Innovate UK
KTN

Unlocking the UK's biomass resources as a feedstock for Chemical Manufacturing

Enabled by Industrial Biotechnology and Engineering Biology

Executive summary

The Chemical Manufacturing industry supplies a range of downstream sectors with chemicals that go on to be used in a wide range of everyday applications including pharmaceuticals, consumer products (e.g. cleaning, health care and wellbeing etc), materials, coatings, as well as food and drink. Currently, much of this supply chain relies on fossil based carbon as a feedstock and with the transition towards a net zero economy, as part of the UK Government's 10 point plan for a green industrial revolution, it is essential we defossilise and adopt more sustainable feedstocks.

Biomass is an attractive sustainable feedstock for the Chemical Manufacturing sector which does not carry the negative environmental footprint of petrochemicals. However, the full potential of biomass-derived products for the Chemical Manufacturing sector is yet to be unlocked. There are several areas that require addressing before the full potential can be realised including; financial support, scale up infrastructure (for both new and existing technologies), further data collection, information sharing and supporting policy.

In this report, we set out the opportunity to transition to a sustainable Chemical Manufacturing supply chain in the UK with emphasis on utilising IB and EB technologies.

Innovate UK KTN Chemistry and Industrial Biotechnology team have already explored potential technology areas with industry in this area including information sharing webinars, a report on the role of catalysis, upskilling programmes for innovators, the release of the SAF analysis tool for the sustainable aviation industry to access biomass networks, and partnership with the Bioeconomy Cluster Builder Project. Our work has also informed the BEIS Biomass Strategy call for evidence in 2021.

> The majority of the chemical industry is based on carbon and therefore biomass is one of the limited bulk sustainable carbon feedstocks available to supply the chemical industry. Waste biomass provides a way of creating circular economy as well as decarbonisation.
>
> **Chris Holt, NEPIC**

> Recycling biogenic carbon dioxide is a better option for the planet than introducing new carbon dioxide to the atmosphere that was previously buried underground.
>
> **Kris Wadrop, CPI Ltd**

To build on previous activities, IUK KTN's Chemistry and Industrial Biotechnology team brought together stakeholders from across the chemical sector supply chain, to share ideas and gather insights for the mutual benefit of all parties involved through a survey.

The survey, entitled "Scoping the UK Feedstock landscape and associated IB & EB opportunities to meet chemical supply chains needs as part of the transition to a net zero economy by 2050", was conducted in 2021 with a total of 60 industry relevant participants.

This report details key insights derived from the survey of academic institutions, innovation centres, scale up centres, funding bodies, policy makers, innovators, small and medium-sized enterprises (SMEs), large companies, waste producers, farmers and growers, and chemical industry end-users, on the topic of harnessing biomass feedstocks as an alternative to petrochemicals in the Chemical Manufacturing sector.

Some of our participants

- Unyte Hemp
- Synthomer
- Biome Technologies
- Ensus
- Cellucomp
- Croda
- Johnson Matthey
- Argent Energy
- Lanzatech
- Green Fuels
- Fiberight
- Ingenza
- IBioIC
- Biovale
- CPI
- NEPIC

This document aims to reach these industry stakeholders, and those with the influence to affect real change throughout the Chemical Manufacturing sector. It is crucial for the levelling up of the UK's infrastructure, directing finances and that policymakers are informed of the capability of biomass to provide many of the much-needed products developed in Chemical Manufacturing. Funding support and the correct legislation will boost the impact that biomass can have on defossilising the UK's Chemical Manufacturing sector in the coming decades.

Our recommendations for enabling the transition to biomass feedstocks include: mapping the UK biomass sources and their applications, developing a prioritised list of high value chemicals refined from biomass sources, securing further engagement across the supply chain, and the formation of an open and accessible biomass refinery, among others.

Glossary of key terms

The Chemical Manufacturing sector – is a crucial industry that underpins the modern economy and is responsible for the production of vital chemicals including plastics, textiles and pharmaceuticals.

Feedstock/biomass – a feedstock is the raw material used to fuel a machine or process, and in a biomass context this refers to organic material including but not limited to food and animal waste. It can be purposely grown, or arise as a co-product of other processes, or as post-consumer waste, such as Municipal Solid Waste.

IB – Industrial Biotechnology

EB – Engineering Biology

Biorefinery – is a refinery used to convert biomass into useful products often through fermentation or the action of microorganisms. The focus is on multiple product streams including high value chemicals, biofuels and bioenergy.

Bioenergy – is energy generated from biomass sources, typically in the form of bio-gas.

High value chemicals – are in high demand by manufacturers in the Chemical Manufacturing sector for their functionality and specialist use.

Circular economy – involves the continuous use, reuse and replenishment of resources to reduce waste and environmental consequences. Through a circular economy the impact of human activities is more sustainable.

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The role for biomass in sustainability

The government and industry in collaboration have a significant opportunity to move towards the UK's net zero targets through the effective utilisation of biomass in the Chemical Manufacturing supply chain. This opportunity is yet to be fully realised.

This sector produces chemicals used across almost all industries. It produces inputs for pharmaceuticals and scientific research, as well as the component materials used to produce packaging, fertilisers that are crucial to global agriculture, and other high value chemicals in paints, catalysts and consumer cosmetics.

The range of applications which fundamentally rely on products of the Chemical Manufacturing sector is diverse, however much of the raw material used to develop these products is extracted from non-renewable fossil fuels, typically crude oil and natural gas. Transformation, processing and distillation of crude oil springs a vast amount of chemicals that are necessary for our infrastructure, our economy and our public health, with a significant negative impact on the environment.

The Chemical Manufacturing sector must adapt to 'go green' in line with global sustainability goals and net zero targets. However, widespread reliance on the sector will persist, and demand for high value chemicals is predicted to grow, alongside concurrent growth in demand in areas such as pharmaceuticals.

The UK government has set the ambitious target of reaching net zero by 2050, and this in turn will involve the phasing out of fossil-based carbon across all sectors and industries, including the Chemical Manufacturing sector. Therefore, new sustainable sources to replace fossil-based feedstocks are needed for this sector, and here we focus on one of these: biomass.

> "Climate change means coal, oil, and gas must stay underground."
>
> **Michael Lewis, Heugh Farm**

Realising the full potential of biomass

Across the UK there are biomass feedstocks that are not yet being considered in terms of the Chemical Manufacturing sector, and as such are not being utilised to their full potential. These can be purposely grown, or arise as a co-product of other processes, or as post-consumer waste. Examples include co-products and offsets from food and alcohol production, forestry residues, municipal solid waste, and non-food crops.

Recently, biomass has been considered a 'carbon-neutral' bioenergy solution, by taking large amounts of organic materials and burning them to generate electricity, but in many circumstances this is not the most effective or sustainable use of biomass. Burning of biomass as a cheap alternative to fossil fuels overlooks its potential to provide a huge variety of desperately needed high value chemicals for the Chemical Manufacturing sector.

> Biomass will make an essential contribution to supplying renewable and sustainable chemicals and fuels to enable the UK's transition towards net-zero. Effective use of the available biomass is critical to prioritise areas which cannot be met through other renewable forms of energy.
>
> **Jonathan Wagner, Loughborough University**

Already the Industrial Biotechnology (IB) and Engineering Biology (EB) communities have developed a range of sophisticated technologies for extracting the most value from various biomass feedstocks, and many of these technologies have been scaled up successfully and emerged as established companies, for example Croda, Cellucomp and Fiberight to name but a few who are thriving in this area, producing key high value chemicals/materials to market success.

However, many more technologies are proven, and show great commercial promise, but face significant scale-up barriers before they can reach the next stage of technological readiness. Nonetheless, the foundational science continues to develop rapidly.

As explored in this report, one barrier to widespread implementation of these technologies is a lack of connection and understanding from the two ends of the supply chain: the farmers and growers who are responsible for generating feedstocks, and Chemical Manufacturing sector end-users who utilise high value chemicals in the applications discussed previously.

By engaging with these groups, and providing clarity on the technologies and opportunities already being developed, as well as supporting a better understanding of the high value chemical demands of the end users, we can bring together this community and begin to realise the benefits.

> Biomass grown primarily for energy generation represents a low value crop for the farmer. Many feedstocks offer additional opportunities for added-value products that can be extracted prior to processing for energy generation. These include both high value products and high-volume chemicals/chemical feedstocks. As we move towards trying to achieve net zero there is an urgent need to find alternatives to those chemicals that are normally derived from crude oil via petrochemical refining.
>
> **Jane Ward, Rothamsted Research**

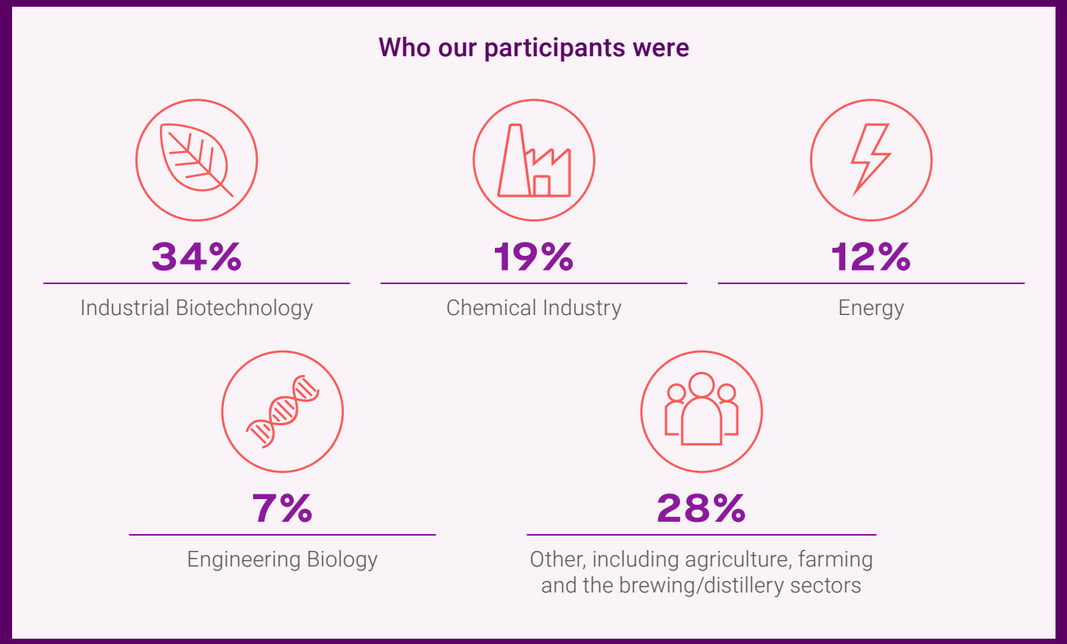

Figure 1. Chart to show sectorial representation of participants

Considering the UK landscape

Every region's biomass feedstocks are unique, with nuances and characteristics that don't exist anywhere else. The UK cannot compete on scale with much larger nations like the USA and China for quantity, and as such it is imperative that the UK's biomass resources are understood fully in terms of supply, demand, and utilisation.

From large algae farms off the coast, to hectares of hemp farms in the Midlands and the most prestigious whisky breweries in Scotland, the UK is not short on variety. From each individual feedstock, there is the potential to extract a variety of chemical products, with each biomass source having strengths and weaknesses that must be considered and analyses, such as ease of cultivation and available chemical transformation technologies.

This report outlines the next steps to enabling biomass to begin to replace fossil-based feedstocks in the Chemical Manufacturing supply chain, decreasing the environmental footprint of the sector and contributing to a cleaner industry. While the transition towards a sector not backed by fossil fuels will require time, we must continue to build a strong foundation to build from to enable this significant cross over. This report will also identify the main challenges in making this happen, alongside recommendations for how these challenges could be addressed.

The UK is fortunate to have many existing biomass feedstocks that can provide a primary resource for the sector, and the potential to develop new feedstocks necessary to meet demand for chemical production.

By effectively using the resources already available to us, along with an enhanced understanding of the needs and drivers of the supply chain, the sector can begin to transition away from non-renewables and come closer to meeting national net zero targets over time.

Innovate UK KTN is keen to bring the biomass community together to share learnings and optimise engagement across the whole supply chain. For further information around the biomass innovation landscape, please get in touch with Dr Catherine Julia Mort at catherine.mort@ktn-uk.org, or join one of our upcoming webinars.

> Biomass has the potential to play an important role in the transition to a greener future. Done well, the use of sustainable biomass could allow us to decarbonise sectors that would be hard/ impossible to decarbonise in other ways.
>
> **Joanna Sparks, Aston University**

EB/IB Survey Participation | Demographic Split | Supply Chain

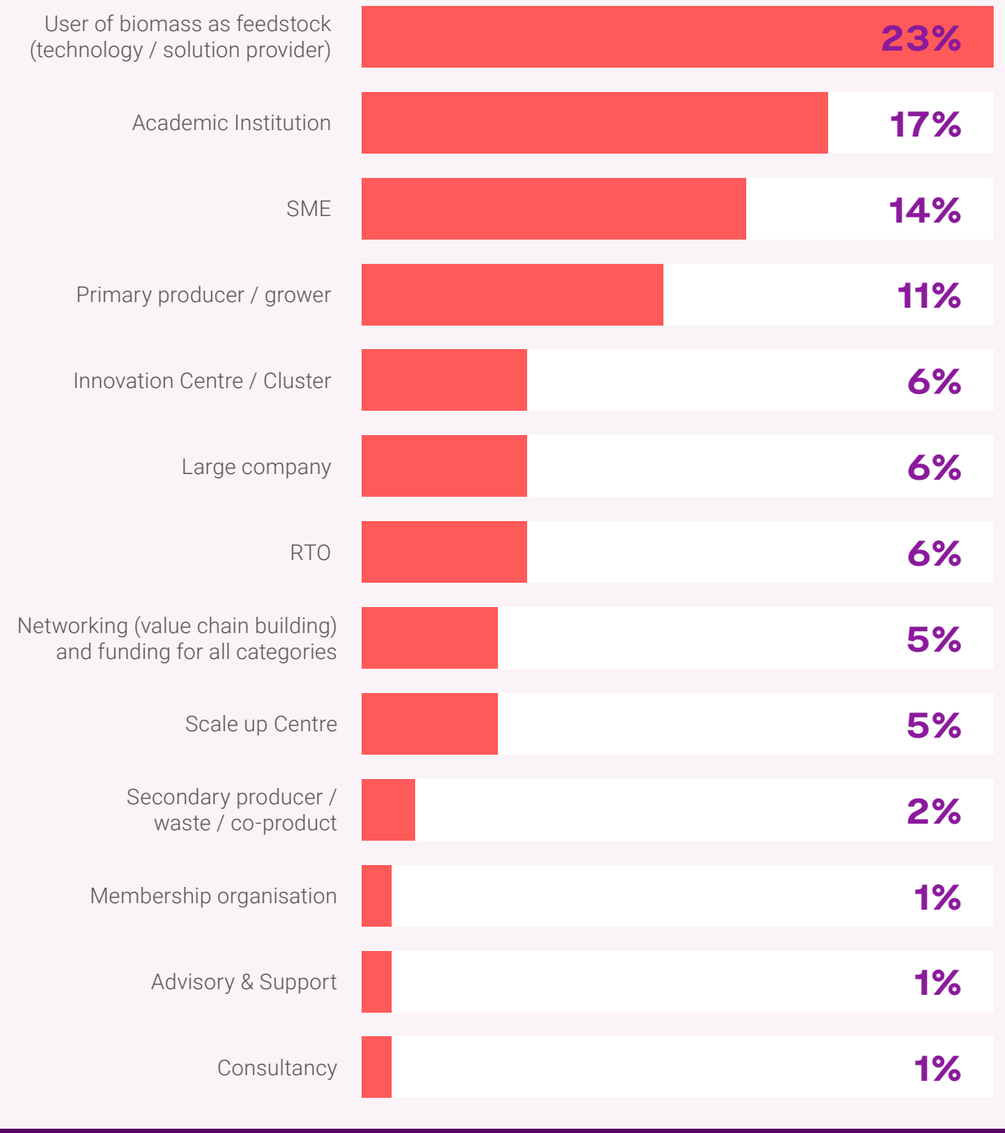

Figure 2. Chart representing which part of the supply chain the survey participants align with

Our research into the Chemical Manufacturing supply chain

While there has been significant discussion and support for biofuels (such as the Green Fuel, Green Skies competition and the UK Sustainable Aviation Fuels mandate), the production of high value chemicals from a biomass source remains a largely untapped opportunity.

For example, there has not yet been a discussion with stakeholders across the supply chain (farmers / growers and the Chemical Manufacturing sector end users) to determine the high value chemicals that are in greatest demand, and the quantities of these chemicals required. With this consensus, farmers / growers would have a greater understanding of the needs of the end users and can plan what they produce in a commercially relevant manner in alignment with what is required to be grown.

By establishing goals and guidelines like this, clarity and purpose can be placed behind the sector, enabling key stakeholders to make informed decisions and support collaboration for the mutual success of all.

Participants agreed that biomass will undoubtedly play a key role as a future feedstock, and it will do so in tandem with a wide range of other feedstocks such as carbon dioxide and waste plastic.

For successful change to be made in this sector, at the speed needed to accommodate the government net zero commitments, collaboration from all stakeholders must be secured.

It is also important that both biomass producers (farmers and growers) and the chemical industry end-users are involved in these conversations, so that they can make informed decisions on biomass development and consumption which will aid in this biomass revolution. Broad-scale engagement is fundamental when responding to the recommendations that will be outlined in this report. For this seismic shift in how we develop chemicals to be successful we must listen to all perspectives and evolve this sector with intentional collaboration and innovation.

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Survey results analysis

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What we found

Through the research process we developed greater understanding of the current biomass landscape in the UK, with key feedstocks and their related chemical products being shown below in **Figure 3**. This has underpinned a series of recommendations we make later on in the report.

Sources of biomass seen as having the greatest potential included forestry by-products, marine biomass and, most highly rated, non-food crops. This final category includes agricultural products like hemp, willow, sugar-beet and crop residues.

Many of the benefits of using biomass sources as a substitute for petrochemicals are two-fold, not only reducing the reliance on non-renewable fossil fuels, but also providing non-toxic by-products that can be returned to soil once their value has been extracted.

Waste biomass and by-products were also highlighted by our survey participants as perhaps one of the most front-of-mind sources to the general public. This subsection can be classified as anything that is derived from an existing process or organic material that is thrown out as waste, including food waste, municipal solid waste, crop residues and bioprocess by-products like spent whiskey grains.

This type of biomass has a lower carbon footprint because it predominantly uses end-of-life carbon and does not require large swathes of land dedicated solely to its growth. Further development of waste biomass as a source for the Chemical Manufacturing sector will propel the UK towards a circular economy in this area without significant changes in current agricultural practices.

From this initial data we can see that across the UK, companies are harnessing biomass feedstocks to produce a host of key chemicals used in industry today including polymers, biofuels, textiles, and foodstuffs. But while these findings give a glimpse into the potential of biomass utilisation if supported strategically, more supporting information is required if policymakers and investors are to be convinced of its utility.

Biomass/Feedstock Type	Applications
General Lignocellulostic Biomass	Sugar (Mono Saccharides) Polymers (Coatings, Construction Chemicals, Adhesives, PPE, Textile & Non-Wovens)
Biomethane	Chemical conversion (H2/CO2)
C02 (Industrial off gas)	C1 & H2
Marine Biomass	Seaweed Biorefining (multi-component extraction) Water and wastewater cleaning products and nutritional supplements.
MSW	Chemical & Materials (Glucose, Bioethanol, Ethylene, Ethylene Oxide) Textiles Soil Improver Sustainable Aviation Fuel (SAF)
Non Food Crops	Agri-food applications CHP Power Plant Citric Acid & Bioethanol Construction materials, Bio-Plastics Bio-Energy Neutriceuticals (Hemp Seed Oil & Hemp Protein Powder) High Value / High Volume Chemicals
Organic Waste Unspecified	Energy & Chemicals
Textiles	Cellulose
UCO, Bagasse, Sewage Sludge & Animal Waste	Biofuels
Waste Fats and Oils	Biodiesel Personal Care, Crop Care, Health Care, Coatings, Polymers, Plastic Additives & Lubricants
Wastes from food harvesting and (or) processing	Biofuels Bioplastics Carbonising for multiple applications Cosmetics, Foods & Chemicals Food applications Fat and sugar-replacing functional dietary fibres. Phenol/ Cardanol Proteins
Whiskey & Beer spent grain	Food, Bioplastics & Cosmetics
Wood	High Value Chemicals

Figure 3. Biomass sources currently being utilised in the UK and respective applications

Where shows the most future potential for realising the UK's Net Zero targets?

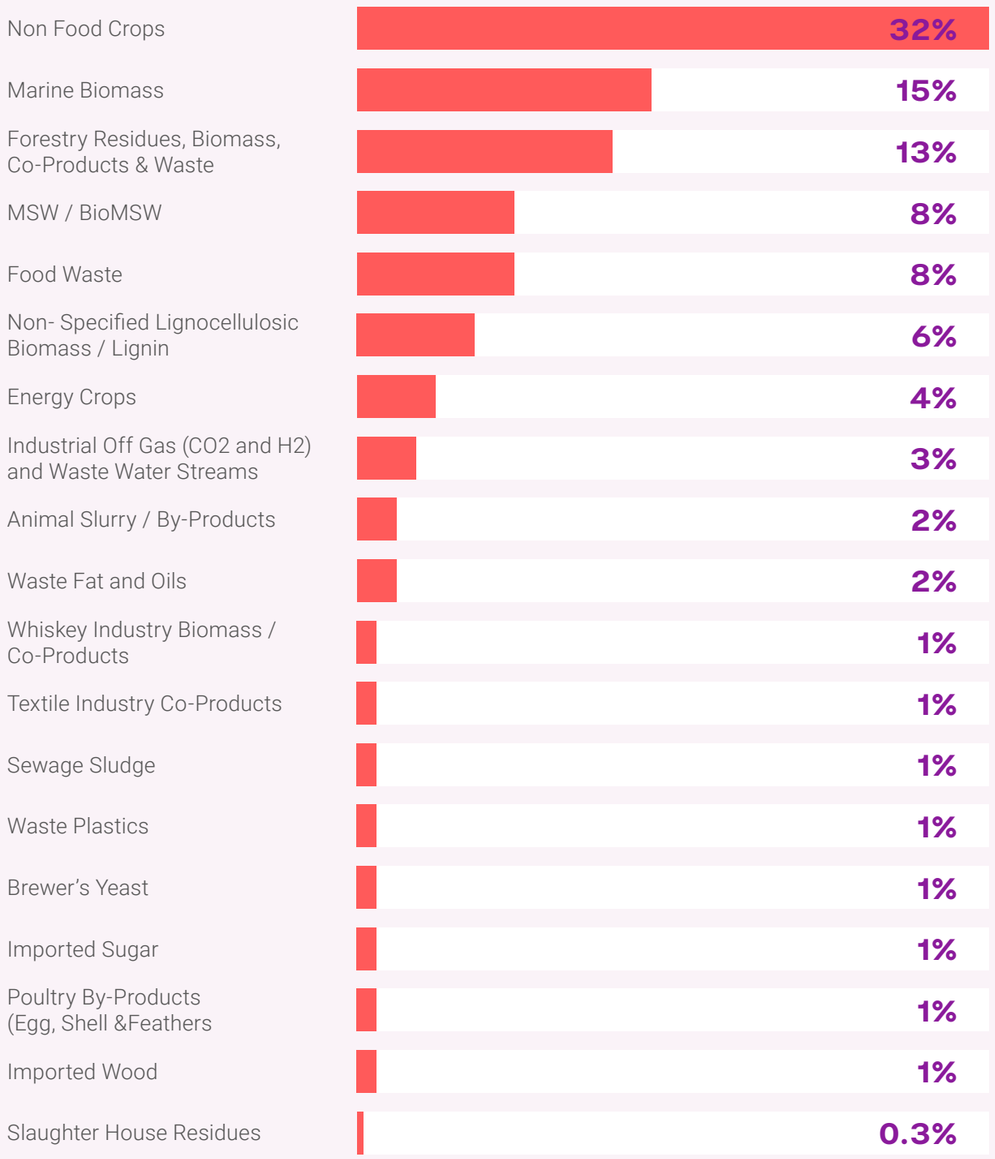

Figure 4. Type of biomass that shows the most future potential for realising the UK's Net Zero targets

Where are the non-food crop priority areas?

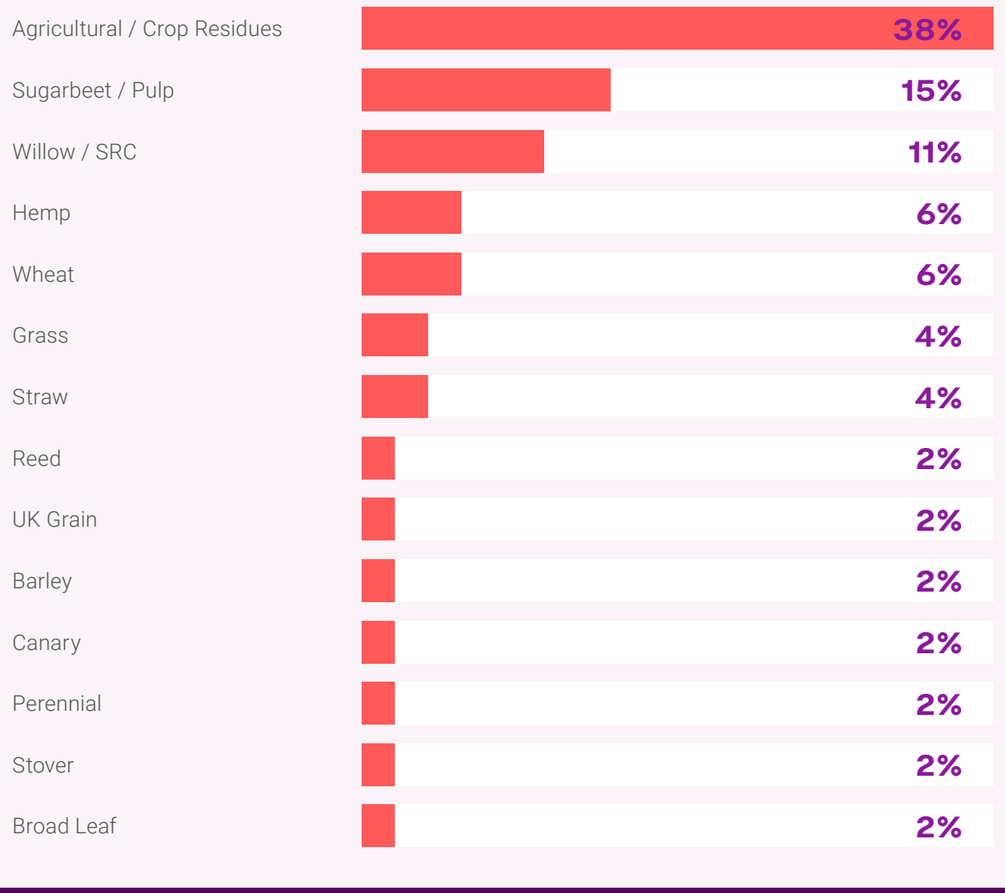

Figure 5. Chart to show the breakdown of non-food crop priority areas

Enabling a biorefinery solution

A significant proportion of participants discussed the value of prioritising the biorefinery concept as a solution here. Biorefineries produce multiple product streams including bioenergy in addition to other high value chemicals and materials. **Figure 6** shows that a vast majority of key stakeholders believe that a biorefinery solution is the best way to extract the most value from a biomass source. This concept would make full use of all biomass fractions to extract maximum value and avoid the burning of precious biomass for bioenergy production as the sole product.

Research & Innovation Priority Areas

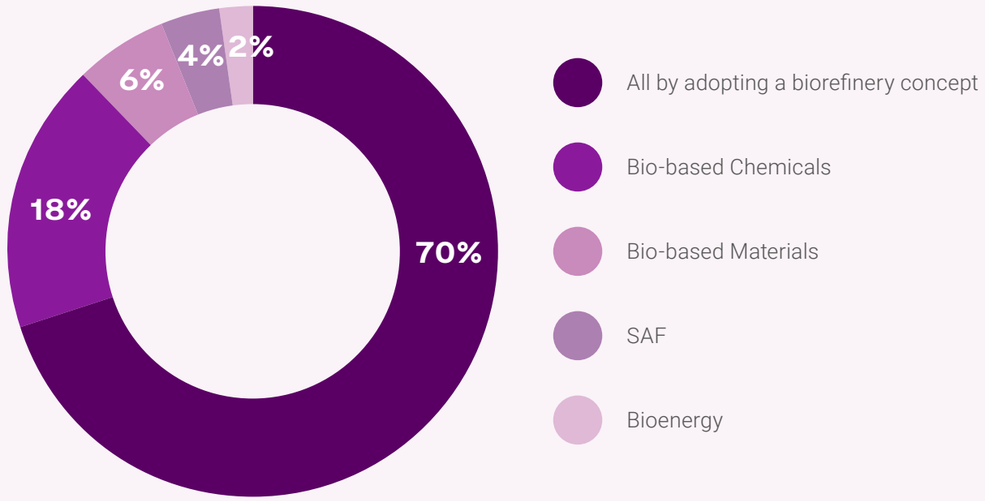

Figure 6. Chart to show product stream priority areas from biomass utilisation

Focusing on a wider biorefinery concept would give the UK the best chance of developing multiple technologies using a range of biomass to help achieve net zero targets and encourage sustainable manufacturing. Focusing on one technology area would limit the UK, by supporting more technology development we would give the UK the best chance of developing a world class bioeconomy.

Lynsey Dunbar, IBioIC

Demonstrating commercial opportunities

The main 'asks' for primary agricultural producers like farmers and growers are around commercial viability. Can the produce be sold, and what support is available for those producing it?

Farmers and growers will be incentivised to produce particular biomass feedstocks if relevant policy and support actions are put in place which parallel those observed with biomass production grown for biofuels and bioenergy. Schemes like these will need to be available before we see acceleration of the required widespread engagement from the top end of the supply chain.

The UK's greatest strengths in biomass innovation

Figure 8. Chart to show the UK's greatest strengths in biomass innovation

Incentives would help shift the economics of these processes, allowing for bio-feedstocks to be utilised by industry when previously this wouldn't have been economically viable.

Chris Holt, NEPIC

Building a priority list of high value chemicals from biomass feedstocks

As previously mentioned, a lack of available data leads to the hesitancy in the uptake of new biomass feedstock resources from stakeholders across the whole supply chain. Further information about feedstock availability, respective volumes of feedstocks, geographical variation, and seasonal changes, must be collated and presented to help guide key stakeholders to prioritise biomass usage. Also required is a greater understanding of the high value chemicals that can and should be made from biomass feedstocks and in which order of priority.

With this priority chemical list, the supply chain could co-ordinate activity and focus research and development efforts. Previous lists such as the BioChem10 must be built upon to evaluate and validate where the efforts of this supply chain are best placed. Once an industry-accepted and agreed upon priority list is developed the focal points for further research and investment will be revealed.

Would a priority list of chemicals from the chemical industry be of value?

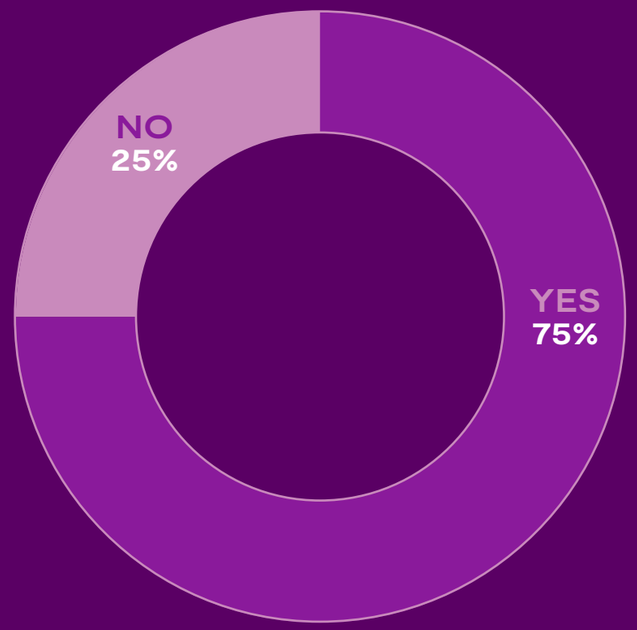

Figure 12. Chart illustrating the value of a priority chemical list coming from the chemical industry

Building on the success of biocatalysis

Enzymatic biotransformation (biocatalysis), is a mature technology highly effective at performing chemical transformations, often at low temperatures and with high efficacy and accuracy. Their proven success here makes them a high priority target for future research and it was chosen as the highest priority individual research area by our respondents as shown in **Figure 7**. Further research into this area would likely result in the diversification of feedstocks that can be used in this process, bringing more value from a broader foundation.

Top technology focus areas

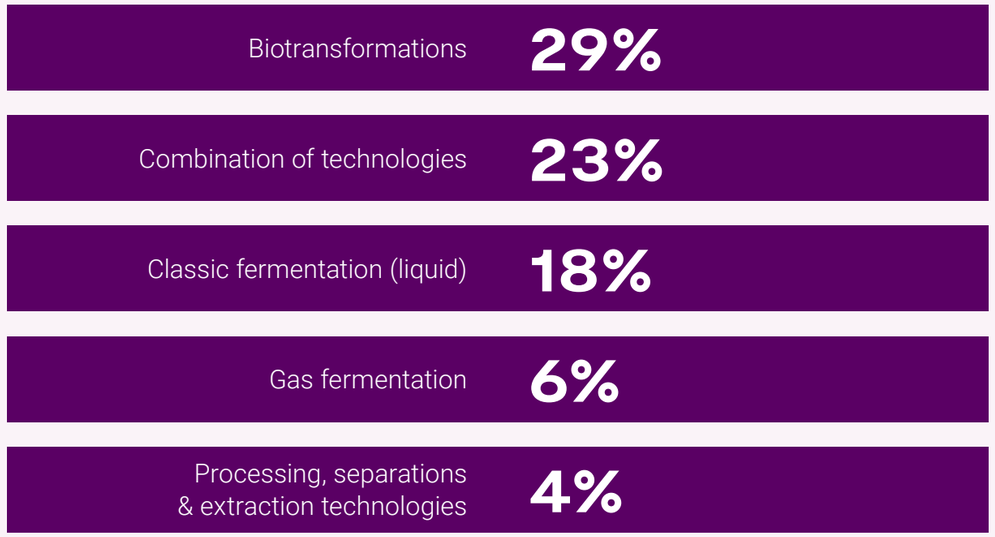

Figure 7. Chart to show technology focus areas

Another area already providing value to the Chemical Manufacturing sector is sugar-fed fermentation. An example of this is the production of bioethanol from organic sources as a base to produce further high value chemicals. Having a clearly defined base chemical, like ethanol, that can then be manipulated further through existing processes, make it a secure alternative to petrochemical sources.

Funding concerns

Further funding for scaling IB/EB technologies is a high priority concern for researchers and R&D businesses. Scotland has shown great success in its bioeconomy, mainly due to clear government initiatives to improve research in this area. A national rollout of similar strategies to the 'National plan for Industrial Biotechnology' and the 'Biorefining Roadmap for Scotland' would present a welcome show of confidence in the longevity of this sector and its potential to replace petrochemicals.

31% of participants said that **policy drivers** were the key challenge to the utilisation of biomass

27% of participants said that **funding** was the key challenge to the utilisation of biomass

20% of participants said that **scale-up** was the key challenge to the utilisation of biomass

7% of participants said that the key challenge to the utilisation of biomass was the **available technologies**

3% of participants said that the key challenge to the utilisation of biomass was that there is **no market**

10% of participants said that **all of these** were key challenges to the utilisation of biomass

Figure 9. Chart to reflect the key challenges the EB/IB communities face in relation to the utilisation of biomass

There is a clear appetite for biomass-based alternatives for Chemical Manufacturing. Internationally, a recognition of the need to 'go sustainable' and pursue net zero goals is more apparent than ever, with companies like Unilever and L'Oréal setting ambitious targets for themselves. And yet there is still a clear disconnect between these large corporations who regularly purchase chemicals, and the IB/EB industry that is beginning to provide green alternatives. **Figure 11** shows that an overwhelming majority of biomass stakeholders feel there is an opportunity for more clear focus and direction from the chemical industry. Greater communication between these two groups on their end-user requirements, readiness and capabilities would benefit both sides greatly.

The current landscape of the biomass-chemicals industry consists of many highly successful and established companies, providing high value chemicals to key customers across the chemicals sector. The barriers to implementation of many proven technologies are missing infrastructure and a lack of funding, not the lack of sophistication of the technology. With clear funding opportunities, outlined in the recommendations below, the process of scaling up many biomass technologies would be expedited without the need for great leaps in research which already exists.

69% of participants were aware of industrial drivers coming from the chemical manufacturing industry

Figure 10. Chart illustrating the awareness of industrial drivers

89% of participants answered that there was no clear focus & direction from the chemical manufacturing industry

Figure 11. Chart illustrating if there is clear focus and direction coming from the chemical manufacturing industry

> "Many technologies function at lab and small scale but the ability to scale up to mid-size systems can be prohibitively expensive."
>
> **David Lawson, SRUC**

Recommendations

Here, recommendations for starting to defossilise the biomass-to-chemicals supply chain will be laid out so that a holistic perspective of the current state of play and opportunity can be outlined for policymakers, biomass producers and chemical industry end-users. IUK KTN sits at a key crossroads of industrial and academic players poised to facilitate these recommendations through our extensive networks of contacts which provide key visibility across all stakeholders.

1

We need a comprehensive, up-to-date map of UK wide biomass availability

To provide all relevant decisionmakers within the biomass-to-chemicals supply chain with full oversight of its potential capacity, well-researched datasets must be developed and made publicly available. For biomass to be utilised in the most effective manner, an up-to-date map of biomass availability should be developed providing clarity on respective volumes and availabilities of different feedstocks as well as information on geographic spread and seasonal variation.

This data relating to the primary sources of biomass must then be coupled with relevant IB/EB technologies available now and in the near future, and their end applications and products in the chemical industry. Once this information project has been concluded key stakeholders will feel more confident to make informed decisions in this area and funding and investment will naturally follow.

2

We need to identify a priority list of high value chemicals for the Chemical Manufacturing sector

Currently no priority list of high value chemicals for the Chemical Manufacturing sector that can be derived from biomass feedstocks exists. This lack of consensus across the sector stifles investment and prevents policymakers and businesses from planning for the future of this industry.

Existing lists like BioChem10 must be verified, expanded and underpinned by accurate research and the involvement of all stakeholders, to establish volume requirements and identify priority chemicals. Once this information is clearly communicated the supply chain will be able to plan accordingly and divert resources to their most effective applications.

3

We must secure engagement from across the supply chain

The successful shift of the Chemical Manufacturing sector from a petrochemicals source to a biomass source will require engagement across the entirety of the supply chain. Often, the 'ends' of this supply chain can feel uninformed or even excluded from this conversation, in particular growers and end users in the Chemical Manufacturing sector.

Further engagement through information sharing projects and improved collaboration will ensure that growers know which biomass feedstocks to invest in, and that chemical industry end-users know which products are available from non-fossil fuel sources.

4

We need an open, accessible, supported biorefinery facility

Innovation in the utilisation of biomass is costly and can represent a significant financial risk for many facilities, particularly smaller businesses. Part of this huge financial cost comes from the development of a new and separate biorefinery to test, prove, and demonstrate feasibility before any commercial operation can begin.

If more innovators had access to a centralised biorefinery, subsidised by a supporting authority, then financial risks would be reduced and new research would be stimulated. The cost of accessing such a facility must be low and not represent a barrier to innovation or else new creativity and thinking in this area will be stifled. This type of collaborative work would provide expedited innovation at lower costs and overall lead to a more rapid defosilisation of the industry.

5

We need a biomass-chemicals funding catalyst

The development of a biomass-to-chemicals funding catalyst would underpin all future research in this area, bringing together expertise, innovators and monetary investment to rapidly shift the sector away from reliance on fossil-based carbon. The catalyst would provide support and resources for innovators to make the most of the previous recommendations such as a comprehensive map of biomass availability and a priority chemicals list.

6

The Biomass Strategy 2022 should address these concerns.

This year the Biomass Strategy will be released by the Department for Business, Energy & Industrial Strategy (BEIS) (the findings of this report formed part of the call for evidence for the Biomass Strategy). It is hoped that the Biomass Strategy will outline the future requirements of a biomass-chemicals supply chain, based on all the available research and stakeholder engagement sourced so far including; supportive policy drivers, mandates, and government incentives to ensure a smooth transition away from

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Conclusion

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Conclusion

If we are to truly defossilise our economy by 2050 in line with government net zero goals, change needs to happen now. No sector must be left behind and efforts to defossilise the Chemical Manufacturing sector could have a significant impact. Key steps must be made sooner rather than later to set us on the right path towards a sustainable future. Biomass will undoubtedly play a key role as a future feedstock, in tandem with a wide range of other feedstocks such as carbon dioxide and waste plastic.

Across the biomass-chemicals supply chain there must be engagement and collaboration for mutual environmental and economic benefit, from growers and farmers to the innovator community, to end users in the Chemical Manufacturing sector. Engagement between all of these stakeholders, and clear evidence of the benefits of this transition to key policymakers, will unlock funding and inform policy with the final goal of a sustainable and circular chemicals industry. The transition away from petrochemicals will not be a simple task, even with existing technologies and their increasingly sophistication in the coming years, but it is necessary to reach global sustainability and environment goals.

Through this report we have documented the opinions and concerns of the current biomass-chemicals supply chain as it stands, offering a brief insight into the potentials of different biomass sources across the country, as well as current shortfalls in their technologies and applications. By pursuing the recommendations of this report, we can level up this supply chain to create a robust industry, backed by informed policy and investment strategies.

Setting out a comprehensive map of biomass availability, coupled with a priority list of chemicals, and underpinned by supply chain engagement and a central funding catalyst would transform this sector, safeguarding the manufacturing of key chemicals needed as we phase out fossil fuel use for a sustainable future.

Innovate UK KTN is dedicated to ensuring that the potential of biomass is realised by influencing key stakeholders and decisionmakers in this area.

If you are interested in finding out more about the utilisation of biomass to defossilise this supply chain, then get in touch with Dr Catherine Julia Mort at **catherine.mort@ktn-uk.org**.

Find out about upcoming biomass events: **https://ktn-uk.org/chemistry/**

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Lastly, a big thank you to the participating organisations and individuals that submitted their thoughts and experiences. Participating organisations include:

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For more on working with us and joining our network of innovators, contact us at:

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