VantagePoint Modelling Scenario Report

PATHWAY 40% REDUCTION TARGET SCENARIO FOR CALDERDALE METROPOLITAN DISTRICT COUNCIL

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Scenario Type:	Pathway 40% Translation	**Date:**	23/11/2011

Purpose of Scenario Development

As part of the analysis of West Yorkshire's emissions reductions, Carbon Descent has produced a Scenario that investigates the impact of the Low Carbon Transition Plan (LCTP) on Calderdale Council and how this, along with a specific focus on Large Wind, CHP (district heating networks) biomass and hydro, can aid the goal of Calderdale in achieving the Friends of the Earth 40% reduction target by 2020 (on a 2005 baseline).

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

This scenario calculates that the LCTP and a focus on large Wind, hydro and biomass generation will provide insufficient carbon savings for Calderdale Council to achieve its carbon emissions reduction target in 2020. As expected the 2020 Measure Deployment is also insufficient to meet carbon emissions reduction targets in both 2035 and 2050.

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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 Calderdale Council as part of a wider piece of work that investigates the impact of the Low Carbon Transition Plan (LCTP) on the local authorities within the Yorkshire and Humber region. The main focus of this report is to outline how far the LCTP with the additional of three areas of focus, namely, large wind, biomass generation and hydro generation will help achieve the ambition of the authority to meet the 40% target by 2020. The Vantage Point scenario that is the basis for this report is the Pathway scenario.

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 Deployment under the LCTP

The level of deployment in the first scenario 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.

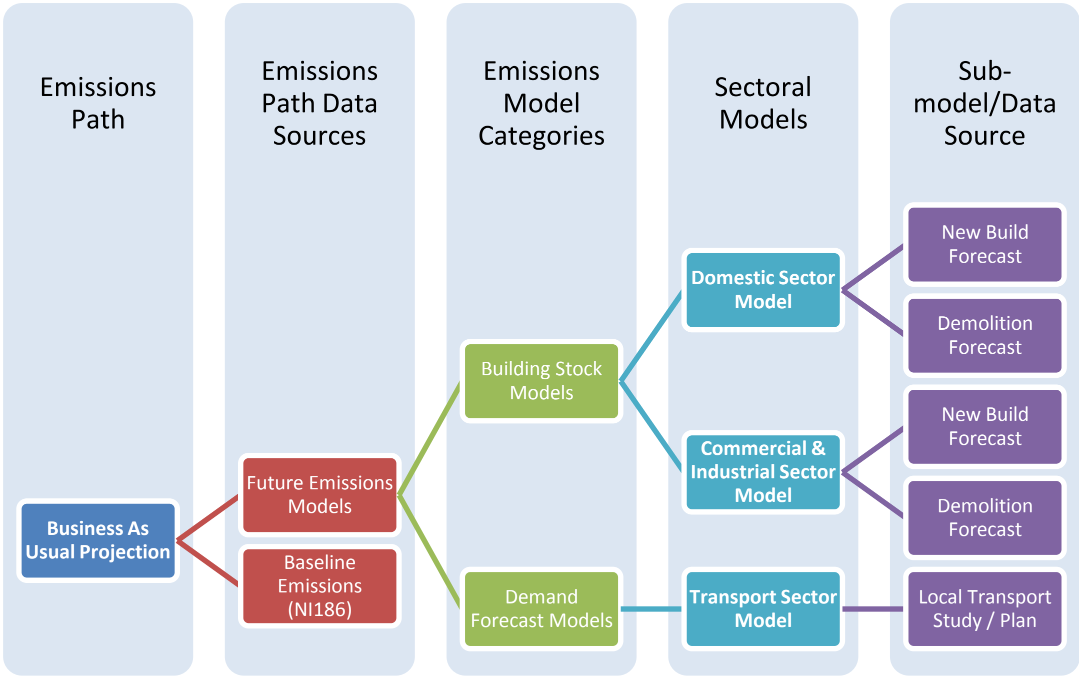
As such, Section 1 provides a basic description of the Scenario and modelling process, required in order to understand and interpret the results. This Section is augmented by the separate *Business as Usual Methodology* and *Deployment Potentials Methodology* reports, which detail the methodology and 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 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.



2.3 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 6: Scenario Deployment Potentials

in Section 4.

2.4 Methodology for Deployment of Measures

The Scenario delivered provides an investigation of whether Calderdale 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 Calderdale 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 8 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, these are included in the table below and this need to be referred to when looking at the savings required as this includes our estimation of growth. That being said caution is required when looking at the growth projects up to 2050 as the further into the future we look the less accurate predictions become. In the case for Calderdale, our model for growth suggests only a small amount of CO2 emissions growth over the next 40 years. This in general can be attributed to de-industrialisation.

CO_2 comparison	2020	2035	2050
Baseline data (2005)	1355	1355	1355
Growth kt	39	64	89
Percentage growth from 2005	3%	5%	7%

Table 1: BAU growth

3.1.2 Scenario Savings Overview

What is important to note is that within both models the deployment only relates to savings up to 2020 and it is very likely that deployment of Measures solely linked to the LCTP may not be sufficient to meet the medium and long term national objectives of carbon reduction.

Two tables have been outlined below to summarise the savings from the *LCTP scenario* and the *Pathway scenario*. As can be seen from Table 2, it is estimated that Calderdale Council's savings will be 374.39 ktCO_2 in period one which is 64% of the target savings. Therefore, the LCTP alone will not deliver sufficient carbon savings for Calderdale Council to achieve its 2020 target of 40%. This is not unexpected, nor is it surprising, as the Pathway target is greater than the national policy target in 2020 and the LCTP was designed by the Government to meet its national target based on a 1990 baseline.

CO_2 comparison	2005-2020	2021-2035	2036-2050
CO2 savings targets (ktpa)	580.99	862.31	1125.87
Total CO2 savings for the scenario (ktpa)	374.39	569.52	633.68
Comparison of targets vs savings (ktpa)	-207 (36%)	-293 (34%)	-492 (44%)

Table 2: Scenario CO2 Savings Overview (LCTP Only)

In contrast, it can be seen in the table below that with an additional focus on large wind, hydro generation and biomass generation it has been possible to generate a *Pathway scenario* that suggests the 40% target is approached by 2020. As can be seen, this extra focus has delivered an additional 169ktpa of CO2 savings by 2020 which translate into 94% of the target savings in this first period. As expected, the target is still not met in the second and third periods. This suggests that further measures and programmes would need to be found, especially beyond 2020 in order to meet the final targets towards 2050. The remainder of this report will therefore focus solely on the *Pathway scenario*.

CO_2 comparison	2005-2020	2021-2035	2036-2050
CO2 savings targets (ktpa)	580.99	862.31	1125.87
Total CO2 savings for the scenario (ktpa)	543.79	659.45	698.55
Comparison of targets vs savings (ktpa)	-37 (6%)	-203 (24%)	-427 (38%)

Table 3: Scenario CO2 Savings Overview (Pathway Scenario)

3.1.3 Scenario System Graph

Figure 1 shows the system graph of CO_2 savings for the *Pathway 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 Calderdale 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).

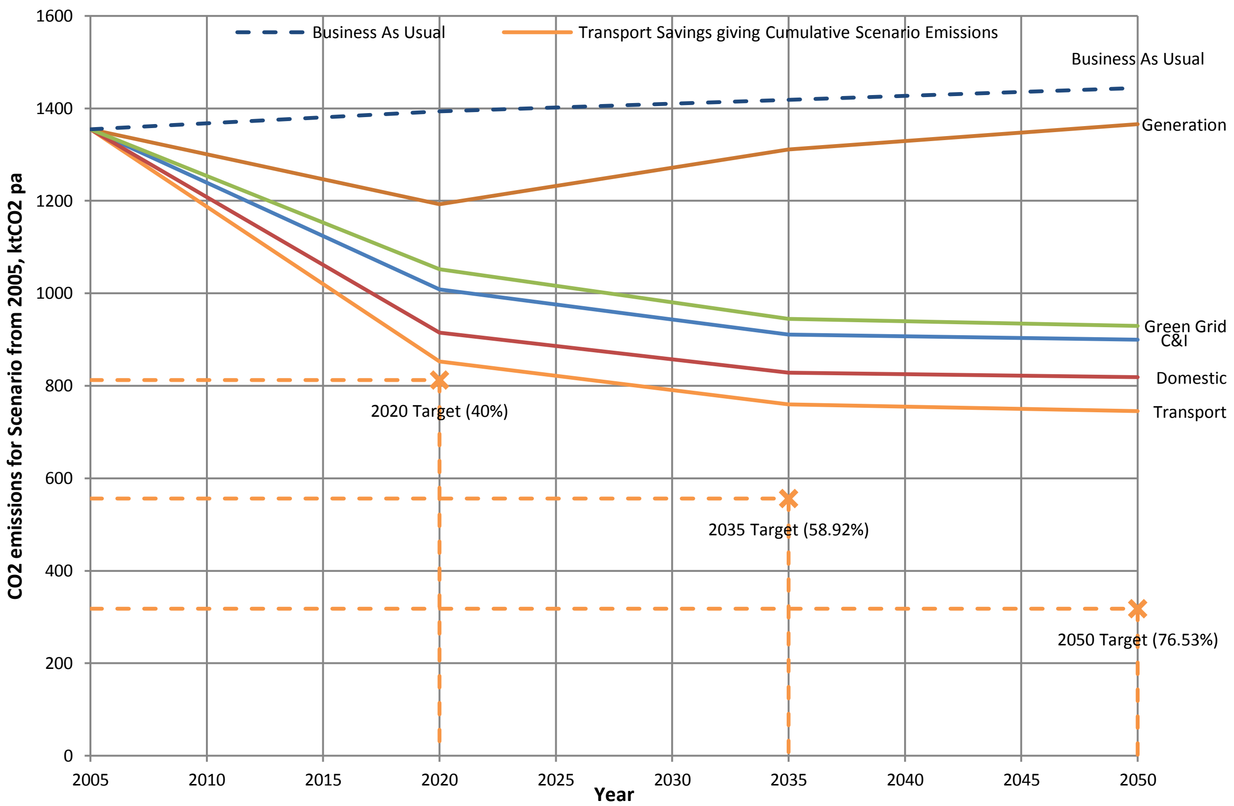


Figure 1: Scenario System Graph

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 deployment up to 2020 diverge in the later periods. As was shown in Table 2, between the first and second periods, Calderdale Council moves from achieving 94% of the savings to achieving 76% of the savings. In this instance an additional 203ktCO2 would need to be found from extra Measures in order to meet the 862.31ktCO2 target. These gap further increases in the final period, 2036-2050, where the Measures deployed achieve 62% of the target savings.

The savings achieved from the greening of the national electricity grid increase in every period and this has an impact on the accounting of carbon savings for local renewables. As the grid becomes cleaner each renewable installation references its savings against the carbon factor for the electricity that would have been utilised from the national grid.

It must be noted that the Generation Sector also produces heat for district heating networks – as this offsets gas use, there is no element of diminishing returns for heat generation.

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	93.231	17%	16%
Commercial & Industrial	43.47	8%	7%
Transport	62.746	12%	11%
Large Generation	201.163	37%	35%
Green Grid	140.855	26%	24%

Table 4: Breakdown of savings achieved per Sector in 2020 *Pathway scenario*

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.

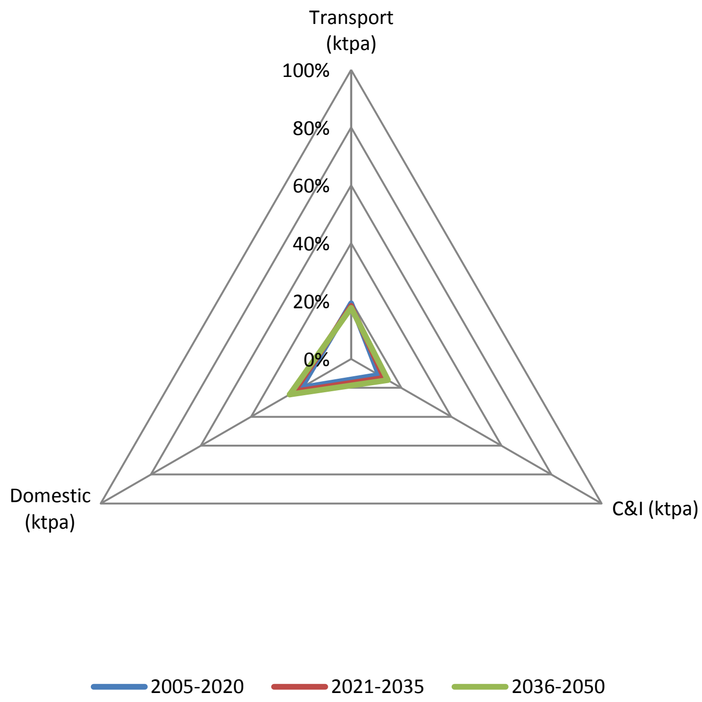


Figure 2: Demand Sector Decarbonisation

It is clear that under the LCTP, decarbonisation is limited for all Sectors and does not vary greatly between periods – consequently the decarbonisation would overlap for the different periods, and significantly more effort is required to further decarbonise these demand Sectors. However, under the *Pathway scenario* maximum decarbonisation occurs in the Domestic Sector, with some 25% of emissions mitigated.

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 Calderdale 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.

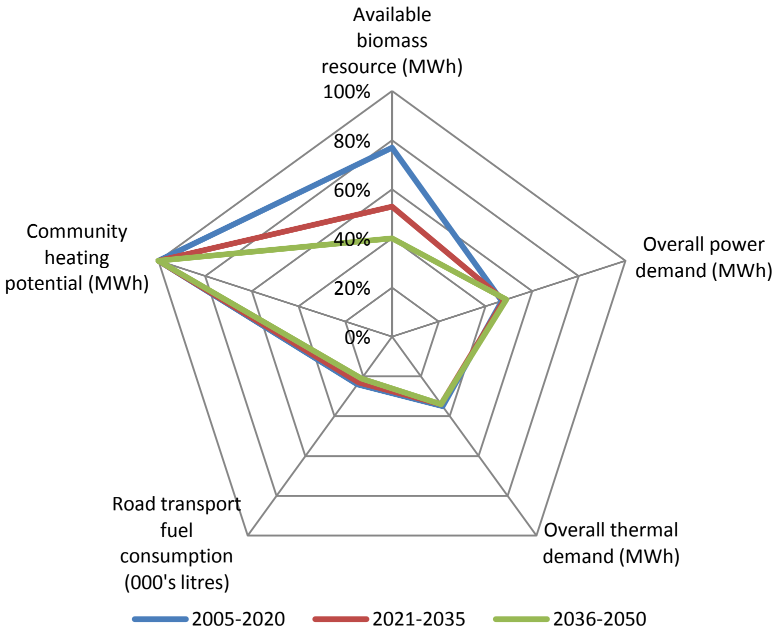


Figure 3: Scenario Energy Performance

In this Scenario, 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 80% of all biomass that could feasibly be utilised in the district. The biomass CHP component of this results in 100% of the community heating potential being utilised from 2020. 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

The four largest CO_2-saving Measures from the *Pathway scenario* in 2020 are outlined in the table below. This table also shows what percentage of the total Scenario savings are achieved by these four Measures, and in this case, together they account for 68% of the total CO_2 savings within the *Pathway Scenario*.

Measure	CO2 Savings (ktCO2pa)	CO2 Savings as % of Total Scenario CO2 Savings	CO2 Savings as % of Target CO2 Savings
Green grid	140.855	26%	24%
CHP biomass	102.482	19%	18%
Wind large	86.965	16%	15%
Road transport efficiency improvements	38.48	7%	7%
Total	**368.782**	**68%**	**63%**

Table 5: 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 *Pathway 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 and extra focus within this scenario. The Green Grid effort level is expressed as a percentage of its ultimate 2050 value. Moreover, as requested, there is additional focus on the use of biomass, hydro generation and large wind generation. Hydro and large scale wind generation both reach their full effort levels by the end of the first period.

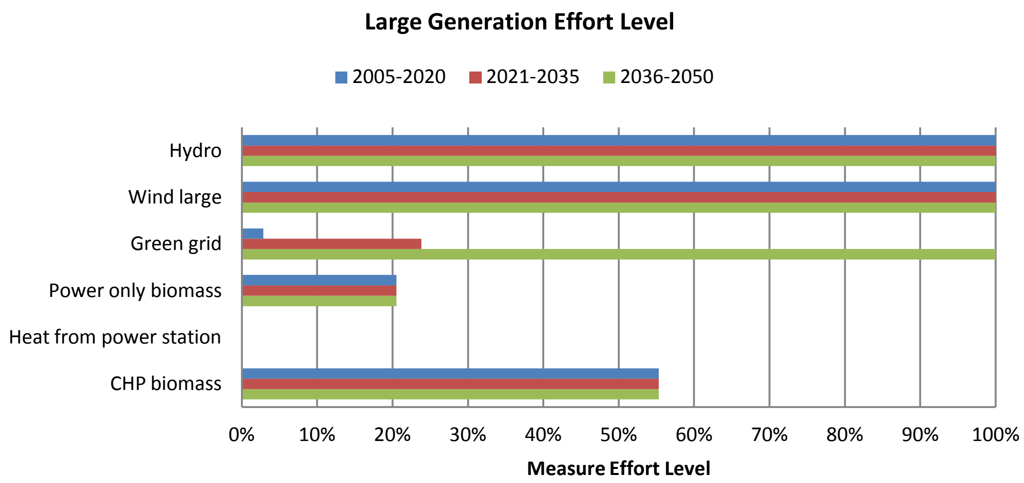


Figure 4: Effort Level for the Large Generation Sect

The next effort level graph,Figure 5 , is for the Transport Sector Measures. Here, the connection of the *Pathway scenario* to 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).

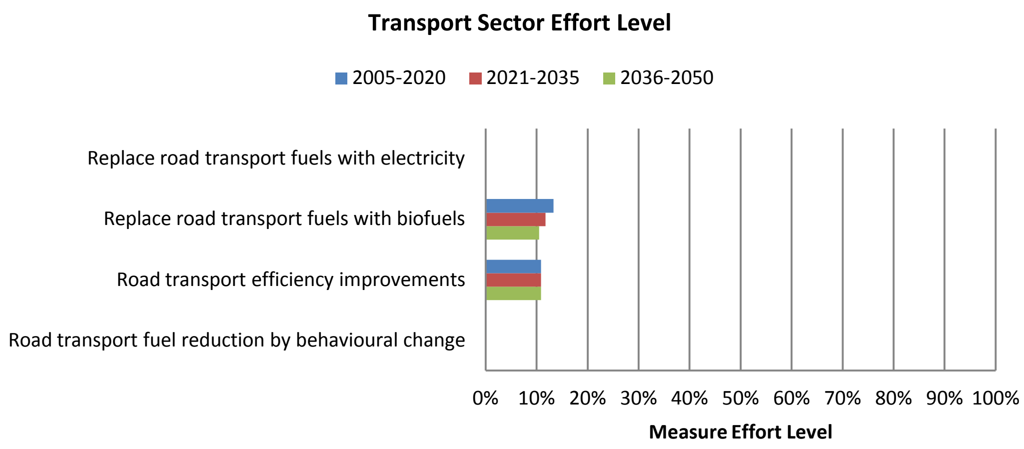


Figure 5: Effort Level for the Transport Sector

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

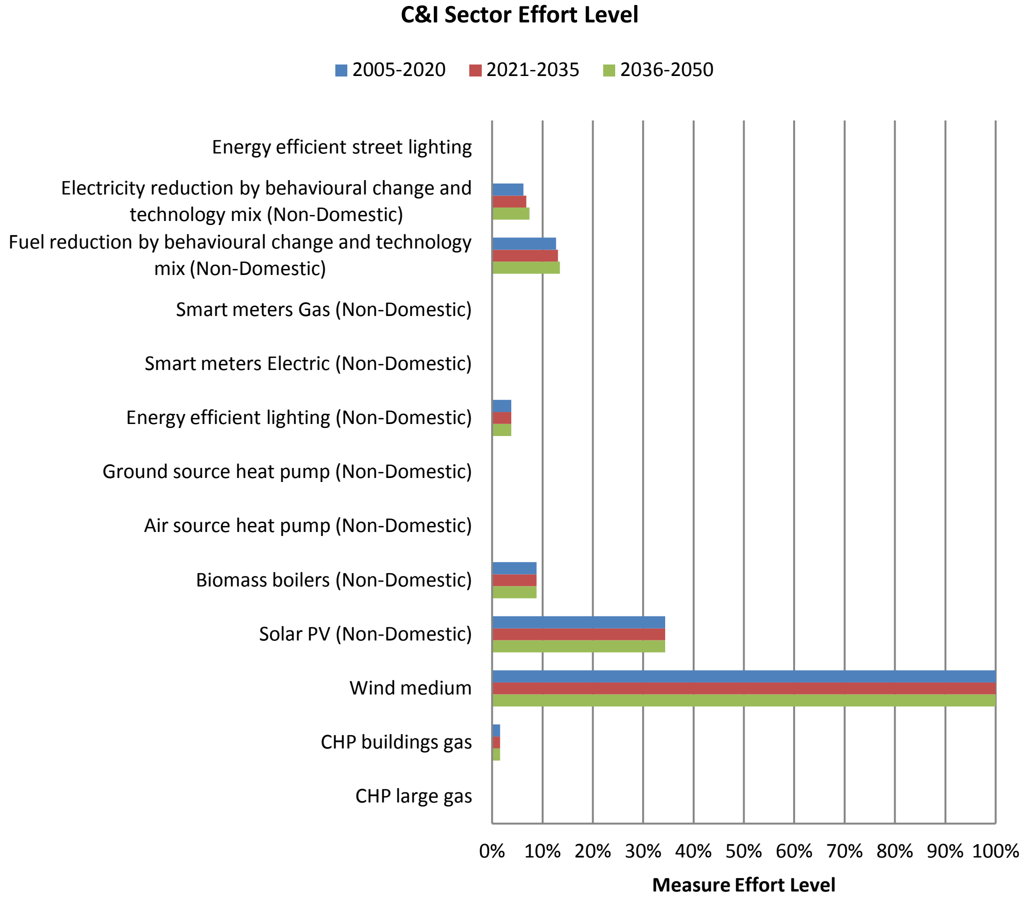


Figure 6: Effort Level for the Commercial & Industrial Sector

Finally, 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.

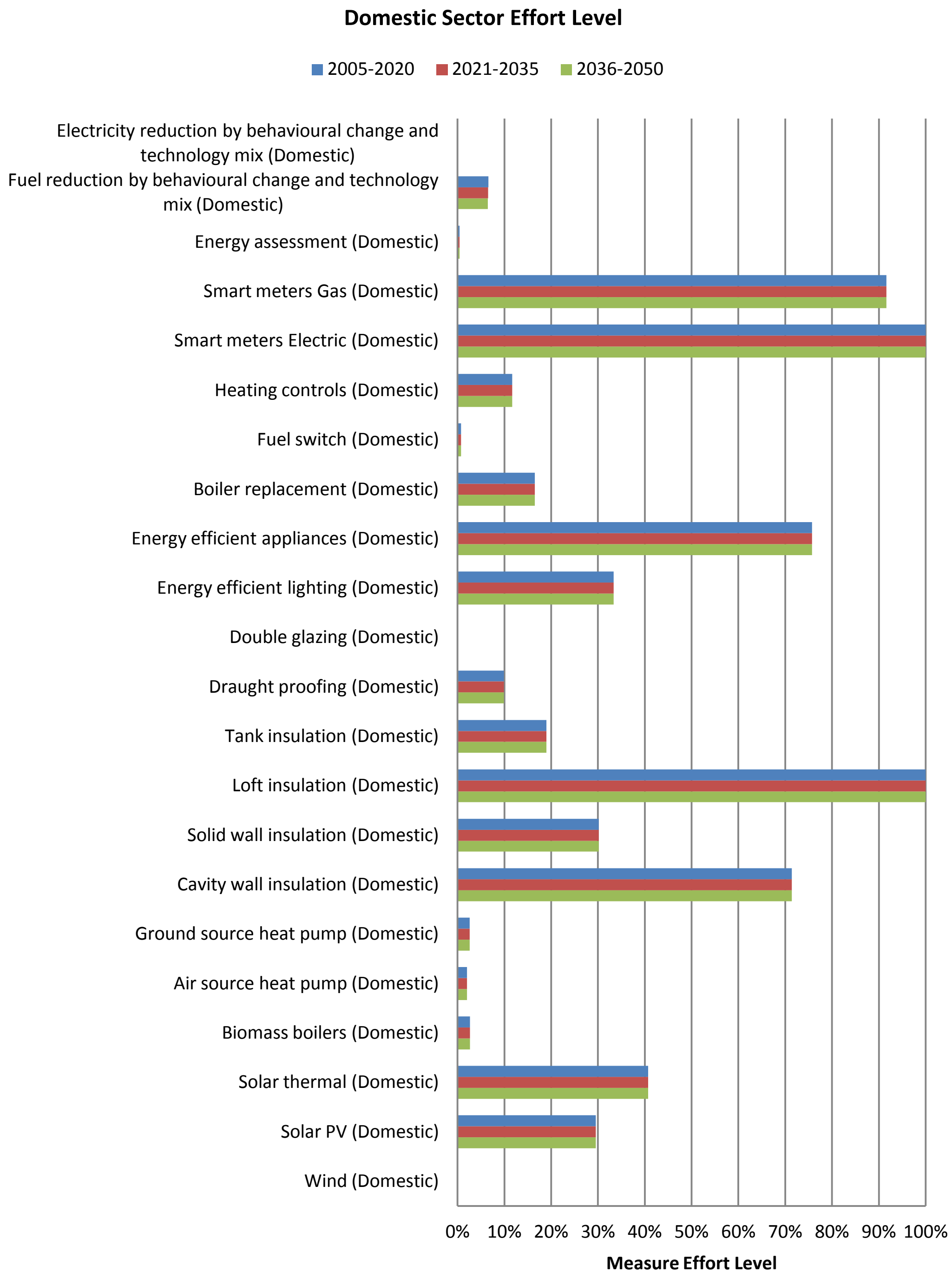


Figure 7: Effort Level for the Domestic Sector

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	26.069	26.069	26.069
CHP large gas	MWe	27.714	27.714	27.714
CHP buildings gas	MWe	36.238	36.238	36.238
Heat from power station	MWth	0	0	0
Power only biomass	MWe	26.069	26.069	26.069
Green grid	%	136.26	136.26	136.26
Wind large	MWe	110	110	110
Wind medium	MWe	1	1	1
Wind (Domestic)	Homes	0	0	0
Solar PV (Domestic)	Homes	22,705.00	22,705.00	22,705.00
Solar thermal (Domestic)	Homes	22,705.00	22,705.00	22,705.00
Biomass boilers (Domestic)	Homes	6,861.00	6,861.00	6,861.00
Air source heat pump (Domestic)	Homes	39,224.00	39,224.00	39,224.00
Ground source heat pump (Domestic)	Homes	39,224.00	39,224.00	39,224.00
Solar PV (Non-Domestic)	MWe	19	19	19
Biomass boilers (Non-Domestic)	MWth	15.246	15.246	15.246
Air source heat pump (Non-Domestic)	MWth	176.75	176.75	176.75
Ground source heat pump (Non-Domestic)	MWth	176.75	176.75	176.75
Cavity wall insulation (Domestic)	Homes	34,001.00	34,001.00	34,001.00
Solid wall insulation (Domestic)	Homes	27,213.00	27,213.00	27,213.00
Loft insulation (Domestic)	Homes	23,228.00	23,228.00	23,228.00
Tank insulation (Domestic)	Homes	7,270.00	7,270.00	7,270.00
Draught proofing (Domestic)	Homes	27,995.00	27,995.00	27,995.00
Double glazing (Domestic)	Homes	0.00	0.00	0.00

Energy efficient lighting (Domestic)	Lamps	2,212,932.00	2,212,932.00	2,212,932.00
Energy efficient appliances (Domestic)	Homes	83,500.00	83,500.00	83,500.00
Boiler replacement (Domestic)	Homes	42,526.00	42,526.00	42,526.00
Fuel switch (Domestic)	Homes	2,222.00	2,222.00	2,222.00
Heating controls (Domestic)	Homes	29,225.00	29,225.00	29,225.00
Smart meters Electric (Domestic)	Homes	90,818.00	90,818.00	90,818.00
Smart meters Gas (Domestic)	Homes	85,326.00	85,326.00	85,326.00
Energy assessment (Domestic)	Homes	83,500.00	83,500.00	83,500.00
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	1589	1589	1589
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	0.00	0.00	0.00
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	142,583.84	161,879.48	181,175.11
Replace road transport fuels with electricity	000's litres	142,583.84	161,879.48	181,175.11
Hydro	MWe	2.00	2.00	2.00

Table 6: Scenario Deployment Potentials

The following table provides the Resource Potentials used for Calderdale 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	336,502	336,502	336,502

Biomass Resource Potential	MWe	930,941	1,361,337	1,791,734
Overall Power Demand	MWe	940,918	920,073	899,227
Overall Thermal Demand	MWe	2,391,699	2,523,247	2,515,421
Road transport fuel Consumption	MWe	142,584	161,879	181,175

Table 7: 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	14.425	14.425	14.425
CHP large gas	MWe	0	0	0
CHP buildings gas	MWe	0.562	0.562	0.562
Heat from power station	MWth	0	0	0
Power only biomass	MWe	5.346	5.346	5.346
Green grid	%	3.90	32.45	136.26
Wind large	MWe	110	110	110
Wind medium	MWe	1	1	1
Wind (Domestic)	Homes	0	0	0
Solar PV (Domestic)	Homes	6,706.00	6,706.00	6,706.00
Solar thermal (Domestic)	Homes	9,246.00	9,246.00	9,246.00
Biomass boilers (Domestic)	Homes	183.00	183.00	183.00
Air source heat pump (Domestic)	Homes	794.00	794.00	794.00
Ground source heat pump (Domestic)	Homes	1,011.00	1,011.00	1,011.00
Solar PV (Non-Domestic)	MWe	6.525	6.525	6.525
Biomass boilers (Non-Domestic)	MWth	1.34	1.34	1.34
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	24,290.00	24,290.00	24,290.00
Solid wall insulation (Domestic)	Homes	8,211.00	8,211.00	8,211.00
Loft insulation (Domestic)	Homes	23,228.00	23,228.00	23,228.00
Tank insulation (Domestic)	Homes	1,378.00	1,378.00	1,378.00

Draught proofing (Domestic)	Homes	2,765.00	2,765.00	2,765.00
Double glazing (Domestic)	Homes	0.00	0.00	0.00
Energy efficient lighting (Domestic)	Lamps	737,183.00	737,183.00	737,183.00
Energy efficient appliances (Domestic)	Homes	63,222.00	63,222.00	63,222.00
Boiler replacement (Domestic)	Homes	7,016.00	7,016.00	7,016.00
Fuel switch (Domestic)	Homes	17.00	17.00	17.00
Heating controls (Domestic)	Homes	3,407.00	3,407.00	3,407.00
Smart meters Electric (Domestic)	Homes	90,818.00	90,818.00	90,818.00
Smart meters Gas (Domestic)	Homes	78,174.00	78,174.00	78,174.00
Energy assessment (Domestic)	Homes	338.00	338.00	338.00
Fuel reduction by behavioural change and technology mix (Domestic)	%	6.563	6.523	6.483
Electricity reduction by behavioural change and technology mix (Domestic)	%	-5.18	-4.93	-4.7
Energy efficient lighting (Non-Domestic)	000's m2	59.868	59.868	59.868
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)	%	12.693	13.075	13.481
Electricity reduction by behavioural change and technology mix (Non-Domestic)	%	6.209	6.768	7.438
Energy efficient street lighting	Lamps	0.00	0.00	0.00
Road transport fuel reduction by behavioural change	%	0.109	0.109	0.109
Road transport efficiency improvements	%	10.835	10.835	10.835
Replace road transport fuels with biofuels	000's litres	18,976.83	18,976.83	18,976.83
Replace road transport fuels with electricity	000's litres	0.00	0.00	0.00
Hydro	MWe	2	2	2

Table 8: Scenario measure 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	102.482	76.576	69.196
CHP large gas	ktCO2pa	0	0	0
CHP buildings gas	ktCO2pa	1.14	1.072	1.068
Heat from power station	ktCO2pa	0	0	0
Power only biomass	ktCO2pa	11.716	3.667	1.039
Green grid	ktCO2pa	140.86	366.71	436.04
Wind large	ktCO2pa	86.965	27.222	7.709
Wind medium	ktCO2pa	0.474	0.148	0.042
Wind (Domestic)	ktCO2pa	0	0	0
Solar PV (Domestic)	ktCO2pa	5.12	1.60	0.45
Solar thermal (Domestic)	ktCO2pa	3.59	3.39	3.38
Biomass boilers (Domestic)	ktCO2pa	0.55	0.52	0.52
Air source heat pump (Domestic)	ktCO2pa	1.05	1.84	2.14
Ground source heat pump (Domestic)	ktCO2pa	1.76	2.47	2.76
Solar PV (Non-Domestic)	ktCO2pa	2.002	0.627	0.177
Biomass boilers (Non-Domestic)	ktCO2pa	1.514	1.419	1.407
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	15.64	14.76	14.73
Solid wall insulation (Domestic)	ktCO2pa	21.09	19.90	19.87
Loft insulation (Domestic)	ktCO2pa	8.70	8.21	8.20
Tank insulation (Domestic)	ktCO2pa	0.23	0.22	0.21
Draught proofing (Domestic)	ktCO2pa	0.74	0.70	0.70
Double glazing (Domestic)	ktCO2pa	0.00	0.00	0.00
Energy efficient lighting (Domestic)	ktCO2pa	3.46	1.08	0.31
Energy efficient appliances (Domestic)	ktCO2pa	8.76	2.74	0.78
Boiler replacement (Domestic)	ktCO2pa	5.41	5.10	5.09
Fuel switch (Domestic)	ktCO2pa	0.04	-0.02	-0.04
Heating controls (Domestic)	ktCO2pa	0.12	0.11	0.11

Smart meters Electric (Domestic)	ktCO2pa	2.89	0.90	0.26
Smart meters Gas (Domestic)	ktCO2pa	1.34	1.27	1.26
Energy assessment (Domestic)	ktCO2pa	0.03	0.03	0.03
Fuel reduction by behavioural change and technology mix (Domestic)	ktCO2pa	20.774	20.772	20.768
Electricity reduction by behavioural change and technology mix (Domestic)	ktCO2pa	-8.041	-2.515	-0.711
Energy efficient lighting (Non-Domestic)	ktCO2pa	0.346	0.108	0.031
Smart meters Electric (Non-Domestic)	ktCO2pa	0.01	0.00	0.00
Smart meters Gas (Non-Domestic)	ktCO2pa	0.38	0.36	0.36
Fuel reduction by behavioural change and technology mix (Non-Domestic)	ktCO2pa	26.112	26.148	26.187
Electricity reduction by behavioural change and technology mix (Non-Domestic)	ktCO2pa	11.494	3.598	1.019
Energy efficient street lighting	ktCO2pa	0.00	0.00	0.00
Road transport fuel reduction by behavioural change	ktCO2pa	0.387	0.439	0.492
Road transport efficiency improvements	ktCO2pa	38.48	43.688	48.895
Replace road transport fuels with biofuels	ktCO2pa	23.88	23.88	23.88
Replace road transport fuels with electricity	ktCO2pa	0.00	0.00	0.00
Hydro	ktCO2pa	2.32	0.73	0.21

Table 9: Scenario CO2 savings by measure