

# Sustainable bioenergy within a net-zero emission target: Synergies between environment, economy and society

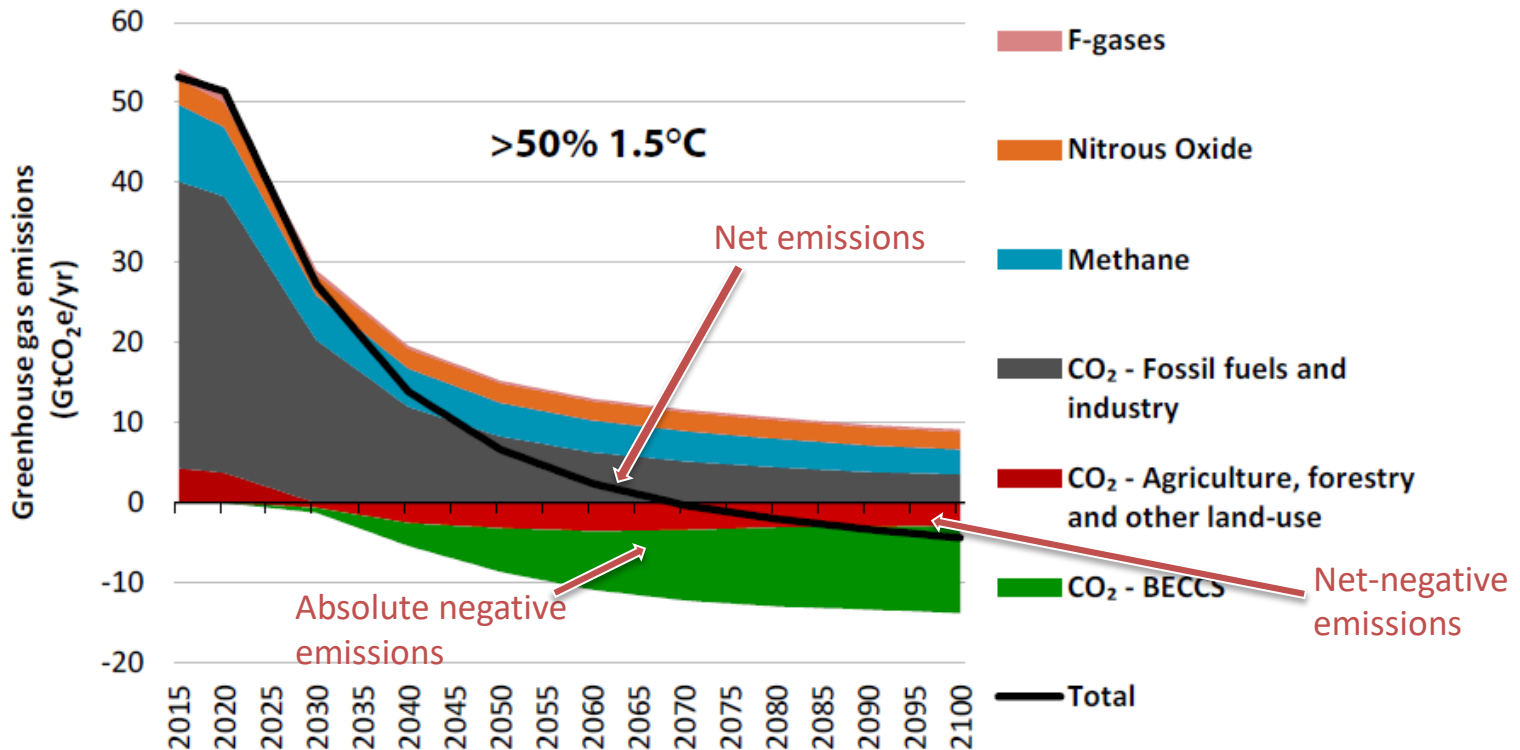
Mirjam Röder, Patricia Thornley - Aston University

Andrew Welfle - University of Manchester

Gothenburg, 6 November 2019

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.

# The challenge of net-zero



Committee on Climate Change(2019). Net Zero – The UK's contribution to stopping global warming

⇒ Net-zero = offset

⇒ Real emissions that need to be offset by negative emissions

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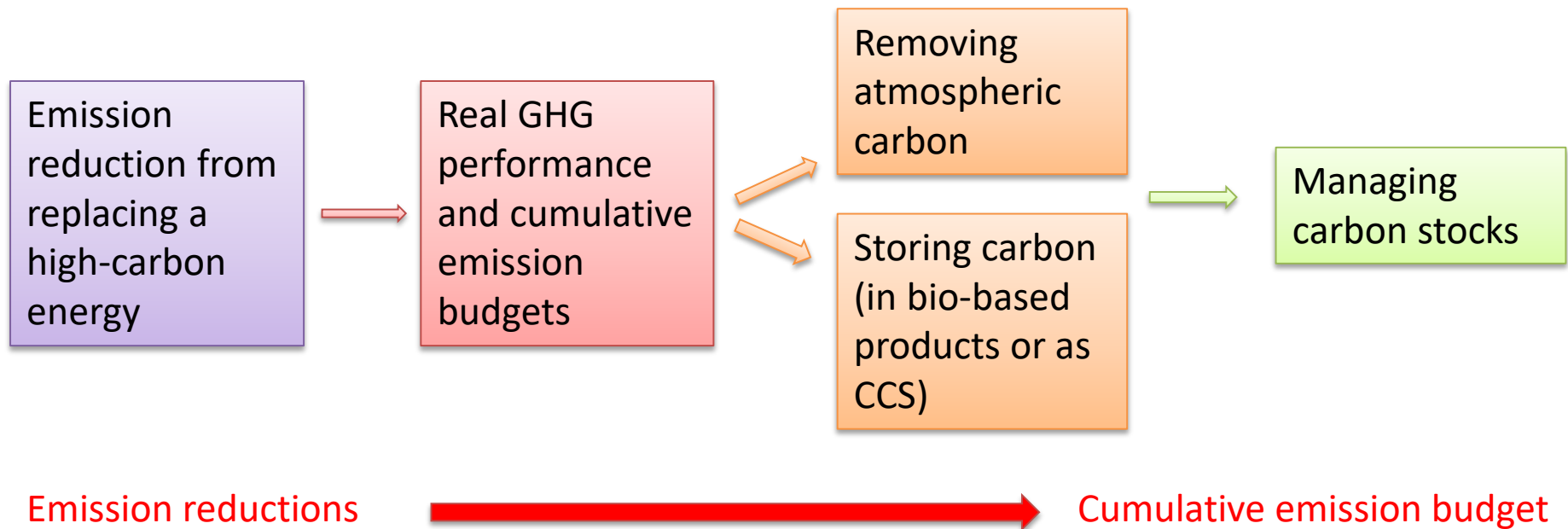


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# The role of bioenergy in a net-zero target

- Biomass sequesters CO<sub>2</sub> from the atmosphere
- Bioenergy in combination with CCS (BECCS) provides longer term removal of CO<sub>2</sub> from the atmosphere (potentially negative emissions)

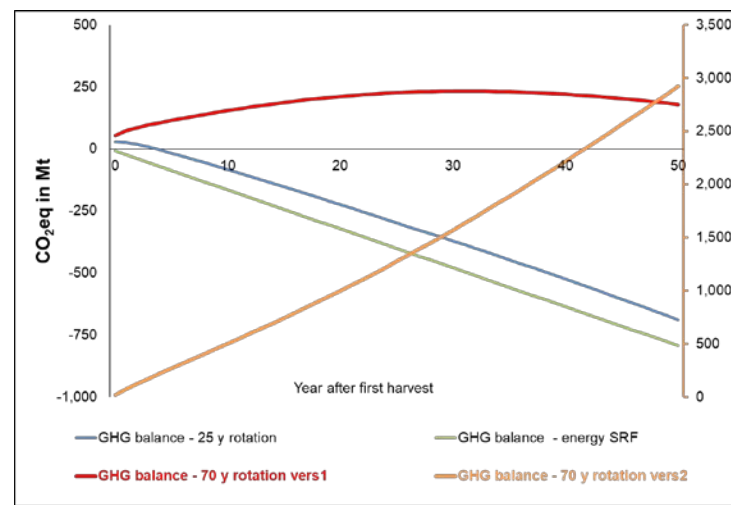
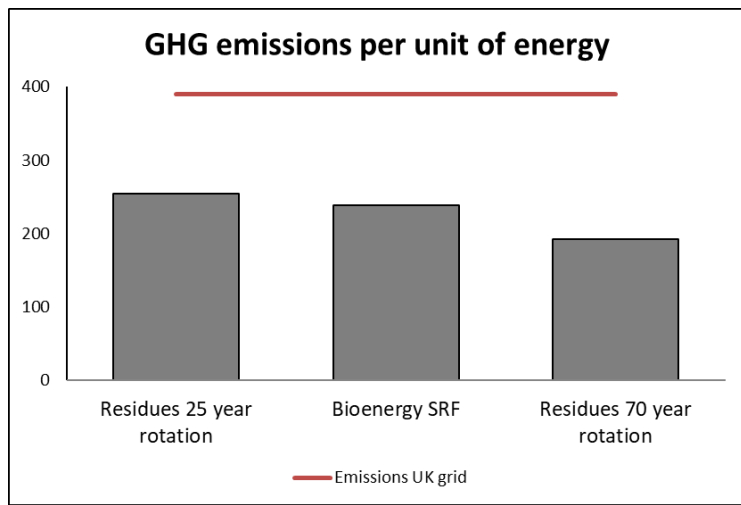


# The challenges of bioenergy in a net-zero target

- Maximizing “negative” emission
  - Most of biomass carbon must be locked in products or CCS
- Accounting and reporting for carbon in international supply chains
  - Who gets what credit?
- Time difference between carbon sequestration and actual storage
  - When does accounting of negative emissions start?
- Traceability of carbon
  - Difficult for processed and waste feedstocks
- Type and mix of bioenergy
  - Technology, application, scale, cost, carbon efficiency
- Interfaces beyond carbon
  - Wider sustainability implications



# From emission reductions to carbon budgets

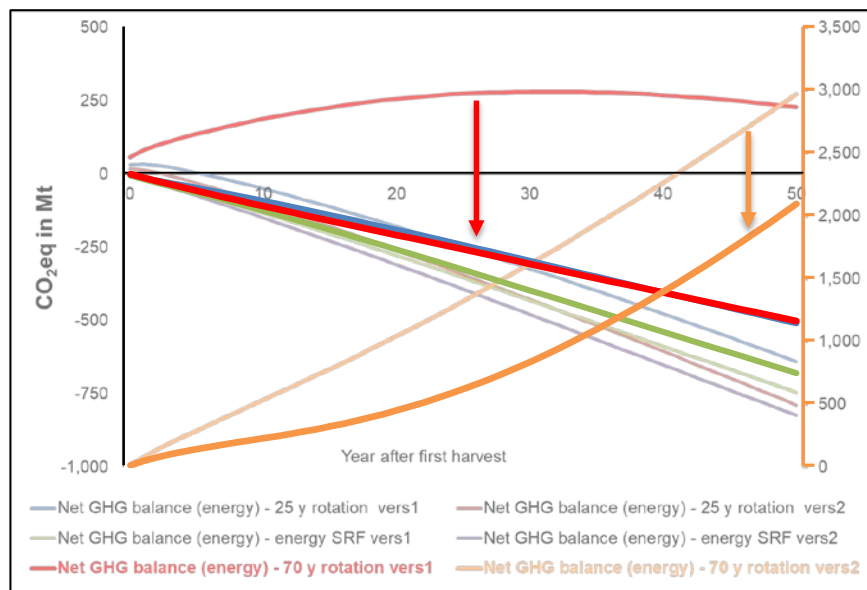


- Emission intensity of bioenergy (supply chain emissions only)
- Emission reductions compared to emission intensity of UK grid (40-60%)

Röder M, et al. Understanding the timing and variation of greenhouse gas emissions of forest bioenergy systems. Biomass and Bioenergy 2019; 121:99-114.

- For net-zero and negative emissions biogenic carbon relevant
- Bioenergy part of a whole (forest) product basket
- Carbon balance of whole (forest) relevant
- How much carbon is for how long in forest, products, biofuels and released back to atmosphere

# Net-emissions and change of system boundaries



From a sectoral perspective  
(Energy production):  
Replacing electricity with bioenergy to  
achieve emission reductions

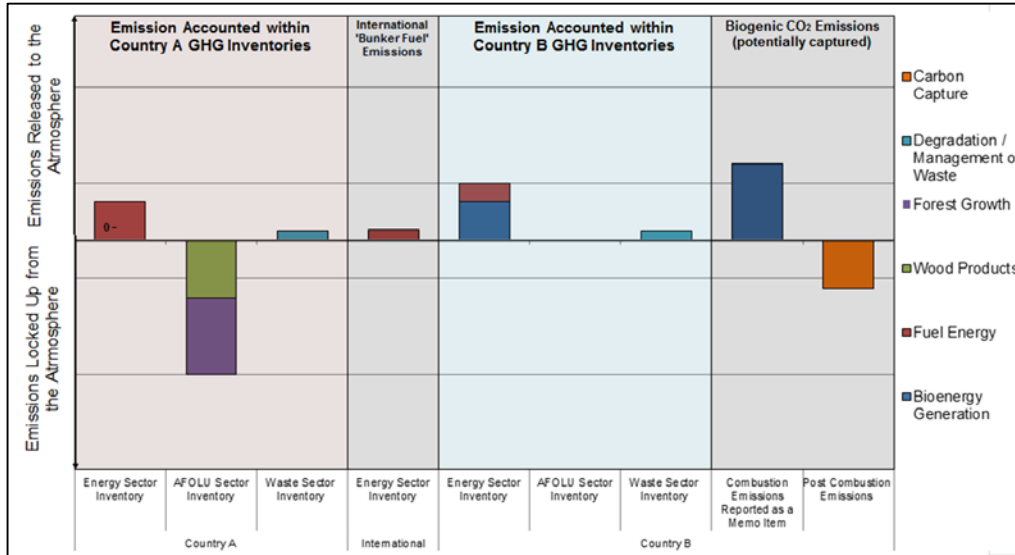


To a whole system perspective  
(Forest production):  
Including bioenergy in the whole  
basket of forest products

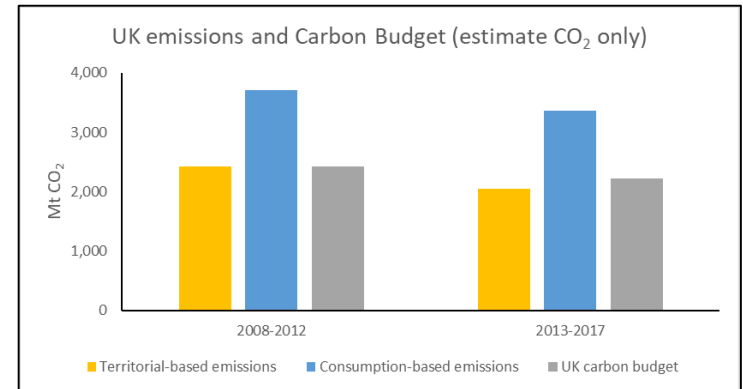
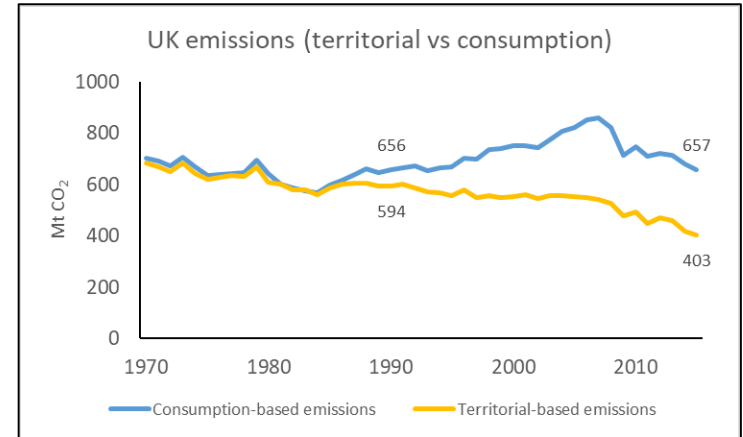
- Bioenergy is part of a wider system with cross-sectoral consequences
- GHG balance storing than releasing carbon does not simultaneously create net-negative emissions for the wider systems of which bioenergy is part



# Emission accounting of international supply chains



<https://www.supergen-bioenergy.net/are-biofuels-the-answer-to-kick-start-decarbonisation-in-the-shipping-sector/>



ONS: The decoupling of economic growth from carbon emissions: UK evidence

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# Sustainability beyond carbon – synergies and trade-offs

What are the main drivers for bioenergy?

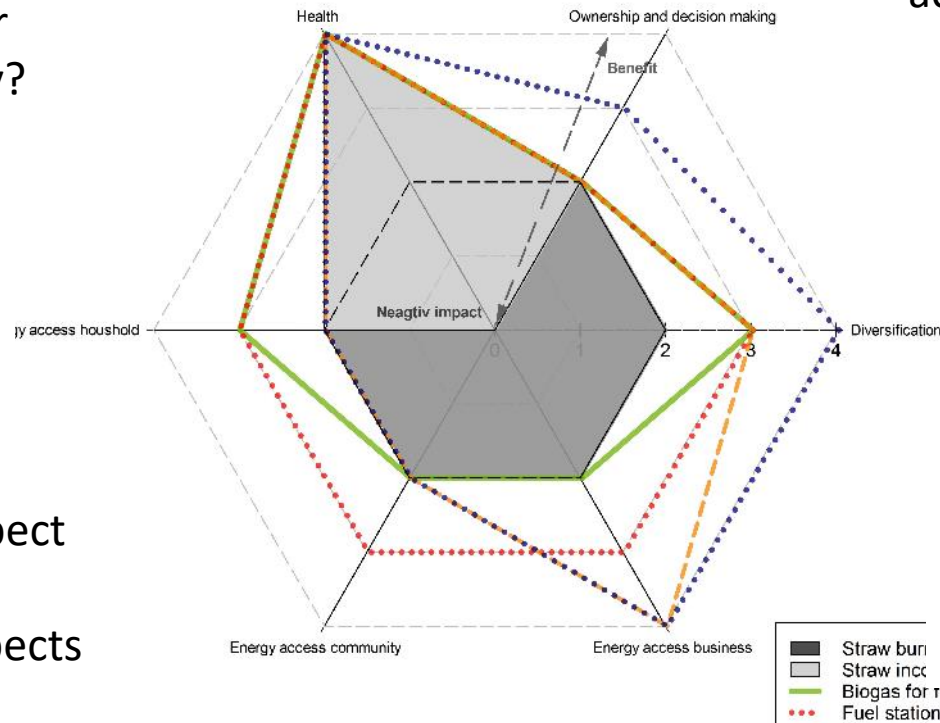
Cross-sectoral, spatial and temporal implication

Change one aspect of a system will affect other aspects

Who will be the actual beneficiaries?

Understand impact and trade-offs for different actors

Maximising environmental benefits might compromise on socio-economic benefits



What are the priorities and sustainability objectives of the bioenergy business model?



# Key messages

- Net carbon reductions can be achieved compared to conventional fuels but not necessarily compared to low carbon energy or forest/crop management without bioenergy
- Non-energy related aspects and factors play a key role
- Challenges of emission accounting and reporting frameworks especially for international and cross-sectoral supply chains
- System approach is necessary to capture all relevant impacts and system's dynamics
- Sustainability across all supply chain process is key to generate, maintain and maximise benefits
- Enabling positive trade-offs and mitigating negative impacts= understanding interfaces and system dynamics



# Contact details



Mirjam Röder

Supergen Bioenergy Hub

EBRI

Aston University

Email: [m.roeder@aston.ac.uk](mailto:m.roeder@aston.ac.uk)

Twitter: [@Mirjam\\_Roeder](https://twitter.com/Mirjam_Roeder)

LinkedIn: [Mirjam Roeder](#)

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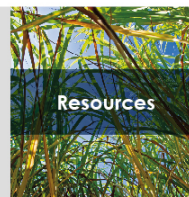


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