Hastings
Low Carbon Energy Study

Hastings Borough Council

Quality information

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Introduction

Hastings Borough Council (HBC) has commissioned AECOM to provide technical support to develop an evidence base for new energy and sustainability policies within the forthcoming Hastings Local Plan and Hastings Climate Emergency Plan. This report presents the existing energy use, carbon dioxide (CO_2) emissions and low and zero carbon (LZC) energy generation in Hastings, discusses some of the anticipated changes that may arise as a result of new development along with broader national trends, and presents a variety of options for responding to these and delivering on the Council's climate emergency commitments through planning policy.

Drivers for achieving net zero emissions

There are a wide range of environmental, social, and economic drivers for taking action to address the threat of climate change, key considerations for Hastings include:

- **National and international policies** – such as the Paris Climate Agreement, the UK Climate Change Act, upcoming changes to Building Regulations and nation-wide strategic priorities to decarbonise heating, electricity, and transport across all sectors.
- **Local and regional strategies** – notably the development of a new Local Plan for Hastings and the declaration by HBC in February 2019 that the Council acknowledges a climate emergency and will work towards becoming carbon neutral by 2030.

These drivers reinforce the urgent need to decrease energy demands and increase the provision of renewable energy, in order to mitigate the effects of climate change.

At the same time, it is important for Hastings to continue to promote growth through new development of housing and employment space. This report aims to quantify some of these impacts in order to identify and prioritise possible response through policy and other actions.

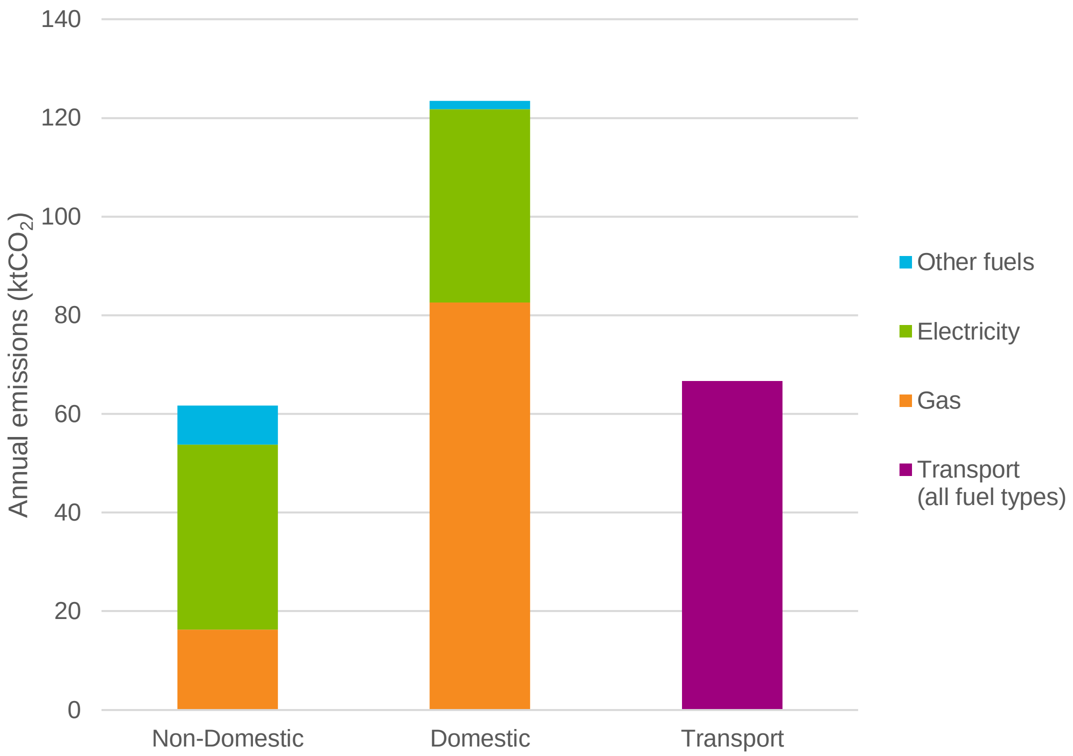
Baseline fuel consumption and carbon dioxide (CO_2) emissions

The Department of Business, Energy and Industrial Strategy (BEIS) publishes fuel consumption and CO_2 emissions data for each Local Authority in the UK. As of 2017 (the most recent year for which data was available):

- Total fuel consumption in Hastings was approximately 1,157 GWh. The largest proportion of fuel consumed was gas (46%), with electricity and petroleum accounting for 26% and 23%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 5%.
- Total CO_2 emissions were 249.4 $ktCO_2$. Gas and electricity combined account for nearly 70% of the total. CO_2 emissions have fallen by nearly 39% since 2005. For Hastings, as for the rest of the UK, this is attributed to changes in fuel consumption but, more significantly, to changes in the carbon intensity of grid electricity; if there had been no electricity grid decarbonisation, emissions in Hastings would have decreased by only 19% over this period.

	Non-Domestic $ktCO_2$	Domestic $ktCO_2$	Transport $ktCO_2$	Total (unadjusted) $ktCO_2$	Total (adjusted) $ktCO_2$
Gas	16.4	82.6	-	98.9	Land Use, Land Use Change and Forestry (LULUCF) adjustment: -2.7 $ktCO_2$
Electricity	37.4	39.2	-	76.6	
Other fuels	7.9	1.7	-	9.6	
Agriculture	0.3	-	-	0.3	
Transport	-	-	66.7	66.7	
Total by sector	**62.0**	**123.4**	**66.7**	**252.1**	**249.4**
Percent of total	*24.6%*	*49.0%*	*26.4%*		

Hastings CO_2 emissions (2017)



CO_2 emissions by sector and fuel type in 2017

Low and Zero Carbon (LZC) technologies in Hastings

According to BEIS statistics, there are over 800 LZC energy installations in Hastings, ranging from small-scale roof mounted solar photovoltaics (PV) to large scale sewage and landfill gas facilities. (These figures include installations registered under the Renewable Heat Incentive (RHI) scheme which covers heat pumps, solar thermal technologies, and technologies utilising biomass or biogas, although further details are not publicly available.) In total, it is estimated that these generate nearly 20,000 MWh of LZC electricity per year. For context, this is roughly 6% of the electricity demand in Hastings in 2017.

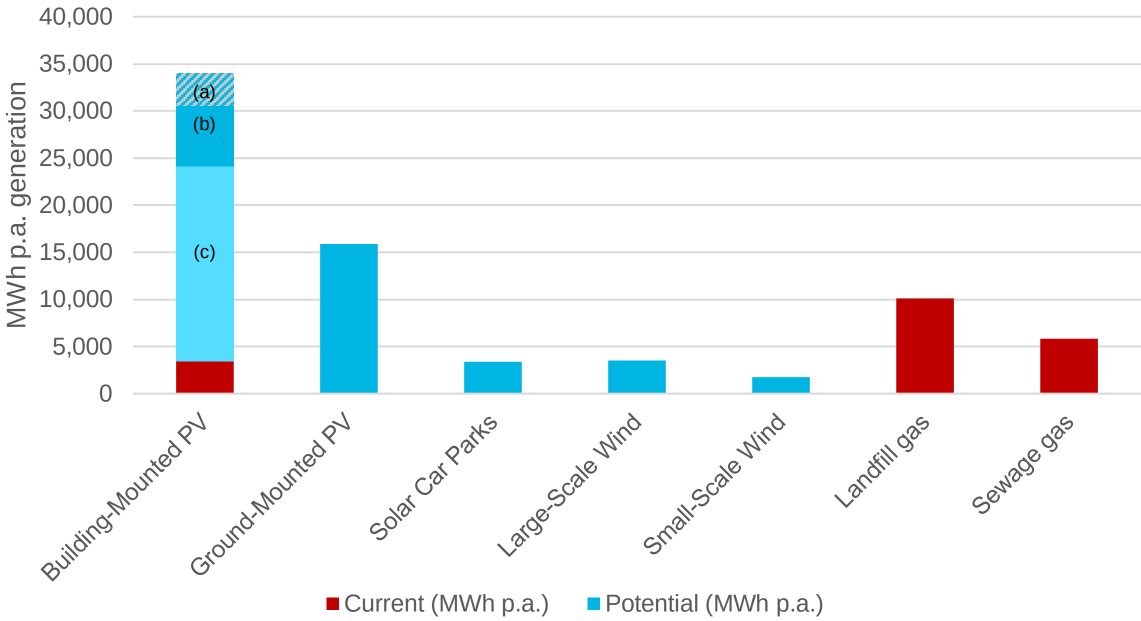
	Photovoltaics	Sewage Gas	Landfill Gas	Domestic RHI	Non-Domestic RHI
Number of sites (#)	767	1	1	42	1-5
Capacity (MW)	3.582	0.772	3.071	*Unknown*	*Unknown*
Generation (MWh p.a.)	3,446	5,854	10,126	*Unknown*	*Unknown*

LZC installations in Hastings as of 2018

As of 2019, there are 135 registered Ultra Low Emission Vehicles (ULEVs) registered in Hastings, supported by 7 public electric vehicle (EV) charging points. This represents a ten-fold increase since 2011 but is only a small proportion of the nearly 47,000 registered vehicles in the borough.

Within the past decade there have been several studies of LZC generation potential within Hastings. AECOM carried out a review and comparison of these studies to understand the differences in scope, methodology and findings. We conclude that these studies provide a comprehensive overview of the potential for additional LZC energy capacity in the Borough. In particular, the Regen (2017) study was carried out fairly recently and provides useful mapping outputs that can be used to inform site allocations for the forthcoming Local Plan.

By combining these previous reports with a further assessment for technologies that had not been previously considered, we estimate that there is potential for a significant increase in the amount of LZC capacity in the Borough, with building-mounted PV technologies offering the greatest potential resource from a practical perspective.



Building-mounted PV is split between (a) industrial (b) other non-domestic and (c) domestic roofs.

Current and estimated potential LZC electricity generation in Hastings

It should be noted that, notwithstanding the current policy constraints on onshore wind development, in principle the level of wind resource in the Borough means that it could potentially support a range of wind energy technologies.

Even if all of these opportunities were realised, however, they would not be sufficient to meet the total energy demand in Hastings. Although a significant proportion of the energy supplies to Hastings will be from the (decarbonised) national electricity grid, it will be necessary take steps to radically decrease energy demands in the Borough and maximise the installation of LZC technologies along with the infrastructure required to support them.

Routes to Net Zero

AECOM carried out a high-level CO_2 modelling exercise to assess the potential scale and direction of impacts from a range of anticipated future trends. These include:

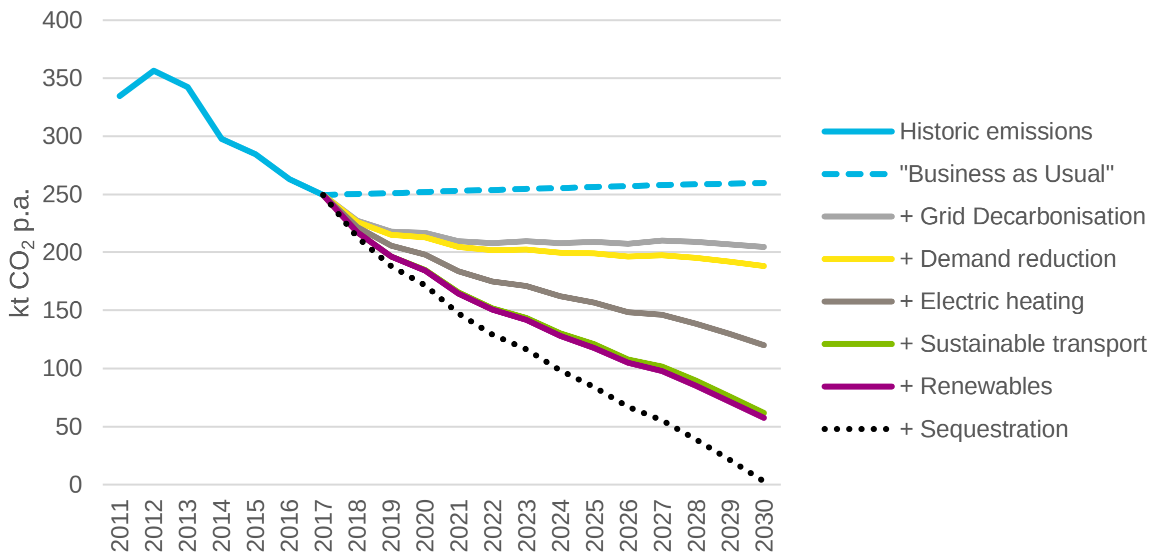
- New housing and employment space to be constructed
- National electricity grid decarbonisation
- Energy demand reduction through energy efficiency measures and behaviour change
- Switching from the use of gas-fired heating to electric systems
- Reducing demand for transport and increasing use of ULEVs; and
- Uptake of LZC technologies

This assessment also provides an indication of the residual CO_2 emissions after all measures are adopted, which can be used to understand the scale of offsetting or sequestration that would be required to meet the net zero target.

Accounting for decarbonisation of the national electricity grid, if all of the above measures were adopted and all of the above LZC energy opportunities were realised, this would reduce total CO_2 emissions by 77% by 2030.

The residual emissions (57 ktCO_2 p.a.) would need to be mitigated through some form carbon offsetting, which could include carbon sequestration (e.g. tree planting) or investing in further renewable energy or energy efficiency projects that may take place outside of Hastings. The scale of offsetting required even in an optimistic scenario would require a huge amount of land and other resources and is clearly not practical. This emphasises the fact that demand reduction and energy efficiency measures must be prioritised.

The image below shows an illustrative set of trajectories towards the year 2030. Starting with a 'Business as Usual' baseline, it shows the cumulative impact of sequentially applying a series of intervention measures. Note that this is not a projection, but merely an illustration of the relative scale and direction of change that each measure would promote. The actual CO_2 emissions depend on a wide variety of factors, including nation-wide changes in grid infrastructure.



CO_2 emissions in Hastings –Accounting for grid decarbonisation (2030 target)

The graph shows that, even if LZC opportunities in Hastings were maximised, these would make a relatively small contribution towards the net zero target (see the 'Renewables' line above), principally because of the relatively limited scale of installation and the decreasing carbon savings they deliver as the grid decarbonises. However, as buildings and vehicles switch away from the use of fossil fuels and towards electricity, local LZC installations will become increasingly important for several other reasons:

- reducing pressure on local grid infrastructure;
- ensuring security of supply, and
- protecting consumers from rising electricity prices.

As a result, one of our key recommendations is for HBC to review opportunities to actively promote and facilitate LZC uptake through supportive policy and direct investment on their own estate.

Opportunities to respond through policy

The Climate Emergency demands a rapid response to reduce CO_2 emissions. Our analysis shows that, in a best-case scenario, it will be difficult to meet the net zero target without a radical change in the way that we use and supply energy across all sectors. On this basis, we recommend that HBC should incorporate policies into the forthcoming Local Plan that address the following topics:

- Support demand reduction, energy efficiency, switching to efficient heat pump systems and uptake of LZC energy technologies through a revised Energy and Heat Hierarchy
- Encourage the development of heat networks where appropriate
- Increase support for LZC energy developments that meet criteria for acceptability, and seek to broaden those criteria
- Encourage energy efficiency retrofitting and/or use of LZC energy technologies in historic buildings and Conservation Areas in line with guidance from Historic England
- Support the provision of infrastructure for ULEVs (and continue to promote measures that reduce the need for private vehicles)
- Increase carbon sequestration through land use policies and/or requirements to include green infrastructure in new developments

Conclusion

The analysis presented in this report aims to build on the work of the previous energy studies and sustainability policies of the Hastings Local Plan, while offering a starting point for further investigation into how best to meet the 2030 target. HBC can take action now to start assessing specific opportunities to deliver additional LZC energy and CO_2 sequestration in the Borough. Going forward, the opportunities and challenges highlighted in this report can be integrated into wider discussions around climate mitigation and resilience.

1. Introduction and context

1.1 Purpose of this report

1.1.1 Hastings Borough Council (HBC) has commissioned AECOM to provide technical support to develop an evidence base for new energy and sustainability policies within the forthcoming Hastings Local Plan. This report presents the existing energy use and low and zero carbon (LZC) energy generation in Hastings, discusses some of the anticipated changes that may arise as a result of new development along with broader national trends, and presents a variety of options for responding to these through planning policy and other interventions.

1.1.2 In addition, recognising that the Council declared a Climate Emergency in February 2019, this report will highlight key issues that are relevant to Hastings' target of becoming carbon neutral by 2030.

1.2 Structure of this report

1.2.1 The report is structured as follows:

- **Section 2** – Provides an overview of the key drivers for achieving net zero emissions, including an overview of the current regulatory context, with a focus on buildings and transport.
- **Section 3** – Describes the current (baseline) fuel consumption and CO_2 emissions in Hastings, along with recent trends.
- **Section 4** – Describes the existing amount of low and zero carbon (LZC) energy generation technologies in Hastings and presents an estimate of the additional generation capacity. This section draws on previous energy opportunity studies, providing additional analysis and discussion where helpful, to ensure a comprehensive assessment.
- **Section 5** – Discusses the potential changes in CO_2 emissions that could occur in the coming decade, with consideration given to trends such as new construction, energy efficiency standards for buildings, switching to electric heating systems, and uptake of ultra low emission vehicles (ULEVs) and LZCs.
- **Section 6** – Presents a set of policy recommendations based on the findings of the previous sections, along with a list of further opportunities for consideration.
- **Section 7** – Conclusions and next steps
- **Appendices** – These contain more detailed information regarding the data sources and methodology used to inform the analysis.

1.3 Scope of CO_2 emissions analysis

1.3.1 For the purpose of greenhouse gas (GHG) reporting, emissions are divided into three categories:

- **Scope 1** – Direct emissions that arise from burning fuels in Hastings. This primarily includes fuel used in boilers to provide heating and hot water, fuel used in any vehicles while they are driving within Borough boundaries, and fuels (other than electricity) used for cooking.
- **Scope 2** – Indirect emissions associated with the use of electricity in Hastings.
- **Scope 3** – Indirect emissions that result from other activities outside the border of Hastings, but that take place as a result of the actions of people or organisations within Hastings, e.g. emissions from commuting, shipping, or aviation.

1.3.2 This report only quantifies Scope 1 and 2 emissions, based on publicly available datasets produced by the Department of Business, Energy and Industrial Strategy (BEIS). This covers a range of sectors and fuel types but does not cover *all* potential sources of GHG emissions within the Local Authority.[1] For example, considering air conditioning units, the dataset includes the CO_2 emissions from the electricity used, but excludes other greenhouse gases emitted by refrigerants (e.g. hydrofluorocarbons). At the time of writing it is understood that such information is not published by BEIS at a Local Authority level.

[1] The Kyoto Protocol covers six GHGs: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6).

2. Drivers for achieving net zero emissions

2.1.1 A selection of targets, policies and initiatives aimed at reducing CO_2 emissions are described below. particularly those related to decarbonising heat, energy and transportation in Hastings.

2.1.2 Although it is not possible to fully capture the wide range of environmental, social, and economic drivers for taking action to address the threat of climate change, these are some of the key drivers that have been used to inform the analysis that presented in this report.

2.2 National

UK Climate Change Act: 2050 Target Amendment Order (2019)

2.2.1 This policy legally commits the UK Government to reducing emissions by 100% by the year 2050, compared with a 1990 baseline.[2] As described by the UK Committee on Climate Change (CCC), *'The Act provides the UK with a legal framework including a 2050 target for emissions reductions, five-yearly 'carbon budgets' (limits on emissions over a set time period which act as stepping stones towards the 2050 target), and the development of a climate change adaptation plan.'*[3]

2.2.2 As noted in the CCC report *'Net Zero: The UK's contribution to stopping global warming'* (2019), this level of carbon reduction is achievable using known technologies and techniques,[4] such as:

- Reducing demand through resource and energy efficiency;
- Societal choices e.g. reducing the amount of meat consumed;
- Electrification of transport and heating;
- Development of hydrogen gas and carbon capture and storage (CCS) technologies; and
- Land use changes that promote carbon sequestration and biomass production.

The Paris Climate Agreement

2.2.3 The UK ratified the Paris Climate Agreement in November 2016. The Agreement's central aim 'is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2º Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5º Celsius.'[5]

2.2.4 A study produced by the Tyndall Centre for Climate Change Research[6] found that, to meet the commitments laid out in the Paris Agreement, *'the recommended energy only CO_2 carbon budget for the Hastings area for the period of 2020 to 2100 is 1.7 $MtCO_2$.'* This could be achieved by adhering to the 5-year carbon budgets set out in Table 1, although the authors note that, *'A smaller carbon*

Budget Period	Carbon Budget ($MtCO_2$)
2018-2022	1.0
2023-2027	0.6
2028-2032	0.3
2033-2037	0.1
2038-2042	0.1
2043-2047	0.0
2048-2100	0.0

Table 1. Recommended carbon budget for Hastings (Source: Tyndall Centre)

[2] The original (2008) target of 80% was amended through subsequent legislation in 2019. *See 'The Climate Change Act 2008 (2050 Target Amendment) Order 2019'*: http://www.legislation.gov.uk/uksi/2019/1056/contents/made
[3] https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/
[4] Available at: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[5] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[6] Tyndall Centre, *'Setting Climate Commitments for Hastings: Quantifying the implications of the United Nations Paris Agreement'* (December 2019). Available at; https://carbonbudget.manchester.ac.uk/reports/E07000062/

budget, with accelerated reduction rates and an earlier zero carbon year, is compatible with this approach.'

National Planning Policy Framework

2.2.5 The National Planning Policy Framework (NPPF) sets out Government planning policy for England. It states that, *'the purpose of the planning system is to contribute to the achievement of sustainable development.'* It provides guidance for local planning authorities drawing up local plans and is a material consideration for those determining applications.

2.2.6 The NPPF further states, *'at the heart of the [National Planning Policy] Framework is a presumption in favour of sustainable development.'* It addresses topics that are relevant to the economic, environmental and social sustainability of development proposals, including but not limited to:

- Delivering a sufficient supply of homes;
- Building a strong, competitive economy;
- Promoting healthy and safe communities;
- Promoting sustainable transport;
- Making effective use of land;
- Achieving well-designed places;
- Protecting Green Belt land;
- Meeting the challenge of climate change, flooding and coastal change;
- Conserving and enhancing the natural environment; and
- Conserving and enhancing the historic environment.

Building Regulations (Part L)

2.2.7 Part L of Building Regulations is the key mechanism that prescribes standards for the conservation of fuel and power in buildings in the UK, based on metrics such as the estimated level of energy demands and CO_2 emissions.

2.2.8 At the time of writing, the Ministry of Housing, Communities and Local Government (MHCLG) has recently released a consultation on proposed future standards (see box below) that would significantly reduce emissions from new domestic buildings in the UK. The consultation also states that the Government will make further improvements to Building Regulations requirements for existing domestic buildings as well as new and existing non-domestic buildings. [7]

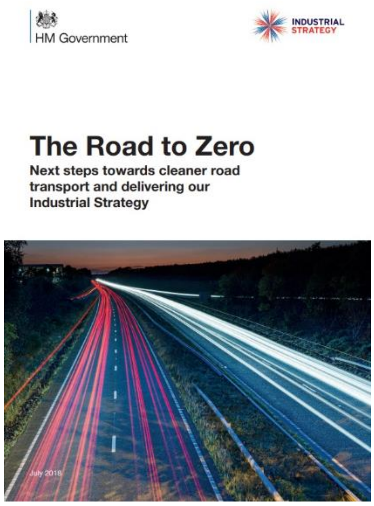
The Future Homes Standard

Under the Future Homes Standard, new buildings would be required to meet significantly higher targets for energy efficiency and carbon savings. The Government states that, *'As part of the journey to 2050 we have committed to introducing the Future Homes Standard in 2025. This consultation sets out what we think a home built to the Future Homes Standard will be like. We expect that an average home built to it will have 75- 80% less carbon emissions than one built to current energy efficiency requirements (Approved Document L 2013). We expect this will be achieved through very high fabric standards and a low carbon heating system. This means a new home built to the Future Homes Standard might have a heat pump, triple glazing and standards for walls, floors and roofs that significantly limit any heat loss.'*

- BEIS, *'The Future Homes Standard Consultation'* (2019)

[7] BEIS, *'The Future Homes Standard Consultation'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843757/Future_Homes_Standard_Consultation_Oct_2019.pdf

The Road to Zero (2018)



2.2.9 The Road to Zero report[8], published in July 2018 sets out the Government's core mission; 'to put the UK at the forefront of the design and manufacturing of zero emissions vehicles and for all new cars and vans to effectively be zero emission by 2040.' The strategy furthers the ambitions of the NO_2 plan[9] and Clean Growth Strategy (see following section) in defining key policies with primary focus upon introduction of low and zero emission vehicles, with the aim that *'at least 50%, and as many as 70%, of new car sales and up to 40% new van sales being ultra low emission by 2030. By 2050 we want almost every car and van to be zero emission.'*

2.2.10 In supporting these longer-term ambitions, the strategy outlines supporting policy action toward fulfilment of these broader goals, including:

- Reducing emissions from existing vehicles on the road;
- Extension of the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) beyond its current scope to include both vans and black cabs; and
- Developing a strategy to tackle HGV and freight-related emissions through Highways England research.

2.2.11 The Government has stated that local action will be supported through new policies, including provision of funding to extend ultra low emission bus schemes and taxi charging infrastructure. Ongoing goals to encourage uptake of clean new vehicles will be backed by developing electric vehicle infrastructure, offering funds and grants for provision of electric charge points.

UK Clean Growth Strategy and Industrial Strategy (2017)

2.2.12 The UK Clean Growth Strategy[10] (CGS) was published in October 2017 and sets out the Government's vision for decoupling economic growth from carbon emissions.

2.2.13 It includes objectives for increasing generation of energy from renewable sources, increasing the delivery of clean, smart and flexible power and accelerating the shift to low carbon transport, smart grids and energy storage. The delivery of low carbon heating is identified as a priority, indicating that heat pumps, district heating networks and a hydrogen gas grid could all support the scale of change required, while acknowledging the significant technical and financial obstacles.

2.2.14 The Clean Growth Strategy also discusses the need to improve energy efficiency in buildings, particularly the existing stock. This includes a strategy of progressively increasing the minimum Energy Performance Certificate (EPC) ratings that will be considered permissible in order to

[8] HM Government, *'The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy'* (2018) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf
[9] Air quality plan for nitrogen dioxide (NO2) in UK (2017) https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[10] HM Government *'Clean Growth Strategy'* (2017). Available at: https://www.gov.uk/government/publications/clean-growth-strategy

allow the sale or rental of buildings, as required by the Minimum Energy Efficiency Standards (MEES) regulations. [11]

2.2.15 The UK Industrial Strategy,[12] published in November 2017, emphasises the themes of the CGS and describes a 'Grand Challenge' for maximising the advantages that the UK can gain from the global shift to a low carbon economy. Both documents note the potential for low carbon industries to deliver a high level of GDP growth compared with the current forecast.

2.3 Regional

Environment Strategy for East Sussex (2011)

2.3.1 The Environment Strategy for East Sussex[13] outlines a commitment to protect the environment, reduce carbon emissions and adapt to climate change. Published in 2011, the Strategy considers a 15-year timeframe (i.e. up to 2026). As described by the East Sussex County Council, *'key aims of the strategy include:*

- *minimising the amount of waste created and getting more waste re-used and recycled*
- *reducing carbon emissions and the use of fossil fuels*
- *improving habitats to reverse and prevent the loss of plant and animal species*
- *creating healthy seas and sustainable fisheries*
- *promoting the use of open and green spaces for healthy and active lifestyles*
- *promoting the economic value of the environment and its opportunities for growth in jobs and prosperity.'*

Draft East Sussex Environment Strategy (2019)

2.3.2 The revised Environmental Strategy for East Sussex seeks 'to contribute to the emerging urgent global and local environmental challenges and to maximise the available opportunities'[14]. The strategy identifies local specific challenges and opportunities. The following five priority environmental themes have been identified within the strategy: climate change, natural capital, air quality, water and resource efficiency. The draft Environment Strategy includes:

- Long term aims for each of the environmental themes;
- Actions that the Environment Board will lead on in the short-term;
- Examples of programmes and projects being delivered nationally and locally; and
- Indicators to monitor progress in implementing the Environment Strategy.

East Sussex Local Transport Plan (2011)

2.3.3 The Local Transport Plan[15] (LTP3) covers the years 2011-2026. It includes a broad-ranging strategy for improving transport within East Sussex, through means such as:

'… promotion and infrastructure for public transport e.g. accessible bus stops, shelters […] implementation of infrastructure to support integrated sustainable travel – walking, cycling, public transport, car sharing etc. For example – bus priority measures, cycle lanes and facilities, improvements to pedestrian routes to key trip attractors, better rail / bus / cycle interchanges [and] charging points for electric vehicles and smart ticketing initiatives…'

2.3.4 LTP3 also acknowledges the need to *'look at non-transport measures which reduce the need to travel to access services.'* As evidenced in Section 3, the transportation sector accounts for

[11] The *'Energy Efficiency (Private Rented Property) (England and Wales)'* Regulations 2015 introduced the Minimum Energy Efficiency Standard (MEES) for buildings across the UK. For further information, see https://www.gov.uk/government/publications/the-private-rented-property-minimum-standard-landlord-guidance-documents

[12] HM Government, *'Industrial Strategy: Building a Britain Fit for the Future'* (2017). Available at: https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

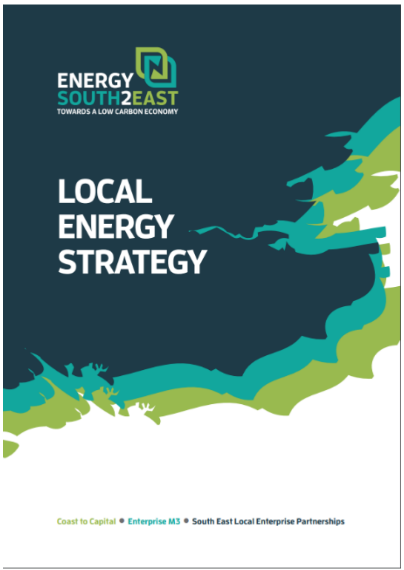
[13] East Sussex Strategic Partnership, *'Environment Strategy for East Sussex'* (2011). Available at: https://www.eastsussex.gov.uk/media/1988/environment_strategy_for_east_sussex.pdf

[14] East Sussex Environment Board, 'East Sussex Environment Strategy' (2019 draft). Available at: https://www.eastsussex.gov.uk/media/14251/east-sussex-environment-strategy-2019-draft.pdf

[15] East Sussex County Council, *'Local Transport Plan'* (2011). Available at: https://www.eastsussex.gov.uk/media/2336/ltp3_main_doc_2011-2026.pdf

a significant portion (26%) of CO_2 emissions in Hastings and is therefore considered a priority area for intervention measures. Note: at the time of writing, LTP3 is being updated.

South2East Local Energy Strategy (2018)



2.3.5 The South2East Energy Strategy[16] is intended to support a group of Local Enterprise Partnerships (LEPs) to deliver decarbonisation and clean growth across the heat, power and transport sectors, in line with the nationwide Industrial Strategy (2017). The Strategy outlines a vision for achieving clean growth through the year 2050, with a focus on the power, heat and transportation sectors. It highlights several key opportunities for the region, including:

- Renewable energy potential, especially solar, wind, energy from waste and landfill gas;
- Rich natural assets (including a high proportion of woodland); and
- Large amounts of planned new development within the region, offering opportunities for deployment of smart, integrated, sustainable energy system models.

2.3.6 The South2East Local Energy Strategy considers strategic regional opportunities in the south-eastern UK and seeks to identify project models suitable for investment and targeted intervention. The report lists a variety of immediate priority actions that could be taken, such as:

- Moving households and businesses to low carbon heat sources e.g. district heat networks (DHNs);
- Deployment of renewables e.g. solar photovoltaics (PV) on disused landfill sites;
- Energy efficiency programmes across industrial, commercial and domestic sectors;
- Utilisation of smart technologies e.g. microgrids; and
- Supporting low carbon transport e.g. through provision of electric vehicle (EV) charging and hydrogen refuelling points.

2.3.7 Overall, it is estimated that over £14 billion in investment would be required to meet the area's fair share of the 2032 carbon emission reduction target, with the potential to create over 75,000 jobs.

Siemens PTI, 'Energy South2East Action Plan and Project Models' (2019)

2.3.8 This document provides further detail related to the South2East Local Energy Strategy. Potential actions and specific opportunities are described with reference to each of the 18 Project Models, listing key actors/stakeholders, timeframes, carbon savings and estimated level of investment. In particular, the Action Plan notes a potential heat network opportunity in Bohemia, within Hastings.

2.4 Local planning policy and guidance

2.4.1 In line with the Localism Act 2011 and the NPPF, local development policies are produced by district and borough councils, which set out the strategic visions and management approach for each area. East Sussex County Council works to ensure the coordinated delivery of infrastructure and services.

Adopted Local Plan for Hastings

2.4.2 The adopted Local Plan for Hastings Borough Council comprises the *'Hastings Planning Strategy'* (2014) and the *'Hastings Development Management Plan'* (2015). At the time of

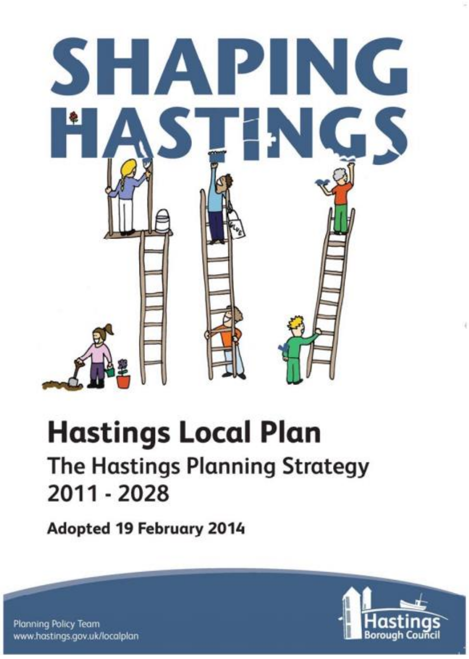
[16] Energy South2East, *'South2East Local Energy Strategy'* (2018). Available at: https://www.southeastlep.com/app/uploads/2019/03/Local-Energy-Strategy-FINAL.pdf

writing, the Local Plan is being updated, and public consultation on a draft Plan is expected to commence in summer 2020.

2.4.3 The Local Plan documents are based around several overarching sustainable development goals, including the objectives 'Addressing the impacts of climate change', 'Supporting sustainable communities', and 'Provision of an efficient and effective transport system'. Policies that are most relevant to energy and CO_2 emissions (as listed in the Planning Strategy) are outlined below.

SC1: Overall Strategy for Managing Change in a Sustainable Way

2.4.4 This policy states that, 'Growth and change will be managed so that development meets sustainability objectives, avoids significant vulnerability to the impacts of climate change [and] improves the quality of the natural environment.'



SC3: Promoting Sustainable and Green Design

2.4.5 This policy states that, 'All development must be designed to:

a) *incorporate appropriate climate change mitigation and adaptation measures such as green roofs and walls, sustainable drainage systems, multi-functional green space, protecting and enhancing biodiversity, waste reduction and recycling facilities, water efficiency, flood risk management, and the use of recycled materials in new development*

b) *enable a low carbon future in a changing climate*

Innovative design proposals that enhance and attractively contrast local surroundings will be supported.'

SC4: Working Towards Zero Carbon Development

2.4.6 This policy sets out a preferred energy hierarchy for use in determining a suitable approach to energy and carbon emissions reduction, as follows:

'The energy hierarchy below sets out the most suitable and cost effective method of achieving low carbon development. Developers are required to follow the hierarchical approach in achieving the energy and carbon dioxide emission requirements of the Building Regulations, for all new residential development. New non-residential development is encouraged to follow the same approach.

1. *to improve energy efficiency through thermal and fabric performance measures, then*
2. *Provide on-site renewable energy generation or on-site connected heating, or Combined Heat and Power (CHP) technologies, or Combined Cooling, Heat and Power (CCHP) system, then*
3. *The remainder of the CO_2 reduction targets to meet Building Regulations targets should be met through suitable additional measures such as larger CHP or district heating systems or Mega Watt (MW) scale wind offsetting.*

Developers are encouraged to meet higher standards than those required nationally and pursue additional low carbon or renewable energy generation measures where practicable. Compliance with this policy approach is required to be demonstrated through design and access statements submitted with a planning application.'

SC5: District Heating Networks and Combined Heat and Power Systems

2.4.7 This policy states that HBC will explore opportunities to develop heat networks in areas in or near Hastings Town Centre, Conquest Hospital and Summerfields Sports Centre.

SC6: Renewable Energy Developments

2.4.8 This policy supports renewable energy developments subject to meeting certain criteria, as follows:

'Proposals for renewable energy developments, including any ancillary infrastructure or building will be supported unless:

a) *their scale, form, design, material and cumulative impacts is unacceptable to the local landscape or built environment; and*

b) *they would adversely impact on the local community, economy, biodiversity or historic interests*

c) *the scale and impact of developments in nationally recognised designations, such as the High Weald Area of Outstanding Natural Beauty, Sites of Special Scientific Interest, Scheduled Monuments, Conservation Areas, Listed Buildings or Registered Parks and Gardens, is not compatible with the purpose of their designation.'*

Policy HN7 – Green Infrastructure in New Developments

2.4.9 This policy supports provision of green infrastructure, as follows:

'Where appropriate, good quality green infrastructure should be integrated into the design of new developments. Development will be permitted where opportunities for green infrastructure and landscaping have been incorporated into the proposals.

New green infrastructure provided as part of a development scheme should create safe links for the community and connectivity for biodiversity should be provided as far as practical, within the existing Green Infrastructure Network.'

Supplementary Planning Documents

2.4.10 In addition to the policies outlined above, HBC has adopted several Supplementary Planning Documents, covering various topics, including but not limited to:

- Householder Development: Sustainable Design (2007)
- Roof materials for Listed Buildings and Conservation Areas (2005)
- Replacement Doors and Windows for Listed Buildings and Conservation Areas (2005)

Emerging planning policy and guidance for Hastings

2.4.11 Section 6 of this report provides options for approaches that could be incorporated into the future version of the Local Plan. These options reflect the findings of the analysis presented in this report and previous energy studies for the area, along with wider changes in the national policy context that have occurred since the adoption of the previous Local Plan.

3. Baseline fuel consumption and CO_2 emissions

3.1 Fuel consumption

3.1.1 Fuel consumption figures were taken from the Department of Business, Energy and Industrial Strategy (BEIS) publication ‘Sub-national total final energy consumption statistics: 2005-2017’ (published in 2018).[17] 2017 is the most recent year for which data is available.

3.1.2 The dataset includes a breakdown of emissions by sector and fuel type, as summarised in *Table 2* below. For the purpose of this report, ‘industrial & commercial’, ‘public sector’ and ‘agriculture’ are collectively referred to as ‘non-domestic’ uses. ‘Bioenergy & waste’ is not reported by sector. Further details are provided in *‘Sub-national methodology and guidance booklet’* (BEIS, December 2018).[18]

3.1.3 In 2017, total fuel consumption in Hastings was approximately 1,157 GWh. As illustrated in *Figure 1*, the largest proportion of fuel consumed was gas (46%), with electricity and petroleum accounting for 26% and 23%, respectively. Other fuels, including bioenergy & waste, coal, and manufactured fuels make up the remaining 5%.

	Non-domestic (GWh)	Domestic (GWh)	Road transport (GWh)	Rail (GWh)	Bioenergy & waste (GWh)	Total (GWh)
Gas	88.1	444.9	-	-	-	533.1
Electricity	147.1	154.0	-	-	-	301.1
Coal	0.8	4.3	-	-	-	5.1
Petroleum	24.7	3.0	232.7	1.3	-	261.6
Manufactured fuels	0.1	4.4	-	-	-	4.5
Bioenergy & waste	-	-	-	-	51.9	51.9
Total by sector	**259.5**	**610.5**	**232.7**	**1.3**	**51.9**	**1,157.2**

Table 2: Fuel consumption by sector and fuel type in 2017

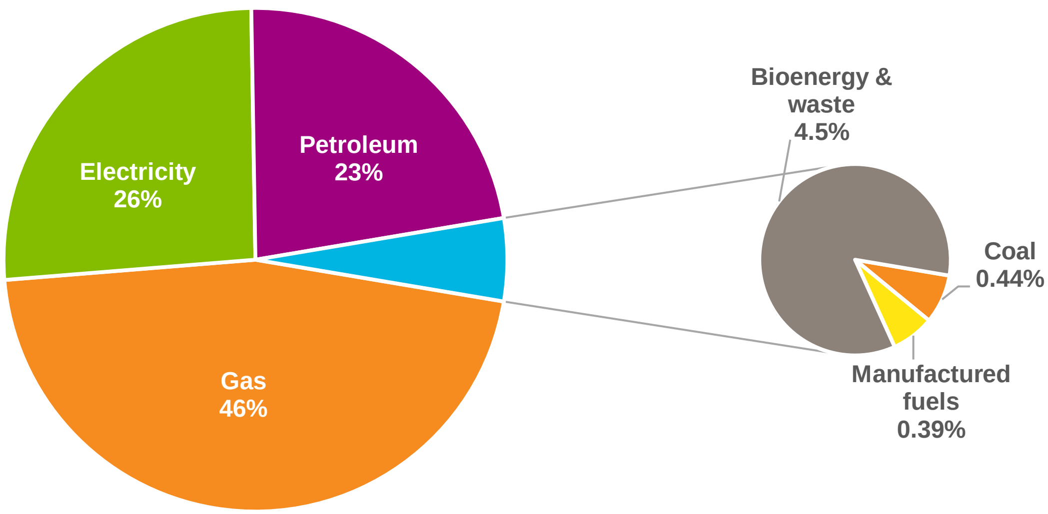


Figure 1: Fuel consumption by fuel type in 2017

[17] https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level
[18] For Further information see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/771895/Sub-national_Methology_and_Guidance_Booklet_2018.pdf

3.1.4 Below, Figure 2 shows that the domestic sector accounts for the highest proportion of energy consumption, followed by road transport and other non-domestic sectors.

3.1.5 Within the domestic sector, approximately 73% of fuel consumed is gas and 25% is electricity. In the non-domestic sector, approximately 34% of fuel consumed is gas and 56% is electricity. Petroleum products are predominately associated with road transport. Electricity used for transport, (i.e. rail or ULEVs) is not represented in the dataset.

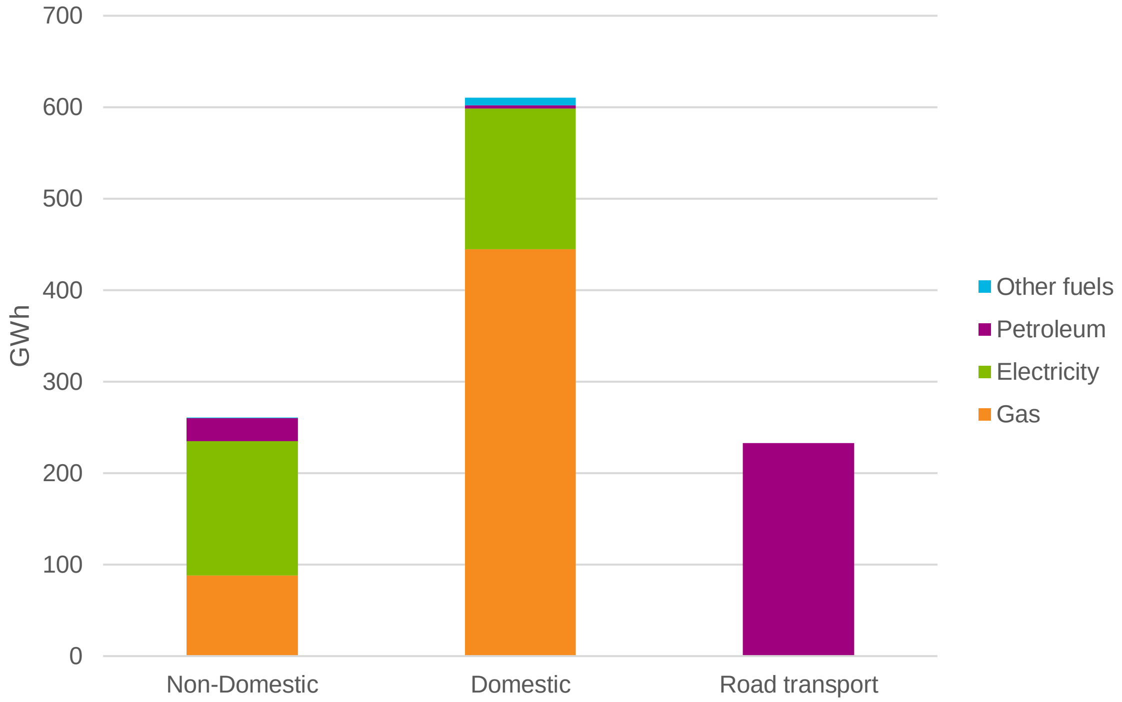


Figure 2: Fuel consumption by sector and fuel type in 2017

3.1.6 Figure 3 shows the changes in fuel consumption in Hastings from 2005 to 2017. During this period, the use of gas, electricity and petroleum products decreased by 27%, 16% and 12% respectively. This is due to a combination of many factors, including consumer behaviour, uptake of energy efficiency measures, economic trends, fuel prices, and weather, to name only a few.

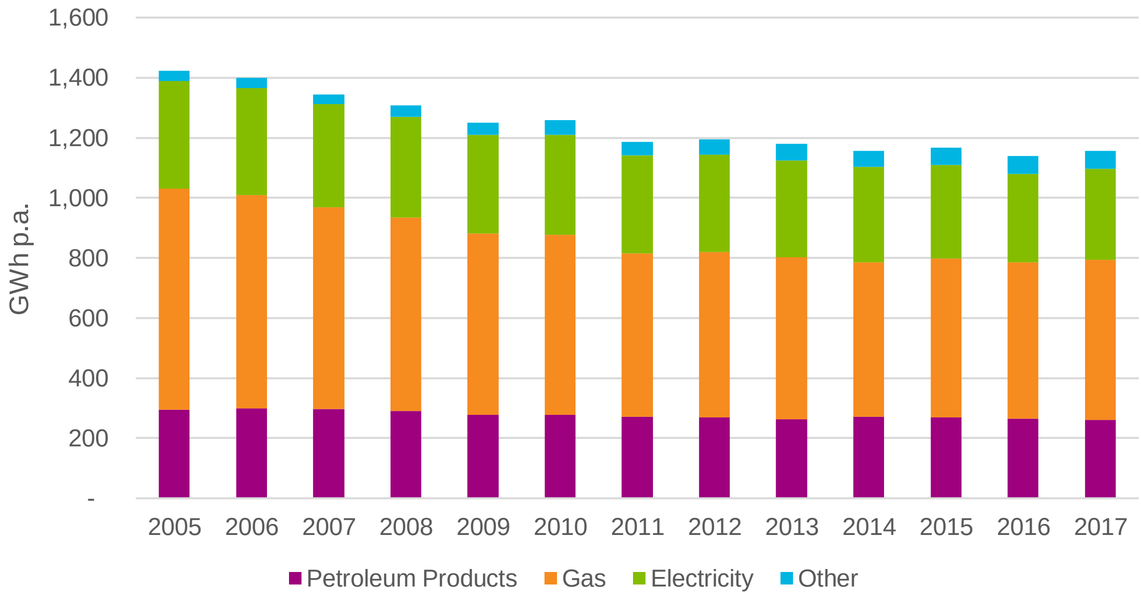


Figure 3. Changes in fuel consumption (2005-2017)

3.2 CO_2 emissions

Current annual emissions

3.2.1 CO_2 emission estimates for Hastings area were taken from *'UK local authority and regional carbon dioxide emissions national statistics: 2005-2017'* (published in 2019).[19] 2017 is the most recent year for which data is available.

3.2.2 The 2017 data breakdown for Hastings is shown in *Table 3* and is further illustrated in *Figure 4* and *Figure 5*. For further information, see *'Technical Report: Local and Regional Carbon Dioxide Emissions Estimates for 2005-2017 for the UK'* (BEIS, June 2019).[20, 21]

	Non-Domestic $ktCO_2$	Domestic $ktCO_2$	Transport $ktCO_2$	Total (unadjusted) $ktCO_2$	Total (adjusted) $ktCO_2$
Gas	16.4	82.6	-	98.9	Land Use, Land Use Change and Forestry (LULUCF)* adjustment: -2.7 $ktCO_2$
Electricity	37.4	39.2	-	76.6	
Other fuels	7.9	1.7	-	9.6	
Agriculture	0.3	-	-	0.3	
Transport	-	-	66.7	66.7	
Total by sector	**62.0**	**123.4**	**66.7**	**252.1**	**249.4**
Percent of total	*24.6%*	*49.0%*	*26.4%*		

Table 3: Hastings CO_2 emissions (2017)

** Note: The adjustment for Land Use, Land Use Change and Forestry (LULUCF) reflects the fact that certain land use activities, such as cutting down or planting trees, result in CO_2 being added or removed from the atmosphere.*

3.2.3 In 2017, total CO_2 emissions in the Local Authority of Hastings in 2017 were 249.4 $ktCO_2$. As depicted in Figure 4, emissions from gas and electricity use in buildings together account for nearly 70% of total emissions. Figure 5 shows that the domestic sector accounted for around 49% of total emissions, with the remainder split between transport (26%) and non-domestic sectors (24%).

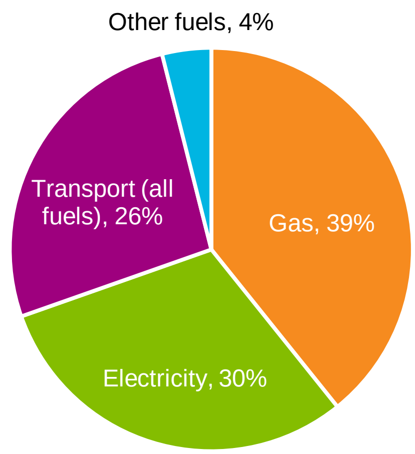


Figure 4: CO_2 emissions by fuel type in 2017

[19] https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2017

[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812146/Local_authority_CO2_technical_report_2017.pdf

[21] BEIS, *'Local and Regional Carbon Dioxide Emissions Estimates 2005-2017: Technical Report'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812146/Local_authority_C02_technical_report_2017.pdf

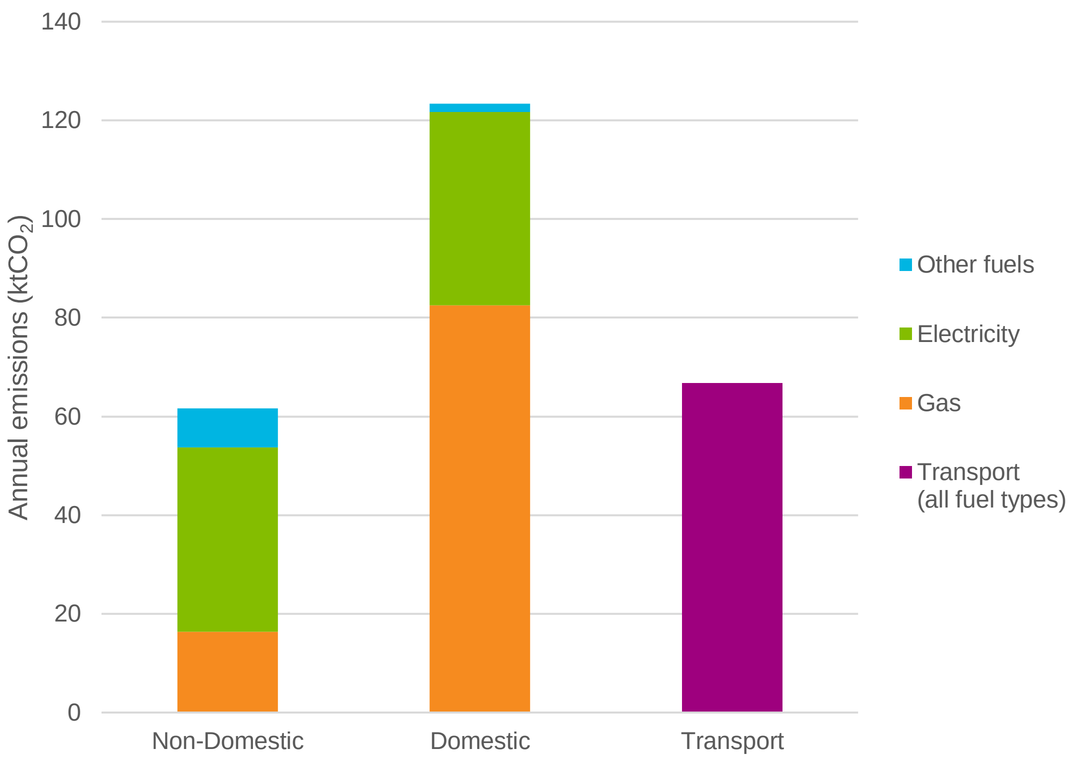
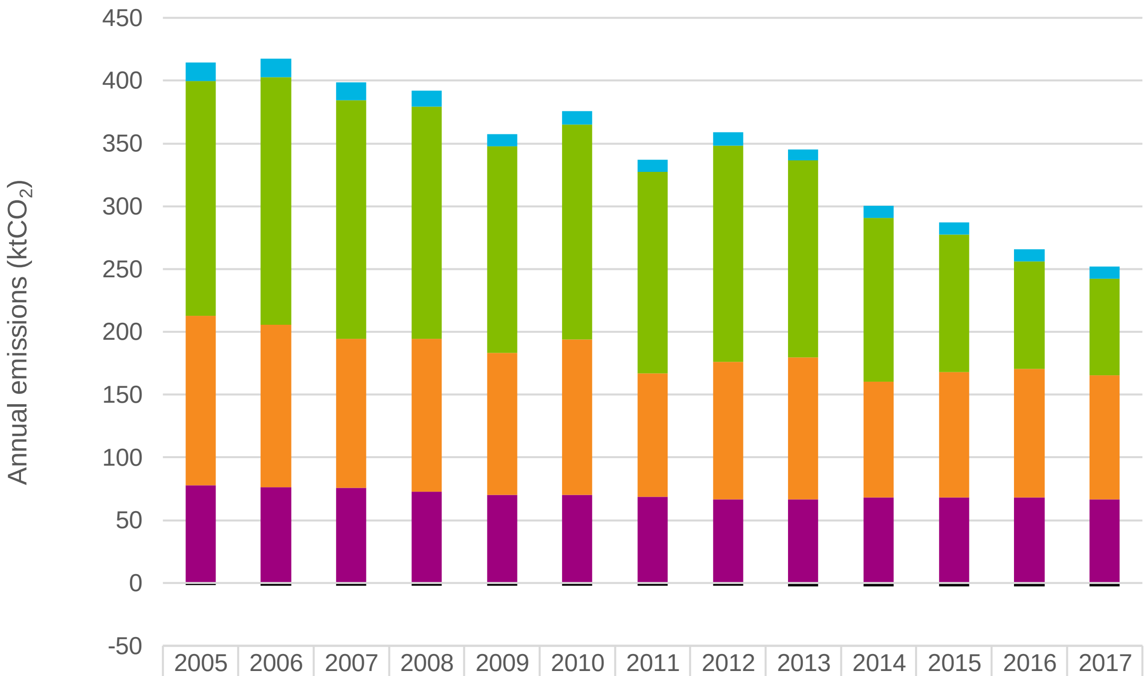


Figure 5: CO_2 emissions by sector and fuel type in 2017

3.2.4 The BEIS data has been used to track a historical trend for emissions in Hasting for the years 2005 through 2017, which is shown in Figure 6.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Other fuels	14.8	14.6	14.3	12.7	9.8	10.9	9.8	10.5	8.7	9.4	9.6	9.7	9.9
Electricity	187.1	197.1	189.9	185.2	164.8	170.9	160.4	172.2	156.8	130.4	109.5	85.6	76.6
Gas	135.2	129.6	118.5	121.5	112.6	124.1	98.6	109.5	112.8	92.3	100.1	102.5	98.9
Transport	77.6	76.3	75.8	72.7	70.4	70.0	68.4	66.8	66.7	68.2	68.1	67.9	66.7
LULUCF	-1.9	-2.0	-2.1	-2.2	-2.2	-2.3	-2.4	-2.4	-2.5	-2.5	-2.6	-2.6	-2.7

Figure 6: Historic CO_2 emissions in Hastings, 2005-2017

3.2.5 Total CO_2 emissions have fallen by nearly 39% since 2005, which is higher than the UK-wide reduction of 32% over the same period. For Hastings as well as the rest of the UK, this is attributed to changes in fuel consumption but, more significantly, to changes in the carbon intensity of grid electricity; if there had been no electricity grid decarbonisation, emissions in Hastings would have decreased by only 19% over this period.

3.2.6 When interpreting these results, it is important to note that:

- Changes in CO_2 emissions do not necessarily reflect changes in fuel consumption or energy efficiency. For instance, an increase in electricity use could be offset by a decrease in electricity grid emissions.
- Similarly, year-to-year changes in fuel consumption relate to factors such as weather and should therefore be interpreted with caution.

Putting the figures into context: the Tyndall Centre carbon budget for Hastings

3.2.7 According to the recommended carbon budget for Hastings (see Table 1, page 7), total emissions in the period 2018-2022 should not exceed 1.0 $MtCO_2$. Averaged across the 5-year period, this would allow for annual emissions of roughly 200 $ktCO_2$ p.a. compared to the 250 $ktCO_2$ emitted in 2017. At this rate, even without accounting for other sources of GHG emissions, Hastings' total carbon budget from now until the year 2100 would be used within the next 6-7 years.

4. Low and Zero Carbon (LZC) technologies in Hastings

4.1 Existing LZC energy generation capacity

4.1.1 The total number and type of LZC installations in Hastings is recorded in *'Renewable energy by local authority'* (BEIS, 2018).[22] Figures were cross-checked against several other databases including the Feed-in Tariff (FiT) and Renewable Heat Incentive (RHI). Further details are provided in Appendix C.

	Photovoltaics	Sewage Gas	Landfill Gas	Domestic RHI	Non-Domestic RHI
Number of sites (#)	767	1	1	42	1-5
Capacity (MW)	3.582	0.772	3.071	*Unknown*	*Unknown*
Generation (MWh p.a.)	3,446	5,854	10,126	*Unknown*	*Unknown*

Table 4. LZC installations in Hastings as of 2018

4.1.2 In total, the BEIS database suggests that the PV, sewage and landfill gas installations generate around 19,426 MWh of electricity per year which, for context, is around 6% of the electricity demand in 2017.In addition, the Renewable Heat Incentive (RHI) Database indicates that there are 42 accredited domestic installations in Hastings, and up to five non-domestic installations. These could include heat pumps, solar thermal technologies, and technologies utilising biomass or biogas, although further details are not publicly available.[23]

4.1.3 Figure 7 shows indicative locations of the existing large and medium scale (50kW and above) LZC installations in and near Hastings. The two largest installations are located at Pebsham Landfill (landfill gas, 3 MW) and Bexhill Wastewater Treatment works (sewage gas, 0.75 MW). There are also several large building-mounted PV systems located on large commercial, industrial and community buildings, including the Priory Meadows Shopping Centre, which offer a combined capacity of around 930 kWp. Details are provided in Table 5.

[22] Available at: https://www.gov.uk/government/statistics/regional-renewable-statistics

[23] Based on the technology split for the Southeast region, and average capacities for each technology, the installed capacity for domestic renewable heat technologies in Hastings could be around 300-400 kW in total, i.e. much less than the total capacity of small-scale PV. Source: BEIS Renewable Heat Incentive Monthly Deployment Statistics (June 2019), *'Table 2.4 - Number of accreditations by local authority'* and '*Table 2.6 - Average capacity and design SPF values'*.

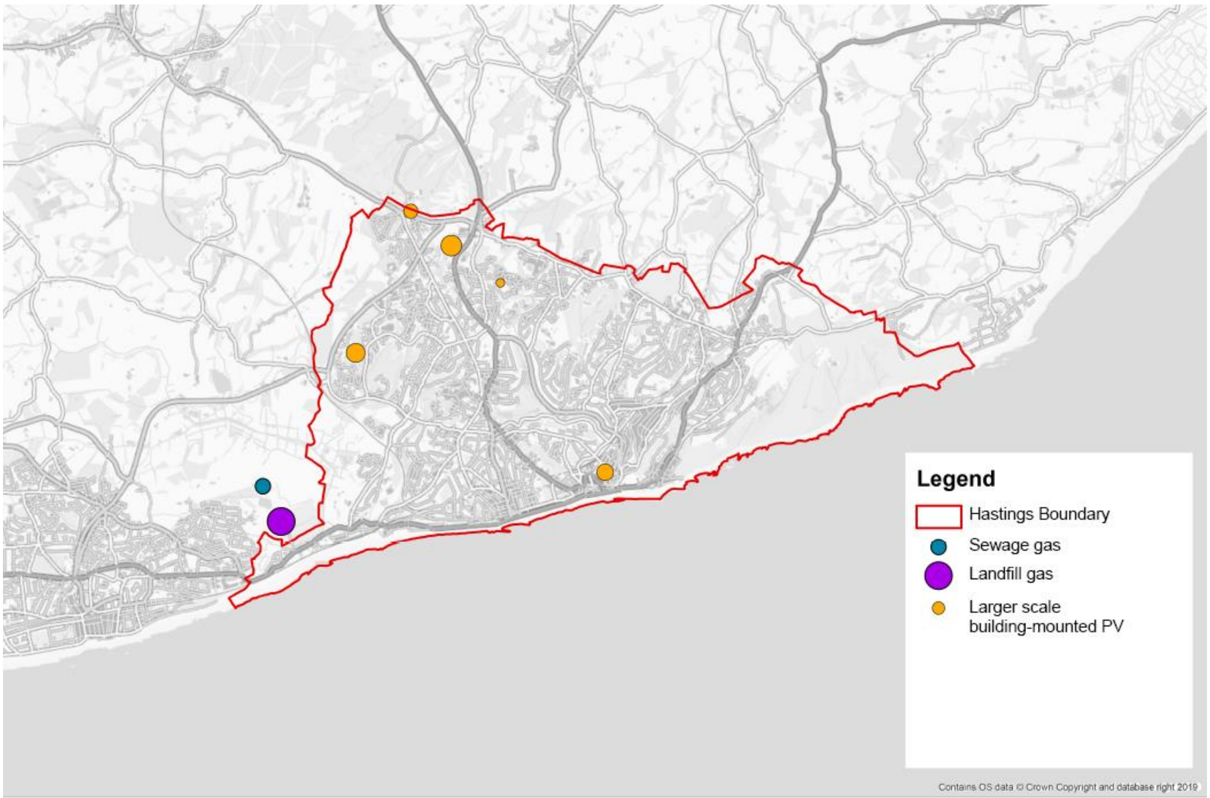


Figure 7. Existing large scale (50kW and above) LZC installations in Hastings

Type	Name or LSOA code	Installed Capacity (kW)	Source
Landfill Gas	Pebsham Landfill	3,000	*REPD*
Sewage Gas	Bexhill Wastewater Treatment Works	750	*Ofgem Database*
PV	*LSOA: E01020970*	250	*FiT Database*
PV	*LSOA: E01020996*	250	*FiT Database*
PV	Priory Meadows Shopping Centre	173	*FiT Database*
PV	*LSOA: E01020970*	158	*FiT Database*
PV	*LSOA: E01020987*	50	*FiT Database*
PV	*LSOA: E01021004*	50	*FiT Database*

Table 5: Existing large scale (50kW and above) LZC installations in Hastings

4.2 Ultra Low Emission Vehicles (ULEVs) and infrastructure

4.2.1 The chart below illustrates that there was a ten-fold increase in the number of Ultra Low Emission Vehicles (ULEVs)[24] in Hastings between 2011 and 2019 – although with only 135 registrations, these represent a small portion of the nearly 47,000 vehicles registered in Hastings.[25] As of 2019, there are a total of 7 public vehicle charging points within the Borough.[26]

[24] Defined as *'vehicles that emit less than 75g of carbon dioxide (CO_2) from the tailpipe for every kilometre travelled. In practice, the term typically refers to battery electric, plug-in hybrid electric and fuel cell electric vehicles.'* See Department for Transport, *'VEH0132: Licensed ultra low emission vehicles by local authority'* (2019). Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles
[25] Department for Transport, *'VEH0105: Licensed vehicles by body type and local authority'* (2019). Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles
[26] See http://maps.dft.gov.uk/ev-charging-map/

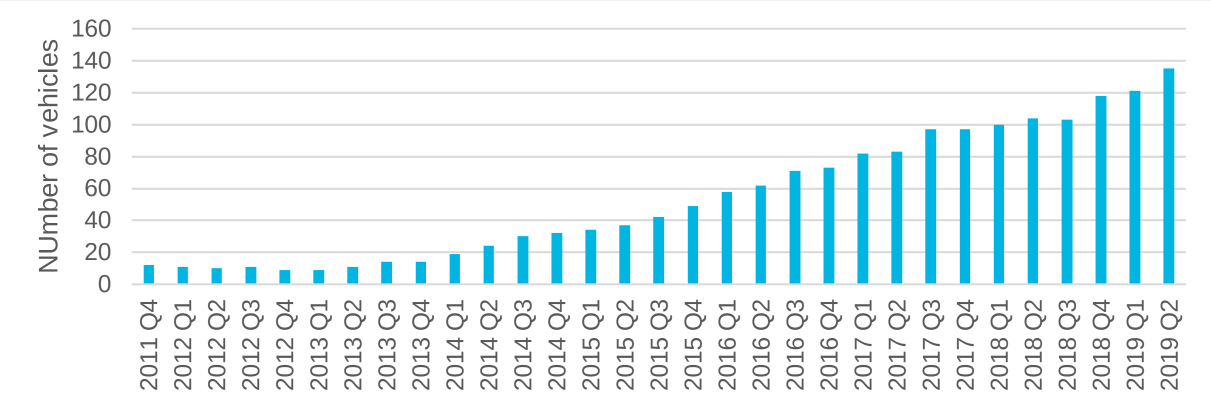


Figure 8. Ultra low emission vehicle (ULEV) registrations in Hastings, 2011-2019

4.3 Potential additional LZC energy generation capacity

4.3.1 Within the past decade there have been several studies of LZC generation potential within Hastings:

- Element Energy, *'Renewable and Low Carbon Energy Study'* (2009)
- Chris Blandford Associates, *'Upper Wilting Farm Wind Turbine Feasibility Study'* (2013)
- CLS Energy Ltd., *'Energy Options Study'* (2017)
- Regen, *'Sustainable Energy Options Study'* (2017)
- CLS Energy Ltd., *'Sustainable Housing in Inclusive Neighbourhoods / SHINE Final Report'* (2018)
- Climate Integrated Solutions, *'Democratisation of Energy Supply in the Ore Valley'* (2019)

4.3.2 To provide a comprehensive assessment of the potential additional LZC capacity in the Borough, AECOM carried out a review and validation exercise of these studies, which varied in their scope and methodology.

4.3.3 Where relevant, we have supplemented the previous analytical work with further calculations carried out in line with the Department of Energy and Climate Change (DECC) Renewable Energy Capacity Methodology (2010).[27] Our estimates have also been informed by discussions with HBC regarding the likelihood of LZC development on specific sites.

Scope of the LZC Assessment

The DECC methodology first estimates the total naturally available resource, which is then narrowed down based on technical constraints, physical constraints, and planning or regulatory constraints. Estimates can then be refined based on more locally specific issues such as economic viability, supply chain constraints, and so on. In this regard, the methodology recognises that a realistic and comprehensive assessment of LZC opportunities must consider a range of issues beyond the maximum naturally available resource. Therefore, the scope of our assessment varies depending on the technology in question.

For example, rooftop solar PV is a cost effective, established technology subject to relatively few policy constraints; our assessment therefore considers opportunities on all domestic roofs across the Borough. By contrast, taking into account the technological and policy constraints for onshore wind, we have assumed that there will be very few opportunities to deliver wind turbines of any scale within the Borough except, potentially, in locations that have previously been granted planning permission or where feasibility studies have already been carried out.

[27] DECC, *'Renewable and low carbon energy capacity methodology'* (2010). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/226175/renewable_and_low_carbon_energy_capacity_methodology_jan2010.pdf The methodology estimates the total natural resource, which is then narrowed down based on technical constraints, physical constraints, and planning / regulatory constraints. It then assumes that estimates will be refined based on more practical issues such as economic viability, supply chains and local ambitions.

4.3.4 Results are shown in the table below and further details are provided in Appendix A. Note that these are based on the current technical performance of each technology and do not account for anticipated changes (e.g. efficiency improvements) unless otherwise stated.

Table 6. Overview of potential additional capacity of LZC installations

Technology	Basis for assumption	Capacity
Building-mounted / small solar PV	Previous energy studies did not include a borough-wide assessment of building-mounted PV capacity, although Regen's *'Sustainable Energy Options Study'* (2017) indicates that there could be around 0.55MW of PV installed as solar car ports and 2.86 MW of roof-mounted PV on HBC owned non-domestic properties. AECOM has estimated the potential for domestic and non-domestic roof-mounted PV based on the DECC (2010) methodology and informed by discussions with HBC. On this basis, we estimate that around 21.5 MW of roof-mounted PV could be installed on domestic properties in the Borough, and 6.7 MW could be installed on non-domestic properties (excluding industrial buildings). HBC estimates that a further 3.6 MW of PV could be installed on the roofs of industrial buildings in the Borough, and up to 3.5 MW as solar car ports.	21.5 MW on domestic buildings (AECOM) 6.7 MW on non-domestic buildings (AECOM) 3.6 MW on industrial buildings (HBC) 3.5 MW on car parks (HBC)
Ground-mounted / large solar PV	Regen's 2017 study provides a comprehensive assessment of large-scale and ground-mounted solar PV potential on both HBC owned land and privately owned land in the Borough. The study assumed that up to 1MW of PV could be installed for every two hectares of land. Other estimates suggest that 1 MW of PV could require up to 5 acres[28] of land; the precise figure will depend on the layout, panel efficiency, site conditions, etc. Therefore, this may be an upper estimate. Specific opportunities considered by the Regen study include: • Pebsham Landfill – up to 6MW • Non-HBC owned low grade agricultural land – up to 10.5 MW • Other sites (e.g. playing fields, moderate / good agricultural land) – up to 6.5 MW but not likely to be approved for LZC development Note that, due to grid capacity constraints any large scale installations would require further discussions with UKPN. For more information, refer to the Regen (2017) report.	Up to 16.5 MW on Pebsham Landfill and low grade agricultural land
Solar thermal	No borough-wide assessment has been undertaken for solar thermal technologies, which use solar energy to supply hot water. Climate Integrated Solution's 2019 study looks at domestic solar thermal potential for the Ore Valley and concluded that it was financially unattractive compared with other technologies. In general, this technology is considered most suitable for domestic properties with hot water cylinders (HWCs), which could potentially represent over 18,000 homes in Hastings,[29] and non-domestic properties with high year-round demands for hot water.	See notes

[28] According to the UK Solar Trade Association: https://www.solar-trade.org.uk/solar-farms/
[29] Estimate based on number of domestic properties in Hastings and typical proportion of properties with HWCs; English Housing Survey (EHS) statistics indicate that HWCs are present in around 43% of homes nationwide. See Ministry of Housing,

Technology	Basis for assumption	Capacity
Large-scale wind	A considerable amount of previous assessment work has focused on identifying large-scale wind opportunities in Hastings, including the 2009 Element Energy study which noted that there is considerable wind resource across the Borough, but very few locations located far enough away from residential development to address potential concerns about visual impact and amenity. Echoing these findings, potential sites identified by the 2017 Regen study include Pebsham (Combe Valley) Countryside Park, East Ore and the area north of Breadsell Lane, but that study suggested that these would be difficult to develop in practice e.g. due to environmental designations. In 2013 a feasibility study was carried out by Chris Blandford Associates in 2013 which suggested that an installation of up to 1.5MW at Upper Wilting Farm might be acceptable on the basis that it would 'not significantly compromise the openness of the landscape.' Planning permission was granted for a 2MW turbine at Queensway Business Park, but this has now expired. Other opportunities are understood to be limited by practical and policy constraints, notably HCWS42 (2015), which at the time of writing would require any sites to be designated as being suitable for wind energy development within the forthcoming Local Plan. From a practical standpoint, therefore, we have assumed that the only potential site for large-scale wind might be Upper Wilting Farm, recognising that even this development would need to meet the criteria of HCWS42. For a more detailed discussion of relevant constraints, see Regen (2017). It is worth reiterating that the entire Borough meets the threshold to support large-scale turbines, and therefore in principle there could be other suitable sites not identified by an area-wide assessment. This would require separate feasibility studies and monitoring.	Up to 1.5 MW at Upper Wilting Farm (Chris Blandford Associates, 2013)
Small-scale / urban wind (50kW and below)	Previous reports have identified opportunities for installing vertical axis wind turbines (VAWTs) along the seafront / promenade (up to 32 no. 40kW turbines) and adjacent to the Crematorium (one 40kW). Although possible from a technical standpoint, studies have shown significant variations in the performance of small-scale wind turbines, which are very susceptible to localised wind conditions, so site-specific analysis and monitoring work would be needed to prove feasibility and viability as well as address other potential constraints to deployment. It is assumed that HCWS42 also applies to small-scale wind so these sites would have to be identified as a suitable site for wind energy within the forthcoming Local Plan, which is likely to be controversial due to visual impact. One consideration for small-scale wind is that it has a much lower output than large-scale wind and therefore may offer lower carbon savings and value (in terms of cost per tonne of carbon saved) as well as lower financial benefits (in terms of returns on investment). This is discussed further in Section 4.4. Note that technological improvements and / or new incentive schemes could in principle	Up to 1.32 MW (based on previously identified sites) depending on the number of VAWTs installed

Communities and Local Government, *'English Housing Survey: 2017-18 Energy Report'* (2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/817757/EHS_2017-18_Energy_Report.pdf

Technology	Basis for assumption	Capacity
	increase the number of suitable locations for small-scale wind generation.	
Air and ground source heat pumps (ASHPs and GSHPs)	No borough-wide assessment has been undertaken previously, although the 'Democratisation of Energy Supply in the Ore Valley' report considered opportunities specific to the Ore Valley area. The DECC (2010) methodology indicates that, from a technical perspective, around 50% of existing buildings* could in principle accommodate either an ASHP or GSHP. Recently proposed changes to Part L of the Building Regulations would tend to promote the use of electrically-driven heat pumps in new buildings, particularly from 2025 onwards. This is discussed further in Appendix C. Note that, from a technical standpoint, heat pumps could be installed in any building, but this would require energy efficiency upgrades and heating system replacement which have significant practical and cost implications; therefore, the DECC 50% figure has been used.	Potentially suitable for approx. 50% of existing buildings and up to 100% of new buildings
District heat networks (DHNs)	The previous energy studies highlight a few sites that have a high heat demand density, for which preliminary investigations into CHP-led heat networks (DHNs) have taken place. The main opportunities are based around the key anchor loads of Conquest Hospital and Summerfield Sports Centre, and Bohemia.	Potentially suitable for sites such as Conquest Hospital, Summerfield Sports Centre, or developments with high density of heat demand
Biomass boilers or CHP	Previous studies indicate that, due to the urban nature of the Borough, any renewable biomass fuel(s) would likely come from outside Hastings and would likely be more suitable for use closer to source. Due to concerns about air quality, along with fuel availability (including transport and storage), it is generally assumed that biomass will not be adopted on a significant scale, which would exclude larger / commercial scale boilers and CHP. However, in some circumstances, it can be suitable for domestic properties that are off the gas grid and currently use a more carbon-intensive solid fuel (i.e. coal) for heating.	Limited application in off gas grid properties if heat pumps not feasible but not generally recommended
Water resources e.g. WSHP / hydro / tidal	This study has not attempted to quantify potential wave or tidal resources. A study carried out in 2016 on behalf of Eastbourne Borough Council[30] included a high-level assessment of tidal resource around Hastings, which found that *'the viability of generating tidal energy in the Eastbourne region is limited.'* The *'South2East Local Energy Strategy'* suggests this should be reviewed in future when these technologies are more mature. Although potential opportunities for hydroelectric installations or WSHPs have been suggested, for example at Buckshole Reservoir, these are not necessarily located close to areas of high heat demand. The obvious exception is the seafront where there is relatively dense development.	See notes

[30] JBA Consulting, *'Eastbourne tidal energy resource review: Final Report'* (2016)

Technology	Basis for assumption	Capacity
	Appendix C contains a high-level discussion of key constraints and GIS maps based on Environment Agency guidance relating to surface water source heat pumps. More detailed investigations would be required to identify suitable locations and types of installation.	
Other opportunities	All waste in East Sussex is either recycled or brought to an incinerator outside of the Borough so there are assumed to be no further opportunities for EfW. It has been noted that there may be an opportunity to utilise waste heat from the Crematorium but there is no existing or planned nearby anchor load to justify a heat network.	N/a

A presumption in favour of LZC technologies?

4.3.5 An area-wide assessment of LZC opportunities cannot account for all the constraints on a given site, and therefore may overestimate the potential renewable generation capacity within the Borough. Conversely, there is also a risk that this approach would miss opportunities to incorporate LZCs into sensitive areas or landscapes in an appropriate and unobtrusive way. With that in mind, the table below outlines the key areas of applicability for the LZC technologies that have been assessed as being most suitable for Hastings.

Table 7. Key considerations for installation of LZC technologies

Technology	Key considerations[31]	Potential applicability
Small scale / building-mounted PV	Visual impact Cumulative impacts Historic environment Constraints associated with the local electricity network	Technically suitable for most building types subject to orientation and overshading, particularly for new developments which can be designed to maximise opportunities (e.g. orientation, roof geometry). May be particularly suitable for industrial buildings because of the large roof areas and architectural character of industrial zones. From a policy perspective, application is often limited for historic assets, listed buildings, Conservation Areas, etc. and installations in high value landscape areas such as AONBs. However, these should not be ruled out automatically.
Large scale / ground-mounted PV	Visual impact Cumulative impacts Constraints associated with the local electricity network	Most suitable for low grade agricultural sites or as temporary installations on brownfield because of competing land uses.
ASHPs	As for building-mounted PV Potential noise concerns	Can be installed new or retrofitted into most building types but may require energy efficiency upgrades and replacement of heating system. Visual and noise impacts can be reduced depending on placement.
GSHPs	Depends on design but groundworks can affect soil, water quality, aquifers, archaeology, etc.	Requires site-specific feasibility study and EA consultation. Not generally suitable for existing buildings.
Large scale wind	Visual impact Cumulative impacts Historic environment	Requires site-specific feasibility study. Constraints vary depending on location, height and number of turbines. Technically suitable for

[31] For more information, see https://www.gov.uk/guidance/renewable-and-low-carbon-energy#particular-planning-considerations-for-hydropower-active-solar-technology-solar-farms-and-wind-turbines

<table>
<tr><td></td><td>Local infrastructure constraints
Noise, flicker and shadow</td><td rowspan="2">areas with adequate wind resource e.g. seafront, rural areas without nearby obstructions. At a strategic level, the entire Borough has wind speeds that could potentially support wind energy developments.</td></tr>
<tr><td>Small scale / urban wind</td><td>As for large wind, but effects likely to be smaller due to difference in size of turbines</td></tr>
<tr><td>ULEV infrastructure</td><td>Visual impact
Local infrastructure constraints</td><td>Can be installed new or retrofitted into existing streetscape / parking infrastructure. Especially suitable to combine with technologies such as solar car ports.</td></tr>
</table>

4.3.6 In declaring a Climate Emergency, HBC has acknowledged the urgent need to transition to a low carbon energy system, which requires a large increase in the deployment of LZC technologies. This is supported by nationwide policies and strategies as outlined in Section 2. In light of this, and given the scale of the challenge in reaching net zero, we propose that HBC could consider a more permissive approach in certain locations. For example, HBC could issue Local Development Orders (LDOs) that would extend permitted development rights for certain LZC technologies, removing the need for a full planning application and thereby reducing development costs. Such LDOs could cover:

- Non-domestic ASHPs and district heating installations
- Hydrogen and electric car fuelling installations
- Canopy mounted solar arrays at specific sites
- Solar arrays specific sites, for example, former landfill sites

4.4 Are there any easy wins? An economic comparison of LZC technologies

4.4.1 The table below presents **illustrative** capital costs, operational costs and payback periods for the LZC technologies listed above, where published information was available. It is important to note that the relative costs and benefits of different technologies has changed rapidly in recent years and will likely continue to do so. Therefore, this information is intended merely to support a discussion of the relative costs at the time of writing, in order to help inform policy recommendations and highlight areas where HBC may wish to carry out wider viability testing. Note that the figures do not include pre-development costs.

Table 8. Illustrative costs of LZC technologies

Technology	Capex (£000s / MW)	Opex (£000s / MW)	Ref.	Payback period*	Notes
Building-mounted PV - Domestic	1,500	13	HBC	10-20 years	*Payback period assumes export payment based on industry figures*
Building-mounted PV - Commercial	900		HBC	-	-
Solar car ports	1,800	-	HBC	-	-
Ground-mounted / large scale PV	1,000	10	1, 2	-	-
Large scale wind	1,000	-	1, 3	-	-
Urban / small scale wind	1,500	41	1, 3	-	-
Solar thermal	1,450	-	4	10-15 years	*The payback period includes RHI and is based on the target return of 6-8% from the scheme. Changes to RHI will affect this estimate.*
ASHPs	900	9	HBC		
GSHPs	1,300	-	HBC		
Gas-fired CHP	700	-	5	5-15 years	*This is affected by a significant number of variables including existing heating costs, biomass price, capex, maintenance costs, system scale etc*
Biomass boilers	310	-	7	5-15 years	*This is affected by a significant number of variables including existing heating costs, spark gap, capex, maintenance costs, system size, relative heat and power demands etc.*
Biomass CHP	3,150	377	7	-	-
WSHP	*See notes*	-	-	-	*Prices vary considerably due to the bespoke interface required*
Hydro	3,000	63	1,3	-	-
Tidal	5,200	211	1	-	-
Wave	6,000	181	1	-	-
Landfill Gas	2,500	135	1	-	-
Sewage Gas	5,500	148	1	-	-

Reference	Source
1	Arup, *'Review of Renewable Electricity Generation Cost and Technical Assumptions'* (2016)
2	BEIS, *'Solar Photovoltaic (PV) Cost Data - taken from the Microgeneration Certification Scheme Installation Database'* (2019)
3	IRENA, *'Renewable Power Generation Costs in 2018'* (2019)
4	DECC 2050 Calculator Tool. Available at: http://2050-calculator-tool-wiki.decc.gov.uk/costs/681
5	Evergreen Energy. Available at: https://www.evergreenenergy.co.uk/heat-pumps/much-heat-pump-cost/
6	AECOM estimate
7	Spon, *'Spon's Mechanical and Electrical Services Price Book'* (2019)
HBC	Estimate provided by Hastings Borough Council

** Building-integrated technologies only*

4.4.2 When interpreting these figures, it is important to consider not only the capital and operational costs of each technology, but also their potential generation outputs.

4.4.3 Taking large-scale PV and wind as an example, although the capital cost is roughly similar, the average annual output for an onshore turbine in the South East of England in 2018 was around 2,600 MWh per MW, whereas for solar the figure is around 1,000 MWh per MW.[32] Small scale / building-mounted PV tends to be around 50% more expensive in terms of capital costs, but the output can be the same as for solar farms. By contrast, the output from smaller scale / urban wind turbines is relatively low.

4.4.4 Figure 9 presents an illustrative comparison of the capital cost per MWh of renewable electricity generated by each of these technologies (£ per MWh). It shows that large scale wind generation is a relatively cheap option, followed by large scale PV and small scale wind, and is significantly more cost effective than building-mounted PV.

4.4.5 However, cost considerations are only one factor that needs to be weighed against the spatial, visual, and other environmental implications of installing each technology. For example, ground-mounted PV competes with other land uses such as agriculture and amenity, so in some cases it may be a less appealing option than building-mounted PV, despite the difference in cost.

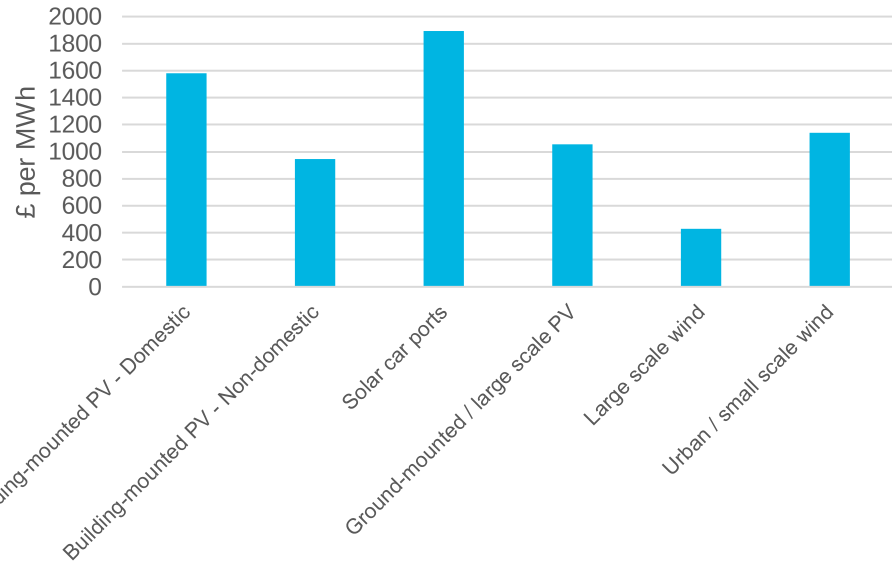


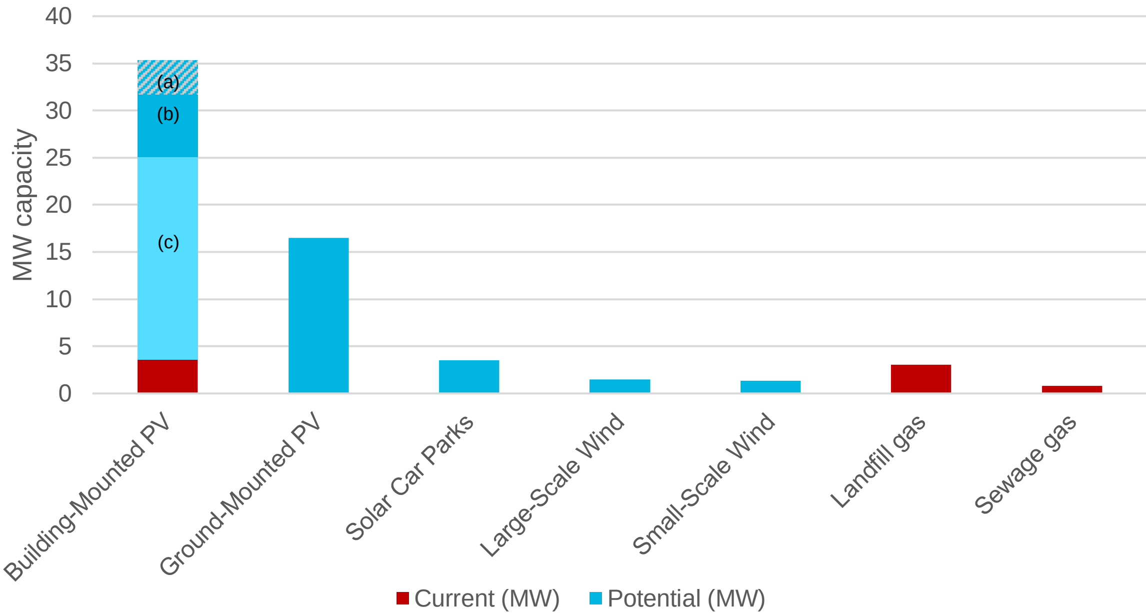
Figure 9. Illustrative cost comparison of PV and wind technologies

[32] BEIS, *'Renewable Electricity by Local Authority 2014-2018'* (published 2019). Available at: https://www.gov.uk/government/statistics/regional-renewable-statistics

4.5 Summary

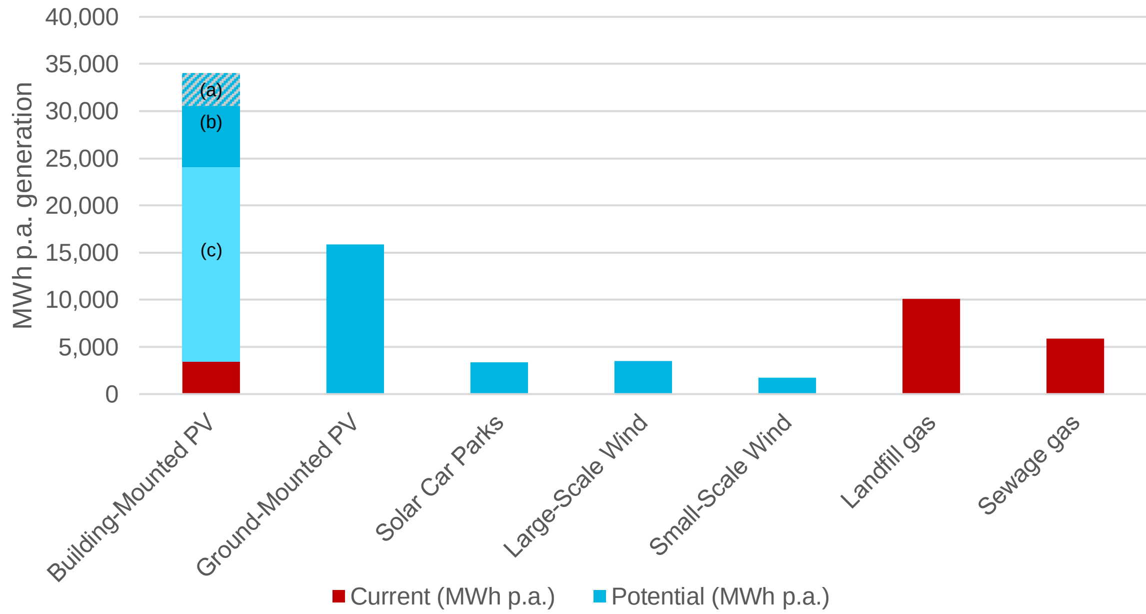
4.5.1 If all the LZC installations described above were operational, these could generate more than 55,000 MWh p.a. of additional LZC electricity. Combined with the current LZC electricity generation, this could supply around 74,450 MWh p.a., equivalent to roughly one quarter of the electricity demand in Hastings.

4.5.2 The relative current and estimated potential capacity and electricity generation of these technologies are illustrated below. Solar technologies offer the greatest opportunity for expansion. Details are provided in Table 9 on the following page. (Heat pumps are not shown because they do not generate electricity, but deliver heating and cooling more efficiently; however, they represent the biggest opportunity in terms of the number of individual installations.)



Building-mounted PV is split between (a) industrial (b) other non-domestic and (c) domestic roofs.

Figure 10. Current and estimated potential LZC capacity in Hastings



Building-mounted PV is split between (a) industrial (b) other non-domestic and (c) domestic roofs.

Figure 11. Current and estimated potential LZC electricity generation in Hastings

	Building-mounted PV*	Ground-mounted PV	Solar car ports	Large-scale wind*	Small-scale wind*	Landfill gas	Sewage gas
Current capacity (MW)	3.58	0	0	0	0	3.07	0.77
Current generation (MWh p.a.)	3,446	0	0	0	0	10,126	5,854
Potential additional capacity (MW)	31.76	16.5	3.50	1.5	1.32	0	0
Potential additional generation (MWh p.a.)	30,554	15,874	3,367	3,495	1,734	0	0
Total potential capacity (MW)	35.34	16.5	3.50	1.5	1.32	3.071	0.772
Total potential generation (MWh p.a.)	34,000	15,874	3,367	3,495	1,734	10,126	5,854

** Includes PV mounted on the roofs of domestic, industrial and other non-domestic buildings*

Table 9. Current and estimated potential LZC electricity generation in Hastings

5. Routes to Net Zero: Projections to 2030

5.1 Modelling approach

Overview

5.1.1 The analysis presented in this report considers interventions that could be influenced by the Council (e.g. energy performance in new buildings), but also accounts for broader trends expected to take place on a primarily national level (e.g. retrofitting existing buildings, decarbonisation of the national electricity grid and ULEV uptake). Key assumptions are outlined below. The methodology is described in detail in Appendix D.

- **National electricity grid decarbonisation** – The emission factor for grid electricity is expected to fall progressively over time, as it will be generated using less fossil fuel and more renewable energy. This analysis considers the impact of a grid decarbonisation trajectory published by BEIS for use in CO_2 emissions reporting, which would see emissions from electricity decrease by around 90% by 2050.[33] Although not a prediction, the trajectory reflects the ambitions set by the Government and seen as necessary to meet the UK's carbon emission reduction commitments.

- **Energy demand reduction through energy efficiency measures and behaviour change** – Based on statistics provided in the UK National Energy Efficiency Database (NEED)[34] we have assumed that fabric upgrades could reduce demand for heating in the existing building stock by around 10% on average, and that electricity use could decrease by around 5% through a combination of behavioural change measures and smart energy management.

  Note that these represent average savings across the entire building stock; in other words, some buildings could achieve greater improvements while others (e.g. Listed Buildings) achieve little or no improvement.

[33] BEIS, *'Green Book Supplementary Guidance: Toolkit for valuing changes in greenhouse gas emissions, Table 1'* (2019). Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[34] NEED, *'Summary of Analysis, Great Britain'* (2019). Available at: 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

- **Switching from the use of gas-fired heating to electric systems** – Based on BEIS statistics for gas consumption, and accounting for differences in the typical performance of gas boilers, direct electric heating, and heat pumps, we have estimated the fuel use if the total 2018/19 heating requirements were met by these technologies.
- **Reducing demand for transport –**We have assumed that a 10% reduction in mileage could be achieved, for instance, by using smart route planning, or taking measures to promote a shift towards walking, cycling, ridesharing and public transport.[35]
- **Uptake of Ultra Low Emission Vehicles (ULEVs)** – In line with assumptions made by the Department for Transport's 'Road to Zero' report, we have assumed that ULEV uptake will increase rapidly in the coming decade and therefore aside from HGVs, all vehicles could be ultra-low emission (powered either by hydrogen or electricity) by 2030.

5.1.2 The model assumes that, in a hypothetical 'Business as Usual' ('BAU') scenario, no actions are taken to reduce emissions, fuel consumption remains steady, and total CO_2e emissions do not change over time.[36] This is used as a baseline for assessing the cumulative impacts of the intervention measures.

5.1.3 **It is important to note that these scenarios are *not* intended to predict actual fuel consumption or CO_2e emissions.** Instead, the analysis highlights priority measures for reducing emissions. In particular, these scenarios assume rapid and widespread uptake of energy efficiency measures, ULEVs and LZC technologies, which is not likely to occur barring major national-scale policy interventions.

5.2 Carbon emissions scenarios

5.2.1 The graphs below show historic emissions for Hastings, along with a hypothetical 'Business as Usual' trajectory as described above. The other lines on the graph show the cumulative impact of sequentially adopting measures to:

1. Reduce energy demands in buildings; and then
2. Switch from gas boilers to efficient electric heating systems; and then
3. Reduce vehicle mileage and switch from petrol and diesel vehicles to ULEV (electric or hydrogen) vehicles; and then
4. Install the LZC energy generation technologies (based on the maximum in Section 4).

5.2.2 Finally, an *illustrative* trajectory to net zero is modelled based on user inputs which indicate the level of CO_2 offsetting needed to meet the target.

[35] Department for Transport and Energy Savings Trust *'Mileage Management – A Guide for Fleet Managers'* (2015). Available at: https://www.energysavingtrust.org.uk/sites/default/files/reports/4548_EST_A4_mileage_mmt_4.pdf
[36] In reality CO_2e emissions depend on many variables, including economic trends, energy prices, and weather, to name only a few. For example, see National Grid *'Future Energy Scenarios'* (2019). Available at: http://fes.nationalgrid.com/fes-document/

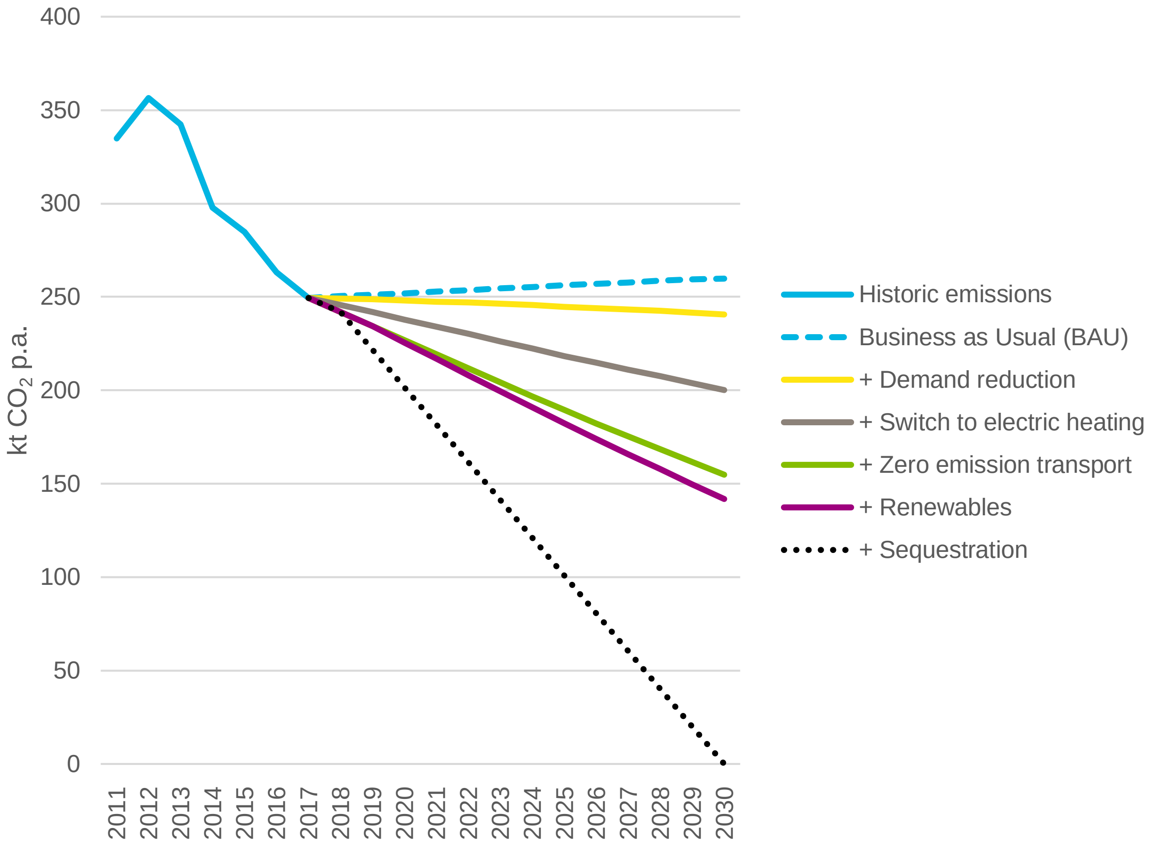


Figure 12: CO_2 emissions in Hastings – No change to electricity grid emissions (2030)

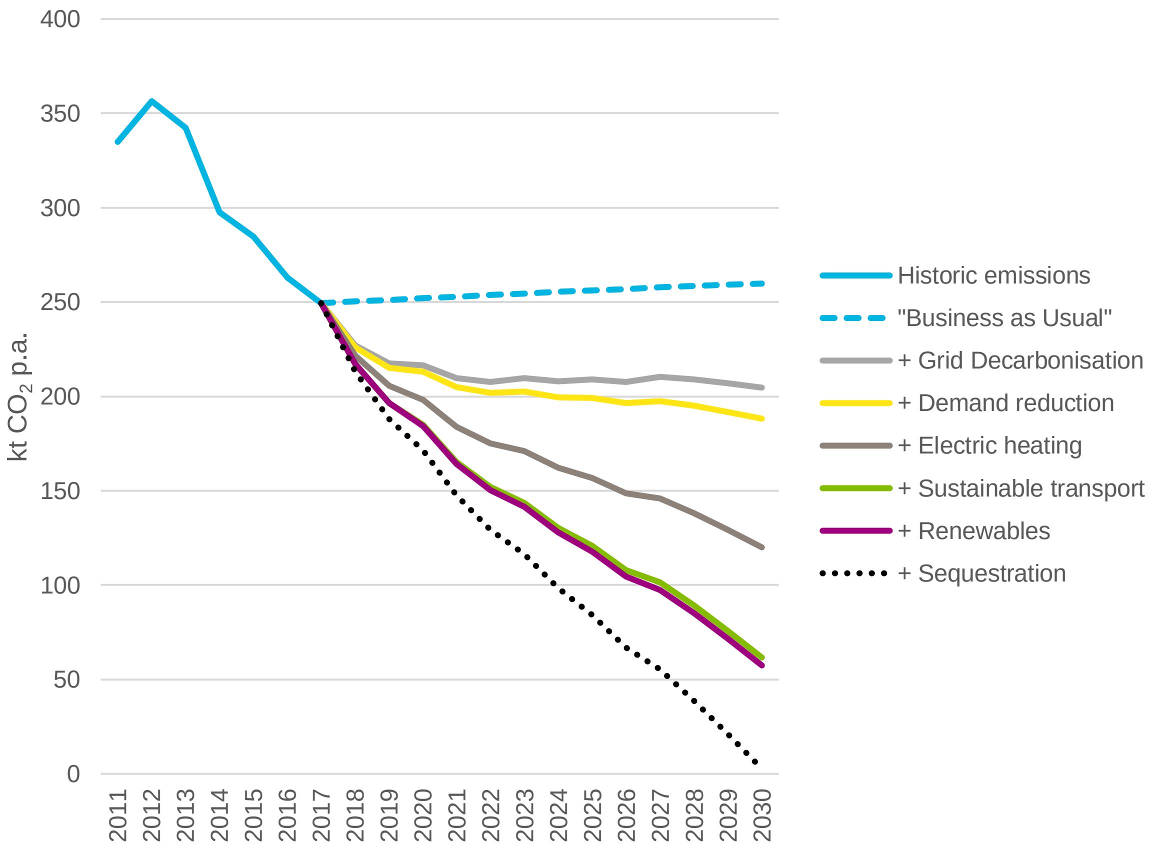


Figure 13. CO_2 emissions in Hastings –Accounting for grid decarbonisation (2030)

5.2.3 Figure 12 shows the potential CO_2 reductions that could be achieved assuming that there is no change in the national electricity grid. In this scenario, if all measures (excluding offsetting / sequestration) are adopted, this would reduce total CO_2 emissions by roughly 43% by 2030. The residual emissions (142 $ktCO_2e$ p.a.) would need to be made up for through renewable electricity generation and offsetting / sequestration.

5.2.4 For context, assuming there is no change in emissions from grid electricity, this would require around:

- 1,155 MW of ground-mounted PV (i.e. several hundred large solar farms); or
- 425 MW of large-scale onshore wind (i.e. several hundred large turbines 70-100m high); or
- Approximately 173,300 acres (700 sq. kilometres) of new woodland – roughly 24 times the area of Hastings.

5.2.5 By contrast, Figure 13 shows what would happen using the same assumptions, assuming the electricity grid decarbonises at the rate indicated by the BEIS Green Book Guidance. In this scenario, if all measures (excluding offsetting / sequestration) are adopted, this would reduce total CO_2 emissions by roughly 77% by 2030. The residual emissions (57 $ktCO_2$ p.a.) would need to be mitigated through some form carbon offsetting, which could include carbon sequestration (e.g. tree planting) or investing in further renewable energy or energy efficiency projects that may take place outside of Hastings.

5.2.6 If all the potential LZC capacity identified in Section 4.3 was installed, it could produce around 74,450 MWh p.a. This level of LZC electricity generation would be enough to save 18,910 tCO_2 per year, or around 7.4% of 2017 CO_2 emissions). However, as time goes on, the level of CO_2 saving will decrease proportional to the change in electricity grid emissions, as illustrated below.

Grid emissions and CO_2 savings scenario	Current	BEIS Green Book Guidance	
Year chosen for analysis	2017*	2030	2050
Emissions from grid electricity (tCO_2 / MWh)	0.254	0.082	0.027
Savings from 74,450 MWh of LZC electricity (tCO_2)	18,910	6,105	2,010

** Selected because it represents the most recently published BEIS CO_2 dataset for Hastings.*

5.2.7 In this example, the CO_2 savings from LZCs would reduce to around 1/10th of their current levels by 2050, so offsetting the same amount of CO_2 would require around 10 times as much LZC electricity generation. This emphasises the fact that grid decarbonisation and offsetting will not be enough for Hastings to reach net zero emissions – it must be supported by strong actions to reduce demand for fuel in buildings and transportation via a range of measures.

5.2.8 The remainder of this section will discuss some of the other trends and changes shown in these graphs before summarising the relative impacts of each intervention modelled.

Impact of grid decarbonisation

5.2.9 Although the level of grid decarbonisation is uncertain, Figures 13 and 14 highlight that it is one of the most important variables that will determine whether the net zero target is achieved. This has both positive and negative implications. On one hand, if the BEIS decarbonisation scenario were to occur, Borough-wide emissions could decrease by up to 18% by 2030 (22% by 2050) even if no other actions were taken. On the other hand, this presents a key risk, because it means that much of the reliance on achieving the net zero target will rely on factors outside of the Council's ability to influence.

5.2.10 To address and mitigate this risk, consideration must be given to how the Council can best facilitate the government's objectives in decarbonising the grid as well as what measures it can take to best insulate itself from the eventuality that grid decarbonisation does not happen as quickly and/or as deeply as the Government intends.[37]

Impacts of new development

5.2.11 If new development in Hastings between now and 2030 uses roughly the same amount of gas and electricity as existing buildings, if all other variables hold constant, this would result in a 4% increase in Borough-wide CO_2 emissions by 2030 (and more than 10% by 2050). Even if they were built to meet the proposed Future Homes Standard, there would still be a small increase. Therefore, it will be vital to ensure that any new buildings are constructed or retrofitted to be capable of becoming net zero in operation[38] and incorporate low and zero carbon technologies as standard.

5.2.12 Note: This estimate is based on the amount of new development as set out in the adopted Local Plan. It is understood that these figures are subject to revision. However, the key point is that new development has a relatively small impact when compared to the scale of total emissions.

Reducing demands for electricity and heating

5.2.13 The demand reduction measures modelled in this report have relatively little impact when considered on their own, offering CO_2 emissions savings of up to 6% compared with 2017 levels. Although this is a conservative estimate of the reduction in demand that could be achieved from a technical standpoint, the timescale is extremely challenging and would require an ambitious programme of energy efficiency improvements.

5.2.14 One of the key obstacles would likely be the absence of a policy driver that requires energy efficiency upgrades to existing buildings. The Minimum Energy Efficiency Standards (MEES) regulations are intended to drive progressive improvements in the existing stock but the impact this will have is not yet clear. Therefore, it will be important to identify any potential sources of funding to implement this measure. Hastings Borough Council could also consider lobbying the Government to promote additional regulations in this area.

Minimum Energy Efficiency Standards

Under the MEES regulations, as of 1st April 2018, any properties newly rented out in the private sector must have a minimum Energy Performance Certificate (EPC) rating of E (some exceptions apply). Fines will be applied for non-compliance.

Owners of buildings with a lower EPC rating will be required to implement energy efficiency measures, though consideration will be given to financial viability, the anticipated payback time and impacts on property value.

Over time, the Government intends to progressively increase the minimum EPC rating, meaning that buildings must become more efficient in order to be sold or rented. A recently-published consultation covering non-domestic buildings proposed that the minimum rating should be raised to B by 2030, subject to actions meeting a seven-year payback test.

- BEIS, *'The Non-Domestic Private Sector Minimum Energy Efficiency Standards: The Future Trajectory to 2030'* (2019)

5.2.15 It is worth noting that there are important reasons other than CO_2 savings which support refurbishing the existing stock. Fabric and building services efficiency improvements can help to protect consumers against changes in fuel prices, mitigate fuel poverty and improve health,

[37] Although there has been significant progress in this area in recent years, future decarbonisation is anticipated to be much more difficult to achieve. To date, the decarbonisation of the national grid has been primarily achieved through the significant reduction in the use of coal fired power stations and the increase in the use of renewable technologies, particularly large-scale wind and biomass (where it is used for co-firing in power stations). However, the use of gas remains a significant component of the generation mix, and the timely replacement of the existing nuclear fleet is already proving to be challenging. Furthermore, significant additional pressures from the use of electricity to provide heating and power vehicles may incentivise power generation from fossil fuel sources to deal with greater peaks in demand.

[38] For more information, see https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

wellbeing and comfort. For Hastings, where rates of fuel poverty are above the national average, this is particularly significant.[39]

Phasing out natural gas

5.2.16 Unlike electricity, which can be generated from a range of renewable technologies, natural gas is a fossil fuel which unavoidably emits CO_2 during combustion. In order to meet the net zero target, it will therefore be crucial to phase out the use of gas, because the scale of investment that would be required to offset these emissions would be significant.

5.2.17 The two main options for achieving this, based on currently available technologies, are to (1) reduce the total demand for heat and (2) switch to using electric heating systems such as direct electric heating (DEH) or heat pumps.[40] Of these, heat pumps are the preferred option due to the lower running costs and smaller impact on the electrical grid. This would have the effect of reducing the Borough's emissions by around 24%, depending on the technology used, assuming there is no change in the electricity grid emissions. As the grid decarbonises, the savings would increase, so fuel switching (with necessary enabling works) could potentially result in a 52% decrease in emissions by 2030.

5.2.18 One method of reducing heat demand which has not been included in this Borough-wide analysis would be to develop heat networks. A heat network involves the centralised generation of heat to serve multiple buildings, which can enable the use of larger and more efficient equipment, thereby delivering higher carbon savings with lower capital and operational costs than solutions for each individual building. Although heat networks at present often utilise gas-fired Combined Heat and Power (CHP) systems, future heat networks will need to deliver low or zero carbon heat and therefore are likely to utilise large-scale heat pump technology or waste heat sources.

5.2.19 As noted in Section 4.3, heat networks have been suggested for the Conquest Hospital and Summerfield Sports Centre, but they could also be suitable for certain types of development where there is a high and consistent heat demand. The potential CO_2 savings have not been quantified in this report; they are likely to be small compared with total emissions because of the relatively limited number of opportunities in Hastings at present. However, one of the benefits is that a single project can enable multiple buildings to switch to a low carbon heat source in one go, speeding up the process of fuel switching.

Switching to ultra-low emission cars and vans

5.2.20 As mentioned in Section 4.2, there has been an increase in electric vehicle registrations in Hastings, and growth is expected to continue; it is estimated that the price of electric, hybrid and traditional fuel cars could converge within the next decade,[41] which would help to facilitate the shift towards sustainable transport. Switching to ULEVs would reduce total CO_2 emissions by around 18% if they were charged using national grid electricity. The savings would increase as the electricity grid decarbonises, or if the vehicles were charged using 100% renewable energy – for instance, generated by PV on the roof of a Council-owned car park.

5.2.21 Although switching to ULEVs will be an important part of reaching the decarbonisation target, even if this goal is achieved, it creates additional challenges. For instance, achieving the Borough-wide net zero target will depend more on the rate of national electricity grid decarbonisation. It will also present a broad-ranging challenge across all areas of electricity infrastructure.[42] Increasing LZC energy generation, the use of smart EV charging and, potentially, vehicle-to-grid systems could mitigate some of the effects on peak demand and help to alleviate some of this pressure.

5.2.22 A large-scale shift to the use of electric vehicles must also be accompanied by a significant modal shift towards walking, cycling, ridesharing, and an increase in the use of public transport.

[39] https://www.hastingsobserver.co.uk/news/number-of-hastings-households-in-fuel-poverty-above-national-average-1-7570348
[40] It may be possible to decarbonise the gas grid by injecting it with biomethane or hydrogen, but this would require a technological step-change and has therefore not been considered given the timeframe for the Councils to reach net zero.
[41] Cambridge Econometrics and Element Energy, *'Fuelling Europe's Future: How the transition from oil strengthens the economy'* (2018). Available at: https://europeanclimate.org/wp-content/uploads/2018/02/FEF_transition.pdf
[42] National Grid, *'Future Energy Scenarios'* (2019). Available at: http://fes.nationalgrid.com/media/1409/fes-2019.pdf

This is necessary to reduce electricity demand – with added benefits in terms of air quality and, potentially, improving people's health.

Reducing emissions from HGVs

5.2.23 At the time of writing, ultra low emission HGVs are not widely commercially available and are not expected to become so in the next decade, barring a technological step-change. In the short-term the Government has suggested a target of reducing emissions from HGVs by 15% through efficiency measures such as driver training. Because HGVs represent a small portion of the total emissions in Hastings,[43] this would probably have a small (<1%) impact. (Note that conversion to hydrogen or electric HGVs is anticipated in the medium to long term.)

Increasing renewable electricity generation

5.2.24 As buildings and vehicles switch away from the use of fossil fuels and towards electricity, it becomes increasingly important to ensure that electricity is supplied from renewable sources. Reasons include:

- reducing pressure on grid infrastructure
- ensuring security of supply, and
- protecting consumers from rising electricity prices.

Offsetting residual emissions

5.2.25 The scenario testing demonstrated that, even with the most optimistic assessment of grid decarbonisation, switching to low emission transport, and uptake of other efficiency measures and LZCs in buildings, there will be significant residual CO_2 emissions that would require offsetting. To achieve net zero, it will become necessary to sequester, capture or store CO_2 in some form.

5.2.26 Further work and consultation would be required to identify the most appropriate and cost-effective opportunities, but these might include tree planting or new woodland creation. The UK Woodland Carbon Code, for instance, provides a means of gaining certification for this type of project.[44]

Other opportunities to reduce emissions

5.2.27 These technologies have not been included in the quantitative analysis above, but present further opportunities for Hastings to reach net zero emissions:

- **District heat networks.** Heat networks offer an opportunity to switch multiple buildings on to lower carbon heating systems and use larger and more complex technologies to deliver higher carbon savings with lower overall capital and operational costs than addressing each building separately. However, by virtue of being larger projects they can be more complex to deliver although the Government is providing technical support and funding through the Heat Network Delivery Unit and Heat Network Investment Programme to assist local authorities in delivering these projects.

- **Smart energy management:** One of the key benefits of smart meters is by improving transparency and user access to their own energy data, making it easier to identify areas of waste. Although it is not clear to what extent this affects user behaviour in the long term, the improved data collection could also facilitate the introduction of demand side response, and on a broader scale, help to balance energy demand and supply, which is particularly

[43] Although not reported separately in the BEIS CO_2 dataset, HGVs account for less than 4% of all fuel used for transportation. See BEIS, *'Sub-national road transport fuel consumption 2005-2017'* (published 2019). Available at: https://www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level
[44] https://www.woodlandcarboncode.org.uk/

important at peak times.[45] In principle, therefore, these have the potential to reduce energy consumption.

- **Battery storage:** There have been significant improvements in battery storage in recent years with implications for energy consumption across all sectors. Although batteries are likely to become crucial to future energy infrastructure, they do not offer CO_2e savings per se. Instead, they help to facilitate uptake of LZC technologies by moderating the intermittency of wind and solar energy generation. Combined with EV uptake and the introduction of vehicle-to-grid systems, this could have a transformative effect on the design of energy infrastructure and the built environment.

- **Carbon capture and storage:** At present, carbon capture and storage technologies have been deployed as pilot projects in the UK. Although these form part of the Government's *Clean Growth Strategy* (2017), at present there is insufficient evidence to provide a realistic estimate of their potential contribution towards the decarbonisation target.[46]

5.3 Key findings of the analysis

5.3.1 The table below summarises the potential impacts of the measures described above. It reports the maximum cumulative potential percentage (%) reduction in CO_2 that could be achieved through sequential adoption of each measure, compared with a 'Business as Usual' baseline. Results are reported for scenarios both with and without electricity grid decarbonisation.

Table 10. Key findings of the CO_2 projection modelling

Potential change in carbon emissions from these measures…	**Without grid decarbonisation**	**With grid decarbonisation***
Demand reduction and fuel switching in buildings		
Reduce demand for electricity and heat…	-4%	-25%
… and switch to electric heating systems	-20%	-52%
Low carbon transport		
Mileage reduction (such as reducing the number of journeys)…	-3%	-3%
… and switching to ULEVs (excludes HGVs)	-18%	-23%
Renewable electricity generation		
Maximise LZC uptake (as per Section 4.3)	-5%	-2%
Total reductions		
All measures implemented (excluding offsetting / sequestration)	-43%	-77%
Residual emissions to offset (tCO_2e p.a.)	143	58

**Note: The figures quoted for the 'grid decarbonisation' trajectory include the 18% reduction that occurs from grid decarbonisation alone. Therefore, the total reductions may be larger than the proportion of current CO_2 emissions from a given source, and these figures are not directly comparable to those shown for the scenario 'without grid decarbonisation'.*

5.3.2 These illustrative scenarios are based on a set of assumptions that are considered technically achievable based on current, proven technologies and intervention measures. In our view, they are not unreasonably ambitious from a technical standpoint. However, in practical terms, achieving this level of decarbonisation over such a short timescale would be very difficult and costly without a significant change in consumer behaviour, along with national-level policies and incentive structures.

[45] BEIS, 'Smart Meters and Demand Side Response' https://www.gov.uk/government/publications/smart-meters-and-demand-side-response
[46] For more information, see https://www.gov.uk/guidance/uk-carbon-capture-and-storage-government-funding-and-support

5.4 Implications for reaching the net zero target

5.4.1 Although CO_2 emissions have decreased in recent years, significant changes must take place across all sectors to achieve net zero emissions by 2030. Based on this analysis, the key priorities prior to offsetting or carbon sequestration are to:

- Reduce the demand for heat and phase out the use of natural gas by switching to heat pumps; and
- Reduce demand for transport and switch from petrol/diesel to ULEVs; and
- Reduce all other electricity demands, in part to minimise pressure on grid infrastructure; and
- Meet any remaining energy demands with renewable energy.

This is illustrated in the diagram below, which draws from Figure 4 (see Section 3.2.3).

Existing sources of CO_2 emissions

Phase out the use of gas

Reduce demand for transport + switch to ULEVS

Reduce all other electricity demands

Meet remaining energy demands with renewable energy

5.4.2 The next section of this report will consider how HBC, as a local authority, can respond to these challenges through planning policy and contribute towards meeting these targets.

6. Opportunities to respond through policy

6.1 Overview

6.1.1 In order to help meet HBC's CO_2 reduction targets, and contribute towards UK commitments on climate change mitigation and adaptation, HBC should consider incorporating policies into the Local Plan that address the following topics:

- Support demand reduction, energy efficiency, switching to efficient heat pump systems and uptake of LZC energy technologies through a revised Energy and Heat Hierarchy
- Encourage the development of heat networks where appropriate
- Increase support for LZC energy developments that meet criteria for acceptability, and seek to broaden those criteria
- Actively encourage energy efficiency retrofitting and/or use of LZC energy technologies across Hastings, including (where appropriate) in historic buildings and Conservation Areas
- Support the provision of infrastructure for ULEVs (and continue to promote measures that reduce the need for private vehicles)
- Increase carbon sequestration through land use policies and/or requirements to include green infrastructure in new developments

6.2 Policy suggestions

Support demand reduction, energy efficiency, switching to efficient heat pump systems and uptake of LZC energy technologies through a revised Energy and Heat Hierarchy

Context

6.2.1 In order to deliver the net zero ambition, whether to meet the UK-wide 2050 target or Hastings' 2030 goal, it will be crucial to reduce energy demands and transition towards the use of 100% renewable electricity wherever possible. This will require high standards of sustainable design in new buildings along with upgrades to the existing stock.

6.2.2 Demand reduction is a prerequisite for successfully switching towards the use of electric heating and vehicles. For instance, energy efficiency improvements in buildings enable systems such as heat pumps to work at a higher level of efficiency. It also helps to mitigate pressure on electricity grid infrastructure as more systems switch from the use of fossil fuels to renewably generated electricity and reduces the level of offsetting that is required to address any residual emissions. Therefore, although demand reduction on its own would likely only deliver a relatively small reduction in total CO_2 emissions (<10%), it is a top priority for any carbon reduction strategy.

6.2.3 Decarbonisation of heat is a critical component of the Government's plan to meet its net-zero carbon target. This is likely to be one of the hardest challenges and therefore the need to use policy and regulations on new buildings to drive the uptake of low carbon heating systems will be essential. Our analysis of CO_2 emissions in Hastings shows that gas consumption currently accounts for the largest single portion of emissions in the Borough (39%). Switching to energy efficient, electrically driven heat pump technologies could deliver CO_2 savings of up to 24%, and the savings would only increase as the national electricity grid decarbonises.

6.2.4 A recent study by the Committee on Climate Change reported[47] that, over a 60-year timescale, CO_2 emissions from properties that use heat pumps could be up to 90% lower than an otherwise equivalent gas-heated building. It also reported the impact of delayed action, showing that a

[47] Committee on Climate Change, *'The costs and benefits of tighter standards for new buildings'* (2019). Available at: https://www.theccc.org.uk/wp-content/uploads/2019/07/The-costs-and-benefits-of-tighter-standards-for-new-buildings-Currie-Brown-and-AECOM.pdf

property fitted with a gas boiler for 10 years before switching to a heat pump could emit more than three times more carbon than a property installed with a heat pump from day one.

6.2.5 The 2014 Hastings Local Plan includes an energy hierarchy as part of Policy SC4. However, in light of evolving energy policy and priorities, this should be updated. In particular, note the following:

- With the decarbonisation of the grid and updates to SAP emission factors, CHP, specifically gas-fired CHP, is becoming relatively more carbon intensive compared to other low carbon technology. Therefore, is it suggested that the hierarchy be updated to reference secondary or waste heat sources, along with district energy networks. Such networks could themselves be served by heat pumps utilising waste or sources such as rivers or sewers that could not be accessed by individual buildings.
- Although Building Regulations address the total CO_2 emissions from buildings, they are designed to provide flexibility to developers in how the targets are met. In practice this often means installing gas boilers with PV or other add-on technologies. Even if the gas boilers are later replaced with electric heating technologies (e.g. heat pumps), the lifetime CO_2 emissions from these systems will be up to six times higher than if they were fitted with heat pumps from the outset. This is significant when considering the UK's national carbon budget and its implications for global climate change. Therefore, HBC should seek to promote the use of electrically-driven, energy efficient heating technologies where possible.

Proposed approach

6.2.6 It is recommended that Policy SC4 be altered to apply directly to all new development, both residential and non-residential, so that all proposals follow a hierarchical approach in achieving energy and CO_2 savings. We therefore propose that the Energy Hierarchy should promote the following measures in order of priority:

1. Minimise energy demand through energy efficiency measures such as fabric performance and passive design
2. Supply energy efficiently and exploit local energy resources such as secondary heat and district energy networks. Preference must be given to technologies with greater efficiencies, and fuels with lower carbon emissions, to achieve the highest total lifecycle carbon emission savings, following the hierarchy set out below:
    a. Electrically-driven ground or water source heat pumps or use of waste heat sources
    b. Electrically-driven air source heat pumps
    c. Direct electric heating
    d. Gas-fired boilers
3. Utilise on-site renewable energy generation and storage.

Note: For all the systems listed above the use of solar thermal systems in combination to provide a proportion of the annual heat demands may also provide additional carbon and cost savings so should be considered if suitable and viable.

Encourage the development of heat networks where appropriate

Context

6.2.7 HBC have undertaken several studies that assess the potential for delivering heat networks in the town. Both the Renewable and Low Carbon Energy Study (2009) and Energy Options Study (2017) found that the areas around Conquest Hospital and the Summerfield Sports Centre to be potential sites for the development of a heat network. The Democratisation of Energy Supply in the Ore Valley (2019) report indicates that HBC is considering HNDU funding options.

6.2.8 The delivery and expansion of heat networks relies upon the connectivity of potential heat loads. New development can facilitate the creation of heat networks if buildings are designed to connect to an existing network or with the ability to make a future connection.

6.2.9 The new Local Plan should therefore include a requirement for all suitable major developments to consider including a heat network and/or incorporate the necessary infrastructure to enable future connection. 'Suitable developments' will generally be those with a sufficiently high density of heat demand[48] and/or those located within Heat Network Opportunity Areas.

6.2.10 For commercial buildings, the costs of designing to enable future connection to a heat network should be no greater than the alternative approach. The likely requirements include the location of the plant room, provision of space within the plant room for a heat exchanger, capped off connections to the flow and return pipework, lower temperature heating systems and the choice of control systems. For residential buildings, there could be additional costs associated with the communal heating network within blocks of flats if compared to individual heating systems.

Proposed approach

6.2.11 We would recommend updating Policy SC5: District Heating Networks and Combined Heat and Power Systems to include wording that addresses the following topics:

- HBC will continue to explore opportunities for district heat networks in the vicinity of Conquest Hospital, Summerfiels Sports Centre and any other suitable areas
- Developments should prioritise communal systems or district heat networks over individual systems where viable. In particular, major developments and those within a Heat Network Opportunity Area should be required to consider installing a communal or district heating network.
- It is expected that future heat networks will need to be supplied by heat pumps making use of low carbon heat sources in line with the UK's Clean Growth Strategy. Heat networks will allow the ability to access sources of heat such as rivers, surface water, sewer and other sources of waste heat that would are much less likely than at the individual building level.
- The supporting text or technical guidance for this policy should explain how developers can demonstrate compliance. For example, this could comprise an update to the existing *'Supplementary Planning Document on Sustainable Design'*.

Increase support for LZC energy developments that meet local criteria for acceptability, and seek to broaden those criteria

Context

6.2.12 The NPPF states that, in order to help increase the use and supply of renewable and low carbon energy local planning authorities should amongst other things *'consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources.'*

6.2.13 As outlined in Section 4, HBC have undertaken several studies to assess potential future capacities and suitable sites for various renewable energy technology. Opportunities include large scale wind and solar installations and district heat networks, along with smaller, building scale, renewable energy projects such as building-mounted PV or heat pumps. Our estimates suggest that solar and wind energy could deliver an additional 57,000 MWh p.a. of local LZC electricity. Combined with existing PV, landfill and sewage gas installations, this could deliver the equivalent of roughly one quarter of Hastings' 2017 electricity demand. However, this is still not enough to ensure that Hastings will be able to reach net zero, and therefore we suggest that HBC should actively seek to reduce barriers to uptake through policy and other means.

[48] A common rule of thumb is that Combined Heat and Power (CHP) DHN schemes are likely to be economically feasible for developments above 50 dwellings per hectare. See, for example, Energy Saving Trust (2014) *CE299: The applicability of district heating for new dwellings.*

6.2.14 There are additional considerations related to wind energy development. The Written Ministerial Statement on Wind (HCWS42, 2015) states that, when determining planning applications for wind energy development involving one or more wind turbines, local planning authorities should only grant planning permission if:

- the development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood plan; and
- following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.

6.2.15 In order to support large scale renewable energy development while giving due consideration to local conditions and the requirements of HCWS42, HBC has several different options:

1. Designate the entire Borough as being 'strategically suitable' for wind energy;
2. As above, but create exceptions for specific areas or sites;
3. Designate specific sites for wind energy development;
4. Do not designate specific sites, leaving this to the Neighbourhood Planning process; or
5. Do not designate specific sites and clarify that wind is not suitable.

Proposed approach

6.2.16 Evidence from this study, along with previous renewable energy studies for Hastings should be used to update Local Plan policies, including those that relate to wind energy. In particular:

- Reaffirm HBC's strong support for building-integrated and standalone renewable energy developments.
- Clarify that buildings and areas are not automatically excluded on the basis of specific designations e.g. Conservation Areas, listed buildings, etc. recognising that any potential impacts are site-specific and can be mitigated through careful design.
- Designate the entire Borough as an area of search suitable for wind energy development subject to local criteria for acceptability – addressing key requirements of HCWS42.
- Require major new developments to demonstrate how the layout, orientation and massing has been designed to maximise opportunities for on-site renewable and low carbon technologies.

6.2.17 In addition to updating the policy wording, there are several ways that HBC could facilitate LZC uptake:

- Expand the types of LZC and energy efficiency projects eligible to submit a self-certification form[49] in lieu of a full planning application (and review the restrictions therein). For instance, properties in Conservation Areas are not currently eligible to submit the self-certification form. HBC should review the Permitted Development rights regarding solar panels and other renewable technologies to assess whether restrictions can be loosened without compromising the broader goals of the development policy.
- Consider issuing Local Development Orders (LDOs) that would extend permitted development rights for certain LZC technologies, removing the need for a full planning application.

[49] https://www.hastings.gov.uk/planning/need/selfassessment/

Actively encourage energy efficiency retrofitting and/or use of LZC energy technologies in historic buildings and Conservation Areas where appropriate

Context

6.2.18 Gas and electricity use in existing buildings combined account for roughly 70% of all CO_2 emissions in the Borough. Reducing emissions from this sector will require a significant change in policy and incentive structures if Hastings is to become carbon neutral.

6.2.19 Within Hastings there are multiple Conservation Areas and several hundred Listed Buildings which are historically or culturally significant. Although it is not possible to predict the level of energy efficiency based solely on a building's age, in general, evidence suggests that older buildings tend to have higher heat demands and less efficient services, and therefore result in higher CO_2 emissions than modern structures.[50] HBC should work to preserve these historic assets, whilst acknowledging the need to dramatically reduce energy demand in the existing stock.

6.2.20 As discussed in Section 4.3, energy efficiency measures and building-integrated LZC technologies can in principle be incorporated into the historic built environment in a sensitive way.

6.2.21 Because our analysis has shown that building-integrated technologies (particularly heat pumps and PV) represent the biggest opportunity for increasing LZC capacity in Hastings, this policy along with Policy EN1: Built and Historic Environment should be updated to clarify that such measures are in fact actively encouraged, provided that they are appropriately designed and integrated. Approximately 14% of residential buildings in Hastings are located inside of Conservation Areas – a relatively small proportion, but as shown in Section 5, in order to meet the Climate Emergency targets Hastings must take advantage of all opportunities to reduce demands and increase LZC uptake.

Proposed approach

6.2.22 We suggest adding wording to Policy EN1: Built and Historic Environment (or any similar policy brought forth within the new Local Plan) to clarify that energy efficiency measures and/or LZC installations **carried out in line with best practice guidance** (e.g. from Historic England) are considered compatible with the policies related to protecting heritage assets.[51]

Support the provision of infrastructure for Ultra-Low Emission Vehicles

Context

6.2.23 The UK government has placed strong emphasis on supporting electric vehicle uptake and is channelling £400m into a Charging Infrastructure Investment Fund. The East Sussex Local Transport Plan 3, 2011 to 2026 strategy calls for 'better use of technology to make the best use of the existing transport network' via charging points for electric vehicles, among other methods.

6.2.24 Adoption of electric vehicles can cut local carbon emissions and improve local air quality. Moreover, due to the decarbonisation of the electricity grid, use of electric vehicles should entail a net reduction in carbon emissions. As of Q2 2019, there were roughly 135 ULEVs in Hastings – a tenfold increase since 2011. If UK-wide strategy described in the Government's *Road to Zero* report (see Section 2.1) is implemented successfully, ULEV uptake will continue to increase dramatically in the coming years and most cars will be electric by 2050. Adequate infrastructure must be in place for this growth to be realised.

6.2.25 Developers should be required to demonstrate that EV charging points will either be provided or that it is prohibitively costly to do so. Our research shows that the cost of retrofitting EV

[50] BEIS, *'National Energy Efficiency Database (NEED): Summary of Analysis 2017'* (published 2019). Available at: 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
[51] For example, see https://historicengland.org.uk/advice/technical-advice/energy-efficiency-and-historic-buildings/

charging points is higher than installing during initial construction, so there is an opportunity cost if charging points are not installed.[52]

Proposed approach

6.2.26 ULEVs and associated infrastructure are not mentioned in the 2014 Local Plan. The new Local Plan should address the need to:

- Reduce reliance on private vehicles; and
- Support the provision of ULEV infrastructure, particularly within new developments and car parks.

Increase carbon sequestration through land use policies and/or requirements to include green infrastructure in new developments

Context

6.2.27 The analysis in Section 5 of this report has shown that some level of carbon sequestration or offsetting will be necessary for Hastings to achieve net zero emissions. Because Hastings is a predominantly urban area, the role of natural carbon sinks in the town is relatively limited. Therefore, it will be important to maximise carbon sequestration opportunities within the Borough. This could include:

- Developing a management strategy for all new and existing parks, green spaces and/or urban green infrastructure that aims to maximise carbon offsetting;
- Adopting a policy within the new Local Plan to promote such practice e.g. requiring large developments to include green roofs, walls or landscaping features; and/or
- Adapting existing policy wording on green infrastructure to ensure that carbon sequestration is considered alongside biodiversity, amenity and other benefits.

6.2.28 This approach aligns with the recommendations of the Tyndall Centre report (see Section 2), which states: 'We also recommend that the LULUCF [Land-use, land-use change and forestry] sector[53] should be managed to ensure CO_2 sequestration where possible. The management of LULUCF could also include action to increase wider social and environmental benefits.'

Proposed approach

6.2.29 The new Local Plan should emphasise the need to incorporate good quality green infrastructure wherever possible, and in particular maximising opportunities on any major new developments. Design and management strategies for green infrastructure should consider opportunities to increase the carbon sequestration potential of the site or area alongside other benefits such as biodiversity and amenity.

6.2.30 Separate to the Local Plan update, HBC should assess opportunities for increasing the CO_2 sequestration potential of existing parks, open spaces and green infrastructure through site allocations and management plans. Quantifying such opportunities within Hastings is beyond

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[5252] See Energy Saving Trust, *'Guide to chargepoint infrastructure for business users'* (2017). Available at: https://www.energysavingtrust.org.uk/sites/default/files/reports/6390%20EST%20A4%20Chargepoints%20guide_v10b.pdf and Department for Transport, *'Industrial Strategy: Electric Vehicle Charging in Residential and Non-Residential Buildings'* (2019). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/818810/electric-vehicle-charging-in-residential-and-non-residential-buildings.pdf

[53] LULUCF stands for 'Land use, land use change and forestry', defined by the UN Climate Change Secretariat as: *'A greenhouse gas inventory sector that covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change and forestry activities.'* In other words, agricultural practices and soil disruption, along with urban expansion, emit CO_2 during the process of land use change, such as digging or clearing land, and lower the carbon sequestration potential of the land itself. See UN Climate Change Secretariat (n.d.): https://unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms

the scope of this report but there is a variety of research, including reports by Natural England,[54] that supports carrying out such an assessment.

6.3 Other potential responses

6.3.1 In addition to the recommendations laid out above, there are a variety of other options and actions that HBC could consider, which are presented below for information:

- Include a requirement for all developments to complete an energy statement to demonstrate compliance with the relevant policies. Applicants would need to provide details of the LZC energy technologies installed and the estimated reduction in CO_2 emissions these will deliver. At present, per Policy SC4, energy use is to be addressed within the Design and Access Statement.
- Introduce requirements relating to Lifecycle Carbon Assessments (particularly for larger developments) to minimise the embodied energy of proposed schemes.
- Introduce requirements relating to Circular Economy measures, which would have the effect of reducing embodied energy in the built environment by minimising demand for resources while also minimising the CO_2 emissions associated with the production and management of waste.
- Implement plans and/or new policy that promotes walking and cycling e.g. by establishing new cycle lanes, pedestrian routes, and public transport links within Hastings and beyond.
- Allocate specific sites or areas in Hastings for carbon sequestration projects.

6.4 Note: Scope 3 emissions in development and construction

6.4.1 Although not captured in existing datasets, it is worth noting that there are Scope 3 CO_2 emissions (see Section 1.3) associated with the construction and demolition process itself, as well as the materials used in construction.

6.4.2 In order to minimise these emissions while simultaneously delivering the amount of new housing and other developments that are required within the Borough, the Council could also consider introducing a policy that addresses embodied carbon or circular economy principles, thus encouraging developers to (for instance):

- Carry out a comprehensive options assessment to consider whether it is necessary to build new, and how to maximise the use of existing buildings, materials, and infrastructure
- Use renewable energy on-site (i.e. avoid diesel generators)
- Routinely carry out embodied carbon lifecycle assessments of all proposals
- Maximise the end-of-life value of any buildings, materials and infrastructure that cannot be reused by assessing opportunities for reclamation, remanufacturing, recycling, etc.
- Design new buildings to facilitate maintenance (e.g. through use of robust materials) and future changes in use (e.g. generous floor to ceiling heights) so that, in the future, demolition and new construction can be avoided

[54] I. Alonso, K Weston, R. Gregg & M. Morecroft (2012) *Carbon storage by habitat - Review of the evidence of the impacts of management decisions and condition on carbon stores and sources.* Natural England Research Reports, Number NERR043. [online] Available at: http://publications.naturalengland.org.uk/publication/1412347

7. Conclusion

Overview

7.1.1 By declaring a Climate Emergency, HBC has acknowledged the impacts that human activities are having on the environment and the need for urgent action to avoid the worst implications of climate change. The Local Plan presents one of multiple opportunities for HBC to respond to this issue in a holistic manner.

7.1.2 This study provides a technical evidence base to support CO_2 emissions reduction measures in the Local Plan, including an area-wide LZC opportunity assessment, and high-level CO_2 projection modelling that can be used as a starting point to inform an evidence-based approach to reducing fuel consumption and CO_2 emissions.

7.1.3 Our analysis shows that CO_2 emissions in Hastings in 2017 were approximately 249.4 $ktCO_2$. The amount of planned new development in the area would increase this by around 4% by 2030 based on a 'Business as Usual' scenario. Although this proportion is small compared to the current total, any increase will make it harder to achieve net zero emissions.

7.1.4 In the coming decades, in line with the national CO_2 reduction targets and the UK Clean Growth Strategy, it will be necessary to transition away from the use of fossil fuels in heating and vehicles, towards the use of highly efficient electric heating systems and vehicles, powered by electricity from renewable sources. In order to facilitate this switch and reduce demands on grid infrastructure, it must be accompanied by large-scale uptake of energy demand reduction measures, including (but not limited to) behaviour changes and retrofitting the existing building stock.

7.1.5 Furthermore, it will be crucial to maximise local LZC energy generation to both support the decarbonisation and address the risks associated with security of supply and costs. Our analysis indicates that there is potential to achieve a significant increase in LZC energy generation compared with the current levels, primarily in the form of building-mounted / small scale PV installations.

7.1.6 Finally, our analysis shows that these measures are unlikely to be enough to fully achieve the net zero target and that the residual CO_2 emissions will need to be mitigated through offsetting (e.g. investing in CO_2 reduction projects elsewhere) or sequestration (e.g. woodland creation), within and outside of the Borough's geographic boundary.

Policy recommendations

7.1.7 Based on our analysis, we propose that the following should be considered for incorporation into the forthcoming Local Plan:

- Support demand reduction, energy efficiency, switching to efficient heat pump systems and uptake of LZC energy technologies through a revised Energy and Heat Hierarchy
- Encourage the development of heat networks where appropriate
- Increase support for LZC energy developments that meet criteria for acceptability, and seek to broaden those criteria
- Actively encourage energy efficiency retrofitting and/or use of LZC energy technologies in historic buildings and Conservation Areas where appropriate
- Support the provision of infrastructure for ULEVs (and continue to promote measures that reduce the need for private vehicles)
- Increase carbon sequestration through land use policies and/or requirements to include green infrastructure in new developments

Other opportunities to influence through planning policy

7.1.8 Separate to the specific policies outlined above, HBC could investigate adopting the following approach(es) to implementing policies and decisions:

- Affording more weight to the CO_2 reduction potential of proposals for extension, refurbishment, etc.
- Establishing a carbon offset scheme to enable developments that cannot meet the carbon reduction policy on-site to achieve compliance.
- Extending Permitted Development rights to encourage energy efficiency measures and LZC uptake in existing buildings, e.g. through issuing Local Development Orders and/or making more types of projects eligible to submit a self-certification form rather than a full planning application.
- Reviewing the mechanism for MEES enforcement to determine HBC's level of influence on energy efficiency in existing properties.
- Lobby the Government to promote stronger policies in this area, working with other organisations and Local Authorities where appropriate.

Taking the next step: A Climate Emergency Action Plan

7.1.9 HBC is in the process of developing a Climate Emergency Action Plan that will include additional commitments and identify specific opportunities for advancing the decarbonisation and sustainability agenda. The findings of this analysis should be aligned with the Climate Emergency Action Plan where relevant.

Appendix A – Previous energy studies

This section presents an overview of key documents that form the existing evidence base for renewable energy policies within Hastings.

Element Energy, 'Renewable and Low Carbon Energy Study' (2009)

This report presents an assessment of renewable and low carbon energy options appropriate for Hastings, with consideration given to the increase in energy consumption and CO_2 emissions that would result from new development through 2026. It also presents a comparative assessment of the CO_2 cost effectiveness of a range of different energy efficiency measures and LZC technologies.

The report indicates that energy efficiency measures, DHN/CHP systems and carbon offsetting (likely to comprise large-scale wind turbines) represent the most cost effective carbon reduction strategy for the Borough. It also notes, however, that opportunities for large-scale wind are subject to a range of environmental and regulatory constraints (notably AONB, SSSI and proximity to built-up areas).

These recommendations were intended to support local planning policy that would align with the government's plans to gradually increase the CSH targets for new domestic buildings, a policy that was withdrawn in 2015 (see Section 2.2).

Climate Integrated Solutions, 'Democratisation of Energy Supply in the Ore Valley' (2009)

This report presents an estimate of the baseline fuel consumption, along with a high-level assessment of different LZC technology options that could be implemented in the Ore Valley. It presents analysis and discussion of different options for democratisation of the energy supply, from the perspective of (a) highest democratisation and (b) highest generation of revenue for the Council. It indicates that ASHPs and GSHPs could meet the majority of heat demand. Consideration is given to utilising waste heat from the Crematorium but the contribution is expected to be very small in comparison to GSHP and ASHP options.

Chris Blandford Associates, 'Upper Wilting Farm Wind Turbine Feasibility Study' (2013) with addenda

This report presents a more detailed feasibility study of the sites identified around Upper Wilting Farm. The area is located to the west of Hastings; some of the specific locations that were considered lie within the boundary of HBC whereas others are within Rother Borough.

The report assessed five different options for wind energy development and made recommendations based on consideration of both technical and economic factors. It also outlined key issues that would need to be addressed during the planning process to ensure that the development is acceptable. The 5 options discussed in the report covered a range of different turbine heights, numbers and capacities.

CLS Energy Ltd., 'Energy Options Study' (2017)

The report primarily focuses on energy opportunities that would generate income and/or result in financial savings for HBC. It considers energy efficiency in buildings and transport, LZC technologies, and incentive schemes / income streams.

CLS Energy Ltd., 'Sustainable Housing in Inclusive Neighbourhoods / SHINE Final Report' (2017)

The SHINE project is a residential energy efficiency initiative supported by funding by the SU Interreg 2 Seas Programme. This report focused on four Conservation Areas in St Leonards-on-Sea.

Regen, 'Sustainable Energy Options Study' (2017)

The main purposes of the Sustainable Energy Options Study were: to undertake an assessment of the sustainable energy investment opportunities available to HBC; evaluate energy generation options that could help lower energy bills; and identify any key sustainable energy opportunities.

The report broadly follows the national resource assessment methodology for renewable and low-carbon capacity, published by the Department for Energy and Climate Change (DECC, now BEIS) in 2010.[55] The approach is also in line with the Element Energy study from 2009.

Given the level of detail provided in the report, and given that it was produced fairly recently, our assessment is that the key findings remain valid and relevant to the forthcoming Hastings Local Plan.

[55] https://www.gov.uk/government/news/decc-publishes-methodology-for-renewable-and-low-carbon-capacity-assessment

Appendix B – Methodology for assessing the potential additional LZC capacity of Hastings

Air and Ground Source Heat Pumps (ASHPs and GSHPs)

The DECC Methodology (2010) states:

> *'The regional assessment of the potential for heat pumps is […] based on the premise that most buildings (existing stock and new build) are suitable for the deployment of at least one of the heat pump options.' – Paragraph 3.25*

The DECC (2010) suggested parameters for estimating potential heat pump installations at regional scale are shown in below:

Table 3-9: Detailed assessment of opportunities and constraints for heat pumps

No	Parameter	Description	Assessment requirement	Where to source data from
Opportunity assessment - natural and technically accessible resource				
1	Existing building stock	Number of buildings suitable for heat pumps	Domestic - 100% of all of-grid properties; for the remaining stock - 75% of detached and semi-detached properties, 50% of terraced properties and 25% of flats Commercial -	CLG Statistics English Housing Survey (EHS) ONS data
2	New developments	Number of new buildings suitable for heat pumps	50% of all new build domestic properties	RSS new housing provisions
3	System capacity	Average generation capacity of an individual system kW	Domestic - 5kW Commercial - 100kW	no data required
Constraints assessment - physically accessible and practically viable resource				
	n/a		No significant specific parameters have been defined as most constraints have already been taken into account in the assumptions applied for the parameters above.	no data required

Source: SQW Energy and Land Use Consultants

The table below shows the estimated potential number and capacity of domestic heat pumps in Hastings, based on the DECC (2010) methodology.

Dwelling type	No. units	Percentage (%) of buildings suitable for heat pumps	Potential number of buildings suitable for heat pumps	Total potential capacity (kW)*
Detached house	7,002	75%	5,252	26,258
Semi-detached house	9,336	75%	7,002	35,010
Terraced house	10,270	50%	5,135	25,674

Flat, maisonette or apartment	18,672	25%	4,668	23,340
Other domestic	1,400	*Not in DECC methodology; excluded from analysis*	-	-
All domestic	46,680	-	22,056	110,282
All non-domestic	5,349	50%	2,675	267,450
TOTAL	**52,029**		**24,731**	**377,732**

**Note: Average domestic system capacity of 5kW and non-domestic system capacity of 100kW as per DECC (2010).*

It should be noted that this methodology focuses on developing a universal approach to ASHPs assessments at local authority level. This means that these assumptions are broad and do not take into consideration local constraints for heat pump deployment. For instance, for buildings located in Conservation Areas, there may be practical constraints on deployment if ASHPs would have an unacceptable visual impact.

GSHP constraints mapping

In order to determine whether it is possible to install a GSHP on a specific site, detailed analysis must be undertaken, which is beyond the scope of this report. Our assessment has therefore sought to map some of the major constraints on a Borough-wide basis, in order to provide a qualitative assessment of whether GSHPs could be a feasible solution on sites that are allocated for new development.

Different constraints apply depending on the specific technology in question, i.e. whether the GSHP is horizontal or vertical, open or closed loop). In all cases, however, the most important considerations relate to excavations, drilling and ground conditions rather than visual impact.

According to the Environment Agency's *'Environmental good practice guide for ground source heating and cooling'* (2011), in order to determine whether a proposed GSHP is in a 'sensitive location', an environmental impact assessment should assess whether the site is:

- Within a defined groundwater source protection zone 1
- Within 50m from a well, spring or borehole used for potable water supply
- On land affected by contamination e.g. historic landfill sites[56]
- Close to a designated wetland site
- Within 10m of a watercourse
- Close to other GSHP schemes[57]
- Adjacent to a septic tank or cesspit

Additional considerations include:

- Location of buried infrastructure e.g. gas pipelines, sewers, cables
- Other site designations e.g. Archaeological Notification areas, Regionally Important Geological Sites, Sites of Special Scientific Interest, etc.

According to DEFRA's online mapping resource,[58] there are no Zone 1 Source Protection Zones, Drinking Water Protected Areas or Drinking Water Safeguard Zones[59] within Hastings. The

[56] Maps available at https://data.gov.uk/dataset/contaminated-land
[57] Close proximity to open-loop GSHPs could result in thermal interference.
[58] https://data.gov.uk/dataset/3d136e9a-78cf-4452-824d-39d715ba5b69/drinking-water-protected-areas-surface-water
[59] Drinking Water Safeguard Zones (Surface Water) are catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water), which are at risk of failing the drinking water protection objectives.

Groundwater Vulnerability Map shows that there is a secondary aquifer beneath much of Hastings which is designated as 'intermediate' to 'high' vulnerability.[60] No data on wells, springs, boreholes, septic tanks, cesspits and existing GSHP schemes was available at the time of writing.

Solar PV and hot water systems

The DECC (2010) methodology states:

> *Solar water heating (SWH) depends on three site-specific factors: (1) available roof space (to install the system), (2) orientation and exposure of the roof (to be able to capture enough solar radiation), and (3) hot water demand on-site (SWH is typically sized to supply 50% of the hot water demand11, although some systems offers space heating service as well). SWH systems are suitable for most domestic buildings, where the biggest potential is, and for some energy intensive non-domestic buildings.*
>
> *Solar PV depends only on two of the above site-specific factors: (1) available roof space (to install the system) and (2) orientation and exposure of the roof (to be able to capture enough solar radiation). Solar PV systems are equally suitable for domestic and non-domestic buildings although the actual update is currently and potentially in the future mainly across the housing stock. Domestic buildings tend to have pitched roofs and therefore orientation is a strong factor, unlike commercial and industrial buildings, which often have flat roofs. The capacity assessment explores the entire regional building stock.*

Table 3-8: Detailed assessment of opportunities and constraints for solar energy

No	Parameter	Description	Assessment requirement	Where to source data from
Opportunity assessment - natural and technically accessible resource				
1	Existing roof space	Number of roofs suitable for solar systems	Apply the following assumptions for number of suitable roofs: • Domestic properties - 25% of all properties (including flats) • Commercial properties - 40% of all hereditaments • Industrial buildings - 80% of the stock	CLG Statistics English Housing Survey (EHS) ONS data
2	New developme nts	Number of new roofs suitable for solar systems	Assume that 50% of all new domestic roofs will be suitable for solar systems	RSS new housing provisions
3	System capacity	Average generation capacity of an individual system kW	Apply the following assumptions for average system capacity: • Domestic - 2kW (thermal or electric) • Commercial - 5kW (electric only) • Industrial - each region use their own assumption	no data required
Constraints assessment - physically accessible and practically viable resource				
	n/a		No specific parameters have been defined as most constraints have already been taken into account in the assumptions applied for the parameters above.	no data required

Source: SQW Energy and Land Use Consultants

[60] Not reproduced in this report due to licensing constraints but available at http://apps.environment-agency.gov.uk/wiyby/117020.aspx

Solar energy generation can typically be delivered anywhere there is a suitable surface with adequate solar access (i.e. minimal overshading). From a planning perspective, as for ASHPs, the main constraint may be associated with concerns related to visual impacts – particularly in, on or around Conservation Areas, Listed Buildings and other heritage assets.

The table below shows the estimated potential number and capacity of domestic solar systems in Hastings, based on the DECC (2010) methodology, tailored to reflect local conditions following discussions with HBC. This is based on the number of roofs suitable for solar systems which is also reported in the table below.

Dwelling type	No. units	Percentage (%) of roofs suitable for solar systems	Number of suitable roofs	Total potential capacity (kW)*
Detached house	7,002	25%	1,751	3,501
Semi-detached house	9,336	25%	2,334	4,668
Terraced house	10,270	25%	2,567	5,135
Flat, maisonette or apartment	18,672	20%	3,734	9,336
Other domestic	1,400	*Not in DECC methodology; assume 25% which is in line with other estimates for domestic properties*	350	700
All domestic	46,680	-	10,736	21,473
All non-domestic	5,349	25%	1,337	6,686
TOTAL	**52,029**		**12,073**	**28,159**

**Average domestic system capacity of 2kW and average non-domestic system capacity of 5kW as per DECC (2010). This does not account for industrial sites that could accommodate larger arrays.*

In general, greenfield and large new development sites may offer greater potential for solar energy generation; the relative lack of built environment constraints means that there are more opportunities to maximise sustainable design measures from the outset. Similarly, industrial sites may be more suited to solar technologies as they tend to have large roof areas.

Wind energy opportunities

Notwithstanding the need to carry out a feasibility assessment for any specific site, from a strategic perspective, the entire Borough is potentially suitable for large-scale wind turbines on the basis of wind speed. The DECC (2010) methodology states (Table 3-1) that wind speeds should be a minimum of 5 m/s at 45 feet above ground level to support large turbines. As shown in the map below (extracted from the NOABL database), and as confirmed by the 2009 Element Energy report (Section 7.1), this threshold is met across the entire Borough.

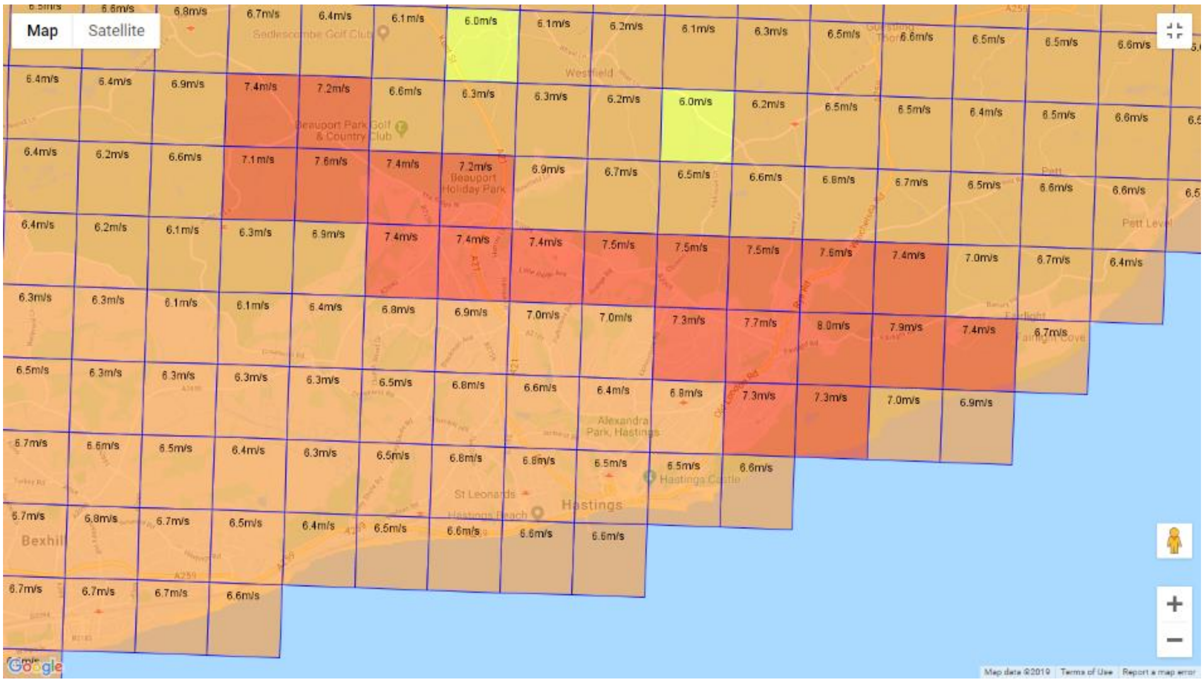

Figure 14. Extract from the NOABL wind speed database

The 2017 Regen study followed the DECC (2010) methodology and found, through a process of elimination, that the number of sites suitable for large-scale wind were severely restricted.

For small-scale turbines, it is difficult to assess wind resource on an area-wide basis; identifying specific opportunities requires a site-specific feasibility study. The DECC (2010) methodology suggests assessing wind resource using the NOABL database at 10m above ground level and applying a scaling factor depending on whether the area is rural or urban.[61] This would indicate that no sites in Hastings can accommodate small scale wind turbines. However, the NOABL map relies on an air flow model that does not allow for thermally driven winds such as sea breezes or mountain / valley breezes, so this approach does not reflect the unique position of Hastings.

For this reason, and recognising the national policy context which limits opportunities for wind energy development, our *quantitative* assessment of total area-wide capacity has only included specific sites that have been previously identified as offering small scale wind potential, i.e. the seafront and the Crematorium. It is possible that, in future, factors such as technological developments, new incentive schemes for renewable electricity generation, increased financial penalties for emitting carbon and / or greater acceptance of the visual impacts of wind turbines would make it easier to deliver small-scale wind turbines on these or other sites, so this does not represent the maximum theoretical potential for small-scale wind energy.

Other technologies excluded from this analysis

Water resources: Heat pumps, tidal and hydroelectric power

This report does not include a quantitative assessment of the potential for surface water source heat pumps (WSHPs), tidal or hydroelectric power. A detailed feasibility study would be necessary in order to determine specific suitable locations for any of these technologies, which would also require consultation with, and approval from, the Environment Agency (EA). However, this section provides a brief overview of some of the key considerations and constraints.

Figure 15 below shows that the Hastings coastline is a designated Special Protection Area (SPA), and the western portion is a Marine Conservation Zone. The eastern coastline is designated as both a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). This would need to be

[61] For more information, see https://www.rensmart.com/Information/NOABLModel

considered as part of any application to install LZC technologies even if there are no other technical barriers.[62]

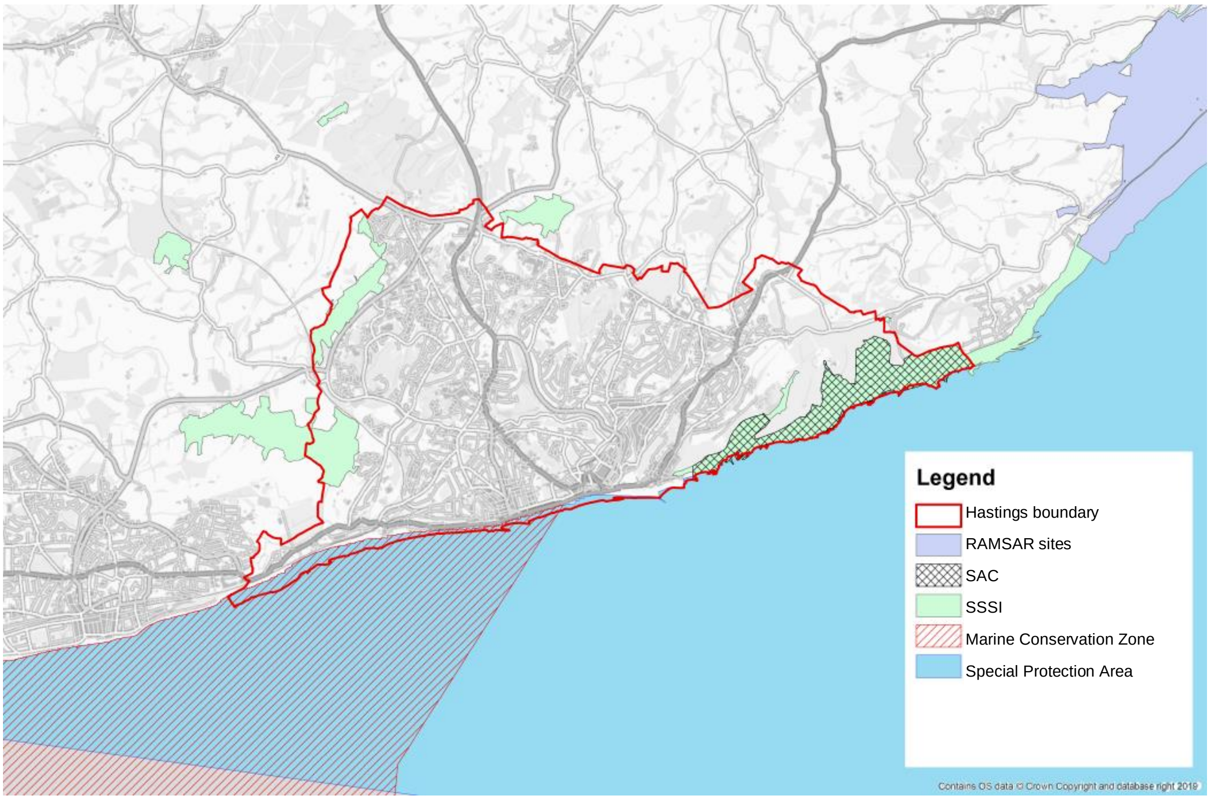

Figure 15. Environmental designations relevant to WSHPs, tidal or hydroelectric technologies

According to the British Hydrological Association, as of 2014 there were no hydropower installations in East Sussex[63] and our review of LZC databases (see Appendix C) indicates that none have been installed since then. Similarly, our review has not shown that there are any tidal power generating technologies in the area. These have not been considered further.

WSHPs are more suitable in areas with a heat demand that exceeds 5-10 kWh/m^2 according to guidance published by DECC in 2015.[64] A high-level map of heat demand (extract below) indicates that Hastings would meet this threshold,[65] but it should be noted that the map was produced in 2014 and has since been decommissioned.

[62] Department of Energy and Climate Change, *'National Heat Map: Water Source Heat Layer'* (March 2015). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416660/water_source_heat_map.PDF
[63] *http://british-hydro.org/wp-content/uploads/2018/03/BHA14_LR.pdf*
[64] For more information, see DECC, *'National Heat Map: Water Source Heat Layer'* (2015). Available at: *https://www.gov.uk/government/publications/water-source-heat-map-layer*
[65] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/342353/High_Level_Water_Source_Heat_Map-Context_8Aug__3_.pdf

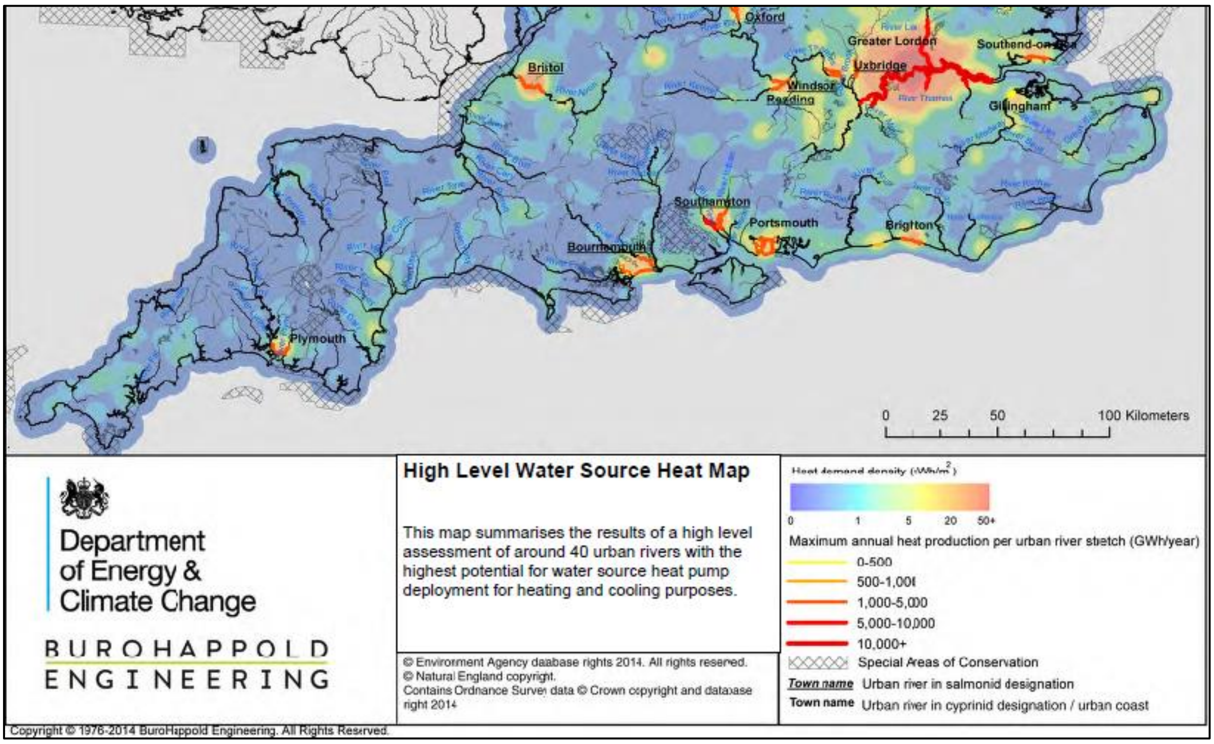

Figure 16. Extract from the DECC High Level Water Source Heat Map (2014)

There are relatively few examples of surface water source heat pumps (WSHPs) in the UK. The first marine source heat pump in the UK was installed in Anglesey, Wales, in 2014.[66] A larger scale (2.3 MW) river source heat pump is in operation at Kingston-Upon-Thames[67] and there are plans to install one as part of the Brighton Marina development. Therefore, this technology could potentially be suitable for developments in Hastings that are located near the seafront and are expected to have high heat demands, subject to approval from the EA and other relevant authorities.

Offshore wind

Offshore wind falls outside of the remit of HBC. There is currently a large-scale wind farm (Rampion Wind Farm) off the coast of Brighton, with a capacity of 400MW.

Energy from waste (EfW) and biogas

Waste covers local authority collected waste and commercial/industrial waste. Both can be used to derive power via combustion, pyrolysis, gasification or anaerobic digestion. Biogas covers both landfill gas and sewage gas.

The same air quality concerns surrounding biomass apply to any waste fuels that emit particulate matter. In addition, depending on the fuel source, there may be odour issues.

Sites that could theoretically provide potential opportunities for EfW include:

- Material recovery facilities
- Landfill sites
- Waste transfer stations
- Sewage systems

In practical terms, constraints on EfW technologies relate not only to the availability of fuel, but also require the alignment and interests of potential delivery partners. Based on discussions with HBC, it is considered unlikely that any of the historic landfill sites in the area have any realistic potential for deriving energy from waste / landfill gas.

[66] The 300 kW system provides heat to Plas Newydd House, an historic mansion operated by the National Trust. For details, see https://www.kimpton.co.uk/marine-source-heat-pump-plas-newydd/
[67] https://heating.mitsubishielectric.co.uk/KnowledgeBase/Public/kingston_case_study.pdf

Appendix C – Review of data sources containing information on LZC installations

A desk review has been carried out to investigate the number and the capacity of the existing LZC installations in Hastings, with consideration given to the following technologies:

- Building-mounted and large-scale photovoltaic (PV) panels
- Solar thermal / solar hot water (SHW)
- Large and small / urban scale wind
- Energy from waste (EfW)
- Biomass boilers and Combined Heat and Power (CHP) systems
- Heat networks
- Air and ground source heat pumps (ASHPs and GSHPs)
- Water resources (WSHPs, hydroelectric and tidal power generation)

In addition to the BEIS dataset, *'Renewable energy technologies by local authority'* (2018), this review examined the following sources of information:

OFGEM Feed in Tariff (FiT) data: The Feed-in Tariffs scheme was a government programme designed to promote the uptake of renewable and low carbon electricity generation technologies. The scheme was introduced in 2010 and is available for anyone who has installed, or is looking to install, one of the following technology types up to a capacity of 5MW, or 2kW for CHP:

- Solar photovoltaic (solar PV)
- Wind
- Micro combined heat and power (CHP)
- Hydro
- Anaerobic digestion (AD)

Ofgem publishes regularly UK Quarterly reports which gives a breakdown of accredited installations (anonymised) under the Feed-in Tariff scheme from 01 April 2010 and these available in regional format. Data was taken from *'Feed-in Tariff Installation Report 30 June 2019'* (accessed 27/08/19) and was processed down to Local Authority level for the purposes of this report. Note that the FiT has been closed to new applications since 1st April 2019 and therefore any technologies installed since then will not be included. [68]

Renewable Heat Incentive (RHI) data: The Renewable Heat Incentive scheme is a government environmental programme that provides financial incentives to increase the uptake of renewable heat. The scheme is available for domestic and non-domestic use and eligible installations receive quarterly payments over 20 years based on the amount of heat generated.

The Department for Business, Energy & Industrial Strategy (DBEIS) publishes monthly reports on RHI deployment data and these are available in regional format. Data was taken from 'RHI deployment data: July 2019'[69] (accessed 27/08/19) and was processed down to Local Authority level for the purposes of this report.

The use of the RHI datasets means that only registered or accredited schemes have been captured by this study. This incentive scheme is regarded as a key driver for micro generation installations due to the more favourable financial conditions it creates. However, for some technologies, in particular SHW, a number of installations may have been present before the introduction of the RHI or simply may not have been registered.

Ofgem Renewables and CHP Register: The Renewables and CHP Register (the Register) is a web-based system used to manage several schemes that Ofgem administers on behalf of government. These includes Renewables Obligation (RO), Renewable Energy Guarantees of Origin (REGO), Feed-in Tariffs (FIT) and Climate Change Levy (CCL) exemption for Renewables. The Register is used for administration purposes and provides live detailed data of the accredited stations under those schemes.

[68] https://www.ofgem.gov.uk/publications-and-updates/feed-tariff-installation-report-30-june-2019
[69] https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-july-2019

The Accredited Stations reports[70] (accessed 27/08/19) for all four schemes were reviewed for the purpose this study.

CHP Focus - BEIS installed CHP capacity: 'CHP Focus' maintains a public domain database of CHP schemes on behalf of the Department for Business Energy and Industrial Strategy. The 'BEIS CHP Focus' online database (accessed 28/08/19)[71] was reviewed for the purpose of this study and no CHP installations were identified in Hastings.

The Renewable Energy Planning Database ('REPD'): REPD is managed by Eunomia Research and Consulting Ltd ('Eunomia') on behalf of the Department of Business, Energy & Industrial Strategy ('BEIS'). The database tracks the progress of renewable electricity projects including those that could also be used for CHP. The REPD is updated on a monthly basis and provides detailed information on electricity storage projects and renewable energy projects that are 150KW and over. Data was taken from 'Renewable Energy Planning Database (REPD): June 2019'[72] (accessed 27/08/19) and was processed down to Local Authority level for the purposes of this report.

The British Hydropower Association's 'Map of Hydropower Installations' (2014): The British Hydropower Association publishes a map of large (10 MW and above) small (1 MW - 9.99 MW) and mini (0.1 MW - 0.99 MW) hydropower schemes across the UK. The most recent version of the map, dated 2014, does not show any hydropower schemes in Hastings or the surrounding area. It is possible that there are micro scale (<0.1 MW) installations not captured by this review. However, a report by BHA on behalf of DECC *'England and Wales Hydropower Resource Assessment'* (2010) found that there were no sites within East Sussex with potential hydropower resource capacity, and therefore this data gap is not expected to significantly impact the results.

Data validation and accuracy

Although care has been taken to ensure that the information presented in this report is complete and accurate, because databases were not compiled by AECOM, the company cannot take responsibility for the accuracy of the data they contain. Wherever possible, databases were cross-checked, and Google satellite images were used to confirm the locations of larger installations.

[70] https://www.renewablesandchp.ofgem.gov.uk/Public/ReportViewer.aspx?ReportPath=/Renewables/Accreditation/AccreditedStationsExternalPublic&ReportVisibility=1&ReportCategory=1
[71] https://chptools.decc.gov.uk/chp/public
[72] https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

Appendix D – Carbon projection modelling methodology

Scope of the analysis

For the purpose of greenhouse gas reporting, CO_2 emissions are divided into three categories:

- **Scope 1** – Direct emissions that arise from burning fuels in Hastings. This primarily includes fuel used in boilers to provide heating and hot water, fuel used in any vehicles while they are driving within Borough boundaries, and fuels (other than electricity) used for cooking.
- **Scope 2** – Indirect emissions associated with the use of electricity in Hastings.
- **Scope 3** – Indirect emissions that result from other activities outside the border of Hastings, but that take place as a result of the actions of people or organisations within Hastings, e.g. emissions from commuting, shipping, or aviation.

This report only quantifies Scope 1 and 2 emissions, based on publicly available datasets produced by the Department of Business, Energy and Industrial Strategy (BEIS). This covers a range of sectors and fuel types but does not cover *all* potential sources of greenhouse gas emissions within the Local Authority. At the time of writing it is understood that such information is not published by BEIS at a Local Authority level.

The table below shows the categories of emissions reported in the BEIS dataset. In this report, some of the categories representing a small proportion (<1%) of total emissions have been consolidated in order to align the emissions baseline with the fuel consumption figures as much as possible.

Category	Sub-categories as listed by BEIS	Sub-categories as listed in this report
Industrial & commercial (Note: This includes public sector and agricultural fuel consumption and is referred to as 'Non-domestic' in this report)	• Electricity • Gas • Large industrial installations • Other fuels • Agriculture (Note: Fuel not specified)	• Electricity • Gas • Other fuels • Agriculture (all fuels)
Domestic	• Gas • Electricity • Other fuels	• Gas • Electricity • Other fuels
Transport	• Road transport (A roads, motorways and minor roads) • Diesel railways • Other	• Transport (all fuels)

The methodology used by BEIS to estimate carbon emissions varies depending on the source of emissions under consideration. For example, for gas and electricity, a carbon emission factor is developed for each fuel and applied to the sub-national fuel consumption data to provide an estimate of the CO_2e emissions associated with the use of that fuel. In the case of transport, emissions are estimated based on the types of vehicles and vehicle movements that take place on each stretch of road within the UK, and these are allocated to a Local Authority dataset based on geographic boundaries. Total emissions may also include point-source estimates for certain consumers, and therefore it is not possible to directly align the fuel consumption data with the emissions data.

For further information, see the *'Technical Report: Local and Regional Carbon Dioxide Emissions Estimates for 2005-2017 for the UK'* (BEIS, 2019).

Summary of key inputs

The following assumptions have been applied to the projection modelling scenarios:

Topic	Model input	Data source
Demand Reduction		
Potential reduction in gas use in existing buildings over time to 2030	10%	NEED 2019 Report, *'Table 3: Typical savings following multiple energy efficiency measures'* suggests 12% reduction in heating is possible; 10% has been used as a conservative estimate.
Potential reduction in demand for heating in new buildings over time to 2030	75%	This reduction is in line with the levels indicated by the Future Homes Standard consultation.
Potential reduction in demand for electricity for appliances and lighting over time to 2030	5%	Assumes that appliance use will increase but a small reduction could be achieved through behaviour change. Research indicates up to 10% possible – low / conservative estimate used.
Fuel Switching		
Existing buildings switch to electric heating over time to 2030	90%	Assumes that, in the next 10 years, it will become a requirement to switch when otherwise replacing boilers. Based on a 15-year replacement cycle, this means that the majority of boilers would be replaced by 2050. 90% is used as a conservative estimate assuming that some heating systems cannot be replaced
New buildings that are built with electric heating	100%	Assumes all new builds will be required to use electric heating.
Proportion of existing building electric heating systems that are heat pumps	50%	Estimate. The remainder are assumed to be direct electric systems where it is not feasible to install heat pumps.
Proportion of new building electric heating systems that are heat pumps	90%	Estimate. The remainder are assumed to be direct electric systems where it is not feasible to install heat pumps.
System Efficiencies		
Typical gas boiler	80%	Low / conservative estimate
Heat pump	250%	Low / conservative estimate
Direct electric heating	100%	1:1 conversion is normal
Transport		
Reduction in mileage over time to 2030	10%	Estimate.
Vehicles that switch to zero emission over time to 2030	92%	Assumes that HGVs do not switch.

Key assumptions

Built environment

Existing buildings

The modelling assumes that existing buildings will continue to have the same gas and electricity consumption in a 'BAU' scenario. Reductions to fuel consumption are then applied to test the relative impact of different intervention measures (described below) as part of the carbon projection modelling.

New buildings

The amount of proposed new development (number of dwellings and m^2 of employment floorspace) is multiplied by benchmarks to provide an estimate of energy demand.

In order to estimate the impact of new construction / development within the Borough as a whole, benchmarks were used to estimate the fuel consumption of new buildings. For domestic buildings, benchmarks were derived from median consumption figures for Hastings as reported in NEED. For non-domestic buildings, CIBSE Guide F benchmarks were used to estimate gas and electricity demand. In both cases, the heat / gas demand figures were reduced by 75% to reflect higher fabric performance standards. The level of heating demand reduction was informed by the recently published consultation documents related to Parts L and F of the Building Regulations, and the introduction of a Future Homes Standard.

Grid decarbonisation pathway

Carbon emission factors (CEFs) for electricity were taken from HM Treasury/BEIS *'Green Book Supplementary Guidance: Toolkit for valuing changes in greenhouse gas emissions, Table 1'* (2019) which is intended for use by organisations reporting on their greenhouse gas emissions. Note that this trajectory reflects the level of decarbonisation that would be necessary for the UK to meet its current decarbonisation targets. It is not a projection of the likely emissions from grid electricity.

Electricity demand reduction

Evidence suggests that reductions of around 5% can be achieved through measures such as behavioural changes, smart metering, and zone lighting. Case studies suggest that greater reductions are possible for some organisations. However, in recognition of the fact that electricity use has increased in the past decade due to factors such as increasing use of electronic appliances, 5% has been used as a conservative estimate.

The model assumes that total electricity consumption will decrease linearly through to the year 2030, at which point this reduction will be achieved.

Heating demand reduction from energy efficiency measures

Evidence from NEED indicates that installing multiple energy saving measures (such as cavity wall or loft insulation) can reduce heating bills by around 5-12%. From a technical standpoint, higher savings (over 75% in some properties) could be achieved with more ambitious retrofitting strategies,[73] but 10% has been used as a conservative estimate.

This would not necessarily require all buildings to undergo a retrofit – it represents an average across the entire stock. In other words, some buildings could be retrofitted to a higher standard, while others (such as Listed buildings) receive no upgrades.

The model assumes that total gas consumption will decrease linearly through to the year 2030, at which point this reduction will be achieved.

Impact of fuel switching

This calculation assumes that the metered gas consumption is delivered by individual gas boilers (80% efficiency). The total metered gas consumption data is used to provide a rough estimate of the amount of electricity that would be required if this level of demand was instead met using direct electric heating (DEH) with 100% efficiency or heat pumps with COP of 2.5 (this is intended as a conservative estimate that reflects the performance of air source heat pumps (ASHPs) in situ).

The model assumes that 90% of existing buildings will switch to an electric heating system by 2050. This would require an ambitious programme of heating system replacement with significant cost implications. Therefore, the calculation also assumes that 50% of the new heating systems will be DEH and 50% will be ASHP as an illustrative scenario, in recognition of the fact that DEH may be cheaper and more practical to install. Additional carbon reductions could potentially be achieved if more systems were replaced with ASHPs.

The model assumes that gas heating systems will be replaced with electric heating systems at a consistent rate (i.e. linearly) to 2030.

[73] See https://passipedia.org/certification/enerphit

Vehicle mileage reduction

In the baseline scenario, it is assumed that demand for transport remains stable. This will likely tend to increase over time due to factors such as population growth. A stable trajectory would imply that measures are being implemented to mitigate this demand through encouraging other forms of travel such as walking, cycling or public transport.

According to the ‘Road to Zero’ report: *‘Evidence from 60,000 fleet drivers receiving training through the Energy Saving Trust (EST), a key partner supporting the efficient motoring agenda, gave an average 15% saving of fuel and CO_2 […] Organisations that have incorporated a wider package of behavioural and procedural measures in managing their fleets (see the case study below) have delivered typical emission savings of between 10-30%.’*

The model assumes that a 10% reduction in either journeys, vehicles, or miles travelled will result in a 10% reduction in CO_2e emissions from those vehicles. A travel strategy aimed at reducing emissions would likely seek to target certain types of trips, vehicles, or users, so this approach should be understood as an estimate. However, for the purpose of this analysis, it is considered enough to show a simple proportional reduction to highlight the relative scale of impact such a measure could have, relative to other interventions.

The model assumes that total mileage will decrease linearly through to the year 2030, at which point this reduction will be achieved.

Impact of switching to Ultra Low Emission Vehicles (ULEVs)

Based on the estimated mileage for each vehicle type, we have re-calculated CO_2e emissions using BEIS Green Guide figures for electric vehicles.

Carbon savings from Low or Zero Carbon (LZC) technology energy generation

Carbon savings from Low or Zero Carbon (LZC) energy generation are based on the amount of National Grid electricity that would be offset by renewable electricity. A total figure for the amount of LZC capacity that will be installed by 2030 is inputted into the model, and the model assumes that the total savings will increase linearly up to that point.

An estimate is then made of the potential amount of renewable electricity that could be generated by those technologies (large-scale PV or wind). The electricity generation figure is multiplied by the CEF for a given year to provide an estimate of the total CO_2e savings in a given year.

- *Large-scale PV:* Assumed output of 827 kWh/kWp based on typical performance in the UK
- *Large-scale onshore wind:* Capacity factor of 2,081kWh/kWp

Note that, as the electricity grid decarbonises, more LZC energy generation is required to offset any residual emissions. Therefore, although the amount of LZC capacity is assumed to increase linearly, the savings per MW decrease as the grid decarbonises over time.

Carbon reductions from woodland creation and tree planting

Based on nation-wide statistics from the Woodland Carbon Code, new woodlands created from low-grade agricultural land have the potential to sequester around 356 tCO_2e per hectare over 100 years, or 3.56 tCO_2e per hectare per year on average. In practice, this depends heavily on the type of woodland and its maturity level.

The scale of offsetting has been input in order to target net zero carbon by 2030 assuming all previous measures and changes in market come to pass. This allows HBC to understand the approximate scale of investment in offsetting required to overcome the likely gap shown by our projection modelling. Proposals would need to be backed up with detailed modelling / evidence and supported by a long-term management plan. Therefore, these figures are intended only to provide a rough sense of scale.

Limitations

As stated previously, this study has only considered sources of CO_2e emissions that are listed for Hastings Borough within the published BEIS dataset. Due to lack of information about other GHG emissions at a Local Authority level, therefore, the baseline presented in this report is likely to be an underestimate of the total.

A key overarching limitation of this approach is that any changes modelled would need to be backed up by policies, funding, changes in technology, and user / consumer behaviour which are uncertain.

The analysis does not account for other changes e.g. population growth, energy prices, weather, economic growth, and the many other trends that would impact energy demand – it is primarily focused on built environment measures with consideration given to changes in transportation technology.

Note: Comparison with the SCATTER Tool

Concurrent with this study carried out by AECOM, HBC has been investigating different CO_2 trajectories using the SCATTER tool. The SCATTER tool methodology was developed by BEIS in order to help Local Authorities build a comprehensive inventory of their Scope 1, 2 and 3 emissions, and align trajectories with international CO_2 reduction targets.

The AECOM model, by contrast, focuses on Scope 1 and 2 emissions within the geographic boundary of Hastings. It is primarily focused on illustrating the *scale* and *direction* of key trends and interventions in the built environment sector, particularly those that might be affected by changes in building regulations and planning policy.

Although not directly comparable, we believe that the key findings from these models are broadly aligned in that they both emphasize the need for rapid, deep decarbonisation across all sectors.

Appendix E – Looking forward to 2050

The figures below show the same CO_2 scenarios as presented in Section 5, based on a timescale that is extended to the year 2050, i.e. aligning with the UK's nationwide net zero target.

The modelling methodology is largely the same as for the 2030 projections – aside from the grid decarbonisation trajectory, the scale of each intervention by the end point is the same, but it takes place over a longer period of time. The exception is for the grid emissions which continue to decrease from

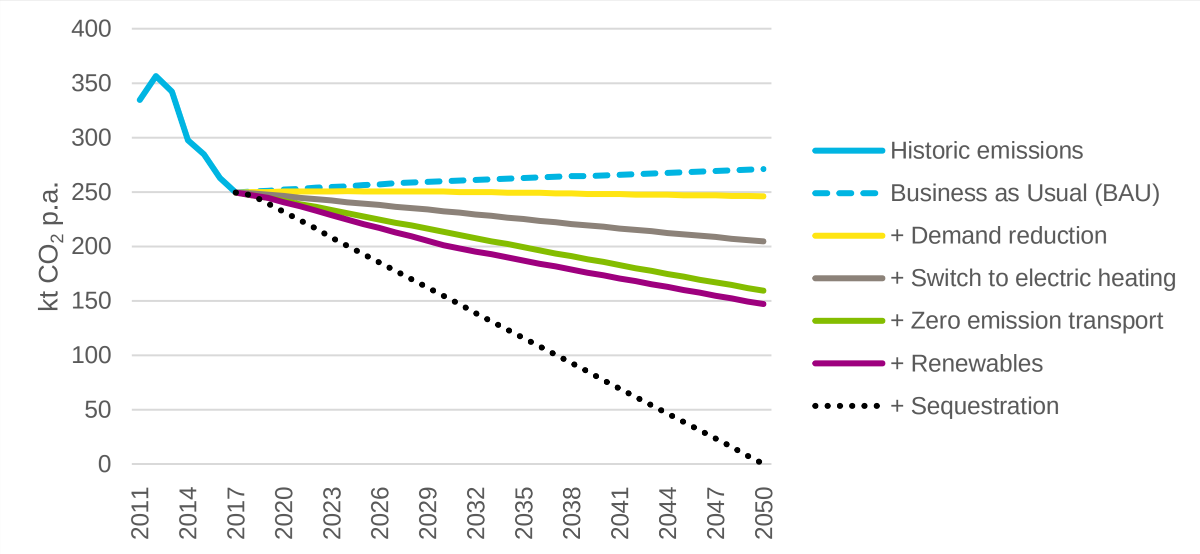

Figure 17. CO_2 emissions in Hastings – No change to electricity grid emissions (2050)

In the scenario shown above, the scale of change from each intervention measure is the same, and the annual CO_2 emissions in 2050 are nearly identical to those in 2030 in the previous version of the model (although they are slightly higher because the model assumes that new development continues over that timescale). However, the *cumulative* emissions could be lowered by over 60% if the changes can be achieved by 2030 instead of 2050 (2,567 $ktCO_2$ compared with 6,681 $ktCO_2$). This difference is highly significant when considering the Hastings carbon budget (see Section 2.1).

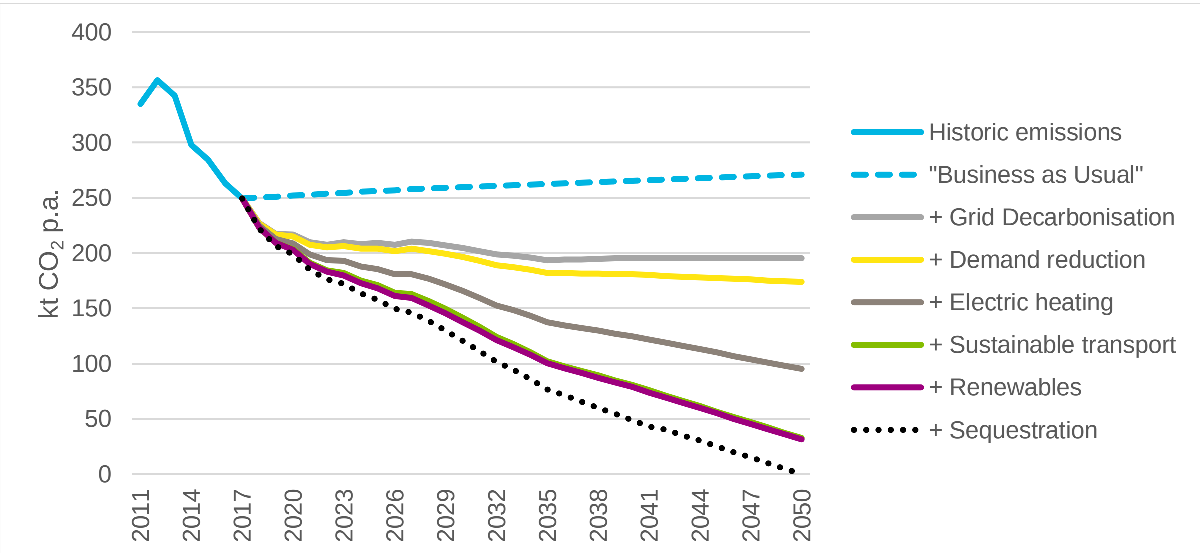

Figure 18. CO_2 emissions in Hastings –Accounting for grid decarbonisation (2050)

Considering the grid decarbonisation scenario some of the important take-home messages are:

- By 2050, annual emissions in the grid decarbonisation scenario (after accounting for LZCs) are 31 $ktCO_2$ p.a., representing an 87% reduction from 2017 levels, compared with 57 $ktCO_2$ p.a. (a 77%) in the 2030 model. As stated above, due to the methodology used, this is solely attributed to the change in electricity fuel factors. Higher reductions would be achieved if there is faster and deeper national grid decarbonisation.

- Compared with 2050, setting a 2030 deadline increases the apparent CO_2 savings from LZCs and lower savings from switching to electrically driven heating systems and ULEVs, for the reasons outlined in Section 5.1. In other words, the relative benefit from different intervention measures will appear to change over time. However, they depend on each other for success: In order to reap the benefits of switching to heat pumps, emissions from electricity must decrease, and this requires mass deployment of LZCs compared with current levels.
- Because the residual emissions are lower in the 2050 scenario (after accounting for renewables), the amount of offsetting / sequestration required would be lower. Offsetting 62 $ktCO_2$ p.a. would require around 40,000 acres of **mature** woodland in the 2030 scenario, but in the 2050 scenario the emissions would be only 31 $ktCO_2$, requiring 21,500 acres. Although this difference is significant, it is clearly not practical to implement woodland creation projects on this scale, which is why demand reduction and local LZCs are so important.

Appendix F – Stakeholder Engagement Workshop

A stakeholder engagement workshop was held on 29th September 2020. This Appendix briefly summarises the aims of the workshop, the topics discussed, the key points raised along with a list of the attendees.

Aim of the workshop

The aim of the workshop was to share the results of this study and solicit views on the policies being proposed and the actions that both the Council and the wider community can take to address the climate emergency.

Format and structure

The workshop was held via Microsoft Teams. It began with a presentation from AECOM which summarised the project and described its key recommendations. Then, participants were invited to share their views on the following topics in a semi-structured discussion:

1. Opportunities for decarbonising new and existing buildings
2. Opportunities for new low carbon energy and transport infrastructure
3. Projects the Council is planning
4. Other opportunities to do more (note that this discussion was consolidated with #3)

Main topics of discussion and feedback

1. Opportunities for decarbonising new and existing buildings

- In terms of retrofitting measures, there was some interest in promoting 'no regrets' interventions (i.e. those that are proven to be cost-effective and offer reliable energy and CO2 savings in all decarbonisation pathways, such as loft insulation, replacing single glazing, water efficient sanitaryware and low energy light fittings) and providing more advice on best practice in this regard.
- Participants recognised the challenge of retrofitting historic buildings and those in Conservation Areas. The predominant view of those who spoke tended to be in favour of allowing more sustainability interventions in those areas. In less sensitive locations, industrial areas for example, one participant suggested that the use of LDOs could be potentially beneficial in speeding up the planning process.
- Fuel poverty was clearly a topic of concern, with participants keen that the response to the climate emergency would take this into account.
- Several participants raised the issue of priority misalignment between tenants and landlords. The topic of MEES enforcement was raised, suggesting that some participants were not aware of how this was being carried out. HBC explained their approach to MEES enforcement and how this was being expanded.
- There was also some concern that developers would be resistant to the idea of switching away from gas boilers. One participant suggested that it might be easier to promote uptake of heat pumps in the commercial sector since those buildings would be more likely to have mechanical ventilation systems for heating and / or cooling, so it would be a smaller 'leap' to low carbon heat pumps.
- With heat pumps, several participants noted the potential risk of noise issues and visual impact. This would need to be addressed through careful design and commissioning.

2. Opportunities for new low carbon energy infrastructure

- Community energy groups were discussed as a potential avenue for increasing uptake of LZC technologies. A key benefit of this approach, participants noted, was the opportunity to deliver benefits to local individuals and organisations.

- On the topic of wind energy, one participant mentioned the opportunity to put turbines along the seafront, but this idea was not discussed in detail.
- On the topic of large-scale solar PV, HBC explained that Natural England had raised concerns about a proposal, so they were exploring other options (e.g. land management regimes that could improve biodiversity and carbon sequestration).
- There was a clear desire among some participants that the future Local Plan would help to promote more LZC technologies and for the Council to take a leadership role. (HBC noted that they had already installed PV and other energy saving technologies on their own buildings.)
- Participants indicated that, at present, there is insufficient infrastructure for EVs and pedal bikes. The issue of storage space for bicycles was raised by more than one participant.
- Participants were generally supportive of measures to improve sustainable transport and cycling infrastructure, but noted that this would require changes in road layout, provision of appropriate cycle / pedestrian routes, adequate cycle storage, changing facilities, and so on.
- Regarding transport, there was concern about how to increase use of public transport in the longer term in light of Coronavirus restrictions and guidance.

3. Projects the Council is planning and 4. Other opportunities to do more

- HBC provided an overview of ongoing projects and activities following the Climate Emergency Declaration. This includes producing a Climate Change Strategy based around six priority themes, and undertaking an assessment of the Council's carbon emissions to understand how they can decarbonise their own operations / assets.
- HBC received positive feedback on the climate change related resources provided on the Council's website.
- Participants were interested in activities that would raise awareness and provide advice both to householders and businesses.

Key take-home points

Participants seemed to be generally supportive of the aims of the study and raised a variety of points regarding local issues and opportunities.

For new and existing buildings, there was clearly an ambition to achieve higher environmental standards, but it was acknowledged that this area would be challenging both in terms of retrofitting and new development. Other key concerns were fuel poverty and how to balance heritage / conservation considerations.

There was support for the idea of increasing LZC uptake, particularly via community energy groups. Participants suggested making it easier to deliver PV and heat pumps on existing buildings, potentially through use of a Local Development Order(s).

The issue of sustainable transport was particularly important and there was a clear desire for measures that could promote modal shift and reduce vehicle movements (including both private vehicles and HGVs/LGVs).

Participants clearly saw the Council as an organisation with an important leadership role, with opportunities to promote climate change response measures via the Council's own corporate strategy, Local Plan, awareness raising, and other forms of collaboration and engagement.

List of attendees

- Hastings Borough Council officers
- AECOM staff
- Hastings Borough Council Cllrs
- Optivo staff
- National Residential Landlords Association
- East Sussex County Council officers
- Sea Change Sussex
- New River Retail
- Rother District Council officers
- Park Lane Homes
- Hastings Voluntary Action
- Citizens Advice Bureau 1066
- Unveiled
- Retrofit Works