Barnsley Town Centre Urban Design and Sustainability

Zero Carbon Strategy for Barnsley Town Centre

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1 Executive Summary

This report establishes a Baseline for buildings related green house gas emissions for Barnsley Town Centre and a high-level programme comprising interlinked elements required to reduce emissions over each of the 5-year periods to 2045.

The study is partly complete, with spatial options for the town centre being proposed for consultation. Further analysis of the implications of spatial changes will be carried out once preferred options are identified.

2 Introduction

Barnsley Metropolitan Borough Council (BMBC) aims to progress on creating a vibrant Town Centre that meets the needs of their inhabitants, improving health & wellbeing and meeting the sustainability agenda by becoming carbon neutral in its operations by 2040.

2.1 Scope

This report is a subset of the works undertaken by URBED to complete the Barnsley Town Centre Urban Design and Sustainability Study.

The scope of this report is:

- For the Town Centre area defined by the local plan.[1]
- To quantify the carbon emissions from the buildings within the town centre based on the best data available down to building by building energy assessment where available.
- To provide strategies to reduce the emissions from buildings to help achieve zero carbon by 2040.
- To describe how those emissions reduction measures could be achieved.

The analysis in this report covers the Town Centre (TC) and only considers the Scope 1 (direct) and Scope 2 (indirect) emissions associated with operation of buildings, so relates to the energy delivered at the meter for gas and electricity.

A definition of Scopes [2] of emissions: **Scope** 1 covers direct emissions from owned or controlled sources. **Scope 2** covers indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the reporting entity. **Scope 3** includes all other indirect emissions that occur in an entities value chain.

This analysis does not include any corrections for increases in the number of residents, properties, buildings/floor space.

It does not cover the carbon dioxide equivalent of other gas emissions from processes or operations such as methane production or refrigerant leaks.

This report also does not consider emissions from transport or waste.

2.2 Methodology

The study behind this report consists of three consecutive parts as shown by Diagram 1.

Part 1 provides a definition of Zero Carbon and relates this to the existing BMBC targets to align proposed strategies and timeframes. We establish a Carbon Emissions baseline for 2018 using EPC data and other sources. This supersedes the earlier baseline based on Office for National Statistics (ONS) data[3] and BEIS statistics[4] for electricity and gas consumption presented in the Medium and Lower Super Output Areas (MSOA, LSOA) data, since that could not be related to specific buildings within the town centre.

In Part 2, a series of different building typologies are defined, and more specific CO_2 emissions are associated with these typologies. Strategies to achieve Zero Carbon are presented and tested for each type to demonstrate possible solutions.

In Part 3, using the preferred strategies, the final recommendations are presented giving a timeline for the implementation to achieve zero carbon for the Town Centre by 2040.

2.3 Baseline

In recent UK studies several different models and methodologies have been applied to calculate baselines of carbon emissions and develop carbon savings pathways. These studies include Greater Manchester, Sheffield, Bristol, and Brighton, among others.

Greater Manchester and Sheffield studies have conducted their research by applying the SCATTER TOOL method in collaboration with Tyndall Centre for Climate Research. The tool recommends an overall Carbon budget and defines pathway projections with annual mitigation rates to reduce carbon emissions year by year.

Other sample reports, such as the ones developed for Bristol City Council and Brighton & Hove, have applied other quantification method's by using Department for Business, Energy & Industrial Strategy (BEIS) and ONS national data sets on energy and carbon emissions statistics for local authority administrative areas. This

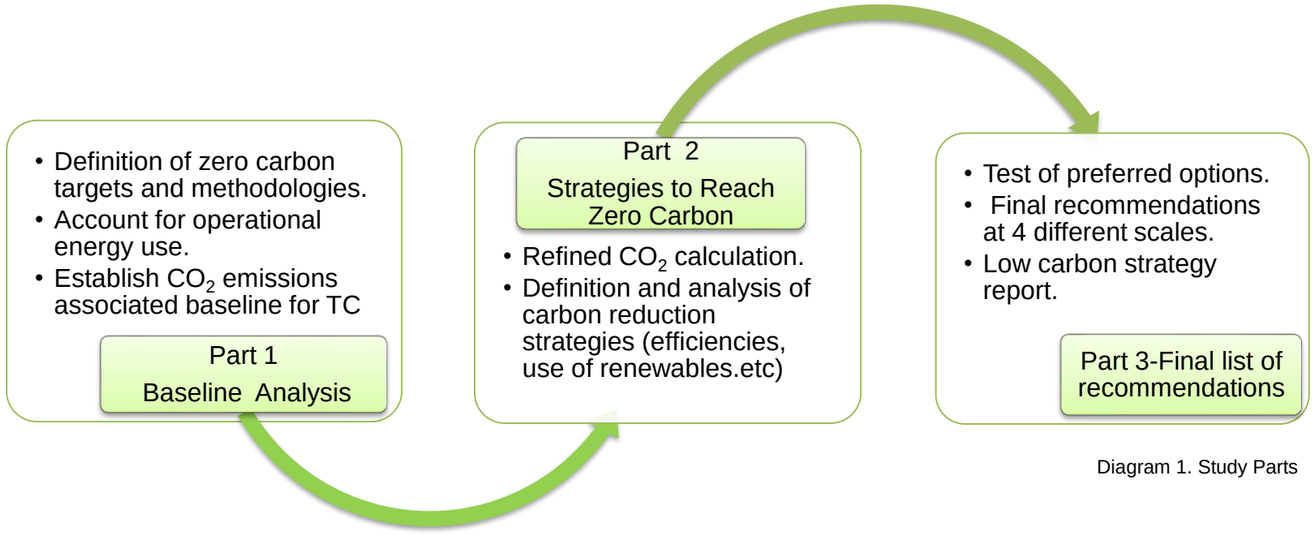

Diagram 1. Study Parts

[1] Barnsley Local Plan. Policies Map; January 2019. P.5
[2] Green House Protocol (GHG); Scopes and definitions, P.11
[3] Office of National Statistics (ONS), April 2018
[4] BEIS energy consumption statistics; Lower and Middle super output areas statistics (www.gov.uk)

allows to establish a numerical baseline for building sectors and sub-sectors. This more granular data enables more informed measures for carbon savings to be formulated.

The revised baseline for 2018 within this report is calculated based upon publicly available EPC data for domestic and non-domestic buildings, augmented with data from BMBC's own buildings (2019 operations) and data derived from business tax data and energy benchmarks. The previous BEIS data approach was found not to allow individual buildings to be considered.

To calculate the associated carbon emissions, BEIS carbon reporting conversion factors for the corresponding type of fuels have been applied.

2.4 Barnsley Town Centre Overview

Today the Town Centre (TC) covers 74.6 hectares [5], which represents just below 1% of the Borough's total area[6]. The BMBC area has an overall population of 245,199 inhabitants, where the town centre serves over 70,000 people[7] as a mixed-use destination of retail, civic and cultural services within its boundaries.

2.5 Boundary Limits

The Town Centre is characterized by a distinct hierarchy of streets and primary routes which are open to traffic and offer access to the different areas and key sites, as seen in Diagram 2.[8]

The main gateways, which limit the TC boundaries, are A628/Shambles Street and Townend roundabout at the western site, Barnsley main Interchange/ Elson's street at the East site, Huddersfield road /A635 which limits the northern part of the centre and connects with Church Lane gateway and A628/Alhambra Roundabout to the south. Secondary routes offer pedestrian access to the core retail, shopping areas and public spaces such as Cheapside and Market street.

Diagram 2 *Main primary and secondary routes. Regeneration study, 2016.*

2.6 Neighbourhood Scale

According to the local plan[9], nine major areas are identified, as seen in Diagram 3.

The northern part of the Town Centre - the courthouse campus – contains a large proportion of the educational and office buildings, with the Digital Media Centre, Barnsley College, and the University Campus Barnsley, combined with car parks and open areas. The eastern side of the TC contains - The Lanes - and -The Markets – areas, where several buildings owned by the council are concentrated, mixed with small and big retail spaces and public leisure buildings. Transport Facilities - Barnsley Interchange and big retail outlets and complexes defines the main uses around Eastern Gateway boundaries. Looking to the west side of the centre - Westgate/ Market Hill- conservation buildings prior to 1919 can be found together with gardens and green public spaces.

Residential and domestic housing is located within 3 specific locations; The Southern Fringe area at the east side of the TC boundary limits, The Yards towards the southern TC limits, and along the Old Mill Lane street towards the northern limits.

These areas are mixed with big retail around generally segregated by the TC primary road gateways A635, A628 and A61.

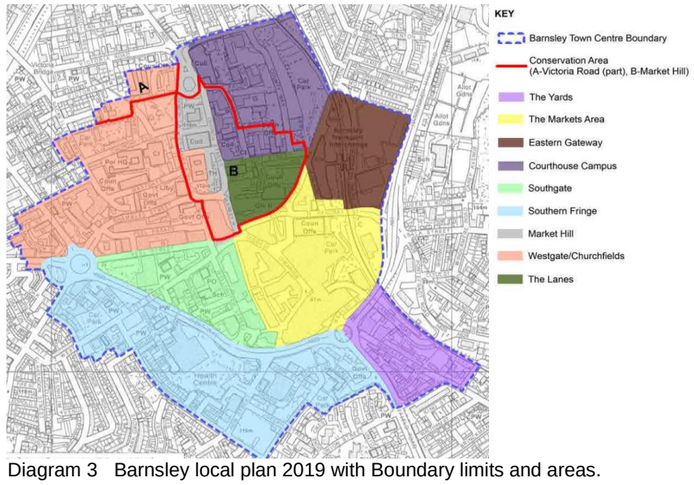

Diagram 3 Barnsley local plan 2019 with Boundary limits and areas.

2.7 Domestic sector

Within the Borough there are 110,590 households[10] and 25,000 new homes are planned to be built by 2033 [11]. Council's Housing accounts for 18,500 of the properties[12], with an averaged Energy Performance Certificate (EPC) rating C - which is equivalent to 51-75 kWh/m2 per year.

From the private sector, it is estimated that 22.500 household (28% of the total) are built pre-1919, which were constructed with solid walls or cavity walls with a lack of insulation.

The averaged SAP rating[13] for private homes in Barnsley is 57, corresponding to a yearly energy use of 101-135 kWh/m^2. 31% of private homes scored 35 points (171-200 kWh/m^2 per yr.) and therefore have much greater risk of being in fuel poverty.

2.8 Non-Domestic Sector

Within the TC, the main building sub-sectors consist of retail (small shops and big commercial), the refurbished market spaces, public buildings, and educational institutions.

Council's properties [14] include several non-domestic buildings. These are public institutions and facilities with primary schools, development centres, the Town Hall, and the New Library. The civic and leisure centres play a major role on energy use, with big spaces such as the Barnsley Markets, the Cooper Gallery and the Metrodome.

In BMBC non-domestic buildings reached a total energy consumption [15] of 1,671 GWh. The energy performance varies hugely according to year of construction, volume, systems characteristics, and its specific tenure.

[5] URBED QGis Maps. Local Plan- Town Centre Boundary
[6] Office of National Statistics (ONS). Sourced from 2011 Census key statistics
[7] Barnsley Town Centre prospectus and feasibility study, P.6
[8] Barnsley Town Centre Regeneration Plan; Arup, 2016. P.15.
[9] Barnsley Local Plan. Policies Map; January 2019. P.5.
[10] Office of National Statistics (ONS), April 2018.
[11] Housing strategy 2014-2033. P.11
[12] Barnsley Energy Strategy 2015-2025; Total number of household's properties P.28
[13] LSM, Research Centre; Barnsley Metropolitan Borough Council Green Deal Pioneer Places. P.11
[14] Council local energy data sets, March 2020
[15] BEIS energy consumption statistics. Sub-national gas consumption statistics 2005-2018

3 Targets and Policies

3.1.1 International and UK national targets

In November 2008, with the 'Climate Change Act' [16](CCA), the UK government set the target to reduce their greenhouse gas emissions by at least 80% of 1990 levels by 2050.

In December 2015, the UK government were signatories to the Paris Agreement to limit the increase in global average temperature to well below 2 °C above pre-industrial levels; and to pursue efforts to limit the increase to 1.5 °C, to substantially reduce the risks and impacts of climate change. This should be done by reducing emissions as soon as possible.

The latest scientific report[17] *'Special Report on Global Warming of 1.5ºC'* published by the Intergovernmental Panel on Climate Change (IPCC, October 2018) called for the global community and BMBC to take action and establish targets to limit cumulative CO_2 emissions.

The Committee on Climate change (CCC) set up by the CCA provides UK and devolved government independent advice on setting and meeting carbon budgets and preparing for climate change. It also monitors progress in reducing emissions and achieving carbon budgets and targets. In May 2019 it produced a report[18] outline how the governments of Great Britain could achieve Net Zero by 2050 and meet the commitments of the Paris Agreement.

In June 2019, The Climate Change Act 2008 (2050 Target Amendment) Order 2019 [19] was signed into force by the UK government committing by law to achieve 100% (net zero carbon) emissions by 2050.

3.1.2 Barnsley Council's targets and definition

BMBC declared a Climate Emergency [20] on the 18th September 2019, and to support the national transition to a net zero carbon they approved two programmes:

- Achieving net zero carbon emissions on Council's operations by 2040.
- Achieving net zero carbon emissions for the Borough and Barnsley operations by 2045.

Both programmes are held by the BMBC[21] key strategy plan titled "Energy Strategy 2015 – 2025", which is part of the corporate plan for 2017-2020.

Additionally, an internal report "Developing A Zero Carbon Strategy For The Council And The Borough And Declaration Of Climate Emergency", was delivered to BMBC cabinet to support the decision with the same title.

This internal report outlines the continued support and has figures and targets for achieving its two programmes. We have used tables and figures from this report.

The Energy Strategy 2015-2025 states an intention to deliver a phase 2 emissions reduction plan based on its own operations including the following targets:

- Reduction of 30% in carbon emissions by 2020/21 from a 2012/13 baseline.
- Generating 20% of energy used from renewable sources by 2020/21

BMBC is also under the development of detailed evidence based on four Sustainable Energy Action Plans [22](SEAP) for every five years running up to 2040.

3.1.3 Net Zero Carbon definition

The CCC May 2019 report includes thorough information about GHGs effects and this useful definition[23] of what is meant by Carbon Emissions:

> *"Long-lived greenhouse gases like carbon dioxide accumulate in the atmosphere. Therefore, their emissions must be reduced to zero in order to stop their cumulative warming effect from increasing and to stabilise global temperatures (see Chapter 2).*
>
> *Some activities, such as afforestation, actively remove CO2 from the atmosphere."*
>
> ***'Net-zero' emissions means that the total of active removals from the atmosphere offsets any remaining emissions from the rest of the economy.** The removals are expected to be important given the difficulty in entirely eliminating emissions from some sectors.*
>
> *Sometimes 'net-zero' is used to refer to CO2 only, and sometimes it refers to all GHGs. There are some merits in each, which we consider in this report. Our recommendation …. is that the UK should set a net-zero target to cover all GHGs and all sectors, including international aviation and shipping."*

Based on the BMBC declaration of Climate Emergency approved programmes to achieve net zero, the definition of Net -Zero carbon in relation to the scope of this report corresponds to:

> ***'Net-zero' emissions means that the total of active removals from the atmosphere offsets any remaining emissions from the operation of buildings within the town centre.***

Strategies to reach net zero carbon (or carbon neutrality, the terms are synonymous) can imply a whole raft of options from energy efficiency and changing processes, switching energy sources, generating renewable energy on buildings or larger scale inside or outside the boundary and implementation or purchase of carbon removals schemes. Purchased offsets in the form of energy emissions reductions or energy efficiency are not deemed suitable as they do not actively remove additional carbon dioxide from the atmosphere.

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[16] Climate Change Act 2008. www.legislation.gov.uk
[17] Word Resources Institute. IPCC's Special Report on Global Warming of 1.5ºC: https://www.ipcc.ch/sr15/
[18] Net Zero Technical Report. Committee on Climate Change, May 2019
[19] The Climate Change ACT 2008 (2050 Target amendment). Order 2019
[20] Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40). Appendix 1: Climate Change Declaration.
[21] BMB official website. Key Strategies; Corporate Plan for 2017-20. https://www.barnsley.gov.uk/services/our-council/key-strategies
[22] BMB official website. Reducing Carbon emissions. https://www.barnsley.gov.uk/services/our-council/reducing-carbon-emissions
[23] Net Zero Technical Report. Committee on Climate Change, May 2019. P.45

4 Part 1 - Baseline Analysis - Borough and Council's Carbon emissions

4.1 Barnsley Borough Carbon emissions

The Borough accounts total CO_2 emissions of 1,199 kt CO_2/yr. based on the latest statistic year 2018.

BMBC have set net zero goals by 2045 with an initial 45% reduction by 2030 followed by further targets at the end of each 5-year period. See Figure 1, below.

	2018 baseline	45% reduction to 2030		To zero carbon		
SEAP period		2020-25	2025-30	2030-35	2035-40	2040-45
Emissions tonnes	1,199,000	850,000	503,000	378,000	253,000	0

Figure 1 Barnsley Borough. Carbon emissions plan, 2018. Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40)

Shown in Figure 2, the 2018 baseline[24] covers direct and indirect emissions within the whole Borough for stationary energy (domestic and non-domestic buildings) and transportation. Stationary energy represents 72.8% of the total, where transport is responsible for 27.2% of the overall carbon emissions. The baseline does not cover Scope 3 emissions that occur outside the borough. Scope 3 are emissions associated with goods purchased, business travel and waste for example.

2018 Sectoral Emissions of Carbon within Barnsley	Tonnes of Carbon
Industry and Commercial	436,000
Domestic Housing	438,000
Transport	324,000
Total	1,199,000

Figure 2 Barnsley sectoral carbon emissions, 2018. [Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40)]

4.2 Council's Carbon Emissions

BMBC's operational carbon emissions is reported [25] as 28 kt CO_2/year for 2018 as shown in Figure 3, which represents 2.3% of the overall Borough wide carbon baseline. This total is the sum of direct and indirect emissions associated with the operational energy demand from the buildings owned by the council (gas and electricity emissions) and also includes some Scope 3 emissions associated with business travel.

The council has set target for the 5 year plans to set goals to achieve net zero carbon by 2040, in concordance with BMBC's Energy Strategy document.

	2018 baseline	60 % reduction by 2030		To zero carbon by 2040	
SEAP period		2020-25	2025-30	2030-35	2035-40
Emissions (tonnes)	28,000	19,600	11,200	5,600	zero

Figure 3 *Council baseline emissions, 2018. [Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40)*

5 Baseline Analysis for Town Centre

A refined baseline analysis has been carried out to account for properties in the Town Centre. Several different energy data sets and EPC records have been used to analyse each of the main sectors:

- ***Domestic sector*** *– EPC records for the town centre provided by BMBC (checked with open source EPCs)*
- ***Non-Domestic sector***
  - *Open source EPC records*
  - *Non-EPC data (Records of business rates) used to predict energy use*
  - *BMBC Buildings Heat and Gas energy consumption data sets (Council energy data sets)*

For the domestic sector, energy performance certificates selected based on the postcodes in the town centre have been used to calculate the annual primary energy baseline (kWh/year) and consequent space heating and power carbon emissions. To evaluate, adjust and fill any gap in the data records, the official website *Energy performance certificates register* has been used.

To refine the preliminary baseline, new data sets have been gathered and analysed to extract annual heating and power consumption to build an extended carbon emissions baseline with regards to BMBC buildings.

For the non-residential sector we have used two different data sets and separate methodologies to try and cover the full range of properties. The first set contained a record of energy certificates and applying the same methodology as with the domestic set, the relevant energy performance certificates were selected based on postcode. To calculate their annual primary energy (kWh/year) the data was converted from carbon emissions to annual energy use using a carbon factor previously verified.

In parallel a benchmark methodology was applied to the tax service properties provided by ADE regeneration using the Energy Benchmarks (*CIBSE Energy Benchmark* for Gas and Electricity) and added to complement the existing EPC energy data set. Thus, for the different building uses, a benchmark for gas and electricity has been applied by floor area to the properties listed in tax records using postcodes to limit the data to the town centre. Some assessment has been carried out to ensure that there are no buildings double counted between the sets, but due to the quite different information held in the datasets, duplications and omissions may still possibly exist.

The new baseline has been calculated by splitting carbon emissions by gas (space heating) and electricity (space heating and other uses). The baseline accounts more accurately for the number of properties and therefore likely energy use and associated carbon emissions in the town centre.

From the assessment, the Town Centre comprises 687 dwellings, 42 BMBC Buildings and 1372 private and small businesses.

5.1 Domestic buildings baseline

When analysing the domestic energy certificates, the primary energy use (kWh/m2) per property is multiplied by the floor area to provide the total annual energy consumption together with estimated space heating and water heating energy using the open source EPC records. Electricity use is then subtracted from the total.

Using this analysis, we have calculated that:

- 38 % of household's heating (space and hot water) demand is supplied by mains gas.
- Therefore, 62 % of the housing is electrically heated.
- 11174 kWh of gas is supplied per property on average.

[24] Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40). P.5

[25] Developing a Zero Carbon Strategy for the Council and the Borough and Declaration of Climate Emergency (Zero40). P.4

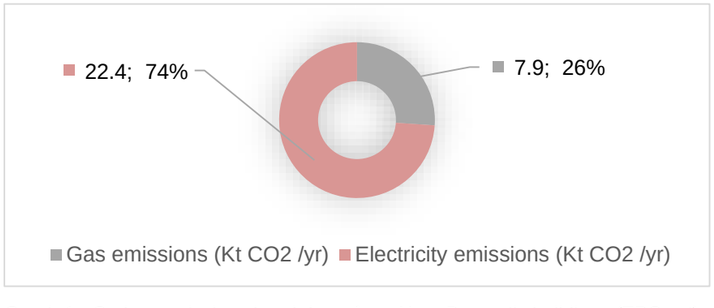
- 6320 kWh of electrical energy on average per property (used for lighting, fans/pumps, for cooking and plugged-in appliances)

The split of consumption is 2.8 GWh for Gas and 5.7 GWh for electricity, with resulting emissions of 0.6 kt CO2 and 1.6 kt CO_2 respectively.

Therefore, the total baseline for carbon emissions from domestic properties is 1.9 kt CO_2/yr

5.2 Non-Domestic buildings baseline

According to the energy data set based on the data gathered from the official Energy Performance Certificates (EPC) records, there are 534 business properties broken down by retail & professional business, offices, and restaurants; the breakdown (graph 1 below) of the properties with EPC records by type of fuel shows around a quarter heated by gas and three-quarters heated by electricity.



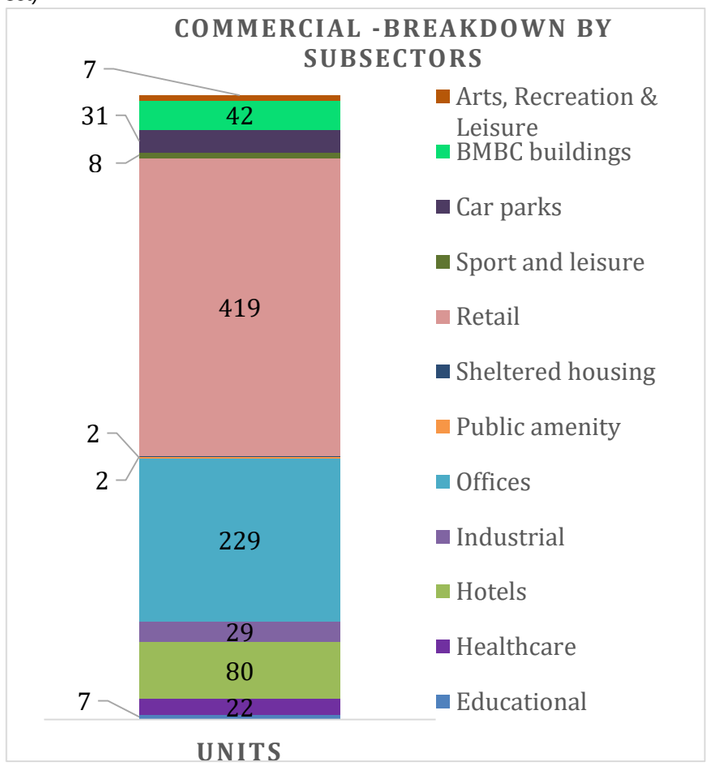
Graph 1 - Carbon emissions breakdown from Non -Domestic buildings (EPC set)

For the business tax set, where energy benchmarks have been applied, graph 2 below shows a total of 836 properties divided by sub-sectors, where retail and offices account for the largest number of properties. Represented on the graph, BMBC buildings represents 5% of the total, but accounts for a larger energy consumption and consequently has a significant impact on the total carbon emissions with a sub-total of 3.5 kte CO_2.

The overall split of consumption for the 1372 business properties is 69 GWh for gas and 102 GWh for electricity, with resulting emissions of 14 kte CO_2.and 28.8 kte CO_2 respectively, as shown in Table 1.

Therefore, the total Carbon emissions baseline is calculated to be 48.4 kte CO_2. /yr.

Graph 2- Split of source of non-domestic emissions for the Town Centre (ADE set)



Within the TC boundaries retail, offices and workshops are the main business units. Non-domestic buildings represent 95% of the total carbon emissions and the non-domestic sector is where the primary focus should be to meet the 2040 carbon targets.

5.3 Baseline for Combined Domestic and Non-Domestic buildings

The analysis above results in the combined total emissions for the TC as shown in table 1 below.

Building sector (TC sclale from SLOA/MSOA)	Gas consumption (Gwh)	Electricity consumption (Gwh)	Gas emissions (Kt CO_2 /yr)	Electricity emissions (Kt CO_2 /yr)	Sub-Total emissions (Kt CO_2/yr)
Domestic	2.8	5.7	0.6	1.6	2.2
Non-Domestic (EPC's)	38.7	79.0	7.9	22.4	30.3
Non -Domestic (ADE Set)	29.9	22.6	6.1	6.4	12.5
BMBC Buildings	9.1	5.7	1.9	1.6	3.5
Sub-Totals	**80.5**	**113.0**	**16.5**	**32.0**	**48.4**
Total emissions (Kt CO2/yr)					

Table 1- Barnsley Town Centre –Refined carbon emissions Baseline

The new baseline accounts for lower gas emissions for the domestic sector, since the number of properties heated by gas just represents 40% (226 properties) of the total with an averaged gas consumption lower than from BEIS source in the original baseline. The new baseline therefore shows the amount of apartments heated by electricity as a much larger number of properties than the original baseline which was effectively averaging a larger area including the town centre. When it comes to the non-residential sector, the number of private businesses accounted for nearly double the number in the original baseline based on gas and electricity meters located within each LSOA. This may well be due to sub-metering of gas or heat in some of the larger buildings. Furthermore, the properties heated by means of electricity account for 60% with higher average consumption where the benchmarks applied for retail properties account for higher electricity consumption than it does for gas to cover space heating.

6 Part 2 - Pathways to meet Targets

Future trajectories and pathways to meet Barnsley emission targets are represented in Table 2. Projections are based on a 5-year plan following the internal report *"Developing A Zero Carbon Strategy For The Council And The Borough And Declaration Of Climate Emergency",* and the two programmes developed for:

- Achieving Net zero carbon emissions on Council's operations by 2040.
- Achieving Net zero carbon emissions for the Borough and Barnsley operations by 2045.

At the same time, each period corresponds to each of the four Sustainable Energy Action Plans [26](SEAP) for every five years running up to 2040 and extended up to 2045 to offset remaining carbon emissions and achieve carbon neutrality for Barnsley Town Centre operations.

6.1 Key Pathways

The key elements of the decarbonisation programme are:

- Removing energy demand from the TC
- Reducing demand of existing and new buildings
- Decarbonizing energy supply
- Offsetting unavoidable residual emissions

For each element the steps are identified for each of the 5 year periods to gradually reduce the scope 1 and 2 emissions. These elements interlock to provide an effective route to net zero emissions.

6.1.1 Remove demand

Removal of demand may occur during the timeframe of the Zero Carbon Strategy for the Town Centre. Changes to activity/uses in the town centre including businesses ceasing to trade and relocating out of the TC will have an impact on energy use and emissions. Some changes may be planned, such as moving a high energy use business into a location where it can be connected to a low carbon source such as a heat network). Urban and masterplan changes can be a source of demand removals, for example locating a car park in a location previously occupied by an office building, or re-converting car parks into green spaces. Some use changes may however result in increases in demand and these will need to be considered carefully to determine if the use change along with associated changes to other areas of emissions (for example transport) justify the change due to an overall reduction in emissions.

Projection periods	2020	2020-2025		2025-2030		2030-2035		2035-2040		2040-2045	
Net GHG emissions (Gte/annum)	48.4	20%	38.7	30%	24.2	30%	9.68	15%	2.42	5%	Zero
0 - Remove demand		Study of removal opportunities						Implementation		Implementation	
1 - Reduce demand 1.1 Residential											
1.1.1 Existing stock		Prepare and pilot retrofit plans		Retrofit all easier properties		Retrofit all easier properties		Retrofit harder properties		Retrofit harder properties	
1.1.2 New stock		Propose standards, train and develop contractors		Implement new energy in use standards		Require lower embodied energy		Require lower embodied energy			
1.2 Non-residential											
1.2.1 Existing stock		Prepare and pilot retrofit plans		Retrofit all easier properties		Retrofit all easier properties		Retrofit harder properties		Retrofit harder properties	
1.2.2 New stock		Propose standards, train & develop contractors		Implement new energy in use standards		Require lower embodied energy		Require lower embodied energy			
2 - Decarbonise supply 2.1 Local PV arrays		Study of roof-top and solar farms potential		Local and large PV installation		Local and large PV installation		Local and large PV installation		Local and large PV installation	
2.2 Power purchase		Study opportunities and legal issues				See benefits		See benefits		See benefits	
2.3 Low temperature heat network		Study and pilot plans for LTHN implementation		Implement LT heat networks		Implement LT heat networks		Implement LT heat networks		Implement LT heat networks	
3 - Offset residual emissions 3.1 Woodland creation		Study offset residual emissions - Woodland/ Circular ecology		Woodland creation/tree planting		Woodland creation/tree planting		Woodland creation/tree planting		Woodland creation/tree planting	

Table 2 -Trajectories to meet carbon targets

6.1.2 Reduce demand

Strategies to minimize the energy demand in buildings are a key element of the plan to reduce carbon emissions. Generally, buildings and the construction represent about one third of total energy consumption[27] and 40% of the total carbon emissions and therefore the built environment has a large contribution to make in reducing emissions.

Existing properties

Energy use in the domestic and non-domestic sector must be reduced through energy efficiency measures. For the existing building stock, retrofit plans have to be prepared and piloted during the first 5-year period ready for large scale roll out in the second and third 5 year periods. Plans must adjust to the building typology to ensure appropriate choices are made. Issues such as tenure will also affect how retrofit can be incentivised and paid for.

[26] BMB official website. Reducing Carbon emissions. https://www.barnsley.gov.uk/services/our-council/reducing-carbon-emissions

[27] International Energy Agency. https://www.iea.org/topics/buildings

The second and third 5-year periods (2025-2035) are where the greatest proportion of domestic and non-domestic retrofits take place. Better insulation and energy efficient systems can reduce the heating consumption up to 60% and replacement equipment can reduce the electricity consumption for electric appliances and lighting up to 50%. Buildings with historical features will be more limited in what fabric improvements are possible, and therefore other buildings should have the deepest retrofit possible to balance this and enable the overall reductions in emissions required to be achieved.

Table 3 shows measures to reduce heating and electricity demand which can be applied in both domestic and non-domestic buildings. Some measures such as increasing insulation and replacing gas boilers with heat pumps can provide great energy demand reductions for the housing and non-domestic buildings. Other measures such as using efficient appliances and lighting systems in combination with smart controls will have a bigger impact on the non-domestic stock where the overall electricity usage is higher than on the housing stock.

Reduction of Energy needs
External building envelope insulation
Improved Air tightness
Improved windows with better insulation & solar gain control
Efficient ventilation with heat recovery
Replacement of gas boilers with:
Individual heat pump systems
Local heat networks based on heat pumps
Improvements to Heating controls
Efficient lighting system
High efficiency appliances
Efficient cooling system

Table 3 -Measures to reduce energy demand

Domestic retrofits will also have benefits such as the reduction of risk of fuel poverty, increased comfort levels and wellbeing (reduction of radon exposure, under/ overheating) and improved internal air quality.

The last 10-year window (2035-2045) shows reduced rate of carbon savings being achieved. In these periods harder retrofits on properties which requires special attention are carried out, as well as building upgrades to improve the energy efficiency of those buildings already around EPC band C. The potential improvements in these cases are smaller and harder to achieve.

New stock

New build for domestic and non-domestic stock are expected to be built with much higher energy efficiency criteria than the existing stock. Within the TC the increase of new residential is expected to be gradual up to 2033, with proposed development on the Courthouse Campus [28] with 138 dwellings and Southern Fringe with 88 dwellings expected to progress.

To reduce the energy demand from new build requires to propose and set energy efficiency standards beyond current minimum requirements and train contractors to achieve them. Increasing the skills available to deliver energy efficient, comfortable, and healthy buildings should be a priority during the first 5-year period (2020-2025).

According to Barnsley's Energy Strategy 2015-2025, there are ongoing plans to encourage new build compliance with the *Code for Sustainable Homes*, a new revision of the Building Regulations (part L). The Code for Sustainable Homes is no longer widely used, and we recommend adoption of an energy standard focused on construction of high-quality building fabric and that delivers high winter and summer comfort levels for people using the buildings and ensures good internal air quality with reduced condensation and mould growth risks. LETI and other organisations have proposed targets that are appropriate for new buildings within areas aiming for net zero carbon. Adopting higher standards now will ensure that buildings do not need to be retrofitted to be fit for purpose in 2045. Adopting a standard for new build in Barnsley TC based on sound building physics principles and measured against a clear target should be a priority. Passive House or AECB building standard would form a solid basis for this.

The implementation of new energy in use standards should occur by the second 5- year window (2025-2030).

New build should also reduce embodied energy associated with the materials of construction to contribute to lower scope 1, 2 and 3 emissions associated with the buildings. Together with reducing operational emissions, this would reduce overall building carbon emissions progressively over the periods 2025-2030 and 2035-2040.

6.1.3 Decarbonize supply

Strategies to remove fossil fuels from heat generation should be developed in the 2020-2025 period and implemented in the 2025-2030 period. No gas boilers should be installed in new build properties from 2025 in line with UK targets[29] and where possible boiler replacements should be heat pump installations.

As the Town Centre transitions from burning gas for heating and hot water generation to electricity, renewable electricity supplies must be secured to match the electricity demand.

Some local renewable electricity may be possible by installing Solar PV panels on buildings with appropriate roof orientations and which are not shaded.

Much of the electricity required by the Town Centre will need to be imported and to ensure that sufficient renewable generation is constructed to meet the Town Centre demand, power purchase agreements may need to be used. Power purchase agreements provide certainty of demand for the organisations constructing the renewable generation projects. For the purchasers, there would potentially be opportunities to negotiate favourable pricing and to have certainty over energy bills for the long term.

Local PV arrays

Within Barnsley Town Centre, opportunities to increase the amount of local renewable electricity with the deployment of rooftop, building integrated PV installations or small ground mounted PV are proposed to be studied during the first 5-years period.

Stated on the Energy Strategy plan, the council has set '*the Energise Barnsley programme'* to install solar PV panels on council houses with 1.4GWh of electricity generated with solar photovoltaic schemes across 300 properties. This programme encompasses the installation of solar PV panels for the non-domestic sector owned by the BMBC and industrial unit roofs.

Projections to implement local and large PV installation are set to take place during the following 10 years' window. For the non-domestic and industrial sector, the creation of medium-large scale solar farms could cover the electricity demand of big consumers.

[28] Barnsley Town Centre Regeneration Plan; Arup, 2016. P.37

[29] Spring Statement 2019. Philip Hammond's speech. https://www.gov.uk/government/speeches/spring-statement-2019-philip-hammonds-speech

Power Purchase

Since the opportunities to develop renewable energy generation facilities within the town centre boundary will be limited, the purchase of renewable energy from external sources is highly likely to form part of a zero carbon TC strategy.

Power purchased as part of the zero carbon transition for the town centre should be additional capacity, which may be direct purchase of facilities along with a long term supply contract, or an agreement to purchase power from a facility that enables the facility to be built on the basis of long term commitment and pricing.

Low temperature heat networks

Although large scale heat networks have been ruled out for the town centre, some localised networks to connect heat producers and users and to utilise shared heat pumps should be considered where appropriate. These systems will utilise low temperature or ambient loops to enable a variety of sources of low temperature heat to be integrated.

Preparing for the implementation of any local heat networks should be carried out in the first period 2020-2025.

Where heat is provided by combined heat and power plants these can be converted from gas to large heat pumps and reduce the carbon intensity. However, some additional electricity supply will need to be provided to make up for the lost power export as well as the additional electricity demand.

6.1.4 Offset residual emissions

Following the projected carbon emissions trajectories, 5 % of the total carbon emissions will be left over the last 5-year period gap (2040-2045). Approximately 15.2 kte of CO2e/yr will need to be offset by planting trees or alternative negative carbon measures. Given the quantity of trees required, this tree planting will need to be outside the town centre and suitable locations will need to be identified along with plans for ongoing management of these areas.

Other alternatives for carbon offsetting should be evaluated. Gold Standard or similar robust offsets should be prioritised. These will cost more than some offsets available, but are more readily verified as being effective and monitored to ensure they are maintained for the long term.

Carbon offsets are done by buying carbon credits in carbon reduction projects (for example reforestation or REED - reducing emissions from deforestation and forest degradation) among others.

Carbon savings are accounted by credits equivalent to a carbon reduction of 1 tonne of CO2. As projected, approximately 15.200 credits would be needed each year from 2045 to achieve the TC Net Zero target after other measures are completed and emissions savings verified.

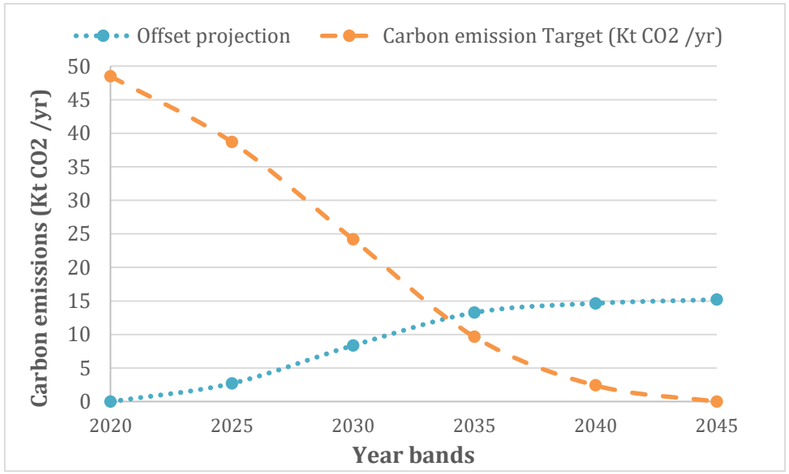
6.2 Results of combined domestic and non-domestic buildings

Table 4 shows the carbon reductions by the end of each period. It can be seen that major efforts have to be made to reduce emissions from non-domestic properties with a residual of 14.22 kte CO_2 /yr. At the same time, it is recommended to monitor savings by the end of each 5-year band to plan future interventions to achieve rapid and sustained emission reductions.

Emissions to Zero Carbon (kte CO2 /yr.)	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
Domestic Gas	0.6	0.6	0.54	0.53	0.53	0.52
Domestic Electricity	1.60	1.46	1.18	0.79	0.56	0.46
Non-domestic gas	15.9	14.0	11.14	7.51	5.6	4.94
Non-domestic Electricity	30.4	25.4	19.71	14.11	10.39	9.28
Total (kte CO2 /yr.)	48.5	41.4	32.6	22.9	17.1	**15.2**
Cumulative Offset projection	0.0	2.72	8.36	13.26	14.65	**15.2**
Carbon emission Target (kte CO2 /yr.)	**48.5**	**38.7**	**24.2**	**9.68**	**2.42**	**0.0**

Table 4 Carbon emission reductions programme

Graphic 3, shows the projected evolution to meet carbon neutrality for the Town Centre and Barnsley operations by 2045 and the accumulated offset projections with a total of 15.2 kte $CO_{2.}$ which represents approximately 30% of the total. It is recommended to implement offsets by the end of each year to absorb residual emissions along the programme.



Graphic 3. Carbon emissions target and offset projections

6.3 Key findings to meet targets

Key findings and recommendations:

- To prioritize retrofits from high energy use buildings. This will allow to achieve potential savings during the first 10-year period, 2020-2030.
- Identify any urban and masterplan changes that might allow for energy demand removals.
- Monitor carbon savings by the end of each 5-year period to plan future areas of intervention such as:
  - Increase of PV deployments
  - Potential buildings connected to local heat networks
  - Power purchases
- Consider a Power Purchase Agreement (CPPA) strategy to support investment in renewable power generation.
- Focus on Offsetting residual emissions by the end of each period.

7 Big consumers and study case scenarios

7.1 Baseline visualization

A visualization map was developed to summarize and represent the main results from the analysis of the data sets and EPC records used.

This helps to:

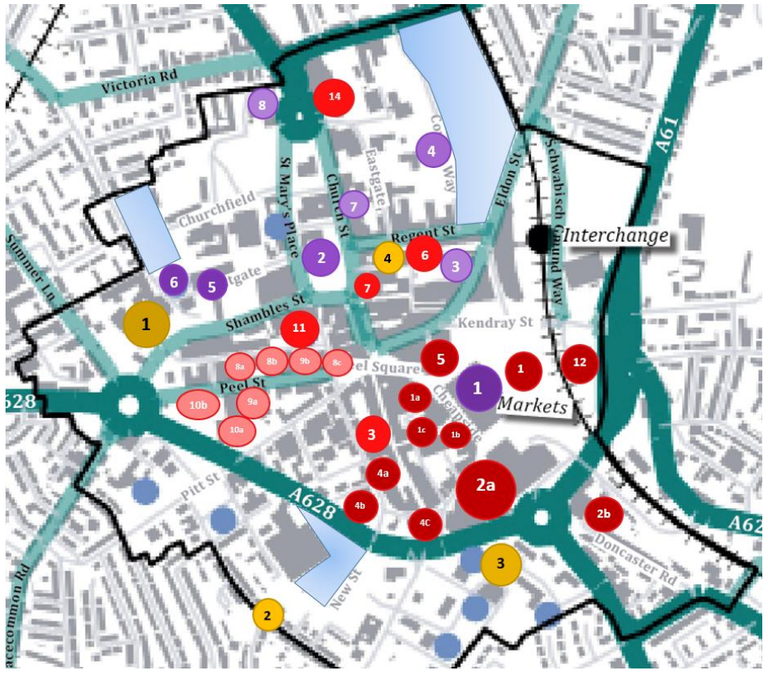
- *Identify high energy consumers and properties with high carbon emissions density.*
- *Visualize and establish which areas could be prioritised when developing retrofit plans*
- *Visualize current and future scenarios.*
- *Test preferred options.*

From the domestic sector, four buildings were identified as main big consumers. The *Plaza quarter* apartment building has the highest carbon emission rate accounting for 0.57 KtCO2/year which is further analysed as a case study scenario on section 8.2.2.

Looking at the non-domestic sector and small retail, table 3 shows the postcodes with the highest carbon emission rates and which buildings have the most impact as big energy consumers where the *Alhambra* shopping centre, *Cheapside* and *Market street* have significant contribution.

With regards BMBC properties, the Glassworks and Westgate Plaza One are identified as big consumer buildings followed by the Town Hall.

As each building sector has their particular needs and characteristics, four case studies were developed to illustrate the approaches that might be followed for different building typologies and to develop best strategy approach to reduce demand up to a level from where residual carbon emissions can be directly offset or by a CPPA (Corporate Power purchase agreement) to meet the greenhouse gas emission targets.



Visualization map- *Location of high energy consumer's (carbon emissions density)*

Indicative number	Domestic Buildings -Main consumers	Postcode	Sub-Total Emissions Gas & Electricity (Kt CO_2/year)
1	PLAZA QUARTER	S70 2RF, 2RH, 2RP, 2RQ	0.57
2	PRINCESS STREET	S70 1PJ, 1PF	0.25
3	SKYLINE FLATS	S70 1DL, 1LW	0.28
4	REGENT HOUSE	S70 2AT	0.13

Table 1-List of big consumers from the domestic sector

Indicative number	Buildings – Main consumers	Postcode Buildings BMBC	Sub-Total emissions Gas & Electricity (Kt CO_2/year)
1	Markets-part of Glassworks	S70 1GW	0.76
2	Town Hall	S70 2TA	0.32
3	Civic Hall	S70 2JL	0.08
4	Digital media centre	S70 2JW	0.19
5	Westgate plaza one	S70 2DR	0.37
6	Gateway plaza, floor 4-9	S70 2RD	0.34
7	Cooper Gallery	S70 2AH	0.04
8	Buckley house- Berneslay homes	S70 HX	0.23

Table 2-List of big consumers from the BMBC sector

Indicative number	Postcode Non-Domestic EPC	Sub-Total emissions Gas& Electricity (Kt CO_2/year)	Notes-Big consumers	Mains gas/EL
1	S70 1RR	2.01	1.a- Boots the Chemists 1.b- Unit 1-4 Cheapside 1.c-12, Albert Street East	Gas/ EL/EL
2	S70 1SB	2.48	2.a-Alhambra shopping centre 2.b-Zero Ice	EL/Gas
3	S70 1SL	1.16	23 Market Street- big consumer	EL
4	S70 1SW	2.31	4.a -Arcadia house 4.b-Buka Night club 4.c-Rock café	Gas/ EL/Gas
5	S70 1SX	1.39	Metropolitan Shopping Centre- big main consumer	EL
6	S70 2EG	0.78	Regent house -big main consumer	both EL/Gas
7	S70 2AB	1.22	1-3, Church Street, Walkabout	both EL/Gas
8	S70 2RA	0.73	8.a-23-29, Peel Street 8.b-Iceland Foods-13-17, Peel street 8.b-YMCA- 23-27, Peel Street 8.c-2-8, Peel Street	EL/Gas/EL
9	S70 2RE	0.87	9.a-Coco night club 9.b-Stereo	EL/ Stereo both
10	S70 2RL	0.78	10.a-47-51 Peel Street 10.b-Cooper house	EL/Gas
11	S70 2SW	0.99	8, Shambles Street	EL
12	S70 1AY	0.97	Gala bingo- Big main consumer	Gas
13	S70 1DE	0.50	Market Parade Shopping Centre	EL
14	S70 1SX	0.00	Barnsley college	Gas

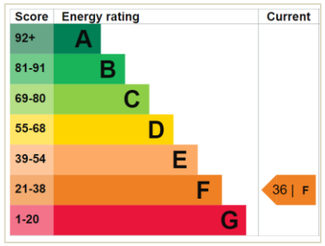
Table 3-List of big consumers from the non-domestic sector

7.2 Study case scenarios

7.2.1 Domestic case study 1- Terraced Housing

- **Building case** - *Princess street (S70 1 PF, PL, PJ, PZ)*

Terraced houses from the early 1900's. Often private rented housing, although some may be owner occupied. Typical brick/stone façade with two storeys and pitched roof. Heating and hot water with conventional or combi gas boiler.



- **Main Characteristics**
  - Early 1900's construction
  - Solid brick/stone with no insulation and poor roof insulation (<150mm) with uninsulated suspended ground floors
  - uPVC double glazed windows (may be low quality)
  - Timber or uPVC doors
  - Main heating with gas boiler, supplementary gas fire or electric fire
  - Natural ventilation (may have intermittent extract from bathroom)
  - Lighting mix. of fluorescent, halogen, and LED fittings, maybe still some incandescent
  - Cooking with gas or resistance electric hob
  - Appliances close to end of life/cheapest new models.

- **Strategy**

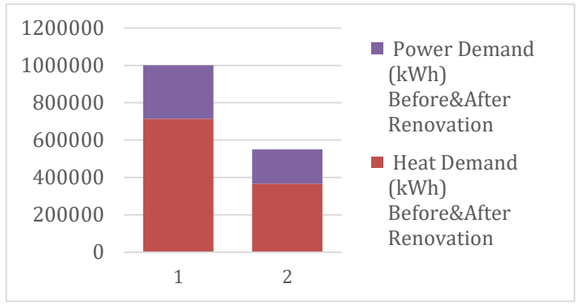
Implement serial prefabricated renovation based on the Dutch *Energiesprong* concept for some of the building's elements. That can lead to a quick and cost-effective solution for the domestic sector for large scale refurbishments on same building typology.

Reduce Energy demand

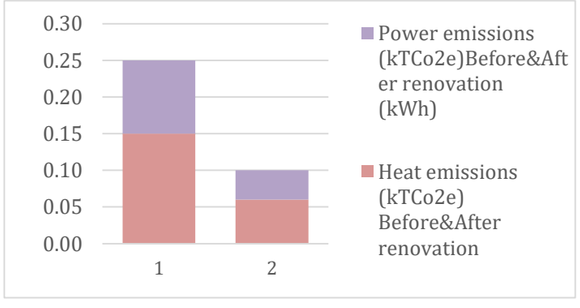
- Fabric first approach for solid walls with internal insulation in the front to preserve appearance and external insulation on the rear and end terrace gable walls.
- High performance windows and doors
- Roof insulation with integrated photovoltaic (prefabricated roof module)
- Improved airtightness
- Efficient ventilation MVHR with heat recovery efficiency above 80%
- Individual air-water heat pump system for space heating and DHW - COP above 3.0 and well insulating pipe work and hot water cylinder.

Decarbonize energy supply

- Renewable power – potentially offer an incentive to use an agile tariff or "Barnsley" tariff with an agreement (Power purchase) with a renewable energy supplier to supply power to make houses net zero.
- PV arrangements to offset HP system running costs
- Reduce billing costs helps to reduce fuel poverty



Operational Energy consumption *(Existing and after strategies implementation)*

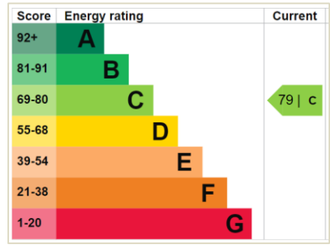


Carbon emissions *(Existing and after strategies implementation)*

7.2.2 Domestic case Study 2- Apartment Block

- **Building case** - *Plaza Quarter (S70 2RP)*

Modern block apartment building build in 2003-2006 with a highly glazed façade, terraces, and balconies with a flat roof. Form factor is poor with lots of potential thermal bridges due to balconies and projections. Heating is provided typically with direct electric panel heaters, hot water with electric cylinders. Ventilation is poor and overheating in summer may be a problem.



- **Main Characteristics**
  - Modern construction- build in 2003-2006
  - U-values as per year of construction convention (0.25-0.35 W/m2K)
  - High glazed façade with double glazing installed by 2002 (2.8 W/m2K)
  - Flat roof (0.25 W/m2K)
  - Main heating with electricity- direct panel heaters
  - Natural ventilation
  - Lighting is likely to be fluorescent/halogen with some LED as replacements
  - Cooking is likely to be electric

- **Strategy**

Due to the construction type, it may be challenging to install additional insulation or reduce thermal bridging without stripping the building back to underlying structure. High power consumption can be reduced by providing heating and hot water via heat pump.

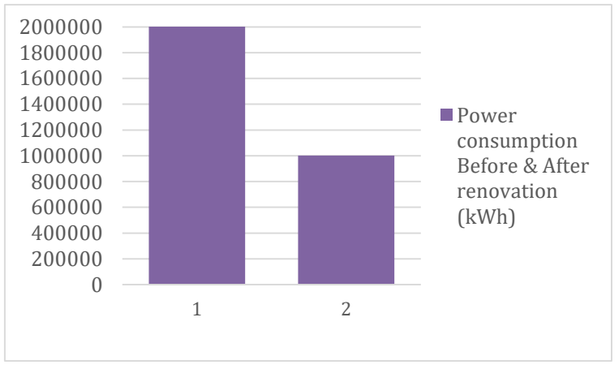
Reduce Energy demand

- Fabric first approach with focus on reducing thermal bridges where fabric interventions are possible.
- Replacement glazing to improve U-value, but also special attention to solar gain to avoid overheating.
- Improved airtightness
- Ensure adequate ventilation. If possible, implement efficient continuous ventilation with heat recovery

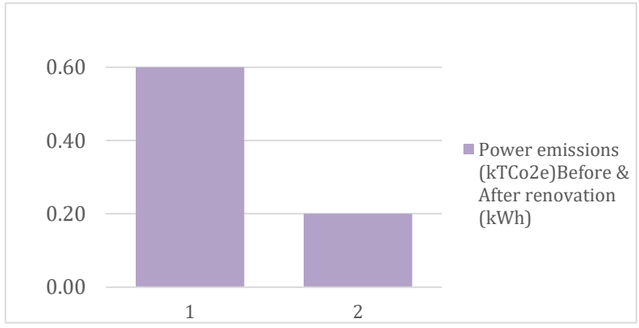
- Communal air source heat pump for space heating and DHW with well insulating pipe work to avoid overheating issues.

Decarbonize energy supply

- Power purchase agreements - alternatives for private renters and community scheme
- PV arrangements to offset HP system running costs
- Reduce billing costs to help to reduce fuel poverty



Operational Energy consumption *(Existing and after strategies implementation)*



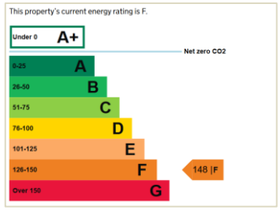
Carbon emissions *(Existing and after strategies implementation)*

7.2.3 Non Domestic case study 1 - Small retail

- **Building case** - *Businesses in Pitt Street (10,14,16 Pitt street)*

Small private business with limited floor area located on the ground floor of a two storey building with housing on the first floor. Typical business of retail and restaurant establishments with a high electricity consumption of regulated and unregulated electricity. Limited sense of community where the accommodations and housing have separated entrance on the rear side of the building.

Fabric first approach and highly efficient systems while finding ways to create a community structure could lead to a big step change achieve NZ targets.



- **Main Characteristics**
  - Solid brick or unfilled cavity walls with no or limited insulation and flat roof also with poor insulation (0.25-0.55 W/m2K)
  - Suspended floor without insulation (0.35 W/m2K)
  - Single or double glazing (3.1-2.8 W/m2K)
  - Main heating with direct electric panels
  - Business may have inefficient appliances (for example refrigerators and cooking equipment) and lighting.

- **Strategy**

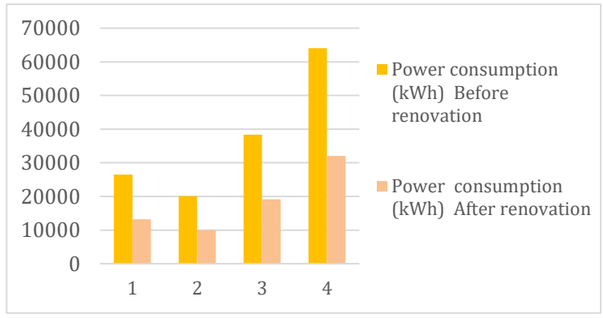
Using prefabricated elements where possible, but more importantly developing a masterplan for tying together the improvements of all the residential accommodation and business accommodation. Consider if a communal entrance area to the residential parts can be formed above the back of the businesses. If the structure allows, then adding an additional floor so that two floors of residential are present over the businesses would enable larger dwellings to be accommodated.

Reduce Energy demand

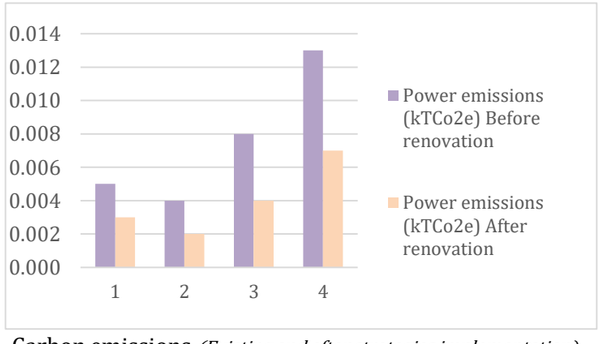
- Fabric first approach for walls and roof insulation
- Replacement improved windows
- Opportunity for PV on roof
- Improved airtightness
- Efficient ventilation MVHR with heat recovery efficiency above 80%
- Individual air source heat pump systems mounted on the roof for space heating and DHW- COP above 3.0 and well insulating pipe for the small retail and above accommodations.

Decarbonize energy supply

- Renewable power – potentially offer an incentive to use an agile tariff or “Barnsley” tariff with an agreement (Power purchase) with a renewable energy supplier to supply power to make houses net zero.
- Attractive leasing arrangements for new “green businesses” that meets certain standards + support for existing businesses to transition.
- Reduce billing costs helps to reduce fuel poverty



Operational Energy consumption *(Existing and after strategies implementation)*



Carbon emissions *(Existing and after strategies implementation)*

7.2.4 Non Domestic case study 2 – Public building

- **Building case** - *BMBC- Digital media Centre (DMC 01)*

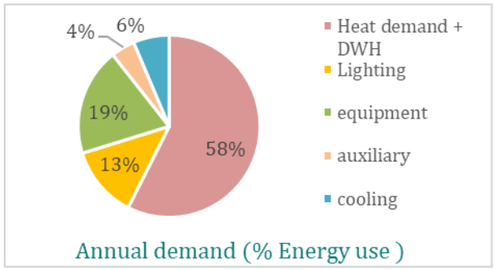
Modern office building build in 2007 build with significant glazed façade, shaded form with a flat roof. The building's compact form should enable better thermal performance. There are no balconies of other external features, so potential for low thermal bridging, however construction methods may have created some. Heating was provided originally with a biomass boiler which was subsequently replaced with a 200kW gas boiler. Due to the mixed office and meeting events use of the building a big portion of the total demand is expected to come from lighting and unregulated electricity from equipment loads. The high internal heat loads can also lead to cooling demand (or overheating)

❑ Funding for Implementing LED Lighting and Solar PV and air source heat pump for space and water heating is approved. This will provide significant energy and carbon savings.

(a) (b)

Figure 20: Digital media centre, (a) gas boiler, (b) thermal store, valves and plant room space

- **Main Characteristics**
  - Modern construction - build in 2007
  - U-values as per year construction convention (≥0.35 W/m2K)
  - Terraced flat roof (≥0.25 W/m2K)
  - High glazed façade which leads to overheating issues (≥ 2.8 W/m2K)
  - Significant equipment density (networks system)
  - Main heating with 200kW gas boiler
  - High equipment and electricity loads due to the existing building use



- **Strategy**

Significant energy and carbon savings can be achieved by implementing efficient lighting and unregulated electricity strategies to the equipment loads. A communal HVAC system to provide heating and cooling with advanced building management controls could lead to a significant reduction in both demands. In combination with envelope improvements to improve glazing properties and implement a shading system this could both improve comfort and reduce energy consumption.

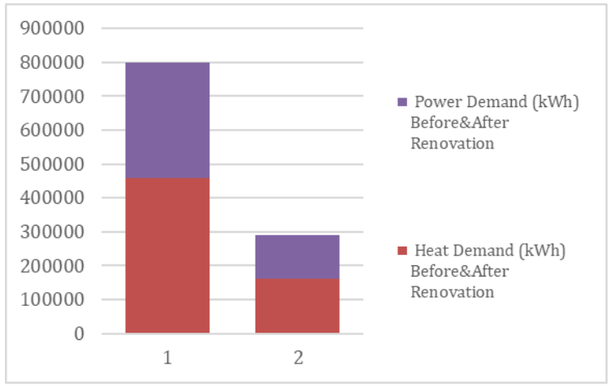
Reduce Energy demand

- Windows solar factor upgrade and shading systems
- Use Roof space to implement a photovoltaic arrangement
- Improve airtightness
- Implement energy efficient continuous ventilation with heat recovery
- Heating system approaches
  - Communal air source heat pump
  - Potential to tie into a future local heat network

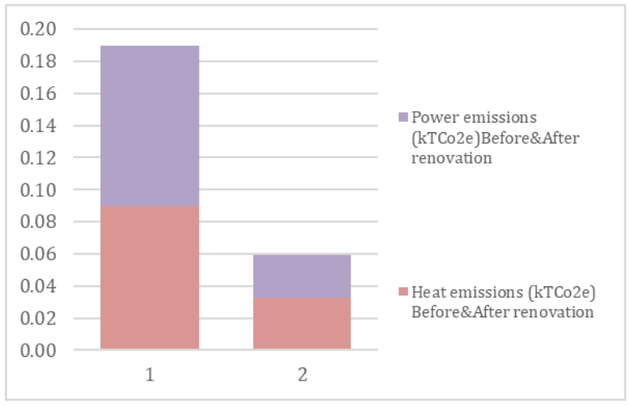
Decarbonize energy supply

- Possibility of placing PV arrangement to offset HP system running costs or electricity demand

- Renewable power – potentially offer an incentive to use an agile tariff or "Barnsley" tariff with an agreement (Power purchase) with a renewable energy supplier to supply power to make houses net zero.



Operational Energy consumption *(Existing and after strategies implementation)*



Carbon emissions *(Existing and after strategies implementation)*

8 Part 3 - Proposals for Implementation

9 Preferred option

10 Final Results

11 Appendix

11.1 Supporting information

11.1.1 Do everything else first and only then offset

How can the town centre procure renewable energy and carbon offsets with certainty that they are having the positive impact intended.

https://www.ukgbc.org/news/ukgbc-consults-on-renewable-energy-procurement-and-carbon-offsetting-guidelines/

Where carbon offsetting has to be used, high quality offsets such as Gold Standard https://www.goldstandard.org/ should be used to ensure that carbon reductions are verified and persistent.

11.1.2 Corporate Power Purchase Agreements (CPPA)

For many of the organisations that operate premises within Barnsley Town Centre, a Corporate Power Purchase Agreement (CPPA) may be a significant part of their strategy to demonstrate compliance with their corporate social responsibility strategy and carbon targets.

A CPPA is a long-term contract where a business agrees to buy electricity directly from a renewable energy generator rather than the traditional approach of simply buying electricity from licensed electricity suppliers.

As the UK moves towards decarbonisation, there is a constant need to build the next generation of renewable assets to meet demand and these long-term agreements help to finance renewable energy projects, giving generators a guaranteed buyer and revenue stream for the energy they produce.

Power Purchase Agreements give organisations budget certainty (including potential to negotiate discounts) and help with transparency and accountability in demonstrating that net zero goals will be met and showing corporate social responsibility. They allow organisations to demonstrate where their power is generated and prove that it is from renewable resources.

For smaller businesses, an intermediary organization to aggregate the needs of the businesses and engage a suitable scale generator in a CPPA may be needed.

A generator in this context may be local to Barnsley TC where a direct CPPA may be possible or remote in which case an indirect CPPA would be used with the licensed electricity supplier 'sleeving' the power between the generator and the consumers.

11.1.3 Woodland Carbon Code

Estimating the carbon that can be removed by planting trees is not straightforward as the CO2e/year reduction varies through the life of the trees, peaking at around 25 years and then reducing again.

The Woodland Carbon Code https://woodlandcarboncode.org.uk/ is a voluntary standard for when claims are being made for carbon sequestered by woodlands.

11.2 Additional information

11.2.1 Connecting with other areas to share best practice.

Carbon Neutral cities Alliance

Achieving deep decarbonisation is a daunting task with few clear roadmaps, and leading global cities have pursued this in relative isolation from each other. That is why the Carbon Neutral Cities Alliance was created. By sharing resources and ideas and collaborating on strategic approaches, CNCA cities can accelerate progress in meeting their aggressive goals; develop more rigor and consistency with which these plans are developed; garner support among key stakeholders critical to their success; and inspire other cities to reach for similarly aggressive goals by providing them with tested, "leading edge" know-how.

This report on the CNCA Framework identifies strategies for driving change.

https://carbonneutralcities.org/wp-content/uploads/2018/04/CNCA-Framework-for-Long-Term-Deep-Carbon-Reduction-Planning.pdf

Place-Based Climate Action Network

The Place-based Climate Action Network (PCAN) is about translating climate policy into action 'on the ground' to bring about transformative change

https://www.pcancities.org.uk/

Leeds is one of the PCAN cities and recently published its Pathway to Net-Zero Carbon Roadmap

https://leedsclimate.org.uk/news/climate-commission-shows-moving-net-zero-emissions-can-help-leeds%E2%80%99-post-covid-recovery.

PCAN has also been developing work on Yorkshire and Humber wide carbon reduction.

https://leedsclimate.org.uk/news/yorkshire-wide-approach-carbon-reduction-needed

11.2.2 Aim to promote and attract sustainable businesses.

B Corp

How many Barnsley based businesses are B Corps https://bcorporation.uk/. Certified B Corps are a new kind of business that balances purpose and profit. They are legally required to consider the impact of their decisions on their workers, customers, suppliers, community, and the environment. This is a community of leaders, driving a global movement of people using businesses as a force for good. Example: The Body Shop at 42 Cheapside S70 1RU

Science Based Targets

How many Barnsley based businesses have set Science Based Targets https://sciencebasedtargets.org/ and therefore lead the way to a zero-carbon economy, boost innovation and drive sustainable growth by setting ambitious, science-based emissions reduction targets. Examples: Vodafone at Cheapside S70 1SB, Sainsbury's (although not in the TC) and M&S at 7 Queen Street S70 1RL.

Workers and Members Co-operatives

While not directly linked to emissions reductions, co-operatives are socially engaged organisations and are likely to align to the values required for business working in a zero carbon town centre.

11.2.3 Levers and strategies for reducing Carbon in Building Systems

LEVERS	STRATEGIES	ACTIONS
Voluntary Action	Encourage Improved Energy Efficiency Performance of Existing Buildings	• Conduct building energy performance challenges • Promote building energy rating systems (commercial ar residential) • Promote voluntary energy use benchmarking programs • Promote voluntary "stretch" building energy conservatic codes and green-building principles by providing inform tion, technical assistance • Promote "cool roofs"—coating of rooftops white to reduce building energy use—and other low-cost ap- proaches • Support best practice information sharing among buildi owners
	Promote Energy Conservation Behaviors by Building Occupants/Tenants	• Work with utilities to improve customer access to energ use data • Conduct public education programs and campaigns tha promote energy-saving measures • Promote green leasing for commercial buildings, which enable a fair proportion of costs/benefits to be allocate to both tenants and landlords
Price Signals	Increase Access to Financing	• Improve access to specialized financing to pay for ef- ficiency improvements
	Support/Provide Rewards for Performance	• Provide regulatory and zoning relief for projects meetin certifiable high standards (e.g., LEED) • Promote supportive market mechanisms such as build- ing appraisal and mortgage underwriting that capture t value of investments in energy efficiency
	Subsidize Capacity Improvements for Building Management	• Support efforts to train building operators in energy ef- ficiency best practices
Public Investment	Expand capacity of efficient heating and cooling Invest in Technology Development and Deployment	• Develop and expand low- to no-carbon district heating and cooling systems • City piloting of new building technologies • Support Municipal Strategic Energy Management programs
	Model the Behavior-Invest in Energy Retrofitting of Government Buildings	• Conduct deep retrofitting combined with installation of on-site renewable energy supply • Improve building operations and preventative maintenance • Improve energy efficiency of public/government-owned housing • Require all rehabilitation projects financed by city to include "green" capital needs assessment
Mandates	Mandate Reporting	• Adopt Building Energy and Reporting Disclosure ordinances • Require energy audits and disclosure • Require sub-metering • Require building rating system
	Mandate No- to Low-Carbon Standards for New Construction	• Adopt/phase-in building and energy conservation code based on carbon neutral, zero net energy, Passive Hou Living Buildings, and other cost-effective high-efficiency approaches
	Mandate Performance Improvement of Existing Buildings	• Require targeted buildings (e.g., commercial above certain amount of floor area) to benchmark (measure ar disclose) energy performance, and/or conduct energy audits, and/or install energy sub-meters for large tenant • Require "deep" retrofitting of buildings at designated in tervention points: time of sale/purchase, financing, majo renovation of building or space, and rebuilding • Require upgrades to commercial/industrial buildings' lighting systems • Require higher standards for energy efficiency of appliances • Require certification of building operators