An assessment of the potential for the establishment of lignocellulosic biorefineries in the UK

Final Report - Executive Summary

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¹ LBNet, a BBSRC Network in Industrial Biotechnology and Bioenergy (BBSRC NIBB)
Executive Summary

There is a significant opportunity for the UK to tap into a biorefinery products market valued at £262 billion in 2014 and growing at an estimated 14% per annum to 2020. This is coherent with the United Kingdom’s greenhouse gas emissions reduction target of 80% by 2050.

Commercial scale solutions are urgently required to decarbonise the economy, especially for the transport sector which accounts for one third of UK greenhouse emissions. Lignocellulosic biofuels produced without detrimental land use change impacts provide a sustainable solution to meeting the demand for liquid transportation fuels whilst reducing carbon emissions. The opportunity to replace liquid fossil fuels with low carbon lignocellulosic biofuels will open broader opportunities for producing renewable chemicals and materials that enable a circular economy and are more sustainable than fossil-based products. The potential scale of this activity provides significant scope for innovation, which the UK is strongly placed to capitalise on through world leading academic and commercial capabilities at lab and pilot scale. Also, the (bio)fuels, chemicals and chemicals-using sector in the UK provide a strong base on which to build commercial scale biorefining activities in the coming years.

In addition to technical capabilities, the establishment of lignocellulosic biorefineries requires available and sustainable feedstocks, viable business models across the entire supply chain, suitable locations with potential for business clustering and downstream users, and a supportive policy framework. This study assessed the potential of four feedstock-specific scenarios for UK biorefineries, which were identified at an LBNet scoping workshop in April 2016. These included the co-location of a lignocellulosic biorefinery with a biomass power station, a straw biorefinery, a municipal waste biorefinery and a dedicated perennial energy crop biorefinery. The report highlights the potential opportunity provided by each scenario, discusses gaps and barriers to realising their potential, and the conditions under which they would be viable. A set of high-level conclusions can be drawn from the assessment of the four scenarios.

Co-location of a biorefinery next to a biomass power station is appealing due to the existing feedstock supply chains, potential scale of operation and integration with existing power generation activities. Commercial competitiveness of this scenario will depend on feedstock costs, and may be challenging as the technology for wood pellet conversion is less mature than for feedstock such as straw, and scales and business models of power generation and biorefining are substantially different.

Straw is an attractive feedstock because conversion technologies are relatively mature and it has a relatively low cost, although the potential for supply may be limited in the UK. Straw is the only feedstock, among the four scenarios, that has been used in commercial scale facilities globally and for which there is a UK lignocellulosic ethanol plant in the design phase. Existing supply chain experience with straw for power generation could be helpful in making use of regional concentrations of this feedstock in the UK.

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2 Including surface transport, aviation and shipping (CCC, 2013)
Producing bio-based products from UK Municipal Solid Waste (MSW) is a favourable scenario with respect to sustainability, feedstock costs and waste policy objectives. A MSW-based biorefinery demonstration plant could support existing UK actors in their path to commercialisation and give the UK a potential competitive advantage in this area. Realising this opportunity will require identifying sites with available and accessible feedstock that is not already contracted to competing uses.

A biorefinery based on perennial crops is attractive from the perspective of having a dedicated feedstock, but poses significant challenges in terms of engaging farmers to grow the crops, establishing dedicated supply chains, and potentially dealing with land use change issues. Overcoming these issues will require careful planning, including finding sufficient land with high yield potential in proximity of the plant, as well as public sector support in establishing the feedstock supply chain. The timescales involved in getting this infrastructure in place are long.

There is already a wide range of biorefinery research and development activities in the UK at lab or pilot scale that can be used to springboard the development of a commercial sector. While continued support of basic and applied research relevant to the area remains important, the sector would benefit from greater emphasis on commercialisation and scale up of activities. Galvanising pre-commercial activity could be achieved through a “UK Biorefinery Demonstration Competition” that would stimulate the UK biorefinery community to address the scale up challenge, potentially in collaboration with international players. Policy that supports the development of sustainable biofuels, biochemical and biomaterials is critically important to encouraging commercial deployment and investment in this sector. Targets discussed for advanced biofuels in the context of the RTFO will send important market signals and additional government support could come from the use of procurement programs along the lines of the US “BioPreferred Program”. Finally, the establishment of a “UK Biorefinery Forum”, that would complement the existing “Industrial Biotechnology Leadership Forum”, would provide a vehicle for biorefinery actors to elaborate activities and actions in support of the sector and set a direction of travel for the UK biorefining sector.