

RESTRICTED – COMMERCIAL

Resource Efficiency Report

Assessment of Energy and Water Savings Opportunities For

Gwynedd Council Carbon Management Plan 2

Prepared for	David Lewis Energy Conservation Manager	Prepared by	Paul Manley
	Gwynedd Council Castle Street Gwynedd LL55 1SH		BG Consult Limited 12 Devon Place Newport NP20 4NN
Tel	01286 679307	Tel	01633 449671
Email	davidmarklewis@gwynedd.gov.uk	Email	Paul@bg-consult.co.uk
Account manager	????	Tel	????? ??????
		Email	??? ?????@CarbonTrust.co.uk
Opportunity ID	OPP-107762		
PO Reference	PO 6040286		
Country	Wales		
Date	February 2015		
Version	2.0 Draft		



CONTENTS

EXECUTIVE SUMMARY	4
1. INTRODUCTION	7
1.1 GENERAL	
1.2 BACKGROUND	
1.3 PROJECT OBJECTIVES	
1.4 DOCUMENT STRUCTURE	
2. CARBON MANAGEMENT STRATEGY	9
2.1 CONTEXT AND DRIVERS FOR CARBON MANAGEMENT	
2.2 LOW CARBON VISION	
2.3 TARGETS AND OBJECTIVES	
2.4 STRATEGIC THEMES	
3. CONSUMPTION AND EMISSIONS	12
3.1 CONSUMPTION OVERVIEW	
3.2 CO ₂ EMISSIONS SCOPE AND BASELINE	
3.3 PROGRESS TO DATE	
4. TARGETS AND BUSINESS CASE	17
4.1 TARGETS	
4.2 FINANCIAL VALUE AT STAKE	
4.3 CARBON VALUE AT STAKE	
5. CARBON & COST REDUCTION OPPORTUNITIES	20
5.1 MONITORING AND TARGETING	
5.2 BUILDING "INVEST TO SAVE" PROJECTS	
5.3 DESIGN AND ASSET MANAGEMENT	
5.4 STREETLIGHTING	
5.5 TRANSPORT	
5.6 WASTE	
5.7 WATER CONSERVATION	
5.8 SUMMARY OF OPPORTUNITIES	
6. EMBEDDING CARBON MANAGEMENT	27
6.1 BARRIERS TO PROGRESS	
6.2 PROGRAMME MANAGEMENT	
6.3 MAIN ROLES AND RESPONSIBILITIES	
6.4 COMMUNICATION AND TRAINING	
6.5 POLICY ALIGNMENT	
6.6 FINANCE AND INVESTMENT	
6.7 ANNUAL PROGRESS REVIEW	

- 7.1 ENERGY MANAGEMENT MATRIX
- 7.2 CO₂ CONVERSION FACTORS USED IN BASELINE CALCULATIONS
- 7.3 LIST OF PROJECTS IDENTIFIED TO DATE

EXECUTIVE SUMMARY

This report has been produced by BG Consult for Gwynedd Council with the support of the Carbon Trust in Wales. The Carbon Trust receives funding from the Welsh Government.

The agreed scope of work was to develop a new Carbon Management Plan (CMP2) as a successor to the original plan which expires in March 2015. The scope of work included:

- Completion of a gap analysis,
- The use of existing information, interrogation of data and completion of site surveys to inform the detailed project list (updating the case for carbon reduction),
- Making recommendations on short, medium and long term targets,
- Present findings to the client group, project board and Cabinet.

This version 2.0 of the final report also incorporates a Project List (see Appendix 7.3) as of February 2015 and compares potential savings with the findings of the initial high level assessment.

Background

In 2009 Gwynedd Council were invited by the Carbon Trust to take part in the Local Authority Carbon Management Programme specifically designed to assist Local Authorities to reduce their carbon emissions created by their core service provision activities.

As a result of this Programme, a Carbon Management Plan was produced outlining the Council's strategy for reducing its carbon emissions by 30% by the year 2014/15, in order to act as a first step towards an aspirational target to reduce overall carbon emissions by 60% by the year 2021.

The aim of the Carbon Management Plan (CMP1) was to provide a strategic direction and corporate work programme to build upon what had been achieved since the baseline year. CMP1 contained a programme of work for the 5 years to April 2015, identified the financial and physical resources required to achieve the initial 30% target and quantified the financial savings which would result from reduced energy consumption.

CMP1 expires in March 2015 and Gwynedd Council working in partnership with the Carbon Trust have developed a successive Carbon Management Plan (CMP2) to cover the six years to 2020/21. The Council has identified the following drivers for producing Carbon Management Plan 2:

- Taking ownership for our effect on the sustainability of our community and its effect on the planet.
- Achieve revenue savings as a result of reducing our carbon emissions and water consumption?
- Economic stability of our business and the unavoidable need to become a low carbon Council.

Gwynedd Council's Vision for Carbon Management

The Council's vision for carbon management was stated within CMP1 as below:

Cyngor Gwynedd will demonstrate leadership for the wider community by reducing CO₂ emissions generated from its' service provision activities by 30% by 2015 as a first step to achieving a 60% reduction by 2021 to ensure that Gwynedd plays its' part to combat the effects of climate change as part of its' aim to ensure a sustainable County.

Low Carbon Council → Low Carbon Gwynedd

Target

The baseline year for CMP1 and CMP2 is 2005/06 being the same baseline year as that adopted by the Local Services Board for the Carbon Footprint Project.

CMP1 was designed to achieve a milestone target of a 30% reduction by 2015 to provide a first step towards a long term aim of achieving a 60% reduction in CO₂ emissions by 2021. Notwithstanding variations in weather conditions and CO₂ conversion factors it seems possible that the Council will come close to achieving the 30% milestone target, as a 24.8% reduction was reported with one year of CMP1 remaining.

However, this study indicates that if the ambitious 60% aspirational target is to be met by 2020/21, it is likely that the Council would need to consider large scale off site-renewables to provide more than 10% of all of the Council's requirements.

Therefore it is recommended that the Council should consider reviewing the target for CMP2 to align with the outcome of this report as below:

Gwynedd Council has an aspirational target to reduce CO₂ emissions from Council Operations by 60% against a 2005/06 baseline and is committed to achieving this through continual improvements to meet Welsh Government Targets for annual CO₂ emissions reductions of 3%.

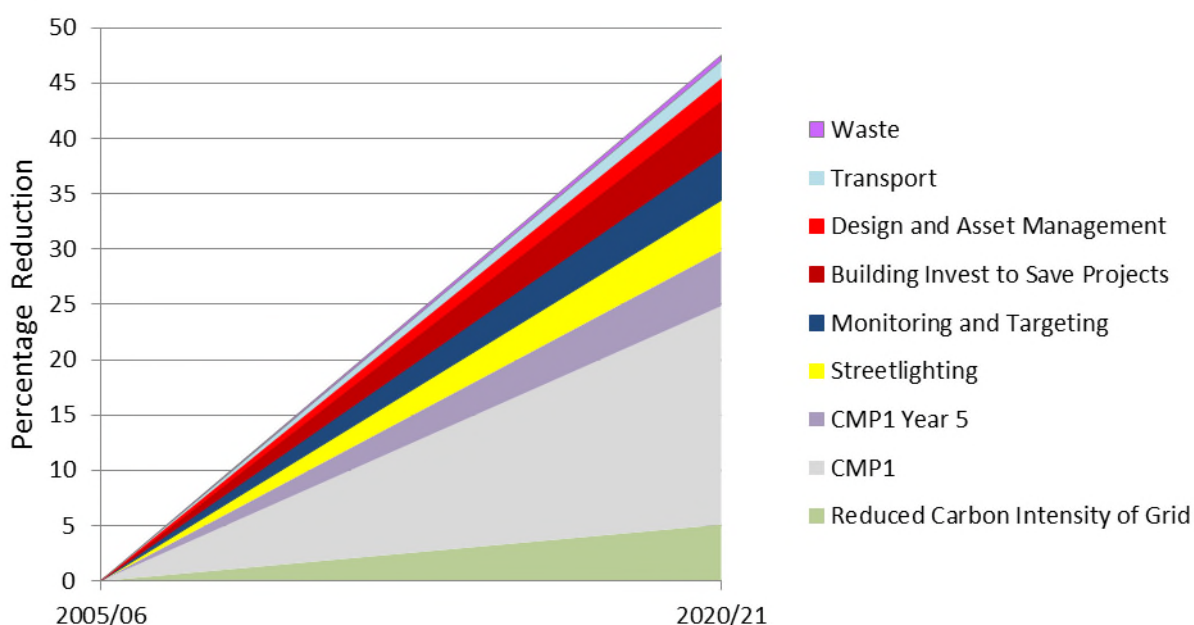
It is strongly recommended that these CO₂ emissions reduction targets are cascaded down to ensure that the Council's bold vision and commitment is fully embedded within the organisation.

Estimated Carbon and Revenue Savings Opportunities

Based on the scope outlined in section 3.2, energy (and water) costs are more than £6M per annum with £2M of this spent on diesel fuel for fleet vehicles and almost £0.7M for streetlighting.

As 40% of baseline emissions relate to non-building related sources it is essential that CMP2 gives greater consideration to activities such as transport and streetlighting if targets are to be met.

A high level assessment has shown that it is possible with sufficient investment and engagement to meet the revised targets using the strategy proposed under CMP2. Progress to date and the potential % reductions for the various opportunities are summarised in the graph below:

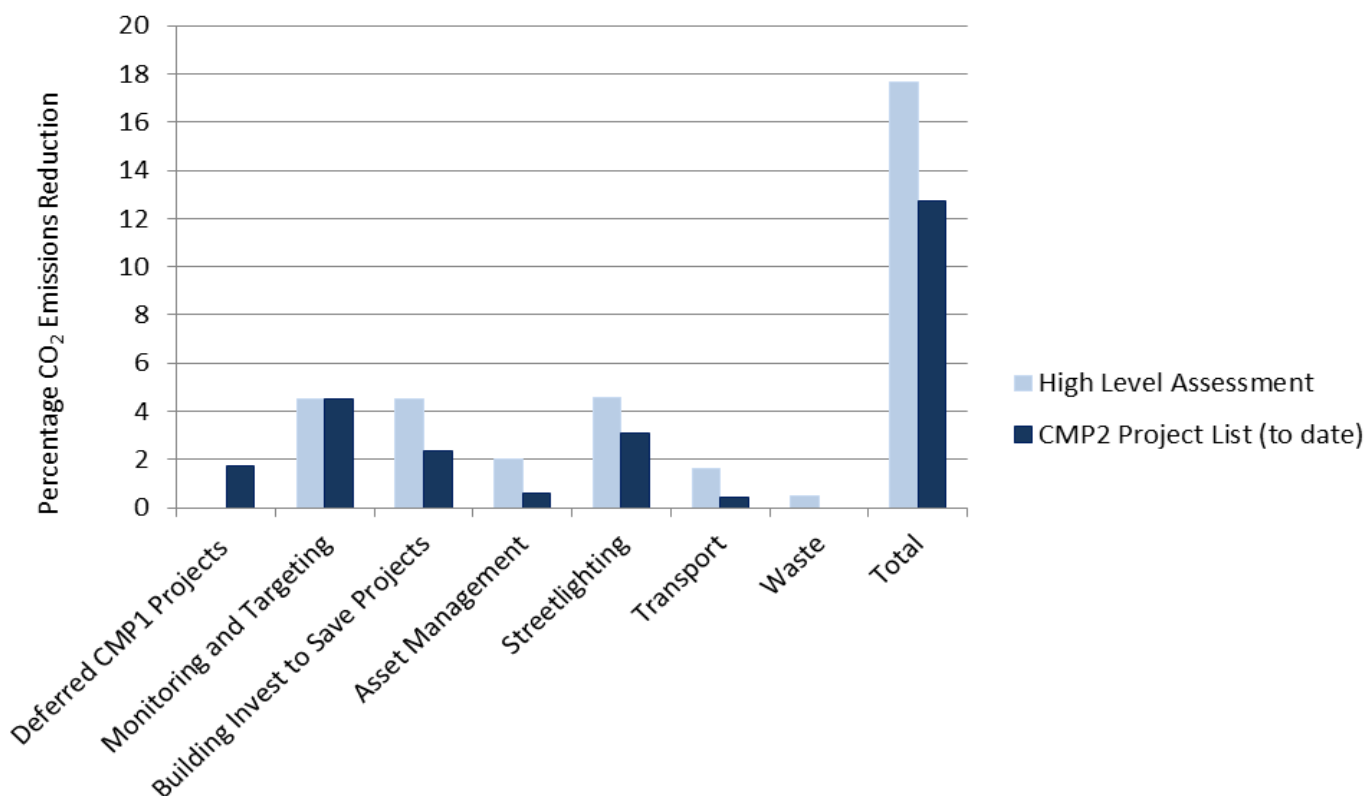


Summary of CO₂ Emissions Reductions by Category based on High Level Assessment

A high level assessment determined that if implemented the above measures could collectively generate revenue savings of approximately £1M per annum (including water efficiency measures) and provide a reduction in CO₂ emissions of almost 18% against the baseline by 2020/21.

Subsequent detailed development of the CMP2 "Project List" supports the findings of the high level assessment and has already identified specific projects able to deliver CO₂ emissions reductions of 12.6% of the baseline.

The Project List summarised in Appendix 7.3 should be regarded as a "live" document and as such will be subject to ongoing development.



Comparison of CMP2 Project List CO₂ Reductions against High Level Assessment Findings

Implementation costs of the measures identified by the high level assessment exercise indicate a required investment of approximately £3.2M excluding transport initiatives (see table 5.2).

It is understood that a number of external funding options remain available for many of the measures.

1. INTRODUCTION

IMPORTANT NOTICE: Whilst reasonable steps have been taken to ensure that the information contained within this Report is correct, you should be aware that the information contained within it may be incomplete, inaccurate or may have become out of date. Accordingly, BG Consult, the Carbon Trust, its agents, contractors and sub-contractors and the Government make no warranties or representations of any kind as to the content of this Report or its accuracy and, to the maximum extent permitted by law, accept no liability whatsoever for the same including without limit, for direct, indirect or consequential loss, business interruption, loss of profits, production, contracts, goodwill or anticipated savings. Any person making use of this Report does so at their own risk. © Queen's Printer and Controller of HMSO. Any trademarks, service marks or logos used in this publication are the property of the Carbon Trust, and copyright is licensed to the Carbon Trust. Nothing in this publication shall be construed as granting any licence or right to use or reproduce any of the trademarks, service marks, logos, copyright or any proprietary information in any way without the Carbon Trust prior written permission. The Carbon Trust enforces infringements of its intellectual property rights to the full extent permitted by law.

The Carbon Trust is a company limited by guarantee and registered in England and Wales under Company Number 04190230 with its Registered Office at: 4th Floor, Dorset House, 27-45 Stamford Street, London SE1 9PY.

1.1. General

This consultation was carried out by Mr. Paul Manley and Dr Andrew Geens of BG Consult Limited for Mr. David Lewis, Energy Conservation Manager, Gwynedd Council.

1.2. Background

In 2009 Gwynedd Council were invited by the Carbon Trust to take part in the Local Authority Carbon Management Programme specifically designed to assist Local Authorities to reduce their carbon emissions created by their core service provision activities.

As a result of this Programme, a Carbon Management Plan was produced outlining the Council's strategy for reducing its carbon emissions by 30% by the year 2014/15, in order to act as a first step towards an ambitious target to reduce carbon emissions by 60% by the year 2021. The baseline year for this Plan was 2005/06 being the same baseline year as that adopted by the Local Services Board for the Carbon Footprint Project. The baseline year was also chosen to reflect typical local weather conditions as reduction targets are absolute and therefore do not take into account annual variations in weather severity.

The aim of the Carbon Management Plan (CMP1) was to offer a strategic direction and corporate work programme to build upon what had been achieved since the baseline year. CMP1 contained a programme of work for the 5 years to April 2015, identified the financial and physical resources required to achieve an initial 30% milestone target and quantified the financial savings which would result from reduced energy consumption.

As CMP1 is about to come to an end Gwynedd Council are once again working in partnership with the Carbon Trust in Wales to produce a second Carbon Management Plan (CMP2) to cover the remaining six years to 2020/21. As with the previous Carbon Management Plan the following carbon emissions are included within CMP2:

- The operational building stock (buildings used to provide a service e.g. schools, leisure centres, homes for the elderly, libraries etc),
- street lighting for all roads adopted by the Council,
- waste generated by the Council's own operational buildings,
- the operational fleet and the use of private vehicles for business travel.

As previously, carbon emissions generated from household and commercial waste sent to landfill in Gwynedd are not included.

1.3. Project Objectives

The main project objective as defined by the Client Brief is to develop a new Carbon Management Plan (CMP2) covering the six year period 2015/16 to 2020/21. The scope of work also includes:

- A gap analysis to identify the level of activity required to achieve ambitious long term targets.
- The use of existing data and site survey information to update the detailed project list.
- Recommendations on short, medium and long term targets.
- Present findings to the Client Group, Project Board and Cabinet.

In addition, a variation to the Client Brief was agreed to also consider potential cost savings from water efficiency measures. It was agreed that data from existing water efficiency surveys completed by Dwr Cymru would be used as the basis for a high level estimate of potential savings to inform the business case. However, it was further agreed that associated carbon savings would not be considered as they were not included within the original baseline emissions.

1.4. Document Structure

The main body of this document follows the following structure:

- **Section 2** – sets out the Council’s Vision and objectives for the revised Carbon Management Plan (CMP2).
- **Section 3** – defines the scope of emissions covered by the revised plan and summarises the progress to date under the current Carbon Management Plan (CMP1).
- **Section 4** – set out the targets and presents the business case for action in financial and carbon reduction terms.
- **Section 5** – identifies carbon and cost reduction opportunities organised into categories and provides an insight into the level of activity needed to meet targets.
- **Section 6** – highlights the potential barriers to progress, the key stakeholders, the management structure for the delivery and oversight of CMP2 and the key policy issues.

This version (2.0 Final) of the report also includes a Project List (Annex 7.3) containing details of individual proposed projects for delivery under CMP2 and direct comparison with the findings of the high level assessment (see Exec. Summary and

2. CARBON MANAGEMENT STRATEGY

2.1 Context and Drivers for Carbon Management

The overall drivers for reducing energy consumption and associated CO₂ emissions are well established and widely accepted being primarily:

- **Legislative** – The Energy Performance in Buildings Directive placed a legal requirement on EU Member States to introduce legislation aimed at reducing CO₂ emissions in support of our obligations under the 1997 Kyoto Protocol. Examples of requirements arising from subsequent legislation include mandatory air-conditioning inspections, Energy Performance Certificates (EPCs) to be generated when buildings are constructed, sold or rented and the requirement for Display Energy Certificates (DECs) for public buildings over 500m² (currently) to be displayed in a prominent position. In addition, Welsh Building Regulations are about to be devolved from the rest of the UK and require a significant improvement in energy performance of between 15-20% over the previous regulations.
- **Financial** - Gwynedd Council in common with all Local Authorities are currently facing substantial financial pressures and there is a need to reduce all costs including energy and water. Punitive taxation schemes such as the Climate Change Levy (CCL) and the Carbon Reduction Commitment Energy Efficiency Scheme (CRC) have been used to create further financial pressure to reduce CO₂ emissions. However, financial incentive schemes such as the Renewable Heat Incentive (RHI) and the Feed-in Tariff (FiT) have also been introduced by UK Government to encourage the uptake of renewable and low zero carbon technologies.
- **Reputational** – the Council uses the branding “Low Carbon Council – Low Carbon Gwynedd” in support of its’ bold vision statement to “...demonstrate leadership for the wider community by reducing CO₂ emissions generated from its’ service provision activities by 30% by 2015 as a first step to achieving a 60% reduction by 2021 to ensure that Gwynedd plays its’ part to combat the effects of climate change as part of its’ aim to ensure a sustainable County.” In addition, the Welsh Government has issued a target for the public sector in Wales of a 3% reduction per year from 2011 against a baseline of average emissions between 2006 and 2010.

In recognition the Council has therefore identified the following drivers for producing Carbon Management Plan 2:

- Taking ownership for our effect on the sustainability of our community and its effect on the planet.
- Achieve revenue savings as a result of reducing our carbon emissions and water consumption.
- Economic stability of our business and the unavoidable need to become a low carbon Council.

2.2 Low Carbon Vision

As stated within CMP1:

Gwynedd Council will demonstrate leadership for the wider community by reducing CO₂ emissions generated from its service provision activities by 30% by 2015 as a first step to achieving a 60% reduction by 2021 to ensure that Gwynedd plays its’ part to combat the effects of climate change as part of its’ aim to ensure a sustainable County.

Low Carbon Council → Low Carbon Gwynedd

The Council is a member of the Gwynedd Local Services Board (which comprises most public sector bodies operating in Gwynedd) and has taken the lead in facilitating action amongst these organisations to reduce the public sector's carbon footprint in the County. The Board has set a challenging target of reducing CO₂ emissions by 60% by 2021.

A milestone target of a 30% reduction by 2015 was also adopted as the main focus of CMP1 to provide a first step towards our long term aim of achieving a 60% reduction in CO₂ emissions by 2021.

2.3 Targets and Objectives

The Council's target as stated within CMP1 is a challenging and inspirational one that has provided the motivation for the Council's success to date.

However, this study has shown to achieve this level of reduction the Council would need to build on existing measures with:

- improved operational management at site,
- significant improvements in areas other than property,
- large scale off-site renewables to meet 10% of all of the Council's requirements.

Therefore a more measured progress towards the target may be more realistic and may also provide the opportunity to adopt emerging technologies at a later date.

Therefore for CMP2, it is proposed that the Council review and restate targets as below:

Gwynedd Council has an aspirational target to reduce CO₂ emissions from Council Operations by 60% against a 2005/06 baseline and is committed to achieving this through continual improvements to meet Welsh Government Targets for annual CO₂ emissions reductions of 3%.

2.4 Strategic Themes

CMP2 continues to concentrate on CO₂ emissions generated from the Council's operational buildings portfolio, street lighting, waste from Council operational buildings, fleet and business travel.

CMP1 has been a great success with the Council likely to come close to achieving the 30% milestone target by 2015. However, savings have so far largely resulted from the implementation of building related projects. With current technologies and if the Council is to progress further, it is important that other areas are giving a similar level of attention as the targets are very challenging.

Therefore the council should now place greater emphasis on the 40% of baseline emissions that are not generated by buildings, improving operational management and making significant investment in renewable energy where appropriate.

Therefore the strategic themes of CMP2 are:

- A continuing commitment to working with other members of the Local Services Board to identify and share best practice together with operational collaboration wherever possible.
- Recognising that embedding carbon reduction within strategic policies remains essential in respect of new build design standards, renewal standards, heating standards and general operation of buildings is important but also that enforcing such policies is essential if they are to be effective.

- Motivating and incentivising managers to make the necessary improvements in operational control at site through the introduction of a reporting methodology known as Monitoring and Targeting (M & T). This is a proven and highly cost-effective approach based on delegating reduction targets to "Site Managers" who are provided with regular feedback on the energy performance of their building(s). A target of 3% per annum has been shown to be achievable by recent case studies and aligns with the Council's overall target.
- Continuing to raise awareness in schools of the need to reduce CO₂ emissions which under CMP1 resulted in the creation of tailored educational and awareness raising programmes. However, all future energy awareness raising activities in buildings (including educational programmes) will be regarded as an integral part of the M & T programme.
- The Energy Conservation Team will continue to deliver further savings from implementing building related "Invest to Save" projects but will also perform a critical role in providing the physical resource necessary to implement and operate the M & T programme.
- As traditional building related "Invest to Save" projects become exhausted the "Project List" will increasingly need to include appropriate renewable energy technologies and emerging technologies as they become viable.
- A detailed and ambitious programme of streetlighting improvements as discussions with the Carbon Trust and work by other Local Authorities has indicated that significant and cost effective opportunities for CO₂ reductions from streetlighting are possible.
- Greater emphasis on reducing emissions from fleet and business travel which collectively account for almost a quarter of Council CO₂ emissions and a third of energy (and water) costs. Therefore, it is recommended that a meaningful reduction target is delegated to "fleet managers", as with building users, to incentivise continual improvements (i.e. reductions) against a combined fleet/business travel baseline. Whilst a recent Transport Review of the Council did not directly quantify CO₂ savings, it is likely that proposals made by the Report would generate efficiencies leading to CO₂ reductions.
- The use of an "Invest to Save" model to fund most carbon reduction projects will continue to be utilised in addition to an allocated a capital sum and reliance on SALIX or other capital funding schemes where applicable.

3. CONSUMPTION AND EMISSIONS

3.1. Consumption Overview

Gwynedd Council consumes approximately 77,600 MWh of energy per annum (based on figures for the 2013/14 reporting year) at a cost of approximately £5.5M with an additional utility expenditure for water and effluent of approximately £0.6M.

Utility	Energy Consumption		Cost	
	kWh/year	%	£/year	%
Electricity	20,036,675	25.8	2,103,851	38.5
Gas	32,110,861	41.4	1,123,880	20.5
Oil	934,992	1.2	46,750	0.9
LPG	4,954,946	6.4	222,973	4.1
Diesel	19,377,149	24.9	1,972,946	35.9
Petrol	195,471	0.3	29,320	0.1
Total Energy	77,610,094	100	5,499,720	100
Water & Effluent	201,228 m ³	-	593,625	-
Total Utilities and Transport	-	-	6,093,345	-

Table 3.1 Summary of Energy Data for last Reporting Year (2013/14)

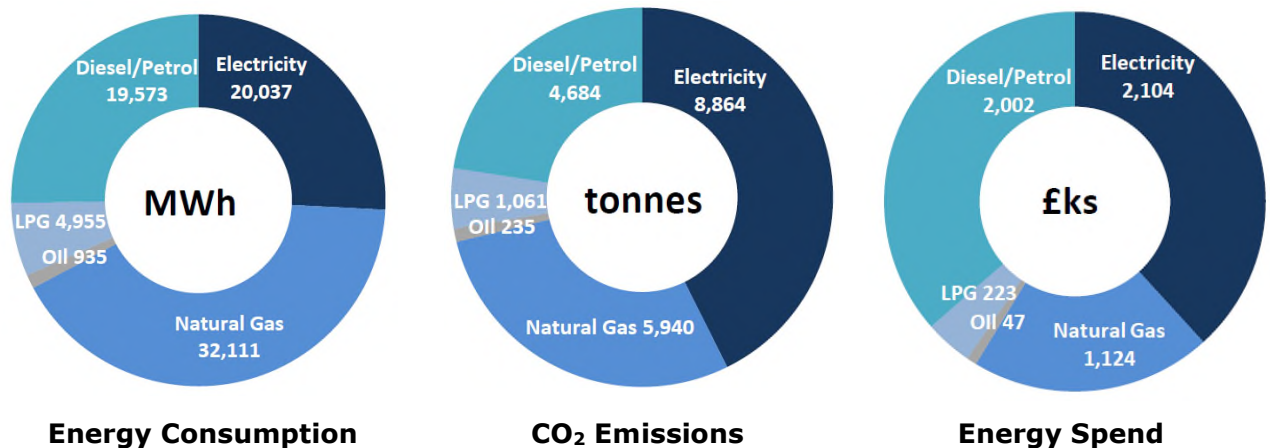


Fig. 3.1 Summary of Energy Data for last Reporting Year (2013/14)

Notes:

1. Above data supplied by Gwynedd Council.
2. Biomass excluded as assumed to be cost and carbon neutral.

3.2. CO₂ Emissions Scope and Baseline

As previously stated, the baseline year chosen by Gwynedd Council is 2005/06 being consistent with that adopted by the Local Services Board for the Carbon Footprint Project.

Consistent with the previous Carbon Management Plan, CMP2 continues to focus on the CO₂ emissions over which the Council has direct control, namely:

- **Operational buildings** – the Council currently operates buildings on approximately 500 sites. Operational buildings can be classified as those used for direct service delivery and include offices, schools, homes for the elderly, libraries, leisure centres (*scopes 1 & 2*).
- **Street lighting** – on roads maintained and adopted by the Council (*scope 2*).
- **Fleet** – consisting of all the Council’s operational vehicles (*scope 1*).
- **Waste** – generated from the Council’s operational buildings (*scope 3*).
- **Business travel** – emissions generated by use of private vehicles by Council staff when carrying out their work duties (*scope 3*).

Note:

Emissions scopes are as defined in The Greenhouse Gas Protocol published by the World Resource Institute in 2004 which is briefly summarised by the Carbon Trust at:

<http://www.carbontrust.com/resources/faqs/services/scope-3-indirect-carbon-emissions>

Baseline emissions for the above scope were reported as 30,748 tonnes within CMP1. However, this was later re-calculated to be 31,155 tonnes due solely to an adjustment in fleet emissions.

CO₂ emissions are calculated by applying CO₂ conversion factors (see appendix 7.2) to raw energy consumption/journey distance data and are recorded using an excel spreadsheet tool. These factors are referenced from DEFRA Greenhouse Gas Reporting Guidelines and are periodically reviewed to reflect variations in the CO₂ intensities of individual fuels. Historical variations have been most noticeable for grid electricity where the CO₂ intensity is determined by the UK power generation mix at any given point in time.

The following methods of data collection are used for baseline calculations and subsequent reporting:

- **Operational buildings** – actual consumption in kWh of electricity, gas, oil and propane for each and every one of the buildings operated by the Council.

The data has been collected either from manual meter readings, from supplier invoices or delivery notes from oil suppliers. This is a labour intensive process requiring manual input into a data analysis database system and is susceptible to input errors and data collection errors on site. Such manually collected data is also historic at the time of input as invoices are received at best on a monthly basis and ensuring that site managers provide meter readings is a continuous battle.

The introduction of Automatic Meter Readers (AMR) has allowed the Council to receive data direct from the energy meter operator providing more accurate and timely data and also reducing the need for manual intervention. AMR can also provide a more rapid response to over consumption thereby minimising waste and revenue expenditure and can also be used to validate supplier invoices assisting to ensure more accurate billing.

- **Street lighting** – The Council’s street lighting is unmetered but as each streetlight has a constant load, the consumption can be calculated from the lamp’s rating and the hours that it is switched on. This work is carried out by Elexon to the BSCP520 standard. Elexon is the balancing and settlement code company which manages the electricity market and trading arrangements. Gwynedd Council refers to this supply operational information whenever any changes are made to the street lighting.

The time that a lamp is switched on is calculated from the lighting regime which may be Dusk to dawn, 24 hours or dusk to midnight. The actual times for the dusk and dawn each day of the year are used for the calculation.

The power requirement is taken from the lamp and control gear rating which is multiplied by the on time to calculate the consumption. This method is used by electricity suppliers to calculate prices and the figures used in the CMP are those provided by suppliers.

- **Fleet** – data provided by the Fleet Manager on actual consumption of fuel in litres. Gwynedd Council has a fleet of vehicles that range from 44 tonne hook lifts, to refuse compactors, road gritting lorries, 4x4 vehicles and down to small vans for the use of highways inspectors and other members of staff. In addition there are numerous items of large and small plant such as sweepers and ride-on mowers down to strimmers and chain saws.

The primary method of fuelling diesel vehicles is from bunkered storage located in strategically placed depots at 5 locations across the County. These supplies are managed by the Timeplan Fuel Management System controlled from a computer in Caernarfon.

Each vehicle has a key fob which enables them to obtain fuel and automatically records appropriate management information on fuel usage, MPG figures, total mileage and fuel costs for each vehicle. A suite of management reports are also available through the system.

15% of fuel is purchased using the Monitor fuel card, administered by Arval PHH. Much of this fuel is petrol purchased for mowers, chains saws, strimmers etc., the Council does not store petrol at its' depots. Diesel is purchased using a fuel card when no bunkered supply is in economical range. The card may be used at most filling stations.

- **Waste** – data is provided by the Senior Waste Manager on tonnes of waste collected from the Council's operational properties.
- **Business travel** – data is provided by the Internal Audit Section from the PUMA database system. The PUMA system's primary function is to manage travelling expenses payments to staff and not to record emissions generated from the use of private vehicles. As all business travel payments to staff are calculated on a single "pence per mile factor" the current travelling claim forms do not require the claimant to state the type of fuel, vehicle engine size or the vehicle's carbon emissions therefore industry recognised assumptions and conversion factors have been used to estimate emissions.

3.3. Progress to Date

In 2013/14 CO₂ emissions were reported to have fallen by 24.8% to 23,414 tonnes (including business travel) against an interim or milestone target of 30% by 2014/15.

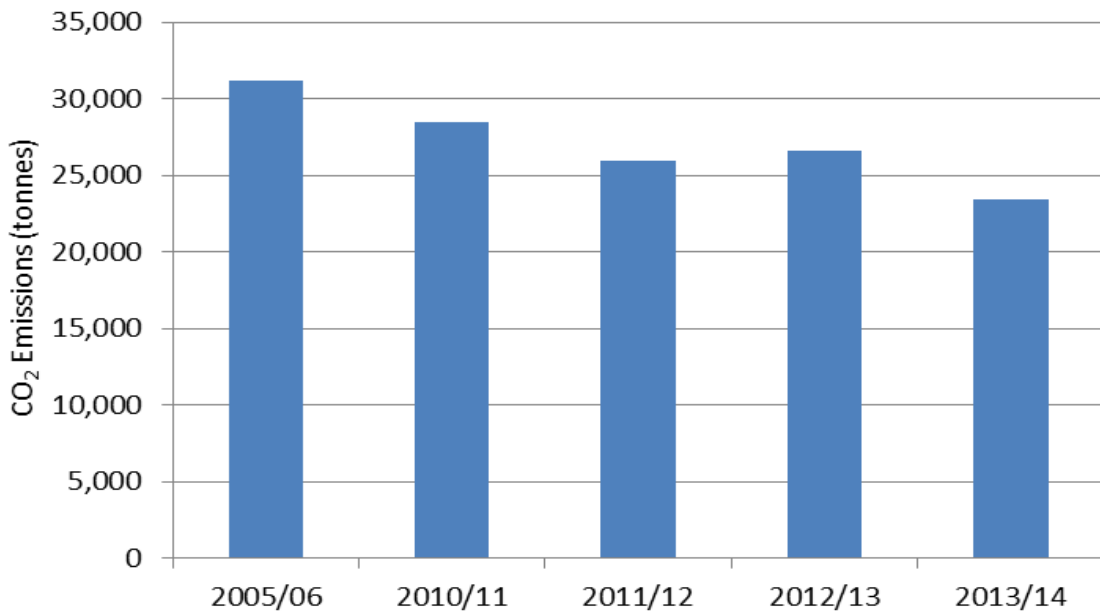


Fig 3.2 Total CO₂ Emissions during CMP1 (to date) v. Baseline Emissions

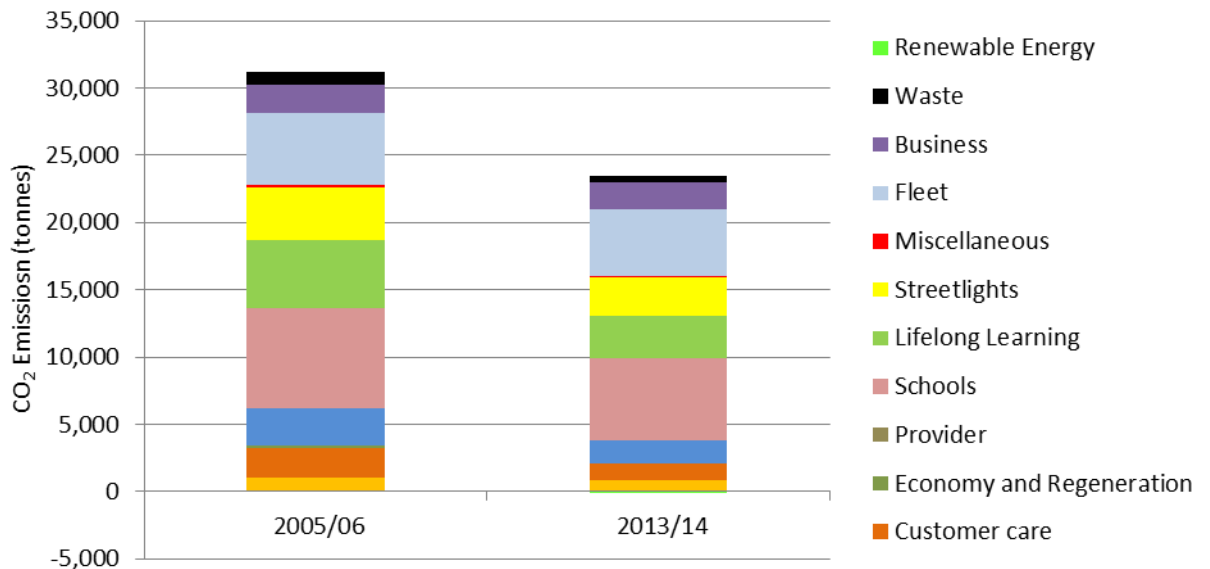


Fig. 3.3 CO₂ Emissions by Category Latest Reporting Year v. Baseline

Category	Highways and Municipal buildings	Customer care buildings	Economy and Regeneration buildings	Provider buildings	Schools buildings	Life long Learning buildings	Streetlights	Miscellaneous buildings	Fleet	Business Travel	Waste	Renewable Energy
% of baseline	3.5	7.2	0.5	8.9	24.4	16.5	12.7	0.6	16	6.8	3	N/A
CO ₂ emissions (tonnes) 2005/06	1,065	2,200	156	2,728	7,506	5,064	3,899	187	4,918	2,095	930	0
CO ₂ emissions (tonnes) 2013/14	877	1,221	20	1,691	6,081	3,121	2,934	115	4,963	1,936	491	-36
% Reduction	-17.6	-44.5	-87.1	-38	-19	-38.4	-24.8	-38.3	-6.8	-7.6	-47.2	N/A

Table 3.2 Reported Reductions in CO₂ Emissions by Category

4. TARGETS AND BUSINESS CASE

4.1. Targets

Gwynedd Council set out a strategy in their CMP1 to achieve an initial 30% reduction in CO₂ emissions by 2014/15 against a baseline year of 2005/06. This was identified as the first step towards an ambitious target to reduce CO₂ emissions by 60% by 2021.

The Council's 60% aspirational target as stated within CMP1 remains the end goal but under CMP2 the rate of progress has been realigned with the Welsh Government CO₂ emissions reduction targets of 3% per annum.

Targets as stated remain absolute and therefore make no allowance for variables that may affect performance such as fluctuations in annual weather severity.

4.2. Financial Value at Stake

The "financial value at stake" is the difference between the energy costs of a "business as usual" and "target scenario". The projections include energy, water and fleet fuel costs but exclude business travel.

A "business as usual" scenario has been provided to estimate likely future consumption and costs based on taking no further action. The scenario extrapolates the latest reported consumption and is based on the following:

- An agreed energy and water price increase of 5% per annum derived from Department of Energy and Climate Change projections.
- The Council's level of energy (and water) demand increasing by 0.7% per annum from 2013/14 levels. Based on the Department of Business, Enterprise and Regulatory Reform's (DBERR) Energy Paper 68 which concluded that an institution's energy consumption will see a 0.7% year on year increase unless it is actively managed downwards.
- The "business as usual" scenario does not include the impact of any new energy efficiency measures over the scenario period.

The "target" scenario has been provided to estimate likely future consumption and costs based on completing CMP1 and implementing CMP2. The scenario extrapolates the latest reported consumption and is based on the following:

- An agreed energy (and water) price increase of 5% per annum derived from Department of Energy and Climate Change projections.
- The Council's level of energy (and water) consumption decreasing by 3% per annum in line with the Council's target under CMP2 for remainder of CMP1 and during CMP2.

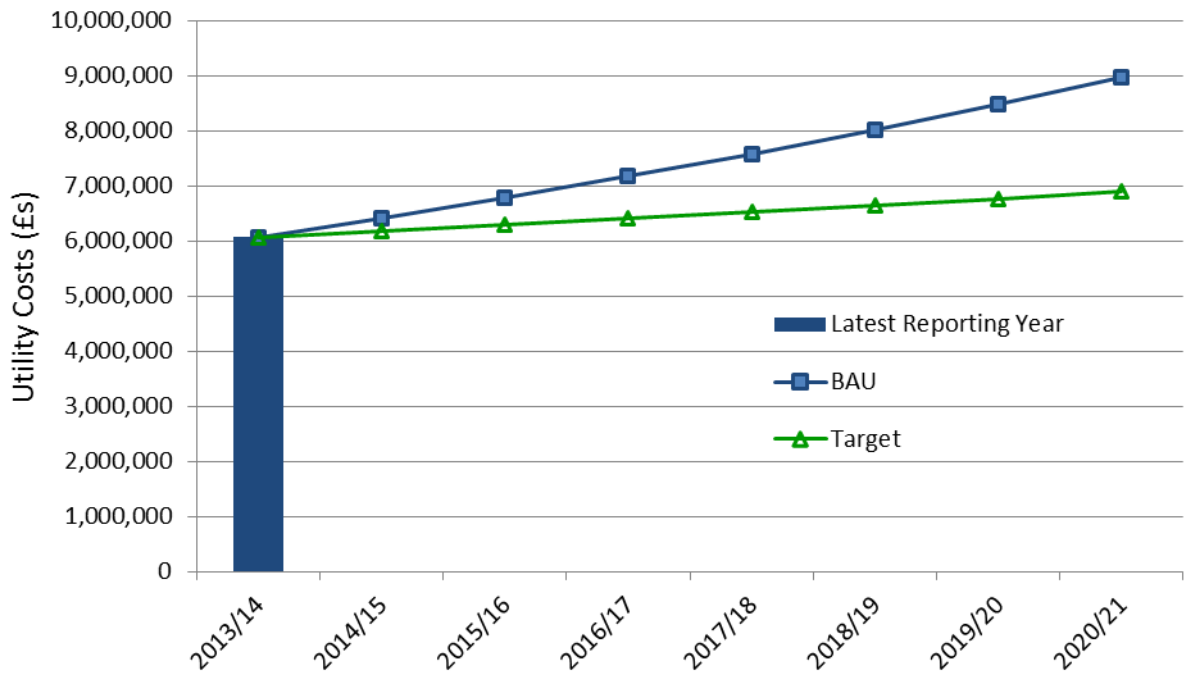


Fig. 4.1 Financial Value at Stake

Compared to the “business as usual” scenario, achievement of the Council’s CMP2 reduction target will result in:

- **Annual cost avoidance of approximately £2.1M by the year 2020/21.**
- **Cumulative cost avoidance of approximately £7.5M over the life of CMP2.**

4.3. Carbon Value at Stake

Similarly the “carbon value at stake” is the difference between the CO₂ emissions from a “business as usual” and “target scenario”. The projections include emissions from energy, water, fleet and business travel.

A “business as usual” scenario has been provided to estimate likely future CO₂ emissions based on taking no further action. The scenario extrapolates the latest reported consumption and is based on the following:

- The Council’s level of energy (and water) demand increasing by 0.7% per annum from 2013/14 levels. Based on the Department of Business, Enterprise and Regulatory Reform’s (DBERR) Energy Paper 68 which concluded that an institution’s energy consumption will see a 0.7% year on year increase unless it is actively managed downwards.
- The “business as usual” scenario does not include the impact of any new energy efficiency measures over the scenario period.
- No change in the value of DEFRA’s CO₂ conversions over the scenario period.

The “target” scenario has been provided to estimate likely future CO₂ emissions based on completing CMP1 and implementing CMP2. The scenario extrapolates the latest reported consumption and is based on the following:

- The Council’s level of energy (and water) consumption decreasing by 3% per annum in line with the Council’s target under CMP2 for remainder of CMP1 and during CMP2.
- No change in the value of DEFRA’s CO₂ conversions over the scenario period.

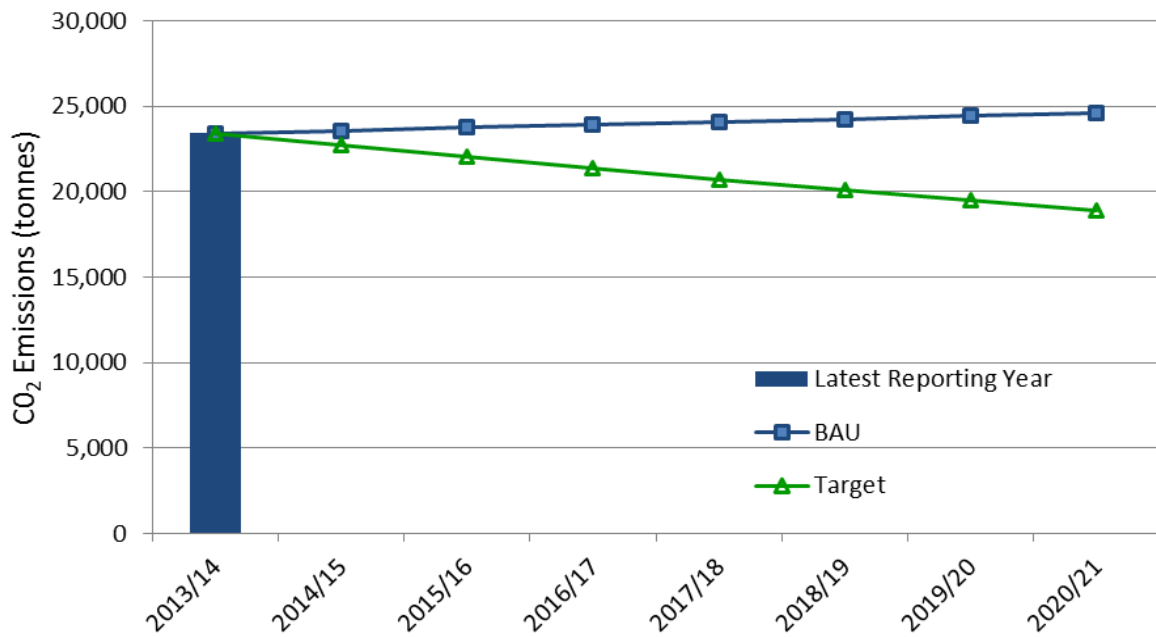


Fig. 4.2 Carbon Value at Stake

Compared to the “business as usual” scenario, achievement of the Council’s CMP2 reduction target will result in:

- An annual saving of 5,668 tonnes of CO₂ emissions by the year 2020/21.
- A cumulative savings of 22,319 tonnes of CO₂ over the life of CMP2.

5. CARBON & COST REDUCTION OPPORTUNITIES

This report contains recommendations for reducing carbon and cost based on a high level assessment. These recommendations are made to provide a strategy for the development of the “live” project list identifying specific projects and detailing individual business cases.

Further more recent work completed during detailed development of the Project List (see Appendix 7.3) has to date identified individual specific projects able to deliver 71.2% of the potential savings indicated by the high level assessment. Continued development of the Project List through the life of CMP2 is anticipated to identify sufficient additional projects to deliver the balance of the required CO₂ emissions reductions.

5.1. Monitoring and Targeting (M&T)

Recent site energy surveys highlighted that site management needs to be dramatically improved if the highest standards of energy efficiency and ambitious targets are to be met.

To achieve this it will be necessary to monitor energy (and water) consumption and provide a motivation to site management and staff to reduce waste. This can be achieved by adopting a technique known as “monitoring and targeting” whereby reduction targets are delegated to “site managers” and data from energy (and water) metering is used to improve operational management.

For an M&T approach to succeed it is critical that:

- There is visible Corporate/Senior Management support.
- Targets are delegated to site level management.
- Performance is regularly monitored and reported on.
- Site support is provided to guide improvements in operational management.

To implement and maintain this approach across all 500 sites would be a large and potentially unmanageable undertaking with the current level of resources. However, analysis has shown that the 73 buildings over 1000m² account for 75% of the energy used across all Council sites and it should be possible to monitor this number of buildings particularly if a phased rollout was adopted. It is recommended that schools are prioritised in the first instance as this was the focus of the sample site energy surveys that indicated poor operational management.

Meters are connected to a dedicated M&T or BEMS system which carries out detailed recording of energy consumption (usually at half-hourly intervals). Such systems use bespoke software to provide energy management functionality, for example to highlight anomalies through both data analysis and automatic exception reporting and to automatically generate management reports for use by the Energy Manager. Further functionality can be provided including electronic processing of supplier invoices that can reduce the administrative burden on the Energy Conservation Team releasing more time to be spent on pro-active energy management.

The Council has had a system in place with partial coverage for more than 10 years and this is used for automatic meter reading (AMR) purposes and to generate a limited amount of monthly reporting. The system is currently being developed on a phased basis and is expected to be connected to most electricity and gas meters by mid-2015.

The ready availability of accurate energy data has been proven to engage and motivate staff to reduce energy consumption and M&T programmes have often achieved savings of 10-12%. Therefore, by applying M&T to buildings over 1000m² a 10% saving should be possible on 75% of energy consumption. As buildings accounted for approximately 60% of emissions in the baseline year it should be possible to achieve a 4.5% reduction in total emissions.

Whilst the Council has chosen not to report water consumption, as scope 3 CO₂ emissions were not included within the original emissions baseline it should be noted that applying M&T to water will reinforce the business case from additional efficiency savings.

M&T is recognised as a highly cost effective carbon abatement measure and based on the above projections applied to current energy prices, would save £140,000 in energy and a further £27,000 in water from £3.6M annual utility budget for Council buildings.

However, as there is a £30,000 annual operating cost for the measure net savings are £137,000 per annum. With a one off implementation cost of £50,000 this project has a payback period of 0.4 years and is therefore potentially self-funding.

5.2. Building “Invest to Save” Projects

The Council currently has operational buildings i.e. those used for direct service delivery including offices, schools, homes for the elderly, libraries and leisure centres on approximately 500 sites.

These buildings account for approximately 60% of the total CO₂ emissions within the scope of this Plan based on the 2005/06 baseline year. More than 75% of these emissions are produced by the 73 buildings each having a gross internal area (GIA) greater than 1000m².

As required by the EPBD, Display Energy Certificates (DECs) have been produced for these buildings for several years. The energy ratings generated are based on a comparison with benchmark values for buildings of the same type and do take into account factors such as annual and geographical weather variations and differences in operating hours. Ratings of A to D indicate that buildings perform better i.e. are more energy efficient than the benchmark value for a “typical” building of that type with “A” being the most energy efficient rating.

It can be seen from the following analysis that almost of these buildings (as defined by GIA) can be regarded as more energy efficient than the “typical” benchmark value with 55.9% of the GIA of these buildings achieving a “C” or greater rating.

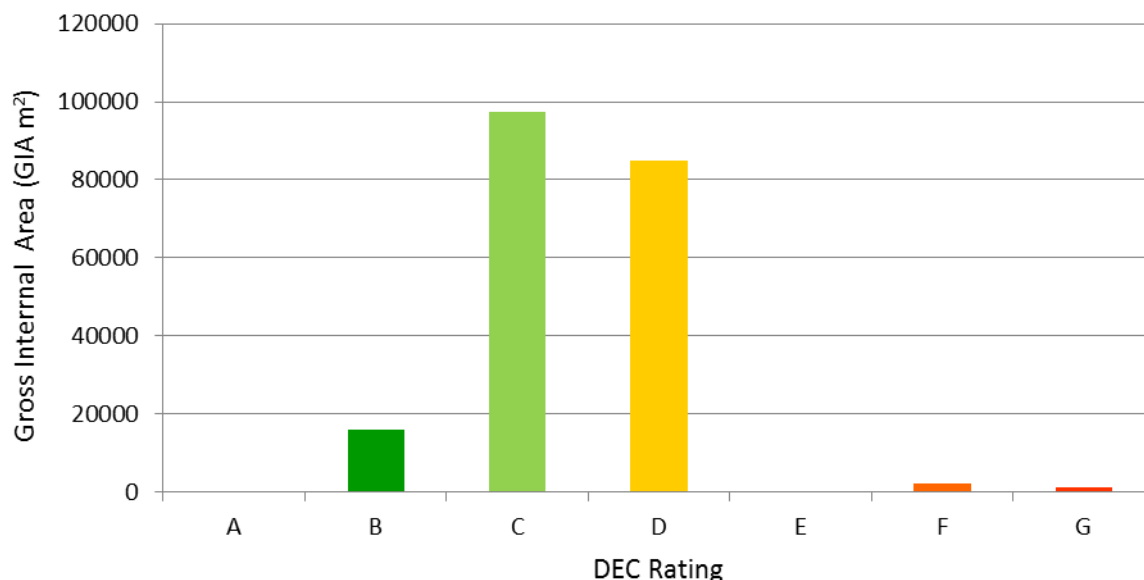


Fig. 5.1 Distribution of Display Energy Certificate Ratings for buildings over 1000m²

The Carbon Trust suggest that CO₂ emissions reductions of up to 40% are possible from buildings without applying renewable energy technologies. Therefore if the Council’s ambitious 60% target is to be met within buildings this will require at least 20% of CO₂

emissions reductions to be met by renewable energy technologies either integrated at site or “off-site” standalone projects.

Recent studies and the Council’s direct experience has shown that the most viable renewable technologies are likely to be solar photo-voltaic panels, biomass boilers and possibly wind turbines. However, all of these technologies are subject to site specific constraints and should not be regarded as universally applicable to all sites.

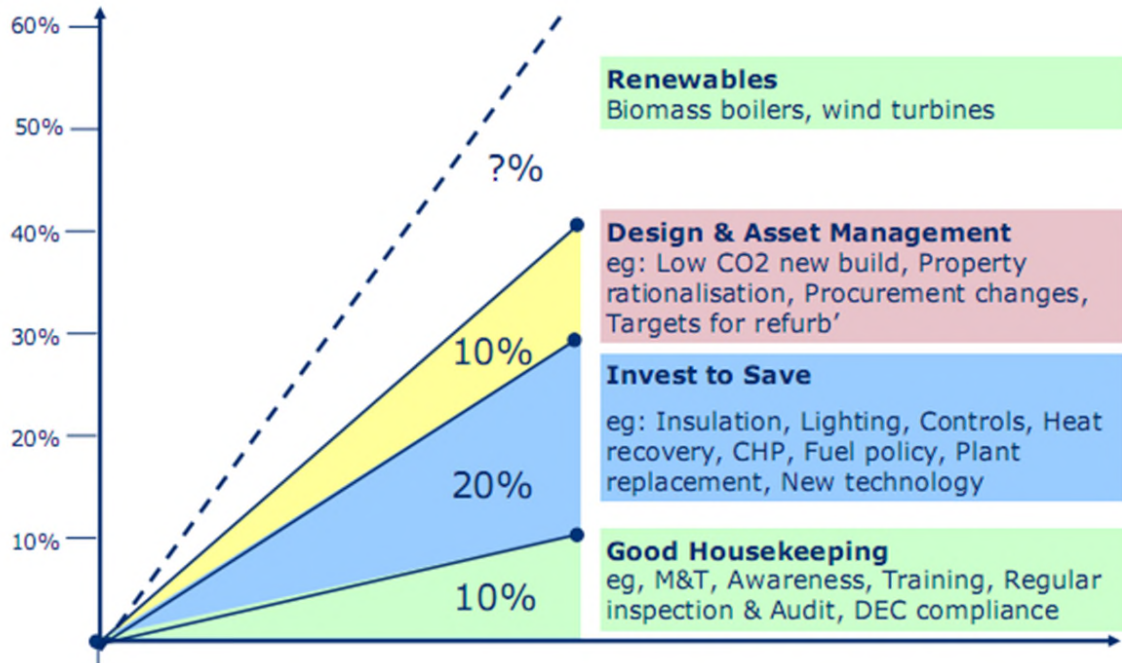


Fig. 5.2 Carbon Trust Potential Percentage CO₂ Emissions Reductions in Buildings

The Council currently operates a detailed and extensive project list as part of CMP1, examples of the cost-effective measures included within the current list are:

- Improved fabric insulation
- Installation of double glazing
- Installation of gas-fired condensing boilers
- Fitting thermostatic radiator valves
- Improved pipework valve insulation
- Provision of building energy management system (BEMS)
- Installation of an automatic meter reading system
- Voltage optimisation
- Improved lighting and lighting controls
- Installation of photo-voltaic panels

The project list is a “live” document which is being further developed for CMP2. As it will become increasingly difficult to identify further cost effective projects, it has been assumed that it will be possible to achieve only half of the savings achieved under CMP1 for high level assessment purposes. After corrections for weather, changes to CO₂ conversion factors and an adjustment for design and asset management measures, a potential reduction of 4.5% of total emissions are believed to be challenging but realistically achievable.

Based on the above projections applied to current energy prices, building related projects could save £140,000 in energy from the Council’s £3.6M annual utility budget. Whilst the detailed project list remains under development, a high level assessment of implementation costs based on an average 6 year payback for projects would be £840k.

5.3. Design and Asset Management

The Carbon Trust define measures such as low carbon new build, property rationalisation, procurement changes and targets for refurbishment within this category. They further suggest that implementing these measures can produce savings of up to 10% of carbon emissions from buildings or in this instance approximately 6% of the Council's total emissions.

It is understood that the Council's experience of low carbon new build is consistent with the construction industry in general, in that many new buildings fail to perform to expected levels. This has become a widespread problem and has become known as the "performance gap". It is essential therefore that any new build projects commissioned are very carefully designed and managed.

The Council currently has no formal policy in relation to energy efficiency standards when completing refurbishment works. The introduction of a Policy and Guidance document with energy performance targets included would help to ensure that the maximum benefit was realised from the opportunity presented by planned maintenance and refurbishment work.

Property rationalisation (i.e. improved space efficiency) is usually a guaranteed method of reducing carbon, utility costs and often many other costs. However, moving staff and closing buildings are sensitive issues and many options are often considered before final decisions are made, therefore it may be difficult to determine with certainty what savings may be possible over the life of CMP2. It should be noted that the business case could potentially be based on reductions in staff, energy, water and other property costs.

This is clearly an area that is subject to change and requires further assessment to quantify the level of potential savings achievable up to the 6% of total emissions indicated by the Carbon Trust and is out of the scope of this study. However, for initial high level assessment purposes a potential reduction of 2% of total emissions has been selected which when applied to the annual £4M energy and water bill for Council buildings would save over £80,000.

5.4. Streetlighting

Streetlighting accounted for 12.7% of total CO₂ emissions in the baseline year with savings of 11% achieved since (discounting changes in CO₂ conversion factors). It is understood that if not for new road schemes savings would have been higher and that these improvements were funded from the maintenance budget without the provision of any additional capital funding.

This was achieved by replacing approximately 2,000 of the 17,500 fittings with more efficient LED fittings, with dimmable control to drop to a lower lighting level overnight and in some cases rationalising nos. of fittings.

If the Council's remaining 15,500 fittings were similarly replaced this would deliver a carbon reduction of 4.57% from overall baseline emissions or 1.5 years of savings from a single measure in the context of a 3% annual target.

The reported savings resulting from the maintenance replacement programme suggests that carbon reduction investment appraisal should be biased towards this area. This view is supported by work carried out by Carbon Trust with other Local Authorities in Wales where cost effective and dependable savings of 50% or more have been identified.

However, this is at risk as the savings to date have been the result of budgeted maintenance/replacement work, to escalate the rate of replacement to increase the contribution to a level needed would require additional capital funding. Eligibility for funding support will strengthen the business case as street lighting programmes may satisfy the requirements of "pay as you save" funding opportunities e.g. SALIX, Green Investment Bank.

In financial terms, the annual saving from addressing the remaining 15,500 fittings is likely to be £250,692 based on a 40% reduction in the current associated electricity cost. From discussions with the Carbon Trust it is understood that other Local Authorities are

anticipating streetlighting projects to deliver typical payback periods of 9 years. Based on this a high level assessment of the investment needed over and above regular maintenance costs to achieve this saving would be in the region of £2.25M.

5.5. Transport

Emissions from Transport include Fleet and Business Travel which collectively account for almost a quarter of all CO₂ baseline emissions.

Fleet relates to emissions from Council owned and operated vehicles and accounted for 16% of total CO₂ emissions in the baseline year with a 6.8% reduction achieved to date.

Business travel relates to the use of Officer's own vehicles on Council business and accounted for 7% of total CO₂ emissions in the baseline year with a 7.6% saving achieved to date. However, recent changes to Hire Car Policy i.e. journeys of up to 180 miles (previously 100 miles) have to be completed in Officers own private vehicles may erode savings to date.

Therefore whilst Transport is responsible for approximately 23% of the carbon emissions of the council it is responsible for 36% of the energy (and water) costs amounting to almost £2M per annum. The disparity is in part due to the high level of taxation on vehicle fuel, which makes carbon reduction initiatives with transport potentially more cost effective than any other area.

In the recent Transport Review Report published in July 2014 by Edge Solutions Gwynedd Council featured 6th in a table of local authority costs per vehicle with a cost of £5,000 per vehicle more than the best performing authority. This strengthens the view that there is considerable scope for reducing costs and carbon emissions with a radical overhaul of fleet management policy. The Edge Solutions report provides clear direction for this action.

Fleet management believes that opportunities exist for savings through:

- Driver behaviour monitoring devices
- More efficient new vehicles
- Centralised control of pool vehicles

In the first instance, immediate and cost effective savings can be made by improved maintenance and driver awareness, it is likely that 10% could be met over the life of CMP2 if managers were able to successfully implement this and the other measures above.

Whilst Fleet and Business should be reported separately, it is suggested that reduction targets should apply to a combined "Transport" emissions figure as initiatives to reduce one category may impact on another e.g. centralised pool cars.

Whilst it is difficult to establish the most likely projects to deliver savings without further investigation following the recommendations of the Edge Solution Report, it is reasonable to expect that a combination of maintenance, driver awareness and other measures could improve fleet fuel efficiency and lead to 10% reductions in carbon emissions delivering annual fuel cost savings of £200,000 from the £2M annual fleet fuel bill.

5.6. Waste

Waste from the Council's own operational buildings represented 3% of total CO₂ emissions in the baseline year with impressive savings of 47% achieved to date.

It is expected that over the remaining months of CMP1 that a further 7.5% reduction will be made. Therefore the likelihood is that the 60% aspirational target for waste will be met within the life of CMP2.

As CO₂ emissions are now equivalent to less than 1.5% of total baseline emissions, it is unlikely that further reductions will have a significant influence on whether overall reduction targets are met.

However, for initial high level assessment purposes a 0.5% reduction in overall emissions has been assumed. It is understood that implementation costs of further reduction measures will either be funded from within existing revenue budgets or self-funded from financial savings.

5.7. Water Conservation

Dwr Cymru have recently funded a water conservation specialist (Aqualogic) to conduct 13 water efficiency surveys for a representative group of Council buildings.

The recommended measures draw on a combination of flow restrictors, push taps, flushing system volume reduction, dual flush siphons, presence detector actuated flushing of urinals.

The table 5.1 below summarises data provided by Aqualogic.

Site Name	Saving (m ³)	Installation Cost (£)	Total saving (£)	Payback (years)
Llys Cadfan Care Home	32	14.23	95	0.15
Bro Dysynni Leisure Centre	648	859.97	1,912	0.45
The Wharf Toilets	320	164.82	944	0.17
Marine Parade Toilets	240	126.27	708	0.18
Ysgol Uwchradd Tywyn	872	453.66	2,572	0.18
Ysgol Penybryn	640	1,241.41	1,888	0.66
Canolfan Dyfi	0	62.85	0	0
Ysgol Brynchrug (now used by community only)	556	361.26	1,640	0.22
Cinema Toilets	72	47.79	212	0.23
Neuadd Dyfi Toilets	0	-	0	0
Tywyn Depot	202	68.79	596	0.12
Tywyn Library	0	63.48	0	0
Neuadd Dyfi Hall	583	712.30	1,719	0.41
Site Survey Total	4,165	4,176.83	12,286	0.34
Council Total	69,400	69,600	204,766	0.34

Table 5.1 Summary of Water Conservation Measures

The combined water consumption of the sample buildings listed is estimated to represent approximately 6% of the total consumption by the Council. If this sample is extrapolated to all building stock this could equate to revenue savings of up to £205,000. The payback periods at all sites are less than one year or 4 months on average and therefore installation costs could be effectively funded from revenue savings.

This is an area that would benefit from immediate attention and should be treated as a priority outside of Carbon Management Plan 2, as implementation would be straightforward and generate immediate revenue savings of up to 61% in some buildings.

Additionally, many buildings may qualify for 100% grant funding from Dwr Cymru if located in a "Deficit Zone", i.e. an area where the existing water supply or treatment infrastructure is struggling to meet demand.

Including water within the monitoring and targeting programme would also help to reduce waste and was estimated to revenue further savings of £27,000 per year.

5.8. Summary of Opportunities

The following table represents a summary of initial high level assessment of the potential CO₂ reductions and revenue savings possible from CMP2.

Opportunity	% CO ₂ Reduction	Revenue Saving (£k)	Investment (£k)	Simple Payback (Years)
Monitoring and targeting	4.5	137 ¹	50	0.4
Building "Invest to Save" Projects	4.5	140	840 ²	6
Design and Asset Management	2	80 ³	-	-
Streetlighting	4.6	251 ⁴	2,250	9
Transport	1.6	200	-	-
Waste	0.5	0	0	-
Water	0 ⁵	205 ⁶	69.6	0.34
Total	17.7	1,013	3,209	-

Table 5.2 Summary of Potential CO₂ and Cost Savings from Individual Opportunities

NOTES:

1. Based on a £140k saving in energy costs a £27k reduction in water and sewerage costs less £30k revenue costs.
2. Based on an assumed average 6 year payback.
3. Based on 2% of building energy and water costs only.
4. Based on other Local Authority experience.
5. Water was not included in original CO₂ emissions baseline.
6. Includes £205k for water efficiency measures (£27k saving from water efficiency is shown within the monitoring and targeting programme savings).

A high level assessment of the potential CO₂ reductions that could be expected by 2020/21 are shown below to demonstrate that the targets set within CMP2 are realistic and achievable.

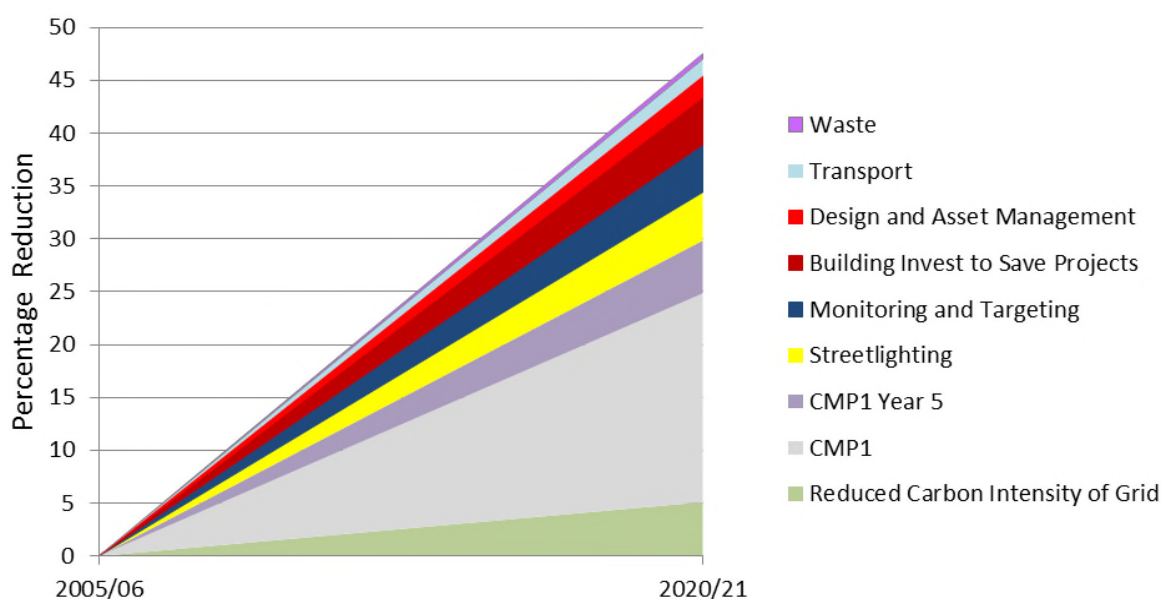


Fig. 5.3 Potential Percentage CO₂ Emissions Reductions under CMP2

The findings of the high level assessment are further validated by the following comparison with individual projects identified within the CMP 2 Project List which as of February 2015 represent 71.2% of the potential savings identified by the high level stud.

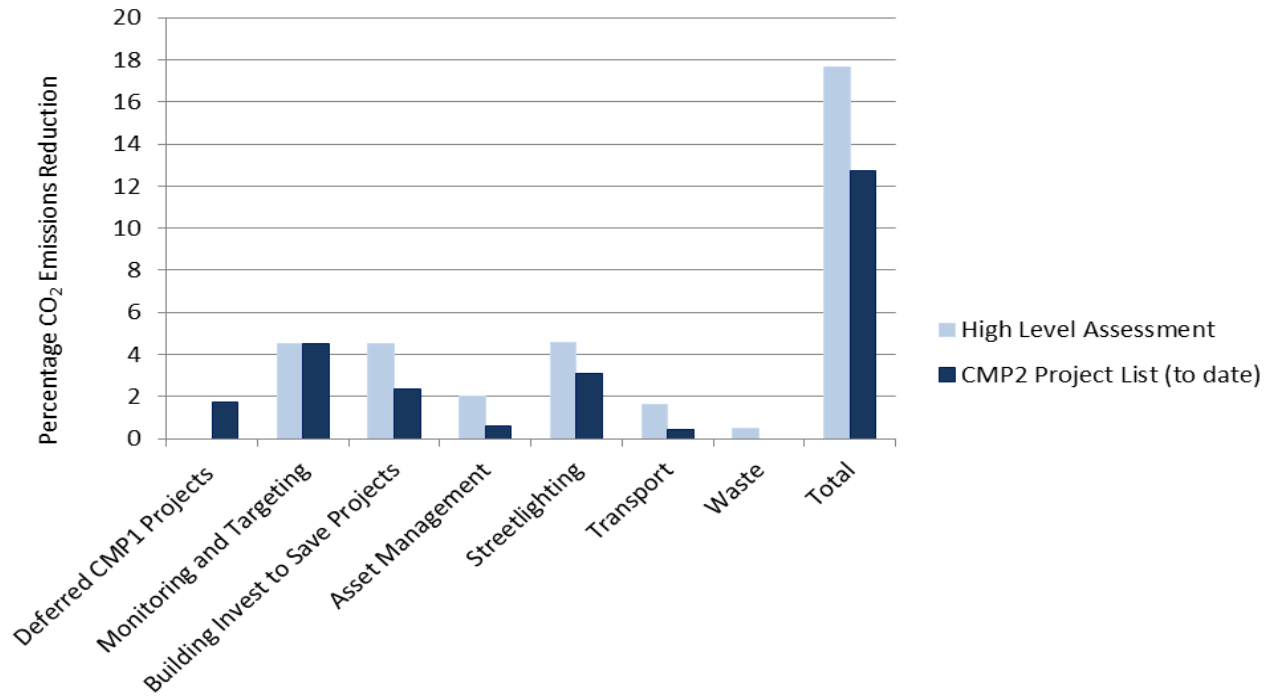


Fig. 5.4 Comparison of CMP2 Project List CO₂ Reductions against High Level Assessment Findings

6. EMBEDDING CARBON MANAGEMENT

The Council's targets are extremely challenging and further improvements to the current level of success will need to be realised if they are to be achieved. This necessitates clearly defining staff responsibilities to reduce emissions through policy guidance and will require motivation of middle management by delegating reduction targets throughout the organisation as appropriate.

6.1. Barriers to Progress

Barrier	Potential Mitigation
<p>Funding</p> <p>The Council's ambitious targets demand large scale investment with further progress becoming reliant on schemes with increasingly longer paybacks.</p>	<p>With current budget reductions and SALIX funding limited to schemes with relatively short paybacks, a more gradual progress towards targets may be necessary.</p>
<p>Inadequate or Inappropriate Data</p> <p>The Council have invested in an automatic monitoring and targeting (aM & T) system which will greatly aid energy management but this does not yet cover all utility meters. Data is not routinely made available to all those responsible for consuming energy at site.</p>	<ol style="list-style-type: none"> 1. The system should be regarded as a key energy management tool and expanded. 2. Energy consumption data needs to be given to "energy users" to provide the necessary information and motivation to improve energy management practices.
<p>Accountability and Motivation</p> <p>Overall responsibility exists at Project Board level but has not cascaded down sufficiently to operational management. Poor energy management practices are widespread throughout the sites visited.</p>	<p>Meaningful targets should to be allocated to users and performance monitored using the M & T system. Comparing the relative performance of individual managers can also serve to motivate.</p>
<p>Lack of Knowledge</p> <p>Whilst conducting the surveys it became apparent that knowledge at site of buildings and systems was variable. The Council has a large number of buildings in their portfolio and should not rely on a small number of staff to hold all the necessary knowledge.</p>	<ol style="list-style-type: none"> 1. Efforts should continue to improve operation and maintenance records. 2. Key staff at each site should be selected for training to improve their site knowledge and overall energy awareness.
<p>Custom and Practice</p> <p>Poor energy management practices such as leaving equipment, boilers and pumps running unnecessarily and the use of portable electric heaters as a supplementary means of achieving elevated room temperatures were evident.</p>	<p>Targets will motivate local management to improve performance but to overcome potential "barriers" policy guidance or reinforcement will need to be provided by the Board e.g. heating policy.</p>
<p>Devolved Budget Responsibilities</p> <p>Some evidence of poor maintenance practices were noted during site energy surveys including faulty or maladjusted heating controls and blocked air filters.</p>	<p>Achieving ambitious targets will require assets to be maintained to a high standard. The Council will need to decide how to raise standards with devolved budget responsibility.</p>

Table 6.1 Barriers to Progress

6.2. Programme Management

Progress in implementing this Plan will continue to be overseen by the Accomplishment Panel led by the Cabinet Member tasked with Corporate Environmental responsibility. The membership of the Panel provides a visible statement of the senior and strategic support for the plan.

6.3. Main Roles and Responsibilities

The Project Leader role has been undertaken by the Council's Corporate Property Manager who leads a Carbon Management Team consisting of the following Officers:

- David Mark Lewis – Energy Manager
- Robert Lewis – Senior Manager Municipal Services
- Kevin Sheret – Fleet Manager
- Amanda Murray – Street Lighting Project Manager
- Colin Worth – Lighting Services Manager
- Steffan Jones – Senior Waste and Commissioning Manager
- Dewi Jones – Strategic Policy Manager Sustainability and Environment
- Eilw Alwyn – Strategic and Improvement Project Manager
- Ffion Madog Evans – Senior Finance Manager
- Delyth Wyn Thomas Jones – Finance Officer
- Huw Ynyr – I.T. Infrastructure Manager

The Carbon Management Team in turn reports to the Accomplishment Panel and are responsible for delivery of individual projects.

6.4. Communication and Training

Whilst the previously named Officers have specific areas of responsibility it is important to communicate to everyone:

1. That they each have a responsibility to reduce the Council's CO₂ emissions as this has important financial, environmental and social benefits.
2. It is also important the individual staff members and pupils are fully aware of their impacts and how their actions can make a difference.

During the Carbon Trust Carbon Management Programme, the Project Board and Carbon Management Team concluded that the Council needed to improve "Communication and Training". In CMP1 the need for "ensuring everyone is aware" was emphasised along with an aspiration to target children at an early age and to incorporate carbon management into the curriculum.

However, experience has shown that if "awareness raising" is the important first step in saving energy and saving carbon then the second is to "inspire and motivate". The provision of regular feedback and the delegation of CO₂ reduction targets as part of a monitoring and targeting approach has been shown to be successful in raising awareness and providing the necessary motivation to realise cost effective saving of more than 10% from behaviour change and improved operational control.

The Council will continue to maintain and accelerate the development of the existing Communication Plan as part of the implementation process for Carbon Management Plan 2.

6.5. Policy Alignment

New and existing policies and strategies

The need to consider carbon management when drafting new policies and strategies has already been identified by CMP1. The requirement for all reports presented to the Board and Full Council to include reference to carbon management was highlighted, as was the need to specifically consider the impact on energy use when assessing all capital bids.

An ongoing review all of the Council's current policies and strategies to ensure that appropriate consideration has been given to carbon management is currently being undertaken and includes the following policies.

Whilst Policies provide essential guidance within an organisation they can only be effective in achieving CO₂ reductions if adhered to. During energy surveys of sites with devolved budgets, several instances were noted where Policy Guidance was not being adhered to.

New buildings

All new building works completed by the Council aim to achieve a BREEAM "Very Good" rating along, an Energy Performance Certificate (EPC) "A" rating and to be operated to achieve a Display Energy Certificate (DEC) "A" rating. However, even with the inclusion of renewable energy technologies, the Council's recent experience has shown that it is difficult to meet all of these criteria. The Council's experience is not unique as this is a relatively common problem that is sometimes referred to in the property industry as the "performance gap" whereby the actual energy performance of new buildings fails to meet their predicted performance.

It is essential therefore that careful consideration is given to energy performance during the design process. The Council do acknowledge that there is likely to be an additional capital cost associated with constructing energy efficient buildings but believe the resulting revenue savings from reduced energy consumption more than offset the additional capital cost. This is accounted for by using a "Whole Life Cycle" costing approach on all new projects.

In addition, technologies such as air-conditioning that are recognised as being particularly high energy consumers are avoided wherever possible through careful design and the use of techniques such as free cooling.

Repair, maintenance and renewal schemes

The Council currently has no formal policy in relation to energy efficiency standards when undertaking significant repair and maintenance works. The Council believe that in respect of repair and maintenance works, ad-hoc arrangements and the requirement to conform to Building Regulation requirements already lead to energy efficient mechanical and electrical installations during refurbishment works. However, it was noted during some of the site energy surveys that use of inappropriate automatic lighting control strategies was reducing the effect of potential savings from lighting improvement works.

Therefore as identified in CMP1 there is a need to provide formal policy guidance as to minimum technical standards for energy efficiency and the use of "whole life" costing methods for appraisal of potential projects.

Heating policy

The Council currently has introduced a formal heating policy for its' buildings defining a September to May heating season the maximum temperatures to which buildings should be heated as follows:

Competitive swimming pools	27°C (IRSM)
Public swimming pools	28°C (IRSM) 1°C higher than pool water temp
Hydrotherapy pools	30°C (IRSM) 1°C higher than pool water temp.
Classrooms	18°C (Carbon Trust Guidelines)
Special needs classrooms	21°C (Carbon Trust Guidelines)
Classrooms for nursery children	21°C (Carbon Trust Guidelines)
Low activity areas in schools	21°C (Carbon Trust Guidelines)
Corridors and sports halls in schools	15°C (Carbon Trust Guidelines)
All other public buildings including offices	19°C
Residential Homes	22°C (Council Policy)

Table 6.2 Space Heating Temperatures as defined within the Heating Policy

Temperatures at leisure centres are managed in accordance with guidelines issued by the Institute of Recreation and Sports Management (IRSM).

Energy efficiency officers have remote control of heating systems in many locations via a Building Energy Management System (BEMS) and have been able to realise significant reductions in energy consumption by close management of heating systems and temperatures. Additionally, where controls systems allow an additional 14°C outside temperature “hold-off” is programmed to prevent unnecessary heating during mild weather.

Whilst the Policy may be effectively implemented where heating systems are centrally controlled, the presence of portable electric heaters was often noted during site energy surveys. This could indicate that they are being used as supplementary heating to achieve higher temperatures than set out in the Policy.

6.6. Finance and Investment

The Cabinet will decide the appropriate funding mechanism for this plan. However, it is anticipated that Salix interest free loans will also need to be utilised, as will contributions from services’ current revenue budgets, capital allocated for repair and maintenance schemes and capital allocated for carbon reduction measures in the Corporate Asset Strategy.

The following unit costs have been agreed for use in calculating savings to inform business cases as shown in the previous section of this document. Constant utility prices have been used in all calculations with the exception of the “value at stake”.

Electricity	10.5 p/kWh*
Gas	3.5 p/kWh
Propane	4.5 p/kWh
Oil	5 p/kWh
Diesel	1.12 p/litre
Petrol	135 p/litre
Biomass	cost neutral
Water	295 p/m ³

Table 6.3 Units Costs used in Business Case Calculations

The level of investment needed to meet these savings will be detailed in a later draft of this report pending receipt of outstanding information and further analysis.

6.7. Annual Progress Review

As with CMP1, the success of the programme will continue to be monitored at the end of each financial year by the Carbon Management Team. The information will also be reviewed by the Programme Board and reported to the Council's Board as part of the usual monitoring of performance targets. These reports will be in line with the Council's responsibility to report on CO₂ reductions as part of the Welsh Government's performance indicator returns.

Annual reviews will consider:

- Overall CO₂ emissions reduction in comparison with baseline emissions.
- CO₂ emissions reduction from buildings in comparison with baseline emissions.
- CO₂ emissions reduction from streetlights in comparison with baseline emissions.
- CO₂ emissions reduction from waste in comparison with baseline emissions.
- CO₂ emissions reduction from fleet and business travel in comparison with baseline emissions.
- CO₂ emissions reduction from business travel in comparison with baseline emissions.
- Actual capital investment to date in comparison with forecasted costs.
- Actual revenue reductions to date in comparison to forecasted revenue savings.

All of the above are included as key performance indicators in the Council's Three Year Plan.

As explained in section 5 of this Plan, it is not possible to quantify with absolute certainty the capital costs and actual savings of each individual project. It will therefore be necessary to closely monitor the success of each project and update the contents of this Plan as necessary.

The indicator monitoring the "overall" CO₂ emissions reduction in comparison with baseline emissions" will act as an overarching indicator and will determine whether or not new projects will need to be considered in order to achieve the target of reducing our carbon emissions by 60% by 2020/21.

APPENDICES

7.1 Energy Management Matrix

The approach to energy management within an organisation is commonly assessed using a mapping tool referred to as the “energy management matrix”. This is a simplified version of the embedding matrix used as part of the Carbon Management Programme and provides a quick, easy to use but effective method of establishing your organisational profile. This is useful to determine strengths and weaknesses as part of an initial status review or if repeated periodically to assist to track and manage change. The results of the assessment carried out by Paul Manley and David Lewis are shown below:

Level	Policy	Organising	Training	Performance Measurement	Communicating	Investment
4	Energy policy, Action Plan and regular review have active commitment of top management	Fully integrated into management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside of organisation	Resources routinely committed to energy efficiency in support of business objectives
3	Formal policy but no active commitment from top management	Clear line management accountability for consumption and responsibility for improvement	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit, or building	Regular staff briefings, performance reporting and energy promotion	Same appraisal criteria used as for other cost reduction projects
2	Un-adopted Policy	Some delegation of responsibility but line management and authority unclear	Ad-Hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of company communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	An unwritten set of guidelines	Informal, mostly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	Ad-Hoc informal contacts used to promote energy efficiency	Only low or no cost measures taken
0	No explicit energy Policy	No delegation of responsibility for managing energy	No energy related staff training provided	No measurement of energy costs or consumptions	No communication or promotion of energy issues	No investment in improving energy efficiency

Table A1. Energy Management Matrix

This assessment emphasises the need to improve staff training and performance measurement which would both be addressed by implementing a monitoring and targeting strategy

7.2 DEFRA CO₂ Conversion Factors used in Baseline Calculations

Fuel	Kg/CO ₂ /kWh
Electricity (grid)	0.523
Electricity - CHP	0.295
Electricity (onsite renewables)	0
Natural gas	0.18497
Gas oil	0.25146
Burning oil	0.24531
LPG	0.21419
Wood	0
Coal	0.32886

These factors are referenced from DEFRA Greenhouse Gas Reporting Guidelines and are periodically reviewed to reflect variations in the CO₂ intensities of individual fuels. Historical variations have been most noticeable for grid electricity where the CO₂ intensity is determined by the UK power generation mix at a given point in time.

7.3 List of Projects Identified to Date

The following "Project List" summarises individual projects identified to date and details implementation costs, annual revenue savings, CO₂ savings and the business case in the form of a simple payback period. It should be noted that the actual Project List is a "live" document and as such is subject to ongoing development. However, sufficient projects have been identified to date to achieve 71.2% of the CO₂ savings required under CMP2.

Project Description	Capital Cost (£)	Revenue Savings (£/pa)	CO ₂ Savings (tonnes/pa)	Payback Period (Years)	Percentage of Baseline
Deferred CMP1 Projects					
Loft insulation to 80% of our Secondary schools	165,000	11,277	80.5	14.6	0.26
Upgrade to HF / Replace lighting to T5 to 90% of our Secondary schools	170,000	20,023	116.1	8.5	0.38
Voltage Optimisation to 47% of our Residential Homes	87,450	6,221	36.1	14.1	0.12
Reduce Business Travel by leasing / hiring cars or using pool cars	100,000	69,170	149.7	1.4	0.49
Loft insulation to 90% of our Primary schools	375,198	23,812	170.1	15.8	0.55
Monitoring and Targeting					
Monitoring and Targeting	50,000	30,000	1380	1.7	4.49
Building "Invest to Save" Projects					
Cefnbraich Hydro	250,000	47,000	96	5.4	0.31
Fachwen Hydro	105,000	13,000	22	8.0	0.07
Upgrade Lighting in our Primary Schools	272,000	60,454	244	4.5	0.79
Solar PV Phase 3	390,000	36,000	121	10.8	0.39
Water Conservation	205,000	70,000	-	2.9	-
BMS Health Checks	160,000	80,000	164	2.0	0.53
Adjust Server Room Temperatures to 25°C in Secondary Schools	-	8,000	45	-	0.15
Insulate Pipework in Plantrooms (Rinnai Water Heaters)	8,000	1,740	10	4.5	0.03
Convert Kitchen Ventilation to Demand Controlled	43,000	7,260	31	5.9	0.10

Project Description	Capital Cost (£)	Revenue Savings (£/pa)	CO₂ Savings (tonnes/pa)	Payback Period (Years)	Percentage of Baseline
Asset Management					
School Reorganisation	-	-	178	-	0.58
Information Technology					
Fleet					
Driver Behaviour System (Lightfoot)	0	20,000	50	-	0.16
Fit speed limiters to vehicles under 3.5 tonne	26,000	10,000	25	2.6	0.08
Enhancement of Fleet Management System	25,000	20,000	10	1.3	0.03
Policy and Driver Handbook	0	5,000	5	-	0.02
Procurement of vehicles	-	20,000	50	-	0.16
Streetlighting					
Upgrade 4771 Lanterns to LED and dim between 10:00 and 06:00	444,000	104,000	463	4.3	1.51
Upgrade 4508 SOX Lanterns to LED	858,000	106,000	482	8.1	1.57
Waste					
Business Travel					
Grand Totals	3,733,648	768,957	3,928.5	4.86	12.61