Supergen Bioenergy

Biomass and bioenergy: a vital component of the UK's green economy?

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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

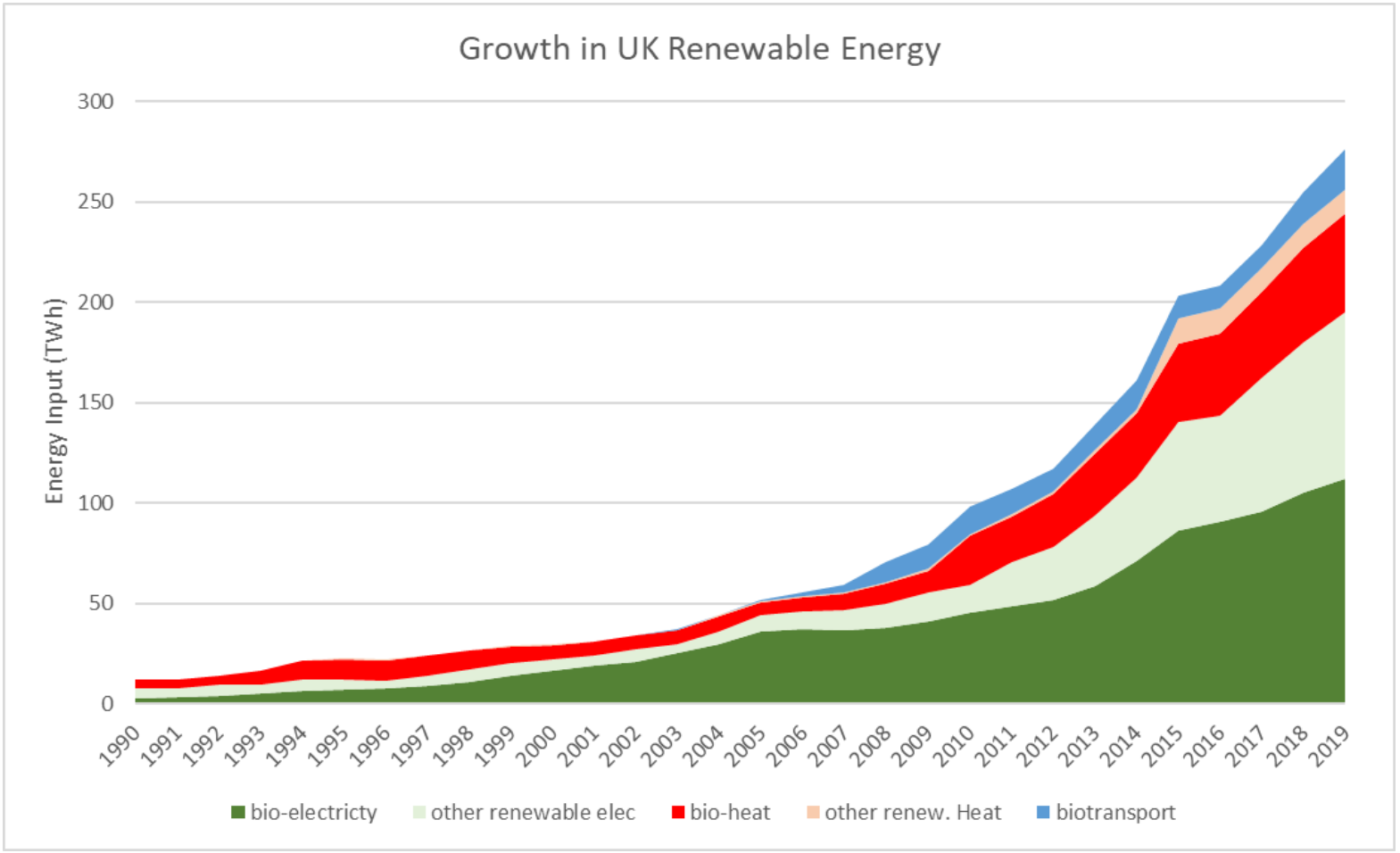
Supergen Bioenergy

EPSRC UK Research and Innovation BBSRC UK Research and Innovation

Overview

1. Current status of UK bioenergy
2. Available feedstocks
3. Conversion technologies
4. Relevant demand sectors
5. Advantages and disadvantages
6. Potential vision for the future of UK bioenergy
7. Research and innovation needs
8. Enabling policy environment

1. Current status of UK bioenergy

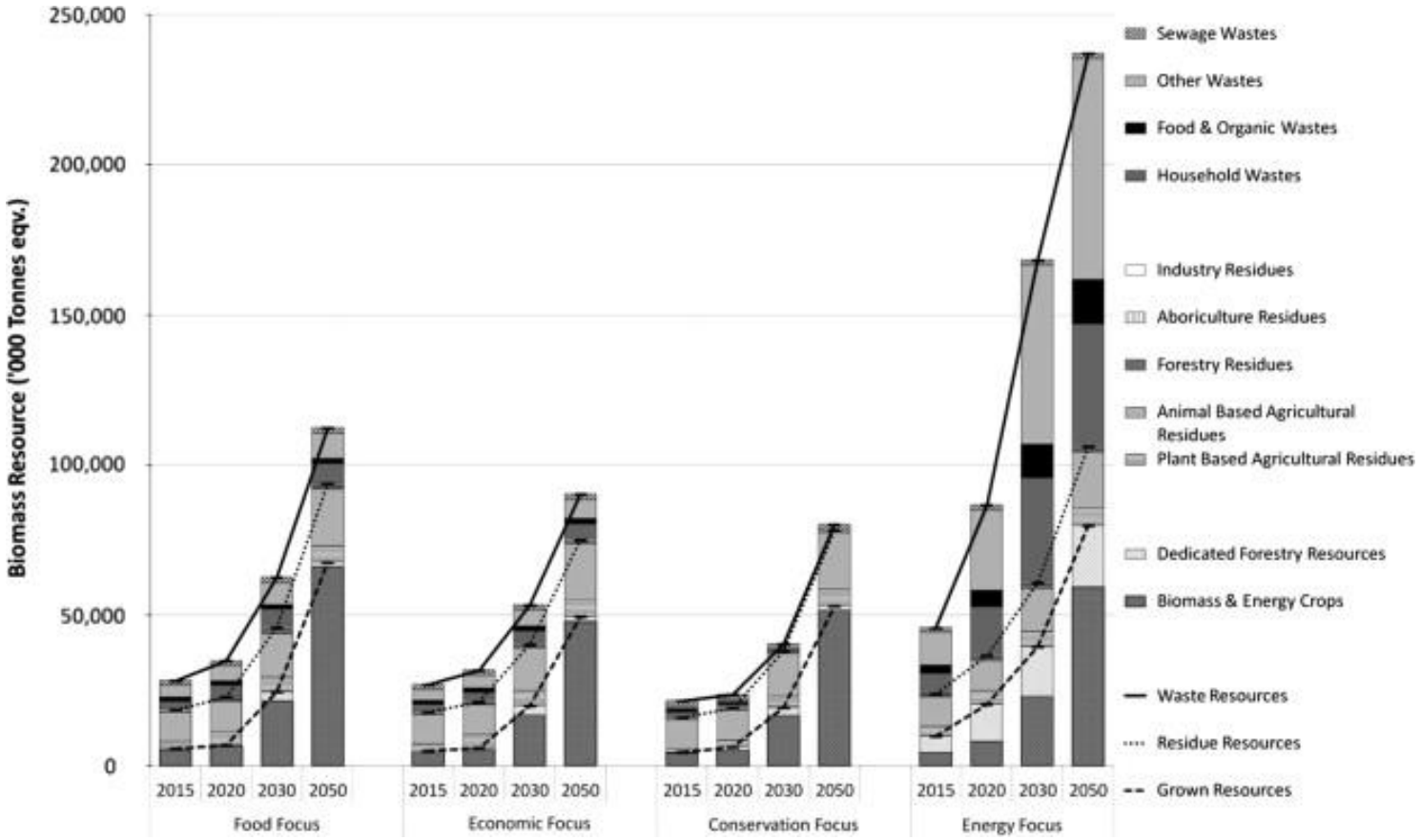


https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2020

Peter Coleman, BEIS

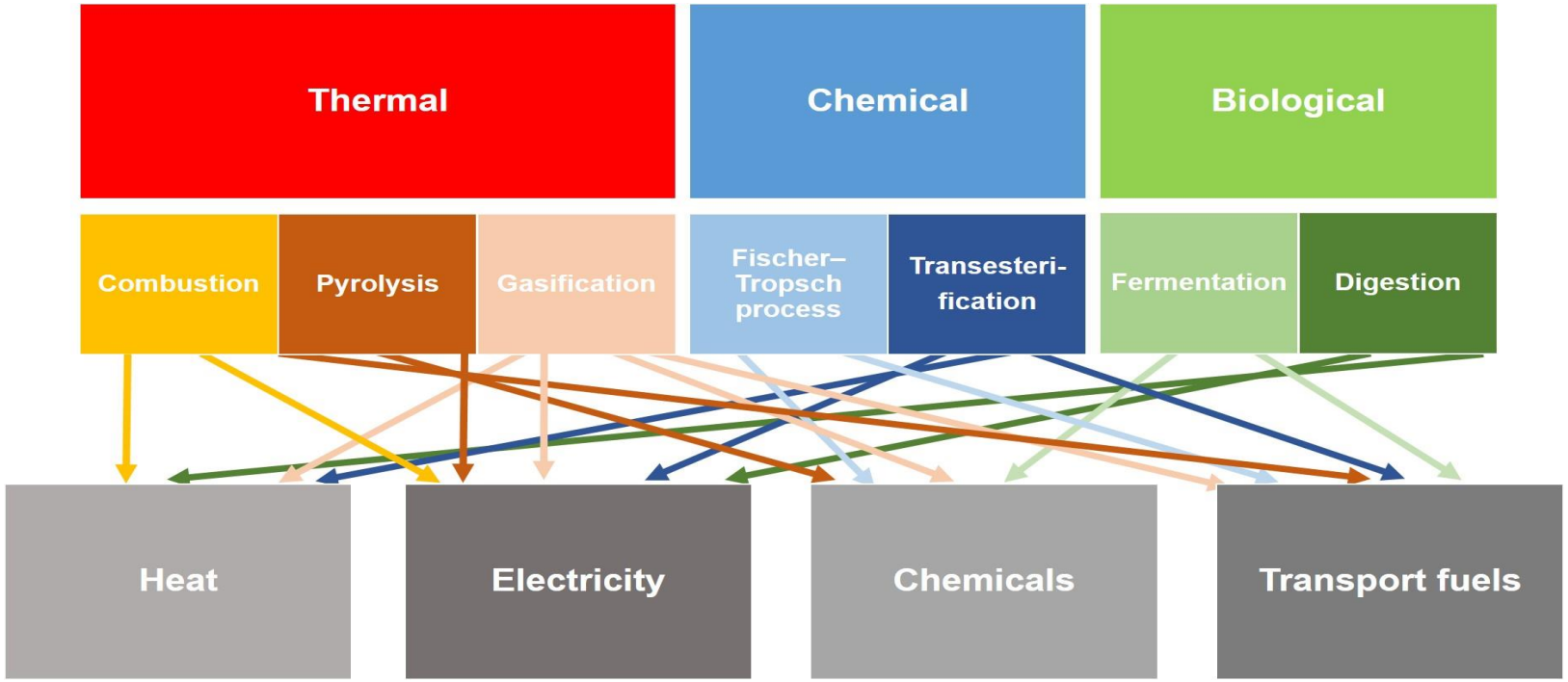
2. Available feedstocks

Available feedstocks (2)



Welfle, Gilbert & Thornley,Securing a bioenergy future without imports, Energy Policy, Volume 68, 2014, Pages 1-14, https://doi.org/10.1016/j.enpol.2013.11.079.

3. Conversion technologies



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

4. Relevant demand sectors

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BIOMASS & BIOENERGY

Research Paper

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

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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 poten-

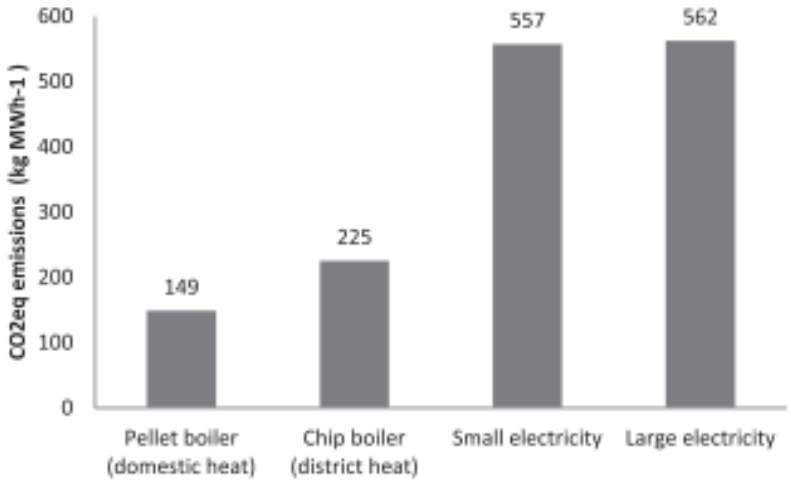
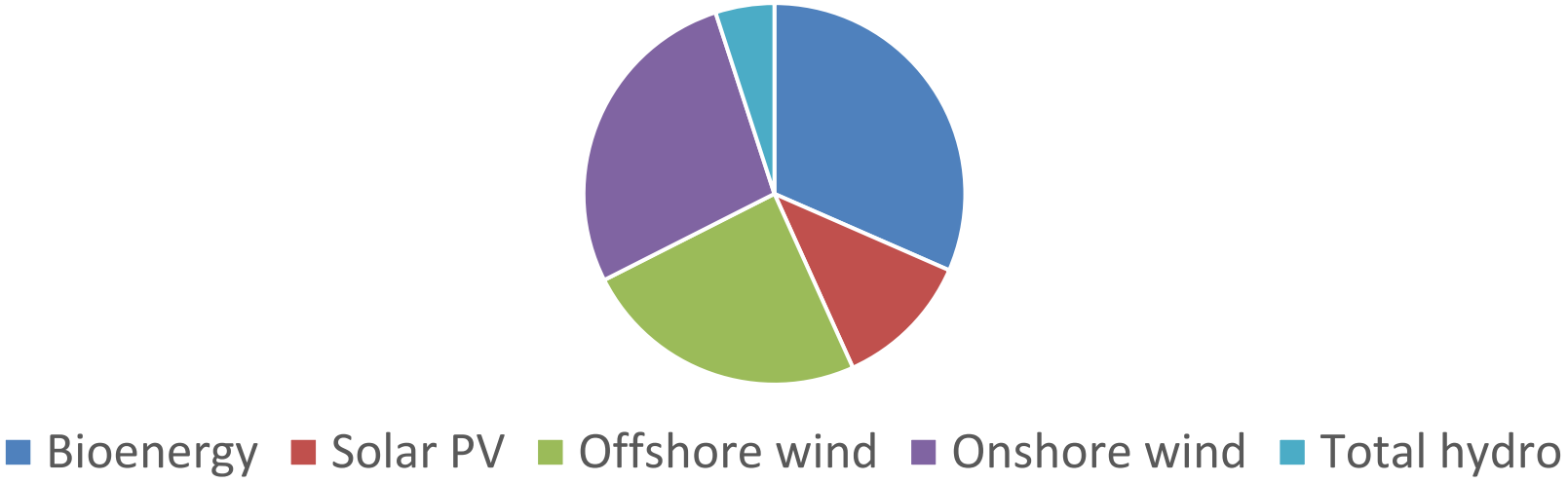


Fig. 2 – Absolute greenhouse gas savings per unit of energy delivered.

Demand sector: electricity from biomass 2018

Electricity generation by fuel source 2018
(Digest of UK Energy Statistics)



Demand sector: electricity

- Electricity generation increased 9.4% from 2018
- Small-scale: 58 new small self-supplying sites in 2018
- Large-scale: Two coal-fired power plant conversions:

  Lynemouth converted to wood (420 MW);
  Drax additional plant biomass capacity (700 MW)
- Energy from waste up 5.5%
- Continued fall of landfill gas (8.6%)

Demand sector: heat

- Historical focus on electricity (NFFO from 1990)

- **Biomethane** from sewage (CHP)
  - 2002: 46 plants 44.9 Mwe
  - 2018: 175 plants 210 Mwe
- RHI: 1 MW min size (sewage plus food); reforming for gas grid injection
- Farms 10% of UK GHG emissions, but >50% of these are methane

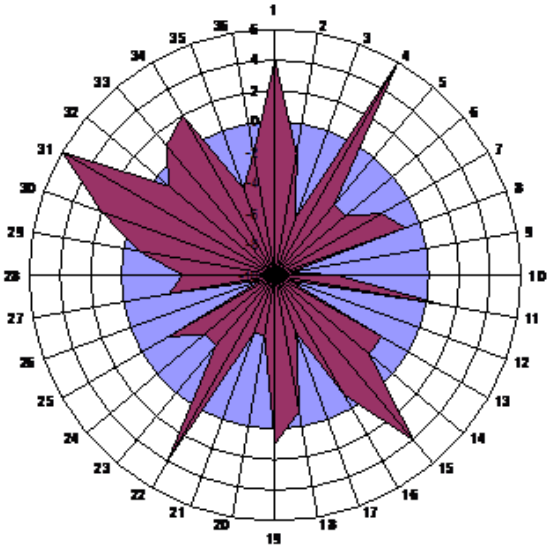
- **Hydrogen:** very efficient gasification pathways (not commercially proven)
- Gas grid injection trials to 20%
- Industrial heat focus

Demand sector: fuels

- Focus on “hard-to-decarbonize” sectors

- **Aviation**
- **Heavy goods vehicles**

5. Advantages and disadvantages



Thornley & Gilbert, "Biofuels: Balancing risks and rewards", Interface Focus, 2013

6. Potential vision for future role for the future of UK bioenergy

- Up to 45% of UK energy demand[1]
- 10% electricity (baseload)
- 50% heat (industrial, district, gas)
- 20% liquid fuels (aviation, shipping, heavy duty/mobile plant)
- Subject of biomass strategy review over next 2 years

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

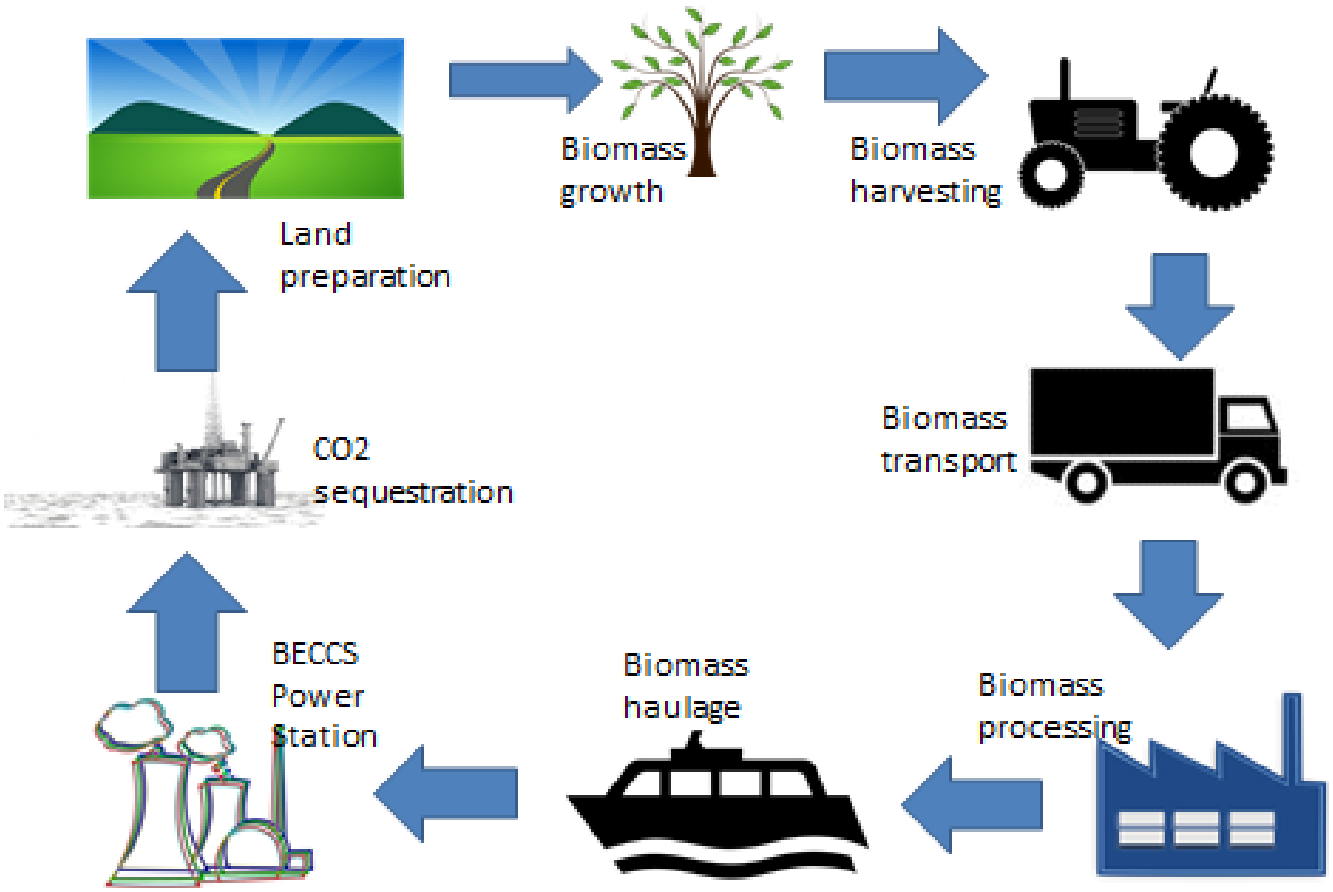
CCC Vision for Biomass in a low carbon economy

"Biomass can be produced and used in ways that are both low carbon and sustainable"

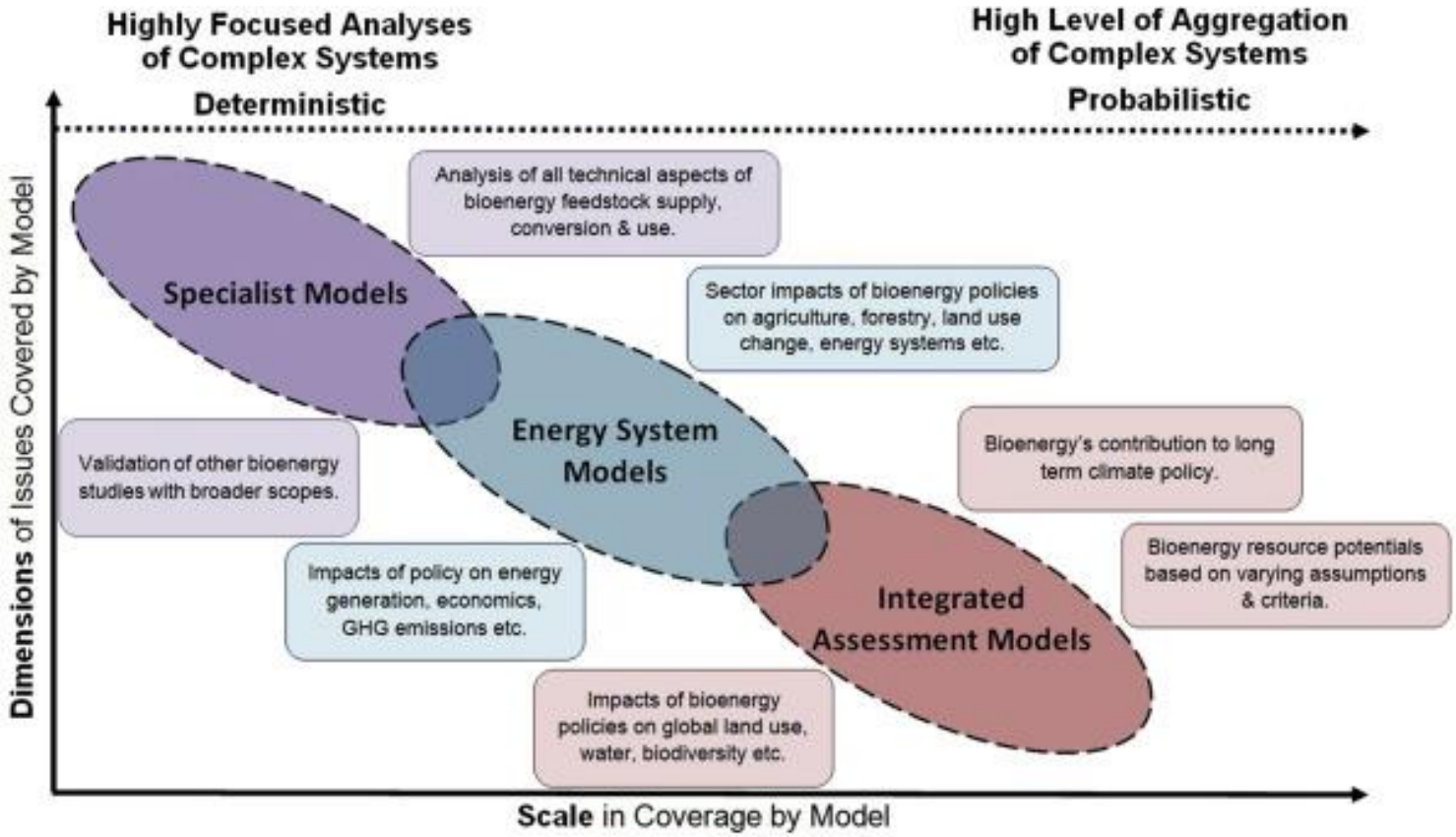
"Biomass can make a significant contribution to tackling climate change"

"There are risks that biomass production and use could in some circumstances be worse for the climate than using fossil fuels"

7. Research and Innovation Needs: BECCS

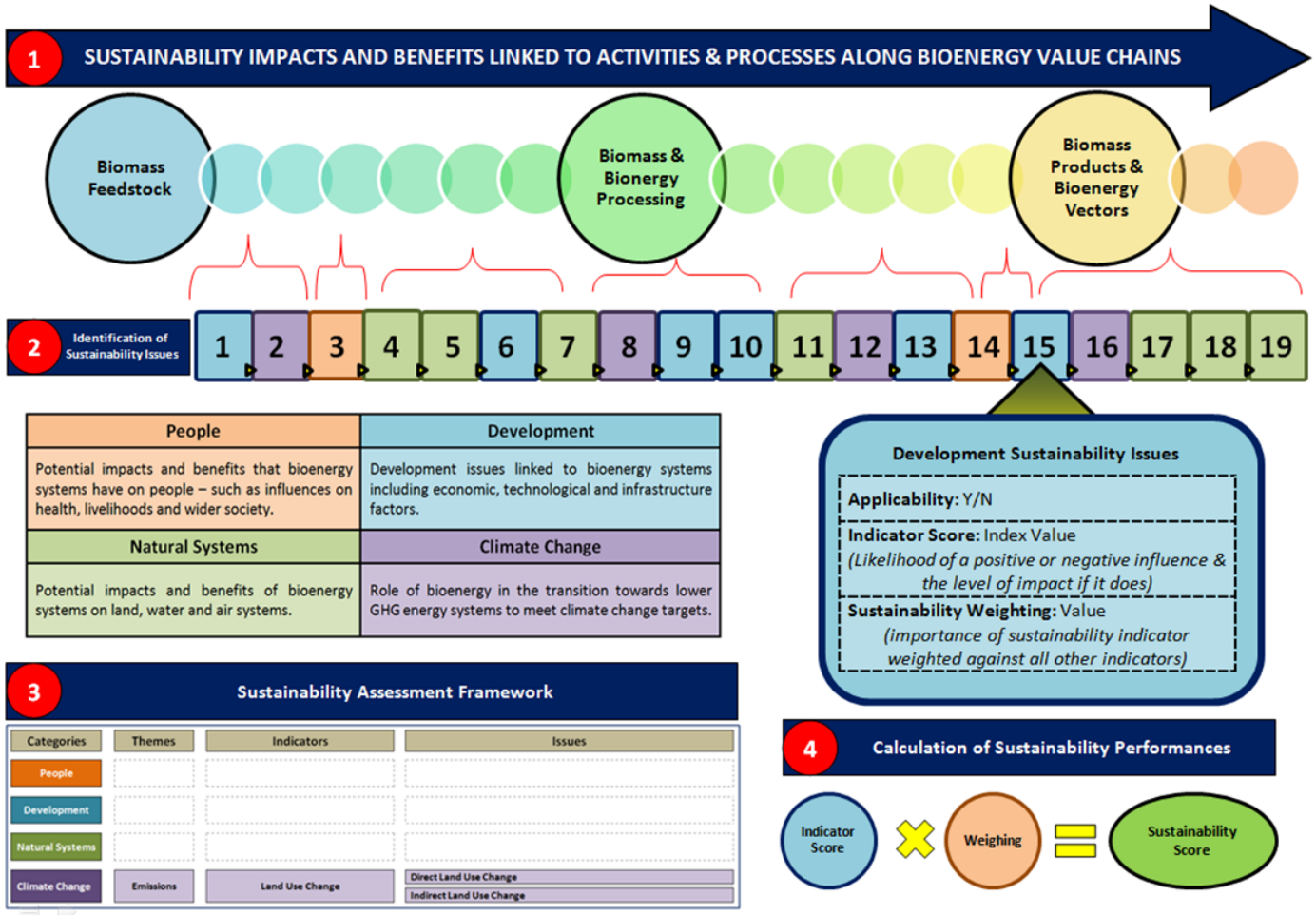


7. R&I Need: Get beyond modelling



Welfle, A., Roeder, M., Thornley, P., A review of the role of bioenergy modelling in renewable energy research & policy development, Biomass and Bioenergy, 2020

7. R&I need: Measuring sustainability



Credit: Andrew Welfle, University of Manchester

8. Enabling policy environment

- 2001: Renewables Obligation
- 2008: Climate Change Act: 80% reduction by 2050
- 2012: Bioenergy Strategy: holistic view of biomass uses in electricity, heat and transport
- 2015: Paris Agreement: “well below 2^{o}C” as soon as possible
- 2019: CCC Biomass in a Low Carbon Economy: aviation; BECCS
- 2019: UK Climate Change Act: “net-zero” by 2050
- 2020: CCC Sixth Carbon Budget: low carbon hydrogen; greenhouse gas removal; woodland
- 2021-2022: Biomass strategy review

Final thoughts

- Prioritize systems with most potential for GHG reductions (stop arguing about how bad the others could be)
- A simple policy framework that counts carbon and incentivizes maximum reductions
- Support technology capital investment with flexibility for feedstocks; consistent benchmarks for demand sectors
- More at Climate Expo: Monday 17 May 12.00-13.00

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