



**Final ERDF Summative Assessment for the
Translational Energy Research Centre (TERC)
Project Number: 28R18S02410
for
The University of Sheffield**

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Translational
Energy
Research
Centre.



European Union
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1 Introduction

Introduction

1.1 ekosgen were appointed by the University of Sheffield in August 2019 to undertake a phased summative assessment of their Translational Energy Research Centre (TERC) project, based on Sheffield Business Park. TERC is an £19m bespoke research facility and associated small and medium sized enterprise (SME) business support offer focused on low carbon technologies. It is part funded by ERDF under Priority Axis 4: *Supporting the Shift towards a Low Carbon Economy in all Sectors*, Investment Priority 4f: *Promoting Research and Innovation in, and Adaptation of Low Carbon technologies*.

1.2 This report presents the results of the Final Summative Assessment, prepared between March and June 2023 and builds upon the findings outlined in the Interim Report submitted in November 2021. This report outlines the overall performance of the project as it heads towards the end of its delivery period in August 2023. It provides:

- Reliable evidence of the performance of the project to date, outlining areas of challenge, best practice and areas for improvement.
- A review of previous recommendations and the extent to which they have been implemented.
- An understanding of progress against contracted outputs and spend forecasts and the anticipated position at the point of project closure.
- Evidence based conclusions and lessons that can support the design and delivery of future programmes of activity and potentially future case making.

1.3 The Final Summative Assessment outlines progress made with the capital build and equipment installation as well as assessing the nature of the SME support package and the impacts it has had on local businesses, their carbon efficiency and their research and innovation ambitions. All elements of the project are detailed in Section 2.

1.4 The report outlines the recommendations put forward as part of the interim assessment to review the level to which they have been implemented and to what effect. It further highlights lessons learned and areas of best practice with points identified to inform the design and delivery of future projects and programmes.

Evaluation Methodology

1.5 The methodology for the final summative assessment stage included:

- A review of any new documents and data produced since the interim report including project change requests, claim information, progress reports and beneficiary feedback.
- Consultation with members of the project team, new suppliers of equipment and beneficiaries of the business support element, to understand changes made to the project scope and gather perspectives on progress made in the previous 18 months.
- A review of project performance against the revised expenditure and output targets, highlighting any factors that may have influenced any under/over performance.
- The preparation of the Final Summative Assessment Report and Summative Assessment Spreadsheet to provide an ERDF compliant report of the TERC development and business support activity.

Previous Recommendations

1.6 From the interim summative assessment, a number of recommendations were made for both the revenue and the capital component of the project. The recommendations are outlined below:

- Continue to build project profile within the SME community to allow the project to hit its targets and build wider awareness of the low carbon opportunities available to SMEs.
- Focus future C1 assists on where the University can add value, ensuring that SMEs can benefit from the specialist expertise within the project team.
- Determine the scope for C26 outputs to be delivered from the TERC facility to ensure that SMEs benefit from the on-site equipment and expertise as part of their assist.
- Consider a workshop follow-on support offer that allows for capture of a C1 output and re-engage multiple SMEs at the same time.
- Develop a forward plan to guide TERC's future beyond ERDF support that clearly articulates how the facility's future will be funded and target uses and users.
- Clearly communicate the focus and relationship between TERC and the Sustainable Aviation Fuels Centre to ensure that referrals are made to the relevant facility and that wider discussions in the City Region are informed.
- Ensure that enough time is allocated for procurement and consult with industry to determine more accurate budgets.
- Acknowledge the complexity of purchasing equipment from overseas which has resulted in protracted contract negotiations to ensure regulation compliance in the past.

1.7 The extent to which these recommendations have been implemented and to what effect will be discussed in Section 4.

Report Structure

1.8 The remainder of this report is structured as follows, reflecting the requirements of Summative Assessment guidance and the key project elements:

- Project Background
- Project Relevance and Consistency
- Project Design and Delivery
- Project Management and Governance
- Beneficiary Perspectives
- Project Performance
- Project Impacts and Value for Money
- Conclusions and Lessons

2 Project Background

Introduction

2.1 This section of the report outlines the background to the TERC facility, the rationale for the investment and the strategic fit with wider policy priorities, as well as a wider support offer. It sets the context for the assessment findings that follow, allowing progress against original objectives to be assessed and the extent to which the project is delivering against its revised ambitions to be considered.

Initial project scope

2.2 In 2019, the University of Sheffield submitted a bid for ERDF funding to develop the Translational Energy Research Centre (TERC) on a site located within Sheffield Business Park that had been acquired by the University in 2016. The intention of the project was to develop a flagship national facility focused on researching and testing the uses and implementation of low carbon technologies, by operating a test facility that supports academic research but also engages businesses with a view to collaborating on innovative new low carbon systems. The project built on the University's existing research expertise and strong and growing national and international standing in the field.

2.3 The original project included a capital budget of £10.4m (of which £6.4m is ERDF funded), to cover the construction of the new facility and the installation of new technologies, and a revenue budget of £1.3m (of which £0.4m is ERDF funded) to support the facility's operation and to provide business support for SMEs based in the South Yorkshire transition region. The building is now constructed, providing circa 1,876sqm of accommodation alongside associated car parking, a service yard and landscaping. The innovation support programme concludes in August 2023.

2.4 Forming part of the Energy Institute within the Faculty of Engineering for the University of Sheffield, it was anticipated that TERC would deliver three main activities:

- To provide research and innovation facilities for University research groups and industry partners to develop low carbon energy products and boost cooperation with research institutes by acting as an open-access national centre;
- Demonstrate low carbon energy technologies and whole system integrated energy technology solutions; and
- Act as a showcase for the University of Sheffield's energy research and low carbon energy technologies, engaging with local businesses.

2.5 The extent to which these overall objectives have been met will be considered throughout the report and outlined within the conclusion to this evaluation.

Evolving project scope

2.6 The project initially received £12.2m to develop the new facility including the supply and installation of bespoke equipment to use as a demonstrator project to allow businesses to view how such equipment could be utilised to generate both low carbon and business benefits.

2.7 In early 2021, TERC identified an opportunity to install further equipment into the centre that would complement their existing offer and provide further demonstration support to the business and research community. The university successfully bid for and received an additional £2.5m of capital funding to install an additional Fisher Trophe Rigg and a further £4.2m to install a further 10 smaller scale projects (pieces of equipment) that complemented/supported the existing offer after it was identified that this would offer further opportunities to support the region's SMEs by increasing the capabilities of the Centre.

2.8 Decarbonising UK industry is central to both regional and national government’s ambitious plan for a green industrial revolution. TERC’s mission is to support the decarbonisation of the regional and national industrial sectors and is in the process of establishing itself as a net zero carbon energy system innovation centre.

2.9 Following feedback gathered by the delivery team from industry stakeholders and in alignment with the government strategy for regional growth and the Prime Minister’s 10 point plan, the University submitted a proposal for additional funding focused on fuel switching, hydrogen and CCU, supported by associated cross cutting technologies. It was anticipated that these facilities would support the region’s SMEs and be an important asset to attract inward investment to the region, thereby creating highly skilled jobs. The new pieces of equipment will provide state of the art research and innovation infrastructure at both a regional and national level.

2.10 The applications for additional funding have been undertaken in two rounds. A further £2.5m was requested and granted to support the installation of a Fisher Tropsch Rigg. The original supplier went into administration and could not fulfil the commitment. Additional funds were requested to complete the project with a new supplier. A further £4.2m requested to fund ten new smaller scale projects that would have more tangible benefits to the business community or support the functionality of existing equipment. A full breakdown of the equipment is listed in Section 3.

Project objectives and anticipated impacts

2.11 The objectives for the centre are outlined below. It is the purpose of the Final Summative Assessment to test if these objectives have been met as the project has progressed through the delivery phase until near completion:

- Create a purpose-built flagship facility that serves as a national centre of excellence for Research, Development, Innovation and Demonstration of renewable and low carbon energy technologies.
- Increase uptake of R&D&I¹ in renewable energy and low carbon technologies by the Sheffield City Region SME base.
- Support the growth and development of the City Region’s low carbon sector by supporting new and existing SMEs to innovate and grow.
- Establish the Sheffield City Region as the UK’s leading demonstrator and centre for R&D&I in renewable and low carbon energy technologies.
- Contribute to a reduction of Greenhouse Gas emissions, regionally (in the medium term) through operational changes implemented by the SMEs that the facility will engage with, and internationally (in the longer term) through the export of new low carbon products and services.

2.12 Outlined in the funding agreement are several intended impacts of the project, as outlined below. Achievements against these measures will be reviewed in the Project Performance section with benefits also expected to continue to build beyond this the delivery phase.

- Increase in renewable energy generation
- Reduce the regional Greenhouse Gas emissions and beyond (through deployment of products and services) over the lifetime of the facility
- Create more economically resilient/resource efficient and lower carbon energy supply systems
- Increase R&D expenditure by regional enterprises leading to more innovation and greater competitiveness
- Increase inward investment into the region including R&D&I

¹ Research, Development and Innovation

- Company growth and formation
- Job creation and retention

3 Project Relevance and Consistency

Need for Investment

3.1 At the time the application for ERDF funding was submitted, it was considered that SMEs in Sheffield City Region lacked the knowledge, expertise and access to specialist equipment to be able to take advantage of the opportunities provided by the renewable and low carbon technology sector. The TERC was designed to overcome the barriers faced and actively engage SMEs in the conversation, responding to both local and national policy agendas.

3.2 TERC was intended to:

- De-risk investment for SMEs by providing the facility to test new and emerging technologies in a purpose built facility;
- Foster University-business collaboration;
- Stimulate SME-led product and process innovation; and
- Catalyse commercialisation of low carbon technologies and processes.

3.3 The facility was designed to offer a flexible, 'whole system' approach with plug-in capability, providing businesses and research institutions with seamless access to demonstration equipment for R&D&I purposes. Engagement with the facility was intended to communicate the business benefits of adopting and utilising the technology exposing SMEs to current and emerging market opportunities. Any increased private sector investment in R&D&I as a result of their engagement with TERC was anticipated to support increases in growth, employment, productivity, competitiveness and business starts in the Sheffield City Region SME base, and encourage inward investment, attracting (as well as retaining) skills and talent.

3.4 It was considered that in the absence of such a facility, SMEs in the City Region would continue to lag behind in terms of engagement in R&D&I activities, which would in turn have implications for business growth, productivity and the adoption of low carbon and renewable energy technologies within the local business base.

3.5 For the new equipment purchased, the work relating to hydrogen would be key to the region (which comprises many industrial and energy-intensive businesses), as many will look to fuel switching as a way to achieve net zero. The TERC facilities would provide a location to demonstrate hydrogen's feasibility and the technical support for implementation of technology key to the region's success.

3.6 Moreover, local SMEs could greatly benefit from the emerging market of Direct Air Capture technologies which TERC can support businesses in understanding and be involved in the supply chain development in this emerging sector.

Market Failure

3.7 Despite the rationale to support advances in the low carbon agenda, market failures prevent projects such as TERC from being delivered without public intervention. The primary market failures identified at the time of preparing the ERDF funding application and that remain relevant are:

Positive externalities / viability constraints: Although there are clear commercial advantages of advancing low carbon technologies, it is considered that a research and demonstrator facility such as TERC would be unlikely to be delivered by the private sector. The facility's primary aim is to act as a demonstrator and research facility supporting continued academic and collaborative research and the adoption of low carbon technologies by local SMEs and larger businesses, contributing to a reduction of Greenhouse Gas emissions, generating positive externalities which are not reflected in potential

revenue of the facility. The project therefore addresses the inability of the private sector to invest in such a facility, when demonstration and research are the main drivers for the facility as opposed to commercial viability.

Risk aversion: Many SMEs have a short-term, bottom line focused outlook that has been further exacerbated by the pandemic and more recently the war in Ukraine and the rising energy costs/inflation. For many, R&D&I is a secondary concern with the main focus being on getting by day to day with the recent economic conditions amplifying this position. TERC helps to de-risk investment for SMEs by providing an opportunity to test new and emerging technologies in a purpose-built facility with minimal risk and a low financial cost to the businesses.

Information asymmetry / lack of information: As referenced above, at the time the application for funding was submitted (both original and subsequent applications), it was considered that many SMEs lacked the knowledge to take advantage of the opportunities provided by the renewable and low carbon technology sector to increase their own profitability by adapting to new ways of working. Many SMEs are simply unaware of or fail to appreciate the benefits they could obtain by engaging with the University and working with a facility like TERC. Providing opportunities to actively engage SMEs is important to overcome this issue and cannot be accommodated within core University budgets.

Strategic Alignment

3.8 The TERC project has continued to show that it is effectively aligned with local and national policy goals. The project has become increasingly pertinent throughout its duration, as global policy decisions see combatting the effects of climate change as a key priority. Regional and national strategies produced since the project started highlight low carbon technologies as a key driver to help the UK meet its Climate Change Act obligations and achieve greater energy resilience, and significant global growth opportunity.

A United Nations commitment

3.9 The move towards Net Zero is one of the UK Government's main priorities. Not only is it seen as a necessary move to help to combat the impacts of climate change, it is also viewed as a key area of growth for the UK economy. While the TERC activity was underway in November 2021, the UK hosted the **26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26)**. At COP26 attendees aimed to accelerate progress towards the goals to mitigate climate change as outlined in the Paris Agreement².

3.10 TERC's research and activity is closely aligned with the goals agreed at COP26. These include a reduction in greenhouse gas emissions, a phasing out of coal and other fossil fuels and accelerating the access and utilisation of affordable green technology. TERC's work on developing innovative energy technologies, improving energy efficiency, and reducing emissions directly supports these goals. TERC's research can contribute to the international efforts agreed at COP26 while its activity will disseminate commercial viable solutions to the climate emergency amongst the business community.

Alignment with Policy Advancements

3.11 A series of policy advancements have been implemented since the TERC proposition was developed and ERDF funding secured. Key changes in both the national and local policy context are outlined below, demonstrating the project's strong strategic relevance.

² The Paris Agreement is a legally binding international treaty on climate change, adopted at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015

The national picture

3.12 The strategic importance of green innovation was highlighted in the **UK Government Spring Budget (March 2023)**. It suggests that the UK government will encourage investment and smarter regulation to accelerate technological advancement in sectors including green industries, digital technologies, life sciences, creative industries and advanced manufacturing. The budget emphasises the importation to transition to net zero for the long term prosperity of the UK and sees green technology investment as a crucial component in the UK's Levelling Up agenda.

3.13 The budget makes further emphasis on the need for clean decarbonised and domestically produced energy as a means to national security in the face of invasion of Ukraine and the supply vulnerability of imported fossil fuels such as natural gas. The budget specifically states:

"The invasion of Ukraine has highlighted the need for energy security. Clean energy will be vital for both our security and net zero goals, and presents an opportunity for growth. The Government is therefore boosting longer-term public and private investment to ensure the country's energy system is secure and clean, and to help meet the government's 2050 net zero commitment."³

3.14 TERC research will contribute to more efficient use of energy, the introduction of greener sources of energy and reduce commercial need to import fuel from international markets where precarity is on the rise.

3.15 As part of the budget, the Government sets out its ambition to establish 12 **Investment Zones** across England. One of these zones being the South Yorkshire Mayoral Combined Authority (SYMCA). Each zone will have access to interventions worth £80 million over a five-year period with local government and research institutions being able to tailor their Investment Zone plans to local needs and opportunities. To access funds, local partners must demonstrate credible plans outlining how the area will leverage priority sector growth, private sector match funding and demonstrate how the Investment Zone will support the UK to reach its 2050 net zero target. A chosen site and sector focus has not yet been identified.

3.16 These announcements emphasise a need to undertake more research into carbon capture and the use of hydrogen to be able to support the industry to decarbonise and TERC can support this. There is also a clear role of institutions like TERC to prompt government investment aligned to the Levelling Up agenda. There is strong evidence from the 2023 budget that the rationale for investment in TERC is based on a sound understanding of the strategic direction that the UK Government is moving towards and its continued position as a priority area for the economy.

3.17 The TERC facility further aligns with the Government's **Net Zero Strategy: Build Back Greener (Nov 2021)** by offering research, support, and demonstration linked to chapter 4: Supporting the Transition across the Economy specifically around innovation to net zero, green investment and empowering the public and business to make "green choices". The strategy commits to an increase in UK government R&D to £22bn by 2027 and the publication of a Net Zero Research & Innovation framework outlining key research and innovation challenges in the area of net zero for the next 5-10 years. The Net Zero Strategy: Build Back Greener sets out innovation as the central pillar to delivering net zero but also highlights the need for net zero innovations to be deployed into markets to allow for business and consumer adoption. TERC has a specific remit to advance the adoption of innovative and disruptive low carbon solutions amongst the business community and therefore is well aligned to UK government policy ambitions.

3.18 The importance of innovation as a component of advancing UK R&D capabilities is outlined in the Government's **Innovation Strategy (July 2021)**. TERC is focused on accelerating the development and commercialization of innovative energy technologies, and works closely with businesses and entrepreneurs to support the translation of research into real-world applications. By providing access to

³ Spring Budget (March 2023, HM Treasury)

state-of-the-art facilities and expertise, TERC helps to create a supportive environment for innovation and seeks to foster collaboration between academia and industry. There is alignment between the Innovation Strategy's four pillars of unleashing business, people, places, and ideas and the ambitions and activity of TERC.

3.19 The **Energy White Paper: Powering our Net Zero Future (2020)** is well aligned to the activities and facilities of TERC, highlighting commitments to invest in carbon capture usage and storage and new hydrogen technologies. This includes an ambition by 2030 to capture 10MtCO₂ per year and work with industry to develop 5GW of low-carbon hydrogen production capacity, including by investing £1 billion up to 2025 to facilitate the deployment of Carbon Capture Utilisation and Storage (CCUS) in two industrial clusters and £1 billion in the UK's energy innovation programme to develop the technologies of the future such as advanced nuclear and clean hydrogen.

3.20 The role of the Jet Zero Council (which the Director of TERC is part of) is also referenced in the Energy White Paper established to:

“accelerate the development and adoption of new technologies to help develop our strategy to reach Net Zero aviation”⁴

3.21 There is ambition to drive the uptake of sustainable aviation fuels and investment in R&D to develop zero emission aircraft, including a £15 million competition to support the production of sustainable aviation fuels in the UK. The development of the Sustainable Aviation Fuels Innovation Centre, which sits alongside TERC and is considered further below, has also played an important role in supporting the university to respond to this agenda.

3.22 Talking to members of the TERC team, it is also clear that they have remained abreast of European policy ambitions which informed a focus on renewable energy, hydrogen and sustainable aviation, often ahead of policy steers being made nationally as demonstrated by the continued commitment of the UK Government to invest in Net Zero in recent policy and strategy.

3.23 **The UK Hydrogen Strategy (August 2021)** outlines how Hydrogen is one of a handful of new, low carbon solutions that will be critical for the UK's transition to net zero. As part of a deeply decarbonised, deeply renewable energy system, low carbon hydrogen could be a versatile replacement for high-carbon fuels helping to bring down emissions in vital UK industrial sectors and providing flexible energy for power, heat and transport. The UK Hydrogen Strategy sets out how the government will drive progress to deliver 5GW production ambition by 2030 and position hydrogen to help meet the Sixth Carbon Budget and net zero commitments. TERC is uniquely placed to support this ambition by offering the opportunity for industry to see how such technology can work in practice and work with the university to utilise hydrogen as a power source for the manufacturing sector.

The Local Context

3.24 The ambition of the South Yorkshire Mayoral Combined Authority (SYMCA) is to make a global impact via R&D and enhance its position and standing as a renowned centre of excellence in low carbon. Sheffield City Region's⁵ Growth Plan highlighted the high GVA created from the Low Carbon sector; and the Integrated Infrastructure Plan (IIP) highlighted the ambition to position the area as a leader in low carbon, resilient energy, providing an opportunity to support a potential additional GVA contribution of £147m per annum from investment in low carbon energy generation, and up to 3,000 jobs.

3.25 The project's evolving local policy alignment includes:

⁴ Energy White Paper: Powering our Net Zero future (2020), HM Government

⁵ *The previous name of the South Yorkshire Mayoral Combined Authority prior to June 2021*

Policy	Project alignment
<p>Delivering for South Yorkshire, Mayoral Priorities (2022)</p>	<p>In 2022, voters in Barnsley, Doncaster, Rotherham and Sheffield elected a new mayor for the combined authority. The mayor has outlined five key priority areas that will improve the region and increase prosperity. TERC is well aligned in helping to deliver these priorities, particularly the priorities of achieving net zero through the support of high growth, green firms. The mayoral authority is seeking to achieve net zero by 2040 with innovative solutions to tackling a dependency on fossil fuels through research programmes at TERC and then dissemination of these ideas among local businesses providing an important opportunity to advance the agenda.</p>
<p>Sheffield Region Strategic Economic Plan 2021-2041</p> <p>City Our Plan</p>	<p>A key aim of the Plan is to “build a zero-carbon future through hydrogen, nuclear fusion, carbon capture utilisation and storage, and other clean energy technologies”. The plan also highlights the need to promote and enable “investment and innovation in low carbon energy generation, distribution, and storage”. The TERC facility capabilities and objectives directly align to these objectives.</p> <p>The Strategic Economic Plan reiterates the City Region’s commitment to reaching Net-Zero carbon emissions by 2041 but highlights challenges to reaching the target including “A large proportion of SCR’s 52,000 SMEs are not actively improving their energy efficiency”, while “driving clean growth and decarbonisation in our local businesses, whilst maintaining their competitiveness” is referenced in order to create change. By working with SMEs and local businesses to support adoption of low carbon technologies, the TERC project helps to address the challenge and support aims set out in the plan.</p> <p>The Plan also references utilising local research strengths, including TERC, in order “to establish SCR as an innovation incubator where clean energy ideas can be taken from concept to production and commercialisation” as well as referencing the work with the University of Sheffield to develop sustainable aviation fuels.</p>
<p>Sheffield Region Action Plan (2020)</p> <p>City Renewal</p>	<p>The Renewal Action plan responds to the Covid-19 pandemic, setting out the approach to rejuvenate the economy over the following 18 months. This includes accelerating the transition to Net Zero Carbon, highlighting strengths in clean energy and low carbon technologies, supporting green energy projects including hydrogen. As part of a proposed investment programme to support employers to accelerate growth and deliver a jobs-led recovery, the Action Plan highlights that support will help to “incentivise and advance innovation from concept to commercialisation”, support strategic growth sectors which includes clean energy, as well as the Net Zero transition. The TERC project directly aligns with these aims and objectives.</p>
<p>Sheffield Region Energy Strategy (2019)</p> <p>City Energy</p>	<p>The Energy Strategy highlights the opportunities for businesses and industry of the low carbon economy. Goals of the strategy which directly align to the TERC activities include to “Support businesses to become more efficient and prosper from the high growth of the low carbon energy sector”; and “Enable the innovation and addition of further generation capacity, storage and balancing technology”.</p> <p>The Strategy references the TERC facility directly stating that it will be “instrumental in the UK’s transition to a low carbon economy and will help businesses stay at the forefront of this rapidly growing market and ensures that research and development leadership in clean energy is retained locally”. In addition, it will “dramatically broaden the scope of the pilot-scale testing facilities currently available in the UK”.</p>

3.26 The recent policy documents show a continued and intensified commitment to achieving Net Zero Carbon, including by supporting investment in innovation in clean energy and low carbon technologies such as hydrogen and carbon capture utilisation and storage. A commitment to supporting local SMEs and larger businesses to become energy efficient and capitalise on the growth of the low carbon energy sector is also highlighted in local policy.

Project Offer Alignment

3.27 The team had secured previous ERDF support to support research and innovation. At the time the project considered by this assessment (referred to as TERC (building) internally) was approved, an existing project (known internally as TERC (equipment)) was already underway. TERC (equipment) is essentially a pilot programme operating on a relatively small scale, whilst TERC (building) forms a much larger project which includes the construction of a new purpose built test facility and large scale unique demonstration equipment. Support to SMEs has been offered through both projects, with TERC (building) operating within a smaller (yet higher priority) geography. An overview of the scope of each is provided below with TERC (equipment) now complete).

TERC (equipment)	TERC (building)
<p>Capital: TERC (equipment) acted as a pilot project for research and development of carbon capture technology. A series of 11 pilot scale research rigs and analytical equipment to be installed in the Pilot Scale Advanced Carbon Capture Centre (PACT), that formed part of the University. The equipment includes a range of conventional energy and carbon emitter technologies as well as small scale carbon capture and flue gas analytical technologies.</p> <p>Revenue: C1, C5, C26, C29, C30 and C34 support has been offered to SMEs as part of TERC (equipment) within the South Yorkshire Mayoral Combined Authority (SYMCA) geography and the D2N2⁶ area. A tenth of activity under this project is supported under Investment Priority 4a.</p>	<p>Capital: TERC (building) was awarded after TERC (equipment) and includes the construction of a new research centre based on Sheffield Business Park. It houses 5 large research rigs which are larger scale carbon utilisation technologies as well as advanced analytical equipment for component testing. The equipment sourced as part of TERC (equipment) has been transferred to TERC (the transfer is not funded by ERDF) and compliments the new equipment sourced as part of TERC (building).</p> <p>Revenue: TERC (building) has a number of funded positions including a Business Development Manager, Operations Manager and 4 x Technicians. A dedicated TERC website has also been produced as part of the project.</p> <p>C1, C5, C26, C29 and C34 support has been offered to SMEs with the Sheffield Transitional area. Support has been supported entirely under Priority 4f and has included: feasibility studies and energy audits to businesses to support them to become more environmentally sustainable; a number of workshops and webinars providing information and advice; and relationship building with SMEs and research institutions with a view to collaborating on a carbon capture/hydrogen fuel project.</p>

3.28 The interim report produced in 2021 recommended that TERC work more closely with SAF-IC to collaborate and signpost businesses to appropriate support functions. The SAF-IC is now an integral part of the TERC with aviation presenting unique and large scale challenges in order to decarbonise the

⁶ D2N2 area refers to the Greater Nottingham and Derbyshire LEP Area

sector. One such challenge is the evaluation and 'clearance' of fuels for flight. SAF-IC is now the largest laboratory in the UK built specifically for the analysis of SAF jet fuel. The Energy Innovation Centre (umbrella for TERC, SAF-IC and UK SAF CH) has recently been awarded the [UK SAF Clearing House \(UK SFA CH\)](#), a virtual entity designed to coordinate all SAF fuel testing in the UK and beyond. These three entities (EIC) are making Sheffield an international hub for low carbon energy systems which will be pursuing activity with academia as well as business at all levels. The operation of all facilities in the EIC are at an early stage with the level of opportunity not as yet been realised. They are however working together as one entity offering a holistic offer to the aviation industry.

4 Project Design and Delivery

Project Design

Capital works

4.1 The TERC project was designed to provide a unique research facility to support local carbon research and demonstration advances. Initial feedback from the market suggested that the project was too complex to procure as one job causing the project team to split the ERDF supported construction works package into two parts:

- CAT A works – comprising the building and primary services, accounting for c80% of activity; and
- CAT B works – providing the specialist services (e.g. supply of gases) required to make the equipment work, accounting for c20% of activity.

4.2 Whilst the building itself provides a focal point for attention, the service yard and supply of specialist infrastructure is central to the project's offer and overall success, providing the infrastructure and flexibility needed to support the TERC to function effectively and meet its research and business engagement objectives. Although the facility is now open and operational at the time of writing not all equipment has been installed or in full use. However, for those elements that are useable the facility has been offering tours and demonstrations to highlight their potential uses for both research and within an industrial setting. TERC is currently working with a number of big companies such as Boeing, The Royal Society and E.ON, but has found it challenging to engage innovative local SMEs in collaborative work with the facility, with C26 performance being lower than anticipated, or wider supply chains, as anticipated at the project's outset

4.3 A further important element of the capital project is the provision and installation (CAT C works) of specialist equipment that facilitates research and demonstration. TERC's on-site equipment offer was intended to bring together equipment previously housed elsewhere (outside the ERDF project costs) and was anticipated – at the time of preparing the ERDF application form – to fund the introduction of four new pieces of kit to support research advances:

Table 4.1: TERC Proposed ERDF Supported Equipment Scope

High Pressure High Temperature Heat Exchange Test Bed (HEX): Supporting innovation in the novel low carbon technologies and to complement the heat exchanger test bed. The equipment was intended to support high-efficiency power conversion cycle R&D&I with applications across a range of energy and industrial sectors, including bioenergy.

Advanced air/oxyfuel pulverised fuel bioenergy test rig: To be used for both conventional and novel bioenergy R&D to support solid biomass based power for combined heat and power energy generation. This piece of equipment did not go ahead with funding moved to support increased cost of the other equipment in scope.

Molten carbonate fuel cell (MCFC): To enable the capture of CO₂ from flue gases emitted by bioenergy facilities on site and generate renewable energy, integrated into the building's smart energy system. The generation of concentrated CO₂ on site was also intended to be used in the methanation plant with renewable hydrogen to generate green-methane or Synthetic natural Gas to drive onsite CHP turbines.

Carbon capture and utilisation methanation plant: To form part of an integrated onsite carbon capture and utilisation chain to convert CO₂ into green-methane fuel which can be used in multiple sectors and in the onsite combined heat and power gas turbines.

4.4 All equipment requirements were determined by the TERC Managing Director and/or Theme Manager to align with opportunities for RD&I (including in response to BEIS priorities) and provide new opportunities for target SMEs to engage in the agenda. The ERDF application anticipated that the

building would be completed and all equipment would have been installed and commissioned by the end of 2020. However, as will be discussed later in the report, the project faced a number of significant challenges which affected the project budget and the supply and installation of key pieces of equipment, some of which is still not fully operational, due to issues relating to suppliers of components of the equipment and one supplier going into administration part way through the delivery period.

4.5 In addition to the four pieces of research equipment originally procured, two major PCR's (in addition to a number of project reprofiles) changing the budget and scope of the project were submitted and approved to fund eleven new installation works:

- The installation of a Fisher Tropsch Rig for the methanation plant project, requiring an additional capital equipment budget of £2.5m for the project to be completed due to the original supplier going into administration.
- 10 new facilities with a focus on fuel switching, hydrogen and CCU, supported by cross cutting technologies and requiring an additional capital equipment budget of £4.2m.

4.6 Details of the 10 new facilities are provided in table 4.2 along with the cost of each element.

Table 4.2: TERC New Equipment	
Project	Budget
1. Hydrogen combustion test rig for industrial decarbonisation and fuel switching: With the ability to undertake near burner, heat transfer to load and furnace, emissions, burner design and performance analysis, as well as many other functions.	£1,078,600
2. Conversion of Gas Turbine to Hydrogen fired combustor + hydrogen fuel handling system: To add to the centres the capability to test hydrogen-based gas turbine burner performance, providing plug-and-play capabilities.	£219,600
3. Direct Air Capture: A technology that captures CO ₂ directly from the atmosphere, which in turn can be used in the production of sustainable fuels, chemicals, building materials and other products.	£739,000
4. Hydrogen Separation and purification Unit Integrated with MCFC: To increase the capability of the MCFC by enabling the rig to produce hydrogen as a co-product.	£387,000
5. CO₂ desulfurization: To recover high purity carbon dioxide from the amine capture plant (ACP), providing the centre with the ability to create high quality aviation fuels and increase durability of the MCFC and Project 6 "Power to Sustainable Fuel Pilot Plant".	£191,500
6. Power to Sustainable Fuel Pilot Plant: To enable direct captured CO ₂ conversion into sustainable fuel when combined with green hydrogen produced on site.	£1,091,300
7. Hydrogen Analyser, Monitor and Control Facilities (Zero-carbon fuel certification laboratories): To test hydrogen samples according to ISO14687 and SAE J2719 standards which will be of great interest to regional SMEs planning to use hydrogen.	£162,000
8. 3-D printer for energy equipment design and construction: To provide workable prototypes printed in a few days, which will help to refine energy projects faster, cheaper, and reduce time to market.	£116,300
9. Multi-Parameter Fuel Cell Test Station: It will enable SMEs to check and certify their products and prototypes throughout a range of performance parameters.	£107,500
10. Enhancing TERC Solar Farm: To provide green power for hydrogen production to be used for power generation, heat and sustainable fuel production.	£110,000
Total	£4,202,800

Delivery experience

Category A works

4.7 The capital works programme experienced some delays. Whilst the category A works started to programme, they were later affected by Covid-19 restrictions. Contractors were only off-site for three weeks but there have been wider implications as contractors returned in reduced numbers, due to restrictions on the number of workers who can be on-site at any given time. The main construction works reached practical completion on 30th October 2020 rather than during September 2020, as originally anticipated. This delay was minimal, given the unprecedented situation encountered and is a testament to the dedication of the project team and contractor to keep the programme on track in difficult circumstances.

Category B works

4.8 Delivery of the category B works have, however, experienced more significant challenges, that impacted on both the timescale and budget. Initially, the delivery of this element of work commenced later than anticipated due to the original bids for the works stating costs significantly higher than had been budgeted for. The project team responded by breaking the works into separate infrastructure and capital build works, making procurement less complex, and helping to increase the number of providers who could potentially meet the requirements and reduce the risk for bidders.

4.9 It is recognised that this facility is a complex project to deliver, with a complicated specialist infrastructure requirement and a number of bespoke and unique pieces of equipment to be commissioned and installed. Breaking down the elements into more manageable procurement processes was beneficial to the project. However, a series of wider delays were incurred due to issues in the supply of specialist equipment associated with the complex systems required. All of these works have now been completed successfully and within the budget identified. The facility was opened in March 2021 with Category B equipment all in use by March 2022 which was behind schedule – anticipated by March 2020.

Category C works

4.10 Delays to the installation of specialist site services had an impact on the ability for the equipment to be installed. The procurement of these components has also experienced their own issues. For example, the bidder for the Molten Carbonate Fuel Cell is based in America. They initially faced challenges regarding UK/EU procurement protocols, requiring time and effort to supply the appropriate evidence to ensure that the procurement is compliant. There were also issues with international Intellectual Property that have needed to be resolved. This resulted in protracted negotiations of over 10 months. However, this equipment has now been installed with the TERC working with the supplier again to provide additional equipment featured with the new 10 facilities identified. Consultation with this supplier outlined a much smoother procurement process for the additional equipment using lessons learned and previous experience to ensure a more efficient process.

4.11 The installation and the commissioning of equipment experienced delays due to supply issues linked to Covid-19 and Brexit. Components took longer to arrive and parts/materials from overseas were delayed due to high demand and logistics issues. Much was outside of the control of the project team, who have been highly praised by the contractors consulted for their excellent communication and commitment to problem resolution in an efficient manner.

"We have found the University to be a good client. I have a good working relationship with [the Project Manager] who is a very good. I talk to [them] at least once a week and meet with the wider project team once a month. We get on well, and despite the challenges we have faced, we have

worked through them together and agreed solutions and an appropriate way forward” – Project Manager for one of the equipment components

4.12 As the project has progressed and more time has been provided to TERC to deliver the CAT C works, three out of four pieces of the original equipment have now been commissioned and installed. Table 4.3 outlines the latest position for equipment identified in the original funding bid.

Table 4.3: TERC ERDF Supported Equipment Position

Specialist equipment	Latest position (correct as of the end of March 2023 claim)
Molten carbonate fuel cell	Contract awarded in June 2021 following an initial failed procurement exercise and negotiation through the second exercise. Delivery was scheduled for August 2021 with installation and commissioning delayed to December 2021, due to infrastructure delays. Consultations completed as part of the summative assessment found issues with IP evidence and the need to ship from the USA. This project has been completed but reopened to include additional equipment – see project 5 in the new facilities table.
Fischer Tropsch Rig	An additional £2.5m of funding was added to this programme of works to cover the additional cost of supply and installation of this piece of equipment due to the original supplier going into administration. This was delivered in May 2023 for completion in August.
Shocktube	Contract awarded in Spring 2021 with delivery scheduled for December 2021 to align with the completion of specialist infrastructure works and the completion of the HEX rig installation. The installation of a Shock tube was added to the project scope to extend the usage of the HEX. This is now complete.
HEX Rig	Design and safety reviews completed with fabrication completed in August 2021. Delivery and commissioning took place in September 2021, three months behind the original programme due to delays to the specialist infrastructure works. This project is now complete.

New Equipment

Table 4.4: TERC New Equipment

Project	Latest Position (as of March 2023)
1. Hydrogen combustion test rig for industrial decarbonisation and fuel switching	Design phase complete and manufacture commenced. Delivery scheduled for May and completion in August.
2. Conversion of Gas Turbine to Hydrogen fired combustor + hydrogen fuel handling system	Design completed. Delivered in March and scheduled for completion in June.
3. Direct Air Capture	Design Complete. Delivery scheduled for June with completion in July.
4. Hydrogen Separation and purification Unit Integrated with MCFC.	This project has been dropped and funding utilised to support projects 5 and 6.
5. CO2 desulfurization:	Now procured through the opening on the Molten Fuel Cell contract.
6. Power to Sustainable Fuel Pilot Plant:	Delivery scheduled for June and completion in July.
7. Hydrogen Analyser, Monitor and Control Facilities	Delivery scheduled for June and completion in July.
8. 3-D printer for energy equipment design and construction:	Completed in May 2022.

Table 4.4: TERC New Equipment

9. Multi-Parameter Fuel Cell Test Station:	Delivery scheduled for May and completion in August.
10. Enhancing TERC Solar Farm	Completed in October 2022.

4.13 As we move closer to the project end date only four out of the 14 pieces of equipment have been completed at the time of reporting. The project delivery team however remain confident that all equipment will have been supplied and installed by the project end date, with much of the equipment in place and scheduled for completion in July and August.

Business support

Planned activity

4.14 The TERC project was developed to support SMEs in the Sheffield City Region transition area to engage in the low carbon innovation agenda. Direct proactive and reactive engagement with businesses was envisioned, both before and after the building was completed, to provide technical advice and consultancy tailored to their needs. The support offer was expected to comprise:

- Access to the research facility and specialist equipment offer to allow SMEs to develop and test their energy innovations.
- Equipment based workshops, including on technologies such as renewable energy, waste to energy, combined heat and power systems, zero carbon power and heat and smart energy systems integration.
- The development and delivery of research projects to support products and services to come to market.
- Supply chain events and engaging global supply chain companies in experimental activities, working with SMEs.

4.15 The intention was to increase the rate of commercialisation of low carbon energy products and services within the SME base, through accelerated innovation and the establishment of supply chain links, within the region and further afield, including those supported by the University's international profile.

Business support delivery

4.16 The eventual programme of business support has not aligned with the intentions set out in the project's application. A series of challenges have been identified through the course of the summative assessment that have contributed to this position, as outlined below.

Impact of Covid-19

4.17 Covid-19 significantly impacted the project in its initial stages of delivery, some of which is still be felt as the project draws to a close. As outlined earlier, a short delay was experienced with the capital works to build the facility, as a result of the closing down of onsite works for a number of weeks followed by a restriction on the number of people that could safely work on-site at any given time. This resulted in the building completing two months behind schedule.

4.18 The pandemic further impacted on the supply of goods and services, particularly those that were coming from overseas, which experienced delays with shipping and in some cases increased costs that the project could not consume – resulting in the re-procurement of certain elements of the equipment. However, despite a slow start the delivery team have worked hard to get the project back on track with all of the equipment purchased, commissioned and installed before project closure, which is commendable considering the larger scale nature and the complexity of the capital works.

4.19 In addition, the University imposed a restriction on recruitment during this period, which delayed the appointment of a Business Development Manager who would be responsible for the business engagement activity linked to the project. This impacted on the project's ability to achieve many C1/C5 outputs in the first 18 months of delivery, as is discussed below.

An evolving offer

4.20 During the early phase of the project, the Project Team adapted the business support offer to enable the support to be delivered remotely and reflect a limited project team being in post. The offer centred on providing energy audits to consider existing energy use and opportunities to reduce usage within SMEs over time. The audits provided SMEs with hypothetical scenarios/recommendations that the businesses could implement to become more energy efficient/environmentally sustainable. They were based on remote conversations (via telephone or video conference) at times when site visits were not possible. SMEs engaged were from a variety of sectors and were targeted via a cold calling/emailing initial contact. Although the audits were appreciated by businesses, the evaluation team felt at the time of preparing the interim report that this approach added limited value to the overall project with little evidence of the SMEs supported going on to further engage with TERC and what it is trying to achieve or drive in-house innovations.

4.21 In order to better engage with the local SME base and increase the levels of C1/C5 outputs, a new approach to engagement was adopted whereby the facility hosted a number of workshops with guest speakers and industry specialists – including experts from TERC – for interested SMEs, to provide them with an overview of Net Zero and how they might be able to implement changes within their own organisations. As part of the workshops, each attending SME would also receive support to consider a particular challenge or opportunity within their business and be provided with recommendations to support changes.

4.22 Although this approach has increased the level of SMEs engaged with TERC the numbers attending the sessions have remained low, with a final workshop planned before August 2023 to boost the overall numbers so that the project can meet its output targets. Feedback from beneficiaries regarding the events has been mixed with a number of businesses feeling that the workshops had been incorrectly pitched and they had been left disappointed with the lack of follow-up in regards to recommendations that they could go onto implement. This will be discussed further in the Beneficiary Perspectives section of the report.

4.23 A website has been produced for the facility with the business support offer outlined with associated social media accounts. Leaflets have been produced and distributed, and case studies have been developed to showcase the work achieved. A concerted effort has also gone into promoting TERC and a regional and sub-regional level to Business Support Agencies and organisations linked to research and innovation. Despite these efforts engagement with SMEs has been a constant challenge throughout the project with little advancement made to support businesses to adopt the technology that that facility demonstrates.

4.24 The focus for business engagement has centred around helping businesses to reduce their carbon footprint. However, the support available has not moved passed the initial energy audits that the project was undertaking through Covid. Although a workshop approach has now been adopted, the overall support to businesses remains linked to how they can reduce their carbon emissions through measures such as changing lights to LED's, adding solar panels or buying a new energy efficient boiler.

ERDF funded support has not, as anticipated at the project's outset, linked the support to the expertise and equipment specifically offered within TERC nor worked with businesses to find ways in which they could apply the methods on display within TERC to offer new products/services to the market or streamline their operations. This offer may evolve over time as more of the equipment becomes available for demonstration purposes but will fall outside the ERDF project scope, due to timing.

Securing business collaboration

4.25 The adopted approach has had a detrimental impact on the ability of the project to collaborate with businesses with a view to them developing a new product or service, with implications for the achievement of C26 and C29 outputs. As the real purpose of TERC has not been adequately conveyed to the business community nor effective business targeting applied, the uptake from engaged SMEs to work with the facility further has been limited. It appears that the benefits of adopting the technology on offer in an SME context has not been fully explored with the local business base or with those that have attended the workshops, despite some of the equipment being operational.

4.26 The completed C1/C5 assists will, however, have raised the profile of the facility and university expertise within the local business base. Furthermore, engagement with local business support functions, such as the Chamber of Commerce and the South Yorkshire Combined Authority, also provide the potential to support longer term working relationships with local SMEs that are looking to innovate in this field.

4.27 At the interim assessment stage, opportunities were being explored around the use of flue gases and the engagement of SMEs with an interest in exploring potential uses of hydrogen. Discussions with the project team also suggested that opportunities for supply chain links to be established with larger businesses were being considered. However, it does not appear that this has been implemented at the time of writing the report which is disappointing for the project and the added value it could have provided. Although not achieved within ERDF timescales (which had been an intention when the project was developed), the delivery team have confirmed that this ambition remains a key component of their forward strategy once all equipment is operational.

4.28 Discussions with the Business Development Manager during the final assessment stage have emphasised the need to focus on the C26 (business collaboration) output for the remainder of the programme – albeit with only a few months remaining. Some initial discussions with interested companies and research institutions have taken place and tours of the facility have been offered but at the time of reporting no C26 collaborations have been achieved and only two reported C29's (new products to firm) have been achieved. The Business Development Manager explained that the challenge herein relates to the need for the collaboration to be mutually beneficial – a challenge that many innovation projects have effectively addressed. However, any work undertaken with industry would be beneficial to the university through raised profile, demonstration of working alongside the business community supporting them to innovate, and using the publicly funded equipment to add value to the local economy.

4.29 Beneficiary engagement levels to date are considered in the Project Marketing and Promotion section and beneficiary perspectives on the programme to date are considered in Section 6.

Project Marketing and Promotion

4.30 The TERC Business Development Manager only started in post in July 2020 – approximately one year into the project's lifetime due to a failed initial recruitment round, followed by a University wide recruitment freeze during the pandemic – limiting the scope for early pro-active awareness raising and business engagement activities. In addition the original post holder left the position in September 2022 and was then replaced in late 2022. The team was alert to the shortfall they faced in this area and drew on the expertise of GP60 (as part of the ad-hoc support offer available through the evaluation team) to explore potential business engagement approaches during 2019.

4.31 The project's marketing and promotional activities throughout have included:

- Creating a TERC website providing a weblink to the works on site, details of the facility's capabilities and case studies of supported businesses.
- Establishing social media accounts (e.g. LinkedIn (296 followers) and Twitter (794 followers)) that have posted updates on the building's progress, visits to the facility and employment opportunities.
- Developing a project brochure and issuing flyers during non-project specific events within the University and to clients engaged in other projects and programmes.
- Hosting a *What is Net Zero and how can your business achieve it?* workshop session in February 2021 to build the project's profile.
- Attending seminars, workshops and business events in the region to help build the project's profile.
- Hosted an online 'Accelerating Hydrogen' webinar that was delivered from the centre, with guest speakers based in the facility⁷. Promotional banners featured in the backdrop whilst sessions were being delivered.
- Hosted a series of *Next steps to Net Zero* workshops in late October 2021 and March 2023 with a further one scheduled for June 2023. These events have been promoted through Sheffield Chamber of Commerce, AMRC, Innovate UK, Sheffield Innovation, and through the Growth Hub.

4.32 Activity to actively identify and target businesses with low carbon innovation potential of the kind that could have benefited from the specialist expertise and equipment available at TERC appears to have been lacking throughout the programme period. This represents a missed opportunity.

4.33 Attendance at the workshops has been low and feedback obtained from the initial workshop in October 2021 found that four out of the 10 that attended were not from the target audience for the support i.e. they were from a strategic organisation such as the South Yorkshire Combined Authority, or from a business that offered net zero support to others in an advisory capacity.

4.34 The workshop delivered in March 2023 saw nine business representatives in attendance, which again is a low figure given the need to increase business support outputs. There are 12 businesses signed up to the workshop in June 2023. It is unclear to the evaluator why more business engagement was not ongoing throughout 2022. Offering more events and workshops during this time would have supported the achievement of C1 targets and potentially helped with pipeline activity for C26 and C29 completions in advance of project closure.

4.35 Relationships with the wider business support community has continued throughout the project, but it would appear that there has been a mis-match between the offer promoted to business (carbon reduction measures) and what the TERC facility can actually offer to businesses in terms of more technical support in adopting technology that would change business operations - as demonstrated by the facility. This has left some businesses confused when attending the workshops when the content has been pitched at a higher level (tour of the facility and the very technical equipment demonstrated) or too low for those who already understand how to reduce their energy consumption. A middle ground would have been more effective with specific businesses targeted who can make use of the technology on display within a SME setting.

4.36 It would be a useful exercise to follow up with those businesses that attended the events to explore if they had implemented any sustainable measures into their working practices since the event,

⁷ This appears to have been a high-profile promotional event that helped to raise the profile of the centre with larger businesses rather than necessarily targeting SMEs who provide the focus for the ERDF funded project. The potential for supply chain links to be established are however recognised.

this could be actioned by a short telephone conversation or e-survey and would determine if new products has been introduce as a result of the support and if carbon reduction savings had been made.

4.37 It would appear that the value in reviewing the priority criteria for future business assists to support accelerated innovation and commercialisation of low carbon products and services recommended at the interim assessment stage has not been taken on board. A different prioritisation process (and potentially publicity and SME engagement approaches) was required to secure this focus and ensure more relevant engagements that have the potential to feed into the C26 and C29 output targets were secured.

5 Project Management and Governance

Introduction

5.1 This section of the report focuses on the management and governance of the project. It considers the project management arrangements that were put into place to guide the delivery phase of the project both from a capital and revenue perspective and how they feed into decision making structures. Key processes to support the project's delivery are also outlined.

TERC Staff

Team structure

5.2 At the time of preparing the ERDF application, it was intended that the TERC project would benefit from a team of supported staff members, as follows:

Job Role	ERDF Funded (1 FTE ⁸ %)	Duration of support (months)
Managing Director	42.50	36
Business Development Manager (New Position)	49.58	36
Project Manager	69.06	36
4 x Technical Theme Managers	45.0	36 months each
Head of Finance	20.97	36
Communications and Marketing Officer	15.27	36
Head of Operations (New Position)	50.54	20
Administration	26.15	20
Head of Partnerships	16.59	20
Theme Manager	32.65	20
4 x Technicians (New Posts)	100	20 months each for two technicians and 9 each for the other two

5.3 Most posts were identified to be part funded by the project (i.e.% FTE), reflecting staff involvement in wider low carbon innovation activities that bring further insights to the TERC project. As part of the project variations, all staff posts have remained at the same level of FTE and have been extended to ensure continued delivery throughout, with those originally in post for 36 months extending to 48 months and the 20 month post extending to 32 months.

Staffing challenges

5.4 Whilst many of the posts outlined above were filled at an early stage (e.g. the Project Manager) or were existing staff members within the University (e.g. the Managing Director), others were newly created posts requiring recruitment. It was envisaged that most posts would be filled close to the commencement of the project in early 2020.

5.5 The funding agreement took six months to sign impacting on early recruitment and then the pandemic caused the University to impose a recruitment freeze that severely hindered the project's ability to recruit a full complement of staff. The freeze commenced in March 2020 and only ended in April 2021 resulting in several posts being filled at a delayed timescale. As examples, the Business Development Manager (a post that was intended to be supported for three years) was expected to be

⁸ Full time equivalent

filled in January 2020 but a postholder was not in place until June 2021. The delays in the recruitment process have had wider implications for the project by effecting revenue expenditure in the early phases of the project.

Key personnel

5.6 All TERC team members have an important role to play in the project's delivery and success. Key posts are however considered to be:

- The dedicated Project Manager who oversees all project activity, both capital and revenue. The Project Manager in turn reports to the Head of Commercial and Finance, with key decisions and progress updates reported up to the Managing Director who feeds into the University of Sheffield User Advisory Panel and the Project Executive Group.
- A Business Development Manager, focusing on engaging with SMEs in the area and gaining C1, C5 and C26 outputs.
- A Compliance Officer who has been heavily involved with the project to ensure that all elements of the project delivery remain compliant with ERDF guidance and has proved to be an important member of the delivery team.
- The involvement of Professor Mohamed Pourkashanian who brings extensive low carbon research experience, an internationally recognised reputation, and strong network of contacts to support TERC to build both a national and international profile.

Project Management Processes

5.7 Several procedures and systems have been implemented to support the project's delivery. Key components of the project management approach are considered below.

Communication

5.8 Regular meetings were established with the internal TERC management team to report on progress, deal with any issues that have arisen and to ensure that the project remained on track. Important decisions are taken to an internal Advisory Panel and the Executive Project Board for approval, ensuring strategic awareness and decision making. This process has provided the project with the strategic governance and support required to support successful delivery.

5.9 Progress meetings and project communications have been undertaken on a regular basis with the capital works team, dealing with both the construction elements of the project and the commissioning and installation of the equipment. Meetings have been held with the individual companies where needed as a part of a wider delivery team meeting where elements are interconnected. This has ensured that all parties are aware of progress and are updated about key milestones. Any challenges or delays have been openly shared, and solutions found by working collaboratively. Minutes have been taken of all meetings and key actions distributed thereafter.

5.10 Consultations with the suppliers of equipment have praised the delivery team for the excellent project management skills and their ability to communicate effectively throughout the process. The project has experienced some challenges regarding the supply and installation of the equipment (typically caused by the delays in the supply chain) but these have been met with solutions and ways to mitigate risks.

5.11 Good relationships have been developed with the suppliers, with some companies being procured to supply more than one element. Going forward the suppliers have been asked to provide training and operational manuals to TERC to ensure the ongoing management and maintenance of the equipment once it is in use. Suppliers have outlined that as part of the ongoing relationship and as part

of their duty of care, they will remain in touch with the delivery team should they encounter any issues with the equipment supplied.

Management of risk and variances

5.12 A project risk register was established at the beginning of the project and is managed and updated by the Project Manager. It is a live document that is regularly reviewed to highlight areas of risk (and their likelihood/severity), how those risks are being mitigated and when risks no longer pose a threat to the project.

5.13 A project Change Log was also established to provide an audit trail of changes to scope, timescales and costs and when decisions/approvals were granted. This has ensured that the project has remained compliant and provides the evidence required to show when important changes have been agreed.

5.14 The project finances and timeline are regularly reviewed and flags raised when elements were at risk of going over budget, out of scope or are delayed. Where possible, solutions have been found to limit impacts in these areas, but some challenges have been outside of the control of the project team (e.g. the impacts of Covid-19), and despite best efforts some issues have arisen (see Section 7 for further details).

5.15 Overall, given the complexity of the scheme, it is considered that the project has been well managed, with appropriate policies and procedures in place as well as clear reporting structures. The delay in appointment of the Business Development Manager initially hindered progress of the businesses support function of the project. Momentum with the C1 support offer did build with the hosting of a number of workshops to facilitate the move to net zero, however the numbers progressing through to a more technical C26 has not been achieved.

5.16 The Compliance Officer has played a key role in the project ensuring that the project has remained compliant with both university and ERDF policies and principles. This has been a significant task given the complexity of the project, the level of procurement required and the amount of funding allocated to the university for delivery.

Implementation of recommendations

5.17 Table 5.2 outlines the recommendations from the interim report and the extent to which their implementation has been achieved.

Table 5.2: Implementation of recommendations	
Recommendation from Interim Report	Progress towards implementation
Continue to build project profile within the SME community to allow the project to hit its targets and build wider awareness of the low carbon opportunities available to SMEs.	Some progress made: the project has maintained relationships with other business support agencies in the city region to promote the offer available at TERC. This has resulted in attendance at workshops and a progression towards C1 targets. Pro-active SME targeting does, however, appear to have been limited.

Table 5.2: Implementation of recommendations	
<p>Focus future C1 assists on where the University can add value, ensuring that SMEs can benefit from the specialist expertise within the project team.</p>	<p>Limited progress made: A small number of businesses have progressed through to implementing a new product to firm as a result of the support received, but the support offer available as part of the 12 hr assist does not align with what TERC can offer from a facility and technical expertise perspective to help identify the scope for potential ongoing engagement. Meaningful SME targeting could also have been beneficial in this respect.</p>
<p>Determine the scope for C26 outputs to be delivered from the TERC facility to ensure that SMEs benefit from the on-site equipment and expertise as part of their assist.</p>	<p>Limited progress made: The support offered to C1's is too far removed from the assistance that could be provided as part of an industry collaboration and so has not led to a pipeline of SMEs coming forward to develop a project further. Work has been undertaken with a small number of businesses, none of which have come to fruition at the time of reporting. It is the evaluator's opinion that a more targeted business engagement approach could have been applied to support progress against this recommendation.</p>
<p>Consider a workshop follow-on support offer that allows for capture of a C1 output and re-engage multiple SMEs at the same time.</p>	<p>No progress made: A follow-on support offer has not been developed to assist the number of claimed C1 assists to be maximised.</p>
<p>Develop a forward plan to guide TERC's future beyond ERDF support that clearly articulates how the facility's future will be funded and target uses and users.</p>	<p>Some Progress made: A Business development strategy has been developed which will build the success of current grant applications from Engineering and Physical Sciences Research Council (EPSRC), UK Research and Investment (UKRI), and Department for Energy Security and Net Zero (DESNZ). Researchers and the Business Development Manager working on the relevant bids at present. Industrial collaborations are ongoing with Boeing, Drax, Airbus, Rolls Royce, with other smaller SMEs in the pipeline.</p>
<p>Clearly communicate the focus and relationship between TERC and the Sustainable Aviation Fuels Innovation Centre to ensure that referrals are made to the relevant facility and that wider discussions in the City Region are informed.</p>	<p>Some progress made: The SAF-IC is now operational with the two facilities working together to provide a greater offer to bigger business and the aviation industry as well as academia. All facilities are in the early stages of operation but the intention is to work together to provide a holistic offer.</p>
<p>Ensure that enough time is allocated for procurement</p>	<p>Achieved: Lessons have been learned from earlier phases of work, with more time allocated for the procurement of goods and services during the latter phase of the project.</p>

Table 5.2: Implementation of recommendations

Acknowledge the complexity of purchasing equipment from overseas which has resulted in protracted contract negotiations to ensure regulation compliance in the past.

Achieved: Further equipment has been successfully procured from overseas. The procurements have run more smoothly, based on previous experience of undertaking the activity.

6 Beneficiary Perspectives

6.1 Securing the first-hand perspectives of businesses who have worked with the project to date has formed an important element of the assessment. Although beneficiary numbers are limited, the consultations completed have provided an opportunity to explore the reasons for engagement, the nature of support received and business experience of an assist. This has allowed an understanding of what has worked well and less well to be secured. Early impacts arising from engagement are also considered in Section 7.

6.2 Interviews have been undertaken at various points throughout project delivery. Some of the interviews took place following the initial energy audits, with others taking place following the workshops in October 2021 and March 2023.

Reasons for Engagement

6.3 While some beneficiaries were alert to the opportunity to adopt low carbon solutions to support the sustainability of their business before engaging with the project, many had only taken small steps in the process. Reflecting the focus of support that has been offered, advice was needed to understand the scale of the environmental impact operations had, consider the options available to them, and how they could be implemented in businesses that are typically small in size. Alongside broad insight around low carbon solutions, many businesses also sought specific solutions to issues they were facing in their business.

“Our main intent was to see if there was any room for us to improve energy efficiency, and see if there were grants for us to use. We use £50k of electricity a month – our main goal is energy efficiency. We are not a normal company we operate very heavy machinery that use a lot of energy so this is very important to us.” – beneficiary consultee

“the reason we wanted this support was in part due to changes in the general attitudes toward the environment from staff and colleagues...in addition to outside forces from the customer base [who are] increasingly focussed on environmental issues and sustainability.. in terms of the products themselves and around the business attitudes and compliance” – beneficiary consultee

“we were quite early on in our thinking, and this opportunity provided us with the impetus to give energy saving more consideration” – beneficiary consultee

6.4 A desire to deliver a real change was also apparent within the businesses supported with a number identifying the commercial need to address their carbon emissions.

“Our reason for engagement was that it [reducing carbon] the right thing to do and aligns with the values of our company” – beneficiary consultee

“We wanted to show we were focused on it...we don’t want to just do tick box” – beneficiary consultee

Experience of Support

Energy audits

6.5 Businesses engaged at the beginning of the project in 2020 were provided with an energy audit and recommendations as to how to reduce their energy consumption. One beneficiary reflected on the ease of the application process, this is due to eligibility checks being undertaken by the delivery team based on company information and not a formal application process. However, it has been noted that obtaining signatures relating to de minimis state aid rules after the support has been provided has proved difficult.

[the application process] *“wasn’t particularly onerous – there were no major issues” – beneficiary consultee*

6.6 Beneficiaries of the audits were also happy with the frequency of contact with one SME referring to the approachable nature of the TERC staff and the level of detail obtained by them through a limited number of conversations.

“Communication was great, the project manager was regularly in contact... we had email communication and virtual meetings” – beneficiary consultee

6.7 Consultations at the time suggested that the project pitched this support at the right level, both in terms of the relevance and cost of solutions proposed for businesses and in the technicality of the reports produced. Overall beneficiaries appeared to be satisfied with the support provided through the energy audit process.

“we were very much satisfied...[the support] produced a very useful action plan, SWOT analysis and a useful summary of what we could do” – beneficiary consultee

“They achieved a lot in short time period for us, probably did more hours than we were meant to receive” – beneficiary consultee

6.8 Overall, the feedback from the initial energy audits was positive and advice provided was well received from the supported businesses. Businesses did not at the time appear to be familiar with the planned TERC facility and overarching project ambitions.

Net Zero Workshops

6.9 The majority of beneficiaries consulted had engaged with TERC as part of a workshop session, with some businesses also receiving some form of follow-on support thereafter.

6.10 However, issues were noted in terms of the specific content covered during the workshop sessions. While all businesses found the facility impressive and enjoyed the tour, the presentational content was seen as either too simplistic for businesses who were already progressing decarbonisation plans or not relevant to their specific concerns.

“We didn’t get everything we wanted from the workshop but there was not much that the TERC could do for us as we were already quite far on the net-zero journey. A lot the things they offered were not applicable to us.” – beneficiary consultee

6.11 It would appear that the content of the workshop had not been adapted to reflect businesses growing knowledge and understanding of decarbonisation that had occurred since the project inception with many businesses already aware of the need for them to reduce their carbon emissions and the commercial benefits it could realise. More advice was sought regarding how to make their business operations more efficient rather than focusing on the premises that they occupy.

6.12 It is considered by the evaluator that businesses looking to attend the workshops should have been asked to provide a summary of what they would have liked to get out of the session. That way the content could have been adapted accordingly, providing a more beneficial outcome to the businesses that attended.

6.13 For the beneficiaries who received follow-on support from the workshop, there was a feeling that there was limited capacity in the TERC advisor team which limited the amount of support that could be delivered to their business.

“they [the advisors] seemed to be so busy we could not really engage with them. We were just one of many” – beneficiary consultee

6.14 Beneficiaries who received follow-on support, had already undertaken some of the simple decarbonisation steps that their business was able to achieve, with the support offered by TERC not

providing anything beyond this other than simple encouragement that the business was on the right track.

“We had done so much research prior to the workshop - and had experience with the biomass so we already had a lot of insight.” – beneficiary consultee

“They did mention LED lighting we have started that process, but we would have likely have done that anyway [without engaging with the advisor].” – beneficiary consultee

6.15 Consultations also raised that, while the advisor engagement was useful in confirming their current plans, there were occasions where a written output was not provided due to staffing changes and this was deemed something that would have been useful.

“It would have been good to receive a full written report, the business manager at the time left their post and apologised for not giving us a written report. Because I thought there would be a report it was kind of disappointing.” – beneficiary consultee

6.16 This is not good practice and will result the C1 output being unable to be claimed as the 12 hr assist was not fully completed and/or the beneficiary will be unwilling to sign the work off. This also affects the reputation of the project and facility more widely if it is unable to deliver against its support function.

Areas for Improvement

6.17 Overall, there was a mixed view of the TERC business support programme amongst beneficiaries. Most found it useful to attend the events and hear from interesting speakers and network with similar businesses to consider and potentially implement best practice.

6.18 However, for many businesses consulted, the TERC programme did not offer an appropriate level of support and was not sufficiently tailored to meet the specific needs of each business. For many consultees, the issues often seemed to be due to capacity within the TERC advisor team and the lack of scope to provide businesses with solutions that would satisfy their specific decarbonisation needs.

6.19 The ability to deliver technical advice and consultancy both before and after the facility was completed and support research projects using on-site facilities and equipment – as was anticipated at the time of preparing the ERDF application – could have played an important role in addressing some of the challenges faced, subject to the effective targeting of businesses. The planned use of large employers to engage SMEs through their supply chain also doesn't appear to have materialised but could generate benefits in the future.

Implementation

6.20 Many beneficiaries consulted had already begun to consider and implement specific decarbonisation solutions to their business. The majority of businesses found that the facility shown to them at the workshop was impressive but far too advanced and not relevant to their business. To mitigate this, it was felt that overly simplistic implementation plans were outlined for beneficiaries – such as shifting to LED lighting. While this may have been a correct course of action for businesses to reduce carbon, many of the businesses consulted were already doing this and therefore did not attribute this implementation of decarbonisation to the TERC programme.

6.21 The support offer should have been better tailored to the needs of businesses based on prior engagement before the workshop to ensure the workshops covered relevant information and was pitched at the correct level, if it was considered that this was the most appropriate way to engage with SMEs. However, the workshops would have generated greater value if they had been centred around how businesses could utilise the types of technology demonstrated by the facility for commercial and environmental gain, rather than basic energy saving principles that a number were already aware

of/adopting. This approach could also have been more effective in supporting the university to identify opportunities for ongoing collaboration, subject to appropriate businesses being engaged.

7 Project Performance

Overarching Position

7.1 This section considers the project's position at the time of submitting the end of March 2023 claim. More expenditure and outputs will be claimed in future quarters in which case a forecast position has been provided to the end of the project delivery period of August 2023.

7.2 Overall, consultation with the project delivery team anticipates satisfying both its expenditure and output targets by the point of project closure, however this appears ambitious in regard to the business support element of the project when the C26 figures are significantly behind target. The project's funding agreement has however required a series of changes to reflect the impact of the Covid-19 pandemic on delivery timescales and wider delays to progress (as outlined earlier in this report). In addition, it covers the variation to the funding agreement to reflect the increased budget from £11.7m to £19m.

7.3 The standard ERDF summative assessment performance table is presented overleaf, showing progress to date and the anticipated position by the point of project closure. This is followed by consideration of progress against output and expenditure targets and profiles in turn.

Table 7.1: Spend and output performance

Indicator	Targets		Performance at time of evaluation (end of March 2023 claim)		Projected Performance at project Q2 end of June 2023 ⁹⁾		Projected performance at project closure (end of September 2023 ¹⁰⁾	Overall assessment (forecast at project close)
	Original	Adjusted	Number	% of target	Number	% of target	% of target	
Total revenue expenditure	£1,295,189	£1,874,417	£1,664,573	89%	£1,767,543	94%	98%	
Total capital expenditure	£10,441,115	£17,143,915	£12,204,708	71%	£13,936,034	81%	100%	
Total project expenditure	£11,736,304	£19,018,332	£13,869,281	73%	£15,703,578	83%	99%	
C1 – number of enterprises receiving support	23	32	26	81%	29	91%	100%	
C5 – number of new enterprises supported	2	3	3	100%	5	167%	167%	
C26 – number of enterprises cooperating with research entities	8	10	0	0%	2	20%	60%	
C29 – number of enterprises supported to introduce new to the firm products	2	4	2	50%	3	75%	100%	
C34 – estimated GHG reductions (tons)	1,172	1,172	0	0%	0	0%	100%	

Source: Project management records

	Less than 85%		Between 85% and 95%		Greater than 95%
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⁹ To allow for the capture of achievements against the C34 indicator

¹⁰ To allow for the capture of achievements against the C34 indicator

Project Budget and Expenditure

7.4 At the end of March 2023, 73% of the project's revised target spend had been achieved. Discussions with the project team indicate that expenditure on the capital works will reach the forecast target as all equipment will be installed by the project closure date (August 2023) and the building itself is complete and operational. Revenue expenditure should also be in line with that forecast, with earlier variations taking account of initial recruitments issues making the budget in line with staffing levels to project completion. The project is forecast to spend 98% of its revenue budget and 100% of its capital budget by project closure.

Progress Towards Output Targets

7.5 Despite the increase in capital funding for this project the output targets have only increased slightly as part of the variations made to the funding agreement. This is a result of the slow progress made against the original targets as a result of the pandemic and delay in recruitment of key staff to take this part of the project forward.

7.6 Although the output targets are relatively low in comparison to a project of this size and nature, the project has made slow progress against them. To the end of March 2023 26 C1 assists had been achieved against a target of 32, which the project team hope to achieve by project closure, linked to the scheduled workshop in June. However, the team will need to make sure that enough businesses request the follow-on support and that this is delivered and signed off within a short timeframe – a further six may not be achievable in this timeframe and would require 50% of forecast attendees to come on the day and commit to follow-up support. This would appear ambitious relative to performance to date.

7.7 The facility has been operational now for nearly two years with the installation of equipment an ongoing process. However, the project has been unable to secure a good pipeline of activity to help them achieve their C26 outputs (target of 10, 0 achieved, 2 forecast), despite the ability to showcase what TERC can offer to industry. Again, consultation with the delivery team highlighted that they were currently working with some industry partners with a view to progressing this element, but at this late stage it appears ambitious that this target will be met. The team should continue to achieve whatever they can against this indicator.

7.8 C29's had reached 50% of target by the end of March 2023 claim but are forecast to hit target by project completion. This is, however, a very low target and should have easily been achieved within the programme timeframe. The two businesses to date that have developed a new product/service to firm have done so on the back of advice and guidance received regarding energy efficiency. One business has developed a new method of remote working for their staff and the other is now offering additional carbon reduction support to their clients. Although this is a positive move forward, the product/services developed do not align with the objectives of TERC and have not utilised the expertise and the facility to support the businesses to develop their own products based on the technologies demonstrated by the project.

7.9 The target for reduced Greenhouse Gas emissions is forecast to be achieved and claimed as part of the final claim. The count criteria for the C34 outputs for the GHG savings is one year following completion of the project. The project forecasts that it may exceed the C34 GHG savings target, based on anticipated carbon savings achieved by those SMEs supported to reduce their emissions. The project has kept in touch with those businesses supported and quantified their savings based on their baseline position (calculated as part of the initial site visit/audit) and the measures adopted.). As is typical for many capital projects, the ERDF indicators have not captured the outputs and outcomes directly arising from the capital investment made, despite this being the major area of expenditure. Appropriate measures for future projects and programmes (beyond the confines of ERDF) may include m² of new research facilities created, number of pieces of equipment secured and potentially measures of how the facilities and equipment have gone on to be used (e.g. number of business users or hours of equipment

use for collaborative research) to allow a sense of the scale of capital outputs and the important role played by new facilities and equipment to be captured.

Horizontal Principles

7.10 The project aligns with ERDF Horizontal Principles by working towards positive environmental outcomes. The new TERC facility has been developed to meet BREEAM standards and is sustainable by design. Furthermore, the intention of the facility is to support research and innovation in low carbon technology with a view to working with industry to move to a net zero position. This will generate wider environmental outcomes as new products, services and ways of working are introduced.

7.11 The University of Sheffield is an inclusive employer with equal opportunities available for all newly recruited members of staff working in the project, regardless of gender, ethnicity, age or physical ability. Equal opportunity of access has been ensured for all events hosted by the project to ensure anyone wishing to attend has the flexibility to do so.

8 Project Impacts and Value for Money

Economic Impacts

8.1 This section of the report focuses on the overall impacts of the project in relation to the targeted outputs. It further considers the value for money that the project has generated compared the amount if investment secured.

8.2 It has been difficult to provide a typical economic impact assessment for this project given the low levels of business engagement and product development as a result of the intervention. Consultation with businesses has not revealed any profit increases or jobs created as a result of the support received, which would typically be used to quantify this type of impact.

8.3 A small number of beneficiaries consulted did, however, identify the following benefits:

- **Providing an impetus to deliver change** – One business is implemented a recommended change to LED lighting with sensors and saw increased workforce awareness of energy saving opportunities since engaging with the project. Over the next five years, they also intend to invest in solar panels, because of the advice received. Another business has revised their environmental policy in light of support and began to do environmental impact assessments, as well changing company car choices to hybrid vehicles, implementing a cycle to work scheme, minimising specialist waste. The support has helped them to progress toward being audited against ISO 14001 which they hope to obtain within the next 6 months.

“The project prompted management to take steps forward” – beneficiary consultee

“...it would have been hard [to prompt change] on my own...the [TERC produced] reports help” – beneficiary consultee

“day-to-day pressures take priority – might not get round to [making changes] to have a clear path and focus [as a result of] TERC has accelerated our ability to do these sorts of things”

- **Energy Savings:** TERC has gone on to work with a small number of companies following their initial 12hr assist. Tufcot worked with together with TERC technicians to determine the feasibility of implementing solar panel onto their roof space to save money and reduce their carbon footprint. The report produced suggested that change would be beneficial. Tufcot have since implemented the panels onto their roof reducing their emissions by half and significantly cutting their energy costs. It is not clear how many of the businesses supported have gone on to implement carbon reduction measures, but those that have will begin to see the energy/cost saving benefits of their investment in the years that follow.
- **Anticipated commercial gains** – it remains early for some of the supported businesses to report the benefits of reduced energy use but gains are expected to be secured over time with some businesses also reporting that their commitment to supporting advances is expected to generate new business opportunities for them, due to the importance placed on the agenda by customers. One beneficiary reflected on the influence that revised environmental policy and information has had on procurement decisions, helping to improve credibility with customers.

8.4 Follow-up conversations with the businesses supported would have been beneficial to the project to determine the level of take-up of the recommendations supplied and the advice provided in the workshops. This would have provided a better indication of cost savings to businesses.

Environmental impacts

8.5 Overall the TERC project will have an environmental impact. As the facility goes on to work with more research institutions and businesses, the adoption of new technologies within industry will begin

to realise the environmental impacts from carbon capture and the use of hydrogen as an energy source.

8.6 The project has not yet followed-up with all supported businesses to determine the levels of CO₂ savings made by those that have implemented decarbonisation measures. It is therefore difficult to gauge the true environmental benefits of the project at the time of writing although the project is forecast to achieve its overall CO₂ reduction target by the point of project closure

8.7 There is some evidence from the initial energy audits undertaken that the support has resulted in some companies adopting the recommended measures resulting in energy savings and some behavioural change within the business (see point 8.3). A case study featured on the TERC website ([Case study: Understanding the solar power potential at a Sheffield manufacturing and engineering firm – TERC](#)) suggested that the company could reduce their emissions by up to 50% and more as time progresses.

8.8 The environmental benefits of the project could be wider ranging especially as the facility grows its profile and works with larger companies going forward. However, this is yet to be seen and the benefits to the region may be lower than originally envisaged.

University impacts

8.9 Considering benefits for the University of Sheffield – as the project sponsor and operator of the TERC facility – the project has:

- Introduced a leading-edge facility and equipment offer to the University's portfolio.
- Provided an opportunity to engage with the local business base, albeit levels remain low.
- Facilitated discussions with external parties, including the Combined Authority, Growth Hub and Chambers of Commerce within the city region and BEIS nationally.
- Supported a growing pool of researchers to be employed with the breadth of research to expand as the new equipment continues to be commissioned.
- Provided opportunities for PhD students to engage in projects related to a broad range of industrial energy research, with the ability to expand learned knowledge across academic networks and build stronger relationships with industry going forward.
- The ability to link fundamental and translational research supports the UoS in taking research through TRLs to create a pathway to wider social and economic impact.
- Generated local and national press coverage, emphasising the University's existing expertise and future research and testing potential.
- Enabled the University to remain at the forefront of a growing policy agenda on the sub-regional, national and international stage – as one consultee commented at the interim stage *"we are right in the centre of the strategy for the Government"*.
- Raised the profile of the University's research expertise as awareness of TERC and what it can offer as a research facility is more widely recognised, both nationally and internationally
- Is fostering relationships with bigger businesses as part of TERC and SAF-IC to research the use of sustainable fuels and how hydrogen capture can be used to better effect.

8.10 Longer term impacts developed as a result of collaborations with industry have not been realised within the project timeframe with no C26's claimed by the time of the March 2023 claim. Discussions are ongoing with a number of businesses, but the extent of the engagement is not known to the evaluator to be able to determine any meaningful impacts.

Impacts for the Sheffield City Region

8.11 At this stage, many of the benefits for the City Region to be generated by TERC remain anticipated rather than actual, reflecting the nature of support offered to those that have been assisted, coupled with the fact that much of the equipment has only become operational in recent months, limiting its usage at this stage. Consultations with stakeholders undertaken at the interim stage did however suggest that the project:

- Offers a distinct support offer to SMEs – due to the presence of the facility and expertise within the University – that is not available through other projects. However, this has not been capitalised upon to date.
- Is already – and can continue in the future – increasing awareness of the Net Zero carbon agenda within the local business base and, over time, support innovation. Over time, there is potential for the project to support the City Region to achieve its Net Zero carbon target but more targeted measures should be undertaken to support the SME base.
- Has brought national and international attention to the area and highlighted the City Region's capabilities, which will continue to build over time.
- Is expected to help attract new investment into the area, as the work delivered from TERC becomes increasingly recognised and businesses recognise the benefit of clustering close to the facility.

8.12 As awareness of the TERC facility continues to grow and local business engagement and the range of support available expands, its benefits to the City Region will be seen more greatly. The facility has the potential to collaborate with other research institutions both nationally and internationally to demonstrate how technology can support industry to adopt carbon saving measures within their operations and as a commercial proposition to their clients. However, it would appear that this potential lies more with working with bigger businesses who may have the resources and the scale of operation to incorporate the types of equipment demonstrated by TERC, rather than being used by the smaller manufacturing base within the City Region. This remains an untapped opportunity that there would be value in the client team continuing to explore.

Intended project impacts

8.13 Within the funding agreement the below intended impacts of the project were identified:

- Increase in renewable energy generation
- Reduce the regional Greenhouse Gas emissions and beyond (through deployment of products and services) over the lifetime of the facility
- Create more economically resilient/resource efficient and lower carbon energy supply system
- Increase R&D expenditure by regional enterprises leading to more innovation and greater competitiveness
- Increase inward investment into the region including R&D&I
- Company growth and formation
- Job creation and retention

8.14 In most cases it is too early to state if these impacts have been generated as the facility is not yet operating at full capacity. In time, TERC will support the reduction of Greenhouse Gas emissions and increase renewable energy generation through the adoption of the technology on display. However, at present the support offered to local businesses has not resulted in any company growth that can be evidenced nor has it created any jobs to date. It has however supported some businesses to adopt low carbon measures to reduce their consumption.

8.15 There would be value in the project team considering how future impacts will be captured beyond ERDF support to allow the full benefits to be recorded and shared with partners, as applicable.

Value for Money

8.16 The TERC project has represented a significant investment of ERDF with the potential to offer a return. Given the delays experienced, the true impacts of intervention remain to be realised as does an understanding of the return to be generated.

8.17 The capital investment represented the predominant area of expenditure. Taking account of the three components of value money, the assessor's perspective is as follows:

- **Economy:** Ensuring the effective management of project costs has been a consideration throughout the project's lifetime. The construction procurement process (including splitting works into smaller packages) helped to reduce potential project costs and risk management during delivery helped to identify areas of potential over-spend and manage them accordingly. Economy has been ensured through this process.
- **Efficiency:** ERDF resource has been spent efficiently to deliver the project's required output – a sizeable research facility and on-site equipment offer. When comparing the construction cost to that of similar facilities, TERC recorded a construction cost of £ 4,105.72 per m². Although it has not been possible to access direct comparator costs as part of the assessment and recognition that cost inflation has been a significant issue for recent developments, this is believed to offer value for money relative to similar schemes that have recently been added to the University's portfolio.
- **Effectiveness:** The facility created meets the requirements and ambitions outlined in the ERDF application. TERC is a high-quality research facility that is well-equipped to meet business needs with the addition of further equipment to the project scope expanding the range of activity that can be delivered. From a capital project perspective, the intended outcomes of expenditure have been achieved.

8.18 Overall, the TERC facility and equipment offer has been delivered within the funding envelope available to the project sponsor and has satisfied the project's requirements.

8.19 The ERDF Grant Funding Award did not place onerous targets on the delivery of revenue activity. This meant that the value for money offered by this component of the programme would always be low relative to many comparator low carbon and wider innovation projects. The latest forecast finance and output position at project close suggests that the revenue component of TERC will deliver in line with expectations at the point of agreed project variations.

8.20 From a revenue perspective the value for money assessment suggests that the project does not represent good value for money. To the end of March 2023, the average cost per assist is £64,000 based on 26 C1 business assists. If the project satisfies its C1 target by the point of project closure, as the team forecast it will do, the cost per assist (based on revenue spend also forecast at the point of project closure) will reduce to £57,400, below the £58,600 forecast at the time of preparing the ERDF application. Although less than anticipated at the project's outset, this is significantly above the typical unit cost for ERDF business support projects and, in this case, does not reflect the delivery of intensive assists.

9 Conclusions and Lessons

Conclusions

A strategically aligned project

9.1 The TERC project has been strategically aligned from its outset and the policy, business and public focus on low carbon technologies and the need to reduce carbon emissions has continued to build since the project was approved, with a growing need to meet net zero targets in the coming decade. As a result, the project is increasingly relevant to local businesses as well as being aligned to a growing range of local and national policy drivers including those linked to the importance of research and innovation.

9.2 By investing in the TERC project – from both a capital and revenue position – the City Region has an opportunity to influence wider knowledge and practice in the field as the facility becomes fully operational (September 2023) and its true purpose can be realised. The facility and equipment offer is distinct, an important addition to the UK's energy research landscape and when the TERC capabilities are considered alongside those of the SAF-IC, the City Region has a very strong asset base as a result of ERDF investment.

Good capital performance in a challenging environment

9.3 The impacts of Covid-19 and Brexit could not have been foreseen and had inevitable impacts on the capital works programme, as was the case for capital projects across the country during this period. Reported delays were outside the control of the project team although, with hindsight, the timescales identified for the specialist services were optimistic.

9.4 The project management of the capital build programme has been strong during a challenging delivery period. Regular meetings and updates helped to keep all parties abreast of progress and any issues arising were identified and dealt with efficiently. The Compliance Officer worked closely with the Project Manager to ensure that all procurement and contractual arrangements linked to the project adhere to both University and ERDF requirements – an important consideration for externally funded works.

9.5 Restrictions on project duration (linked to the ERDF Operational Programme) presented a challenging timescale for projects of the scale and complexity of TERC, particularly when they comprised both capital and revenue elements. The fact that the facility is open with a number of equipment pieces installed and functional is an important achievement, given the scale of the building and specialist infrastructure requirements and the bespoke nature of the equipment that it houses.

9.6 However, at the time of undertaking the evaluation only 5 out of the 14 pieces of equipment are operational. Many have been delivered and are forecast to be complete by project closure, but the time taken to have all technology working as demonstrators has limited its use in supporting local SMEs during the project timescales.

9.7 This is further outlined by the project's ability to identify and deliver additional equipment within the facility as a result of increased project funding. Although beneficial elements to the overall scope of the offer, delivering an £19m project during a challenging delivery period is a significant task, which from a capital perspective has been managed well.

A need for a tailored marketing approach

9.8 Marketing of the project has resulted in varied success. The measures adopted have sought to raise the profile of the centre and the business support services available, but levels of engagement and views secured through the consultation programme suggest it remains relatively unknown within the

SME business base. Relationships have been developed with local business support agencies, but this has not resulted in the levels of business engagement that was originally intended at the point the evaluation was conducted. Research into the make-up of the city region's manufacturing base should have been undertaken to identify specific SMEs that could benefit from the technology demonstrated by the facility and underpin proactive engagement. This way the support would be tailored to business needs and offer commercial/operational benefits for each company in turn – potentially generating greater levels of collaboration.

9.9 TERC along with SAF-IC has continued to build the University of Sheffield's profile with bigger businesses whereby the scale of the technology being demonstrated can more easily be translated into tangible benefits for the likes of Boeing, The Royal Society and E.ON. However, the benefits to the SME base and their supply chains is not coming through.

An unaligned business support offer

9.10 The absence of a Business Development Manager and technicians during the early stages of the project's delivery inevitably impacted on the SMEs that could be engaged and activities that could be delivered, although the low number of C1 assists included in the project's funding agreement mean that the impacts have not been as significant as they could have been. Beneficiary numbers have continued to build but they remain behind what is a low target number of 32 for the level of funding secured at the time of reporting, with a further event being held in June to increase the C1 assists.

9.11 The business support offer has been significantly different from that anticipated at the project's outset with implications for the impacts that have been realised. The facility is still not fully operational, but a number of pieces of equipment that can now be utilised for demonstration are in place. Therefore, its ability to offer the SME support that was originally intended has been limited, but should now be increasing. The focus of early support centred on allowing SMEs to achieve energy efficiencies should have evolved into supporting low carbon research and innovation – the intended focus of Priority 4f – but this has not been the case. The implication is that the project hasn't delivered the benefits of:

- SMEs securing access to the facility and specialist equipment offer
- Establishing new supply chain links, including within the region, nationally and internationally
- New products and services being commercialised
- Any significant attributable reduction in carbon emissions

9.12 At this point in the project, limited time remains to do so. Although the project forecasts achieving its C1 output target by the point of project closure, the quality of achieved outputs is not believed to have satisfied that anticipated at the outset, due to limited direct linkages being made to the facility and equipment offer.

9.13 Whilst some value has been generated for beneficiaries to date, the business engagement activity has not successfully pivoted to focus on what the facility can offer to SMEs in terms of accelerated innovation and commercialisation of products and services that harness the potential of the technology on display in the centre. Instead, the project has retained its carbon reduction offer to businesses through advice provided through a series of workshops, but without following this through in any meaningful way that has translated into implementation of measures, carbon reduction or the development of products. This is a missed opportunity.

9.14 Despite the interim evaluation recommending that the team focus on the development of C26 relationships, none have been achieved at the time of reporting. This is a significant underperformance of the project which calls into question the value for money of the intervention at this point in time, which is significantly above the typical parameters for an ERDF project. This is a disappointing outcome given the £1.8m forecast to be spent on revenue activities by the point of project closure. Greater targeting of

businesses with innovation potential and the scope to enter into a research collaboration could have delivered much improved results. New business engagement and support packages will be required if the facility is to fulfil its potential in the future.

Ensuring value for money

The TERC facility has a capital budget of £19m which has included increased budgets to supply additional pieces of complementary equipment. However, despite the increase in project value the business support outputs have remained low and have in most cases not been reached. The overall benefits of TERC will not be realised for a number of years, once the facility is fully operational. However the cost of the development in relation to the support it has provided to date and the levels of innovation supported has been low and at present does not represent good value for money.

Progress against objectives

9.15 Progress against the project's objectives has been assessed as follows:

TERC objective	Progress to date
Create a purpose-built flagship facility that serves as a national centre of excellence for Research, Development, Innovation and Demonstration of renewable and low carbon energy technologies.	Complete The building is now complete and was opened in 2021, serving the functions anticipated at the project's outset
Increase uptake of R&D&I in renewable energy and low carbon technologies by the Sheffield City Region SME base	Limited and too early to assess Limited uptake on new technology has occurred due to the low number of SMEs supported and nature of assists delivered. This objective needs to remain a focus for SME support delivery beyond the lifespan of ERDF and wider awareness raising that could be delivered.
Support the growth and development of the City Region's low carbon sector by supporting new and existing SMEs to innovate and grow	Not achieved With a limited number of SMEs supported by the project to date, the low carbon sector in the City Region has not developed as a result of the project. There is scope for benefits to continue to build in future.
Establish the Sheffield City Region as the UK's leading demonstrator and centre for R&D&I in renewable and low carbon energy technologies	Some progress made Development of the TERC has supported the City Region to raise its profile with further benefits anticipated once the facility is fully operational which will not be the case until final completion at the end of August 2023 when all equipment will be in place. How the centre goes on to be used will also be central to achieving this ambition.
Contribute to a reduction of Greenhouse Gas emissions, regionally (in the medium term) through operational changes implemented by the SMEs that the facility will engage with, and internationally (in the longer term) through the export of new low carbon products and services	Limited and too early to assess There is a limited amount of evidence that supported SME have implemented the recommended carbon reduction measures. There is the potential that those that have attended recent workshops will go onto to do so, but this cannot be determined at the time of reporting. Medium to long term potential does however remain through TERC's ongoing operations.

9.16 Positive progress has been made against the capital objectives of the project with limited achievement of revenue objectives.

Lessons

9.17 The primary lessons arising from the Final Summative Assessment for the project sponsors are:

Consistent efforts are needed to build project profile within the SME community: Although the project has not established as many relationships with the local SME base as hoped, activity should continue as the facility moves forward. The City Region has a strong manufacturing and industrial base, which should be utilised to develop a pipeline of work for TERC going forward. One of the key purposes of the facility was to support the net zero ambition, and TERC has the potential to achieve that by honing in on companies that would benefit the most from some of the technology demonstrated by the facility. For example, which local companies could benefit from carbon capture, or the capture and use of hydrogen to power machinery? Targeted business engagement activities are required to identify businesses with the greatest potential to benefit from support.

Flexibility is required to pivot the business support offer when necessary: Whilst the move to provide energy audits and carbon reduction advice during and post Covid was a positive use of resources and achievement of outputs, it did not reflect the overall purpose of TERC and the unique offer it can provide. The two most recent workshops, whilst helping to secure C1 outputs, should have been used to highlight how the use of the technology on display would be of benefit to businesses from both a commercial and decarbonisation perspective. Coupled with this, specific businesses who the team thought could benefit the most from the adoption of the technology should have been targeted to attend, with follow-up work undertaken thereafter. This would have in turn supported the development of further collaboration and potentially product development and innovation. The project needed to be responsive to the changing circumstances to ensure that the capital and revenue elements of the offer were aligned throughout the delivery stage adapting to provide a new offer once the facility was open. It is understood that the content of the June workshop will be more reflective of the TERC offer, the results of which are unknown at this stage.

Listen to industry: A number of beneficiaries consulted suggested that the most recent workshop was inappropriately pitched. They found that the tour and description of the facility and its uses was too technical – not articulating how it would benefit them - and the discussion relating to carbon reduction measures was too simplified with many already progressing their decarbonisation journey. Projects such as TERC need to be responsive to feedback received and utilise existing business support networks to better understand what they can offer that businesses can really benefit from and tailor a support offer that meets the needs of the business community.

Execute the plan to guide TERC's future beyond ERDF support: The full impacts of ERDF support will be realised in how the TERC facility goes on to be used beyond the funding period. The project is preparing a business plan to ensure that TERC and other facilities that make up the Energy Innovation Centre go on to create an extensive translational/transformational research and training provision focused on hydrogen and zero carbon fuels. The overall aim is to support research and innovation into end-user hydrogen utilisation, conversion, transport, applications, blue hydrogen production and storage and other zero carbon fuels for next generation energy systems. The SAF-IC is now an integral part of the TERC with aviation presenting unique opportunities to decarbonise the sector, making Sheffield an international hub for driving towards a low carbon energy systems, unparalleled by anywhere in the UK. Funding applications to EPSRC, UKRI and DESNZ are currently being prepared to support the ongoing operation of the facility.

Ensure compliance support is included with projects of this scale: The inclusion of the Compliance Officer in the delivery of the project has been very beneficial, ensuring that all project components and procurement exercises are compliant with both the university and ERDF policies and procedures. The inclusion of this role in other projects of this nature and scale will ensure project success.

9.18 Lessons for the Funding body are outlined as follows:

It takes time to deliver combined capital and revenue projects: The typical three-year maximum project duration typically applied under the ERDF programme presents a challenge for projects such as TERC that should be considered in the planning and implementation of future programmes. The time taken to develop, fit out and open facilities (particularly those of a specialist nature) is extensive leaving limited time for beneficiaries to receive meaningful on-site revenue support.

Benefits should be tailored to the nature of projects: ERDF indicators have been restrictive for many projects under the last programme. With investment focused on capital interventions, the available ERDF indicators failed to capture capital achievements. This topic requires further consideration to allow future programmes to record more accurate measures of capital project achievements.