



VantagePoint Modelling Scenario Report

SOLAR FOCUS SCENARIO FOR NOTTINGHAM CITY COUNCIL

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Scenario Type:	Solar Focus	Date:	24/11/2011

Purpose of Scenario Development

As part of the analysis of the East Midlands' emissions reductions, Carbon Descent has produced a Scenario that focuses heavily upon the maximal use of solar power in Nottingham City Council, while retaining a Low Carbon Transition Plan-derived Measure deployment base. The Scenario delivered is a snapshot, which has been developed, based on current policy, therefore, 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 Nottingham City Council Solar Focus Scenario calculates that the LCTP combined with the focus on maximal use of solar technologies will deliver sufficient carbon savings for Nottingham City Council to achieve its carbon emissions reduction target in 2020. This is in line with the design purpose of the Low Carbon Transition Plan. However, the focus on maximal use of solar power in 2035 and 2050 does not result in sufficient CO₂ emissions savings for either the interim 2035 or the 2050 targets to be achieved.

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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 continue 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.

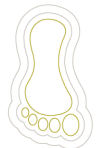
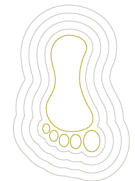


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1 Introduction

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 Nottingham City Council to meet its 2020 carbon reduction targets.

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 have been developed in order to explore how an increased use of solar within the local authority area, could be used, in addition to the measures detailed within the LCTP, to meet targets in subsequent years. The solar focus scenario is a specialist scenario in that it takes the deployment suggested by the LCTP and then increases only solar technologies, until targets are met, or the potential of each technology reaches its maximum deployment. The purpose of this report is to explore the upper limits of specific technologies and outline the extra savings they may yield.

As with the LCTP report, the deployment mechanism that is utilised for each of the LCTP and solar policies is not explored within this report.



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 Description

As part of the analysis of the East Midlands' emissions reductions, Carbon Descent has produced a Scenario for Nottingham 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, in combination with maximal deployment focus on the use of solar power in all its forms will allow Nottingham City Council to meet its Climate Change Act and other carbon reduction targets in 2020, 2035 and 2050. This Solar Focus scenario, therefore, also enables Nottingham City Council to investigate the impact of increasing the deployment of solar Measures beyond that prescribed by the LCTP. Reference to the independent LCTP Translation Scenario Report for Nottingham City Council would allow the reader to compare the effectiveness of focusing on solar Measures.

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

2.3 Constraints of the Model

The Solar Focus Scenario is limited by the amount of solar power that Nottingham City Council can exploit. In particular, this is not so much a function of the amount of available sunlight as it is a function of suitable space for the installation of PV or solar thermal panels, whether domestic or non-domestic. As such, the Deployment Potentials for Domestic and Non-Domestic Solar PV and Domestic Solar Thermal are the main constraints on the savings achievable by solar power.

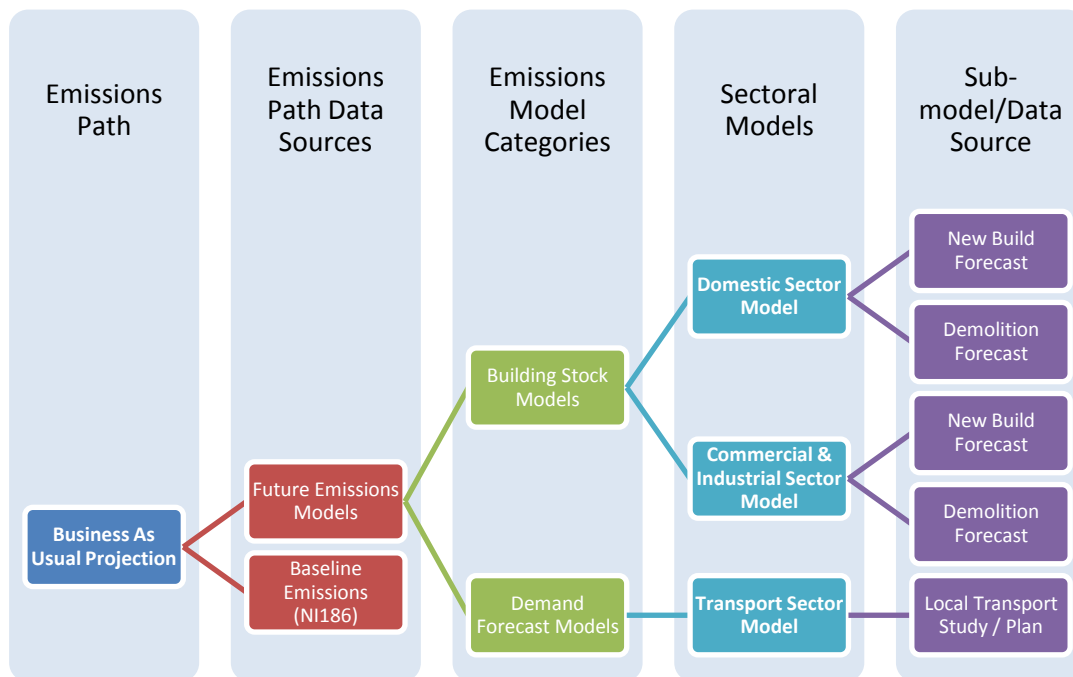
Moreover, the deployment in this Scenario does not exceed that prescribed by the LCTP for all non-solar Measures, and is maintained at that level for all periods beyond 2020.

2.4 Methodology for Business as Usual

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' CO₂ 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 terms of m² 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 7 in Section 4.

2.6 Methodology for Deployment of Measures

The Scenario delivered provides an investigation of whether Nottingham 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.

For all non-solar Measures, deployment is kept in accordance with the LCTP. The suite of national policies this represents has been mapped on to Nottingham City Council. As the LCTP aims to meet 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 non-solar Measure deployment after 2020; instead these deployment levels are maintained, with Solar Measures following a more aggressive path in all three periods.



The Deployment Potentials for Domestic Solar PV and Domestic Solar Thermal both assume full use of the same domestic roofspace. Hence, for both of these Measures to be fully deployed should be considered highly ambitious, and has been done in the Scenario in order to illustrate the relatively small savings that can be achieved even by full deployment of all solar Measures.

The actual measure deployment for this particular Scenario is provided in Table 9 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 if 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)	1899	1899	1899
Growth kt	28	89	160
Percentage growth from 2005	1%	5%	8%

Table 1: Business As Usual (BAU)

3.1.2 Scenario Savings Overview

From the LCTP scenario, it is estimated that Nottingham City Council's savings will be c641.65ktCO₂ in period one which is 141% of the target savings. The LCTP, therefore, delivers sufficient carbon savings for Nottingham City Council in 2020. What is important to note within this model, is that even with the increased deployment of solar Measures in all three periods, the Solar Focus Scenario for Nottingham City Council does not manage to meet the 2035 interim targets, missing them by 17%. As this level of solar Measure deployment is maintained, it is predictable that the solar-only focus is also insufficient for the 2050 Climate Change Act target, undershooting this target by 28%.

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)	455.5	1207.19	1612.62
Total CO ₂ savings for the Scenario (ktpa)	670.7	1003.29	1153.83
Comparison of targets vs. savings (ktpa)	215 (47%)	-204 (17%)	-459 (28%)

Table 2: Scenario CO₂ Savings Overview

3.1.3 Scenario System Graph

Figure 1 shows the system graph of CO₂ 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 CO₂ emissions on the vertical axis in kilotonnes of CO₂ 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 Nottingham 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).

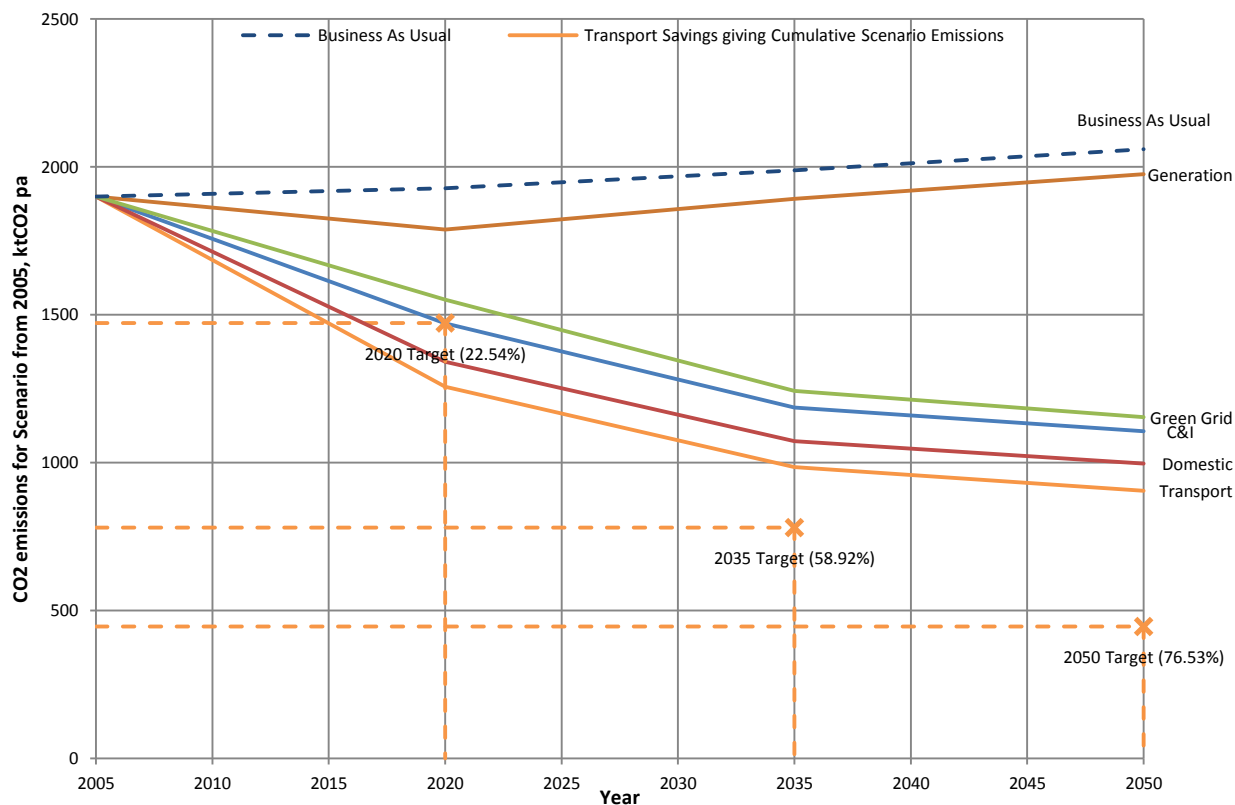


Figure 1: Scenario System Graph

3.2 Analysis & Discussion

3.2.1 Effect of Business As Usual Emissions Growth

Figure 1 shows that even with the increased deployment of solar measures, the Solar Focus scenario does not manage to meet the targets of any period. Due to the limited additional savings provided by the full deployment of all solar Measures under this Solar Focus Scenario, the Scenario emissions projection is hardly deviated from its LCTP-only path. Consequently, additional savings beyond 2020 are largely due to the decarbonisation of the national electricity grid, captured under the Green Grid Measure. Consequently, savings from electricity-generating or offsetting Measures such as Solar PV decrease with time.

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; in effect, the absolute savings target in ktCO₂pa increases or decreases with greater or lesser BAU emissions growth, respectively. 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

The savings are split between the Sectors in the following proportions:

Sector	2020 Target Period		2035 Target Period		2050 Target Period	
	Savings ktCO ₂ pa	As percentage of total savings	Savings ktCO ₂ pa	As percentage of total savings	Savings ktCO ₂ pa	As percentage of total savings
Domestic	129.362	19%	113.498	9%	109.758	10%
Commercial and Industrial	80.082	12%	55.622	5%	47.409	4%
Transport	84.976	13%	88.176	7%	91.375	8%
Large Generation	138.823	21%	96.248	8%	83.604	7%
Green Grid	237.459	35%	649.742	54%	821.681	71%

Table 3: Breakdown of savings achieved per Sector for all periods

From the Table, we can see that the greatest savings in the first period are achieved by the Green Grid, followed by the Large Generation. In the two final periods the greatest savings 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.



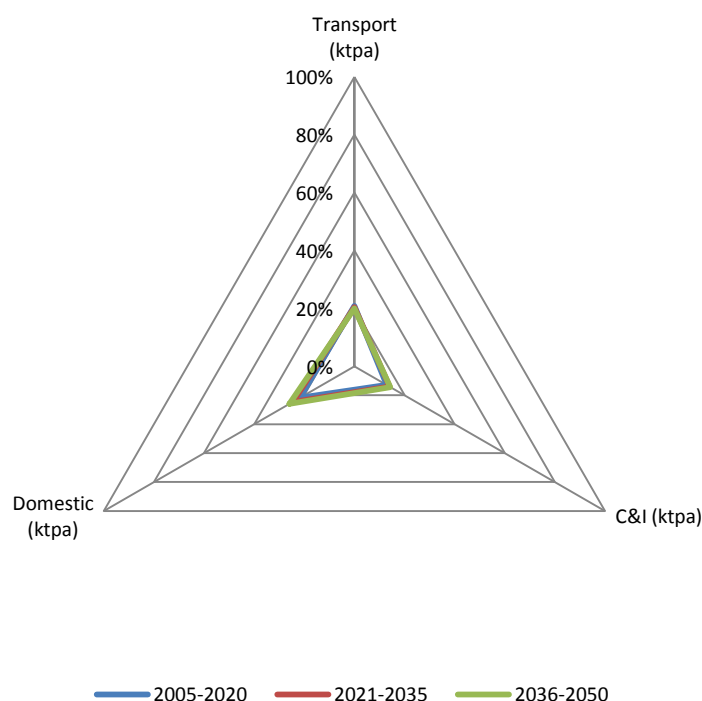


Figure 2: Demand Sector Decarbonisation

It is clear from the figure that under the Solar Focus Scenario, no significant Domestic, Transport or C & I Sector decarbonisation occurs beyond the percent reached in 2020. Counter intuitively, in absolute terms Nottingham City Council's C&I savings decrease with time and its projected C&I emissions decrease even faster once the impact of the Green Grid has been taken into account. Consequently, the decarbonisation percentage increases.

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 Nottingham 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.

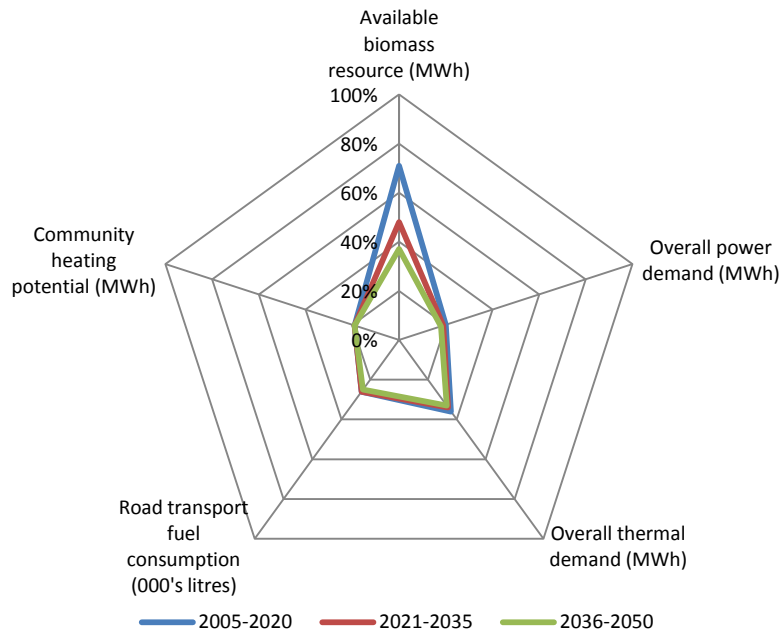


Figure 3: Scenario Energy Performance

As is usual under LCTP Scenarios, the overall 2020 demand displacement and resource utilisation is fairly poor – the LCTP is after all designed for 34% reduction target, and not more. Beyond 2020, limited improvement can be seen; clearly, maximising the use of solar technologies has only a limited impact on Nottingham City Council’s energy performance. As such, no additional use is made of the available energy resources and only a further 2-3% of Overall Power Demand is offset by Domestic and Non-Domestic Solar PV while Domestic Solar Thermal has an imperceptible impact on offsetting Overall Thermal Demand.

3.2.4 Measure-Specific Analysis

In this section, deployment and savings are examined on a Measure-by-Measure basis, considering the key sources of savings, discussing any Deployment Potentials that have been exceeded and finally reviewing the effort level of each Measure.

3.2.4.1 Notable large savings

In 2020, the four largest CO₂-saving Measures within the Scenario are provided in Table 4, and similarly the four largest measures are provided for 2035 in Table 5 and for 2050 in Table 6. These tables also show what percentage of the total Scenario savings are achieved by these four Measures. For example, in the case of 2020, the four Measures together account for 66% of the total CO₂ savings within the Scenario, or 98% of the target savings.



Measure	CO2 Savings (ktCO2pa)	CO2 Savings as % of Total Scenario CO2 Savings	CO2 Savings as % of Target CO2 Savings
Green grid	237.459	35%	52%
CHP biomass	122.02	18%	27%
Road transport efficiency improvements	52.113	8%	11%
Fuel reduction by behavioural change and technology mix (Non-Domestic)	33.112	5%	7%
Total	444.704	66%	98%

Table 4: Notable Large Savings Summary for 2005-2020

Measure	CO2 Savings (ktCO2pa)	CO2 Savings as % of Total Scenario CO2 Savings	CO2 Savings as % of Target CO2 Savings
Green grid	649.742	65%	54%
CHP biomass	90.976	9%	8%
Road transport efficiency improvements	55.281	6%	5%
Fuel reduction by behavioural change and technology mix (Non-Domestic)	33.124	3%	3%
Total	829.123	83%	69%

Table 5: Notable Large Savings Summary for 2021-2035

Measure	CO2 Savings (ktCO2pa)	CO2 Savings as % of Total Scenario CO2 Savings	CO2 Savings as % of Target CO2 Savings
Green grid	821.681	71%	51%
CHP biomass	82.145	7%	5%
Road transport efficiency improvements	58.448	5%	4%
Fuel reduction by behavioural change and technology mix (Non-Domestic)	33.139	3%	2%
Total	995.413	86%	62%

Table 6: Notable Large Savings Summary for 2036-2050

It is interesting to note that the same four Measures remain in the top four for all three periods and retain their order, with only the Green Grid Measure showing a significant increase in both absolute and percentage savings. This is usual for most Scenarios, as the Green Grid Measure represents the projected decarbonisation of the wider national electricity grid – consequently, this means the Green Grid Measure typically provide the largest savings. Furthermore, it can be seen that no solar Measures penetrate the top four in terms of savings; in fact, added together they still wouldn't achieve higher savings than any of the Measures above.

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-defined Measures, deployment remains more or less constant across all periods (for these, 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. As usual, the Green Grid Measure increases strongly over time; the Green Grid Measure is modelled based upon the national grid decarbonisation projection made in DECC's *2050 Pathways Analysis* work (Scenario Alpha), and is therefore, independent of either the LCTP or the Scenario's focus, remaining constant for each District across Scenario types. The Green Grid effort level is expressed as a percentage of its ultimate 2050 value.

It can be seen from the Figure that some effort is undertaken by the LCTP in biomass-related generation Measures, with power only biomass reaching some 21%, while wind large reaches some 5% and CHP biomass reaches some 47%. All Measures remain constant for all periods, in line with the LCTP-defined Measures as explained in Section 2.6.

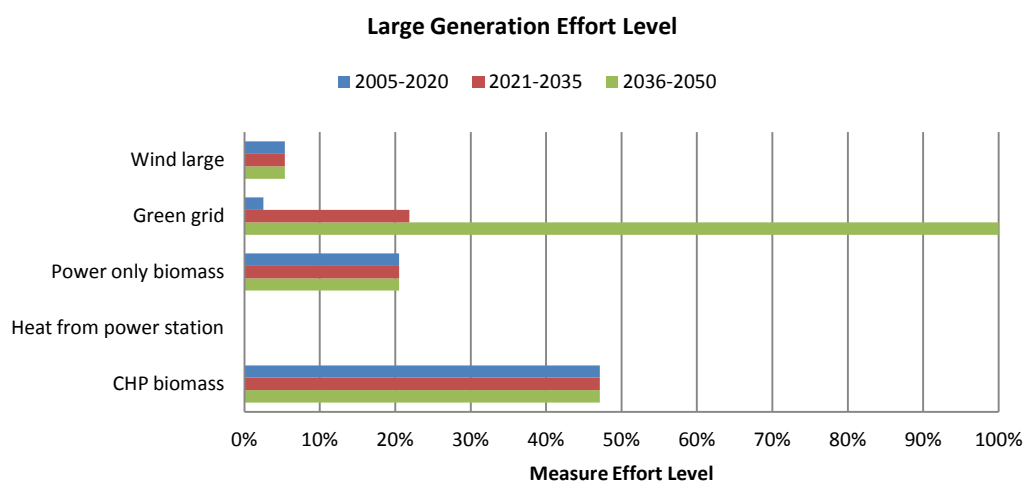


Figure 4: Effort Level for the Large Generation Sector

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 in 2020. The slight decrease in biofuel use effort is due to the increase of total fuel use with time, thereby increasing the biofuels for road transport deployment potential.



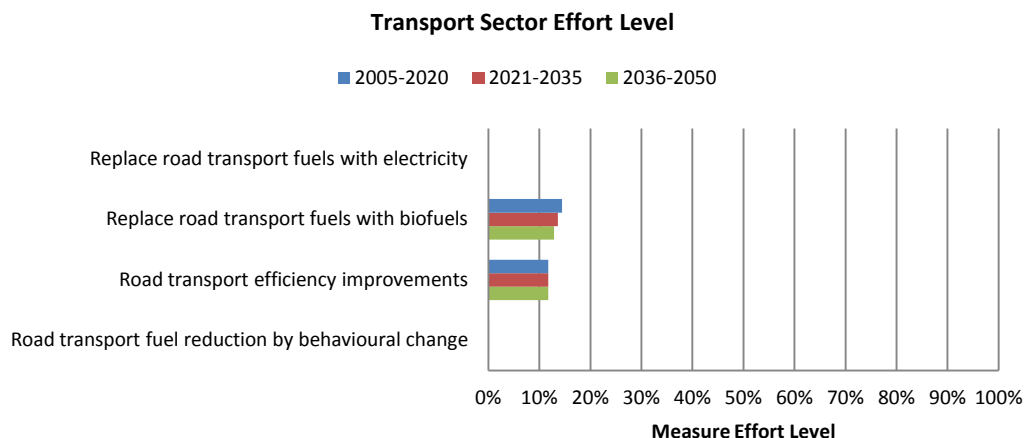


Figure 5: Effort Level for the Transport Sector

The Commercial and Industrial Sector effort levels are shown in Figure 6. The prioritisation of the non-domestic solar PV Measure is clear, and this reaches 100% effort level from the first period onwards. All other Measures remain at LCTP deployment levels, leading to a strong effort in energy efficient street lighting and a reasonable large amount of biomass boilers.

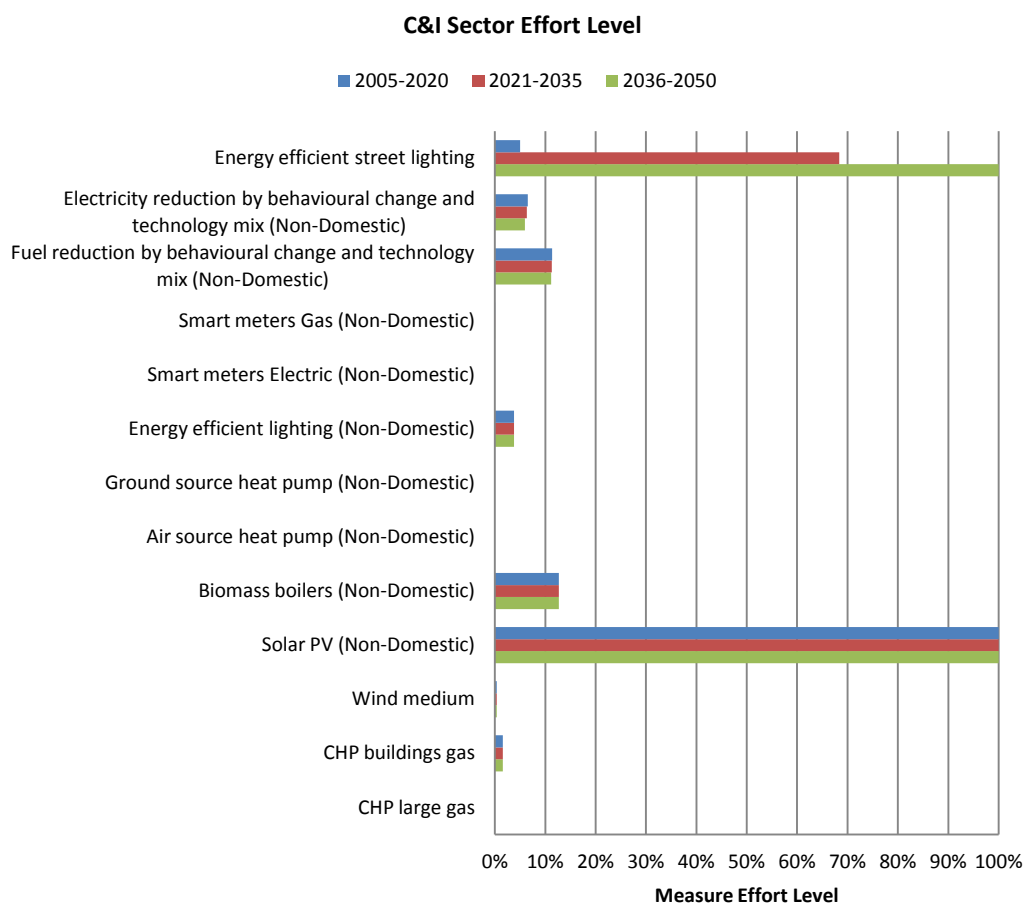


Figure 6: Effort Level for the Commercial & Industrial Sector



Finally, Figure 7 shows the deployment effort level undertaken in the Domestic Sector. Similarly to the C&I Sector, a large effort level of solar Measures can be seen from the first period, with domestic solar PV and solar thermal both reaching 100% effort level by 2020.

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 Insulation, Smart Meters and Energy Efficient Appliances, Measures that the LCTP typically assumes will be more or less fully deployed by 2020.

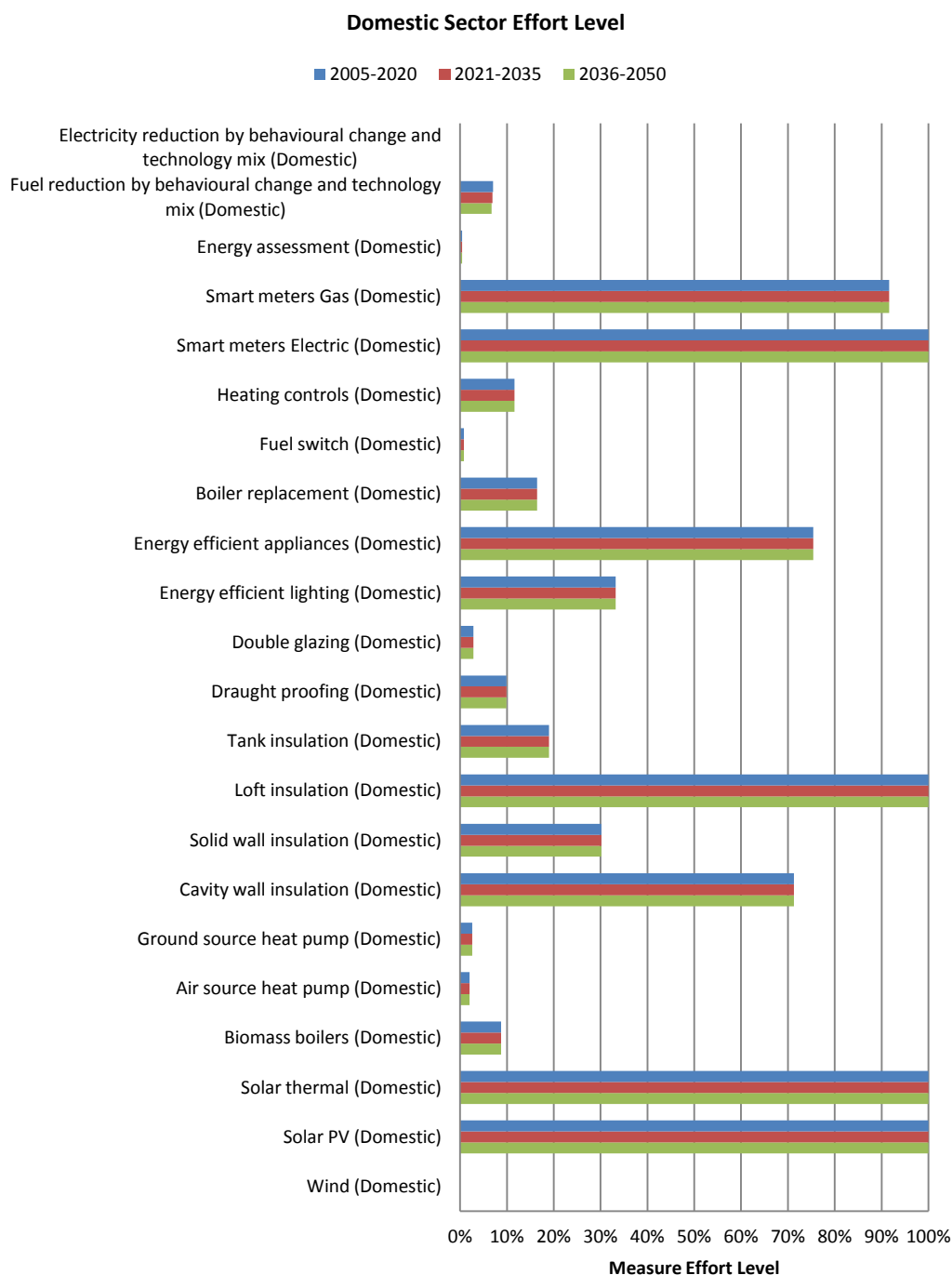


Figure 7: Effort Level for the Domestic Sector



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	37.514	37.514	37.514
CHP large gas	MWe	199.127	199.127	199.127
CHP buildings gas	MWe	260.37	260.37	260.37
Heat from power station	MWth	0	0	0
Power only biomass	MWe	37.514	37.514	37.514
Green grid	%	265.06	265.06	265.06
Wind large	MWe	3.01	3.01	3.01
Wind medium	MWe	2.56	2.56	2.56
Wind (Domestic)	Homes	0	0	0
Solar PV (Domestic)	Homes	21,178.00	21,178.00	21,178.00
Solar thermal (Domestic)	Homes	21,178.00	21,178.00	21,178.00
Biomass boilers (Domestic)	Homes	16,516.00	16,516.00	16,516.00
Air source heat pump (Domestic)	Homes	112,797.00	112,797.00	112,797.00
Ground source heat pump (Domestic)	Homes	51,224.00	51,224.00	51,224.00
Solar PV (Non-Domestic)	MWe	42	42	42
Biomass boilers (Non-Domestic)	MWth	26.234	26.234	26.234
Air source heat pump (Non-Domestic)	MWth	302.582	302.582	302.582
Ground source heat pump (Non-Domestic)	MWth	151.291	151.291	151.291
Cavity wall insulation (Domestic)	Homes	18,374.00	18,374.00	18,374.00
Solid wall insulation (Domestic)	Homes	37,100.00	37,100.00	37,100.00
Loft insulation (Domestic)	Homes	28,327.00	28,327.00	28,327.00
Tank insulation (Domestic)	Homes	3,957.00	3,957.00	3,957.00
Draught proofing (Domestic)	Homes	6,125.00	6,125.00	6,125.00
Double glazing (Domestic)	Homes	6,125.00	6,125.00	6,125.00
Energy efficient lighting (Domestic)	Lamps	563,985.00	563,985.00	563,985.00
Energy efficient appliances (Domestic)	Homes	107,158.00	107,158.00	107,158.00
Boiler replacement (Domestic)	Homes	112,797.00	112,797.00	112,797.00
Fuel switch (Domestic)	Homes	3,749.00	3,749.00	3,749.00
Heating controls (Domestic)	Homes	112,797.00	112,797.00	112,797.00
Smart meters Electric (Domestic)	Homes	128,246.00	128,246.00	128,246.00
Smart meters Gas (Domestic)	Homes	113,995.00	113,995.00	113,995.00
Energy assessment (Domestic)	Homes	112,797.00	112,797.00	112,797.00
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	2725	2725	2725



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	24,000.00	24,000.00	24,000.00
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	177,760.34	188,564.34	199,368.35
Replace road transport fuels with electricity	000's litres	177,760.34	188,564.34	199,368.35

Table 7: Scenario Deployment Potentials

The following table provides the Resource Potentials used for Nottingham 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	2,417,796	2,417,796	2,417,796
Biomass Resource Potential	MWe	1,339,646	1,958,998	2,578,349
Overall Power Demand	MWe	1,538,082	1,624,895	1,735,884
Overall Thermal Demand	MWe	3,204,864	3,451,736	3,514,991
road transport fuel Consumption	MWe	177,760	188,564	199,368

Table 8: 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	17.68	17.68	17.68
CHP large gas	MWe	0	0	0
CHP buildings gas	MWe	4.027	4.027	4.027
Heat from power station	MWth	0	0	0
Power only biomass	MWe	7.694	7.694	7.694
Green grid	%	6.65	58.01	265.06
Wind large	MWe	0.162	0.162	0.162
Wind medium	MWe	0.01	0.01	0.01
Wind (Domestic)	Homes	0	0	0
Solar PV (Domestic)	Homes	21,178.00	21,178.00	21,178.00
Solar thermal (Domestic)	Homes	21,178.00	21,178.00	21,178.00



Biomass boilers (Domestic)	Homes	1,442.00	1,442.00	1,442.00
Air source heat pump (Domestic)	Homes	2,282.00	2,282.00	2,282.00
Ground source heat pump (Domestic)	Homes	1,321.00	1,321.00	1,321.00
Solar PV (Non-Domestic)	MWe	42	42	42
Biomass boilers (Non-Domestic)	MWth	3.329	3.329	3.329
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	13,099.00	13,099.00	13,099.00
Solid wall insulation (Domestic)	Homes	11,192.00	11,192.00	11,192.00
Loft insulation (Domestic)	Homes	28,327.00	28,327.00	28,327.00
Tank insulation (Domestic)	Homes	750.00	750.00	750.00
Draught proofing (Domestic)	Homes	605.00	605.00	605.00
Double glazing (Domestic)	Homes	175.00	175.00	175.00
Energy efficient lighting (Domestic)	Lamps	187,325.00	187,325.00	187,325.00
Energy efficient appliances (Domestic)	Homes	80,827.00	80,827.00	80,827.00
Boiler replacement (Domestic)	Homes	18,557.00	18,557.00	18,557.00
Fuel switch (Domestic)	Homes	29.00	29.00	29.00
Heating controls (Domestic)	Homes	13,077.00	13,077.00	13,077.00
Smart meters Electric (Domestic)	Homes	128,246.00	128,246.00	128,246.00
Smart meters Gas (Domestic)	Homes	104,440.00	104,440.00	104,440.00
Energy assessment (Domestic)	Homes	456.00	456.00	456.00
Fuel reduction by behavioural change and technology mix (Domestic)	%	7.05	6.889	6.734
Electricity reduction by behavioural change and technology mix (Domestic)	%	-4.88	-4.47	-4.13
Energy efficient lighting (Non-Domestic)	000's m2	102.659	102.659	102.659
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)	%	11.329	11.265	11.18
Electricity reduction by behavioural change and technology mix (Non-Domestic)	%	6.531	6.317	5.971
Energy efficient street lighting	Lamps	1,200.00	16,400.00	24,000.00
Road transport fuel reduction by behavioural change	%	0.119	0.119	0.119
Road transport efficiency improvements	%	11.77	11.77	11.77
Replace road transport fuels with biofuels	000's litres	25,698.34	25,698.34	25,698.34
Replace road transport fuels with electricity	000's litres	0.00	0.00	0.00

Table 9: 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 ktCO₂pa reduction in each of the three periods.



CO2 Saved by Measure	Units	2005-2020	2021-2035	2036-2050
CHP biomass	ktCO2pa	122.02	90.976	82.145
CHP large gas	ktCO2pa	0	0	0
CHP buildings gas	ktCO2pa	7.869	7.423	7.41
Heat from power station	ktCO2pa	0	0	0
Power only biomass	ktCO2pa	16.676	5.232	1.448
Green grid	ktCO2pa	237.46	649.74	821.68
Wind large	ktCO2pa	0.127	0.04	0.011
Wind medium	ktCO2pa	0.004	0.001	0
Wind (Domestic)	ktCO2pa	0	0	0
Solar PV (Domestic)	ktCO2pa	15.99	5.02	1.39
Solar thermal (Domestic)	ktCO2pa	8.06	7.60	7.60
Biomass boilers (Domestic)	ktCO2pa	4.26	4.02	4.02
Air source heat pump (Domestic)	ktCO2pa	2.91	5.16	6.02
Ground source heat pump (Domestic)	ktCO2pa	2.24	3.16	3.53
Solar PV (Non-Domestic)	ktCO2pa	12.745	3.998	1.107
Biomass boilers (Non-Domestic)	ktCO2pa	3.523	3.321	3.313
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	8.27	7.80	7.79
Solid wall insulation (Domestic)	ktCO2pa	28.18	26.60	26.56
Loft insulation (Domestic)	ktCO2pa	10.40	9.81	9.80
Tank insulation (Domestic)	ktCO2pa	0.12	0.11	0.11
Draught proofing (Domestic)	ktCO2pa	0.16	0.15	0.15
Double glazing (Domestic)	ktCO2pa	0.12	0.11	0.11
Energy efficient lighting (Domestic)	ktCO2pa	0.87	0.27	0.08
Energy efficient appliances (Domestic)	ktCO2pa	11.07	3.47	0.96
Boiler replacement (Domestic)	ktCO2pa	14.01	13.23	13.21
Fuel switch (Domestic)	ktCO2pa	0.07	-0.03	-0.06
Heating controls (Domestic)	ktCO2pa	0.44	0.41	0.41
Smart meters Electric (Domestic)	ktCO2pa	4.03	1.26	0.35
Smart meters Gas (Domestic)	ktCO2pa	1.76	1.66	1.66
Energy assessment (Domestic)	ktCO2pa	0.04	0.04	0.03
Fuel reduction by behavioural change and technology mix (Domestic)	ktCO2pa	26.94	26.943	26.942
Electricity reduction by behavioural change and technology mix (Domestic)	ktCO2pa	-10.571	-3.314	-0.918
Energy efficient lighting (Non-Domestic)	ktCO2pa	0.586	0.184	0.051
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	33.112	33.124	33.139
Electricity reduction by behavioural change and technology mix (Non-Domestic)	ktCO2pa	21.786	6.835	1.892



Energy efficient street lighting	ktCO ₂ pa	0.09	0.40	0.16
Road transport fuel reduction by behavioural change	ktCO ₂ pa	0.527	0.559	0.591
Road transport efficiency improvements	ktCO ₂ pa	52.113	55.281	58.448
Replace road transport fuels with biofuels	ktCO ₂ pa	32.34	32.34	32.34
Replace road transport fuels with electricity	ktCO ₂ pa	0.00	0.00	0.00

Table 10: Scenario CO₂ savings by measure

In addition to the ktCO₂pa 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	102102	57432.375	28716.188
CHP large gas	£k	0	0	0
CHP buildings gas	£k	3479.328	2609.496	0
Heat from power station	£k	0	0	0
Power only biomass	£k	44432.85	24993.478	12496.739
Green grid	£k	0.00	0.00	0.00
Wind large	£k	243	0	0
Wind medium	£k	27	0	0
Wind (Domestic)	£k	0	0	0
Solar PV (Domestic)	£k	134,215.58	0.00	0.00
Solar thermal (Domestic)	£k	84,712.00	0.00	0.00
Biomass boilers (Domestic)	£k	10,382.40	0.00	0.00
Air source heat pump (Domestic)	£k	15,974.00	0.00	0.00
Ground source heat pump (Domestic)	£k	13,210.00	0.00	2,064.06
Solar PV (Non-Domestic)	£k	168000	0	0
Biomass boilers (Non-Domestic)	£k	1225.072	574.253	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	4,978.93	0.00	1,555.92
Solid wall insulation (Domestic)	£k	41,970.00	0.00	39,346.88
Loft insulation (Domestic)	£k	8,107.19	0.00	2,533.50
Tank insulation (Domestic)	£k	24.61	11.72	0.00
Draught proofing (Domestic)	£k	103.23	49.16	0.00
Double glazing (Domestic)	£k	700.00	437.50	218.75
Energy efficient lighting (Domestic)	£k	187.33	0.00	0.00
Energy efficient appliances (Domestic)	£k	74,259.81	35,361.81	0.00
Boiler replacement (Domestic)	£k	50,771.95	0.00	0.00
Fuel switch (Domestic)	£k	120.35	0.00	0.00
Heating controls (Domestic)	£k	1,438.47	0.00	0.00



Smart meters Electric (Domestic)	£k	29,624.83	0.00	0.00
Smart meters Gas (Domestic)	£k	29,556.52	0.00	0.00
Energy assessment (Domestic)	£k	45.60	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	2566.475	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	408.00	5,168.00	2,584.00
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 11: Scenario capital costs by measure

