innovate UK Technology Strategy Board | Department of Energy & Climate Change | EPSRC Engineering and Physical Sciences Research Council

Large Scale Storage for Network Services (LSSNS)

AES Kilroot Power Limited
Queen's University Belfast

Late-Stage (ECR1)
30 months
£736,175
ref:

The UK has a growing share of sources of energy that are variable or intermittent in their supply of electricity and that cannot provide the same level of system security as conventional power plants. This is leading to increasing constraints on renewable generation, particularly in Northern Ireland, which come at considerable cost to the consumer. Although battery storage solutions exist to address this challenge and have been shown to be commercially viable elsewhere, there remains an issue of access to market in the UK and cautious attitude to new solutions, both of which are barriers to deployment. The proposed project is to connect a 10MW Lithium Ion battery array to Northern Ireland's grid - the largest and only transmission connected battery of its kind in the whole of Europe - in order to work with the transmission system operator and leading academics to monitor, evaluate and substantiate the value of storage in providing flexible services. The project would address any perceived operation concerns and show its value in addressing the energy trilemma, driving the market and catalysing future growth of energy storage.

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The Global Electricity Revolution for Consumers

Tempus Energy Ltd
WEMS
One Sitesolutions Ltd
Viriya Energy Ltd
Sustainability First

Late-Stage (ECR1)
24 months
£717,070
ref:

Tempus Energy (TE) has been established to exploit a disruptive technology and business model that permits all electricity users to benefit directly in electricity cost savings. The TE technology can shift real-time consumption patterns to optimise trading on the electricity market within each half hour, through prediction and consumer usage management, leading to buying electricity more cost effectively. This project will demonstrate the technology with real customers, both domestic, commercial and electricity storage. To demonstrate the value of better matching usage to periods when wholesale prices are low, either because demand is low or power from renewable sources is plentiful, TE will launch as an electricity supplier and build an ecosystem of technology partners which connect the SAM and the trading platform to the consumers. The project will focus on enabling the connectivity of this value chain such that it delivers substantial financial and environmental benefits. TE aims to unlock the smart energy business model in UK and overseas.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Integrated whole energy storage with H2

ULEMCO ltd
Revolve Technologies ltd
Clean Power Solutions ltd

Feasibility (ECR2)
12 months
£209,122
ref: 132159

This 12 month technical feasibility project tests the opportunity for an innovative whole system approach to solve the trilemma of improving energy security from increased deployment of renewable generation which is otherwise grid constrained, providing an overall improvement of the commercial viability of renewable generation, and reducing the cost of producing "green" hydrogen particularly where additional grid costs are incurred, such as farms and remote locations. It creates a technically validated, detailed model, based on using a novel control system, that balances energy generation and use on site that is connection compliant to the parameters stipulated in Engineering Recommendation G83/3, enabling real time cost, grid balancing and peak shaving capability to store and produce low cost hydrogen. The project, led by ULEMCO Ltd with partners Revolve Technologies and Clean Power Solutions, takes the current individual system components (already installed at Springbank Farm, Cheshire), adds SMART on board vehicle storage, low cost h2 refuelling, and then gathers real use data to define, quantify and validate the optimum operating value of the whole system.

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Smart Appliance energy storage solution

Bath labs Ltd

Feasibility (Smart)
£41,000
ref.

A study into the commercial viability of a large-scale, distributed, rapidly-deployable Smart Appliance energy storage solution to improve the cost-effectiveness of renewable energy generation.

This project is a study into the commercial viability of a new approach to storage of energy in a distributed manner across the UK to enable early advantage to be taken of 'Smart Grid' and 'Smart Appliance' technology. This will enable smoothing of demand in real time to match the peaks and troughs of renewable energy generation.

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ChargeSync - intelligent energy storage system

ChargeSync

CR&D (Smart)
£337,000
ref.

To address the need for improved management of demand at a domestic level, ChargeSync seek to develop a cost effective, intelligent energy storage system with demand management capability that will overcome the main barriers associated with other forms of Community and Residential Energy Storage (CRES). Aimed specifically at the domestic market, the proposed ChargeSync smart box will predict, coordinate and optimise mains energy use within homes, deploying stored energy when required and reducing peak loads and offering a plug-and-play solution for existing AC circuits. The system will also have the ability to coordinate many storage devices together, optimising domestic energy use on the grid. Representing a key step change in energy intelligence and storage, the project has the ability to deliver savings in the cost of the average electricity bill), improve resilience at a domestic level for short periods as well as providing improved demand flexibility.

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Domestic Energy Storage - Second Life Batteries

Powervault Ltd

Feasibility (Smart)
£117,000
ref.

Powervault aims to be the UK's first specialist provider of cost-effective distributed energy storage solutions to domestic homes and SMEs, lowering consumers' electricity bills whilst reducing peak grid electricity demand. The Powervault device can accommodate most battery storage technologies.

The device stores low cost electricity generated by solar panels during the day, then releases the stored energy during the evening when household demand peaks. Electricity network operators can remotely control the device via existing household Wi-Fi links ultimately allowing additional benefits to be derived from grid services. The UK's electricity networks face considerable challenges from decarbonisation - with microgeneration, electric vehicle penetration and renewable heat stressing distribution networks which were not designed to take this load. New technologies such as energy storage and demand side response offer potential solutions.

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Technology Strategy Board

Community controlled energy through virtual private energy networks

Moixa Technology
SSE
British Gas
BioRegional
Oxford Brookes

(Localised Energy Systems)
£1,240,000
ref.

This project will demonstrate how distributed storage in a community can be managed to reduce average peak grid load by 65% and increase self-consumption of local PV energy across the community by 2x.

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Technology Strategy Board

Intelligent SME energy management and trading with ancillary services

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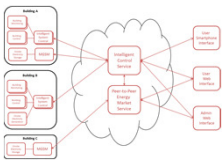

(Localised Energy Systems)
£1,570,000
ref.

This project will deliver a novel low cost intelligent building energy control system integrated with a peer-to-peer energy market that will enable small to medium enterprises to control and automate energy production and consumption while participating in a localised energy market.

This project will also facilitate new sectors of the economy to participate in demand response and time of use electricity pricing programmes. The project aims to create a pilot programme for 1 year where successful operation will optimise energy system efficiency and ensure that clients are paid for what they generate, only pay for what they use, reduce energy bills and are offered a new way to earn money by taking an active part in managing supply and demand.

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Technology Strategy Board

IODiCUS - Interoperable Open Digital Control Unit

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(Localised Energy Systems)
£570,000
ref.

The Interoperable Open Digital Control Unit System Project (IODiCUS) seeks to demonstrate the technical viability and future market for a connected energy network, in buildings with microgeneration and local energy storage and optimised interaction with the electricity grid. It will use a representative set of buildings, residences and dwellings in and around the University of Bristol to demonstrate the efficacy of a Localised Energy System. IODiCUS will evaluate the technical and commercial merits, along with the future needs and constraints of the residential or business customer.

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Ebbs and Flows of Energy Systems (EFES)

-

(Localised Energy Systems)
£1,246,000
ref.

The Ebbs and Flows of Energy Systems (EFES) project looks to develop a grid balancing platform to provide electrical support to the national grid during peak energy demand times. The project will achieve this through development of a virtual power plant (VPP), a cloud based 'power plant', capable of utilising disparate electricity storage assets.

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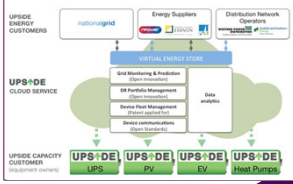
ICT demand management service

Upside Energy

(Localised Energy Systems)
£829,000
ref.

Upside aims to build an ICT service that aggregates energy storage capacity in thousands of small devices and coordinates the charge/discharge cycles of these devices to create a coherent energy store that can be used to manage demand on the grid. This project will help build a pilot-scale service with a novel, "pluggable" ICT architecture, develop new algorithms for coordinating additional classes of device, and explore emerging business models.



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Technology Strategy Board

Managing the value of flexible energy through local battery storage and algorithm based control

-

(Localised Energy Systems)
£1,132,000
ref.

By anticipating local energy consumption and introducing micro-generation and storage systems, including stationary battery storage and electric vehicles, this project seeks to create a fully integrated local energy system of individual and aggregated sites. The project will use smart algorithms to optimise local energy sources and energy demand.

Battery & flow-battery technology
7 projects, £2.5m grant

Li-S
V-H2
Na-ion
Li-ion

Innovate UK Technology Strategy Board | Department of Energy & Climate Change | EPSRC Engineering and Physical Sciences Research Council

Scaled Electricity Storage Using Li-S Batteries

University of St Andrews
Oxis Energy

Feasibility (ECR1)
12 months
£243,384
ref:

OXIS Energy, a manufacturer of a revolutionary new battery technology, and the University of St Andrews have joined together to demonstrate a new battery concept for the storage of grid-scale quantities of electricity. By exploiting OXIS Energy's core "lithium-sulfur" technology using a novel battery configuration the collaboration hopes to demonstrate a new energy storage technology capable of operating at vast scales. OXIS Energy will manufacture, develop and test the critical liquid component of the battery, the Electrolyte. This will be supplied to the University of St Andrews who will use it to develop a novel battery design known as a Redox Flow Battery. By combining these two elements, the project will demonstrate the commercial feasibility of a new battery technology capable of supplying several megawatts of electrical energy, for several hours, from a device the size of a 6m shipping container. This new and potentially cost effective grid scale battery promises to play a critical role in efficiently connecting intermittent renewables to the grid, increasing security of supply while simultaneously reducing consumer bills and carbon emissions.

Innovate UK Technology Strategy Board | Department of Energy & Climate Change | EPSRC Engineering and Physical Sciences Research Council

Vanadium-H2 flow battery for energy storage

Arcola Energy
Alstom
Imperial College

Feasibility (ECR1)
12 months
£257,460
ref:

Increasing the penetration of renewable energy generation contributes significantly to reducing emissions and is one of the most effective ways to secure energy supply. However, renewable sources (e.g. solar and wind energy) are intermittent, unreliable and put stress on the electricity grid. Energy storage systems at scale can compensate for this, enabling greater deployment of renewables at lower system cost than grid reinforcement. This project will carry out a technical feasibility study into a novel hybrid fuel cell redox flow battery for energy storage at scale at 25% reduced cost compared to comparable existing technologies. The project therefore targets all three aspects of the energy trillema, addressing both carbon reduction and energy security through enabling greater use of renewable energy generation, while specifically addressing the cost of energy storage systems.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Ultra-low-temperature battery

Hyperdrive Innovation ltd
Oxis Energy
British Antarctic Survey

Feasibility (ECR2)
12 months
£112,348
ref: 132153

This project brings together two companies - Hyperdrive Innovation and Oxis Energy - who are the forefront of battery technology in the UK to explore the technical feasibility of a new generation of energy storage for use in extremely cold climates. This will be achieved by developing a low temperature electrolyte for Lithium-Sulfur (Li-S) rechargeable battery chemistry, and chemistry-agnostic battery management system and packaging that can withstand and outperform the current lead-acid battery solution. British Antarctic Survey will act as subject matter experts to inform the development of a battery capable of operating in one of the harshest environments on the planet. Such a battery would allow British Antarctic Survey (BAS) to significantly increase autonomous scientific measurements made in the Antarctic, but without increasing transport costs or emissions. The resulting technology will lead to a follow-on mid-stage project to develop a high energy density rechargeable battery that can operate at -80 °C for Antarctica survey organisations and several other crossover markets for energy storage and unmanned systems.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Low-cost sodium-ion battery

Queen Mary Univ. London
Johnson Matthey plc

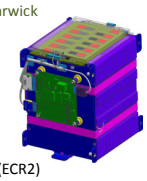
Feasibility (ECR2)
12 months
£183,240
ref: 132155

Due to their outstanding energy and power density, lithium-ion batteries have become the main technology for today's electrical energy storage, from small portable electronics up to large electrical grid storage. However, the lithium-ion batteries are not suitable for small scale energy storage because of their relatively high cost and increasingly higher strain on lithium resources. Recently, sodium-ion batteries started to receive significantly more attention as a low cost and affordable alternative to lithium-ion batteries. This collaboration between School of Materials Science and Engineering at Queen Mary University of London (QMUL) and Johnson Matthey (JM) will advance the development of low cost and highly performing anodes based on abundant and renewable resources and cathode development based on reduced use or substitution of critical raw materials with more abundant, lower cost, elements while maintaining performance. This will accelerate the development of sodium ion batteries which could be later integrated into battery modules, creating a new generation of affordable stationary battery systems.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Low-cost storage of renewable energy

Faradion ltd
Moixa ltd
Univ. of Warwick



Mid-stage (ECR2)
36 months
£459,962
ref: 102471

The project is a three year programme undertaken by Faradion Ltd, Moixa Ltd and Warwick University to develop sodium-ion batteries for the storage of domestic solar energy. The stored energy, generated when there are high levels of sunlight can then be used later in the day when demand is at its highest. The attraction of sodium-ion batteries is that they promise to be significantly cheaper than lithium-ion batteries so enabling a faster take-up of energy storage technology.

Innovate UK Technology Strategy Board

EPSRC Engineering and Physical Sciences Research Council

Low-cost high-energy density anode for stationary energy storage

University
Business

Feasibility (ECR3)
12 months
£
ref.

Business and University are working together to develop a new low-cost high-energy density anode material for sodium-ion batteries.

The new material will be an important step in the development of this very young technology. This project will play an important part in providing energy storage in the UK and tackling the energy trilemma.

The devices will lower the cost of domestic energy storage making it financially viable for consumers, increasing the uptake of renewables and contributing to a reduction in the UK's reliance on fossil fuels.

Innovate UK Technology Strategy Board

EPSRC Engineering and Physical Sciences Research Council

Anodes for Lithium Sulphur Batteries

Business
Business
Business
University
University

Mid-Stage (ECR3)
36 months
£
ref.

Innovative anodes delivering higher performance, high energy density and lower cost Li-S cells for use in smart grid energy storage applications.

The approach also enables replacement of critical metals such as Co/Ni currently used in Li-ion batteries with lower cost carbon, sulphur and lithium. The consortium combines skills in novel materials and electrode design, coatings, scale up of electrodes and industrially relevant sized cells, also testing and system design.

The project will deliver a module design study, assessing the performance of the new technology components interlinking performance of project cells with usage patterns/cycles for energy/power in main market applications in the energy storage sector.

Heat storage projects
5 Projects, £1.6m

heat
electricity-to-heat-to-electricity
PCMs

Innovate UK Technology Strategy Board

Department of Energy & Climate Change

EPSRC Engineering and Physical Sciences Research Council

Ground Heat network Strategy at City Scale

WDS Green Energy Ltd
British Geological Survey
City of Cardiff Council

Feasibility (ECR1)
12 months
£256,744
ref:

In many parts of the UK and Europe geothermal energy stored in natural shallow underground water aquifers has the potential provide a safe, affordable, secure, and low-carbon source of heat for generations. Currently in the UK, ground source heat pump (GSHP) technology is only used by a small number of individual homes and businesses. By increasing GSHP capacity they can be used heat to entire streets via a smart network. Why has this not already been done? The technology for city scale networks is not yet developed and requires a new energy market based on large-scale GSHP capture and distribution networks. Before this can happen new technology needs to be developed and trialled to ensure systems are developed in a sustainable way. The potential champions of heat networks are Councils, who are tasked with approving planning consents for new developments. This highly innovative project, if funded, will design and build trial heat systems networks in less than 12 months, to prove that British GSHP network technology can be reliably deployed on an industrial scale in the UK. If successful, this new technology can be transferred to other UK cities and overseas markets.

Innovate UK Technology Strategy Board

Department of Energy & Climate Change

EPSRC Engineering and Physical Sciences Research Council

Two-phase polytropic energy storage

University of Edinburgh
Artemis Intelligent Power Ltd

Feasibility (ECR1)
12 months
£213,781
ref:

The project aims to prove the feasibility of a grid-scale energy storage technology based around thermal energy stores in the form of un-pressurised insulated containers of rock gravel. One store will be at high temperature and the other at low temperature. The concept is scalable to very large size and should have storage time-constants well beyond diurnal. Unlike pumped storage schemes, such storage systems could be built almost anywhere and close to or within large electrical load centres such as cities. In the storage phase, electrical energy will be transformed to mechanical energy and thence to heat and cold in the gravel stores via thermodynamic compression and expansion processes not unlike those used in refrigerators and heat pumps. Energy recovery to generate electricity will be by the reverse sequence. To allow the use of cost-effective un-pressurised thermal rock stores, the working fluid of the compression and expansion processes will be a combination of a gas and a liquid which will transport thermal energy between the pressurised gas and the un-pressurised thermal stores.

Innovate UK Technology Strategy Board

Department of Energy & Climate Change

EPSRC Engineering and Physical Sciences Research Council

Renewable Integrated & Sustainable Electric Heating System (RISE Heating System)

Building Research Establishment Ltd (BRE)
Glen Dimplex
EDF Energy
University of Liverpool
Eastbourne Homes Ltd

Mid-Stage (ECR1)
24 months
£494,494
ref:

In the UK there over 25 million domestic dwellings. More than 80% of these homes depend on gas boilers to provide space and hot water heating. Against the context of dwindling UK gas reserves, increased sensitivity to gas supplies sourced internationally and the potential for unsustainable growth in peak time electricity generation, there is a growing imperative to seek alternative heating systems. RISE (Renewable Integrated & Sustainable Electric Heating System) is such an alternative, all-electric heat pump with storage heating system that avoids the use of peak time power. The RISE Project will build on the earlier technical validation of the concept, to carry out live trials in up to four apartments in a multi-dwelling unit (MDU) in Eastbourne. This live demonstration will utilise optimising controls to simulatenaously control the occupants thermal comfort needs and the electricity demand proflies to provide a Smart Grid approach to sustainable heating for the UK, in real time. The project schedule is to start April 2015, with live trials starting in October 2015, with the performance monitoring. The project's outputs will support RISE towards commercialisation and manufacture.

Innovate UK Technology Strategy Board | Department of Energy & Climate Change | EPSRC Engineering and Physical Sciences Research Council

High temperature PCM/Brayton cycle

Environmental Process Systems
P.A.K Engineering Ltd
University of Nottingham
SG BioDrying Ltd
Geo Green Power Ltd

Mid-Stage (ECR1)
24 months
£468,000
ref:

This proposed project is aimed at developing an effective energy storage system to establish an equilibrium between variable renewable energy supply and consumer energy demand, therefore acting as a grid buffer. The proposed project will involve the design, optimisation, construction and testing of the first-of-its-kind prototype power generation/energy storage system. The system will use a novel High Temperature Phase Change Material (HTPCM) which is suitable for thermal storage in the temperature range of 300˚C-450˚C. Various HTPCMs will be tested and the one which responds as required will be selected. A range of PCM heat transfer enhancement methods will be investigated to help increase the effective surface area for heat transfer. The performance of the HTPCM/Brayton power will be evaluated. The successful implementation of this HTPCM technology will enable the possibility of producing electricity using renewable energy sources such as solar and wind, biomass, while maintaining continuity of supply.

Innovate UK Technology Strategy Board

PCMs for active thermal mass energy storage

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CR&D (Smart)
£151,000
ref.

Development of prototype using phase change materials to enhance active thermal mass energy storage in buildings to achieve low energy and comfortable indoor climates.

The project aims to develop a prototype phase change cooling product with increased ability to store and transfer energy. Low energy buildings frequently feature highly insulated facades, carefully designed day lighting & airtight building construction. However, as these initiatives drive down energy usage, the conditioning of the incoming ventilation air becomes a significantly larger proportion of the energy usage. This presents an opportunity to further reduce the energy consumption by actively using thermal mass, although achieving low energy comfort with the controllability users require has proved difficult. The limitations of storage capacity & thermal conductivity of the mass, have restricted the ability of such systems to deal with higher loads or more extreme temperatures.

H2 & Chemical storage
3 Projects, £0.9m

H2 (excl. other non-storage H2, FC & electrolysers)
NH3

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Metal hydride H2 storage tank

Univ. of Nottingham
Arcola Energy
ITM Power
Luxfer Gas Cylinders UK

Feasibility (ECR2)
12 months
£144,508
ref: 132140

The technology for the generation and usage of hydrogen as a fuel is established however as present the best way to store the hydrogen is to pressurise the gas to 350 bar and above. That is 350 times atmospheric pressure. This has cost and safety considerations. Handling high pressure hydrogen requires thick and heavy metal cylinders or bulky composite cylinders. Electrolysers driven by electricity from renewables or from the national grid can readily generate hydrogen but this is at low pressures. Thus mechanical gas compressors are needed to compress the gas to above 350 bar. Such mechanical compressors are expensive and require constant maintenance and storing large quantities of hydrogen at high pressure requires blast zones. Being able to store the majority of gas at low pressure utilising metal hydride (MH) solid state stores not only is safer but it requires much less volume of space. Also fuel cells (which convert hydrogen and oxygen to water and electricity) operate at these low pressures too. So for certain stationary applications storing hydrogen utilising a low pressure MH store makes sense and this project will build a prototype and explore this market.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Electrochemical N2-to-NH3 study

Univ. of Oxford
STFC
Siemens plc

Feasibility (ECR2)
12 months
£194,606
ref: 132156

This project is concerned with exciting developments of new electro-catalytic technologies for Green eNH3 production with the energy derived from wind power.

This contrasts with the traditional catalytic process for industrial NH3 production where non-renewable natural gas is used as the energy and H2 source with a concomitant release of large CO2 emission. Thus, the development of new renewable electrocatalytic technologies can substantially reduce carbon emission by utilizing wind energy to produce carbon free NH3.

This electrification of the chemical industry will improve energy security by reducing the dependency on dwindling supply of natural gas. Further applications of eNH3 for energy storage and transportation will reduce the cost of integrating renewable into the energy mix.

Oxford University and STFC will collaborate with Siemens, UK to explore various new catalytic surfaces to produce ammonia from nitrogen and hydrogen (or water) by electrochemical means. This program is part of a wider consortium which is making the UK a central research hub for Green Ammonia.

Innovate UK Technology Strategy Board | EPSRC Engineering and Physical Sciences Research Council

Electrolyser manufacturing capability

ITM Power Trading
Gwent ltd
Escubed ltd

Mid-stage (ECR2)
18 months
£531,271
ref: 102469

With the roll out of Hydrogen Refuelling Stations (HRS) and Power-to-Gas (P2G) systems the requirements for electrolyser production is set to grow rapidly from 2015 onwards.

The UK has a leading position in rapid response PEM electrolysis and whilst it has been, and is possible to fulfil current demand using existing manual production processes the requirements to scale up production capacity is pressing, as is the need to reduce lifetime system costs in order to broaden demand.

This project seeks to address the technical challenges associated with production scale up and low cost manufacturing of PEM MEAs for electrolysers, in order to meet future demand.

This will be achieved by working closely with key supply chain partners bringing expertise from a range of industries to tackle an area of stack production which offers greatest cost reduction opportunities.

Power converters
3 Projects, £0.5m

GaN
SiC

Innovate UK
Technology Strategy Board

EPSRC
Engineering and Physical Sciences Research Council

SiC hybrid power module

Anvil Semiconductors Ltd
Manufacturing Tech Centre

Feasibility (ECR2)
12 months
£199,110
ref: 132137

Driven by competition, demand and legislation designers of products are striving for increased efficiency, smaller size and weight and lower cost, but they are limited by the efficiency constraints of Si or the cost of today's SiC devices. Anvil's unique SiC technology enables the development of devices with the efficiency and size benefits of SiC but at the cost of silicon. However the benefits that can be achieved by changing to SiC are limited by the switching speeds which are in turn limited by the inductances produced by non-close coupling of discrete devices and ancillaries. This project is to develop a low cost hybrid module to enable close coupling of devices and ancillaries, reduce inductances and achieve switching speeds of 100KHz. This significantly increases efficiencies and reduces size and weight by removing ancillary components and heat sinks. The potential applications for such a module are very wide indeed: for example LED lighting, PV converters, general power supplies, electric car charging and EV/HEV.

Innovate UK
Technology Strategy Board

EPSRC
Engineering and Physical Sciences Research Council

Hybrid PV-battery for LV grid using GaN

Navarino Electric Systems ltd
Sharp Laboratories of Europe
Aston University

Feasibility (ECR2)
12 months
£217,436
ref: 132138

Under their "Gone Green" deployment scenario, National Grid forecast that energy generated from photovoltaics (PV) in the UK is expected to rise from 2 to 15 GW over the next 20 years. This is being driven by the UK's legal obligations around installing renewable energy sources & cutting greenhouse gases, the rising cost of energy & concerns around the security of supply – the so-called energy "trilemma". Power electronic converters are a key enabling technology for PV and other low-carbon technologies (LCTs). However the use of LCTs has resulted in problems for the electrical distribution network such as supply voltage distortion and over-voltages, which threaten to limit or delay their uptake. This project aims to mitigate this threat by exploiting the benefits of a new Gallium Nitride power transistor module, which will be developed for use in a hybrid PV-battery unit for residential applications, but will have much broader applications e.g. electric vehicle charging & micro-CHP. These units will be much smaller, lighter & have lower cost than existing Silicon based units and their deployment will lead to an increase in the maximum allowable installed capacity on the network.

Innovate UK
Technology Strategy Board

EPSRC
Engineering and Physical Sciences Research Council

Low cost inverter for energy storage

Business

Feasibility (ECR3)
12 months
£
ref.

Low-cost inverter development for battery storage.

Mechanical storage
1 project, £0.6m (+ previous projects)

Flywheel

Innovate UK
Technology Strategy Board

SDNC- A Distributed Storage Power Solution

-

CR&D (Smart)
£563,000
ref.

SDNC aims to address the substantial market need that exists for new cost effective electricity storage technologies through the development of a flywheel based form of energy storage which will deliver scalable storage at a price competitive with pumped hydro and compressed air therefore overcoming the principle barrier that prevents this form of storage from more widespread adoption. The Distributed Storage Power Solution (DSPS) which will be used initially to compensate for the intermittent production from renewable power sources and improve output rates, combines a novel rotor, motor electronics, and innovative magnetic bearing design to deliver a scalable system that can be manufactured at a price comparable to traditional battery based systems with an efficiency of more than 97% and a storage capability of 50.7 KWhr.

Closing points

- Resilient, clean, affordable energy is a global market & societal desire that requires innovation to deliver
- *Low-Cost* Energy Storage is a key enabler & hence is a priority area for Innovate UK funding
- Innovate UK is about accelerating UK business growth through innovation
  - Policy is what is it is, but projects can deliver results that influence
  - Business opportunities may be outside the UK
  - Complex energy landscape is creating huge opportunities for innovators
  - Opportunities as much in enabling business models as in new technologies
- Are there underserved energy system business opportunity areas – e.g. where are the 2-way V2G projects?

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