

SUPERGEN Bioenergy Hub Leaders Consultation – BECCS & Hydrogen Summary, London 26/09/17

At the London Bioenergy Consultation Event the key discussion themes revolved around the future role of biomass in the hydrogen economy and how the Hub can support greater international collaboration and development. Topics that emerged from the session included questioning the types of policy and regulation and scales of investment that will be required to kick-start a future bioenergy-hydrogen industry. Also the types of resources that will be required by the future bioenergy sector and where these may be sourced. Much discussion also focused on what best end-uses of hydrogen may be and how related technologies may be integrated into wider energy systems.

Bioenergy Stakeholders within discussion groups were particularly interested in seeing more research and new approaches to research around the following themes:

- The infrastructure challenges of the future bioenergy-hydrogen sector need some research focus, especially with respect to integrating with potential CCS and CCU pathways to meet national carbon targets.
- Should we be focusing so much on BECCS, when bioenergy without CCS is a much more mature technology pathway and therefore a safer bet?
- Dedicated whole system analysis needs to be undertaken to better understand the technology capabilities, economics, emissions performance and overall value of bioenergy-hydrogen energy scenarios.
- More analysis needs to be undertaken to definitively clarify what the future resource demands of the UK bioenergy sector will look like, from where this resource will be sourced and to confirm that this resource will not have negative environmental, sustainability or GHG implications.

The stakeholders at the event also confirmed that it would be helpful if the Hub moving forward helped facilitate closer relationships linking academic organisations with the FCO and trade organisations to promote the UK bioenergy sector. Also that the Hub potentially developed specific engagement strategies targeted at increasing linkages with key UK and International stakeholder groups

PROMPT QUESTIONS/THEMES

WHAT IS THE ROLE FOR BIOMASS IN THE HYDROGEN ECONOMY?

HOW CAN THE HUB SUPPORT GREATER INTERNATIONAL MOTIVATION COLLABORATION AND DEVELOPMENT?

SESSION 1: BRAIN STORM

Thematic Research Project Areas

Regulation and policy

- Need for good policy to be able to kick-start industries/economics

Supply chain questions

- Resources/Geographies

Investment potential of UK Hydrogen industry

- International
- BECCS

Hydrogen end-use

Overall energy systems

PROJECT THEMES TAKEN FORWARD FOR DISCUSSION

Infrastructure challenge

(H₂ & CO₂ NOT Biomass) /CCS Flexibility and viability

Overarching themes/questions

CO₂

- Can CCS technologies be operated flexibly?
- Is CCS actually going to be deployed in the UK? Implications if not?
- Countries like China and India have shown interest in CCS and they are still developing industrially. Are there any bioenergy interests that can be utilised in these countries?
- What is the future of CCS/CCU. We believe CCS is more effective than CCV – Is this correct?
- What are the costs and technology challenges of adding CO₂ from bio onto existing CCS (fossil) network?
- Distributed biomass resource versus centralised CCS
- What is the impact and opportunity of (North Sea) oil and gas field decommissioning?
- Early CCS infrastructure will be ‘point’ focused – match to biomass?
- What is the CO₂ market in the UK?
Producers/consumers/prices?
- What is the real quantum of CCU relative to overall emissions
- Are capture technologies the same/different for conventional energy plants and biomass/bioenergy plants?

H₂

- How do different biomass/waste feed stocks affect process performance/ H₂ quality? Flexibility of this output?
- How do we go beyond 20% H₂ in gas grid?
- What does the new H₂ grid look like? Spatial engineering etc

What is the role of the UK H₂ industry in attracting inward investment?

- If BECCS is ‘centralised’ where in the world should it happen?
- Role of an integrated demo project with international partners?
- Ship biomass Versus ship H₂
- Other global activities and UK leadership?

- How exportable is BECCS versus fossil CCS (is it generally applicable/is it geographically specific?)

What are the end uses of hydrogen and how do they affect whole cycle emissions?

- Role of H₂ – containing vectors, eg. Ammonia?
- Questions around H₂ safety/ H₂ end use
- Quality of H₂ – different specs for different application
- Barriers to market for end use (heat, transport)
- End user acceptability of H₂ (heat, transport)

Systems

- Should we use biomass without CCS?
- How can we make progress in the short-term
- Biomass conversion to H₂ plants: flexibility (to match demand?)
- Role for bio (hydrogen) into industrial applications
- How much does BECCS “get you out of jail” on unavoidable fossil emissions?
- Seasonal storage of biomass compared to storage of hydrogen
- Size of Bio- H₂ relative to energy system
- Role for H₂ and Bio- H₂ to a zero net carbon date (pre 2100)
- Constraints imposed by CCS. Resource, end use (and logistics)

Conversion Technology

Overarching themes/questions

- Technology and capability – conversion tech/fuel cells
- Hydrogen generation – purity/economics/possibility of alternate hydrogen carriers/_Efficiency of Hydrogen industry
- Pre-combustion
- Post combustion
- Chemical looping

Pre-treatment conversion technology

- Role/value of pre-conversion technologies
- Costs/impacts of CO₂ spec (and small-scale CO₂ capture)
- Impact of biomass quality on H₂ quality
- Ability to go from BIOSNG to BIO H₂? Costs, GHG, time, flex?

H₂ generation and final use

- How can we produce hydrogen from biomass economically?
- How can hydrogen best be integrated in the wider energy generation economy?
- Hydrogen transport and storage
- Hydrogen purity and other vectors e.g. ammonia
- Based on conversion losses, in which cases does it make sense to convert bio-gas to H₂?

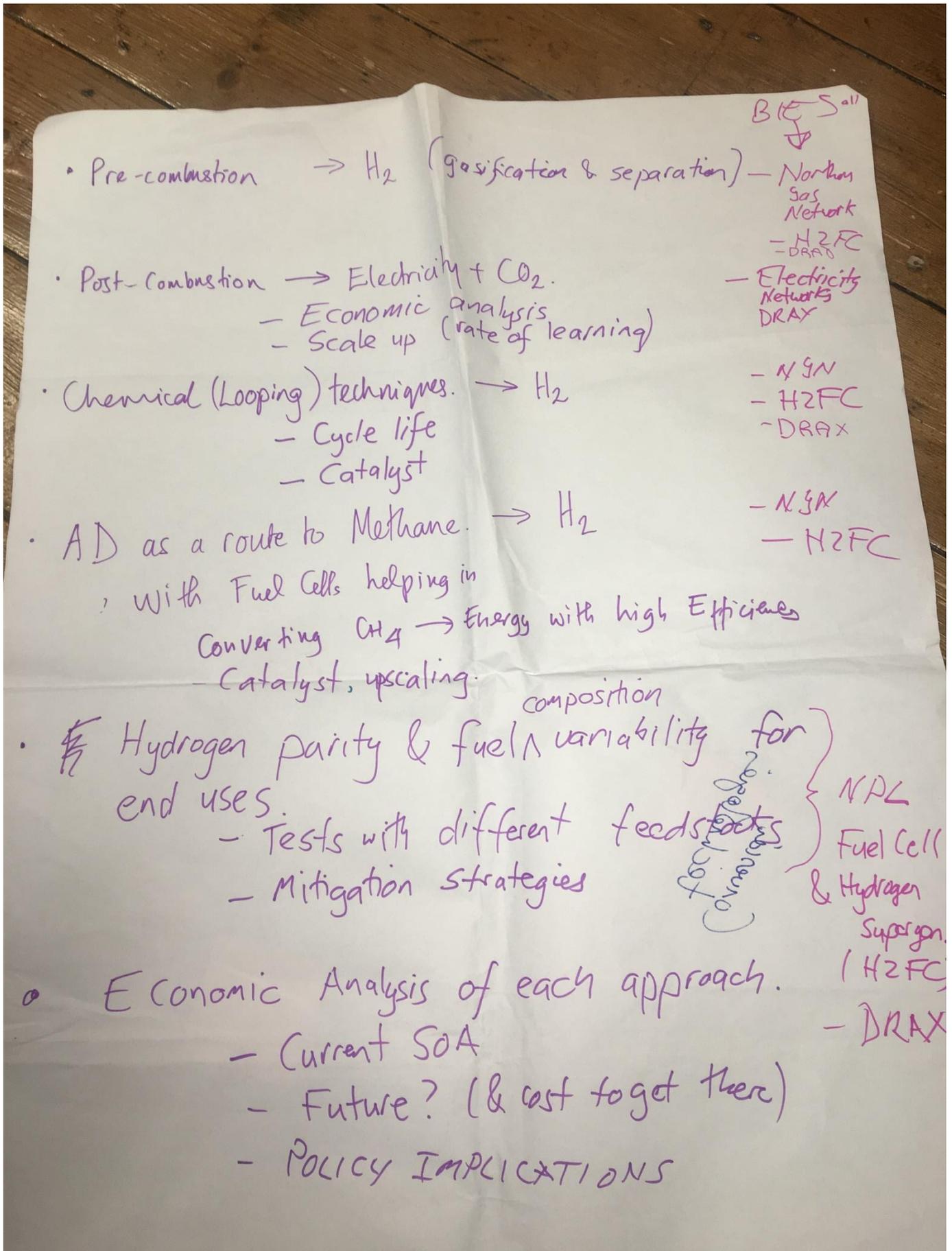
Future role of bioenergy in H₂ economy

- How much H₂ can be generated by bioenergy systems?
- H₂ by bioenergy – cost effective?
- Conversion pathways: biological/biochemical – which one is efficient?
- Is there a possibility of combining energy technologies?

Technology challenge

- How negative can we make BECCS with engineering?
- Capability and systems development of bioenergy supply and tech
- Biomass to energy – conversion factor (value) which do we choose?
- Advanced (more efficient) conversion tech e.g. fuel cells
- Bio methane – energy combustion: Other efficient technologies
- Global – biofuels production and use in the developing world and UK's role in ending this e.g. Advancing technologies

WHAT MIGHT A RESEARCH PROJECT LOOK LIKE?



- Pre-combustion → H₂ (gasification & separation)
 - Northern Gas Network
 - H₂FC - DRAX
- Post-combustion → Electricity + CO₂.
 - Economic analysis
 - Scale up (rate of learning)
- Chemical (Looping) techniques. → H₂
 - Cycle life
 - Catalyst
- AD as a route to Methane. → H₂
 - NGLN
 - H₂FC
 - DRAX
- With Fuel Cells helping in
 Converting CH₄ → Energy with high Efficiency
 - Catalyst, upscaling.

- ~~Hydrogen~~ Hydrogen parity & fuel composition variability for end uses.
 - Tests with different feedstocks
 - Mitigation strategies
- } NPL
Fuel Cell & Hydrogen
Supergen
(H₂FC)
- DRAX
- (convention for)

- Economic Analysis of each approach.
 - Current SOA
 - Future? (& cost to get there)
 - POLICY IMPLICATIONS

Relook at feasibility/impacts

Overarching themes/questions

- Plea for the potential of solar to be reconsidered thoroughly for biomass
- Matching distributed generation to horticulture to capture CO₂
- Direct air capture of CO₂ may be more feasible than currently thought
- Develop models of biomass to energy business cases and calculate costs
- How do we deal with the CO₂ by-produced from bioenergy production?
- How will the biofuels (gas/liquid) be transported? (Technoeconomic analysis)
- Biogas use in transport – impact on emissions reduction
- What is the most economical source of biofuels – domestic (feedstocks) – import/export issues
- Will BECCS plants be centralized and only import biomass?
- Wider environmental role for energy crops?
- What role can bioenergy play in enabling energy security for the UK?
- Impact on food production and biodiversity? Still not clear.
- Supply chains of biofuels for the UK and costs

Biomass resource

Overarching themes/questions

- What is the best use of biomass?
- How much resource is available?
- Quantification and characterization of resource?
- How much can bioenergy support the UK's energy sector? Can supply meet demand?
- Supply Chain
- Environmentalist impact: SUSTAINABILITY INDICATORS
- Policy and regulation: barriers and solutions

What might the research project look like?

WP1: Demand for resource to balance bioenergy

Outputs: Series of modeled scenarios for demand. Roadmaps for demand

Partners: BEIS/DFT. Industry and energy generation (including R&D)

WP2: Supply – availability of different categories of resource

Outputs: Economical and environmental scenarios for supply

Partners: International academic/government/industrial partners, growers, land use managers

WP3: Supply chain – where from?

Outputs: Coupled WP1 and WP2 scenarios and WP4

Partners: All actors in supply chain – growers, transport, end use etc.

WP4: Environment impacts of different resources

Outputs: Full quantification of sustainability indicators of resources from different regions.

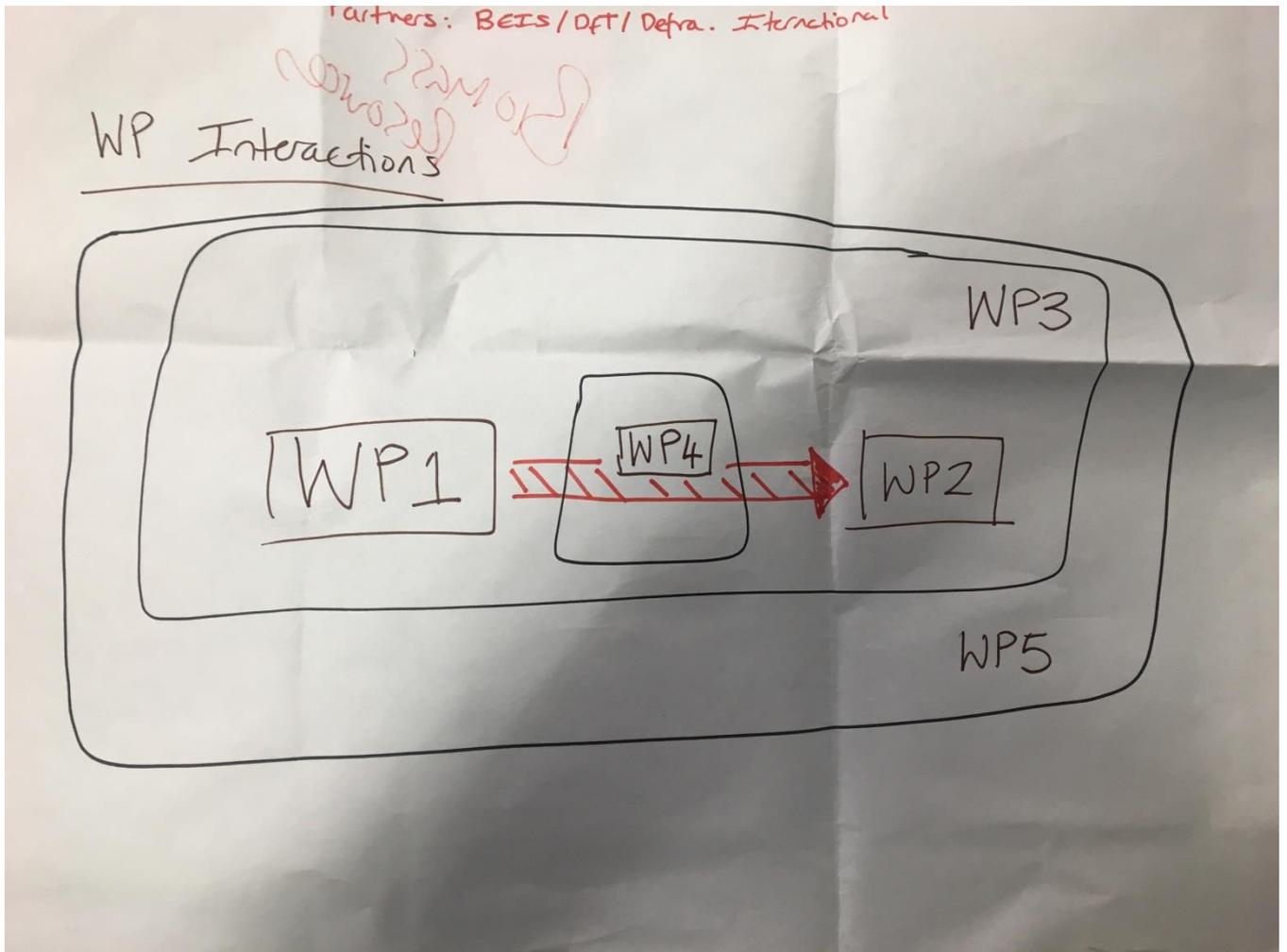
Partners: International academics/UK academics/growers

WP5: Policy and regulation– Sustainable supply

Outputs: Identification of barriers and policy solutions to support sustainable deployment at scale

Partners: BEIS/DFT/DEFRA/International

INTERACTIONS BETWEEN THE WORK PACKAGES:



Thoughts from room following session

- Clearer relationship with Local academic organisations
- FCO and trade organisations – get in touch
- Engagement strategy with specific organisations
- Develop a series of market plans go through with trade officers, market programmes, exchange students,
- Identifying countries with resources
- Infrastructure – moving from large to smaller and localized
- Countries interested in embedding their systems in existing systems
- Early career opportunities – competitions/bid
- Networking event in order to prep the ground
- Croatia/Indonesia – largest producers/super producers biomass waste
- UN/CCC/International collaboration