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# Smart Energy Network Demonstrator Final Summative Assessment

June 2023



# Wavehill: Social and Economic Research

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# List of abbreviations

BEIS	Department for Business, Energy and Industrial Strategy
CO <sub>2</sub> e	Carbon Dioxide Equivalent
DECC	Department of Energy and Climate Change
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
EU	European Union
GHG	Greenhouse Gas
LEP	Local Enterprise Partnership
LIS	Local Industrial Strategy
OFGEM	Office of Gas and Electricity Markets
PEG	Project Executive Group
R&D / RD&I	Research and Development / Research Development and Innovation
SEND	Smart Energy Network Demonstrator
SME	Small and Medium Sized Enterprise
SSLEP	Stoke and Staffordshire Local Enterprise Partnership
TINA	Technology and Innovation Needs Assessment

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# 1. Introduction

Wavehill was appointed by Keele University to undertake an interim and final Summative Assessment of the Smart Energy Network Demonstrator (SEND) project. An interim evaluation report was completed in October 2021. This report is the final evaluation report.

The SEND Project is a £16.6m project which seeks to establish a world class demonstrator facility for smart energy research, development and innovation (RD&I). The project enables businesses to develop, test and evaluate new energy technologies, and allied services, on a smart energy network demonstration system, in order to assess their efficiencies in terms of system integration, energy reduction, cost and greenhouse gas emissions. The overall project comprises:

- Investment in capital equipment, facilities and plant to convert an existing energy supply network into a smart energy network demonstrator (SEND) RD&I facility
- A supply chain development programme for smart energy technologies and services
- A collaborative RD&I product development programme with eligible companies and research organisations to support the development and commercialisation of new SMART energy products and services using the SEND RD&I facility.

The project falls under the ERDF Priority Axis 4: Supporting the shift towards a low carbon economy in all sectors<sup>1</sup> and Investment Priority 4f. SEND began in January 2017 and the completion date is June 2023.

## 1.1 Evaluation Approach

This evaluation adopts an approach which is consistent with the requirements of the European Structural and Investment Funds (ESIF) programme and associated guidance. The evaluation is an independent review of project performance, underpinned by five key requirements, as set out in national programme guidance. These are:

- 1) Relevance and consistency:** exploring the continued relevance and consistency of the project in light of contextual changes, such as shifts in policy, economic circumstances and technological advancements
- 2) Progress against contractual targets:** setting out project progress when measured against contractual targets, over/under performance and projected lifetime results at project closure
- 3) Experience of delivering and managing the project:** outlining the practical experience of implementing and managing the project, lessons learned and evidence of best practice which can be applied to the delivery of other projects
- 4) Economic impact attributable to the project:** in the case of this report, it was not possible to undertake a quantitative economic impact analysis of supported beneficiaries,

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<sup>1</sup> European Regional Development Fund Operational Programme 2014-2020

however impacts have been analysed based on in-depth case studies of supported businesses.

- 5) **Cost effectiveness and value for money:** a quantified value for money assessment has not been provided for this report, however we have included narrative around value for money based on the evidence available.

The evaluation draws from a variety of relevant information, data and qualitative insights:

- **A review of background documentation** submitted as part of the ESIF bid, to understand this in detail and assess its continued relevance;
- **Detailed analysis of project monitoring data**, captured by the team and via beneficiaries, to assess performance against financial, output and result targets;
- **A review of changes in the delivery context** considering economic, policy and organisational dynamics which are likely to have impacted on the delivery and impact of the project;
- **Stakeholder consultations**, engaging the core delivery team and external stakeholders, capturing perspectives on project design, delivery, governance, and impacts;
- **Beneficiary surveys** gathered via an externally commissioned telephone survey, designed to explore the sentiments of businesses that received support from the supply chain development programme as well as their satisfaction levels and impacts achieved (undertaken at interim evaluation stage only);
- **Beneficiary case studies**, allowing for more in-depth analysis of impacts for a number of the businesses that were involved in the collaborative RD&I development programme.

## 1.2 Evaluation Limitations

The evaluation has been constrained in terms of identifying project impacts. Due to the high level of interaction with businesses over the course of the project, the SEND team felt that distributing an evaluation survey to businesses would yield a low response rate and so this was not pursued as part of the final evaluation approach.

The primary sources of evidence for this final evaluation have been interviews undertaken with key stakeholders involved in the project delivery, monitoring data provided by the SEND team, an externally commissioned survey focussing on motivations for seeking the support and business case studies.

It has therefore not been possible to estimate quantifiable project-level impacts or gauge business satisfaction with the support received across a large sample of supported businesses. Instead these impacts are explored through in-depth beneficiary case studies.

## 1.3 Structure of Report

The remainder of this report is structured as follows:

- **Chapter 2:** A review of the original project rationale and associated logic model;
- **Chapter 3:** Setting out key contextual changes that have taken place since the project's conception and have subsequently impacted on project performance;

- **Chapter 4:** A summary of project performance, benchmarked against contractual financial, output and result targets;
- **Chapter 5:** A summary of delivery progress, considering marketing and engagement, beneficiaries supported, quality of support, management, and governance;
- **Chapter 6:** An outline of evidence on project outcomes and impacts achieved to date;
- **Chapter 7:** A summary of research conclusions and recommendations.

## 2. Project Overview

This section sets out the project's logic model which details the rationale, market failures, inputs, activities, outputs and intended impacts of the project. The content set out in the logic model will be used to assess the project's effectiveness and impact. The logic model has been developed through reviewing project documentations as well as through conversations with the delivery team.

### 2.1 Rationale and project need

- **Climate Change Act** – the Act establishes a legally binding target to reduce the UK's greenhouse gas emissions by at least 80 per cent below base year levels by 2050. To achieve this target investment is needed in technology which helps to increase generation and use of renewable energy and improve conservation of energy
- **Smart Grids Supported by Government Policy** - The Smart Grid Forum – set up by the Department of Energy and Climate Change (DECC, now Department for Business, Energy and Industrial Strategy (BEIS)) and the Office of Gas and Electricity Markets (OFGEM) – has highlighted the potential benefits from developing the industry, in the form of reduced costs to consumers, enhanced energy security and enabling the integration of low carbon technologies<sup>2</sup>
- **Need for Demonstration** - development of new technology requires demonstration in situ, which the SEND project will provide. The importance of a SEND type initiative has been highlighted as one of the four priorities for public sector support identified in the Low Carbon Innovation Coordination Group Technology and Innovation Needs Assessment (TINA)<sup>3</sup>
- **Opportunity for Demonstration** - the project will be delivered on the campus of Keele University which has a self-contained and privately owned and operated network of energy assets (electricity, gas, heat, water, waste-water and telecommunications) with real world energy demands covering domestic, commercial and industrial users, at the scale of a small town
- **Local Strategic Alignment** - the project aligns with key local strategies, including the Stoke and Staffordshire Local Enterprise Partnership (SSLEP) ESIF Strategy (February 2016) under Priority Theme 4, Supporting Low Carbon; and SSLEP City Deal.

### 2.2 Market Failures

For the capital investment, the most relevant market failure is the **negative externality** represented by greenhouse gas emissions causing climate change. Public sector investment is needed to limit the effects of climate change, as the costs of emissions do not fall on those conducting activities that emit greenhouse gases.

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<sup>2</sup> Smart Grid Forum (2014) Smart Grid Vision and Routemap

<sup>3</sup> Low Carbon Innovation Coordination Group (2012) Electricity networks and storage Technology and Innovation Needs Assessment (TINA)

For the revenue activities, there are market failures relating to **imperfect information** around development of new technologies. The ‘valley of death’ is a term used to describe the risk challenges of investing in technology at an early stage when its viability is still unknown. Public sector support can help to reduce the risk of investment at this stage. This imperfect information can similarly apply to firms seeking support around business innovation, where there may be a reluctance by firms to pay for support for which the benefits are unknown.

## 2.3 Objectives

The project aimed to deliver seven specific objectives:

1. Deliver Europe’s first “at scale” multi-energy-vector smart energy network demonstrator.
2. Integrate real domestic, commercial and light industrial energy demands with a range of distributed energy resources into an at scale demonstrator.
3. Deliver direct carbon savings of 2,967 tCO<sub>2</sub>e per annum relative to 1990 levels.
4. Engage 26 medium-sized companies in Stoke-on-Trent and Staffordshire in intensive collaborative programmes of research to develop new products and services for international markets *[note: this target was increased as part of the project extension]*
5. Deliver carbon savings of 1,129 tCO<sub>2</sub>e per annum relative to 1990 levels as demonstrated by implementation of new products and services onto the SEND
6. Engage with 243 (217 supply chain assisted, plus 26 enterprises cooperating with research entities) local businesses to use the demonstrator as the basis to better exploit new and significant global markets for smart energy technologies *[note: this target was increased as part of the project extension]*
7. Contribute to the delivery of the Stoke and Staffordshire LEP strategic economic plan and ESIF strategy and specifically furtherance of the area’s comparative advantage in the low-carbon / energy sector.

## 2.4 Inputs

The total funding for the project is £16.63m. This comprises £9.97m of ERDF funding and £6.66m of public match funding. These figures represent the project finances following an extension application approved in 2021; the original overall project value was £15.02m. The table below shows the breakdown and source of project funding.

**Table 2.1: SEND project funding sources**

Funding Contributions	Capital Spend (£m)	Revenue Spend (£m)	Total (£m)
ERDF	4.31	5.66	9.97
BEIS	4.56	-	4.56
Keele University	-	2.10	2.10
<b>Total</b>	<b>8.87</b>	<b>7.76</b>	<b>16.63</b>

## 2.5 Activities

### 2.5.1 Capital and Infrastructure Investment

The capital investment in SEND comprised investment in building and construction, plant and machinery and professional services cost categories.

The investments helped to deliver seven main capability areas (value packs), outlined in the table below. The table shows each value pack, explains the benefit of what was delivered and gives examples of the types of new commercial products and services that could be tested using the new infrastructure. The infrastructure development was primarily undertaken by Siemens Energy following an ERDF compliant procurement process.

**Table 2.2: Summary of SEND infrastructure investments**

Value Pack	RD&I and Demonstration Capacity Delivered	Examples of New Commercial Products and Services
1. Basic information management	As is energy usage, energy supply and usage data, inputs for modelling	New data based services
2. Basic demand side management	Integration of smart meter and home network, appliance level load control	New products / services to support demand side management
3. Advanced metering infrastructure and heat load analysis	Integration of power, gas, heat supply and usage for whole system modelling	Development of new services to enable balancing across energy vectors
4. Integrated energy systems, leveraging advanced information management	Enables renewable energy and storage balancing across whole system	New renewable energy solutions across energy vectors
5. Realising micro-grids through advanced distributed energy resources (DER) management	Enables scheduling / dispatching of renewable DER to balance micro-grid	New companies / services to enable localised energy markets to operate efficiently
6. Unlocking low carbon transport potential	Enable charging and storage “vehicle-to-grid” capability	New products / services to support the growth of alternative fuel vehicles
7. Introduce self-healing network characteristics	Management of energy networks to overcome congestion points & reduce/delay upgrade investment	New companies/ services to deliver congestion management services to network operators.

## 2.5.2 Supply Chain Development Programme

The aim of this programme was to provide support to eligible businesses to appraise their commercial opportunities to develop and commercialise new products and services to meet the growing global market for smart energy network technologies. The supply chain development programme was delivered by Stopford Consulting following an ERDF compliant procurement process.

It was expected that this assistance would include:

- Market research into the market opportunities for new low-carbon technologies to underpin improved company performance
- Opportunities for short pieces of collaborative product and service development by engaging with the SEND demonstrator to generate case study and benchmark data
- Expertise to develop R&D plans for new product or service development
- Expertise on the commercialisation of outcomes from applied research
- Advice on international commercial and intellectual property law and regulation
- Advice on international corporate supply chains
- A programme of events, and seminars to promote the production and distribution of energy from renewable sources including outputs from academic and business RD&I projects conducted using the SEND
- The presentation of new business opportunities that arise from RD&I projects conducted on the Keele University energy system.

## 2.5.3 Collaborative RD&I Product Development Programme

The aim of this programme was to offer a collaborative RD&I product development programme to support high technology businesses over an intensive 3-year or 3-month period (depending on the business' needs) to carry out collaborative research, development and innovation with research organisations, to underpin the commercialisation of new products and services for global smart energy markets.

At the heart of this programme would be a team of Graduate Researchers and Engineers (both from Keele, and procured from other research organisations) working to support eligible businesses. Keele University would lead the development, publication and wide dissemination of a LEP-wide call for eligible businesses to bring forward proposals for collaborative RD&I projects using the SEND in partnership with a named research organisation.

Project proposals from eligible businesses (in partnership with a named research organisation) would be considered against key criteria, including:

- Business eligibility
- A measure of how clearly the proposed programme of RD&I will underpin the development of new products and services
- Global market opportunity the project aims to help access
- Necessity of proposed use of the SEND, as opposed to other facilities locally or nationally;
- Potential for sustainable, high value job creation

- Expertise, experience and suitability of the research partner to supervise the programme of collaborative RD&I and ability to provide a suitably qualified Graduate Researcher or Engineer to carry out an intensive programme of RD&I
- Specific expertise of the named research partner supervisor of the programme of work

Each RD&I programme would consist of either a three-year or three-month programme of collaborative product development activity, using a graduate researcher and research organisation based RD&I supervisory team<sup>4</sup>.

## 2.6 Outputs and Outcomes

The table below sets out the original project targets and the latest revisions following project change requests (PCRs).

At the time of writing, the project had submitted six PCRs:

- The first, submitted in March 2017, did not affect spend or output targets
- The second, submitted in December 2017, altered the profile of capital expenditure and output targets, and shifted some funding from capital to revenue, however did not affect overall spend or output targets
- The third, submitted in August 2018, included changes to the spend profile but not overall project spend. It included uplift to a number of indicators, partly reflecting the incorporation of 3-month alongside 3-year RD&I collaboration business assists
- The fourth, submitted in February 2019, included a minor uplift in revenue funding for the scheme, and a minor uplift in some of the outputs
- The fifth, submitted in November 2020 was the main project extension request and led to a more significant uplift in revenue funding and output targets.
- The sixth, submitted in October 2022, was for a decommitment in the project's revenue budget due to an anticipated underinvestment caused by unfilled roles within the project team. No changes were requested for the capital spend or final targeted outputs, the latest revised figures agreed are as shown in the table below. This final PCR, was agreed in principle between Keele University and DLUHC, but it was not formally approved.

**Table 2.3: Summary of SEND project outputs**

Output	Original Target	Revised Target
Number of enterprises receiving support	243	263
Number of enterprises receiving non-financial support	243	263
Number of new enterprises supported	9	18
Number of enterprises cooperating with research institutions	26	61
Number of enterprises supported to introduce new to the firm products	7	17
Estimated annual decrease of GHG (tonnes of CO <sub>2</sub> e)	4,096	4,523

<sup>4</sup> Stakeholders noted that a small number of businesses requested collaborative projects over a shorter time period than three months.

## 2.7 Project Impacts

The outputs are expected to drive outcomes and subsequent impacts. The project outcomes are as follows. These are not core indicators for the purposes of ESIF funding, however are useful indicators to track the longer term outcomes for supported businesses.

- Net additional jobs created in supported businesses
- Net additional gross value added generated in supported businesses

## 3. Changes to Project Context

This section sets out the socio-economic and policy context SEND has operated in and considers the potential impacts this has had on the project's original rationale. The delivery context can play a significant role in a project's success and therefore understanding the tangible or more discrete shifts in the delivery context is integral to an assessment of progress.

### 3.1 Innovation

Since the interim evaluation, evidence from the UK Innovation Survey indicates that innovative activity has increased in the UK. In 2018-2020, 45 percent of UK businesses reported to be innovation active, a significant increase compared to 38 percent in 2016-2018<sup>5</sup>. Large businesses are more likely to be 'innovation active' than Small and Medium Enterprises (SMEs) with 58 percent of large businesses reporting to be innovation active compared to 44 percent of SMEs.

UK expenditure on R&D has continued to stall. Between 2018 and 2019, gross R&D expenditure dropped by 12.6% in the West Midlands from £3.29 billion to £2.92 billion. When comparing with other regions of England, the West Midlands has the median level of R&D expenditure, however it is still below the mean level due to the high concentration of R&D expenditure in regions like the South East, East of England and London<sup>6</sup>.

The number of businesses exhibiting high employment and turnover growth in the West Midlands has dropped by 20% between 2018 and 2020<sup>7</sup>, highlighting the need for innovation support to stimulate local growth.

Although the lag on this data means it only relates to the early period of project delivery, this indicates that as the project has continued with delivery, the challenges around low investment in research and innovation in the LEP area remained a key issue.

### 3.2 National and Regional Policy

Following the COVID-19 pandemic, the UK Government's Build Back Better: our plan for growth<sup>8</sup> sets out the way it plans to support economic growth through investment in infrastructure, skills, and innovation. It highlights the successes brought about through the collaboration of government, research institutions and business and aims to increase the number of businesses translating new ideas into new products and services through improving the innovation ecosystem.

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<sup>5</sup> UK Innovation Survey, [Report covering the survey period 2018-2020](#), May 2022

<sup>6</sup> ONS, [Gross Domestic Expenditure on Research and Development by Region](#), August 2021

<sup>7</sup> ONS, [High Growth by District and Section](#), December 2021

<sup>8</sup> UK Government, [Build Back Better: Our Plan for Growth](#), March 2021

The publication of Build Back Better: Our Plan for Growth puts an even greater emphasis on the transition to net zero than the UK's previous industrial strategy, seeking to both invest in new green technologies and improve the efficiency of current technologies. The three core pillars of growth highlighted in the plan: Infrastructure, Skills and Innovation are all relevant to this project. At a national level, the current policy context has increased the relevance of a programme like SEND.

Furthermore, since the outset of the project, there has been increasing focus nationally on investment in clean energy and energy networks, including through the Government's 10 Point Plan for a green industrial revolution<sup>9</sup> which has further increased the national significance of this demonstrator.

At a local level, all Local Enterprise Partnerships (LEPs) were required to develop a Local Industrial Strategy (LIS), long term plans that build on local strength to ensure the communities reach their economic potential. The LIS aims to support local businesses to grow and develop, increase productivity and innovation and higher-level skills. The SSLEP industrial strategy is built on four broad themes:

- Future Workforce
- Growing Business
- Innovation
- Place

The innovation theme seeks to develop world class innovation and increase demand and capacity for innovation across the business base. The SEND infrastructure is also recognised in the LIS as a key economic asset in the area's ambitions for growth in the low carbon sector.

The activities undertaken by the SEND project align well with both regional and national industrial strategies. The capital infrastructure provides a highly value national demonstrator facility, whilst the revenue projects aim to maximise the economic value of the infrastructure through supporting development of knowledge transfer and promoting investment in RD&I by SMEs.

## 3.3 Economic Context

### 3.3.1 Inflationary Pressures

Inflation in the UK has risen from 0.7 percent in February 2021 to a peak of 9.6 percent in October 2022, fluctuating around 9 percent up until March 2023<sup>10</sup>. Inflationary pressures have a significant impact on business activity in the UK: on the demand side they're impacted by reduced consumer spending and on the supply side the good that businesses need become more expensive. Energy price inflation in the UK has been one of the primary

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<sup>9</sup> UK Government, [The Ten Point Plan for a Green Industrial Revolution](#), November 2020

<sup>10</sup> ONS, [CPIH Annual Rate Base=2015, 2023](#)

drivers of the increase in overall inflation. Heightened awareness and demand for energy security increases the relevance of a project like SEND.

Although it is anticipated that the UK will avoid a recession, the economy is still forecasted to shrink fractionally in 2023<sup>11</sup>. Negative economic circumstances often correlate with a reduction in innovative activity from businesses<sup>12</sup>, this likely increases the relevance of the Smart Energy Network Demonstrator as a project that is able to take on the risk involved in research and innovation in the smart energy sector.

The upsurge in inflation and the subsequent cost of living crisis was the most commonly cited context change in the stakeholder consultations. Stakeholders noted that the increase in energy costs in particular had significantly increased the relevance of SEND and altered the profile of businesses approaching the project for support during the later stages of delivery. Stakeholders believed that the change in business demand was the primary driver behind the introduction of three-month and even shorter term collaborative research projects. Many of these shorter term projects were focussed on reducing business costs or energy consumption as opposed to developing new products or services.

### 3.3.2 COVID-19

As discussed in the interim report, one of the most significant changes to economic conditions during the earlier delivery stages of the project came as a result of the COVID-19 pandemic. This has had a significant impact on the UK economy and regionally in the SSLEP. Over the course of 2020, GDP nationally declined by 9.8 percent and during the first lockdown in April 2020, GDP was 25 percent lower than it had been two months earlier in February. Although smaller, the second lockdown in January 2021 saw a further decline in GDP of 2.5 percent<sup>13</sup>. By the end of 2021, UK GDP had reached pre-pandemic levels but GDP growth has flatlined.

Large parts of the economy were closed for extended periods, the pandemic also affected the labour market with decreases in the number of payrolled employees, and the employment rate nationally. The latest data show the labour market has recovered well with the number of payrolled employees in the West Midlands reaching pre-pandemic levels by July 2021 and continuing to grow into the beginning of 2023<sup>14</sup>.

At a project level, Covid-19 affected:

- **Marketing activity** – much of which was previously undertaken face to face at events, which were no longer going ahead after Covid-19 lockdowns

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<sup>11</sup> OBR, [Economic and Fiscal Outlook](#), March 2023

<sup>12</sup> Hardy, B. & Sever, C., [BIS Working Paper: Financial Crises and Innovation](#), March 2020

<sup>13</sup> ONS, [UK GDP Monthly Estimate](#), February 2023

<sup>14</sup> ONS, [Estimates of payrolled employees by NUTS1 region](#), March 2023

- **Capital activity** – although most of the significant work had been completed before the impacts of Covid-19, it did cause delays to the final elements, including the installation of smart meters into people’s homes on campus
- **RD&I support** – a number of research projects were delayed as researchers were unable to get into businesses to continue their work – a number of these sought extensions to delivery as a result
- **Supply chain support** – the business support provided by Stopford Environmental had to be moved to online delivery, however the disruption from this was not too significant
- **Businesses may have been less likely to seek support** in some cases due to the need to respond to additional challenges in their business affected by the pandemic and associated economic disruption.

### 3.3.3 Britain’s Exit from the European Union

The European Union (EU) referendum in 2016 and the following period until the UK’s formal withdrawal from the EU on 31<sup>st</sup> December 2020 contributed to uncertainty amongst businesses. This was the case throughout the negotiation where the terms of the Withdrawal Agreement were unagreed and unclear for long periods.

During earlier stages of delivery, this contributed to a climate of uncertainty for businesses and some consultees indicated it may have affected the numbers of enquiries from businesses open to engage with an EU funded project. This was mainly down to misunderstanding but meant additional time was required to engage those businesses and explain that the project was still relevant and would continue.

## 3.4 Technological Change

One of the key objectives of the capital investment in the SEND project was to ensure that the demonstrator remained technologically relevant across the duration of the project’s lifetime and beyond. Stakeholder consultations have shown that this had remained the case primarily due to SEND capability to integrate new technologies into the system. Two key examples of this has been the integration of solar panels and wind turbines into the SEND network and the integration of a renewably powered electrolyser. Integrating these technologies into SEND over the lifetime of the project has ensured that that project has remained at the forefront of technological developments in renewably powered smart energy networks and the generation of green hydrogen.

## 3.5 Summary

A summary of the effects of contextual changes are summarised in the table below. The rating in the final column relates to the extent to which updated contextual data has a positive or negative impact on the need/rationale for the scheme and/or ability to deliver.

Change	Description	Impact on Project Rationale	Rating
<b>Innovation Expenditure</b>	Although innovative activity has increased on a UK-wide level, R&D expenditure in the West Midlands has reduced in that time.	Demonstrates continuing need for investment in RD&I support programme	Positive
<b>National and Local Innovation Policy</b>	Increased priority placed on innovations seen at national and local level and increased focus on investment in clean energy and energy networks in national policy and within the Local Industrial Strategy.	Reinforces the strategic national and local importance of the SEND project.	Positive
<b>Inflation</b>	Increased costs to consumers and businesses mainly driven by an increase in energy prices is having a significant impact on businesses' supply and demand.	Businesses face an increased risk undertaking RD&I, highlighting the need for support in this field.	Positive
		Businesses costs and revenue may have been negatively impacted, causing businesses to focus less on RD&I.	Negative
		Heightened awareness and demand for energy security and efficiency, increasing the relevance of SEND's work in particular.	Positive
<b>COVID-19</b>	COVID-19 has had a significant impact on the UK economy, labour market and socio-economic context in which SIH is being delivered.	Impact on ability of the new project to engage new businesses face to face	Negative
		Challenging economic conditions impacting on businesses' planning horizons making some businesses less likely to access support during this period.	Negative
		Some disruptions to each element of project delivery.	Negative
<b>Brexit</b>	Brexit negotiations and changes to importing and exporting processes have created an uncertain economic climate for businesses.	Uncertainty of businesses around the continued relevance and delivery of the SEND project, given it is EU funded, which may have impacted project take-up.	Negative

Change	Description	Impact on Project Rationale	Rating
<b>Technological Innovation</b>	The flexibility of the SEND capital infrastructure investment allows new technologies to be introduced to the network as they're developed.	The technological flexibility ensures SEND can contribute to a wide range of technological innovations and adapt to the business needs of the day.	Positive

## 4. Financial and Output Performance

This chapter provides a summary of the SEND programme’s financial and output performance against targets.

### 4.1 Performance Against Contractual ERDF Targets

An overview and assessment of SEND’s contracted output and expenditure targets against the project’s performance is displayed in the table below.

Table 4.1: SEND’s output and expenditure profile

Indicator	Targets		Performance at time of evaluation (Q1 2023)		Projected performance at project closure		Overall assessment (RAG)
	Original target	Revised target	No.	% of target	No.	% of target	
Capital Expenditure (£m)	£8.87	£8.87	£8.75	98.7%	£8.85	99.8%	
Revenue Expenditure (£m)	£6.31	£7.76	£7.00	90.2%	£7.29	93.9%	
C1 Number of enterprises receiving support	243	263	257	97.7%	263	100%	
C4 Number of enterprises receiving non-financial support	243	263	257	97.7%	263	100%	
C5 Number of new enterprises supported	9	18	18	100.0%	18	100%	
C26 Enterprises collaborating with research institutions	26	61	41	67.2%	61	100%	
C29 Number of enterprises supported to introduce new to the firm products	7	17	14	82.4%	17	100%	
Estimated annual decrease of GHG (tonnes of CO <sub>2</sub> e)	4,096	4,523	11,076	244.8%	11,076	245%	

Source: SEND Monitoring Data (Q1 2023 claim form)

#### 4.1.1 Financial Performance Against Original Profile

Overall, the project has performed well financially, it is projected to hit its target for capital expenditure and spend 94% of its revenue budget by project close.

The underinvestment in revenue expenditure amounts to around £470,000, and is primarily attributed to a shortfall in the payroll costs. The project team have noted that this underspend was mostly outside their influence or any mitigation action. Over the final two years of delivery, at least one project post has been vacant or awaiting filling at any time, which has been the most significant contributor to the underspend. Furthermore, collaborative research support offered by academics and project researchers was slightly

lower than initially anticipated, which has also contributed to the underspend. Given that the project has still successfully met or surpassed all contracted targets, the project team consider these to be efficiency savings that have increased the overall value for money of the investment.

#### 4.1.2 Output and Result Performance

The output and result indicator performance is very positive, with every contracted target forecast to be reached or surpassed by project close. The target for the number of new enterprises supported and annual decrease in GHG had been reached at the time of the final evaluation. The targets for number of enterprises receiving support and enterprises receiving non-financial support were close to final targets at the time of the final evaluation.

Despite appearing low at this stage (67.2% of final target at the time of the final evaluation), the project team are confident that target for enterprises collaborating with research institutions will be reached by project close. SEND are still currently working with 20 businesses on active collaborative projects, these projects are forecasted to close in the second quarter of 2023, ensuring the final target is met. Similarly, for the C29 target (enterprises supported to introduce new to firm products) the project team are currently working with 3 businesses to finalise the development of products which are forecasted to be complete by the second quarter of 2023.

During consultations with Wavehill, key project stakeholders were asked what factors they felt contributed towards the project's forecasted success in meeting or surpassing each target. The most commonly cited reasons are listed below.

- **Communication between teams:** Consistent communication between the core SEND team and other teams involved in the project, such as the estates team and academics, ensured that businesses could be quickly referred to relevant expertise based on the needs of their collaborative RD&I projects. This strong working relationship allowed the project to maximise the wide range of complementary skills within the team.
- **Site tours:** Offering tours of SEND's capital infrastructure helped to overcome the challenge in communicating the tangibility of SEND. Stakeholders noted that SEND tours often allowed businesses and other organisations to conceptualise what kind of projects could be undertaken with Keele.
- **Adaptable Infrastructure:** The ability to integrate new technologies into SEND's network has ensured it has remained relevant despite technological advances and changes in economic circumstances. One stakeholder noted that SEND was well placed to support businesses facing rising energy costs during the later years of delivery. Another stakeholder noted that the infrastructure was the main contributor towards the success in reducing GHG emissions, having installed live-updating energy use meters and integrated renewable energy generation allowed SEND to significantly surpass its target for reduced GHG emissions.

## 5. Project Delivery and Management

This section assessed the effectiveness of the delivery and management of the SEND programme, drawing on evidence from a range of sources including:

- Project performance data and background information collected by Keele University;
- Consultations with the project delivery team and wider stakeholders, both conducted during the Interim in 2021 and for the final assessment in 2023 – for a list of consultees see Appendix A;
- Responses to an impact survey undertaken by Blueberry market research with businesses that participated in the Supply Chain Development programme;
- 15 responses to an online beneficiary survey, sent in 2021 to 26 beneficiaries that received support from the project;
- Case Studies compiled by Wavehill, documenting the experience of businesses that participated in a collaborative RD&I projects.

### 5.1 Marketing and Engagement with Beneficiaries

Stakeholders noted that different marketing methods were used for the different activities under the SEND programme. Keele University undertook the majority of the marketing relating to the collaborative research projects, the marketing around SEND's capital infrastructure and its broader strategic value to the University. Stopford Consultants undertook a majority of the marketing for the supply chain development programme. It should be noted however, that both organisations maintained an open channel of communication with each other and referred businesses across to other SEND activity streams when appropriate.

Surveys undertaken prior to the final evaluation did not collect data regarding how businesses were initially engaged into SEND's support activities, therefore insight into the marketing and engagement is solely based on evidence collected from stakeholder interviews and interim surveys.

#### 5.1.1 Collaborative RD&I Product Development Programme

The SEND programme was initially marketed under Keele University's business gateway, a one-stop-shop for businesses seeking support from the University. This was deemed to be the most appropriate marketing structure at the outset of the project in order to capitalise on businesses' demand to "work with Keele" as opposed to seeking out any specific project such as SEND. After engaging with the business gateway, businesses would be signposted to the most appropriate programme based on their support needs, where then each individual programme was responsible for fully engaging the business into their offer.

As the project progressed, one stakeholder noted that the marketing approach changed to advertise each Keele support programme more distinctly. This was primarily done through a short booklet which highlighted the capabilities of every business support project (including

SEND) separately. Other marketing methods cited by stakeholders included targeted online advertisements, a business gateway newsletter and award ceremonies for businesses that had participated in SEND projects. Stakeholders felt that these methods became more effective later into the life of the project as they could begin inserting case studies into the marketing which demonstrated the successes other businesses that worked with SEND.

When asked which engagement methods has been most successful, the majority of stakeholders felt that the SEND site tours had been particularly effective in attracting businesses to the support. Some stakeholders noted that SEND as a concept could be difficult to effectively communicate to many businesses, the site tours overcame this challenge, allowing businesses to more clearly understand the capabilities of the demonstrator and how they could potentially collaborate with SEND on a project. Stakeholders therefore perceived the COVID-19 pandemic to be one of the biggest challenges to business engagement as it stopped them from using one of the project's most effective engagement tools.

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“The tours created that initial spark for businesses and organisations: it helped them visualise what kind of project they could do with us, what changes they could make internally, or it made them think of other businesses that would benefit from speaking with us.” **(SEND Stakeholder)**

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Marketing each business support programme (including SEND) independently was felt by many stakeholders to be more effective in the later stages of the project, especially when the narrative used to market the collaborative RD&I pivoted away from smart energy network research to focus on rising energy costs. This helped SEND to appeal to less research intensive SMEs and develop shorter-term projects with businesses seeking to work with SEND to reduce their energy consumption.

### 5.1.2 Supply Chain Development Programme

Marketing for this activity stream was primarily undertaken by Stopford Consulting who were also responsible for the stream's delivery. Delivery staff noted that much of the marketing was undertaken separately from the rest of SEND's marketing with a small amount of input from Keele University.

Stopford initially attempted to utilise the wider marketing undertaken for SEND by Keele University, through attending events and tapping into pre-existing University networks. However, it was felt that the marketing was aimed more at businesses seeking to engage in longer term research projects, which prompted Stopford to engage in separate marketing activities.

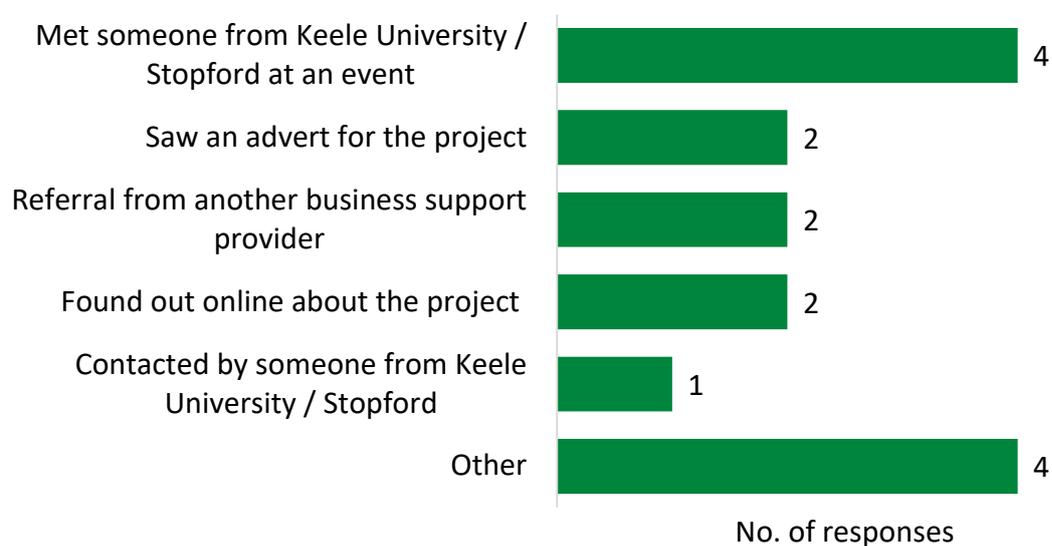
Consultations noted that the most successful engagement method for the supply chain development programme was referrals from other organisations which were already well-connected into the wider Staffordshire business network, such as the Chamber of Commerce or the Staffordshire Business and Environment Network or well-connected

individuals in the Staffordshire area. Some stakeholders expressed that although different streams of the SEND project did refer businesses to other streams, this occurred at a much smaller rate than initially anticipated.

One consultee also noted that the Supply Chain Development programme had been particularly successful in engaging businesses based in the south of Staffordshire, which had been highlighted as a challenge for the SEND project in the interim evaluation report.

Evidence collected in the interim evaluation's beneficiary survey (see figure below) indicates that networking events had been successful in engaging businesses into SEND's different streams. Other engagement methods included project adverts, referrals from other businesses and online searches.

**Figure 5.1: How businesses first heard of SEND (Interim figures)**



Source: Wavehill, SEND Beneficiary Survey (Interim Evaluation), n=15

## 5.2 Take-up, Prioritisation, and Identification of Support Needs

### 5.2.1 Collaborative RD&I Product Development Programme

Stakeholders noted that the research projects were primarily driven by business demand. Each collaborative project began with a series of meetings between the SEND team and the business based on an expression of interest form from the business which would provide a short description of the project and its relevance to the SEND facility. Following eligibility checks, the projects would be fully onboarded through the signing of collaborative working agreements and the hiring of a researcher to support on the project.

During the early stages of delivery, stakeholders noted that many research-intensive SMEs approached SEND for longer-term collaborative projects. For these 3 year projects, the SEND team undertook the recruitment activity and paired the successful candidate with an

academic supervisor that would oversee their progress throughout the duration of the project.

During the final years of delivery, stakeholders noted that SEND's commissioned market research highlighted that SME demands had changed significantly as energy costs and overall inflation began to rise at the beginning of 2021. The type of businesses approaching SEND for support had changed from research-intensive SMEs to high energy users such as engineering firms. Their support needs also changed; businesses were generally demanding shorter term collaborative projects (3 months or less) and were seeking to find ways of reducing their energy consumption in order to cut costs as opposed to developing new products or services. The SEND team responded to these needs by competitively recruiting researchers to undertake these shorter term collaborative projects. Stakeholders noted that one of the main unintended successes of the SEND programme has been the number of researchers that have subsequently been recruited by the companies they worked with during the collaborative research projects.

### 5.2.2 Supply Chain Development Programme

Similarly to the collaborative research projects, stakeholders noted that the support offered through the Supply Chain Development Programme was highly adaptable to business demands. Businesses would develop the initial scope of the project with Stopford, they would then need to complete a beneficiary agreement and comply with an eligibility check undertaken by Keele University. Most of the support offered through the Supply Chain Development Programme was delivered during the early stages of the SEND project's lifetime, as a result the stakeholders didn't note any significant changes in businesses' demands over the course of delivery.

## 5.3 Business Support Activities and Satisfaction

Support delivery took a heavily tailored approach for both of SEND's revenue streams, developing projects and activities based on what businesses scoped out in their initial setup meetings.

Data on business activities and satisfaction with the support were not collected for the final stage of this evaluation. Based on the available data, it is not possible to establish a project-wide understanding of business satisfaction with SEND. Case studies of businesses engaged in the collaborative RD&I projects offer an insight into the satisfaction of a small number of businesses, however these results may not be reflective of the entire population of businesses supported through SEND.

### 5.3.1 Collaborative RD&I Product Development Programme

As noted previously, the support offered was primarily driven by the demand of the businesses that approached Keele. Projects that started earlier in the SEND project’s lifetime tended to be longer term and focus on the development of a new product or service. Later research projects were generally delivered over a shorter timespan with the aim of reducing energy consumption or costs for the firm.

### 5.3.2 Supply Chain Development Programme

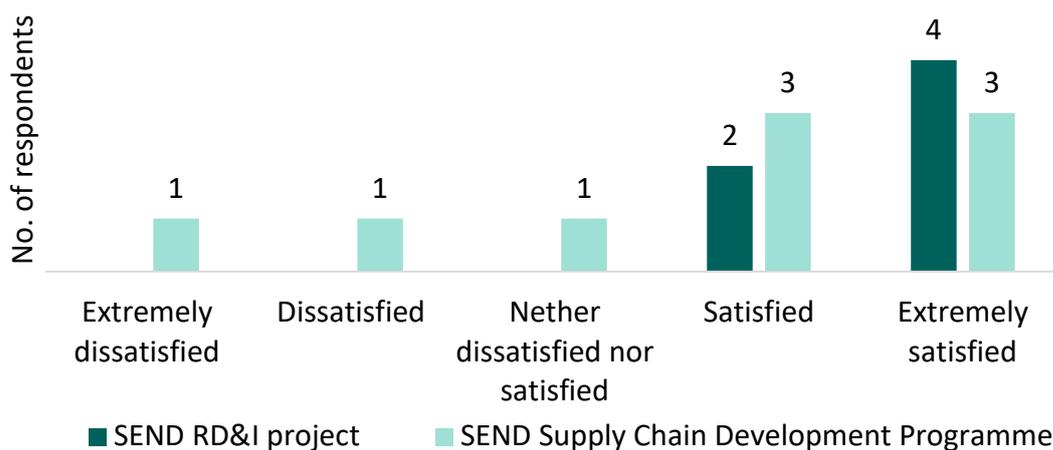
Stakeholder consultations and a short business survey conducted by Blueberry market research provide some insight into the motivations of businesses for engaging with the support and the activities undertaken as part of the support. However, the current body of evidence does not provide any insight into businesses perceptions of, or satisfaction with the Supply Chain Development Programme.

Evidence from both the stakeholder consultations and the business survey show that businesses had a wide range of motivations for engaging with the support, however the most common types of support requested were as follows:

- Developing a new product or service for the renewable energy sector
- Understanding industrial and legal standards around sustainability
- Methods of reducing emissions or costs
- Marketing low carbon products or services

Some indication of business satisfaction can be gauged from the interim survey (see below), however the small sample size means this evidence should be interpreted with caution when considering the programme as a whole.

Figure 5.2: Satisfaction with the support received through SEND.



Source: Wavehill, SEND Beneficiary Survey (Interim Evaluation), n=15

### 5.3.3 Infrastructure Investment

The £8.9m capital investment in the SEND infrastructure has been completed to budget and with only a small timing delay for final elements. While much of the installation occurred before the impacts of Covid-19, some of the later elements including installation of smart meters in domestic properties on campus was delayed as it became more difficult for installers to go into people's homes due to restrictions linked to Covid-19.

Consultees during the interim evaluation were very positive about the quality of the infrastructure installed, feeling that the investment had met its range of objectives, and gone further than originally envisaged. In part this was down to the phased delivery approach employed by the contractor (Siemens), which allowed for each phase of infrastructure installation to be reviewed on completion and a refresh of the next phase plan, taking account of any new technologies developed being undertaken – reducing the risk of the installed technology becoming redundant. One of the key areas of added value highlighted was the introduction of a control centre in the Horwood Energy Centre, which provides a visible presentation of the system, helping to increase engagement with and understanding of the project.

During the final evaluation, consultees remained positive about the infrastructure investment, highlighting its adaptability as a particular strength. As noted in section 3.4, the SEND infrastructure has added new technologies such as solar panels and an electrolyser during the lifetime of the ERDF project. This has allowed SEND to remain relevant as a testing facility for energy networks while also contributing towards research in other fields like hydrogen fuel production. SEND's adaptability has also made it valuable in changing economic contexts being able to support businesses with a wide range of challenges.

## 5.4 Management and Governance

SEND has been managed and overseen by a number of governance groups. The early part of project delivery was overseen by the Project Executive Group (PEG) which was chaired by the University's Deputy Vice Chancellor. The PEG is responsible for larger projects delivered by the university including major capital projects such as SEND. Once the capital aspect of SEND was largely completed, this reverted to the Project Monitoring Board who are responsible for holding the operational team to account for performance against contracted outcomes.

The day-to-day management and decision making is carried out by the Project Operational Group which consists of key SEND delivery partners. Management staff indicated that the structures work well, albeit it was suggested that the multiple layers can cause delays at certain points, such as when new staff recruitment is required – something that was a challenge for the SEND project during the early stages of delivery, where there have been four managers for the project over the course of delivery, with three having left post during the delivery period.

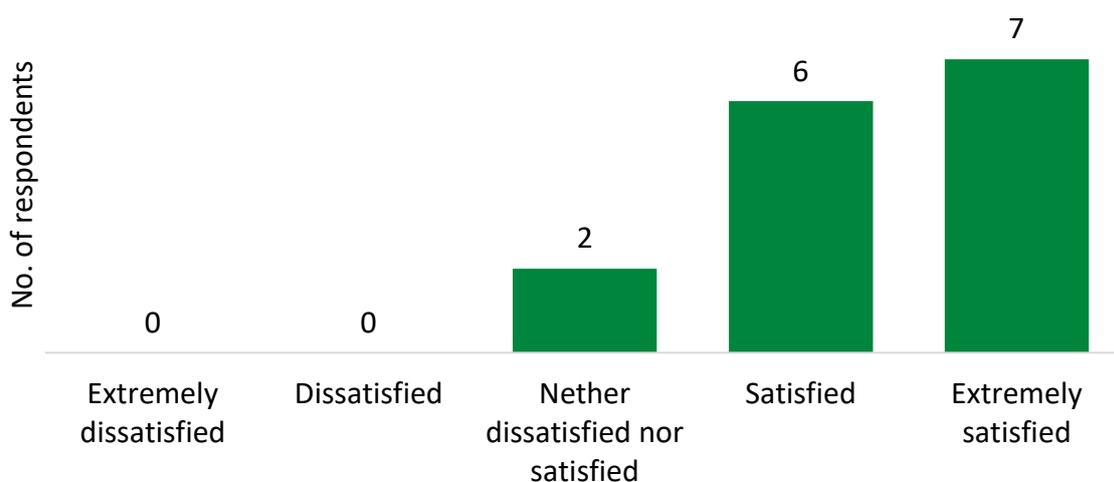
The change in project managers was felt by some to have caused some disruption in the early stages of delivery, however the current project manager and core project team have been praised for ensuring project stability and more effective teamworking with academics and the estate team. The SEND team’s position within the University management structure has also recently changed so that they report directly to the Pro Vice Chancellor of research.

When stakeholders were asked why SEND was projected to reach or surpass all its targets, they most commonly noted that the core SEND team had been effective in ensuring strong communication between all stakeholders involved in the project. Delivery staff indicated that the management structures have been particularly effective in overseeing and monitoring performance indicators, helping to ensure the project remained strongly on track with delivery.

During the interim evaluation, one issue raised by some consultees was that some of the procured research partners could have been engaged better and earlier in the process. One consultee indicated that a separate research group might usefully have been established to bring together key academic teams with the leads on the infrastructure to better develop the way that the research activity could best exploit the high quality infrastructure installed. This issue was raised again during consultations for the final evaluation in relation to SEND’s legacy. Some stakeholders felt that slower academic buy-in during the earlier stages of delivery means that SEND will not be used to its full potential when the project continues beyond ERDF funding.

Some insight into SEND’s management and governance from a beneficiary perspective can also be gleaned from the interim survey. However, the small sample size should be borne in mind when considering programme-wide satisfaction levels with the SEND team. The figure below reports beneficiary responses when asked whether they were satisfied with the administration and delivery SEND’s business support.

**Figure 5.3: Beneficiary satisfaction with SEND’s administration and delivery of support**



Source: Wavehill, SEND Beneficiary Survey (Interim Evaluation), n=15

## 6. Project Outcomes and Impacts

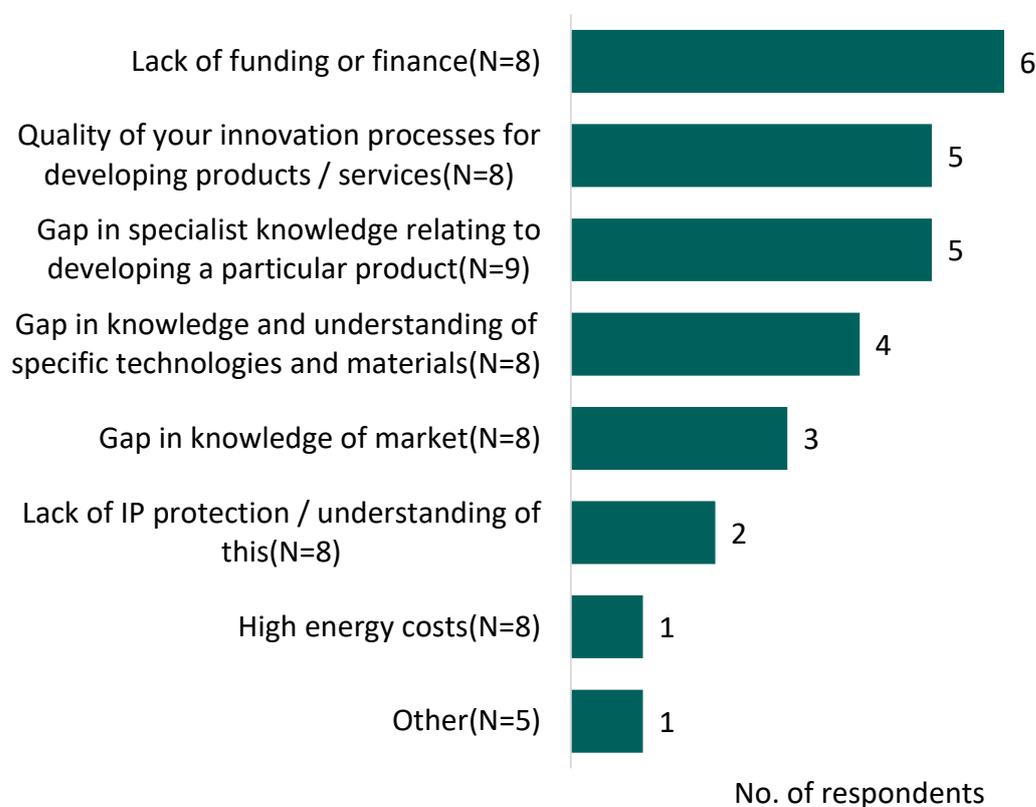
This section sets out evidence of the projects outcomes and impacts, drawing on

- Consultations with the project delivery team and wider stakeholders – for a list of consultees see Appendix A
- Responses to an online beneficiary survey undertaken at interim evaluation stage, sent to all beneficiaries that received support from the project
- Case study consultations undertaken with a selection of supported businesses.

### 6.1 Supply Chain Development Programme

Taken from the interim evaluation survey, figure 6.1 shows the barriers that SMEs highlighted as most significant prior to accessing the supply chain development programme.

Figure 6.1 Number of supported businesses identifying each factor as a significant barrier to growth (SEND Supply Chain Development Programme)



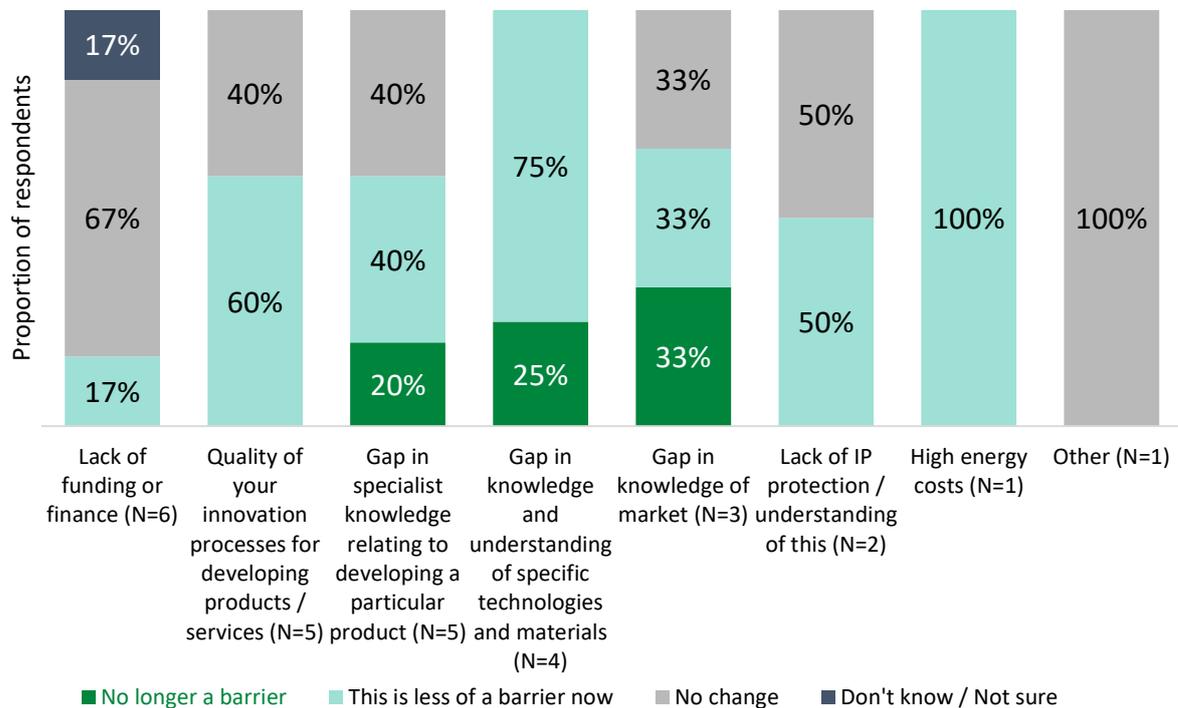
Source: Wavehill, SEND Beneficiary Survey (Interim Evaluation)

The most significant barriers to growth for survey respondents were: lack of funding or finance, gaps in specialist knowledge around developing a product, and quality of innovation processes. The least common barriers were around high energy costs, IP protection and understanding of this, and gaps in understanding of the market. All businesses responding to the survey identified at least one of the barriers as a significant barrier suggesting their suitability for the SEND support.

Figure 6.2, shows the progress that has been made in SMEs overcoming these barriers. It shows that most progress has been made against gap in specialist knowledge relating to product development, gap in knowledge of specific technologies and materials, quality of innovation processes, and gap in knowledge of market. For each of these barriers, at least half of SMEs that identified it as a significant barrier indicated that it was now less of a barrier, following the support received.

Less progress had been made against barriers around lack of funding and finance, with most businesses indicating that this was still as much of a barrier now as at the project outset. This perhaps reflects that this area is less of a core offering of the SEND supply chain development support programme.

**Figure 6.2 Please indicate for each of these whether this is more or less of a barrier to growth now, since you began working with the SEND (supply chain development) programme**



Source: Wavehill, SEND Beneficiary Survey (Interim Evaluation)

Six of the nine businesses that indicated they were experiencing a significant barrier to growth had made progress against one or more of their barriers following the SEND supply chain development support. Each of these six SMEs said that the SEND support had played some role in the progress.

Looking at the turnover and employment impact of the support on these businesses, a majority of the sample (9 out of 15) noted that they had experienced a growth in turnover following the support from the supply chain development programme. A third of businesses reported a positive change in employment numbers following the support, however 7 out of the 15 businesses reported no change. Although some businesses noted that their increase in turnover and employment could be partially attributed the support received by Stopford and SEND, the lack of a final phase survey inhibits this evaluation from commenting on the programme scale employment and turnovers impacts brought about by SEND.

## 6.2 Collaborative RD&I Programme: Case Study Evidence

### 6.2.1 Sunset Lighting Systems Ltd

#### Background

Sunset Lighting Systems Ltd is a Stoke-on Trent based research and development company that specialises in producing waterproof LED lighting systems for challenging conditions. Their Litebar® product is a 12 Volt, one-meter long extruded 25mm conduit unit made either of aluminium or plastic. It is at the cutting edge of 12 Volt lighting development providing brightness equal to that of a 240 Volt unit but much cheaper and safer to use.

#### Work with SEND

Having previously worked with academics from Keele University's School of Chemical and Physical Science, Sunset Lighting Systems Ltd. were introduced to the SEND project through an existing contact at the university. The Litebar® product had already been tested through collaboration with Aston University which confirmed the products durability and the project with SEND aimed to **explore the market opportunities for the product**. The project **explored the potential applications for the product** as well as the **most effective approaches to marketing and selling** the product. This subsequently informed the marketing strategy for the product.

Sunset Lighting Systems Ltd. were pleased with the support they received as well as the way the project was managed and administered. This included regular progress meetings with the University team to ensure the project remained on track.

Despite always believing in the product's potential, the founder of Sunset Lighting System's Ltd. felt that the most beneficial aspect of the project was having this belief ratified by independent organisations and the opportunities this created in terms of increasing sales.

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“Me and my business partner who designed the light were very confident, we'd been working on this for 7-8 years, it was really satisfying and welcoming to have an outside organisation ratifying our claims about our product.” (Sunset Lighting Systems)

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## Impact

The support is also expected to generate economic impacts. To date, the company has seen a moderate increase in turnover since engaging with the SEND support. In the financial year prior, the company was turning over roughly £50,000. Whilst this had increased in the last financial year, the increase was not a significant amount. At the time of the support, the company had no employees and was run by two co-founders. This is still the case following the SEND support and to date there have been no increases in employment.

The company expects to grow significantly in the future and this is mainly due to the prospect of being awarded a government contract to supply 400,000 units for an international aid project. This contract would be worth in the region of £6,000,000 for the company and significantly increase the annual turnover.

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“The project manager for this international aid project although he personally loves the light as he’s used it on another project, he’s got to be able to justify it to British Government so when you have outside bodies like Keele and the SEND project, it helps.” (Sunset Lighting Systems)

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When asked to explain the extent to which these future impacts could be attributed to the SEND project, the founder stated a third of these impacts were down to the SEND project acknowledging the work done through other projects as also playing a role. Whilst they felt it wouldn’t have been impossible to complete the project without SEND support, the project would have been more challenging and costly to implement independently.

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“We would have done it but it would have been more difficult, because it would have been our own money going into it. I think the Government schemes helping new industries get going are vitally important and they’re brilliant, it’s taught us so much too like how to market and sell our product.” (Sunset Lighting Systems)

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## 6.2.2 Potclays Ltd

### Background

Potclays Ltd are a family owned manufacturing business. The business manufactures and sells pottery equipment for studios and potters such as glazes, tools and even kilns. The business operates from two locations: one which combines as a headquarters, manufacturing facility and warehouse and another which is dedicated to clay production.

Potclays were looking to renovate the roof at their main facility, which presented them with the opportunity to investigate the feasibility of generating renewable energy on site. Rising energy costs were eating into the business’ profits, increasing their desire to invest to solar voltaic electricity generation on the roof. The business was keen to receive independent

non-commercial advice from an organisation with expertise in renewable energy generation and energy networks, making SEND the ideal partner to collaborate with on this project.

### Work with SEND

A graduate researcher was tasked to support Potclays by producing a report which would recommend how solar panels could be integrated into the business' energy system. The research involved multiple site visits as well as a regular virtual meeting to keep the company updated on the progress of their research. This way of working was highly praised by the business.

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“More than [satisfied], it was fantastic. The majority of the project was a desktop review which was fine by us as it meant the impact on our own business was pretty minimal. It was a trouble-free exercise and we got a really nice deliverable at the end of it and it's sparked our imagination at the business.” (Potclays Ltd)

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The business were particularly appreciative of the breadth of expertise which SEND brought to the table. Potclays emphasised that they had quite a thorough understanding of the financial side of the business, the SEND team added value with their scientific expertise which they were able to translate into a financial context for the business' consideration. Potclays were very satisfied with the support they received, noting their only regret was that they couldn't dedicate more of their own capacity to the project to get even more out of SEND's support.

### Impact

The greatest impact of the support has been on Potclays' operational efficiency, the recommendations laid out in the SEND researcher's report has allowed the business to effectively plan out their building investments over the coming year, anticipating a clear reduction in their annual overhead costs.

Currently the business makes an annual turnover of £3.8m, of which they estimate five to six percent of that turnover has been spent on energy costs in the last year. Although the business isn't anticipating an increase in turnover over the coming years, the support from SEND will directly allow them to make significant savings on energy. Potclays estimate that costs will reduce from roughly six percent of their turnover to two percent once the solar panels have been integrated into their energy system. The support from SEND will therefore allow Potclays to increase their profits by roughly £150,000 each year as a direct result of the energy costs saving recommended by the SEND researcher.

## 6.2.3 The Bill of Consulting

### Background

The Bill of Consulting is a housing consultancy business operating in the West Midlands area. Although the services offered by the businesses were initially very broad and catered to individual needs of each client, the company quickly developed a desire and expertise to work more closely in the Green Energy industry.

The company were contracted to undertake an evaluation of properties with certain parameters in order to develop policy around these specific properties. Undertaking this work offered a strong opportunity for the Bill of Consulting to further specialize and develop their expertise in the Green Energy space, however the business needed to significantly expand their data analysis capacity as well as gain access to specific datasets. With in-house expertise in data analysis and green infrastructure, SEND was well placed to support the Bill of Consulting with their project.

### Work with SEND

The business first engaged with SEND during a green infrastructure networking event, where they discussed the prospect of collaborating on a project. After establishing the parameters of the work, the business worked remotely with a graduate researcher that accessed and analysed the necessary data to support their work. The business were particularly appreciative of how little their own capacity was taken up briefing the researcher, beyond monthly progress catch-up meetings and come discussions to improve the researchers understanding of the property industry's context, the project didn't generate any significant additional drain on the business' time or resources.

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“[They went] above and beyond, the level of work the researcher did was incredible and the team were constantly supportive. The work that's come out of [the project] was really high end.” (The Bill of Consulting)

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As well as directly benefiting from the final report product by the SEND researcher, the business also noted that SEND has opened up a great deal of networking opportunities for them, allowing them to get to know and learn from other businesses and organisations operating in the industry. The Bill of Consulting were so satisfied with their collaboration with SEND that they could not provide any suggestions on how it could be improved, however they did acknowledge their collaborative research project was quite unique compared to other projects.

### Impact

Although the Bill of Consulting has experienced an increase in their turnover following the collaborative project with SEND and their success in their housing research project could have been achieved without SEND's support, the businesses did not feel their turnover growth was attributable to support they received. They instead emphasised the indirect impacts which have been achieved as a result of the support they received through SEND,

chief of which is an expanded network within the Green Infrastructure sector, which in the future may secure the business future work or partners to collaborate with.

#### 6.2.4 Thermal Recycling Ltd.

##### Background

Thermal Recycling are a world leading waste treatment business that have developed a unique method of converting asbestos within roof-bound chrysotile into a safe material. Known as 'denaturing', Thermal Recycling use their own technology to convert the asbestos into a new composite material that can be reused in construction products, offering a pioneering method to reduce the amount of asbestos heading to landfill.

Sustainability is Thermal Recycling's key ethos, they were therefore keen to demonstrate the positive climate impacts their denaturing method could have when compared to the current practice of sending roof-bound asbestos to a landfill. The denaturing process involves the use of a kiln and gases and a further treatment process to convert the new material into a composite for the construction industry. Therefore, Thermal Recycling were keen to work with the SEND team to undertake a life cycle assessment of their treatment process to quantify the emissions saved by using their composite material. Having worked with Keele University in the past, Thermal Recycling were keen to continue collaborating with them, which opened the opportunity to work with SEND.

##### Work with SEND

Working with a researcher from SEND, Thermal Recycling were aiming to evaluate whether their denaturing process led to a net reduction in emissions, by showing that the emissions generated by their gas kiln was smaller than the emissions that would otherwise be released using the conventional process to treat the asbestos. This was perceived by the business as one of their biggest barriers to expanding the business, due to the uncertainty about the process' environmental impact. As a small business, Thermal Recycling were very appreciative of SEND's support, noting that it would not have been possible to undertake this research as they could not have raised the fund to do it privately.

Thermal Recycling were complimentary of the structures that supported their researcher, in particular the academic supervision and the admin from the SEND team allowed them to undertake their work in an efficient manner, providing regular updates on their progress virtually. The project's final output, a report of the emissions life cycle assessment, was delivered in a shorter timeframe than initially planned.

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*"Honestly the researcher was really excellent, and she did a really good job, the report that she did was what we needed ... it exceeded our expectations, it was great." (Thermal Recycling)*

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The report demonstrated that once the emissions of cement production were also accounted for, Thermal Recycling's denaturing method produced 35% less emissions to create the same amount of composite material.

### Impact

Thermal Recycling are in a very early stage of their business, with ambitions to significantly expand their business. Although the business is anticipating a turnover growth of 20% in the coming year, they don't attribute that growth to the support they received from SEND. However, they acknowledge that the output of the report will support their marketing efforts and potentially lead to an increase in turnover in the future. Thermal Recycling are keen to continue their partnership with Keele University after collaborating with them on another successful project.

## 6.3 Wider Programme Outcomes

The delivery of both the capital and revenue streams of the project have led to a variety of wider outcomes and strategic benefits for Keele University beyond its contracted targets.

### 6.3.1 Contribution to future technologies

The capital infrastructure of SEND was designed with the intention to be able to integrate new technologies into Keele University's closed loop network. SEND has therefore been able to integrate some key pieces of infrastructure to ensure it remains at the forefront of smart and green energy technologies. One key example has been the introduction of wind turbines and solar panels, which, once plugged into the SEND network's monitoring systems, have significantly reduced Keele University's carbon output.

Perhaps one of the most recent and significant additions to the network has been an electrolyser powered by the turbines and solar panels. The electrolyser has allowed SEND to function as a testing hub for green hydrogen. The adaptability of SEND's infrastructure will allow the project to continue making significant contributions towards smart and green energy technology beyond the delivery window of this current ERDF funding project.

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'I don't like talking about "legacy" in SEND's case, because it has such a bright and active future with people using it and adding new things to the network' (SEND Stakeholder Consultation)

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### 6.3.2 National and International Recognition

The technological significance of SEND's capital infrastructure has facilitated partnerships between Keele University and a number of national and international institutions:

- **National Grid:** The SEND team were invited to the National Grid control centre in Derby where alongside a tour of the facilities, a notable discussion took place around sector knowledge transfer. The SEND team were able to provide valuable insight on the future knowledge transfer and staffing needs of the grid with a focus on AI, Data Science and Network Systems experts.

- **Department for Business and Trade:** Visits to the SEND site were organised by the Department to highlight opportunities for trade, skills development and knowledge exchange. Discussions with the delegates highlighted skills shortages in engineering, data science, computing and mathematics for the smart energy sector which Keele may be able to support in the future.

## 6.4 Value for Money

The lack of survey for the final phase evaluation hinders this evaluation from providing a quantifiable value for money assessment. Case studies and stakeholder consultations allow some preliminary conclusions to be drawn about the economy, efficiency and effectiveness of the programme, reflecting on different aspects of value for money.

- **Economy:** From a costs perspective, consultees were satisfied with the capital infrastructure with minor delays caused by the COVID-19 pandemic. The project was successfully delivered to budget, anticipated to reach or surpass all its targets with a budget underspend due to unfilled positions over the duration of the project, which can be interpreted as efficiency savings.
- **Efficiency:** Given all project targets are forecasted to be delivered successfully, there is an argument to be made that the project has been delivered efficiently. However, as highlighted in the interim evaluation there continues to be some underutilisation of the capital infrastructure in the business support aspect of the project. Had it been possible to integrate that better with the revenue support side of the project, this could have led to greater efficiency.
- **Effectiveness:** Evidence from the case studies potentially indicates limited impacts for businesses in the short term with many businesses not attributing a high amount of the turnover or employment gains to the project. However, this is not unusual on the case of RD&I project support, where impacts can take longer to materialise – particularly as many have been completed within the last weeks and months of this evaluation being written and the major economic impacts of Brexit, the pandemic and cost of living crisis. The case studies did indicate some of those businesses expected greater impacts in the medium and longer term as a result of the support received. It may therefore be too early in the lifetime of the project to make assertions about its efficiency. With respect to strategic outcomes to the University however, the SEND project appears to have demonstrated a great deal of effectiveness, by entrenching their position as a leader in smart energy network research, attracting international attention for their contribution to this research.

# 7. Conclusions and Recommendations

## 7.1 Conclusions

As noted in section 1.2, the evidence to fully evaluate this project has been severely limited by the lack of survey data to capture aspects like business satisfaction, engagement routes and benefits that can be attributed to the support they received. When interpreting the conclusions made in this section, these limitations should be borne in mind.

### 7.1.1 Project Relevance and Consistency

With levels of RD&I expenditure below the UK mean paired with a UK-wide rise in innovative activity among businesses, the SEND project is ideally positioned to support businesses looking to develop within smart energy sectors. The project remains well-aligned to regional and national priorities making it as relevant if not more relevant than when its initial ESIF application was submitted.

More recent inflationary pressures, which have impacted energy prices in particular, have only increased the relevance of the SEND project. Due to the flexibility of the support and capital infrastructure, the project has been able to transition during its final year of delivery to offer support to businesses seeking to implement energy saving efficiencies whilst continuing to support businesses making smart energy innovations.

As highlighted in the interim report, the SEND support has responded effectively to enable scheme continuation and provided the opportunity for businesses to access support they need in order to innovate and grow against a challenging economic backdrop.

There continues to be slight mismatch between SEND's national and international significance and the limitation of ERDF revenue support only being accessible to businesses within the SSLEP area. Widening the reach of the project to a greater business base beyond the SSLEP area might have provided opportunities for much greater economic impacts, and should be considered in any forward strategy for the SEND facility.

### 7.1.2 Progress Against Contractual Targets

Despite initial challenges presented by the COVID-19 pandemic and recent inflationary pressures, the SEND project has successfully adapted to these external shocks and are projected to either meet or surpass all contracted targets.

Stakeholder consultations highlighted that the success against these indicators can be attributed to three primary features of the project:

- Strong communication between the core SEND team and the estates and academic teams, allowing for effective collaboration with businesses during the research projects.
- Using tours of the SEND infrastructure as a method of engaging potential business collaborators and wider partners, overcoming the challenge in communicating the

merits of a smart energy demonstrator to audiences without the academic and technical expertise.

- Adaptable physical infrastructure has allowed SEND to remain relevant across different economic and technological contexts, allowing it to effectively support businesses with widely varying needs across the project's lifetime.

A project change request was submitted in response to an underinvestment in the revenue stream of around £470,000 due to various unfilled job positions throughout the lifetime of the project. Considering that all contractual targets are projected to be reached, this underspend could be considered an efficiency saving, increasing the project's value for money.

### 7.1.3 Delivery and Management Performance

One of the key challenges in assessing the delivery and management performance of the SEND project has been the inability to monitor the impacts of the support on the businesses or their satisfaction with the support. This means that insights into this aspect of the project are based on a small number of case studies and evidence collected in stakeholder consultations.

Delivery of the collaborative RD&I projects and supply chain development programme were undertaken mostly separately with both programmes referring participants to each other on occasion. Stakeholders felt the supply chain development programme delivered by Stopford was generally successful, offering businesses catered light touch support to adhere to their needs, most businesses were seeking to develop or market a new product or service, or they were aiming to gain a better understanding of industrial and legal standards relating to sustainability. It was noted that this stream of the project had been particularly successful in tapping into local business networks in order to market itself, successfully supporting a large number of businesses in the south of SSLEP, an area which Keele has historically struggled to market to due to the campus being located in the north of the LEP.

The collaborative RD&I project delivered by Keele University was also considered to be very successful in providing businesses with highly catered support. The key change in delivery for this stream of the project has been the shift from supporting research intensive SMEs with long term research projects towards supporting more traditional SMEs with shorter term research projects aimed at reducing energy consumption in response to rapidly rising energy prices. As noted in the previous section, stakeholder felt that the in-person SEND site tours were a particularly effective tools for reaching out to new businesses.

Management structures were felt to be effective in the later years of delivery once a consistent project manager had been appointed. Stakeholders attributed much of the project's success to the core SEND team's ability to form strong connections with academics and the estates team, ensuring that project delivery remained on schedule and the relevant expertise could be accessed to support businesses.

As noted in the Interim evaluation, the limitation of only being able to recruit businesses within the SSLEP may have meant that not all businesses supported fully met the original

aspiration that supported businesses should benefit from use of the SEND infrastructure, especially in the later stages of delivery which focussed on reducing energy consumption. Providing support to a broader range of businesses in surrounding areas that might have benefitted more from access to the SEND facilities might have been beneficial and should be considered in any future business support activity linked to the demonstrator facility.

The capital installation part of the project was very positive, with the infrastructure having been delivered on budget, and mostly on time (albeit final elements including installation of domestic smart meters was delayed due to Covid-19 restrictions). Consultees commonly felt the infrastructure had strongly delivered against its objectives and even exceeded expectations in some aspects, such as the introduction of a control centre in the Horwood Energy Centre, providing a visible presentation of the system.

However, one of the key issues for delivery was that the capital and revenue elements of the project had to be delivered concurrently, in order to deliver within the available funding timescales, which meant that much of the business support activity was already underway before the capital elements had been completed. As such, this would have constrained the ability of supported businesses to utilise the infrastructure as part of their business support in any case.

During the interim evaluation, some concern had also been raised about the joining up of research opportunities with the infrastructure installation, with a number of consultees feeling that more engagement could have taken place at an earlier stage to explore how this could optimally function. Consultations conducted for the final evaluation indicate that some progress has been made to overcome this challenge, the core SEND team has been moved within Keele University's management structure to facilitate a more direct line of communication with researchers, the current members of the SEND team have also been credited with making stronger connections with academics across the University such as those in computer science, mathematics and the social sciences.

#### 7.1.4 Outcomes, Impacts and Value for Money

The case studies in section 6.2 provide preliminary evidence that the SEND programme has succeeded in offering very high quality support to businesses that would not have been able to achieve similar outcomes without their support. Although businesses currently do not attribute many of their job and turnover increases to the support they received from SEND, it should be borne in mind that many businesses have only recently finished their collaborative project and many are expected to experience additional benefits in the future.

Combining all the evaluation evidence sources allows for an assessment of SEND's progress against the objectives which were initially set for the project, table 7.1 below summarises its progress.

Table 7.1: Progress against initial core objectives

Objective	Progress	RAG Rating
Deliver Europe’s first “at scale” multi-energy-vector smart energy network demonstrator.	Although the current version of SEND does not fully adhere to the original design, the changes made during the multi-phase development have led to a more technologically relevant facility than was initially scoped out.	Green
Integrate real domestic, commercial and light industrial energy demands with a range of distributed energy resources into an at scale demonstrator.	This facility has successfully integrated a wide range of energy sources, such as solar panels and wind turbines. From the demand side, SEND has been able to integrate smart energy meters and a hydrogen energy electrolyser in order to simulate demand at scale.	Green
Deliver direct carbon savings of 2,967 tCO <sub>2</sub> e per annum relative to 1990 levels.	The project has surpassed this target by a significant margin, delivering 11,076 tCO <sub>2</sub> e per annum of savings through the integration of renewable energy generation. The monitoring technology integrated into SEND allows for continuous analysis of the facilities impact on carbon reduction.	Green
Engage 26 medium-sized companies in Stoke-on-Trent and Staffordshire in intensive collaborative programmes of research to develop new products and services for international markets <i>[note: this target was increased as part of the project extension]</i>	Although 26 businesses were successfully supported through SEND’s RD&I programme, case study and consultation evidence indicates that many of these projects have not yet led to the development of new products. Many other positive impacts were achieved through these projects, however it may indicate a slight misalignment between the project’s original design and the needs of SMEs in the SSLEP area.	Yellow
Deliver carbon savings of 1,129 tCO <sub>2</sub> e per annum relative to 1990 levels as demonstrated by implementation of new products and services onto the SEND	The project has surpassed this target by a significant margin, delivering 11,076 tCO <sub>2</sub> e per annum of savings through the integration of renewable energy generation. The monitoring technology integrated into SEND allows for continuous analysis of the facilities impact on carbon reduction.	Green
Engage with 243 (217 supply chain assisted, plus 26 enterprises cooperating with research entities) local businesses to use the demonstrator as the basis to better exploit new and significant global markets for smart energy technologies <i>[note: this target was</i>	Although the project was successful in the supporting the targeted number of businesses, there is little evidence to suggest that businesses engaged with the demonstrator facility as part of the support they received. This reflects the timing misalignment between the capital and revenue aspects of the project which did not enable this.	Yellow

Objective	Progress	RAG Rating
<i>increased as part of the project extension]</i>		
Contribute to the delivery of the Stoke and Staffordshire LEP strategic economic plan and ESIF strategy and specifically furtherance of the area's comparative advantage in the low-carbon / energy sector.	<p>From a research and infrastructure perspective the SEND project has been highly successful in furthering the SSLEP's comparative advantage in this field. The infrastructure will continue to provide significant value for researchers long beyond the lifetime of this ERDF project.</p> <p>However, there is little evidence to suggest that the SEND project has successfully furthered the SSLEP's comparative advantage in terms of the readiness of it's SMEs. This may be due to the tendency for large businesses to dominate in this sector.</p>	

## 7.2 Recommendations

On the basis of the evaluation work undertaken, the following recommendations are outlined for the SEND project:

To support delivery of SEND for the remainder of the infrastructure's lifetime, further work should be developed to consider how the demonstrator can best be exploited for: business engagement, research opportunities and communication about smart networks:

1. **Research** – bring together relevant research teams within the university with leads on the SEND infrastructure to explore and identify key opportunities to draw in research funding that enables the university to exploit and utilise the nationally and internationally significant demonstrator facility
2. **Research** – work with relevant research teams in neighbouring universities, which have relevant strengths complementing those of Keele (e.g. engineering departments) to help identify collaborative opportunities for those teams to work with the Keele SEND facility and attract research funding to exploit the infrastructure
3. **Business support** – cited as one of the strongest aspects of the project, researcher placements provide strong practical knowledge transfer for the researchers while contributing to SSLEPs strategic aim of developing their comparative advantage in low carbon energy sector.
4. **Business support** – for future programmes, seek to open up accessibility for any business support programmes to businesses from beyond the LEP area, recognising that to fully exploit the demonstrator for national economic benefits, it may require working with

businesses from further afield and larger businesses that could gain the most from working with the SEND facility to test their clean energy products and services

5. **Business support** – for those businesses already supported by the project (and additional business supported over the remainder of the programme period), review how many of these businesses directly utilised the SEND infrastructure, and for those that did, identify how these link with the opportunities indicated under the seven value packs of the infrastructure investment (outlined in Section 2.5.1 of this study), in order to identify which elements of the infrastructure have been most valuable so far, and where there are gaps. Feedback loops could also be built in to better understand beneficiary perspectives on quality of support on an ongoing basis. Enhancing this understanding will help focus future marketing and communications work around business support
6. **Communications** – develop the messaging around what the infrastructure incorporates, how it can be used and the potential benefits for different stakeholders groups
7. **Communications** – integrate feedback collection into business engagement to ensure a better idea of which aspects of the project are working particularly well and which could be improved. A greater understanding of SEND’s impact on businesses will likely also support in the search for further research funding.

# Appendix A

Table A.1: List of stakeholders interviewed for SEND Final Evaluation

Name	Role	Organisation
Professor Zhong Fan	SEND Academic Director	Keele University
Professor Eran Edrisinghe	Pro Vice Chancellor of Research	Keele University
Dr Ben Herbert	Director	Stopford Consulting
Victor Sellwood	Consultant	Siemens Group
Ian Shaw	SEND Operations Engineering Manager	Keele University
Mark Turner	Send Business Development and Engagement Manager	Keele University
Rob Meadows	Marketing and Communications Officer	Keele University

# Appendix B

Although no beneficiary survey was undertaken for the final evaluation, the report makes use of the survey distributed as part of the interim evaluation for SEND.

The interim beneficiary survey was issued online, using Qualtrics, to all beneficiaries that have had been claimed as a C1 support when the interim evaluation was undertaken (August to October 2021).

The interim survey was issued in August 2021 to beneficiaries with two additional reminder emails sent. In total, 232 beneficiaries were invited to participate in the survey. Of which, 15 completed the survey, eliciting a response rate of 6 percent.

Statistically, at a 90 percent confidence level and a margin of error is 5 percent, survey result findings could be c.21 percent higher or lower for the population as a whole than was found in the survey sample.

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