



EPSRC Energy Theme: An Overview

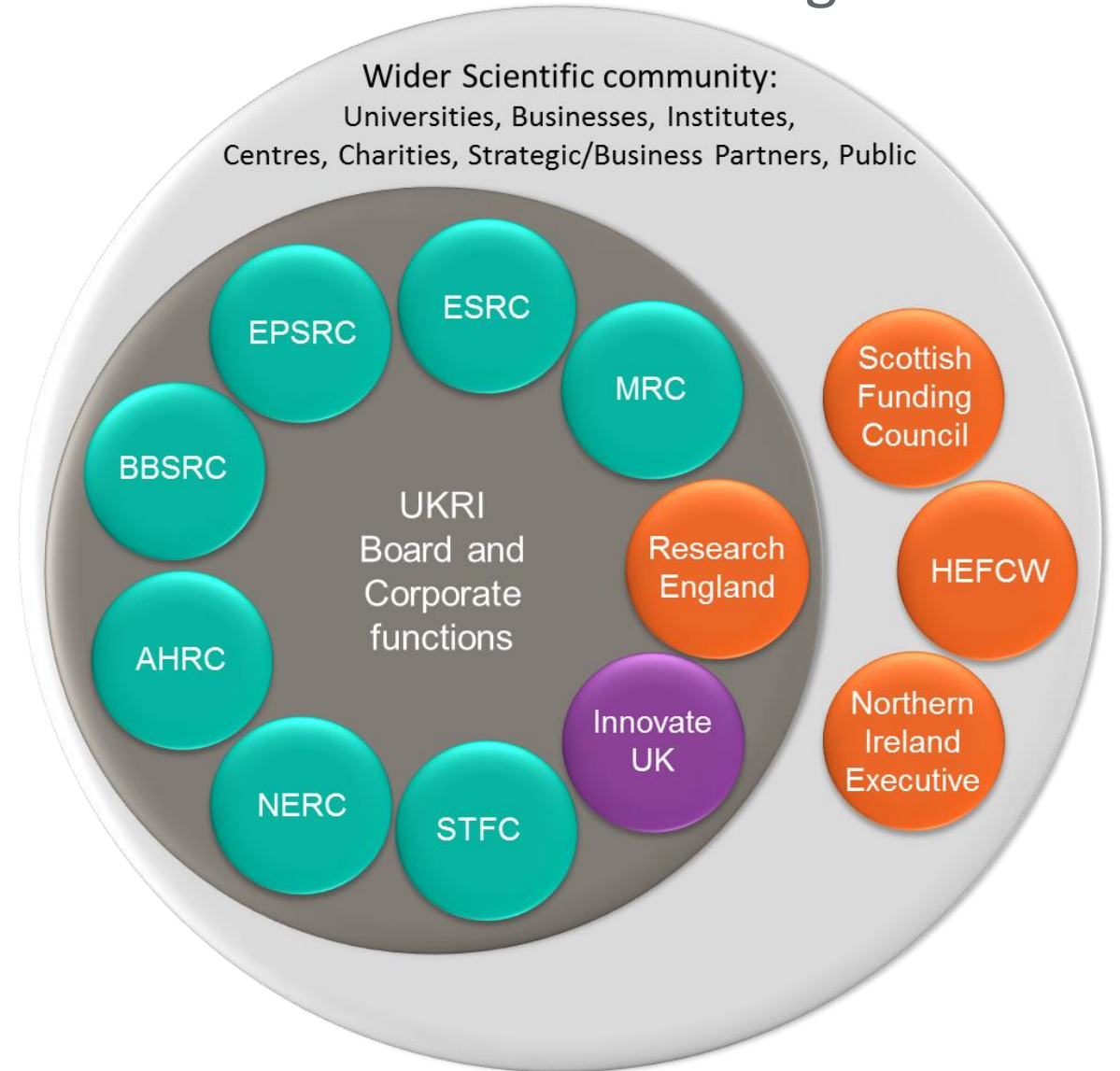
Dr Jim Fleming, Head of Energy Theme



“To be an outstanding organisation that ensures the UK maintains its world leading position in research and innovation”

UK Research and Innovation (UKRI), launched in April 2018, is the new funding organisation for research and innovation in the UK.

UKRI brings together the seven **UK Research Councils**, **Innovate UK** and a new organisation, **Research England**, working closely with its partner organisations in the devolved administrations.





The UKRI Family



- Greater **strategic vision** for UK science
- Providing a **stronger voice** into Government in support of UK science
- Creating greater space for individual Research Councils to put **more effort into science** (and less into back-office)
- Enabling **greater co-ordination** including for interdisciplinary research
- Improved **policy for science** and improved **science for policy**

- **More than £6.5 billion** in combined budget per year
- **3,900** research and business grants issued every year
- **151** universities receiving research funding
- **38** institutes, laboratories, units, campuses and innovation catapults



To achieve our vision, we need to get the foundations right. We will focus on **four key areas**

UK Research and Innovation: Foundations for research and innovation



Leading talent

Nurturing the pipeline of current and future talent



Openness and transparency

Supporting the development of a research and innovation system that is accessible, transparent and cooperative



A trusted and diverse system

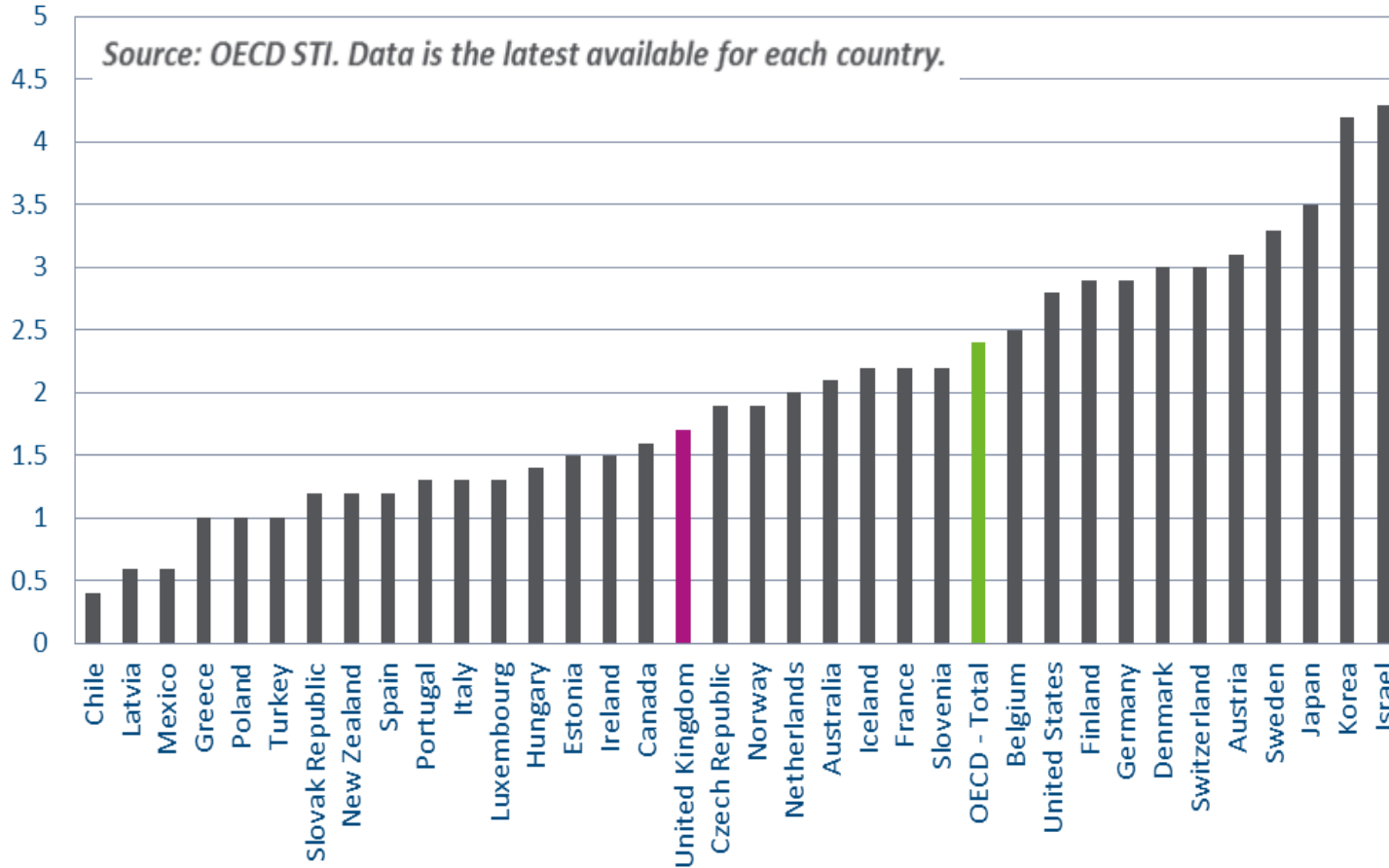
Driving a culture of equality, diversity and inclusivity providing the best opportunities for individuals and teams of people from all backgrounds to thrive



Research culture

Promoting the highest standards of research, collaboration and integrity.

Gross Expenditure on R&D as a percentage of GDP



- In 2015 UK's expenditure on R&D represented **1.7% of GDP** – below the OECD average R&D intensity of **2.4%**.
- The Government has committed to reaching **2.4% of GDP** investment in R&D by 2027, and to reaching **3%** in the longer term. As a first step it will invest an additional **£2.3 billion** over what was previously planned in 2021/22. UKRI worked with Government to develop a roadmap for meeting this target, published in 2018.

Delivering UKRI's vision and the Government target of 2.4% of GDP spend



Deliver economic
impact

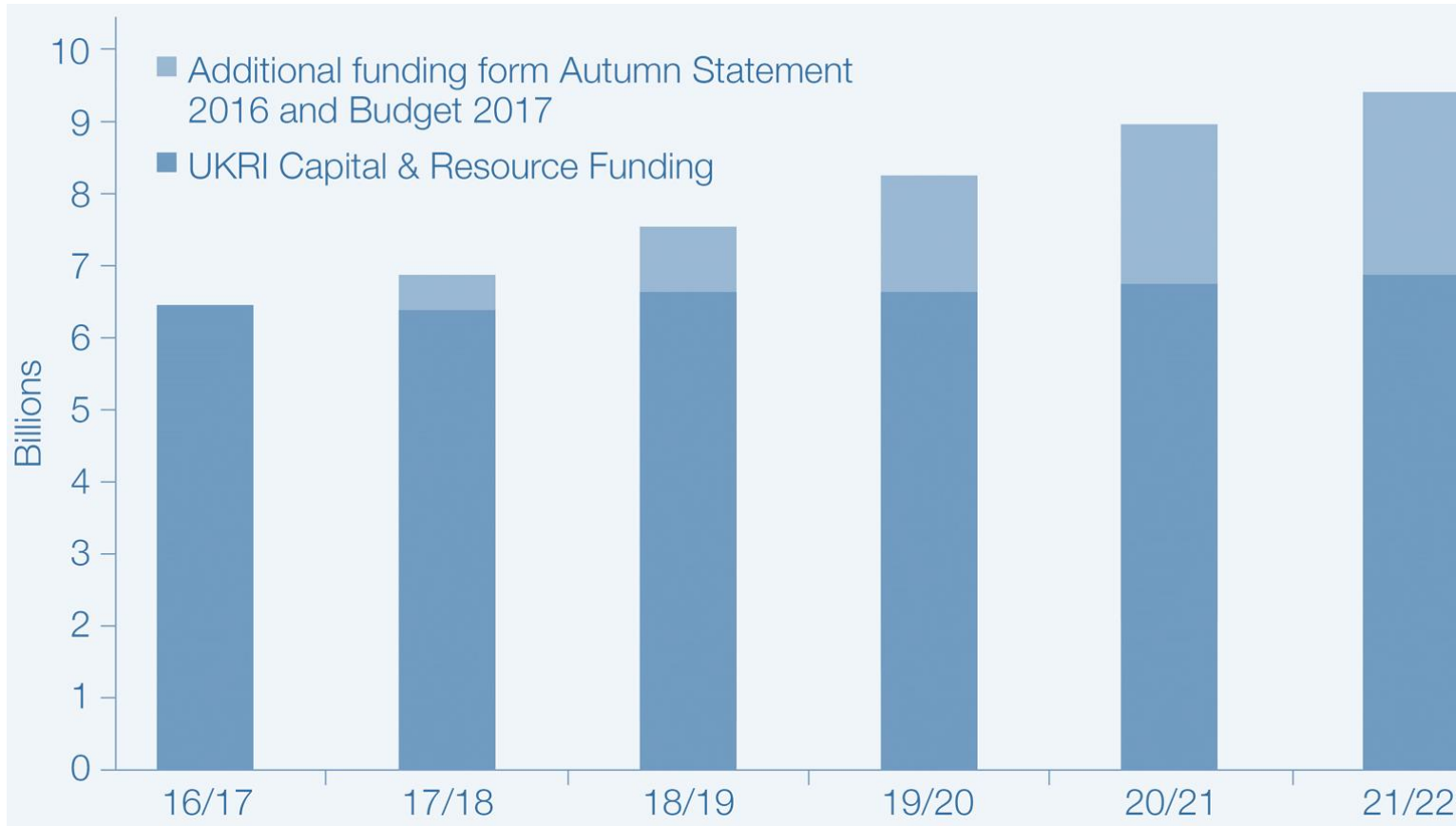


Create social and
cultural impact



Push frontiers of human knowledge and understanding





- In the 2016 Autumn Statement **£4.7 billion of additional funding for R&D** was announced, with a rising profile, over the period 2017/18 to 2020/21.
- The 2017 Budget saw an additional **£2.3 billion** added in 2021/22
- **Much of this funding is being delivered through UKRI**

The Government published its Industrial Strategy White Paper in November 2017



Additional funding available through the National Productivity Investment Fund (NPIF)*	2017-18 (£m)	2018-19 (£m)	2019-20 (£m)	TOTAL (£m)
Industrial Strategy Research Fund (ISCF)	195	270	260	725
Strength in Places Fund	2	32	81	115
Strategic Priorities Fund	70	190	320	580
Fund for International Collaborations	10	45	55	110
Additional funding to support Talent and Skills	22	98	180	300
TOTAL	299	635	896	1,830

* approximate figures



Investing in science, research and innovation

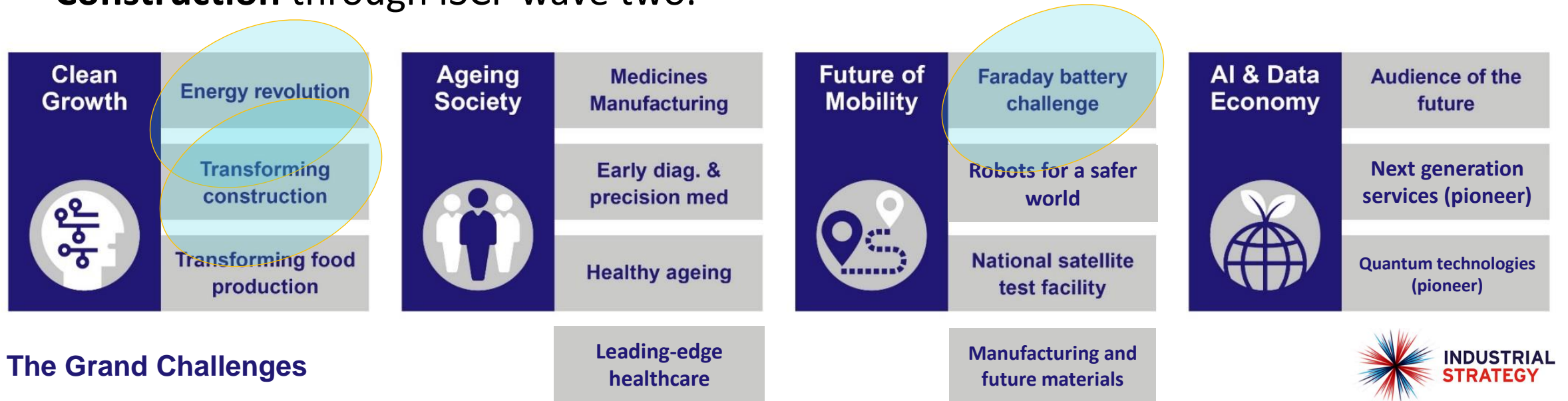
We must become a more innovative economy and do more to commercialise our world leading science base to drive growth across the UK

Industrial Strategy Challenge Fund

- Industry-led
- Building on UK strengths in industry and research
- Driving up productivity and growth
- Based on the best expert advice and evidence
- Tackling the most important challenges for our economy/society
- A very significant long-term investment
- A key element of the Industrial Strategy

Included in the Government’s £4.7 billion increase in research and development funding over 4 years:

- **£246 million** investment in the **Faraday Battery Challenge** through the Industrial Strategy Challenge Fund (ISCF) wave one.
- **£103 million** investment in **Energy Revolution** and **£170 million** in **Transforming Construction** through ISCF wave two.



Clean and flexible energy – the Faraday Battery Challenge

The Faraday Battery Challenge comprises a **£246 million** commitment over 4 years to fully exploit the industrial opportunity of vehicle electrification through world-leading batteries developed, designed and manufactured in the UK, by:

- Increasing multi-disciplinary application-led research in battery technologies
- Supporting UK businesses' investment capability in research, development, demonstration and testing of battery technology
- Using R&D to secure additional overseas investment



Clean and flexible energy – the Faraday Battery Challenge



Prospering from the Energy Revolution

- **Prove investable, scalable local business models** by 2022, that
 - deliver cleaner, cheaper energy services
 - build more prosperous and resilient communities
 - benefit the whole energy system
 - use integrated, intelligent approaches
- **Unlock private investment** in local integrated energy systems in 2020s (vs business as usual).
- **Accelerate new products and services to commercialisation** creating real world proving grounds.
- **Build UK leadership** in integrated energy services provision

Prospering from the Energy Revolution

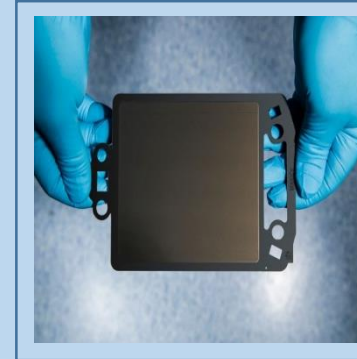
Practical Demonstrators



Future Designs



Future Energy Model Proving



Innovation
Development



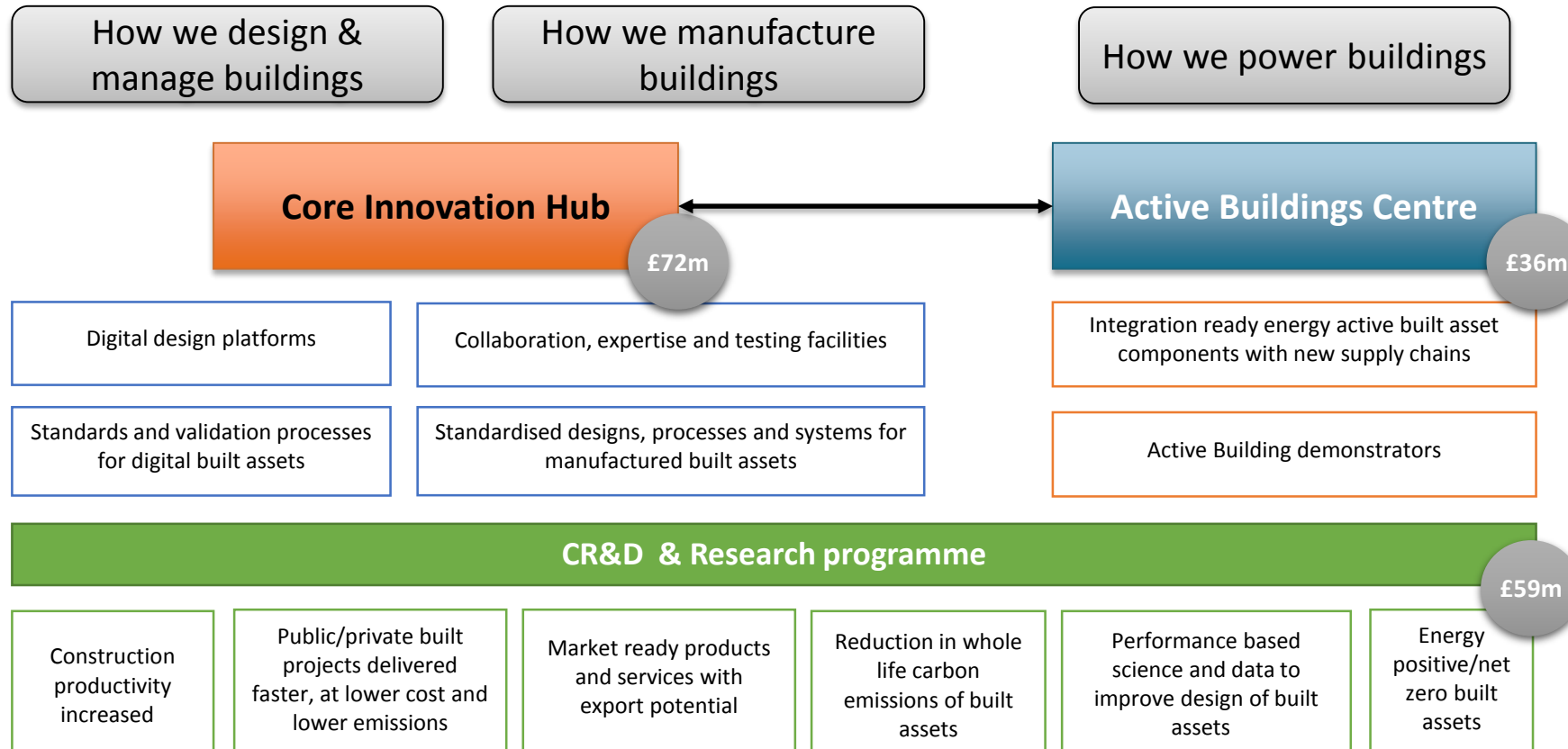
Expertise, Capability, Coordination.

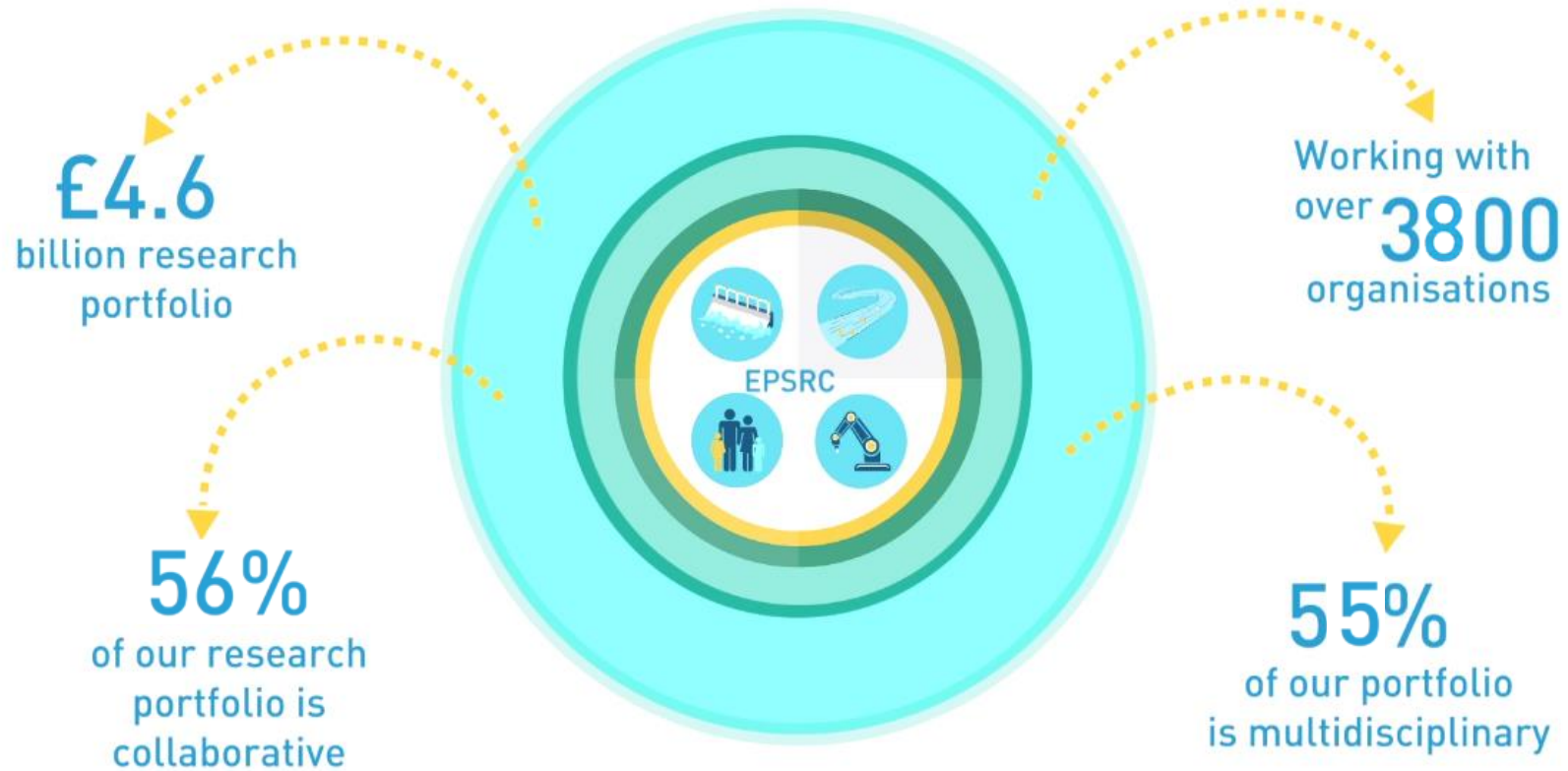
Transforming construction

- This ISCF challenge will bring together the construction, manufacturing, energy and digital sectors to revolutionise how we deliver the buildings the UK needs.
- Concentrating on:
 - How we manufacture buildings
 - How we digitally design & manage buildings
 - **How we power buildings**



Transforming construction

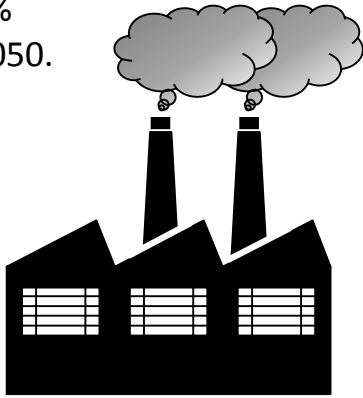




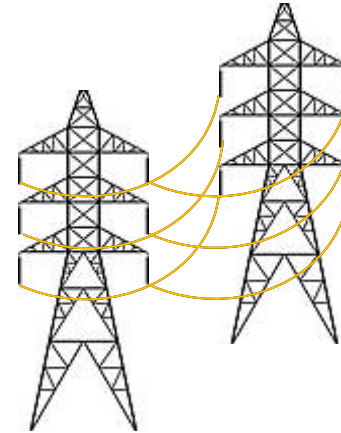
OUR
PORTFOLIO

Research Councils' Energy Programme: Tackling all elements of the energy 'trilemma'

Reduce GHG by 80%
emissions before 2050.



Reduce emissions



**Enhance security
of supply**



Increase use of renewable
energy to at least 15%
before 2020



Reducing cost

To support a **full spectrum of energy research** to help the UK meet the objectives and targets set out in the 2007 Energy White Paper.

To **work in partnership** to contribute to the research and postgraduate training needs of energy-related business and other key stakeholders.

To increase the **international visibility** and **level of international collaboration** within the UK energy research portfolio.

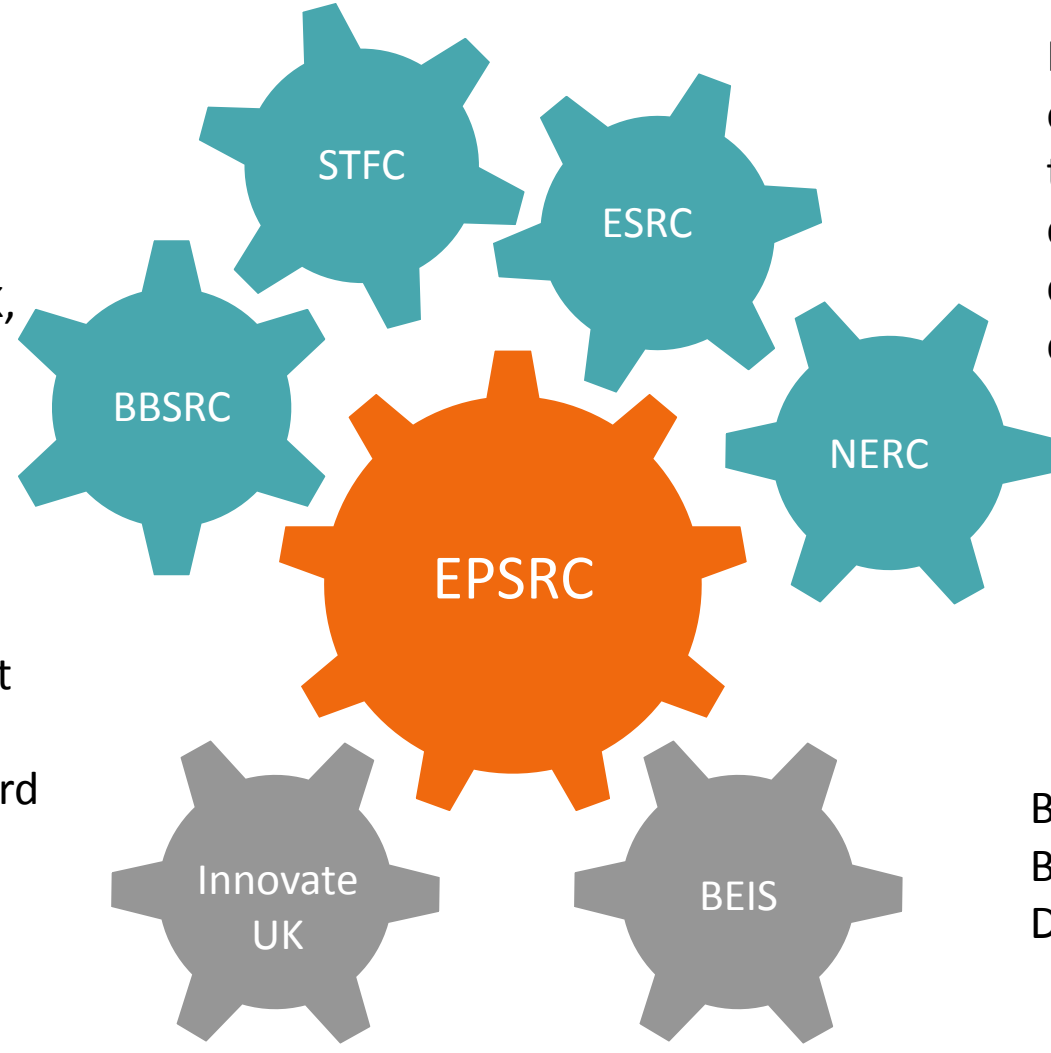
To expand **UK research capacity** in energy-related areas.



Cross Council Energy Programme

The Research Councils work together to plan, develop and deliver energy research and training within a common strategic framework through the Research Councils Energy Programme.

High level input from a Scientific Advisory Committee: industry, academic, Innovate UK, BEIS representation



Public Sector organisations working together to provide coordinated activity and a complete innovation chain.

New cross-government board established – Energy Innovation Board (EIB).

Board covers BEIS, IUK, RCUK, DFID, DfT, DEFRA, Devolved

Chaired by GCSA

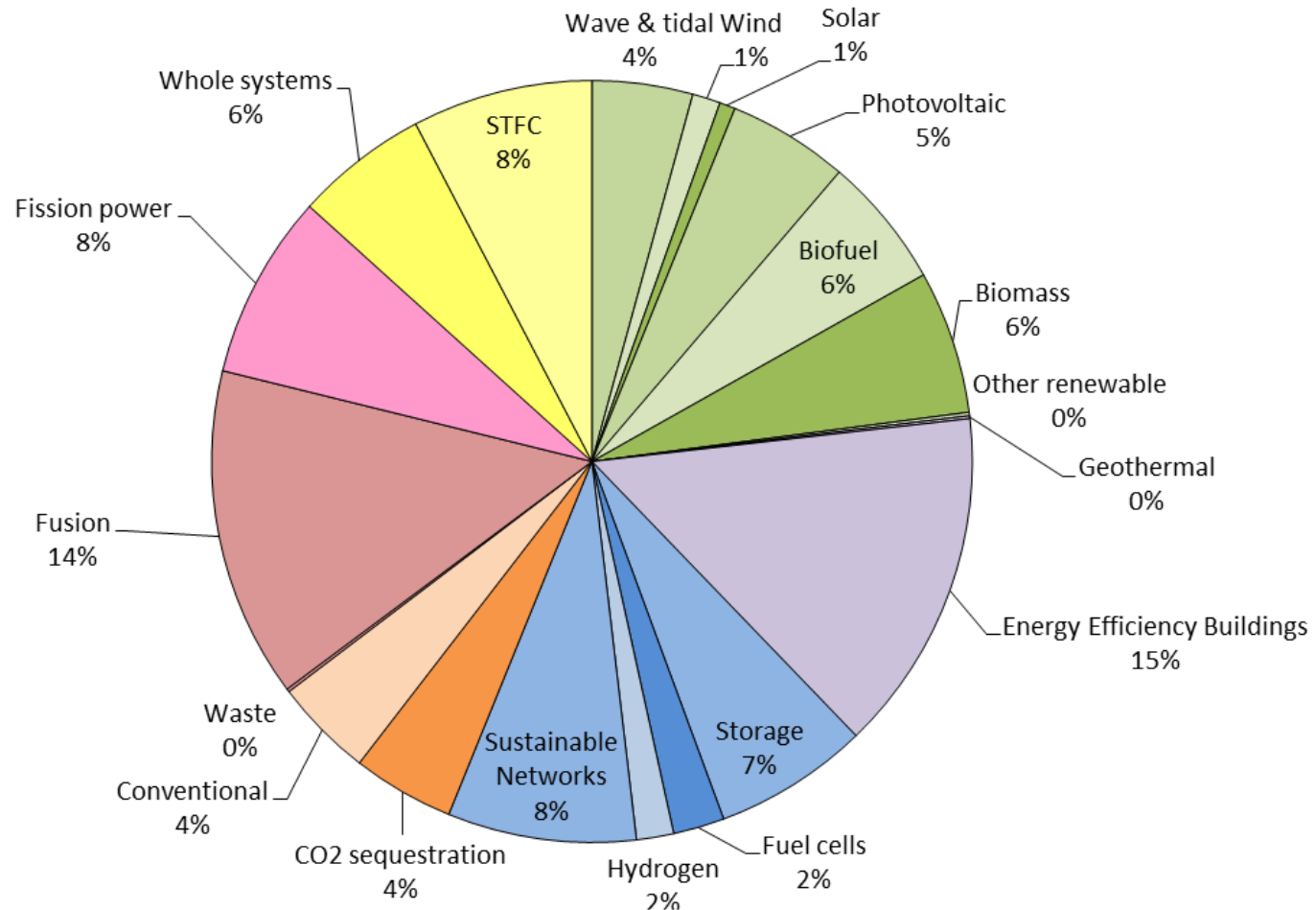
Research Councils' Energy Programme: Working together – cross-UKRI activities

- **UK Energy Research Centre Phase 3** (£14 million, led by EPSRC with ESRC and NERC) and **Phase 4** (£18 million, led by EPSRC with NERC and ESRC).
- **UK-China Offshore Renewables Energy** (£4 million from Newton Fund led by EPSRC with NERC, matched funding from NSFC, China).
- **Accelerating CCUS Technologies (ACT)** - £6.5 million led by BEIS with NERC and EPSRC, plus funding from international partners.
- **CDT in priority area of renewable energy** (led by EPSRC, NERC contribution of £2.2 million).
- **InnovateUK Energy Catalyst calls (1-6)** with co-funding from EPSRC (and other Government departments)
- **Bioenergy Supergen Hub** (EPSRC with BBSRC)
- NERC and ESRC £8 million programme on **Unconventional Hydrocarbons in the UK Energy System: environmental and socio-economic impacts and processes**

Research Councils' Energy Programme: Our portfolio

The Energy Programme positions the UK to meet its energy and environmental targets and continues to be a major funding investment strand for the UK Research Councils.

Energy Programme 2014-15
Annual Expenditure £193M; total portfolio £940M





Dr Jim Fleming
Head of Theme



Dr Sam Riches
Head of Decarbonising Industrial Clusters



Dr Luke Davies
Head of Faraday Challenge



Dr Christina Turner
Head of Prospering from the Energy Revolution



Dr Neil Bateman
*Senior Energy Manager, Nuclear Fusion, International,
Decarbonising Electricity*



Dr Katharine Dunn
*Senior Energy Manager, Hydrogen and Alternative Energy
Vectors, Fuel Cell Technology, Industry Strategy, Supergen*



Dr Bill McAllister
*Senior Energy Manager
Faraday Institute, Energy Storage, Decarbonising Transport*



Dr Gerard Davies
*Senior Energy Manager, Decarbonising Heat, Environmental
Change. Prospering from the Energy Revolution*



Miss Jasmine Cain
Power Networks, Whole Energy Systems

Mr Edward Jones
End Use Energy Demand (EUED)



Dr Lizzy Bent
*Bioenergy,, Carbon capture and storage, Conventional
generation, Unconventional hydrocarbons, Geothermal*



Dr Heather Macklyne
Nuclear Fission



Dr Ruhina Miller
Solar. Offshore Renewables



Head of Energy : Jim

Decarbonising
Electricity : Neil

Renewables:
Solar,
Bioenergy, and
ORE

Nuclear: Fission
and Fusion

Decarbonising
Industry:
Katharine

Decarbonising
Heat: Gerard

Decarbonising
Transport: Bill

Storage and Alternative Vectors: Hydrogen, Energy Storage
and Fuel Cells

Greenhouse Gas: CCS and Conventional Generation

Energy Infrastructure: EUED, Networks and Whole Energy Systems

ESRC

- ☞ **Sophie Martin**
- ☞ **Claire Spooner**
- ☞ **Ben Miller**

BBSRC

- ☞ **Rod Westrop**
- ☞ **Elizabeth Saunders**

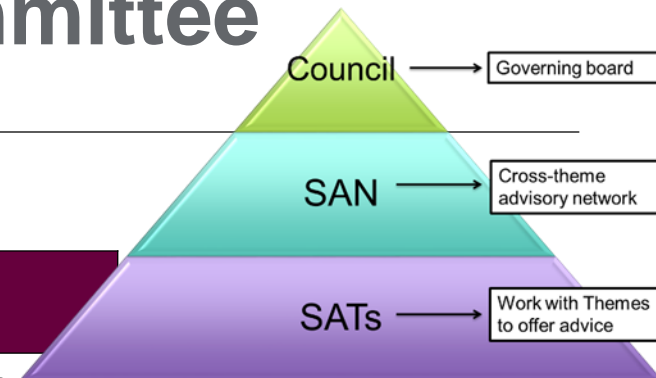
NERC

- ☞ **Beth House**
- ☞ **Weihaio Zhong**
- ☞ **Michelle Truman**

STFC

- ☞ **Stephen Loader**

Main Advisory Body



NAME	AFFILIATION	EXPERTISE	NAME	AFFILIATION	EXPERTISE
Dr Keith Maclean (Chair)	UKERC	Energy system	Professor Karl Whittle	University of Liverpool	Nuclear fission, materials
Dr Iliana Portugues	National Grid	Energy Networks	Professor Deborah Greaves	University of Plymouth	Marine renewable energy
Mr Rob Millar	Williams Advanced Engineering	Batteries and EVs	Dr Mike Colechin	Independent	Energy systems
Dr Valeska Ting	University of Bristol	Energy Materials	Dr Jeanette Whitaker	Centre for Ecology & Hydrology	Bioenergy
Professor John Barrett	University of Leeds	Energy Economics	Professor Stephen McArthur	University of Strathclyde	Energy Networks
Professor Jonathan Radcliffe	University of Birmingham	Energy Systems and Policy	Professor Philip Eames	Loughborough University	Heat
Professor Stuart Hazeldine	University of Edinburgh	Carbon Capture and Storage, geological disposal	Professor Peter Robertson	Queen's University Belfast	Solar Technology
Professor Serena Corr	University of Sheffield	Materials, Energy Storage	Professor Janette Webb	University of Edinburgh	Economics of Energy
Professor David Manning	Newcastle University	Natural Environment			



The Clean Growth Strategy
Leading the way to a low carbon future



EPSRC
Investing in research for discovery and innovation

PIONEER

Engineering and Physical Sciences Research Council. EPSRC is part of UK Research and Innovation

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Home improvements

Science and engineering for a hi-tech low carbon world

Aston Martin DB11 – the supercar with green credentials

Self-sufficient buildings powered by sunshine

Mark Miodownik on the circular economy of plastics

Squeezing more juice from electric vehicle batteries

Recycling eggshells into plastics makes cracking savings

3D-printed metals for stronger, lighter manufacturing

Self-healing, longer-lasting concrete



INSIDE: Chickens Chocchals Cows Cooking Colds Coffex Crops Cars Cops Clothes Cogs Crags Circles Cubes

Saving our energy

If we're serious about saving the planet for future generations, we have to get serious about how we generate, consume, store and safeguard our energy supply. EPSRC's Head of Energy, **Dr Jim Fleming**, describes EPSRC's sustainable energy commitments

Research is key to the UK achieving a secure and affordable low-carbon energy system while conserving our natural resources, the environment and our quality of life. It is also vital to ensuring continued economic growth as the country moves toward a circular economy decarbonises its industry and transport sectors, and transitions away from its dependence on fossil fuels.

EPSRC leads the UKRI Energy Programme on behalf of all UK Research Councils. Our £1.1 billion energy portfolio covers the full range of speculative and user-led energy research from nuclear, solar, tides and wind energy to sustainable energy storage and future electricity networks. Through our investments we are also nurturing the next generation of highly skilled energy researchers.

Support
We have long recognised that so vital to the global energy consortium can only come through coordinated multi-disciplinary research. Which is why, since 2005, we have led Synergise (see page 31), the UK's flagship research initiative in sustainable power generation and supply.

Funded under the UKRI Energy Programme, Synergise is a multidisciplinary research initiative allowing a vast green energy landscape, taking in areas such as climate change, fossil fuel extraction rates, emissions control, and increasing public awareness of environmental concerns.

Focusing on collaborative research projects between industry and academia, Synergise is helping the UK meet its environmental emissions targets through a radical improvement in the sustainability of the UK's power generation and supply.

Research into renewable energy is deemed to play a pivotal role in the UK's power generation mix. The scientists and engineers we support in this field are tackling a host of challenges, including the intermittent nature of solar and wind energy, the need for power networks to be able to adapt to a constantly changing impact, and the decarbonisation of transport. For example, the rapid increase in the number of electric vehicles on UK roads will require the development of smarter electricity networks and

hydrogen fuel facilities that can accommodate and sustain larger quantities of renewable energy.

Bioenergy
Bioenergy – derived from either burning or chemical treatment of biomass crops such as willow and miscanthus, trees or agricultural waste – is an exciting research area attracting some of the UK's most innovative researchers, among them Professor Jason Halliday, from Imperial College London.

With PhD student Florence Giszewski, Professor Halliday formed a company, Chrysalis Technologies, to transform unwanted waste wood into a low-cost raw material for use in the production of clean and inexpensive chemicals, materials and fuels. He has also nurtured the careers of other members of his group, including Dr Derrinchie Chamberlain, who successfully biosynthesised the PhD herbicide role as co-founder and chief technologist of social enterprise Oera, which is working to bring such herbicide-free seed electricity to rural India.

Continued on page 28



SUSTAINABLE ENERGY

Continued from page 27

To further support research in this dynamic field, in 2018 we introduced a new Sustainable Energy Fund led by Professor Francis Horley from York University. The fund brings together a network of scientists, industrial and policy specialists to maximise the environmental benefits of sustainable energy.

Wind, wave and tidal energy
Research into harnessing the wind and tides, currents is already well established in the UK, which was the world's wind energy pioneer. In Europe, and EPSRC's partners world leading research into the harnessing of energy from waves and tidal streams.

Among recent initiatives, in 2016 we introduced a new program, Offshore Renewable Energy (ORE) Catapult, led by Professor Deborah Gibson, ORE Catapult's director. The hub brings together scientists and engineers working in wave, tidal and offshore wind research to share the skills, resources and expertise of the UK's leading experts in this exciting area. The centre is also allowing industry, universities and multi-disciplinary colleagues to develop a coordinated response to national and regional needs.

Among the EPSRC-funded projects, Professor Gibson is conducting an initiative to investigate the viability of wave energy impacts on light houses (see page 30).

Many of the offshore energy projects we would energy generation and supply will be solved through the application of exciting new technologies such as robotics and automation. Our investments in this area include a £4 million wave energy technology consortium led by the Director of EPSRC-funded Ocean Energy Centre, which is investigating the use of robotics, artificial intelligence and advanced manufacturing technologies to help maintain offshore energy infrastructure. A notable example is the EPSRC-funded research to commercialise our wave energy technology with UK partners (see page 30) to offshore renewable energy.

POK 2019 Autumn 2016

Offshore projects such as harnessing the energy and to clean wind energy of 2000.

Synergise, a company co-funded by EPSRC, will use EPSRC-funded PhD students to develop a new wave energy technology, which will harness the power of offshore wind waves, such as turbines which by their nature are remote and inaccessible. The technology significantly reduces companies' operating costs.

Solar
Solar energy is the only renewable energy technology that in theory could provide a significant amount of cheap, clean electricity energy storage could meet all of the world's energy needs. The researchers we support are working to develop new technologies in the field, combining with industry to develop charging solutions, processing and efficiency. Many have successfully secured their academic research to commercial applications.

For example, solar technology Professor Henry Gray, who is the Director of Oxford who supported the development of hybrid materials for energy and photovoltaics, formed the one PV to bring his research to market.

Professor Gray has been using a host of materials for his research, which has included a range of international research and exchange and has identified the commercial viability of solar energy generation.

Another example of the internationally relevant nature of our portfolio is the

work of Prof Suresh, a PhD student at the University of Manchester's Graham Institute, and Professor John Nelson, head of the Institute's materials research, who worked with Oera, a research intensive, oil from in their villages with electric lighting.

Energy storage
One method of storing fossil fuel combustion is to store it cheaply and move it to the right place, such as storing and transporting renewable energy. EPSRC supported research in this field has been in long-term impact over many decades.

For example, research in the 1980s by Professor John Goodenough, Mike Thackeray, Peter Thackeray and Bill Dreyer was pivotal in the development of the first commercial lithium ion battery, which has since transformed portable electronics devices. Professor Stone is also one of the pioneers of the lithium-ion battery which could hold the key for next-generation electric vehicles.

Another pioneer is Professor Clare Gray, a chemist, who is now in the space station to research the development of a new type of battery, which has been developed by her team at Oxford to store energy in a battery. Her research was helped to understand how batteries charge and discharge and has identified the physical processes in an environmentally important material.

She has also pioneered new battery technology, including a prototype lithium-ion battery, which is also known as the Porosity-based battery. This research has led to a new type of battery, which is also known as the Porosity-based battery. This research has led to a new type of battery, which is also known as the Porosity-based battery.

A more notable effort supported by EPSRC, with friends like the Advanced Research Centre for Energy Storage (see page 30).

- Investment in high-quality, inter-disciplinary research to target the **energy 'trilemma'** of reducing carbon emissions, energy security and affordability
- **Systems Approach:** whole energy systems and integration within the energy system.
- **Understanding Future Energy Options:** Social, governmental environmental and economic implications.
- **Reducing Energy Consumption and Demand:** Development of behavioural, market and technological advances informed by a whole system understanding.
- **Enabling Technologies:** that underpin research across disciplines, such as energy storage, materials, digital technology.
- **Speculative Research:** To define future energy options and draw developments from other disciplines into energy research.
- **Accelerated Deployment of Technologies:** Working with Innovate UK, BEIS, ETI/Energy Systems Catapult and others to tackle challenges around deployment and encourage policy and user impact from research, e.g. the Energy Catalyst
- **Building Capacity and Diversity:** Providing the skilled people to deliver new energy futures through the training and development of new researchers, policy makers and business leaders. e.g. Growth in career advancement and leadership fellows.
- **Build on our major international links:** Working with India, China and other priority countries, enabling leading researchers to address global energy challenges together.

Major Recent Investments

- Supergens
- UKERC Phase 4
- CREDS
- Nuclear – DISTINCTIVE/PACIFIC
- Programme Grants
- Smart Meter Research Portal
- CSRF
- International



- **Current calls**

- Decarbonising Transport Networks+
- Energy Storage Network+
- UK-Japan Nuclear Decommissioning
- EUED Technologies
- UK-South Korea Nuclear
- UK involvement in 2019 NEUP programme
- Also... investment through ISCF, SPF, FIC



- Decarbonising Heat Workshop
 - Monday 25th March 2019
- Towards Sustainable Materials for Energy Applications Workshop
 - materials science community workshop on 26 March 2019
 - Physical Sciences Theme
- Japan Civil Nuclear
- India Civil Nuclear
 - 30 April 2019
- Follow Ups to Current Calls

10 YEARS TO PREPARE

for a low carbon transition

Between 2025 and 2050 - 26 million homes will require new low carbon installations

20,000 homes per week

the equivalent of 10 Million Keynes each year

Few consumers are presently engaged to change their heating systems to combat emission reductions



our consumer research highlights people want better control of time, effort and money

There are two principal pathways for decarbonising domestic space and water heating



local area schemes using heat networks and individual home systems using electricity for heating

Eliminating emissions from buildings is more cost-effective than making deeper cuts in other sectors

£100_{bn}



likely cost of comprehensively retrofitting seven million homes

Carbon abatement costs increase around

30%

if electric heat systems are not used in any transition

Next decade is critical 10 Years



in preparing for transition as rapid implementation is required from 2025 to meet 2050 targets



90% of the UK's housing stock will still be in use in 2050



20% contribution of household heating to national carbon emissions

As an investor in research, we are committed to attracting the best researchers from a diverse population into research and innovation careers.

The [RCUK Action Plan for Equality, Diversity and Inclusion](#) launched in May 2016.

EPSRC Implementation plan includes:

1. Ensuring Fair and Unbiased Peer Review:

- Fairness of peer review processes reviewed
- Introducing bespoke unconscious bias training for staff, panel chairs, members, peer reviewers
- Piloting anonymous peer review process



Research and Training

Research Schemes

New Investigator awards

Standard grants (responsive mode)

Programme Grants

Fellowships

Managed Calls

Infrastructure

High Performance Computing

Training Schemes

Centres for Doctoral Training (CDTs)

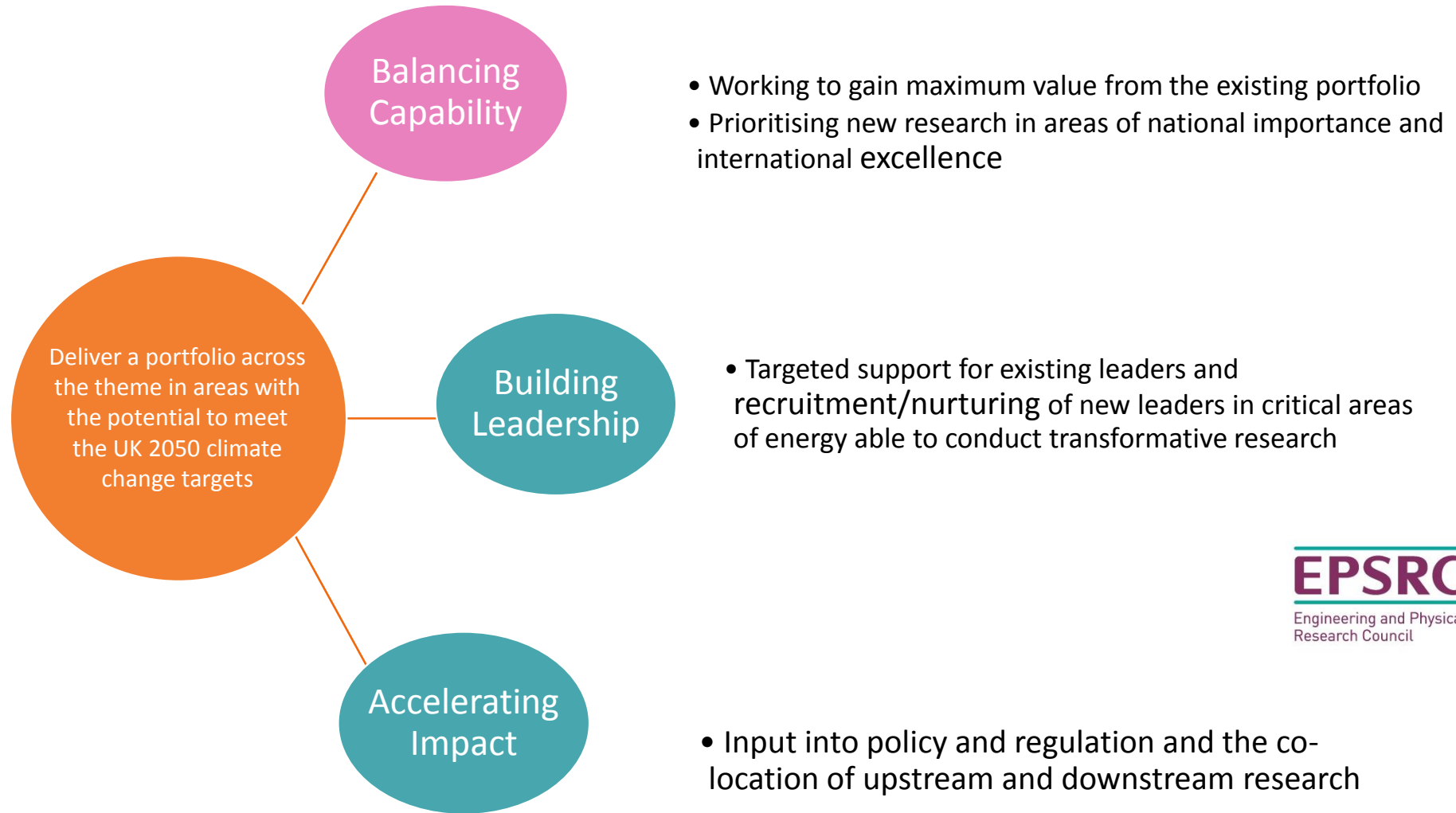
EPSRC Centre for Doctoral Training (CDT) in Nuclear Fission- Next Generation Nuclear	Livens, Professor F, The University of Manchester
EPSRC Centre for Doctoral Training in Nuclear Energy: Building UK Civil Nuclear Skills for Global Markets.	Lee, Professor WE, Imperial College London
EPSRC Centre for Doctoral Training in Power Networks at The University of Manchester	Professor P Crossley, The University of Manchester
EPSRC Centre for Doctoral Training in Future Power Networks and Smart Grids	McArthur, Professor S University of Strathclyde

Doctoral training awards (DTPs)

Industrial CASE awards (iCASE)

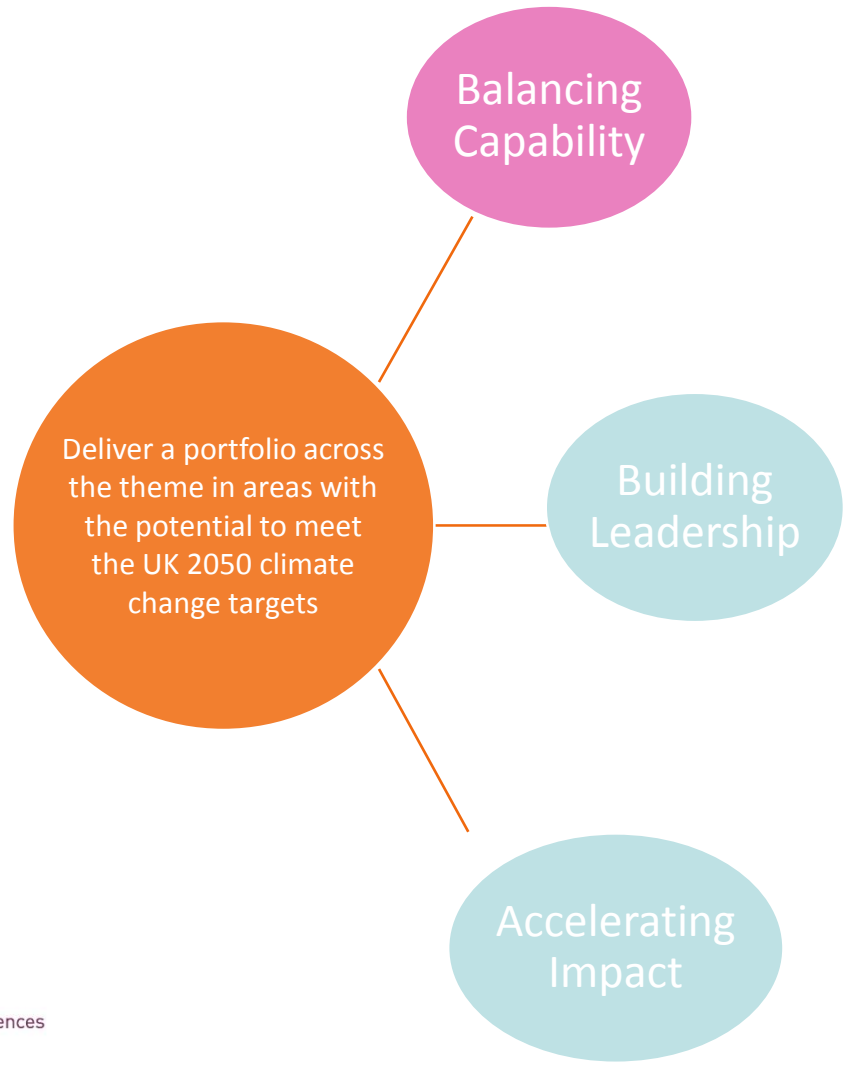


EPSRC Strategies and Energy





Balancing Capability



Research Area	Action
Bioenergy	Maintain
Carbon Capture and Storage (CCS)	Maintain
End Use Energy Demand (Energy Efficiency)	Maintain
Hydrogen and Alternative Vectors	Maintain
Marine, wave and tidal	Maintain
Nuclear Fission	Maintain
Solar Technology	Maintain
Storage	Grow
Whole Systems	Maintain
Fuel Cell Technology	Reduce
Wind Energy	Maintain
Fossil Fuel Power Generation	Maintain
Energy Networks	Maintain
Materials for Energy Applications	Grow
Catalysis	Maintain
Infrastructure and Urban Systems	Maintain

Building Leadership – Centres for Doctoral Training

The aims of our CDTs:

- Provide a stimulating multidisciplinary training experience
- Teach topical courses that balance cutting edge technologies with fundamental principles and core concepts
- Develop transferable skills in leadership, business and research management
- Foster innovative, internationally leading research
- Work in partnership with industry to provide industrial experience and maintain relevance
- Call launched early 2018; shortlisted 200 (main call); decisions by end of 2018; launch February 2019

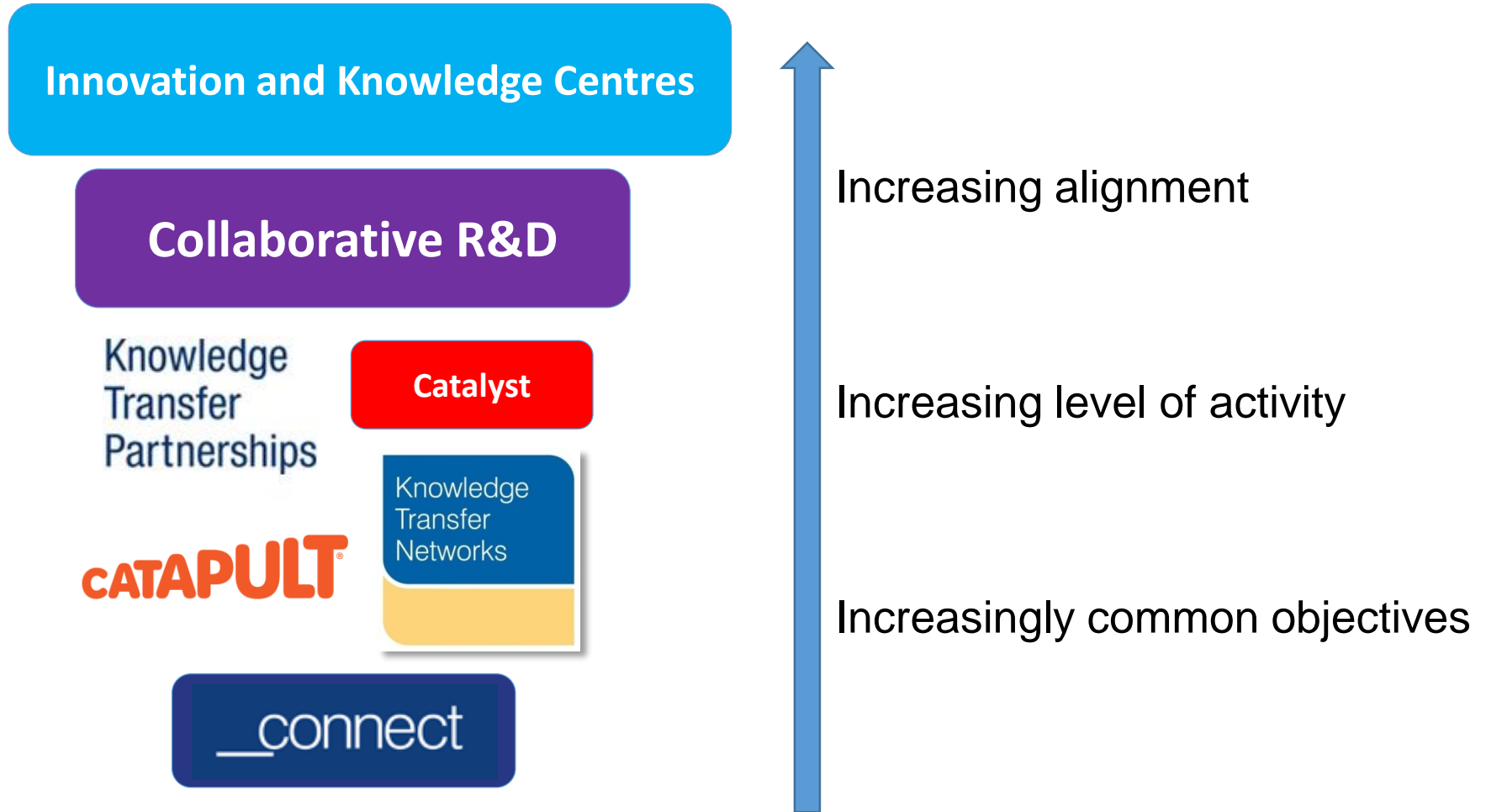


- Support for three stages:
 - Postdoctoral
 - Early Career
 - Established Career
- A **'person specification'** is used to describe the desired attributes for each career stage

Post-doctoral Fellowships	Early career Fellowships	Established career Fellowships
Bioenergy	Bioenergy	
End-use Energy Demand	End-use Energy Demand	End-use Energy Demand
	Carbon Capture and Storage	Carbon Capture and Storage
Energy Networks	Energy Networks	
Energy Storage	Energy Storage	Energy storage
Nuclear Fission	Nuclear Fission	
Solar Energy	Solar Energy	
	Offshore Renewable	Offshore Renewable
	Hydrogen and Alternative Vectors	Hydrogen and Alternative Vectors
Energy Systems Integration	Energy Systems Integration	Energy Systems Integration



Research Councils' Energy Programme: Joint working across UKRI— a broad collaborative spectrum





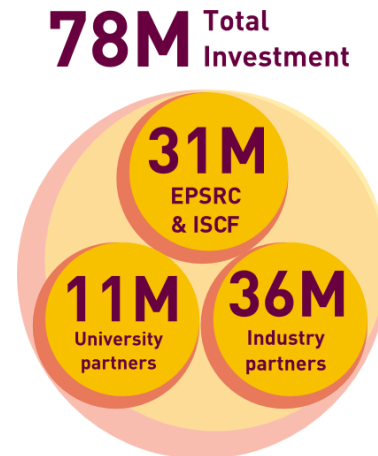
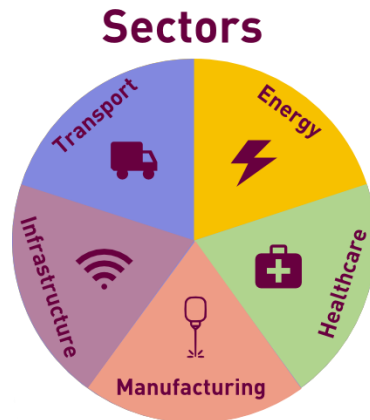
Energy Catalyst

- The Energy Catalyst is a programme that supports UK-based businesses to develop highly innovative, market-focused energy technologies.
- Recent calls have focussed on DFID and EPSRC funding
- Projects can involve universities, SMEs and large companies
- There are three stages of award:
 - Early stage – technical feasibility
 - Mid stage – technology development
 - Late stage – technology validation

<https://www.gov.uk/guidance/energy-catalyst-what-it-is-and-how-to-apply-for-fundingg/energy-catalyst>

Research-Business Partnerships for a Prosperous Nation

- Prosperity Partnerships engage large international businesses and smaller companies in long-term, low TRL, user-inspired EPS research
- Support for existing, strategic, research-based partnerships between businesses and universities
- Opportunity for co-investment in large-scale collaborative research programmes in low TRL research



Delivering Enhanced Through-Life Nuclear Asset Management

- A **£2.2M** award to the University of **Strathclyde**, working in partnership with **Babcock**, BAM Nutall, Bruce Power, EDF Energy, Kinectrics and The Weir Group
- Complements and expands research undertaken in the context of the Advanced Nuclear Research Centre at the University of Strathclyde, which already had considerable engagement from the project partners



A New Partnership in Offshore Wind

- A **£3.9M** award to the University of Sheffield, working in partnership with **Siemens Gamesa**, Ørsted, Durham University, University of Hull
- To address the fundamental research problems that will help to reduce the levelised cost of electricity from offshore wind
- To enable the UK to remain at the forefront of offshore wind technologies and to support UK supply chain growth



Partners: Ørsted, Durham University, University of Hull

All-perovskite Multi-junction Solar Cells – University of Oxford & Oxford PV

Smart Pumping for Subsurface Engineering – Strathclyde University & The Weir Group

- Provide opportunities for **excellent UK researchers** to flourish in global research collaborations
- Enhance the **value and impact** of research through international collaboration
- Show our commitment to key **global responsibilities** in a world where challenges cross national boundaries
- Increase our influence in international research **strategy and policy** development.

The UK's place in the world

Global Challenges Research Fund

- Focus areas:
 - Equitable access to sustainable development
 - Sustainable economies and societies
 - Human rights, good governance and social justice

Global research: e.g. ALMA

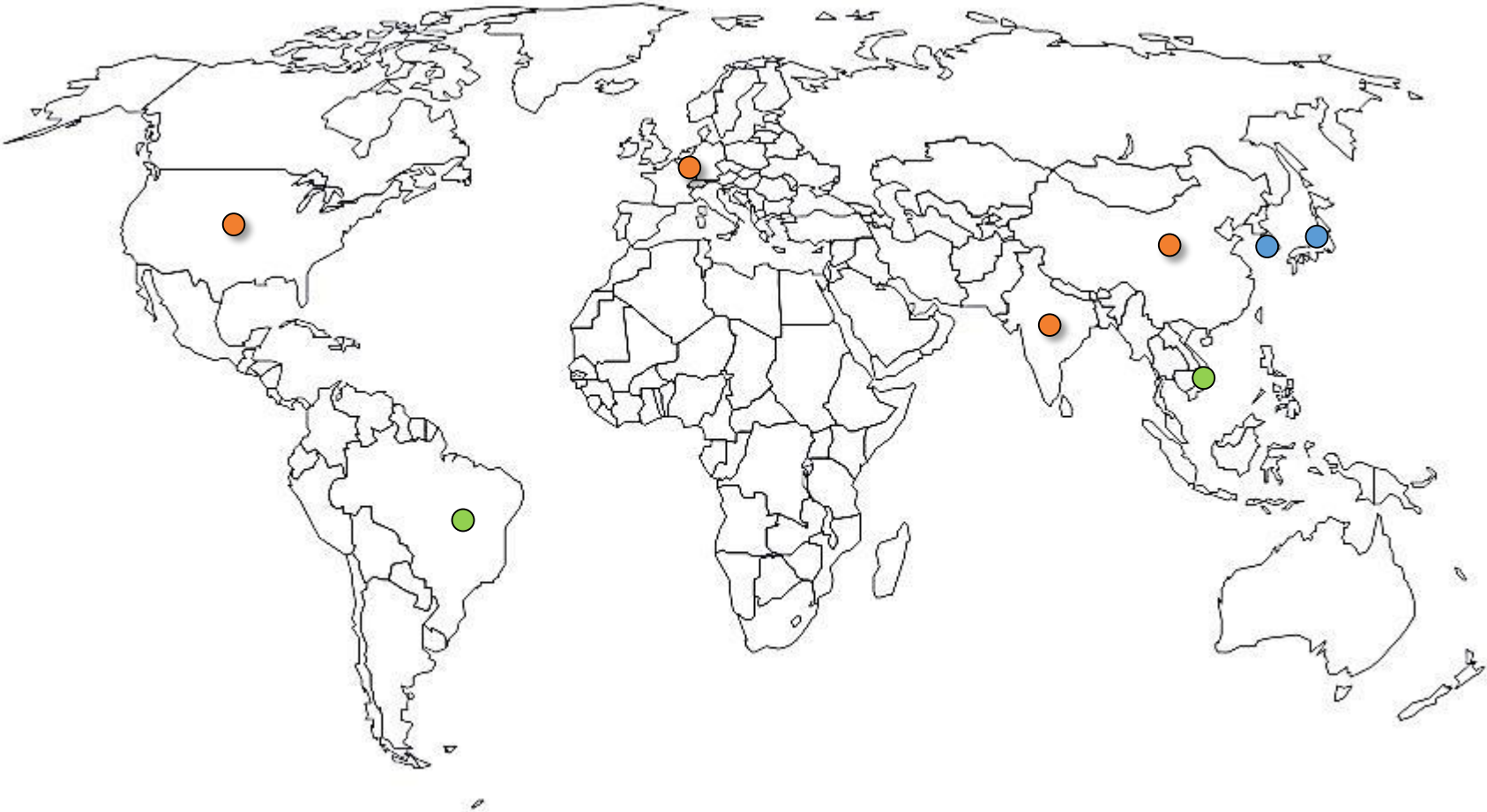


SUSTAINABLE DEVELOPMENT GOALS



International Engagement – Where?

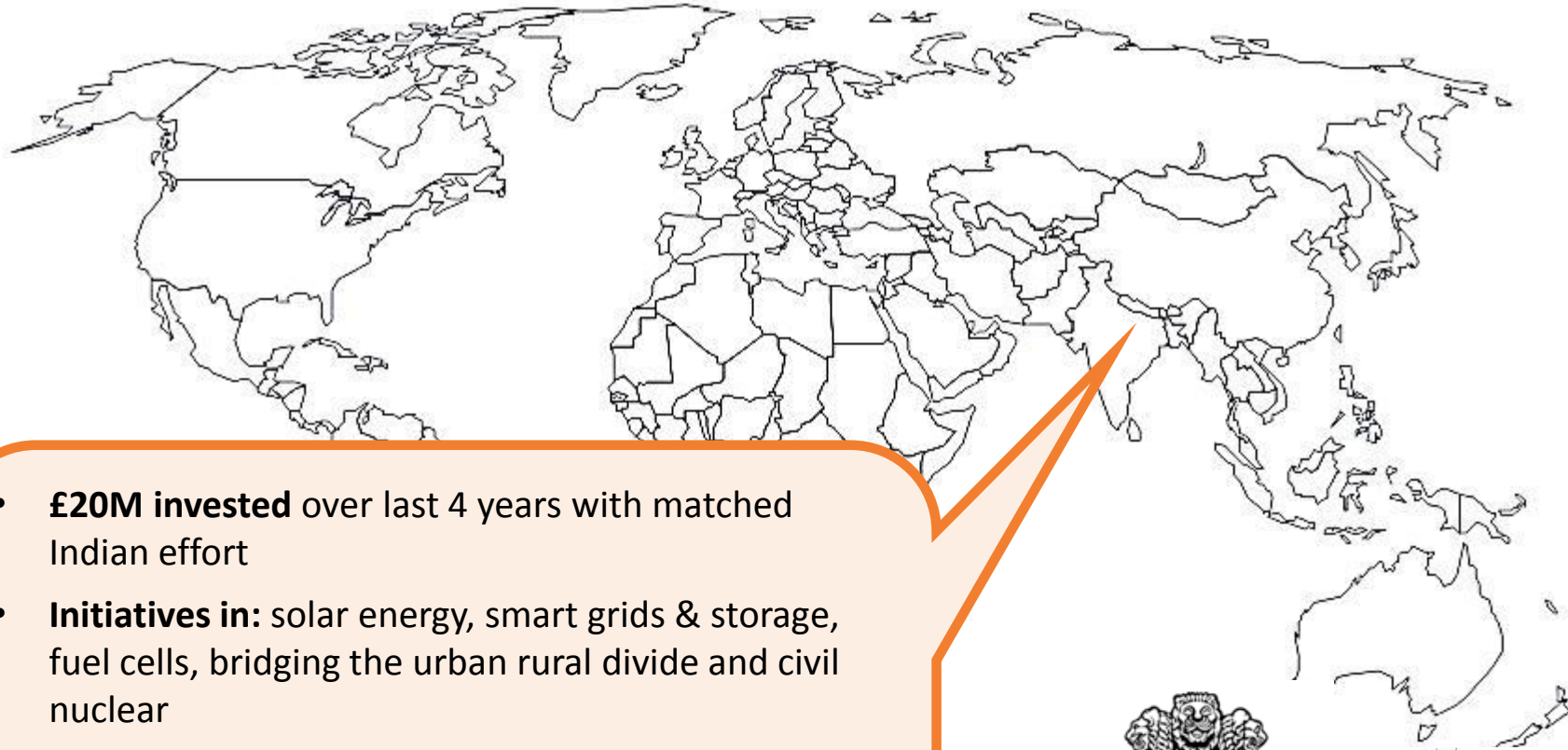
Focused on Priority Countries: China, India, USA, Europe





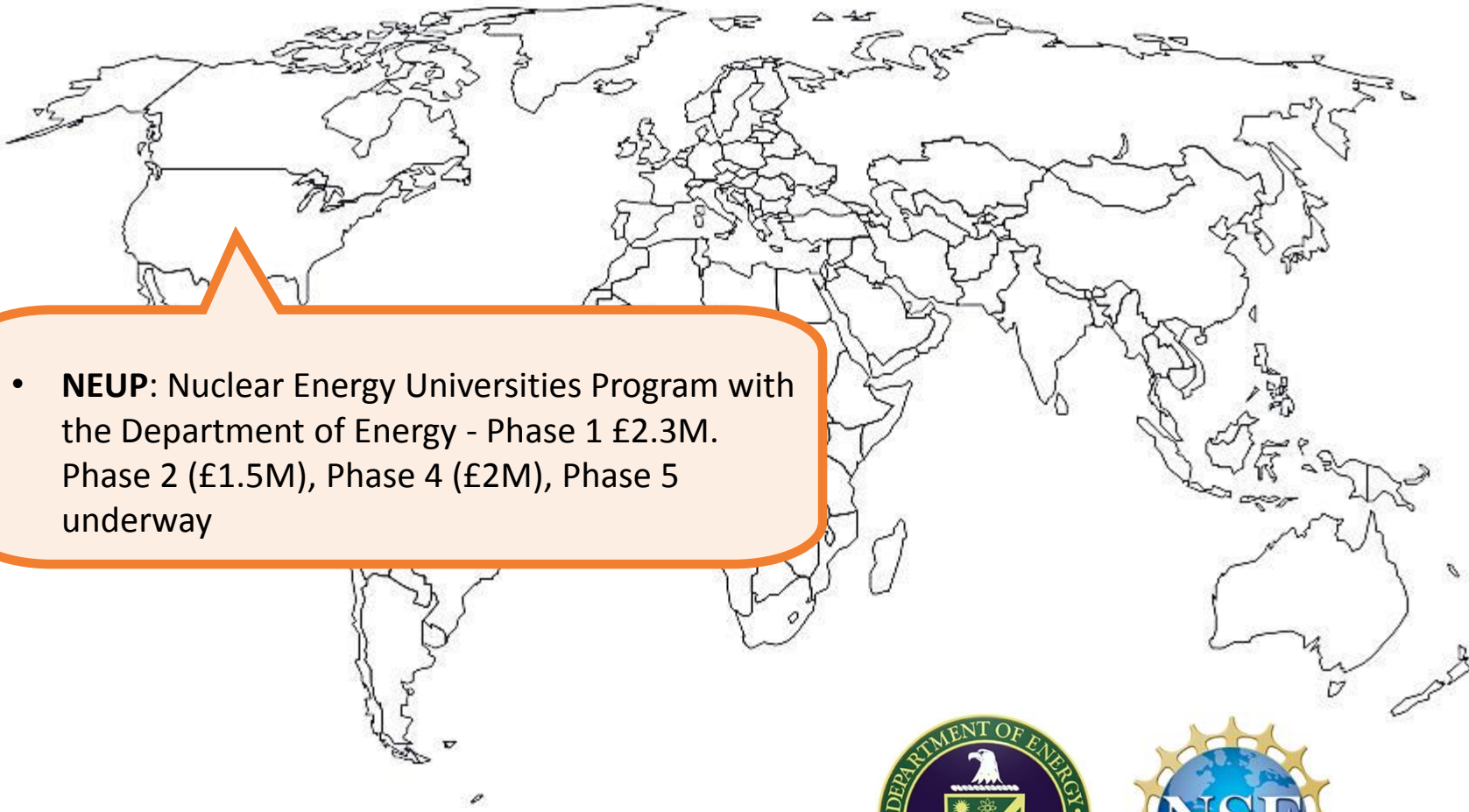
- **Over £30 million invested** over last 6 years with matched Chinese effort.
- **Initiatives in:** renewable energies, grid- scale storage, CCS, cleaner fossil fuels, smart grids, vehicles to grid , low-carbon cities with NSFC, off-shore renewables, Low Carbon Manufacturing





- **£20M invested** over last 4 years with matched Indian effort
- **Initiatives in:** solar energy, smart grids & storage, fuel cells, bridging the urban rural divide and civil nuclear
- **Developing collaboration** with India in civil nuclear (with agreement from FCO) and joining Global Centre for Nuclear Energy Partnerships (GCNEP)



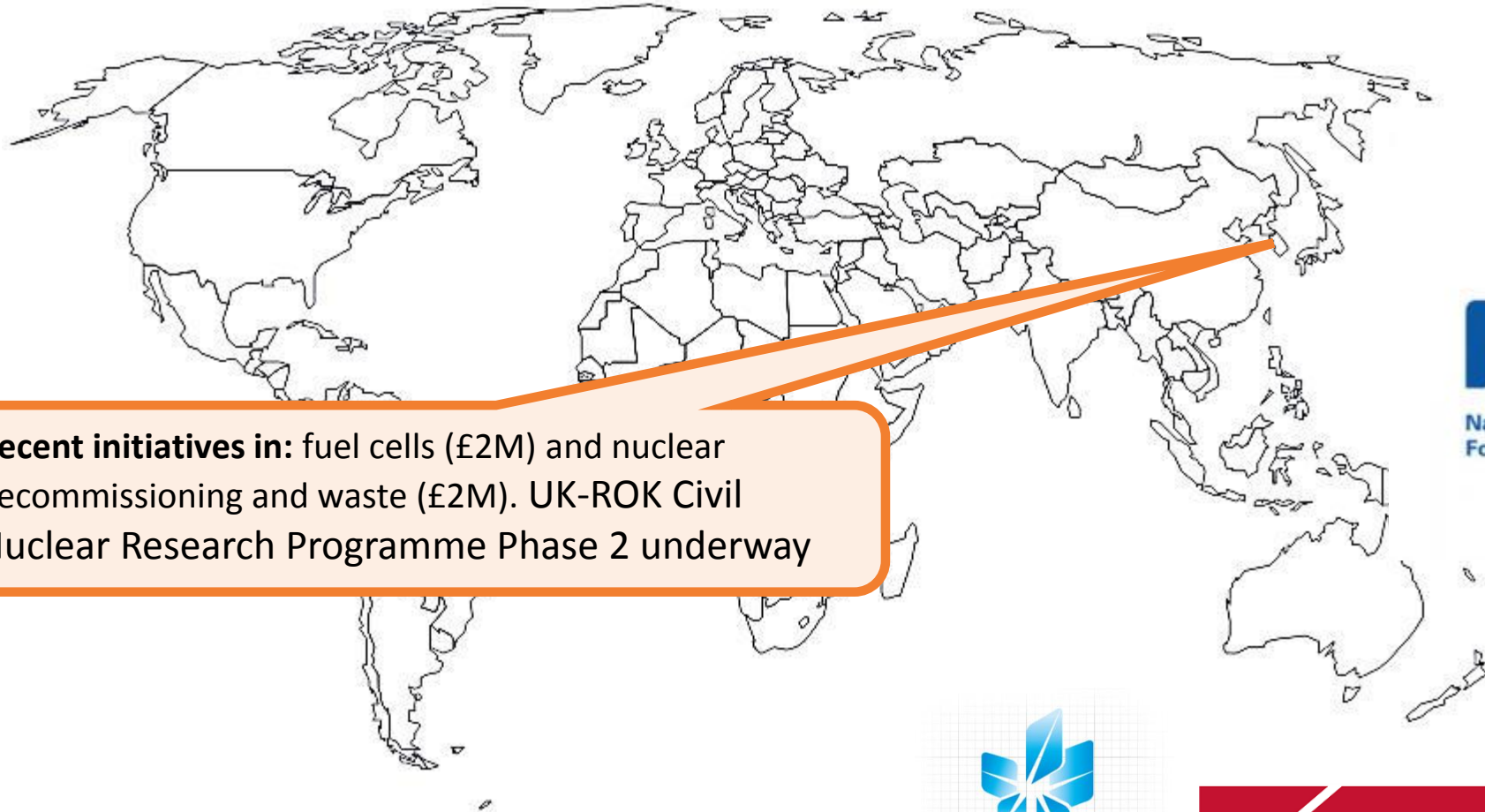


- **NEUP:** Nuclear Energy Universities Program with the Department of Energy - Phase 1 £2.3M. Phase 2 (£1.5M), Phase 4 (£2M), Phase 5 underway





International – New partners: Republic of Korea



Recent initiatives in: fuel cells (£2M) and nuclear decommissioning and waste (£2M). UK-ROK Civil Nuclear Research Programme Phase 2 underway



