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Collated Evidence Base

Evidence base review for Stoke-on-Trent and Staffordshire LEP Energy Strategy

Prepared for
Stoke and Staffordshire LEP

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Contents

1. Introduction

This report is an interim document, setting out the evidence base for Staffordshire that will feed into the creation of an energy strategy for the region. It sets out the documents that have been considered, and the areas they cover, as well as identifying the gaps in the evidence base and what needs to be added to this to make it more comprehensive.

2. Policy review

2.1 National

In recent years the government has been revising and updating its policies relating to the UK energy system. There has been renewed focus on the 2050 climate change targets with the signing of the Paris agreement, and an increased impetus looking at how these targets could be met.

2.1.1 Industrial Strategy

The government's Industrial Strategy Green Paper of January 2017 (1) set out ten pillars to drive UK growth, including particular focus on science, research and innovation. The Green Paper also set out a number of ways in which investment in energy infrastructure and support for the low carbon economy would play an important role in delivering the country's growth ambitions.

This was followed up by the Industrial Strategy White Paper (2) in November 2017 which set out five foundations of productivity to transform the economy. This also set 'Grand Challenges' to put the UK at the forefront of the industries of the future in areas of:

- Clean Growth
- AI and Data Economy
- Future of Mobility
- Aging Society

Government committed to £725m of funding for challenges within the second wave of the Industrial Strategy Challenge Fund, to capitalise on Britain's strengths in research and innovation, and help deliver the Grand Challenges, potentially investing in areas such as:

- Clean Growth
  - Transforming construction
  - Prospering from the energy revolution
  - Transforming food production
- AI and data
  - Audience of the future
  - Next generation services
- Ageing Society
  - Data to early diagnosis and precision medicine
  - Healthy ageing

As the Stoke and Staffordshire Energy Strategy is developed further and stakeholder feedback is incorporated, the areas that are most appropriate for the LEP and Local Authorities to focus on will be identified in more detail, and specific projects that could be considered within this reviewed.

2.1.2 Clean Growth Strategy

The Clean Growth Strategy sets out how the UK will grow the national income while cutting greenhouse gas emissions, in line with the target to reduce carbon emissions by 80% by 2050 and the five year carbon budgets leading up to that. The Clean Growth Strategy covers the period up to and including the fourth and fifth carbon budgets, leading up to 2032.

There are a number of commitments in the energy sector made as part of this strategy, (3) in several key areas, including:

- Improving business and industry efficiency
- Improving homes
- Accelerating the shift to low carbon transport
- Delivering clean, smart, flexible power

A few of the key commitments are highlighted below.

Improving homes

- An extension of ECO out to 2028 including a review of the best way to do this beyond 2022
- Consulting on the regulations requiring minimum energy efficiency standards in the Private Rented Sector (PRS) from April 2018 and developing a long term trajectory to improve energy performance of as many as possible to EPC Band C by 2030
- Phasing out the installation of high carbon fossil fuel heating in new and existing homes currently off the gas grid during the 2020s, starting with new homes

Most areas of the UK, including Staffordshire, have significant energy demands from domestic properties. The extension of ECO funding will enable more of the 'hard to treat' properties with poor energy efficiency to be targeted with retrofit measures to improve their energy consumption.

Across the national housing stock the sector with the highest proportion of F and G SAP ratings is the private rental sector (PRS). Conversely, councils and housing associations have been very proactive in upgrading their worst performing stock, typically with internal targets to achieve a SAP C rating across their portfolio within the near future. Owner occupied properties are typically less likely to have undergone retrofit, but there has been more progress made here than in the private rental sector, where landlords have little to no incentive to improve the energy efficiency of their stock in a market where housing demand often exceeds supply. The minimum energy efficiency standards for the PRS have been signposted for some time and will make it illegal to rent out F and G rated properties, although whether this can be effectively enforced remains to be seen.

Plans to phase out installation of high carbon fossil fuel heating in homes off the gas grid could be important for Staffordshire, given the rural nature of some of the area. Focus is initially on new homes, which are easier to tackle, but there will also be policies put in place to encourage retrofit of low carbon heating systems to existing properties using oil, LPG or solid fuels.

A contributing part of this will be the continuation of the Renewable Heat Incentive (RHI) to encourage take-up of technologies such as heat pumps, biomass boilers and biomethane. Beyond this government are considering a range of policy options and will involve consumers and industry in developing new policy.

Low carbon transport

- To meet the 2050 targets, almost every car and van will need to be zero emission by 2050. The Government has announced an end to the sale of all new conventional petrol and diesel cars and vans by 2040
- The Government will set out further detail on a long-term strategy for the UK's transition to zero road vehicle emissions by March 2018.

The end of petrol and diesel vehicle sales by 2040 will not mean an end to petrol and diesel vehicles on the roads immediately, however this policy means a decline in numbers of these vehicles is expected leading up to this date and an increase in alternatively fuelled vehicles, such as hydrogen and electric vehicles, is likely to be seen.

The major impacts of this are twofold, firstly the growth of electric vehicle numbers will need to be accompanied by a growth in charging points and associated infrastructure to ensure travel remains unimpeded. As electric vehicles are produced that can travel longer distances without recharging, the importance of rapid chargers increases. These are chargers such as the Tesla Supercharger that require over 50kW of power and can charge a battery to 80% in 30 minutes. The distribution of these chargers will potentially be limited by the pre-existing grid constraints in Staffordshire which could prevent the drawing of such significant amounts of power in certain areas, potentially requiring innovative solutions such as chargers co-located with generation and storage to make this viable.

Almost all major car manufacturers have either already produced an electric vehicle or are working on their first model, which shows the direction of travel of the industry. While much of this was already underway, the government announcement has provided added impetus to manufacturers to manoeuvre themselves ahead of the competition. This represents both a problem and a potential opportunity, as new technology requires new supply chains to be put in place to deliver this. New and existing suppliers in the Staffordshire area could be well placed to fill newly emerging supply chain gaps and use their existing relationships with manufacturers to diversify.

Business and Industry

- Enable businesses and industry to improve energy efficiency by at least 20% by 2030.
- To achieve this Government will put in place a simpler, more ambitious and long-term regulatory framework to:
  - Make it easier for business to identify energy savings

  - Ensure improvements in the leasing sector and in new commercial and industrial buildings
  - Help to understand how the Government can encourage greater investment in energy efficiency measures and technologies
- Phase out the installation of high carbon forms of fossil fuel heating in new and existing businesses off the gas grid during the 2020s, starting with new build

These policy areas are focused on helping businesses cut energy consumption, and through this cut energy costs, making them more competitive. Businesses in Staffordshire could benefit from energy efficiency support to become more competitive. A set of actions are already in place to decarbonise the ceramics industry in Staffordshire, which is one of the main industrial sectors in the area (4).

One of the options being considered is establishing a minimum energy performance standard for commercial buildings to incentivise landlords to invest in energy efficiency measures which could reduce energy consumption for their tenants.

Other than energy efficiency they are particularly interested in phasing out high carbon forms of heating, such as oil. This will initially be targeted using the Renewable Heat Incentive (RHI) but a successor policy to this is likely to be put in place, potentially including stronger carbon pricing.

Smart, flexible power

- Around £900 million of public funds between 2015 and 2021 in research and innovation invested in the power sector including:
  - £265 million in smart systems to reduce the cost of electricity storage, advance innovative demand response technologies and develop new ways of balancing the grid, and;
  - £177 million to further reduce the cost of renewables
- Implementing the smart systems plan, which will help consumers to use energy more flexibly and could unlock savings of up to £40 billion to 2050
- Target a total carbon price in the power sector which will give businesses greater clarity on the total price they will pay for each tonne of emissions.

Grid constraints within Staffordshire, as discussed in the following sections, mean that there could be opportunities for smart grids and flexible power provision to alleviate some of these constraints. Flexible power will support one of the main aims as set out in the strategic plan for Staffordshire to create sustainable energy infrastructure and develop more employment sites (5).

The Distribution Network Operator (DNO) that owns and operates the electricity infrastructure within Staffordshire is responsible for the network, and is currently transitioning from DNO to Distribution System Operator (DSO) which will involve more active local management of network load, generation and constraints (6).

The government's investment in innovation includes £265 million in the area of smart systems aiming to reduce the cost of electricity storage, advance innovative demand response technologies and develop new ways of balancing the grid. These are technology areas that could prove beneficial to Staffordshire, and indeed it may be

possible to identify sites within Staffordshire that could operate as pilot sites for feasibility studies investigating these opportunities.

The Feed-In tariff is due to be phased out in 2019, so the update promised is welcome as it will provide clarity on the likely development of small scale renewable generation beyond this. Renewable energy auctions – through the Contracts for Difference (CfD) mechanism will continue, these are focused on large scale renewables.

Public Sector Leadership

- A commitment to introduce a voluntary public sector target of 30% reduction in carbon emissions by 2020-21
- Provide £255 million of funding for energy efficiency improvements in England and help public bodies access sources of funding

This is something that should be monitored closely, as while the initial proposed target is only voluntary there is likely to be a consultation on plans to introduce a mandatory target by 2025. This will require local authorities to review their Carbon Management Plans and take steps to reduce carbon emissions in line with the targets put in place. Funding for energy efficiency improvements will enable these targets to be met.

Local leadership

- Support for local energy strategy development
- Local Energy programme to support local areas to play a greater role in decarbonisation
- Support for LEPs and local authorities to access clean technology innovation funds

The clean growth strategy recognises that moving to a productive low carbon economy cannot be achieved by central government alone; it is a shared responsibility across the country. Local areas are best placed to drive emission reductions through their unique position of managing policy on land, buildings, water, waste and transport. They can embed low carbon measures in strategic plans across areas such as health and social care, transport, and housing.

The Government have recognised the importance of local action on decarbonisation and so are putting in place resource to support LEPs and local authorities to take action.

2.1.3 Government support for local energy

BEIS local energy hubs

BEIS have identified that barriers to progression towards a low carbon economy at a local level include 'limited capacity and capability amongst Local Enterprise Partnerships (LEPs) and local authorities' to deliver local energy investment.

The BEIS Local Energy programme is designed to address the gap in the capacity and capability of LEPs and other local organisations. Part of this involves funding LEP Energy Strategies to understand the opportunities and challenges across each LEP area.

The overall aim of the BEIS proposal is to provide a series of local energy hubs across England (7) that, via staff and funding, will:

- Develop and prioritise a pipeline of local energy projects identified through LEP and partner energy strategies and take these projects from concept to business cases that attract investment and are then taken forwards to implementation by other partners.
- Help coordinate local action across several local LEP areas.
- Provide a local good practice link between local LEP activity, other local LEP areas, and national Government.
- Energy Efficiency, generation and smart distribution across the public estate and social housing
- Building integrated clean and smart generation for larger sites and underused land, including heat and power networks and storage (electric/hydrogen)

There will also be capacity to enable better sharing of best practice in other areas between the local LEPS and local authorities.

Heat network support

One element of government support for local energy that is well established is the funding from the Heat Network Development Unit (HNDU). This has been running since 2013 and was set up to address the capacity and capability challenges which local authorities identified as barriers to heat network deployment in the UK.

Government are keen to support the development of heat networks because they can enable a transition to lower carbon heating sources, and can be effectively implemented using a variety of different heat supply technologies. Once the infrastructure is in place, even if carbon emitting fuel sources such as gas boilers are used to supply the heat initially, it will be possible in future to replace the central plant used to supply the heat with lower carbon options without causing any disruption to the homes or businesses supplied, therefore enabling easier decarbonisation of heat supply.

HNDU provides support to local authorities in England and Wales through the early stages of heat network development:

- Heat mapping
- Energy master planning
- Techno-economic feasibility
- Detailed project development
- Early commercialisation

This funding enables local authorities to explore the potential opportunities for heat networks within their towns and cities, and move from there through feasibility to initial commercialisation to a point where a local heat network may become commercially viable. Local authorities within Staffordshire have been proactive in exploring these opportunities.

Many of these studies have identified networks where the commercial returns are marginal, and are unlikely to be taken forward by the private sector; this has led to capital funding being made available by government to support these in order to overcome initial economic barriers to investment. This funding is known as the Heat

Networks Investment Project (HNIP), and is a £320m capital investment programme providing support for the capital costs of heat networks. So far £24m of support has been provided to a total of nine local authority projects.

2.2 LEP policy and plans

2.2.1 Strategic Economic Plan

The Stoke and Staffordshire Strategic Economic plan dates from 2014 (5). The key focus is on developing strategic connections, creating more employment sites, improving digital connectivity and promoting sustainable energy infrastructure.

The focus of SEP is on two key centres:

- North of Staffordshire conurbation which includes Stoke-on-Trent and Newcastle-under-Lyme cities
- Additional strategic centres which include Stafford, Burton-on-Trent, Cannock, Lichfield and Tamworth

The overall vision for Staffordshire is to achieve an economy growth of 50% and generate 10,000jobs in the next 10years (this is also referred to as the 50:50:10 aim).

Also identified by the LEP are business and industrial clusters in growth sectors across and within key locations in Staffordshire that have significant potential, particularly:

- Applied materials
- Agri-Tech
- Aero-Auto
- Medical technology
- Energy generation
- Business and professional
- Tourism and leisure

Energy has been identified as a priority area here due to the physical, locational and research assets, particularly in the power generation sector. Strong presence of energy generation companies highlights the possibility to expand the sector even further.

There is priority around decarbonisation of the ceramics sector, with the development of a supportive and long-term policy framework, with stronger representation of the sector and enhanced collaboration with relevant governmental instruments. Focus is also drawn on research and innovation of manufacturing and operational technologies used (4).

There are plans on combating fuel poverty by focusing on reducing energy consumption through behavioural change and improvements of the building fabric, maximising the household's income, reducing fuel costs and increasing the amount of energy generated from renewable and low carbon sources (8).

District heating is currently enabled in Staffordshire through the development of a Low Carbon District Heat Network with a potential deep geothermal heat source. Future plans include a city-wide district heat network and biomass boilers, biomass CHP, micro CHP, air source heat pumps and photovoltaics. (9)

2.2.2 Stoke-on-Trent and Staffordshire EU Structural and Investment Fund Strategy

The LEP has developed a set of ambitions for use of ESIF funds which complement and reinforce the objectives within the Strategic Economic Plan. These include focus on decarbonisation and building on established strengths in the energy generation sector. The ambitions are set out below: (10)

1. A more productive economy: Stoke-on-Trent and Staffordshire will make progress towards closing the existing productivity gap between itself (£14,900 per head) and the national average (£21,300) by creating new, higher value added jobs, and by helping the existing business base to grow and engage with emerging sectors.
2. A more diverse and resilient economy: building on established (and acknowledged) strengths in a number of high value added priority sectors including Advanced Manufacturing, Advanced Materials, Creative Media and Energy Generation.
3. An innovation driven economy: with established relationships between major companies, R&D functions and Higher Education and with a SME business base which has the capacity and knowledge to engage and add value to local and regional supply chains.
4. A strong and growing base of SMEs across both urban and rural areas: as a result of a comprehensive and joined up approach to the provision of support.
5. A leading low carbon economy: driven by its unique approach to local energy generation and by an SME base which has evolved and embedded low carbon principles, practices and activities.
6. A well-qualified and adaptable workforce: with the skills sets appropriate to the needs of existing business sectors in Stoke-on-Trent and Staffordshire, as well as those in which we have aspirations for economic growth.
7. More inclusive communities: having made progress towards addressing issues of low aspirations and worklessness, through targeted approaches to engagement, training and employability.
8. A more attractive place to live, work and visit: renowned for its vibrant and diverse places, strong cultural and leisure offer in Stoke on Trent complemented by visitor attractions and a high quality environment across the LEP area.

2.2.3 Stoke-on-Trent and Staffordshire City Deal

The Stoke-on-Trent and Staffordshire City Deal (11) is a deal to create more local jobs by encouraging economic growth. The city deal will take advantage of the area's natural resources, support Stoke-on-Trent and Staffordshire's world famous advanced manufacturing and applied materials (e.g. ceramics) sectors, and the emerging energy and renewables growth sector.

It is based on four connected strands:

- Delivering a new and local approach to energy production;

- Providing local and incoming businesses with support to develop the next generation of products and materials;
- Developing local sites for new businesses or existing business to expand into, along with a strengthened local planning and development context and;
- Bringing employers and education together to ensure residents have the skills and training that they and local businesses need to drive the economy forward.

Support for energy under the City deal

There are several key energy projects that have been developed as part of the City deal, including district heating, smart energy management and combined heat and power.

The City Deal has included support for the development of a large-scale, low carbon heat network system in Stoke city centre which is fed by deep geothermal energy that will produce up to 45GWh per annum and save approximately 10,000 tonnes of CO_2 per annum.

The deal also includes support to implement the Smart Energy Network Demonstrator (SEND) at Keele University for the testing and evaluation of new smart energy scenarios, the application of which has the potential to save between 1,700 tonnes and 77,000 tonnes of CO2 per annum if applied to households, business and other institutions connected to the Stoke-on-Trent District Heat Network (and more if applied to urban locations nationally and internationally).

Local partners have delivered a £140 million Energy from Waste Plant at Four Ashes in South Staffordshire. Through flexibilities agreed through the City Deal, a business case has been developed with government departments, including with the BEIS Heat Network Delivery Unit, to assess the future potential to offer Combined Heat and Power to local facilities and businesses. This project has the potential to lever £8 million in private investment.

There has been work towards development of a Combined Cycle Gas Turbine power station at Meaford. This has the potential to add a Combined Heat and Power unit to a strategic employment site which could create 2,500 jobs. The scheme has obtained a development consent order and is currently being used as a basis to secure a supply contract.

2.2.4 Ceramic Sector Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan

The Ceramic Sector Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan (12) is key collaboration between Government and industry to help the ceramics industry make the low carbon transition while also maintaining its competitiveness. It has been developed through partnership between the British Ceramics Confederation (BCC) and the Department for Business, Energy and Industrial Strategy (BEIS).

The ceramics sector is energy-intensive and consumes around 4.7 TWh of delivered energy per year, with gas accounting for 80 to 82% of the industry's overall energy mix. Total emissions in 2012 were 1.2 million tonnes CO_2, with the Roadmaps pathways showing a maximum technical abatement potential of up to 0.7 million tonnes CO_2 by 2050 if cost considerations are not taken into account. Most of this was

through the electrification of heat and accompanying grid decarbonisation, although energy efficiency including heat recovery and the use of biofuels could also make significant contributions.

Energy costs are a major factor for the sector, accounting for as much as one third of production costs, thereby naturally driving efficiencies and improvements. The UK's heavy clay sector, for example, has recently invested in some of the most energy- and carbon-efficient manufacturing ceramic operations in the world. Long-term planning is essential, however, as ceramics is a capital-intensive sector with long–investment cycles; a production plant can typically last more than 40 years.

The action plan will be delivered through a combination of government support, commitment from industry (BCC and its members) and involvement of other complementary organisations (such as Innovate UK, the Knowledge Transfer Network and academia). The action plan involves the following:

- Creation of a Decarbonisation Leadership Group to provide strategy and leadership for decarbonisation within the ceramic sector and to collaboratively develop a supportive, long-term policy framework for Energy Intensive Industries.
- Increase the adoption of state-of-the-art technology and existing energy-efficiency practices through sharing knowledge and bolstering financial support
- Define innovation requirements for the sector and implement mechanisms for collaborative innovation including funding to stimulate technology development, demonstration and implementation
- Increase RD&I with potential applications in the ceramic sector and maximise its funding from both Government and the sector
- Develop and demonstrate advanced heat recovery technologies to increase the re-use of waste heat
- Increase the use of bioenergy in the sector
- Increase implementation of on-site renewables for self-generation of electricity requirements
- Collaborate with customers to create market pull for decarbonisation in the sector
- Develop a long-term engagement strategy with suppliers in the sector
- Increase skills and knowledge within the sector to enable an internationally competitive, energy / carbon-efficient future

2.3 Policy summary

It is clear from the preceding sections that energy is becoming more of a priority at both a national and a local level. Meeting the UK's decarbonisation targets will be challenging, and requires a clear action plan to be put in place to ensure Stoke and Staffordshire contribute effectively. Furthermore, access to energy is crucial for growth. For large manufacturing within Staffordshire energy can represent a significant cost and access to low cost energy is crucial to staying competitive. The Stoke-on-Trent City Deal aims to put Stoke at the forefront of the development of renewable and low carbon energy projects.

In this context it is clear that an energy strategy for Stoke and Staffordshire is needed in order to ensure that work done looking at different aspects of the energy system can be drawn together and a clear action plan put in place to help Stoke and Staffordshire reach a future with secure low carbon energy supply to drive local economic growth.

3. Evidence base review

3.1 Existing documents and areas covered

This is covered in a separate spreadsheet appended to this report, and summarises the areas covered by differing existing reports, where the gaps are, and datasets that could be utilised to fill these.

3.2 Domestic Energy Efficiency

Stoke-on-Trent has had work done to assess energy performance of domestic dwellings on a ward and LSOA basis utilising data from Energy Performance Certificates (EPCs). This helps identify areas with poorer levels of energy efficiency and where energy efficiency levels are relatively higher.

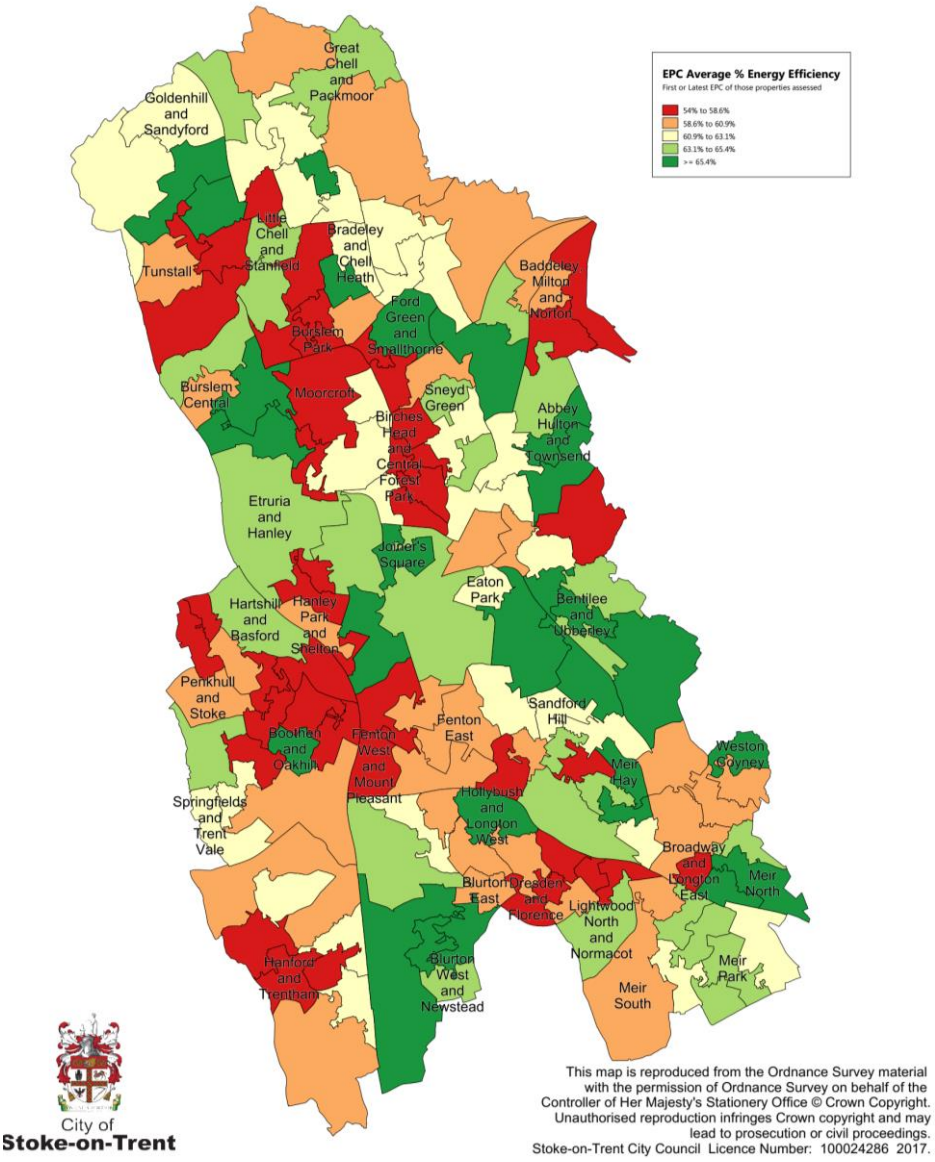

Figure 1: Energy efficiency levels across Stoke-on-Trent from EPC data

This energy efficiency data isn't available for Staffordshire as a whole and so represents an area that could be improved to help target energy efficiency improvements.

3.3 Renewable energy potential

Several studies have contributed to the below summary of the total renewable energy resource across Staffordshire. This sets out the maximum possible energy generation resource from different technologies that could be reached in the future.

Table 1: Total renewables potential of each local authority area in MW by technology across Staffordshire (13)

		Stoke-on-Trent	Cannock Chase	East Staffordshire	Lichfield	Newcastle-under-Lyme	South Staffordshire	Stafford	Staffordshire Moorlands	Tamworth	Total (MW)
Onshore wind	Large scale	8	40	1209	1148	540	497	1901	1208	23	**6,566**
	Small scale	0	0	45	45	27	0	40	52	0	**209**
Hydro		0.1	0.02	2	0.4	0.05	0.3	2	3	0.2	**8**
Solar	Photovoltaics	55	22	32	26	28	27	40	29	15	**219**
	Water heating	46	18	25	21	24	22	34	22	12	**178**
Heat pumps	Ground source heat pumps	105	36	52	41	50	43	61	46	27	**356**
	Air source heat pumps	421	146	207	165	200	171	245	182	106	**1,422**
Biomass	Managed woodland – elec.	0.1	0.1	0.2	1	1	1	2	1	0.1	**6**
	Managed woodland - heat	0.1	0.2	1	1	1	1	2	2	0.1	**8**
	Energy crops – elec.	0.1									**0**
	Energy crops - heat	0									**0**
	Waste wood – elec.	2	1	1	1	1	0.5	1	0.5	0.5	**7**
	Waste wood - heat	1	0.5	1	0.5	0.6	0.4	1	0.4	0.4	**5**
	Agricultural arisings (straw)	0	0.1	1	2	0.2	2	2	0.1	0.1	**8**
	Animal waste (wet organic waste)	0.5	0.2	9	3	5	4	15	14	0.2	**50**
	Animal waste (poultry litter)	0	0	0.2	0	0	0.4	0.03	0.1	0	**1**
	Municipal solid waste	10	3	4	4	4	4	4	4	2	**29**
	Commercial & industrial waste	6	2	4	3	3	2	4	2	2	**22**
	Landfill gas	3	2	1	0	0	2	1	0.6	0.3	**7**
	Sewage gas	3	0	1	0	0	2	0.6	0.6	0	**4**
	Co-firing of biomass	0	0	0	106	0	0	0	0	0	**106**
Total	Electricity (MW)	85	70	1308	1339	609	541	2,012	1,315	43	**7,237**
	Heat (MW)	573	201	286	229	276	237	343	252	146	**1,970**
Overall	Total (MW)	658	271	1,594	1,568	885	778	2,355	1,567	189	**9,865**
	% of Staffordshire total	6.7	2.7	16.2	15.9	9.0	7.9	23.9	15.9	1.9	**100**
	% of West Midlands total	1.2	0.5	3.0	2.9	1.6	1.4	4.4	2.9	0.4	**18.3**

A 2011 study looking at renewable energy capacity for the West Midlands (13) summarises total renewables potential from different types of technologies across the different local authority areas.

The study follows a standard methodology that was published by the Department of Energy and Climate Change (DECC) in 2010. This allows us to compare the current situation of renewable energy installations against this potential, and assess how much of this would need to be utilised to meet long-term carbon reduction targets.

From Table 1 it can be seen that Stafford, East Staffordshire, Lichfield and Staffordshire Moorlands have significant wind resources as well as some hydro, PV and biomass resources. The smaller land area of Tamworth leads to correspondingly lower potential generation from most of these technologies, with a contribution to the total West Midlands potential of only 0.4%.

3.4 Renewable energy deployment

Large scale (>1 MW) renewable deployment is set out below, as identified in the Renewable Energy Planning Database (REPD). This database covers all large scale renewable development and is complied with reference to a number of data sources including feed-in tariff deployment and local authority planning data so should be comprehensive for large scale projects.

From Figure 2 it can be seen that there are a wide range of renewable technology installations across Staffordshire. Schemes identified are all greater than 1 MW generation capacity. The black lines in Figure 2 show the local authority boundaries within Staffordshire.

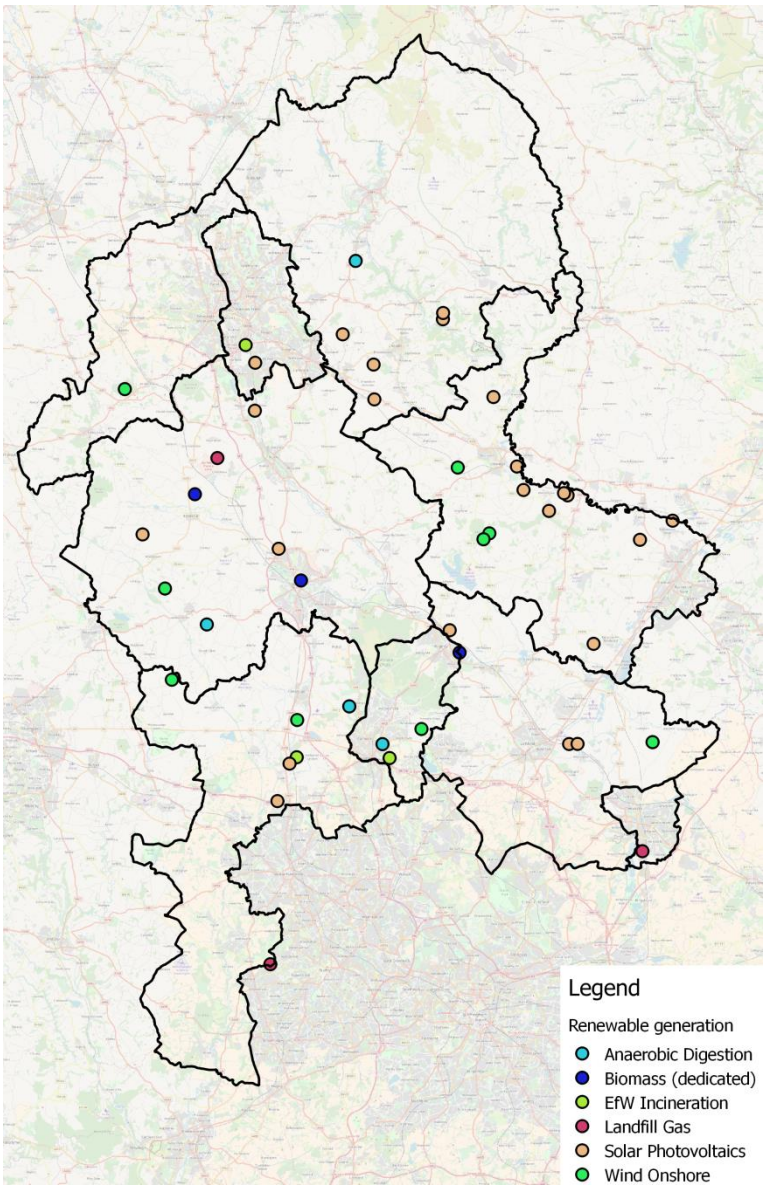

Figure 2: Staffordshire large-scale renewable deployment – operational sites (14)

There has been wider deployment of large scale solar PV schemes within East Staffordshire and Staffordshire Moorland. There are also a number of onshore wind turbine developments, particularly in East Staffordshire, taking advantage of the significant wind resources in the county.

Other opportunities include Anaerobic Digestion, Biomass, Landfill gas generation and Waste to Energy Incineration (EfW) developments, locations of which vary. There are some further projects that are either under construction or have secured planning permission and are awaiting construction that are summarised in the table below.

Table 2: Summary of technology installations by planning status and local authority area (14)

	Stoke-on-Trent	Cannock Chase	East Staffordshire	Lichfield	Newcastle-under-Lyme	South Staffordshire	Stafford	Staffordshire Moorlands	Tamworth
Awaiting Construction (MW)			**10.0**	**1.7**		**2.5**			
Anaerobic Digestion						1.5			
Biomass (dedicated)						1.0			
Solar Photovoltaics			10.0	1.7					
Operational (MW)	**16.7**	**23.0**	**49.2**	**2.0**		**21.0**	**5.2**	**24.9**	**1.0**
Anaerobic Digestion			6.0				1.3		
Biomass (dedicated)							2.6		
Landfill Gas						4.4	1.3		1.0
Solar Photovoltaics	2.5		43.2	2.0		12.6		24.9	
Wind Onshore						4.0			
EfW Incineration	14.2	23.0							
Grand Total (MW)	**16.7**	**23.0**	**59.2**	**3.7**		**23.5**	**5.2**	**24.9**	**1.0**

4. Updated Evidence Base

Statistics available through the data.gov.uk site have been used to update the evidence base for Staffordshire. This work establishes a baseline energy and carbon analysis that can be used in the next phase to look at the Energy Strategy opportunities for Staffordshire. Some of this data is available on a local authority level, some more granular, and others only on a regional basis, in which case assumptions have been made to apply this to Staffordshire.

4.1 Energy use in Staffordshire

The graphs below summarise overall energy use across Staffordshire.

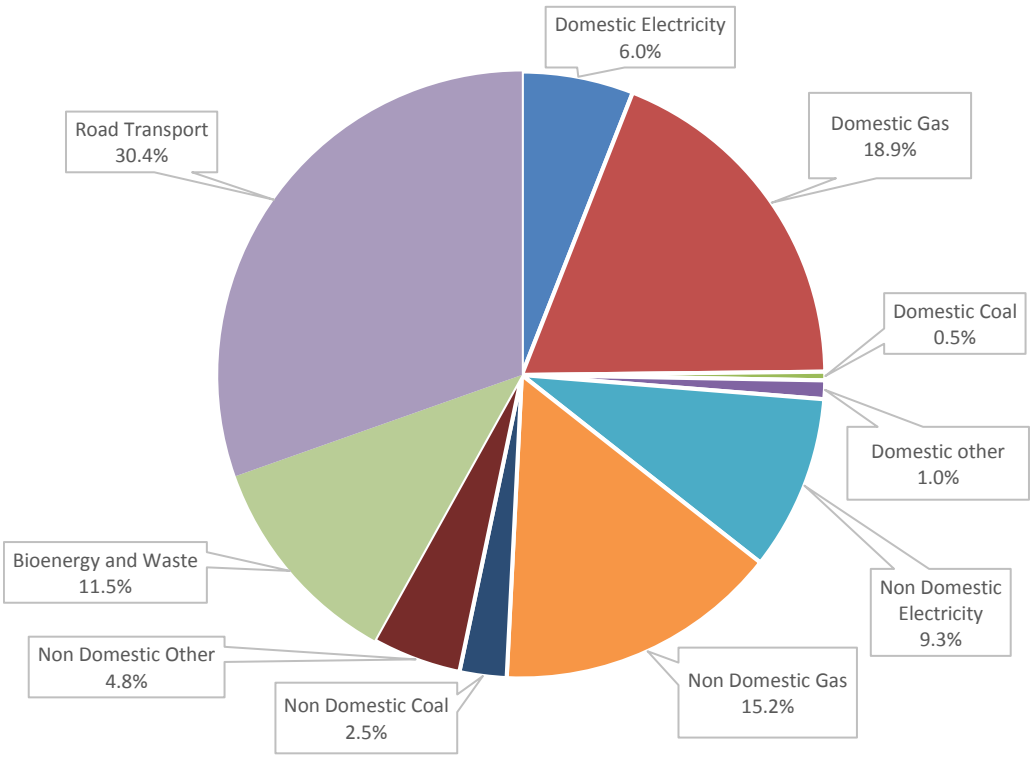

Figure 3: Energy use by fuel and sector in Staffordshire (15) (16) (17) (18)

Figure 3 shows the split of overall energy use by sector and fuel type in Staffordshire. This breaks down the consumption by domestic/non-domestic use and final fuel consumed, i.e. electricity, gas, coal, bioenergy and road transport fuels.

From this it can be seen that road transport makes up over a quarter of energy consumed in Staffordshire, the largest single energy use. Non-domestic energy consumption is higher than domestic energy consumption. Gas is the main fuel used, demonstrating the relatively wide access to the gas network within Staffordshire. Non domestic 'other' and domestic coal together make up less than 6%, indicating there is still some energy demand that is met by high carbon fuels such as oil and coal rather than gas or electricity.

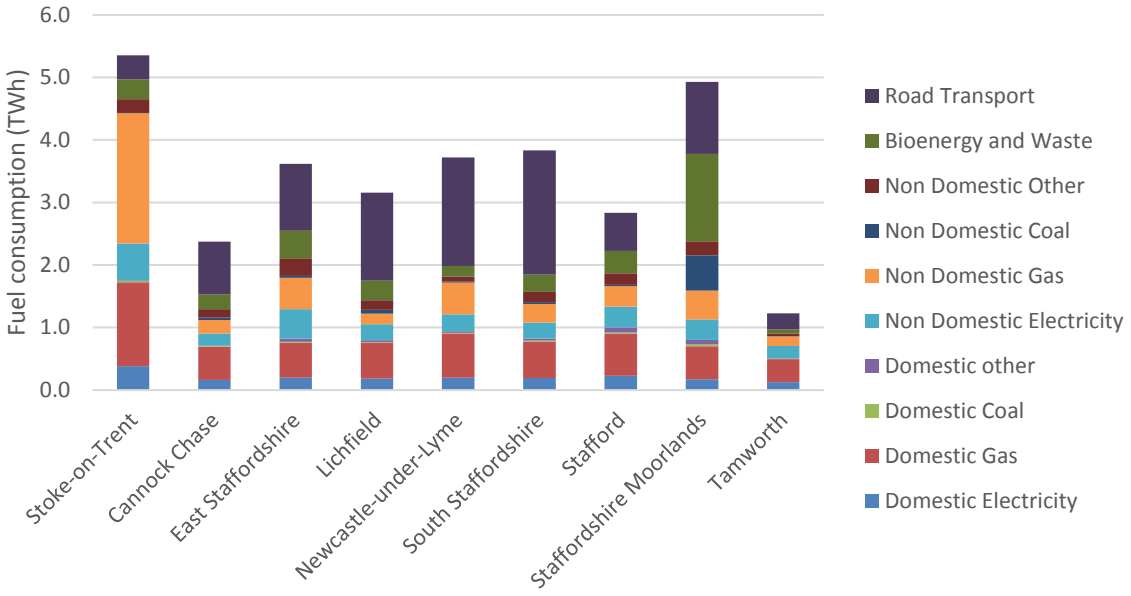

Figure 4: Energy consumption by fuel and by sector per local authority (15) (16) (17) (18)

From Figure 4 it can be seen that road transport is the single largest energy use in many of the local authority areas. Domestic gas consumption is significant, representing the large fuel demands for heating homes, while non-domestic energy demands vary with the levels of industry in the district. One of the highest non-domestic energy demands is seen in Stoke-on-Trent. Staffordshire Moorlands has significant consumption of bioenergy and waste for fuel.

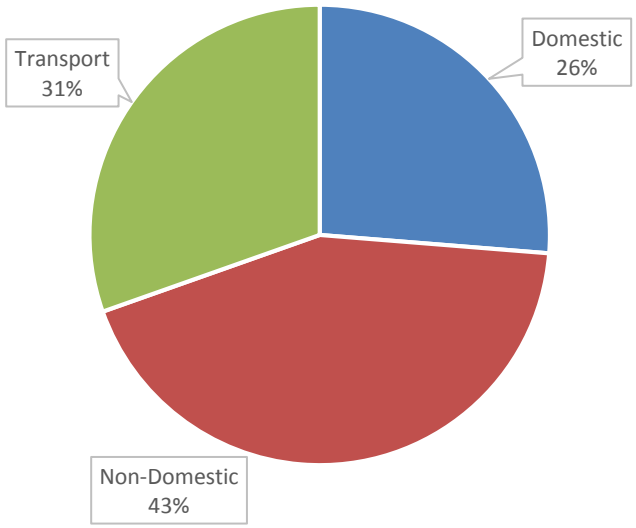

Figure 5: Energy use by sector (15) (16) (17) (18)

Energy use by sector is typically split approximately into third. Non-domestic here makes up 43% of total energy consumption. An increased proportion of non-domestic energy consumption compared to domestic and transport energy consumption could

represent a differing ratio of industry to population to the national norm. It could also point to a higher density of businesses that are large energy users.

Figure 6 shows the percentage of off-gas properties within each Lower Super Output Area (LSOA). Off-gas properties are those that are not connected to the gas network. LSOAs represent divisions of England for census purposes based on population, and so represent smaller geographical zones within urban areas than within rural areas. By comparing the number of domestic gas meters within each LSOA with the number of households from the previous census, the proportion of households that are connected to the gas network and are therefore capable of using gas for domestic heating purposes can be estimated.

From Figure 6 it can be seen that the majority of Staffordshire has below 40% of properties off-gas, with some of the more sparsely populated rural areas, particularly in Staffordshire Moorlands District and areas in Stafford District and East Staffordshire District off the gas grid presenting higher proportion of properties of the gas grid.

This lack of access to the gas network has major impacts for the heating fuels used, correlating with increased use of other more carbon emissions intensive fossil fuels such as oil or coal within rural homes. Changing the heating fuels in these homes is one of the government's key plans for decarbonisation of heat within the UK as set out in the Clean Growth Strategy (3).

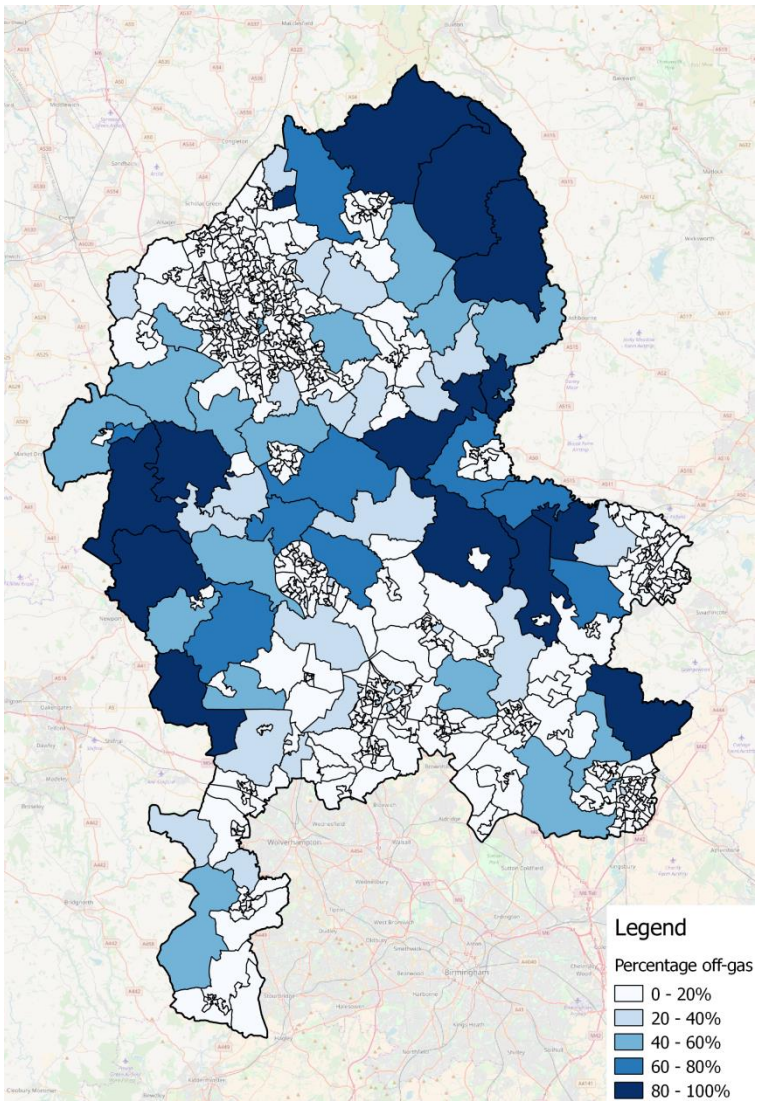

Figure 6: Percentage of off-gas properties by Lower Super Output Area (LSOA) (19)

4.2 Heat demand

The heat demand of each local authority area has also been explored using the DECC (now BEIS) National Heat Map (20). This is a tool that has built up heat demand using a bottom up approach assessing heat demand by building type and size, and is useful on an aggregate level to assess expected heat demands.

Figure 7 below shows the total heat demands across all sectors for Staffordshire. The map in dominated by Birmingham south of Staffordshire, but there are important hotspots flagged up around Stoke-on-Trent, Stafford, Burton-on-Trent and Tamworth.

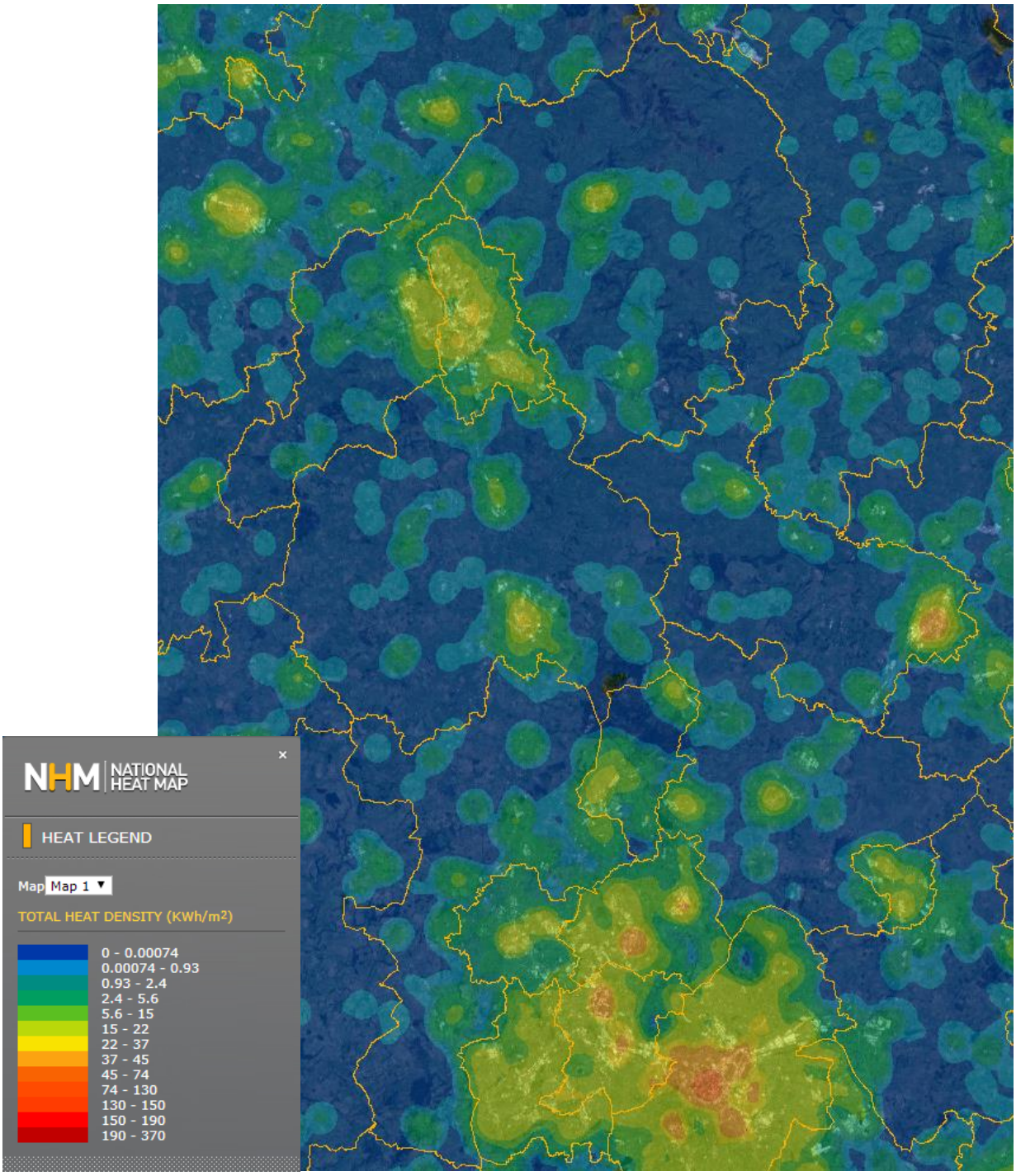

Figure 7: National heat map output for Staffordshire (20)

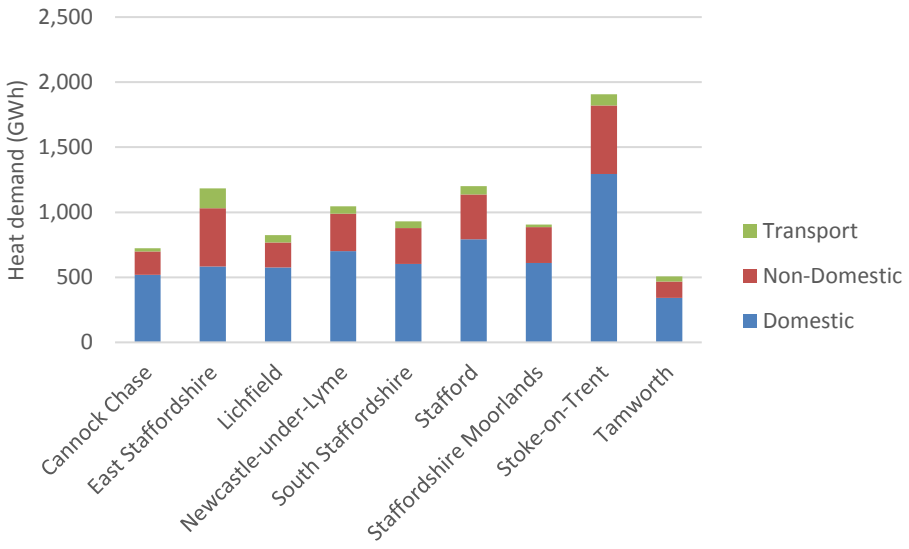

Figure 8: Heat demand by sector and local authority area (20)

Figure 8 shows that the majority of heat demand in each local authority area is for domestic premises, with the bulk of the rest made up of non-domestic demand with a small amount for transport. The domestic demand is easily understood, and is made up of heat to people's homes, supplied by a range of different fuel sources, as explored in section 4.1.

The non-domestic heat demand is broken down further in Figure 9. From this it can be seen that the proportion of heat demand for industrial buildings is significant in many of the local authority areas, with other significant contributions to total heat demand from Retail, Hotels, Health, Education and Transport.

This analysis helps to understand the potential opportunities that may be in place for heat networks or provision of alternative heating options in non-domestic premises.

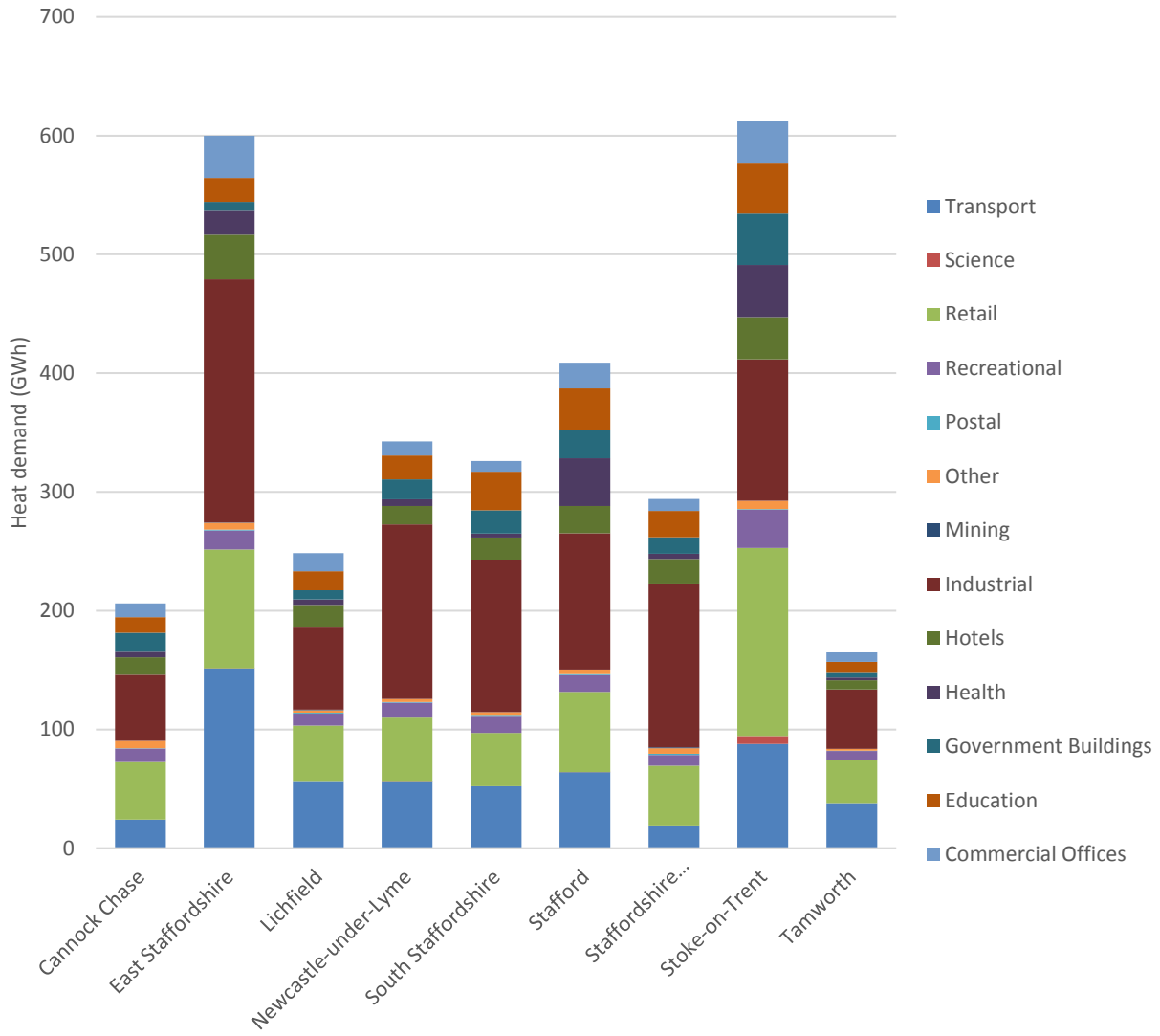

Figure 9: Non-domestic heat demand by industry and local authority area (20)

4.3 Carbon emissions

In this section Carbon is used as shorthand for greenhouse gas emissions. This is made up primarily of Carbon Dioxide (CO2), but also includes other major greenhouse gases weighted by global warming potential to produce a single aggregate figure known as Carbon Dioxide equivalent (CO2e).

The following data comes from the National Statistics publication *'UK local authority and regional carbon dioxide emissions 2005-2015'* (21).

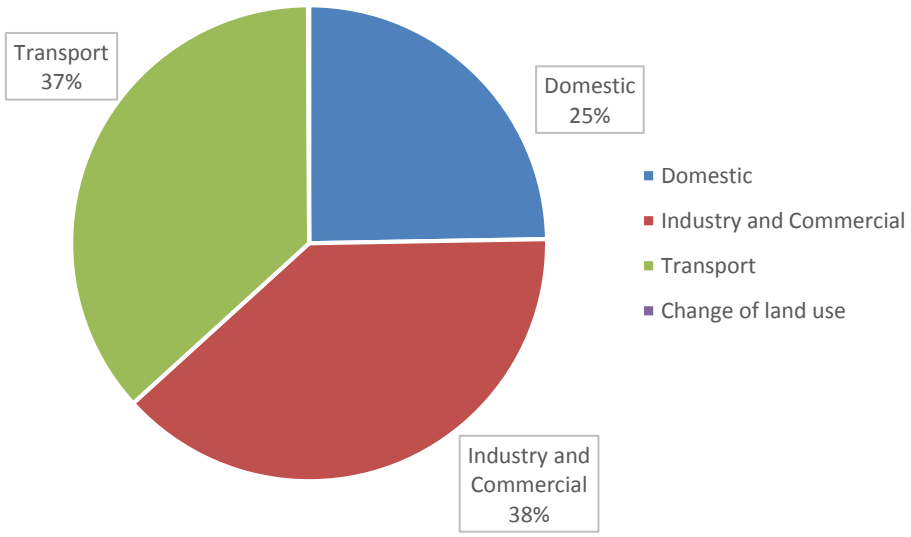

Figure 10: Staffordshire proportion of carbon emissions by sector, 2015 (21)

The industry and commercial sector accounts for the majority of carbon emissions. The transport sector is the second largest sector in terms of carbon emissions. The domestic sector presents the lowest emissions out of the three and accounts for almost a quarter of the total emissions. Change of land use is a category that encompasses change of the sector utilisation of land including removal of forests. This is a small proportion of overall carbon emissions, but it useful to monitor particularly its impact within rural areas where there is significant potential for development on greenfield sites. In the case of Staffordshire, the proportion of carbon emissions that is assigned to the change of land use sector is almost null.

Transport emissions have grown relative to the proportion of total energy use set out in Figure 3. This indicates that transport is a relatively high source of carbon emissions utilising primarily fossil fuels.

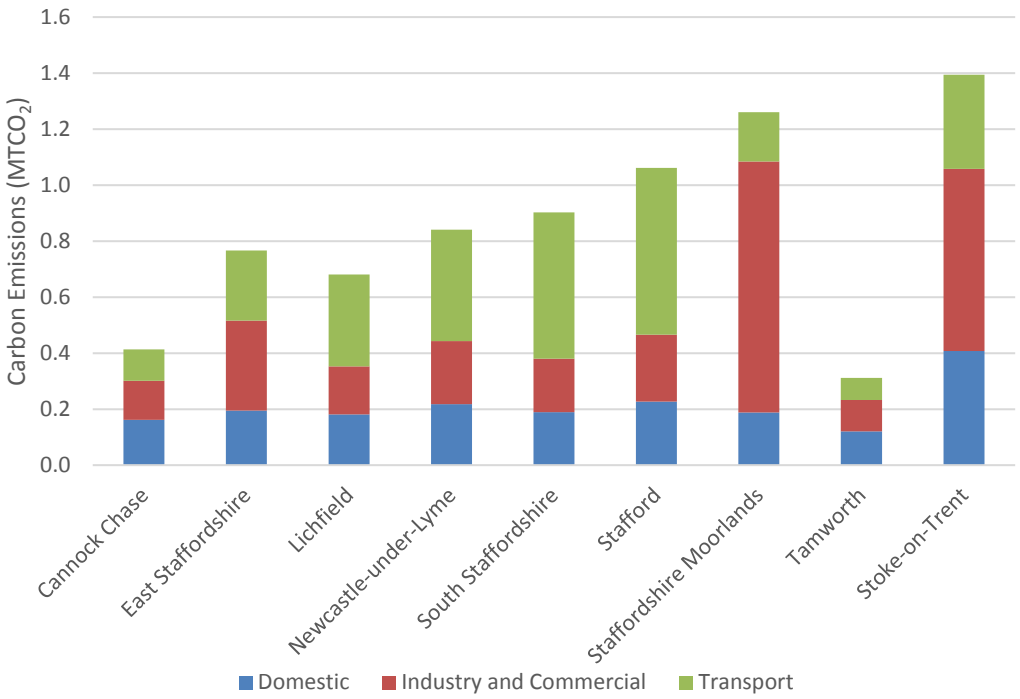

Figure 11: Total Carbon emissions breakdown by sector and local authority area, 2015 (21)

Figure 11 shows the sectoral breakdown of carbon emissions between domestic, non-domestic and transport emissions. From this it can be seen that Staffordshire Moorlands and Stoke-on-Trent industrial carbon emissions are substantial.

Converting total carbon emissions figures for each local authority area to a normalised figure of tonnes emitted per person allows us to compare these figures on a more even footing, as well as comparison to national benchmarks.

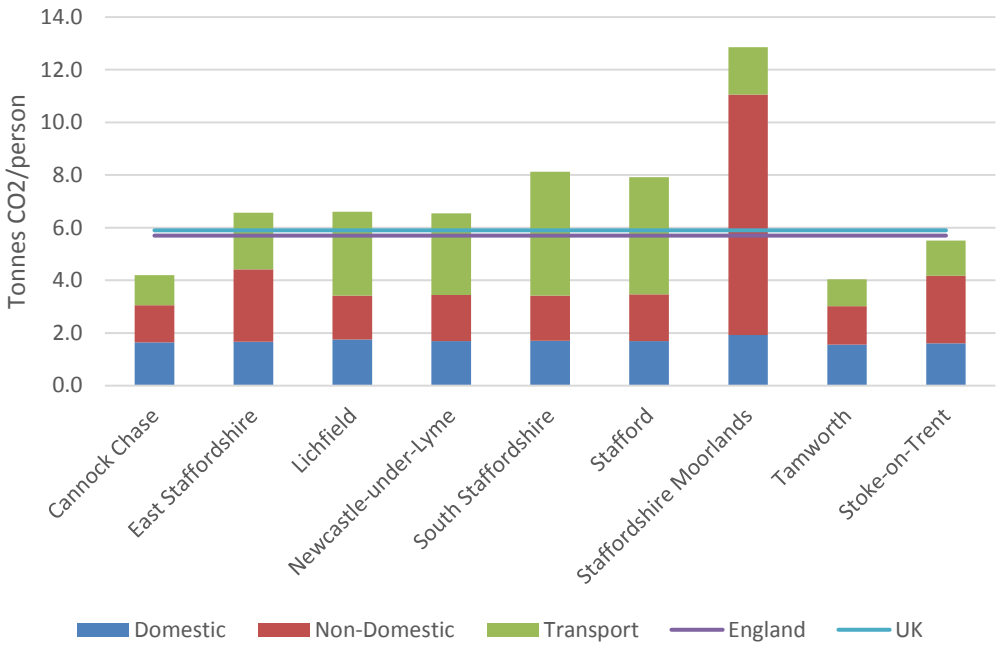

Figure 12: Carbon emissions per capita by category and local authority area compared to national benchmarks (21)

Figure 12 shows that that most of the local authority areas have emissions per capita figures around or below the national average. Carbon emissions on a domestic basis are similar, while non-domestic and transport emissions vary more widely. As seen in Figure 11, we can see the scale of the emissions from Staffordshire Moorlands. On this scale they look even larger relative to the other areas due to the relatively low population of the area.

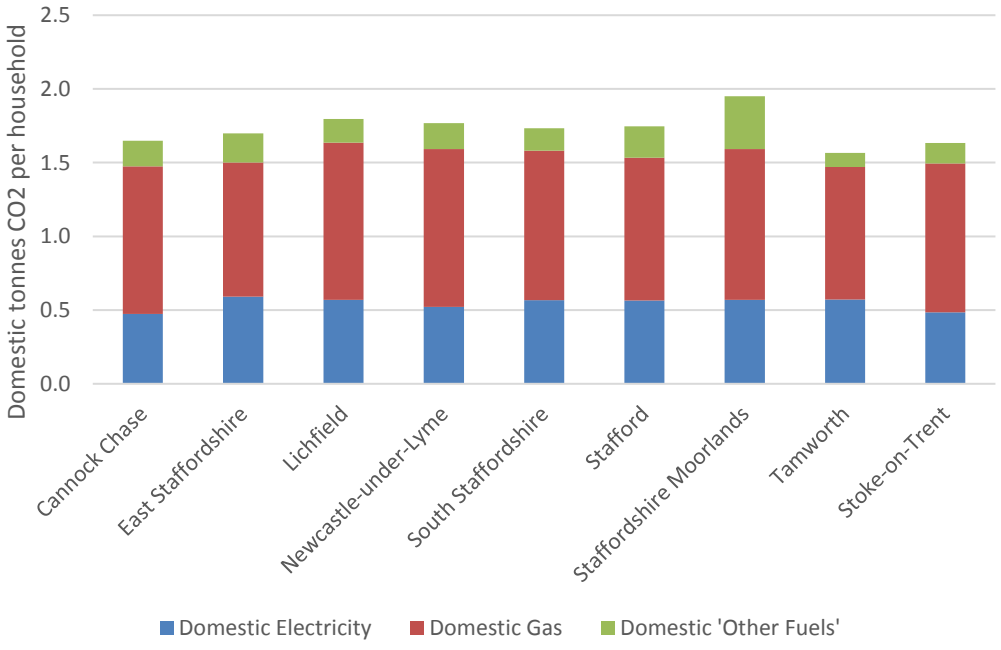

Figure 13: Domestic Carbon emissions by household (21)

Figure 13 shows domestic carbon emissions split by fuel consumed on a per household basis. A per household basis is most appropriate for comparison here as it is the number of households not the number of people that is more important in determining energy consumption.

Domestic electricity consumption carbon emissions are similar across all areas, with varying proportions from gas consumption. However, it can be seen that the prevalence of gas as the heating fuel of choice minimises the contribution to emissions from 'other fuels' such as coal and oil. Areas with higher proportion of non-access to the gas network, such as Staffordshire Moorlands, have higher emissions from 'other fuels.' This category includes oil and solid fuels such as coal which have significant carbon emissions and so will have a proportionately higher contribution to carbon emissions than to energy consumption alone.

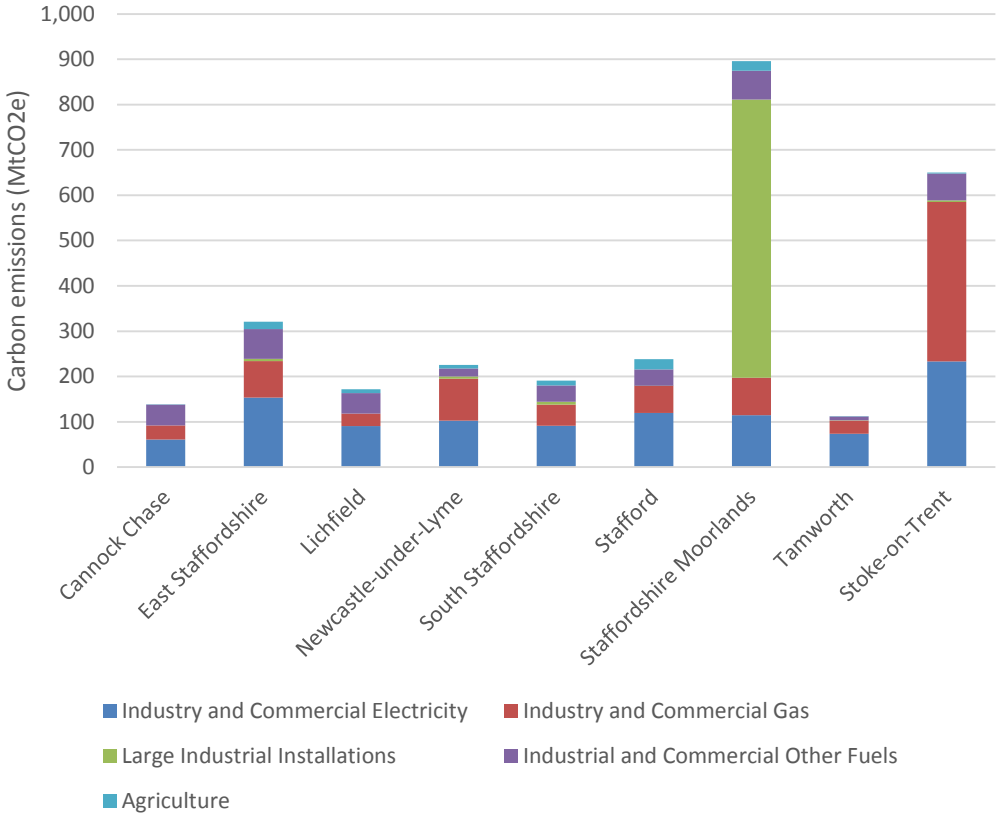

Figure 14: Non-domestic Carbon emissions broken down by sector and local authority area (21)

Figure 14 shows non domestic carbon emissions broken down by sector. From this it can be seen that the largest contributor to carbon emissions within each local authority area is typically industrial and commercial electricity use. The graph separates agriculture out specifically from industrial and commercial carbon emissions, and it can be clearly seen that agriculture to an extent to the larger, more rural areas such as Staffordshire Moorlands and Stafford Districts, but relatively little to that of more urban areas. Given the agricultural land within each local authority area this is to be expected, but it does highlight that for more rural areas to decarbonise they will need to tackle carbon emissions from agriculture.

The main stand out from the graph is again the carbon emissions contribution from Staffordshire Moorlands, categorised here as 'Large Industrial Installations', which skews the graph somewhat. Across most districts, there is a substantial contribution to emissions from industrial use of 'Other fuels'. This highlights a potentially easy route for initial carbon reduction if some of this energy use could be switched to gas as a lower carbon fuel.

Carbon emissions from electricity use are not something that can be controlled on a local authority or regional level, given the interconnected nature of the electricity network and the responsibility of national government to set policy related to the electricity generation mix. However, current national projections show carbon emissions from electricity generation following the current trend and falling over time, indicating that carbon emissions from electricity use are likely to decrease.

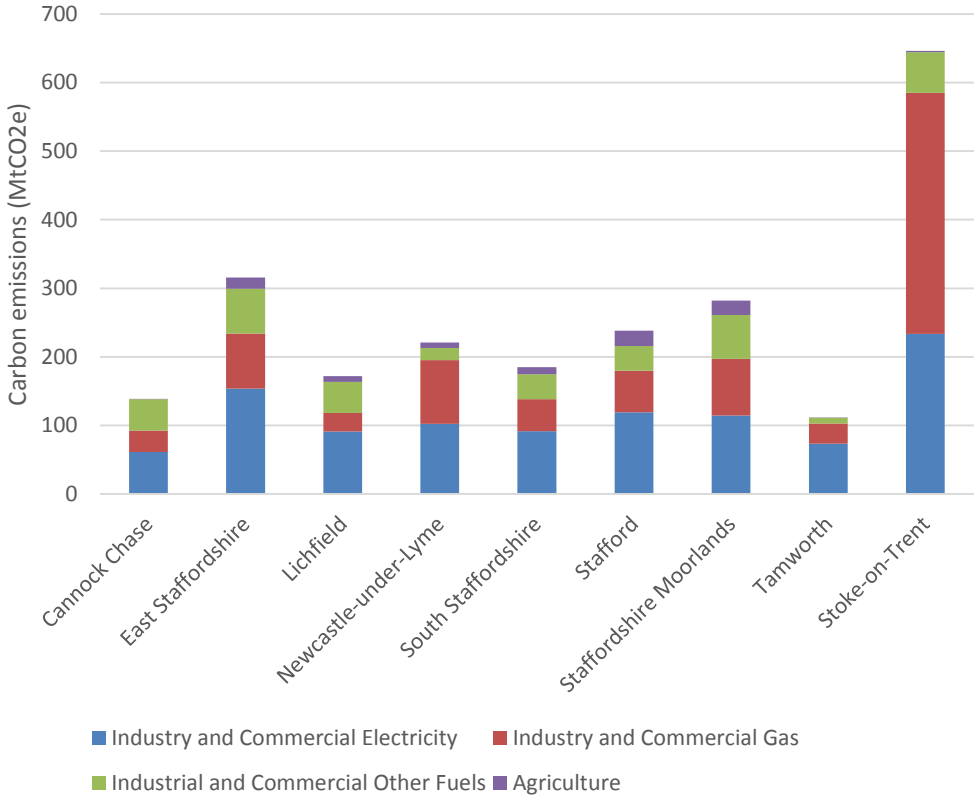

Figure 15: Non-domestic Carbon emissions broken down by sector and local authority area (large industrial installations removed) (21)

Figure 15 shows the data from Figure 14 with the effect of large industrial installations stripped out for ease of comparison of some of the other figures. On this basis it is easier to interpret some of the data discussed above.

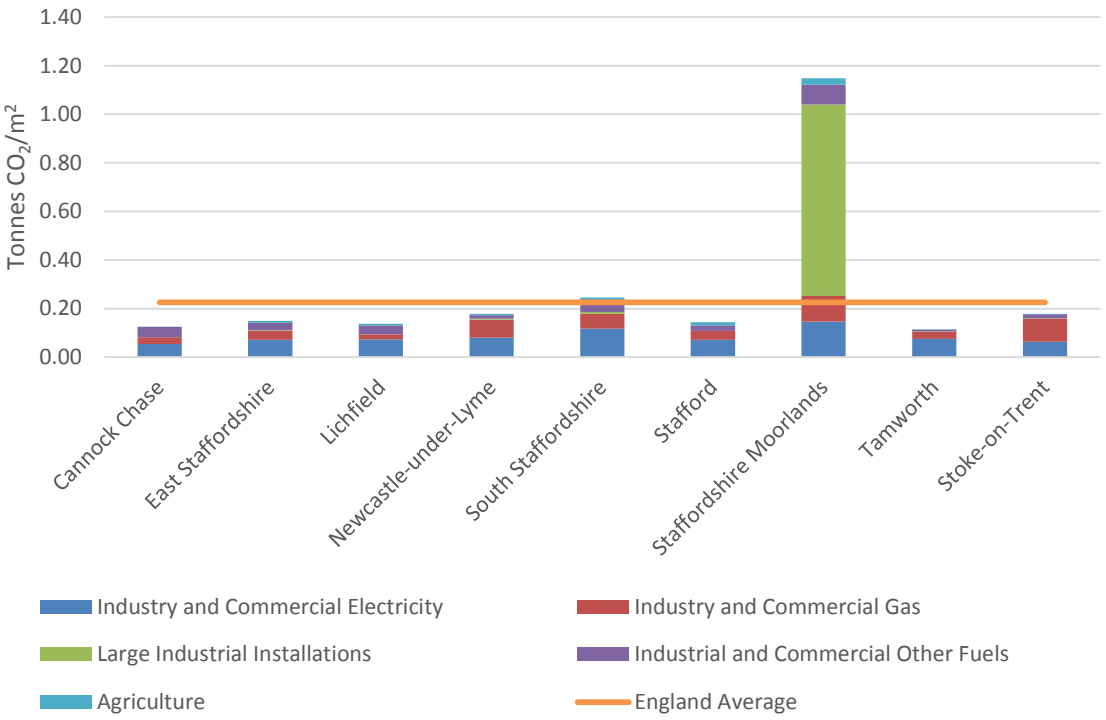

Figure 16: Non-domestic Carbon emissions per metre squared of commercial floor area by sector and local authority area (22)

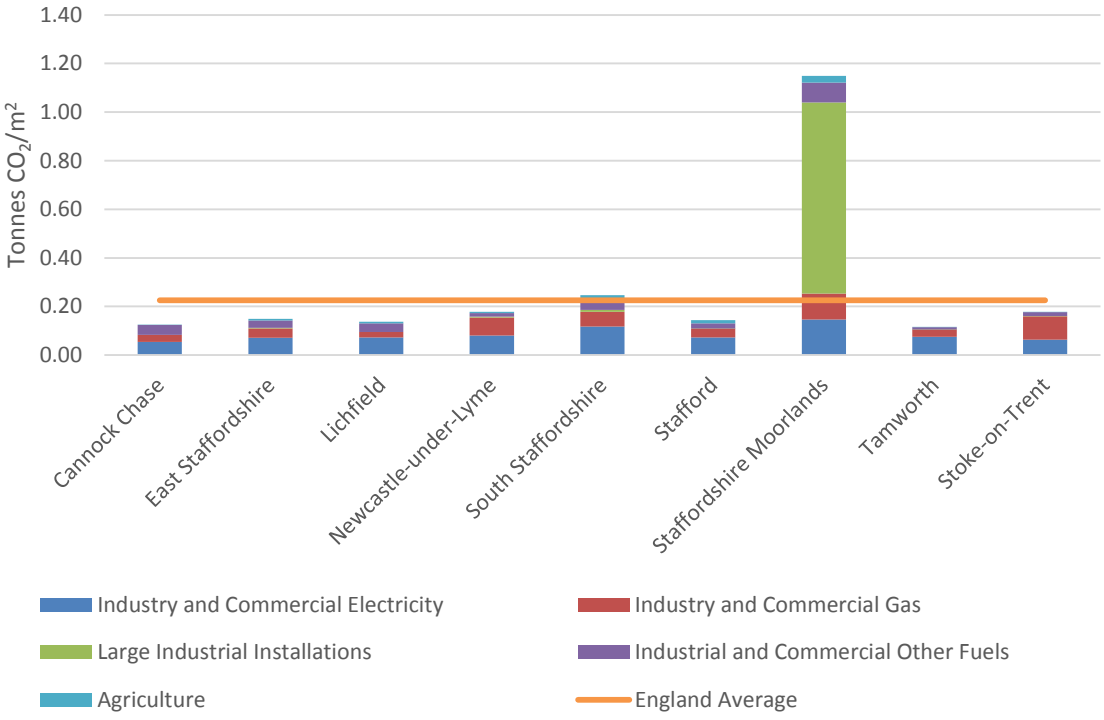

Figure 16 shows the same data as Figure 14, but presented on a normalised basis for ease of comparison. Total emissions have been set against total commercial floor area from Valuation Office Agency (VOA) statistics to produce a carbon emissions figure per metre squared of commercial floor area, which is then compared to the national figure.

From this it can be seen that the majority of the local authority areas have emissions below the national average on this basis, some substantially below. This indicates that in some places where emissions have been relatively higher this is due to a concentration of industry in these places.

Energy efficiency measures could help reduce industrial carbon emissions, and as set out in the Clean Growth Strategy (3), this is an area that the government is looking at.

4.4 Grid capacity review

A review of the Long Term Development Statements from Western Power (23) are presented in this section, who are the Distributed Network Operator (DNO) responsible for Staffordshire. The substations of 33kV and 132kV have been colour coded within each region according to how feasible it is to connect additional generation to them (with green meaning feasible, amber not as feasible and red constrained). The black lines in Figure 17 show the local authority boundaries of Staffordshire.

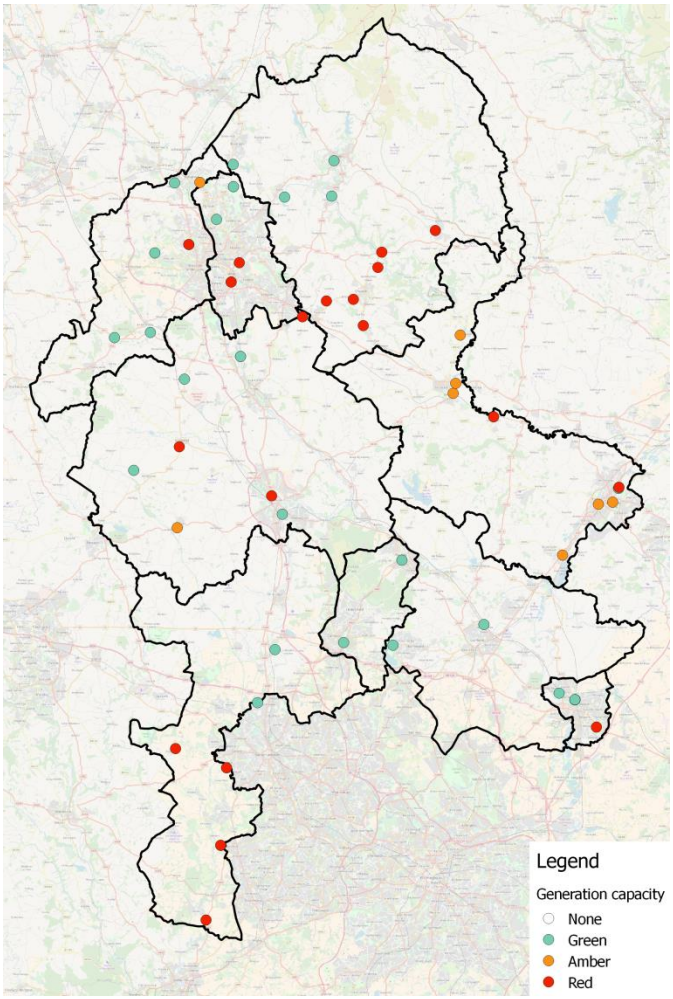

Figure 17: Staffordshire substation grid capacity review – generation headroom (23)

In Figure 17 it can be seen that, although a high proportion of substations can easily connect to the network (green points), almost half of substations within Staffordshire

have generation constraints associated with them (amber and red). This means that large electricity generators, for example wind or solar farms may be unable to secure a connection to the network without paying for significant reinforcement costs. This can impact on the potential future investment and expansion opportunities in the renewables sector across Staffordshire. Under the G83 protocols, very small scale generation below 4kW, such as a domestic solar installation, does not need to apply to the DNO to connect and only needs to notify. If small-scale installations continue to proliferate this could further decrease the ability of large scale generation to access an affordable connection.

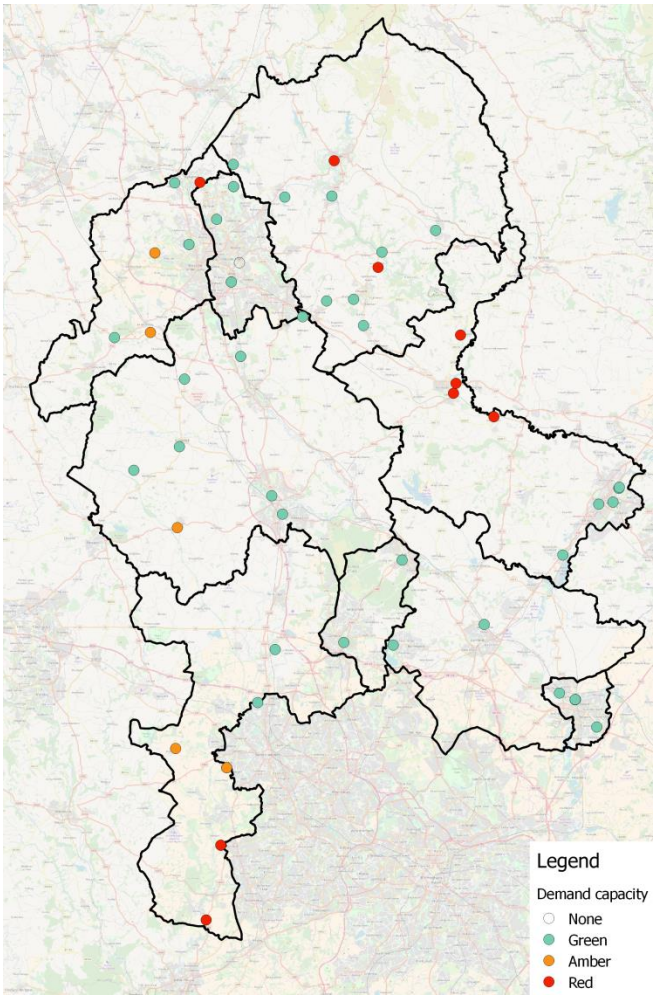

Figure 18: Staffordshire substation grid capacity review –demand headroom (23)

Figure 18 shows headroom by substation for additional demand, with red representing substations that have little available headroom for additional load to be connected. The black lines show the local authority boundaries of Staffordshire. The substations are less constrained when considering adding additional demand rather than generation. The main constraints are identified in the northern part of East Staffordshire and the southern parts of South Staffordshire.

4.5 Electric vehicle charging

One important area to explore is availability of electric vehicle charge points, as a lack of availability of these is likely to put consumers off electric vehicle ownership. The geographical spread of these is important, as is the power of the charger. The larger the power output of the chargers the faster cars will charge, and the shorter the waiting time for customers. However, the power of the chargers that it is possible to install is limited by the locally available grid capacity.

Electric vehicle chargepoint data comes from the National Chargepoint Registry (this incorporates all data included in Zap Map and Chargepoint databases). These are all charge points that can be accessed by the public, although some include restrictions. Domestic charge points installed by consumers at home are not included in this map. Electric vehicles can be charged from a domestic plug socket at up to 3kW, while a specially installed domestic charge point can charge the car at up to 7kW.

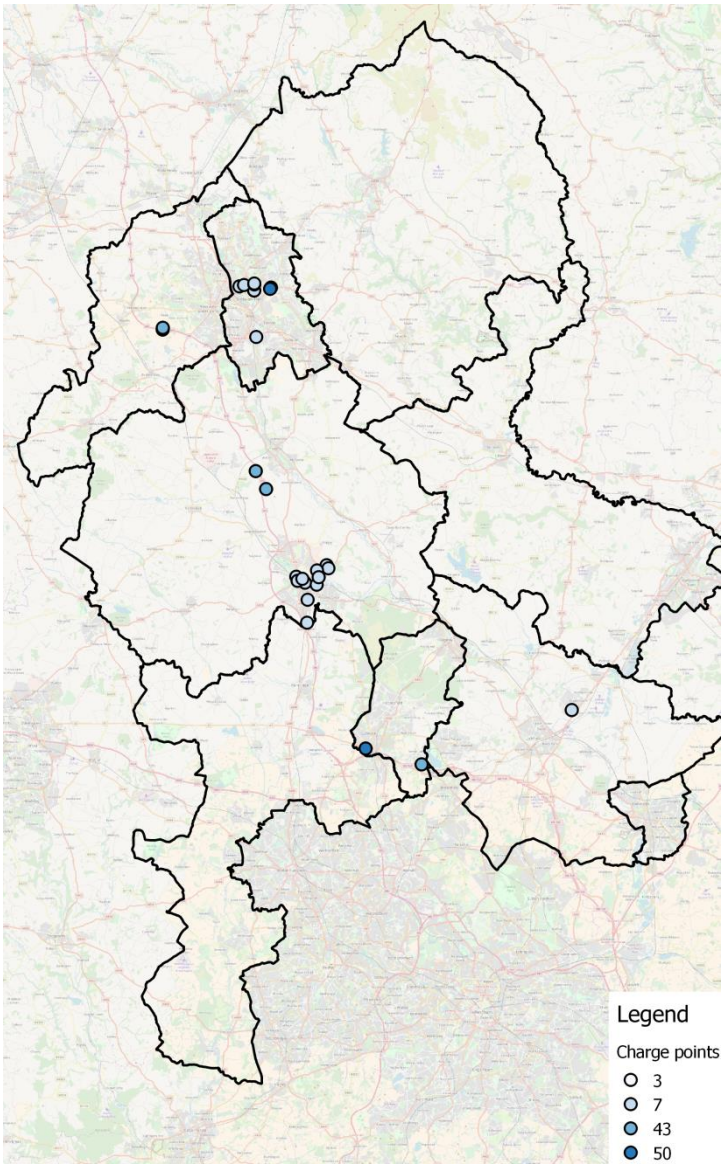

Figure 19: Electric vehicle charge point locations (24)

From Figure 19 it can be seen that there are charge points across Staffordshire, with 39 separate charging locations and 81 charge points. Fast charging locations can be found at service stations up the M6, these are operated by Ecotricity and account for 10 of the charging locations. Other sites include a Nissan, Toyota and Peugeot dealerships (for customers only) and several public car parks.

At each of the locations on the map there are up to three chargers per site, although not all of them will necessarily be the same capacity as the one denoted by the colour of the dot on the map, for example at some of the Ecotricity sites two of the three charging points are 50kW while a third is 43kW.

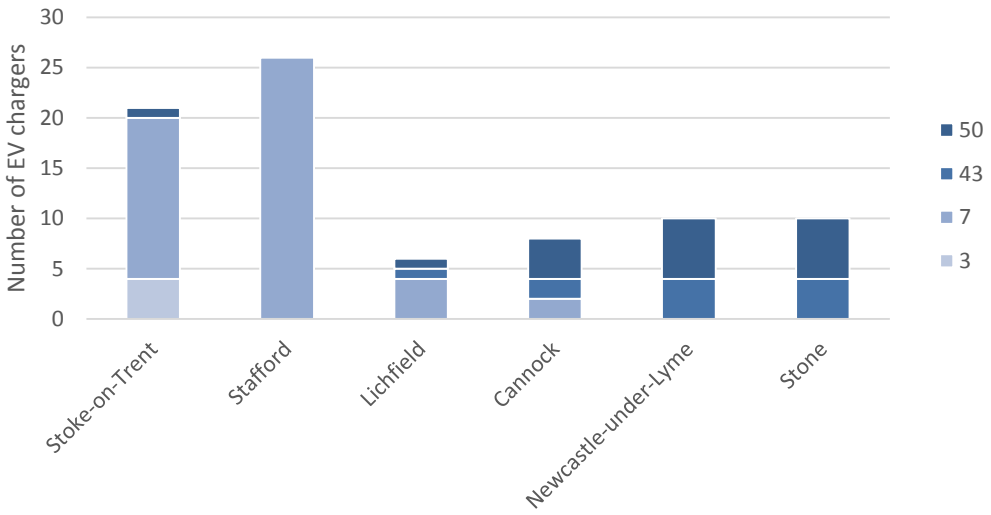

Figure 20: Electric vehicle charge point availability by local authority area (24)

Figure 20 shows the breakdown of charging point numbers by local authority area, this refers to total available charging points not charging locations, the number of charging points is greater than the number of locations as many locations have more than one available charger.

From Figure 19 and Figure 20 it can be seen that current charging provision for electric vehicles is limited, with a particular lack of fast charging provision across much of Staffordshire minimising the attractiveness of electric vehicles to consumers within the Staffordshire. This is an issue which the electric vehicle industry is currently grappling with in that consumer uptake of EVs will be slower while charging point infrastructure is inadequate. However, private charge point providers have no incentive to invest in charging point provision without the customers there to use them. This situation is slowly changing, particularly with use of central government or European grant funding to deliver additional charging points.

4.6 Smart grids and flexibility

One potential route to circumvent network capacity restrictions as seen in areas of Staffordshire is the utilisation of smart grid technology and smart energy management. The inclusion of storage with smart controls within some of these opportunity areas may free up additional capacity.

The network operators already make connection offers to potential generators including 'Alternative Connections'. This is a type of connection that involves a limit on the times that they are allowed to export on to the grid, so generators are able to connect if they won't be exporting at the times of peak generation. This usually occurs during the day in the summer, when solar PV generation is at its peak.

The addition of flexibility and storage can present an opportunity for generators to circumvent expensive grid reinforcement options that would be involved in their site.

4.6.1 Smart Energy Network Demonstrator

Keele University in Staffordshire has an estate with a mixed business, academic and residential community of over 10,000 people, with over 2.2 million ft^2 of built environment (academic, business, commercial, retail, banking, leisure and residential) and circa 90km of private utilities: heat, gas and electricity networks. There is an ongoing project to enhance this Energy Grid to deliver a Smart Energy Network Demonstrator (SEND). (25)

The SEND, utilising a mixed energy supply and demand environment, will provide a facility for trialling and evaluation of new and evolving energy technologies and provide the opportunity to assess their efficiencies, both individually and combined, in terms of energy reduction, cost, and CO_2 emissions, through real-life data analysis and scenario modelling:

- Energy Supply and Demand Scenario Planning/Modelling - demand response.
- Energy Generation Performance Monitoring.
- Energy Source, Capacity, Storage, Prioritisation and Evaluation.
- Energy Mix Design and Evaluation.

Keele University has provided access to its own technical energy and estates managers, and academic research team and engaged a range of people including estate managers, innovators, manufacturers, installers, planners, developers and energy suppliers to:

- Demonstrate the application of a multi-vector Smart Energy Grid and how it can be used to efficiently manage and distribute energy generated from a range of supply solutions and technologies, thus stimulating the concept of "Local Smart Energy Grids" as a transferable solution which can be implemented in other areas.
- Use the Facility to test and evaluate the performance of new, evolving and developing energy technologies, by connecting them to the network and assessing performance in both general and specific energy demand scenarios.
  - Plug and Play Research and evaluation of new and evolving technologies
  - Pre- implementation design verification
  - Evaluating end user use and behaviours.
- Use the Facility to test, evaluate and adapt energy solutions (individual and/or mixed) against varied demand scenarios to establish the most efficient energy solution in terms of energy reduction, CO2 reduction and cost reduction; and then implement the solution in a real world location/ development.

This is an important innovation project that could lead to investment within the sector in Staffordshire and opportunities to build on the project to develop solutions that could be applicable in other areas of the county.

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Appendix II Evidence base sources

Please see accompanying spreadsheet P3684 Evidence Base data sources.xlsx