



Capabilities and Opportunities for Joint Working on Biorefining and Industrial Biotechnology

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A Project for Innovation Norway and Technology Strategy Board.



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The NNFCC

The UK's National Centre for Biorenewable Energy, Fuels and Materials

The NNFCC is committed to the sustainable development of markets for biorenewable products. We promote the benefits of biorenewable energy, fuels and materials for enhancement of the bioeconomy, environment and society.

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Executive Summary

Innovation Norway and the UK's Technology Strategy Board have signed a Memorandum of Understanding (MoU) with the intention of developing a partnership in the areas of industrial biotechnology and biorefining. Both countries have expertise and activities in biorefining and biotechnology and there are already extensive collaborations between the countries on which this partnership can be built. This report fulfils the first action under the MoU in identifying high level opportunities and synergies for Norway and the UK.

An assessment of the market pull for different products, the availability of raw materials, expertise and infrastructure in the UK and Norway resulted in the identification of a number of areas where the countries have mutual or synergistic interests and expertise. These areas were consolidated and refined into a series of key short term and longer term opportunities for collaboration between the countries.

The short term opportunities are:

1. Using microalgae for omega oils for the aquaculture industry and for bioactive ingredients for the consumer goods industries.
2. Using marine wastes as a source of bioactive molecules for the consumer goods industry.
3. Using wood as a feedstock for the production of bulk chemicals and fuels.

In the longer term, a number of joint projects could be envisaged. These include:

1. The utilisation of lignin from the pulping industry as a feedstock for high value chemicals production.
2. The production of chemicals and fuels from macroalgae.

These opportunities are the starting point for a more detailed investigation of innovation needs and the underpinning research required to realise these opportunities. A series of workshops and exchange visits will be required to build relationships and to develop detailed proposals for research and development projects. The approach needed in these meetings will differ depending upon the target end market.

Recommendation 1 - Developing Collaborative Ventures between the UK and Norway in Areas where there are Synergistic Interests and Capabilities. The approach needed to bring together stakeholders from the UK and Norway will differ depending upon the end market targeted.

The speciality chemical using industries are secretive about products in development and prefer to discuss what functionalities are desirable for their product ranges. As a result, we suggest that any meetings should initially focus on the specific competences offered by specific institutes and companies. This will aid the speciality chemicals industry to identify to what extent each of the interested parties could help in the development of specific bioactives of interest and will help more focussed, potentially confidential discussions on opportunities, probably under non disclosure

agreements. The Chemistry Innovation KTN is the key contact point in the UK to develop contacts and relationships in the speciality chemicals sector.

In contrast, the chemicals required by the bulk chemicals industry is a better defined area, with specific chemicals of interest for the UK bulk chemicals industry including ethanol, bio-butanol, MMA, lactic acid and succinic acid. In this sector, it is important to first establish that the technology developers have a strategic interest in developing a technology for a particular feedstock. Chemistry Innovation KTN can provide the key contacts with industrial end users in this sector, while Biosciences KTN is the key contact for the industrial biotechnology industry. The newly formed UK Algal Bioenergy Special Interest Group provides a key link with the UK macroalgae and microalgae industries.

Recommendation 2 – There is a need to stimulate relationships between complementary enterprises in both countries. This could be achieved through exchange of personnel and the joint management of specific projects. Exchange of academic personnel could be funded through existing research council schemes, but there needs to be further considerations on how the exchange of industrial personnel could be facilitated and funded.

Collaboration should be facilitated between centres with expertise in:

1. Fermentation.
2. Macroalgae cultivation.
3. Marine biobanks.
4. Biocatalysis.

In addition to these more focussed actions, a number of overarching actions will need to be developed to help promote the development of joint UK-Norway projects and collaborations. The following recommendations provide a basis for developing these actions.

Recommendation 3- Mechanisms for the identification of stakeholders in both the UK and Norway need to be developed and publicised more widely. While both Innovation Norway and Technology Strategy Board have made progress in developing tools to promote stakeholder identification and networking, these tools need to be advertised widely in both countries to ensure the full value of these resources is maximised.

Recommendation 4 – Consideration needs to be given on how to engage with industrial stakeholders. In particular, it may be difficult to get industrial stakeholders to engage with other stakeholders without prior information exchange on the benefits of any potential collaboration e.g. upfront information on funding could help stimulate industrial engagement.

Recommendation 5 - Upcoming calls in the European Framework Programme and similar schemes such as Interreg should be reviewed. We suggest that Innovation Norway and Technology Strategy Board focus networking and consortia building activities around these calls as this could be one mechanism of funding collaborative activities.

Recommendation 6 - The TSB and Innovation Norway should review their countries participation in ERA-Nets aligned to Industrial Biotechnology and Biorefining. The ERA-Net programme could

provide an effective mechanism for funding collaborative research projects involving UK and Norwegian partners.

Recommendation 7 – There is a need to promote TSB and Innovation Norway funding schemes such as the Norwegian IFU contract scheme which could provide a mechanism for funding bilateral projects. It may be pertinent for TSB to consider, especially for the high value chemical opportunities, developing a call similar to the ‘High Value Chemicals from Biomass’ call, with a scope focusing on the identified opportunity areas but not excluding other opportunities. We estimate that for each of the four opportunities identified in this report, around £2 million public funding would be required to support four to five projects based on 50% public funding being matched with 50% industrial funding.

In conclusion, both the UK and Norway have expertise in both biorefining and industrial biotechnology. There are areas where both the UK and Norway have strength, while in other areas; one country may have a particular strength. While there are already links between the UK and Norway in a number of relevant areas, such links have developed spontaneously rather than through any concerted action. The development of the MoU between the UK and Norway in this area can help promote opportunities in both countries which otherwise may not have developed and thus create important new opportunities for both countries.