

# ENERGY RESEARCH ACCELERATOR **A REGIONAL CASE STUDY**

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## Energy Research Accelerator (ERA)

Established in 2016 as the UK's first cross-disciplinary energy research acceleration hub, the pioneering Energy Research Accelerator (ERA) brings together 1,400 researchers in eight internationally-recognised research universities from the Midlands region (Aston, Birmingham, Cranfield, Keele, Leicester, Loughborough, Nottingham and Warwick) and the British Geological Survey. It was funded as a large-scale pilot to establish whether wide scale collaborative working could deliver significant regional impact. The five-year programme was created in discussion with BEIS and was financially supported by Innovate UK. The core objectives were to integrate research, develop advanced energy systems, reduce dependence on importing energy, enhance energy security and resilience, deliver regional economic benefit, develop future energy leaders and help to achieve the region and UK's carbon reduction targets.

After only four years, already there has been significant success and economic impact, the latter amounting to a 9:1 return on the original £60m government investment. Benchmarking suggests the level of funding catalysed would result, over a longer term, in a net GVA of £3bn and 10,000 new jobs. Whilst not all of this activity has been led by ERA, ERA funding has been a key contributor in unlocking opportunities.

The Midlands is a region which has historically underperformed in terms of employment, skilled jobs and has been significantly impacted by Covid-19, and hence ERA aligns strongly to the levelling-up agenda. The region is home to around 10,000 companies working in the energy sector, including National Grid, E.ON UK, Engie, Rolls-Royce, Worcester-Bosch plus many promising emerging SMEs, of which ERA has supported over 1,000 within the region. The Midlands employs around one third of the people in the UK's energy sector with over 56,000 regional jobs. Every year more than £2.5 billion of capital investment is made in energy technologies and infrastructure (excluding buildings and transport) across the Midlands<sup>1</sup>.



The Midlands employs around **one third** of the people in the UK's energy sector with **over 56,000** regional jobs.

<sup>1</sup> Low Carbon Environmental Goods and Services (LCEGS) Report for 2011/12, July, Department for Business Innovation and Skills



## The development of ERA

Investment in ERA initially took place in 2016, but in reality was the culmination of a number of stages of activity involving the partner organisations without which there not have been investment in ERA.

In the 2000s Birmingham, Loughborough and Nottingham were 3 of the 4 priority research partners actively working with E.ON UK's own research and innovation teams, but the joint working also led to enhanced collaboration between these initial partners who went on to form the Midlands Energy Consortium (MEC). The Consortium then went on to secure funding for the Energy Technologies Institute which was formed in 2007 and worked with a range of commercial organisations to accelerate the development, demonstration and commercial deployment of a focused portfolio of energy technologies. Key commercial partners included EDF Energy, Shell, E.ON UK, Caterpillar, and Rolls-Royce.

The MEC was able to build a much stronger set of relationships and understanding about energy research in the three universities and the three initial members grew to include the University of Warwick and the British Geological Survey. This joint working over a significant period has allowed trusted relationships to develop, understanding of complementary capabilities to evolve and joint strategic positioning between university management in the partner universities to be aligned. All of these stages of development have been important for both the establishment and running of ERA as a joint initiative by the partners.

Today ERA operates in coordination with its nine research and innovation partners. In recent years it has built stronger collaborative relations with the Midlands Engine and with the Midlands Energy Hub, who work on behalf of the LEPs across the region, supporting the roll out of low carbon energy solutions. It has expanded its network of businesses involved in its activities, building an ecosystem of energy related activity across the region and beyond.

ERA is having a core team of 5 people including a Director, Programme Director, Marketing and Communications Manager, Skills Manager, and an Executive assistant. These core posts and the operations are funded through contributions from the partner institutions. Consultants are used to boost capacity around key development areas.

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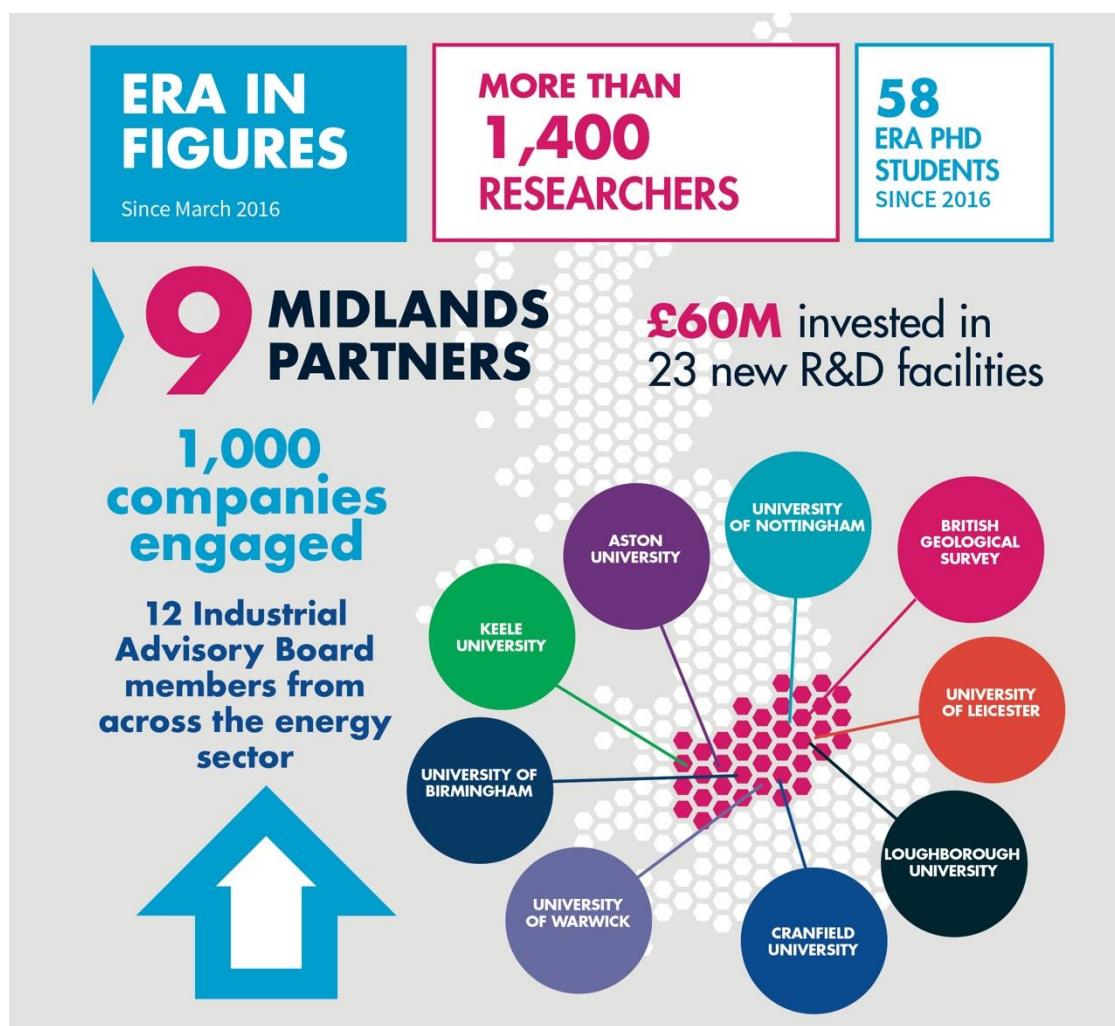


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## Overall outcomes

- ERA established 23 new research facilities across the partnership which have been the catalysts for working with business and generating new research areas and developments.
- So far, over **1,000 companies** have engaged with ERA and this is expected to increase further now that ERA facilities are operational. Industrial organisations in the region are able to access R&D facilities, obtain advice from experts, and deliver collaborative research. ERA's success in supporting businesses is well illustrated by the development by CPL Industries of a coal substitute to fuel industrial processes (see case study, page 12).
- ERA has established an **Industrial Advisory Board** comprising 12 senior representatives from across the energy sector, including Rolls-Royce, Siemens, ITM Power, Engie, EDF, Cadent, Centrica and National Grid, to offer an industrial perspective and help align ERA's strategy and priorities with commercial, real-world opportunities. So far, this has created six 'big ideas' for which there is strong industrial backing.
- ERA has engaged with over **1,400 researchers**. It has facilitated stronger collaboration and networking between the partner institutes and with industry, enabling higher quality research to be driven forward.
- The success of ERA resulted in two further universities, Cranfield and Keele, becoming members. The integration of the Keele University HyDeploy project, which is associated with hydrogen deployment into the gas grid, and the smart campus infrastructure programmes, SEND, and Cranfield University's hydrogen production project (HyPER) into the ERA network, has enabled us to further develop activity in the **hydrogen economy, smart networks and living labs**.
- Whilst there are a number of energy R&D initiatives supported by the UK government, ERA is unique in that it enables a **place-based** collaboration between regional universities, enabling and building long-term partnerships between regionally based researchers, businesses and civic organisations.



## Thematic focus and technology delivery

The first phase of ERA was focused around three themes of energy research, supported by the world-class expertise at the founding universities and the British Geological Survey in terms of the research and economic opportunity:

- **Thermal Energy Accelerator (T-ERA):** To lead the development and integration of thermal (heating and cooling) energy technologies and the global thermal economy.
- **Integrated Energy Systems Accelerator (I-ERA):** To deliver integrated energy solutions addressing major energy-use markets – including lithium-ion battery technology.
- **Geo-Energy Systems Accelerator (G-ERA):** Focusing on next-generation technologies including geo-energy, CCS, and energy storage.

ERA Phase 1 has led to the delivery of **23 facilities** (see annex 1), including **several large-scale demonstrators**, such as the Trent Basin community energy project, the Tyseley Energy Park and the creation of the smart manufacturing approach ‘Factory in a Box’ (see annex 2). Key examples include:

- The creation of the Trent Basin housing development, which will finally comprise 500 houses across a 250-acre brownfield regeneration site, has been strongly supported by the ERA investment both in terms of capital and expertise. This housing development is a living demonstrator of new energy technologies and will soon include a 450-pupil primary school. The installation of the community battery at Trent Basin has delivered new knowledge of how to run a community energy services company (ESCO) and has supported several businesses to develop and understand better their battery technologies. It has also allowed peer to peer trading of energy to be trialled.
- The establishment of bioprocessing technologies and further development of the Tyseley Energy Park (TEP) – one of five **Energy Innovation Zones** in the West Midlands – has seen the installation of a low-carbon vehicle refuelling station and a plan to link waste heat generated on site to the City of Birmingham district heating system. The GBSLEP have funded the construction of an Innovation Hub at TEP (to open April 2021) and a business incubator is being developed. This transformation from a former industrial site to a new hub for circular economy and low carbon energy demonstrates what can be achieved at similar sites across the region and beyond.
- The creation of **battery innovation and manufacturing facilities** at Warwick, supported by JLR, provided a basis for the UK Battery Industrialisation Centre, £130m, and the foundations for a future Gigafactory investment which has been set as a priority by the West Midlands Combined Authority.
- Investment into a new process, hydrothermal carbonisation, in collaboration with CPL at Immingham, has enabled high moisture biowaste streams to be converted into solid products that displace coal and therefore reduce greenhouse gas emissions. The work has also led to patents for the processing of coloured PET, which is notoriously difficult to recycle, to produce pure terephthalic acid that can be directly recycled for PET production, separation of coloured PET.
- Research into **thermal energy storage** and investment in pilot-scale facilities has led to the development of large-scale activities in China, where opportunities exist for demonstration and commercialisation of ideas by UK companies, given the scale of infrastructure investment taking place. Developments include the installation of >1.2GWh of thermal energy storage for curtailed wind power, new air conditioning systems for high-speed trains, and refrigeration systems for food transportation, all sponsored by industry. These facilities have furthered the development of Highview Power’s ‘liquid air energy storage’ technology, originally developed by an ERA academic, which are now in commercial deployment.



- The creation of a borehole testing facility at Sutton Bonington, near Nottingham, which is vital for understanding the **migration of carbon dioxide in geological sites** as Carbon Capture and Storage programmes are developed across the UK.
- The ERA funded Manufacturing Technology Centre's (MTC's) "Factory in a Box" programme, developed two demonstrators with SMEs to **locally deploy modular manufacturing solutions for production of thermal energy products**. This has led to a suite of projects to commercialise the solution across a range of sectors with industrial customers, as well as a follow-on project with a physical testbed and digital sandpit for FMCG and pharma.



## Skills

- The ERA Skills programme was an addition to the original programme and was funded by the partner universities. It was established in 2016 to maximise the research capability associated with ERA facilities and to develop future energy leaders, delivering an innovative cohort experience for doctoral researchers drawn from across ERA. **58 PhD students** are part of ERA's institutionally-funded **Doctoral Training Partnership**
- Over 100 Midlands-based PhD students regularly engage with the ERA skills programme and a large number have benefitted from **15 tailored ERA events** where students have been able to gain specific training unlikely to be available from individual institutes, widening knowledge and enhancing future collaboration opportunities both with other research institutes and with industry.
- Over 250 delegates from 12 universities attended the ERA **early career researcher conference in summer 2020**.
- The establishment of the **Doctoral Training Centre on Sustainable Hydrogen** between the Universities of Nottingham, Loughborough, and Birmingham brings together the world leading expertise in **hydrogen generation, purification, sensors/monitoring, and storage, along with whole systems issues** and utilises the ERA facilities.
- The ERA skills team in collaboration have been awarded a significant £4m **Research England grant** with £3.4m in match funding to support skills development for **post-doctoral researchers** (C-DICE), an important skills gap in the development of early career researchers, with the focus being on energy and infrastructure with UKCRIC and ERA.





## International reach

- A **Mission to China** at the start of 2020, assisted by the FCO and the British Embassy in Beijing, helped to reinforce many existing links of the ERA partners as well as establishing new relationships. These links enable the partners to act quickly and together as new opportunities arise, and has already resulted in ERA entering **partnering discussions with Tsinghua University, JITRI (Nanjing) and various businesses in Hangzhou, particularly around hydrogen energy systems, energy storage and renewables integration**. These Chinese organisations are prepared to financially invest in funding collaborative research.
- ERA has developed collaboration links with **Germany's leading innovation organisation, the Fraunhofer**. Joint projects are being developed which are linked to bioprocessing for fuels and chemical products, and the production of sustainable aviation fuels.
- An existing relationship with the **E.ON Research Centre in Aachen, Germany**, has been extended, particularly focusing on research into grid systems and next-generation fuels.





## Supporting evidence-based policy making and regional activities

ERA has supported both the 'Midlands Engine' and the West Midlands Combined Authority as energy has become a top priority:

- Most recently ERA has played a significant role in the development of the **Midlands Engine's Green Growth Action Plan**, running stakeholder workshops, providing technical insights, access to a large number of ERA's stakeholders as well as drafting documents.
- ERA has helped shape the energy strategy of the West Midlands through the creation of **Energy Capital** and the formation of **Energy Innovation Zones**. ERA academics co-led a **Policy Commission**, chaired by Sir David King, which developed the concept of the 'Energy Innovation Zone'. This formed the basis for the WMCA energy strategy.
- The outputs from **ERA's Policy Commissions**, for example the recent Policy Commission on 'Energy from Waste and the Circular Economy' (2020), are helping to shape UK thinking and unlock barriers to progress in various sectors. The concept of 'Resource Recovery Clusters' is seen as a key transition vehicle for utilising redundant coal-fired power stations in the region and was recently presented to the **Rt Hon Kwasi Kwarteng MP (Minister for Business, Energy and Clean Growth)**. ERA academics have led, with the CBI, a Policy Commission on Decarbonisation of Heat (2020) and co-funded the ERPs report on Medium Term Energy Storage.
- In addition, ERA has supported its partner institutions, working closely in their regions, fulfilling the '**anchor institute**' role for universities. The development of the **Peterborough Integrated Renewables Infrastructure (PIRI)** project is a recent example which is the largest smart city-wide, low carbon energy system in the UK<sup>2</sup>.
- More recently ERA has taken a regional coordination role to establish a network of interested industry, civic and academic members to develop a **hydrogen vision for the Midlands**.
- The **Trent Basin Community Energy Demonstrator** directly informed the Energy Revolution Stream of the Industrial Strategy Challenge Fund as well as numerous policy documents, e.g. Financing the Transition: Harnessing UK cities' Ambition for Clean Energy (UK100, 2017), The Future for Small-Scale Low-Carbon Generation (BEIS, 2018), Accelerating the Rate of Investment in Local Energy Projects (UK100, 2020).
- ERA continues to work increasingly with both the **Midlands Energy Hub and the Energy Systems Catapult**, looking for ways of joint working and increased coordination to help deliver the best solutions for the region.
- ERA is also supporting the UKRI Prospering from the Energy Revolution projects RESO, based in Coventry, and Decarbonising the Black Country and is also supporting Net Zero Rugeley.

<sup>2</sup> <https://www.cranfield.ac.uk/press/news-2020/largest-uk-smart-city-wide-low-carbon-energy-system-plans-unveiled>

## SME engagement

- ERDF projects worth around £50m have been delivered by ERA partners. These have provided business leaders access to world class expertise and the knowledge to drive innovation. This transformational support has been provided to over **1,000 regional SMEs**. Typical engagement involves providing support to SMEs to identify ways to improve efficiency, to identify new market prospects and to test and demonstrate new ideas and therefore grow their business. The ATETA programme<sup>3</sup> at Birmingham which was established in 2017 has generated a net income of £25 million for the local economy.
- ERA is supporting the development of an incubation hub for SMEs linked to ERA research facilities.
- New **export and international partnership opportunities** have been established for regional SMEs, which have been helped to engage and compete on an international level. In partnership with DIT and business networking groups, ERA has fostered opportunities for SMEs in Central and South America, Asia, USA, and Australia.
- ERA facilities have also supported **overseas investment** in new technologies, new ventures, and commercialisation. Already there has been ~£1m of funding, from Chinese businesses alone, for research using ERA expertise and facilities.
- EBRI at Aston University has supported 200 companies via its **Master Class programme** which utilises ERA funded equipment. It has helped business decision makers to assess opportunities and access analytical support to realise commercial success. The team has established regular communication with 8,000 contacts across the region.

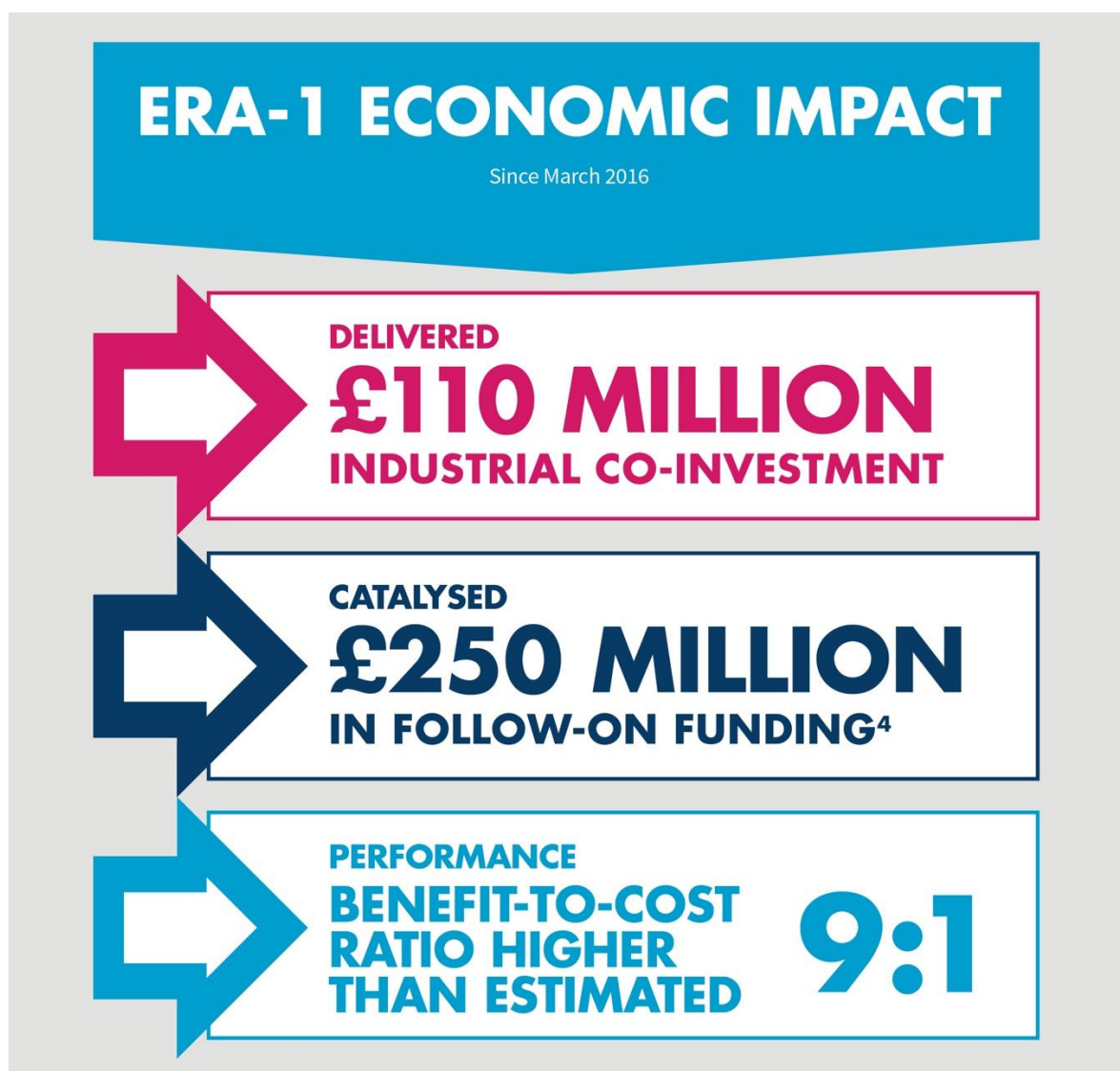


<sup>3</sup> <https://www.birmingham.ac.uk/research/energy/research/ATETA.aspx>



## Economic impact:

- The ERA Phase 1 **economic case** was centred around overcoming the ‘valley of death’ between research and commercialisation, helping UK industries to develop new technologies and solutions. The capital investment by the government of £60m for equipment and buildings to support the demonstration of emerging energy technologies has generated a significant return on investment.
- The project has delivered the committed £110m of co-investment from industrial partners such as CPL, Blueprint, Air Products, Repsol, E.ON UK, Rolls-Royce JLR, and Schlumberger, plus institutional matched-funding from our original research partners.
- The ERA investment has catalysed **£250m in follow-on funding<sup>4</sup>**, with £100m of this funding going to ERA partners.
- The benefit-to-cost ratio, **BCR, of ERA is 9:1**, before consideration of the impact on the companies involved in the research programme or the skills programme. This estimate is **significantly higher than the original estimated BCR of 6:1** which was considered to be “very high” value for money at the time of the economic case being considered.



<sup>4</sup> Funding which utilises the facilities or skills developed during ERA Phase I

## Lessons learnt

The Energy Research Accelerator has proven the value of establishing a pan-regional partnership to deliver wide-reaching research, innovation, and demonstration projects at a large, commercially viable scale. These are some of the lessons we have learnt on our journey:

- Building a strong partnership takes time. ERA has worked hard at engaging with academics, researchers, students, and business development staff within its partner universities, and now has a significant reach and a high level of awareness amongst all of its partners. ERA has also made strong links with industrial and public sector partners both regionally and nationally. However, this is not something that can be achieved overnight and takes considerable time and effort to achieve, but the benefits are considerable. There are now several ERA managed, cross-university collaborations taking place between academics and industry, who are working together to develop proposals for new programmes and projects. A good recent example of this is the Centre for Postdoctoral Development in Infrastructure Cities and Energy, which was led by the ERA universities of Birmingham, Cranfield, and Loughborough, and involves several of our industrial partners. This is a £4m programme for training and developing postdoctoral researchers.
- The impact of ERA has been achieved by bringing together a range of interventions and funding. These include:
  - The capital investment via government of the original ERA programme which was used to build new facilities
  - ERDF funds to build the SME business networks
  - UKRI funds to support PhD development
  - Support from universities to fund the ERA team

ERA also spans a range of different priority areas from energy to housing to transport and industry. Our work also covers a range of Technology Readiness Levels bridging the 'Valley of Death' between fundamental research and commercialisation. For these reasons we have worked with several government departments and funding bodies including EPSRC, NERC and Innovate UK. Due to the diversity of government departments and funding bodies involved, in future, could there be an approach in future that would enable all of this to effectively happen as a result of one funding award?

- In a complex multi-partnership and multi-agency programme such as ERA, the right leadership is vital in order to obtain the support of institutional partners and also industry, and to secure the buy-in of academics, researchers and students.



## Annex I: Facilities developed during ERA1

# WORLD-CLASS FACILITIES

## Projects from the ground up – 2016 to 2020

Facility Title	Description	Location
<b>Advanced Biomass Processing Facility</b>	Expanded analytical and processing capability in biomass, biofuels, biochemical and bioproducts.	EBRI, Aston University
<b>Advanced Insulation, Glazing and Solar Collector Laboratory</b>	Test facilities to develop high performance insulation materials, façade systems for improved building energy performance.	CREST, Loughborough University
<b>Battery Testing</b>	Bespoke facility for abuse testing of cells beyond their normal operating limits. This enables the stripdown, autopsy and analysis of cells to understand the reasons for failure.	Energy Innovation Centre, University of Warwick
<b>Cell Manufacturing (cylindrical and pouch)</b>	Pilot line for the manufacture of cylindrical and pouch format batteries. Pack scale testing facility for testing of full vehicle battery packs up to 1MW, 900V.	Energy Innovation Centre, University of Warwick
<b>Community Energy Demonstrator</b>	Local integrated energy system supplying power for the local community.	Trent Basin Development, Nottingham
<b>Cryogenic Engineering Research Lab</b>	Support the development of cold engine technology.	Wolfson School, Loughborough University
<b>Geoenergy Test Bed</b>	Comprising of a set of 11 boreholes and data recording infrastructure / office accommodation. The facility will be used to carry out research into new technology sensors and for research related to the geology of the site and into gas injection, including CO <sub>2</sub> .	Sutton Bonington Campus, University of Nottingham
<b>Hardware in the Loop (HIL) Lab</b>	Bespoke facility for the simulation of drive cycles, incorporating motors/batteries.	Energy Innovation Centre, University of Warwick
<b>High Performance Compression and Expansion Lab (HPCEL)</b>	Facilities at the University of Nottingham and the University of Leicester for research into gas compression, expansion, and energy storage.	Jubilee Campus, University of Nottingham
<b>Hot and Cold Thermal Materials Manufacturing Laboratory</b>	Newly refurbished space for the Birmingham Centre for Energy Storage to continue its work into researching and manufacturing cryogenic, sensible heat and high temperature energy storage materials, components, and systems.	Metallurgy and Materials Building, University of Birmingham

Facility Title	Description	Location
<b>Hybrid Cryogenic IC Engine Facility</b>	Hot and cold hybrid engine research facility, building on the existing EPSRC 8 Great Technologies funded Liquid Air engine test laboratory. The new facilities allow wider integration with thermal, and in particular, cold-chain technologies through the development of the applications of liquid air.	Mechanical and Civil Engineering Building, University of Birmingham
<b>Hydrogen Systems Test Bed</b>	A flexible test facility for the evaluation of hydrogen as an energy source and energy storage medium.	Jubilee Campus, University of Nottingham
<b>Hydro Thermal Carbonisation Rig</b>	Facility for the evaluation of low carbon biofuels produced from waste materials.	CPL Works, Immingham
<b>UESTV</b>	Research into gas compression, expansion, and energy storage.	Department of Mechanical Engineering, University of Leicester
<b>Latent Heat Energy Storage Laboratory</b>	Materials characterisation laboratory and test facilities for photovoltaic energy generation.	CREST, Loughborough University
<b>Materials Lab</b>	For the development of new battery materials and chemistries.	Energy Innovation Centre, University of Warwick
<b>Multidisciplinary Development Lab (MDL)</b>	The MDL is equipped with state-of-the-art facilities for near-ambient pressure photoelectron spectroscopy, nanoscale imaging, gas-storage & separation, thermal analysis, fuel cell testing & accelerated gas cycling.	Jubilee Campus, University of Nottingham
<b>New Cell Chemistries, Electrolytes and Materials</b>	For the development of new battery materials and chemistries.	University of Leicester
<b>Second Life and Wireless Testing Facility</b>	For testing and integrating second life packs/modules into a range of applications including vehicle charging and static storage.	Energy Innovation Centre, University of Warwick
<b>Solid Loop Adsorber</b>	Facility for the evaluation of improved means of scrubbing CO <sub>2</sub> from combustion products.	Jubilee Campus, University of Nottingham
<b>Thermal Analysis Technologies Laboratory</b>	Development of thermal energy materials.	Faculty of Engineering, University of Warwick
<b>Thermal Belt Demonstrator Facility</b>	Development of novel biomass conversion technologies for the production of biofuels.	Tyseley Energy Park, Birmingham
<b>Thermal Technology Companies Manufacturing Assessment and Support to FIAB Demonstrators</b>	Development of thermal energy manufacturing capability. Create digital/virtual manufacturing environment and two factories in a box to demonstrate Industry 4.0 principles in the thermal energy sector.	Manufacturing Technology Centre



## Annex II: Key demonstrators developed as part of ERA1

### TRENT BASIN

Trent Basin is an innovative and contemporary neighbourhood, delivered by award-winning developers Blueprint as part of the 250-acre Waterside Regeneration area in Nottingham, and set to deliver 500 new low energy homes once complete. The £100 million scheme, now starting its third phase of build, is also the site of a transformational energy project that hosts one of Europe's largest community energy batteries.

Project SCENe (Sustainable Community Energy Networks), a pioneering community energy pilot is being supported by £10 million of Innovate UK and ERA investment, match funded and delivered by a formidable consortium of public and private sector partners, including Blueprint and The University of Nottingham. Its aim is to accelerate the adoption of Community Energy Systems by offering a different way of generating and supplying locally generated heat and electricity to homes and commercial buildings.

On the ground, the pilot intends to develop a viable model that can deliver renewable energy generation on new urban developments, which in turn, generates financial returns for the community to offset energy costs. Whilst the model is still in its early stages, the project has drawn both national and international attention and many energy companies are now watching Trent Basin very closely.

Solar photovoltaics are installed on the site, along with the communal battery. A unique community energy company has also been established and residents that have opted to join are provided with Amazon's new Echo Spot, smart thermostats (Honeywell EvoHome) and additional in-home monitoring equipment that will be accessible from a purpose built app. Blueprint will continue to build on this offer in future phases, eventually offering a full suite of smart technology, from appliances to security features.

The Trent Basin energy system is connected to the grid; utilising sophisticated arbitrage software the system stores energy generated on and off-site distributing power back to the grid at peak times contributing to grid resilience and generating income for the resident members of the community energy company

The project aims to develop a business model that meets government sustainable living targets in a way which is financially stable and future proof.

**Trent Basin is a major multi-partner collaboration.** Project partners: Innovate UK, the Energy Research Accelerator (ERA), Blueprint, University of Nottingham, Project SCENe (Sustainable Community Energy Networks), AT Kearney, Smartklub, Siemens, URBED, Slam Jam, Sticky World, Loughborough University, Solar Ready and supported by Nottingham City



**TRENT  
BASIN**  
blueprint



## TYSELEY ENERGY PARK

Integrating waste and recycling with energy, fuels and transportation solutions for the City of Birmingham, the Tyseley Energy Park (TEP) is an Energy Innovation Zone being developed in the City of Birmingham to help drive the transformation of the city to meet its plan for decarbonisation and the development of a clean air zone.

Situated on the site of Webster and Horsfall existing manufacturing facility, TEP integrates energy from waste plants with electricity and fuels production. ERA's investment in Tyseley has centred around an innovative Thermo-Catalytic Reformer (TCR), which uses an improved pyrolysis technology to transform various kinds of biomass into synthesis gas, charcoal, and diesel quality oil.

This effectively uses around 70% of the energy in the biomass. The TCR process converts the biomass into high quality syngas, bio-oil, biochar, and water. TEP has been adopted by Energy Capital, the organisation within the West Midlands Combined Authority, as one of the five trial Energy Innovation Zones within the region, aimed at leading the clean energy and transport transition within the region. Birmingham City Council has set stretching targets to deliver a 60% reduction in CO<sub>2</sub> emissions by 2027.





## MTC – Smart Manufacturing Accelerator, and Factory in a Box

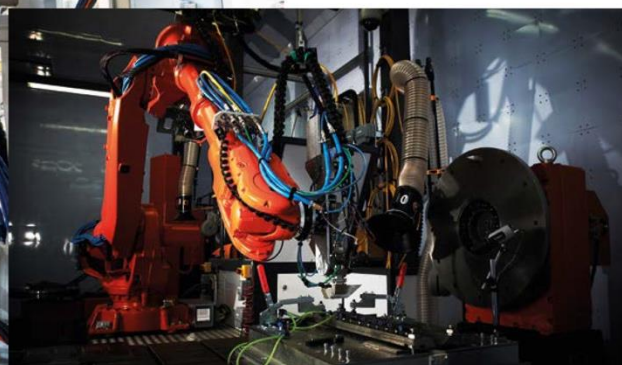
The Smart Manufacturing Accelerator (SMA) is a framework for delivering integrated manufacturing and supply chain solutions enabled by the application of industrial digital technologies.

Funded by ERA through Innovate UK, the project was delivered by the MTC, in partnership with the University of Birmingham's Birmingham Energy Institute and Loughborough University, as well as a few technology partners from industry. It aims to support UK-based businesses to catapult their expansion through the adoption of smart manufacturing techniques, Internet 4.0 technology and the very latest remote manufacturing practices.

Developed as part of this project was the Factory in a Box (FIAB) demonstrator; a modular manufacturing supply chain network enabled by industrial digital technologies. The FIAB is contained within a unit the size of a shipping container, and provides a rapidly deployable, remotely managed flexible solution that is fully digital and able to be controlled and monitored from a central control centre. It was officially launched in March 2019 at the MTC in Coventry, to an audience of nearly 300 industry thought-leaders, academia, and key stakeholders.

In 2019, the project also developed Factory in a Box 2 (FIAB 2); a mixed reality demonstrator for which the factory design, ICT and controls architecture was fully virtually commissioned. Delivered in partnership with Siemens, FIAB 2 can demonstrate several manufacturing processes using mixed reality to visualise real time production data.

"The Smart Manufacturing Accelerator process helps companies design, develop and operate a remote Factory in a Box and provides tools to adopt advanced manufacturing technology in a traditional manufacturing facility," says Dr Hannah Edmonds, technology specialist at the MTC. The project is currently working alongside the defence and pharmaceutical sectors on further development of the commercial application of the SMA framework.





## CPL INDUSTRIES

### University of Nottingham partners with CPL industries to make 'biocoals'.

ERA is working with the University of Nottingham and CPL Industries to produce a commercial scale facility capable of converting biomass into next-generation solid fuels having coal-like properties. The technology being used to develop the biocoal is known as Hydrothermal Carbonisation (HTC). This converts high-moisture biomass into solid fuels using moderate temperatures and high pressures. The HTC process effectively mimics the long-term natural process of coal formation, with the process taking a matter of hours rather than millennia! The facility, which is based at CPL's production site in Immingham, is operated by CPL Industries, a major manufacturer and distributor of solid fuels which already has products on the market containing biomass materials. CPL is working with Professor Colin Snape at the University of Nottingham, who is Director of the Centre in Efficient Power from Fossil Energy and Carbon Capture Technologies.

Speaking about the new facility Jason Sutton, Director of CPL, said: "The technology has the potential to revolutionise the treatment of high-moisture organic waste streams, producing value-added products that displace fossil fuels and promoting the circular economy."



**CPL**  
INDUSTRIES





## JAGUAR LAND ROVER

In 2015, Jaguar Land Rover (JLR) pledged to support the creation of unique ERA facilities to serve the automotive, commercial, and off road, marine and rail sectors, through creating enabling technologies in energy storage.

The vision was to help enable the effective design, characterisation, and manufacture of technically, economically, and environmentally sustainable future battery packs and scale up and prepare for exploitation and ongoing research into future battery chemistries.

ERA has delivered on this vision, with the facilities created predicting and underpinning the rapidly accelerating decarbonisation and 'Net Zero' agenda. ERA has been a precursor to the Faraday Battery Challenge and the creation, in Coventry, of the UK Battery Industrialisation Centre, opening in Spring 2020.

The Jaguar I-PACE, which has won three World Car of the Year awards embodies the innovation that has put JLR at the forefront of the electric vehicle revolution. JLR is investing in an electrified industrial footprint, with every new Jaguar and Land Rover model line to be electrified.

Building on the learning from ERA JLR has made an investment in a major Battery Assembly Centre being developed at Hams Hall.



## Annex III: ERAI's Skills and Doctoral Training Academy

### SKILLS AND DOCTORAL TRAINING

#### Developing future leaders in low carbon energy

The ERA Skills Academy's vision is to create a holistic energy-related skills provision to help hone and develop the talent of the Energy leaders of tomorrow. Our doctoral students benefit from a wide spectrum of energy research specialisms across six top class academic institutions and work alongside industry world leaders in applied energy research. To help them develop the skills required to be the next generation of energy leaders ERA provides a variety of developmental events looking at impact, energy policy and communication skills, whilst giving them the opportunity to engage with, work in, and tour the exceptional ERA facilities.

The ERA Skills Academy was established in 2016 and now has three cohorts of students. To help build a cohort feel, introduce the PhD students to ERA facilities, and expose them to Energy research outside their direct field of study ERA has arranged tours of its facilities, these prove very popular.

#### Personal Resilience

ERA strives to provide the training, experiences and skills that the doctoral students need to tackle the ups and downs of life as a researcher so that they can fulfil their potential to become the energy leaders of tomorrow. One of our doctoral students' highlights was welcoming the renowned scientist and education advocate Dr Emily Grossman to provide training in techniques to communicate their work and ideas in a clear and engaging way.

#### ERA students trade energy

Over 20 of ERA's doctoral researchers gathered at the British Geological Survey (BGS) to take part in an energy trading game. The game involved teams generating and selling electricity to customers, and was designed to help students, businesses and policy makers understand how energy markets work. The winning team made a profit of over £11 million and the event was considered a major success.

#### A lifelong Journey

As the PhD students start to come to the end of their journey with ERA, it is important for them to have time and space with experts on hand to help them work on their thesis. ERA provides support in this area by arranging writing retreats that offer advice and support to students at this critical time of their PhD work.







## Collaborate with us

ERA welcomes engagement with research, industry and policy-makers across the energy sector.

### For more information:

📄 [era.ac.uk](http://era.ac.uk)

✉ [enquiries@era.ac.uk](mailto:enquiries@era.ac.uk)

🐦 [@EnergyRA](https://twitter.com/EnergyRA)

**era.ac.uk**



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Midlands Innovation has made every effort to ensure that the information in this brochure was accurate when published. Please note, however, that the nature of the content means that it is subject to change from time to time, and you should therefore consider the information to be guiding rather than definitive.

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