Overview of the Energy Global Research Priority

The Energy GRP

Why Energy?

Arguably the single biggest challenge to mankind over the next 50 years – a truly global issue

Involves all sectors of the research community

Recognised by funding councils as major issue

Objectives of the Energy GRP

1. Draw together Energy Research Community
2. Provide Critical Mass
3. Use the Campus as a living laboratory

Main Themes

WARWICK Global Research Priorities ENERGY

Energy GRP

Power Electronics

Solar Energy

Thermal Energy

Energy Storage

Energy Management

Low Carbon Transport

Power Electronics

Dependence on electrical power is set to grow as dependence on fossil fuels reduces so how power is delivered via a smart grid infrastructure is a critical issue.

- Research includes:
  - Underpinning technologies
  - Transformations of networks
  - Electrical vehicle systems
  - Security and reliability of supply

Solar Energy

Efficient conversion of the sun's energy into electrical energy is the main focus of this theme, using conventional crystalline and organic materials

Solar research at Warwick includes:

- Evaluation of solar thermal and photovoltaic systems
- Improvement of materials and development of cost-effective silicon photovoltaics
- High performance vacuum flat plate solar thermal collectors for hot water and process heat

Thermal Efficiency

This theme focuses on the processing of heat from the sun or other sources to provide electrical energy as well as heating and cooling.

Thermal research includes:

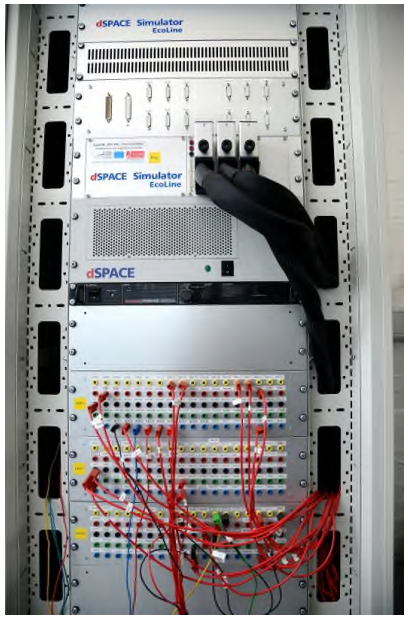
- Transformation and upgrading of thermal energy
- Evaluation of thermal energy stores
- Development of cost effective foam external wall insulation system for mass adoption in the UK retrofit market

Energy Storage

UK and global energy networks face a unprecedented challenges during the next few decades

Research into energy storage is key to provide solutions to these challenges, at Warwick this includes:

- Grid-scale storage
- Thermal storage
- Battery storage



Warwick also has £13m Energy Innovation Centre which covers electrical storage R&D from novel electrochemistry through to full battery packs for electric and hybrid vehicles.

Energy Management

The global energy industry faces challenges from growing demand in developing economies, alternative sources of supply, climate change, regulation and energy security.

Theme includes:

- Research into changes in structure and new business models in the Energy Industry
- Energy Security
- Global Energy MBA programme - brings together people from a wide range of sectors to develop industry leaders of tomorrow
- Energy Management on Campus

Low Carbon Transport

Warwick is at the centre of developments in electric vehicle technologies in the UK.

Rapid improvements in this technology will allow the decarbonisation of transport to take place.

Warwick research includes:

- Vehicle Engine Testing Facility – state of the art research and facility for testing hybrid capable of testing whole hybrid vehicle powertrains, components and subsystems.
- Development of Low Carbon Vehicles
- Advanced Propulsion Centre Hub and co-ordinator of the APC Electrical Energy Storage Spoke

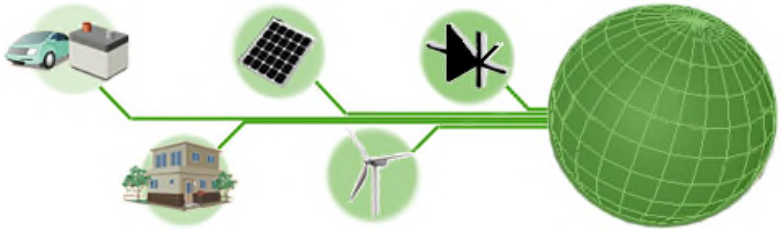
Major Research Projects

WARWICK Global Research Priorities ENERGY

HubNet
The Supergen Energy Networks Hub

Research Councils UK Energy For a Low Carbon Future

Top and Tail Transformation
A Grand Challenge in Energy Networks

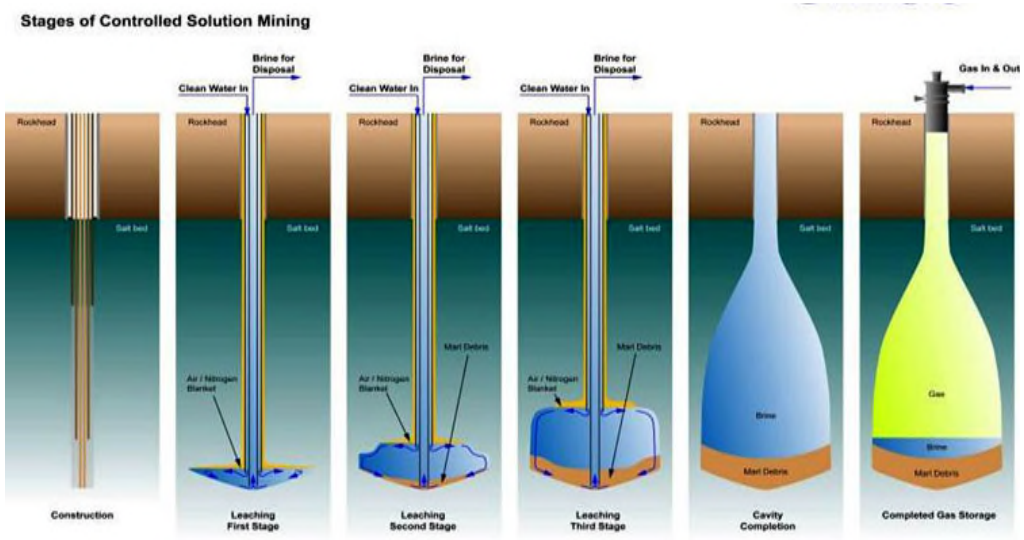


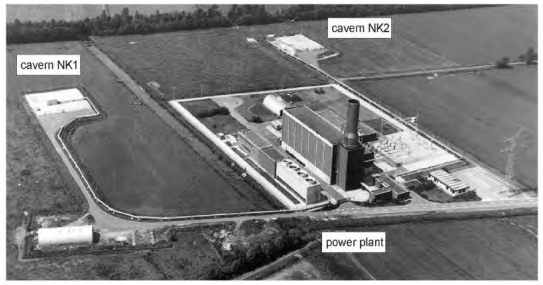
Major Research Projects

- Warwick one of six Midlands universities in Chancellor's announcement of £60 million for energy research
- Funding will see a step change in energy research in critical areas such as thermal energy and energy storage.
- Partnership between six leading UK Universities - the University of Warwick and the Universities of Birmingham, Nottingham, Loughborough, Aston and Leicester - and the British Geological Survey (BGS)

Major Research Projects

Integrated, Market-fit and Affordable Grid-scale Energy Storage





IMAGES

Number of rocks types could provide storage horizons

Salt – ideal storage horizon

- thick beds or flow structures
- ductile & flows
- very high impermeability - gas tight
- 'easily' create large voids by solution mining – pressure vessels

2 salt cavern facilities in world

- Huntorf, Germany (1978)
- McIntosh, USA (1981)

Major Research Projects

Vehicle Electrical Systems Integration (VESI)

- Aim: Reduce the cost, size and improve reliability of the electrical power systems by integration of functionality in automotive applications
- £3.5m multi-partner project funded by EPSRC (led by Professor Phil Mawby, School of Engineering at the University of Warwick)
- 6 themes which include semiconductors, design tools, packaging, motors, converters and passives

i-STUTE

Research Councils UK Energy For a Low Carbon Future

interdisciplinary centre for

Storage,

Transformation and **U**pgrading

of

Thermal

Energy

WARWICK

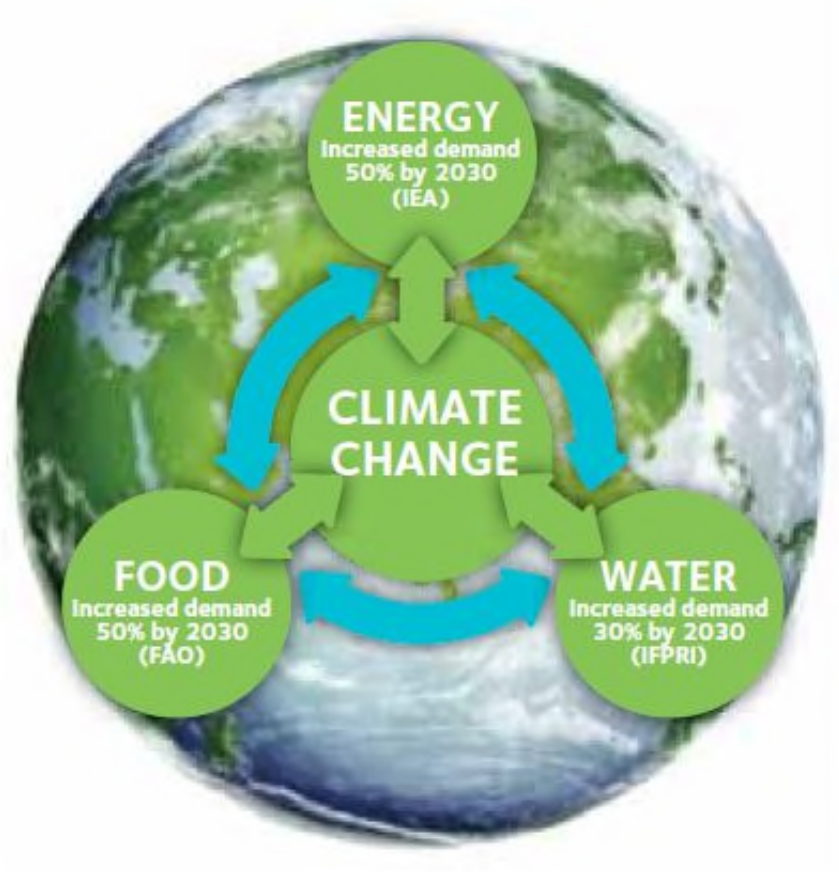
Midlands Energy Consortium

- Comprises the University of Birmingham, Loughborough University, University of Nottingham, the University of Warwick and the British Geological Survey.
- The Consortium has over 200 staff and 900 postgraduate students active in Energy Research.
- Hosts the Energy Technologies Institute (ETI) - a public-private partnership established to speed up deployment of new low-carbon energy technologies
- Focus for dialogue with Research Councils
  - EPSRC meeting on energy research strategy November 2014

Nexus Research

- Nexus approaches recognise the **intricate connections** between **water, energy and food** and their **security dimensions** across space and time and particularly in the context of **climate change and other global challenges**.
- Sustainable development will require *consideration of the interlinkages between different sectors* and assessments of the *synergies and trade-offs* in multiple future scenarios.
  - Recent focus on growth/poverty reduction has resulted in the term 'sustainable prosperity'
  - Global population and resource demands are challenged by resource availability

Globally rising demand pressures



The ESRC Nexus Network

- http://thenexusnetwork.org/
- ESRC funded, led by University of Sussex, University of East Anglia and Cambridge Institute for Sustainability Leadership.
- **Aims**
  - Develop **collaborative projects and improve decision making** on food, energy, water and the environment.
  - Support **interdisciplinary, cross-sector collaborations between social and natural scientists**, and between academic researchers and those in government, business and civil society engaged in these debates.
  - **Develop and share new methodologies, data, conceptual frameworks, skills and practices**
- **NEXUS2020: The nexus and business**
  - ***What are the most important questions around business practice that, if answered, could help companies manage their dependencies and impacts upon food, energy, water and the environment?***
  - http://www.thenexusnetwork.org/nexus2020-what-are-the-most-important-questions-for-business/

Energy Trail

16 innovative points of interest:

- University House Data Centre Cooling
- Lower energy transport, Car Park 15
- Low carbon transport: IARC
- Solar energy: Engineering Building
- Absorption refrigeration: Mathematics and Statistics
- Solar tracker
- Self regulating smart building: IIPSI
- Low energy technology and design: IDL
- Bluebell thermal storage
- Low energy technology and design: CTU
- Energy efficient technology and design: CMCB
- Student designed wind turbine, Cryfield sports pavilion
- Energy efficient technology and design: Sherbourne
- Energy efficient technology and design: WBS
- Solar energy: MAS
- Combined heat and power (CHP) system