

The National Gallery Carbon Management Plan



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Contents

Foreword from Nicholas Penny Director of National Gallery..... 3

Foreword from the Carbon Trust 4

Executive Summary..... 5

Introduction..... 8

 1.1 Our low carbon vision8

 1.2 Context and drivers for carbon management8

2.0 Emissions baseline and projections 9

 2.1 Scope.....9

 2.2 Baseline.....10

 2.3 Projections and Value at Stake.....11

 2.4 Targets and objectives13

3.0 Carbon management programme..... 15

4.0 Carbon management projects 18

5.0 Annual progress review 20



Foreword from Nicholas Penny Director of National Gallery

Saving energy and thereby reducing our carbon footprint has been a long-held ambition at the National Gallery. This ambition informs the approach of our Building and Facilities Department in its efforts to employ evermore efficient ways of maintaining the requisite environmental conditions in our buildings. Participation in the Carbon Trust programme has provided the Gallery with the focus and structure to extend this culture and way of thinking throughout our organization.

With encouragement from the Carbon Trust, the Gallery has established a cross-departmental team that has brought forward ideas on carbon reduction from various departments in the museum. These measures are described in this report. Most ambitious among them is the commitment to install LED lighting in all of our galleries by the spring of 2013. This will represent a saving of 85% on the energy used to illuminate the paintings in the Gallery's collection. The decision comes after the successful trial of the lights in four of our galleries and their innovative application with a system that automatically adjusts roof light blinds according to the amount and angle of sunlight.

We are committed to making the National Gallery as energy efficient as is practical while acknowledging the constraints imposed by our particular circumstances: the necessity to maintain our galleries within strict temperature and humidity limits to best preserve the collections in our care and the challenge of housing most of these works in a Grade I listed, nineteenth-century building.

We are very pleased with the support we received from the Carbon Trust in creating a Carbon Management Plan that takes these needs into account, with the embrace by staff members and Trustees of this initiative, and, of course, with the resultant savings in our energy consumption. All this work has provided a solid foundation that will enable us to achieve these savings over the next ten years and to continue to seek energy-efficient means to operate the Gallery.

Nicholas Penny
Director National Gallery



Foreword from the Carbon Trust

Cutting carbon emissions as part of the fight against climate change should be a key priority for central government organisations. Carbon management is about realising efficiency savings, transparency, accountability and leading by example. The UK government has identified the public sector as key to delivering carbon reduction across the UK in line with its Climate Change Act commitments and the Central Government Carbon Management Service is designed in response to this. It helps organisations to save money on wasted energy and put it to better use in other areas, while making a positive contribution to the environment by lowering carbon emissions.

The National Gallery partnered with the Carbon Trust on this pilot programme in 2010 to realise the substantial carbon and cost savings. This Carbon Management Plan commits The National Gallery to a target of reducing CO₂ by 43% by 2014/15 and underpins potential financial savings and cost avoidance to the organisation of around £1.18 million by that date.

Central government organisations can contribute significantly to reducing CO₂ emissions and improving efficiency. The Carbon Trust is therefore very proud to support The National Gallery in their on-going implementation of carbon management.

A handwritten signature in black ink, appearing to read 'Richard Rugg'.

Richard Rugg
Head of Public Sector
Carbon Trust

Executive Summary

The National Gallery's Carbon Management Plan presents measures which will reduce its carbon emissions in accordance with government targets and ways in which these measures will be financed and communicated throughout the organization. In preparing this plan, the Gallery participated in the Carbon Trust's Central Government Carbon Management Pilot Scheme, a ten-month programme, involving various workshops, 'webinars' and peer-to-peer sessions, that guided the organization through the steps necessary to create a framework for energy saving projects and for gaining institutional support.

Gallery participation in this initiative was broad and included staff from a number of departments in the Gallery who formed our Sustainability Carbon Group; the Gallery's Head of Technical Services who served as the Programme Leader; the Director of Operations and Administration who served as the Programme Sponsor as well as the Gallery Director, Nicholas Penny and its senior management team who endorsed the plan.

The NG Environmental Policy

The National Gallery is committed to integrating energy-saving and carbon reduction measures into its activities and to adopting the best environmental practices, wherever possible, into all areas of its operations.

The mission of the Sustainability Carbon Group is to increase the efficiency of the National Gallery and reduce its carbon footprint through collaboration among colleagues within all departments. The group will also facilitate the full implementation of the Gallery's programmed plan.

Objectives

The National Gallery (NG) has joined the Central Government Carbon Management pilot scheme with an aim to complete the Carbon Trust Five-Step Carbon Management Programme. Here are our objectives:

- Engaging all key stakeholders within the NG to ensure we work as a team to provide a manageable future Carbon Plan
- Continually recording and monitoring scope 1 and 2 emissions, those involving electricity, gas, water, and refrigerants)
- Establishing a robust method of capturing non energy-related emissions data scope 3 emissions, (staff travelling and waste disposal)
- Identifying targets and clearly understanding the measures required to meet them
- Developing a communications strategy (both internal and external)
- Gaining support from senior management and signing off a Carbon Reduction Plan.
- Identifying quick-win and Long term Carbon Reduction projects
- Assessing the budget ramifications of all carbon reduction projects.

The Carbon Management 5 Step Process



Key Drivers

The future projections for global warming through increased greenhouse gases such as carbon dioxide (CO₂) and the effects this is already having on our planet are clear focal point for our work.

The key driver of this plan is to reduce the National Gallery's carbon emissions in the future through providing clear measures and guidelines. Crucially, this involves setting targets to reduce carbon, but also includes the following important considerations:

- Fully understanding the carbon impact of the organisation and its activities
- Increasing awareness of carbon management throughout the NG
- Complying with UK Government targets: currently a 34% reduction in emissions by 2020 and an 80% reduction by 2050, based on 1990 baseline figures
- Increasing collaboration with other galleries
- Demonstrating leadership among other similar organisations
- Engaging key staff to manage departmental carbon reduction
- Developing an open forum for discussion across all departments
- Reducing our energy consumption and costs
- Reducing the financial impact of the Carbon Reduction Commitment Scheme (CRC)

Our carbon reduction target

The UK Government has established objectives for organisations to reduce carbon dioxide emissions by 34% by 2020 relative to the baseline year of 1990.

The Gallery has set a target to achieve a 43% reduction in emissions by 2015 (2014/2015 financial year), surpassing the government target in terms of the level of emissions and when the reductions are realized.

The baseline year for the Gallery's Carbon Reduction target is 2005 when our emissions totalled 9,417 tonnes CO₂. To achieve our target, our emissions need to be reduced to 5,437 tonnes CO₂ by 2014/2015.

Through various initiatives and projects from 2005 the National Gallery had achieved savings of 1,698 tonnes CO₂ up to 2009/2010. This represents an 18% reduction on our baseline carbon emission tonnage. The remaining savings required represent a further 2,316 tonnes CO₂ reduction to meet our target of 43% by 2015.

The National Gallery is committed to reducing its carbon emissions, while the target reductions set out in this plan are certainly challenging, at the same time they are also realistic.

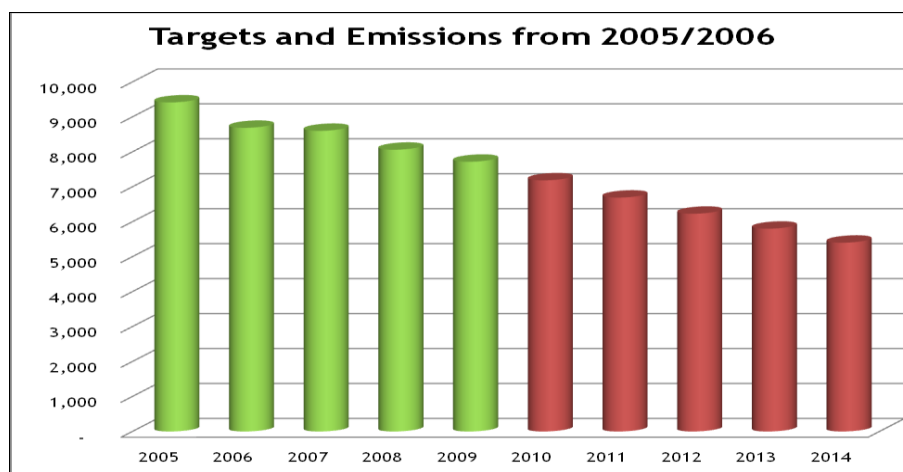


Figure 1 - CO₂ Emissions and Targets

Projects

Key projects have been identified to reduce carbon emissions via this plan. The National Gallery will meet its target emission reduction through engineering solutions that use gas and electricity more efficiently. Such solutions include a new CHP plant, a new improved, efficient cooling plant and low energy lighting. These projects are listed in section 4 of this plan, the associated carbon savings together with financial savings are expressed in Table 1 below.

Year	(TCO ₂ /Year)	Energy Reduction £	CRC Tax Saving £	Total £
2011/2012	604	£82,145.55	0	£82,145.55
2012/2013	2,219	£302,070.65	£26,632.74	£328,703.40
2013/2014	2,644	£359,856.26	£31,727.54	£391,583.80
2014/2015	2,555	£347,793.09	£30,663.97	£378,457.05
Cumulative Total	8,022	£1,091,865.55	£89,024.25	£1,180,889.80

Table 1- Projects Cost and Savings

The above table includes savings associated with the CRC scheme, which will come into force in 2011/2012. The current cost has been set at £12.00 per tonne of CO₂ but this is likely to increase once this scheme has been introduced. Based on the current figures above, this represents an annual saving of £31,723.00. Refer to section 2.3 for more detail.

Measures to implement the plan

Seeking to implement the full complement of projects is essential if we are to further reduce our carbon footprint. Over the last 12 years, the Building and Facilities department has played a central role in reducing our scope 1 and 2 emissions. The various projects they have initiated have resulted in a steady reduction in our energy consumption.

Through the Sustainability Carbon Group, the aim is to now expand this commitment to all levels of operational management, to increase awareness and communication, and to thereby ensure momentum is maintained.

Regular monthly meetings will be held for ideas to be shared and evaluated against the objectives as set out in the CMP.

The CMP will be updated every six months and incorporated into the budget review process in order to identify key projects and provide a justification for their implementation and funding requirements.

Introduction

The National Gallery houses one of the most important collections of Western European art in the world, comprising 2,300 exhibits paintings that we hold in trust for the nation. Most are on permanent display to the public. The main building dates back to 1838 when thermal efficiencies were not much of a priority, particularly in a construction of this sort. Most of our 72 galleries are fully air-conditioned – 24 hours a day, 7 days a week – to best preserve the paintings in the collection. Therefore, a high percentage of our carbon footprint is associated with the energy required to maintain the environmental conditions within these galleries.

In response to the impact of carbon emissions on the environment and the prospect of dwindling fossil fuels, the UK government has set target deadlines to reduce CO₂ production. Our government's current target is a 34% reduction in emissions by 2020 and an 80% reduction by 2050. (These figures are measured against 1999/2000 baseline values).

The need to reduce carbon emissions is ongoing and must be met even during challenging financial times such as these. The economic downturn and the reduction in government funding have, of course, resulted in budget tightening across all sectors. The Gallery will continue to prioritize the need to reduce its carbon footprint and, where it can, invest in systems that will further that goal.

The National Gallery Carbon Management Plan reflects those investments, serves as a record of our goals and includes the means and processes to achieve them. The Plan is a working document that will be regularly reviewed and formally updated every six months. The Plan identifies projects to be implemented over the next five years that will enable the Gallery to achieve the goals set for 2014/15. We will seek to commission a revised Carbon Management Plan in the future to identify additional Carbon Savings to help us meet the Governments objective of 80% reduction by 2050.

The Gallery's Sustainability Carbon Group will seek to improve the Gallery's systems and operations, and will work to ensure that the Gallery's senior management understands and supports the measures necessary to meet, and where possible, to exceed our carbon reduction goals.

1.1 Our low carbon vision

The National Gallery will preserve the nation's collections in its care in a way that is environmentally responsible and it will give priority to measures that reduce its carbon emissions from all areas of its operations.

1.2 Context and drivers for carbon management

There have been many examples of the effects of climate change over the past decade, a major one being the record flood levels being recorded on an almost yearly basis in parts of Europe and other continents such as Asia and Australasia.

Reducing global CO₂ emissions is one way to reduce the effect of global warming by this greenhouse gas.

The other driving factor to reduce energy consumption is the unpredictable costs of fossil fuels in this uncertain economic climate. Therefore, by reducing energy consumption we are reducing the impact this has on our climate while also improving our efficiency and hence reducing our annual running costs.

We also strive to lead the way in developing new engineering solutions, using the latest technology to improve efficiency. One example of this is the introduction of LED lighting to our galleries. This, together with daylight control through externally-controlled louvers, provides a more efficient system, thus enabling us to maximise the use of daylight wherever possible. Such projects can help to establish the National Gallery as a world leader within the museum group by finding efficient solutions to maintaining internal environmental conditions.

2.0 Emissions baseline and projections

2.1 Scope

To set targets for emissions a reference point must be established against which reductions can be measured. The National Gallery's baseline year has been established as financial year 2005/2006 (1st April to 31st March).

Our emissions scope covers the following emissions produced in the Wilkins Building and Sainsbury Wing. These are considered to be activities that are under the direct control of the gallery.

- Gas Consumption – Scope 1
- Refrigerants – Scope 1
- Electrical consumption – Scope 2

Scope 3 emissions, such as staff travelling and waste disposal, have not been included to date, but the data is currently being sourced and shall be included in the plan in the future. Initial findings suggest that these emissions only equate to less than 1% of the baseline emissions.

Item	(TCO ₂ /Year)
Emissions from waste	37.87
Emissions Air Travel	32.11
Emissions Rail Travel	2.79
Emissions Taxis/Car	5.0*
Emissions From Water	13.29
Total	91.06

Table 2 - Scope 3 CO₂ Emissions

* Actual Unknown and best estimate made

2.2 Baseline

- Our baseline is the 2005/2006 financial year.
- All data has been taken from our energy data spreadsheet that is updated monthly to record consumption figures from meters and utility bills.
- The conversion factors used for calculating carbon emissions are as follows:
 Gas 0.18396
 Elec 0.54418
- The target reduction for The National Gallery takes into account energy saving measures as of 2005 and continues through to 2014/15.

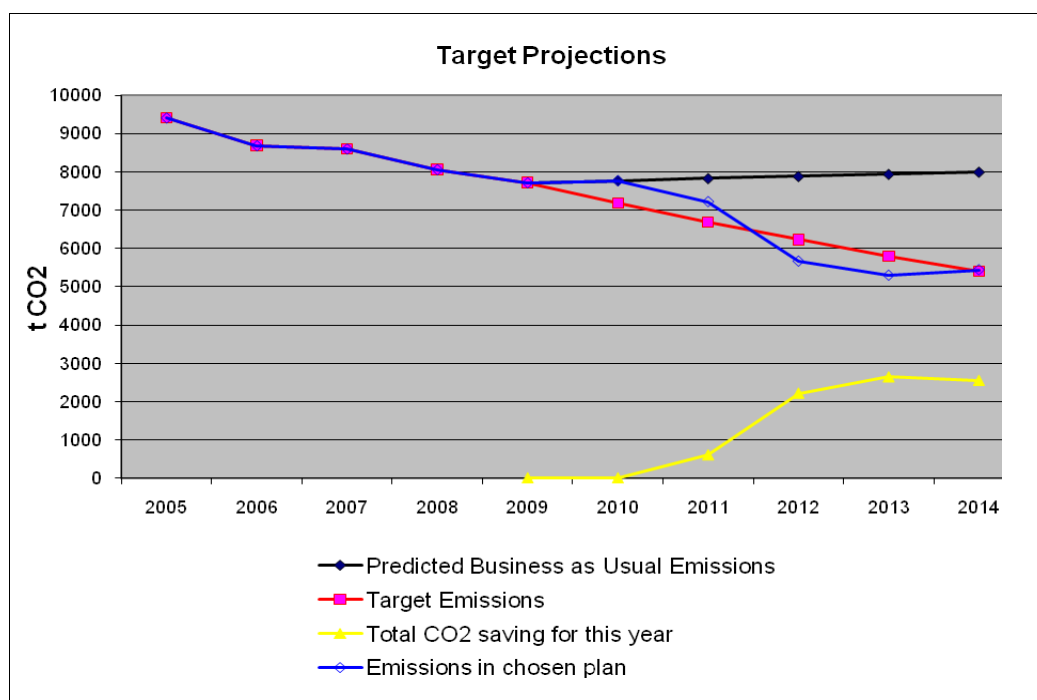


Figure 2 - Target Projections

The following table recognises the reduction in carbon achieved by the National Gallery through various completed projects over these next five years, giving in total an **18% reduction in CO₂ emissions**.

Year	(TCO ₂ /Year)	% Reduction	Cumulative
2005/06	9,417	-	-
2006/07	8,689	8%	8%
2007/08	8,603	1%	9%
2008/09	8,062	7%	14%
2009/10	7,719	4%	18%

Table 3 - Emissions Reductions to date

2.3 Projections and Value at Stake

Business as Usual (BAU) is a projected carbon emissions level reflecting no reduction initiatives taking place. A factor of 0.7% demand increase has been used to predict the carbon value for each year from the baseline year. (Please note that for The CMPR (carbon management project register) the baseline in this document has been referenced as 2009/10), this is due to the limitations of this tool to clearly indicate the impact of the current and future carbon reduction projects.

The "Value at Stake" is the difference between not implementing any carbon reduction initiatives and the emissions reduction stated in the Carbon Management Plan. This gives a clear indication of carbon saved and can be expressed in the following chart (Figure 3). The saving is the cumulative difference between the values in the chosen plan and those indicated in the BAU prediction line. For example, in 2014, the emissions in the chosen plan will be reduced to 5,437 tCO₂ while the BAU emissions are predicted to be 7,993 tCO₂, giving a saving of 2,556 tCO₂.

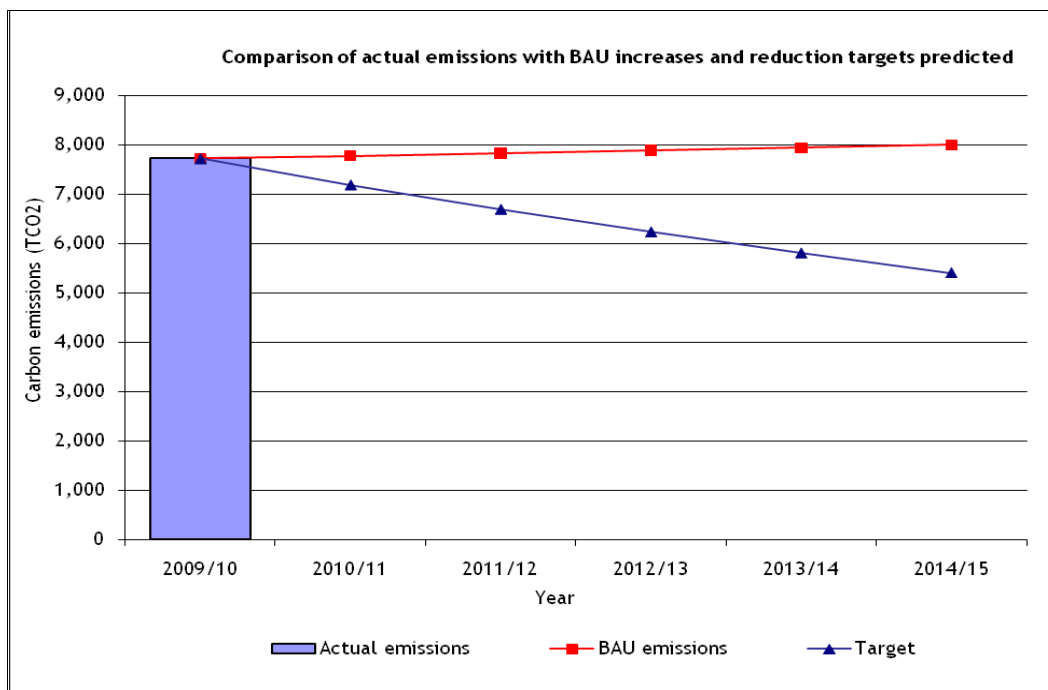


Figure 3 - Value at Stake CO₂

The table below gives an indication of the Value at Stake if the National Gallery were not to implement carbon saving measures and carry on with Business as Usual. Obviously, a reduction in carbon emissions will save energy. However, the graph above also illustrates the financial savings that can be made including those from the CRC Tax. The total cumulative value at stake for the plan period is estimated as below:

Year	(TCO ₂ /Year)	Energy Reduction £	CRC Tax Saving £	Total £
2011/2012	604	£82,145.55	0	£82,145.55
2012/2013	2,219	£302,070.65	£26,632.74	£328,703.40
2013/2014	2,644	£359,856.26	£31,727.54	£391,583.80
2014/2015	2,555	£347,793.09	£30,663.97	£378,457.05
Cumulative Total	8,022	£1,091,865.55	£89,024.25	£1,180,889.80

The total financial Value at Stake per year can also be represented by the following chart (Fig 4). In this graph the Carbon Commitment Reduction Tax (CRC) has also been included to represent a cost saving through implementing the carbon reduction initiatives in the plan and is shown as a direct saving as a result of a reduction in carbon emissions. The cost savings have been based upon 2009 energy costs and so the actual value at stake could be higher if utility cost increases. The following points have been expressed diagrammatically below.

- Total tonnes CO₂
- Cost of energy saved £
- Predicted saving on CRC based on £12.00 per tonne of CO₂

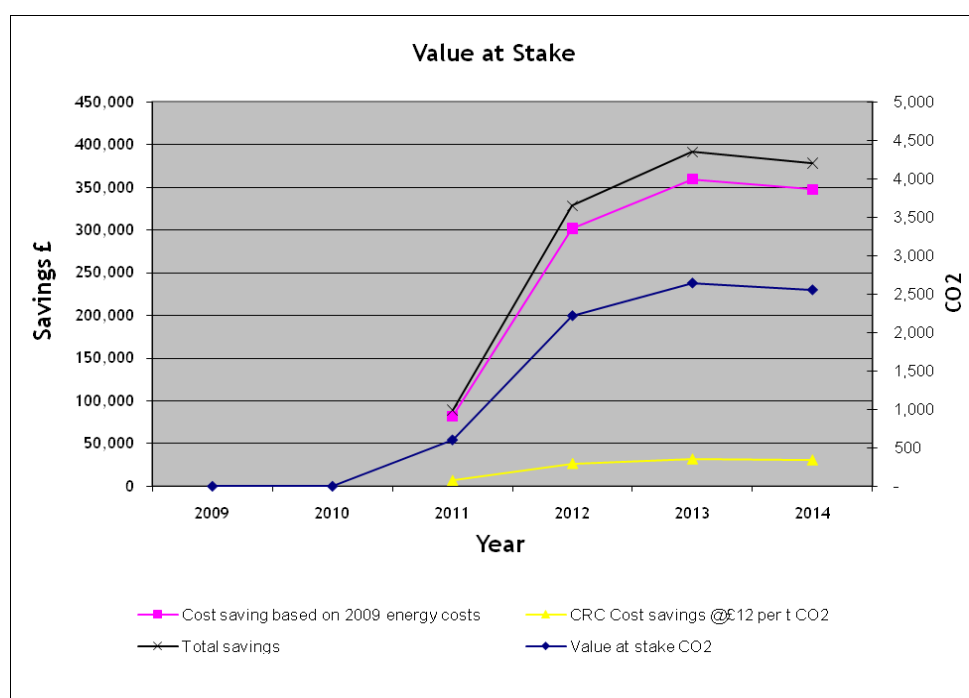


Figure 4 Value at Stake cost savings including CRC

2.4 Targets and objectives

The following table gives a prediction of carbon savings associated with the CMP. Presently, the projects are scheduled to be implemented through to 2014/2015. Once the carbon plan evolves and the Gallery considers projects beyond the next five years, the ambition would be to reduce our carbon emissions further.

Our Carbon Management Plan (CMP) is a five-year programme that will significantly contribute towards reducing the National Gallery's carbon dioxide emissions ¹ – representing a 43% reduction by 2015 (2014/2015 financial year).

The baseline year for the Gallery's Carbon Reduction target is 2005 when our emissions totalled 9,417 tonnes CO₂. To achieve our target, our emissions need to be reduced to 5,437 tonnes CO₂ by 2014/2015.

Year	Predicted BAU	Target Emissions	Total CO ₂ Saving yr	Emissions in chosen plan
2005	9,417	9,417	-	9,417
2006	8,689	8,689	-	8,689
2007	8,603	8,603	-	8,603
2008	8,062	8,062	-	8,062
2009	7,719	7,719	-	7,719
2010	7,773	7,187	-	7,773
2011	7,827	6,692	604	7,223
2012	7,882	6,232	2,219	5,662
2013	7,937	5,802	2,644	5,293
2014	7,993	5,403	2,555	5,437
Total Savings				43%

Table 4 - Target Emissions in current plan

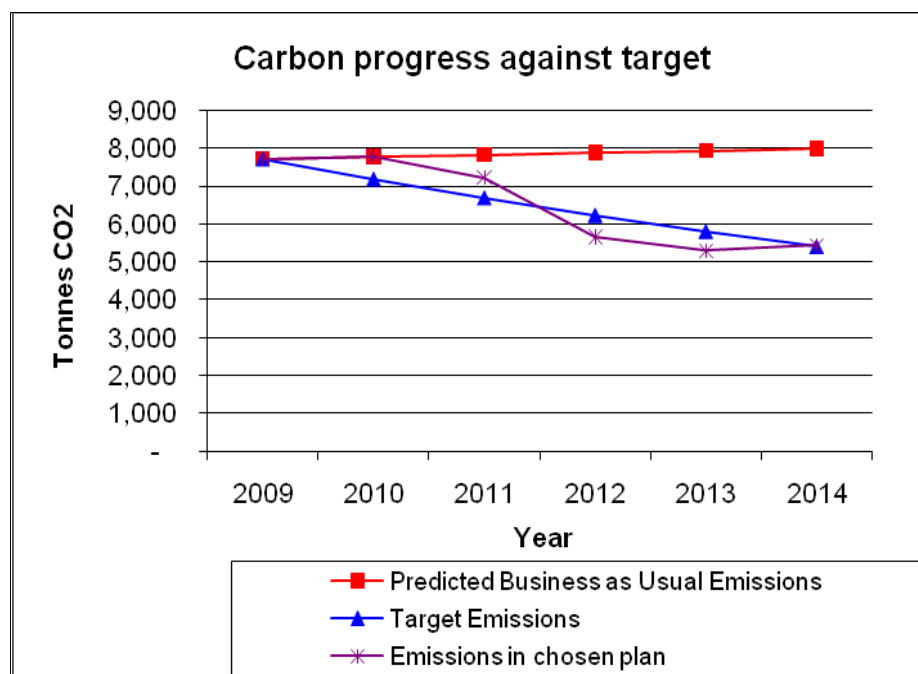


Figure 5 - Emissions progress against target

Our current plan covers five years, however, our commitment to carbon reduction is ongoing and we anticipate that in future years we will achieve even further reductions.

"The National Gallery is committed to reduce its carbon emissions by 43%, from a 2005/6 baseline, by end March 2015"

3.0 Carbon management programme

The National Gallery participated in the Central Government Carbon Management pilot scheme with a mind to implementing the Carbon Trust Five-Step Carbon Management Programme. This process helped to establish the following objectives, benefits and outputs:

3.1 Objectives

- Engaging all key stakeholders within the NG to ensure we work as a team to provide a manageable future Carbon Plan
- Continually recording and monitoring scope 1 and 2 emissions, (Electricity, Gas, Water, Refrigerants)
- Establishing a robust method of capturing non energy-related emissions data scope 3 emissions, (Staff Travelling and waste disposal)
- Identifying targets and clearly understanding the measures required to meet them
- Developed a communications strategy (both internal and external)
- Gaining support from senior management and signing off a Carbon Reduction Plan.
- Identifying quick-win and Long term Carbon Reduction projects
- Assessing the budget ramifications of all carbon reduction projects

3.2 Benefits

Through the carbon management programme, the Gallery has:

- Gained a fuller understanding of the carbon impact of the organisation and its activities
- Achieved an increased awareness of carbon management throughout the Gallery
- Increased collaboration with other galleries
- Engaged key staff to manage departmental carbon reduction
- Developed an open forum for discussion across all departments
- Gained support from Carbon Trust

3.3 Outputs

Step 1

- Initial presentation to senior management
- Identify key stakeholders and develop a communications strategy
- Organise Sustainability Group representing key departments
- Hold regular meetings
- Communicate by email on progress and developments
- Gather information to be included in plan
- Sign-off action plan by senior management

Step 2

- Agree baseline for Scope 1 and 2 emissions
- Identify Value at stake (business as usual and projections)
- Identify quick-win opportunities
- Establish baseline Scope 3 emissions as far as possible
- Set targets

Step 3

- Carry out peer-to-peer sessions with National Portrait and Tate Galleries
- Conduct an internal opportunities workshop
- Develop a projects register and assess impact upon emissions reduction
- Quantify and prioritise opportunities
- Increase Carbon Awareness via communications strategy

Step 4

- Shortlist projects; set timescales and budgets
- Identify funding streams
- Reassess reduction scenarios and cost benefit
- Compile and adopt a reduction plan

Step 5

- Launch reduction plan
- Communicate success
- Maintain momentum
- Regularly review and monitor
- Imbedding the Plan
- Implement projects

3.4 Drivers for carbon management

Climate change is a pressing issue with overall global temperature rising significantly over the last few decades; there is a broad movement towards reducing the effect of green house gases. The key driver of this plan is the need to reduce the National Gallery's carbon emissions in the future in an effective, structured way through providing clear measures and guidelines. Crucially, this involves setting targets to reduce carbon, but other considerations include:

Our key drivers are as follows:

- Reducing our overall energy consumption and thereby reducing the impact to our environment
- Reducing our utility budgets in this uncertain economic climate with respect to fossil fuel costs
- Reducing the impact of the CRC tax
- Developing and incorporating latest proven technology to our engineering systems to improve efficiency without a reduction in quality
- Complying with latest government targets for CO₂ emissions
- Working more closely with peers in other museums to share and implement common goals
- Accounting for scope 3 emissions and include these in the plan

4.0 Carbon management projects

Over the past twelve years, the National Gallery has invested in a number of projects to reduce energy consumption. Some of the work that has been undertaken so far is listed below:

- Variable speed drives (VSD) to all pumps and fans
- Insulation to the roof areas
- Upgrade of external glazing
- Review of plant control strategy
- Variable flow chilled water system
- Passive infrared (PIR) lighting control to gallery spaces and back of house areas
- Floating set point for seasonal adjustment of galleries' conditions
- Part-replacement of air-cooled chillers
- External Blind strategy to maximise daylight control
- Introduction of CO₂ control on our air-conditioning systems to limit fresh air requirements
- Replacement high-frequency lighting to all roof lay light areas

The above projects have contributed in reducing our carbon emissions from our baseline year of 2005/2006.

Looking into the future, key projects have been identified to further reduce emissions.

The single project that will have the greatest significance in our efforts to reduce emissions is the CHP installation replacing our Boiler No 1 (project Ref No 7). This project alone provides 62% of our target emissions.

Whilst we recognise that our plan relies heavily on this project coming to fruition, we are also conscious this adds a certain amount of risk to the achievement of the target. This is mitigated by the fact that the project has been identified by the institution as one of its highest capital priorities and therefore will receive funding and other institutional support. As of the publication of this plan, the Gallery has completed the initial design work and is poised to purchase the combined heat and power plant.

The following table provides information on the full list of projects in our CMP.

Existing approved funded projects

Ref	Project	Annual Savings (yr 1)		% of Target	Implementation Year
		Financial (Gross)	tCO ₂		
1	Seasonal adjustment of chilled water leaving set point winter period 1.0 Deg C	£9,311	50.7	2.19%	2010
2	Replacement Air cooled Chillers Phase 2 & 3 (over 2 years)	£74,306	404.4	17.46%	2010
3	SW General Area lighting Par 30 LED lamps	£10,291	56	2.42%	2010
4	Grand staircase lighting	£7,160	39	1.68%	2010
5	Gallery 62 LED lighting	£919	5	0.22%	2010
6	Galleries 6&8 LED lighting	£2,279	12.4	0.54%	2010
10	Seasonal adjustment of chilled water leaving set point summer period 0.5 Deg C	£4,610	25.1	1.08%	2010
12	Install LED lighting to SW restaurant	£2,346	12.8	0.55%	2011
14	Galleries 5&10 LED lighting	£2,034	11.1	0.48%	2010
	Totals	£113,256	616.5	26.22%	

Planned approved funded projects

Ref	Project	Annual Savings (yr 1)		% of Target	Implementation Year
		Financial (Gross)	tCO ₂		
7	CHP installation replacement Boiler No1	£295,485	1440.1	62.19%	2011
8	Installation of LED lighting to all SW Picture Galleries	£18,720	101.9	4.4%	2011
9	Installation of LED lighting to all Wilkins building Picture Galleries	£57,800	314.5	13.58%	2012
	Totals	£372,005	1856.5	80.17%	

Planned unapproved unfunded projects

Ref	Project	Annual Savings (yr 1)		% of Target	Implementation Year
		Financial (Gross)	tCO2		
11	Install Sabien controllers to boilers	£8,100	49.7	2.15%	2011
13	Replacement Boilers to increase efficiency by 10%	£17,944	110.	4.75%	2012
15	SW Bridge link LED Lighting	£2,102	11.4	0.49%	2011
	Totals	£28,146	171.1	7.39%	

5.0 Annual progress review

The National Gallery will review the carbon reduction process by management control of each project to establish the completion timescales and to evaluate savings achieved. Evaluation would be either by calculation or monitoring of meters to establish actual figures.

This will be overseen by the Programme Leader and reported to the Sustainability Carbon Group and to the Programme Sponsor.

The Carbon Management Plan will be updated six-monthly and annually to incorporate these updates.

We will also provide notices that reach those outside of the institution, possibly through our Annual Review and our Annual Report and Accounts.