



Ausilio Bauen

E4tech

The future of UK bioenergy: a systems approach

Dr Ausilio Bauen

ETI 10 Years of Innovation, London

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Integrated analysis of the role of bioenergy within the wider UK energy system

ELUM

- UK biomass production pathways delivering genuine carbon savings

Enabling UK Biomass

- Benchmarking of energy crop competitiveness and identifying potential business models

Characterisation of UK Feedstocks

- Linking properties to provenance; proximate and ultimate analysis

Techno-economic assessment of pre-processing activities

- When it does / does not 'pay' to pre-treat biomass

Energy from Waste

- Waste arisings, composition and technology pathways

Waste Gasification

- Demonstration of integrated gasification gas clean-up and power systems

BwCCS

- Biomass to Power with CCS technology development: costs, barriers, opportunities

BVCM

Bioenergy Value Chain Model
Optimising Bioenergy



- Available UK biomass
- Technology cost and performance trajectories

- Energy demands
- Negative emission requirements
- Specific vector demands



RELB

- Refining estimates of UK land for bioenergy

SSH Programme

- Future district heating strategies for the UK

CCS Programme

- Piping infrastructure
 - CO₂ storage
 - H₂ storage

ESD Programme

- Gas vectors: costs and engineering issues to use/move CO₂, H₂, syngas and Bio-SNG

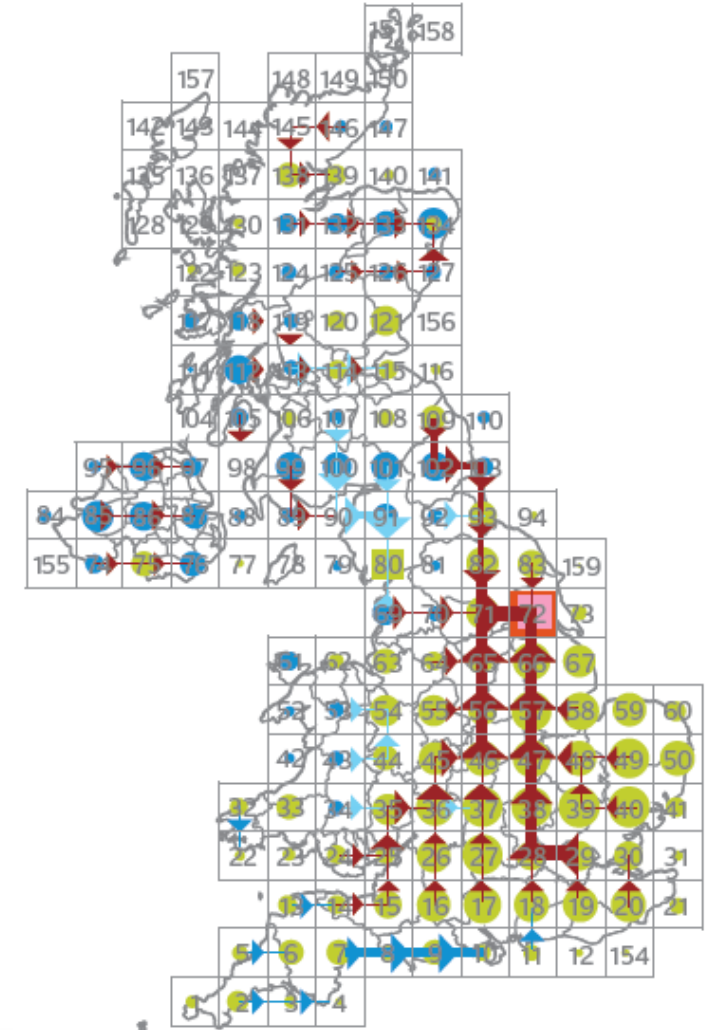
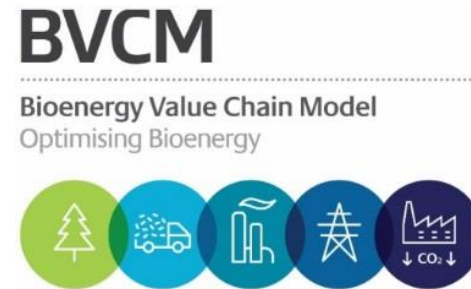
Transport Programme

- Future requirements for alternative biofuels for LDVs and HDVs

Orange boxes denote data and information flowing from ETI Bioenergy projects, and grey boxes denote data used from other ETI projects.

BVCM is a flexible, spatially explicit toolkit for whole system bioenergy value chain optimisation

- First UK optimisation model that considers bioenergy system spatially at 50km resolution out to 2050
- Matches biomass resources, logistics and conversion technologies
- Optimises based on energy, economic and/or emissions targets
- Funded by ETI, led by E4tech, with Imperial College Consultants, EIFER/EDF, Rothamsted Research, University of Southampton, Black & Veatch and Agra CEAS Consulting
- Developed in 2011, has been updated continuously with new resources, technologies and logistics options

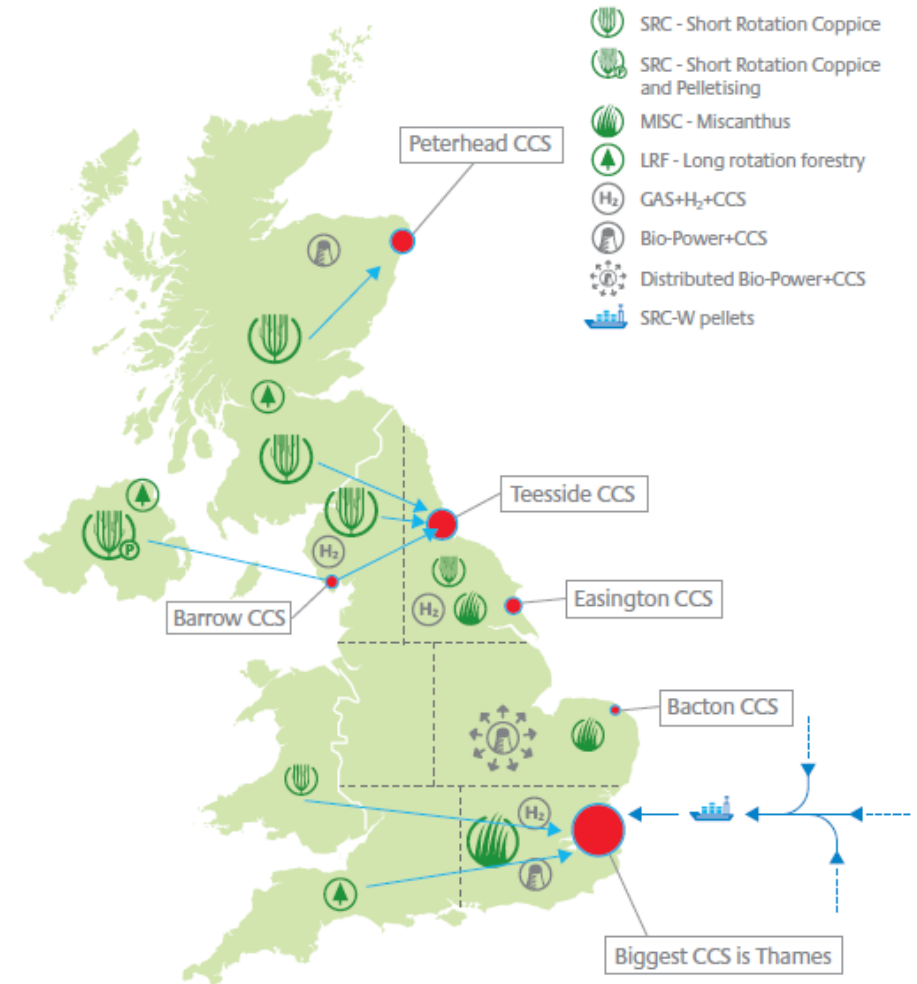


How can bioenergy best contribute to future UK energy system requirements?

BVCM tells us WHAT, WHERE, HOW

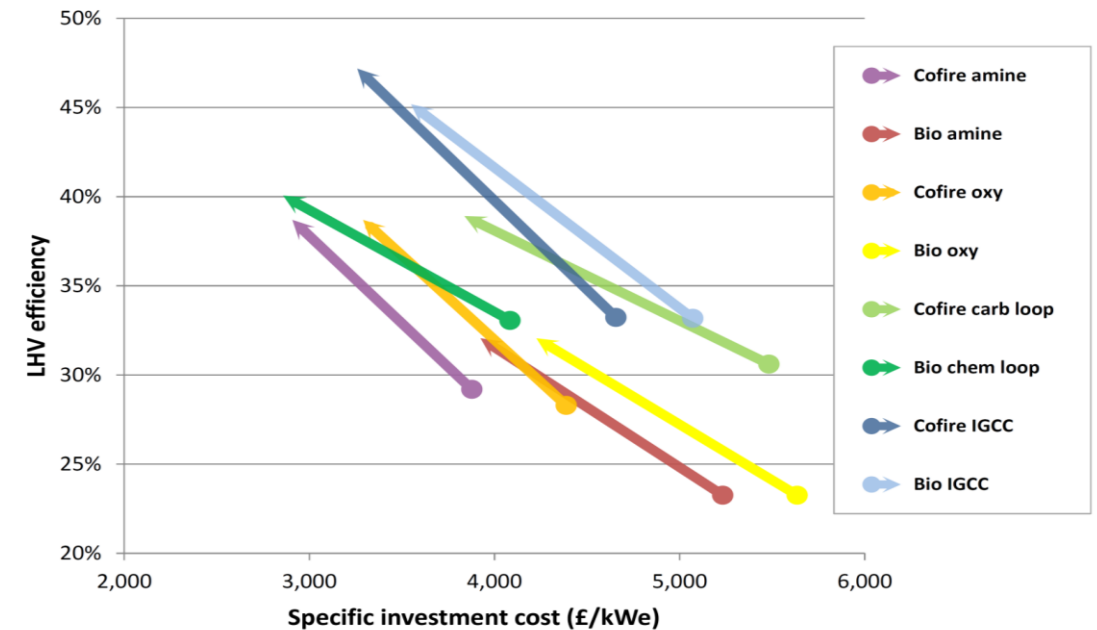
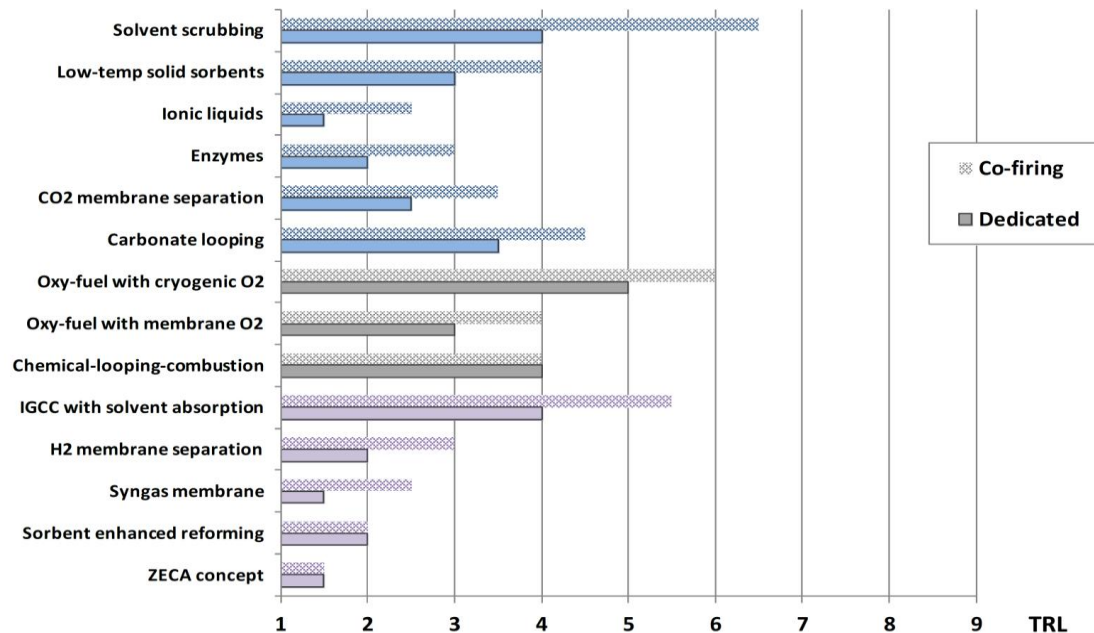


- How do different bioenergy value chains compare?
- What role can they play in meeting energy system objectives?
- What is the potential of energy crops?
- How does bioenergy fit with CCS?
- What biomass pre-treatment will be worthwhile?
- What does all this mean for innovation?



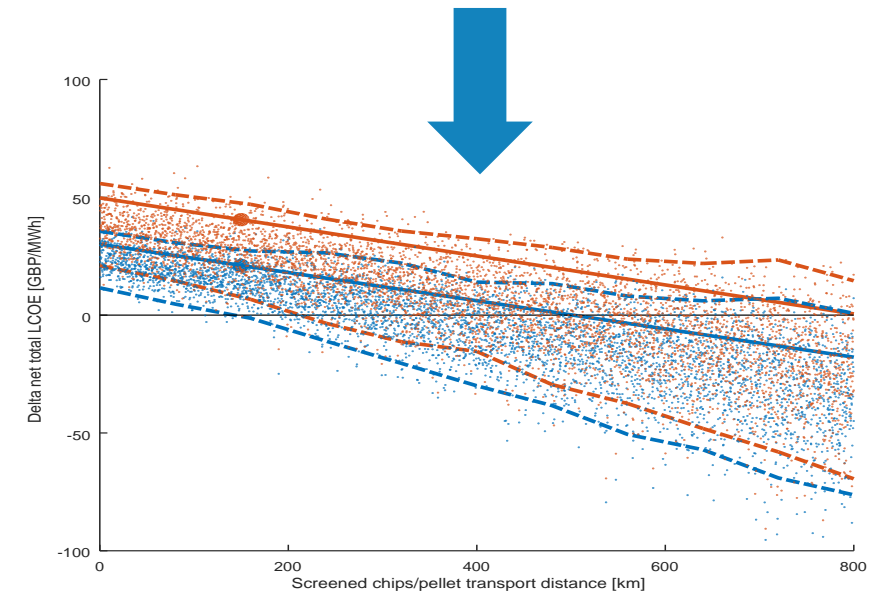
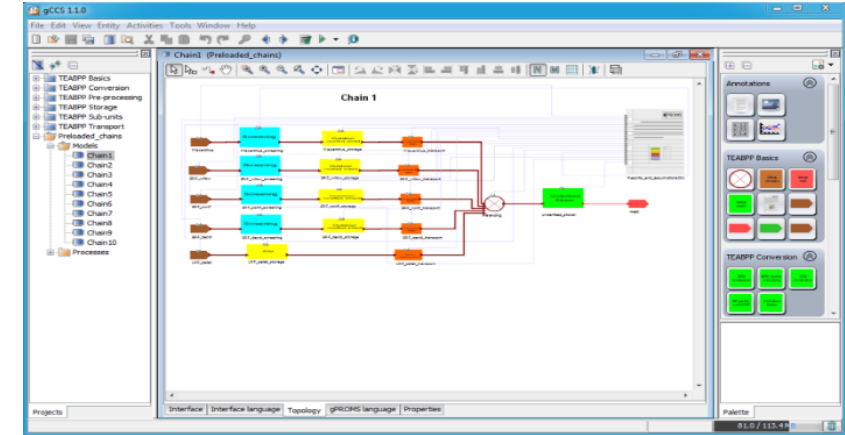
Techno-economic assessment of bio-power with CCS (TESBIC)

- First comprehensive assessment of all potential BECCS routes, back in 2012 – looking at status, developers, prospects, risks, barriers and techno-economics
- Lead by CMCL innovations, with E4tech, Doosan Babcock, Drax, EDF, Imperial College, University of Cambridge, and University of Leeds



Techno-economic assessment of biomass pre-processing (TEABPP)

- Benchmark biomass conversion and pre-processing technologies, their status and how they perform with different feedstocks
- Model costs, performance and emissions of 10 supply chains, to compare chains with and without pre-processing
- Identify where the benefits of improved feedstocks outweigh the costs of pre-processing
- Establish optimal designs, highlighting steps with greatest potential for innovation improvement
- Enable ETI to make justified recommendations for technology acceleration
- Project led by E4tech, with Imperial College, PSE, CMCL innovations, Black & Veatch, Universities of Sheffield & Leeds



ETI has provided most comprehensive approach to UK bioenergy analysis, and contributed value to industry and government

- BVCM, TESBIC, TEABPP and related work continues to inform government and industry
 - BEIS heat strategic options programme:
 - Techno-economics of biomass heating supply chain options
 - Innovation potential and impact quantification
 - Industry technology assessments e.g. pre-treatment options
 - Industry understanding and formation of networks e.g. Sustainable Fuel Register for RHI
 - Ongoing bioenergy systems research by SUPERGEN Bioenergy
 - ETI staff expertise has fed into competitions, e.g. DfT advanced biofuel demonstration competition

Thank you for your attention

ausilio.bauen@e4tech.com