# VantagePoint Modelling Scenario Report

## LCTP TRANSLATION SCENARIO FOR DERBY CITY COUNCIL

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|---|---|---|---|
| **Commissioned by:** | East Midlands Regional Efficiency and Improvement Partnership | **Developed by:** | Loukas Botsis |
| **Prepared for:** | Anne Gayfer | **Written by:** | Jonas Rooze |
| **Modelled Area:** | Derby City Council | **Checked by:** | Craig Copeland |
| **Scenario Type:** | LCTP Translation | **Date:** | 23/11/2011 |

## Purpose of Scenario Development

As part of the analysis of East Midlands' emissions reductions, Carbon Descent has produced a Scenario that investigates the impact of the Low Carbon Transition Plan (LCTP) on Derby City Council. The Scenario delivered is a snapshot which has been developed based on current national policy, and it will be important to periodically update the Scenario as additional data becomes available and national policies are refined and updated. The periods chosen to be modelled are: 2020, 2035, and 2050.

## Scenario Results

The Derby City Council LCTP Translation Scenario calculates that the LCTP will provide insufficient carbon savings for Derby City Council to achieve its carbon emissions reduction target in 2020. As expected the 2020 LCTP-informed Measure Deployment is also insufficient to meet carbon emissions reduction targets in both 2035 and 2050.

Carbon Descent Third Floor 84 Long Lane London SE1 4AU
www.carbondescent.org.uk T 020 7089 6970 F 020 7407 9646

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Delivering a Sustainable Future

# CARBON DESCENT

Carbon Descent is an independent social enterprise and environmental trust with the experience, expertise and commitment to create strategies and deliver solutions that measurably reduce carbon footprints, creating a sustainable and equitable future for all.

Working in the key areas of energy, resource use, transport, the built environment and renewables for over 10 years, we partner with local authorities, private business, charities and communities to foster a low carbon world. We have wide experience of conducting energy and water audits, environmental assessments and technical feasibility studies, identifying carbon reduction measures, investigating the potential for renewable energy in new and existing developments and project management.

As awareness of climate change and the urgency to reduce our impact on the environment increases, Carbon Descent continues to help organisations take mitigation actions. By working with large organisations on strategies that reach thousands of people to working at the coal face directly with community members we understand the mechanisms and investment needed to create lasting behaviour change.

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# 1 Introduction

## 1.1 Commissioning Background

This report has been produced on behalf of the East Midlands Regional Efficiency and Improvement Partnership with the aim of investigating the impact of the Low Carbon Transition Plan (LCTP) on the local authorities within the East Midlands. In particular, this scenario translates the policies encapsulated in the government's Low Carbon Transition Plan into specific carbon reduction measures and technologies, which belong to the Transport, Domestic, Commercial and Industrial (C&I) and Large Generation sectors. The ultimate purpose of this study is to calculate whether the savings achieved from the LCTP will be sufficient for Derby City Council to meet its 2020 carbon reduction targets. This report should be read in conjunction with the *Meeting the National Targets report* and three additional focused scenarios that detail the impacts of focusing on the three core technologies of Solar PV, Biomass and the electrification of heating and transport.

## 1.2 The Low Carbon Transition Plan

The LCTP details how 43 UK and EU policies aim to achieve emissions cuts of 18% on 2008 levels by 2020. According to the LCTP all major UK government departments have been allocated their own budget and have been tasked with producing their own carbon reduction plan. The LCTP aims for 40% of UK's electricity to be delivered from low carbon sources; this will be achieved through policies that will lead to 30% production of electricity from renewable and facilitation of the building of new nuclear power stations and funding up to 4 carbon capture and storage projects in power stations. Moreover it will aid the greening of the domestic sector by channelling some £3.2 billion to help households become more energy efficient, roll out smart meters to every household, steer "pay as you save" ways in which the savings on energy bills will be used to repay upfront costs, aid emerging clean energy cash back schemes so that energy consumers will be rewarded when they use low carbon sources and by opening a competition for 15 towns and villages to take a leading role in community green development and innovation. The plan also sets out a way to help more vulnerable energy consumers by creating mandated social price support at the earliest opportunity with increased resources compared to the current voluntary system, helping 90,000 homes by leading a community based approach to greening the domestic sector of low income areas and by increasing the level of Warm Front grants so the majority of eligible applicants can receive their energy saving measures without having to put in a payment themselves. Furthermore LCTP aims to establish UK as a leader in the green industry by investing in clean technologies and specifically by investing £120 million in offshore wind and an extra £60 million to establish UK's position as a global leader in marine energy. New projects will be supported in the transport sector in order to reduce the average car emissions by 40% compared to the 2007 levels and to deliver 10% of UK transport energy by renewable resources. LCTP also sets out a framework to reduce emissions from farming. Finally in order to increase energy security, gas imports will be 50% lower than would otherwise have been the case.

## 1.3 The purpose of this report

This report and associated scenario has been developed in order to outline how the carbon reduction measures contained within the LCTP are expected to be deployed at the local level. The level of deployment has been determined by analysing the deployment of LCTP measures up to 2020 and calculating what this equates to as a proportion of the overall national potential for each measure. Once the national roll out percentage is determined this is applied to the local potential for each measure



thereby giving a nationally apportioned estimate of deployment in each authority.

The deployment mechanism that is utilised for each of the LCTP policies is not explored within this report and the reader should refer back to the LCTP. For example, some measures, such as the decarbonisation of the national electricity grid, will require no direct intervention from the Local Authority. Other measures, such as Cavity Wall insulation, will have varying degrees of intervention at the Local Authority level.



# 2 Scenario

## 2.1 Report Structure

This report is designed to provide the key results and the majority of the understanding at the start, while the latter sections are used to provide additional, in-depth analysis and detailed data results. As such, there is no separate conclusion section at the end of this report – refer to the Title Page or Section 3.1 instead.

As such, Section 2 provides a basic description of the Scenario and modelling process, required in order to understand and interpret the results. This Section is augmented by the separate *Business as Usual Methodology* and *Deployment Potentials Methodology* reports, which detail the methodology and assumptions of the VantagePoint model setup work.

Section 3 first summarises the key results before engaging in sectoral and energy-based analysis of the scenario results, while the last part of this section provides more extensive Measure-specific detail. As such, the first two parts of Section 3 are the most relevant in terms of providing a broad understanding of the Scenario. For even greater detail, Section 4 provides the raw Scenario VantagePoint input and output data.

## 2.2 Description

As part of the analysis of the East Midlands' emissions reductions, Carbon Descent has produced a Scenario for Derby City Council which has been outlined below. This Scenario has been developed in order to determine whether national policy, encapsulated in the LCTP and subject to the current understanding of technology, will allow Derby City Council to meet its Climate Change Act carbon reduction target in 2020. Moreover, this Scenario details how the LCTP will deliver carbon savings for the later modelling periods, to provide insight into the scale of effort required beyond the LCTP in order to meet later targets.

The chosen modelling years are: 2020, 2035 and 2050.

## 2.3 Constraints of Model

The deployment in this Scenario does not exceed that prescribed by the LCTP, and is maintained at that level for all periods beyond 2020.

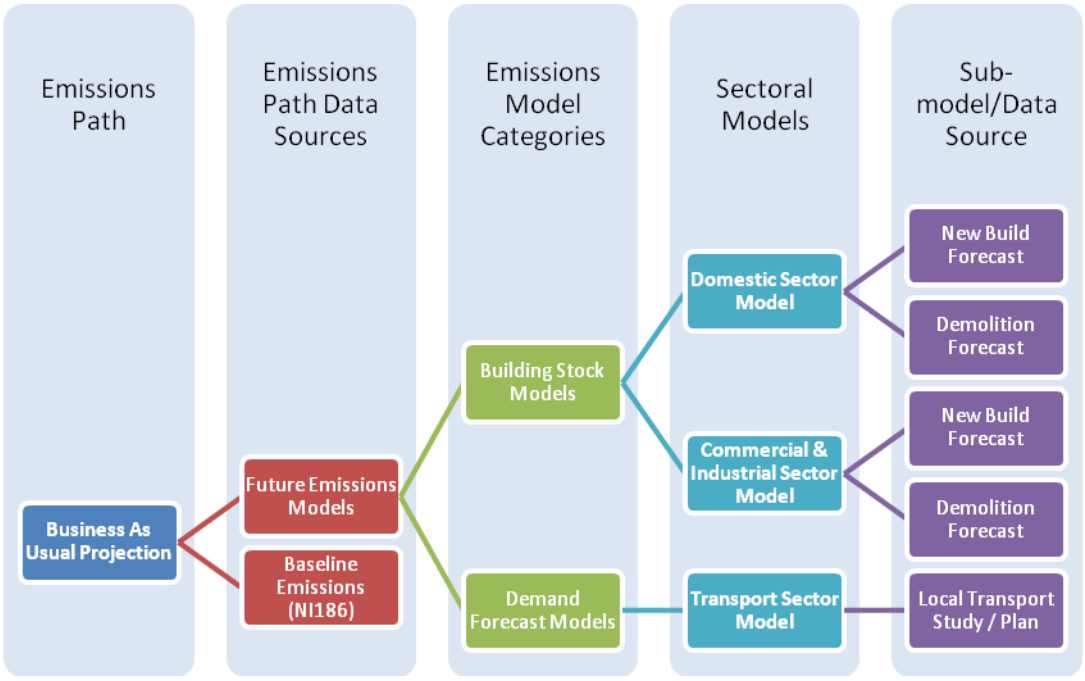
## 2.4 Methodology for BAU

The Business As Usual (BAU) projection for emissions is calculated in accordance with the separate *Business as Usual Methodology* report. The BAU emissions projection up to 2050 is used as a reference 'no further intervention' $CO_2$ emissions case – typically led by energy demand growth – to which the emissions reductions Measures are applied during the Scenario modelling stage.

The BAU modelling process is portrayed diagrammatically below. The projection takes the current emissions from the NI186 as a basis in the starting year. It then forecasts emissions change in all three Sectors: Domestic, Commercial & Industrial (C&I) and Transport. Both the Domestic and C&I models are building-stock based – the Domestic model in terms of the number of dwellings, and the C&I model in terms of $m^2$ of floorspace. For both, the pertinent questions relating to emissions growth are what the level of new build and demolition will be. The transport model is demand-based, typically extrapolating



emissions using local transport demand growth forecasts.




## 2.5 Methodology for determining Deployment Potentials

The Deployment Potential for a given Measure was calculated wherever possible using pertinent local data or studies. Where this was not available, standard Carbon Descent methodology was applied to regional or national datasets in order to calculate the Deployment Potential. The methodology used for each Deployment Potential is given in the separate *Deployment Potentials Methodology* report. The Deployment Potentials for this particular Scenario are provided in Table 5 in Section 4.

## 2.6 Methodology for Deployment of Measures

The Scenario delivered provides an investigation of whether Derby City Council can meet its carbon emissions reduction targets under the conditions outlined below, subject to the current understanding of technology, and subject to current policies. It will be important to periodically update the Scenarios as additional data becomes available and national policies are refined and updated.

The Scenario modelled here is in accordance with the LCTP. The suite of national policies this represents has been mapped on to Derby City Council. As the LCTP aims to contribute to the 2020 national Climate Change Act carbon reduction target of 34% (on a 1990 baseline), no deployment is prescribed by it after 2020. Consequently, this Scenario does not increase measure deployment after 2020, instead deployment levels are maintained.

The actual measure deployment for this particular Scenario is provided in Table 7 in Section 4.



# 3 Results and Analysis

## 3.1 Key Scenario Results

### 3.1.1 Business As Usual (BAU)

When modelling emissions into the future it is important to understand the *doing nothing* position and how that may affect the magnitude of measure deployment. This is what is encapsulated within the BAU model that has been completed as part of this work. As noted above the methodology for our BAU is contained within a separate report, the reader should refer to this is more detail is required.

In most instances each local authority will have some growth in emissions over the next few years and may have significant estimates of emissions up to and including 2050. That being said caution is required when looking at the growth projections up to 2050.

| $CO_2$ comparison | 2020 | 2035 | 2050 |
|---|---|---|---|
| Baseline data (2005) | 1678 | 1678 | 1678 |
| Growth kt | 295 | 555 | 815 |
| Percentage growth from 2005 | 18% | 33% | 49% |

**Table 1: Business As Usual (BAU)**

### 3.1.2 Scenario Savings Overview

What is important to note is that within this model the LCTP only relates to savings up to 2020 and it is probable that the deployment of Measures solely linked to the LCTP may not be sufficient to meet the short, medium and long term national objectives of carbon reduction.

As can be seen from the table below, it is estimated that Derby City Council's savings will be 510.39 $ktCO_2$ in period one which is 76% of the target savings. The LCTP therefore does not deliver sufficient carbon savings for Derby City Council to achieve its 2020 target. Consequently, the LCTP alone will not provide sufficient savings in Derby City Council for the later modelled periods.

The table below provides an overview of the Scenario savings for each period in relation to the savings required to meet the targets in each period.

| $CO_2$ comparison | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|
| $CO_2$ savings targets (ktpa) | 672.99 | 1543.34 | 2098.72 |
| Total CO2 savings for the Scenario (ktpa) | 510.39 | 950.75 | 1191.57 |
| Comparison of targets vs. savings (ktpa) | -163 (24%) | -593 (38%) | -907 (43%) |

**Table 2: Scenario CO2 Savings Overview**

### 3.1.3 Scenario System Graph

Figure 1 shows the system graph of $CO_2$ savings for the Scenario. Cumulative savings per Sector from the BAU emissions case (dotted dark blue line) provides the final Scenario emissions projection (solid orange line) in relation to the Scenario targets (on a 2005 baseline).



The graph shows the $CO_2$ emissions on the vertical axis in kilotonnes of $CO_2$ saved per annum (ktpa). The horizontal axis indicates the modelling points between 2005 and 2050, as well as the emissions targets (recalculated to show the percentage savings required on a 2005 baseline). Following this the graph depicts a wedge display of cumulative savings down from the Business as Usual emissions case for each target period. From top to bottom, the savings have been grouped into the following wedges: ***Large Generation***, ***Green Grid*** (effectively the savings 'achieved' in Derby City Council by the national electricity grid becoming cleaner), ***Commercial & Industrial***, ***Domestic*** and ***Transport***. Transport, the final savings wedge, leads to the overall Scenario emissions (shown as a solid orange line).

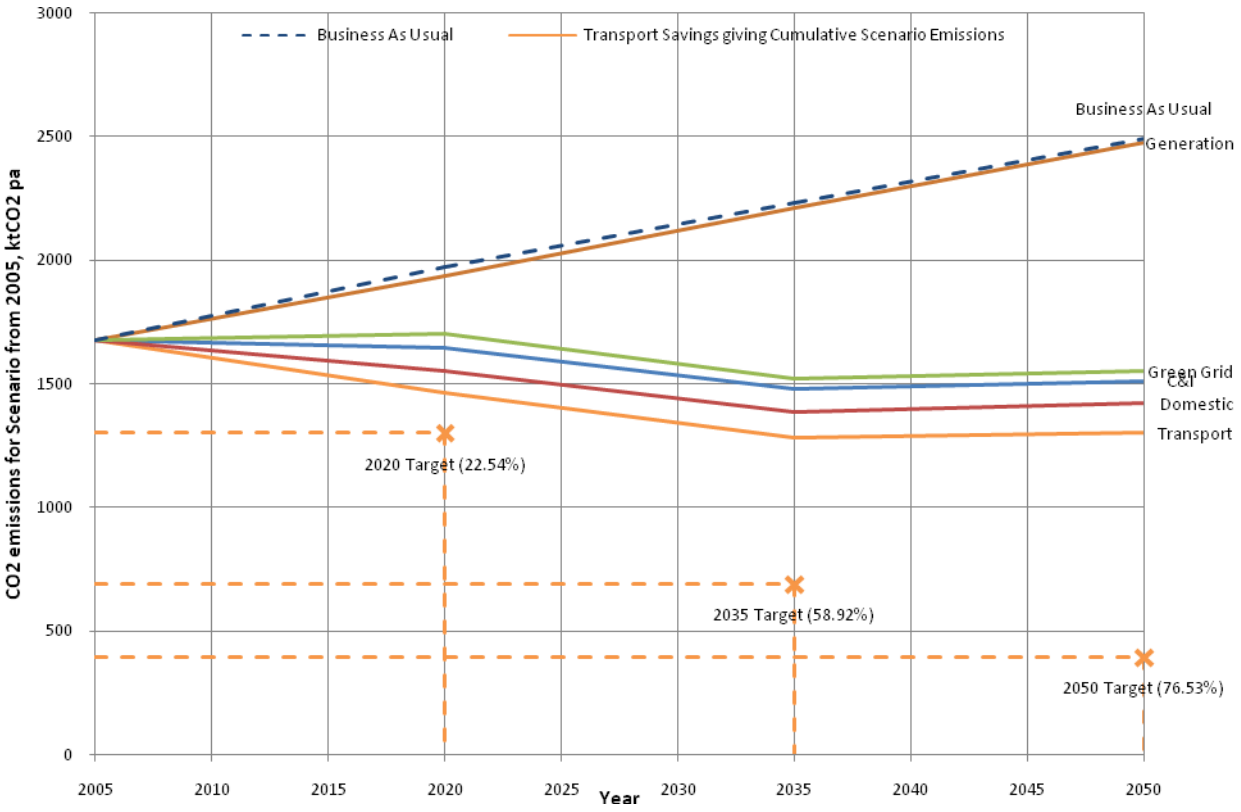



**Figure 1: Scenario System Graph**

## 3.2 Analysis & Discussion

### 3.2.1 Effect of Business As Usual Emissions Growth

What can be seen from Figure 1 is that as the target savings increase as the national government aims to reduce emissions within each budget period. As a consequence the savings informed by the LCTP diverge in the periods beyond 2020 which in turn will require a greater degree of measure deployment.

As shown in Table 2, between the first and second periods, Derby City Council moves from achieving 76% of the savings to achieving 62% of the savings. In this instance an additional 593ktCO2 would need to be found from extra Measures in order to meet the 1543.34ktCO2 target. This gap further increases in the final period, 2036-2050, where the Measures deployed achieve 57% of the target savings.

In all instances the savings assume that emissions growth under BAU (typically led by energy demand

growth) will be as predicted. If growth is less than calculated within the BAU and as depicted on Figure 1, then it would bring the authority closer to its interim targets. Effectively, the absolute savings target in ktCO2pa increases or decreases with greater or lesser BAU emissions growth. Consequently, greater or lesser emissions growth will move the final Scenario emissions projection up or down on Figure 1. This could affect whether or not targets are met.

### 3.2.2 **Sectoral Analysis**

The following section will analyse the carbon savings on a Sectoral basis. In conjunction with the Measure-Specific Analysis given in Section 3.2.4, as well as the raw Scenario deployment numbers provided in Section 4, an understanding can be gained from this section as to the effectiveness of decarbonisation efforts in each of the Sectors, and potentially where significant potential still exists for decarbonisation in order to meet the targets.

#### 3.2.2.1 Sectoral Savings Breakdown

In 2020 the savings are split between the Sectors in the following proportions:

| Sector | Absolute savings ($ktCO_2pa$) | As percentage of total savings | As percentage of target savings |
|---|---|---|---|
| Domestic | 96.188 | 19% | 14% |
| Commercial & Industrial | 56.725 | 11% | 8% |
| Transport | 88.053 | 17% | 13% |
| Large Generation | 38.127 | 7% | 6% |
| Green Grid | 231.3 | 45% | 34% |

**Table 3: Breakdown of savings achieved per Sector in 2020**

From the Table, we can see that the greatest savings in 2020 are achieved by the Green Grid, followed by the Domestic Sector.

#### 3.2.2.2 Demand Sector Decarbonisation

Further analysis is provided in Figure 2. This figure shows to what extent the energy demand Sectors (Transport, C&I and Domestic) have been decarbonised in each period against the 2005 baseline. This is shown as the savings achieved in the Sector in each period as a percentage of the Sector emissions predicted under the BAU for each period. Consequently, it gives an indication of the success achieved by the relevant measure deployment in abating emissions from each demand Sector.



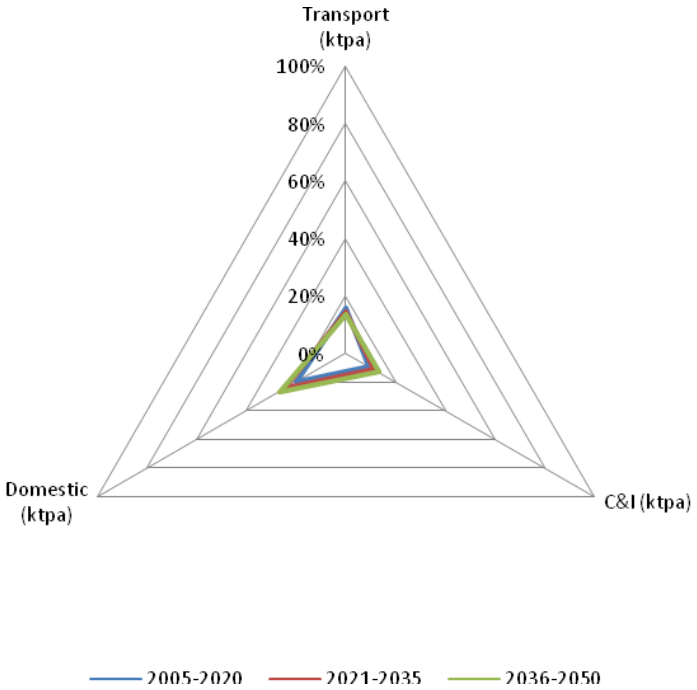



**Figure 2: Demand Sector Decarbonisation**

It is clear from the figure that under the LCTP, decarbonisation is limited for all Sectors and does not vary greatly between periods – consequently the decarbonisation is shown as overlapping for the different periods, and significantly more effort is required to further decarbonise these demand Sectors. The maximum decarbonisation occurs in the Domestic Sector, with some 30% of emissions mitigated. This is in accordance with the impression given by Section 3.2.4.2, which indicates that the LCTP prescribes significantly more deployment effort for the Domestic Sector.

### 3.2.3 Energy Analysis

Having considered the Scenario results from a carbon savings perspective, the following section takes an alternative view on the Scenario results by examining energy instead. In particular, energy demand may be split into the following categories: thermal demand and power demand, both measured in MWh, as well as transport fuel demand (whether conventional fossil fuel, biofuel or electricity, but all measured for convenience in thousands of fossil fuel litres). Two exploitable energy 'resources' are also included: biomass resource (MWh), and community heating potential (the amount of Derby City Council's heating demand that could be met by a district heating network).

Figure 3 considers the Scenario's energy performance, split into the categories defined above, giving the extent to which BAU energy demand has been offset under the Scenario, or the extent to which available energy resources have been utilised. In more detail, the graph shows, as a percentage of the predicted energy demand under Business as Usual, the extent to which energy demand has been displaced by the installed Measure deployment for the three energy demand categories. It also shows the utilisation of the two exploitable energy resource categories as a percentage of their Deployment Potentials.

It must be understood, however, that energy demand displacement does not necessarily translate into direct emissions reductions; for example, the Fuel Switch measure displaces a certain amount of



domestic thermal demand, previously supplied by electric heating, with only marginally cleaner gas heating, giving limited carbon savings. This observation makes an instant case for energy efficiency measures.

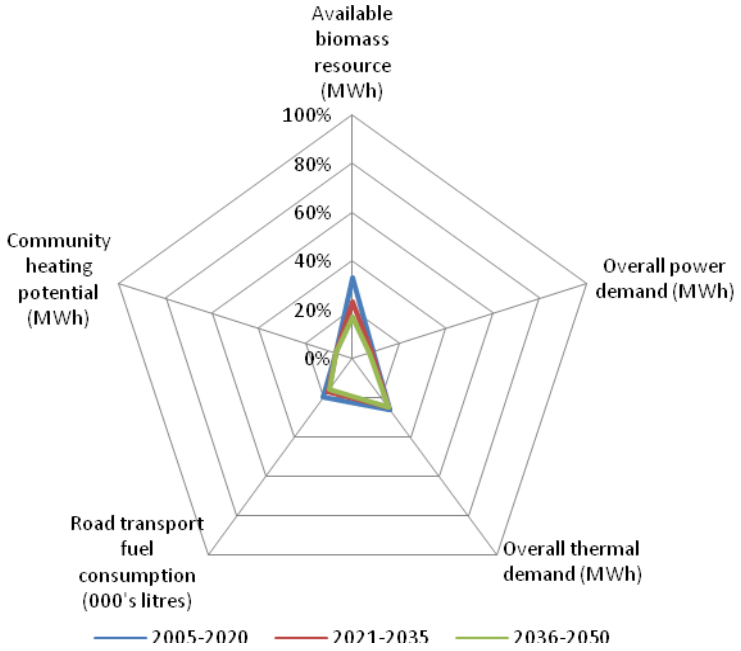



**Figure 3: Scenario Energy Performance**

As is usual under LCTP Scenarios, the overall demand displacement and resource utilisation is fairly poor – the LCTP is after all designed for 34% reduction target, and not more. Typically under LCTP, Overall Thermal Demand has a higher level of energy displacement, in part because the LCTP is quite focused on domestic energy efficiency and insulation measures, thereby offsetting thermal demand previously supplied by a mixture of gas, electricity and other fuels.

In this Scenario, LCTP-related deployment has resulted in use being made of the Biomass resource, with large-scale heating and power systems such as Combined Heat and Power (CHP) biomass and power only biomass installations consuming some 30% of all biomass that could feasibly be utilised in the county. The biomass CHP component of this, as well as other CHP deployment prescribed by the LCTP, results in some 10% of the community heating potential being utilised. It should be pointed out that in this case it is observed that the utilisation of biomass resource seems to drop over the periods. This is due to the fact that the available biomass resource increases over the years and not because the deployment of biomass technologies reduced over the years

Finally, the use of biofuels instead of conventional road transport fuel, as well as road transport efficiency improvements, result in some 20% of all road transport fuel demand being offset or abated.

As was the case for Figure 2: Demand Sector Decarbonisation, the Scenario energy performance results for the different periods overlap due to the LCTP-derived Measure Deployment being maintained across periods.



### 3.2.4 **Measure-Specific Analysis**

In this section, deployment levels and carbon savings are examined on a Measure-by-Measure basis.

#### 3.2.4.1 Notable large savings

In 2020, the four largest $CO_2$-saving Measures within the Scenario are provided in Table 4. This table also shows what percentage of the total Scenario savings are achieved by these four Measures. In this case, the four Measures together account for 69% of the total $CO_2$ savings within the Scenario.

| Measure | CO2 Savings (ktCO2pa) | CO2 Savings as % of Total Scenario CO2 Savings | CO2 Savings as % of Target CO2 Savings |
|---|---|---|---|
| Green grid | 231.3 | 45% | 34% |
| Road transport efficiency improvements | 54.001 | 11% | 8% |
| Replace road transport fuels with biofuels | 33.51 | 7% | 5% |
| Fuel reduction by behavioural change and technology mix (Non-Domestic) | 32.415 | 6% | 5% |
| **Total** | **351.226** | **69%** | **52%** |

**Table 4: Notable Large Savings Summary for the 2005-2020**

#### 3.2.4.2 Deployment Effort Levels

The following charts set out the effort levels for each Measure, grouped by Sector. The effort level is defined as the Measure Deployment divided by the Deployment Potential. Effectively, this gives an indication of the amount of effort that has been undertaken in relation to the complete utilisation of that Measure's Deployment Potential, giving an idea of the scale of savings that could still be achieved by further deployment.

For the LCTP scenario, deployment remains more or less constant across all periods (where deployment changes, this is usually due to Deployment Potentials changing with time).

The first effort level graph, Figure 4, shows how much focus has been given to specific Large Generation Measures. Green Grid is the only measure that changes with time – the decarbonisation of the grid as modelled by Carbon Descent is independent of the LCTP. The Green Grid effort level is expressed as a percentage of its ultimate 2050 value. Moreover, there is some focus on the use of biomass in this Scenario, in the form of CHP and power only biomass. Finally there is also a fair deployment of large wind generation.



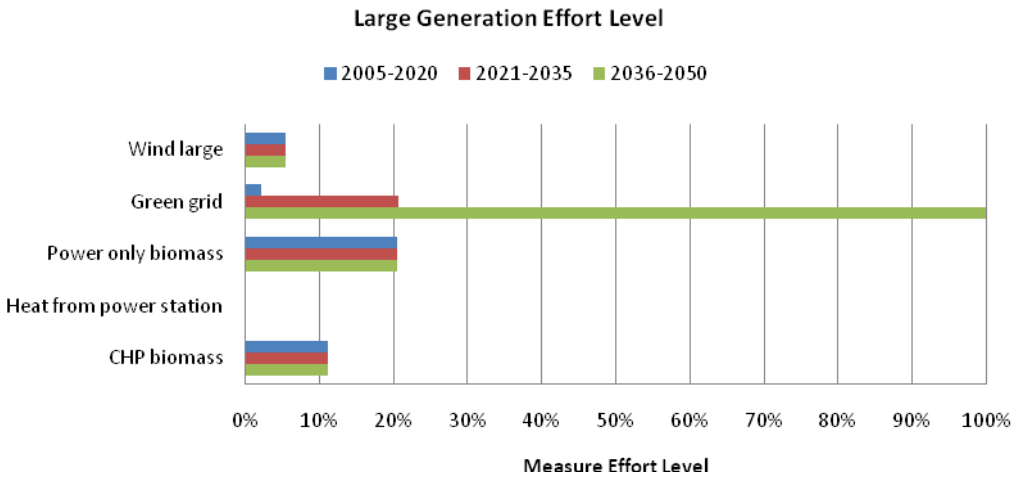



**Figure 4: Effort Level for the Large Generation Sector**

The next effort level graph, Figure 5, is for the Transport Sector Measures. Here, the LCTP Translation results in road transport efficiency improvements, and increased replacement of road transport fuel with biofuel (the effort level shown varies due to the increase in its Deployment Potential, which is in fact the total amount of transport fuel used; this subsequently increases towards 2050 in line with the modelled BAU increase in transport demand).

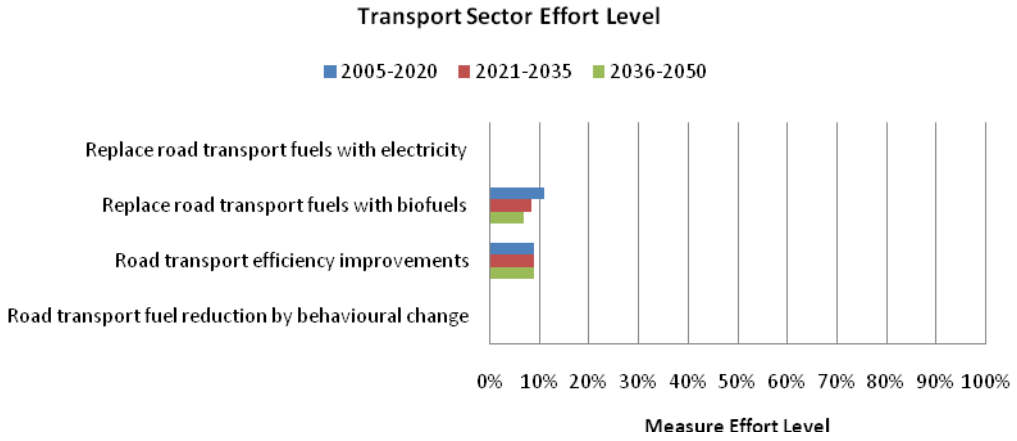



**Figure 5: Effort Level for the Transport Sector**

The Commercial and Industrial Sector effort levels are shown in Figure 6. Here, there is clearly a strong effort in non-domestic solar PV and biomass boiler installations.

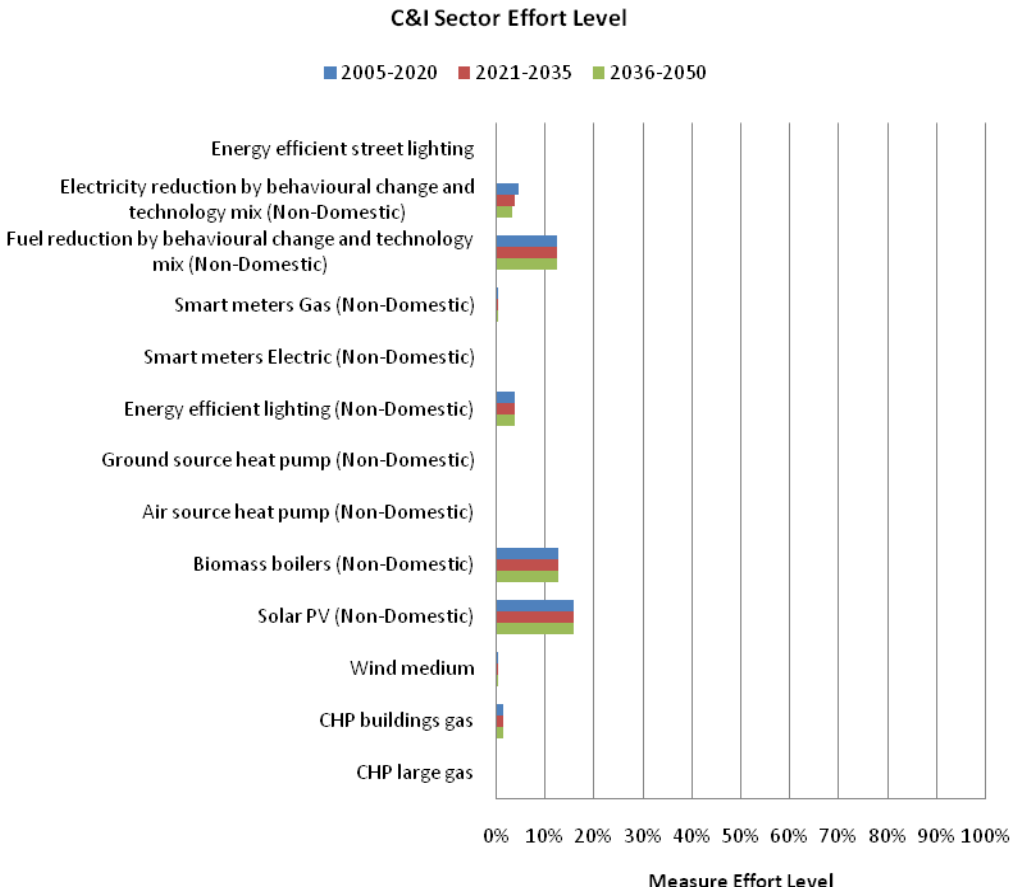



**Figure 6: Effort Level for the Commercial & Industrial Sector**

Finally, Figure 7 shows the deployment effort level undertaken in the Domestic Sector. In Carbon Descent's experience, the LCTP prescribes the greatest deployment focus in this Sector. This is therefore where higher effort levels can be found for this Scenario, particularly for the domestic energy efficiency and insulation measures, such as Cavity Wall and Loft Insulation, Smart Meters and Energy Efficient Appliances, Measures which the LCTP typically assumes will be more or less fully deployed by 2020. Domestic scale solar technologies also see relatively strong deployment focus.



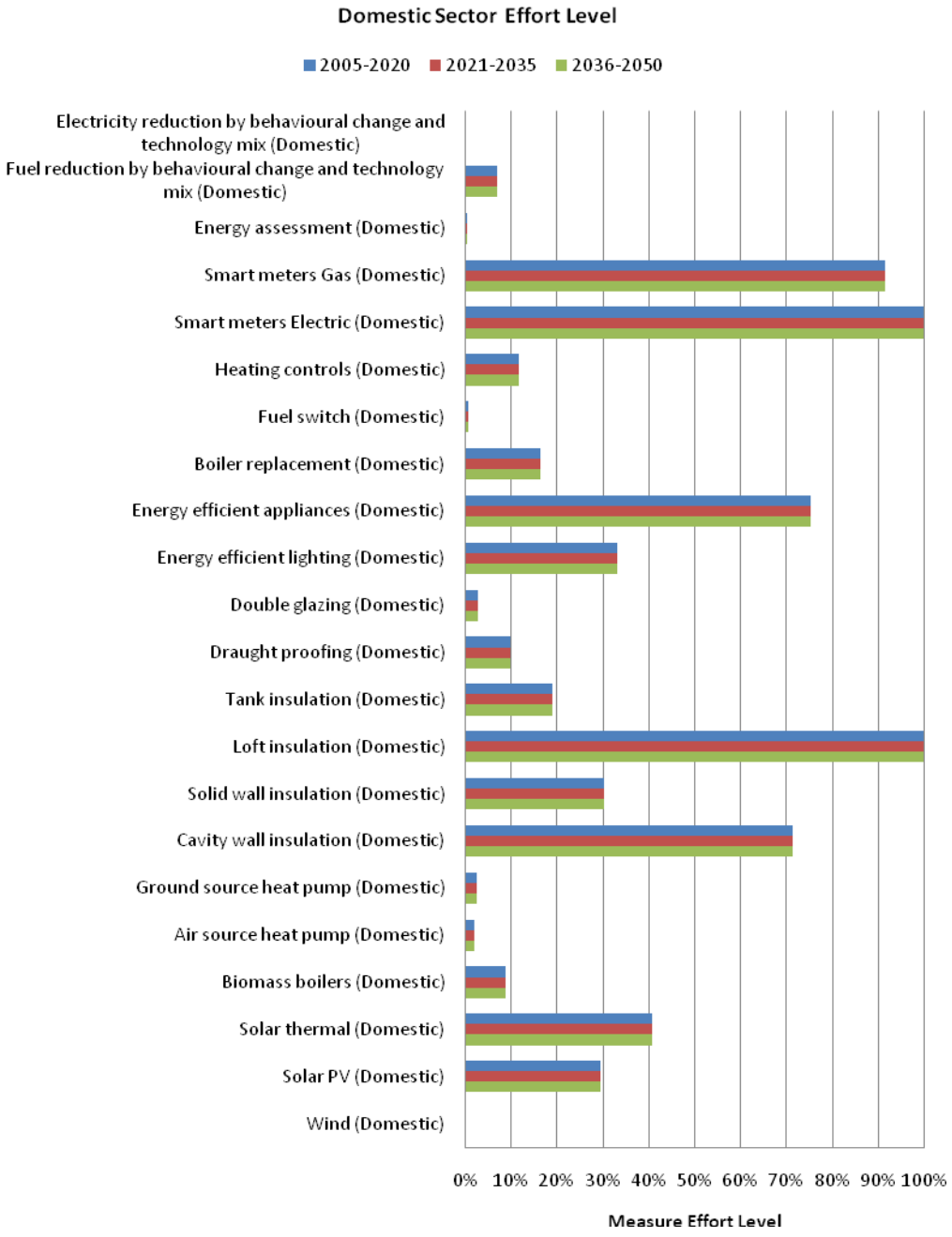



**Figure 7: Effort Level for the Domestic Sector**

# 4 VantagePoint Outputs from Scenario

This section of the report will provide the raw outputs as given by the VantagePoint software. This is the output used in the analysis above.

The Deployment Potentials within the Scenario are defined below and are used to provide an upper limit on the number of installations of each measure.

| Deployment Potentials | Units | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|---|
| CHP biomass | MWe | 31.142 | 31.142 | 31.142 |
| CHP large gas | MWe | 124.793 | 124.793 | 124.793 |
| CHP buildings gas | MWe | 163.174 | 163.174 | 163.174 |
| Heat from power station | MWth | 0 | 0 | 0 |
| Power only biomass | MWe | 31.142 | 31.142 | 31.142 |
| Green grid | % | 298.28 | 298.28 | 298.28 |
| Wind large | MWe | 9.95 | 9.95 | 9.95 |
| Wind medium | MWe | 8.65 | 8.65 | 8.65 |
| Wind (Domestic) | Homes | 0 | 0 | 0 |
| Solar PV (Domestic) | Homes | 15,248.00 | 15,248.00 | 15,248.00 |
| Solar thermal (Domestic) | Homes | 15,248.00 | 15,248.00 | 15,248.00 |
| Biomass boilers (Domestic) | Homes | 8,101.00 | 8,101.00 | 8,101.00 |
| Air source heat pump (Domestic) | Homes | 98,588.00 | 98,588.00 | 98,588.00 |
| Ground source heat pump (Domestic) | Homes | 46,247.00 | 46,247.00 | 46,247.00 |
| Solar PV (Non-Domestic) | MWe | 30 | 30 | 30 |
| Biomass boilers (Non-Domestic) | MWth | 6.504 | 6.504 | 6.504 |
| Air source heat pump (Non-Domestic) | MWth | 75.021 | 75.021 | 75.021 |
| Ground source heat pump (Non-Domestic) | MWth | 37.511 | 37.511 | 37.511 |
| Cavity wall insulation (Domestic) | Homes | 23,066.00 | 23,066.00 | 23,066.00 |
| Solid wall insulation (Domestic) | Homes | 32,784.00 | 32,784.00 | 32,784.00 |
| Loft insulation (Domestic) | Homes | 52,564.00 | 52,564.00 | 52,564.00 |
| Tank insulation (Domestic) | Homes | 2,554.00 | 2,554.00 | 2,554.00 |
| Draught proofing (Domestic) | Homes | 9,836.00 | 9,836.00 | 9,836.00 |
| Double glazing (Domestic) | Homes | 30,309.00 | 30,309.00 | 30,309.00 |



| | | | | |
|---|---|---|---|---|
| Energy efficient lighting (Domestic) | Lamps | 777,516.00 | 777,516.00 | 777,516.00 |
| Energy efficient appliances (Domestic) | Homes | 98,588.00 | 98,588.00 | 98,588.00 |
| Boiler replacement (Domestic) | Homes | 13,402.00 | 13,402.00 | 13,402.00 |
| Fuel switch (Domestic) | Homes | 933.00 | 933.00 | 933.00 |
| Heating controls (Domestic) | Homes | 34,506.00 | 34,506.00 | 34,506.00 |
| Smart meters Electric (Domestic) | Homes | 31,909.00 | 31,909.00 | 31,909.00 |
| Smart meters Gas (Domestic) | Homes | 24,562.00 | 24,562.00 | 24,562.00 |
| Energy assessment (Domestic) | Homes | 98,588.00 | 98,588.00 | 98,588.00 |
| Fuel reduction by behavioural change and technology mix (Domestic) | % | 100 | 100 | 100 |
| Electricity reduction by behavioural change and technology mix (Domestic) | % | 100 | 100 | 100 |
| Energy efficient lighting (Non-Domestic) | 000's m2 | 916 | 916 | 916 |
| Smart meters Electric (Non-Domestic) | % | 100.00 | 100.00 | 100.00 |
| Smart meters Gas (Non-Domestic) | % | 100.00 | 100.00 | 100.00 |
| Fuel reduction by behavioural change and technology mix (Non-Domestic) | % | 100 | 100 | 100 |
| Electricity reduction by behavioural change and technology mix (Non-Domestic) | % | 100 | 100 | 100 |
| Energy efficient street lighting | Lamps | 35,000.00 | 35,000.00 | 35,000.00 |
| Road transport fuel reduction by behavioural change | % | 100 | 100 | 100 |
| Road transport efficiency improvements | % | 100 | 100 | 100 |
| Replace road transport fuels with biofuels | 000's litres | 244,696.13 | 316,374.80 | 388,053.46 |
| Replace road transport fuels with electricity | 000's litres | 244,696.13 | 316,374.80 | 388,053.46 |

**Table 5: Scenario Deployment Potentials**

The following table provides the Resource Potentials used for Derby City Council. These are the limits to the amount of biomass available and the total amount of heat that could viably be provided by a district heating scheme.



| Resource Potentials | Units | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|---|
| Community Heating Potential | MWe | 1,515,236 | 1,515,236 | 1,515,236 |
| Biomass Resource Potential | MWe | 1,112,115 | 1,626,273 | 2,140,431 |
| Overall Power Demand | MWe | 1,498,150 | 1,725,792 | 1,953,435 |
| Overall Thermal Demand | MWe | 2,698,710 | 2,885,325 | 2,914,761 |
| Road transport fuel Consumption | MWe | 244,696 | 316,375 | 388,053 |

**Table 6: Scenario Resource Potentials**

The following table provides the measure deployment used to build this specific Scenario – these are the installations assumed to be in place by the end of the relevant period.

| Deployment | Units | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|---|
| CHP biomass | MWe | 3.441 | 3.441 | 3.441 |
| CHP large gas | MWe | 0 | 0 | 0 |
| CHP buildings gas | MWe | 2.524 | 2.524 | 2.524 |
| Heat from power station | MWth | 0 | 0 | 0 |
| Power only biomass | MWe | 6.387 | 6.387 | 6.387 |
| Green grid | % | 6.48 | 61.62 | 298.28 |
| Wind large | MWe | 0.536 | 0.536 | 0.536 |
| Wind medium | MWe | 0.035 | 0.035 | 0.035 |
| Wind (Domestic) | Homes | 0 | 0 | 0 |
| Solar PV (Domestic) | Homes | 4,504.00 | 4,504.00 | 4,504.00 |
| Solar thermal (Domestic) | Homes | 6,209.00 | 6,209.00 | 6,209.00 |
| Biomass boilers (Domestic) | Homes | 707.00 | 707.00 | 707.00 |
| Air source heat pump (Domestic) | Homes | 1,994.00 | 1,994.00 | 1,994.00 |
| Ground source heat pump (Domestic) | Homes | 1,192.00 | 1,192.00 | 1,192.00 |
| Solar PV (Non-Domestic) | MWe | 4.781 | 4.781 | 4.781 |
| Biomass boilers (Non-Domestic) | MWth | 0.825 | 0.825 | 0.825 |
| Air source heat pump (Non-Domestic) | MWth | 0 | 0 | 0 |
| Ground source heat pump (Non-Domestic) | MWth | 0 | 0 | 0 |
| Cavity wall insulation (Domestic) | Homes | 16,444.00 | 16,444.00 | 16,444.00 |

| | | | | |
|---|---|---|---|---|
| Solid wall insulation (Domestic) | Homes | 9,890.00 | 9,890.00 | 9,890.00 |
| Loft insulation (Domestic) | Homes | 52,564.00 | 52,564.00 | 52,564.00 |
| Tank insulation (Domestic) | Homes | 484.00 | 484.00 | 484.00 |
| Draught proofing (Domestic) | Homes | 971.00 | 971.00 | 971.00 |
| Double glazing (Domestic) | Homes | 866.00 | 866.00 | 866.00 |
| Energy efficient lighting (Domestic) | Lamps | 258,249.00 | 258,249.00 | 258,249.00 |
| Energy efficient appliances (Domestic) | Homes | 74,363.00 | 74,363.00 | 74,363.00 |
| Boiler replacement (Domestic) | Homes | 2,205.00 | 2,205.00 | 2,205.00 |
| Fuel switch (Domestic) | Homes | 7.00 | 7.00 | 7.00 |
| Heating controls (Domestic) | Homes | 4,000.00 | 4,000.00 | 4,000.00 |
| Smart meters Electric (Domestic) | Homes | 31,909.00 | 31,909.00 | 31,909.00 |
| Smart meters Gas (Domestic) | Homes | 22,503.00 | 22,503.00 | 22,503.00 |
| Energy assessment (Domestic) | Homes | 399.00 | 399.00 | 399.00 |
| Fuel reduction by behavioural change and technology mix (Domestic) | % | 6.926 | 6.871 | 6.817 |
| Electricity reduction by behavioural change and technology mix (Domestic) | % | -4.93 | -4.69 | -4.47 |
| Energy efficient lighting (Non-Domestic) | 000's m2 | 34.526 | 34.526 | 34.526 |
| Smart meters Electric (Non-Domestic) | % | 0.00 | 0.00 | 0.00 |
| Smart meters Gas (Non-Domestic) | % | 0.02 | 0.02 | 0.02 |
| Fuel reduction by behavioural change and technology mix (Non-Domestic) | % | 12.52 | 12.43 | 12.34 |
| Electricity reduction by behavioural change and technology mix (Non-Domestic) | % | 4.498 | 3.753 | 3.219 |
| Energy efficient street lighting | Lamps | 0.00 | 0.00 | 0.00 |
| Road transport fuel reduction by behavioural change | % | 0.089 | 0.089 | 0.089 |
| Road transport efficiency improvements | % | 8.86 | 8.86 | 8.86 |
| Replace road transport fuels with biofuels | 000's litres | 26,631.28 | 26,631.28 | 26,631.28 |
| Replace road transport fuels with electricity | 000's litres | 0.00 | 0.00 | 0.00 |

**Table 7: Scenario Deployment**

For the Scenario deployment provided above, VantagePoint calculates the CO2 savings. The full breakdown of Measures has been detailed in terms of their ktCO2 reduction in each of the three periods.



| CO2 Saved by Measure | Units | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|---|
| CHP biomass | ktCO2pa | 23.866 | 17.81 | 16.083 |
| CHP large gas | ktCO2pa | 0 | 0 | 0 |
| CHP buildings gas | ktCO2pa | 4.968 | 4.684 | 4.673 |
| Heat from power station | ktCO2pa | 0 | 0 | 0 |
| Power only biomass | ktCO2pa | 13.843 | 4.343 | 1.202 |
| Green grid | ktCO2pa | 231.30 | 690.09 | 924.66 |
| Wind large | ktCO2pa | 0.418 | 0.131 | 0.036 |
| Wind medium | ktCO2pa | 0.017 | 0.005 | 0.001 |
| Wind (Domestic) | ktCO2pa | 0 | 0 | 0 |
| Solar PV (Domestic) | ktCO2pa | 3.40 | 1.07 | 0.30 |
| Solar thermal (Domestic) | ktCO2pa | 2.37 | 2.24 | 2.24 |
| Biomass boilers (Domestic) | ktCO2pa | 2.10 | 1.98 | 1.98 |
| Air source heat pump (Domestic) | ktCO2pa | 2.57 | 4.54 | 5.29 |
| Ground source heat pump (Domestic) | ktCO2pa | 2.04 | 2.87 | 3.21 |
| Solar PV (Non-Domestic) | ktCO2pa | 1.451 | 0.455 | 0.126 |
| Biomass boilers (Non-Domestic) | ktCO2pa | 0.881 | 0.83 | 0.827 |
| Air source heat pump (Non-Domestic) | ktCO2pa | 0 | 0 | 0 |
| Ground source heat pump (Non-Domestic) | ktCO2pa | 0 | 0 | 0 |
| Cavity wall insulation (Domestic) | ktCO2pa | 10.43 | 9.84 | 9.83 |
| Solid wall insulation (Domestic) | ktCO2pa | 25.03 | 23.62 | 23.59 |
| Loft insulation (Domestic) | ktCO2pa | 19.39 | 18.30 | 18.28 |
| Tank insulation (Domestic) | ktCO2pa | 0.08 | 0.07 | 0.07 |
| Draught proofing (Domestic) | ktCO2pa | 0.26 | 0.24 | 0.24 |
| Double glazing (Domestic) | ktCO2pa | 0.60 | 0.57 | 0.57 |
| Energy efficient lighting (Domestic) | ktCO2pa | 1.20 | 0.38 | 0.10 |
| Energy efficient appliances (Domestic) | ktCO2pa | 10.19 | 3.20 | 0.89 |
| Boiler replacement (Domestic) | ktCO2pa | 1.67 | 1.58 | 1.58 |
| Fuel switch (Domestic) | ktCO2pa | 0.02 | -0.01 | -0.01 |
| Heating controls (Domestic) | ktCO2pa | 0.14 | 0.13 | 0.13 |



| | | | | |
|---|---|---|---|---|
| Smart meters Electric (Domestic) | ktCO2pa | 1.00 | 0.31 | 0.09 |
| Smart meters Gas (Domestic) | ktCO2pa | 0.38 | 0.36 | 0.36 |
| Energy assessment (Domestic) | ktCO2pa | 0.04 | 0.03 | 0.03 |
| Fuel reduction by behavioural change and technology mix (Domestic) | ktCO2pa | 21.685 | 21.684 | 21.683 |
| Electricity reduction by behavioural change and technology mix (Domestic) | ktCO2pa | -8.403 | -2.636 | -0.729 |
| Energy efficient lighting (Non-Domestic) | ktCO2pa | 0.197 | 0.062 | 0.017 |
| Smart meters Electric (Non-Domestic) | ktCO2pa | 0.01 | 0.00 | 0.00 |
| Smart meters Gas (Non-Domestic) | ktCO2pa | 0.36 | 0.34 | 0.34 |
| Fuel reduction by behavioural change and technology mix (Non-Domestic) | ktCO2pa | 32.415 | 32.441 | 32.463 |
| Electricity reduction by behavioural change and technology mix (Non-Domestic) | ktCO2pa | 16.429 | 5.155 | 1.426 |
| Energy efficient street lighting | ktCO2pa | 0.00 | 0.00 | 0.00 |
| Road transport fuel reduction by behavioural change | ktCO2pa | 0.542 | 0.701 | 0.86 |
| Road transport efficiency improvements | ktCO2pa | 54.001 | 69.819 | 85.638 |
| Replace road transport fuels with biofuels | ktCO2pa | 33.51 | 33.51 | 33.51 |
| Replace road transport fuels with electricity | ktCO2pa | 0.00 | 0.00 | 0.00 |

**Table 8: Scenario CO2 savings by measure**

In addition to the ktCO2 savings per measure, where known, the indicative capital expenditure has been outlined in the table below. The costs are for each period and are not cumulative.

| Capital Expenditure | Units | 2005-2020 | 2021-2035 | 2036-2050 |
|---|---|---|---|---|
| CHP biomass | £k | 19871.775 | 11177.873 | 5588.937 |
| CHP large gas | £k | 0 | 0 | 0 |
| CHP buildings gas | £k | 2180.736 | 1635.552 | 0 |
| Heat from power station | £k | 0 | 0 | 0 |
| Power only biomass | £k | 36884.925 | 20747.77 | 10373.885 |
| Green grid | £k | 0.00 | 0.00 | 0.00 |
| Wind large | £k | 802.5 | 0 | 0 |
| Wind medium | £k | 108 | 0 | 0 |
| Wind (Domestic) | £k | 0 | 0 | 0 |



| | | | | |
|---|---|---|---|---|
| Solar PV (Domestic) | £k | 28,544.10 | 0.00 | 0.00 |
| Solar thermal (Domestic) | £k | 24,836.00 | 0.00 | 0.00 |
| Biomass boilers (Domestic) | £k | 5,090.40 | 0.00 | 0.00 |
| Air source heat pump (Domestic) | £k | 13,958.00 | 0.00 | 0.00 |
| Ground source heat pump (Domestic) | £k | 11,920.00 | 0.00 | 1,862.50 |
| Solar PV (Non-Domestic) | £k | 19124 | 0 | 0 |
| Biomass boilers (Non-Domestic) | £k | 0 | 142.14 | 0 |
| Air source heat pump (Non-Domestic) | £k | 0 | 0 | 0 |
| Ground source heat pump (Non-Domestic) | £k | 0 | 0 | 0 |
| Cavity wall insulation (Domestic) | £k | 6,250.36 | 0.00 | 1,953.24 |
| Solid wall insulation (Domestic) | £k | 37,087.50 | 0.00 | 34,769.53 |
| Loft insulation (Domestic) | £k | 15,043.82 | 0.00 | 4,701.19 |
| Tank insulation (Domestic) | £k | 15.88 | 7.56 | 0.00 |
| Draught proofing (Domestic) | £k | 165.68 | 78.89 | 0.00 |
| Double glazing (Domestic) | £k | 3,464.00 | 2,165.00 | 1,082.50 |
| Energy efficient lighting (Domestic) | £k | 258.25 | 0.00 | 0.00 |
| Energy efficient appliances (Domestic) | £k | 68,321.01 | 32,533.81 | 0.00 |
| Boiler replacement (Domestic) | £k | 6,032.88 | 0.00 | 0.00 |
| Fuel switch (Domestic) | £k | 29.05 | 0.00 | 0.00 |
| Heating controls (Domestic) | £k | 440.00 | 0.00 | 0.00 |
| Smart meters Electric (Domestic) | £k | 7,370.98 | 0.00 | 0.00 |
| Smart meters Gas (Domestic) | £k | 6,368.35 | 0.00 | 0.00 |
| Energy assessment (Domestic) | £k | 39.90 | 0.00 | 0.00 |
| Fuel reduction by behavioural change and technology mix (Domestic) | £k | 0 | 0 | 0 |
| Electricity reduction by behavioural change and technology mix (Domestic) | £k | 0 | 0 | 0 |
| Energy efficient lighting (Non-Domestic) | £k | 863.15 | 0 | 0 |
| Smart meters Electric (Non-Domestic) | £k | 0.00 | 0.00 | 0.00 |
| Smart meters Gas (Non-Domestic) | £k | 0.00 | 0.00 | 0.00 |
| Fuel reduction by behavioural change and technology mix (Non-Domestic) | £k | 0 | 0 | 0 |
| Electricity reduction by behavioural change and technology mix (Non-Domestic) | £k | 0 | 0 | 0 |



| | | | | |
|---|---|---|---|---|
| Energy efficient street lighting | £k | 0.00 | 0.00 | 0.00 |
| Road transport fuel reduction by behavioural change | £k | 0 | 0 | 0 |
| Road transport efficiency improvements | £k | 0 | 0 | 0 |
| Replace road transport fuels with biofuels | £k | 0.00 | 0.00 | 0.00 |
| Replace road transport fuels with electricity | £k | 0.00 | 0.00 | 0.00 |

**Table 9: Scenario capital costs by measure**