University of Wolverhampton
Carbon Management Programme

Carbon Management Plan (CMP) Update 2017 - 2023

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Foreword from the Vice Chancellor

Wolverhampton University has a responsibility to protect and enhance our environment and reduce the negative impacts of excessive resource use and the carbon emissions produced. This carbon management plan update formalises our continued commitment to sustainability through limiting our use of fossil fuels and reducing our carbon emissions.

This updated carbon management plan covers the period from 2017 to 2023. Our previous CMP introduced in 2010 secured £2.8 million in investment to deliver a 25% reduction in carbon emissions by 2015. The plan actually delivered a 41% reduction from the 2007/8 baseline to 2016/17, exceeding the CMP target by 11%. The University is committed to delivering further on going carbon reductions.

This updated plan builds upon the previous success by adopting a hard hitting plan of action of practical and commercially viable investment in further carbon reduction projects in addition to continuing with the excellent energy management practices which have clearly been demonstrated over the last 7 years.

Our plan from 2017 – 2023 is backed by a detailed robust survey of all the Universities facilities. This incorporates a combination of operational and investment opportunities which will be funded by an investment of £1.85 million. This will deliver savings of 1,730 tonnes of carbon and an overall return on our investment in 5 years. The plan also factors in savings from replacement of older equipment that will be reaching the end of its life and will be replaced with modern more efficient equipment such as modern condensing boilers.

Carbon management enables the University to make a significant contribution to the environment – benefiting current and future generations; also carbon management helps the University to manage scarce resources effectively, enabling maximum investments to be made in facilities and services for the benefit of our students, staff and visitors.

I commend this Carbon Management Plan together with its targets, as a vehicle for the delivery of carbon reductions, which will make a significant contribution towards HEFCE, government and global carbon reduction goals; and a contribution to the ongoing reduction of the University of Wolverhampton's operational costs

Professor Geoff Layer
Vice-Chancellor, University of Wolverhampton

Executive Summary

This document outlines the University's Carbon Management Plan (CMP) from 2017 to 2023, which sets out the strategy to achieve the commitment by the University of Wolverhampton, which has been endorsed by Vice Chancellor Geoff Layer. The implementation of the CMP, will deliver the strategy for the University of Wolverhampton to reduce the CO_2 emissions from its activities by a further 10.3% from the 2007/8 baseline by August 2023. This equates to a reduction by approximately 1,730 tonnes of CO_2 per annum by 2023.

The institution's carbon emissions baseline has been calculated using data from 2007/8 academic year (1st August 2007 to 31st July 2008). This year has been chosen as it is the earliest year for which reliable and robust data is readily accessible. In determining the University's carbon footprint analysis of gas, electricity and water consumption have been undertaken, which together with quantification of its waste streams and internal transport mileage, indicates that the University was responsible for 16,746 tonnes of CO_2 emissions per year in 2007/8.

In the latest academic year 2016 / 2017 the Universities carbon footprint had reduced to 9,868 tonnes following the previous 2010 CMP. This is equivalent to a 41% reduction in carbon emissions.

In this revised 2018 – 2023 plan the University has set a target of 15% reduction in carbon emissions. This is equivalent to a 3% annual saving over the five year period. This target has been set based on the recent detailed energy survey that has been completed.

Section 3: of this report reviews the original baseline and demonstrates the progress and carbon reductions achieved through implementation of the 2010 CMP through to 2017.

Section 4: of the plan identifies individual projects designed to deliver the above savings. If all projects identified in section are completed the University's target of reducing CO_2 emissions against 2007/08 baseline will be exceeded.

The estimated cost of implementing all projects identified in section 4.0 is in the region of £1.85 million (excluding vat) and is forecast to achieve, at today's costs, revenue savings of £370,000 per year or a total of approximately £1.9 million (at current utility unit costs) through implementation of the projects over a 5 year programme by 2023.

The delivery of the University's carbon reduction plan identified in **section 4** will be closely monitored by the Carbon Management Team and Senior Management Team. Assuming the University makes good progress with carbon savings and implementation of projects, the opportunity would arise to formally increase its commitment to reducing CO_2 emissions further.

The development and implementation of this Carbon Management Plan and its endorsement by the Vice Chancellor and the Board of Governors will demonstrate that the University undertakes its corporate and social responsibilities and pro-actively manages carbon in an environmentally responsible manner; thereby reducing the impact of our "day to day activities" on the environment. Whilst the effective delivery of projects identified in the programme is essential, the need for continued funding approval is required.

1.0 Introduction

The University of Wolverhampton is a leading modern university with a tradition of providing opportunity and academic excellence dating back nearly 190 years.

On 1 September 1969, the College was officially designated a Polytechnic. Comprising five Faculties: Applied Science, Art and Design, Arts, Engineering, and Social Sciences, a further Faculty of Education was established in 1977. The seventies also saw Wolverhampton develop into a truly international community with students from Iran, Malaysia, and Nigeria, and the delivery of Wolverhampton courses internationally beginning to flourish.

In 1983, a second Royal visit, this time from HRH The Duke of Kent, officially opened Wolverhampton Polytechnic as a stage VIII Polytechnic institution, and this was followed by a period of rapid expansion over the next ten years. A merger with the West Midlands College of Education in 1991 led to the creation of what is now Walsall Campus, and further mergers with Teacher Training Colleges in Wolverhampton and Dudley led to the construction of an ambitious third campus in Telford.

In 1992, Wolverhampton Polytechnic was granted university status and became the University of Wolverhampton. Today our four Faculties offer courses in over 70 different subjects and over 4,000 students graduate from Wolverhampton each year.

This Carbon Management Plan (CMP) updates on the progress Wolverhampton University has made during the previous CMP phase (2010-2017) and sets out the next phase of works the University will undertake to further reduce our impact on the environment.

The second phase of the Carbon Management Plan period from 2017 to 2023 focuses on the continued implementation of technical and behavioural reduction projects while providing continuing support for the strategic and operational policy actions already embedded during the previous phase. This plan is backed by a robust and detailed energy survey completed by independent energy consultants which identified and prioritised energy reduction projects including the cost of implementation, cost savings and carbon savings. This document is intended to provide a practical and formal basis for implementing these carbon emission reduction actions over the short to medium term.

1.1 Updated Carbon Reporting Methods

In the 2010-2015 CMP, Scope 2 emissions from electricity generation and consumption were reported including a UK average factor for the transmission losses experienced in the supply of the electricity through the national grid. However, since 2013 this is no longer included within best practice calculations of Scope 2 emissions. In order to accurately take this change into account, this document has re-calculated the previously reported carbon figures for 2013 to 2016. The baseline figures for the 2007/08 academic year (2007/08 represents the first reliable year for which data was available rather than the normal 2005/06 HEFCE base line which is commonly used by many Universities in their CMP's).

1.2 Scope of CMP

The data in this CMP covers emissions from Scope 1 and Scope 2 activities on all the University campus's in Wolverhampton, Walsall and Telford, as well as from University-owned transport activities. The plan also includes Scope 3 data.

Scope 1. Direct emissions that occur from the combustion in University boilers, furnaces and vehicles.

Scope 2. Emissions from the generation of electricity consumed by the University.

Scope 3. All other indirect emissions which are a consequence of the activities of the University and occur from sources not directly owned or controlled by the University. This includes internal University transport, water and sewerage but it excludes student and staff transport due to complexities in collecting and the unreliability of data. Wolverhampton is also a regional university and transport is not a significant factor against overall carbon emissions.

2.0 Carbon Management Strategy

The University of Wolverhampton has formally acknowledged the importance of carbon management and its commitment to reduce emissions by the successful implementation of the 2010 plan. This carbon management programme update serves to underpin, a key part of the proposed carbon reduction strategy from 2017 to 2023. The programme aim is to quantify and further reduce the University's 'carbon footprint', which is the amount of carbon dioxide (CO_2) produced from its activities such as energy use in buildings, transport, waste disposal and water use.

2.1 Strategic Drivers

The University CMP embeds the concept of providing for today whilst ensuring a positive legacy for future generations and is fundamental to our culture and decision making. The University strives to ensure its own legacy is positive for both the University and wider community. Carbon management is fundamental to these responsibilities. By limiting the use of fossil fuels it ensures fuel is available for future generations; reducing CO2 emissions limits the potential impacts of climate change; and the savings achieved through reduced energy bills and reduced waste will be invested into the core business of education.

This CMP responds to UK legislative requirements on energy and carbon performance and recognises the financial advantages of reducing resource use and waste.

The Climate Change Act has a long term goal to reduce CO_2 emissions by 40% by 2020 and 80% by 2050 from a 1990 baseline to help the UK's transition to a low carbon economy. This has created a number of legislative and financial drivers. This includes Display Energy Certificates, the Carbon Reduction Commitment, enhanced Building Regulations Part L and access to capital funding through the Salix Grant Scheme.

3.0 Carbon Management Plan Update

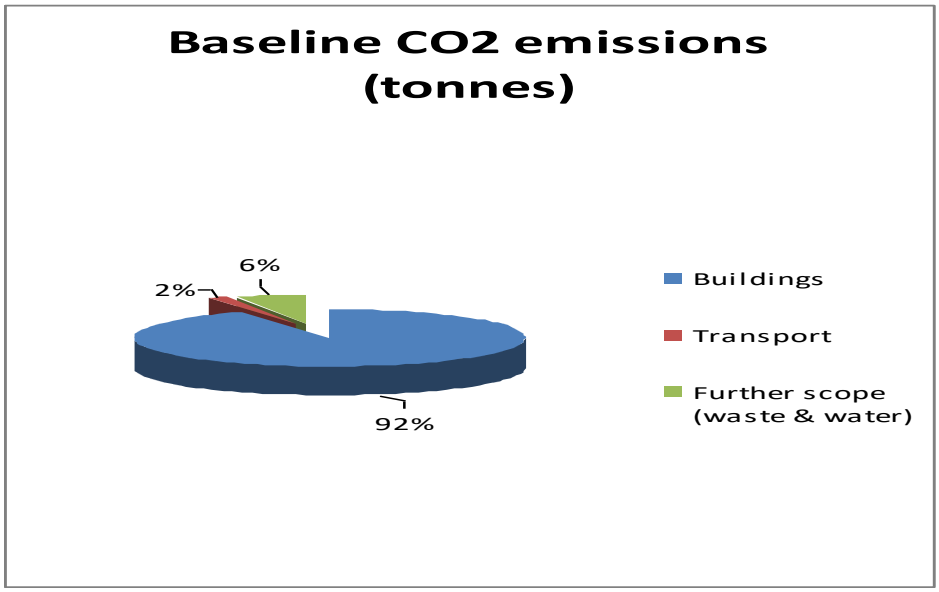
3.1 Baseline 2007/8

The Wolverhampton Universities carbon emissions baseline was calculated using data from 2007/8 academic year (1st August 2007 to 31st July 2008). This year was been chosen as it represents the earliest year for which reliable data was readily accessible.

The table below shows the University's scope 1 and 2 total emissions in tonnes of CO_2 for the selected 2007/8 baseline year. The chart is broken down into three main areas: buildings, transport and further scope (covering waste and water). This shows that energy usage by buildings is the main source of CO_2 emissions, at about 93% of the total baseline emissions. Emissions from buildings account for about 84% of the total baseline costs. Therefore, targeting buildings will deliver the majority of cost and emissions savings. While transport and further scope emissions are smaller, they will still have an important part to play in reducing emissions as in future the scope of these areas is expanded increasing their relative significance.

Emissions and Cost	Total CO_2 Emission (tonnes)	Buildings	Transport	Further scope (waste & water)
Baseline CO_2 emissions (tonnes)	16,746	15,507	252	987
Baseline Cost (£)	£2,751,313	£2,311,042	£92,744	£347,526

The percentage emissions breakdown is summarised in the chart below:



The figures in the above table are based on the following information sources:

Data	Owner	Sources	CO_2 Conversion Factors
Utilities use (gas, electricity, oil & water)	Estates & Facilities: Estates Management Division	Invoices Information, verified by manual meter readings. Oil is based on bulk delivery invoices.	Electricity 0.537 $kgCO_2/kWh$ Gas 0.185 $kgCO_2/kWh$ Water 0.400 $kgCO_2/m^3$ Oil
Fleet transport (University's owned or leased vehicles)	Estates & Facilities: Operations & Transport	Fuel purchases & mileage records.	Diesel 2.63 $kgCO_2$/litre Petrol 2.30 $kgCO_2$/litre
Inter-campus bus travel (for staff & students)	Estates & Facilities: Operations & Transport	Fuel consumption.	Bus (Euro I/II category) 0.62$kgCO_2$/km
Waste Management	Estates & Facilities: Operations & Transport Waste contractors	Invoices Tonnage estimates for waste sent to landfill and recycling.	Waste sent to landfill 447$kgCO_2e$/tonne

Estimate of Emissions

The University's carbon emissions baseline for the 2007/08 academic year (1st August '07 – 31st July '08) used the data sources listed in Table 3. This data continues to be used for this CMP review.

Table 3: Data required for baseline calculations: -

Data	Owner	Sources
Utilities (gas, electricity, water)	Estates Management	Invoices Meter readings & sub-metering system
Fleet Transport (University's owned or leased vehicles)	Estates & Facilities – Campus Operations Division	Mileage records Fuel purchases Vehicle tracking data
Inter-campus Bus Travel	Estates & Facilities – Campus Operations Division	Fuel consumption
Waste Management	Estates & Facilities – Campus Operations Division	Tonnage data for landfill waste Tonnage estimates for recycling

The billing information used for gas, electricity and water, in the base line, contained some estimated consumption readings. Going forward, the implemented metering strategy has provided accurate readings for subsequent years and will continue to for the next stage of the CMP towards 2023. It is to be noted that the data management task is not to be underestimated. Oil consumption is based on bulk delivery invoice figures. Waste & recycling data is based on weight estimates, based on the bin per capacity per waste stream and the number of lifts.

The University's CO_2 emissions baseline for 2007/08 totals 16,746 tonnes of CO_2.

3.2 Business as usual projections

Energy, CO_2 and Other Assumptions

Due to the volatility of energy markets during the recent past, it is very difficult to predict the price of fuel and utilities in a year's time, let alone in five years' time. This has led to various assumptions being made during the calculation of the Value at Stake in 2010, which have been based on information and market intelligence available to the University. This volatility continues to exist in 2017.

Historically, the University has purchased its gas and electricity under fixed price contracts which are tendered every three years. The University re-tendered its electricity contract in summer 2009 with a 3% increase in costs. Electricity was subsequently re tendered in 2012 and 2015 and is due to be renewed in 2018. The electricity unit price has increased by around 20% between 2009 and 2017.

The University retendered its gas contract during 2009 and this has been retendered every 3 years in 2012 and 2015 with an approximate 20% increase in unit costs. The current costs have been used in the Value at Stake calculations until the end of contracts and 5% pa rises have been assumed thereafter. This assumption sets an upward trend in costs, but is likely to be conservative at best.

Combining electricity and gas price fluctuations the overall estate has seen an approximate 20% increase between 2008 and 2017.

In 2007/8 the base year energy costs were £2.7 million. Following the business as usual model this would have risen to an estimated £4.4 million per annum (a £1.7 million increase per annum).

The 2010 CMP set a target saving in carbon of 5% per annum from 2010 to 2015 (based on 2009/10 figures) or 25%. The university actually achieved a 36% reduction based on absolute figures, exceeding the target by 11%. From 2007/8 to 2016/17 the carbon reduction has been 41%. In terms of energy costs for the University in a period where unit costs have risen by around 20% the implementation of the plan and subsequent carbon savings has maintained overall energy costs at £2.95 million, an increase of £250,000 compared to a business as usual projection of a £1.7 million increase.

The baseline year (2007/8) showed our CO_2 emissions to be about 16,000 tonnes. If we did nothing, our emissions were set to increase by over 1,000 tonnes over the five year period.

The University has invested and committed to the Carbon Management plan. The targets, progress and achievements of the implemented plan and the impact on carbon emissions is shown in section 3.3.

Planned building changes

In the 2010 CMP there were limited planned major changes in the University building portfolio, due to the funding environment in the HE Sector

Specific estate changes which have occurred between 2010 and 2016 include:

- Compton campus was closed after 2010.
- Walsall campus Performance Hub (library and dance studio) was constructed around 2012. This delivered a four storey fully vented and air conditioned building.
- City Wulfruna campus Rosaline Franklin building was constructed in 2013 / 14 in place of the original wet heated building. The new building is fully vented and air conditioned with laboratories and science labs. The energy load on this building will have increased.
- City Molineux campus Lord Swrajj Paul building. This is a 5 storey mechanically ventilated building with comfort cooling.

Between 2010 and 2017 the University estate contracted slightly with the closure of Compton campus but the opening of Mary Seacole, Rosaline Frankline and Lord Swraj Paul buildings (2016/17) increased floor areas. Floor areas have changed from 173,324m^2 in 2010 to 173,594m^2 in 2016.

There are a number of planned changes that will affect the 2017/23 plan. These include Elite Centre for Manufacturing Skills (ECMS) Thomas Dudley new build, ECMS Springfield Campus new build, opening of new facility in Stafford and The School of Architecture and Built Environment (SOABE) new build.

The Science Park was excluded from the 2010 plan and is excluded from the 2017 plan as it is classed as a stand alone partnership. The CMP is for University buildings only.

Student Numbers

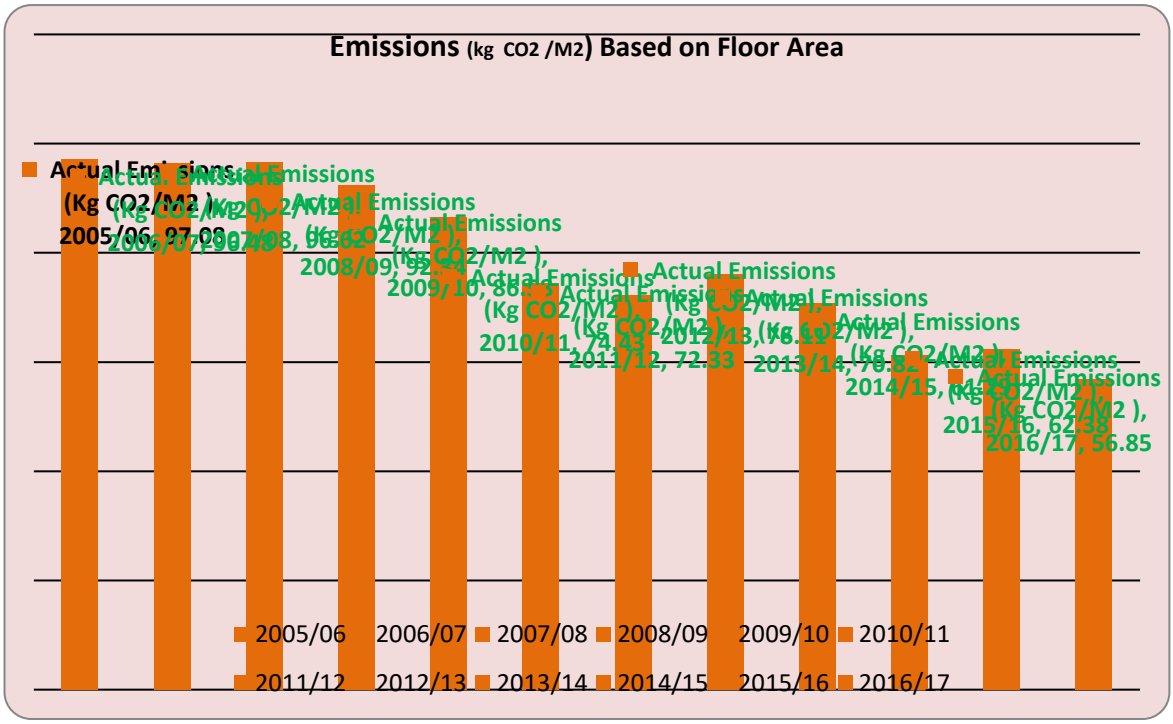
Since 2010 there has been an increase in student numbers although the numbers have stabilised with a slight reduction in numbers forecast for the 2017 / 18 intake.

3.3 Targets, Progress and Achievements

The targets and actions set out in 2010 to achieve the target savings included formal adoption of the plan by the Executive, Vice Chancellor and Estates committee. A dedicated ring fenced fund for the carbon reduction measures was established to allow implementation of the identified projects.

The 2010 CMP originally asked for £2.9 million of funding. The University invested £3.7 million (£2.9 million of University fund direct investment plus £800,000 from HEFCE revolving green fund (RGF) over a 7 year programme from 2010 to 2017 to achieve £1.2 million year on year savings in energy costs.

The University chose to base its targets on a reduction on absolute carbon emissions rather than intensity based on student numbers or floor areas however the table below indicates the significant 41% reduction in building energy intensity that has been achieved between 2010 and 2017 by adoption and implementation of the CMP:



Prior to the 2010 CMP a number of initiatives had already been established. This included development of an automatic metering system campus wide involving over 400 meters feeding in to a system-link energy management software package to allow Monitoring and Targeting (M&T). This continues to be used to target performance of individual buildings, establishing Combined Heat and Power Quality Assurance (CHPQA), Display Energy Certificates (DEC's), Energy Performance Certificates (EPC's), Carbon Reduction Commitment (CRC) reporting, TM44 air conditioning inspection data and feeding in to estates management statistics and green score card. This has been fundamental in the achievement and monitoring of the many subsequent projects implemented from 2010 to present day.

The implementation of the M&T system and software identified and allowed the recovery of approximately £600,000 through incorrect billing due to incorrect correction factors and estimated readings from meter roll over. This demonstrated the value of the M&T investment and created an understanding of the benefits for future investment.

In 2008 to 2009 all the air conditioning systems were evaluated and a strategy developed for subsequent long term replacement to improve efficiency, control and satisfy statutory requirements to remove R22, a now banned refrigerant, from the campus.

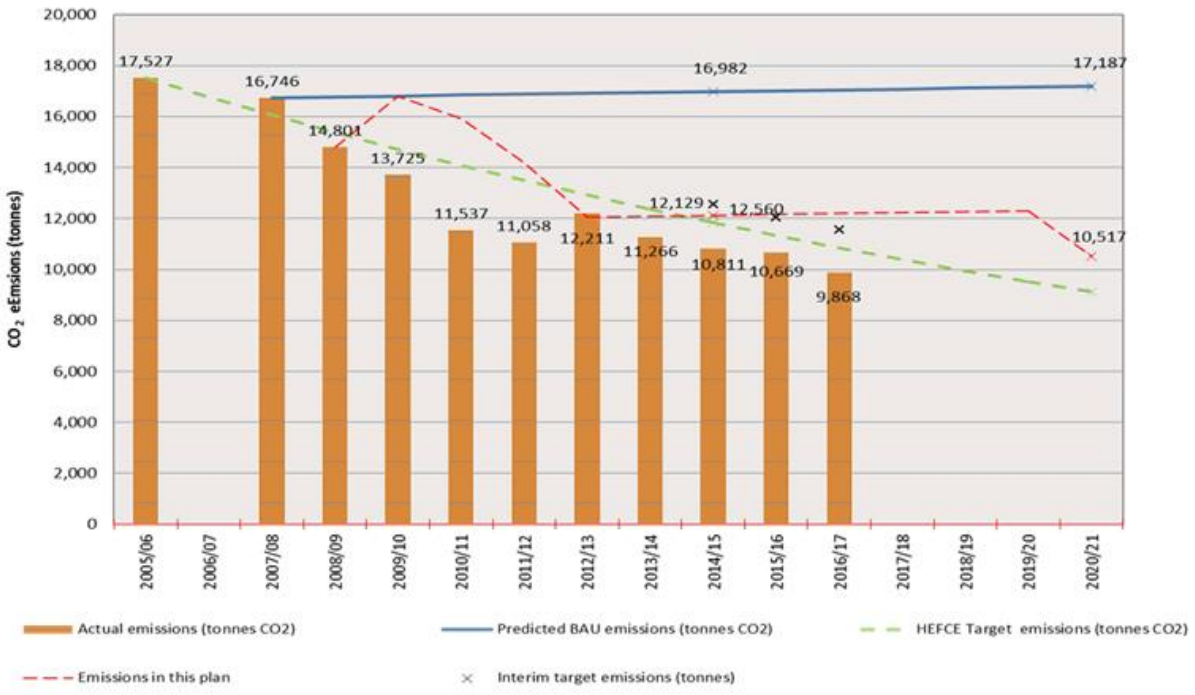
An initial review of the Building Management System (BMS) control strategy was completed prior to 2010 but the main implementation was completed and included as part of the post 2010 CMP. It is considered that further savings can be made and the further optimisation of the BMS is underway and included in the 2017 - 2023 CMP.

A project list was produced by the University Energy Manager in 2010 for the years 2010 to 2015. The project list included 34 measures requiring investment of approximately £2.8 million excluding VAT with a projection of £3.5 million revenue savings on a business as usual basis (an overall return of just over one year). Without the programme of energy reduction projects the energy expenditure would have risen to a projected £4.5 million.

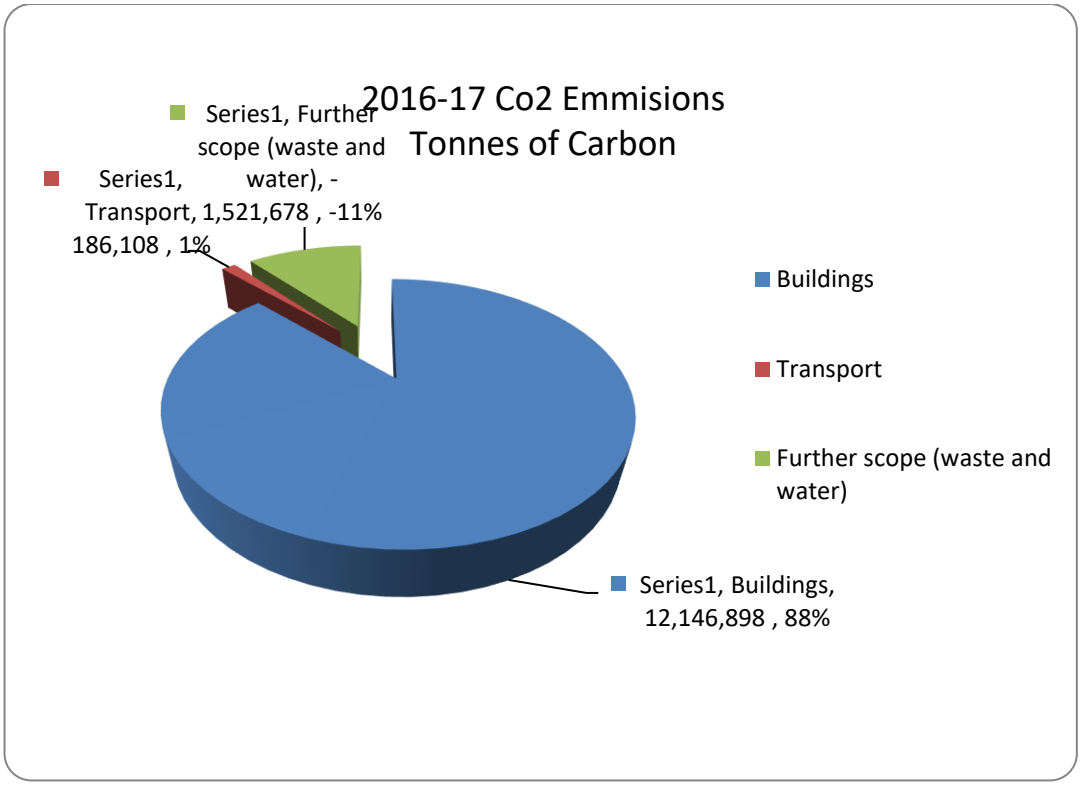
In addition to projects put forward in the 2010 plan, there have been a large number of projects implemented funded from normal University maintenance budgets which have had an additional impact on the Universities energy use.

A review of the 2010 project list, additional projects and those projects currently being implemented in 2017 are shown in Appendix D.

Progress to date on carbon savings from 2007/8 to 2016/17 is represented in the graph below.



This shows clearly how the implementation of the 2010 CMP has exceeded the HEFCE target savings. The red dotted line indicates the projected carbon emissions following implementation of the 2010 plan and this has clearly been exceeded. The chart below indicates the impact of each element of buildings, transport and waste / water affects the university carbon emissions.



Absolute emmissions figures. The following table clearly shows a 41% reduction in carbon emmisions when compared to the University base year of 2007/8 and 44% when compared to the HEFCE 2005/6 base year. (Estates mangement statistics EMS use the 2005/6 base year for all reporting).

Year	CO2 Tonnes	% change from 2005/6	% change from 2007/8
2005/6	17,527	0	0
2007/8	16,746	4.5	0
2016/17	9,868	43.7	41.1

The implementation of the 2010 CMP over a period when energy prices have risen over 20% has restricted the absolute increase to 7.4% or £204,000 per annum.

	Cost £	% change
2007/8	2,751,313	0
2016/17	2,955,807	7.4

4.0 Carbon Management Projects

4.1 Scope of projects

This section identifies and outlines the projects that will need to be implemented in order to achieve the Universities CO_2 emissions reduction target of 15% over the next 5 years. The projects listed cover a number of areas such as: technical solutions, operational procedure changes and behavioural management changes.

The University commissioned an independent, detailed and comprehensive review of carbon reduction opportunities. The review considered opportunities broadly broken down in to the following areas:

- **Immediate operational/improvement measures** – including adjustments to settings and advice regarding current energy management and operational strategies.

- **Fast payback measures** – minor investment programme to improve controls and operations. This includes investments in simple controls delivering paybacks of less than 1 year.

- **Building services infrastructure development** - a major source of carbon savings will be "Invest to Save" measures. These will typically have paybacks up to 5 years and are likely to be Salix funding loan compliant, and include a wide range of measures such as dedicated hot water service boilers, improved heating controls, energy efficient lighting, automatic lighting controls, draught stripping and simple building insulation. The room by room survey compiled an accurate register of lighting, heating and control changes to be used in submissions for future funding.

- **Longer term technology opportunities** – a wide range of measures, particularly those improving the building structure, upgrading boiler plant and installing modern LED lighting will have extended payback periods up to and exceeding 7 years. These measures can be particularly important where infrastructure is reaching the end of its existing life and hence investment is required to maintain the buildings operational reliability, or on health and safety grounds. Where on going facilities improvements are made the University specifies the latest low energy technologies.

- **Renewable technology opportunities** - an assessment of the viability for installing renewable technologies to each of the buildings and highlight it within our report when there is a 'specific' benefit for that building or for the site. The incorporation of renewable technologies is considered in the specifications for all new buildings and significant refurbishments.

The 2010 CMP focused on many of the no and low cost opportunities with relatively quick returns on investment. This plan now incorporates those longer term opportunities and measures which tend to have a longer payback than previously. A schedule of these projects including capital investment, cost savings and carbon savings is shown in Appendix A.

4.2 CMP 2017 – 2023 Savings Summary

The review of energy and carbon saving opportunities at the four campuses: City Molineux; City Wulfruna; Telford Innovations and Walsall identified a total of 242 projects split between operational, low cost and high cost measures. The projects are supported by a comprehensive 'room by room' schedule of opportunities for lighting, insulations and BMS control modifications. The University has a opportunities database of the identified projects which are summarised in the following tables below. Further details on each project may be found in appendix A.

The following table summarises the potential savings from the review, split broadly into measures with a simple payback of less than one year and greater than one year.

Total all Sites Savings								
Energy	**Energy Saving kWh/yr**	**Cost Saving £/yr**	**Carbon Saving tCO2e/yr**	**Capital Cost £**	**Payback Period yrs**	**% of All University Total Energy Cost**	**% of All University energy kWh**	**% of All University carbon**
Measures with payback period under 1 year	4,307,284	160,285	846	109,629	0.7	6.5%	8.52%	7.39%
Longer payback measures	1,697,330	211,172	885	1,744,342	8.3	8.5%	3.36%	7.73%
TOTALS	**6,004,614**	**371,457**	**1,730.2**	**1,853,971**	**5.0**	**15.0%**	**11.88%**	**15.12%**

The breakdowns of project savings are shown per campus in appendix F.

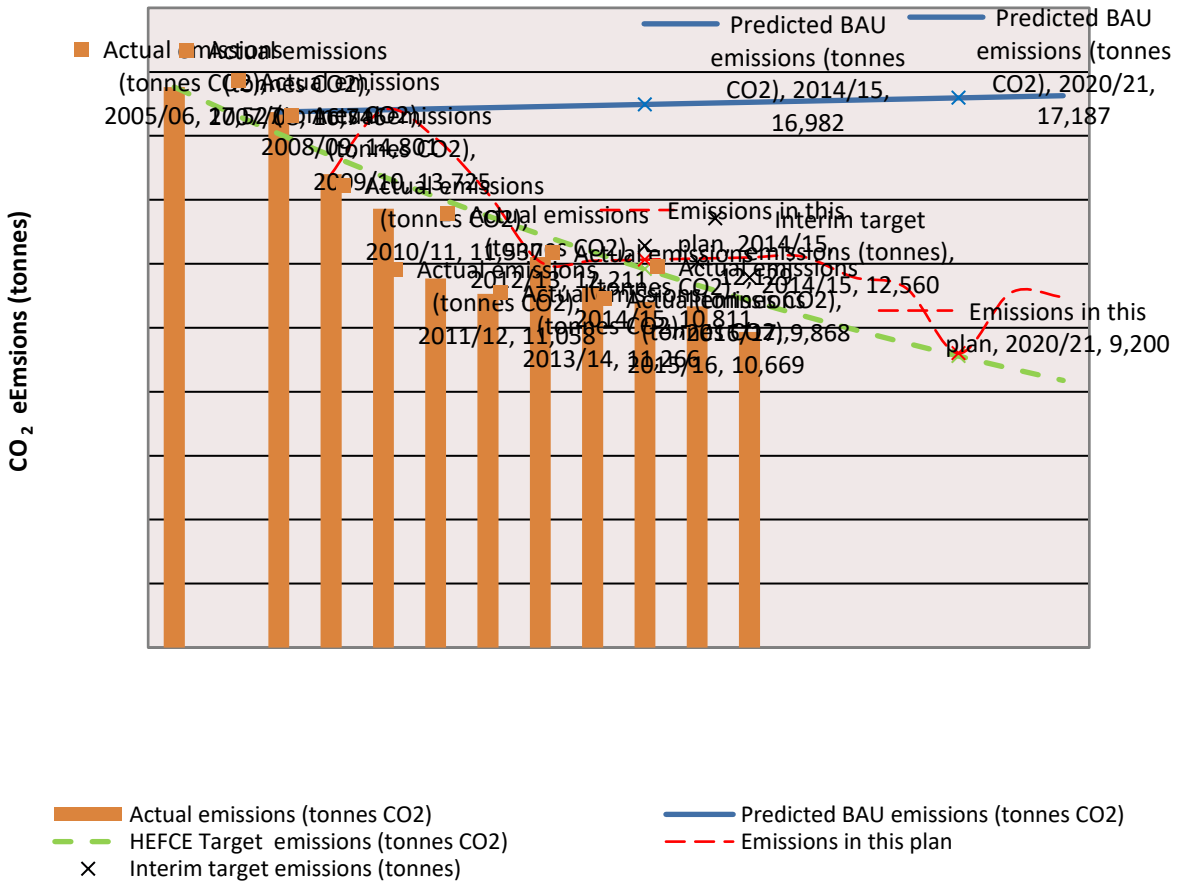
The projects include on-going optimisation of the building management system to match occupancy requirements; investment in new LED lighting; insulation of pipe work. The projects also include further integration of Combined Heat and Power and Photovoltaic's where viable.

The plan recognises that many of the boilers, typically found in residential facilities are reaching the end of their life and there replacement with modern efficient boilers are included in the project plan.

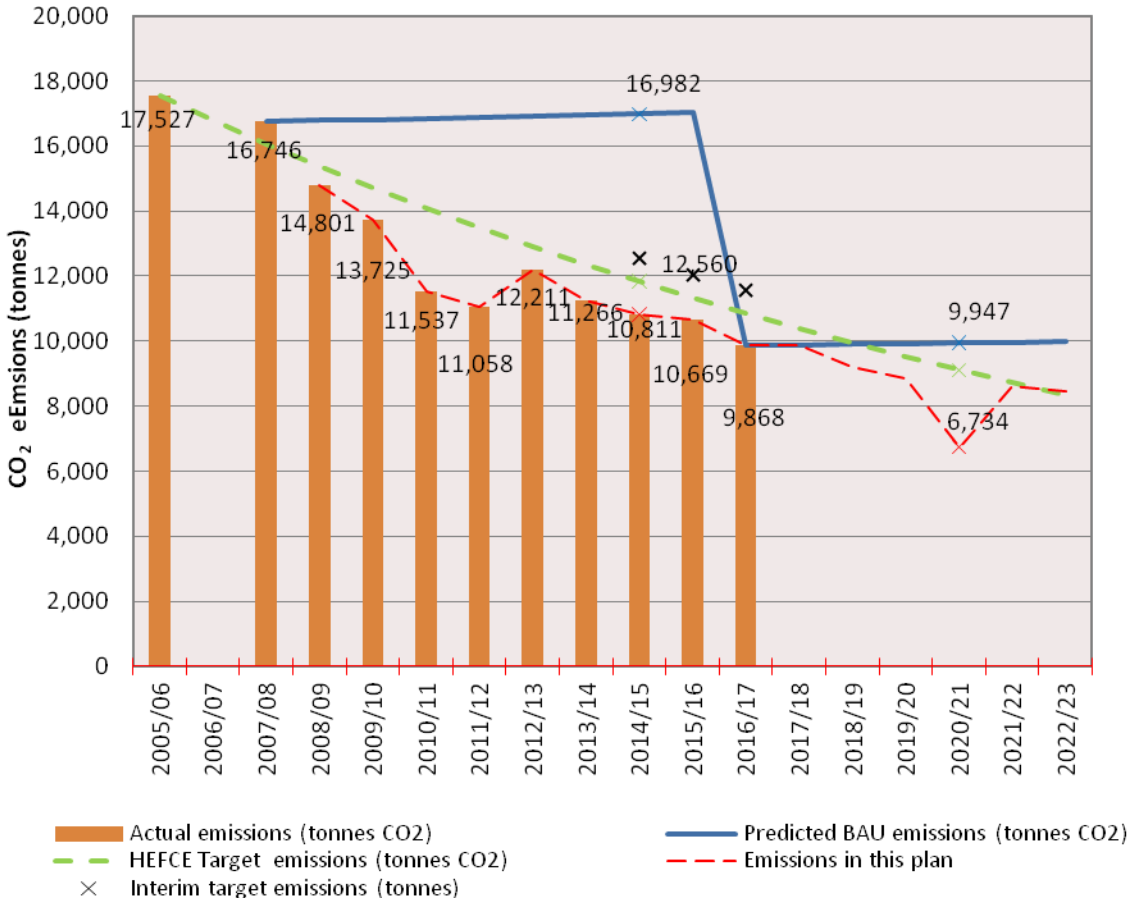
The report and model of carbon savings assumes that the low / no cost opportunities will be implemented in 2018/19/20/21 and that subject to capital availability the major projects will be implemented in 2019/20/21. The plan assumes that the smaller projects, often including LED lighting replacement will be completed in 2020/21 and 22.

Where possible the projects will be integrated with any building refurbishment works to minimise disruption to students and staff.

The following graph extends the original 2010 carbon saving plan without reflecting that the initial target savings have been exceeded.


Predicted BAU emissions (tonnes CO2), 2014/15, 16,982
Predicted BAU emissions (tonnes CO2), 2020/21, 17,187
Emissions in this plan, 2020/21, 9,200
Actual emissions (tonnes CO2)
HEFCE Target emissions (tonnes CO2)
Interim target emissions (tonnes)
Predicted BAU emissions (tonnes CO2)
Emissions in this plan

In the following graph the business as usual and projected emissions from implementing this plan has been re-set to reflect the true carbon emissions in 2016/17. This clearly demonstrates the university emissions are and will continue to be below the HEFCE target.



5.0 Carbon Programme Management

We all share in the responsibility to protect and preserve our environment. This Carbon Management Plan has challenging and ambitious targets of 15% over the next five years, building on the successful implementation of the previous 2010 plan. As such it needs wide support both in financial backing and the time and efforts of staff and students. To engage with all staff and students it is vital they are provided with information on what the University is doing, how they can help and the results of any actions taken. The University will also continually monitor the progress of this project moving forward.

Ultimately, the implementation of this Carbon Management Plan is expected to produce significant benefits for the University both in financial terms and in CO_2 savings. For the most part, the projects listed can be seen as a structured investment approach in order to reduce environmental impact, reduce long term operational costs in perpetuity and go someway to protect the University against the vagaries of a very volatile energy market.

5.1 Funding

This plan will require capital investment of about £1.85 million to implement over the next five years to 2022/23, and will provide estimated annual savings of £371,000 per annum. The payback period for the capital cost of the measures is 5.0 years.

The utility costs assumed for savings from projects are outlined below. These costs will change over the remaining period of the plan, with continued increases in unit costs likely. This may have the effect of reducing the payback period for some measures as cost savings increase, assuming that implementation costs do not suffer a corresponding increase also.

This plan assumes the following utility costs for the savings from the projects:

- Electricity – 12.70 p/kWh
- Gas – 3.25 p/kWh
- Fuel Oil – 3.72p/kWh
- Water – 166.66 p/m^3

The saving project opportunities tool used to identify and monitor the progress of implementation allows changes in utility costs and carbon factors to be updated and reflect the financial return of the projects at any time. The projects list is held and managed by the University Energy Manager.

The implementation of the previous CMP was funded directly by the university through a £2.9 million investment. Wolverhampton University also has access to the Salix energy efficiency loan scheme for higher education for investment in energy efficiency projects. In the last CMP period the University received £800,000 in Salix funding to implement a wide range of projects including LED lighting and controls replacements, heating pipe work insulation and improved heating controls.

The University also continually invests in internal capital improvement projects.

5.2 Responsibility and Management

In order for the CMP to be successful, it is important and necessary to implement and embed Carbon Management themes and strategies into the day-to-day operational business activities of the University.

The Director of Estates and Facilities and Vice Chancellor has given strong support and endorsement for this Carbon Management Plan. The CMP will serve as a published document for the University and shall be uploaded to both the intranet and internet websites, with a provision for regular updates on progress.

The University Energy Manager has primary responsibility for the delivery of this CMP and to identify and manage carbon reduction initiatives. He is supported by the Director of Estates and Facilities with approval as required by the Governors Estates Sub committee and Board of Governors.

5.3 Communication

The release of this Carbon Management Plan will be notified to all personnel via the Director of Estates and Facilities and Governors Estates sub committee. The plan will also be publicly available via the Wolverhampton University website.

The delivery of the projects identified in section 4 and Appendix A of the CMP programme will be considered by the Energy Manager, Director of Estates and Facilities, Governors Estates sub committee and Board of Governors who will provide sign off and funding. Each project will be considered to ensure alignment to University key policies and procedures and will be programmed in a structured plan i.e. University's minor works, larger capital works and long term maintenance programmes. This structured approach will ensure that the requisite funding and project management capacity is available; projects will not prejudice the future activities of the university and will be focussed on delivery of facilities for students, staff and visitors, always referencing the ethos of the CMP. The Director of Estates and Facilities will be responsible for the CMP going forward and also for its implementation following approval from the Governors Estate sub committee. The Director of Estates and Facilities will also be responsible for the communication of relevant and regular updated progress reports.

5.4 Monitoring Reporting and Evaluation

The University has invested over the last 5 years in a comprehensive metering system to monitor and record building energy use and performance. To ensure the plan retains momentum and the targets are met there will remain a continuous monitoring and evaluation process, actively working to improve and develop future projects.

The technical programmes will be overseen by the Energy Manager and will monitor Scope 1 energy consumption of University fiscal meters on a monthly basis and through billing verification. The Director of Estates and Facilities and Governors Estates sub committee as a whole will monitor progress against CMP targets.

The Energy Manager will provide annual updates to the Director of Estates and Facilities and Governors Estates sub committee.

Appendix A: Definition of Projects

City Campus Molineux Projects

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
1	City North Residence Blocks	Corridor lighting upgrade	7,370	936	3.0	7,315	7.8
2	City North Residence Blocks	Bedroom lighting upgrade	51,995	6,603	21.4	32,894	5.0
3	City North Residence Blocks	Kitchen lighting upgrade	19,943	2,533	8.2	10,463	4.1
4	City North Residence Blocks	Bathroom lighting upgrade	5,112	649	2.1	15,235	23.5
5	City North Residence Blocks	Laundry lighting upgrade	584	74	0.2	240	3.2
6	City North Residence Blocks	Stairwell lighting upgrade	1,512	192	0.6	1,890	9.8
7	City North Residence Blocks	Heating boiler upgrade	145,320	4,723	26.9	118,000	25.0
8	City North Residence Blocks	Heating distribution pipework insulation	60,951	1,981	11.3	4,099	2.1
9	City North Residence Blocks	BMS saving opportunities	382,158	13,632	73.6	0	0.0
10	City North Teaching Blocks	BMS saving opportunities	564,288	24,777	119.8	19,153	0.8
11	City North Teaching Blocks	Replacement boilers	128,744	4,184	23.8	88,000	21.0
12	City North Teaching Blocks	Heating distribution pipework insulation	34,750	1,129	6.4	4,550	4.0
13	Mary Seacole	Stairwell lighting upgrade	1,050	133	0.4	735	5.5
14	Mary Seacole	Office lighting upgrade	666	85	0.3	600	7.1
15	Mary Seacole	Kitchen lighting upgrade	306	39	0.1	360	9.3

City Campus Molineux projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
16	Mary Seacole	lobby lighting upgrade	162	21	0.1	60	2.9
17	Mary Seacole	Lecture Theatre lighting upgrade	3,974	505	1.6	2,760	5.5
18	George Wallis (Main)	Circulation area lighting upgrades	13,833	1,757	5.7	4,660	2.7
19	George Wallis (Main)	Circulation area lighting upgrades	4,557	579	1.9	2,755	4.8
20	George Wallis (Main)	Office area lighting upgrade	5,655	718	2.3	1,910	2.7
21	George Wallis (Main)	Teaching area lighting upgrade	1,159	147	0.5	1,315	8.9
22	George Wallis (Main)	Toilet area lighting upgrade	287	36	0.1	306	8.4
23	George Wallis (Main)	Dark room lighting upgrade	108	14	0.0	110	8.0
24	George Wallis (Main)	Reception Area lighting upgrade	549	70	0.2	265	3.8
25	George Wallis (Print Services)	Print Services lighting upgrade	7,166	910	3.0	2,915	3.2
26	George Wallis (Ceramics)	Ceramics workshop lighting upgrade	6,681	848	2.8	2,268	2.7
27	ML	Maintenance Workshop lighting upgrade	10,909	1,385	10.9	2,340	1.7
28	ML	Glass Workshop lighting upgrade	11,625	1,476	11.6	3,948	2.7
29	ML	Circulation area lighting upgrades	3,752	477	3.8	2,750	5.8
30	ML	Toilet lighting upgrade	223	28	0.2	300	10.6

City Campus Molineux projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
31	ML	Office area lighting upgrade	14,310	1,817	14.3	9,484	5.2
32	ML	Counselling area lighting upgrade	2,134	271	2.1	1,435	5.3
33	ML	Kitchen lighting upgrade	141	18	0.1	240	13.4
34	ML	Prayer room area lighting upgrade	6,088	773	6.1	5,160	6.7
35	Arthur Storer	Circulation area lighting	4,245	539	4.2	3,425	6.4
36	Arthur Storer	Toilet lighting	1,058	134	1.1	1,350	10.0
37	Arthur Storer	Office lighting	14,696	1,866	14.7	18,370	9.8
38	Arthur Storer	Lecture Theatre Lighting	1,496	190	1.5	1,680	8.8
39	Lord Swraj Paul	Stairwell lighting	2,130	271	2.1	2,130	7.9
40	MX	Circulation area lighting	7,819	993	7.8	4,655	4.7
41	MX	Toilet lighting upgrade	5,632	715	5.6	5,280	7.4
42	MX	Teaching area lighting upgrades	6,006	763	6.0	6,270	8.2
43	MX	Meeting room lighting upgrade	3,507	445	3.5	3,840	8.6
44	MX	Office area lighting upgrade	24,192	3,072	24.2	30,860	10.0
45	MX	Coffee shop area lighting upgrade	1,605	204	1.6	1,560	7.7
46	MX	Ground floor Cashiers area lighting upgrade	1,200	152	1.2	900	5.9
47	MX	Post room lighting upgrade	2,028	258	2.0	825	3.2
48	MX	Student services area lighting upgrade	1,393	177	1.4	1,075	6.1
49	Whole Site	Photovoltaic panel installations	47,400	6,020	47.4	95,000	15.8
		TOTALS	**1,622,469**	**89,321**	**490**	**525,735**	**5.9**

City Campus Wulfruna Projects

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
1	Wulfruna	Heating Distribution pipework	10,222	332	1.9	4,125	12.4
2	Wulfruna (Arena Theatre Plantroom)	Heating distribution pipework	23,968	779	4.4	11,055	14.2
3	Wulfruna (MA061 Plantroom)	Heating distribution pipework	17,902	582	3.3	8,580	14.7
4	Ambika Paul Building (lower plant room)	Heating distribution pipework	4,852	158	0.9	2,800	17.8
5	Ambika Paul Building (lower plant room)	Heating boilers	151	5	0.0	55	11.2
6	Ambika Paul Building (roof plant room)	Heating distribution pipework	2,988	97	0.6	5,025	51.7
7	Whole Site	BEMS Savings opportunities	2,075,414	72,315	395.6	63,518	0.9
8	Wulfruna	MA304 Stairwell lighting (Adjacent glass lift)	502	64	0.2	450	7.1
9	Wulfruna	MA304 Forensic demo flat lighting	110	14	0.0	242	17.3
10	Wulfruna	1st floor corridor lighting	436	55	0.2	300	5.4
11	Wulfruna	1st floor teaching space lighting	2,127	270	0.9	2,200	8.1
12	Wulfruna	Unused area lighting		0	0.0		0
13	Wulfruna	VC Office Suite	1,042	132	0.4	860	6.5
14	Wulfruna	Grd floor corridor lighting	533	68	0.2	360	5.3
15	Wulfruna	Grd Floor office lighting	3,155	401	1.3	4,320	10.8

City Campus Wulfruna Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
16	Wulfruna	West side toilet lighting	279	35	0.1	340	9.6
17	Wulfruna	Lower ground floor corridor lighting	828	105	0.3	410	3.9
18	Wulfruna	Lower ground floor teaching space lighting	704	89	0.3	675	7.5
19	Wulfruna	Lower ground floor teaching space lighting	528	67	0.2	795	11.9
20	Wulfruna	Lower ground floor Lab lighting	1,996	253	0.8	630	2.5
21	Wulfruna	Caretaker Office lighting	959	122	0.4	705	5.8
22	Wulfruna	1st floor admin office lighting	95	12	0.0	55	4.6
23	Wulfruna	Staff kitchen lighting	607	77	0.3	865	11.2
24	Wulfruna	Faculty office lighting	1,886	240	0.8	2,460	10.3
25	Wulfruna	MAO61 stairwell and circulation lighting	607	77	0.3	360	4.7
26	Wulfruna (Arena Theatre)	Circulation area lighting	1,024	130	0.4	800	6.2
27	Wulfruna (Arena Theatre)	Green room lighting	144	18	0.1	90	4.9
28	Wulfruna (Arena Theatre)	Seminar room lighting	470	60	0.5	576	9.6
29	Wulfruna (Arena Theatre)	Office lighting	627	80	0.6	384	4.8
30	Wulfruna (Arena Theatre)	Main Auditorium area	281	36	0.3	323	9.1

City campus Wulfruna Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
31	Rosalind Franklin Science Centre	Store room lighting	243	31	0.2	333	10.8
32	Millennium City Building	4th floor teaching room lighting	7,532	957	7.5	5,818	6.1
33	Millennium City Building	4th floor toilets lighting	473	60	0.5	525	8.7
34	Millennium City Building	3rd floor circulation area lighting	225	29	0.2	175	6.1
35	Millennium City Building	3rd floor teaching room lighting	1,472	187	1.5	1,137	6.1
36	Millennium City Building	3rd floor office lighting	6,625	841	6.6	4,606	5.5
37	Millennium City Building	3rd floor toilets lighting	655	83	0.7	525	6.3
38	Millennium City Building	2nd floor office lighting	4,082	518	4.1	2,804	5.4
39	Millennium City Building	2nd floor toilets lighting	473	60	0.5	525	8.7
40	Millennium City Building	2nd floor teaching room lighting	4,964	630	5.0	3,835	6.1
41	Millennium City Building	1st floor office lighting	6,002	762	6.0	4,162	5.5
42	Millennium City Building	1st floor toilets lighting	742	94	0.7	825	8.8
43	Millennium City Building	Grd floor circulation area lighting	1,955	248	2.0	680	2.7
44	Ambika Paul Building	Sports Hall lighting	2,150	273	2.2	2,520	9.2
45	Ambika Paul Building	Gymnasium lighting	2,812	357	2.8	880	2.5

City campus Wulfruna Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
46	Ambika Paul Building	Fitness suite lighting	2,246	285	2.2	900	3.2
47	Ambika Paul Building	Teaching room lighting	2,761	351	2.8	3,125	8.9
48	Ambika Paul Building	Circulation area lighting (sports hall and students union)	405,712	641	5.0	1,341	2.1
49	Ambika Paul Building	Students Union lounge lighting	1,995	253	2.0	1,200	4.7
50	Ambika Paul Building	"The Venue" lighting	1,836	233	1.8	1,570	6.7
51	Ambika Paul Building	SU Reception area lighting	164	21	0.2	175	8.4
52	Ambika Paul Building	Concourse area lighting	1,236	157	1.2	560	3.6
53	Ambika Paul Building	Campus store lighting	1,254	159	1.3	1,225	7.7
54	Ambika Paul Building (Harrison Learning centre)	Ground floor learning centre lighting	13,979	1,775	14.0	5,553	3.1
55	Ambika Paul Building (Harrison Learning centre)	First floor learning centre lighting	20,400	2,591	20.4	10,175	3.9
56	Ambika Paul Building (Harrison Learning centre)	Team office lighting	850	108	0.9	600	5.6
57	Ambika Paul Building (Harrison Learning centre)	Individual/group study rooms lighting	3,664	465	3.7	3,296	7.1
58	Ambika Paul Building (Harrison Learning centre)	2nd floor PC lab lighting	1,426	181	1.4	600	3.3

City campus Wulfruna projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
59	Ambika Paul Building (Harrison Learning centre)	2nf floor MD2126	2,767	351	2.8	1,995	5.7
60	Ambika Paul Building (Harrison Learning centre)	3rd floor postgrad lab	302	38	0.3	480	12.5
61	Ambika Paul Building Ext (Harrison Learning centre)	Perimeter lighting	3,528	448	3.5	1,400	3.1
62	Ambika Paul Building Ext (Harrison Learning centre)	Study/meeting rooms	2,912	370	2.9	3,120	8.4
63	Ambika Paul Building Ext (Harrison Learning centre)	Ist floor open area	12,600	1,600	12.6	8,400	5.2
64	Ambika Paul Building Ext (Harrison Learning centre)	Ground floor office area	3,978	505	4.0	2,520	5.0
65	The George	Circulation area lighting	366	46	0.4	170	3.7
66	The George	Office lighting	4,964	630	5.0	4,290	6.8
67	The George	Meeting room lighting	823	105	0.8	1,425	13.6
68	The George	Grd flr open space lighting	708	90	0.7	230	2.6
69	Alun Turing (Old Building)	Teaching room lighting	1,896	241	1.9	1,990	8.3
70	Alun Turing (Old Building)	Circulation area lighting	2,944	374	2.9	2,705	7.2

City campus Wulfruna Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
71	Alun Turing (Old Building)	Toilet lighting	718	91	0.7	1,425	15.6
72	Alun Turing (Old Building)	Meeting room lighting	38	5	0.0	75	15.5
73	Alun Turing (Old Building)	Lab lighting	1,582	201	1.6	715	3.6
74	Alun Turing (Old Building)	M1041office lighting	1,888	240	1.9	1,200	5.0
75	Alun Turing (Old Building)	3rd floor circulation area lighting	990	126	1.0	1,100	8.7
76	Alun Turing (New Building)	3rd floor Disabled toilet lighting	10	1	0.0	25	19.7
77	Alun Turing (New Building)	3rd Floor Kitchenette	10	1	0.0	25	19.7
78	Alun Turing (New Building)	3rd floor office area lighting	3,427	435	3.4	2,040	4.7
79	Alun Turing (New Building)	Atrium uplighting	4,000	508	4.0	2,000	3.9
80	Alun Turing (New Building)	MAC LAB task lighting	3,900	495	3.9	1,872	3.8
81	Alun Turing (New Building)	2nd floor circulation area lighting	1,822	231	1.8	1,350	5.8
82	Alun Turing (New Building)	1st floor circulation area lighting	2,025	257	2.0	1,550	6.0
83	Alun Turing (New Building)	Digital media support suite lighting	195	25	0.2	300	12.1
84	Alun Turing (New Building)	Ground floor circulation area lighting	225	29	0.2	150	5.2
85	Alun Turing (New Building)	M1037 Offices lighting upgrade	92	12	0.1	120	10.3
86	Alun Turing (New Building)	Labs lighting	1,947	247	1.9	1,645	6.7

Telford Innovation Campus Projects

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
1	Telford Residence Blocks	Corridor lighting upgrade	10,222	1,298	4.2	4,125	3.2
2	Telford Residence Blocks	Bedroom lighting upgrade	23,968	3,044	9.9	11,055	3.6
3	Telford Residence Blocks	Kitchen lighting upgrade	17,902	2,274	7.4	8,580	3.8
4	Telford Residence Blocks	Stairwell lighting upgrade	4,852	616	2.0	2,800	4.5
5	Telford Residence Blocks	Laundry lighting upgrade	151	19	0.1	55	2.9
6	Telford Residence Blocks	Bathroom lighting upgrade	2,988	379	1.2	5,025	13.2
7	Telford Residence Blocks	Kitchen lighting controls	4,438	564	1.8	4,200	7.5
8	Telford Residence Blocks	Laundry lighting controls	101	13	0.0	200	15.6
9	Telford Residence Blocks	Heating Boiler Replacement	256,200	8,327	47.4	140,000	16.8
10	Telford Residence Blocks	Boiler room insulation	42,336	1,376	7.8	3,500	2.5
11	Telford Residence Blocks	Loft Insulation	106,142	3,450	19.6	30,000	8.7
12	Telford Teaching Blocks	Heating Boiler Replacement	156,000	5,070	28.9	120,000	23.7
13	Telford Teaching Blocks	Boiler room insulation	64,754	2,105	12.0	7,110	3.4
14	Hutchinson	Lecture Theatre lighting upgrade	2,010	255	0.8	2,400	9.4
15	Hutchinson	Dining area lighting upgrade	1,171	149	0.5	1,595	10.7

Telford Innovation Campus Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
16	Hutchinson	Kitchen area lighting upgrade	3,193	406	1.3	2,365	5.8
17	Hutchinson	Learning Centre lighting upgrade	11,581	1,471	4.8	13,065	8.9
18	Hutchinson	Atrium area lighting upgrade	2,413	306	1.0	910	3.0
19	Hutchinson	Atrium area lighting upgrade	749	95	0.3	770	8.1
20	Hutchinson	Admin area lighting upgrade	1,520	193	0.6	990	5.1
21	Hutchinson	Chaplaincy lighting upgrade	415	53	0.2	300	5.7
22	Business Technology Centre	Oswestry Room lighting upgrade	455	58	0.2	260	4.5
23	#REF!	Corridor lighting upgrade	20	3	0.0	20	7.9
24	Business Technology Centre	Meeting room lighting upgrade	67	9	0.0	80	9.4
25	Business Technology Centre	Disabled toilet lighting upgrade	14	2	0.0	20	11.2
26	Business Technology Centre	Visualization centre lighting upgrade	960	122	0.4	600	4.9
27	Business Technology Centre	Ground floor open plan office lighting upgrade	350	44	0.1	400	9.0
28	Darby	2nd Floor Meeting areas lighting upgrade	5,446	692	2.2	8,560	12.4
29	Darby	Circulation area lighting upgrade	3,728	473	1.5	2,140	4.5
30	Darby	Teaching area lighting upgrade	10,327	1,312	4.3	9,885	7.5

Telford Innovation Campus Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
31	Darby	Office area lighting upgrade	10,061	1,278	4.1	6,960	5.4
32	e-Innovation	Circulation lighting upgrade	6,130	779	2.5	5,190	6.7
33	e-Innovation	Toilet lighting upgrade	666	85	0.3	665	7.9
34	e-Innovation	Kitchenette lighting upgrade	49	6	0.0	105	16.9
35	e-Innovation	Meeting/common area lighting upgrade	1,250	159	0.5	660	4.2
36	e-Innovation	Reception area lighting upgrade	1,000	127	0.4	420	3.3
37	e-Innovation	Office area lighting upgrade	1,235	157	0.5	1,390	8.9
38	Priorslee Hall	Bar Area lighting upgrade	1,655	210	0.7	1,700	8.1
39	Priorslee Hall	Orchard room area lighting upgrade	1,123	143	0.5	1,500	10.5
40	Priorslee Hall	Main building circulation lighting upgrade	1,760	224	0.7	1,500	6.7
41	Priorslee Hall	Main building toilet lighting upgrade	225	29	0.1	265	9.3
42	Priorslee Hall	Main building office lighting upgrade	4,878	620	2.0	3,050	4.9
43	Priorslee Hall	Main building teaching room lighting upgrade	1,400	178	0.6	1,330	7.5
44	Priorslee Hall	Kitchen lighting upgrade	1,490	189	0.6	1,110	5.9
45	Whole Site	Exterior Lighting upgrade	13,770	1,749	5.7	9,700	5.5
46	Whole Site	Photovoltaic panel installations	63,432	8,056	26.1	122,400	15.2
47	Whole Site	CHP Fuel Cell Installation	-460,943	55,384	83.8	260,000	4.7
48	Whole Site	BEMS Savings opportunities	441,821	18,248	91.1	5,000	0.3
		TOTALS	**825,475**	**121,793**	**381**	**803,955**	**6.6**

Walsall Campus Energy Saving projects

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
1	Walsall Residence Blocks	Corridor lighting upgrade	15,376	1,953	6.3	7,830	4.0
2	Walsall Residence Blocks	Bedroom lighting upgrade	13,077	1,661	5.4	12,950	7.8
3	Walsall Residence Blocks	Kitchen lighting upgrade	2,146	273	0.9	990	3.6
4	Walsall Residence Blocks	Bathroom lighting upgrade	4,540	577	1.9	12,095	21.0
5	Walsall Residence Blocks	Laundry lighting upgrade	175	22	0.1	180	8.1
6	Walsall Residence Blocks	External lighting replacement	1,662	211	0.7	1,000	4.7
7	Walsall Residence Blocks	Accommodation Services office lighting upgrade	350	11	0.1	660	58.0
8	Walsall Residence Blocks	New Heating Boilers + Infrastructure	100,000	3,250	18.5	50,000	15.4
9	Walsall Residence Blocks	Boiler room insulation	16,732	544	3.1	1,110	2.0
12	William Penny Brooks	Pool changing area heating upgrade	6,912	878	2.8	5,000	5.7
13	William Penny Brooks	Pool water circulation VSD	10,000	1,270	4.1	2,000	1.6
14	Jerome K Jerome	Circulation area lighting upgrades	5,027	638	2.1	2,665	4.2
15	Jerome K Jerome	Office area lighting upgrades	9,417	1,196	3.9	7,281	6.1
14	Jerome K Jerome	Blend Centre lighting upgrade	911	116	0.4	2,420	20.9
15	Jerome K Jerome	Boardroom lighting upgrade	164	21	0.1	480	23.0

Walsall Campus Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
16	Jerome K Jerome	Ground floor Toilet lighting upgrade	216	27	0.1	360	13.1
17	Jerome K Jerome	Kitchen lighting upgrade	4,183	531	1.7	3,590	6.8
18	Jerome K Jerome	Second flr store rooms/unused offices lighting upgrade	534	68	0.2	1,680	24.8
19	Jerome K Jerome	Second flr store rooms/unused offices lighting upgrade	450	57	0.2	313	5.5
20	Jerome K Jerome	Staff common room lighting	2,862	363	1.2	4,050	11.1
21	Faith Centre	Teaching area lighting upgrade	761	97	0.3	1,199	12.4
22	Institute of Education	Lighting upgrades	222	28	0.1	325	11.5
23	Institute of Education	External Lighting replacement	546	69	0.2	400	5.8
24	Institute of Education	Office lighting upgrade	4,543	577	1.9	3,948	6.8
25	Performance Hub	Canopy and porch lighting upgrade	660	84	0.3	360	4.3
26	Samuel Johnson	Entrance lobby lighting upgrade	852	108	0.4	220	2.0
27	Samuel Johnson	Corridor lighting upgrade	9,488	1,205	3.9	3,300	2.7
28	Samuel Johnson	Toilet lighting upgrade	936	119	0.4	1,300	10.9
29	Samuel Johnson	Faculty admin dept lighting upgrade	5,096	647	2.1	3,625	5.6
30	Samuel Johnson	Deanery Lighting upgrade	1,971	250	0.8	1,575	6.3

Walsall Campus Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
31	Samuel Johnson	Teaching room lighting upgrade	8,156	1,036	3.4	7,965	7.7
32	Samuel Johnson	Lecture Theatre lighting upgrade	3,570	453	1.5	4,020	8.9
33	Samuel Johnson	Cafe lighting upgrade	1,859	236	0.8	1,485	6.3
34	Sister Dora	Circulation area lighting upgrades	152	19	0.1	175	9.1
35	Sister Dora	Teaching room lighting upgrade	2,260	287	0.9	4,200	14.6
36	Sister Dora	Office lighting upgrade	4,317	548	1.8	9,120	16.6
37	Sister Dora	Toilet lighting upgrade	527	67	0.2	400	6.0
38	Sports Centre	Circulation area lighting upgrades	6,576	835	2.7	3,132	3.8
39	Sports Centre	Changing area lighting upgrade	1,509	192	0.6	1,040	5.4
40	Sports Centre	Toilet lighting upgrade	493	63	0.2	350	5.6
41	Student Union	Bar office/kitchen lighting upgrade	279	35	0.1	125	3.5
42	Student Union	Toilet lighting upgrade	149	19	0.1	100	5.3
43	Student Union	Circulation area lighting upgrades	434	55	0.2	660	12.0
44	Student Union	Meeting room lighting upgrade	294	37	0.1	140	3.7
45	William Penny Brooks	Pool changing area lighting upgrade	144	18	0.1	600	32.8

Walsall Campus Projects continued

Ref No.	Location	Opportunity Title	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO_2e/yr	Capital Cost £	Payback Period yrs
46	William Penny Brooks	Pool office lighting upgrade	70	9	0.0	90	10.1
47	William Penny Brooks	Toilet lighting upgrade	81	10	0.0	180	17.5
48	William Penny Brooks	Performance lab lighting upgrade	4,234	538	1.7	3,600	6.7
49	William Penny Brooks	Performance lab changing lighting upgrade	390	50	0.2	720	14.5
50	British Judo	Main Hall lighting upgrade	2,842	361	1.2	2,970	8.2
51	British Judo	Main office lighting upgrade	1,022	130	0.4	385	3.0
52	British Judo	Medical Room lighting upgrade	324	41	0.1	220	5.3
53	British Judo	Meeting room lighting upgrade	648	82	0.3	440	5.3
54	British Judo	Gymnasium lighting upgrade	624	79	0.3	720	9.1
55	British Judo	Gymnasium office lighting upgrade	94	12	0.0	96	8.0
56	British Judo	Gymnasium store lighting	141	18	0.1	144	8.0
57	Whole Site	Exterior Lighting upgrade upgrade	15,095	1,917	6.2	11,000	5.7
58	Whole Site	Photovoltaic panel installations	45,000	5,715	18.5	65,000	11.4
59	Whole Site	BEMS Savings opportunities	843,603	31,313	165.4	21,958	0.7
		TOTALS	**1,164,696**	**61,028**	**271**	**273,941**	**4.5**

Appendix B: CMP Technical Support Data

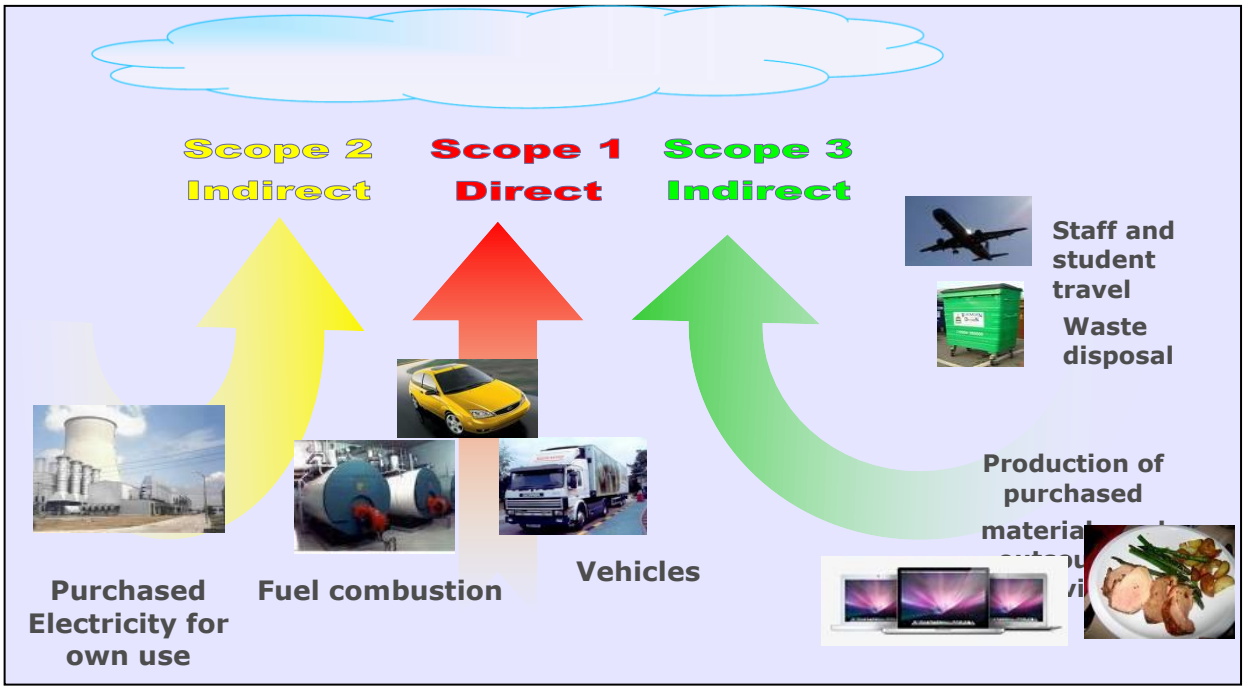
Support data is provided in the comprehensive energy survey reviews of the four campuses. These are held by the University Energy Manager.

The data includes comprehensive analysis of annual energy use at each campus and an audit of energy using areas plus an excel based tracking tool to monitor the progress on the implementation of the projects highlighted in Appendix A.

Appendix C - Emissions Scope

The World Resource Institute developed a classification of emission sources around three 'scopes':

- **Scope 1:** emissions are direct emissions that occur from sources owned or controlled by the organisation, for example emissions from combustion in owned or controlled boilers/furnaces/vehicles
- **Scope 2:** accounts for emissions from the generation of purchased electricity consumed by the organisation
- **Scope 3:** covers all other indirect emissions which are a consequence of the activities of the organisation, but occur from sources not owned or controlled by the organisation – for example, commuting and procurement



Appendix D – Review of implemented and on –going projects

The original 2010 CMP project list included 34 measures requiring investment of approximately £2.8 million excluding VAT with a projection of £3.5 million revenue savings on a business as usual basis (an overall return of 1 year). Without the programme of energy reduction projects the energy expenditure will have risen to a projected £4.5.

The comprehensive list of projects implemented is highlighted in the 2010 CMP, The list of projects also includes many items that were outside the original scope of the CMP. The list of projects is held in a separate file by the University Energy Manager.

Appendix E 2016/17 Energy and Carbon use baseline for savings

City Campus Molineux					
Resource	Consumption Unit/yr	Cost £/yr	% of Total Cost	Carbon Emissions tCO2e/yr	% of Total Carbon
Electricity	3,579,574	452,822	59.9	1,476	48.0%
Natural Gas	8,655,033	302,737	40.1	1,601	52.0%
TOTALS	12,234,607	755,559	100.0	3,073	100.0%

City campus Wulfruna					
Resource	Consumption Unit/yr	Cost £/yr	% of Total Cost	Carbon Emissions tCO2e/yr	% of Total Carbon
Electricity	2,058,995	296,057	30.1	848	18.5%
Natural Gas	20,239,389	686,744	69.9	3,743	81.5%
TOTALS	22,298,384	982,801	100.0	4,592	100.0%

Telford Innovations campus					
Resource	Consumption Unit/yr	Cost £/yr	% of Total Cost	Carbon Emissions tCO2e/yr	% of Total Carbon
Electricity	1,646,127	172,479	60.8	678	47.8%
Natural Gas	4,006,678	111,180	39.2	741	52.2%
TOTALS	5,652,805	283,659	100.0	1,419	100.0%

Walsall campus					
Resource	Consumption Unit/yr	Cost £/yr	% of Total Cost	Carbon Emissions tCO2e/yr	% of Total Carbon
Electricity	1,649,086	214,162	47.7	679	28.8%
Natural Gas	8,023,760	208,654	46.5	1,484	63.0%
Fuel Oil	701,238	26,064	5.8	193	8.2%
TOTALS	10,374,084	448,880	100.0	2,357	100.0%

Total all sites					
Resource	Consumption Unit/yr	Cost £/yr	% of Total Cost	Carbon Emissions tCO2e/yr	% of Total Carbon
Electricity	8,933,782	1,135,520	46.0	3,681	32.2
Natural Gas	40,924,860	1,309,315	53.0	7,569	66.1
Fuel Oil	701,238	26,064	1.1	193	1.7
TOTALS	50,559,880	2,470,899	100.0	11,444	100.0

Appendix F 2017/23 Energy and Carbon Project Savings per Campus

City campus Molineux								
Energy	**Energy Saving kWh/yr**	**Cost Saving £/yr**	**Carbon Saving tCO2e/yr**	**Capital Cost £**	**Payback Period yrs**	**% of City North Site Utility Cost**	**% of City North site energy kWh**	**% of City North site carbon**
Measures with payback period under 1 year	946,446	38,409	193.4	19,153	0.50	5.08%	7.74%	6.29%
Longer payback measures	676,023	50,912	296.7	506,582	9.95	6.74%	5.53%	9.64%
TOTALS	1,622,469	89,321	490.1	525,735	5.89	11.82%	13.26%	15.93%

Cith campus Wulfruna								
Energy	**Energy Saving kWh/yr**	**Cost Saving £/yr**	**Carbon Saving tCO2e/yr**	**Capital Cost £**	**Payback Period yrs**	**% of City South site Total Energy Cost**	**% of City South site energy kWh**	**% of City South site carbon**
Measures with payback period under 1 year	2,075,414	72,315	395.6	63,518	0.88	7.36%	9.31%	8.61%
Longer payback measures	236,940	24,413	177.7	153,827	6.30	2.48%	1.06%	3.87%
TOTALS	2,312,354	96,728	573.3	217,345	2.25	9.84%	10.37%	12.48%

Telford Innovation campus								
Energy	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO2e/yr	Capital Cost £	Payback Period yrs	% of Telford Site Total Energy Cost	% of Telford site energy kWh	% of Telford site carbon
Measures with payback period under 1 year	441,821	18,248	91.1	5,000	0.27	6.43%	7.82%	6.42%
Longer payback measures	383,654	103,545	289.8	798,955	7.72	36.50%	6.79%	20.42%
TOTALS	825,475	121,793	380.9	803,955	6.60	42.94%	14.60%	26.83%

Walsall campus								
Energy	Energy Saving kWh/yr	Cost Saving £/yr	Carbon Saving tCO2e/yr	Capital Cost £	Payback Period yrs	% of Walsall Site Total Energy Cost	% of Walsall site energy kWh	% of Walsall site carbon
Measures with payback period under 1 year	843,603	31,313	165.4	21,958	0.7	7.0%	8.13%	7.02%
Longer payback measures	400,713	32,302	120.4	284,978	8.8	7.2%	3.86%	5.11%
TOTALS	**1,244,316**	**63,615**	**285.9**	**306,936**	**4.8**	**14.2%**	11.99%	12.13%