



# Supergen



Bioenergy

## What next for (bio)energy?

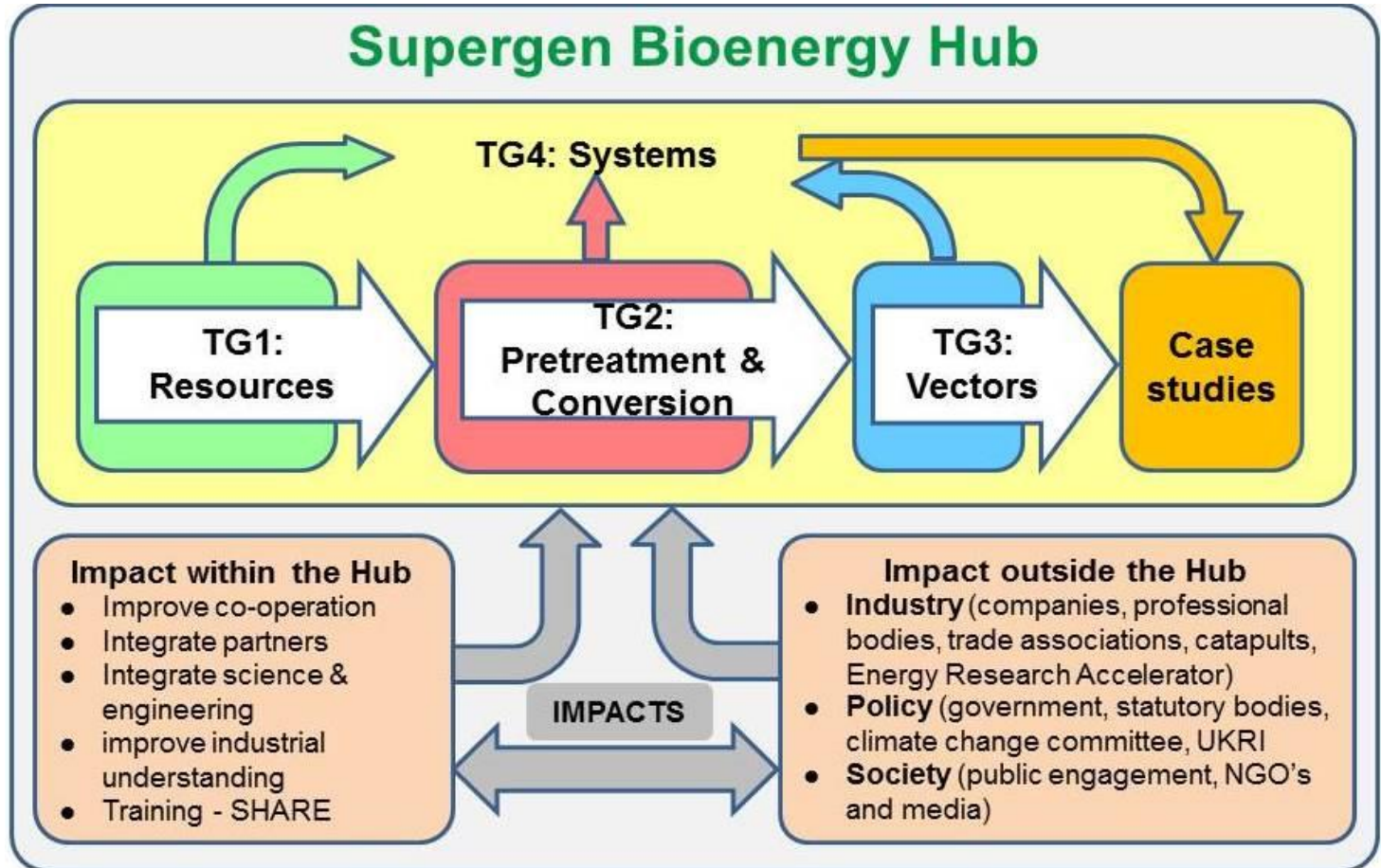
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Bioenergy Research Institute  
National Research Network  
Low Carbon Energy and Environment Cluster  
5 September 2018



Aston University

**EBRI**  
European Bioenergy Research Institute

# Supergen Bioenergy Hub



# Vision 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

# Evolution of UK Bioenergy

- Near term flexible heat and power (diverse feedstocks, pollutants, materials, ecosystem benefits, circular economy, pre-treatment)
- Medium term fungible hydrocarbons (catalysis, pre-treatment, yield increases)
- Long term gaseous vectors (gasification, AD, hydrogen) and negative emissions

# Ideal energy system

- Low carbon
- Secure
- Resilient
- Flexible
- Economic



# Challenge for sustainable bioenergy

- Occupation of land - physical & market interfaces e.g. water, food, land, transport, material/product systems
- Many different energy and product vectors with different markets, commercial values, carbon abatement and energy service potential
- Efficient bioenergy systems rely on multiple actors with diverse priorities



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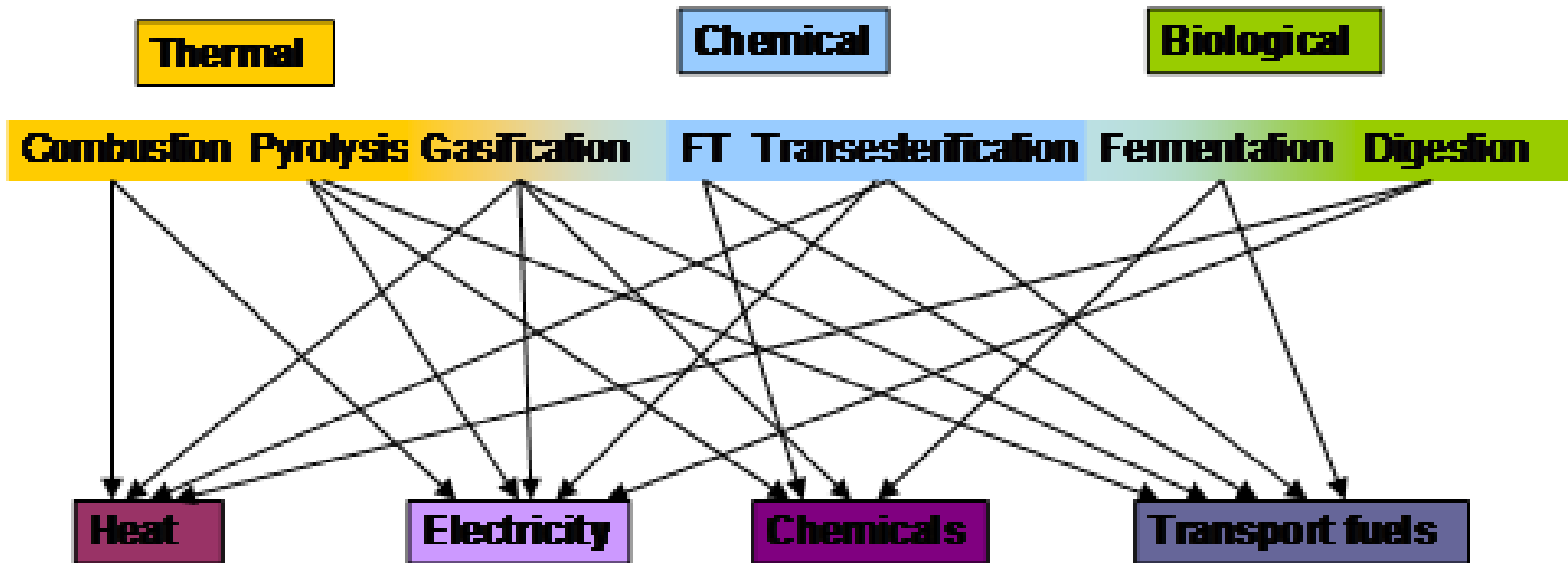
# Production challenges and opportunities

- Land-use
- Climate interfaces
- UK supply
- International supply
- Waste management & circular economy





# Bioenergy technology options



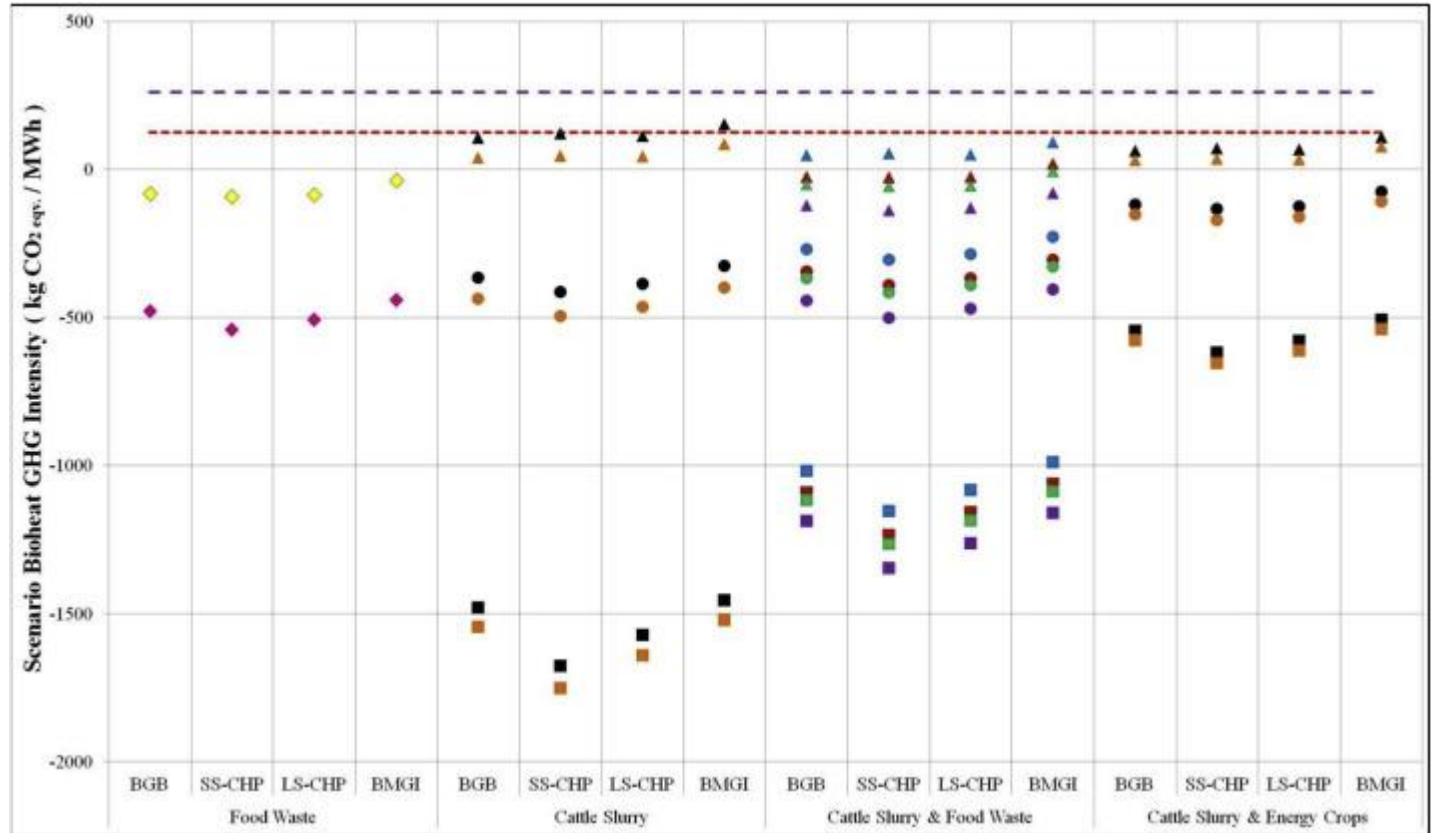
Thornley, P., "Biofuels Review", Report for Government Office for Science, prepared as part of the Foresight Programme, June 2012

# Bioenergy technology: challenges and opportunities

- Agricultural technology
- BECCS
- Renewable gas
- Aviation biofuels



# Bioenergy climate performance



Welfle, A., Gilbert, P., Thornley, P., Stephenson, A., Generating low carbon heat from biomass: Life-cycle assessment of bioenergy scenarios, Journal of Cleaner Production 149, 448-460, 2017

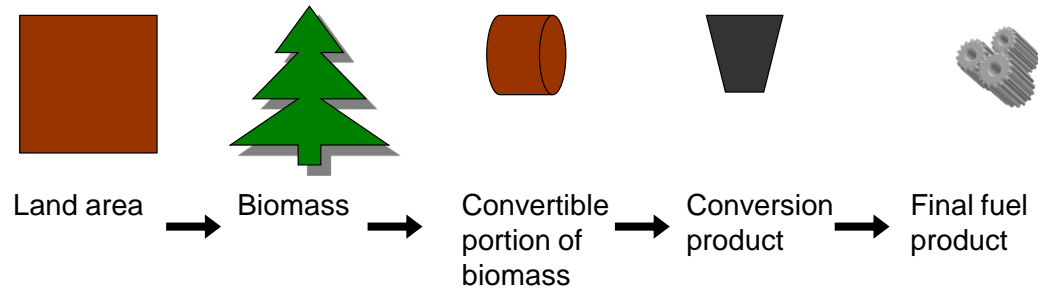
# Climate performance: challenges and opportunities

- Variation
- Variability
- Measurement & validation

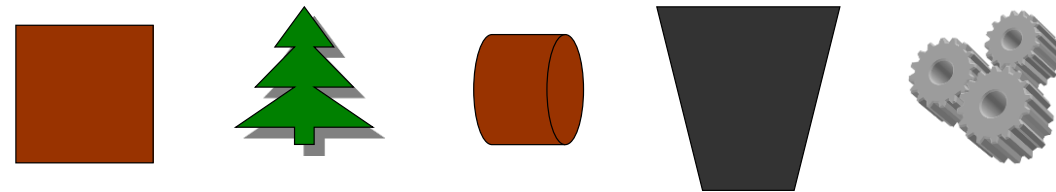


# Ensuring sustainability (1)

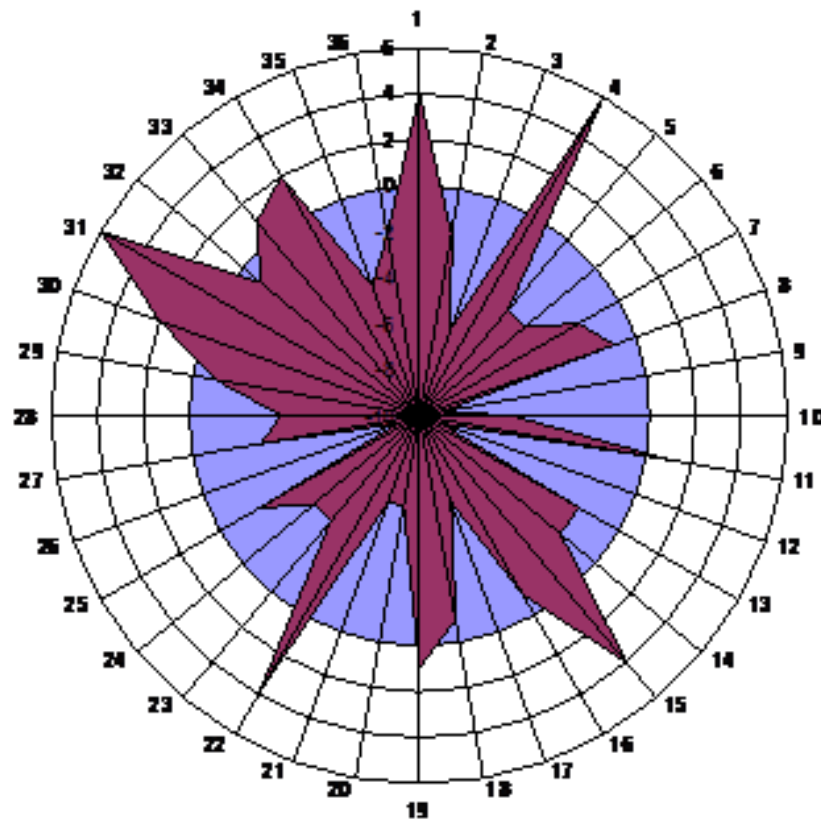
*First generation*



*Second generation*



# Ensuring sustainability (2)



■ Reference level  
■ Scores for Argentinian soy system

# Key points

- Deployment > fossil fuel
- Sustainability beyond carbon
- International import base
- Limits of certification
- Governance framework: risk focused; incentivizes best; recognizes trade-offs and institutional capacity





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