

# Supergen



# Rationale for gasification in the UK

[supergen-bioenergy.net](http://supergen-bioenergy.net)

We work with academia, industry, government and societal stakeholders to develop sustainable bioenergy systems that support the UK's transition to an affordable, resilient, low-carbon energy future.

Supergen Bioenergy Hub

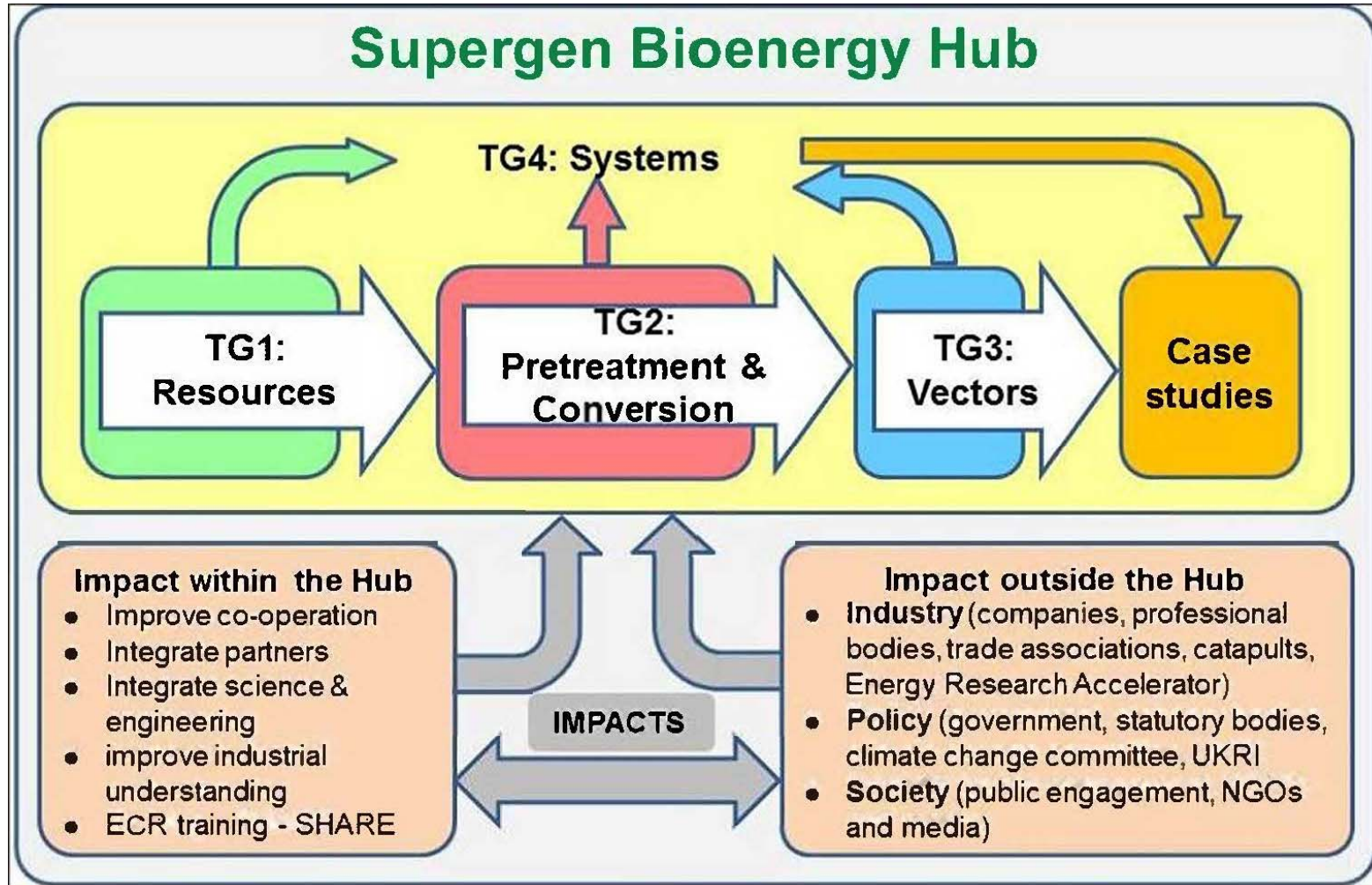


Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Hub structure

Director: Patricia Thornley



Supergen Bioenergy Hub



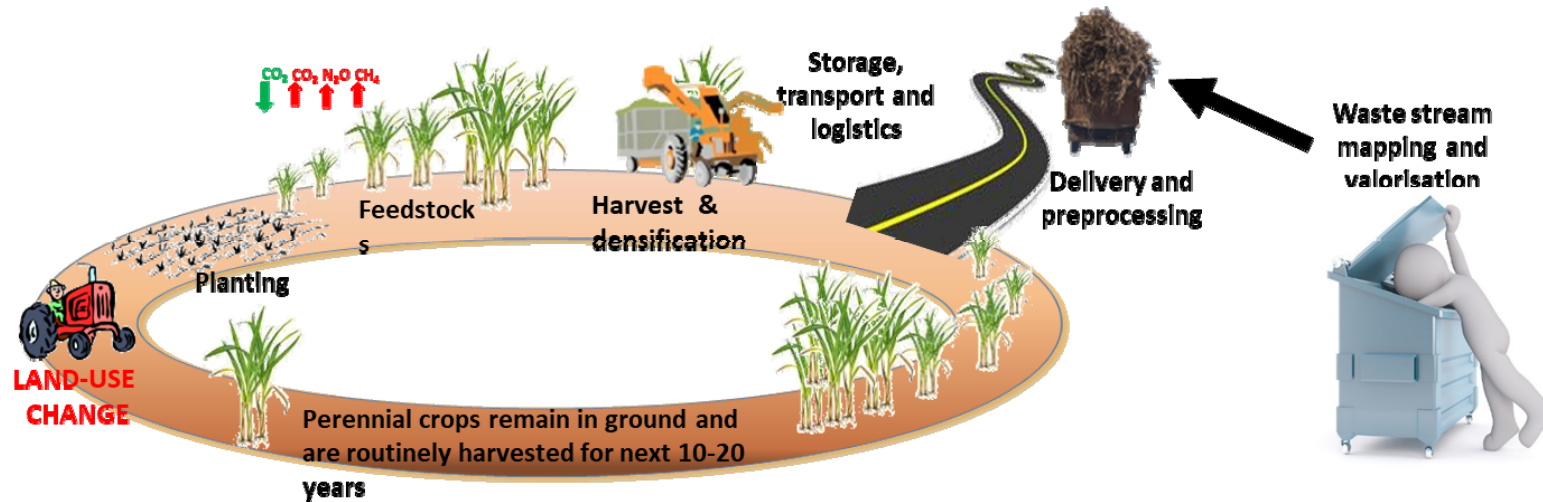
Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Topic Group: Resources

Iain Donnison (Aberystwyth University), Rebecca Rowe (Centre for Ecology and Hydrology)

## Biomass and waste feedstocks for energy and transport fuels



**Research questions:** How can we grow biomass on lower grade land, make crops more resilient to extreme weather events, and deliver ecosystem services?

More specifically, how can: **1)** energy crop establishment costs be reduced, yields be reliably increased, and waste streams be mapped and valorised; **2)** biomass be matched to end user requirements; and **3)** positive environmental benefits of energy crop cultivation and waste management be maximised and negative impacts minimised?

Supergen Bioenergy Hub



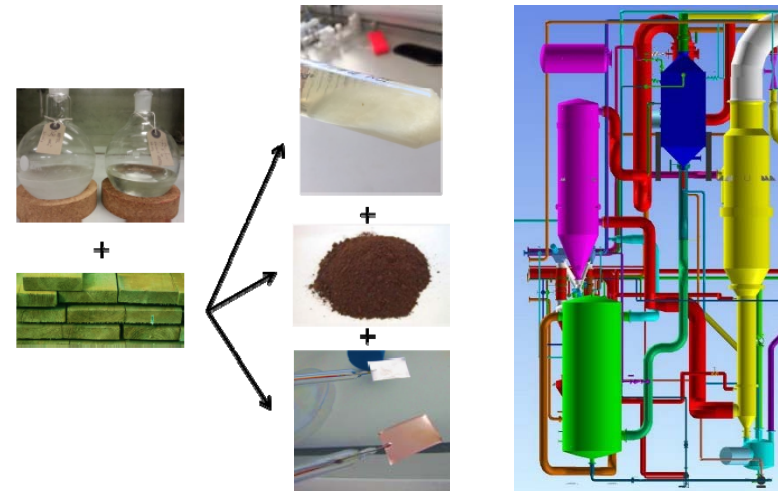
Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Topic Group: Pre-treatment and Conversion

Jason Hallett (Imperial College London), Chris Hardacre (University of Manchester), Tony Bridgwater (Aston University), Katie Chong (Aston University)

- Interface between biomass and its conversion and the important interactions
- How do feedstock characteristics influence the choice of pre-treatment and conversion technology?
- How does choice of pre-treatment and/or conversion technology influence choice of the most suitable feedstocks?
- Focus on ionic liquids, photocatalysis, pyrolysis
- Interested in:
  - Heavily contaminated feedstock
  - Economics
  - Circular economy
  - Materials from all streams
    - Biofuels
    - Bioplastics
    - Renewable materials



Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Topic Group: Vectors

Marcelle McManus (University of Bath) and Andrew Welfle (University of Manchester)

- Identify preferred bioenergy pathways that will produce appropriate bioenergy vectors to meet the UK's demands
- Analyse the role that different bioenergy vectors could have within the wider UK energy network
- Determine how these fit within the UK's wider bioenergy, bio-refinery and carbon reduction strategy
- Aim to reduce emissions, reliance on fossil fuel and improve national and regional resilience through bioenergy



Supergen Bioenergy Hub



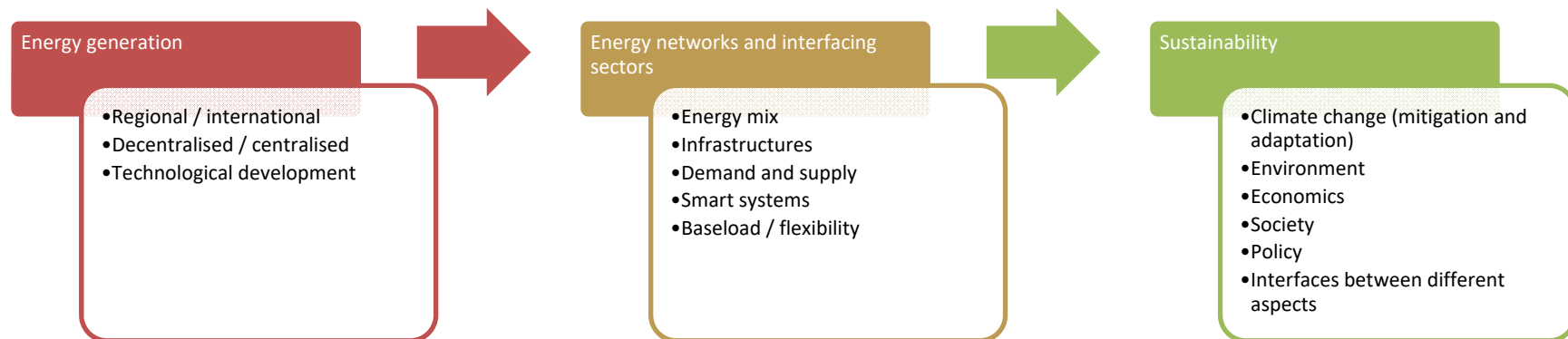
Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Topic Group: Systems

Mirjam Röder (Aston University), Rob Holland (Southampton University), Andrew Welfle (University of Manchester)

- Role and impact of bioenergy on the current and future energy system and interfacing sectors, and its implications for the UK's policy objectives (eg, climate change, sustainability, land use, ecosystem services, waste and circular economy, regional and international development)
- Analyse trade-offs and impacts of bioenergy to address the energy trilemma (affordability, resilience and carbon reductions) and deliver wider benefits
- Assess the impact of the UK's policies on the development and deployment of bioenergy systems and system integration



Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Potential for UK Bioenergy

- Up to 45% of UK bioenergy demand<sup>1</sup>
- 10% electricity (baseload)
- 50% heat (industrial, district, gas)
- 20% liquid fuels (aviation, shipping, heavy duty/mobile plant)

1. Welfle A., Gilbert P., Thornley P., Securing a bioenergy future without imports, Energy Policy, vol 68, 2014

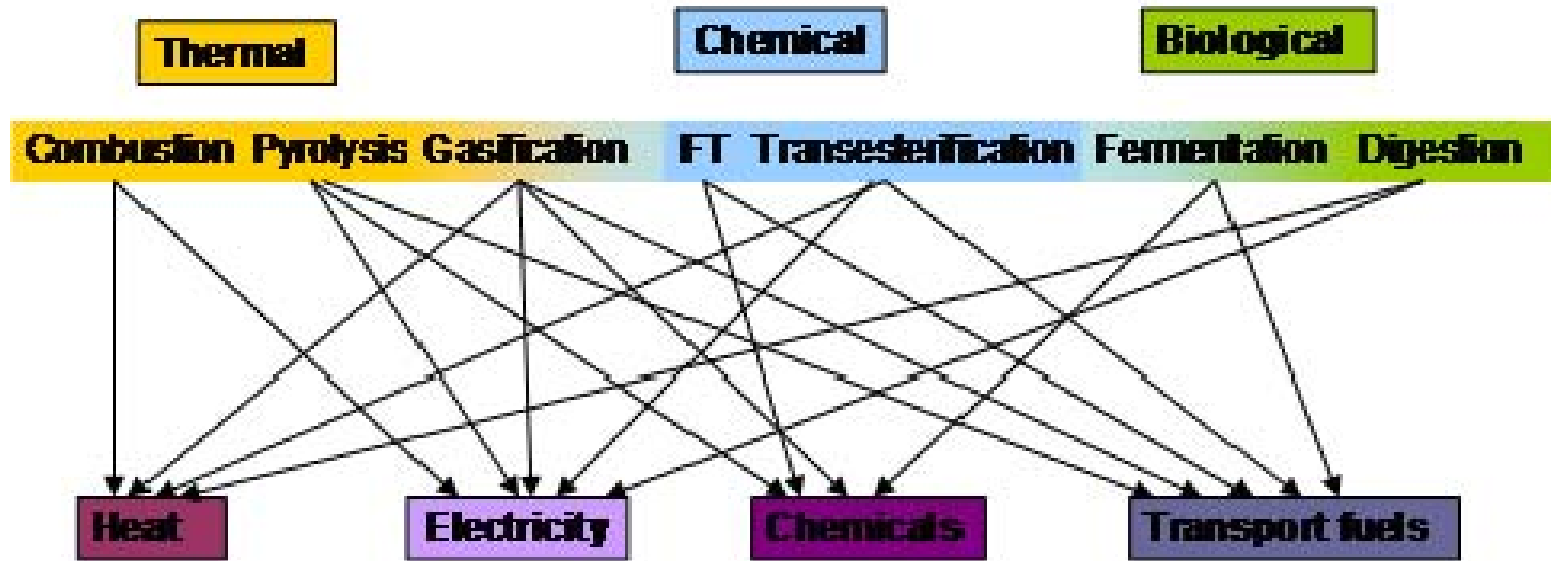
Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Bioenergy range of pathways and products



Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation





## Biomass in a low-carbon economy

Committee on Climate Change  
November 2011



BIOMASS AND BIOENERGY 81 (2015) 35–43



ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

<http://www.elsevier.com/locate/biombio>



### Research Paper

## Maximizing the greenhouse gas reductions from biomass: The role of life cycle assessment



Patricia Thornley <sup>a,\*</sup>, Paul Gilbert <sup>a</sup>, Simon Shackley <sup>b</sup>, Jim Hammond <sup>b</sup>

<sup>a</sup> Tyndall Centre for Climate Change Research, School of Mechanical, Aerospace and Civil Engineering, University of Manchester, M13 9PL, UK

<sup>b</sup> UK Biochar Research Centre and School of Geosciences, University of Edinburgh, Crew Building, The King's Buildings, Edinburgh, EH9 3JN, UK

#### ARTICLE INFO

##### Article history:

Received 27 August 2014

Received in revised form

3 May 2015

Accepted 4 May 2015

Available online

##### Keywords:

Biomass

Electricity

Chemicals

#### ABSTRACT

Biomass can deliver significant greenhouse gas reductions in electricity, heat and transport fuel supply. However, our biomass resource is limited and should be used to deliver the most strategic and significant impacts. The relative greenhouse gas reduction merits of different bioenergy systems (for electricity, heat, chemical and biochar production) were examined on a common, scientific basis using consistent life cycle assessment methodology, scope of system and assumptions. The results show that bioenergy delivers substantial and cost-effective greenhouse gas reductions. Large scale electricity systems deliver the largest absolute reductions in greenhouse gases per unit of energy generated, while medium scale wood chip district heating boilers result in the highest level of greenhouse gas reductions per unit of harvested biomass. However, ammonia and biochar systems deliver the most cost effective carbon reductions, while biochar systems not-

[www.theccc.org.uk/publication/biomass-in-a-low-carbon-economy/](http://www.theccc.org.uk/publication/biomass-in-a-low-carbon-economy/)

# Supergen Bioenergy Hub



Supergen  
Bioenergy

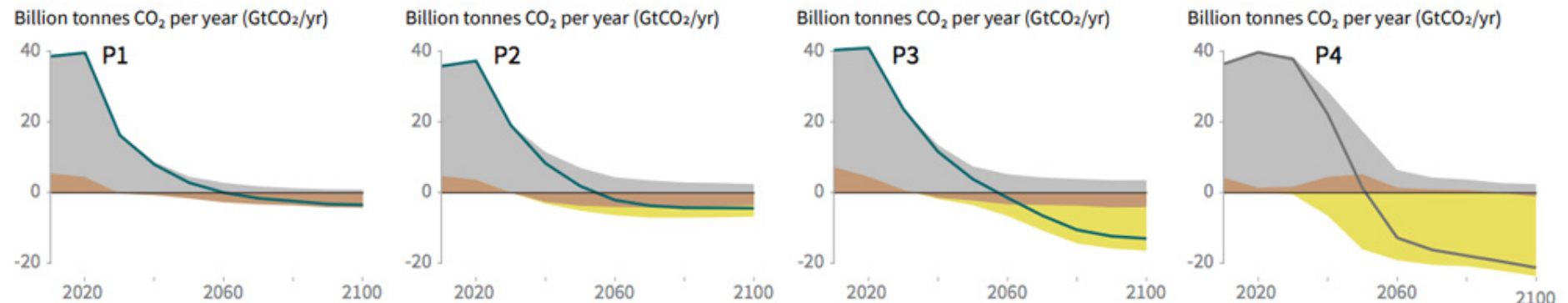
EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# CCC Report: The importance of bioenergy

Bioenergy is particularly valuable in achieving future GHG/climate targets because of its ability to sequester carbon dioxide from atmosphere.

## Breakdown of contributions to global net CO<sub>2</sub> emissions in four illustrative model pathways

● Fossil fuel and industry ● AFOLU ● BECCS



10

Supergen Bioenergy Hub



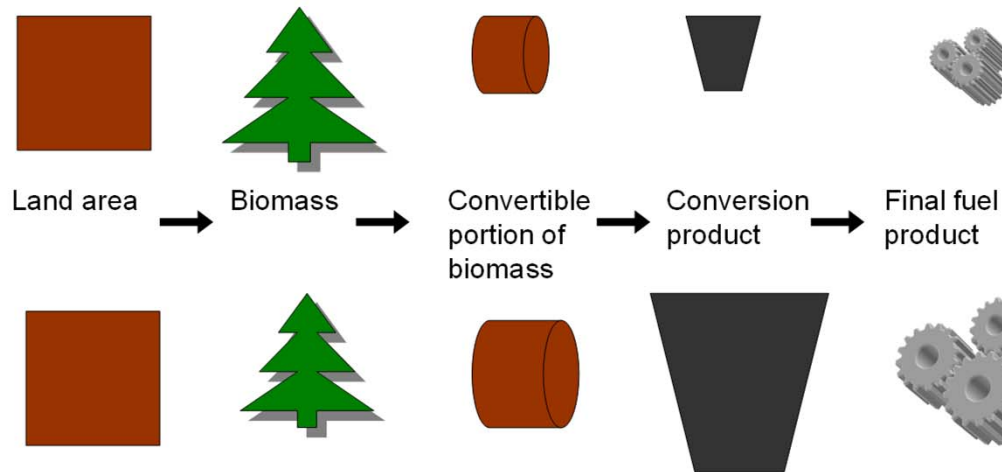
Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Supergen



*First generation*



*Second generation*

Thornley, P., "Biofuels Review", Report for Government Office for Science, prepared as part of the Foresight Programme, June 2012

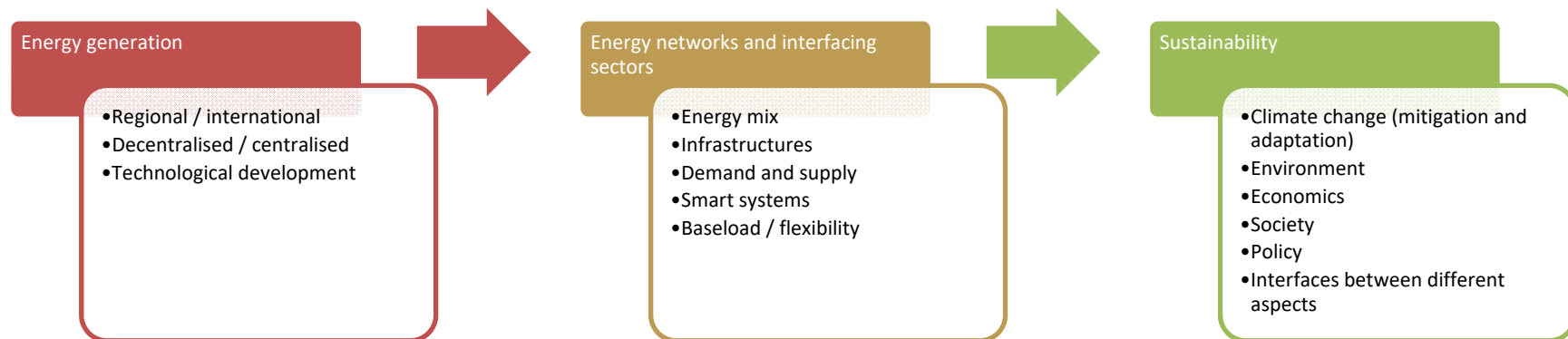
Supergen Bioenergy Hub



# Topic Group: Systems

Mirjam Röder (Aston University), Rob Holland (Southampton University), Andrew Welfle (University of Manchester)

- Role and impact of bioenergy on the current and future energy system and interfacing sectors, and its implications for the UK's policy objectives (eg, climate change, sustainability, land use, ecosystem services, waste and circular economy, regional and international development)
- Analyse trade-offs and impacts of bioenergy to address the energy trilemma (affordability, resilience and carbon reductions) and deliver wider benefits
- Assess the impact of the UK's policies on the development and deployment of bioenergy systems and system integration



Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

# Our members



Supergen Bioenergy Hub



# Follow us



@SupergenBioHub



Supergen Bioenergy Hub

Visit [supergen-bioenergy.net](http://supergen-bioenergy.net)

Email [supergen-bioenergy@aston.ac.uk](mailto:supergen-bioenergy@aston.ac.uk) to sign up to the mailing list

Supergen Bioenergy Hub



Supergen  
Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation