Aston University

Energy and Bioproducts Research Institute (EBRI): Business Investment in Research – Successor Project

Summative Assessment

May 2023

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Project:	Energy and Bioproducts Research Institute (EBRI): Business Investment in Research – Successor Project
Document Title:	Summative Assessment
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Contents Page

		Page
1.0	Introduction	3
2.0	Project Context	4
3.0	Project Progress	16
4.0	Project Delivery and Management	24
5.0	Project Outcomes and Impact – Business Feedback	36
6.0	Case Studies	68
7.0	Economic Impact	85
8.0	Value for Money	86
9.0	Key Lessons and Recommendations	90

Appendices

Appendix A – Economic Impact Analysis

1.0 Introduction

In July 2020, Focus Consultants 2010 LLP was appointed by Aston University to undertake an independent summative assessment and evaluation of the Energy and Bioproducts Research Institute (EBRI) Successor project. There are three phases to this exercise – an interim evaluation (April 2021), a Progress Report (September 2022) and this, the final evaluation. The project is due for completion in June 2023. This report sets out the findings of the Summative Assessment, bringing together the findings from the whole evaluation period.

As outlined in the brief, the final evaluation includes:

- Documentation and Output Review: including the original application, logic model, contract agreements, progress / claim reports and highlight reports, determining a thorough understanding of how the project has progressed to date and to assess progress against profiled outputs, outcomes, spend, and milestones.
- Strategic review – analysis of the changing policy context
- Staff Consultation: to be undertaken throughout, adding value to the "hard "project information from the people delivering the project.
- Beneficiary Consultation: results of an online questionnaire issued to SMEs that have received business assistance, as well as feedback gathered by the EBRI team on the Surgery Calls, Tailored Reports and Master Classes.
- Case Studies: in-depth one-to-one conversations with beneficiary businesses to gain a more detailed understanding of the project impact.
- Economic Impact Assessment: a critical component of the evaluation, assisting in outlining the project's progress in terms of impacts and adherence to ERDF requirements.
- Assessment of value for money
- Reporting: Pulling together the information captured in the above methodology and adhering to the structure outlined in the ERDF Summative Assessment Guidance, the information is compiled into a cohesive report that includes key conclusions and recommendations.

There is a requirement for all ERDF grant recipients to undertake a summative assessment. The Summative Assessment Final Report follows the intended structure and covers each of the elements outlined in the ERDF Project Summative Assessment Guidance Appendices (June, 2020). This requirement is fixed and applies to all projects irrespective of the nature or scale of the projects.

Focus has taken every care to conduct the study professionally, openly and thoroughly, to retain an objective stance, to balance the opinions expressed and explore the justification for the comments made. It must also be recognised that there are inevitable budget and time constraints, which limit the resource available for the evaluation.

2.0 Project Context

This section considers the context in which the project was designed, including the project objectives and the rationale for the delivery approach.

2.1 Background and Context

2.1.1 Background

The Energy and Bioproducts Research Institute (EBRI) at Aston University is a world leading centre for bioenergy research and technology development. Created with the assistance of the European Regional Development Fund (ERDF), EBRI evolved from a research facility with the installation and commissioning of capital plant and equipment to the delivery of structured industry engagement programme for bioenergy and associated sectors. EBRI's research and technology capabilities extend to cover the breadth of advanced thermal and biological conversion processes, including gasification, pyrolysis, anaerobic digestion and thermo-chemical refining of biomass to high-quality engine fuels.

EBRI Phase 1: The original EBRI project was co-financed by an ERDF award in 2011, to fund a 1,900m² building to house an industrial research and demonstration facility on bioenergy – notably the combination and calibration of advanced thermal and biological processes, focused on intermediate pyrolysis and gasification, anaerobic digestion and thermo-chemical refining of biomass to high quality products and fuels.

EBRI then diversified to accommodate a more business-orientated agenda. The original demonstration aspects were adapted to facilitate the transfer of bioenergy technologies and expertise to regional businesses – with an increasing focus on fostering innovation and supporting SMEs to achieve concrete results. The first phase was completed and fully evaluated in 2015, with the evaluation findings, including extensive consultation with the business community directly informing Phase 2.

EBRI Phase 2: Phase 2, the "EBRI: Business Investment in Research" project, supported the development of a regional bioenergy supply chain and the promotion of innovative new bioenergy technologies. Running between 2016 and 2019, Phase 2 supported the exchange of ideas and commercial research to enable local businesses to identify business and value opportunities. It also supported businesses to identify and trial technologies or processes that help them diversify into bioenergy or develop new products or services.

The EBRI team facilitated collaborations between businesses and academics and supported applied research. They engaged local SMEs in knowledge exchange, research and innovation, bringing new products and processes to market in bioenergy and energy systems.

EBRI Phase 3: the EBRI Successor project commenced in July 2019 and will run until June 2023. The project supports SMEs across the Stoke and Staffordshire, Coventry and Warwickshire, Greater Birmingham and Solihull, the Marches and the Black Country LEP areas. The project is supporting the adoption of research and innovation amongst SMEs.

Aston University's project engages SMEs in knowledge exchange, research and innovation and brings new products and processes to market in bioenergy and energy systems. The EBRI team delivers awareness raising events, business support and business access to demonstration facilities to facilitate investment in research and innovation by SMEs in technologies identified through smart specialisation in the growth area of "low carbon" energy systems and value from waste from across the value chain.

The project specifically promotes innovation and research in SMEs and provides access to the UK knowledge base to enable companies to develop and introduce new innovative products and processes. The project is therefore focused on the development of new technologies rather than dealing with retrofit or other mainstream and established practices.

The project, worth £3,505,803 in total, was awarded £1,752,902 from the European Regional Development Fund as part of the European Structural and Investment Funds Growth Programme 2014-2020. This was matched with a £1.75m contribution from Aston University.

2.1.2 Meeting ERDF Requirements

EBRI Successor Project was formulated in response to the requirements set out under Priority Axis 4, Investment Priority 4f 'Promoting research and innovation in, and promoting adoption of, low carbon technologies.'

The project aligns with the objectives of Investment Priority 4f; it does this in a number of ways:

- Deploying staff to work on supply chains with direct links to Aston University specialists in the field. The project uses the EBRI smart energy platform as a demonstrator for companies.
- The project provides access to a £20m research facility and industry level demonstrator for beneficiaries as well as links into national and international research networks.
- EBRI is working with LEPs and regional networks to engage with SMEs to deliver the renewable energy roadmap.
- EBRI has a track record of working with SMEs and business groups to promote adoption of integrated systems supporting low carbon transport.
- The project supports business leaders and decision makers with the process of business start-up and commercialisation through a series of focused workshops and Master Classes backed up by direct support for new product development.
- The project continues EBRI activities linking businesses with sources of finance to support adoption of low carbon technologies.
- The team provides access for beneficiaries to the EBRI low carbon technology demonstrators.
- The project includes support for innovation in secondary and bio-product development.

2.1.3 Project Details

The project is delivered by the professional staff on the EBRI business technology support team plus access to the specialist knowledge base at Aston. The project supports SMEs across the Stoke and Staffordshire, Coventry and Warwickshire, Greater Birmingham and Solihull, the Marches and the Black Country LEP areas.

The project delivered the contracted activities from the outset until the Covid-19 pandemic necessitated the development of an alternative delivery model. Initially, the project delivered the following activities:

Awareness Raising and Marketing

- The project is promoted through industry exhibitions and events, through trade associations and in partnership with the Growth Hubs.
- Workshops to link businesses with the cutting-edge practical research knowledge.
- Events for business decision makers, entrepreneurs and developers to build awareness of bioenergy, energy systems, value from waste and their applications.

Business Support

Personalised service tailored to each individual business hinging around a minimum of two days of support in:

- Testing: access to test facilities, feedstock analysis, and company reports on viability and technology requirements
- Economics: practical feasibility studies on bioenergy and energy systems - the nature of the site and feedstock, the proposed technology and economic assessments of risk and return. This will include decision support tools and economic modelling as well as technical assessments of feedstock logistics and transport.
- Technology: an assessment of emerging products and technologies. This includes the development of new products from waste by chemical recycling.
- Markets: an individual appraisal of the bioenergy marketplace in a detailed options and opportunities report.
- Innovation ecosystem: The project will work across the whole value chain and will include mapping and opportunity assessments. This will include companies working at high technology levels but also companies able to adopt a range of new innovations and explore options across the value chain.

The delivery also includes one to one work, Master Classes for business decision makers and follow on collaborative projects. These give businesses the ability to understand the technologies, how to bring them to market and apply them in a commercial environment.

Facilities

- Access to demonstration facilities including advanced gasification, pyrolysis, CHP engine and integrated building systems. Mobile demonstration facilities are also available for use across the region.

In March 2020, in adapting to the Covid-19 pandemic, the project developed an alternative model that centred on online delivery:

- Due to the constraints enforced by the pandemic, the project shifted to a surgery-based approach, delivering a more personalised, tailored service to each SME online. This approach has enabled the team to deliver more intense engagements with businesses.
- Workshops have been substituted for 30-minute virtual low carbon challenge consultations for individual companies – enabling a more personalised, tailored approach with companies helping them to address their unique challenges. Following each session, the EBRI team would conduct its research and then devise a summary of findings, guidelines and recommendations for the business.
- Following an initial surgery consultation, the academic team conduct detailed research and investigation on behalf of the business, presenting the findings in an analytical report for businesses to consider.

The pandemic also limited SME access to demonstration and testing facilities; the project team experienced a 75% fall in their access to EBRI laboratories. Therefore, the project supplied tailored reports to businesses based on investigations of existing material where possible. The project has since returned to delivering Master Classes in-person throughout the target LEP areas whilst maintaining the new surgery-based approach.

The project aims to drive up the number of SMEs participating in research and development by removing barriers to involvement and opening up wider opportunities for research collaborations through university contacts and networks. Through the spread of bioenergy and energy systems it is aiming to develop the cross LEP low carbon business community, a key growth sector.

2.1.4 Outputs

The project was contracted to deliver the following ESIF outputs:

Contracted Outputs		Project Target
C1	Number of enterprises receiving support	80
C4	Number of enterprises receiving non-financial support	80
C5	Number of new enterprises supported	7
C26	Number of enterprises cooperating with research entities	21
C29	Number of enterprises supported to introduce new to the firm products	9
Source: EBRI, ERDF Claim Form		

All businesses receive a minimum of 2 days of non-financial support in the form of participation in a surgery consultation which enables businesses to develop an action plan and conduct an assessment of the business benefits of low carbon technology.

In terms of collaboration, the project includes joint assessments of innovative ways to reduce carbon through use of alternative fuels, power generation methods and application of smart energy systems. The collaborations are used as direct input into the business planning process for participating companies, support for investment proposals, ways of entering new markets and the foundation for further research.

In addition, the project supports the development of new products by assisting companies to innovate by providing a range of support services including materials testing, supply/ value chain opportunity assessments and market and technology evaluations.

More details on the project's progress on achieving these outcomes is considered in later sections and a full description of each output, and its requirements, is in Section 3.

2.2 Market Failure

Midlands Energy Hub's (MEH) Low Carbon and Environmental Goods and Services (LCEGS) sector was worth £26.6bn to the MEH's economy in 2019/20, as indicated by the value of sales in the sector. These sales were generated by over 10,500 businesses that employed over 195,000 people in the sector in 2019/20 (MEH Regional Report 2021).

The number of companies in MEH's Low Carbon and Environmental Goods and Services sector in 2019/20 was 10,559, up from 9,531 in 2017/18. Annual growth rate in the number of companies was 3.7% between 2017/18 and 2018/19 and 6.9% between 2018/19 and 2019/20. This rate of growth is slower than the UK average for the same period (9.3% and 10.3% respectively) however, the fast rate of growth in London raises the UK average.

MEH's five largest sub-sectors by sales have all enjoyed high levels of growth in sales, number of employees and number of companies between 2017/18 and 2019/20:

- Alternative Fuels – sales have grown from £3.4bn to £3.8bn (11.4% increase), number of employees by 10.9% and number of companies by 10.8%.
- Water & Wastewater Treatment – sales have grown from £1.8bn to £2.0bn (11.3% increase), number of employees by 11.0% and number of companies also by 9.9%.

In response, the project was designed to create a 'super triage' facility with a single point of contact for bioenergy, energy from waste, bio-products and energy systems to drive up SME engagement to develop and adopt renewable technologies. The project is targeted at a number of LEP areas, each of which are demonstrably requiring of support in order to mobilise SMEs to develop renewable technologies. The Regional Innovation Scoreboard shows the West Midlands to be the joint lowest performing region with:

- The GBSLEP area importing almost all of its energy at a cost of £3.38bn per annum.
- The Black Country generating more than 500,000 tonnes of domestic waste and more than 3.2 million tonnes of commercial and industrial waste. The economic value of processing these value streams locally in a more environmentally friendly way is approximately £1 billion a year.

The key market failures addressed by the project are identified in both the Sir Andrew Witty Review of Universities and Growth, and the Dowling Review of University and Business Collaborations (2016):

- The future growth of the UK economy will in large part come from fast growing SMEs, but our performance in terms of the proportion of SMEs that are innovative is relatively weak.

Universities offer SMEs varied and substantial benefits, but many SMEs lack resources for external engagement and the quality of support available from the local university is key.
- Lack of engagement with companies that have never participated in collaborations but could profit from doing so.
- Lack of engagement of technical and academic staff with business.
- The need for more support for access to collaboration opportunities such as KTP, CASE etc.

2.3 LEP Policy Context

A review of the EBRI Successor project needs to take account of the changing context within which it has operated, its role in servicing SMEs of the sector, the evolving priorities of the LEPs it serves as well as national Government policies for growth. It is therefore important to understand where the project is positioned in this landscape and explore the continued relevance and consistency of the project in the light of policy and economic circumstances during its delivery period.

2.3.1 Context in the LEP Areas

a. Stoke and Staffordshire

Bioenergy has been identified as a priority area for economic growth and sustainable development by the Stoke and Staffordshire Local Enterprise Partnership (LEP).

Stoke and Staffordshire LEP's Energy Strategy aims to support the growth of low-carbon energy, including bioenergy, by identifying and capitalising on development opportunities. It also aims to increase energy efficiency and lower carbon emissions. This strategy also set out to reduce carbon emissions in the area by 80% by 2050, whilst aiming to increase the share of renewable electricity in the local energy mix from 6% in 2012 up to 15% by 2020.

The LEP's Biomass Strategy outlines the potential for the area's biomass industry to grow. It identifies opportunities for biomass supply chain development, such as sourcing biomass from forestry residues and waste wood which links directly to work that is being completed as part of the EBRI Successor project. Additionally, the strategy also identifies the potential to generate up to 100 MW of renewable electricity from biomass in the Stoke and Staffordshire area, which could reduce carbon emissions by up to 200,000 tonnes per year.

Moreover, the project is particularly relevant to the LEP's Low Carbon Freight and Logistics Strategy which encourages the use of low carbon fuels, such as biofuels and sets a target to reduce carbon emissions from freight and logistics operations in the area by 15% by 2025. The Staffordshire Heat Network Strategy similarly aims to encourage the development of heat networks in the area, which may include the use of bioenergy as a heat source. The Stoke and Staffordshire LEP sets out a number of economic goals, including an ambition to:

- Reduce carbon emissions in the area by 80% by 2050.
- Generate up to 100 MW of renewable electricity from biomass.
- Reduce carbon emissions from freight and logistics operations by 15% by 2025.
- Grow the economy by £3.5 billion by 2030.

b. Coventry and Warwickshire LEP

CWLEP's Strategic Reset Framework aims to drive activities that will be needed to minimise the negative economic impacts of Covid-19 in Coventry and Warwickshire, by creating the environment for innovation and enterprise to flourish in the future. CWLEP also plan to build on its R&D assets and the nationally and internationally recognised strengths of its universities to continue to shape the development of its future industries. The LEP's stated objective to rest the economy is founded on a number of reset principles, including:

- Delivery will be to the wider climate change and sustainability agenda, encouraging a green recovery across all of the local economy, and embracing new and innovative low carbon technologies.

The Framework recognises that their sectors are transforming, through cross-sector innovation, creativity and digital technologies, and the net zero carbon imperative, for their sustainable future.

Moreover, the Low Carbon and Environmental Goods and Services sector in the Coventry and Warwickshire LEP grew year on year since 2017/18. In 2017/18 total sales in the sector were worth £3.1bn and have now reached £3.4bn in 2019/20, which represents a significant market for low carbon innovation support.

c. GBSLEP

The low carbon sector is one of the region's key areas of strength that can enable clean growth and prosperity in the coming years. By focusing on opportunities to boost the growth and productivity of low-carbon businesses, Greater Birmingham, and the wider West Midlands, can boost both domestic and foreign inward investment, scale-up its export potential and ultimately create jobs and improve quality of life. The sector already makes a significant contribution to the region's economy, contributing £3.3bn GVA across the West Midlands Combined Authority (WMCA), and is forecast to dramatically increase.

The GBSLEP has been assigned the Low Carbon and Environmental Sector as one of its key sectors to deliver on under the region's Local Industrial Strategy. To this end, the GBSLEP has developed and is the process of refining the region's first Low Carbon and Environmental Technologies (LCET) Action Plan that aims to ensure the low-carbon businesses in the region are well-placed to grow during the transition to net zero and recovery from Covid-19. The 'low-carbon' sector. It incorporates a large proportion of the energy system which is leading the low carbon transition, and increasing proportions of the transport/automotive and construction/housing sectors. Specifically, the Action Plan proposes to "seek to maximise local collaboration between research and innovation entities and businesses".

The Action Plan states five Action Themes:

1. Encourage development and commercialisation of low carbon innovation.
2. Provide ad-hoc support to existing LCET businesses and to the ones that aim to become LCET business.
3. Enhance Business Leadership and visibility of the LCET sector in the region.
4. Increase the Low Carbon workforce.
5. Maximise impact of public sector investment in LCET and local procurement.

The Plan also sets out a number of challenges that are relevant to the project:

- There is a wealth of support and resources for innovators in the region (including EBRI), however these lack visibility and often do not effectively reach out to SMEs who could benefit from such support.

d. The Marches

The Marches LEP Economic Recovery Plan 2021-22 considers actions to be undertaken by the Marches LEP in response to the economic downturn associated with the Covid-19 pandemic and ensuing lockdowns. The Plan highlights that investment on innovation within businesses, spend on research and development and take up of available funding and tax credits in the Marches is historically lower than in other places. The Marches ranks as the second lowest LEP for business expenditure on R&D at around £46m, or £69 per person, and the fourth lowest LEP for Innovate UK funding (Innovate UK 2020).

The economic downturn may act as a driver for innovation, product, service and supply chain development. The Marches Growth Hub and the LEP's Higher Education (HE) Group have a critical role to play here.

The Recovery Plan sets out a number of immediate and medium-term actions, including:

- Identify ways of building links between UK Research and Innovation and the Marches LEP's HE Group.
- Finalising the Energy Strategy Steering Group action plan to confirm priority strategic actions and how these will contribute to both the local authorities' net zero targets and a green recovery.
- Consider opportunities for new/revised provision including: Engagement with emerging sectors that have high future economic and productivity growth potential, including environmental technologies (low carbon environmental goods and services), cyber security, agri-tech and innovative health and social care.
- Work with LEP Skills Advisory Plan (SAP) members to raise the profile of growth sectors, including those within and outside the environmental technologies sector which can directly support the transition to net zero.

The Marches has sectoral strengths in advanced manufacturing with specialisms in metals, machinery and automotive, particularly light weighting and composites, as well as emerging, nationally important strengths in environmental technology, cyber security and resilience, agri-tech, and innovative health and social care.

The Marches sets out a number of economic goals, including an ambition to:

- Create 1,000 new jobs in low carbon sectors by 2030;
- Move to 50% renewable electricity by 2030;
- Reduce 1990 carbon emissions by 57% by 2032;
- Lower fuel poverty to below 10% by 2030;
- Grow the economy to £23.8bn by 2038.

e. Black Country

The development of low-carbon and renewable energy technologies, including bioenergy, is identified as a key priority for the region's economic growth in the Strategic Economic Plan. The plan emphasises the importance of promoting biomass as a renewable energy source and increasing the region's capacity to generate bioenergy. It also states that they will “support the development of a low carbon sector that creates high-value jobs and business opportunities” and they will “seek to increase the number of businesses engaged in low carbon activity across the Black Country”.

The Black Country Energy Strategy similarly emphasises bioenergy's potential to contribute to the region's energy mix while reducing its carbon footprint. The strategy includes policies to encourage the development of bioenergy projects and to help the region's bioenergy sector grow.

Furthermore, the Black Country LEP's 2021-2026 Strategic Economic Plan aims to expand the Black Country economy by £4.2 billion and create 45,000 new jobs by 2030. This represents a 26% increase in Gross Value Added (GVA) between 2018 and 2030. The plan also identifies a number of priority sectors for regional economic growth, such as advanced manufacturing, construction, creative industries, health and social care, and low-carbon and environmentally friendly goods and services. The LEP's goal is to help these priority sectors grow in order to drive economic growth and create new job opportunities throughout the Black Country.

Black Country LEP’s five largest sub-sectors by sales have also all enjoyed high levels of growth in sales, number of employees and number of companies between 2017/18 and 2019/20:

- Alternative Fuels – sales have grown from £302m to £338m (12.0% increase), number of employees by 16.5% and number of companies by 17.1%

2.4 UK and Regional Policy Context

The UK has a clear commitment to clean growth, where the economy continues to grow while reducing greenhouse gas emissions. The commitments are set out in the Industrial Strategy and the Clean Growth Strategy. Although the UK is arguably a world leader in clean growth, there is an ongoing need for further development across multiple sectors to deliver on the low carbon economy commitments both local and central government are pursuing. LEPs in the Midlands are fully cognizant of the need to support and further develop the green economy, as set out in their Energy Strategies and Local Industrial Strategies.

The Government's Build Back Better - Plan for Growth (2021) sets out a departure from its Industrial Strategy which means that Local Industrial Strategies are no longer recognised by central government. The Strategy aims to deliver long-term growth whilst retaining a guiding focus on achieving the people's priorities: including supporting the transition to net zero. The plan sets out an ambition to invest in net zero to create new opportunities for economic growth and jobs across the country, including supporting up to 60,000 jobs in the offshore wind sector, 50,000 jobs in carbon capture, usage and storage (CCUS) and up to 8,000 in hydrogen in industrial clusters. In addition, the plan states an aim to row the current net zero industries and encourage new ones to emerge. This includes working with industry, aiming to generate 5GW of low carbon hydrogen production capacity and capture 10Mt CO2/year using CCUS by 2030, and ending the sale of new petrol and diesel cars and vans in 2030.

In 2020 the government published the Ten Point Plan for a Green Industrial Revolution, setting out how the UK can make the most of the opportunities presented by the shift to net zero. This announced £12 billion of UK Government investment, and the ambition to leverage three times that amount of private investment by 2030 across key technologies such as hydrogen, offshore wind, nuclear, electric vehicles, heat and buildings. The plan includes a commitment to increase bioenergy use, particularly biomethane and biofuels.

The development of more efficient and sustainable processes for producing biofuels, the expansion of the use of biomethane as a renewable gas, the use of waste products as feedstocks for bioenergy production, and the integration of bioenergy with other renewable energy technologies, such as solar and wind, are all future areas of need in the bioenergy sector. The development of sustainable and cost-effective production methods, as well as the optimization of resource efficiency and waste reduction, are all future areas of need for bioenergy, products, and fuels.

The Build Back Better strategy also focuses on delivering the Ten Point Plan, which will support up to 250,000 highly-skilled green jobs, including through:

- Becoming a world-leader in technology to capture and store harmful emissions away from the atmosphere, with a target to remove 10Mt of carbon dioxide per year by 2030, equivalent to all emissions of the industrial Humber today, or taking around four million cars off the road. We will establish four CCUS (carbon capture, usage and storage) clusters, two by the mid-2020s and a further two by 2030;

The West Midlands Combined Authority (WMCA) has set a target to achieve net-zero carbon emissions by 2041. The declaration of a Climate Emergency by WMCA, many local authorities and a host of private and public organisations, as well as increased public awareness and concerted action from local residents means that the demand for LCET products and services is set to grow. A substantial opportunity exists to identify, develop and procure products and services from local LCET businesses.

Major developments in the region such as the introduction of a Clean Air Zone (CAZ) in Birmingham, the construction of HS2 and a potential for pioneering smart energy trials all provide opportunities for LCET businesses. Aston University's EBRI (Energy and Bioproducts Research Institute) Successor project seeks to investigate and promote sustainable and renewable energy solutions for LCET businesses and other SMEs alike.

2.5 Growth Potential

Broadly speaking, the bioenergy sector is expected to play a growing role in meeting future energy demands, particularly as countries strive to reduce their reliance on fossil fuels while meeting climate targets. The work being done as part of the EBRI Successor Project is assisting in driving innovation in this area and developing new technologies that can aid in making bioenergy a more sustainable and efficient source of energy.

Alternative fuels (sales of £3.8bn) is a highly scalable sub-sector, although at present it is growing in line with the UK and holds a share of the UK market in line with the regional average for the sector. The sub-sector has a 15.6% skills shortage (MEH average is 8.7%) and although it has an extremely high upskilling potential, it has a below average training capacity. For a sub-sector that has a large market and high estimated CO2 reduction potential, this is a significant area for improvement.

Waste Management (sales of £1.8bn) is a notable sub-sector, being a large market, with slower growth than the UK average, but being significantly above average market size (24.0% vs 12.1% MEH average). It is not particularly scalable and is not high in terms of CO2 reduction potential but has good training capacity and good upskilling potential and only has a skills shortage of 5.9%.

The LCET sector is expected to grow dramatically in response to the escalating concern about climate change and the need to move to a low carbon economy. The projected growth across the UK is 11% per year between 2015-2030, which is four times the growth rate of the UK economy overall (5 Committee on Climate Change & Ricardo Energy and Environment, 'UK business opportunities of moving to a low-carbon economy' (March 2017). Evidence suggests that LCET businesses benefit from targeted business support that focuses on building networks and partnerships. Thus, local networks for LCET businesses, supported by the public sector, are an excellent means of supporting growth of the sector.

Data relating to the Low Carbon and Environmental Tech (LCET) sector's economic contributions can be found below:

- There are 740 enterprises and 22,750 jobs across WMCA related LCET.

- This sector contributes £3.6bn to GVA in WMCA.
- GVA per employee of £156,764 – the highest of any WMCA sector.
- LCET plays a key role in transformation of other WMCA sectors such as automotive and construction.
- LCET sector could make up over £9 billion or 10% of the WMCA economy. (West Midlands State of the Region 2019).
- LCET is the only sector in which the WMCA has a higher GVA per employee than the UK overall with CWLEP: £148,000, BCLEP: £130,000 and GBSLEP: £132,000. (West Midlands Industrial Strategy Sector Evidence Full Pack, September 2018).

It is clear the project's strategic fit has become even stronger since inception of the project with the commitment to net zero carbon, the publication of the Ten Point Plan for a Green Industrial Revolution and the growth of the Low Carbon and Environmental Tech in the region.

3.0 Project Progress

This section summarises the EBRI Successor Project's progress to date in achieving the output and spending targets outlined in the ERDF Funding Agreement. It does so by focusing on the project's implementation and drawing on annual and lifetime performance against the expenditure, activity, and output targets. It entails analysing quantitative data supplied by Aston University. When necessary, it is additionally supported by qualitative data gleaned from consultations to offer commentary.

The summative assessment method has been designed to allow the positive/negative impact on those assisted to be measured, both qualitatively and quantitatively, while also emphasising the direct impact of the assist delivered while drawing conclusions against the hypotheses established at the start of the project.

3.1 Output Targets

3.1.1 Output Definitions

Output data was collected during the interim programme period, up to and including **Q4 2022**, to assess the effectiveness and efficiency of the ERDF programme. The following are the output definitions:

- C1 Number of enterprises receiving support
- C4 Number of enterprises receiving non-financial support
- C5 Number of new enterprises supported
- C26 Number of enterprises cooperating with research entities
- C29 Number of enterprises supported to introduce new to the firm products.

C1 - ERDF – Number of enterprises receiving support

This is a minimum of either:

- 2 days (12 hours) active consultancy support (for non-financial support)
- Grant or Loan/Risk Finance Investment of at least £1,000 (for financial support investment).

Although this is the official definition for C1 outputs, EBRI does not offer the grant or loan. Only supplying the 2 days consultancy support.

This type of support includes consultancy, information, diagnostic advice, and guidance to individual businesses that results in the production of goods and/ or services. Assistance counted can include initial diagnostic and assessments, as well as any defined subsequent support. The method for delivering assistance can be face-to-face, telephone or web-based dialogue, through conferences, seminars, meetings, and workshops dependent on the needs of individual businesses.

Activities should support the project's objectives and be directed towards ultimately improving the performance of the business. Support can be provided across a range of activity including management/ leadership support; access to new supply chains and markets including new international markets; marketing; innovation and commercialisation of R&D; process improvement, quality assurance; resource efficiency.

C4 outputs (number of enterprises receiving non-financial support) is a subset of indicator C1. To register as non-financial support, the business must be provided with a service or services by the project with no direct payment of monies.

C5 - ERDF – Number of new enterprises supported

Activity must be to support a new business or a business locating in the England programme area for the first time. A new business is one which:

- Has been registered at Companies House or HMRC for less than 12 months before assistance is provided; or
- Is a business locating in the England programme area for the first time, to start trading.

This is a subset of indicator C1 – therefore Count Criteria under C1 must be fulfilled.

C26 – ERDF – Number of enterprises cooperating with research entities

- Collaboration must include a minimum of one enterprise and one research entity.
- Each enterprise in a collaboration may be counted.

This focuses on collaborations which are about transferring good ideas, research results and skills between the knowledge base and business to enable innovative new products and services to be developed and includes:

- Research collaborations and free dissemination of research.
- Joint and long-term development of new business or services.
- Formation of joint ventures and spin-out companies.

C29 - ERDF – Number of enterprises supported to introduce new to the firm products

The indicator measures if an enterprise is supported to develop a 'new to the firm' product. It includes process innovation as long as the process contributes to the development of the product. Projects without the aim of actually developing a product are excluded.

A product is new to the firm if the enterprise did not produce a product with the same functionality or the production technology is fundamentally different from the technology of already produced products. Products can be tangible and intangible (including services).

Supported projects that aimed to introduce new to the firm products but did not succeed are still counted.

3.1.2 Contracted Outputs

The output targets shown in the table below are from a funding agreement between the Ministry of Housing, Communities and Local Government (now the Department for Levelling Up, Housing and Communities) and Aston University. They highlight what the project is contractually obligated to deliver.

ERDF Output Targets					
Overall	**2019**	**2020**	**2021**	**2022**	**Total**
C1	2	31	39	8	**80**
C5	0	2	5	0	**7**
C26	0	13	4	4	**21**
C29	0	1	6	2	**9**

3.2 Progress Towards Outputs

The table below summarises progress toward each of the identified ERDF output targets as of December 2022, as well as all outputs achieved since the project's inception.

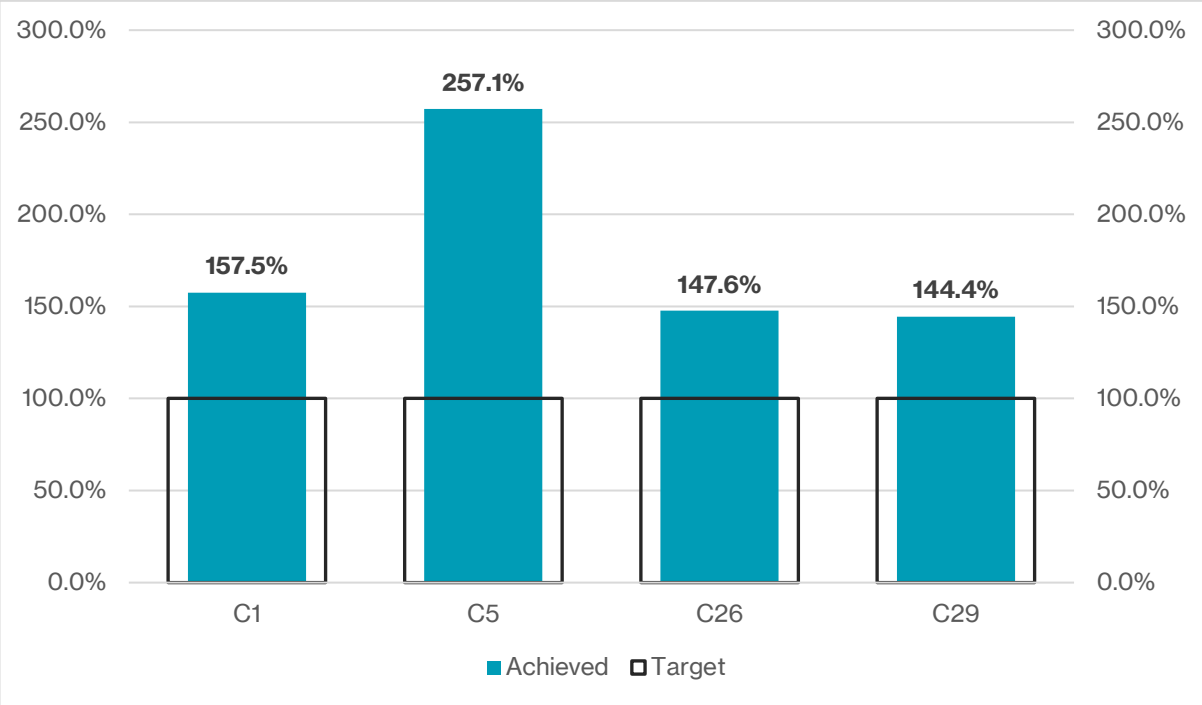
3.2.1 Review of Outputs Achieved

ERDF funding is characterised by a series of predetermined outputs and outcomes, against which tangible success can be measured. The following table lists each of the outputs (code number and definition), and records the contracted output target, progress against those targets to date, and how that relates as a percentage towards the contracted outputs.

ERDF - Project Outputs			
Output	**Contracted Output**	**Progress Against Targets**	**%**
C1 - Number of enterprises receiving support	80	126	**157.5%**
C5 - Number of new enterprises supported	7	18	**257.1%**
C26 - Number of enterprises cooperating with research entities	21	31	**147.6%**
C29 - Number of enterprises supported to introduce new to the firm products	9	13	**144.4%**

- All four of the outputs contracted at the start of this project have already been exceeded as of **December 2022.**

- The project has supported 126 enterprises with 12hrs of support (C1) to date, which represents 157.7% of the overall target with six months of delivery remaining. This goes far beyond the originally contracted outputs and emphasises the critical demand for the project's services.
- With 18 new enterprises supported, the project has met **257.1%** of its contracted output target for C5s.
- With an initial target of **21**, the project has achieved **31 (147.5%)** of the **C26** outputs relating to the number of enterprises cooperating with research entities.
- Finally, the **C29** output target of **9** has been met and exceeded, with **13 (144.4%)** enterprises supported to introduce new to firm products to date.



It is also important to recognise the intangible nature of many of the additional/non-contracted outputs generated as a result of enterprises' participation in the EBRI Successor Project. Businesses themselves report that the project has helped to add value, increase profit margins, improve efficiency, aid in new product development, improve understanding, and foster long-term collaborations, which aren't always reflected in these outputs.

3.2.2 LEP Areas

The project focuses on the following LEP geographic areas, and the following proportion of outputs are assigned to each LEP area based on an assessment of likely demand from the SME community:

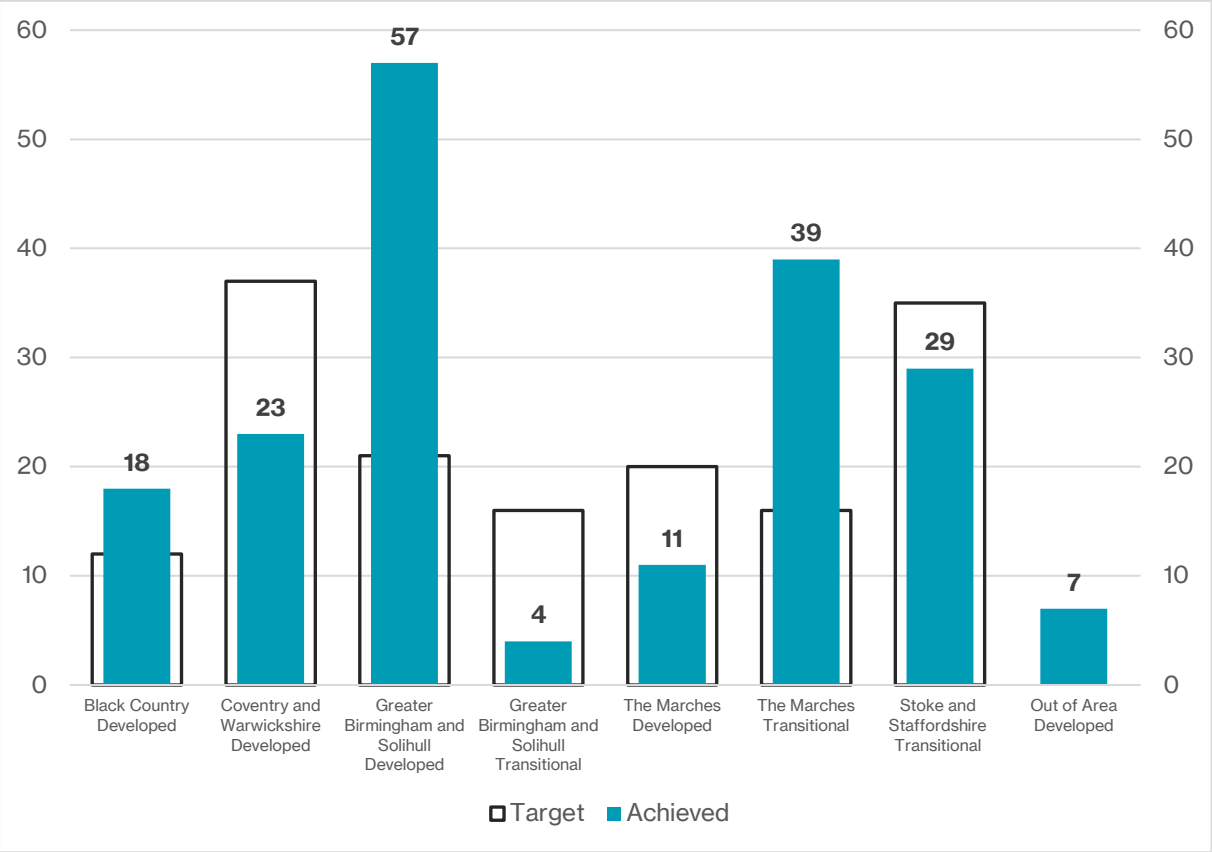
- Greater Birmingham and Solihull, **23.75%**
- Coventry and Warwickshire, **23.75%**
- Stoke-on-Trent and Staffordshire, **22.5%**
- The Marches, **22.5%**
- Black Country, **7.5%**

Areas are defined as Category of Regions (CoR) based on their Gross Value Added (GVA) rates. Three CoR groups exist: Less Developed, More Developed, and in Transition. The table below uses a cumulative sum of all outputs to show the project's progress in each Developed/Transitional LEP/CoR area. This shows that the project has achieved its goals in the Developed LEP areas for the Black Country and Greater Birmingham and Solihull, as well as the Transitional area of The Marches.

a. Sum of Outputs Achieved by Category of Region

Sum of Outputs - Progress Towards Targets by LEP			
Outputs - LEP/CoR Split	**Target**	**Outputs Achieved**	**%**
Black Country Developed	12	18	**150.0%**
Coventry and Warwickshire Developed	37	23	**62.2%**
Greater Birmingham and Solihull Developed	21	57	**271.4%**
Greater Birmingham and Solihull Transitional	16	4	**25.0%**
The Marches Developed	20	11	**55.0%**
The Marches Transitional	16	39	**243.8%**
Stoke and Staffordshire Transitional	35	29	**82.9%**
Out of Area Developed	0	7	**N/A**

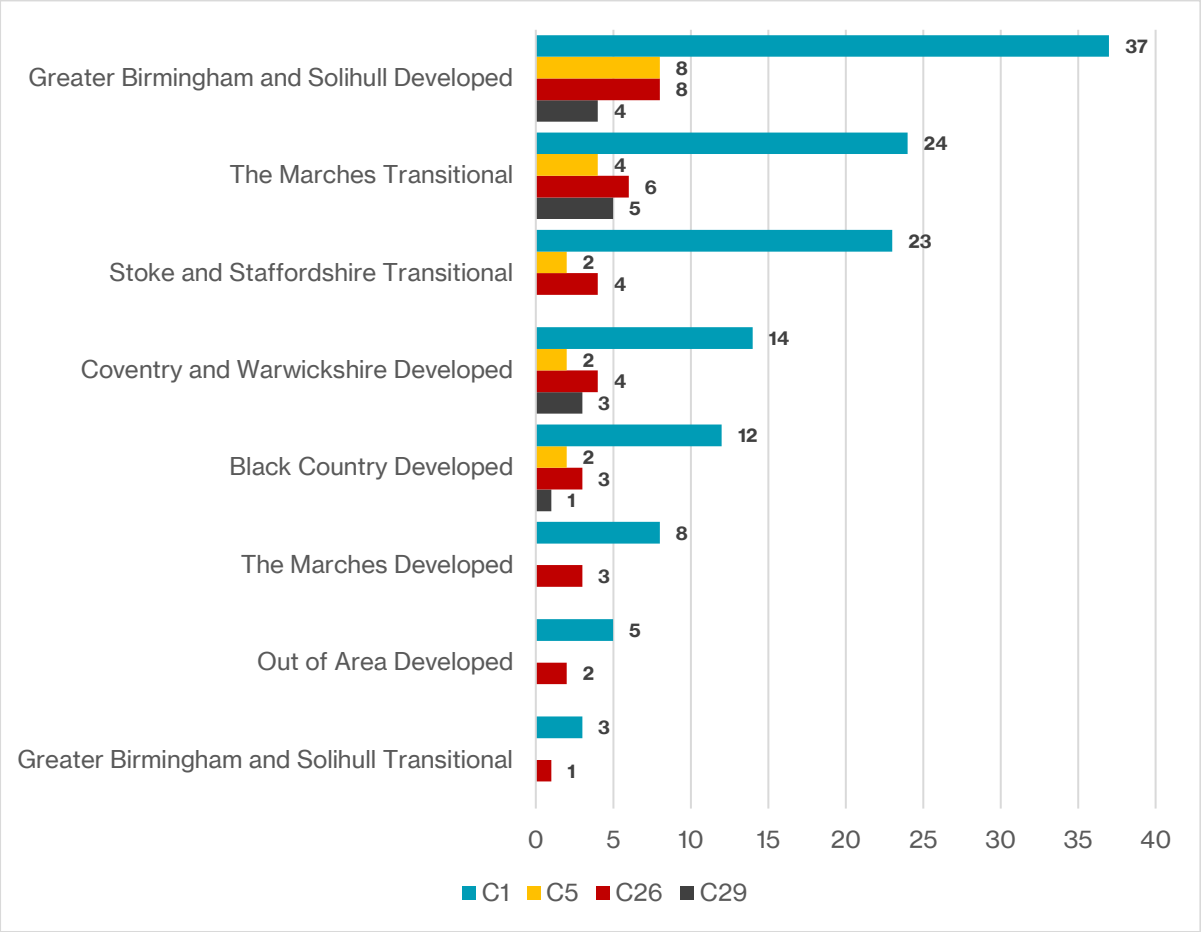
The project sets different goals for each output in each LEP area. The table and graph below show the project's output progress against each target in each of the LEP areas.



- The project has already already exceeded its targets in the Black Country More Developed, GBSLEP More Developed and The Marches Transitional COR areas.
- Overall, the project has achieved 128.9% of the total sum of outputs targets for the More Developed areas, as well as 107.5% of the total sum of outputs in the Transitional areas.
- The data shows that there has been significant over-achievement in some areas whilst enrolments have been lower that projected in the Greater Birmingham and Solihull Transitional, The Marches Developed and Coventry and Warwickshire Developed areas in particular.

b. Outptus Achieved by More Developed COR Areas

Outputs by More Developed Areas				
Outputs	**C1**	**C5**	**C26**	**C29**
GBSLEP Developed	37	8	8	4
The Marches Transitional	24	4	6	5
Stoke and Staffordshire Transitional	23	2	4	0
Coventry and Warwickshire Developed	14	2	4	3
Black Country Developed	12	2	3	1
The Marches Developed	8	0	3	0
Out of Area Developed	5	0	2	0
GBSLEP Transitional	3	0	1	0



- Most of the project's activity has been delivered in the Greater Birmingham and Solihull More Developed area, which accounts for 29.4% of the total C1s and 25.8% of the total C5s achieved respectively.
- The Marches Transitional area is home to the most C29 outputs (38.5% of the total achieved).
- The project has additionally achieved 7 outputs (5 x C1s and 2 x C26s) Out of Area.

3.3 Spend

The project is funded under Priority Axis 4f: Promoting Research and Innovation in, and promoting adoption of, low carbon technologies.

The table below shows the projected and actual expenditure figures for the project to **December 2022**.

Aston Costs	Contracted to December 22	Actuals to December 22	%
Salaries	£1,978,787	£1,779,428	89.9%
Marketing	£75,299	£72,177	95.9%
Professional Fees	£20,000	£9,456	47.3%
Other Revenue	£96,280	£44,923	46.7%
Overheads	£540,341	£474,132	87.7%
Aston Total	**£2,710,707**	**£2,380,116**	**87.8%**
Source: Project Progress Report 2022			

As of **December 2022**, the EBRI Successor Project had spent **£2,380,116** in total, accounting for **87.8%** of the total expenditure target for this period, and 67.9% of the total project budget of £3,505,803. Underspend to date is in part the result of the impact of the Covid-19 Pandemic during 2020 and 2021, whilst variance in salaries is attributed to project team vacancies during periods of the project. With six months still to operate at the time of analysis, there is potential for the project to achieve or be close to achieving its overall expenditure target by the end of June 2023.

3.4 Summary – Project Progress

- All four of the outputs contracted at the start of this project have been exceeded as of **December 2022.** The project has supported 126 enterprises with 12hrs of support (C1) to date, which represents 157.7% of the overall target with six months of delivery remaining.
- With 18 new enterprises supported, the project has met **257.1%** of its contracted output target for C5s. With an initial target of **21**, the project has also achieved **31 (147.5%)** of the **C26** outputs relating to the number of enterprises cooperating with research entities.
- Finally, the **C29** output target of **9** has been met and exceeded, with **13 (144.4%)** enterprises supported to introduce new to firm products to date.
- The project has already achieved more outputs in total than contracted in the Black Country More Developed, GBSLEP More Developed and The Marches Transitional COR areas.
- Overall, the project has achieved 128.9% of the total sum of outputs targets for the More Developed areas, as well as 107.5% of the total sum of outputs in the Transitional areas.

- The majority of the project's activity has been delivered in the Greater Birmingham and Solihull More Developed area, which accounts for 29.4% of the total C1s and 25.8% of the total C5s achieved respectively.
- As of **December 2022**, the EBRI Successor Project had expended **£2,380,116** in total, accounting for **87.8%** of the total expenditure target for this period, and 67.9% of the total project budget of £3,505,803.

4.0 Project Delivery and Management

This section provides a qualitative analysis of the project's implementation and management. It examines delivery performance, academic experience, SME engagement, governance, management, ideas, and next steps. It is based on discussions with project academics and other stakeholders at Aston University.

4.1 Project Management and Governance

Responsibility for the management of the project rests with EBRI within Aston University. The EBRI Successor Project is overseen by the Director of Engagement at EBRI. There are no delivery partners associated with the project.

The project retains a similar team to the one that has delivered the previous ERDF projects; in keeping the established team EBRI and Aston University have created a sustainable platform through the creation of 'Knowledge Exchange Associates' – professional staff capable of bridging the worlds of academia and commerce, understanding, and working in both.

The Director of Engagement chairs monthly meetings and prepares monthly reports on expenditure and progress against objectives that are submitted to the College of Engineering and Physical Sciences Senior Management Team.

The Knowledge Exchange Associates apply academic expertise in fields – such as engineering and economics – and through spreadsheet analysis can show businesses how these have a commercial impact, by increasing profits, identifying, and minimising risks and understanding the investments required. The Knowledge Exchange Associates help to translate unique and emerging technologies developed at the University into simple commercial applications capable of being taken forward by individual companies.

4.2 Staff and Stakeholder Consultation

To demonstrate the wide-ranging impact of the project and to assess the effectiveness of the project's design and performance, this section details the results of consultation with project staff and stakeholders. The consultation included one-on-one interviews with academics from the project team, as well as key stakeholders from across Aston University. The following people were consulted with as part of the evaluation:

- Director of Regional Strategy and Projects
- Pro-Vice Chancellor for Research
- Deputy Dean for Research
- Executive Director of Business Engagement
- Professor and Executive Dean, Executive Deans Office
- Director, Aston Institute of Urban Technologies, and the Environment
- Senior Lecturer, Aston Business School
- Lecturer, Infrastructure and Sustainable Engineering, Aston University
- Lecturer, Infrastructure and Sustainable Engineering

- Lecturer, Chemical Engineering and Applied Chemistry
- Lecturer, Infrastructure and Sustainable Engineering
- Chair in Electrical Power Engineering, Electrical and Electronic Engineering
- Director of Advancements, Developments and Alumni Relations office

The findings of this consultation have been grouped together under themes and have not been attributed to particular individuals.

4.2.1 Project Design

The EBRI Successor Project at Aston University is working to conduct research in the fields of bioenergy, bio-based products, and biofuels. The project aims to create new and sustainable methods for producing biofuels and chemicals, as well as to investigate new applications for bio-based products. The project is also looking into the use of waste materials as feedstocks for bioenergy production, such as food waste and agricultural residues.

In 2019, EBRI changed its name from the European Bioenergy Research Institute to the Energy and Bioproducts Research Institute to accommodate a slight shift in vision offered by the new EBRI Director. The change of name represents a slightly broadened brief, with EBRI aiming to focus on high-value products as well as bioenergy. The change in name therefore also provided broader appeal to academics working with high-value products.

In the last few years, it was suggested that EBRI has become increasingly receptive to the concept of commercialisation; the Institute has now developed into a team of progressive academics who increasingly see the importance of commercialisation to their own research. The main aim of the project is therefore the commercialisation of bioproducts resulting from EBRI's pyrolysis technologies and the application and development of different aspects of the research, such as soil improvement. This adapted perspective requires a breadth of perspective, not looking solely at any one chemical process, instead looking at it as an entire proposition, and what benefits the process is going to create.

EBRI and the project are crucial to Aston University's commercial potential; the project is one of the university's interventions that identify and encourage scalable commercial propositions out of their academic research. After the pandemic, EBRI organised a range of Master Classes helping to engage with SMEs and raise awareness of EBRI's technologies, which are a starting point for academics to provide support for SMEs and to develop opportunities for collaborative research projects.

The project involves a range of staff from across different research areas in the university, aiming to bridge scientific research and industry challenges. The project facilitates the development of a network of academics invested in similar research areas and across different institutions, including the likes of University of Birmingham and Keele University.

The project also responds to an increasing need for 'levelling up' of sustainability skills within SMEs. Sustainable practices and Sustainable Development Goals were less pertinent and commonplace for business owners a decade and more ago; the Master Classes therefore play a crucial role in

raising awareness of ways to adopt sustainable practices into long-running business models that need assistance to change.

The ERDF project is typically limited by its output definitions to 12hrs of support per SME, supplemented by additional support as required; however, the project helps to identify larger companies with an ambition for a research project which can be taken forward outside of the parameters of the ERDF project.

In terms of delivery, academics receive requests from business partners who might want to test their feedstock, or proof of concept development, or the processing of ideas; academics contribute by technically supporting and delivering the experiments, and in the writing of reports for businesses as part of a consulting service that complements the free service to businesses afforded by the ERDF project. Some academics are also responsible for supervising PhD students in EBRI, whilst also being involved with business engagement meetings to help to develop opportunities connected to their work.

4.2.2 Business Engagement

The Master Classes, which were organised after the Covid-19 pandemic, were well received, and thought to be of high quality. The classes were an excellent source of communication and knowledge, and they were thought to have greatly aided PhD students in networking and gaining first-hand knowledge of how local businesses and engineers operate. Furthermore, feedback has emphasised the flexibility of the Master Classes, and what was initially perceived as a challenge has added value to the project and the University as a whole. Consultees highlighted that even well-established businesses can learn things they didn't know before, and learn what other businesses are doing, gain contacts, and experience from other businesses, including solutions to shared challenges around sustainability and waste management.

In response to the Covid-19 pandemic, the project adapted quickly with face-to-face interaction limited, laboratory work reduced, and academic involvement limited at times. The project needed to shift from delivering physical sessions to delivering virtual surgeries. Remote delivery presented a number of challenges, both practical and in terms of success; it is believed to be more difficult to persuade potential clients to change their behaviour remotely.

As a result of social distancing requirements and isolation periods, the pandemic also limited access to both laboratories and staff, causing some delays in the progress of some projects that required lab work, such as PhD projects. Academics, on the other hand, were able to successfully adapt their approach, and Aston's labs reopened earlier than some other institutions. The rapid transition to remote delivery and the adapted support mechanism for SMEs is strong evidence of the programme's adaptability and ability to respond to the evolving challenges facing businesses at any one time in the UK.

The project has performed especially well in terms of engaging with SMEs at a time when businesses of all sizes were preoccupied with other pressing priorities. The pandemic has inevitably though had an impact on this project and many others involving businesses, which can be attributed to survival taking precedence over innovation. Businesses have also been facing the

dual pressures of rising inflation and a cost-of-living crisis pushing energy bills and operating costs up to unsustainable levels.

Despite the challenging economic climate, EBRI is considered very good at taking their message out to the community and making a difficult subject in terms of innovation and innovative practise understandable and relatable. They make it accessible and ensure that people understand why it is important.

The EBRI ERDF project is particularly effective at engaging its target beneficiary market. It takes advantage of an audience that may be more open to adopting new technologies; the project is so relevant to an increasingly prevalent context of sustainability that once businesses are engaged, maintaining a relationship with them has been relatively simple.

4.2.3 LEP Delivery

The project is engaged with the local LEP Technical Assistance Teams and Growth Hubs to support localised delivery within the target LEP areas. The project has run successful workshops and engaged with companies to look at specific technologies and opportunities across the LEP areas. For many companies, the Master Class workshop develops an understanding of the technology and market place that allows them to develop opportunities as a service provider. This could include providing feedstock or equipping them to offer engineering services into this market place.

4.2.4 Project Management and Governance

Based on its long track record of delivering successful ERDF programmes, EBRI's project benefits from a strong, well-defined organisational structure. EBRI has delivered a number of ERDF-funded projects over the years to help businesses in the region generate energy from waste, use energy more efficiently, and create valuable products from waste. EBRI has also worked with SMEs and business groups to promote the adoption of integrated systems that support local carbon reduction. There is also a sense that EBRI project staff enjoy their work and are passionate about their subject.

The project benefits from clearly defined roles and responsibilities. The strong relationship established between the EBRI ERDF project, and its academics has a positive impact on research; the ERDF funded delivery is thought to be supportive of academic development outside of the project. The project has also established an effective communication network, which allows academics to collaborate more effectively - the EBRI team approaches academics on a regular basis with suggestions and SME proposals.

One consultee praised the project management for being simultaneously focused on delivering the ERDF objectives and being open to seeking advice, meeting on a quarterly basis with key players such as the Director of Business Engagement to discuss project performance and where the project could benefit from connections to the rest of the university.

The EBRI team is considered to have the right attitude in terms of being commercially facing; the project needs to provide the team with the interactions they want to have, because academics themselves aren't being trained to interact with businesses and industry. The project creates a forum to bring together researchers and those looking to exploit such research.

4.2.5 Benefits to the Academics

EBRI's long-standing reputation, prestige, and industry connections are especially beneficial to academics looking to establish contacts and connections with a diverse range of industry partners and local stakeholders in order to find suitable industries for their research projects. EBRI provides an excellent opportunity for academic staff to apply their skills in a setting where they can directly benefit beneficiaries in the community and within the university. The EBRI team connects academics with SMEs by bringing in their specific skill set, allowing academics to contribute their expertise without having to lead the entire project, which their time would not allow.

The real value for academics is in making industrial contacts and being part of a consortium. Academia is typically focused on producing high-quality journal publications and generating research findings from laboratory-focused fundamental research. The real added value of the EBRI Successor Project is the facilitating role it has in fostering relationships and contacts between academics, businesses, researchers and industry contacts. Aston's academics are able to test their research in real-world scenarios, benefitting academics not just in terms of research, but also in terms of professional development and academic progression.

The project allows academics to better apply their knowledge, potentially develop more opportunities, create more projects, and write better academic papers, all of which contribute to the advancement of an academic career. EBRI also plays a key role in facilitating collaboration between chemical engineers and biochemists, an advantageous interface that brings in different perspectives to tackling the same challenges. EBRI's adoption of varied specialisms has broadened both the research approach and bioprocessing.

Furthermore, when it comes to writing bids, the EBRI team is also helpful in terms of reviewing and submitting bids. In practice, more and more research grant applications require proof of societal benefit, some commercialisation, and publication potential – information and evidence that can often be overwhelming for academics alone. The ERDF project facilitates connections between academics and commercial partners who are likely to already have arguments to support the product, increasing their chances of receiving funding.

For example, the EBRI team has assisted in identifying other academics with whom to collaborate and develop projects. The effectiveness of EBRI as this interface is attributed to their own combination of academic and industry experience. As a result, academics have been able to submit multiple applications in recent years. One example is that, as a result of a relationship facilitated by the EBRI team, one academic submitted an £8 million bid to Horizon 2020 alongside the University of Birmingham, with Aston University one of a number of proposed key players. In another case, a UK-Columbia proposal arose from an EBRI team opportunity to investigate quinoa cultivation as a means of shifting economic benefits to more socially appropriate beneficiaries.

One of the project's successes has been the development of practical projects for students who have academic knowledge but lack practical experience. This project has effectively created a role for students to use and develop their knowledge in a working environment. One academic's PhD student is based in industry, and the student has been offered a full-time position with the company at the end of their research project.

PhD students benefit from working in industry, collaborating with academics, and having access to facilities. Due to the high level of competition, finding and funding PhDs - whether through college funds or external grants - would have been much more difficult without the ERDF project.

4.2.6 Links to other initiatives

EBRI was founded to connect local industries and continues to excel in this area. The research conducted as part of the EBRI project supports a variety of initiatives and programmes throughout the region. It is critical for Aston to collaborate with regional partners in order to become more than the sum of their parts, and EBRI is an important part of that connection and contribution. EBRI is thus an important institution in terms of place-based research, and its importance will only grow in the future.

The ERDF project is the most recent iteration of EBRI's business support, which is an important component of Aston's larger research agenda and sustainability strategy. The university plays a key role in the Energy Research Accelerator (ERA), a regional grouping of energy-oriented research-intensive organisations. Aston also houses the Supergen Bioenergy Hub, which collaborates with academia, industry, government, and societal stakeholders to create sustainable bioenergy systems that will aid the UK's transition to a low-carbon, resilient energy future. The hub is part of the larger Supergen Programme and is funded jointly by the Engineering and Physical Sciences Research Council (EPSRC) and the Biotechnology and Biological Sciences Research Council (BBSRC). As a result, UK academics are assisting policymakers and industry in identifying and characterising sustainable bioenergy systems that can be prioritised for providing power, heat, liquid and gaseous fuels, and value-added chemicals.

EBRI academics working on the project are also represented in a number of hydrogen-related projects, including the HYDEX project (a hydrogen development and Knowledge Transfer Project) recently funded by Research England for £5 million, which includes eight universities and seven industries and aims to demonstrate hydrogen capabilities in the Midlands. The EBRI team is also negotiating projects to supply hydrogen in Birmingham with the City Council to support their hydrogen busses. These initiatives and programmes are supported by the research conducted as part of the EBRI project.

Cross-disciplinary collaboration is a priority for Aston, with academics from various colleges hoping to collaborate with the EBRI team to generate new proposals, eventually joining with some PhD supervision or perhaps some other internal/external funding to allow them to work together. Academics are optimistic that EBRI will continue to receive research funding, and some are hoping to be included in any proposals.

One example is the collaboration with Electrical Power Engineering at the School of Informatics and Digital Engineering, where academics want to use EBRI's research to investigate its application in power generation, heat generation, smart grids, energy storage, and internal smart energy systems. EBRI collaborates with other Colleges within the University to capture different areas of expertise; for example, EBRI is linked to the Low Carbon SMEs project at Aston Business School.

The key lessons learned from sector-specialist projects such as EBRI will be applied to Aston's other projects in IT, business, and the Aston Centre for Growth's work with the Treasury. The EBRI team facilitates internal cross-fertilisation, which adds value to beneficiaries in ways that go beyond the scope of each individual project. There is currently informal contact between the Business School, the Centre for Growth, and the departments of Engineering and Physical Sciences, but this could be expanded to use feedback from companies that have worked with EBRI to better inform new and existing schemes.

4.2.7 Impact on Beneficiary SMEs

The project is considered to be strong in facilitating knowledge exchange and increasing innovation in the sector, particularly among smaller businesses that may have struggled in the past with the role of universities and how they can assist them. The project is thought to make it easy for SMEs to interact with EBRI; the team demystifies some of the university's expertise, presenting it in a practical way and encouraging SMEs to interact with it. One of EBRI's key strengths is its team of academics who are skilled at communicating clearly, making it easier for them to engage with SMEs in a useful way. The most important lesson to be learned is the importance of being able to communicate at the appropriate level with one another. EBRI is effective at acting as that interface between the two; otherwise, talks can break down.

Some people approach Aston with a request, usually for a bio-based material that needs to be disposed of or reused. SMEs interested in scientific testing or expertise can be referred to the institute's academics for further investigation. The project's goal is to find a way to turn waste into a valuable product, increasing their competitiveness and potentially increasing their revenue. Some companies work with EBRI to investigate how the project can help with supply chain management or even management, as well as the project's technical support.

As a result of their involvement in the project, SMEs are able to create new processes and products. Through Master Classes and free consulting services, the project also expands SME knowledge. Businesses can use the labs for their own R&D, facilitating knowledge transfer between companies, industry, and EBRI. Businesses benefit financially from generating a return on waste, whereas previously, many of them were required to pay to dispose of their own waste.

Some ERDF projects have been suggested to be more inward looking, achieving only their set outputs, whereas EBRI adds value above and beyond its contractual targets. Both the funders and Aston University, receive far more than the contract stipulates. EBRI is thought to be an outlier in terms of its ability to add such value.

4.2.8 Impact on the University

Through EBRI and the project, Aston University is able to better serve its three-pronged approach: the region and society benefit from local partners, the project's work with local SMEs supports industry, and Aston's students can participate through PhDs. Aston is one of the UK's leading universities for working with SMEs; the government's Build Back Better programme was developed at Aston Business School, and the university has a significant presence with SMEs.

The project, and EBRI more widely, plays an important role in supporting Aston University's civic objectives. Aston's regional activity includes interactions with various regional bodies, groups, MPs, councillors, and the development of the university's Civic Agreement; one of the agreement's key themes is sustainability. Aston engage with EBRI as well as other projects within the university to develop a sustainability strategy, which can then be shared with regional bodies around what Aston offers as a whole. The project itself forms one means that the university is engaging with SMEs to improve sustainability in industry and to develop solutions to wider sustainability challenges.

In recent years, the university's key research strengths have become more formally and systematically structured as accredited URIs. EBRI is one of four University Research Institutes (URI) at Aston University, chosen for the quality of its research and its high profile. Research-oriented research institutes primarily focus on early-stage concepts and developments for universities, whereas EBRI's core offer to SMEs is working with technologies that are much closer to market. The project raises public awareness of the science that Aston is studying and how it can be applied to industry challenges; thus, the project is valuable in that it contributes to Aston's larger mission of providing relevant, applied research. The way EBRI interacts with businesses is an important part of its journey and role as a URI in highlighting the university's best strengths.

The growth and success of EBRI has created a need for projects like the Successor Project, which connects one of Aston's core areas to the surrounding industry. Aston hopes to entice people to consider how they can engage with the university further by sharing their research and expertise. The EBRI project connects SMEs with the larger university community by recruiting businesses interested in larger research projects or contributing themselves.

EBRI is an essential component of obtaining research funding, building a pipeline of younger scholars to target bids and awards concerning one of Aston's primary science areas and one that is extremely relevant to the sustainability and net zero agenda. The revenue generated by bids and awards helps to fund the university's research activities. If funding for this project had not been available, there would have been less support and funding for analytical labs, and academics would not have been able to establish the contacts they do with industry. There would also be fewer jobs created within EBRI that are required to put knowledge into practice. For example, EBRI contributed to Aston University's application for an Innovation Grant, which resulted in the formation of a spin-off company, and there are numerous other developments in the works.

4.2.9 Cofton Nursery Biochar Demonstrator

The project has delivered its core activity whilst simultaneously expanding its reach across the university. The Cofton Biochar Demonstrator project, funded by EBRI and the Greater Birmingham

and Solihull LEP Local Growth Fund, is a mobile pyrolysis unit delivered in collaboration with Birmingham City Council, which provides waste cuttings, trimmings, and plant material that can be transformed into pyrolysis oil; the project is a means of capturing energy-rich molecules from what would otherwise be waste products. Biochar is another by-product of the pyrolysis process that is considered to be relatively useful as a fertiliser to add to soils to ameliorate and improve their properties, thereby improving plant growth and carbon offsetting. The collaboration between Cofton Nursery, EBRI, and Birmingham City Council is critical in ensuring that diverse biomass samples are collected from greenspace departments throughout Birmingham for processing.

The project is a test concept in which academics prepare soils with varying percentages of biochar, which will then host different tree species to measure the impact of biochar on tree growth. The main goal is to collect preliminary data that can be used to create a KTP or another funding application based on the information. As the first of ten sites across Birmingham and Solihull, the demonstrator is intended to be scalable, as well as supporting carbon offsetting. The EBRI team also spoke with Bruntwood, a private company based in the knowledge quarter, about using biochar to help decarbonise their estates.

The potential city-wide expansion of the Cofton project exemplifies how the expertise developed at EBRI can be applied at scale, where EBRI's technologies could provide direct benefit to the Birmingham community. The ERDF project achieves this broader goal through Master Classes, which show participants how to use the demonstrator facility. Furthermore, PhD students are getting hands-on experience with real-world industrial processing and outputs through their work on the Cofton project.

4.2.10 Challenges

At times it has been difficult to sell the idea of sustainability investments to SMEs during a time of economic uncertainty due to the inevitable increases in initial costs to uptake new technologies or to explore new ways to utilise waste. The business-facing team play an important role in convincing SMEs that pursuing sustainability could also reduce costs and increase profits where possible – these are typically low-hanging fruit solutions. However, the majority of project beneficiaries' approach EBRI having already adopted the easiest sustainability measures; thus, more often than not, EBRI's suggested solutions will come at a cost to the business which inevitably can be a difficult proposition for businesses. EBRI are supporting businesses to get ahead of the curve in terms of sustainability investments.

Some full-time staff are complemented by part-time academics who can be used on a consultancy basis to draw in additional expertise when required from across the university, including chemical engineers, materials science and mechanics. However, at times, the flexible eligibility criteria meant SMEs were invited to engage with the project to explore broader range of specialisms than could be accommodated at Aston University. Academic staff endeavoured to support businesses in any way they could, but sometimes this required more time and resource than expected. Consultees reported that at times, the project's academics could have benefitted from more direction and clarity around the ways in which they are expected to support SMEs.

Overall, the Aston University EBRI Successor project faced numerous challenges during its execution including those related to Brexit, the Covid-19 pandemic, and the unstable economic environment. Despite these obstacles, the project was able to move forward and deliver results due to effective planning, communication, and adaptation to changing circumstances.

4.2.11 The Future

The Institute is developing a number of large funding proposals which are informed and influenced by the ERDF Successor project. The project is therefore playing an important role in laying a foundation for EBRI's broader long-term sustainability and its ability to impact both local business but also the wider policy agenda.

EBRI are targeting EPSRC Supergen funding as well as a mix of other sources of industry funding to maintain its sustainability and to transfer its research into industry practice and wider policy. EBRI are also building on their years of experience by developing an EPSRC Doctoral Training Centre Expression of Interest to train the next generation of researchers in bioenergy and bioproducts. EBRI will be looking at a full spectrum of activities from basic fundamental research through to impact on industry as well as policy influence.

EBRI is facing an uncertain future with the withdrawal of EU research funding - domestic sources such as the BBSRC are thought to be more competitive and difficult to access.

Despite the uncertainties, it is considered that EBRI's researchers are in high demand because sustainability is now at the top of many businesses' agendas. EBRI is more important than ever before; companies that had never considered sustainability before are now required to do so. The NHS, for example, has recently introduced their Green Plan; another of Aston's projects is engaging with its NHS partners to explore how to introduce sustainability into their supply chain; it is hoped that this will have a snowball effect for other industries as well, representing additional markets for EBRI to support. The supply chain contains many different aspects that lend themselves to EBRI's sustainability research: packaging, transportation, building fabrics, and many more are all relevant and represent potential areas of growth. EBRI are an important part of the university's core offer to these supply chains, providing value through waste expertise in addition to the other business support functions provided. There is an increasing demand for projects that improve EBRI's ability to connect with a growing pool of businesses in need of assistance with sustainability and bioproduct development.

Moreover, bioenergy and biomass are likely to form an important part of the UK's efforts to reach its net-zero targets. EBRI's research – both academic and business facing – will play an important role in demonstrating the value of bioenergy and biomass to helping the UK to meet its net zero targets by influencing both policy and public perception. EBRI are building an evidence base that could prove the feasibility and value of biomass.

The most recent consultation process once more emphasised the significance of the funding for this project and others like it. Stakeholders were keen to insist that without the funding they wouldn't have been able to even begin a discussion about the topics addressed, let alone provide the assistance to businesses and academics alike.

4.3 Summary - Project Management and Governance

- Building on its success among project beneficiaries, the project has successfully broadened its reach, connecting SMEs with other areas of the university; the project has taken advantage of opportunities to add value to its beneficiaries by collaborating with various teams and specialists within Aston. The project is integrated with the rest of the university, and data sharing across projects is seen as both a good practice example and a growth opportunity for Aston. The EBRI team facilitates internal cross-fertilisation, which adds value to beneficiaries in ways that go beyond the scope of each individual project.

- Despite the challenging economic climate, EBRI is very good at taking their message out to the community and helping them understand a difficult subject in terms of innovation and innovative practise. The team makes it accessible and ensures that people understand its relevance to their business. EBRI has been receiving increasing interest from local industries, establishing connections with them, and receiving more samples.

- Based on its long track record of delivering successful ERDF programmes, EBRI's project benefits from a strong, well-defined organisational structure. The project is thought to prioritise successfully delivering its core activity before expanding on it and seeking ways to extend its reach, checking with other parts of the university to ensure the project connects in the best way possible.

- EBRI's long-standing reputation, prestige, and industry connections are especially beneficial to academics looking to establish contacts and connections with a diverse range of industry partners and local stakeholders in order to find suitable industries for their research projects. EBRI provides an excellent opportunity for academic staff to apply their skills in a setting where they can directly benefit beneficiaries in the community and within the university. In practice, an increasing number of research grant applications require proof of societal benefit, as well as some commercialisation and publication potential. The ERDF project facilitates connections between academics and commercial partners who are likely to already have arguments to support the product, increasing their chances of receiving funding.

- The EBRI project's research contributes to a number of initiatives and programmes throughout the region, including the Energy Research Accelerator (ERA), the Supergen Bioenergy Hub, and the HYDEX project. The Institute is developing a number of large funding proposals which are informed and influenced by the ERDF Successor project. The project is therefore playing an important role in laying a foundation for EBRI’s broader long-term sustainability and its ability to impact both local business but also the wider policy agenda.

- As a result of their involvement in the project, SMEs are able to create new processes and products. Some ERDF projects have been suggested to be more inward looking, achieving only their set outputs, whereas EBRI adds value above and beyond its contractual targets. One of EBRI's key strengths is its team of academics who are skilled at communicating clearly, making it easier for them to engage with SMEs in a useful way.

- The potential city-wide expansion of the Cofton project exemplifies how the expertise developed at EBRI could be applied across Birmingham and Solihull, where EBRI's technologies could provide direct benefit to the wider community. The ERDF project achieves this broader goal through Master Classes, which show participants how to use the demonstrator facility.

5.0 Project Outcomes and Impact – Business Feedback

To demonstrate the wide-ranging impact of the project, this section details the results of consultation with businesses engaged. A range of consultation with business has been undertaken during the evaluation stage using the following:

- **Beneficiary Feedback** – An analysis of customer feedback data gathered from recipients of:
  - Surgery Calls
  - Tailored Reports
  - Master Class.
- **Online Questionnaire for Beneficiary Businesses** – A questionnaire was circulated to SMEs directly involved with the project capturing details about the benefits that taking part in the programme has had on their businesses.
- **Case Studies of Beneficiary Businesses** – This section captures more in-depth feedback from one-to-one consultation with businesses who have received in depth support and provides a more detailed understanding of the impacts that support from the EBRI Successor Project can have.

The findings of each of these is shown over the following pages.

5.1 Questionnaire for Beneficiary Businesses – Surgery Calls

This section analyses feedback gathered by the EBRI team from businesses that had recently completed a surgery consultation with the EBRI team. The survey has captured feedback on Surgery Calls from September 2020 to February 2023.

5.1.1 Engaging with EBRI

Businesses were asked how they heard about EBRI and the Business Investment in Research – Successor Project. There were a mix of responses, with most finding out about the project via a recommendation and others via a newsletter.

The survey asked businesses what their main motivations were for getting involved in the EBRI project. Businesses sought to engage with EBRI to overcome specific challenges, to support with analysis and testing, and to explore the opportunities surrounding waste. A selection of responses is below:

- "To have a wider understanding of sustainability and understand what we can do as a business to reduce consumption".
- "This was to address a challenge and to help exploit a new opportunity".
- "We want Aston to help us access project funding, advise on data collection, carry out analysis, and assist with dissemination".
- "We see ourselves as participating in the green economy and wanted to explore the options from a local significant player with global connections, to give us both a wider perspective and match our ideas with those of others in the field".

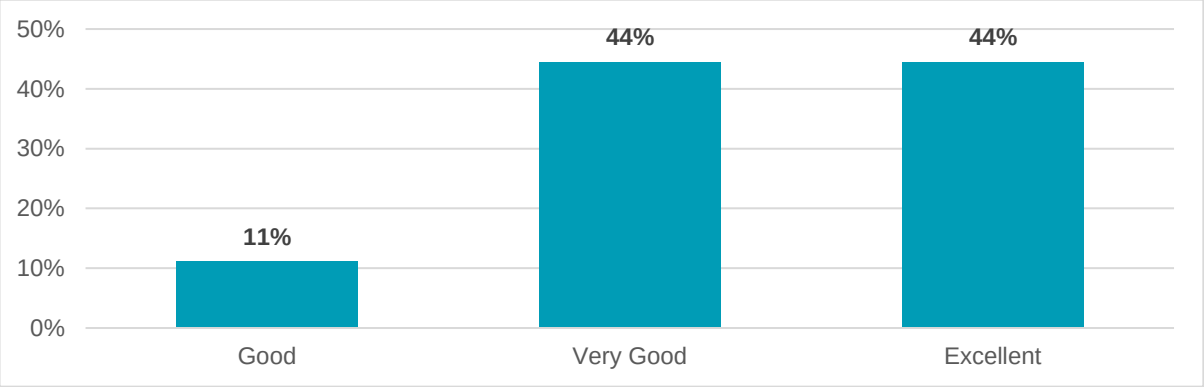
- "We wanted to link [our business] with energy savings – really good figure given the low carbon challenge".

"We as a company are keen to learn and spread the sustainability message to our clients and suppliers alike so it is important to learn the key fundamental of sustainability so education is vital here. Putting sustainability at the heart of our corporate mission allows us to facilitate companies who want to become more sustainable by providing them access to your team and resources. It also provides us with a competitive advantage and a key differentiator from our competition".

5.1.2. The Support from EBRI

The survey sought to determine how businesses rated the support they received from EBRI, and to highlight any areas of good practice or improvements. 44% of businesses said that the support they received was 'excellent', with 44% saying that it was 'very good'.

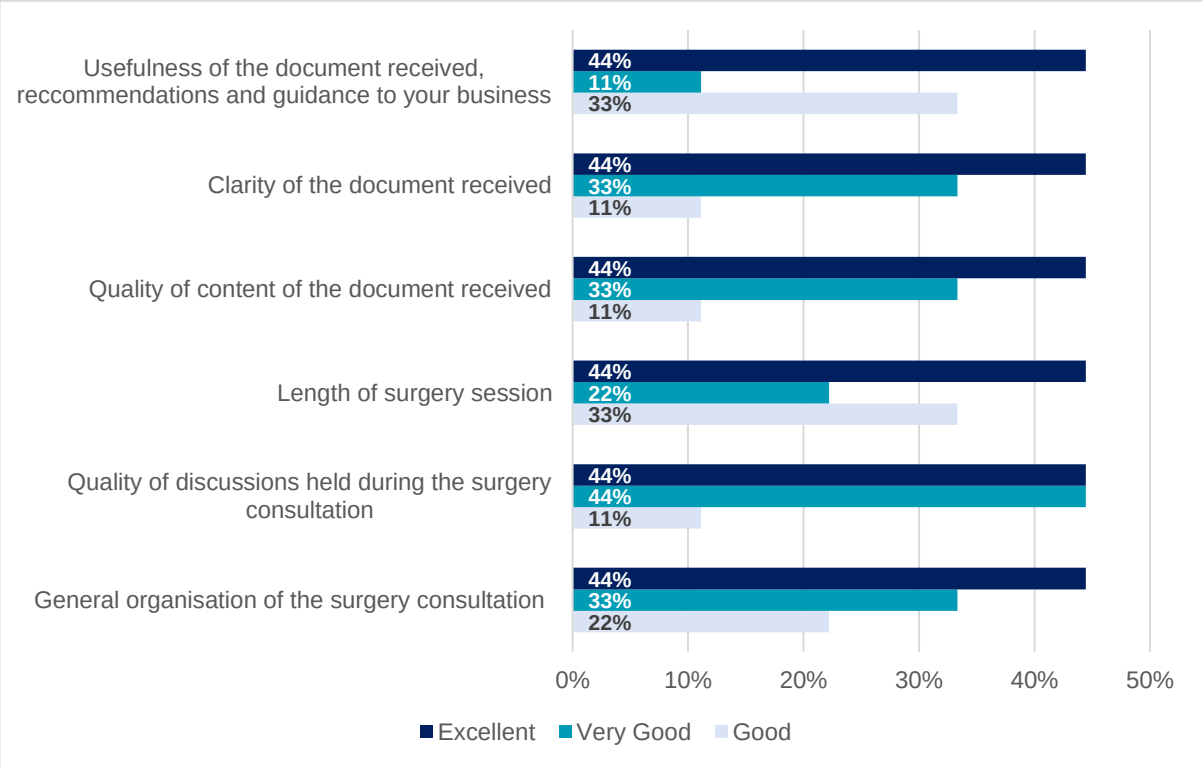
Q: Overall, how did you rate the support you received from EBRI?



Additional comments from businesses have been listed below:

- "Very professional and open team".
- "The consultants listened carefully to our project. Asked detailed questions and produced a report with technical recommendations for enhancing our prototype".
- "The information received was informative and presented in a friendly manner".
- "The workshop I attended was extremely informative and interesting, it was delivered expertly in a welcoming environment. Thanks to this two-day event my business was able to benefit from the tailored report which will be invaluable".

Q: Ratings of each element of the Surgery Consultation



The chart shows that all elements of the surgery were rated 'excellent' by nearly half (44%) of the businesses who responded to the survey.

- 88% of respondents considered the quality of discussions to be 'excellent' or 'very good'.
- 77% of respondents considered the clarity of the document, quality of the content, and general organisation of the surgery consultation to be 'excellent' or 'very good'.
- 66% of respondents considered the length of the survey session to be 'excellent' or 'very good'.
- 55% of respondents considered the usefulness of the document received, recommendations and guidance to their business to be 'excellent' or 'very good'.

Businesses were asked to provide details around their ratings. These responses have been listed below according to the element to which they refer.

How did you rate the general organisation of the surgery?	*"Once it happened, I was delighted that Aston mustered the right people in the room, and things flowed from that. It would have been useful to have a set of notes after the meeting".* *"The consultants came to the site and sense checked the product in development and engaged with us on a personal level"*
How did you rate the quality of discussions	*"The right people were there, we had enough time, we discussed and exchanged useful ideas and information".*

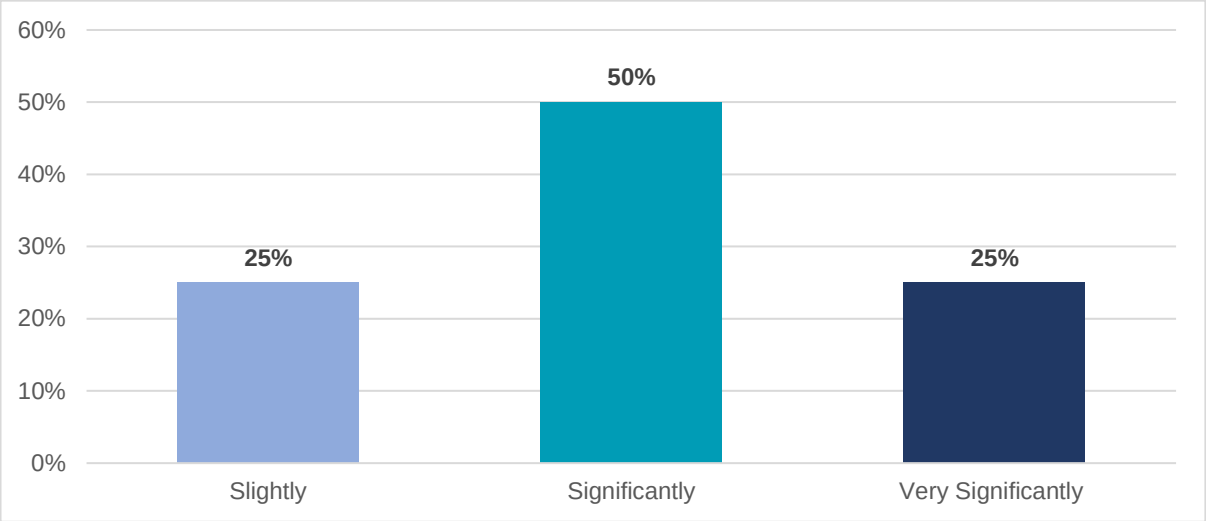
held during the surgery consultation?	*"A good rigorous cross-examination and detailed investigation".*
How did you rate the length of the surgery session?	*"We had enough time, and we didn't waste time, although it would have been useful to have a set of notes afterwards".* *"They took the time they needed and weren't cursory in any way".*
How did you rate the quality of content of the document received? Were your challenges and relevant topics addressed?	*"Good practical suggestions for improving the project with all the suggestions costed".* *"Very well presented. Clear, concise and informative. Just what busy decision-makers are looking for".* *"Really good report which we'll be using in our marketing going forward".*
How did you rate the clarity of the document received? Was the document provided to you easy/difficult to interpret?	*"Technical but clearly presented with sound logic and a refreshing absence of abstruse terminology".*
How did you rate the usefulness of document received? How would you rate our recommendations and guidance to your business?	*"All the recommendations are within our capability and will genuinely add value to our original concept".*

The comments reveal how the surgery meetings provide added value to businesses. For one, the surgery was a "detailed investigation" that resulted in "good practical suggestions" that will "add value to our original concept". In some cases, the project helps companies focus on the right thing to take their business forward. However, it is acknowledged that impact sometimes takes the form of an informed decision not to proceed in a particular direction.

5.1.3 Overall Rating

Businesses were asked whether overall, how much did they think EBRI's support (including guidance and recommendations) will help their business to develop. The chart below shows that 50% of businesses felt that EBRI's support will 'significantly' help them to develop, with 25% saying that the support will 'very significantly' help.

Q: Overall, how much do you think EBRI's support (including guidance and recommendations) will help your business develop?



5.1.4 Business Challenges

Businesses were asked what they main technical and business challenges are. Responses included challenges around funding opportunities, training and certification, decarbonisation support and market research. The project could benefit from seeking solutions to the challenges discussed by businesses.

- Finding funding opportunities for our Bioethanol production using sweet sorghum as feedstock project.
- How to ensure that there is a stable retrofit supply chain for SMEs and homes
- Training/ certification/ regulation of green skills and occupations.
- How to access funding for retrofit for buildings.
- How to access funding for instrumentation of homes to make it a 'living lab'.
- How to decarbonise water heating at domestic level, how to store energy from summer PV surplus to use during the winter.
- Testing the viability of burning used pots and substances to create energy.
- Surveying manufacturing options and researching the market in more detail, as well as seeking financial backing.
- New client acquisition in a post-lockdown world.

5.1.5 Additional Support

The survey sought to better understand the ways in which businesses are seeking new opportunities to save money, which reveals where the project can further support these businesses moving forwards. Businesses identified the following cost-saving measures:

- Energy usage
- Production costs
- Cutting back on waste/reusing company waste

Businesses were also asked what areas they are looking for help in; the results can inform where the project team needs to offer support to these businesses moving forwards. In particular, 75% of businesses said that they were looking for help with funding for equipment, whilst 50% said that they were looking for business to business networking opportunities.

- Funding for equipment
- Businesses to business networking opportunities
- Developing new services and products
- Support with technical specialities
- Accessing highly skilled new employees
- Upskilling and developing the current workforce

5.1.6 Outcomes and Impacts

In some cases, businesses anticipate that their involvement with the project will add value, increase profit margins, improve efficiency, aid new product development, improve understanding, and help to create long-term collaborations. A selection of responses is below:

- "Yes, there will be long-term impacts, because we better understand what feedstock will be better for our Bioethanol production".
- "We anticipate that EBRI is going to add value to our product and increase the profit margin".
- "Our product which relies on recycling organically produced heat and stored light have been given a wider range of chip technology than we had hitherto considered, some technical adjustments that make our system more efficient and ways of gathering data that will expedite the development of the product rather than relying on an experimental hit and miss approach".
- "Meeting some wonderful people and increased knowledge on sustainability".

Summary – Surgery Calls Feedback

- 44% of businesses said that the support they received was 'excellent', with 44% saying that it was 'very good'.
- 88% of respondents considered the quality of discussions to be 'excellent' or 'very good'.
- 77% of respondents considered the clarity of the document, quality of the content, and general organisation of the surgery consultation to be 'excellent' or 'very good'.
- 66% of respondents considered the length of the survey session to be 'excellent' or 'very good'.
- 55% of respondents considered the usefulness of the document received, recommendations and guidance to their business to be 'excellent' or 'very good'.
- 50% of businesses felt that EBRI's support will 'significantly' help them to develop, with 25% saying that the support will 'very significantly' help.

5.2 Questionnaire for Beneficiary Businesses – Tailored Reports

This section analyses feedback received from surveys issued to businesses that had received a tailored report from the EBRI team as part of the project. The survey has captured feedback on the project's Tailored Reports from October 2020 to January 2023.

5.2.1 Engagement with EBRI

Businesses were asked how they heard about EBRI. Half of the businesses said that EBRI had been recommended. Businesses also heard about the project from the local Growth Hub, at the Energy Now Expo Show, Telford, via Sustainability West Midlands, and via Aston alumni.

The survey also sought to determine what the main motivations were for getting involved in the EBRI project. For one business, the key motivator was a desire "to try and solve a waste problem"; for another, they engaged with the project "to exploit a new opportunity for revolutionary technology".

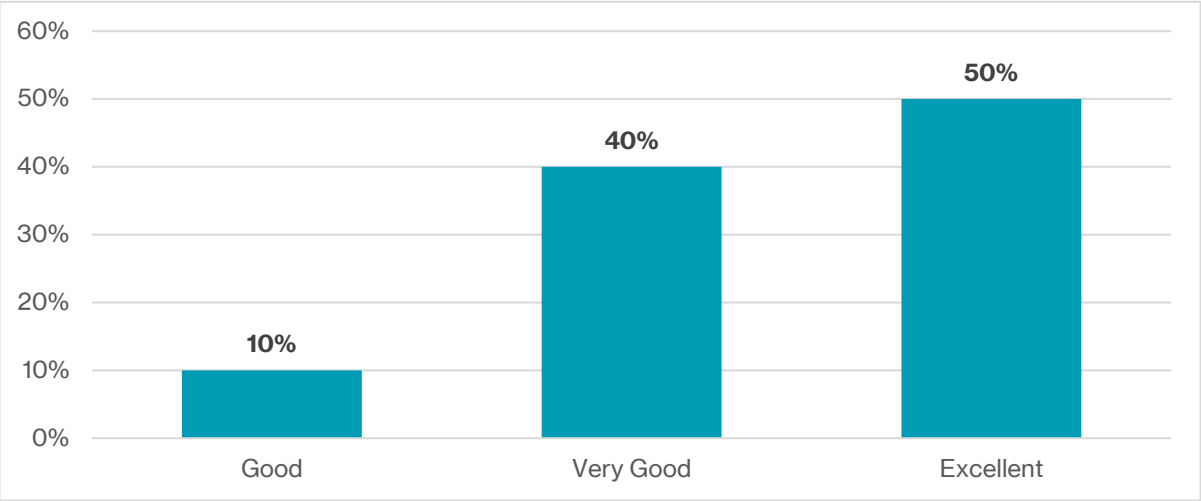
- "I needed expert advice and to be able to pass on that knowledge. My job is hands on, I salvage, restore and recirculate clothing but the technical data can be challenging even for those who work in the industry. It is also open to misinterpretation. This report has used in depth knowledge of my business and therefore gives an informed opinion which is invaluable to a small business like mine".
- "To have a wider understanding of sustainability and understand what we can do as a business to reduce consumption".
- "To address a challenge in measuring carbon emissions for home workers".
- "We are keen to prove our claims to be leading in horticultural environmental innovation, which has previously been commercially focused (e.g. green roofing, plant health management). Biochar seems to be much more relevant to our new domestic audience."
- "Seek equipment but most importantly to find people who understood what we are trying to achieve and the best possible way to do that. There ongoing support would be most welcomed".

5.2.2 Support from EBRI

Overall, 50% of businesses rated the support they received from EBRI to be 'excellent'. The support was described as "very helpful" and "a high-quality service, I would most certainly be recommending them".

The results are graphed over the page.

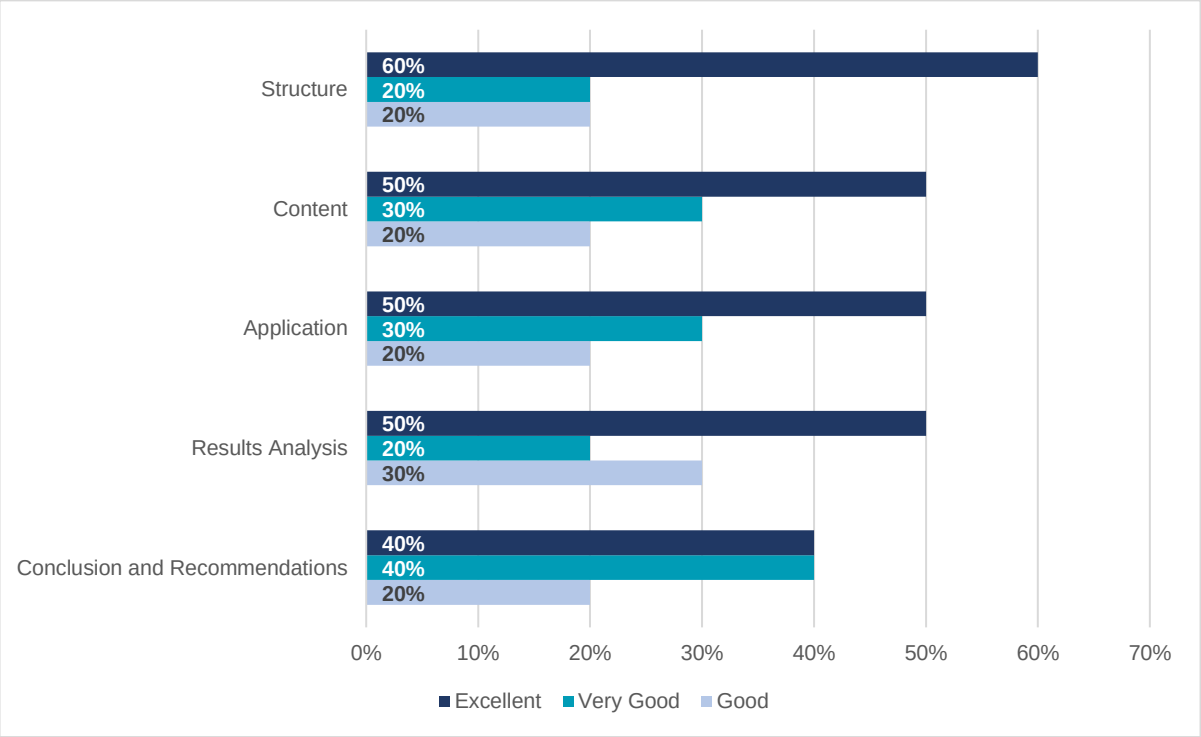
Q: Overall, how did you rate the support you received from EBRI?



Businesses were also asked to rate different elements of the tailored report.

- 80% of respondents considered the structure, content, application, conclusions and recommendations of the tailored reports to be 'excellent' or 'very good'.
- 70% of respondents considered the results analysis of the tailored reports to be 'excellent' or 'very good'.

Q: Ratings of each element of the Tailored Reports



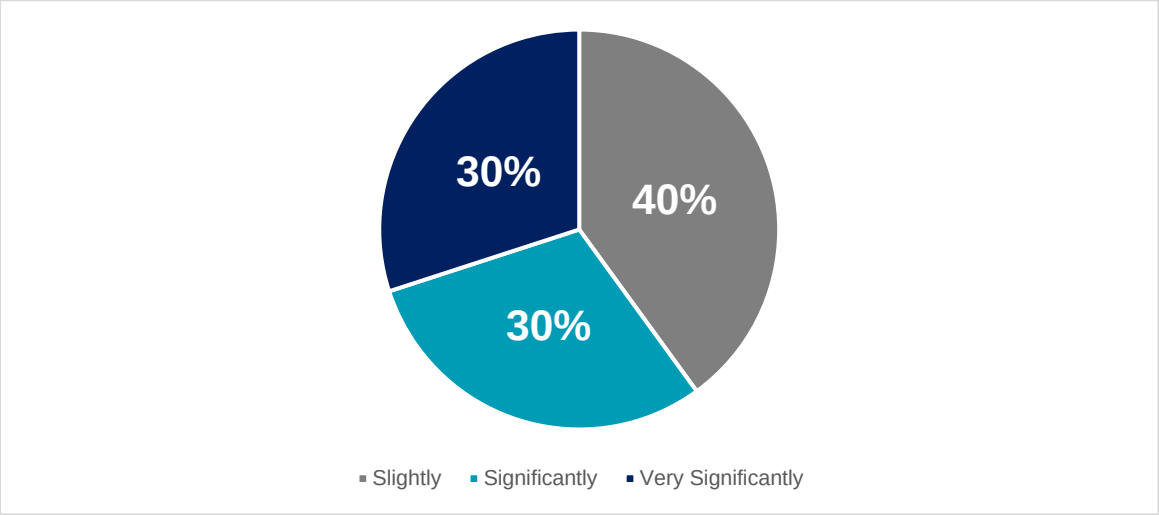
Businesses who received a tailored report also were asked to provide details around their ratings. These responses have been listed below according to the element to which they refer. The team were praised for their explanations of the report and for being ready to answer questions.

How did you rate the Structure – clear presentation, easy to follow, length?	*"The team was always ready to answer any questions asked".* *"Thorough detail on the background of biochar and current situation, well explained".* *"Clear explanation for use and well set out – easy to follow and lots of examples".*
How did you rate the Content – relevant topics addressed, level – to easy/difficult to understand?	*"Some of the topics were a little bit hard to follow, but the team were always ready to explain".* *"Very clear explanation of a complex subject"* *"The range of topics addressed was excellent, I learnt far more from the report about the industry I'm in than I have over several years. The relevance to my business will ultimately make a significant difference to my future work".*
How did you rate the Application – information applied to your interests/innovation?	*"We now have back up paper work to help us try to convince people who have never heard of what we are trying to do".* *"Very good and very helpful".* *"There was an understanding of my work that will ultimately help to add value to what I do".*
How did you rate the Results analysis – presentation and layout, easy to interpret, depth?	*"The results are what I was hoping for, now we only have to convince people".* *"This was not really an analysis of results but the summary of previous work and current standards were well explained".*
How did you rate the Conclusions and Recommendations – appropriate conclusions drawn, conclusions supported by results analysis, practical recommendations given?	*"Made it clear that only pyrolysis was suitable with supporting data. Not as much practical recommendations for us as we likely won't use the excess as soil enhancer".* *"It was particularly useful to provide the information on the health and safety risks of handling biochar".*

5.2.3 Overall Rating

Businesses were asked whether overall, how much did they think EBRI's support (including guidance and recommendations) will help their business to develop. The chart below shows that 60% of businesses felt that EBRI's support will 'very significantly' or 'significantly' help them to develop.

Q: Overall, how much do you think EBRI's support (including guidance and recommendations) will help your business develop?



5.2.4 Additional Support

Businesses were asked whether they were seeking new opportunities to save money; the survey provided a range of possible options that the EBRI project could support them with. Businesses noted the following as possible cost-saving opportunities:

- Energy usage
- Production costs
- Cutting back on waste/reusing company waste
- Developing new services and products

Businesses were also asked what areas they are looking for help in; the results can inform where the project team needs to offer support to these businesses moving forwards. Businesses surveyed that had completed a tailored report were looking for help with:

- Funding for equipment
- Networking opportunities
- New service and product development
- Developing new services and products
- Accessing highly skilled new employees
- Business to business networking opportunities
- Upskilling and developing the current workforce

5.2.5 Outcomes and Impacts

As a result of receiving a bespoke tailored report with recommendations from the EBRI team, businesses involved said that they would be better placed to convince people of their concept; and that they understand pyrolysis to be an appropriate method.
In terms of longer-term impacts, businesses anticipate that their engagement with the project – and the production of a tailored report – would have a positive impact on the future success of the business, and by helping one business to improve their waste management.

- "We anticipate improved customer/stakeholder relationships and increased credibility for our company group as we navigate the various options for improving our environmental performance in the future".
- "I hope it will help potential customers take my business more seriously. There is a tremendous amount of work involved in restoring clothing, I believe the report will add value to my business as a whole".
- "We will look at composting/recycling waste rather than burning for larger sized facilities".
- "An easy to use tool that will provide home office employees / micro businesses with carbon reliable emission data which feeds into their carbon reduction plans".
- "I feel the bespoke report and the fact that I have worked with the company/University impacts positively for future needs".

Summary – Tailored Reports Feedback

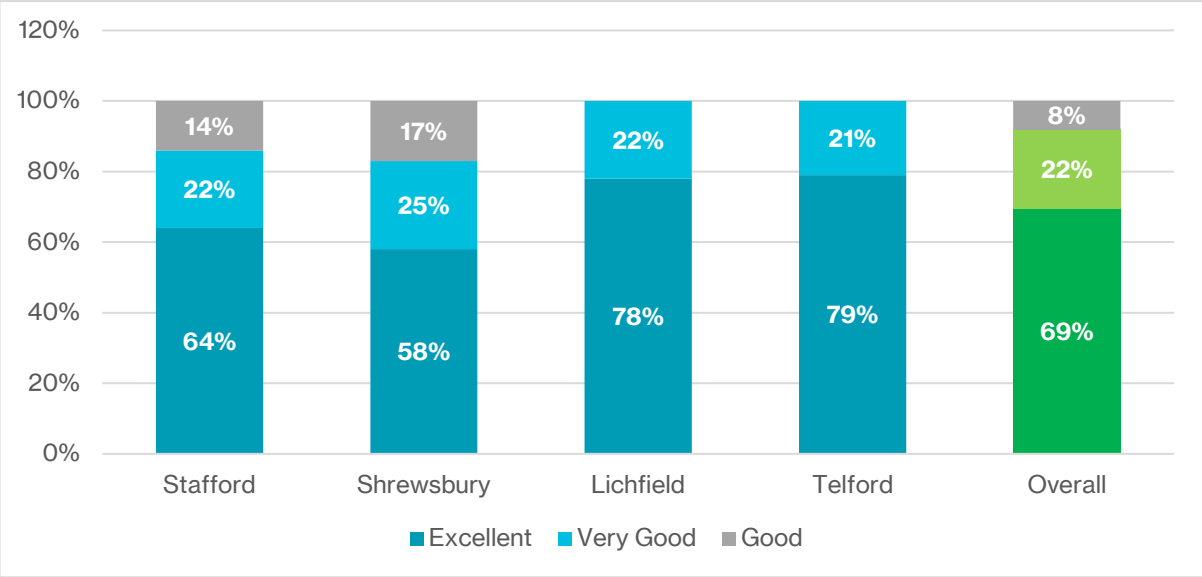
- Overall, 50% of businesses rated the support they received from EBRI to be 'excellent'.
- 80% of respondents considered the structure, content, application, conclusions and recommendations of the tailored reports to be 'excellent' or 'very good'.
- 70% of respondents considered the results analysis of the tailored reports to be 'excellent' or 'very good'.
- 60% of businesses felt that EBRI's support will 'very significantly' or 'significantly' help them to develop.

5.3 Questionnaire for Beneficiary Businesses – Master Classes

This section analyses feedback gathered by the EBRI team from businesses that had recently completed a Master Class. The project hosted four separate 'Sustainability, Energy & Bioproducts' Master Classes: in Stafford, Shrewsbury, Lichfield and Telford.

5.3.1 Overall Rating

Businesses were asked how they rated the Master Class courses. 92% of attendees rated their Master Class course as 'excellent' or 'very good'. Both the Telford and Lichfield courses were rated as 'excellent' or 'very good' by 100% of attendees.



A selection of responses is below:

Stafford

- "Enjoyed the range of subjects under discussion and the knowledge of other delegates".
- "Engagement, questions & discussion with attendees very interesting & added huge value as experienced & knowledgeable guests as well as presenters".

Shrewsbury

- "Very thought-provoking. Great examples. Good mix of knowledge sharing and time for us to ask questions. All speakers and the team very approachable and helpful".
- "The trend towards larger numbers of smaller biomass energy generating units being needed for sustainability goals of course provides essential foundation training in the full range of combustion opportunities from torro to gasification that is vital for sustainable offices to be made for renewable energy production for 1,000s of SMEs.".

Lichfield

- "Extremely enjoyable Master Class with lots of packed information about biomass and how to reduce your carbon footprint".
- "Very informative, in-depth knowledge and food for thought!"
- "Worth two days out of the office to totally focus on the course content".

Telford

- "A good blend of academic and practical presentations".
- "Very engaging course. Great having a range of people able to express opinions etc. Interesting principles".
- "I have learnt so much and given so much food for thought to make key decisions in our business".

"The presenters and the course content were outstanding. Vitor's knowledge on sustainability and the way he articulates it to the audience is priceless – just what industry and individuals want to understand this diverse subject".

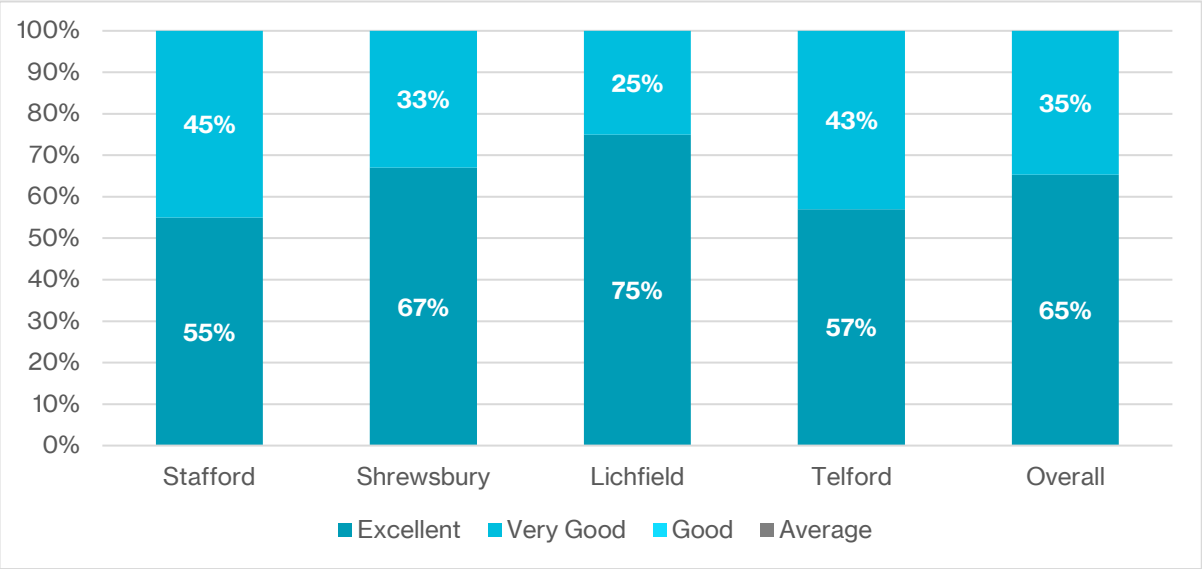
Telford

5.3.2 Individual Sessions

Master Class attendees were asked to rate each of the following sessions individually.

Key Principles of Sustainability in Business

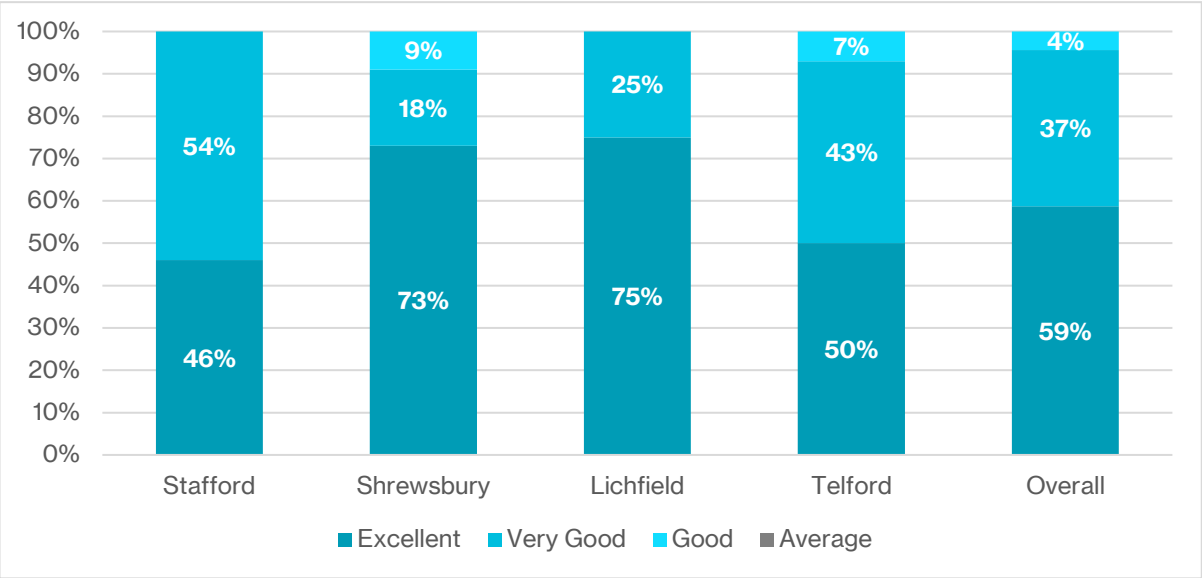
- 100% of Master Class attendees thought the Key Principles of Sustainability in Business session was 'excellent' or 'very good'.
- The Lichfield (75%) and Shrewsbury (67%) sessions received the highest proportion of 'excellent' responses.



- "Found this section of the course very interesting to break down all the key aspects of sustainability principles" (Telford)
- "Very informative session and simplified to everyone's understanding" (Telford)
- "I was able to see ways to improve on the sustainability of my business using methods I was unaware of before" (Lichfield)
- "Basic training to reprogram business assumptions about the most important considerations for climate change reduction" (Shrewsbury)

Business Approaches to Sustainability

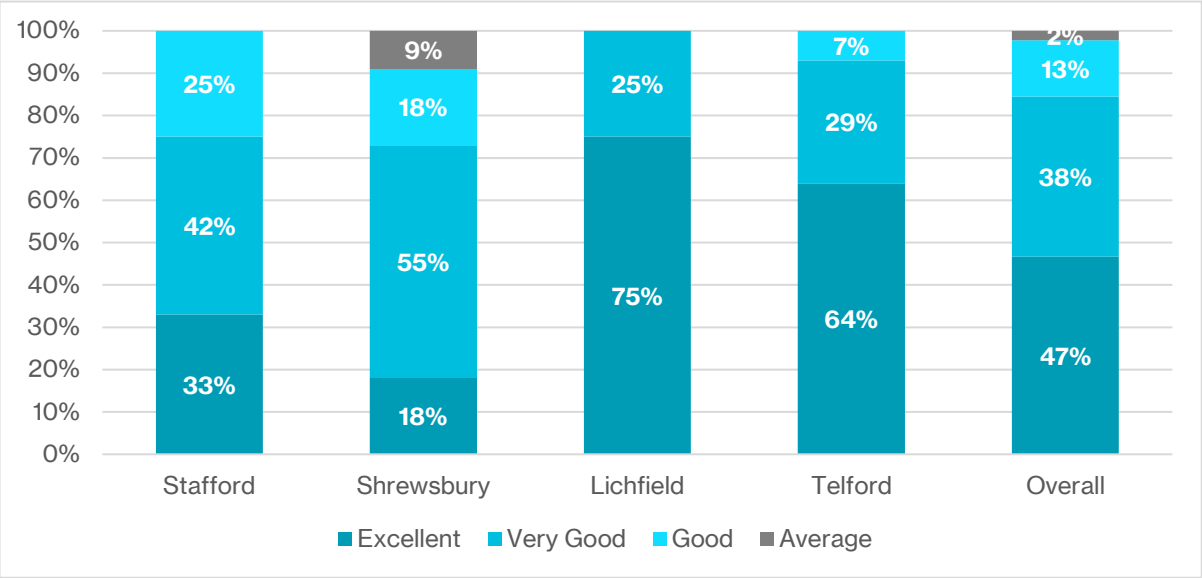
- 96% of Master Class attendees thought the Business Approaches to Sustainability session was 'excellent' or 'very good'.
- The Lichfield (75%) and Shrewsbury (73%) sessions received the highest proportion of 'excellent' responses.



- "Essential training for anyone reporting on SME sustainability with suggestions to help SMEs select the best candidate actions for achieving emission reduction targets" (Shrewsbury)
- "Relevant information for business applications" (Lichfield)
- "Well delivered, clear, and relevant" (Shrewsbury)

Practical Opportunities with Biomass, Bioenergy and Biofuels

- 85% of Master Class attendees thought the Practical Opportunities with Biomass, Bioenergy and Biofuels session was 'excellent' or 'very good'.
- The Lichfield (75%) and Telford (64%) sessions received the highest proportion of 'excellent' responses.

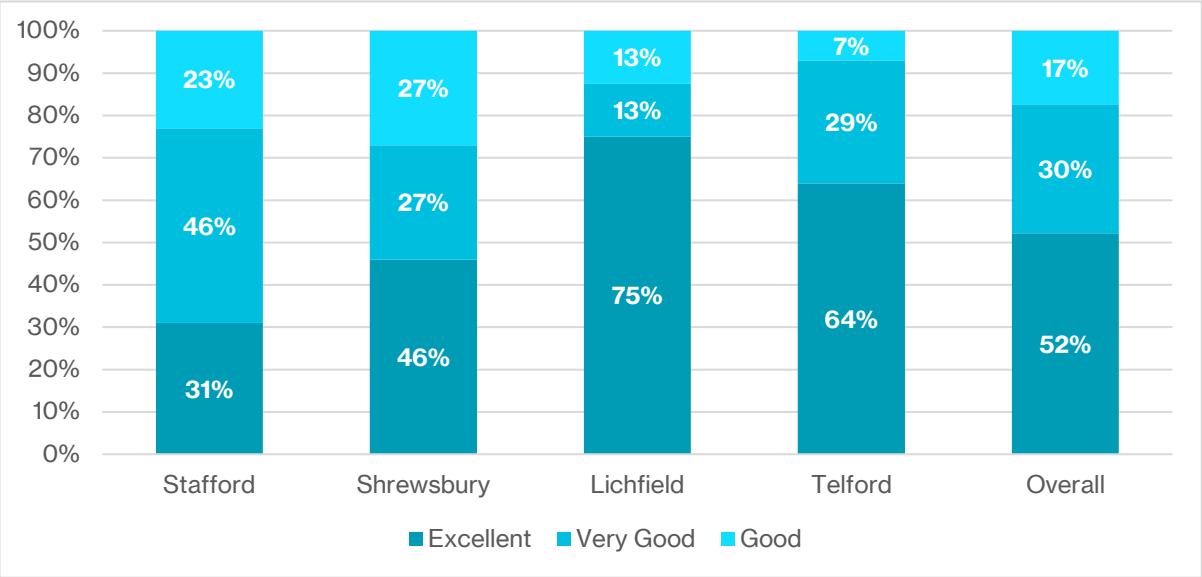


- "Technical process delivered in a simplified way. I really enjoyed the engagement and activity piece" (Telford)

- "Great to see business applications" (Lichfield)
- "Just a note that this was less my focus, but of course enjoyed the topic from an awareness perspective" (Shrewsbury)

Creation of Low Carbon Energy and Products

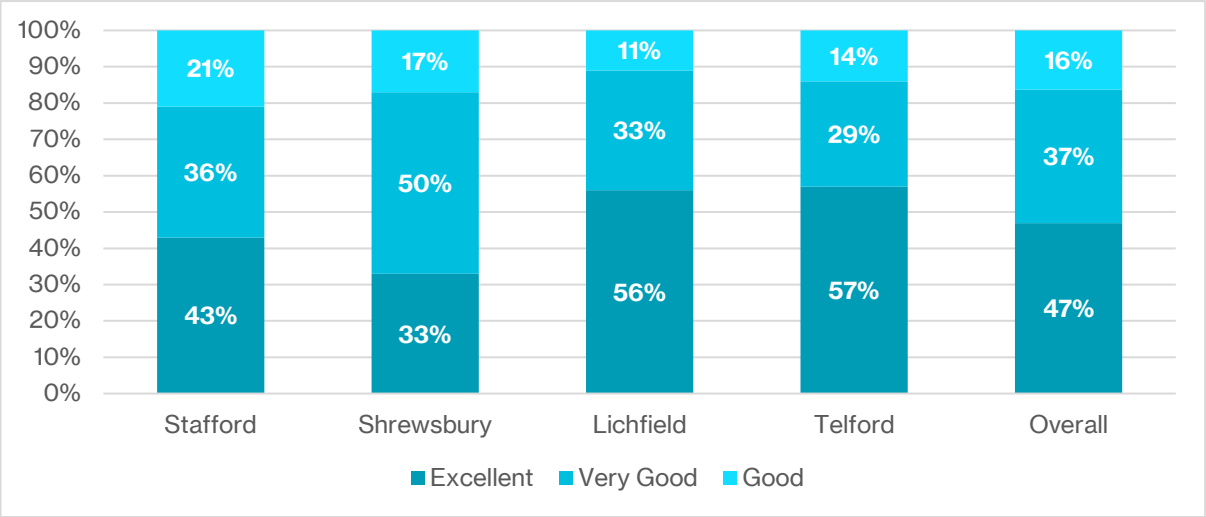
- 82% of Master Class attendees thought the Creation of Low Carbon Energy and Products session was 'excellent' or 'very good'.
- The Lichfield (75%) and Telford (64%) sessions received the highest proportion of 'excellent' responses.



- "Interesting array of options" (Stafford)
- "Did not know the UK legislation, so helpful indeed" (Telford)
- "Informative and interesting. Complex but interesting" (Lichfield)

Value from Waste – Opportunities and Materials

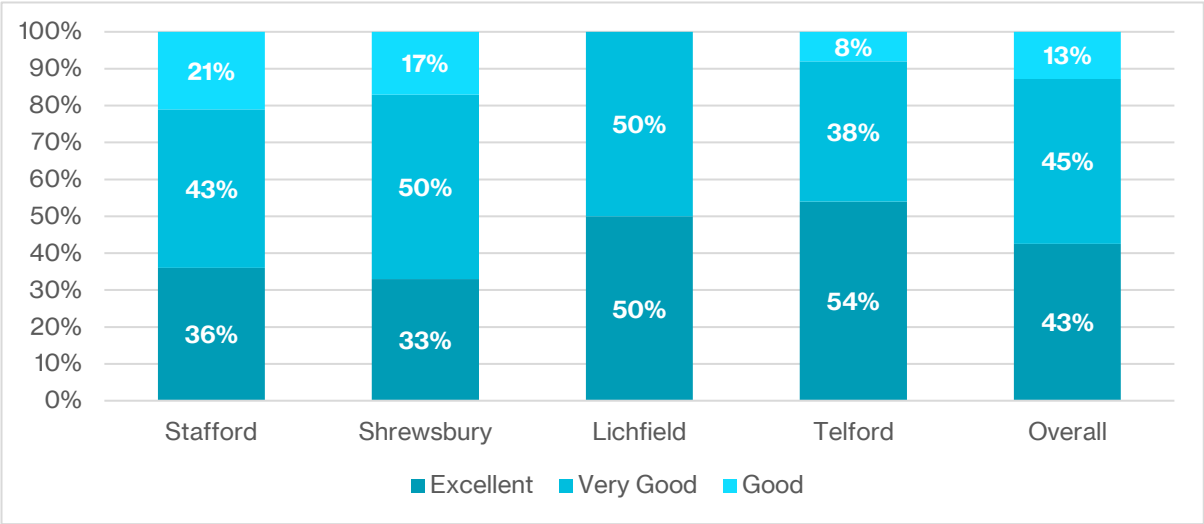
- 84% of Master Class attendees thought the Value from Waste session was 'excellent' or 'very good'.
- The Telford (57%) and Lichfield (56%) sessions received the highest proportion of 'excellent' responses.



- "Lots of useful and practical information" (Stafford)
- "Very interesting part of the sessions. Something that the business I am within work with first hand. Interesting to learn more on and of the practical setting" (Telford)
- "Expert knowledge" (Shrewsbury)

Practical Biological Processes and Materials

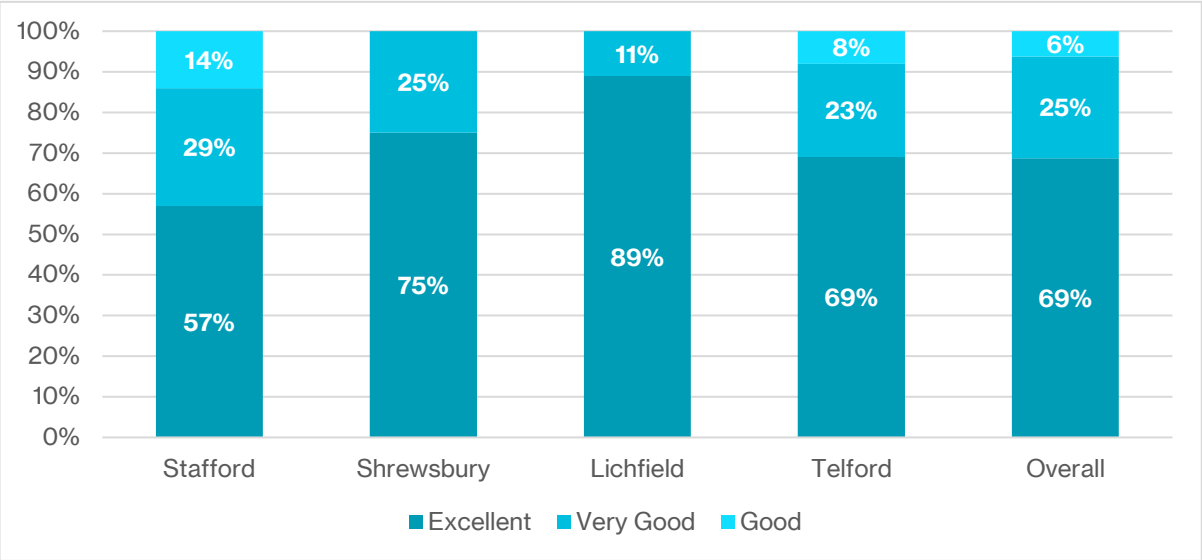
- 88% of Master Class attendees thought the Practical Biological Processes and Materials session was 'excellent' or 'very good'.
- The Telford (54%) and Lichfield (50%) sessions received the highest proportion of 'excellent' responses.



- "Complex, detailed, yet useful knowledge" (Stafford)
- "Technical subject well delivered and all our comments and questions were answered as the presenter was presenting" (Telford)
- "Good to do practical exercises" (Lichfield)

Carbon Footprint Assessment

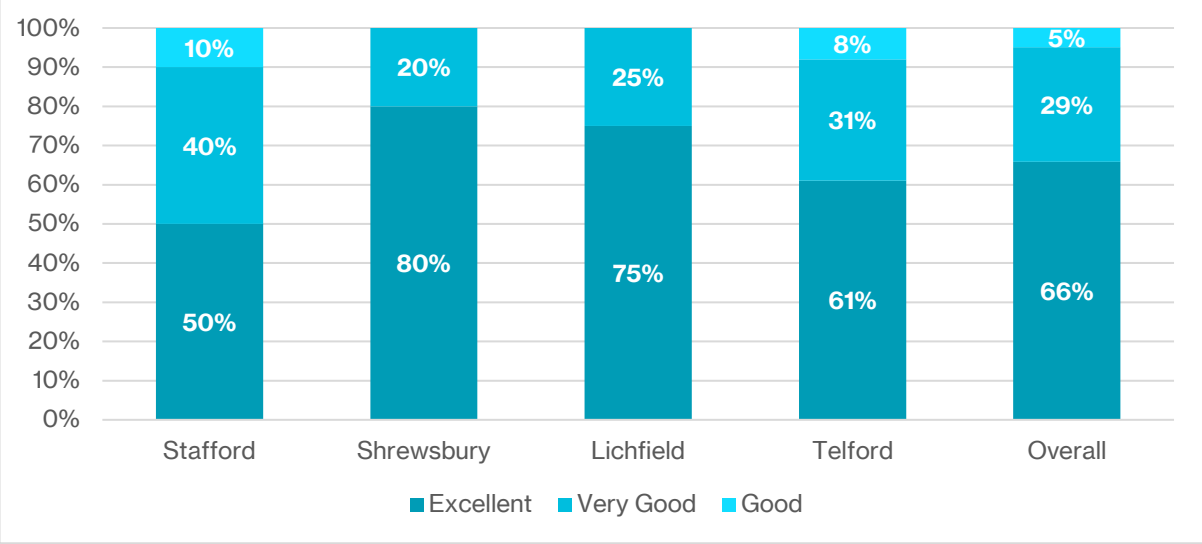
- 94% of Master Class attendees thought the Carbon Footprint Assessment session was 'excellent' or 'very good'.
- The Lichfield (89%) and Shrewsbury (75%) sessions received the highest proportion of 'excellent' responses.



- "Presentation style 'spot on'" (Stafford)
- "Very useful and presented in a more simplified and relative approach" (Telford)
- "A very good insight into soon what will be a mandatory requirement" (Lichfield)

Emissions Reduction Strategies

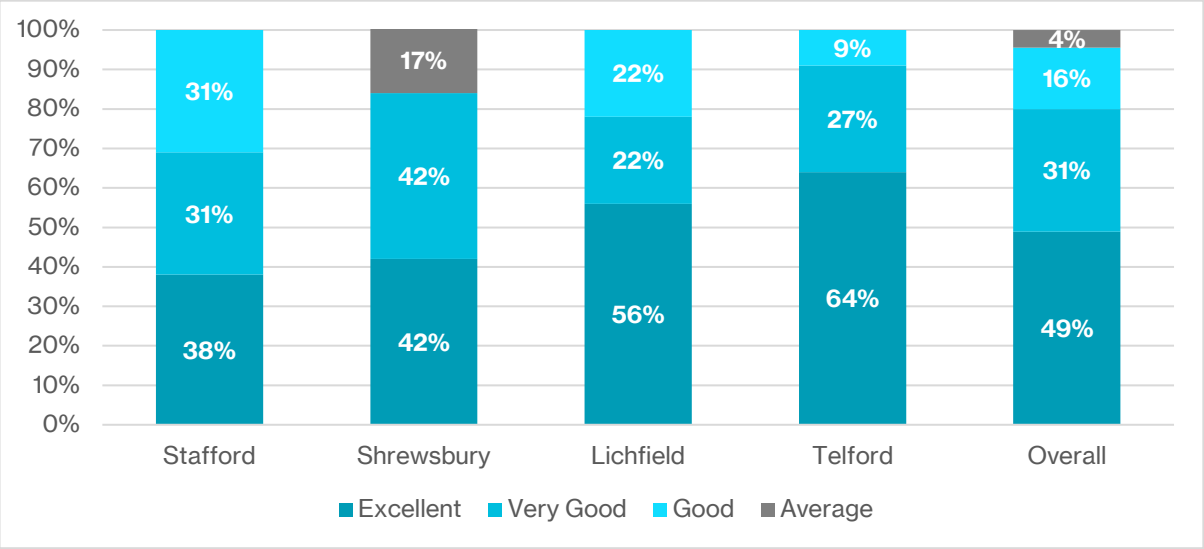
- 95% of Master Class attendees thought the Emissions Reduction Strategies session was 'excellent' or 'very good'.
- The Shrewsbury (80%) and Lichfield (75%) sessions received the highest proportion of 'excellent' responses.



- "Very helpful to the audience who had no idea of how to implement these within their farming businesses and other" (Telford)
- "Although I work from home I can still make some practical changes" (Lichfield)
- "Lots of practical applications" (Shrewsbury)

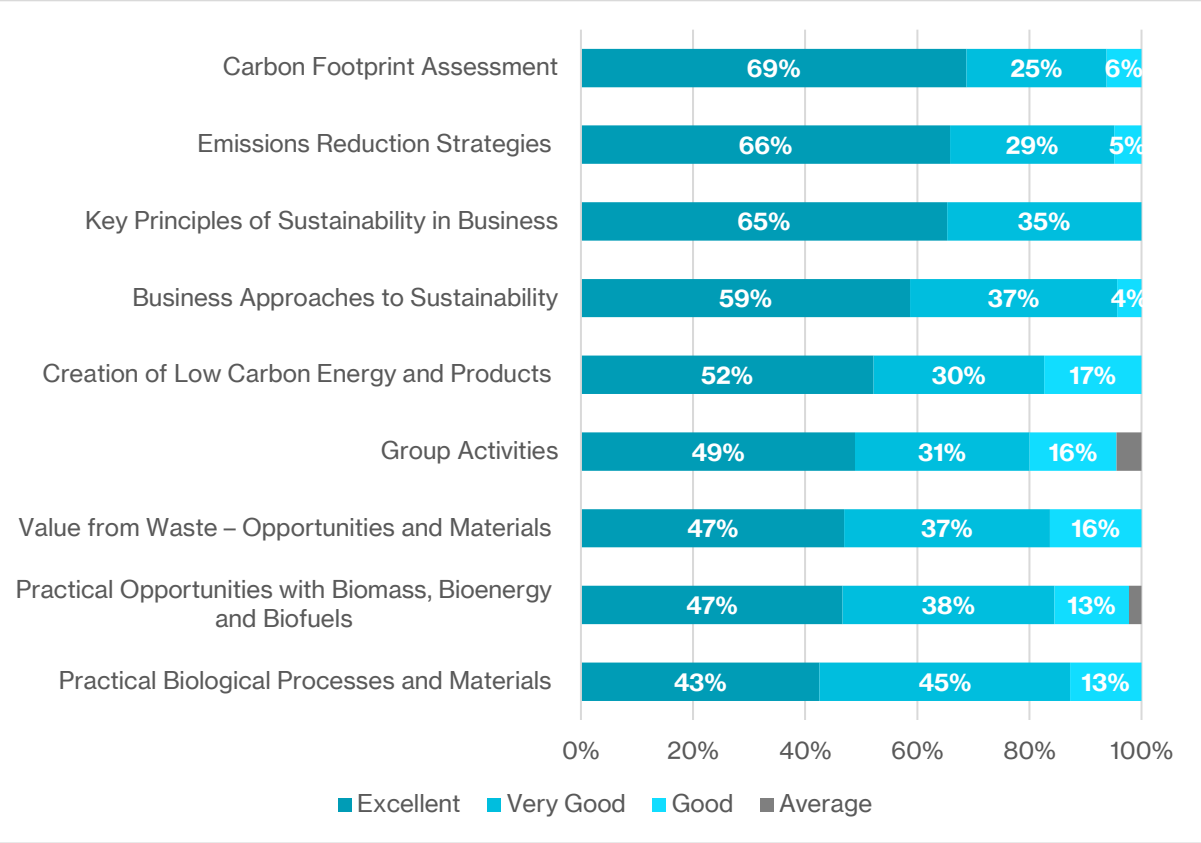
Group Activities

- 80% of Master Class attendees thought the Group Activities session was 'excellent' or 'very good'.
- The Telford (64%) and Lichfield (56%) sessions received the highest proportion of 'excellent' responses.



- "Enjoyed the open discussion especially with everyone's expertise" (Shrewsbury)
- "There was good interaction between speakers and attendees – lots of information exchange" (Stafford)
- "Good to discuss topical business practices regarding environment and sustainability with other business owners" (Telford)
- "The workshops were thorough and well delivered in a lovely venue and a good mix of business" (Lichfield)

All Locations



- The Carbon Footprint Assessment and Emissions Reduction Strategies sessions of the Master Classes were the most frequently cited as 'excellent' or 'very good' by attendees across all locations.

5.3.3 Technical and Business Challenges

The survey sought to determine what the beneficiary respondents' main technical and business challenges are. Respondents discussed specific technical challenges regarding energy production and carbon emissions, as well as business challenges around knowledge exchange and skills/expertise shortfalls. The issue of sustainability awareness was also raised, in the context of emphasising the importance of reducing waste and emissions within both the business itself and amongst their clients - either through process innovation, new sustainability policies, renewable technologies, or utilising more sustainable materials.

A selection of challenges is listed below:

"Understanding how to define measuring our sustainability and emissions. Putting together a sustainability policy. Finding suitable materials and experts to help us produce innovative new products using sustainable sources. Recycled plastics, replacements for plastics, replacement for cement etc".

- "Product/service innovation; knowledge and insight into the sector".
- "Proof of concept"
- "Finding solutions for energy production that are within ROI parameters that generate energy for a business that uses vast amounts of electricity".
- "Reducing our carbon footprint and CO2 emissions".
- "We are at a crossroads in terms of technology and roll-out to business. We need a cohesive pipeline of knowledge exchange".
- "Analysis of waste material for value. Carbon credits generation of environmental services".
- "Building business models around CO2 reduction and potential carbon capture projects".
- "Development of our carbon calculation system for our sector. Collaboration with others in the sector and cross-sector partners to deliver a circular ecosystem in the West Midlands for the WEEE sector".
- "Engineering a low carbon sustainable energy source into a tractor at a viable cost".
- "Specific knowledge of ways to use a variety of waste products".
- "As a Cold Storage business our main challenge is energy use (electric), we aim to reduce as much as possible, and invest in renewables where we can, but our biggest barrier is the capital cost and trusted technologies".
- "Using energy sustainably, identifying supply chain and sourcing issues. Creating a carbon reduction plan".
- "Calculating the traceability of the textile waste I recover and save".
- "Technical: Grid limitations/restrictions. Business: Limit of resources – human + equipment. Technical competence/understanding of Clients.".

"Getting our clients to understand what sustainability is all about and how they can play their part to reduce their carbon footprint".

5.3.4 Future EBRI Support

The survey sought to better understand the ways in which businesses will be seeking support from EBRI in the future; the results can inform where the grant recipient could offer support to these businesses moving forwards.

Future Support	
Area of Support	**% who said 'Yes'**
Other EBRI events, such as business focused seminars and workshops	82%
Funding opportunities for your business	82%
Joint collaboration opportunities (i.e. working with EBRI on joint proposals)	80%
Tailor-made report on the viability of your business' technology requirements	53%
Techno-Economic Assessment of proposed technology	47%
Feedstock analysis	42%
Access to EBRI's pyrolysis and gasification test facilities	31%

A compilation of data from across the Master Classes reveals that the areas of support most sought after from beneficiary businesses are other EBRI events (82%), funding opportunities (82%) and joint collaboration opportunities (80%). Around half of business respondents said that they would like support from EBRI in the future in the shape of tailor-made reports on the viability of their business' technology requirements (53%) or a Techno-Economic Assessment of a proposed technology (47%).

Businesses mentioned Knowledge Transfer Partnerships, laboratory testing and further collaboration/partnering with EBRI as particular areas of support.

A selection of specific responses is below:

"Just knowing who to ask when I don't have the right questions is really reassuring – I know where to go for help! This brought up areas to think about that I hadn't even considered".

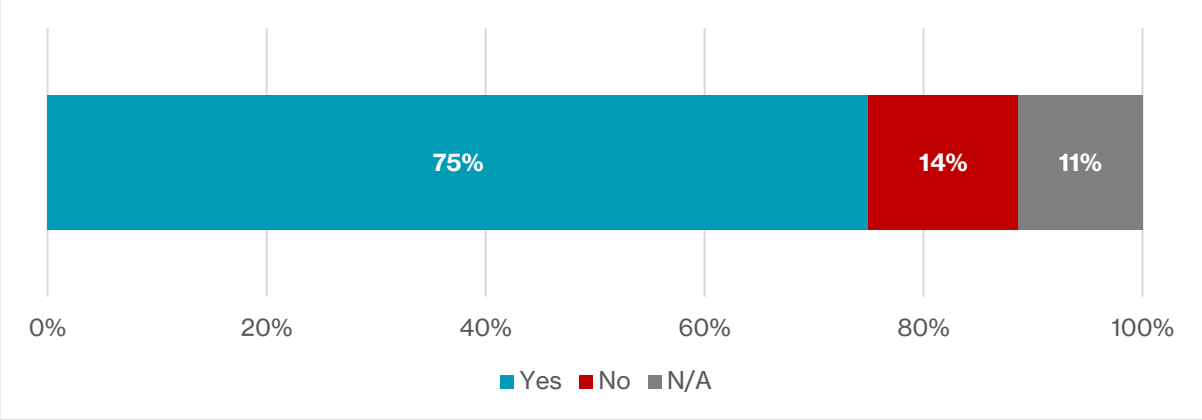
- "General review of our activities and product types to see where EBRI's expertise and contacts could be beneficial. More information on the KTP scheme".
- "Partnering with EBRI would be useful for our organisation, to allow collaboration and passing on clients who need more technical advice on technologies to subject matter experts within EBRI".
- "Overall very pleased that I attended this event. Developed some potentially useful collaborations with other delegates & EBRI for further development".
- "Very much want to have EBRI/Aston as partners in our business venture".
- "What to do with different waste products".
- "Looking to further explore the benefits of biochar from agricultural residues".
- "There is some mileage in academia and the business sector lobbying central govt. The message must be that we need funding to deliver on the Green agenda".
- "Nearly everything feels like it could be relevant to my business as so much of it can be scaled and adapted".

"Lab facilities-testing; research into other by-products e.g. olive kernels, sunflower husks; showcasing @ Aston; charcoal partnership; interns; research".

5.3.5 EBRI's Networking and Showcasing Club

75% of survey respondents said that they would be interested in joining EBRI's Networking and Showcasing Club for businesses connected to the bioeconomy and beyond.

Q: Would you be interested in joining EBRI's Networking and Showcasing Club?



Summary – Master Classes Feedback

- 100% of Master Class attendees thought the Key Principles of Sustainability in Business session was 'excellent' or 'very good'. The Carbon Footprint Assessment and Emissions Reduction Strategies sessions of the Master Classes were also the most frequently cited as 'excellent' or 'very good' by attendees across all locations.
- More than 9-in-10 attendees thought the Business Approaches to Sustainability (96%), Emissions Reduction Strategies (95%), and Carbon Footprint Assessment (94%) sessions were 'excellent' or 'very good'.
- At least 8-in-10 attendees thought the Practical Biological Processes and Materials (88%), Practical Opportunities with Biomass, Bioenergy and Biofuels (85%), Value from Waste (84%), Creation of Low Carbon Energy and Products (82%), and Group Activities (80%) sessions were 'excellent' or 'very good'.
- 92% of attendees rated their Master Class course as 'excellent' or 'very good'. Both the Telford and Lichfield courses were rated as 'excellent' or 'very good' by 100% of attendees.
- Overall, the Lichfield Master Classes were rated 'excellent' by the highest proportion of attendees for more than half (56%) of the individual sessions; the Telford Master Class individual sessions were similarly considered to be the most 'excellent' by 34% of attendees.
- Technical challenges discussed by businesses included energy production and carbon emissions, as well as business challenges around knowledge exchange and skills/expertise shortfalls.
- The areas of support most sought after from beneficiary businesses are other EBRI events (82%), funding opportunities (82%) and joint collaboration opportunities (80%).
- 75% of survey respondents said that they would be interested in joining EBRI's Networking and Showcasing Club for businesses connected to the bioeconomy and beyond.

5.4 Questionnaire for Beneficiary Businesses

As part of this evaluation a beneficiary survey was developed to engage and seek feedback from those who have accessed support from the EBRI Successor Project. The aim of the consultation was to gather feedback on how effective the different elements of the programme have been and the impact it has had upon its beneficiaries.

The survey was designed in consultation with project staff and an electronic survey link was circulated to businesses to take part in the survey.

In total, 10 businesses completed the questionnaire. The findings are based on this sample size and are shown in the following section.

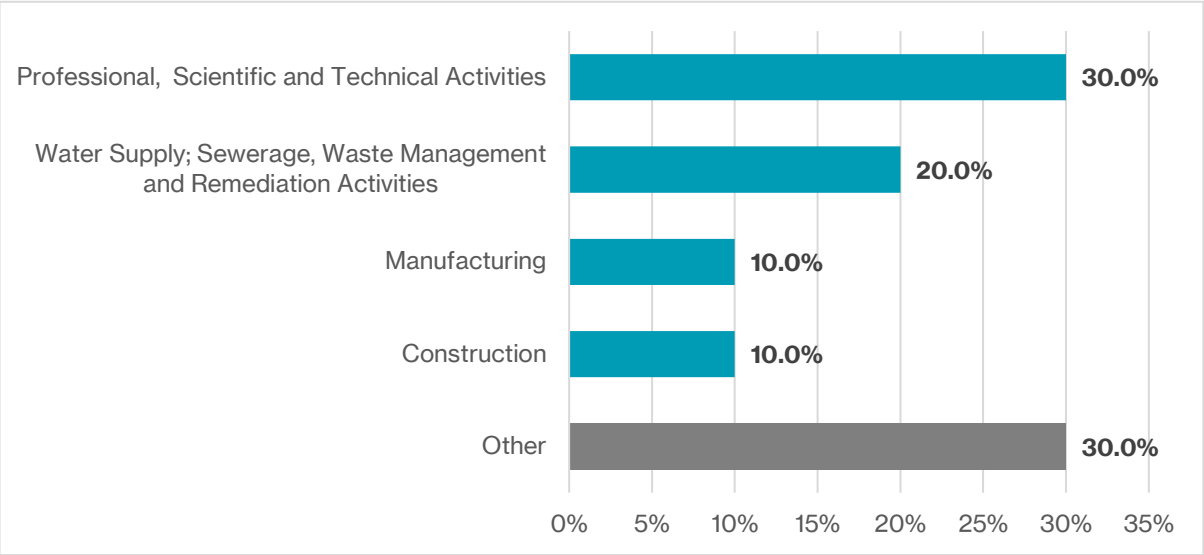
5.4.1 Snapshot of the Businesses Taking Part

a. Sectors

Businesses taking part in the survey were asked which sectors they were a part of. The responses are shown in the graph below, which illustrates the diversity of sectors covered by the EBRI Successor Project and is indicative of both the broad types of businesses in the target LEP areas and the variety of sectors for which bioenergy support is applicable.

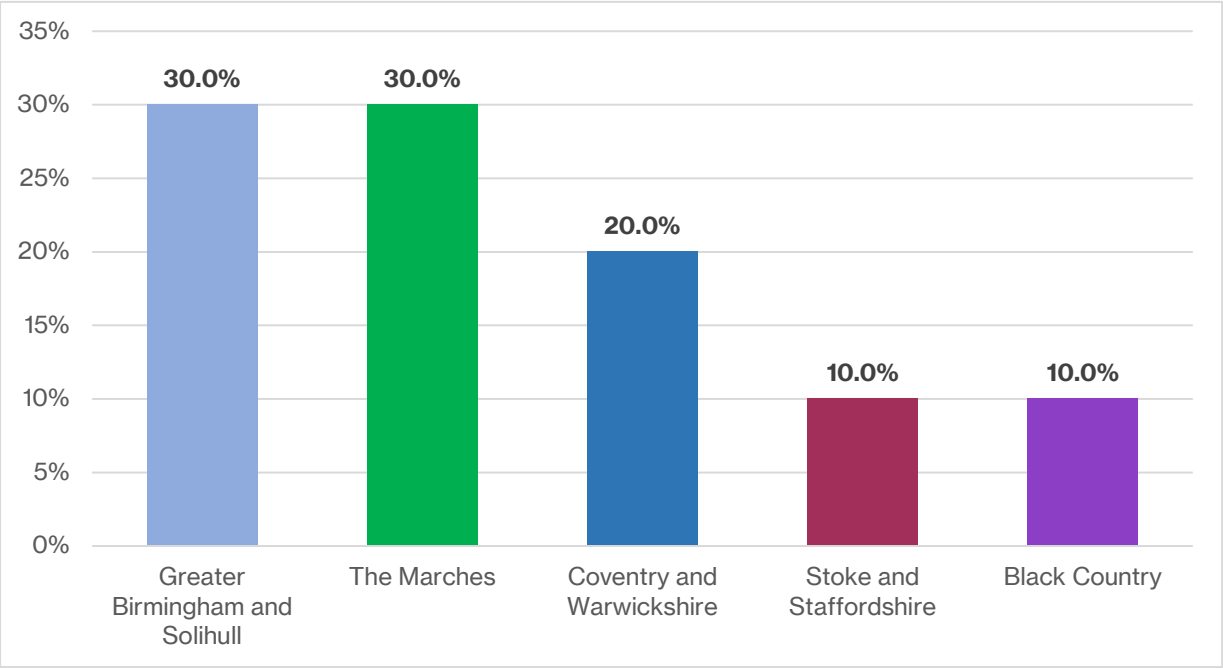
Nearly one-third of the respondents to the survey are made up by businesses from the Professional, Scientific and Technical Activities sector (30%), with strong representatives from the Waste Management (20%), Manufacturing (10%) and Construction (10%) sectors.

Q: What sector does your business primarily operate in?



b. Local Enterprise Partnership Area

The survey received responses from each of the LEP areas engaged by the project.

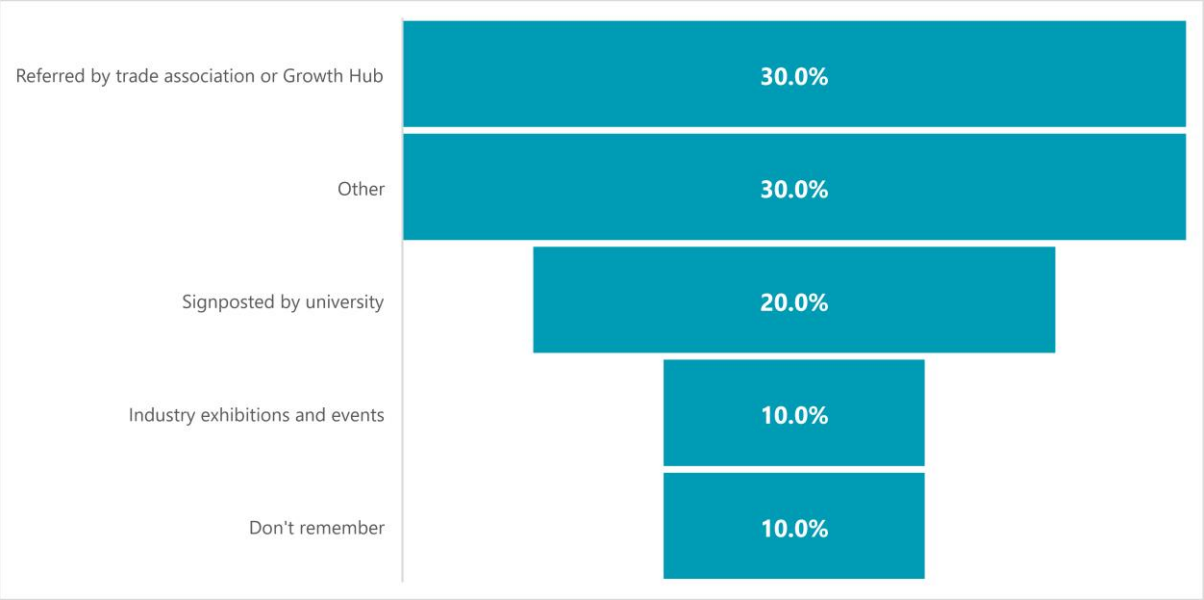


5.4.2 Engagement with the Project

a. Initial Engagement

Businesses were asked how they found out about the support on offer from the EBRI Successor Project.

Q: How did you find out about support on offer from EBRI?



Anecdotal evidence from beneficiary businesses consulted with as part of the case studies suggests that EBRI, and Aston University in particular, has a strong brand and reputation in the region. This is evidenced by the fact that 30.0% of respondents said that they were referred to the

project by the Growth Hub or a trade association, whilst 20.0% were signposted by the university itself.

5.4.3 Involvement with the Project

a. Rationale for Involvement with the EBRI Successor Project

The survey sought to determine the rationale for SME engagement with the EBRI Successor Project. It was designed to offer expert support to businesses looking to reduce their carbon footprint, diversify into new markets with sustainable products, or collaborate to develop new technologies.

Motivations varied, from a few businesses who were looking to learn more about pyrolysis or sustainability, to those specifically looking to reduce carbon emissions by using EBRI's analytical capabilities.

A selection of responses is below.

"A core aim of our new business is to apply, promote and commercialise the bioenergy and bioproduct research knowledge of EBRI internationally. Our Integrated Sustainability Model involves a detailed feasibility methodology that includes EBRI analytical capabilities".

- "Evaluation of chemical extraction via pyrolysis".
- "Ways our business might improve its uses/ reduction of Carbon".
- "We were evaluating the potential of pyrolysis as a means to extract value from waste materials we process".
- "To further develop ideas and technologies around bio-Sciences in Agriculture".
- "We have been on the pyrolysis training course. They also did some assessments of materials for thermal processes".
- "General interest in sustainability".
- "EBRI assisted me in establishing the leakage levels from PVC pipes and to design a 3 d printing of one of my fitments".
- "Gain cleaner energy through a solar panel project".
- "To assist with an ECO development for my product".

"We are planning to deepen our collaborative relationship with EBRI to include the testing, feasibility, technology and market analysis areas mentioned above".

b. Interventions Involvement

Businesses were asked about which areas of the project they were involved in. The results can be seen in the table below. Most businesses participated in the Master Classes (77.8%), before

engaging with one of the Testing, Economics or Technology areas of support as well as biochar insights (all 22.2% respectively).

EBRI Successor Project Activities	
Activity	**%**
Master Classes	77.8%
Testing: access to test facilities and feedstock analysis	22.2%
Economics: practical feasibility studies on bioenergy and energy systems	22.2%
Technology: an assessment of emerging products and technologies	22.2%
Biochar insights	22.2%
Follow-on collaborative project	11.1%

Project activities have included the use of EBRI's analytical facilities, the production of a number of reports for the beneficiary companies as well as practical support work to enable companies to adopt new low carbon technologies and to produce low carbon products and services. As of December 2022, the new demonstrator equipment was in place and has been used as part of a targeted marketing campaign to promote support to beneficiaries in the transitional areas.

"I took part in a sustainability masterclass over two days in December 2021. It was fascinating, particularly the interaction with likeminded SMEs who were at different stages of their journey".

5.4.4 The EBRI Team

Businesses were asked how they found working with the EBRI team, and whether the support they received met their expectations. The support was described as "supportive", "very helpful", "informative", "responsive", and "professional".

One business acknowledged that following their involvement with the EBRI project, they decided not to pursue a new manufacturing process as the team had helped them to understand that it wouldn't be a cost-effective approach. There is significant value for the SME in identifying where an approach might not be commercially viable, which could save the business significant spend in the long run.

A selection of comments can be found below:

- "Very helpful, supportive and friendly team".
- "The information on Leakage levels was excellent. The 3D printing was excellent, we established it was not cost effective to my business. Which really helped".
- "We feel we have excellent relations with EBRI's leadership and the team".
- "The team has been supportive and responsive".
- "Surpassed expectations. Very enjoyable and informative. As a postgrad of Aston it's very nice to see them engaged in this field".
- "The support was good at the start in learning what pyrolysis could do, both at testing and industrial scale".

"Yes a professional and knowledgeable approach to these technologies and opportunities has been experienced from EBRI".

5.4.5 Outcomes and Impacts

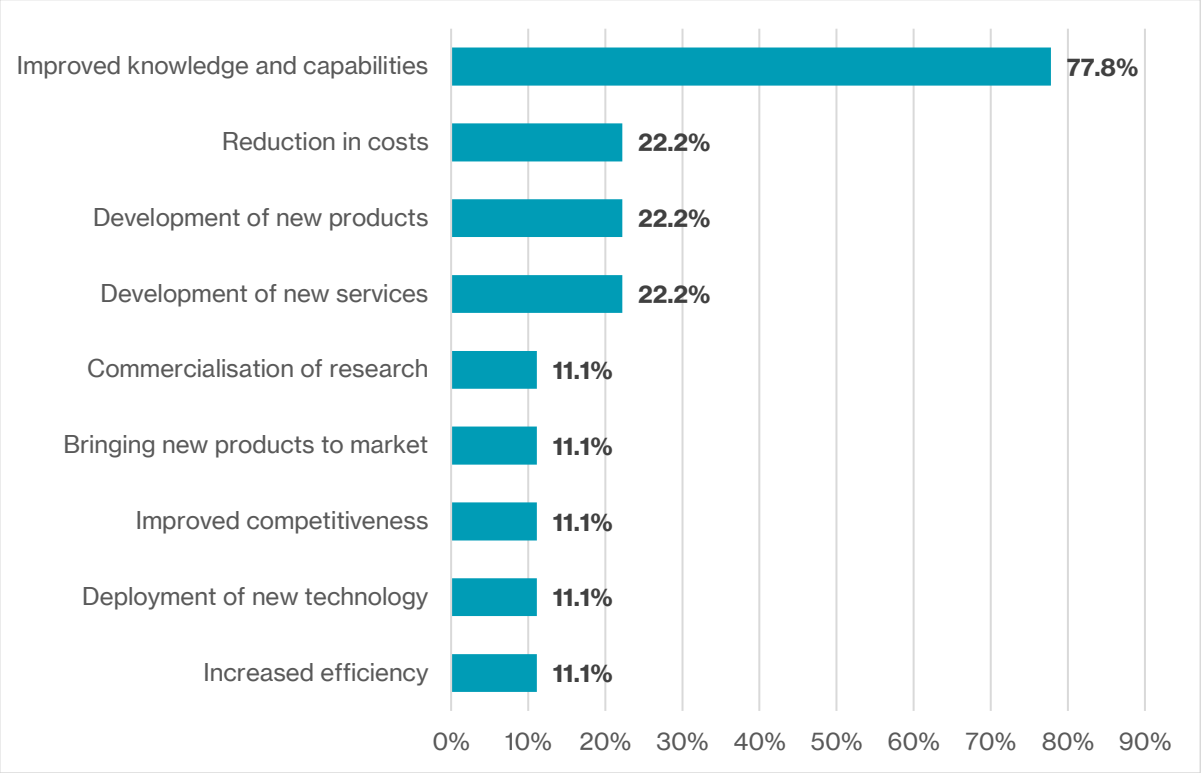
a. Outcomes

Businesses were asked whether their involvement with the EBRI Successor project had helped them to achieve improved outcomes, including improved efficiency, competitiveness, new product development and more. The data is overwhelmingly positive:

- More than three-quarters (77.8%) said that they have improved knowledge and capabilities as a result of their involvement with the EBRI Successor project.
- Nearly a quarter of respondents have developed new products, new services, and reduced costs (22.2% respectively) as a result of their involvement with the project.
- Businesses have also increased efficiency, deployed new technology, improved competitiveness, brought new products to market, and commercialised research following their involvement (11.1% respectively).

The data is illustrated below:

Q: Has the project helped you to achieve any of the following outcomes?



When asked to summarise in what way the project had positively impacted their business, the range of responses is testament to the number of different benefits businesses can draw from working with the EBRI Successor project. For some businesses, the project has helped in the short-term to reduce their energy consumption or to reuse their waste, whilst in the long-term, businesses said that the project has improved their knowledge of sustainability, demonstrated the viability of their biomass approach, shown which areas of the manufacturing process to concentrate on, or been pivotal to their plans.

Some respondents elaborated on the positive impact that the EBRI project has had for them:

"Partial elimination of waste, recycling of our waste to other businesses, our waste becoming their raw material".

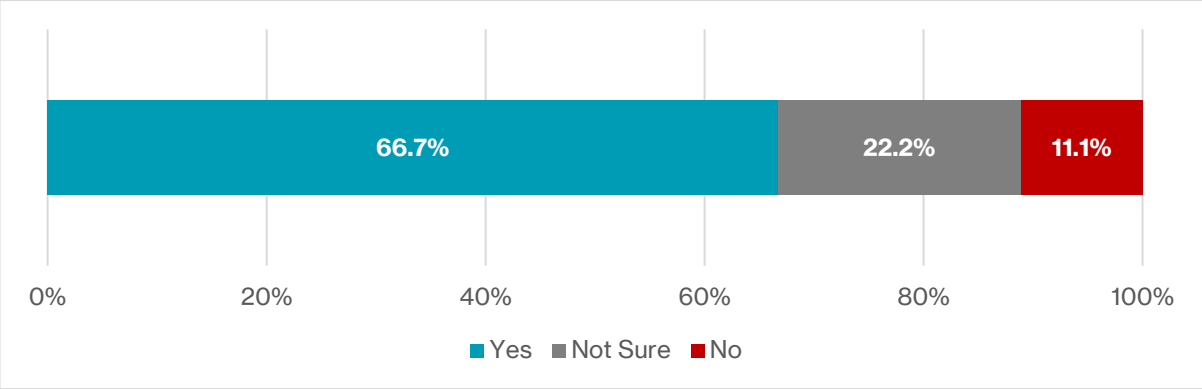
- "It has helped us start our journey to Carbon Zero".
- "Realistic evaluation of the options and the costs allow us to focus on the fuel to biomass route".
- "It has improved our environmental impact".
- "It will help us with our energy bills long term".
- "It has been extremely positive and pivotal to our plans".
- "The contact helped us evaluate pyrolysis as a possible process for handling compost oversize".
- "Lightened our energy consumption from the grid".
- "Yes it has shown me areas to concentrate my manufacturing effort and given me and my customers reassurance".
- "The oversize is now cleaned up and sent to biomass combustion".
- "We realised that the technology would not be cost effective and to look at alternative ways".
- "We are committed to adhering to rigorous Sustainability standards (environment, economic, social) in all aspects of our project developments".
- "Helped us make good decisions".
- "It gave us the push we needed to consider changing our business".

"We are an early-stage venture and as carbon project developers, we feel to date we have had just the right level of support in our planning and development phases".

b. Need for the Project

Two-thirds of business respondents (66.7%) said that there is a need for projects of this nature in the future.

Q: Is there a need for projects of this nature in the future?



One business attributed this to the central role that universities have to play in the decarbonisation effort. Some of the other responses draw attention to EBRI's role in supporting both local and global communities with its research:

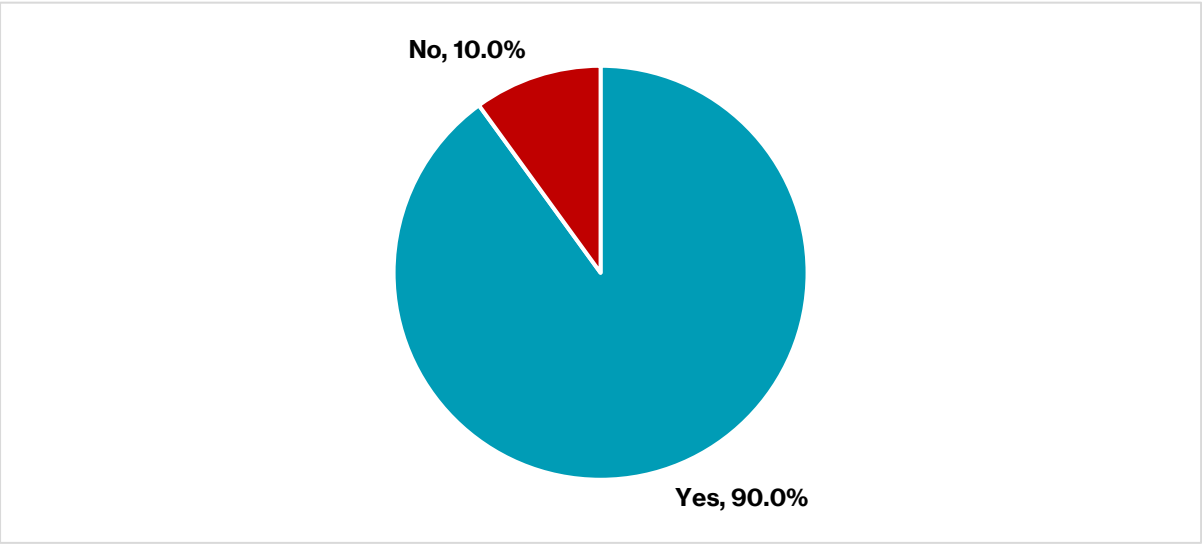
- "Our business is designed to have a long-term impact on communities and we hope to have EBRI/Aston as partners as we scale up operations globally".

"I think that Universities have a central role to play in decarbonisation".

c. Future Engagement with Aston University

A key outcome of the project is the longer-term collaborative relationships between SME beneficiaries and Aston University academics. The survey sought to determine whether the project has had an impact on SME attitudes towards a research collaboration or long-term relationship with Aston University, and what types of support will be needed in the future.

Q: Will your involvement with the EBRI Successor project encourage you to consider a research collaboration or long-term relationship with Aston University?



90.0% of businesses said that the project has encouraged them to engage further with Aston University – with 126 businesses supported to date, this represents a strong appetite amongst industry to access additional services at the university following their involvement with the EBRI Successor project.

A selection of responses is below:

- "There is a lot of common ground to explore and EBRI have a super network of contacts".
- "In our eyes, EBRI is a core partner [for us] and we wish to explore multiple ways we can collaborate for mutual benefit as we develop our new processing centres in locations around the world".
- "We appreciate the knowledge-sharing mindset, research skills and leadership on offer".
- "Good set of outward facing academics".
- "The future of Agriculture in the UK and globally will depend on this area of Research".

"We are an early-stage venture and as carbon project developers, we feel to date we have had just the right level of support in our planning and development phases".

Businesses were also asked what support they think they will need in the future. Survey respondents highlighted Carbon Zero mapping, management support, techno-economic feasibility studies, and the continued providing of bioprocessing and bioproduct expertise:

- "Notably, support with techno-economic feasibility studies, management frameworks/ tools/resources and access to knowledge of new developments in the bioprocessing and bioproduct fields".
- "Carbon Zero mapping and lots of others. Collation of Feedback from other projects".
- "Mass and energy balance for the system, and how to retain ammonia and nutrients".
- "That more Government funding be made available for this vital sector to the UK communities, in Food production, health, welfare and wealth".

"Better understanding of our business in respect of materials recovery and repurposing in which pyrolysis is perhaps just one potential process we could use among many".

5.4.6 Improvements and Suggestions

The survey sought to determine whether, from a business perspective, there were any improvements that could be made to the project or whether there were any services that were missing from the offer.

Although some respondents said that they didn't think anything could be improved, others noted that they would benefit from scale-up support following their involvement with the EBRI Successor project, in addition to supplementary funding. One business said that they would benefit from

having more time to explore EBRI's existing resources. The responses also highlight the need to manage business's expectations of what can be achieved through the project.

A selection of responses is below:

- "We have found the academic good at what they do".
- "By our company having more time to explore EBRI's existing resources".
- "Help improve design of next scale up".
- "Funding that leads to real deliverables with real, collaborative research and testing with all parties involved".
- "However, I do think any future EBRI replacement should be looking at chemical and material recovery rather than fuel due to the very negative impact of generating CO2. This is clearly demonstrated in the fact that currently pyrolysis as a production method is legally classified in both the UK and EU as a form of incineration due to the fact that the majority of use cases result in the majority of the waste stream being turned into CO2 as the final end result. The reason we need projects of this nature in the future is to completely move away from this approach to a non-CO2 focus that results in pyrolysis being legally reclassified as a consequence".

Summary – Questionnaire for Beneficiary Businesses

The results from the questionnaire illustrate the wide array of benefits that businesses have had from working with EBRI.

- The survey illustrates the diversity of sectors covered by the EBRI Successor project and is indicative of both the broad types of businesses in the target LEP areas and the variety of sectors for which bioenergy support is applicable. Nearly one-third of the respondents to the survey are made up by businesses from the Professional, Scientific and Technical Activities sector, with strong representatives from the Waste Management, Manufacturing and Construction sectors.

- Anecdotal evidence from beneficiary businesses consulted with as part of the case studies suggests that EBRI, and Aston University in particular, has a strong brand and reputation in the region. This is evidenced by the fact that 30.0% of respondents said that they were referred to the project by the Growth Hub or a trade association, whilst 20.0% were signposted by the university itself. The breadth of engagement reflects the momentum and reputation that the project has built-up to date.

- The project was designed to offer expert support to businesses looking to reduce their carbon footprint, diversify into new markets with sustainable products, or collaborate to develop new technologies. Motivations varied, from a few businesses who were looking to learn more about pyrolysis or sustainability, to those specifically looking to reduce carbon emissions by using EBRI's analytical capabilities.

- Most businesses participated in the Master Classes, before engaging with one of the Testing, Economics or Technology areas of support as well as biochar insights. Project activities have included the use of EBRI's analytical facilities, the production of a number of reports for the beneficiary companies as well as practical support work to enable companies to adopt new low carbon technologies and to produce low carbon products and services.

- The data is overwhelmingly positive. More than three-quarters (77.8%) said that they have improved knowledge and capabilities as a result of their involvement with the EBRI Successor project, whilst nearly a quarter of respondents have developed new products, new services, and reduced costs. Businesses have also increased efficiency, deployed new technology, improved competitiveness, brought new products to market, and commercialised research following their involvement.

- For some business, the project has helped in the short-term to reduce their energy consumption or to reuse their waste, whilst in the long-term, businesses said that the project has improved their knowledge of sustainability, demonstrated the viability of their biomass approach, shown which areas of the manufacturing process to concentrate on, or been pivotal to their plans.

- Two-thirds of business respondents (66.7%) said that there is a need for projects of this nature in the future. One business attributed this to the central role that universities have to play in the decarbonisation effort. Some of the other responses draw attention to EBRI's role in supporting both local and global communities with its research.

- 90.0% of businesses said that the project has encouraged them to engage further with Aston University – with 126 businesses supported to date, this represents a strong appetite amongst industry to access additional services at the university following their involvement with the EBRI Successor project. Survey respondents highlighted Carbon Zero mapping, management support, techno-economic feasibility studies, and the continued providing of bioprocessing and bioproduct expertise as areas SMEs identified as needing support in the future.

- Although some respondents said that they didn't think anything could be improved, others noted that they would benefit from scale-up support following their involvement with the EBRI Successor project, in addition to supplementary funding. One business said that they would benefit from having more time to explore EBRI's existing resources.

- It should be acknowledged that an overall weakness of ERDF projects is the constraints of eligible activity; businesses who are signposted to alternative services outside the remit of the project cannot be supported in the transition with project resources.

6.0 Case Studies

This section captures more in-depth feedback from one-to-one consultation with businesses who have received in depth support and provides a more detailed understanding of the impacts that support from the EBRI Successor Project can have.

6.1 Certainly Wood

6.1.1 Background

Located in Hereford, Certainly Wood is one of the UK's largest specialist producer of British kiln dried logs and kindling and indeed the pioneer of kiln drying firewood in the UK, having been established in 2006 by brothers Nic and George Snell. The company has grown significantly from producing 1,000 tonnes of barn-dried firewood to over 16,000 tonnes of premier kiln-dried firewood and 2,500 tonnes of kindling wood. The business uses only sustainable British woodland, locally sourced within a 100-mile radius.

The business sells firewood, firelighters and kindling for wood burning stoves, providing maximum heat but with a clean burning process. Products are sold throughout the UK via a network of retailers and also through its online shop selling direct to consumers and delivering bulk volumes direct to customer's homes.

The business has endeavoured to bring a more professional approach to what is a very traditional cottage industry, hoping to make it not only easier for customers to buy firewood in known quantities, but also of consistently high quality, hence the HETAS quality assurance. The business also belongs to the Grown in Britain campaign and to have been the first UK producer to be help set up and be a part of the Woodsure/HETAS quality assurance scheme for firewood.

Sustainability

Sustainability is one of the main priorities for Certainly Wood, with the business already taking several measures in order to become more environmentally friendly:

- All firewood is locally sourced from sustainable woodland.
- Kilns have been converted to run from wood waste (sawdust, offcuts etc.) rather than oil; all wood waste is now goes into the boilers to provide heat for the kilns.
- In 2019, the business changed their packaging to ensure bags were 100% recyclable and are made using 30% recycled materials.
- All logs are dried in unique wood fired kilns with 200kW of solar panels providing electricity.
- Plantation of circa 5,000 hardwood trees in 2021.

Certainly Wood's kiln-fired kindling is dried to a moisture content of below 12%, and is advertised for both indoor and outdoor burning. The Ready to Burn hardwood logs are advertised as being below an average of 20% moisture content, ensuring they burn longer and hotter, creating a cleaner burn to ensure optimum efficiency and minimal particulate emissions. These products sought to tackle an industry-wide problem with 'wet wood', which is reported to cause 80% of issues with wood-burning stoves. Certainly Wood is a founding member of the Woodsure Ready to Burn scheme, backed by Defra and guaranteeing below 20% moisture content. To reinforce its sustainability, Certainly Wood is approved under this scheme which provides a guarantee that all its firewood has been grown in the UK in accordance with the UK Government Timber Procurement Policy. It promotes active management to create a more sustainable future for British woodlands.

6.1.2 Involvement with the EBRI Successor Project

The company have been seeking new ways to be mindful about the planet and to be sustainable in their production. In an effort to reduce their carbon footprint, the business engaged with EBRI seeking support to calculate their carbon emissions and to find new routes to minimise them, particularly looking at carbon neutrality.

Certainly Wood engaged with EBRI via the Low Carbon Challenge Consultations, a bespoke, 30 minute, one-to-one event that aimed to supporting businesses to explore green product and service innovations, how to get value from waste, as well as how to maximise market opportunities in industry. One of the Certainly Wood team had previously participated in the Goldman Sachs 10,000 Small Businesses UK Programme, from which Aston University acquired a strong reputation and which contributed to the businesses following-up on the opportunity.

Initially it was thought that carbon neutrality would be an unsustainable aim, due to the required level of offsetting. The business primarily wanted to understand what their carbon emissions were at present, and to better understand how realistic it would be to achieve carbon neutrality over a period of time. It is also seen within the business as a positive marketing strategy for a company that prioritises sustainability.

EBRI first produced a report which detailed a carbon calculator for Certainly Wood's business model, taking into account all carbon inputs and outputs provided by the company. The report also explored various grants and funding available to mitigate against the capital investment required to take up any of the report's recommendations.

After additional engagement with Certainly Wood, EBRI produced a further report on Carbon Emission Accounting, which contributed to the calculation of emissions of Green House Gases (GHG). It was recommended that although SMEs are not required to report on their emissions, setting up a yearly recalculation system may be advisable to protect the company from future funding regulations alterations. The report also explored further emissions displacement strategies and sustainable energy production.

6.1.3 Impact of the EBRI Successor Project

EBRI's support with measuring the business's carbon footprint is enabling Certainly Wood to take some initial steps to adapt to a changing world, and to create a more resilient business. The calculator detailed how to minimise the environmental impact of the different inputs that fuelled the business's production; these included advice on replacing carbon-intensive equipment with more efficient hardware or changing to non-carbon emitting fuels.

The calculator is the first step towards creating a roadmap to carbon neutrality. The calculator enables the business to consistently, accurately and transparently look at the amount of carbon their production creates, which looks at direct emissions from future fuel consumption and from purchased electricity for the assets in operation.

The business was also advised to intensify its tree culture to expedite carbon capture and off-set emissions from the production plant. Report recommendations included:

- To use wood waste as fuel to power the boilers, which were previously powered by electricity.
- To re-use the heat from the boilers to heat the kilns.
- Planting of 5,000 hardwood trees in 2021.
- Wood-burning stoves and solar panels.

Moreover, the Carbon Emissions Accounting report found that Certainly Wood was displacing eight times more emissions than it was producing, demonstrating that the company has already made notable efforts towards sustainability. The report was also able to determine that the company could fully off-set their emissions by sequestering emissions across 11 hectares or 27,500 trees.

The reports have helped the business to gain a true understanding of where the business is now. The reports have dispelled any lingering cynicism within the business around the possibility of reaching net zero and increased internal confidence around achieving this. In terms of mindset, the reports are helping company personnel to start considering all areas where they could achieve greater sustainability. The reports have focused the team on where they are now and what could be possible, and where they can make a significant difference.

The business conferred that it was particularly useful to be made aware of the different methodologies and standards used for calculating carbon emissions and carbon neutrality; the business now understands that in the first stage, their emissions calculations are contained with the business's primary on-site activity only. Understanding the different standards for measuring around the world is thought to be incredibly useful. The calculator, in acting as a malleable template, also allows the business to understand the impact that any actions or changes to their production has and will make to their carbon emissions. It is considered crucial that EBRI has been able to provide the business with a tool that they can continue to use moving forwards.

Solar Panels at Certainly Wood

As a result of the recommendations provided through the reports, the business is installing a new 75 kW solar array on the rooftops, which fits with the wider ambition to become carbon neutral; the solar array has been secured through grant funding (West Midlands, Worcester). The solar panels will have the dual-impact of reducing costs of electricity (particularly as recent rises in the cost of raw materials has increased both the cost of firewood and the cost of drying) and improving marketability; the panels fit with the wider ambition to advertise the company as one that prioritises sustainability and sustainable production. Increasing sustainability also increases efficiency, which offsets some of these increases and keeps processing costs to a minimum.

Moreover, the report identified that energy savings could be made with regards to the heating of the paraffin wax in which their firelighters are dipped; the business is now instead looking into a wood-fuel boiler could be used to melt the wax. Similarly, with the report recording any and all of the energy inputs into the business's production, it was noted that their traditional fork-lifts could be replaced with electric or biodiesel models when they reach the end of their shelf-life.

6.4 Seaweedology

6.4.1 Background

Established in August 2020 and located in Warwickshire, Seaweedology Ltd is looking to establish a sustainable seaweed aquaculture facility off the coast of Tenby and Caldy Island in Pembrokeshire. The aim of the company is to develop a sustainable and eco-friendly way to enable long-term kelp farming in the UK for human consumption and industrial applications. The Seaweedology Seaweed Farm would cover approximately four hectares with the company's aim to develop a "sustainable aquaculture facility" growing native kelp for human consumption.

Seaweed is currently experiencing a renaissance in demand; with many trace elements that are essential to a healthy diet, is has potential as a superfood, biofuel, animal feed, edible food packaging, eco-friendly fertilizer, and in pharmaceuticals and cosmetics. Seaweed farming is a growing business in the UK with other sites already established in Devon, Dorset and Scotland, with offshore, deep water, farming also in development. With long stretches of suitable coastline, UK seaweed farming can offer sustainable production of kelp whilst playing an important role in carbon sequestration and the reduction of greenhouse gas emissions, as well as encouraging the growth of marine life.

The company is working with Green Ocean Farming, a company which has helped set up seaweed farms elsewhere, with the cost of this project estimated to be around £25,000. Green Ocean Farming offer their support to prospective businesses, and offer a business model that allows individuals and businesses to purchase lines of kelp on their farm, to receive both a return on investment and to reduce their carbon footprint.

Seaweed is a nutritious food source for humans and also provides habitat and food for marine life as well as reducing carbon levels (known as Carbon Sequestering) in the sea Green Ocean Farming state. Once harvested, kelp is dried, chopped, and sold to businesses in the cosmetics, clothing and biofuel industries. The is no waste with seaweed, if it doesn't go into the human food chain it can be used as animal feed, it can be processed for various extracts, made into biofuel, bio plastic and biochar as a soil improver or make into fertiliser.

6.4.2 Involvement with the EBRI Successor Project

Although an initial personal investment from the directors will contribute to the set-up costs, the company required additional funding resources to cover the capital expenditure and other requirements. Initially contacting the Solihull Chamber of Commerce in hope of being signposted towards funding options, the business was put into contact with EBRI, who could support them to evidence how much carbon would be sequestered by a farm of the size that they were planning to install; the data could then be used to attract large organisations who might invest to offset their carbon footprint, in a similar model to the one offered by Green Ocean Farming. Tangible data was essential to demonstrate the value of the farms to any prospective investors.

Although the EBRI team have been unable to work in detail to evidence the environmental impact of the farm, the team instead supported Seaweedology with a funding application to the European Maritime and Fisheries Fund (EMFF) 2014-2020, which is being considered. EBRI provided much of the background research needed to support the bid. EBRI have also worked to source further funding opportunities to establish Seaweedology's first kelp farm, a few of which have been identified as potential funders moving forward.

Seaweedology expressed how interesting it has been to engage with academics as part of their involvement with EBRI. Although the Covid-19 pandemic has necessitated that the support was delivered online and remotely rather than in person, it has felt like a very natural process. The team were also praised for working on some last-minute amendments to the funding application too.

6.4.3 Impact of the EBRI Successor Project

In terms of the outputs of their engagement with the EBRI project, Seaweedology expressed that the support provided was exactly what they were hoping for and more. As a time-pressured business, working with EBRI has allowed them to conduct research in more detail than would have been possible independently. Funding bids and applications often involve significant levels of research of legislation, which the business simply did not have time to do. As a direct result of their involvement with EBRI, the business has been able to develop a much more robust bid; the team have significantly helped them to increase their opportunity to secure funding. The research undertaken by the team have also provided an evidence base of sorts which the business can use to market their offer.

6.4.4 The Future

Seaweedology are inclined to continue working with EBRI in some respect, perhaps through feedstock analysis of the kelp, or further exploration of funding opportunities. EBRI's team of chemical engineers can assist Seaweedology with algae guidance, feedstock analysis and the development of new technologies in kelp farming, which would see benefits across the aquaculture industry around the globe. As part of his business plan, Simon is planning to engage with EBRI regarding collaborative research opportunities which could help his company innovate and expand, under several funding schemes such as Knowledge Transfer Partnerships (Innovate UK) and European Partnerships (Horizon Europe).

6.5 Clun Brewery

6.5.1 Background

Founded in 2007, Clun Brewery was established to produce local craft ales at a micro scale for the White Horse Inn in Shropshire. Between 2007 and 2011, the brewery relied on a nine-gallon double mash, producing nine gallons of beer once or twice a month, before upgrading in 2011. By 2019, the 'nano brewery' has slowly increased its production to 72 gallons on site and will soon be moving to a new brewing plant which will drastically increase their production capacity.

The vast majority (90-95%) of the brewery's trade is Business-to-Business, providing craft ales to their two pubs exclusively, as well as selling guest ales at around 60 pubs in Shropshire.

The raw materials for brewing are cheap, but the time and resources needed are expensive. The business felt that they wanted to create a better, socially conscious brewery, one that championed sustainability and self-sufficiency. In an effort to pursue and develop its green credentials, the brewery sought out EBRI for support and analysis of further potential actions to improve their sustainability and business model. It was felt that sustainable processes and full waste recycling could help the brewery to improve their carbon footprint and become more profitable.

6.5.2 Involvement with the EBRI Successor Project

The challenge the brewery sought to overcome was an anticipated issue with waste – spent grain, hops, wastewater effluent and yeast – when the business aims to scale-up its production in the near future. Waste from the brewing production process offers several commercial opportunities for innovative small breweries. Traditional breweries typically discharge 70% of their incoming water as effluent. Reducing water consumption is a challenge for breweries seeking to meet their sustainability goals.

In recent months, Clun Brewery has submitted a grant application to move into a 10-barrel brewery, which represents a five-fold increase on the current production levels. The new brewing plant will soon be incorporated and will increase its production capacity greatly. Although the Covid-19 pandemic forced production to cease, the brewers opened a local deli, and were therefore interested in what products they might be able to create from the brewing process.

Granted time to consider the future of the business by the Covid-19 pandemic's necessitated social distancing and national lockdowns, the brewery sought to better understand how they could be more sustainable and more environmentally friendly. Clun Brewery were signposted to EBRI via the Growth Hub in Shrewsbury to investigate how to manage the forthcoming increase in waste produced. Prior to the Covid-19 pandemic, the brewery hadn't considered seeking business support, but the Growth Hub have proved particularly useful at signposting.

At present, the brewery's small-scale brewing process produces around 400kg of spent grain per fortnight, which has been easily distributed locally to farmers as animal feed and soil treatment. Similarly, the spent grain is supplemented by 15kg of spent hops and some quantities of yeast too as a result of the production process.

Spent grain, due to its high protein and fibre content can be used in baking, such as bread, pizza crusts and biscuits. Spent yeast can be turned into yeast extract, rich in B-group vitamins, which can be used in vegetarian products.

However, with production expected to increase five-fold when the business moves into a 10-barrel brewery, the brewery need to find a sustainable means of disposing or reusing the waste materials. The new system is anticipated to produce over a tonne of waste every week.

EBRI's report investigated how the brewery could recycle their waste onsite, including how food and coffee waste from the pub hospitality area could be combined with the spent grain waste generated from the brewing to produce new products such as compost. The report considered how the waste could be re-used as a fertiliser, fuel or as animal bedding after going through a process of anaerobic digestion.

6.5.3 Impact of the EBRI Successor Project

The research has helped Clun Brewery to identify new gaps, and it is hoped that the wealth of information provided by EBRI will lead to a more profitable and sustainable business. By identifying the right option early and building the new processes into their new facility, Clun can make the most effective use of their waste and potentially create new revenue streams. As part of their research, the team investigated how Clun Brewery can improve their water and energy consumption to help the brewery make the right decisions early in the transition. The report considered a range of opportunities for increased sustainability aligned with financial gains in both the reduction of wastewater, and in renewable energy production. EBRI's report made a number of recommendations of ways to improve the efficiency of the cooling and washing stages to better recycle water.

EBRI's in-depth report has provided a wealth of information, as well as signposting to various links and contacts that could represent an opportunity to access further support. As Clun moves into bigger and better-equipped premises, EBRI's recommendations will help them integrate cost-effective and sustainable practices across their whole operation, from their energy sources to their washing methods.

6.5.4 Next Steps

Clun Brewery are considering how best to apply the findings and recommendations provided by EBRI. The implementation of the new brewing plant towards the end of 2021 will present the opportunity to adopt the recommendations made by EBRI, with new processes being built into the new production. The new plant will include a mash tub, kettle and fermentation vessel, which will allow for further product development.

6.6 Luther Marketing Group

Based in Walsall, Luther Marketing Group (LMG) offers a range of telemarketing, data and consultancy services. In an effort to expand their portfolio, LMG sought to establish an ethical and environmentally-conscious platform from which to promote business between companies sharing the same fundamental values and ideals. Set up in 2017, LMG is marketed as a business-to-business direct marketing company with a social purpose; broadly, the business's philosophy is to help SMEs to attract and find new customers.

With sustainability a key part of their ethos, LMG sought to develop an ethical and environmentally conscious online platform – The Inclusion Post – which would promote businesses sharing the same fundamental values. The Post represents a concentration of their market activities to businesses who share their ethos of inclusivity and sustainability.

The Inclusion Post covers a range of sustainable and inclusive news, from showcasing businesses believing in social inclusion and environmental sustainability, highlighting individuals on their inclusion journeys, along with articles offering positive discussion and awareness.

6.6.1 Involvement with the EBRI Successor Project

After liaising with the business support team at EBRI, this led to an opportunity for the Luther Marketing Group to receive a virtual consultation with EBRI's team of scientists and business advisors on how EBRI can aid the West Midlands company with sustainability knowledge and practices to enhance its business strategy and marketing plans.

LMG primarily contacted EBRI in order to receive an assessment of how the institute can aid companies with their sustainability-related queries. In an effort to develop their own understanding of sustainability, LMG reached out to EBRI, who were also identified as an entity who could support their clients with sustainability related challenges. The business wanted to work together with EBRI to simultaneously raise the profile of EBRI and LMG's capabilities.

EBRI's report elucidated the recent work that has been undertaken by the Institute, and centred on showing how small and medium businesses in the West Midlands can be helped with sustainable growth according to their eligibility criteria. EBRI provided a summary document detailing their capacities taking into account the assistance and case studies of current and past projects, and reported how LMG could enhance their own business to be more sustainable and provide similar advice to their client base.

6.6.2 Impact of EBRI Successor Project

LMG brokered a relationship with EBRI as a means of supporting their sustainability objectives and their offer of sustainability support to their market. LMG act as an intermediary between their clients and EBRI, facilitating conversations with EBRI for any clients that are interested in discussing sustainability in more depth.

The primary market for LMG has been businesses within the IT, logistics and material handling sectors, which are becoming increasingly conscious of their environmental impacts and are under pressure to enhance their sustainability and reduce their carbon emissions. To date, LMG have offered businesses marketing health checks; working alongside EBRI, the business can now facilitate access to EBRI's exclusive one-to-one sustainability health checks. Working in tandem means LMG can now offer both marketing and net zero advice.

For LMG, their mutually beneficial relationship with EBRI means they can market themselves as sustainability champions; for EBRI, LMG offer an alternative route to accessing businesses. EBRI's reports – providing sustainability guidance and a range of case studies demonstrating their impact – is helping the business to raise awareness in their market of ways businesses can reduce their environmental impact whilst saving money, and even differentiating themselves from their competitors, increasing demand for their products and services.

The group's relationship with EBRI allows them to offer a new area of digital marketing services, and it will allow them to widen their target market, reaching out to companies who share a similar interest in ethical and environmental matters. Without EBRI, the business would not have the expertise in sustainability to be able to facilitate accurate discussions with their clients.

"The report provided by EBRI following our consultation was fantastic and very informative. We are now putting sustainability at the heart of our corporate mission and the guidance we have received will help us and other companies we work with achieve this."

Michael Melhado, Founder, Luther Marketing Group Ltd.

6.6.3 The Future

The EBRI team also provided Michael with useful information regarding additional business support programmes and student placement schemes available at Aston University. These could help enable his company to expand in the future, as they connect with more and more business decision makers seeking to meet their sustainability goals on the path to net zero.

"Putting sustainability at the heart of our corporate mission allows us to facilitate companies who want to become more sustainable by providing them access to [EBRI's] *team and resources. It also provides us with a competitive advantage and a key differentiator from our competition."*

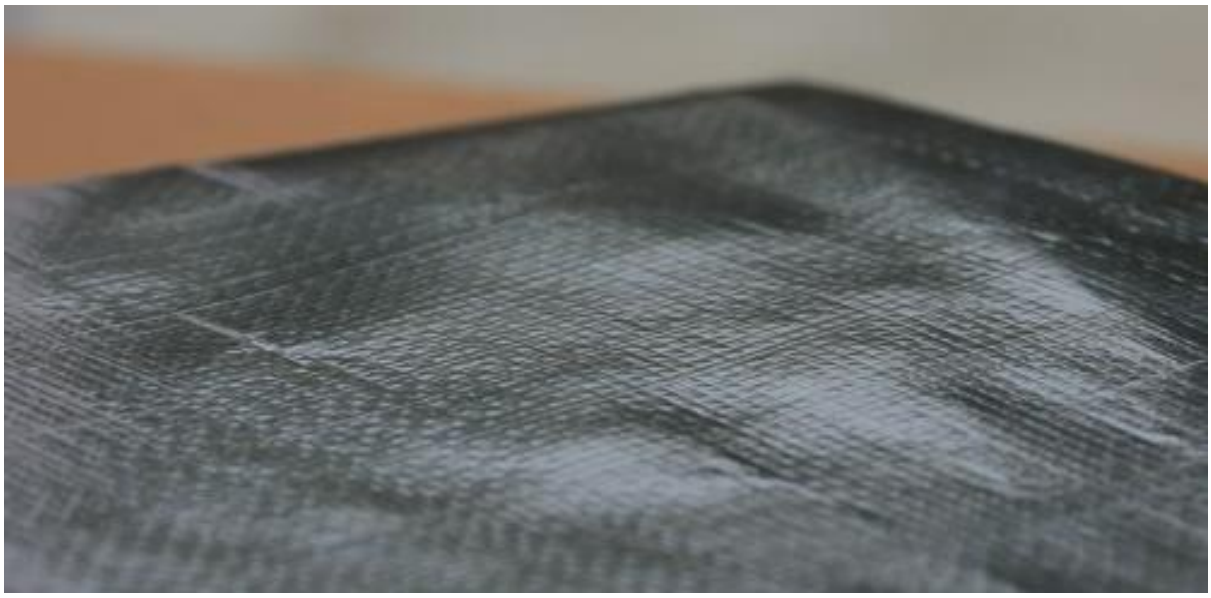
Michael Melhado, Founder, Luther Marketing Group Ltd.

6.7 Plastic Waste

6.7.1 Background

Established in 2012, a company was designed to produce an economic solution to transporting pharmaceutical products; their Thermal Cover Protection (TCP) product would uniquely control and protect the temperature of biomedical goods and pharmaceutical products whilst outside of controlled environments during transit. Using the material developed under the auspices of the parent company, a new manufacturer launched in 2016 and is one of the UK's leading manufacturers and retailers of vehicle blinds, which used an advanced thermal insulation material. The business's TCP double layer of air pockets gives it remarkable insulation properties, which make it an extremely effective material for 'Thermal Blinds' in cars.

Thermal Cover Protection (TCP), an advanced insulation material used in the thermal protection of pharmaceuticals and vehicles, consists of plastic and aluminium. The waste generated from the manufacture of TCP cannot be recycled with traditional methods. The TCP manufacturing process produces offcut waste material which generally ends up in landfill, although thermal treatment such as pyrolysis has the potential to reduce the amount of waste disposed of in landfill.



An example of pharmaceutical protection material

6.7.2 Involvement with EBRI Successor Project

Under the parent company, the material was used in the thermal market to protect goods; the net result saw a significant amount of waste. The combination of silicon and aluminium into a single-use, air-filled temperature-protective product proved difficult to dispose of effectively; clients saw no value in returning the product, in part because of its size. The business's distribution process therefore produced two sets of waste – both the packaging from distributed pharmaceutical products, and the waste from the manufacturing process itself. The production process generated enough waste packaging material to fill two 30-tonne skips every week – which were being sent to landfill - and the 'composite' nature of the residue made it difficult to recycle.

As a packaging business, the company wanted to pursue sustainability in their materials, particularly in light of burgeoning demand for their products. The new manufacturer's Research & Development department investigated different materials, including proposals to switch to recyclable corrugated cardboard, but these options compromised their thermal protection. The business did not have the R&D capabilities in-house to find a solution.

The business also felt a certain responsibility to explore their energy consumption, looking into areas where this could be improved. The wider pharmaceutical industry is under pressure to lower its carbon footprint and respond to the global call for sustainability.

The business therefore sought EBRI's expertise to explore alternative uses for its waste material, or to see whether any value could be extracted from the waste, as a means of contributing to the circular economy. EBRI held a virtual Low Carbon Consultation with the business to analyse their waste. Decomposing TCP back into its constituent parts - polyethylene, polyethylene terephthalate and aluminium - is extremely challenging, and the large plastic component makes it almost impossible to recycle.

An example of a TPC

EBRI investigated the use of a thermal conversion process to break down the waste, establishing that the PE and PET plastics used in the business's production process can be efficiently depolymerised and cracked into gases, liquids, waxes, aromatics and more. Pyrolysis was found to be a potential solution for recycling the product.

EBRI produced a white paper exploring the feasibility of applying a pyrolysis process to breaking down the waste material to something recyclable. Before engaging with the EBRI team, the business was not aware of the pyrolysis process, having previously only pursued the possibility of incinerating or superheating their waste, but this process produced too many toxins. EBRI determines that pyrolysis would be the most versatile approach, and one that is available with a smaller investment; the by-products of pyrolysis have a range of commercial applications as fuel sources and chemical components, and in materials like other plastics and synthetic rubber.

6.7.3 Impact of the EBRI Successor Project

The report provided by the EBRI team has provided the business with the intelligence needed to pursue the possibility of applying a pyrolysis process to their waste; the business doesn't produce sufficient waste to maintain their own pyrolysis plant, and so are brokering relationships with other companies in the pharmaceuticals industry with the objective of creating a shared pyrolysis plant. Having ruled out an on-site pyrolysis plant, EBRI are helping the business find an external pyrolysis partner to supply with their waste.

However, waste from pharmaceutical companies isn't localised, which presents a number of collection issues. Despite the challenges, the pharmaceutical industry is increasingly concerned with its waste, and is increasingly set on the idea of their waste being sustainably re-used or recycled.

As a result of the report from EBRI, the business has been introduced to a pyrolysis organisation to further the aim of building an industry consortium to manage large-scale waste materials, initially looking at a trial use of an operational pyrolysis plant in the West Midlands over the next few months. There will undoubtedly be challenges around how to combine different types of waste across the industry, with the waste needing to share chemical characteristics in order to be recycled together, but it represents a huge opportunity for the UK.

The business's pursuit of a sustainable use for its waste will also have its commercial advantages; if the industry can prevent its waste from reaching landfill, it is likely to save on disposal costs. It is anticipated that the business could make a saving of around 50% by diverting waste from landfill to a pyrolysis process. There is a shared understanding that from a commercial perspective, as a single entity there is little value in waste management, but the potential to unify the industry as a whole could have a much larger impact. The industry is set on lowering its carbon footprint and adding sustainability to its core operation.

6.8 Carbiome

6.8.1 Background

Carbiome Ltd is a Birmingham-based company that will work in the sustainability sector, focusing on bio-products and bio-processing with the goal of producing sustainable solutions. Carbiome's ultimate goal is to establish a global network of biodiversity plants to provide long-term solutions to 'risk problems', concerning wildfires and the issues that arise from them. For instance, when a forest is cleared to create fire breaks, the leftover peat is burned as a result of its low value. Carbiome's sought EBRI's expertise in pyrolysis to take the low-value stock and turn it into bio-liquids, biogases, and biochar.

Currently, much of their work is centred on the Pacific Northwest of the United States, which has a high proportion of wildfires, as well as the United Kingdom. It is hoped the collaboration will assist Carbiome in developing the global network in which there has been a great deal of interest thus far.

6.8.2 Involvement with the EBRI Successor Project

Carbiome were signposted to the EBRI project having already worked with Aston University. EBRI invited the business to participate in a two-day Master Class and supported the business to test their ideas on sustainability and to understand the potential impact and value of their business model.

The business are also hoping to benefit from a longer-term relationship with EBRI and Aston University that could see current students offered work placements or employment in the future. Carbiome have two main objectives, the first of which is to prove the concept over a period of 2-3 years. It was acknowledged that EBRI's involvement has already added credibility to their model and had accelerated their proof-of-concept development.

6.8.3 Impact of the EBRI Successor Project

Additionally, Carbiome hope to implement a platform that allows for rapid scale-up with features such as centralised research, a global education programme, and centralised and controlled knowledge sharing. Access to a talent pool of people from various backgrounds and countries who are eager to learn and have the knowledge to move into an area of business with the potential to scale up quickly is seen as a real added value for Carbiome. The business emphasised that support from EBRI has far exceeded their expectations – the team are easy to work with and honest – they will tell you if they don't think something is going to work.

Carbiome reported that their engagement with the project team, participation in the Master Classes, and continued knowledge exchange, has improved their business knowledge significantly.

Carbiome plan to expand further into other markets (such as Africa) whilst implementing a globalised education programme raising awareness of how they can support businesses to reduce risk from wildfires and the opportunities associated. Carbiome hopes to build biodiversity facilities in other countries once funding is secured in order to carry out and provide long-term solutions globally, particularly in the case of wildfires.

6.9 Combind Industries

6.9.1 Background

Founded in 2019, Combind Industries is a spin-off of FuturEnergy, a previous beneficiary of EBRI and Aston University. Combind Industries designed their own system for biomass re-processing, which has evolved into their own range of products called Comkiln™, which is available in three sizes - a small lab-based system (one of which is hosted at Aston University), a larger system (funded via EBRI as a demonstrator project), and finally a full-scale production version capable of 1 tonne-per-hour throughput and a continuous feed process, making it a unique system within the industry.

Combind Industries work is applicable to almost all biomass waste sources and can take advantage of multiple commercialisation routes for products such as:

- Biochar
- Bio-oil
- Biogas

With the new technology they were able to produce derived materials and use a different process due to the type of kilns they use which have unique characteristics compared to others in the market.

6.9.2 Involvement with the EBRI Successor Project

Having previously collaborated with EBRI, the business was aware of the benefits and added value that access to Aston University's facilities and expertise would provide. Combind Industries was entering a completely new area with the development and manufacture of new, unique equipment and sought EBRI's support to assist their new developments.

As well as attending one of the two-day Master Class sessions, Combind Industries is currently collaborating with EBRI to validate their design and adding credibility to a product/process that will be marketed internationally. EBRI have also supported Combind Industries to address skills gaps in the company such as the expertise needed for the analysis of the thermal chemical composition. Combind Industries reported that the EBRI Successor Project has provided access to academia and testing facilities that would be prohibitively expensive for SMEs.

6.9.3 Impact of the EBRI Successor Project

Some of the outcomes that can be attributed to the support provided by EBRI include:

- Increased levels of R&D investment
- Improved business knowledge and capabilities
- New technology development
- Improved production processes and or new product/service development
- New jobs created.

Combind's involvement with the project has added credibility to their designs whilst a close association with EBRI and Aston University in particular has helped to access new customers and markets. The Master Clases have proven effective both as a knowledge sharing forum and as a means of meeting likeminded businesses.

6.10 Summary – Case Studies

- The case studies demonstrate the project's broad and positive impact on a variety of commercial activities, including biochar.
- So far, the project has assisted businesses in developing new products and processes, demonstrating the commercial value of their products, increasing marketability and sustainability, and providing businesses with the confidence to sell their products more widely, as well as facilitating the opening of an international market that smaller businesses would either be unable to access or would find it extremely difficult and time consuming to access.

The project has brought expertise and skills to businesses that they would not be able to afford otherwise, and this has really helped businesses progress with the processes and proof of concept.

- Additionally, case studies have emphasised the advantages that the project has offered in terms of networking with other companies whose practices differ slightly from their own and exchanging knowledge with them. This has opening up new business opportunities and identified new markets for the businesses engaged.
- Without the limits of ERDF criteria, EBRI and Aston University would benefit from being able to offer more of a 'cross-school' offer to SMEs, comprising other areas of the university that can offer support.
- One business noted life cycle and environmental impact analysis as two areas of potential exploration for EBRI moving forwards.

7.0 Economic Impact

7.1 Summary

A high-level economic impact assessment has been undertaken for the project to understand the potential economic impact that the project has and will have on the businesses supported. The calculations are based on the quantitative data collated through the beneficiary survey. We have particularly focussed on the quantifiable estimated economic impacts that the project has had, or is anticipated to have, on:

- Additional employment created
- Increase in business research and development expenditure.
- Increase in business turnover.

The approach taken is rooted in HM Treasury 'Green Book' methodology, using a mix of relevant technical guidance, and judgements, primary data or standard assumptions for key economic factors. The research undertaken has been designed to estimate the total effect of the business interventions made by the EBRI Successor Project. This means considering a wide range of consequential or induced effects as well as the immediate effects. The findings are summarised below:

Economic Impact to Date

- **RD&I Spend:** It is anticipated that businesses supported through the EBRI Successor Project to date have invested £35k (total for all businesses) in RD&I as a result of their involvement with the project.

Economic Impact in the Next Two Years

- **Employment:** Potential estimated additional total direct and indirect employment impact for the target LEP areas of the EBRI Successor Project = 74 Jobs Created
- **GVA Impact of Additional Employment:** The anticipated jobs that will be created as a result of the EBRI Successor Project will have the potential to generate an additional £3.66 million of GVA per annum for the local economy.
- **RD&I Spend:** It is anticipated that businesses supported through the EBRI Successor Project have the potential to invest £1.05m (total for all businesses) in RD&I as a result of their involvement with the project in the next two years.
- **Turnover:** The potential increase in business turnover in the next two years of the businesses supported (total for all businesses) as a result of their involvement with the project is estimated to be circa £16.76m per annum.

Note: All above calculations are based on sample data from businesses completing a questionnaire about their involvement and benefits from working with the EBRI Successor Project. Calculations assume that the businesses completing the questionnaire are a representative sample of all businesses supported through the project. Figures are based on 126 businesses being supported by the end of the programme.

8.0 Value for Money

To explore the extent to which the EBRI Successor Project has represented value for money we have applied a simple but standard analysis of the estimated cost per output. This enables comparison to be undertaken with the cost per output achieved within the Priority Axis 4 of the ERDF Programme. Drawing upon the analysis in the consultation and impact assessment sections, this section provides a clear analysis of the value for money that the project has provided and is benchmarked against similar interventions.

It should be noted that this is only an approximate method of understanding efficiency, as projects and programmes deliver a range of activities. The results should be viewed alongside the overall quality and impact of the project.

8.1 Cost per Outputs

8.1.1 ERDF Cost per Outputs

The ERDF England Operational Programme 2014 to 2020 (December 2020) highlighted that the allocation of programme funding for Priority Axis 4 (PA4) was as follows:

- €487,216,254 for More Developed areas, equating to £434,936,845

The table below details the published targets under Priority Axis 4 (PA4). The targets are taken from ERDF England Operational Programme 2014 to 2020 (2020): '2.A.6.5 Table 5: Common and Programme-specific output indicators (by investment priority, broken down by COR for the ERDF). We have calculated the cost per ERDF output by dividing Union Support (£) by the ERDF Target.

ERDF PA4 Cost per Output		
Output	**PA4**	**Cost per ERDF Output**
Number of enterprises receiving support	23,667	£18,377
Number of new enterprises supported	640	£679,589
Number of enterprises cooperating with research entities	219	£1,986,013
Number of enterprises supported to introduce new to the firm products	361	£1,204,811

8.1.2 EBRI Successor Project Cost per Outputs

The total budget for the EBRI Successor Project is £3,505,803. The ERDF contribution for this is £1,752,902. This can be used to work out the costs per output of the outputs contracted and achieved by the project.

The table below shows the cost per output for the contracted outputs – this is what the cost per output was anticipated to be at the start of the project and assumes the full £1,752,902 was spent. It has been calculated using the following calculation:

EBRI Successor Project Contracted Project Budget (ERDF Contribution) / Contracted Outputs = Cost per Output Contracted

The table below also shows the cost per output of the outputs that have been achieved so far by the project. We have taken the 'worst case scenario' – assuming that all of the project contracted spend will be spent but no further outputs will be achieved.

In reality, the actual cost per spend achieved by the end of the EBRI Successor Project is likely to be better than this, as the numbers of outputs reported by the EBRI Successor Project increases as the project draws to a close.

EBRI Successor Project Cost per Output				
Output	**Outputs Contracted**	**Cost per Output**	**Outputs Achieved**	**Cost per Output**
Number of enterprises receiving support	80	£21,911	126	£13,695
Number of new enterprises supported	7	£250,415	18	£97,383
Number of enterprises cooperating with research entities	21	£83,472	31	£56,545
Number of enterprises supported to introduce new to the firm products	9	£194,767	13	£134,839

8.2 Benchmarking – Value for Money

The table below shows the cost per output of the EBRI Successor Project benchmarked against the ERDF PA4 outputs. It shows both the cost per output of the actual outputs achieved to date by the project and the original contracted cost per output that was anticipated at the start of the project.

EBRI Successor Project v ERDF PA4 Cost per Output			
Output	**Contracted Cost per Output**	**Cost per Output Achieved to date**	**Cost per Output – ERDF Programme**
Number of enterprises receiving support	£21,911	£13,695	£18,377
Number of new enterprises supported	£250,415	£97,383	£679,589
Number of enterprises cooperating with	£83,472	£56,545	£1,986,013
Number of enterprises supported to introduce new to the firm products	£194,767	£134,839	£1,204,811

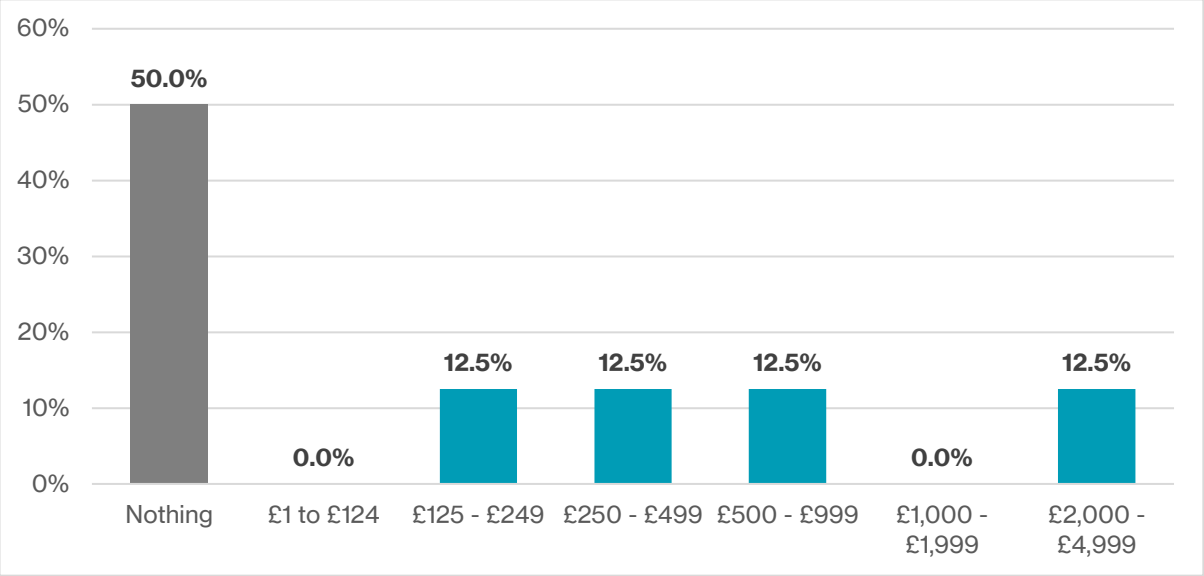
The data suggests that when all of the contracted outputs have been achieved, the project will deliver all comparable outputs at a better value for money than the average ERDF programme target for Priority Axis 4.

For some of the outputs the project is already performing below the average programme expenditure; outputs relating to the number of enterprises cooperating with research institutions, enterprises supported to introduce new to the firm products, and enterprises supported have been delivered significantly below the programme level "cost per output".

The table also shows where the project needs to concentrate its resources in order to align with ERDF target cost per outputs. If the project continues to achieve outputs relating to the number of enterprises receiving support, it will have achieved the outputs at most 75% of the cost per output of the ERDF PA4 programme, or lower. This is likely to improve as further outputs are reported for the project.

8.3 Perceived Value from Businesses

Respondents were made aware of the fact that the services they received from the team were provided free of charge due to external funding secured from the European Union. The survey asked businesses how much they would have been prepared to pay for the service they received, if this funding was not available.



If we take a midpoint value for each category, we can calculate an average value to each SME of £586 attributed to the services received through the project.

> *"In that respect, it was good value for money as it gave us access to resources that we literally had no means to pay for, so without the funding via the Uni, we would have been completely unable to access the educational and informational resources we needed to develop our business".*

Value for Money by Activity

We can determine the perceived value for money of each of the EBRI Successor project activities by breaking down the survey data:

Value for Money by Activity		
Activity	**Responses**	**Average Value**
Master Classes	5	£187
Testing: access to test facilities and feedstock analysis	2	£0
Economics: practical feasibility studies on bioenergy, energy systems	1	£1,750
Technology: an assessment of emerging products and technologies	2	£469
Markets: an individual appraisal of the bioenergy marketplace	0	N/A
Online consultations	0	N/A
Biochar insights	1	£750
Follow-on collaborative project	0	N/A*

The project's practical feasibility studies were attributed the highest average perceived value (£1,750), followed by biochar insights (£750) and the assessments of emerging products and technologies (£469).

*Businesses were asked whether the project represents good value for money. One business – who had participated in the Master Classes, received biochar insights, and undertook a follow-on collaborative project - told us that "post-funding we will agree suitable service charges based on the specific project work. This amount will likely exceed £10k".

8.5 Summary – Value for Money

- When all of the contracted outputs have been achieved, the project will deliver all comparable outputs at a better value for money than the average ERDF programme target for Priority Axis 4.
- For outputs relating to the number of enterprises cooperating with research institutions, enterprises supported to introduce new to the firm products, and enterprises supported, activities have been delivered significantly below the programme level "cost per output".
- If the project continues to achieve outputs relating to the number of enterprises receiving support, it will have achieved the outputs at most 75% of the cost per output of the ERDF PA4 programme, or lower.

9.0 Key Findings and Lessons Learnt

9.1 Key Findings

- It is clear the project's strategic fit has become even stronger since inception of the project with the commitment to net zero carbon, the publication of the Ten Point Plan for a Green Industrial Revolution and the growth of the Low Carbon and Environmental Tech in the region.

- All four of the outputs contracted at the start of this project have been exceeded as of December 2022**.** The project has supported 126 enterprises with 12hrs of support to date, including 18 new enterprises, with 13 enterprises supported to introduce new to firm products – even with six months of delivery remaining.

- Building on its success among project beneficiaries, the project has successfully broadened its reach, connecting SMEs with other areas of the university; the project takes advantage of opportunities to add value to its beneficiaries by collaborating with various teams and specialists within Aston. EBRI team facilitates internal cross-fertilisation, which adds value to beneficiaries in ways that go beyond the scope of each individual project.

- The EBRI project's research contributes to a number of initiatives and programmes throughout the region, including the Energy Research Accelerator (ERA), the Supergen Bioenergy Hub, and the HYDEX project. The Institute is developing a number of large funding proposals which are informed and influenced by the ERDF Successor project. The project is therefore playing an important role in laying a foundation for EBRI's broader long-term sustainability and its ability to impact both local business but also the wider policy agenda.

- The survey data is overwhelmingly positive. More than three-quarters (77.8%) said that they have improved knowledge and capabilities as a result of their involvement with the EBRI Successor project, whilst nearly a quarter of respondents have developed new products, new services, and reduced costs. Businesses have also increased efficiency, deployed new technology, improved competitiveness, brought new products to market, and commercialised research following their involvement.

- 88% of businesses surveyed said that the support they received through the Surgery Calls was 'excellent' and 'very good'.

- 90% of businesses rated the Tailored Report they received to be 'excellent' or 'very good'.

- 92% of attendees rated their Master Class course as 'excellent' or 'very good'.

- The case studies demonstrate the project's broad and positive impact on a variety of commercial activities, including biochar. So far, the project has assisted businesses in developing new products and processes, demonstrating the commercial value of their products, increasing marketability and sustainability, and providing businesses with the confidence to sell their products more widely, as well as facilitating the opening of an

international market that smaller businesses would either be unable to access or would find it extremely difficult and time consuming to access.

- The 74 anticipated jobs that will be created as a result of the EBRI Successor Project will have the potential to generate an additional £3.66 million of GVA per annum for the local economy. In the next two years, businesses supported through the EBRI Successor Project have the potential to invest £1.05m (total for all businesses) in RD&I, and to increase their turnover by circa £16.76m per annum, as a result of their involvement with the project.

9.2 Lessons Learnt

The Summative Assessment guidance requires the identification of lessons learnt for organisations delivering projects of this nature as well as funders of this activity and policy makers. These are summarised below.

- It is important for academics to understand what it is the business wants to do, and it is important for the SME to understand how feasible the development is. Academics need to manage expectations, and set out the mechanics and steps required to turn a business's objectives into reality, such as which key research questions need to be answered. It is important to get the balance right between sounding approachable and ensuring they understand the complicated nature of the multi-faceted problem they are trying to solve.

- Another key lesson from the EBRI project is the importance of understanding what business's needs are over and above the ERDF project, understanding how the university can help with these. Sometimes businesses aren't relevant to the field that's EBRI are working on, but that doesn't mean that they can't be supported by the university elsewhere through referrals to other departments or the Growth Hub.

- Similarly, it is important to establish early on how serious businesses are about committing to a research project, and sharing an idea of how much research cost will be required on the part of the university. It was suggested that this can help to filter out businesses who might not be intending to invest sufficiently in a project with postdoctoral research. This process helps academics to work out which businesses are really serious.

- It was suggested that ERDF projects are more successful if they are more focused, perhaps more so than projects with a broader remit and a general focus on raising awareness. The project helps to create a specific community of interest that can offer longevity and commitment because EBRI is such a key part of Aston's future. The project is viewed by businesses as part of Aston's much larger commitment to developing bioenergy solutions and developing green technology and biofuels. The project is therefore a gateway to a deeper relationship with the university, whereas some projects are largely 'transactional' in which businesses will acquire a new skill or capacity, before moving onto the next project. The EBRI project is much more about understanding the future direction of businesses, and creating a critical mass of interested researchers and businesses pursuing the same aim.

- Despite the uncertainties, there is a perception that EBRI's researchers are increasingly in demand because sustainability is at the forefront of many business's agendas now. EBRI is more relevant than ever before; companies that previously had never considered sustainability are now required to think about it. There is a growing need for projects that enhance EBRI's ability to connect with an increasing pool of businesses requiring support in sustainability and the development of bioproducts. This will be reliant on EBRI growing its base of dedicated full-time academics.

- The project is therefore playing an important role in laying a foundation for EBRI's broader long-term sustainability and its ability to impact both local business but also the wider policy agenda. EBRI is targeting EPSRC Supergen funding as well as a mix of other sources of industry funding to maintain its sustainability and to transfer its research into industry practice and wider policy. EBRI will be looking at a full spectrum of activities from basic fundamental research through to impact on industry as well as policy influence.

Appendix A

Economic Impact Analysis