

# OUR RESILIENT FUTURE:

## A FRAMEWORK FOR CLIMATE AND ENERGY SECURITY



**BRISTOL**  
**2015** EUROPEAN  
GREEN CAPITAL



**Description:** This document defines the strategy and action plan for improving the resilience of the City of Bristol in addressing the threat of climate change through the sustainable use and generation of energy. It sets out our existing commitments; progress to date against these and what more must be done to meet them. Future actions which are to be led or enabled by Bristol City Council are defined as well as a broader range of initiatives which are in progress across the city.

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# OUR RESILIENT ENERGY FUTURE

## Foreword by Mayor George Ferguson

As Mayor of Bristol I am focused on how to make the city a great place to live, work and play. I am implementing many local initiatives to do this – whether these are improving our streets for walking and cycling, investing in modern public transport or increasing our energy efficiency.

Bristol has long been an inclusive yet outward facing, international city that has helped shape our shared global future. We are a key trading port, home to leaders in green businesses that are creating the solutions to today's challenges, and European Green Capital 2015.

Climate change and the security of energy are both global and local issues, which affect every part of our city. I am proud that Bristol is both helping to secure a global climate agreement and leading the UK in reducing carbon emissions and our reliance on imported fossil fuels, and doing this in ways that make our city a better place to live by simultaneously achieving more and better jobs, active travel options, improved health outcomes and recognises that the poorest and most vulnerable in Bristol as well as globally will be most affected by climate change.

The people, businesses, organisations and politicians of Bristol are concerned about climate change and are taking action right now to take us towards a sustainable future where we can live well and do business without further damaging the climate that we rely upon.

In 2009 Bristol City councillors unanimously adopted ambitious targets to reduce CO<sub>2</sub> emissions and energy use. Since then we have made good progress and we have a strong programme for the coming years which is set out in this framework. Through this updated framework I am reaffirming the City Council's commitment to those targets and setting our interim targets for 2025 and 2035.

Achieving these targets will require significant action from the city council and I set out some of the major projects we will lead to achieve this. However it also needs action from every person, community and business in the city and so in this document I describe some of the ways in which the city council will help enable action by others in Bristol. We also know that we do not yet fully understand all the challenges and opportunities which realising the ambitious targets set in 2009 will entail – I therefore describe areas which we want to explore with partners, locally, regionally, nationally and internationally to create the next generation of projects which will be implemented over the next 10-20 years.

Making Bristol a low carbon city will improve our environment, will improve our citizen's quality of life, it makes sound economic sense and will create thousands of new jobs. I look forward to realising these opportunities.

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### Executive Summary

Bristol is well placed to become a happy, healthy, low carbon city. Our residents and businesses care about climate change and are taking action within their communities, we're a leading centre of business and academic expertise in sustainable development and we have a clear shared ambition to become a sustainable, inclusive, low carbon city.

Climate change and energy security are important issues to the people of Bristol. Across the whole city 70% of residents are concerned about the effects of climate change and in every Neighbourhood Partnership area the majority of residents are concerned about these impacts. Bristol is the UK's leading centre for sustainability expertise. We have the largest cluster of environmental technology and service businesses in the core cities and we have two leading universities with excellent research and teaching capabilities in climate, energy and sustainability issues.

Bristol has the shared ambition to become a sustainable city, as illustrated through our green capital journey. Some 10 years ago the public, private and voluntary sector in Bristol agreed a common goal - to be a green capital in Europe. Our achievement of "European Green Capital 2015" was the result of many people working in their own areas and working collectively, with both small and large initiatives to make Bristol a greener city.

Bristol City Council unanimously adopted targets to reduce the city's energy use by 30% and carbon dioxide emissions by 40% 2005-2020 and we have made good progress. By 2013, the last year of data, we have reduced energy use by 20% and carbon dioxide emissions by almost 18%. This performance is affected by local, national and international factors.

This Framework summarises some key initiatives that are already underway which will contribute to the achievement of our targets. However, significant additional investment and action is needed, by all sectors, to achieve the 2020 targets and to plan for and deliver our longer term targets leading to the decarbonisation of the city. This Framework sets out some of the areas of future development which we need to explore.

This framework also translates our existing 2050 CO<sub>2</sub> reduction target of 80% into key milestones of 50% reduction by 2025 and 60% by 2035, and associated energy efficiency improvement targets. This will help to provide a more tangible long-term pathway towards the substantial decarbonisation of Bristol whilst also aligning with planning horizons for other functions within the City, which are crucial to achieving our targets. In this document, Bristol City Council (BCC) also commits to new targets for its own corporate energy efficiency and CO<sub>2</sub> emissions having almost achieved its 2020 target 5 years early.

Decarbonising the city will require significant financial investment and the University of Bristol has conducted 'The Economics of Low Carbon Cities: A Mini Stern Review for the City of Bristol', to identify the opportunities in terms of their energy and carbon reduction potential and their economic impacts and job creation potential. The key challenges and opportunities are:

- Bristol's population is forecast to continue to grow, increasing by approximately 5% by 2020, and 20% by 2036 on 2015 levels. This will increase the overall

demand for energy, and could impact upon our ability to meet targets.

- Approximately 13% of all households in the City of Bristol lived in fuel poverty during 2012, and whilst levels of fuel poverty vary greatly across the City, in the worst affected ward 27% of households were considered as being fuel poor.
- The Sustainability, low carbon environmental goods and services, and environmental technology sectors make up an increasing component of Bristol's economy, contributing jobs and wealth, and this can be developed.
- National action alone will not achieve Bristol's targets and local action is needed.
- Bristol's targets for 2020 and 2025 are achievable through the implementation of relatively simple, individually cost beneficial measures.
- Bristol's targets for 2035 are achievable if a basket of measures are implemented and these could collectively be cost neutral to the Bristol economy.
- The total cost-neutral investment potential for Bristol to 2025 is £2.2Bn. Many of the measures make sound commercial sense and would pay for themselves in a relatively short period of time, and if done well there may be a wide range of indirect benefits.
- These investments would generate significant levels of employment and economic growth in the process, with 2000 jobs created by the cost effective measures, and a further 8000 will full implementation of the cost neutral measures.
- The cost-neutral measures would reduce Bristol's annual energy bills by £300m.
- Significant investment opportunities exist within the most deprived parts of the City of Bristol, and taking action to implement energy improvement measures in these areas provide a greater return on investment, as well improving the health and quality of life of residents.

Changing how we use energy in the city creates huge opportunities to make the city a better place to live for everyone – with cleaner air, warmer homes and a higher quality of life. It enables us to address some key social and health issues, in particular fuel poverty, but also creates some threats which could increase inequality. In preparing this framework we have considered the other benefits and the social impact of a range of key measures. The Framework analyses these opportunities and risks and identifies a set of priority measures. They have been clustered into 4 complementary themes; domestic, commercial, industrial and transport.

This Framework sets out an action plan for Bristol City Council which reflects the city council's role in the city. The initiatives have been organised into three groups where the city council will Lead action, Enable action by others, and will Explore opportunities and future action with others. This provides both appropriate accountability for the city council and inclusion of initiatives which are being led by or in partnership with Bristol communities, the business community, public bodies and wider civil society.

Finally, a robust monitoring and review framework is defined here to clearly define transparent criteria for success and to ensure the plan is flexible to changes in technology, society and the economy.



*\*Gross Value Added (GVA) is a productivity metric that measures the difference between output and intermediate consumption. It provides '£' value for the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production.*

Figure i: The City of Bristol's Energy Economy

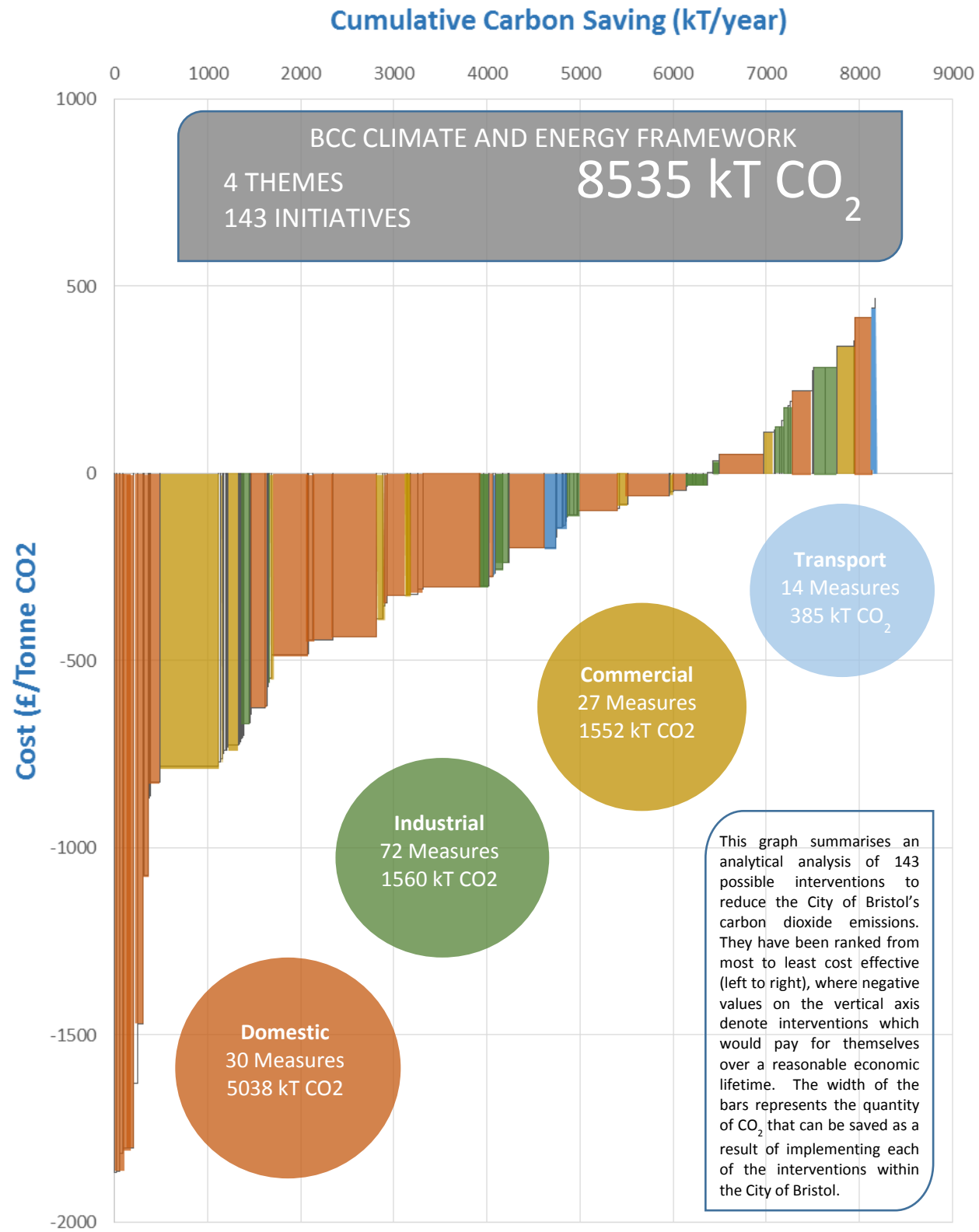


Figure ii: Marginal Abatement Cost Curve for All Interventions in All Sectors to 2035



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## INTRODUCTION

### Framework Scope

This document outlines the action that Bristol City Council (BCC) will undertake directly, or indirectly to enable action by others, to tackle the City of Bristol's carbon dioxide (CO<sub>2</sub>) emissions. Through further consultation and development in early 2016 it will develop into a more comprehensive plan which takes into account the action being taken across the city by a wide range of stakeholders. This will help ensure that future policy making in the area is truly "joined-up" – avoiding duplication, capitalising on synergies and increasing investor confidence in Bristol as a global leader in city-scale action on climate change.

The City of Bristol uses energy directly, for example in our homes, and indirectly, as embodied energy, for example through the food or products that we purchase or dispose of. The targets and the data presented in this framework relate to our direct energy use, and the associated CO<sub>2</sub> emissions, from homes, other commercial and industrial buildings and transport. The Framework focuses on these direct activities, but also recognises the need to better understand and reduce our indirect emissions. As a result, the Framework includes a number of actions relating to food, waste and other indirect emissions.

The focus of the framework is on climate change mitigation, i.e. reducing CO<sub>2</sub> emissions, identifying action to address how the city sources, consumes, and produces energy. However, in mitigating CO<sub>2</sub> emissions the city will influence, and be influenced by, a range of other issues and strategies including energy security, fuel poverty, climate adaptation and resilience. These strategies will need to be well integrated to reduce duplication, share resources and costs, and maximise co-benefits.

Whilst the framework is focused on action within the administrative area of BCC, it recognises that energy systems extend beyond administrative boundaries and as such BCC will continue to work with neighbouring authorities in the West of England to progress towards a low carbon and energy secure future.

### Our Approach

Our energy system is complex, and our energy use and the resultant CO<sub>2</sub> emissions we generate, are constantly influenced and affected by the decisions of many people, communities, organisations and industries in Bristol and beyond. The approach to developing and implementing this framework follows a number of distinct but iterative stages. These are described below and shown in Figure 1:

- Reviewing current targets, agreeing the vision, and creating clear long term targets and objectives;
- Defining and developing our understanding of the energy system;
- Identifying sources and gathering data to quantify our emissions;
- Identifying and assessing the costs and benefits of potential interventions;
- Planning and using our knowledge to inform the application of interventions to reduce emissions;
- Implementing interventions and influencing plans and strategies across other the city to reduce emissions; &

- Monitoring progress and using our learning to adjust plans to respond to societal, economic and technological change.



**Figure 1: Developing Our Climate And Energy Security Framework**

Whilst development of this framework has been informed by data, knowledge and other inputs from a wide range of sources, two key projects have underpinned our work:

- The Systems Thinking for Efficient Energy Planning (STEEP) project, through its research into the use of group model-building workshops with stakeholders to reach a shared understanding of complex energy systems, has greatly influenced the development of this framework; and
- 'The Economics of Low Carbon Cities: A Mini Stern Review for the City of Bristol', (hereafter referred to as the 'Mini-Stern') conducted by the University of Bristol (UoB), which provides a comprehensive economic assessment of the cost and carbon effectiveness of a wide range of the low carbon interventions that could be applied across the City of Bristol in the domestic, commercial, industrial and transport sectors.

In addition to these inputs the framework also draws on the experience of officers and senior managers from across BCC, as well from the STEEP and UoB project teams, and a range of other stakeholders.

However, to further build upon the work undertaken to date, and given the iterative nature of the framework development process, broader stakeholder engagement is required in order to obtain wider 'buy in' and better influence City wide decisions to tackle CO<sub>2</sub> emissions and improve energy security. Especially since most of the council action described in this Framework is developed and implemented through other strategies and plans, for example on transport, land use, housing and strategic resilience.

Therefore, stakeholder engagement will continue after the adoption of this framework for consultation, and in early 2016 broader consultation will capture and incorporate the views of key stakeholders. This will be informed by the stakeholder mapping undertaken for STEEP and the economic modelling conducted by the UoB. This engagement and consultation will seek to develop and refine the strategy for achieving the city's targets and reflect and encourage action by key organisations in the city.

The Framework will be adopted for Consultation in November 2015, and consultation will take place during January, February and March 2016. The revised framework will be adopted in the summer of 2016, and will be subject to continuous review.

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## OUR TARGETS: WHAT DO WE WANT TO ACHIEVE?

### National & International Targets

The European Union has set targets to cut greenhouse gas emissions by 20% by 2020, 40% by 2030, and 85-95% by 2050, based on a 1990 emissions baseline<sup>i</sup>. These are supplemented with targets for raising the share of EU energy generated from renewable resources to 20% and for a 20% improvement in the EU's energy efficiency, by 2020.

In the UK, the Climate Change Act 2008 commits the UK to reducing emissions by at least 80% on 1990 levels by 2050. This target represents an appropriate UK contribution to global emission reductions consistent with limiting global temperature rise to as little as possible above 2°C. The UK Government has also set further short term limits for greenhouse gas emissions, through legally binding carbon budgets, equating to a reduction of 23% by 2012, 29% by 2017, 35% by 2020, and 50% by 2025, all from 1990 levels.

It is planned that a new global agreement and set of climate targets will be agreed in December 2015 at the United Nations Framework Convention on Climate Change (UNFCCC), Conference of Parties 21 (COP21) in Paris. The aim of this agreement will be to reduce global emissions to limit global temperature rise to 2°C<sup>ii</sup>.

### Playing our part: Bristol's Existing Targets

Towns and cities account for more than half of all of society's greenhouse gas (GHG) emissions<sup>iii</sup>. Interestingly and very importantly, whilst there is no duty on UK local government under the 'Climate Change Act 2008' to reduce the GHG emissions or energy use of their cities, there is a statutory requirement to consider the provisions and objectives of the Climate Change Act 2008 in the National Planning Policy Framework (NPPF) and the associated official guidance. This includes the requirements for local authorities to adopt proactive strategies to mitigate and adapt to climate change in line with the provisions and objectives of the Act and to co-operate to deliver strategic priorities which include climate change. It is clear that without securing reductions in the areas under the influence of local authorities, the UK would not be able to achieve the reduction in GHG emissions required to meet carbon budgets<sup>iv</sup>.

In recognition that local governments share the responsibility and are uniquely placed to lead in combatting climate change, BCC is committed to demonstrating effective decentralised action and to supporting businesses, individuals and communities in reducing greenhouse gas emissions. As such, BCC has committed to achieving the following city and council wide targets, from a 2005 baseline to<sup>v</sup>:

- Reduce energy use 30% by 2020;
- Reduce CO<sub>2</sub> emissions 40% by 2020; &
- Reduce CO<sub>2</sub> emissions 80% by 2050.

2005 was selected as the baseline year for Bristol targets because this is the first

year for which reliable local data on emissions published by the Department of Energy & Climate Change (DECC<sup>vi</sup>) where available.

A simple estimate of Bristol's 1990 emissions suggests that emissions were reduced by approximately 10% between 1990 and 2005. This means that Bristol's targets equate to approximately 45% for 2020 and 82% for 2050, when compared to a 1990 baseline.

**Table 1: Bristol, UK & European Emission Targets from 1990 Baseline**

	2020	2050
European	20%	85-95%
UK	35%	80%
Bristol	c.45%	c.82%

BCC has signed a number of international commitments to reporting and taking action on climate change in support of these targets<sup>vii</sup>. This requires BCC to demonstrate that action is being taken on climate change by adopting an action plan identifying targets, resource requirements, administrative structures and firm time-bound commitments to action over the next 3-4 years. This Framework currently meets those commitments and will be developed further to meet future commitments.

**Other Cities' Targets**

The UK Core Cities<sup>viii</sup>, and other West of England authorities, have also adopted targets to reduce CO<sub>2</sub> emissions, and whilst there are differences in their baseline years, the targets adopted and target years chosen, on average roughly equate to a 33% reduction in CO<sub>2</sub> emissions by 2020, and 80% by 2050, from a 2005 baseline.

The European Green Capitals have also all set their own climate targets, which are influenced by their progress in the decarbonisation journey. The most ambitious targets are set by Copenhagen, which aims to be Carbon Neutral by 2025, and Stockholm, which aims to be fossil fuel free by 2050. Whilst Bristol's targets are not as challenging as Copenhagen's and Stockholm's, they are as ambitious as those of Hamburg, Vittoria Gasteiz and Essen, and are broadly considered to be challenging given the current UK economy and policy context.



Bristol's  
New Targets

BCC has reviewed its existing commitments, has reflected upon our progress against these commitments, and has decided to incorporate milestone targets for citywide emissions and energy demand reduction. At the citywide level these targets are designed to broadly align with the West of England's (WoE) Joint Local Transport Plan (2011-2026) and the WoE Joint Spatial Plan (2036) cycles so that the contributions of these processes can be measured against the revised targets.

BCC proposes to adopt the following targets from the 2005 baseline, in the context of those targets already adopted for 2020 and 2050:

**Table 2: City Of Bristol Proposed Reduction Targets**

	2020	2025	2035	2050
<b>Citywide CO<sub>2</sub> emissions</b>	40%	<b>50%</b>	<b>60%</b>	80%
<b>Citywide Energy consumption</b>	30%	<b>35%</b>	<b>45%</b>	55%
<b>Citywide Renewable Energy</b>	To be developed through consultation			

(New targets shown in **Bold**)

**Table 3: Bristol City Councils Proposed Reduction Targets**

	2020	2025	2035	2050
<b>BCC CO<sub>2</sub> emissions</b>	50% (was 40%)		<b>60%</b>	
<b>BCC Energy use</b>	40% (was 30%)		<b>50%</b>	

(New targets shown in **Bold**)

<sup>i</sup> 1990 is the baseline for the previous global agreement on climate change – the Kyoto Protocol adopted in 1997.

<sup>ii</sup> An impact of less than 2°C would exacerbate impacts already observed and other impacts would be triggered. 2-4°C would lead to worsening impacts at all scales. If sustained this could lead to several metres of sea level rise (Source: Committee on Climate Change <https://www.theccc.org.uk/tackling-climate-change/the-science-of-climate-change/setting-a-target-for-emission-reduction/>)

<sup>iii</sup> See: [http://www.eumayors.eu/IMG/pdf/covenantofmayors\\_text\\_en.pdf](http://www.eumayors.eu/IMG/pdf/covenantofmayors_text_en.pdf)

<sup>iv</sup> See: [https://www.theccc.org.uk/archive/aws/Local%20Authorities/LA%20Report\\_summary.pdf](https://www.theccc.org.uk/archive/aws/Local%20Authorities/LA%20Report_summary.pdf)

<sup>v</sup> Targets are set against a 2005 baseline and as an 'absolute reduction', and approved by full Bristol City Council in 2009 and 2010

<sup>vi</sup> CO<sub>2</sub> emissions within the scope of influence of Local Authorities excludes emissions from Road Transport (Motorways), Diesel Railways, Land Use, Land Use Change and Forestry sectors and EU Emissions trading system sites have been removed from the "Large industrial installations" sector with the exception of energy suppliers (e.g. power stations), whose emissions are indirectly included via the end-user estimates for electricity use.

<sup>vii</sup> For example: Covenant of Mayors, Compact of Mayors, The Carbonn Climate Registry, The Nantes Declaration of Mayors and sub-national Leaders on Climate Change.

<sup>viii</sup> The UK's Core Cities are Birmingham, Bristol, Cardiff, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield.

## OUR CURRENT PERFORMANCE: BRISTOL'S ENERGY USE AND EMISSIONS

### The City of Bristol

Bristol is one of UK's ten core cities and the largest city in the South West region. The City Council's administrative area covers approximately 110km<sup>2</sup> with a population of over 440,000<sup>9</sup> people.

Bristol's population is forecast to increase by approximately 5% by 2020, and by 20% by 2036 on 2015 levels<sup>10</sup>. On the basis of recent demographic trends the number of households is also predicted to rise by approximately 10,000 (5%) by 2020 and by 40,000 by 2036 (c.20%). These changes in population will increase the overall demand for energy, will impact upon Bristol's ability to meet its emission targets, may impact upon the quality of life of Bristol's residents, and could affect Bristol's status as the UK's most liveable city.

The latest data available shows that approximately 13% of all households in the City of Bristol lived in fuel poverty during 2012<sup>11</sup>, and whilst levels of fuel poverty vary greatly across the City, in the worst affected ward 27% of households were considered as being fuel poor.

There is no direct code for the low carbon sector in the Standard Industry Classification (SIC) system, however data available on the Low Carbon Environmental Goods and Services (LCEGS) sector<sup>12</sup> has been collated to measure growth in the 'green economy'. This data indicates that between 2007 -13, the LCEGS sector accounted for an average of 4.7% of all jobs in Bristol, with an additional 3.6% of jobs made up from the environmental technology category.

### Bristol's Energy System

At present, the majority of Bristol's energy is supplied from the national energy infrastructure and the ability to meet carbon reduction targets depends heavily on the decarbonisation of the national electricity network. As a result overall energy mix and uptake of energy efficiency, low carbon and renewable measures is heavily impacted by policy, regulation and incentives set at the national level.

There are many stakeholders with different roles within the energy system including users, generators, suppliers, distributors, transportation and storage providers, traders, service providers, financial investors and advisers, land owners and third sector organisations. These have been mapped as part of the STEEP project.

This section describes the Bristol energy system in terms of the type and quantity of fuels and energy consumed. It looks at how energy is used within Bristol, and presents the current understanding of local energy generation.

### What We Measure?

Bristol has been monitoring its energy use and carbon dioxide emissions at the City and Council level since 2005. The scope of Bristol's monitoring program has changed, and will continue to change as our understanding of the Bristol energy system evolves, and in response to BCC's international commitments under initiatives such as the 'Covenant of Mayors'<sup>13</sup> and the 'Compact of Mayors'.

BCC currently uses data collected by the UK Government Department for Energy and Climate Change (DECC)<sup>14</sup> to monitor and reports on the CO<sub>2</sub> emissions arising from within the City of Bristol and CO<sub>2</sub> emissions associated with grid supplied electrical energy consumed within the City of Bristol, but generated elsewhere, for:

- Domestic buildings;
- Non-domestic buildings, equipment/facilities including commercial, industrial, education, public administration but excluding some major industrial operations;
- Road Transport within the local authority area (excluding traffic on motorways); and,
- Residual fuel consumption.

BCC also collects energy consumption and CO<sub>2</sub> emissions data for Council activity including energy used for operating buildings, street lighting, running vehicle fleet and business travel. In recognition that full and up to date data will better inform action to reduce emissions, BCC will keep the scope of its monitoring framework under review.

In response to commitments to international initiatives including the Compact of Mayors, future data reporting will include:

- Emissions data in metric tonnes of CO<sub>2e</sub> (carbon dioxide equivalents);
- Emissions from additional sectors (i.e. waste, industrial processes and product use (IPPU) & agriculture, forestry and other land use);
- More Greenhouse gases (methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O)); &
- GHG emissions that occur outside the city boundary as a result of consumption activities (e.g. food production) taking place within the city boundary<sup>15</sup>.

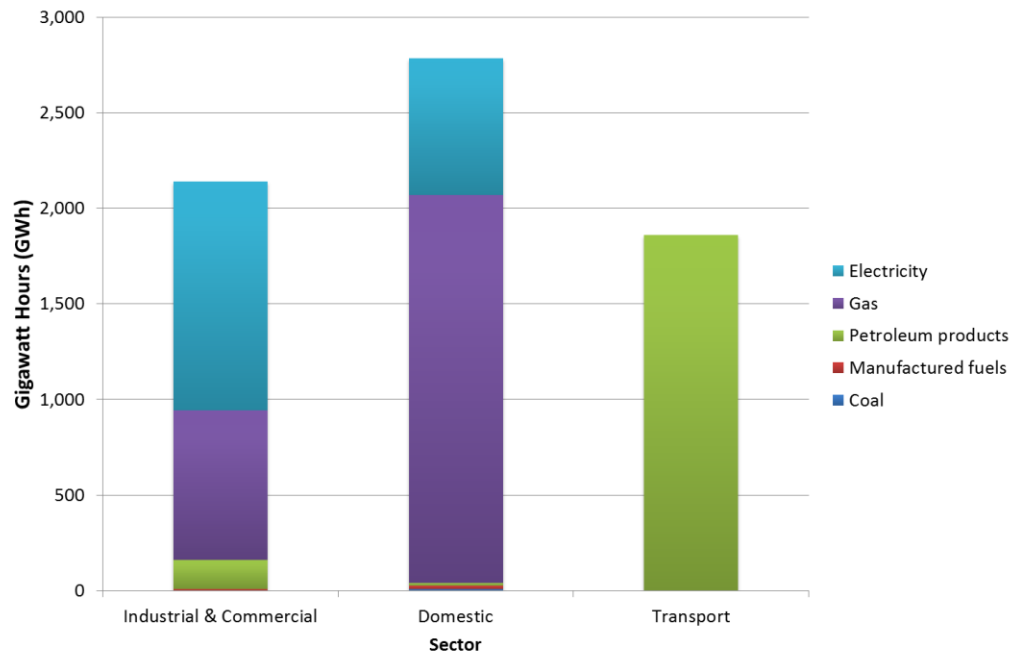
### City of Bristol Energy Use, Energy Generation and Carbon Emissions

#### ENERGY USE

Based on most comprehensive and current DECC data available<sup>16</sup> a total of 6,602 GWh of energy was consumed by the City of Bristol in 2013. 27% of all energy was consumed in the transport sector, 32% in non-domestic, and 41% in the domestic sector.

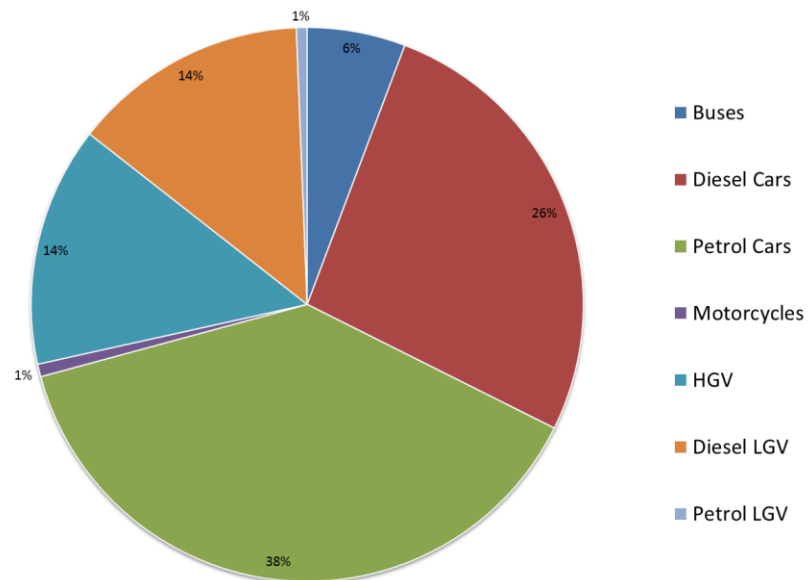
The City of Bristol uses more gas than electricity, with gas accounting for approximately 40%, and electricity for approximately 28% of all fuel consumed. Gas was the dominant energy source for the domestic sector accounting for 72% of the all energy consumed, whilst electricity was the dominant energy source for the non-

domestic sector accounting for 63% of all energy consumed.



**Figure 2: Bristol's Energy Consumption by Sectors (2013)**

For transport, approximately 130 thousand tonnes of fuel were consumed in 2013 of which 40% was petrol and 60% diesel<sup>17</sup> (See Figure 3 below). DECC statistics indicate that total energy consumption for transport declined by 9% over 2005-2013. Within this, personal transport declined by 13%, while freight transport increased by 2%.



**Figure 3: Fuel Vehicle Use for City of Bristol (2013)**

## ENERGY GENERATION

Research shows that the City of Bristol has a total installed generation capacity of renewable electricity of 60.5MW, and an installed renewable heat capacity of 20MW. In terms of non-renewable sources, there is 4.92MWe of gas CHP and 1,145MW of conventional power generation (at one site, Seabank, which feeds directly into the national transmission network).

Bristol is a dense urban area and the options for the deployment of large scale renewable installations are limited. This said, in recent years there has been rapid growth in the amount of renewable energy generated, albeit from a very low base, and this growth has seen renewable energy contribute ~ 3% of Bristol's current energy demand<sup>18</sup> (See tables 4 and 5 below).

**Table 4: Local Renewable Electricity Generation<sup>19</sup>**

Technology	Installations	Capacity (MW)	Estimated annual output (GWh)
Anaerobic digestion	2	5.750	Not known
Biomass	1	12.936	Not known
Energy from waste	3	13.110	Not known
Sewage gas <sup>20</sup>	1	5.75	Not known
Solar photovoltaic	3,128	12.769	7.7
Wind	3	23	49.9
<b>Total electricity</b>	<b>3,318</b>	<b>60.546</b>	

**Table 5: Local Renewable Heat Generation**

Technology	Installations	Capacity (MW)
Anaerobic digestion	2	4.25
Biomass	27	7.64
Heat pumps	54	0.572
Sewage gas	1	7
Solar thermal	140	0.61
<b>Total heat</b>	<b>224</b>	<b>20.072</b>

Research conducted as part of the STEEP project has highlighted that there are significant opportunities for further deployment of renewable energy technologies in the City of Bristol<sup>21</sup>:

- Whilst there is limited scope for significant additional generation of wind energy within Bristol, up to 30 15kW turbines could be constructed in Avonmouth giving an additional capacity of 450kW.
- Roughly 640 oven dry tonnes (odt) per year of biomass could be expected from woodlands, with woodchip from tree surgery activities in Bristol's parks and streets, and in a survey undertaken for the Bristol Biomass Study (CSE, 2003) around 270 odt per year of untreated wood residues were identified from 10 joinery/sawmill firms in Bristol, generating 0.4 MW (heat-only).
- A report produced in 2011 as part of the Bristol Solar Rooftop Mapping Project identifies potential solar PV capacity of at least 322MW.

### CO<sub>2</sub> EMISSIONS

Based on emissions data available from DECC<sup>22</sup> for the year 2013:

- A total of 1,968,000t CO<sub>2</sub> was emitted through activity within the local authority area.
- Of Bristol's CO<sub>2</sub> emissions, 22% are from the transport sector, 38% from non-domestic, and 40% from the domestic sector. This compares to the national breakdown of 24%, 41% and 35% respectively.

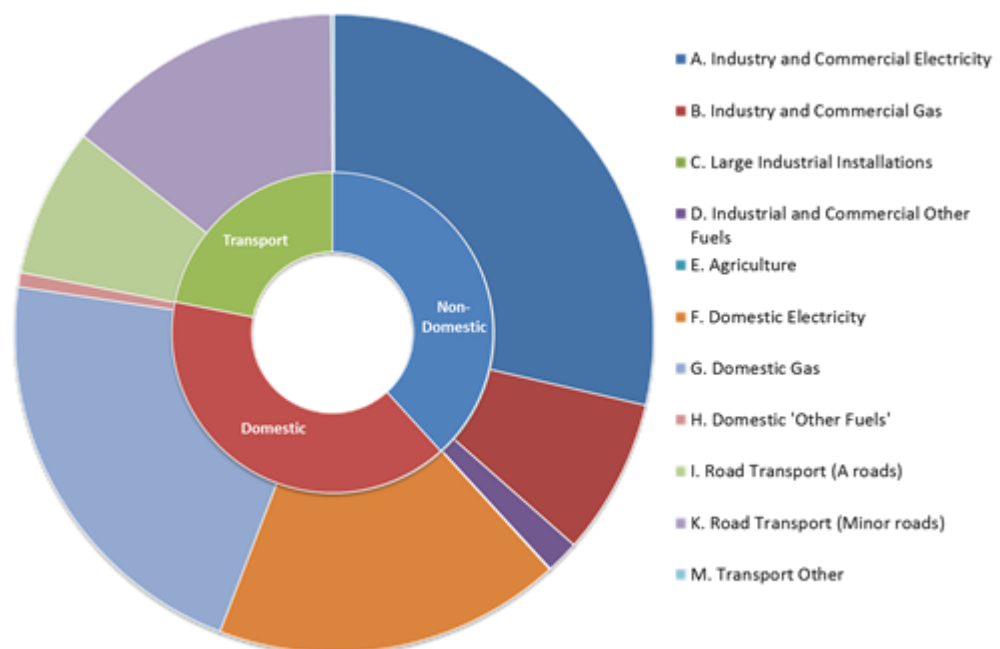


Figure 4: City of Bristol CO<sub>2</sub> Emissions (2013)

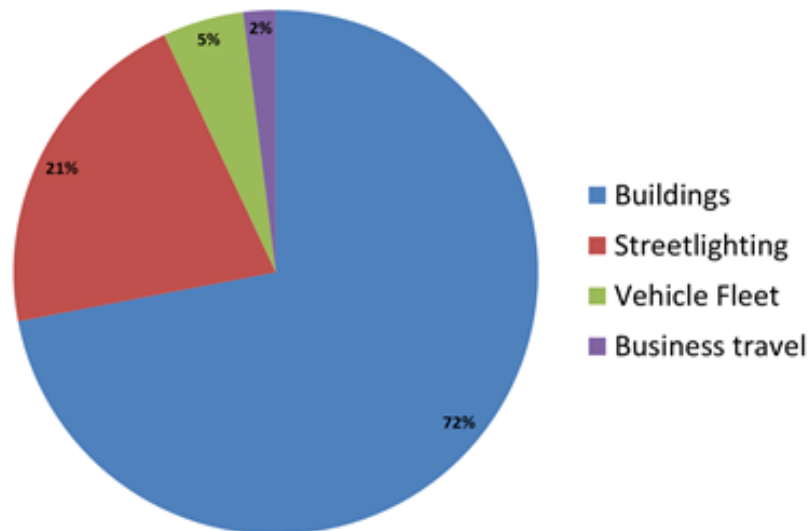
### Bristol City Council Energy Consumption and Carbon Emissions

Whilst directly responsible for only a small fraction of overall city emissions, Bristol City Council (BCC) is a key player in delivering emissions reductions and has scope to influence and facilitate action and engage partners beyond its immediate responsibilities. It is therefore important that BCC demonstrates leadership and is transparent and supportive in its approach to reducing its own greenhouse gas emissions and addressing climate risk. BCC collects information annually on its energy consumption and carbon emissions for the purposes of its Annual Environmental Statement, which are verified by an independent auditor.

Data indicates that electricity accounts for 55% of energy consumed, 41% by council buildings and 14% by street lighting. Gas use within buildings accounts for 44% of energy consumed.

With regards to transport, BCC consumed approximately 52,400 litres of petrol and 678,444 litres of bio-blend diesel. This equates to approximately 7% of BCC's total energy use.

BCC's CO<sub>2</sub> emissions for the 2014/15 financial year were 35,635 tonnes. Of the total emissions, 72% are attributed to the operation of Local Authority buildings (e.g. offices, museums and libraries), 21% from the operation of street lighting and 7% from business travel.



**Figure 5: Bristol City Council's Carbon Emission Profile**

Bristol City Council has successfully reduced its emissions by 38% from a 2005 baseline, thus almost achieving its 2020 emission reduction target 5 years early (See Figure 6 below)





**Figure 6: Bristol City Council CO<sub>2</sub> Emissions 2005-2015**

<sup>9</sup> Population Estimates for UK, England and Wales, Scotland and Northern Ireland, Mid-2014  
<http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcn%3A77-368259>

<sup>10</sup> Source: Table 2: 2012-based Subnational Population Projections for Local Authorities in England -  
<http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Sub-national+Population+Projections#tab-data-tables>

<sup>11</sup> A fuel poor household is one in which a household has required fuel costs that are above the median level; and were the household to spend that amount, they would be left with a residual income below the official poverty line (<https://www.gov.uk/government/collections/fuel-poverty-sub-regional-statistics>)

<sup>12</sup> The definition is broad and includes activities that may appear under the overlapping headings of Environmental, Eco, Renewables, Sustainable, Clean Tech, Low Carbon or No Carbon. The threshold for including a company in the analysis is if at least 20% of estimated sales activity can be attributed to the LCEGS Sector.

<sup>13</sup> The Covenant of Mayors and Mayors Adapt are merging and in the future the Sustainable Energy Action Plans (SEAPs) will include an adaptation/resilience component and will be called a Sustainable Energy and Climate Plan (SECAP). It will need to be submitted every two years.

<sup>14</sup> The DECC data show emissions allocated on an “end-user” basis where emissions are distributed according to the point of energy consumption (or point of emission if not energy related). Except for the energy industry, emissions from the production of goods are assigned to where the production takes place. Therefore, emissions from the production of goods which are exported will be included, and emissions from the production of goods which are imported are excluded. See: <https://www.gov.uk/government/organisations/departments-of-energy-climate-change/about/statistics#emissions-and-climate-change-statistics>

<sup>15</sup> UK evidence suggests that emissions occurring outside the city, but driven by the consumption of materials within cities are significant, and may in some instances be twice as large as those arising from the use of electricity, gas, solid fuel and transportation within the city. See: John Barrett, Glen Peters, Thomas Wiedmann, Kate Scott, Manfred Lenzen, Katy Roelich & Corinne Le Quéré (2013) Consumption-based GHG emission

accounting: a UK case study, Climate Policy, 13:4, 451-470, DOI: 10.1080/14693062.2013.788858 To link to this article: <http://dx.doi.org/10.1080/14693062.2013.788858>

<sup>16</sup> Source: <https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2010>

<sup>17</sup> Source: DECC Sub-national road transport fuel consumption statistics - <https://www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level>

<sup>18</sup> Source: STEEP website and The Bristol Solar Rooftop Mapping Project ([http://www.bristol.gov.uk/sites/default/files/documents/environment/climate\\_change/5%20Bristol%20Sunshine%20-%20An%20Analysis%20of%20Rooftop%20Solar%20Mapping.pdf](http://www.bristol.gov.uk/sites/default/files/documents/environment/climate_change/5%20Bristol%20Sunshine%20-%20An%20Analysis%20of%20Rooftop%20Solar%20Mapping.pdf))

<sup>19</sup> Data sourced from Regen SW's annual renewable energy survey ([http://www.regensw.co.uk/wp-content/uploads/2014/08/progressreport\\_2014\\_web\\_26a4646ced906a17.pdf](http://www.regensw.co.uk/wp-content/uploads/2014/08/progressreport_2014_web_26a4646ced906a17.pdf)) , the Feed-In Tariff register (<https://www.ofgem.gov.uk/environmental-programmes/feed-tariff-fit-scheme/feed-tariff-reports/installation-reports>) , and the Renewable Energy Guarantees of Origin report : <https://www.renewablesandchp.ofgem.gov.uk/Public/ReportManager.aspx?ReportVisibility=1&ReportCategory=0>.

<sup>20</sup> Renewable Energy Guarantee of Origin data puts sewage gas capacity at 5.55MW, while Regen SW survey puts it at 5.75MW

<sup>21</sup> Source: [http://tools.smartsteep.eu/wiki/Bristol\\_Energy\\_Plan\\_System\\_Description](http://tools.smartsteep.eu/wiki/Bristol_Energy_Plan_System_Description)

Note: Table includes Energy from Waste which is defined as partially renewable and only the energy contribution from the biogenic portion would count towards renewable energy targets ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/284612/pb14130-energy-waste-201402.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/284612/pb14130-energy-waste-201402.pdf))

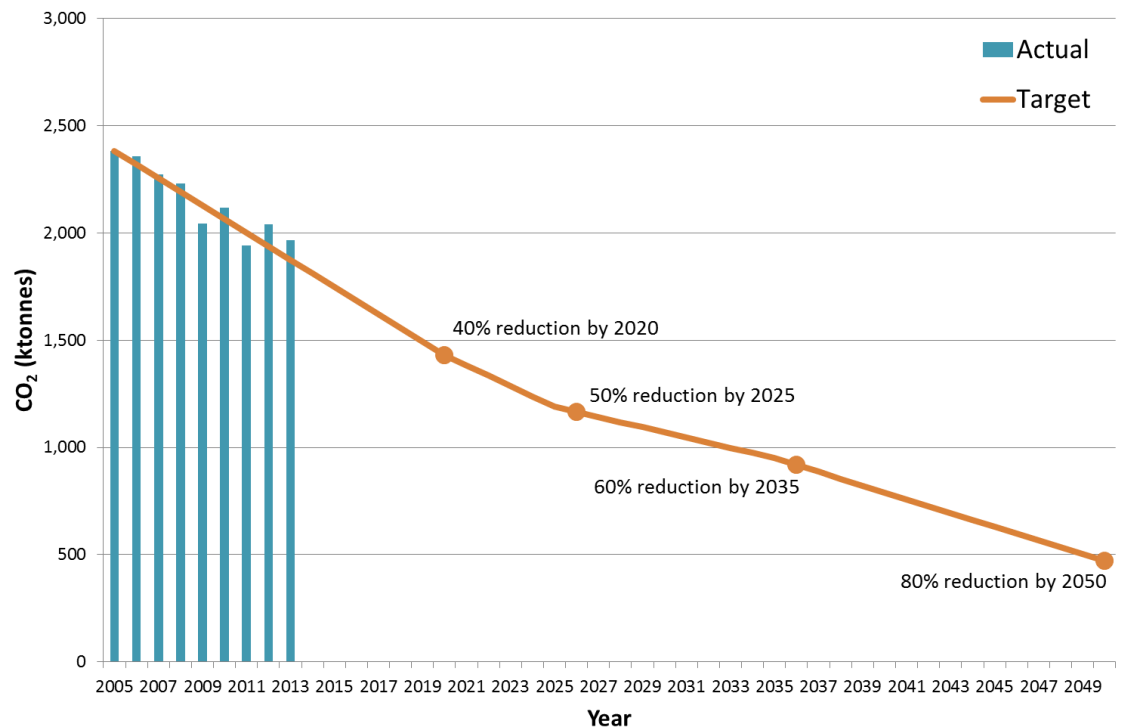
<sup>22</sup> NOTE: Current data available is from DECC. It incorporates LA emissions for transport, domestic and industrial and commercial activity. It excludes waste and waste water, and excludes shipping, aviation and military transport. BCC is in the process of updating its emissions inventory and in doing so is reviewing the scope. Ideally we would be using local data to refine these figures. These are decisions we need to make on the scope of the inventory.

## OUR PROGRESS SO FAR: WHAT WE'VE DONE TO REDUCE EMISSIONS

### Progress against targets

#### TRENDS AND PERFORMANCE AGAINST CURRENT TARGETS

Businesses, public bodies, NGOs and citizens have undertaken a range of interventions within Bristol in recent years. This combined with grid decarbonisation and other external factors, such as the 2008 recession, has significantly reduced energy demand and carbon dioxide emissions in the City (see Figure 7). This reduction has been achieved in the context of a growing population.



**Figure 7: Graph of Progress against Target**

CO<sub>2</sub> emissions in any year are subject to a wide range of factors – including changes in the mix of energy used in UK power stations and the weather.

DECC<sup>23</sup> data shows that for the years 2005-2013:

- Absolute emissions fell 17.4%, from 2,383,000 to 1,968,000 t CO<sub>2</sub>.
- Per Capita Emissions decreased 23.5%, from 5.9 to 4.5 t CO<sub>2</sub>
- The industrial and commercial sector, followed by domestic and then transport, saw the biggest reduction in CO<sub>2</sub> emissions.
- The City of Bristol has achieved an average reduction in emissions of 2.3% a year. It had previously been identified that a 3% year on year reduction was required to meet the 2020 target.

- At its current average rate the City of Bristol would achieve a 40% reduction from 2005 levels in around 2022, two years later than planned (See below).
- In order to achieve the 40% target by 2020, a further 22.6% reduction is required, equating to a year on year reduction of approximately 4.5% (See below).
- Energy consumption for the City of Bristol fell from 8,300 Gigawatt Hours (GWh) in 2005 to 6,789 GWh in 2012. This amounted to a reduction of approximately 18%, achieved at an average rate of 2.8% per year. A further 12% reduction is required in order to attain the 30% target by 2030.

With over 50% of the human population living in urban areas cities have a major role to play in reducing greenhouse gas emissions, and the City of Bristol is committed to playing its part in achieving wider UK targets for reducing emissions, through setting city-wide targets for reducing emissions by 40% by 2020, and 80% by 2050.

Reviewing our status leads to some key factors to consider in planning for the next phase of action:

- The City Council is on course to achieve a reduction from its own activities in line with the city-wide target for 2020 and is providing leadership in this field.
- The City of Bristol has achieved an average reduction in emissions of 2.3% a year. This is marginally faster than the UK average but not sufficient to achieve the targets on time.
- Some of the reductions in CO<sub>2</sub> emissions are likely to be a result of the recession; however Bristol has succeeded in significantly reducing the carbon emissions per pound of GVA.
- Bristol's economy and population are growing and this is driving an increased demand for energy, and CO<sub>2</sub> emissions.
- In the last few years there has been significant action by BCC and others which is creating a pipeline of projects and interventions which are not yet reflected in the data.
- Many of the savings have been achieved by relatively easy "quick wins", however we are aware there is still more to do.
- Progress so far has been achieved thanks to action from all sectors and many businesses, public bodies and citizens. Achieving our future targets will require an even greater substantial contribution from all sectors, and a scale of action, investment and collaboration significantly beyond what we have seen to date.
- Annual monitoring and reporting through our Eco-Management and Audit Scheme (EMAS) is a key mechanism to help drive improvements.

### Action taken to date

In February 2010, Cabinet adopted the Climate Change and Energy Security Framework incorporating actions aimed at meeting the adopted targets for emissions reduction.

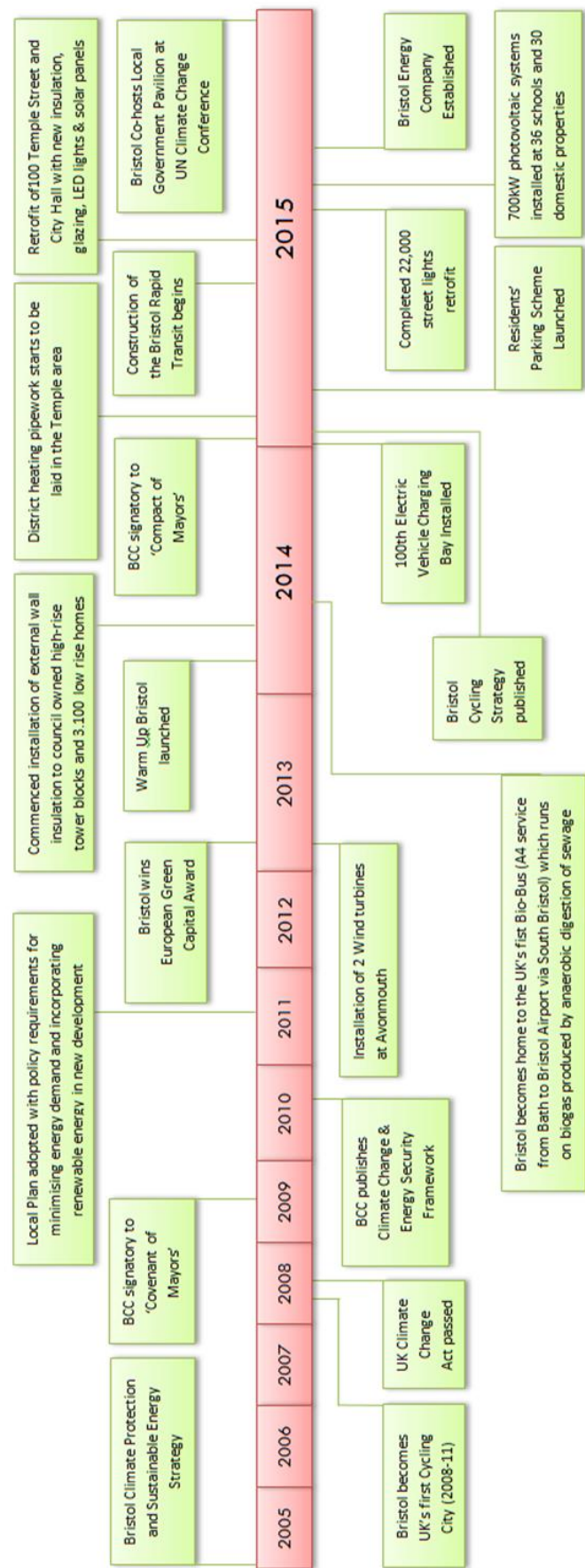
Subsequently, in March 2012 Cabinet updated the Framework for the period 2012-15. This set out a range of actions across eight sectors to be undertaken by BCC alongside delivery partners.

Significant progress has been made against a number of the key actions identified within the 2012-2015 framework and by other action taken by citizens and organisations across the city. The diagram below illustrates some of the key actions taken to date which have assisted in reducing Bristol's emissions.

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<sup>23</sup> Source: Sub-national total final energy consumption in the United Kingdom 2005-2012 (DECC)

Figure 8: Timeline of Some of BCC’s Climate Change Activities



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## OUR OPPORTUNITIES FOR ACTION: HOW CAN WE FURTHER REDUCE OUR EMISSIONS?

### Analysis of Evidence

The University of Bristol (UoB) have conducted a 'Mini-Stern' review to identify and assess the range of interventions and scenarios available to reduce the City of Bristol's CO<sub>2</sub> emissions. The study reviews the cost and carbon effectiveness of a wide range of the low carbon options (143 in total) that could be applied at the local level in households (30), industry (72), commerce (27) and transport (14), shown in the appendix of this report. The review used nationally available datasets including estimates for Gross Domestic Product (GDP), discount rates, interest rates, energy prices, population and new building activity, to estimate savings emerging from different measures (energy, cost and carbon), future energy prices, and the rate of decarbonisation of the UK electricity grid. For assessing business-led mitigation scenarios a typical, yet relatively conservative, interest rate of 8% is applied. When considering more ambitious scenarios the maximum potential for the deployment of interventions is assumed.

The interventions have been selected based upon previous work by the UK Committee on Climate Change and the inputs have been refined using Bristol specific information provided by the STEEP project and Bristol City Council (BCC) in order to improve the accuracy of the models. Interventions have been assessed on their scope for deployment, the associated investment needs, financial returns and carbon savings, and the implications for the economy and employment. The study covers the City of Bristol (CoB), an area with a population of 450,000 people, an economy worth £14 billion a year and an energy bill of £0.9 billion a year. All calculations have been based upon Gross Value Added (GVA), a productivity metric that measures the difference between output and intermediate consumption. GVA provides a pound (£) value for the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production.

### Results

Preliminary results indicate that by 2025, compared to 2005 levels, the City of Bristol could reduce its carbon emissions above and beyond the expected reductions forecast from, for example, the decarbonisation of the national grid and increases in the price of energy (sometimes termed 'business-as-usual') by:

- 12% through cost effective investments that would pay for themselves (on commercial terms) over their lifetime. This would require an investment of £580 million across Bristol's economy, generating average annual savings of £175 million, paying back the investment in 4 years before generating further savings for the lifetime of the measures.
- 17% through cost neutral investments that could be paid at no net cost to the city's economy if the benefits from cost effective measures were captured



and re-invested in further low carbon measures. This would require an investment of £2.2billion, generating average annual savings of £240 million, paying back the investment in 10 years before generating further savings for the lifetime of the measures. This includes the cost effective measures listed above.

- 18% with the exploitation of all of the realistic potential of the different measures. This would require an investment of £4.1 billion, generating annual savings of £250 million, paying back the investment within the lifetime of the measures. This includes the cost effective and cost neutral measures listed above.

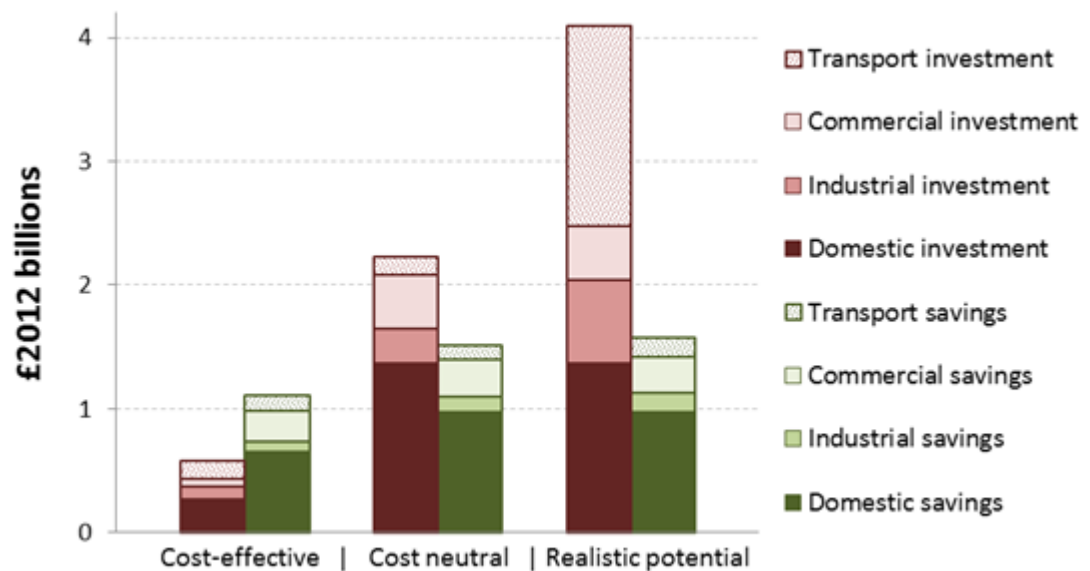


Figure 9: Investment Scenarios and their Return Between 2015-2025

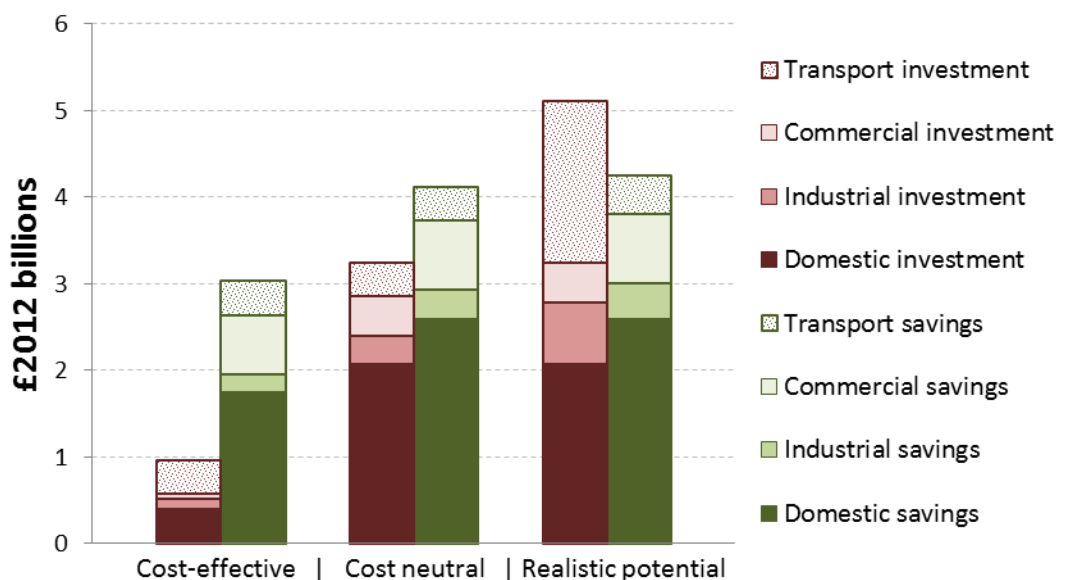


Figure 10: Investment Scenarios And Their Return Between 2015-2035

However, this assumes that all measures are implemented simultaneously where in reality it has been assumed in many instances that the actual deployment rate is approximately 10% per annum over ten years, thus achieving full deployment within 10 years. This is why figures 10 and 11 don't show all returns on investment immediately, and in reality the savings take place over a much long period of time.



Figure 11: The City of Bristol's Energy Economy

Whilst many of the cost effective interventions for households and commercial make significant returns on their investments over the 10 year period, 2015 to 2025 (figure 10), interventions in the industry and transport sectors only break even. When considered over a longer period, from 2015 to 2035 (Figure 11), households, commercial and industrial interventions all produce a significant return on investment, whereas the transport sector interventions again only break even. This is because some of the industry and all the transport interventions have very long payback periods. Furthermore, transport intervention investments often have other benefits which provide a compelling case for their implementation, for example reducing congestion, improving air quality, increasing productivity, which are not considered within this analysis.

### Meeting Our Targets?

Under a business as usual scenario assuming central energy prices and taking into account projected grid decarbonisation (the blue line on figure 12) the City of Bristol will not meet any of its future emission targets (shown in green). However, the City of Bristol can meet its 2020 and 2025 emission targets (a 40% and 50% reduction on 2005 baseline respectively) through implementing the majority of the cost effective measures. To achieve its 2035 emission target (60% reduction in CO<sub>2</sub> on 2005 baseline), the City of Bristol will have to implement all cost neutral measures. It is also worth mentioning that the business as usual scenario (the blue line) is by no means guaranteed and if government policy does not deliver broad national grid decarbonisation, or increased prices, then greater efforts will be needed at the local level for the City of Bristol to achieve its carbon dioxide emission commitments.

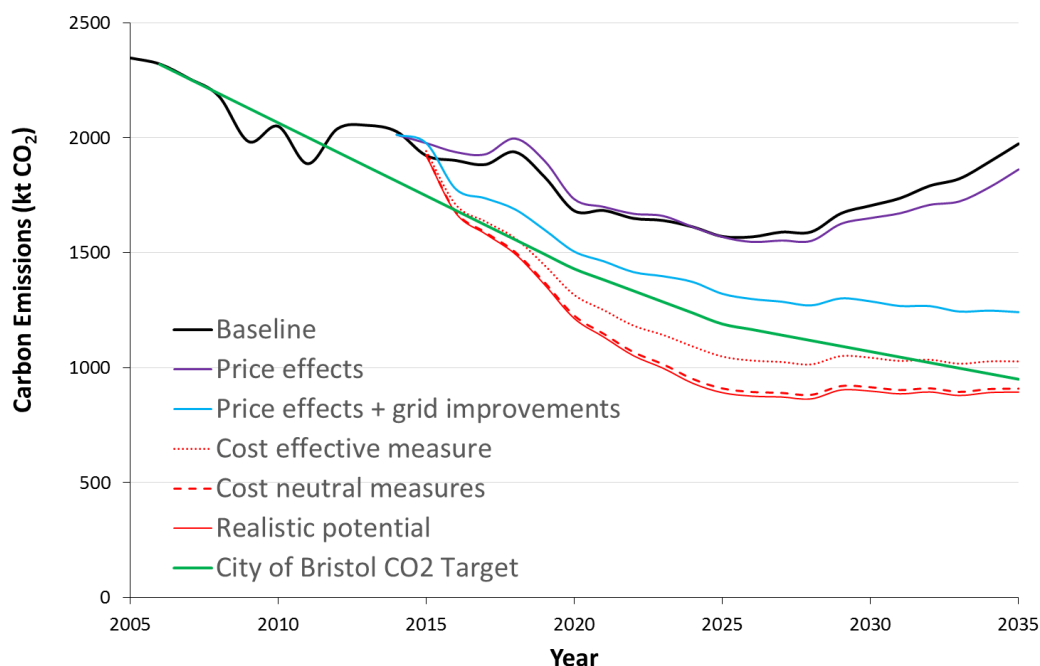


Figure 12: City of Bristol CO<sub>2</sub> Emissions and Intervention Scenarios

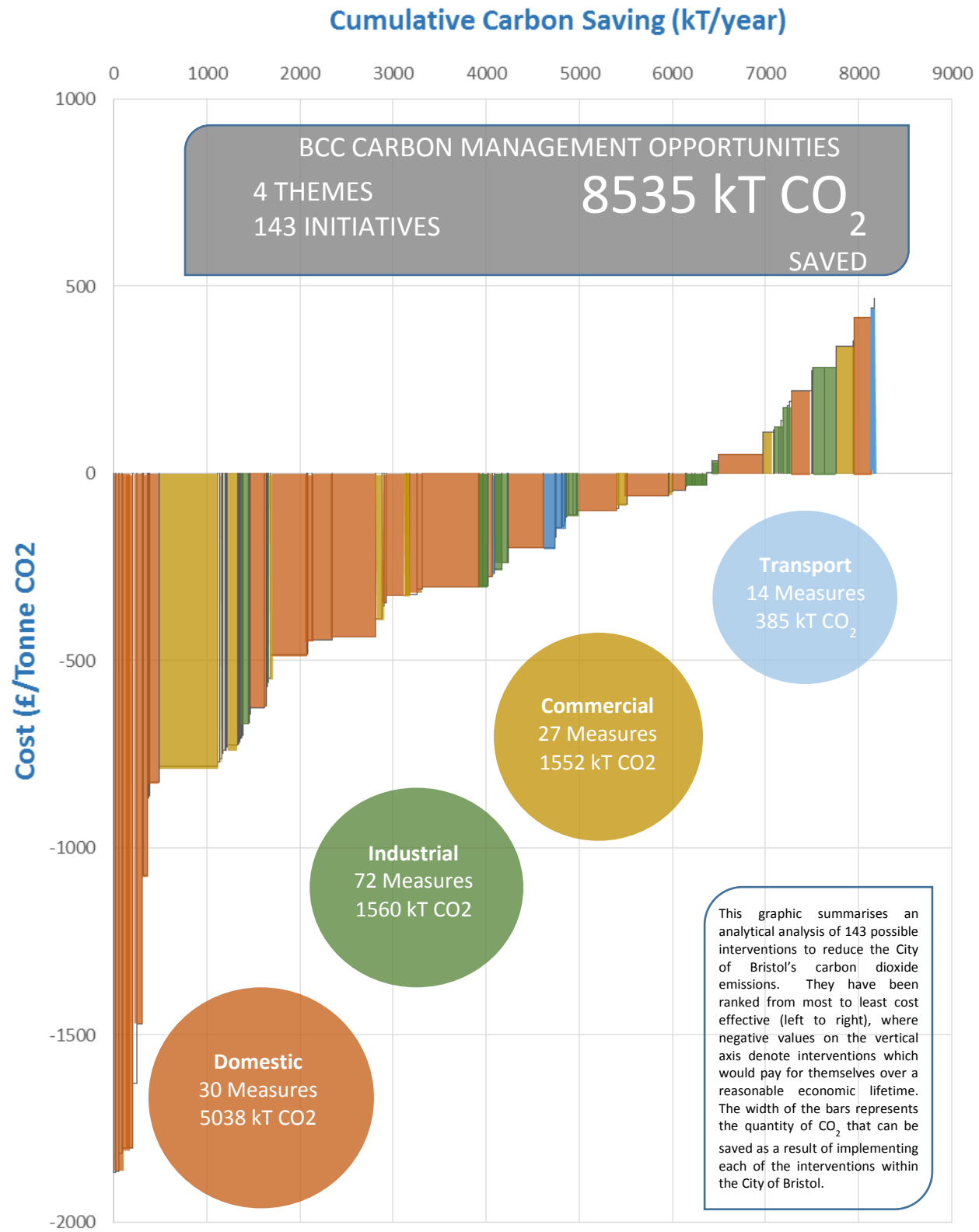


Figure 13: Marginal Abatement Cost Curve for All Interventions in All Sectors to 2035

### Energy Bill Savings

The energy savings identified by the Mini-stern analysis are particularly significant given projected energy price increases. The City of Bristol's energy bill is currently £870 million per year and under the business-as-usual trends this will remain at approximately the same level in 2025, as reductions in energy use are offset by rising energy prices. However, investments now will help to significantly reduce the City's energy bill:

- with investment in all of the cost effective measures, the 2025 annual energy bill could be cut by £220 million (26% of the projected cost).
- with investment in all of the cost neutral measures, it could be cut by £300 million (35% of the projected cost).
- with investment to exploit all of the realistic potential, it could be cut by £320 million (38% of the projected cost).

Against these projected energy price increases, such investments could provide an effective buffer and reduce the impact of energy prices fluctuations, thus making the city more resilient.

### Employment Impacts

The investment in reductions in energy bills and carbon footprints will also have wider economic benefits, providing additional jobs and money for the City of Bristol. If all the cost effective measures were implemented by 2025 this will generate 2,000 jobs, whereas if all the cost neutral measures were exploited this would lead to a further 8,000 jobs. This includes those directly and indirectly created as well as those induced by economic multiplier effects. Implementation of all the cost effective and cost neutral measures would lead to the generation of 10,000 jobs over the next ten years.

### Low Carbon Investment: Supply and Demand

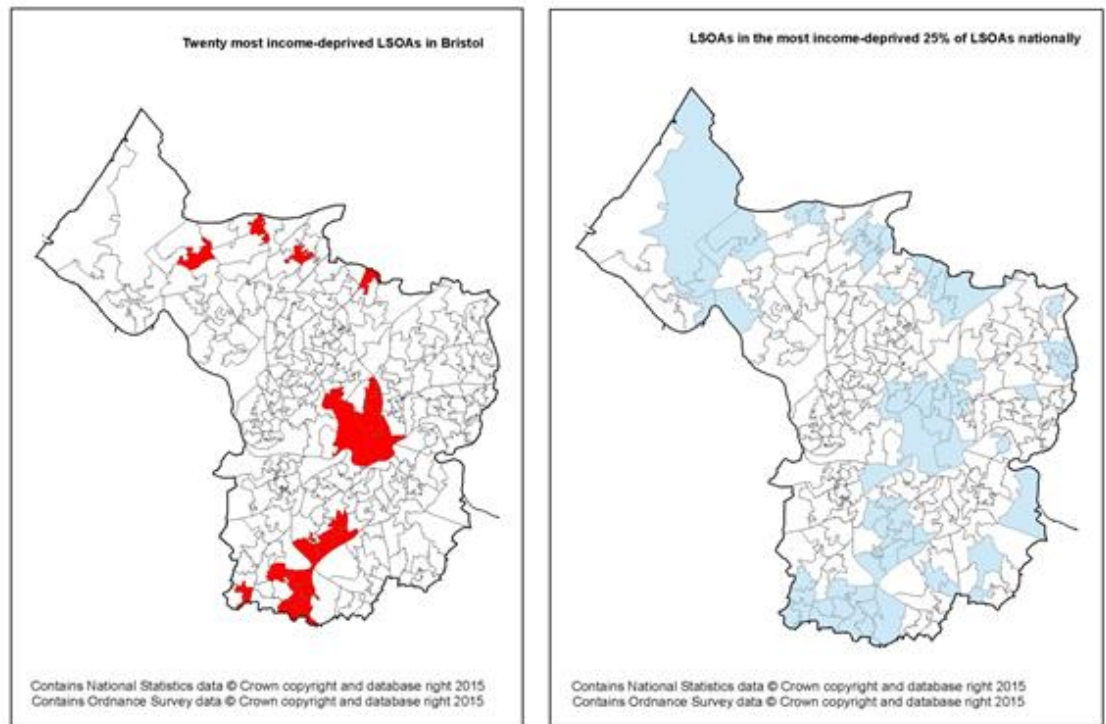
The Mini-Stern analysis identifies considerable potential for the City of Bristol to reduce its energy use and carbon emissions whilst benefiting the local economy. However, this will require significant investment and innovative financing mechanisms based on new forms of cost recovery and benefit sharing, not to mention new ways of managing risk. This is particularly true for the cost neutral measures where the income generated from the cost effective measures needs to be captured and reinvested in further interventions within the City of Bristol.

### Realising Co-Benefits

Whilst the Mini-Stern Review for Bristol quantifies energy savings, carbon reduction, pay-back periods, and job creation associated with a range of carbon reduction measures, there is a need to consider social equity and broader sustainability issues, such as reducing fuel poverty and improving health. For example, home energy improvements should reduce heating costs, prolong the lifespan of housing stock, and improve comfort and health, and these benefits will

have greater impact when applied to older less efficient housing stock and lower income homes.

Interventions must be designed in such a way that reduces emissions and maximizes these wider co-benefits. This requires careful consideration of the combination and order in which measures are deployed, and the scale and location of deployment. As such, a further level of detailed analysis and planning will be required to ensure that the action identified in this framework is implemented in a way that is cost-effective, maximises carbon reduction and other co-benefits.



**Figure 14: Deprived Areas within the City of Bristol<sup>24</sup>**

To illustrate this point, CSE has undertaken a social impact analysis of domestic intervention measures as part of the STEEP project. The analysis looked at 20 home improvement measures which lend themselves to spatial analysis, and assessed the impact concentrating these measures in specific most deprived areas of the city<sup>25</sup> (see Figure 14). The study found that:

- The direct financial savings per £ invested were greater in the more deprived areas than in the city as a whole, providing a 4.4% annual rate of return as opposed to 3.6%.
- If all possible measures were installed some £200m of investment opportunities exist within these most deprived areas of the City of Bristol.
- That there would be other additional benefits improving health and quality of life but these were not quantifiable.

### National & International Frameworks

The European and National framework for energy policy, regulation and incentives is a major determining factor in meeting emissions reduction targets. As such, BCC will continue to work with UK government to advocate the continuing decarbonisation of the national energy system, and enhance the uptake of energy efficiency, sustainable transport, low carbon and renewable energy measures at the local level.

There are multiple drivers of emissions which are beyond Local Authority Control<sup>26</sup>. To inform this framework it is necessary to understand the scope of BCC influence and the extent to which BCC can lead, enable and explore action to reduce emissions.

BCC has the potential to enact change through a range of tools and services including:

- Housing and planning
- Council land, buildings and services
- Finance and procurement
- Infrastructure funding and delivery
- Advocating change at national, regional and local levels
- Engaging, facilitating, linking and cooperating with local organisations
- Providing funding, information and capacity to support local action
- Informing citizens and encouraging behavioural change
- Working with VCS organisations on better governance and capacity building

### Energy & Climate Security

#### ENERGY SECURITY

Having secure supplies of energy is crucial for social and economic development, and our current systems provide abundant and reliable energy. However our energy systems are currently unsustainable and are increasingly vulnerable to shocks, stresses and strains which we need to identify, plan for and respond to, these include:

- The UK imports the majority of the energy it currently consumes – from across the world. Some of these supplies are vulnerable to changes in other government's policies, conflict and other disruptions.
- Fossil fuels are finite and fuels, like oil, are becoming increasingly more difficult to produce and this will affect their availability in the coming decades.
- World energy prices are predicted to rise over the coming decades, placing more people at risk of not being able to afford to heat their homes and increasing manufacturing and business costs.
- The UK is committed to reducing their carbon emissions and diverting their



## OUR RESILIENT FUTURE

focus away from fossil fuel power stations to less carbon intensive energy sources, however this will require significant investment that is not yet secured.

Bristol's energy security is inextricably linked to the security of the UK energy system. However, we can make our energy system more resilient, and improve our energy security at a local level, by focusing upon three priorities:

- Reducing energy use
- Generating energy locally
- Managing local energy supply through the creation of a locally owned energy company
- Assuring other organisations are doing similarly

In addition, we identify a variety of security issues which we need to explore further.

Improving the security of Bristol's energy system is a long term process and will be linked with the development of resilience across the city as a whole. A key part of this is the development of a Resilience Plan. This will address how the city becomes better able to flourish despite the shock, stresses and strains which will affect it over the coming decades.

### CLIMATE SECURITY

The world's climate is changing, and Bristol's climate is changing and will continue to change. We will need to adapt to the new climate and the resultant changes in weather. Bristol City Council will develop its adaptation plans as part of its work to develop a Resilience Plan for the city. The Resilience Plan will include the city's climate adaptation priorities. The outcome of this process will need to be properly integrated with this 'Framework for Climate and Energy Security' and BCC's wider corporate and land use planning strategies.

### Integration with Other Bristol initiatives

This Framework draws together the key relevant initiatives of the already adopted plans for Bristol and the West of England and seeks to inform emerging plans and strategies.

### JOINT LOCAL TRANSPORT PLAN 2011-26:

This is the statutory transport plan for the West of England, and sets a key objective to reduce carbon emissions. It sets out a wide range of ways to achieve this including:

- Promotion of low carbon choices
- Improving to walking and cycling infrastructure
- Public transport enhancements
- Demand management and reducing the need to travel



The Joint Local Transport Plan is supplemented by a range of other more detailed plans and major projects. Full details of these can be found at [www.travelwest.info](http://www.travelwest.info).

Some of the key projects are reflected in this Framework.

A new transport strategy for the West of England is being developed and the Climate and Energy Security Framework will inform its development.

### **THE BRISTOL LOCAL DEVELOPMENT FRAMEWORK:**

This is the statutory land use planning policy to 2026. It sets out an aim for the city to reduce carbon emissions and address the challenges of climate change, and sets out objectives to:

- realise the city's potential to use energy from renewable and low carbon sources
- Build new homes and businesses to high standards of environmental performance.

The planning policies also seek to support sustainable travel and to reduce the need to travel.

Full details of these can be found at [www.bristol.gov.uk/ldf](http://www.bristol.gov.uk/ldf)

A new West of England Spatial Strategy is being developed and the Climate and Energy Security Framework will inform its development.

## Conclusions

From a climate and carbon perspective, the analysis in this report suggests that the City of Bristol promptly pursues a range of decarbonisation interventions because the City cannot rely upon business-as-usual practices and the decarbonisation of the national grid to meet its target of a 40% reduction in emissions by 2020, let alone future emission commitments. Furthermore, if the decarbonisation of the national grid progresses more slowly than planned, Bristol could see a rise in emissions beyond 2025.

The economic returns on investment could be very significant indeed. Many of the measures make sound commercial sense and would pay for themselves in a relatively short period of time, they would generate significant levels of employment and economic growth in the process, and if done well there may be a wider range of indirect benefits (not least from being a first mover in this field).

The business case for large investments in the low carbon economy is very strong indeed. However, the transition depends on political and business leadership as well as financial capital. Achieving the targets will require major new initiatives with widespread and sustained influence in the domestic, commercial and industrial sectors.

<sup>24</sup> Lower Layer Super Output Area (LSOA) is geography area for the collection and publication of small area statistics. They are used on the Neighbourhood Statistics site and across National Statistics. They have an average of roughly 1,500 residents and 650 households.

<sup>25</sup> A summary of this work can be found on the CSE website: <https://www.cse.org.uk/>

<sup>26</sup> See: [www.theccc.org.uk/archive/aws/Local%20Authorities/LA%20Report\\_summary.pdf](http://www.theccc.org.uk/archive/aws/Local%20Authorities/LA%20Report_summary.pdf)

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## OUR PLAN: WHAT WILL BRISTOL CITY COUNCIL DO?

### Our Strategy

Bristol is committed to decarbonising our energy systems, our transport systems, our homes and our businesses. We don't yet know exactly how this will be done – that is a matter of political choices for successive national and local governments, and will be influenced by new technologies and economics. However, there are three fundamental goals which we will need to achieve:

- To replace energy from fossil fuel (i.e. coal, oil and gas) with energy from renewable sources which produce lower carbon dioxide emissions – such as wind, tidal, hydro and solar energy.
- To replace energy from fossil fuels with energy from low carbon sources, which are a by-product of resource use; e.g. anaerobic digestion, waste heat, biomass, and sewage sludge.
- To make our homes, transport and businesses much more energy efficient, reducing the overall demand for energy so that we can supply it from renewable and low carbon energy.

Many of the actions we will take to achieve these two goals will also generate other benefits – more efficient homes will be cheaper to heat, helping people out of fuel poverty, and helping to create healthier homes and healthier citizens.

### Lead, Enable, Explore

Through the action identified in this framework, Bristol City Council (BCC) is demonstrating strong leadership and responsibility in cutting carbon emissions, both from the Council's own estates and operations, and also those arising within the City of Bristol.

This section considers the evidence obtained through stakeholder engagement, a review of existing initiatives and strategies, and the outputs from the STEEP project and Mini-Stern, and uses this evidence to identify the actions that BCC needs to deliver against its energy consumption and carbon reduction targets.

The Framework seeks to establish an integrated and transparent plan for the whole city, whilst ensuring Local Authority accountability. As such, an appropriate balance needs to be struck between ensuring proper accountability of the Local Authority on the one hand and a fully inclusive approach on the other – recognizing and supporting other stakeholders in the fight against climate change.

The actions BCC can adopt have been sorted into three categories, defined as 'Lead', 'Enable' & 'Explore'. Actions are defined for the period 2015 – 2020, and our progress against these targets will be regularly reviewed and updated.

## Lead: BCC Shall Plan and Deliver

Local Authorities have a unique leadership opportunity to influence and drive significant changes to their energy systems resulting in reductions in greenhouse gas emissions. Bristol City Council has implemented a range of initiatives in previous years which have resulted substantial reductions across the City of Bristol.

However, much more needs to be done and Bristol City Council must maintain its current momentum and continue to develop further initiatives to tackle climate change across the domestic, commercial, industrial and transport sectors. Set out below is a list of actions which BCC will lead to tackle climate change across the City of Bristol.

### 1. Domestic Housing Low Carbon Refurbishment

#### What?

Bristol has launched one of the UK's largest energy efficiency and renewable energy domestic property investment programmes:

- 'Warmer Homes' will bring improvements to certain types of council homes, including numbers of low rise flats, houses and bungalows, and blocks of high rise flats. Over a nine to 10 year period we plan to (a) repair and improve 30 blocks of flats and (b) repair and improve 3,200 homes which were built using the 'No-fines' and 'Easiform' construction methods. In addition to Warmer Homes we are also delivering a range of other energy efficiency improvements e.g. high efficiency boilers, new glazing, loft and cavity insulation via separate programmes.
- 'Warm up Bristol' delivers energy efficiency improvements to privately owned homes, through assessing home energy performance, identification of improvements, provision of options and advice for grant funding and manages the installations.

#### Budget:

Warmer Homes:

- Cabinet approval has been given for up to £45M of external wall insulation for low rise homes and up to £60.5M for tower block external wall insulation projects, both subject to the capacity of the Housing Delivery Business Plan.

Warm Up Bristol:

- £40m of capital investment and circa £11m of ECO funding to support this investment

## OUR RESILIENT FUTURE

<p><b>Why?</b></p>	<p>The domestic sector accounts for approximately 40% of the City of Bristol's CO<sub>2</sub> emissions, with heating demand comprising the major source of emissions.</p> <p>The Bristol Mini-Stern identifies numerous opportunities for reducing the energy use and CO<sub>2</sub> emissions. Whilst reduce household heating by 1 °C, installing A++ rated cold appliances, installing ground and air source heat pumps and cavity wall insulation are some the most cost effective measures, external/internal and cavity wall insulation, low energy lighting, solar PV and mains gas, condensing combi-boilers have significant potential to reduce the City of Bristol's total energy consumption.</p> <p>The Mini-Stern suggests that cost-effective domestic measures could deliver a cumulative reduction in emissions in the region of 2200kt of carbon out to 2025, and 5030kt out to 2035.</p> <p>Additional co-benefits of adopting these interventions include:</p> <ul style="list-style-type: none"> <li>• Reducing heating costs for thousands of families, with secondary benefits to the local economy</li> <li>• Improving the appearance of much of Bristol's housing stock</li> <li>• Prolonging the lifespan of Bristol's housing stock</li> <li>• Reduced housing stock repairs and maintenance costs</li> <li>• Increasing the comfort of housing and improving residents' health - particularly to most socially disadvantaged and therefore vulnerable to climate change</li> </ul>	<p><b>KPIs/Targets:</b></p> <p>By 2018, these projects are expected to deliver:</p> <ul style="list-style-type: none"> <li>• £95m of investment in the City's domestic housing stock;</li> <li>• £14m of ECO funding to support this investment;</li> <li>• 17,900 tonnes of CO<sub>2</sub> savings annually;</li> <li>• £3.5m savings on residents' energy bill savings annually; and</li> <li>• A theoretical 5% reduction in Bristol's annual domestic gas usage.</li> </ul> <p>However, budget cuts may affect the delivery of the Housing Delivery Business Plan.</p>
<p><b>Who?</b></p>	<p>Bristol City Council: Energy, Major projects, Housing Delivery and Estates Management Services</p>	<p><b>Strategic Theme:</b> Domestic Buildings</p>

## 2. Heat Networks: City Centre, Redcliffe & Temple Quarter Enterprise Zone

<p><b>What?</b></p>	<p>BCC are planning and installing Heat Networks across the City in order to supply Low Carbon Heat</p>	<p><b>Budget:</b></p>
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	<p>and Power to connected buildings via underground, insulated pipework.</p> <p>The first sections of the Redcliffe &amp; Temple Heat Network were installed in Summer 2015 (as part of a General Purpose Service Trench that also included Superfast broad band ducting). This first section included Heat mains on the new Arena Island bridge to enable the Arena development to be connected. Construction has also been started on the first Energy Centre to supply the network incorporating a 1MW biomass boiler to supply zero Carbon heat.</p> <p>In addition to Redcliffe &amp; Temple, BCC are also planning a City Centre network (in association with the University of Bristol and University Hospitals Bristol Foundation Trust.</p> <p>The programme for the City Centre, and the Redcliffe and Temple areas forms the first phase of wider plans for a City wide Heat network that will take a number of years to develop and incorporates the delivery of a number of Gas CHP and biomass energy centres to supply council, public and private buildings.</p>	<p>£13million is allocated to developing and installing Heat Networks, but it is subject to change depending upon opportunities.</p>
<p>Why?</p>	<p>Space heating and hot water use is responsible for a significant proportion of the City of Bristol's CO<sub>2</sub> emissions and heat networks offer the most cost effective opportunity to reduce these as the alternative would be to retrofit low or zero Carbon technologies to every building which would be inherently expensive. Heat networks themselves do not directly reduced CO<sub>2</sub> emissions but allow low or zero carbon heat sources to be installed and also at the appropriate size rather than at a building by building level). Representative data on Heat Networks is being collected to for future application of the Mini-Stern.</p> <p>Heat Networks are a proven carbon saving technology, which also provides a range of additional co-benefits including:</p> <ul style="list-style-type: none"> <li>• Reduced CO<sub>2</sub> emissions through the more efficient use of fuel, and the use less carbon intensive fuels such as natural gas and biomass as fuel sources</li> <li>• Reduced fossil fuel consumption, resulting in lower emissions of nitrogen oxides (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>)</li> </ul>	<p><b>KPIs/Targets:</b></p> <ul style="list-style-type: none"> <li>• Completion of Redcliffe &amp; Temple Heat network Phase 1 – February 2016.</li> <li>• Redcliffe Phase 2 (expanded R&amp;T Heat network – 2020.</li> <li>• City Centre Phase 1 Heat network completed - 2019</li> </ul>

## OUR RESILIENT FUTURE

	<ul style="list-style-type: none"> <li>Despite relatively high capital costs, the provision of long term affordable costs and long term price stability</li> <li>The efficient management of heat provision, through a resilient design with the flexibility to respond to changes in fuel sources</li> </ul>	
Who?	<p>BCC - Energy Service, Planning Development Management and, Bristol Futures</p> <p>Delivery Partners - University of Bristol, University of Bristol Hospitals Trust, private developers</p>	<b>Strategic Theme:</b> Sustainable Energy Supply

### 3. Bristol Energy Company

What?	<p>The Energy Company will offer competitive, fair and simple energy tariffs with any profits reinvested back into local communities, and it will be the delivery vehicle for major energy efficiency and low carbon energy projects. Its initiatives will focus on supporting customers to use less energy, make homes cheaper to heat and helping communities become more self-sufficient.</p> <p>The Bristol Energy Company will be established, its business plan will be implemented, and the business will achieve Controlled Market Entry to supply energy across the City of Bristol, and beyond by the end of 2015.</p>	<p><b>Budget:</b></p> <p>£1.575m initial set up costs plus working capital funding, repaid with interest over time<sup>27</sup>.</p>
Why?	<p>Stationary energy use across the domestic, commercial and industrial sectors account for almost 80% of the City of Bristol's CO<sub>2</sub> emissions. Coupled with wide range of cost effective and emission reducing interventions identified through the Mini-Stern, makes this a significant focus area for tackling the City of Bristol's carbon emissions.</p> <p>Furthermore, there are a wide range of additional co-benefits of establishing the Bristol Energy Company will include:</p> <ul style="list-style-type: none"> <li>Generation and supply of locally generated low carbon energy</li> <li>Provision of fairer energy deals for households currently on prepayment meters</li> <li>Supporting community investment in renewable and low carbon projects</li> </ul>	<p><b>KPIs/Targets:</b></p> <p>The Bristol Energy Company is in the development stage and it is too premature to provide KPIs/Targets for its operation. They will be included when completed.</p>



	<ul style="list-style-type: none"> <li>Developing Heat Networks, electrical distribution and broadband/digital networks</li> <li>Protecting critical infrastructure and improving the City of Bristol's resilience</li> </ul>	
Who?	Bristol City Council: Energy Service	<b>Strategic Theme:</b> Sustainable Energy Supply

#### 4. Energy Efficiency Improvements to BCC Corporate Buildings

What?	<p>Whilst Bristol City Council (BCC) buildings only make a small contribution to the City of Bristol's overall carbon emissions, it is important that BCC show leadership in improving building retrofits through a programme of corporate energy efficiency projects that include:</p> <ul style="list-style-type: none"> <li>Finalising a major retrofit of City Hall which is currently underway</li> <li>Retrofitting the M-Shed, Central Library, City Museum and Colston Hall</li> <li>Retrofitting two exemplar schools to attract other schools to do similar work</li> <li>Upgrading the core BMS system to improve energy management across 8 core BCC buildings</li> <li>Developing an overarching strategy for retrofitting the Council's remaining buildings</li> <li>Creating an energy efficiency procurement framework to allow for large scale cost effective delivery</li> <li>Working with Bristol Workplace, Property, Housing, and Education work streams to increase energy efficiency by adding capital funding to exiting programmes.</li> </ul>	<p><b>Budget:</b></p> <ul style="list-style-type: none"> <li>The Capital Programme includes provision for the Bristol Workplace of £40.5m<sup>28</sup>.</li> <li>In principal agreement has been made to increase SALIX funding from £ 1.2m to £1.7m.</li> <li>Total pipeline is ca. £1m at this point of time for 2015/16 financial year; BCC will aim to deliver a similar amount in 2016/17. Long term we will try to get other LAs and public sector on board under our framework.</li> </ul>
Why?	<p>Improving the energy efficiency of buildings is the core focus of the public retrofit strand. The Mini-Stern identifies that measures including renewal of office equipment, building improvements and optimization of heating and cooling systems are most cost effective carbon reduction measures. However, the installation of heat pumps, improvement in building fabric and increasing the air tightness of buildings provide some of the largest overall reductions in energy use. These improvements in energy efficiency will also reduce</p>	<p><b>KPIs/Targets:</b></p> <p>2 year target - additional £500k yearly energy saving, additional 2000 tCO<sub>2</sub> yearly saving</p>

## OUR RESILIENT FUTURE

	the operating costs of our buildings.	
Who?	Bristol City Council Energy Service and Property Service	<b>Strategic Theme:</b> Corporate Buildings

### 5. Securing High Energy Performance for New Buildings

What?	The Council will require all new build projects that are Council funded or delivered on Council land to achieve high standards of energy performance. This will include schools, care homes and council housing. This will be achieved through working with departments responsible for build programmes to update or develop standards for BCC developments & disposals, including contractor standards and specifications, and implementation through the design and procurement process.	<b>Budget:</b>  There is no specific budget and any costs will be considered as part of the project development and approval processes
Why?	Buildings constructed now will be in operation for many years to come. It is important that designs achieve a high standard of energy performance, and incorporating high levels of efficiency at the point of construction will reduce the risk of requiring more expensive retrofits in the future.	<b>KPIs/Targets:</b>  DEC and EPC ratings for new buildings
Who?	Bristol City Council: Major Projects, Education, Housing Delivery services	<b>Strategic Theme:</b> Corporate buildings

### 6. Solar Photovoltaic Programme

What?	<p>A programme to secure funding and deliver solar photovoltaic (PV) on council land, buildings, including homes, schools and council's corporate properties, and further investment in public buildings including University of Bristol.</p> <p>BCC received Cabinet approval in October 2013 for £5.96m spend on solar projects and BCC is investing in two significant large scale land mounted solar PV ventures:</p> <ul style="list-style-type: none"> <li>Severn Road Solar Park is situated on the wind turbine site in Avonmouth, with a 1.8MW installed capacity. 7200 panels are predicted to provide an annual output of 1.71 GWh.</li> <li>The Lawrence Weston Road site comprises of</li> </ul>	<p><b>Budget:</b></p> <p>£5.9m for 2015/16, and this will be reviewed for 2016/17.</p> <p>Severn Road budget is £1.9m and construction starts in October 2015 with an estimated 4-6 week build programme.</p> <p>Lawrence Weston Road budget is £4m per site, both to be commissioned in 2016.</p>
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Why?	<p>2 sites each of 4.2MW; each having 13,544 panels and a predicted annual output of 4.09GWh. Planning approval is granted. Shared grid connection secured with Western Power Distribution.</p> <p>BCC will also install 1.5 MW of solar PV on roofs by 2016 (until the Feed-In Tariffs (FITs) get cut), and we will focus on the big roofs in the city. Lack of support mechanisms beyond April 2016 are unlikely drive delivery of ground mounted PV.</p>	
	<p>Multiple studies have identified that there is good potential for solar PV deployment in Bristol and the Mini-Stern highlights that energy solar PV, despite the initial investment, will result in a significant reduction in the City of Bristol's CO<sub>2</sub> emissions, and does have long-term benefits for households and businesses through reducing energy bills and building resilience in the city.</p>	<p><b>KPIs/Targets:</b></p> <p>Delivery of ground mounted solar projects.</p> <p>Delivery of ca. 1.5MW per year on roof mounted PV</p>
	Bristol City Council Energy Service	<p><b>Strategic Theme:</b></p> <p>Sustainable Energy Supply</p>

## 7. Metro-Bus Implementation

What?	<p>Deliver the MetroBus network including:</p> <ul style="list-style-type: none"> <li>• ~ 6 km of new highway;</li> <li>• ~2.5 km guided busway (two-way);</li> <li>• ~ 18 km of bus lane and unguided bus alignments (one-way);</li> <li>• ~ 10 km of new cycling infrastructure;</li> <li>• ~ 48 pairs of new or improved stops and interchanges;</li> <li>• ~ 50 new hybrid drive vehicles; and</li> <li>• A reconfigured city centre interchange and public domain upgrade.</li> </ul> <p>Across three routes:</p> <ul style="list-style-type: none"> <li>• Ashton Vale to Temple Meads and Bristol City Centre</li> <li>• North Fringe to Hengrove</li> <li>• South Bristol Link</li> </ul>	<p><b>Budget:</b></p> <p>£265m for construction of the three Metro-Bus routes</p>
Why?	<p>Whilst the implementation of the Metro-Bus system will bring about reductions in the City of Bristol's transport emissions, it is also part of a the West of England's plan to:</p>	<p><b>KPIs/Targets:</b></p> <ul style="list-style-type: none"> <li>• Construction complete by Summer 2017</li> <li>• Smartcard ticketing</li> </ul>

	<ul style="list-style-type: none"> <li>• support sustainable economic growth,</li> <li>• promote accessibility,</li> <li>• contribute to better safety, security and health,</li> <li>• improve quality of life and create a healthy natural environment</li> </ul>	<p>system implemented</p> <ul style="list-style-type: none"> <li>• Modal shift from private car to bus (up to 5m passenger/kms)</li> <li>• Reduced transportation carbon emissions</li> <li>• Positive change across suite of scheme-specific congestion indicators.</li> <li>• Increase in cycling trips in proximity to new infrastructure.</li> </ul>
Who?	Bristol City Council Transport Service, with delivery partners, North Somerset Council and South Gloucestershire Council	<b>Strategic Theme:</b> Sustainable Travel

## 8. A Sustainable Transport Programme

What?	<p>Bristol City Council will undertake a range of actions to support an increase in use of public transport, walking and cycling in the City of Bristol, through:</p> <ul style="list-style-type: none"> <li>• Implementation of the Bristol Cycle Strategy including the delivery of an 8-80 cycle network</li> <li>• Implementation of relevant planning policy to ensure new development encourages walking, cycling, and well connected to public transport</li> <li>• Mobility Management including information, behaviour change and 'soft measures' (links with implementation of Metrobus – See above).</li> <li>• Urban Traffic Control and management of the highway network.</li> <li>• Conventional public transport improvements.</li> </ul>	<p><b>Budget:</b></p> <p>The Cycle Strategy has will invest £16 per head of population (£7 million) year on year to deliver transformational cycle change to meet our targets by 2020.</p>
Why?	<p>The transport sector is responsible for 27% of energy consumed, accounting for 22% of Bristol's CO<sub>2</sub> emissions. The decrease in emissions in transport has been lower than for the non-domestic and domestic sectors. 94% of fuel consumed in the sector is by vehicles other than buses. As a result there is significant opportunity to reduce emissions particularly from passenger cars through reducing the number of trips and encouraging modal shift to public transport, cycling and walking.</p> <p>Benefits of modal shift include the alleviation of</p>	<p><b>KPIs/Targets:</b></p> <ul style="list-style-type: none"> <li>• Increase in number of cycling trips</li> <li>• % of households who are within 40 minutes travel</li> <li>• time of a key employment site trips</li> <li>• Investment in cycling infrastructure</li> <li>• Targets:</li> </ul>

	congestion and improvements in health and a decrease in the demand placed on health services through lower pollution, a reduction in obesity and an increase in physical fitness.	<ul style="list-style-type: none"> <li>• 20% of commuter trips into the city centre made by bike</li> <li>• 20% of children cycling to secondary school</li> <li>• 75% of all pupils to have taken part in Level 2 Bikeability training</li> <li>• Meeting cycle infrastructure investment target</li> </ul>
Who?	Bristol City Council Transport Service, Planning Service, Bristol Futures	<b>Strategic Theme:</b> Sustainable Travel

## 9. Land Use Planning

What?	<p>Through the Joint Spatial Plan, and the forthcoming local plan, the Council will seek to reduce energy demand and greenhouse gas emissions. This will include consideration of the following:</p> <ul style="list-style-type: none"> <li>• Locating development in a way that reduces the need to travel</li> <li>• Locating development in a way that maximises potential for Heat Networks</li> <li>• Seeking to maximise the requirements for energy efficiency, Heat Networks and renewables within the national framework that is current at the time of writing</li> <li>• Identifying the need for and locations of existing and future key energy infrastructure</li> <li>• Considering whether there is scope to apply other planning mechanisms such as CIL / allowable solutions in a way that delivers energy efficiency and renewable programmes at scale</li> <li>• Planning and requiring green infrastructure in a way that increases walking and cycling</li> <li>• Working with developers to encourage design to fully consider how it can reduce emissions for example through passive design and incorporating green infrastructure to reduce the urban heat island effect and improve building energy efficiency.</li> </ul>	<p><b>Budget:</b></p> <p>No specific budget or costs envisaged.</p>
Why?	The Mini-Stern highlights that there are high opportunities to reduce energy use and mitigate carbon dioxide emission from the domestic sector.	<p><b>KPIs/Targets:</b></p> <p>These are in the development stage and it is</p>

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Who?	These will be maximised if interventions are included at the construction stage of buildings and maximised throughout the lifetime of the building.	too premature to provide KPIs/Targets for its operation. They will be included when completed.
	Bristol City Council: Futures Group and Planning Service	<b>Strategic Theme:</b> Domestic Buildings

## 10. Data Monitoring and Reporting

What?	<p>As a signatory of international initiatives, including the 'Covenant of Mayors' and the 'Compact of Mayors', the scope and detail of Bristol City Council's energy and greenhouse gas emission reporting will need to expand to include:</p> <ul style="list-style-type: none"> <li>Emissions data in metric tonnes of CO<sub>2e</sub> (carbon dioxide equivalents)</li> <li>Emissions from additional sectors (e.g. waste, industrial processes and product use &amp; agriculture, forestry and other land use)</li> <li>More Greenhouse gases (methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O))</li> <li>Other GHG emissions that occur outside the city boundary but occur as a result of activities taking place within the city boundary will also be researched further.</li> </ul> <p>Furthermore, all data will be subject to independent audit as part of the city council's Eco Management and Audit Scheme.</p>	<p><b>Budget:</b></p> <p>Included in existing staff revenue costs.</p>
Why?	<p>There are a number of sectors for which data is not currently collated and which are known to contribute to the City of Bristol's greenhouse gas emissions of BCC. For this reason the initiatives for carbon reporting to which BCC is a signatory now require us to establish a full emissions for the City.</p>	<p><b>KPIs/Targets:</b></p> <p>All reporting requirements will be met, if not exceeded.</p>
Who?	Bristol City Council: Sustainable City and Climate Change Service	<b>Strategic Theme:</b> Cross-Sectorial

## 11. Metro West

What?	<p>BCC will work with partners to secure funding and deliver the Metro West scheme:</p> <p>Phase 1 (by May 2019):</p> <ul style="list-style-type: none"> <li>• Reopening of the Portishead line</li> <li>• Half hourly train services for the Severn Beach line</li> <li>• More trains serving Keynsham, Oldfield Park, Bedminster and/or Parson Street</li> </ul> <p>Phase 2 (by May 2021):</p> <ul style="list-style-type: none"> <li>• Half hourly train services to Yate</li> <li>• Hourly services on a reopened Henbury line (with capacity for two new stations)</li> <li>• Additional stations at Ashley Down and possibly Horfield</li> </ul>	<p><b>Budget:</b></p> <ul style="list-style-type: none"> <li>• Phase 1: £45-£55m (based on 2019 prices)</li> <li>• Phase 2: £43.1m est. (based on 2021 prices)</li> </ul>
Why?	<p>Whilst the MetroWest schemes hasn't been included within the Mini-Stern analysis, improvements to the City of Bristol's mass transit system will reduce the City's emissions, and provide a wide range of other co-benefits, including:</p> <ul style="list-style-type: none"> <li>• reducing congestion</li> <li>• improving air quality</li> <li>• Improving transport safety</li> <li>• increasing productivity</li> </ul>	<p><b>KPIs/ Targets:</b></p> <ul style="list-style-type: none"> <li>• Construction complete by 2019 and 2021</li> <li>• Modal shift from private car to train</li> <li>• Reduced transportation carbon emissions</li> <li>• Positive change across suite of scheme-specific congestion indicators</li> </ul>
Who?	Bristol City Council: Transport Service, Planning Service, Bristol Futures	<p><b>Strategic Theme:</b> Sustainable Travel</p>

<sup>27</sup> See: [https://www.bristol.gov.uk/committee/2015/ua/ua000/0203\\_6.pdf](https://www.bristol.gov.uk/committee/2015/ua/ua000/0203_6.pdf)

<sup>28</sup> See: [https://www.bristol.gov.uk/committee/2014/ua/ua000/1007\\_8.pdf](https://www.bristol.gov.uk/committee/2014/ua/ua000/1007_8.pdf)



## Enable: We'll Support Others to Deliver

The responsibility for changing our energy system and reducing carbon emissions lies not only with BCC, but with many of Bristol's businesses, social enterprises, public bodies and communities. Furthermore, there may be opportunities where BCC does not have appropriate jurisdiction to take a lead role and BCC will collaborate, empower and enable these organisations through, for example helping secure funding, providing resources, sharing skills, knowledge and expertise, and providing political support.

We have sought to identify those actions that are playing a significant role in reducing City of Bristol emissions and are being led by or delivered in partnership with other organisations, and to understand what role/form of support BCC is providing or can provide to enable these actions.

Set out below is a list of actions where BCC has an enabling role to play. This list is not exhaustive and our approach will require an ongoing dialogue with stakeholders and BCC welcomes comments to identify further projects and relationships to deliver these projects.

No specific funding is allocated to these actions and they will be progressed as existing resources and external funding will allow.

### 1. Establishment of Car Clubs

What?	Through planning and transportation services, BCC will work with Car Club operators to increase the potential for car club use and service across the City of Bristol through, for example Traffic Regulation Orders (TROs) and other on highway measures.	
Who?	Bristol City Council: Transport Service	<b>Strategic Theme:</b> Sustainable Travel

### 2. Improve Bristol's Busses

What?	There are opportunities to improve the quality of Bristol's bus fleet and Bristol City Council (BCC) will work with bus operators and other associated partners to help secure funding for cleaner bus fleets and to improve the efficiency of bus operations (e.g. giving buses priority)	
Who?	Bristol City Council: Transport Service	<b>Strategic Theme:</b> Sustainable Travel

### 3. Delivery of a Low Carbon Temple Quarter Enterprise Zone



What?	Building on the work undertaken for STEEP project looking at the potential for a low carbon Temple Quarter Enterprise Zone (TQEZ), Bristol City Council (BCC) will seek to promote high levels of energy efficiency and the integration of Heat Networks and renewables across the TQEZ. BCC will seek opportunities to work with partner organisations to reduce energy demand directly and indirectly through the planning and urban design of TQEZ (e.g. reducing urban heat island effect to minimise risk of overheating and use of mechanical ventilation, maximizing passive solar design etc.).	
Who?	Bristol City Council: Energy Service, Planning Development Management and, Bristol Futures	<b>Strategic Theme:</b> Energy

#### 4. Maximise Community Owned Renewable Installations

What?	Bristol City Council (BCC) will work with community energy groups to maximise the contribution that community energy can make in achieving the targets outlined in this framework. The Energy Service is the lead service and will administer the £880,000 community energy funding pot. This will require transparency, openness and collaboration with community groups in order to understand the problems, develop a shared approach, leverage additional investment, and share skills and knowledge in order to maximize the delivery of low carbon and renewable energy in the City at a community level. However, although there are clearly articulated procedures already in place for the delivery of solar PV projects, given the current challenging funding environment there is need to further explore and implement sustainable business/community energy models to secure the delivery of this programme.	
Who?	Bristol City Council: Bristol Futures, Energy Service	<b>Strategic Theme:</b> Energy

#### 5. Support Delivery of the Bristol Community Strategy for Energy

What?	Bristol City Council (BCC) will explore how the BCC can work with the organisations who created the Bristol Community Strategy for Energy to deliver the goals within the strategy. This could include supporting the implementation of an Energy Compact setting out how its officers will work with the community energy sector, ensuring fairness, openness and transparency become the norm for the long term, making the value of community owned energy explicit and understood within relevant teams, whilst also recognizing that the council must carry out legitimate due diligence to protect its assets.	
Who?	Bristol City Council: Bristol Futures, Energy Service	<b>Strategic Theme:</b> Energy

## 6. Open Data & Open Energy Planning

What?	Bristol City Council (BCC) will lever the unique value that community energy can contribute to meeting the targets described in this framework, particularly in areas where the council's reach is limited, and where possible sharing plans with key stakeholders such as community owned energy organisations will support and enable additional investment, capacity and ultimately energy generation and energy saving measures.	
Who?	Bristol City Council: Bristol Futures, Energy Service	<b>Strategic Theme:</b> Energy and Planning

## 7. Procurement & Community Owned Energy Organisations

What?	Bristol City Council (BCC) will seek to enable greater uptake of community led energy initiatives, making sure that the benefits of community energy are better understood and market community energy to developers and investors as part of our Corporate programmes. This will empower citizens and communities and enable them to have real influence over what happens in their communities and strengthen support for the work of voluntary and community organisations across the city.	
Who?	Bristol City Council: Bristol Futures, Energy Service	<b>Strategic Theme:</b> Energy

## 8. The Good Food Plan

What?	The food system contributes to greenhouse gas emissions across the City of Bristol and beyond, so Bristol City Council (BCC) will support the implementation of the 'Good Food Plan' <sup>29</sup> objectives through relevant BCC projects, plans and services. For example, through exploring ways that BCC activity can protect and promote food production in Bristol and the West of England Region, establish markets for local producers, and minimise food waste. BCC will help promote system change by outlining realistic targets, actions and a call for action from all relevant stakeholders involved in the food industry - producers and consumers alike.	
Who?	Bristol City Council: Bristol Futures	<b>Strategic Theme:</b> Food

## 9. Growing Green Capital

What?	<p>Bristol City Council will work with partners to ensure that 2015 is the beginning, not the end of our journey to becoming a truly green city. We will do this by:</p> <ul style="list-style-type: none"> <li>• Recognising the achievements of residents, groups, organisations, and 'Bristol 2015' in securing the Bristol Green Capital award and supporting these groups to maintain their momentum</li> <li>• Working strategically, holistically and collaboratively with parties to ensure we align our goals, ensure we share resources and support each other to deliver.</li> <li>• Promote Go Green and support businesses, charities and organisations of all shapes and sizes to access expertise and case studies tailored to their business size and type to generate their own bespoke Go Green Action Plan to improve their carbon emissions, sourcing policies, travel plans.</li> </ul>	
Who?	Bristol City Council: Bristol Futures	<b>Strategic Theme:</b> Planning

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<sup>29</sup> See: [http://bristolfoodpolicycouncil.org/wp-content/uploads/2013/03/Bristol-Good-Food-Plan\\_lowres.pdf](http://bristolfoodpolicycouncil.org/wp-content/uploads/2013/03/Bristol-Good-Food-Plan_lowres.pdf)

## Explore: We'll Research & Deliver More

The greater the challenges we have to face, the greater the opportunities for innovation. Bristol City Council has a great track record in promptly identifying problems, clarifying the challenges, seizing opportunities and delivering outcomes. However, as the scope and complexity of the challenges increase, so too must BCC increase its efforts to identify and explore opportunities to innovate to tackle climate change. Whilst the future is ever evolving and dynamic, set out below is a list of actions which BCC will pursue and explore further. This list is not exhaustive and our approach will require ongoing monitoring of our environment, the identification of trends, and continued dialogue with stakeholders. BCC welcomes input and support from any group or parties interested in exploring the future.

No specific funding is allocated to these actions and they will be progressed as existing resources and external funding will allow.

### 1. Strategic Energy Planning

#### What?

We have made significant progress to reduce energy demand and generate more energy from low and zero carbon technologies. However it is widely recognised that to maximise the efficiency of the broader energy system and consider the impacts of individual actions on other sectors, it is necessary to take a holistic and integrated approach to energy planning. In recognition of this and of the fact that energy planning is a continuous iterative process, BCC will consider how it can best work with partners and stakeholders to further develop an integrated energy plan for City of Bristol. This will ensure that the energy system is planned as a single integrated system that maximizes carbon reduction potential.

- A full list of aims and objectives for the plan will need to be developed in partnership with stakeholders from across the energy system. However, the future Energy Plan could:
- Seek to balance energy production and demand, and drive the efficient use of energy in the city through for example smart grids, local energy generation, storage solutions and ICT
- Identify synergies with other plans, actions and strategies to achieve energy consumption and emissions reduction targets
- Learn from work undertaken elsewhere on future low carbon fuel options (e.g. new, green and renewable gas sources such as hydrogen and biomethane )
- Be informed by the resilience planning process, particularly in respect of energy security
- Explore the feasibility of achieving a 100% renewables target for the City
- Adopt a broad and inclusive approach to energy planning and governance
- Take full account of interdependencies within the energy system
- Support the goals of the Bristol Community Strategy for Energy

Who?	<ul style="list-style-type: none"> <li>Plan for short, medium and long term action</li> </ul>	
	Transport Service, Planning Service, Bristol Futures	<b>Strategic Theme:</b> Energy

## 2. Strategic Transport Planning

What?	<p>Significant progress has been made to improve Bristol's transport system, to reduce congestion, improve road safety, and manage environmental impact through the implication of low carbon technologies and behaviour change initiatives. However, to make even greater improvements to the transport system a much more holistic and integrated approach needs to be taken, an approach which considers the impacts of individual actions across the broader transport system. BCC will work with partners and stakeholders across the city to develop our understanding of the transport system and further develop a single integrated transport plan for the City of Bristol.</p> <p>The future transport plan could:</p> <ul style="list-style-type: none"> <li>Inform the development of West of England transport plans, so that they can make their contribution to reducing emissions.</li> <li>Explore the development of a Mobility Plan for the city, to sit beneath the Joint Local Transport, outlining a strategy to achieve improved mobility and lower carbon and other emissions.</li> <li>Submit bids for major projects and transport schemes to continue to deliver low carbon transport measures, building on MetroBus, MetroWest and Cycling Growth</li> <li>Continue to explore opportunities for funding to decarbonize transport in the city, and do this in a way that also benefits most those who are currently dependent on the car to perform critical services e.g. people with certain disabilities and mobility impairments, carers, people doing home visits, carrying equipment and so forth – which are likely to increase as the overall population ages.</li> <li></li> </ul>	
Who?	Bristol Futures and Energy Service, and stakeholders from across the energy system	<b>Strategic Theme:</b> Sustainable Travel

## 3. Scaling Up Investment in Home Energy Efficiency

What?	<p>Bristol has launched one of the UK's largest energy efficiency and renewable energy investment programme through the Warm up Bristol and the Warmer Homes initiatives. The Council is now planning the next phase, to scale up this investment and achieve significant carbon and energy savings.</p>	
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Who?	The project will utilise the measures which were included on the UK Green Deal system implementation list, including and not limited to: loft insulation, heating controls, solar panels, cavity wall insulation, boilers, connection to Heat Networks, heat pumps, external cladding, windows, internal wall insulation, home control systems, doors, new advanced appliances, lighting and power configurations, in-house storage, water saving devices, hot water systems, kitchens, bathrooms, electrical wiring if unsafe etc.	
	Energy Service and partner organisations	<b>Strategic Theme:</b> Housing

#### 4. Scaling Up Our Heat Networks System

What?	<p>Further feasibility studies are required to identify opportunities and, where feasible, seek funding to plan and deliver additional sections of the Heating Network. These include:</p> <ul style="list-style-type: none"> <li>• Piping waste heat from Avonmouth and Severnside to the City Centre</li> <li>• City Centre Phase 2 Heat network</li> <li>• BS3</li> <li>• Easton Heat network</li> </ul> <p>The opportunity and potential viability for installation of cooling systems will also be explored.</p>	
Who?	<p>Bristol City Council: Energy service</p> <p>Delivery Partners – Power plant operators, existing building owners and new build developers</p>	<b>Strategic Theme:</b> Energy

#### 5. Developing a Low Emissions Transport Programme

What?	<p>The council will explore the feasibility of, and seek to secure funding for measures that will bring about a step-change in the uptake of ultra-low emissions (ULEV) transport. Options may include:</p> <ul style="list-style-type: none"> <li>• Installing improved infrastructure for electric vehicles</li> <li>• Encouraging electric vehicles to reduce emissions in air quality management areas</li> <li>• Promoting services to increase uptake of ULEV vehicles (e.g. dedicated parking)</li> <li>• Promoting the uptake and use of EV taxis,</li> <li>• Promoting the use of electric bike for personal and business use</li> <li>• Working with public transport providers to transition to low emission buses</li> <li>• Reviewing funding mechanisms for low carbon vehicles</li> </ul>	
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Who?	<ul style="list-style-type: none"> <li>Establishment of low emission vehicle car clubs and the use of car clubs by businesses</li> <li>Improved Multimodal transport integration</li> <li>New freight consolidation services for small traders</li> <li>Using electric vehicles for last mile delivery</li> </ul> <p>Through the West of England partnership, Bristol is leading three OLEV funding bids of a combined worth of £20 million which would be funded from 2016 - 2020 and shared between 2 - 4 cities.</p>	
	Transport Service, Bristol Futures	<b>Strategic Theme:</b> Sustainable transport

## 6. Developing a Low Emissions Transport Programme

What?	<p>Technology has huge potential to increase the efficient and more intelligent use of energy resources, thus decreasing overall demand and GHG emissions. Bristol has an established creative and technology sector which can contribute and benefit from the application of smart technologies and applications for the energy sector.</p> <p>BCC will identify opportunities and pursue funding (e.g. Smart Cities and Communities (SCC1) under Horizon 2020) that enables BCC and partners to explore, pilot and implement schemes that use smart technologies to reduce energy demand and carbon emissions. For example through:</p> <ul style="list-style-type: none"> <li>The use of highway and city management tools, such as the control centre and UTM system, to inform citizens of transport options, manage flows, encourage modal shift to lower carbon transport, and increase the efficiency of the transport system;</li> <li>The use of open data and apps to inform decisions of citizens and businesses (e.g Travel Choice info and apps for example <a href="http://www.TravelWest.info">www.TravelWest.info</a> and BusChecker App);</li> <li>Demand responsive transport around Avonmouth;</li> <li>The integration of energy, mobility, and ICT to establish 'nearly zero' or low carbon districts through for example intelligent lighting and sensors, smart grids, integrated energy /fuelling infrastructure, use of smart meters, local energy generation and storage solutions, electric vehicles (bikes and cars), open data, smart ticketing and demand management.</li> <li>SoLa Bristol<sup>30</sup> - "B.R.I.S.T.O.L." is the Buildings, Renewables and Integrated Storage, with Tariffs to Overcome network Limitations project being led by Western Power Distribution. BCC Energy will seek to explore opportunities with WPD and other partners to build on the SoLa Bristol project.</li> </ul> <p>The deployment of the internet of things to benefit citizens by offering environmental improvements, economic opportunities, and more efficient and effective delivery of services such as transport, healthcare and energy.</p>	
	Bristol Futures, BCC Transport, technology	<b>Strategic Theme:</b>



	providers, local businesses and NGOs, citizens and community groups, academic institutions.	Sustainable transport
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## 7. Grow the Bristol Brain

What?	<p>We will pursue the development of a Bristol Brain, which will be a city common, facilitated by Bristol City Council but under common ownership co-developed by its citizens. It will enable policy precision in addressing city carbon management.</p> <p>Open and accessible, the Bristol Brain combines data from public and private sources, from a network of city-wide sensors, analyses them and creates scenarios to visualise different futures of Bristol. By looking at future scenarios we can identify the health of the Bristol ecosystem today: the pulse of the city (employment, housing), how clogged are its arteries (roads, rail and river), how clear are its lungs (air quality), its emotional state (is it a happy city, a playable city), and how resilient is it?</p> <p>It will be a fun way of bring together the public, private and academic sectors to make serious decisions about the future of the city based on real evidence. It will capture the City's complexity by combining behavioural insights (generated by user interaction) with hard data sets, both continually evolving via data collected by Bristol Is Open, public and private smart meters, smart phones and other data people are willing to share; in a visual and engaging way.</p> <p>The simulator is not a static virtual reconstruction of Bristol but one that evolves as the city does, that invites different city actors to play with the city, to imagine different futures and engages them in debate and design to achieve a sustainable, resilient, happy city.</p>	
Who?	Bristol Futures	<b>Strategic Theme:</b> Planning

## 8. Making More of Marine Energy

What?	<p>Owing to its portfolio of energy resources, including wind, wave and tidal, the Bristol Channel and Severn Estuary is a major, as yet undeveloped, energy asset for the region and the country.</p> <p>Bristol City Council has a significant opportunity to build Bristol's position as the 'gateway' for a new global industry. The Council must provide leadership in the sustainable development of the resource and demonstrate that the Bristol Channel can provide a significant amount of clean energy without compromising its internationally significant habitats or the existing economy of the area.</p> <p>Bristol will explore options and seek to maximize tidal energy, by:</p> <ul style="list-style-type: none"> <li>• Bringing forward viable projects; <ul style="list-style-type: none"> <li>○ Identification of a project pipeline and first mover projects.</li> </ul> </li> </ul>	
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Who?	<ul style="list-style-type: none"> <li>○ Development and review of proposals for specific projects.</li> <li>○ Provide a joint, clear and consistent vision for the Bristol Channel.</li> <li>○ Pre-commissioned research to reduce uncertainty.</li> <li>○ Facilitate development of public/private financial model to provide enabling finance.</li> <li>○ Bristol Energy Company may seek to purchase power generated.</li> </ul> <ul style="list-style-type: none"> <li>● Enabling appropriate governance; <ul style="list-style-type: none"> <li>○ Sustainable use of the marine energy resource requires government agencies, local authorities and other key stakeholders to work together to provide governance and leadership.</li> </ul> </li> <li>● Supporting the industry cluster; <ul style="list-style-type: none"> <li>○ Through the Bristol Tidal Energy Forum and South West Marine Energy Park, Bristol City Council will continue discussions with the industry and all major stakeholders.</li> <li>○ Ongoing dialogue with national government and government agencies</li> <li>○ Promote the Bristol Industry clusters and expertise to target international markets and partner countries.</li> <li>○ Present the Bristol Marine Energy opportunity at relevant industry events.</li> <li>○ Working with local tidal manufacturers to develop business</li> </ul> </li> </ul>	
	Energy Services	<b>Strategic Theme:</b> Energy

## 9. Bristol City Council Procurement

What?	<p>BCC will seek to understand the extent to which BCC procurement processes already consider carbon emissions and the effectiveness of current BCC procurement policy. It is important that BCC explore opportunities to further reduce emissions associated with BCC procurement activities to ensure it demonstrates leadership and commitment to tackling climate change across all BCC functions and the services it delivers to City of Bristol.</p> <p>BCC will identify lessons learnt from the European sustainable public procurement (SPP) regions project (to which BCC is a partner) and to integrate the findings into BCC systems and operations.</p>	
Who?	Procurement	<b>Strategic Theme:</b> Corporate Emissions

## 10. Developing our Knowledge and Mini-Stern

What?

The Mini- Stern only takes account of direct emission from the City of Bristol, and we acknowledge that the results do not take into account the levels of carbon that are embedded in all of the goods and services consumed in Bristol. Research has shown that these are significant: a large proportion of the emissions for which the UK is responsible are produced outside of the UK. Only by understanding the extent to which consumption in Bristol results in emissions elsewhere can we start to identify how action within the city can contribute to reducing these emissions. BCC will explore the impact of consumption driven emissions for the City of Bristol.

Furthermore, the Mini-Stern review identified many opportunities to reduce greenhouse gas emissions across the city of Bristol; however the majority of the interventions are largely within the domestic sector, with some in the commercial and industrial sectors, and the least in the transport sector. To improve our models we will:

- Review the Mini-Stern and identify and include additional interventions for all sectors
- Collaborate with partners in all sectors identify more interventions and source more accurate Bristol specific data
- Identify barriers to interventions and work with partners in these sectors to reduce these

Who?

Bristol Futures

**Strategic Theme:**  
Planning

## 11. Re-Investing In Our Future

What?

The Mini-Stern analysis identifies how the City of Bristol can reduce its energy use and carbon emissions, however to achieve its 2035 emission commitments, there is a need to invest the income generated from the cost effective measures to be reinvested into cost neutral interventions. Bristol City Council will explore and review innovative financing mechanisms based on new forms of cost recovery and benefit sharing to deliver these investments.

Who?

Bristol City Council Future Group

**Strategic Theme:**  
Planning

## 12. Healthy Climate and Healthy People

What?

Bristol City Council recognises the important link between matching up climate change and other environment and sustainability objectives with Public Health co-benefits, and so will work with and as a member of Bristol Health Partners to explore how its Strategic Future Workforce, Better Use of Data and Sustainability programmes can lead to a range of benefits from health partner organisations

Who?	cutting their emissions and other environmental impacts to the way the housing and other physical aspects of the city is planned and developed using public health evidence to combine with climate change objectives to increase the rate of change.	
	Bristol City Council Future Group	<b>Strategic Theme:</b> Planning

### 13. Influencing Government Policy

What?	The European and National framework for energy policy is a major determining factor in meeting emissions reduction targets. As such, BCC will explore opportunities to work with UK government to influence and advocate the continuing decarbonisation of the national energy system, and enhance the uptake of energy efficiency, sustainable transport, low carbon and renewable energy measures at the local level.	
Who?	Bristol City Council Future Group	<b>Strategic Theme:</b> Energy

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<sup>30</sup> [http://www.westernpowerinnovation.co.uk/Projects/SoLa-Bristol.aspx#FAQLink42;javascript:void\(0\);](http://www.westernpowerinnovation.co.uk/Projects/SoLa-Bristol.aspx#FAQLink42;javascript:void(0);)

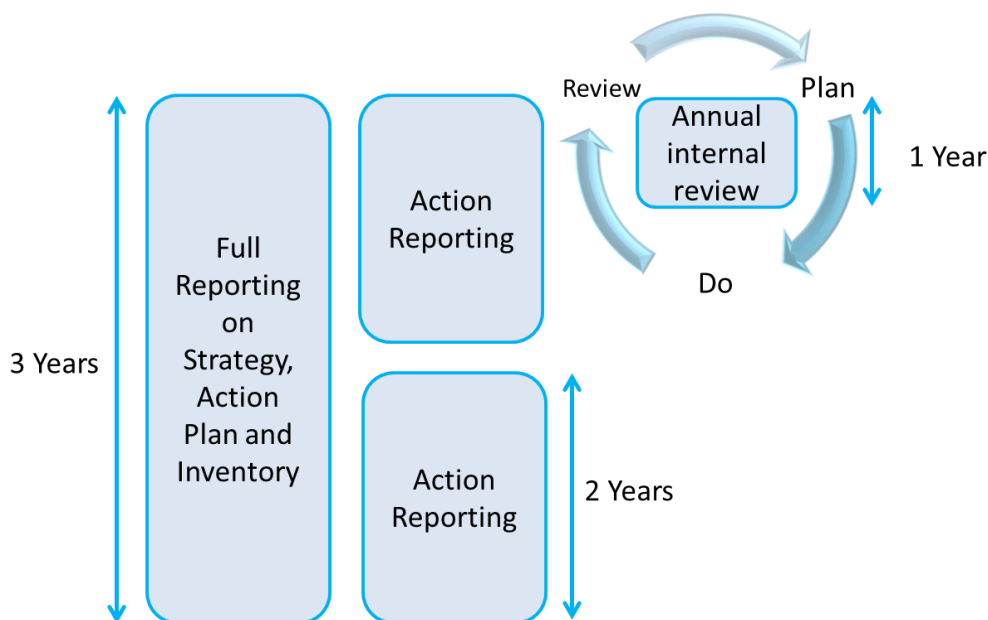
## STAYING CURRENT: MONITORING AND REVIEWING THIS FRAMEWORK

### Monitoring and Review

Regular monitoring and review of the emissions inventory and Framework, not to mention the adoption of corrective measures if necessary, is crucial to BCC achieving its targets. In recognition of this and of the constant evolution of the energy system in Bristol, performance against this framework will be reviewed on an annual basis and the Framework will be refreshed every three years.

This process will make use of best available national and local data to refine priorities and actions in response any changes in the context, policy, good practice and new opportunities. A basic level of review will be undertaken on an annual basis to keep the inventory up to date and track progress against strategic priorities and specific activities. The annual review is likely to comprise a fine-tuning exercise, unless progress is slow or the context changes radically.

Further to the annual review, and as a signatory to the 'Covenant of Mayors' and the 'Compact of Mayors', BCC is required to set out and enact a process for monitoring, review and public reporting on emissions. This process requires reporting on the emissions inventory and actions plan/framework and to set timescales and specified levels of detail. As such, the following reporting cycle will be applied:



**Figure 15: CCESF Review and Reporting Cycle**

A comprehensive review and drafting of a new action plan/framework is required every 3 years<sup>31</sup> to ensure that opportunities are maximised, and BCC's long term aims are achieved.

The annual reporting process will ensure that the priorities and actions are adjusted to meet strategic objectives, and will comprise the following steps:

- **Review** – Reviewing the strategic priorities to ensure that they remain relevant, and that the actions required to achieve these priorities are progressing at an adequate pace. Identifying corrective action where necessary.
- **Plan** – Ensuring that the corporate business plan and individual service plans account for the actions identified within the framework, with adequate structures, staff, assets and financial resources in place to deliver the strategic objectives and priorities.
- **Do** – Ensuring that action, outputs and outcomes result from all planned activities – this is about delivering what has been agreed and checking to make sure that it results in the intended outcomes.

BCC will determine a set of high level KPIs in order to monitor progress against this framework. An initial exercise to identify potential KPIs has been undertaken as part of the STEEP project, and it will be used to inform the final set of KPIs.

### Equalities

There is some evidence that historically actions similar to those set out in this Framework have proportionately low take up from equalities communities<sup>32</sup> such as black and minority ethnic (BME) communities, older people, etc. For this reason full Equalities Impact Assessments will be required for each action as it commences implementation.

### Governance

This is a Bristol City Council framework, and its implementation will be monitored through BCC's managerial and democratic processes. However, much of the action which will be needed over the coming years and decades will not be undertaken by BCC, but by other public, private, community and voluntary organisations. For example, the University of Bristol has set itself a goal to become a carbon neutral campus by 2030. Currently there is no single way of informing and co-ordinating action. During the consultation process we will seek ideas and views on how effective action on climate and energy issues can be better co-ordinated and supported

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<sup>31</sup> See: [http://www.compactofmayors.org/content/uploads/sites/14/2015/04/Compact-of-Mayors\\_Definition-of-compliance.pdf](http://www.compactofmayors.org/content/uploads/sites/14/2015/04/Compact-of-Mayors_Definition-of-compliance.pdf)

<sup>32</sup> See: <https://www.bristol.gov.uk/people-communities/equalities-groups>

## APPENDIX 1:

### THE ECONOMICS OF LOW CARBON CITIES: A MINI-STERN REVIEW FOR THE CITY OF BRISTOL EXECUTIVE SUMMARY

## The Economics of Low Carbon Cities: A Mini Stern Review for the City of Bristol

### Executive Summary

What is the most effective and efficient way to decarbonise a city? There are hundreds of low carbon options available and, although they present a significant opportunity to reduce energy bills and carbon footprints, there is often a lack of reliable information on their performance. The higher levels of risk and uncertainty that emerge as a result of this lack of reliable information can be a major barrier to action, making it hard to develop a political, a business or a social case for investment in low carbon options.

The City of Bristol is an area with a population of 450,000 people, an economy worth £14 billion a year and an energy bill of £870 million a year.

In an attempt to address this problem, this report reviews the cost and carbon effectiveness of a wide range of the low carbon options that could be applied at the local level in households, industry, commerce and transport. It then explores the scope for their deployment, the associated investment needs, financial returns and carbon savings, and the implications for the economy and employment.

It does this for the City of Bristol, an area with a population of 450,000 people, an economy worth £14 billion a year and an energy bill of £0.9 billion a year. Whilst highlighting the very significant and commercially viable opportunities for the decarbonisation of the city – and the potential economic benefits associated with these – the report also recognises the scale of the challenge, the need for investment and the requirement for investment vehicles and delivery mechanisms that can exploit the potential for significant change.

# Executive Summary

## Our Approach

Our approach has been to develop a robust model for assessing the costs and benefits of different levels of decarbonisation at the city region scale. We use data from a wide range of sources on the potential energy, cost and carbon savings from hundreds of low carbon measures. We take into account changes in the economy and the wider energy infrastructure, but we focus primarily on the potential for the wider deployment of energy efficiency measures and small-scale renewables. We also assess the potential for their deployment and the rates at which they could be deployed at the local level. Our mitigation estimates are based upon production-based emissions accounting, which considers the carbon emitted within the city's borders and that emitted indirectly due to electricity use. Thus, we do not account for the carbon effectively embodied in imported goods or services.

We use best-available projections to estimate savings emerging from different measures (energy, cost and carbon), future energy prices, and the rate of decarbonisation of the UK electricity grid. For assessing business-led mitigation scenarios we use typical interest rates (8%), while when considering more ambitious scenarios we estimate the maximum potentials for the rates and scales at which different technological and behavioural options could realistically be adopted.

## The Potential for Carbon Reduction – Investments and Returns

We find that by 2025 – compared to 2005 levels – the City of Bristol could reduce its carbon emissions above and beyond business-as-usual<sup>1</sup> trends (including in the decarbonisation of electricity supply) by:

- 11.6% through cost effective investments that would pay for themselves (on commercial terms) over their lifetime. This would require an investment of £580 million, generating average annual savings of £175 million, paying back the investment in 4 years before generating further savings for the lifetime of the measures.
- 17.5% through cost neutral investments that could

be paid at no net cost to the city's economy if the benefits from cost effective measures were captured and re-invested in further low carbon measures. This would require an investment of £2.2 billion, generating average annual savings of £240 million, paying back the investment in 10 years before generating further savings for the lifetime of the measures.

- 18.3% with the exploitation of all of the realistic potential of the different measures. This would require an investment of £4.1 billion, generating annual savings of £250 million, paying back the investment within the lifetime of the measures.

It is important to note though that these figures do not take into account the levels of carbon that are embedded in all of the goods and services consumed in Bristol. Research has shown that when these are taken into account for the UK as a whole, carbon emissions are substantially higher and are rising rather than falling.

## Impacts on Future Energy Bills

These figures are particularly significant in the context of projected energy price increases. We calculate that the City's energy bill is currently £0.87 billion per year and estimate that, under business-as-usual trends, this will remain at approximately the same level in 2025, as reductions in energy use are offset by rising energy prices.

- With investment in all of the cost effective measures, the 2025 annual energy bill could be cut by £220 million (26% of the projected cost).
- With investment in all of the cost neutral measures, it could be cut by £300 million (35% of the projected cost).
- With investment to exploit all of the realistic potential, it could be cut by £320 million (38% of the projected cost).

The City of Bristol could therefore significantly enhance its energy security through investments in energy efficiency and low carbon options.

The current City of Bristol energy bill is £870 million per year, this means that 6.4% of everything £1 that is earned in the city is spent on energy

<sup>1</sup> Business as usual here, and throughout the report, refers to emissions trajectories under central energy prices and expected grid decarbonisation, in an absence of a concerted effort to deploy low carbon measures.



## Executive Summary

### The Wider Context – Other Influences on the City of Bristol’s Carbon Emissions

To put these energy savings and carbon reduction figures into a wider context, we find that:

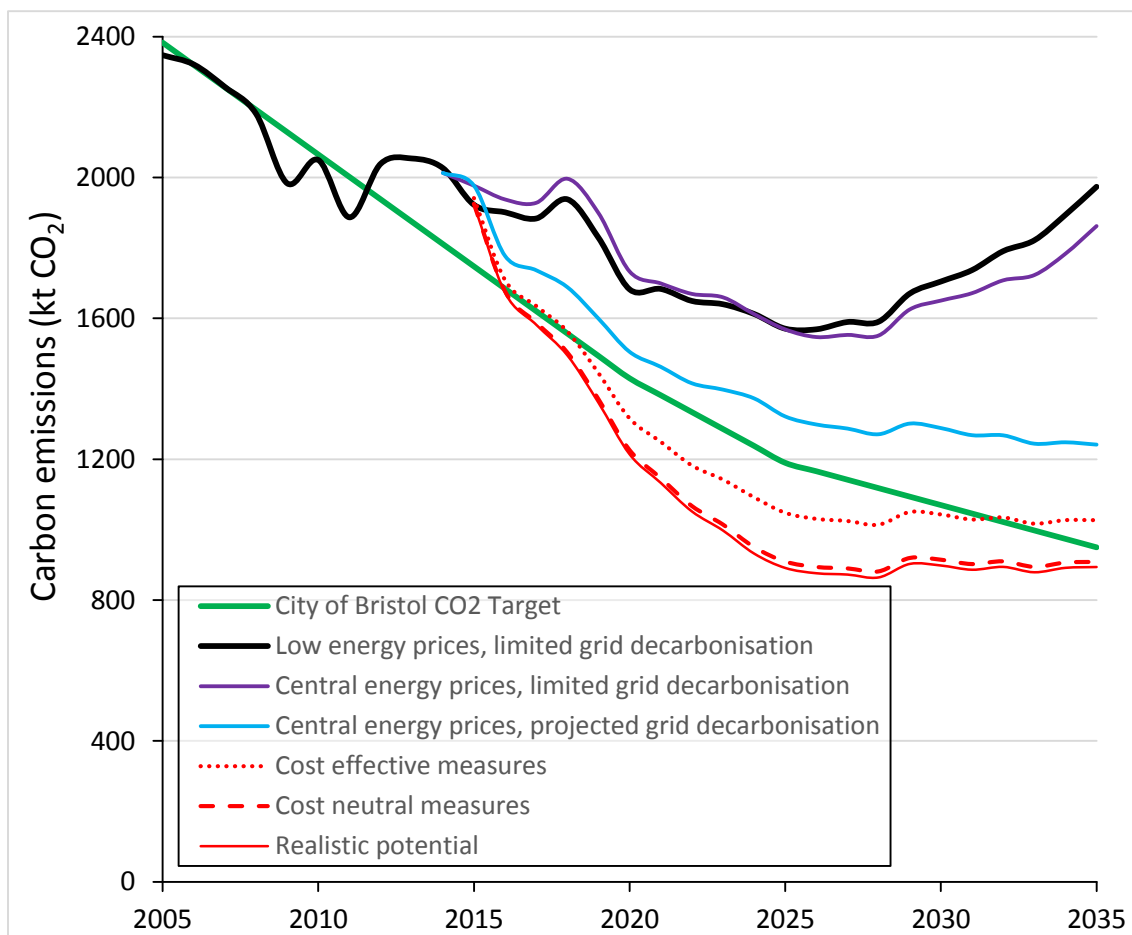
- With low energy prices, slow decarbonisation of UK electricity and a continuation of current trends in energy use and efficiency within the city, background trends would lead to a 33% decrease in Bristol’s carbon emissions between 2005 and 2025. Without extra effort in the city. This would lead to the city missing its 2020 emissions reduction target of 40%.
- Business-as-usual trends, with higher energy prices and the currently expected rates of decarbonisation of the national electricity system, would lead to Bristol’s carbon emissions falling by 44% between 2005 and 2025. This would mean that the city came closer to meeting its 2020 emissions reduction target, but extra effort would also be needed to meet the

2020 target.

- Together, higher energy prices, the currently expected rates of decarbonisation of the national electricity system and the exploitation of all of the cost effective low carbon options within the city would generate a 55% drop in Bristol’s carbon emissions between 2005 and 2025.
- The total effect of all of the above plus the exploitation of the remaining cost neutral options would be a 61% drop in Bristol’s emissions between 2005 and 2025.
- The total effect of all of the above plus the exploitation of all of the remaining realistic potential would be a 62% drop in Bristol’s carbon emissions between 2005 and 2025.

The impacts of these price effects, grid decarbonisation and cost effective, cost neutral and realistic potential are shown in the Figure below.

Figure 1: Baselines and Analysis of Price Effects, Grid Decarbonisation and Cost Effective, Cost Neutral and Realistic Potential





# Executive Summary

## Wider Impacts on Employment and Economic Growth

We also calculate that the levels of investment required to realise these reductions in energy bills and carbon footprints could have wider economic benefits within the City of Bristol:

- Over the next ten years, the levels of investment needed to exploit all cost effective measures with employment generating capacity would lead to the generation of over 2,000 jobs<sup>2</sup>.
- Over the next ten years, the levels of investment needed to exploit the all of the cost neutral measures with employment generating capacity would lead to a further 8,000 jobs.
- In total, therefore, we predict that the levels of investment needed to exploit all of the cost effective and cost neutral measures with employment generating capacity would lead to the generation of 10,000 jobs over the next ten years.

## Low Carbon Investment: Supply and Demand

The analysis highlights that within Bristol there is considerable potential to reduce energy use and carbon footprints through cost effective and cost neutral investments on commercial terms. However, the fact that these opportunities exist on this scale is obviously not enough to ensure that they are actually exploited. Incentives – no matter how strong they are – have to be matched with appropriate capacities if progress is to be made. These relate both to the capacity to supply appropriate levels of investment and to the capacity to stimulate and sustain demand for such investments.

To stimulate the supply of the very significant levels of investment that are needed, we need to think about innovative financing mechanisms, based on new forms of finance, delivery, cost recovery and benefit sharing and new ways of managing risk. And we need to develop new delivery vehicles that can stimulate and sustain demand for investment in low carbon options by overcoming the many potential barriers to change.

## Conclusions and Recommendations

From a climate and carbon perspective, the analysis in this report suggests that background trends – particularly in the decarbonisation of electricity – will do a lot to help the City of Bristol to meet its target of a 40% reduction in emissions by 2020, compared to 2005 levels. However, these background trends are not guaranteed. This report has shown that Bristol has significant opportunity to do much more. There are substantial opportunities for the city to reduce its carbon emissions through cost-effective or cost-neutral investments. The analysis shows that many of these opportunities could also be economically attractive and socially beneficial.

Pursuing a low carbon Bristol on this scale and at this rate should be possible. The technological and behavioural options assessed in this report are readily available, the energy and financial savings associated with these are clear (even based on conservative assessments) and, for a significant proportion of the available measures, the investment criteria are commercially realistic.

The economic returns on investment could be very significant indeed. Many of the measures would pay for themselves in a relatively short period of time, they would generate significant levels of employment, and if done well there may be a wider range of social benefits, particularly relating to reductions in fuel poverty and enhanced mobility. The political, social and economic case for large investments in the low carbon economy is very strong.

However, the transition depends on political and social will as well as financial capital. The levels of ambition, investment and activity needed to exploit the available potential are very significant indeed. Substantial levels of investment are required, along with major new initiatives with widespread and sustained influence in the domestic, commercial, transport and industrial sectors. Of course there are significant questions relating to how such investments could best be realized and about the ways in which large-scale programmes could best be designed and delivered.

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<sup>2</sup> Including those directly and indirectly created as well as those induced by economic multiplier effects.

Whilst this report provides some vital insights, we should of course recognise that economics is not the only discipline that has something useful to say on the transition to a low carbon economy/society. A wider analysis should also consider the social and political acceptability of the different options, as well as issues relating to the social equity and broader sustainability of the different pathways towards a low carbon economy and society.

And, as the discussion in the report makes clear, the significance of consumption-based emissions highlight the need to consider the wider impacts of Bristol's role in climate change. Previous research indicates that, for an average Bristol resident, consumption-based emissions may be twice as large as their production-based emissions. Furthermore, past trends in the UK suggest that consumption-based emissions are rising faster than production-based emissions are falling. Tackling consumption-based carbon emissions is a major challenge.

We also need to think about 'future proofing' investments to consider their compatibility with the more demanding targets for carbon reduction and with the different levels of climate change that are likely to come after beyond 2025

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## APPENDIX 2:

### THE ECONOMICS OF LOW CARBON CITIES: A MINI-STERN REVIEW FOR THE CITY OF BRISTOL SUMMARY OF INTERVENTIONS

Sector	Measures
Commercial	0.95 Power factor correction
Commercial	95% efficiency boilers
Commercial	Air source heat pump
Commercial	Air tightness
Commercial	Chilled beams - active
Commercial	Chilled beams - passive
Commercial	Cooling (Chiller CoP5.4)
Commercial	Cooling (SFP 2.0l/s)
Commercial	Daylight sensing
Commercial	DC drive fan coils
Commercial	External shading
Commercial	Fabric improvements
Commercial	Heat recovery
Commercial	Heating controls
Commercial	LED lighting
Commercial	Movement sensing (PIR)
Commercial	Replace single with double glazing
Commercial	Solar PV 100kWp
Commercial	Solar PV 10kWp
Commercial	Solar PV 50kWp
Commercial	Solar thermal 50m2
Commercial	T5 lighting
Commercial	T5 lighting - conversions
Commercial	T5 lighting - new luminaries
Commercial	Variable speed pumps
Commercial	Warm air blowers
Commercial	Wind turbine 20kW
Domestic	A rated ovens
Domestic	A+ rated wet appliances
Domestic	A++ rated cold appliances
Domestic	Air source heat pump
Domestic	Cavity wall insulation
Domestic	Draught proofing
Domestic	External wall insulation
Domestic	Ground source heat pump
Domestic	Hot water tank insulation
Domestic	Hot water tank thermostat
Domestic	Induction hobs
Domestic	Integrated digital TVs

Domestic	Internal wall insulation
Domestic	Loft insulation
Domestic	Low energy lighting
Domestic	Mains gas, condensing combi
Domestic	Oil condensing combi
Domestic	Old double to triple glazing
Domestic	Reduce heating for washing machines
Domestic	Reduce household heating by 1 C
Domestic	Reduced standby consumption
Domestic	Room thermostat
Domestic	Single to triple
Domestic	Solar PV
Domestic	Solar thermal
Domestic	Solid floor insulation
Domestic	Suspended floor insulation DIY
Domestic	Suspended floor insulation professional
Domestic	Thermostatic radiator valves
Domestic	Turn unnecessary lighting off
Industrial	Boilers and Steam Piping - Automatic monitoring of steam traps
Industrial	Boilers and Steam Piping - Boiler maintenance
Industrial	Boilers and Steam Piping - Feedwater economiser
Industrial	Boilers and Steam Piping - Flash condensate
Industrial	Boilers and Steam Piping - Heat exchanger
Industrial	Boilers and Steam Piping - Improve steam traps and maintain steam traps
Industrial	Boilers and Steam Piping - Improved blowdown
Industrial	Boilers and Steam Piping - Improved process control (including flue gas monitoring)
Industrial	Boilers and Steam Piping - Insulate valves and fittings
Industrial	Boilers and Steam Piping - Insulation pipes (Improvement and Maintenance)
Industrial	Boilers and Steam Piping - Minimise short cycling (via multiple boiler operation and/or boiler downsizing)
Industrial	Boilers and Steam Piping - Reduced excess air
Industrial	Boilers and Steam Piping - Repair leaks
Industrial	Boilers and Steam Piping - Return condensate
Industrial	Boilers and Steam Piping - Vapour recompression
Industrial	Boilers and Steam Piping - Vent condenser
Industrial	Compressed Air Systems - Address restrictive end use drops and connections
Industrial	Compressed Air Systems - Correct compressor intake problems
Industrial	Compressed Air Systems - Correct excessive pressure drops in main line distribution piping
Industrial	Compressed Air Systems - Correct excessive supply side pressure drop
Industrial	Compressed Air Systems - Eliminate artificial demand with pressure optimisation/control
Industrial	Compressed Air Systems - Eliminate inappropriate compressed air uses
Industrial	Compressed Air Systems - Fix leaks, adjust compressor controls, establish ongoing plan
Industrial	Compressed Air Systems - Improvement of automatic control
Industrial	Compressed Air Systems - Install dedicated storage with metered recovery
Industrial	Compressed Air Systems - Install sequencer
Industrial	Compressed Air Systems - Match air treatment to demand side needs

Industrial	Compressed Air Systems - More frequent filter replacement
Industrial	Compressed Air Systems - Predictive maintenance
Industrial	Compressed Air Systems - Reconfigure branch header piping to reduce critical pressure loss
Industrial	Compressed Air Systems - Replace existing condensate drains with zero loss type
Industrial	Compressed Air Systems - Shut-off idle equipment, engineered nozzles
Industrial	Compressed Air Systems - Size replacement compressor to meet demand
Industrial	Compressed Air Systems - Variable speed drive
Industrial	Fan - Correct damper problems
Industrial	Fan - Correct damper problems
Industrial	Fan - Correct poor airflow conditions at fan inlets and outlets
Industrial	Fan - Fix leaks and damaged seals
Industrial	Fan - Install variable speed drive
Industrial	Fan - Isolate flow paths non-essential or non-operating equipment
Industrial	Fan - More efficient motor
Industrial	Fan - Predictive maintenance
Industrial	Fan - Repair or replace inefficient belt drives
Industrial	Fan - Replace oversized fans with more efficient type
Industrial	Furnaces - Efficient design burners (e.g. low NOx)
Industrial	Furnaces - Flue gas heat recovery
Industrial	Furnaces - Improved process controls (e.g. air-to-fuel ratio)
Industrial	Furnaces - Maintenance of door and tube seals
Industrial	Furnaces - Oxygen enrichment
Industrial	Furnaces - Reducing Radiation heat losses
Industrial	Furnaces - Reducing Wall heat losses
Industrial	Furnaces - Reducing wall heat losses on already insulated areas
Industrial	Pumps - Fix leaks, damaged seals and packaging
Industrial	Pumps - Install variable speed drive
Industrial	Pumps - Isolate flow paths to no-essential equipment
Industrial	Pumps - More efficient motor
Industrial	Pumps - More efficient pump
Industrial	Pumps - Predictive maintenance
Industrial	Pumps - Remove scales from heat exchangers and strainers
Industrial	Pumps - Remove sediment/scale buildup
Industrial	Pumps - Trim or change impeller to match output
Industrial	Pumps - Use of pressure switches
Industrial	Refrigeration - Electronically controlled pumps
Industrial	Refrigeration - Improved compressor / heat exchanger
Industrial	Refrigeration - Improved insulation
Industrial	Refrigeration - Improved process measuring and control
Industrial	Refrigeration - Multicompressor refrigeration systems
Industrial	Refrigeration - Multi-level compression and soprtion process
Industrial	Refrigeration - Reduced cooling load
Industrial	Refrigeration - Regular clearing / maintenance
Industrial	Refrigeration - Speed-controlled compressor and fan
Industrial	Refrigeration - Systems optimisation
Transport	Bus Priority and Quality Enhancements

Transport	Express Bus/Coach Network
Transport	Full hybrid - petrol engine
Transport	Local rail services operating at enhanced frequency
Transport	Micro-hybrid - 2nd gen petrol engine
Transport	Mild Hybrid - petrol engine
Transport	New railway Stations/Lines
Transport	Park and Ride (Bus + Dedicated service)
Transport	Park and Ride (Bus)
Transport	Plug-in hybrid - petrol engine
Transport	Rapid Transit Network
Transport	Smartcard/smart ticketing
Transport	Smarter Choices (Travel Planning)
Transport	Walking / Cycling