SHEFFIELD CITY REGION DRAFT ENERGY STRATEGY

Green Heart of Great Britain

Sheffield City Region

SHEFFIELD CITY REGION (SCR)

Geography

<<Insert text>>

Local Enterprise Partnership

<<Insert text>>

Mayoral Combined Authority

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Our Economy

The economy in South Yorkshire is not dominated by a single sector or type of industry. Instead there is a diverse base which includes advanced manufacturing, high performance materials, transport and logistics as well as significant business services; all benefitting from close links to two world-class Universities and an enterprising public sector. Yet, within South Yorkshire the productivity levels and wages are low, employment rates and entrepreneurship are below the national average, and growth is slow[1].

The refreshed Strategic Economic Plan (SEP) focusses on ways to improve this picture including taking advantage of those sectors which offer increased growth and productivity. Productivity has several drivers including quality of infrastructure, business growth and innovation expenditure. Furthermore, too many of our citizens are distant from the labour market, not in employment or training, are experiencing poor physical or mental health, and have low or no skills to help them get better jobs. Addressing productivity, therefore, will require intelligent investments in high-quality and innovative sectors like the low carbon energy sector, which is highly productive, and can contribute to South Yorkshire's productivity challenge.

[1] Sheffield City Region – Economic Evidence Base (2019) (LINK; Accessed: DATE)

The low carbon economy is projected to grow 11% per year until 2030; four times faster than the growth of the UK economy as whole[2]. The UK's low carbon and renewable energy (LCRE) economy grew by over 6.8% to £44.5 billion in 2017 of which 28% was in the manufacturing sector[3]. Of the 209,500 jobs in the LCRE sector, 29% were in the manufacturing sector and 9% in the professional and scientific sector. Once the indirect activity is also accounted for, the total turnover from the LCRE economy was £79.6 billion in 2017.

However, a balanced transition will be required to move towards a low carbon economy, with the increased economic investment that it will bring, whilst at least maintaining the competitiveness of key businesses.

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf

[3] ONS – Low carbon and renewable energy economy final estimates (2019) (https://www.ons.gov.uk/redir/eyJhbGciOiJIUzI1NiJ9.eyJpbmRleCI6MSwicGFnZVNpemUiOjEwLCJwYWdlIjoxLCJ1cmkiOiIvZWNvbm9teS9lbnZpcm9ubWVudGFsYWNjb3VudHMvZGF0YXNldHMvbG93Y2FyYm9uYW5kcmVuZXdhYmxlZW5lcmd5ZWNvbm9teWZpcnN0ZXN0aW1hdGVzZGF0YXNldCIsImxpc3RUeXBlIjoicmVsYXRlZGRhdGEifQ.nI8MRImQU75J-LbmCVu0RsFfvW82J1g5dOfU7pIvJ_U; Accessed: 05/12/2019)

CONTENTS

LEP BOARD CHAIR & MAYORAL FOREWORD

<< Insert foreword>>

EXECUTIVE SUMMARY

Vision

For South Yorkshire to be recognised as the
'The Green Heart of Great Britain' *with:*

A clean, efficient and resilient energy system, which supports a healthier environment for people to live, work and visit, and which drives our transition to a low carbon economy.

This SCR Energy Strategy sets out the vision, goals, policies and targets in support of the refreshed Strategic Economic Plan (SEP) and has been developed in collaboration with the Department for Business, Energy and Industrial Strategy (BEIS), local authority partners, and stakeholders from academia, business, industry, charity, community groups and members of the public. It provides a strategic framework to give confidence to businesses looking to invest in low carbon energy generation, energy infrastructure, and energy efficiency within South Yorkshire. Over the past 15 years our energy usage and carbon emissions have decreased steadily whilst our economy has grown. This shows that there is no longer a direct link between economic prosperity and reducing our impact on the planet (Figure X) – indeed, quite the opposite. The UK's low carbon economy is projected to grow 11% per year until 2030; four times faster than the growth of the UK economy as whole[4] meaning that there are opportunities for our businesses and industry to take advantage of this market. Doing so will help create jobs, secure new investment, and grow our economy.

This SCR Energy Strategy also seeks to address aspects of social deprivation and health and well-being, and – perhaps most importantly – help to tackle the causes of anthropogenic[5] climate change.

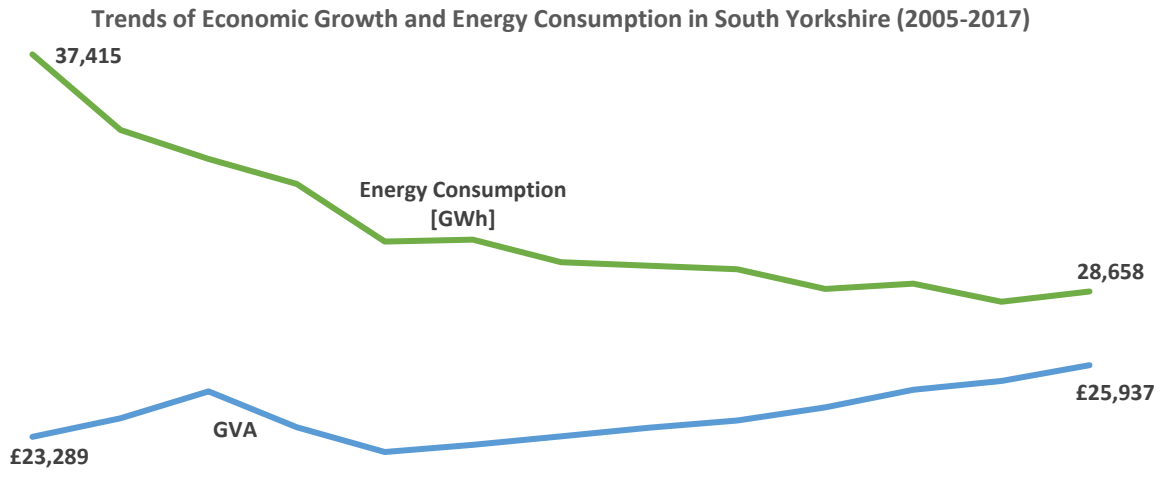


Figure X – The 'decoupling' of economic growth and energy consumption in South Yorkshire

[4] BEIS – Clean Growth Strategy (2017) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf; Accessed: 17/12/2019)
[5] Anthropogenic = from human activity

Our Vision will be achieved by meeting the following Goals:

1. **Drive clean growth and decarbonisation in our local businesses and industry whilst maintaining their competitiveness.**
2. **Promote investment and innovation in low carbon energy generation, distribution and storage.**
3. **Improve the energy efficiency and sustainability of our built environment and encourage communities to be part of the transition.**
4. **Accelerate the transition to ultra-low emission vehicles (ULEVs) and transport systems through modal shift and supporting infrastructure.**

In addition to these Goals, the public sector has a responsibility to lead by example. As such, an SCR Climate Action Plan will be developed to put SCR as an organisation on a path towards net-zero carbon as part of a wider SCR Sustainability Plan setting out how public and private sector bodies, and individuals can contribute.

To succeed, there are many challenges across South Yorkshire that need to be addressed including energy resilience and the current reliance on fossil fuels.

Energy Resilience & Clean Energy Transition

South Yorkshire generates far less electricity than it consumes and has an over reliance on the 'import' of energy as a whole. All of the 'traditional' fossil fuel electricity generation has been decommissioned in South Yorkshire leaving only low carbon generators. However, 83.5% of South Yorkshire's electricity is generated elsewhere and assuming that nationally 50% of this is low carbon, means that over 40% of the electricity consumed is still being generated using fossil fuels.

Although, the direction of travel is the move from fossil fuels such as coal and gas to renewables, as illustrated in the diagram below, fossil fuels will continue to play an important role in energy generation in the short-medium term through the transitional period, as other forms of renewable energy generators are developed and brought on stream. Similarly, it will be important that business competitiveness is not unduly impeded through this transitional period.

***Figure X**: The transition of electricity generation in the UK. The low carbon proportion of electricity generation increased to a record 50.1% in 2017 in contrast to coal whose share decreased to 6.7%.*[6]

South Yorkshire is in a strong position to develop and implement solutions that will place clean growth and energy efficiency at the heart of our economy including the high-value manufacturing industry. There is an opportunity to build on local supply chains and strengths in logistics to become forerunners in this quickly accelerating market. The energy intensive sectors within South Yorkshire present a significant opportunity for transformational energy projects and innovative technologies, which will deliver increased productivity and significant cost savings that benefit the *bottom-line* of businesses. An example of this is the Government's Clean Steel Fund which will consider how hydrogen can be used to decarbonise the steel industry and reduce the reliance on imported natural gas.

[6] Digest of UK Energy Statistics (DUKES) 2018 (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/736148/DUKES_2018.pdf; Accessed: 23/04/19)

Overview of Policies

GOAL 1 – Business & Skills	 **Encourage Clean & Efficient Business Growth** Support businesses to become more efficient and prosper from the high-growth of the low carbon energy sector.	 **Train and Upskill the Energy Workforce** Providing people with opportunity to gain the skills to design, install and maintain our future energy systems.	 **Promote Industrial Decarbonisation** Support industry to both remain competitive and decarbonise. Link to cluster schemes e.g. Zero Carbon Humber.
GOAL 2 – Infrastructure	 **Utilise Current Infrastructure** Make better use of our infrastructure for energy efficiency, low carbon energy generation, or sustainability.	 **Enhance Energy Resilience** Enable the innovation and addition of further generation capacity, storage and balancing technology. Future-proofing with smart technology.	 **Drive Investment in Heat Decarbonisation** Supporting the move to 4/5G heat networks, hydrogen for heat, and electrification of heat.
GOAL 3 – Built Environment	 **Improve the Energy Efficiency of Existing Dwellings** Improve the energy efficiency of the current housing stock to reduce costs and support our most vulnerable residents.	 **Increase the Standard of New Build Dwellings** Move towards all new-build dwellings having high levels of energy efficiency with EV charging points and smart technology.	 **Enable Community Energy Schemes** Work closely with community groups to develop and support community schemes across South Yorkshire.
GOAL 4 – Transport	 **Inspire Modal Shift Towards Active Travel** Promote and incentivise Active Travel where possible. Providing the infrastructure to allow the shift to happen.	 **Deliver a Clean Transport Network** Work with partners to ensure South Yorkshire moves to a zero-carbon transport network.	 **Accelerate the Uptake of ULEVs** Accelerate the transition to ultra-low emission vehicles and the roll-out of the required refuelling infrastructure.

Overview of Targets (Initial DRAFT examples - subject to consideration)

Net-zero CO_2 emissions by 2040

GOAL 1 – Business & Skills	• 90% of commercial lighting is LEDs by 2040. • 1,500 jobs created in the low carbon and renewable energy sector by 2040.	• Provide 2,000 people with training for the low carbon and renewable energy sector.	• Establish 5 low carbon clusters in South Yorkshire by 2040.
GOAL 2 – Infrastructure	• At least 5 minewater energy schemes operational by 2040.	• Increase solar PV capacity to 1.3GW by 2040. • Increase onshore wind capacity to 0.9GW by 2040.	• 90% low carbon heating penetration (or hydrogen-ready) by 2040.
GOAL 3 – Built Environment	• 100,000 cavity walls insulated by 2040. • 125,000 solid walls insulated by 2040.	• No fossil fuel heating in new homes from 2025. • All new homes to be built close to PassivHaus standard from 2030.	• Double the number of community energy organisations in South Yorkshire by 2040. • 100kW per year of community energy by 2030.
GOAL 4 – Transport	• 10% reduction in car miles by 2030, rising to a 25% reduction in 2040.	• Fully zero-emission public transport network by 2035.	• Fully zero-emission private hire fleet by 2035.

INTRODUCTION

International Context

In 2013, the concentration of CO_2 in the global atmosphere breached the 400 parts per million (ppm) barrier for the first time in human history[7]. In response to this, the international community have signed several treaties aiming to limit the emission of greenhouse gases. The most notable of which being the Kyoto Protocol and the Paris Agreement/Accord. The Paris Agreement came into force in November 2016 and pledged to act to limit the average global temperature rise to 2°C with an aim to remain below 1.5°C warming. The Intergovernmental Panel on Climate Change (IPCC) published a Special Report on Global Warming in October 2018, which reported that *'Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate'.* (REF) Some of the impacts of this temperature increase will be long-lasting or irreversible, such as the loss of some ecosystems.

In November 2019, the European Parliament declared a 'Climate and Environmental Emergency' and urged all EU countries to commit to net-zero greenhouse gas emissions by 2050 (REF). Many developed and developing countries are committed to moving towards a cleaner energy future, although there is a significant proportion that are still to commit to wholesale changes.

National Context

The UK's Industrial Strategy was published in 2018 (REF) and sets out the Government's plan to create an economy that boosts productivity and earning power throughout the UK. It sets Four Grand Challenges where the UK can lead the global technological revolution:

- **Clean Growth**: maximising advantages for UK industry from the global shift to clean growth.
- **Artificial Intelligence (AI) and Data Economy**: putting the UK at the forefront of AI and data revolution.
- **Future of Mobility**: being a world lead in shaping the future of mobility.
- **Ageing Society**: harnessing the power of innovation to help meet needs of an ageing society.

These challenges each have strong links with the energy and low carbon sectors and with economic growth. The UK Industrial Strategy highlights several ways in which we will need to consider low carbon energy and energy efficiency to build an economy that works for everyone. These include:

- Upgrading energy infrastructure to enable growth and support new technologies;
- Delivering affordable energy and keeping energy costs down for businesses;
- Delivering clean growth and securing the economic benefits of the transition to a low carbon economy;
- Investing in science, research and innovation, including energy storage and grid technologies; and
- Supporting businesses to start and grow.

The Industrial Strategy recognises that LEPs will play an important part in supporting local growth, and emphasises the importance of collaboration between LEPs, alongside the need for policy flexibility at the regional level. In terms of funding, Government recognises that LEPs require financial support to be effective. Additional financial resources will be made available to LEPs that demonstrate ambitious levels of reform.

The Clean Growth Strategy (CGS), published in 2017 (REF), provides an ambitious blueprint for Britain's low carbon future, outlining how investment in green energy goes together with economic growth and placing clean growth at the centre of the Industrial Strategy. Core to the CGS are:

- **Accelerating Clean Growth**: developing world leading 'Green Finance' capabilities.

[7] NASA Climate Change (https://climate.nasa.gov/climate_resources/7/graphic-carbon-dioxide-hits-new-high/; Accessed: 20/07/2018)

- **Improving our Homes**; upgrading energy efficiency; strengthening building standards; rolling out heat networks; phasing out of high carbon heating.
- **Accelerating the Shift to Low Carbon Transport**: supporting the uptake of ULEVs; developing an EV charging network; shifting freight from road to rail; and battery technology.
- **Delivering Clean, Smart, Flexible Power**: phasing-out of coal, developing new ways of grid balancing through storage and demand response.
- **Improving Business and Industry Efficiency**: improving energy productivity and commercial building standards; delivering industrial energy efficiency; investing in industrial innovation.
- **Enhancing the Benefits and Value of Our Natural Resources**: a new network of forests; zero avoidable waste by 2050.
- **Leading in the Public Sector**: setting a voluntary public sector carbon reduction target; funding energy efficiency improvements in England.

What is Net-Zero?

"'Net-zero' emissions means that the total of active removals from the atmosphere offsets any remaining emissions from the rest of the economy."

i.e. all efforts are made to reduce emissions to zero but all residual emissions are offset by removing emissions from the atmosphere.

In May 2019, the Committee on Climate Change recommended that the "The UK should legislate as *soon as possible to reach net-zero greenhouse gas emissions by 2050. The target can be legislated as a 100% reduction in greenhouse gases (GHGs) from 1990 and should cover all sectors of the economy, including international aviation and shipping."*[8]. This recommendation was accepted by the UK Government and in June 2019, the UK became the first major economy to legislate for net-zero[9].

In November 2020, the UK will host COP26[10] – the United Nations Framework Convention on Climate Change meeting of governments which will be working to develop the international response to the climate emergency.

Local Context

In November 2019, the Mayoral Combined Authority of Sheffield City Region declared that we were in a 'Climate and Environmental Emergency'[11] . This followed declarations by Barnsley Metropolitan Borough Council, Doncaster Metropolitan Borough Council and Sheffield City Council earlier in 2019. Rotherham Metropolitan Borough Council is currently considering a similar position.

Purpose and Scope of the SCR Energy Strategy

The Department for Business, Energy, and Industrial Strategy (BEIS) are delivering a Local Energy Programme, which intends to enhance the levels of support that LEPs will receive when delivering low carbon projects. The first phase of this programme provided funding to all LEPs in England to support them in developing a bold, coherent and well-evidenced Energy Strategy, with an emphasis on identifying investable projects which enhance decarbonisation opportunities across their regions.

[8] CCC – Net-Zero: The UK's Contribution to Stopping Global Warming (https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf), May 2019
[9] House of Commons Library – The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (2019) (https://www.legislation.gov.uk/ukdsi/2019/9780111187654/pdfs/ukdsi_9780111187654_en.pdf; Accessed: 18/12/2019)
[10] UNFCCC – UK to host COP26 (25 Sep 2019) (https://unfccc.int/news/united-kingdom-in-partnership-with-italy-to-host-cop-26/cmp-16/cma-3; Accessed: 18/12/2017)
[11] SCR – Minutes of Mayoral Combined Authority Meeting (09 Nov 2019) (https://moderngov.sheffieldcityregion.org.uk/documents/g173/Printed%20minutes%2018th-Nov-2019%2014.00%20SCR%20-%20Mayoral%20Combined%20Authority%20Board.pdf?T=1; Accessed: 20/12/2019)

This SCR Energy Strategy will set the framework for South Yorkshire's transition to a 'net-zero carbon' economy whilst taking advantage of the significant economic opportunities that it will unlock. In order to maximise the local economic benefit associated with the transition, areas of competitive advantage have been identified that can be utilised, including those brought by existing businesses, educational institutions, communities, and existing infrastructure. SCR has a unique opportunity to stimulate innovative investment opportunities in the low carbon energy sector to develop and decarbonise the South Yorkshire economy.

The SCR Independent Economic Review in 2013 (REF) noted that South Yorkshire's "technology, manufacturing and engineering offer is as good as anywhere in Western Europe with a world-leading cluster of research institutes and innovative businesses centred around the Advanced Manufacturing Park". While the Science and Innovation Audit carried out by BEIS in 2016 (REF) identified energy as a key sector that provides the potential for economic growth based on its science base.

This SCR Energy Strategy therefore highlights the areas where the SCR can have the greatest impact in terms of leading the rapid decarbonisation required in South Yorkshire, and those areas where partners will be required to take the lead with SCR's support. It is important that this SCR Energy Strategy is not seen as an end-point – it is much more a starting-point to meet the decarbonisation and economic aspirations of South Yorkshire, whilst maintaining energy resilience and not unduly impacting on the competitiveness of local businesses.

This will require close collaboration with our local, regional and national partners in a co-ordinated way to seek opportunities and to jointly invest in our low carbon future.

VISION AND GOALS

Vision

For South Yorkshire to be recognised as the
'The Green Heart of Great Britain' *with:*

A clean, efficient and resilient energy system, which supports a healthier environment for people to live, work and visit, and which drives our transition to a low carbon economy.

Goals

Four high-level Goals have been established to support the Vision. Within each of these Goals, three Policies have been developed (Section X) to highlight specific areas of action.

1	Drive clean growth and decarbonisation in our local businesses and industry whilst maintaining their competitiveness.
2	Promote investment and innovation in low carbon energy generation, distribution and storage.
3	Improve the energy efficiency and sustainability of our built environment, and encourage communities to be part of the transition.
4	Accelerate the transition to ultra-low emission vehicles (ULEVs) and transport systems through modal shift and supporting infrastructure.

The evidence supporting the Vision and these Goals is given in the following Sections.

ENERGY

Energy Consumption

In 2017, South Yorkshire consumed a total of 28.7 TWh of energy. This represents a 23.4% decrease on 2005 levels (FIGURE X) [12]. The reduction in energy use has been seen across transport, domestic, and industry and commercial; but the reduction has not been evenly distributed across the economy with industry reducing its consumption by over one-third[13] and transport reducing its consumption by only 5% owing mainly to increasing passenger-km travelled (REF).

Much like the rest of England, South Yorkshire's energy use is fairly evenly split between transport (32%), domestic (34%), and industry and commercial (34%)[14]. However, there is a fairly large difference between the four Local Authority areas with the energy use in transport varying between 23% and 42% depending on the LA (FIGURE X).

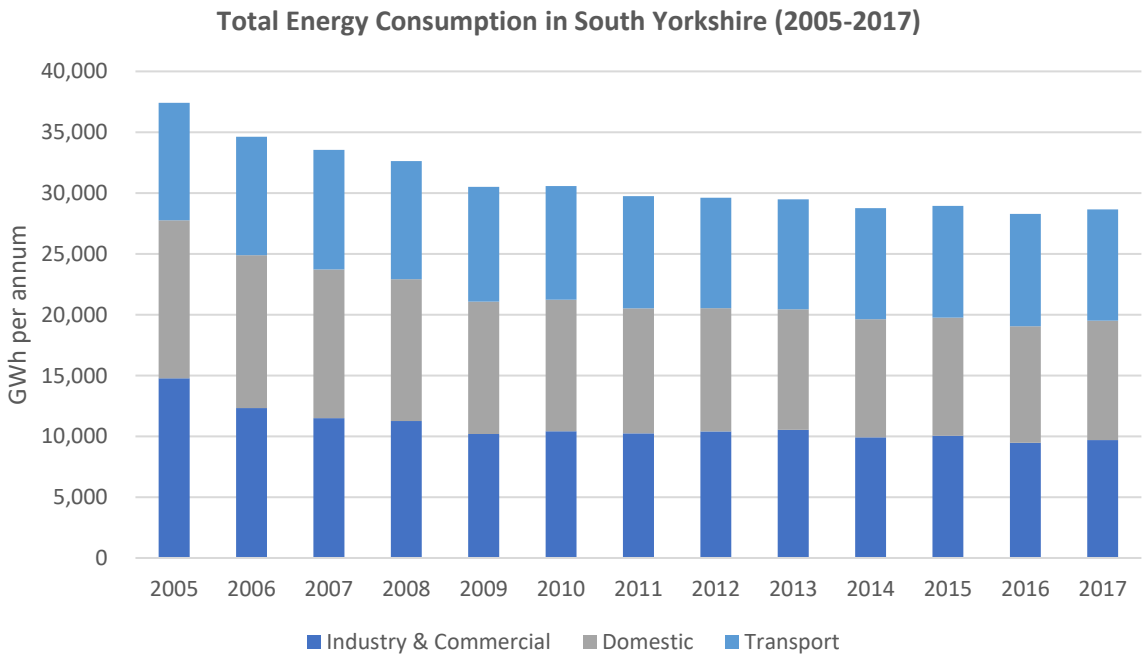


Figure X – Total Energy Consumption for South Yorkshire between 2005 and 2017

[12] BEIS – Sub-national total final energy consumption statistics (2019): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833987/Sub-national-total-final-energy-consumption-statistics_2005-2017.xlsx [Accessed: 30/10/2019].

[13] Although a proportion of this reduction is due to the closure of some energy intensive industry within South Yorkshire rather than efficiency gains.

[14] BEIS – Sub-national total final energy consumption statistics (2019): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833987/Sub-national-total-final-energy-consumption-statistics_2005-2017.xlsx [Accessed: 30/10/2019].

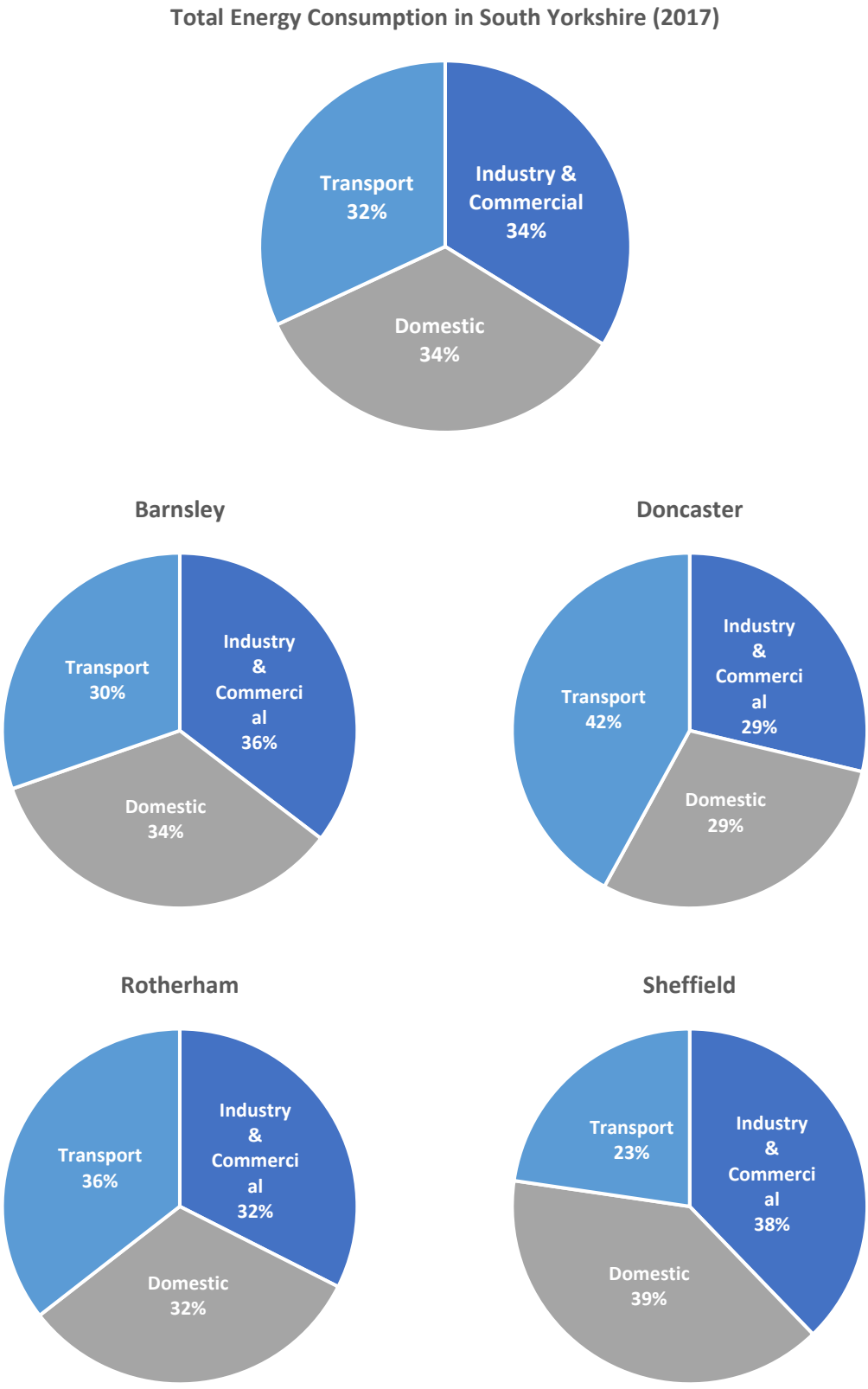


Figure X – Total Energy Consumption for each Local Authority in South Yorkshire in 2017[15]

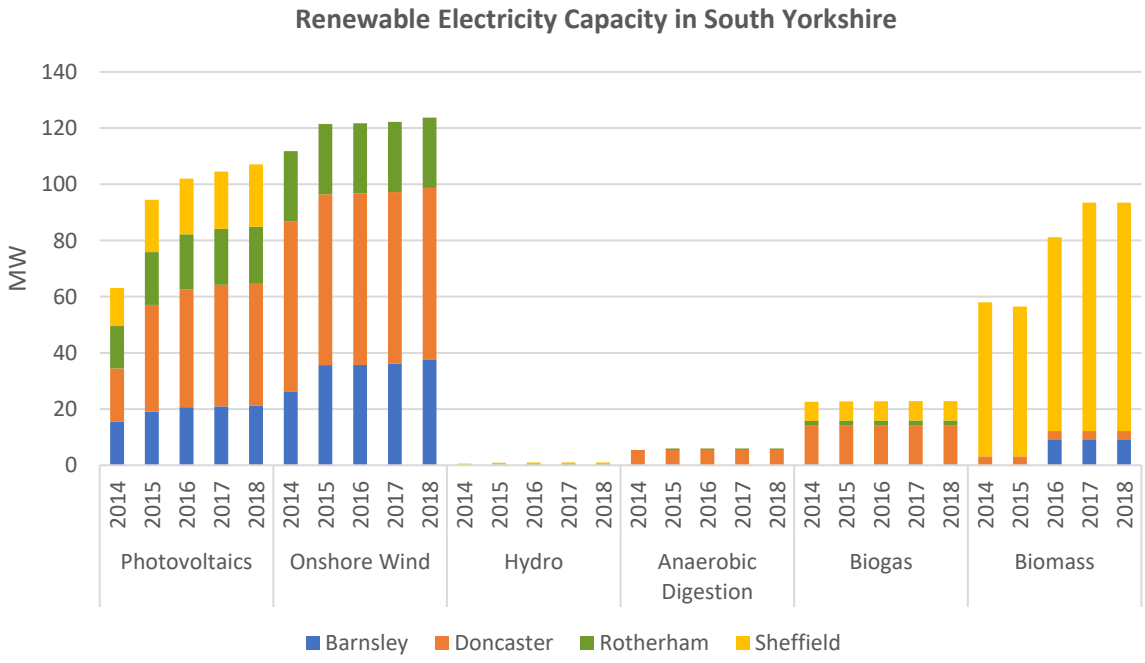
[15] BEIS – Sub-national Total Final Energy Consumption Statistics (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833987/Sub-national-total-final-energy-consumption-statistics_2005-2017.xlsx; Accessed 31/10/2019)

Most of the energy that is consumed in South Yorkshire is produced from fossil fuels. Petrol and diesel still dominate in the transport sector, with natural gas dominating in the domestic and industry and commercial sectors. Overall, fossil fuels still account for 89% of South Yorkshire's energy supply with renewables, bioenergy and waste accounting for a small but growing proportion (11%). Fossil fuels therefore will be a required – but reducing – part of the energy landscape in the short-to-medium term.

Smart technologies are increasingly important in alleviating strain on the electricity network and meeting the demands of new patterns and types of energy consumption. They do this through increasing flexibility by shifting some of the demand to off-peak times, matching demand with generation, and digitising energy. This will reduce the extent to which large scale replacement and upgrading works will need to be carried out on the electricity network thus keeping costs down for consumers. Demand-side response (DSR) is a proven way in which to reduce the effect of electricity consumption on the network by shifting usage from periods of high consumption (peaks) to periods of low consumption (troughs). Typically, the consumer receives a financial incentive to reduce usage on non-essential items when there is high demand or reduced supply, or a financial incentive can even be given to use power when there is an excess of supply e.g. a windy day. This provides the suppliers with a more stable load, and consumers with the opportunity to reduce their bills. Currently, DSR is underutilised within South Yorkshire but is becoming increasingly more accessible.

Electricity Generation

South Yorkshire's electricity generation is very low owing to having limited generation capacity (Figure X). In 2017, South Yorkshire consumed 5,399 GWh[16] of electricity but only generated 16.5% (892 GWh[17]) through renewable generation (Figure X). This shows that we will likely rely on power from outside of South Yorkshire for the foreseeable future due to the increased consumption associated with the move towards electric vehicles and electrification of heat.



[16] BEIS – Sub-national total final energy consumption statistics (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833987/Sub-national-total-final-energy-consumption-statistics_2005-2017.xlsx; Accessed: 30/10/2019)

[17] BEIS – Renewable Electricity by Local Authority (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834142/Renewable_electricity_by_local_authority_2014_to_2018.xlsx; Accessed: 13/11/2019)

Figure X – Renewable electricity capacity in South Yorkshire [MW][18]

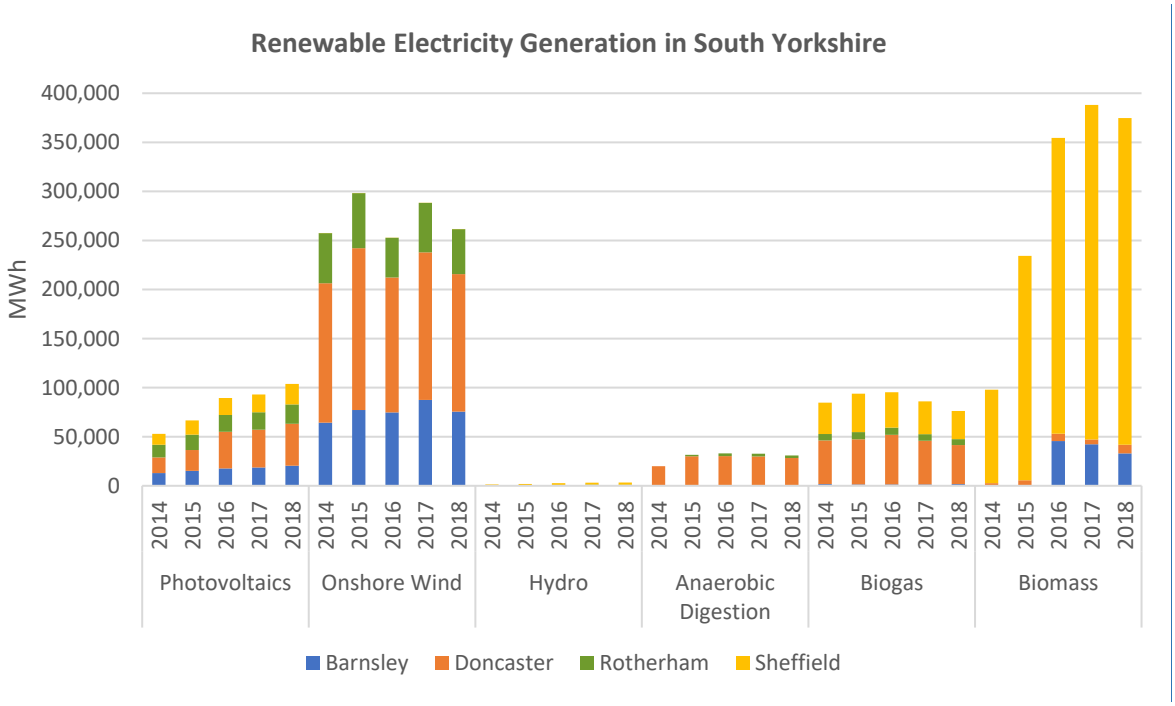


Figure X – Renewable electricity generation in South Yorkshire [MWh] [19]

Much of the renewable generation in South Yorkshire comes from the Blackburn Meadows Power Station[20]: a 29MW_e and 25MW_{th} capacity biomass-CHP power station operated by E.On whose district heat network supplied Sheffield Arena, Sheffield Forgemasters, and IKEA. The opening of Templeborough Biomass Power Plant in 2019 which has a capacity of 41MW_e (enough to supply electricity to over 78,000 dwellings[21]) further increases South Yorkshire's biomass generation.

Onshore wind contributes over 250 GWh of electricity to South Yorkshire; the largest proportion of which comes from Doncaster which has seven onshore windfarms including: an 8.2MW farm at Marr, an 8.2MW farm at Hampole, and a 44MW farm at Tween Bridge Moor – the largest in South Yorkshire (Figure X). Rotherham has a 20.4MW onshore wind farm at Penny Hill[22].

[18] BEIS – Renewable Electricity by Local Authority (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834142/Renewable_electricity_by_local_authority_2014_to_2018.xlsx; Accessed: 13/11/2019)

[19] BEIS – Renewable Electricity by Local Authority (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834142/Renewable_electricity_by_local_authority_2014_to_2018.xlsx; Accessed: 13/11/2019)

[20] Blackburn Meadows Biomass Power Plant (https://www.eonenergy.com/business/why-eon/case-studies/blackburn-meadows.html; Accessed: 04/12/2019)

[21] Templeborough Biomass Power Plant (https://www.templeboroughbiomass.com/templeborough-biomass-power-plant/; Accessed: 04/12/2019)

[22] Penny Hill Wind Farm (https://www.banksgroup.co.uk/projects/renewables/penny-hill/; Accessed: 04/12/2019)

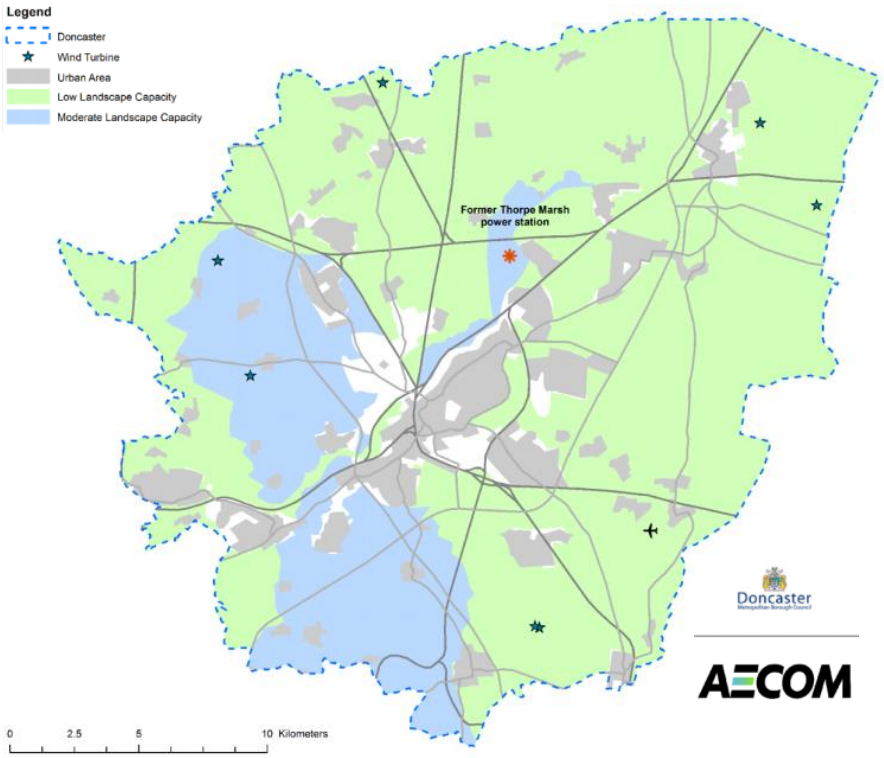


Figure X – Location of wind farms in Doncaster Borough (adapted from the Doncaster Local Plan (REF))

Whilst solar PV has a lot of capacity within South Yorkshire, its capacity factor is low meaning that the amount generated is relatively low. Yet, one of the region's solar PV successes is Energise Barnsley which was set up to deliver community-owned renewable energy, energy efficiency and energy supply projects. As of October 2019, Energise Barnsley had 321 domestic installations of solar PV (alongside energy efficiency and battery storage) saving residents an estimated £150,000[23]. Residents of Barnsley were able to invest from £100 with an expected rate of return of 5%.

One source of low carbon electricity not captured in Figure X is the contribution of EfW (energy from waste). In Sheffield, the Veolia EfW plant has an electrical generation capacity of 21MW_e which feeds into the national distribution network and, via private wire, recharges the batteries on their two electric refuse collection vehicles (REF). In addition to this, there is a 3MW_e EfW plant in Doncaster, and a planned 20MW_e EfW site at Haughton Main in Barnsley.

Electricity Storage

There is not a significant amount of existing electrical storage capacity in South Yorkshire at the moment, however this is seen as a growth area for the region. Currently, there is over 90MW of electrical battery capacity with planning permission granted in South Yorkshire for an additional 60MW already operational (Table X).

Table X – Location and capacity of electricity storage systems in South Yorkshire[24]

Location	Battery Capacity	Development Status
Nether Moor Field	49.9 MW	Awaiting Construction
Tofts Lane	40.0 MW	Operational

[23] CRESR – Catalysing People-Powered Energy in Yorkshire and the Humber (https://www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/catalysing-people-powered-energy-y&h.pdf; Accessed: 19/12/2019)
[24] Renewable Energy Planning Database (REPD) – September 2019 (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839368/Public-Database-September-2019.xlsx; Accessed: 13/12/2019)

Aven Industrial Estate	20.0 MW	Awaiting Construction
Petre Street	20.0 MW	Operational
Long Lands Lane	12.0 MW	Awaiting Construction
Blackburn Meadows	10.0 MW	Awaiting Construction
Thrybergh Hydro Scheme	300 kW	Awaiting Construction

Although electrical storage deployment has been slow in South Yorkshire, all of the elements required for sector growth are in place. CREESA (see Section X) – part of the University of Sheffield's Energy Institute – are leaders in research and development of electrical storage systems. South Yorkshire is also the location of a number of battery technology companies and in July 2019, SCR provided a Business Investment Fund grant to Ricardo to set up a battery manufacturing and assembly plant in Rotherham for McLaren[25]. Battery re-use and recycling has become increasingly important due to the increased use of the technology in smart phones, EVs, and large-scale electrical storage. CREESA have demonstrated the potential of EV battery 'second life' as support to the electrical distribution network[26]. On a commercial level, RS Bruce in Rotherham are aiming to establish the UK's first lithium battery recycling centre in 2020[27].

Heat Generation

Heat is generated for a variety of reasons and across different sectors. Within the domestic sector, heat energy is used for hot water supply and space heating, and within industry and commerce for process heating and drying processes, amongst many other applications. Heat is also a common waste product across many industries. The easiest and thus most common way to produce heat is through burning combustible matter, typically fossil fuels, which is highly carbon intensive. Technologies have been developed to decarbonise heating, although these are often not as well known or understood by the public or businesses meaning the uptake of technologies such as heat pumps has been low.

The Renewable Heat Incentive (RHI) is a scheme that has been developed to encourage domestic and commercial users to generate heat from renewable sources, these may include: solar thermal systems, heat pumps (air source, ground source or water source), and biomass/biogas boilers. Users of the scheme benefit from payments for every unit of heat energy they generate and use themselves.

Using data[28] from the RHI, it can be seen that domestic and non-domestic sectors across the UK had installed 24MW and 99MW of renewable heating capacity respectively by 2017. Combined, this new capacity accounts for only 3% of the total capacity of installed measures taking advantage of the RHI scheme. Typically, biomass systems are preferred by non-domestic users, covering 97% of all non-domestic capacity. For domestic users, the capacity spread for each technology is more balanced, biomass is still the most preferred (43%), but heat pumps (specifically air source, 39%) also provide a substantial share of capacity (REF).

The Veolia managed Sheffield District Energy Network is the most successful District Heat Network in the UK since its opening in 1988. The District Energy Network now provides over 140 buildings with low carbon energy from un-recyclable waste that would otherwise be sent to landfill. Pipework currently extends 45km under Sheffield saving over 20,000 tonnes of carbon emissions and providing heat to Universities, hospitals, public and private businesses, and dwellings (REF).

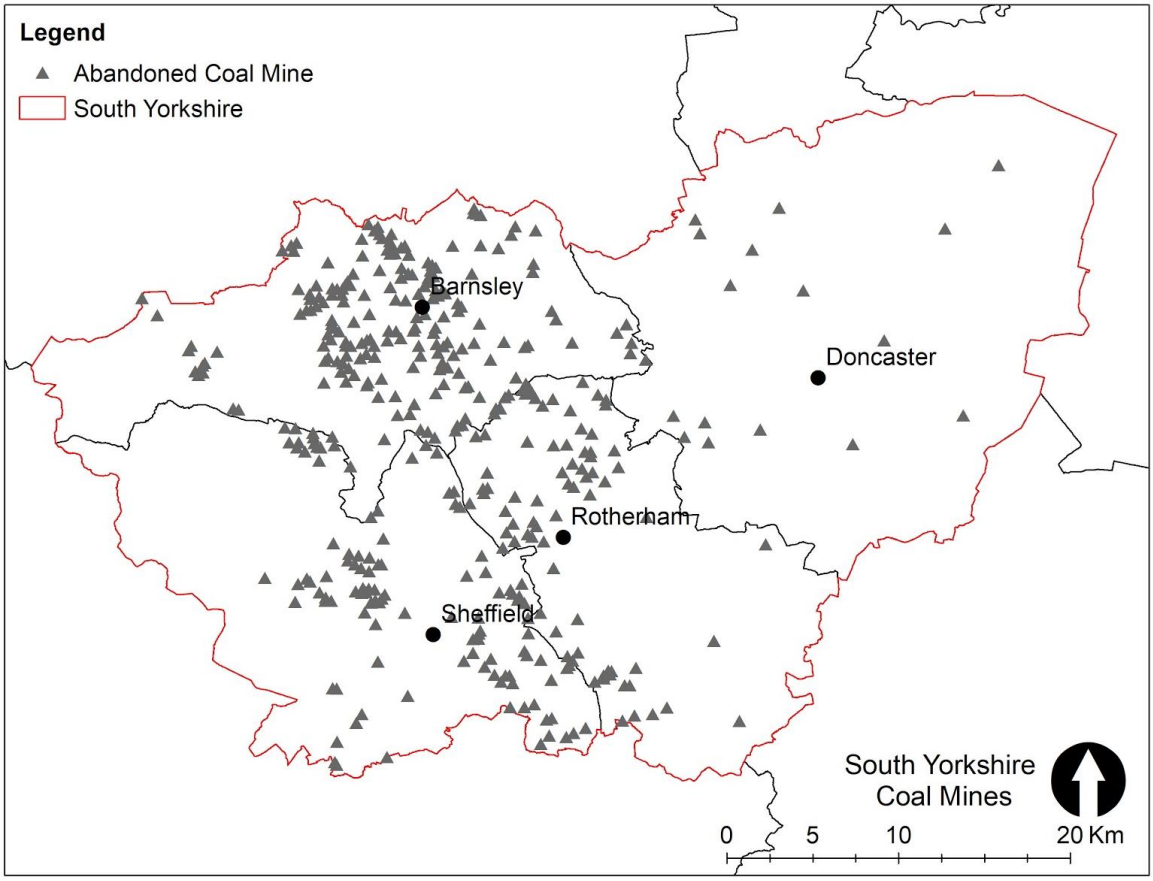
[25] Machinery Market – 'Ricardo plans battery plant for Rotherham' (06 Jul 2019) (https://www.machinery-market.co.uk/news/24247/Ricardo-plans-battery-plant-for-Rotherham; Accessed: 13/12/2019)
[26] University of Sheffield (CREESA) – Willenhall Project Facts (https://www.sheffield.ac.uk/creesa/willenhall/facts; Accessed: 18/12/2019)
[27] RS Bruce – R S Bruce 'supercharges' its battery recycling ambitions (https://rsbruce.com/lithium-ion-battery-recycling/; Accessed: 17/12/2019)
[28] BEIS – Renewable Heat Incentive Statistics (https://www.gov.uk/government/collections/renewable-heat-incentive-statistics; Accessed: 21/11/2019)

The idea of using hydrogen gas to replace natural gas for domestic heating has gained traction in recent years. The UK government and the wider industry have several large-scale innovation projects investigating the potential including H21[29] , and Hy4Heat[30] . Hydrogen used to make up 50-60% of the UK's 'town' gas supply in the mid-20th century, but now only 0.1% of hydrogen is allowed within the gas network[31]. Research[32] is currently ongoing at Keele University to understand the impact of increasing the percentage of hydrogen in the gas network to 20%.

Heat Storage

There is little or no heat storage currently within South Yorkshire, but new opportunities exist, but will require demonstration projects to prove technical and commercial viability for 'scaling up' schemes, if they are to play a significant role in the future energy mix.

One such opportunity is to build on South Yorkshire's mining heritage, and explore the use of geothermal energy from abandoned mines could be a key form of low carbon energy production in the future – particularly in areas where a decarbonised 'gas' network is not present. These legacy subterranean structures can also be used to store thermal energy (from waste heat or purposefully generated solar heat) generated during summer months for use during the winter – 'inter-seasonal storage' (Figure X). It is essential that these assets are exploited if commercially viable opportunities can be demonstrated, such that South Yorkshire becomes a front runner in developing former coalmines for use in energy schemes and thereafter benefitting from a variety of first-mover advantages in the market.



[29] Northern Gas Networks – H21 (2017) (https://www.northerngasnetworks.co.uk/wp-content/uploads/2017/04/H21-Report-Interactive-PDF-July-2016.compressed.pdf; Accessed: 21/11/2019)
[30] Hy4Heat (https://www.hy4heat.info/; Accessed: 21/11/2019)
[31] Gas Safety (Management) Regulation 1996 – Schedule 3 (Content and other characteristics of gas) (http://www.legislation.gov.uk/uksi/1996/551/schedule/3/made; Accessed: 22/11/2019)
[32] HyDeploy (https://hydeploy.co.uk/; Accessed: 21/11/2019)

Figure X – The distribution of the 400+ mines throughout South Yorkshire[33]

Community Energy

Community energy projects are a perfect way to accelerate the deployment of distributed energy, putting individuals at the heart of energy systems. These schemes can deliver an array of benefits resulting in improved resilience, education, and empowerment for local communities; a great example of this in action is Energise Barnsley, the largest local authority and community energy solar PV and battery storage project in the UK. But overall, South Yorkshire has a relatively low number of community energy projects per resident compared to the South West or London (Figure X). Barriers to deployment include: changes in national policy e.g. feed in tariffs, capacity of volunteers and staff, economies of scale, connections to investors, access to sites, high risk-aversion, and costs associated with connecting to the electricity distribution network[34].

By working with local authorities, the wider public and the voluntary sector, the development of more community energy schemes will be encouraged. Community Energy England – whose headquarters are in Sheffield – will be a key partner in this area and helping to achieve some of the recommendations in the 'Catalysing People-Powered Energy in Yorkshire and the Humber' report by the Centre for Regional Economic and Social Research at Sheffield Hallam University. It is also important that local communities can invest in the energy infrastructure of South Yorkshire.

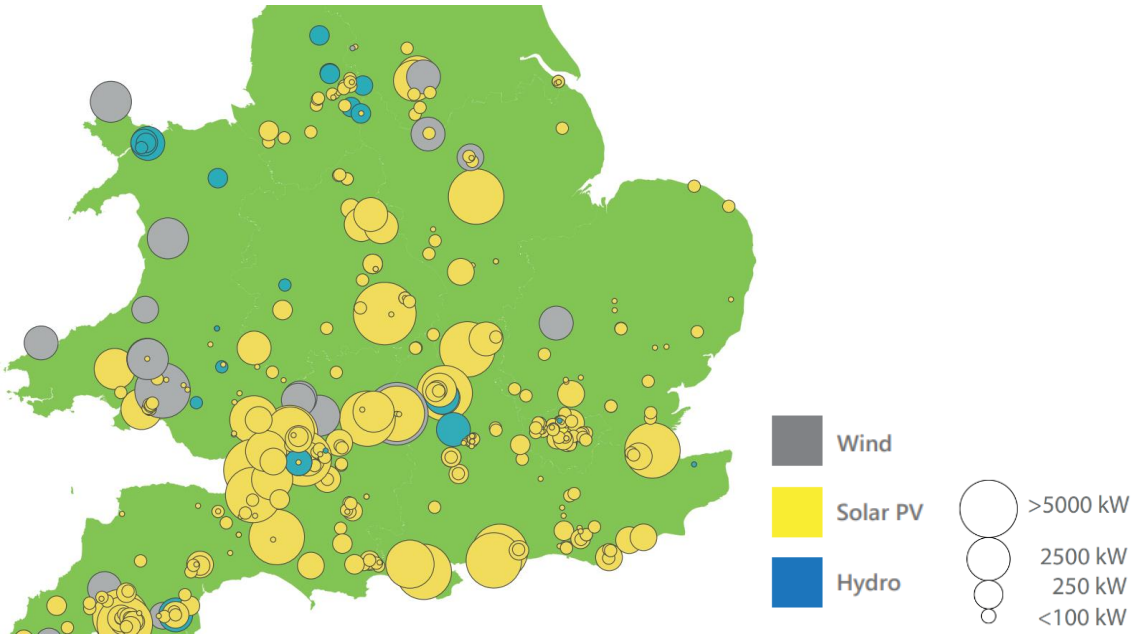


Figure X – Total electricity generation capacity from community energy schemes[35]

[33] University of Sheffield – Energy Strategy Provocation (2019) (https://moderngov.sheffieldcityregion.org.uk/documents/s1865/Appendix%201%20University%20of%20Sheffield%20Provocation%20Draft%20Final%20Report.pdf; Accessed: 11/11/2019)

[34] CRESR – Catalysing People-Powered Energy in Yorkshire and the Humber (https://www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/catalysing-people-powered-energy-y&h.pdf; Accessed: 19/12/2019)

[35] Adapted from: Community Energy England – State of Sector 2019 (2019) (https://communityenergyengland.org/files/document/327/1564062173_SOTS19_Infographicsv.1.3StandardQuality.pdf; Accessed: 04/12/2019)

BUILT ENVIRONMENT

Existing Housing Stock

Our population is forecast to grow by 9.3% between 2016 and 2041[36]. At the same time, predicted trends suggest that the average household size will reduce because of the increase in single person households (REF). These trends put more pressure on our existing housing stock, and we need more new houses to support economic and population growth as well as to meet the demands of an ageing population.

Overall, South Yorkshire includes a significant proportion of older homes which are difficult to heat, and some, particularly in the private rented sector, are poorly maintained. In contrast, the majority of social housing and housing association stock is largely in a good condition due to significant public investment. However, these need ongoing maintenance and further investment can help to reduce the costs of heating for residents meaning they have more disposable income.

An Energy Performance Certificate (EPC) is an indicator of the energy efficiency of a dwelling[37]. Across England in 2017, the average EPC rating was a 'D' with a score of 62 points[38] (Figure X). The typical energy bill of a dwelling with a 'C' rating is around £270 lower than a 'D' rated dwelling, and £650 lower than an 'E' rated dwelling[39]. Using these figures, if all dwellings in South Yorkshire were brought up to a C rating, this would save residents over £250m per year[40].

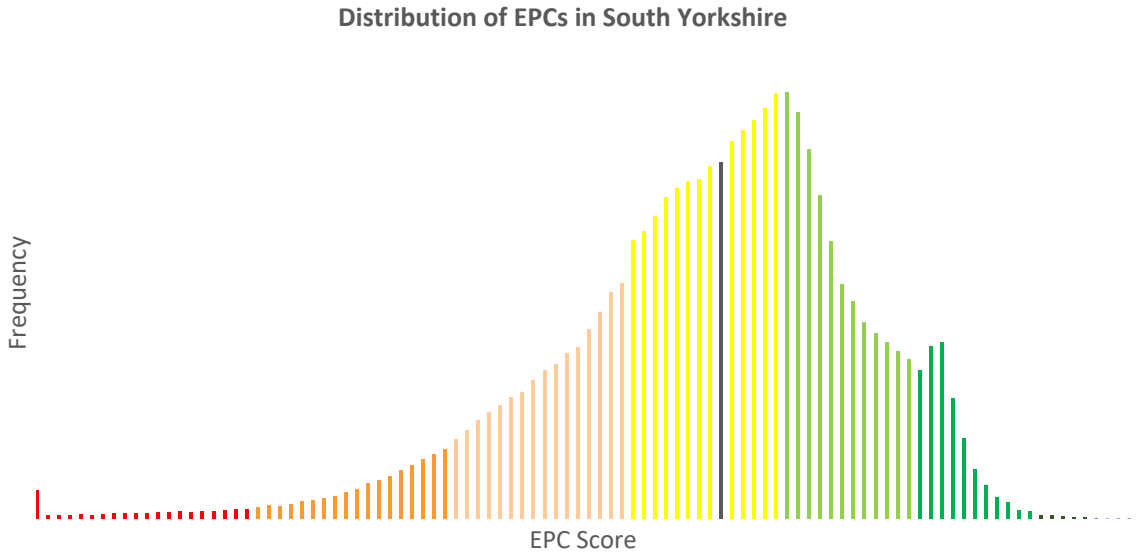


Figure X – Frequency of EPC score in South Yorkshire (2005-2016)[41] with 1 on the left to 100 on the right (average rating in England shown in grey).

[36] ONS - Population projections for local authorities (https://www.ons.gov.uk/file?uri=%2fpeoplepopulationandcommunity%2fpopulationandmigration%2fpopulationprojections%2fdatasets%2flocalauthoritiesinenglandtable2%2f2016based/table2.xls; Accessed 02/12/2019)

[37] Note: An EPC is only required on the transfer (sale/rent) of a dwelling and therefore the EPC database does not include each dwelling in South Yorkshire but is likely to be representative.

[38] MHCLG – English Housing Survey Headline Report (2017-18) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834603/2017-18_EHS_Headline_Report.pdf; Accessed 04/12/2019)

[39] BEIS – Call for Evidence: Building a Market for Energy Efficiency (2017) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653731/Call_for_Evidence_-_Building_a_Market_for_Energy_Efficiency_Final.pdf; Accessed 04/12/2019)

[40] Number of dwellings in South Yorkshire = approx.. 586,000. 586

[41] MHCLG – Energy Performance of Buildings data: England and Wales (https://epc.opendatacommunities.org/; Accessed: 16/08/2019)

Figure X shows that South Yorkshire has a typical energy consumption trend, mirroring the trend for Great Britain as a whole, butt more will need to be done to reduce the amount that residents are spending on their energy bills. Figure X shows that South Yorkshire as a whole has a far lower median electricity consumption compared to England as a whole. This could be the result of better behaviours such as not leaving electrical equipment on when not in use, or technological improvements such as LED lighting. Nevertheless, this still results in an electricity bill of over £450 per year[42] per household (a total of £267m across South Yorkshire) compared to the national average of £495 per year.

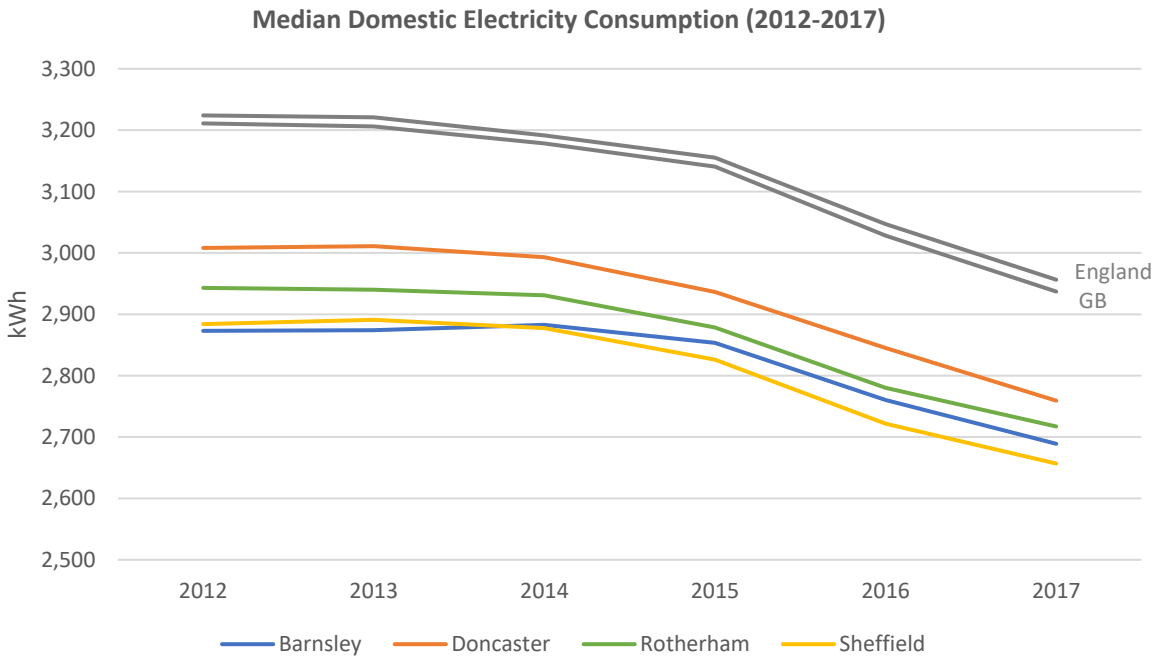


Figure X – Median domestic electricity consumption in South Yorkshire compared to England and GB[43]

The median domestic gas consumption in England is 12,300 kWh per year[44] equating to around £515[45]. Some LSOAs (lower super output areas) in South Yorkshire are using far beyond this (Figure X) but the reasons are not fully known – it could be that homes are poorly insulated; homes are much larger than average; there is an above average occupancy rate leading to higher cooking and hot water requirements; or a combination of these.

[42] Electricity: 2,700kWh x £0.1500 per kWh = £405 per year. Standing charge: £0.15 per day x 365 days = £54.75 per year. Total = £454.75 per year.

[43] BEIS – Sub-national electricity consumption statistics (2005-2017) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834196/Sub-national_electricity_consumption_statistics_2005-2017.xlsx; Accessed 30/10/2019). Note: Only 2012-2017 data used due to change in methodology.

[44] BEIS – National Energy Efficiency Data-framework (NEED): Summary of Analysis, Great Britain 2019 (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812561/National_Energy_Efficiency_Data_Framework_NEED_report_summary_of_analysis_2019.pdf; Accessed 04/12/2019)

[45] Gas: 12,300kWh x £0.0375 per kWh = £461.25 per year. Standing charge: £0.15 per day x 365 days = £54.75 per year. Total = £516.00 per year.

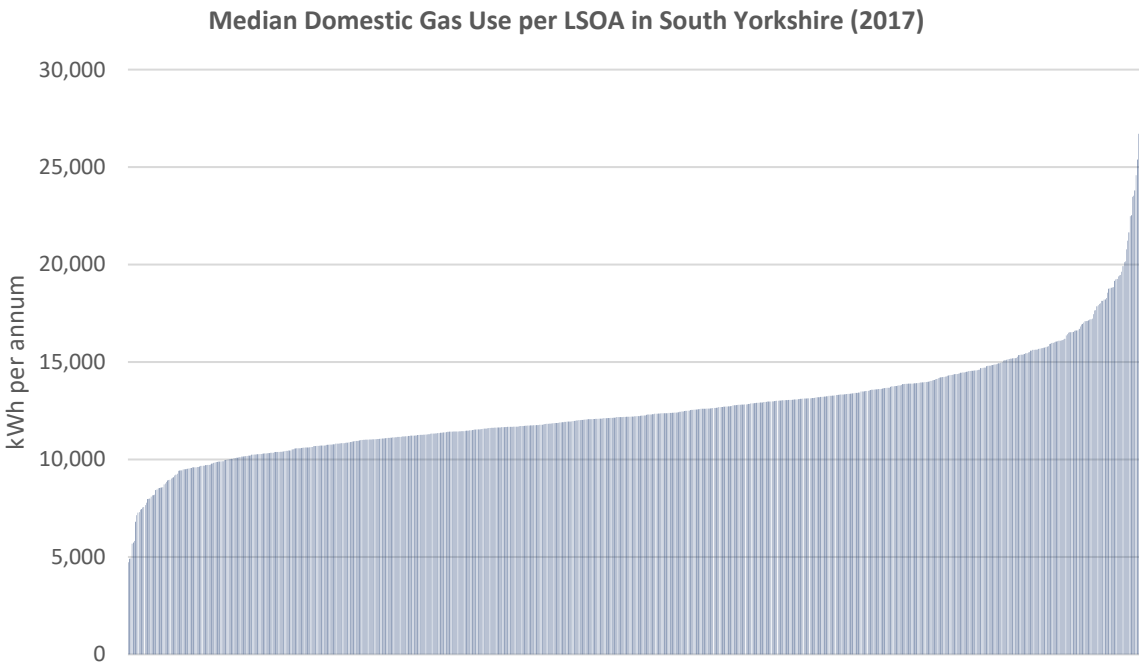


Figure X – Ranked median domestic gas use in each LSOA in South Yorkshire (2017)[46]

Installation of insulation or a new boiler is proven to reduce the gas bills of a dwelling (Table X), in addition to increasing the perceived comfort level. These measures do typically come with a significant price tag which often puts them out of reach for those on the lowest incomes.

Table X – Median gas savings in 2017 for measures installed the previous year and the range of installation costs

Energy Efficiency Measure	Median Savings[47]	Installation Cost[48]
Condensing Boiler	6%	£1,600 – £4,000
Cavity Wall Insulation	7%	£480 – £660
Loft Insulation	4%	£185 – £670
Solid Wall Insulation	13%	£6,800 – £15,000

[46] BEIS – Domestic Gas Consumption by LSOA 2017 (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766981/LSOA_domestic_gas_2017.csv.csv; Accessed: 11/11/2019)

[47] BEIS – National Energy Efficiency Data-framework (NEED): Summary of Analysis, Great Britain 2019 (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812561/National_Energy_Efficiency_Data_Framework__NEED__report_summary_of_analysis_2019.pdf; Accessed 04/12/2019)

[48] BEIS – What does it cost to retrofit homes? (2017) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/656866/BEIS_Update_of_Domestic_Cost_Assumptions_031017.pdf; Accessed: 04/12/2019)

Whilst gas heating is still the most prominent within South Yorkshire, there are a proportion of dwellings who use alternate heating including: electricity, solid fuels, heating oil, and LPG. Approximately 1-in-40 dwellings is not connected to the gas network in South Yorkshire[49] which poses both challenges and opportunities. Assuming that any future hydrogen/bio- gas network will not expand significantly to accommodate these dwellings, this leaves the options of electrification of heat (e.g. air/ground source heat pumps) or mini heat networks connected to a local heat supply (e.g. minewater or waste heat).

Currently, the number of dwellings that have installed a low carbon heating system under the Government's Renewable Heat Incentive is low across South Yorkshire with under 1,400 applications between April 2014 and October 2019[50].

New Housing Stock

The ONS estimate that there will be 79,000 net additions to the housing stock in South Yorkshire between 2017 and 2041[51]. This is slightly lower than the combined 4,000-5,000 per year being planned in Local Plans for the four South Yorkshire Boroughs. It is important to build quality new homes which meet the expectations of reduced running costs of the occupants and take account of the movement away from fossil fuels for heating[52].

Several new housing schemes are being piloted in South Yorkshire to test new housing product innovations such as Passivhaus, modular build, and other higher energy efficient building standards, that lower the energy use of new homes and ensure they are fit for the future. This includes the Citu development at Little Kelham[53] in Sheffield supported by the SCR Housing Fund. The challenge is to learn from these pilots to enable the roll-out of these innovations at greater scale, which would present additional opportunities for up-skilling, local job creation, and local supply chains. In a similar way, community heating networks can also be developed on new housing areas or introduced to existing residential neighbourhoods. For example, Sheffield City Council operates 135 community energy networks covering almost 6,000 council homes (REF). They can enable residents to manage their energy use and costs much more effectively with high tech controls and smart meters as well as low carbon heating systems. New homes in South Yorkshire are increasingly required to be more climate resilient to reduce the impact of climate intensified flooding which will require additional green infrastructure and sustainable urban drainage systems (SUDS) to be installed.

Fuel Poverty & Excess Winter Deaths

A household is considered to be in fuel poverty where[54]:

- they have required fuel costs that are above average
- were they to spend that amount, they would be left with a residual income below the official poverty line

The three main contributors to a household being in fuel poverty are: household income; household energy requirements; and fuel prices.

In 2017, the percentage of households in fuel poverty in South Yorkshire was 10.6%[55]. Indeed, all four of the South Yorkshire local authorities had fuel poverty levels slightly below the England average of 10.9% (Table X), however there is significant variation depending upon the IMD (index of multiple deprivation) decile (Figure X)

[49] BEIS – MSOA estimates of households not connected to the gas network (2018) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/767351/MSOA_estimates_of_households_not_connected_to_the_gas_network_2017.xlsx; Accessed: 17/12/2019)

[50] BEIS – RHI Deployment Data (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/847371/RHI_monthly_official_stats_tables_Oct_19_final.xlsx; Accessed: 18/12/2019)

[51] ONS – Household projections for England (2019) (https://www.ons.gov.uk/file?uri=%2fpeoplepopulationandcommunity%2fpopulationandmigration%2fpopulationprojections%2fdatasets%2fhouseholdprojectionsforengland%2f2016based/maintablesupdatedniupdated.xlsx; Accessed: 02/12/2019)

[52] The UK Government have pledged to introduce a future homes standard, mandating the end of fossil-fuel heating systems in all new houses from 2025. (HC (13 March 2019) Vol 656, Col 351. Available at: https://hansard.parliament.uk/commons/2019-03-13/debates/5B9C772E-1769-437A-A4F0-06DEAC55D676/SpringStatement (Accessed: 02/06/2019))

[53] Citu – Little Kelham, Sheffield (https://citu.co.uk/citu-places/little-kelham; Accessed: 01/12/2019)

[54] Definition taken from: https://www.gov.uk/government/collections/fuel-poverty-statistics (Accessed: 02/12/2019).

[55] BEIS – Fuel Poverty Statistics (2019) (https://www.gov.uk/government/statistics/fuel-poverty-detailed-tables-2019; Accessed: 02/12/2019)

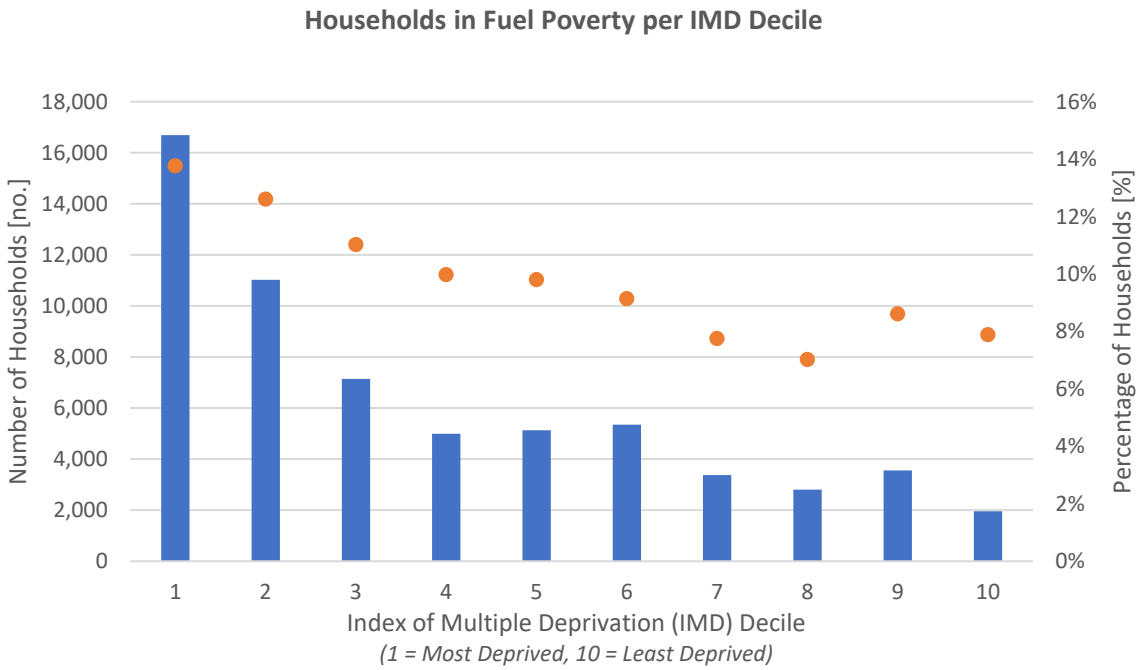


Figure X – Number (bars) & percentage (dots) of households in fuel poverty by IMD decile[56].

Table X – Comparison of fuel poverty rate and disposable income per head in each of South Yorkshire's local authority areas

Local Authority	Fuel Poverty[57]	Average Gross Disposable Household Income (2016)[58]
Barnsley	10.7%	£15,552
Doncaster	10.8%	£15,595
Rotherham	10.1%	£15,465
Sheffield	10.7%	£15,057

Fitting existing homes with energy efficiency measures is proven to be the most effective way to tackle fuel poverty and raise living standards, by reducing energy use and helping keep energy prices affordable, especially when combined with households transitioning to more affordable low carbon heating. Together these actions will help not only reduce the number of people living in fuel poverty, but they will improve health and well-being which ultimately will reduce the excess winter deaths.

A wide range of people are vulnerable to the cold, often due to a medical condition, a disability or other personal circumstances, such as a low income. In 2017/18 there were approximately 1,290 excess winter deaths in South Yorkshire – the highest figure for 20 years (Figure X).

[56] Analysis carried out by Sheffield City Region by matching the fuel poverty statistics to the IMD statistics at LSOA level.
[57] BEIS – Fuel Poverty Statistics (2019) (https://www.gov.uk/government/statistics/fuel-poverty-detailed-tables-2019; Accessed: 02/12/2019)
[58] ONS – Regional gross disposable household income by local authority (2018) (https://www.ons.gov.uk/file?uri=%2feconomy%2fregionalaccounts%2fgrossdisposablehouseholdincome%2fdatasets%2fregionalgrossdisposablehouseholdincomegdhibylocalauthorityintheuk%2f1997to2016/vcregionalgdhibylareordered.xlsx; Accessed: 04/12/2019)

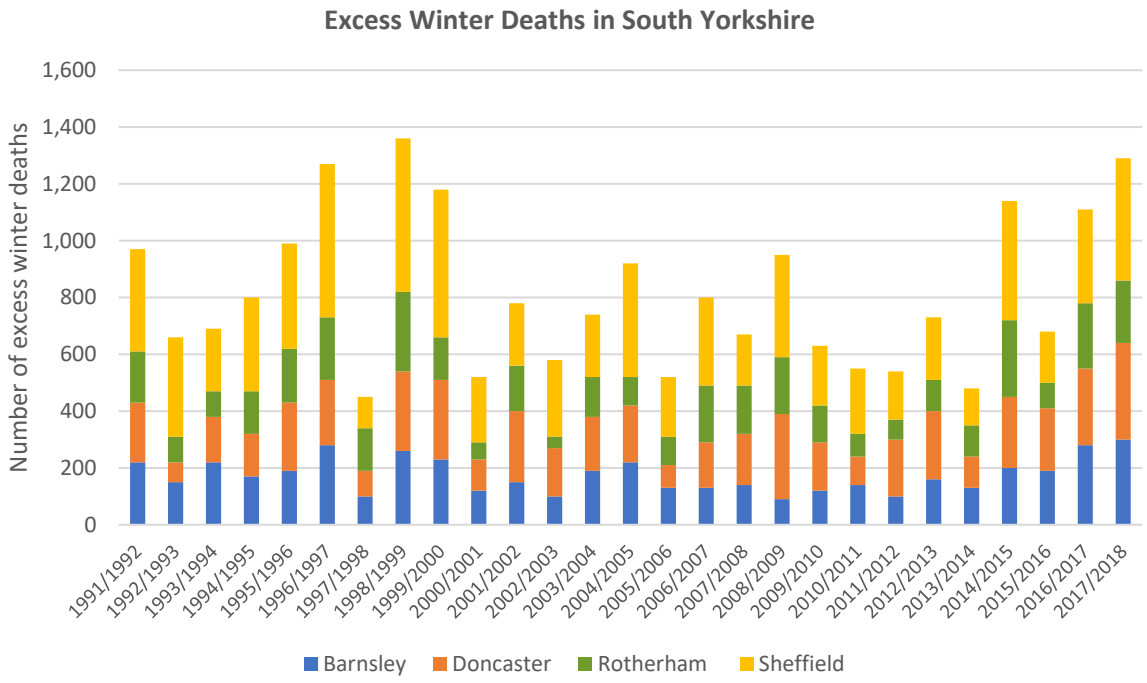


Figure X – Excess winter deaths in South Yorkshire by Local Authority area[59]

[59] Office of National Statistics - Excess winter mortality in England and Wales: 2018 to 2019 (provisional) and 2017 to 2018 (final) (2019) (https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/excesswintermortalityinenglandandwales/2018to2019provisionaland2017to2018final#excess-winter-mortality-across-regions; Accessed 27/11/2019).

TRANSPORT

This SCR Energy Strategy aims to complement the SCR Transport Strategy[60] to deliver an innovative, cleaner public transport networks and kick-start further ambitious projects for active travel. It will be a key priority of the SCR Executive Team to ensure that the low carbon elements of the SCR Transport Strategy are aligned and delivered jointly. Projects of this type will lower carbon emissions and have a significant positive impact on both air quality and health. Equally, the future demands on the energy system will be strategically managed.

Modal Shift & Active Travel

In April 2019, Dame Sarah Storey became the SCR Active Travel Commissioner with the brief to champion active travel and enable more people within South Yorkshire to travel on foot, by bike, or by public transport[61]. The position of SCR Active Travel Commissioner enhances the targets set in the SCR Transport Strategy to increase trips by: 18% on bus, 100% on rail, 47% on tram, 21% walking and 350% cycling.

The Mayor and Active Travel Commissioner's pledges[62] are:

1. Being led by communities
2. Enabling walking and cycling rather than encouraging it
3. Requiring infrastructure to meet or exceed requirements
4. Requiring infrastructure to be accessible for all

Following this the Active Travel Interactive Map[63] was launched in October 2019 which asked people what they think of the current walking and cycling infrastructure, and what they would like to see in the future.

Recognising the parallels between energy, transport and improvements to our air quality, reduced dependency on the private car is seen as a key part of the solution thereby changing the way people travel, and encouraging more active travel. Where journeys cannot be made via Active Travel or using public transport it needs to be ensured that there is a coherent city-wide network of refuelling infrastructure, helping to increase the uptake of electric and other ultra-low emission vehicles (ULEVs).

Electric Vehicles

In 2015, the UK Government set a target for 'almost every' car and van to be zero emission by 2050. This was followed in 2016 by a plan to ban the sale of diesel and petrol cars and vans by 2040. To meet this target, an interim target was set in the 'Road to Zero Strategy' stating that at least 50% of new car sales and 40% of new van sales will be zero emission by 2030.

Whilst nationally the sales of ULEV cars are increasing at a rapid rate[64] their overall penetration into the private vehicle market is low[65]. ULEV sales are expected to continue to grow exponentially as market projections suggest EV price equivalence with petrol and diesel (ICEs) by the mid-2020s[66]. At time of writing, the Government have a grant available to help boost the uptake of EVs but the grant for 'plug-in-hybrids' was removed in 2018.

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[60] Sheffield City Region – Transport Strategy (2019) (https://d2xjf5riab8wu0.cloudfront.net/wp-content/uploads/2019/03/SCR_Transport_Strategy_11.04.2019.pdf; Accessed: 04/12/2019)
[61] Sheffield City Region – 'Dame Sarah Storey Named as Mayor Dan Jarvis' Active Travel Commissioner' (01 Apr 2019) (https://sheffieldcityregion.org.uk/dame-sarah-storey-active-travel-commissioner/; Accessed: 18/12/2019)
[62] Sheffield City Region – 'Dame Sarah Storey Announces Active Travel Pledges for the Sheffield City Region' (17 Jun 2019) (https://sheffieldcityregion.org.uk/dame-sarah-storey-announces-active-travel-pledges-for-the-sheffield-city-region/; Accessed: 18/12/2019)
[63] Sheffield City Region – SCR Active Travel Interactive Map (https://cyclewalkscrmap.sheffieldcityregion.org.uk/; Accessed: 18/12/2019)
[64] 20% increase from 2017 to 2018 (DfT – Vehicle Licensing Statistics: Annual 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800502/vehicle-licensing-statistics-2018.pdf; Accessed 02/10/2019)
[65] 2.2% of new registrations in 2018 (DfT – Vehicle Licensing Statistics: Annual 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800502/vehicle-licensing-statistics-2018.pdf; Accessed 02/10/2019)
[66] Business, Energy and Industrial Strategy Committee – Electric Vehicles: Driving the Transition (2018) (https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/383/383.pdf; Accessed 02/10/2019)

In line with the projections of EV uptake, the EV charging infrastructure is expected to grow in the UK. There are now over 26,000 charging points in over 9,750 locations[67] an increase of nearly 400% in five years. However, under 5% (1,305) of the UK's EV charging points are in the Yorkshire and Humber. These service around 12,000 plug-in vehicles (REF).

In November 2019, the UK Department for Transport published a table showing the number of public charging devices per 100,000 population. The table shows the wide variation in charge point provision and shows that South Yorkshire has 10 per 100,000, which is one of the lowest allocations nationally[68].

The National Infrastructure Commission recommends that Government, Ofgem and local authorities roll-out charging infrastructure in line with EVs making up 100% of new vehicles by 2030. National Grid projects that the increase in peak demand from EVs is likely to be in the region of 5GW nationally. Smart charging technologies, vehicle to grid technology and incentives to charge vehicles at off-peak times will reduce the impact. If clusters of EV charge points emerge without sufficient planning and mitigation measures then charging could overload low voltage networks. Yet, Northern Powergrid's recently published tool (REF once public in January) shows which of the low voltage substations will be under strain in different EV uptake scenarios allowing for an immediate overview of where reinforcement will be required.

The University of Sheffield, alongside seven other northern universities, are part of the DecarboN8 network which focusses on surface transport emissions and are leading the 'Digitisation, Demand and Infrastructure' theme. In 2017, road transport alone contributed around 36% of South Yorkshire's total CO_2 emissions. A battery electric vehicle emits during a full functional life, half the amount of CO_2 compared to a conventional reference vehicle.

Hydrogen Vehicles

Hydrogen vehicles are still relatively scarce in the market but are increasing their penetration in areas such as HGVs, buses, trains. A hydrogen-based switch over for HGVs would require approximately 800 refuelling stations to be built across the UK before 2050[69]. Given the strategic road networks (M1, A1(M), and M18) that pass through South Yorkshire, and the iPort located in Doncaster, presents an important economic opportunity in developing the refuelling network. In addition to this, analysis has been carried out by Arup, on behalf of SCR, to investigate the costs and practicalities of introducing hydrogen buses within the South Yorkshire public transport system.

South Yorkshire is already at the forefront of the quickly growing hydrogen economy. Sheffield is home to ITM Power who are creating the largest electrolyser manufacturing facility in the world which – when opened in early-2020 – will be capable of producing 1GW of electrolysers per year[70]. ITM Power's current operations require them to employ around 180 members of staff; this will increase with the demands of the new facility and the recent award of a £500,000 grant from the UK Government to demonstrate the delivery of bulk, low-cost and zero-carbon hydrogen[71]. Doncaster also have an innovative electrolyser manufacturer, CPH2, who have plans for significant growth. The electrolysers produced by these local companies are essential for the move towards hydrogen vehicles as they are an integral part of the refuelling infrastructure. Rotherham has the northern-most hydrogen refuelling station in England in operation connected to the UK's largest Hydrogen Mini-Grid System[72]. The refuelling station creates hydrogen gas from water using the power from a 225kW wind turbine making the fuel truly zero carbon 'green hydrogen'[73].

[67] ZapMap Statistics (2019) (https://www.zap-map.com/statistics/; Accessed 02/10/2019)
[68] DfT – Electric vehicle charging devices by local authority (2019) (http://maps.dft.gov.uk/ev-charging-map/; Accessed 27/11/2019)
[69] CCC – 'Net Zero – The UK's contribution to stopping global warming' (2019) (https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf; Accessed: 19/12/2019)
[70] ITM Power – New Factory Update and Senior Production Appointment (22 Jul 2019) (https://www.itm-power.com/news/new-factory-update-and-senior-production-appointment; Accessed: 19/12/2019)
[71] ITM Power – 'Gigastack Feasibility Study with Ørsted' (29 Aug 2019) (https://www.itm-power.com/item/58-project-to-demonstrate-delivery-of-bulk-low-cost-and-zero-carbon-hydrogen-through-gigawatt-scale-pem-electrolysis-manufactured-in-the-uk; Accessed: 19/12/2019)
[72] Note: This was developed as part of the International Energy Agency's Hydrogen Technology Collaboration Programme with funding from Yorkshire Forward. The mini-grid has 200kg of hydrogen storage with a 30kW fuel cell system capable of providing back up power to nearby buildings.
[73] Note: 'Green' hydrogen is created using electrolysis where the electricity has been generated using renewable sources. 'Blue' hydrogen is created through steam methane reformation where natural gas is split into hydrogen and carbon dioxide using steam; the CO_2 is then captured using CCUS technology. 'Brown' methane is identical to 'blue' hydrogen, but the CO_2 is not captured and is instead released to atmosphere.

Further detail about South Yorkshire's emerging hydrogen economy and the opportunities that exist can be found in the report 'Establishing a regional hydrogen economy'[74] produced by Arup on behalf of the South Yorkshire Hydrogen Network – a collaboration of public and private sector partners.

Air Quality

South Yorkshire faces significant air quality issues with 28 Air Quality Management Areas (AQMAs) across South Yorkshire (Figure X). Poor air quality is linked to a variety of health concerns ranging from short term illness to serious diseases and premature death. The UK Department of Health and Social Care reports that the impact of reducing fine particles has a bigger impact on life expectancy than eliminating passive smoking or traffic accidents (REF). In South Yorkshire an average of 4.7% of all adult deaths can be attributed to PM2.5[75] air pollution (Barnsley 4.5%, Rotherham 4.8%, Doncaster 5.0%, Sheffield 4.6%) (REF). Individuals who are particularly sensitive and exposed to the most elevated levels of pollution have an estimated reduction in life expectancy of as much as nine years. The impact on health and life expectancy is more significant for some social groups than others; including the most deprived in South Yorkshire.

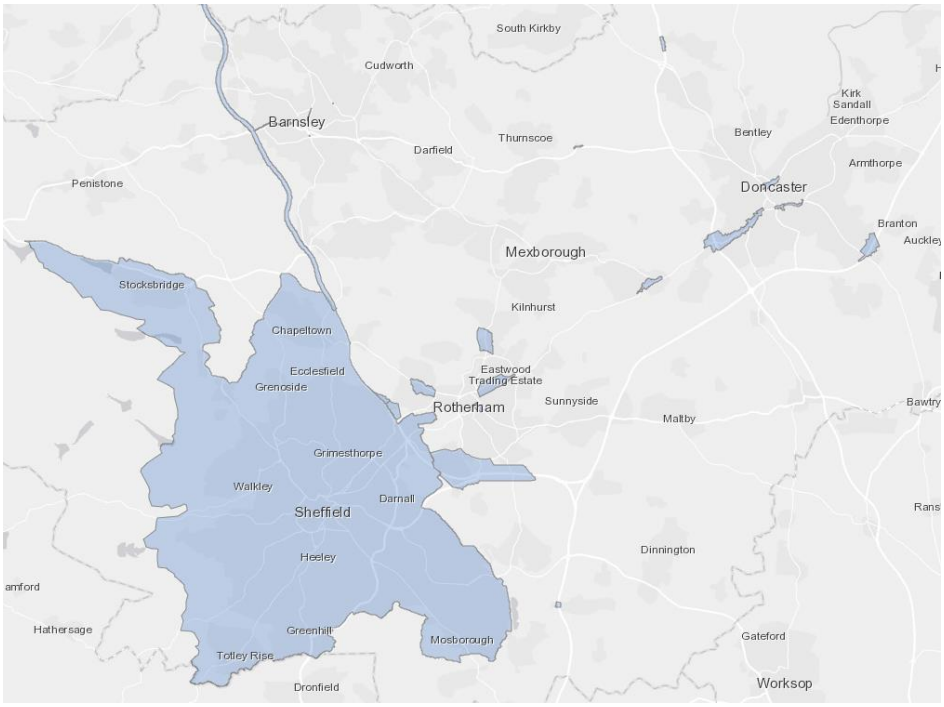

Figure X — Air Quality Management Areas (AQMAs) in South Yorkshire

Across Sheffield alone there are 51 locations where the European Union's annual average limit value for NO_2 (40µg/m^3) has been exceeded in one or more of the three-year periods (2010-2012), and a 30% reduction in NO_2 emissions would be needed in order to comply with the limit value. Analysis indicates that road transport is the single most significant contributor to Sheffield's NO_2 emissions at these locations therefore reducing exhaust pipe pollutants has an important part to play; including the use of Clean Air Zones (CAZs). The significant air quality issues across South Yorkshire also emphasises the importance of delivering transport networks that encourage shifts to low carbon transport. A move to ultra-low emission vehicles (ULEVs) such as those powered by hydrogen or full-electric would significantly reduce emissions in South Yorkshire.

[74] Ref – once published
[75] PM2.5 is particulate matter of 2.5 millionths of a metre (2.5µm) in diameter

Sheffield City Council (SCC) and Rotherham Metropolitan Borough Council (RMBC) are undertaking a CAZ Feasibility Study, to ensure compliance with legal thresholds in the shortest possible time. To address the particular challenges in Sheffield a Charging CAZ[76] has been proposed which would target the most polluting vehicles that do not meet required emissions standards. At the time of writing, the consultation has closed on SCC's proposals that would require improvements to buses, coaches, taxis, HGVs and LGVs from 2021.

This is an important challenge for SCR and, together with the South Yorkshire Passenger Transport Executive, is in a strong position to deliver the pace of change required through the devolved power given by Government and the aims of the SCR Transport Strategy. Mitigating the impact of the motorway network on air quality represents a significant challenge for South Yorkshire and success will be dependent on collaboration with Highways England and national Government.

[76] Sheffield City Council – Clean Air Zone Outline Business Case (2019) (https://www.sheffield.gov.uk/content/dam/sheffield/docs/pollution-and-nuisance/air-pollution/clean-air-zone/Sheffield%20and%20Rotherham%20CAZ%20-%20Outline%20Business%20Case.pdf; Accessed 04/12/2019)

INDUSTRY & COMMERCIAL

South Yorkshire is synonymous with industry; decarbonising this sector while maintaining its competitiveness will be an enormous challenge[77]. However, the challenge also offers an opportunity to both find cost savings and new markets in which to sell.

The manufacture of fabricated metal products is the largest contributor to turnover of businesses with locations in South Yorkshire (REF). This is aligned with the South Yorkshire's industrial heritage with products from this sector feeding into aerospace, automotive, defence and energy sectors – all growth areas under Industry 4.0. Industry 4.0 is characterised by exponential changes to the way we live, work and communicate due to the adoption of cyber physical systems and the Internet of Things, and will lead to much greater digitisation across all industries and aspects of society.

The steel industry is one of the most polluting in the UK, contributing around 12 $MtCO_2$ to UK emissions in 2017 (REF). The sector employs around 32,000 people (REF) including 9,000 in Yorkshire and Humber (REF). Three of the five electric arc furnaces in the UK are in South Yorkshire which melt scrap steel instead of requiring raw materials. Since they're electrically powered, decarbonising these is integrated with the decarbonisation of the electrical network as a whole. Yet, by investing in on-site renewable generation and battery storage costs can be reduced when generating power but also by purchasing electricity when the price is low and selling electricity to the network when generation is lower than demand. This would also improve resilience against power outages.

Natural gas is used for many of the steel manufacturing processes including re-heating and drying. Hydrogen could be used to decarbonise these processes, but it is likely that a redesign of equipment will need to take place as the combustion of hydrogen produces water vapour (which is detrimental to the drying process) and will need to be removed. The UK Government's proposed Clean Steel Fund[78] and Low Carbon Hydrogen Production Fund could provide a step-change in this industry, and South Yorkshire is well-placed to capitalise.

Opportunities also exist in other energy intensive industries to use hydrogen including glass manufacture where high temperatures are used to melt the raw materials, and a hydrogen-rich atmosphere is used in the manufacture of float glass. These high energy users typically produce a significant amount of waste heat which can be 'dumped' into a heat network to provide an additional income stream.

There are many opportunities for non-industry to gain from the transition to a net-zero carbon economy. The Clean Growth Strategy (CGS) set out a stretching ambition to support businesses to improve their energy efficiency by at least 20% by 2030 leading to a potential 30% reduction in SME energy bills[79]. Despite this, there remains a large proportion of SMEs who are unaware of how to reduce their energy usage and the extent of savings they could make through implementing resource efficiency measures. Support is therefore required to help businesses reduce the costs involved in initial connection to the energy grid and invest in energy efficiency measures and low carbon heat and power, which could significantly reduce fuel bills for businesses within South Yorkshire, protecting them against rising energy prices.

One of the Missions of the UK Industrial Strategy set by the UK Government was to 'establish the world's first net-zero carbon industrial cluster by 2040 and at least 1 low-carbon cluster by 2030'. Humber are making strides to achieve this goal with the Zero Carbon Humber project[80] – a collaboration between Drax Group, Equinor and National Grid. As a neighbouring region, South Yorkshire is well placed to build on and support this transformative project.

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[77] "Government must implement an approach to incentivise industries to reduce their emissions through energy and resource efficiency, electrification, hydrogen and CCS in ways that do not adversely affect their competitiveness. In the short-term, this is likely to imply a role for Exchequer funding." (CCC – 'Net Zero – The UK's contribution to stopping global warming' (2019) https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf; Accessed: 19/12/2019)

[78] BEIS – Creating a Clean Steel Fund: Call for Evidence (https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence; Accessed: 19/12/2019)

[79] BEIS – Energy Efficiency Scheme for Small & Medium Sized Businesses – A Call for Evidence (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/785541/energy-efficiency-scheme-smes-cfe.pdf; Accessed 21/11/19).

[80] Zero Carbon Humber (https://www.zerocarbonhumber.co.uk/; Accessed: 19/12/2019)

RESEARCH, DEVELOPMENT & INNOVATION

South Yorkshire has a significant offering with regards to world-leading research, development and innovation. Some of the areas with direct impact on the energy sector have been highlighted in this Section.

UK Atomic Energy Authority (UKAEA)[81]

In autumn 2020 the UK Atomic Energy Authority (UKAEA) will open a 2,500m^2 nuclear fusion research facility at the Advanced Manufacturing Innovation District (AMID) in Rotherham. The facility will bring 40 highly-skilled jobs to South Yorkshire following funding from BEIS and SCR's Local Growth Fund. UKAEA's aim is to produce a conceptual design for a 'Spherical Tokamak for Energy Production' (STEP) reactor by 2024 and ultimately commercialise nuclear fusion as a plentiful source of low carbon electricity[82]. The facility will require specialist metals and materials, providing further opportunities for companies in South Yorkshire and boosting the region's economy.

High Value Manufacturing Catapult[83]

Established by Innovate UK, the Catapult provides access to world-class research and development facilities and expertise that would otherwise be out of reach for many businesses in the UK. In 2018/19 the Catapult supported 4,650 innovative projects (including almost 2,500 with SMEs) which totalled over £0.5bn. In South Yorkshire, the Catapult has two main centres: the Advanced Manufacturing Research Centre (AMRC), and the Nuclear AMRC, both with capabilities in Advanced Assembly, Automation, Resource Efficient and Sustainable Manufacturing, and Virtual Reality.

Sheffield Hallam University[84]

Sheffield Hallam University (SHU) is one of the largest universities in the UK by student population with over 30,000 enrolled[85]. SHU has thirty research centres spanning a wide range of topics including Health and Social Care, Sport and Exercise Science, and Food Engineering. The Olympic Legacy Park (OLP)[86] in Sheffield will provide a world-class centre for research and innovation in health and well-being. The Advanced Well-Being Research Centre will be based at the OLP and will be the most advanced physical activity research and development centre in the world. Other research centres at SHU include CRESR and MERI.

CENTRE FOR REGIONAL ECONOMIC AND SOCIAL RESEARCH (CRESR)[87]

CRESR focusses on the impact of social and economic disadvantage and the assessment of policies which aim to address these issues. Sustainability is one of the workstreams of CRESR which is broken down into: housing, place, responses to climate change, and valuation of environmental benefits. Previous work from this research group includes studies into fuel poverty, community energy, heat networks, and the economic benefits of improvements to the natural environment. CRESR has also worked on the 'State of the Coalfields'[88] report showing the contrast between these communities and other economic areas in the UK.

[81] UKAEA (https://www.gov.uk/government/organisations/uk-atomic-energy-authority)
[82] BEIS – UK to take a bis 'STEP' to fusion electricity (03 Oct 2019) (https://www.gov.uk/government/news/uk-to-take-a-big-step-to-fusion-electricity; Accessed: 20/12/2019)
[83] High Value Manufacturing Catapult (https://hvm.catapult.org.uk/)
[84] Sheffield Hallam University (https://www.shu.ac.uk/)
[85] Higher Education Statistics Agency (HESA) – Where do HE students study? (https://www.hesa.ac.uk/data-and-analysis/students/where-study; Accessed: 20/12/2019)
[86] Sheffield Olympic Legacy Park (https://sheffieldolympiclegacypark.co.uk/)
[87] CRESR (https://www4.shu.ac.uk/research/cresr/)
[88] CRESR – The State of the Coalfields 2019 (https://www4.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/state-of-the-coalfields-2019.pdf; Accessed: 19/12/2019)

MATERIALS AND ENGINEERING RESEARCH INSTITUTE (MERI)[89]

MERI is an interdisciplinary research institute dedicated to addressing industrial challenges. MERI encompasses groups including: the Centre for Automation and Robotics Research which has research areas such as artificial perception and integrated manufacturing; the Thin Films Research Centre which has a research group focussing on solar energy conversion; and Hallam Energy which has expertise, and provides consultancy in, areas including industrial heat recovery working with international companies such as Nestlé to improve the efficiency of their operations.

University of Sheffield[90]

The University of Sheffield is a world-class University ranked 12th overall in the UK, and part of the prestigious Russell Group. Boasting no fewer than eight energy related research centres as part of the Research Institute for Energy: one of the Europe's largest energy research institutes with over 120 academics and 250 PhD students undertaking energy research and innovation. The University owned Advanced Manufacturing Research Centre (AMRC) – based in Rotherham – was the winner of the 2007 Queen's Anniversary Prize for Higher and Further Education[91].

THE ADVANCED RESOURCE EFFICIENCY CENTRE (AREC) [92]

AREC is a facility to promote collaboration between industry and academia to meet the challenge of resource efficiency and sustainability across supply chains by proposing new ways of reducing risk for partners in overcoming the challenges of resource availability. AREC has the infrastructure in place to work in partnership with industry to address world challenges in supply chain resource sustainability, focussing on four key areas: advanced materials and manufacturing, energy and nuclear; water; and agritech and food.

UK CARBON CAPTURE AND STORAGE RESEARCH CENTRE (UKCCSRC)[93]

UKCCSRC brings together a membership of over 1,400 world-class academics, industrial experts, regulators, Government and others in the sector to provide a national focal point for the research and development of carbon capture and storage. The University of Sheffield is a core institution of UKCCSRC and hosts the Pilot-scale Advanced CO_2 Capture Technology (PACT)[94] facilities which are the national specialist research and development facilities for carbon capture technology research for power generation and industrial applications.

CENTRE FOR RESEARCH INTO ELECTRICAL ENERGY STORAGE AND APPLICATIONS (CREESA)[95]

CREESA is one of the UK's leading research centres on all aspects of electrical energy storage and home of the 'Centre for Doctoral Training in Energy Storage and its Applications'. It includes the unique Battery Energy Storage Demonstrator – a 2MW grid connected research facility utilising a lithium titanate battery at a substation in the West Midlands. More recently the facility has been set up as a test bed for Industry 4.0, in collaboration with industrial partners, for battery digitisation research with reference to the Internet of Things and cloud computing.

FACTORY 2050[96]

Factory 2050 is a 6,730m^2 building dedicated to research into robotics and automation, integrated large volume metrology, digitally assisted assembly and manufacturing informatics by the Integrated Manufacturing Group. In partnership with Boeing, Factory 2050 is particularly active in the aerospace sector but also delivers impact across the automotive, healthcare, infrastructure, energy, and food and drink sectors.

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[89] MERI (https://www.shu.ac.uk/research/specialisms/materials-and-engineering-research-institute)
[90] University of Sheffield (https://www.sheffield.ac.uk/)
[91] Award was presented for 'working with leading companies to improve efficiency in aero engines' (https://www.queensanniversaryprizes.org.uk/winners/researching-and-embedding-new-manufacturing-techniques-in-aerospace-engineering/; Accessed 28/11/2019)
[92] AREC (https://www.sheffield.ac.uk/arec)
[93] UKCCSRC (https://ukccsrc.ac.uk/)
[94] PACT (https://pact.group.shef.ac.uk/)
[95] CREESA (https://www.creesa.co.uk/)
[96] Factory 2050 (https://www.amrc.co.uk/facilities/factory-2050)

NUCLEAR ADVANCED MANUFACTURING RESEARCH CENTRE (NAMRC)[97]

Based in Rotherham, the NAMRC is part of the High Value Manufacturing Catapult and is a collaboration of academic and industrial partners from across the nuclear supply chain, with the mission of helping UK manufacturers win work. The NAMRC has developed its position at the heart of the UK's civil nuclear manufacturing industry and is leading on the research and development of small modular reactors (SMRs) and the Fit4Nuclear[98] (F4N) benchmark. The F4N programme helps companies measure their current operations against the standards required to supply the UK's new generation of nuclear power stations and take the necessary steps to enter this £40bn market.

SHEFFIELD SIEMENS GAMSEA RENEWABLE ENERGY (S^2GRE)[99]

Siemens established its UK wind turbine generator R&D competence centre at the University of Sheffield in 2009. The research centre specialises in providing the overall technology, architecture and design of onshore and offshore wind turbine generators for the global market. The collaboration translates into real world solutions with benefits to both the wind industry and the environment. The University of Sheffield are also the lead for the EPSRC Prosperity Partnership: A New Partnership in Offshore Wind[100].

TRANSLATIONAL ENERGY RESEARCH CENTRE (TERC)[101]

The TERC is a state-of-the-art testing facility for energy technologies which will be instrumental in the UK's transition to a low carbon economy and will help businesses stay at the forefront of this rapidly growing market and ensuring that research and development leadership in clean energy is retained locally. The TERC will dramatically broaden the scope of the pilot-scale testing facilities currently available in the UK and include equipment for conventional energy, carbon capture, utilisation and storage, biomass, hydrogen, renewable energy, energy storage and smart grids.

URBAN FLOWS OBSERVATORY[102]

The Urban Flows Observatory seeks to understand how the physical (energy and material resources) metabolism of cities can be effectively measured, understood and utilised. To do this, mobile and fixed sensors will be deployed around Sheffield to improve our understanding of the city. The aim is to provide the methodologies and tools to manage and analyse urban data streams. From this, a robust evidence base will be developed to facilitate local and national decision making, supporting the creation of zero carbon, healthy, happy cities.

URBAN INSTITUTE[103]

The Urban Institute is a research centre focussed on how cities adapt to the challenges and opportunities posed by deepening urbanisation, technological innovation and constraints on resources. Academics at the Urban Institute undertake interdisciplinary research to analyse the socio-technical, political and ecological dynamics of urban environments. Mistra Urban Futures[104] is an international project in which the Urban Institute are participating where the United Nations Sustainable Development Goals are being used to understand whether urbanisation is taking place in a sustainable way.

[97] NAMRC (https://namrc.co.uk/)
[98] Fit4Nuclear (https://namrc.co.uk/services/f4n/)
[99] S^2GRE (https://www.sheffield.ac.uk/eee/research/groups/electrical-machines-and-drives/siemens-gamesa)
[100] New Partnership in Offshore Wind (NPOW) (https://npow.group.shef.ac.uk/)
[101] TERC (https://www.sheffield.ac.uk/news/nr/translational-energy-research-centre-sheffield-university-leading-experts-uk-work-with-collaborate-1.852523)
[102] Urban Flows Observatory (https://urbanflows.ac.uk/)
[103] Urban Institute (http://urbaninstitute.group.shef.ac.uk/)
[104] Mistra Urban Futures (https://www.mistraurbanfutures.org/en)

KEY CHALLENGES

1. Far fewer people are employed in the low carbon sector in South Yorkshire than other parts of the North of England.

2. Forecasts suggest South Yorkshire will capture only a minimal amount of potential economic growth and new jobs in the low carbon and renewable energy sector.

3. Current infrastructure is under-utilised and deployment of technologies to improve resilience is slow.

4. Reducing the energy demand of South Yorkshire's industry will require significant investment from central government.

5. South Yorkshire generates <20% of the electricity that it consumes.

6. Two-thirds of dwellings in South Yorkshire have an Energy Performance Certificate rating below band C with over one-quarter being in the lowest bands (E, F or G).

7. There are over 1,200 excess winter deaths each year in South Yorkshire and 10.6% of households are in fuel poverty.

8. South Yorkshire has significantly fewer community energy schemes compared to other regions.

9. Poor air quality blights parts of South Yorkshire with 28 designated Air Quality Management Areas (AQMAs).

10. Road transport is the single largest contributor to CO_2 emissions in South Yorkshire.

POLICIES & INTERVENTIONS

Introduction

Beyond the adoption of this SCR Energy Strategy a range of projects will be developed, started, or accelerated depending upon their current position within the pipeline. Complementary projects will form programmes of work which will ultimately seek to meet the overall goals and targets of this Strategy. Some of these projects/programmes will be led by SCR; some the SCR will contribute to; and others which SCR will seek to influence. Delivery will therefore rely on a whole host of public and private organisations and individuals.

This Section of the Strategy gives more information about the policies that we believe – based on analysis of the evidence provided in Section X and refined based on stakeholder input – will address the Key Challenges provided in Section X. The key strategic interventions that are currently known to SCR, and how they will be brought forwards within the national and sub-national context, will also be detailed below.

Local Interventions

Our local interventions need to build on those being developed nationally. Globally, there is an increasing focus on energy being generated locally in a decentralised way rather than being reliant on large-scale electricity generation. This provides a number of opportunities within South Yorkshire for the development of schemes which generate renewable electricity. For heat, the national focus is in three areas: electrification, hydrogen, and heat networks. Since South Yorkshire has a history of developing and running an efficient heat network this is an obvious area for expansion. However, it would be foolish to place all eggs in one basket. Fourth and fifth generation heat networks make use of low temperatures which then allows for the incorporation of electrically-driven heat pumps, either at the source and/or user-end. South Yorkshire also has a head-start with world-leading expertise in hydrogen generation via electrolysis. Hydrogen provides two key contributions: generating hydrogen for both heat and transport fuel, and it can be used as a storage medium to help balance the national electricity network by generating hydrogen when there is a surplus of renewable electricity being generated rather than paying generators to not produce electricity.

There will likely be a spatial element to any local interventions owing to the natural resources and current assets that already exist within South Yorkshire. For example, the wind resource is far more plentiful in some areas than others making the case for onshore wind – which is already the cheapest form of electricity generation[105] – much more viable and cost-effective.

SCR take a principled approach to any direct investment and would aim to prioritise those opportunities where it is possible to recover the investment to re-invest in further decarbonisation schemes or energy related infrastructure.

The remainder of this section provides an indication of some of the local interventions that could be implemented by SCR or public or private partners. Each of the interventions are guided by our policies and support the commitments set out in the Strategic Economic Plan and those made in the Mayoral manifesto.

Policies

A – ENCOURAGE CLEAN AND EFFICIENT GROWTH IN OUR LOCAL BUSINESSES AND INCREASE THE NUMBER OF JOBS IN THE LOW CARBON ENERGY SECTOR.

To achieve this we will:

- Provide support to businesses to help them: reduce the costs involved in initial connection to the gas and electricity network, and invest in energy efficiency measures and low carbon heat and power.
- Support SMEs to become aware of, and apply for, low carbon innovation funding provided from the UK Government

[105] BEIS – Electricity generation cost report (Annexes 1-3) (2019) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/803605/Generation_Costs_Report_2016_Annexes.xlsx; Accessed 03/12/2019)

and elsewhere.

- Establish South Yorkshire as an innovation incubator where energy innovations can be taken from concept, to prototype, to trial, through to full-scale production.
- Aim to create regular networking and CPD opportunities for energy professionals within our SMEs to allow skills and knowledge transfer, and further learning.

B – INVEST IN THE TRAINING AND UPSKILLING OF THOSE WHO WILL BE DESIGNING, INSTALLING AND MAINTAINING OUR FUTURE ENERGY SYSTEMS.

To achieve this we will:

- Assist businesses and young people to develop the skills they need to take advantage of opportunities in the energy sector.
- Encourage those working in sectors with similar skill sets to re-train and/or gain additional qualifications such that they can also operate in the low carbon sector.
- Work to develop an apprenticeship scheme for those who are looking to work within specific areas of the low carbon energy sector where we expect high growth e.g. hydrogen, heat networks, heat pumps, and electrical engineering.

C – PROMOTE INDUSTRIAL DECARBONISATION AND CLUSTER SCHEMES TO DELIVER ENERGY AND COST SAVINGS, AND DRIVE INNOVATION IN KEY GROWTH AREAS.

To achieve this we will:

- Support industry to take advantage of central government funds including the Industrial Energy Transformation Fund and the Clean Steel Fund.
- Work with colleagues in the Humber region to assist with their development of the 'Zero Carbon Humber' net-zero industrial cluster and linking businesses in South Yorkshire to the arising opportunities.
- Work with organisations to implement cluster schemes within hubs of local economic activity which deliver collective energy and financial savings, and drive innovation in key growth areas.
- Seek opportunities where partnerships can be created between developers of energy efficient technologies and industrial companies willing to test innovative technologies on-site.

D – UTILISE AND/OR REPURPOSE OUR CURRENT INFRASTRUCTURE AND NATURAL RESOURCES TO DECARBONISE THE ENERGY SUPPLY.

To achieve this we will:

- Partner with the Coal Authority to understand the sub-surface conditions of former mining areas and prioritise those that have the best potential for minewater energy schemes.
- Work with Local Energy Hubs to establish the regulatory requirements to bring minewater energy schemes to fruition.
- Plan the heat network required to distribute the low cost, low carbon minewater energy to those buildings in close proximity.
- Work with residents and business owners to build an understanding of the potential benefits of a minewater energy scheme.
- Look for, and bring forward, other opportunities that have an energy, decarbonisation, and economic benefit.

E – IMPROVE OUR ENERGY RESILIENCE THROUGH THE ADDITION OF LOCAL LOW CARBON GENERATION AND STORAGE, AND THE INCREASED USE OF SMART GRIDS.

To achieve this we will:

- Investigate energy storage opportunities within South Yorkshire including for energy intensive industries to make them more efficient and helping to balance the load on the local electricity/gas distribution network.
- Consider 'meanwhile uses' of public land and buildings to generate further power from renewable sources for South Yorkshire.
- Seek to develop and deploy a zero-carbon smart microgrid within South Yorkshire; this could include working with Northern Powergrid as part of their Smart Grid Enablers project.
- Consider further opportunities for onshore wind as part of South Yorkshire's renewable energy mix; subject to local

planning, environmental constraints, and community engagement.

F – DRIVE INVESTMENT HEAT DECARBONISATION INCLUDING HEAT NETWORKS, THE ELECTRIFICATION OF HEAT AND HYDROGEN FOR HEAT.

To achieve this we will:

- Support the expansion of existing and development of new heat networks throughout South Yorkshire particularly low temperature (4th and 5th generation) heat networks.
- Work with organisations and industries who expel waste heat to connect into a heat network.
- Consider improvements to heat networks including increased monitoring, thermal storage, and the physical connection of heat networks into a heat grid.
- Work with gas network operators to understand the potential for mixing hydrogen into the natural gas supply.
- Plan the roll-out of heat pumps – particularly in areas not connected to the gas network.

G – SUPPORT AND INVEST IN WIDESPREAD ENERGY EFFICIENCY IMPROVEMENTS TO EXISTING DWELLINGS ACROSS SOUTH YORKSHIRE.

To achieve this we will:

- Identify 'priority' dwellings/households i.e. those with biggest need for improvement (e.g. solid walls, fuel poor, elderly, deprived areas, etc.).
- Use devolution funds to create a 'Mayor's Community Energy Fund' to help priority households with capital costs of installing low carbon heating/cooling and energy efficiency measures.
- Work with partners to develop innovative ways to quickly assess the required improvements to dwellings and their rapid deployment.

H – ENSURE THAT NEW HOUSING WITHIN SOUTH YORKSHIRE IS OF A HIGH QUALITY IN TERMS OF ENERGY USE AND EFFICIENCY.

To achieve this we will:

- Work with developers and Local Planning Authorities to strongly encourage the adoption of higher energy efficiency standards, beyond those of Part L of the UK Building Regulations, towards the levels required for the Passivhaus standard.
- Focusing the SCR Housing Fund to supporting housing developments with high energy efficiency standards and/or low carbon heating systems.
- Seek to create an off-site, modular construction supply chain within the South Yorkshire which focusses on creating quality, low-carbon housing at scale.

I – ENABLE COMMUNITIES TO DEVELOP LOCAL ENERGY SCHEMES AND PROVIDE OPPORTUNITIES FOR RESIDENTS OF SOUTH YORKSHIRE TO INVEST IN ENERGY INFRASTRUCTURE.

To achieve this we will:

- Encourage and support community energy schemes in which residents can invest and benefit with low risk. Schemes could include (but are not limited to) solar farms, onshore wind farms, hydro power, low carbon heat, or electric vehicle infrastructure.
- Work closely with Community Energy England to identify opportunities for community energy schemes within South Yorkshire.
- Ensuring that the profits from community energy schemes are reinvested locally to broaden the impact of chosen interventions and create a circular economy/investment fund.

J – ENABLE A MODAL SHIFT AWAY FROM INDIVIDUAL CAR USE TO PUBLIC TRANSPORT, CYCLING AND WALKING.

To achieve this we will:

- Work towards delivering the pledges laid out by the Mayor and Active Travel Commissioner, and the shared priorities set out in the SCR Transport Strategy.
- Provide sustained investment in high-quality cycling and walking infrastructure.
- Develop a plan for, and roll-out, Low Traffic Neighbourhoods across South Yorkshire.

K – DELIVER A LOW CARBON TRANSPORT NETWORK INCLUDING A ZERO CARBON PUBLIC TRANSPORT NETWORK.

To achieve this we will:

- Deliver a zero-carbon public transport network, which requires upgrading the bus and taxi fleets, and other public vehicles, and supporting decarbonisation programmes for our railways.
- Consider the expansion of the ECO Stars Fleet Recognition Scheme to encourage HGV, Bus, Coach and Taxi operators to improve efficiency, reduce fuel consumption and cut their emissions.
- Support pan-Northern schemes to electrify railways and extend EV charging infrastructure along pan-Northern routes.

L – ACCELERATE THE DEPLOYMENT OF ULTRA-LOW EMISSION VEHICLES, AUTONOMOUS VEHICLES AND RELATED INFRASTRUCTURE.

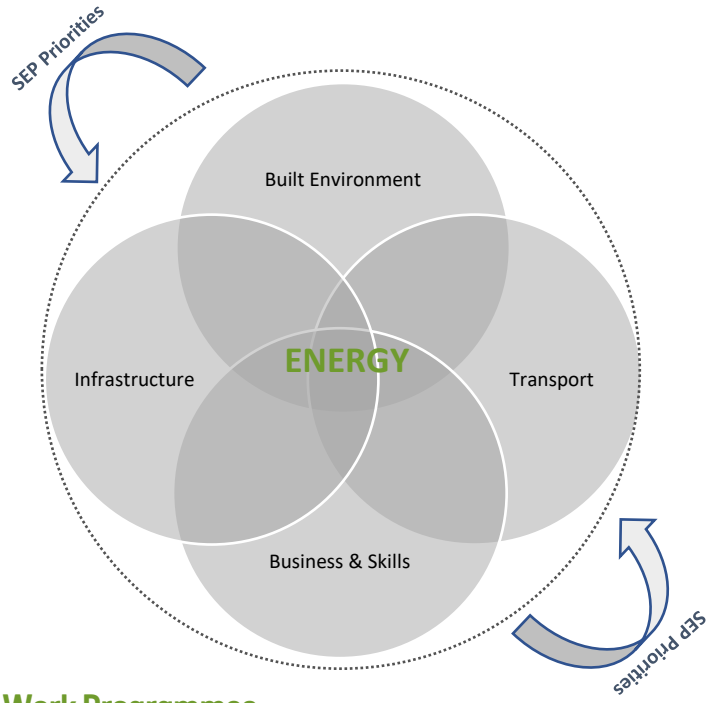
To achieve this we will:

- Invest in expanding the network of EV charging points and hydrogen refuelling stations across South Yorkshire in a strategic way to ensure full coverage.
- Encourage private vehicles using our roads to be ULEVs, and to be used primarily for trips that cannot be made by alternatives, such as public transport, walking and cycling.
- Work with partners to introduce and enforce clean air zones; supporting them in delivering cuts in emissions through encouraging sustainable modes of transport and reducing the need to travel.
- Encourage freight to shift from road to rail or canal boat; and where this is not possible, encourage those road vehicles to be electric, hydrogen, or using a first/last mile service to reduce the number of delivery vehicles in urban centres.

DELIVERY OF THE STRATEGY

Introduction

Implementing this Energy Strategy will require joint working between the Sheffield City Region (SCR) Mayoral Combined Authority (MCA), Local Enterprise Partnership (LEP), local authorities, Central Government, private organisations, charitable/community bodies, and individual residents of South Yorkshire. Some of the schemes that are implemented following publication of this strategy will be brought forward directly from private organisations who are looking to optimise their working procedures and become more efficient. Yet, there will be schemes that will need some funding or directional support by the public sector including the SCR LEP and MCA where relevant – subject to agreement and the appropriate due diligence.



Developing Future Work Programmes

To ensure that the Goals, Policies and Targets of this ambitious Energy Strategy are achieved, an Evaluation Framework has been created by the Carbon Trust to ensure that ongoing and future projects around South Yorkshire are aligned with SCR strategic priorities. Any project requiring the input of the SCR will be initially assessed using this Evaluation Framework (Figure X) to inform consideration onto any SCR project pipeline through the appropriate SCR Governance arrangements and due diligence processes.

We will therefore use this Evaluation Framework as a 'first filter' to developing a project pipeline / programme within South Yorkshire, in liaison with partners, scheme sponsors and stakeholders. By its very nature, the scheme pipeline will be a fluid and will adapt as the low carbon energy market grows and shifts, and as technological changes take place. It will allow new projects and innovations to be considered in the context of our low carbon principles.

***Figure X**: Evaluation Framework for potential energy schemes*

Governance Structure

This SCR Energy Strategy has been developed by Sheffield City Region Local Enterprise Partnership and Mayoral Combined Authority following with support from the Department for Business, Energy and Industrial Strategy; initial evidence gathering and reporting by The Carbon Trust; and input from a large number of stakeholders from around South Yorkshire and beyond. These stakeholders include: local authority partners, private sector organisations, charitable bodies, academic institutions, community groups, and individuals. It is these stakeholders and their projects that will ultimately help deliver this Energy Strategy.

Where the SCR is taking a part, or is taking a leading role within a project, particularly where financial assistance is involved, projects will be subject to the SCR Governance arrangements and due diligence processes.

The SCR Infrastructure Board will oversee and monitor progress in delivering the SCR Energy Strategy, reporting to the SCR Local Enterprise Partnership and Mayoral Combined Authority. However, the promotion, funding, project development, and implementation of projects and programmes will rely on a whole range of partners and stakeholders to deliver, including Central Government.

A project 'Steering Group' will be created to provide oversight and direction for the programme(s) as a whole. They will comprise of representatives of relevant projects and others who are able to advise, enable and support project and programme delivery. The Steering Group(s) will report regularly to the SCR Infrastructure Board.

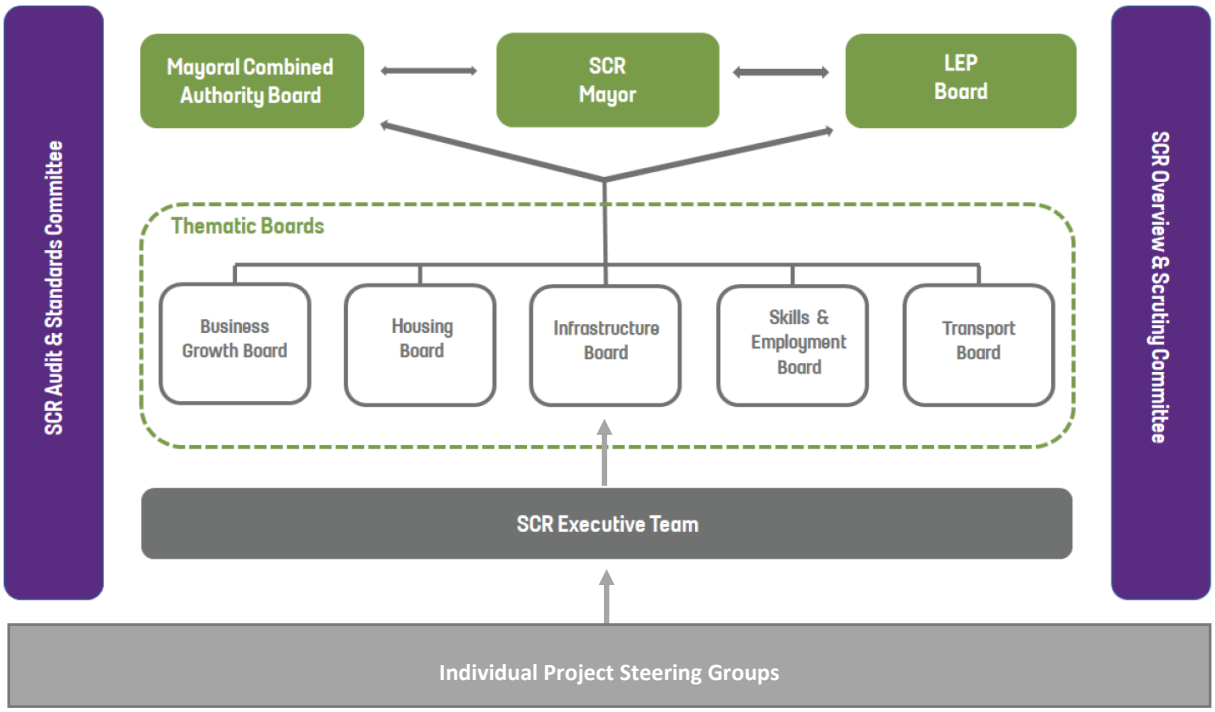


Figure X: Sheffield City Region decision making structure

CLIMATE TARGETS

In 2019, SCR commissioned Ricardo Energy & Environment to undertake analysis which would result in a science-based carbon budget being developed for South Yorkshire and the specific actions that would be required to stay within that budget. There were three phases to the commission: a top-down analysis, a bottom-up analysis, and an economic analysis.

The top-down analysis gives an understanding of what South Yorkshire's 'fair share' of the 2015 Paris Agreement target but not the achievability of that target. The bottom-up analysis has assessed deliverability to give confidence that the target, whilst stretching and ambitious and reflecting the nature of the climate emergency, is also achievable. The economic analysis has then assessed the impact on jobs, GVA and productivity of the possible pathways to decarbonisation.

South Yorkshire's Carbon Budget

The analysis by Ricardo Energy & Environment (REF) concludes that the overarching carbon budget for South Yorkshire between 2020 and 2100 is 44.7 $MtCO_2$. At 2017-rates, this would be emitted in under seven years. To make progress towards remaining within that budget, annual emmissions reductions of 13.2% is required across the whole of South Yorkshire.

In line with the UK-level targets, only Scope 1 and Scope 2 emissions are included within this budget. These include agriculture, fuel combustion for heating, waste, industrial processes, transport and generated electricity. However, Scope 3 emissions are excluded meaning emissions from aviation and shipping do not form part of this budget.

Policy Targets

Draft Headline policy targets to be inserted once the Consultants have completed their quality assurance process in line with the net-zero target.. refer to the carbon reduction curve diagram below:

Insert carbon reduction curve diagram

FOLLOWING CONSIDERATION BY THE SCR LEP OF THE POSSIBLE SCENARIOS SET OUT IN THE THEMATIC TABLES BELOW, A PREFERRED DESIRED PATHWAY WILL BE CONFIRMED TO DELIVER OUR ENERGY AND CLIMATE CHANGE AMBITIONS

In the following tables, Scenario A represents the most ambitious targets which will achieve the goal of remaining within the carbon budget. If the chosen path deviates from Scenario A in one thematic area, then another thematic area must exceed the target to remain on the decarbonisation pathway.

In the power sector, the decarbonisation scenarios are summarised in Table X.

Thematic Table X – Decarbonisation scenarios for the power sector

	Solar PV	Solar Thermal[106]	Onshore Wind
A	An installed capacity of 0.432 GW by 2025 and 1.312 GW by 2040.	Approx. 23,000 installations per year for next 20 years.	An installed capacity of 0.248 GW by 2025 and 0.921 GW by 2040.

[106] Note: This assumes household numbers rise to approximately 671,000 by 2040

B	An installed capacity of 0.265 GW by 2025 and 0.688 GW by 2040.	Approx. 6,700 installations per year for next 20 years	An installed capacity of 0.272 GW by 2025 and 0.740 GW by 2040.
C	An installed capacity of 0.154 GW by 2025 and 0.303 GW by 2040.	No additional installations	An installed capacity of 0.197 GW by 2025 and 0.240 GW by 2040.

For residential buildings, the decarbonisation scenarios are summarised in Table X.

Thematic Table X – Decarbonisation scenarios for the housing sector

	Insulation	**Lighting and appliances**	**Heating**
A	500,000 homes to receive additional draught proofing by 2040. 465,000 homes to receive triple glazing by 2040. 250,000 homes to receive additional loft insulation by 2040. 100,000 homes to receive cavity wall insulation by 2040. 125,000 homes to receive solid wall insulation by 2040. New homes to be built close to the PassivHaus standard.	All domestic cooking to use electricity.	80-90% of households have a heat pump. Remaining homes heated using a combination of gas boilers (biogas/hydrogen), electric heating, geothermal and district heating. No new fossil fuel boilers after 2040.
B	72,000 homes to receive additional loft insulation. 44,000 homes to receive cavity wall insulation. 18,000 homes to receive solid wall insulation.	Continued improvement in lighting and appliance efficiency. No new gas cooking appliances installed from 2030.	Additional 403,000 homes with heat pumps. 106,000 homes on heat networks
C	Additional 30,000 homes to receive floor insulation. 50,000 homes to receive triple glazing. New homes built to 2006 insulation standards.	No change to current cooking split of approximately 47% electricity and 53% gas. For lighting and non-cooking appliances, current trends towards more energy-efficient equipment.	Existing current high percentage of gas boilers. Newer technologies will continue to become more efficient and the gas network is likely to have a higher proportion of biogas and/or hydrogen so emissions would be expected to fall but would not reach zero.

For commercial buildings, the decarbonisation scenarios are summarised in Table X.

Thematic Table X – Decarbonisation scenarios for the commercial sector

	Lighting and appliances	Heating
A	Overall demand will decrease by 30% from 2007 baseline. 90% of lights are high efficiency LEDs. 100% of cooking appliances to be electric.	80-90% of buildings have a heat pump. Remaining buildings heated using a combination of gas boilers (biogas/hydrogen), electric heating, geothermal and district heating. No new fossil fuel systems after 2040.
B	Continued improvement in lighting and appliance efficiency. No new gas cooking appliances installed from 2030.	Completely decarbonised heat in commercial buildings by 2050. Gas used for peak heating demand in heat networks is decarbonised by shifting to hydrogen.
C	Business as usual for cooking, lighting and other appliances. Increase in energy demand of 25%.	Newer technologies will continue to become more efficient and the gas network is likely to have a higher proportion of biogas and/or hydrogen so emissions would be expected to fall but would not reach zero.

For commercial buildings, the decarbonisation scenarios are summarised in Table X.

Thematic Table X – Decarbonisation scenarios for the transport sector

	Road Modal Shift ***(% change relative to 2020)***	**Road transport demand** ***(% change relative to 2020)***	**Electrification** ***(% share of fleet)***
A	10% reduction in car miles by 2030 and 25% by 2040	25% reduction in car miles by 2030 and 25% by 2040 10% reduction in freight miles by 2030 and 30% by 2040	100% by 2035
B	5% reduction in car miles by 2030 and 15% by 2040	15% reduction in car miles by 2030 and 20% by 2040 6% reduction in freight miles by 2030 and 20% by 2040	100% by 2040
C	2% reduction in car miles by 2030 and 5% by 2040	2% reduction in car miles by 2030 and 5% by 2040 3% reduction in freight miles by 2030 and 10% by 2040	100% by 2040

IMPACT ON JOBS, GVA AND PRODUCTIVITY

<<Analysis still ongoing>>