Carbon Management Plan

2016 - 2021

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Introduction

The University of Aberdeen is committed to the management of its environmental impacts and acknowledges the important role it can play in contributing to carbon emissions reduction efforts locally, nationally and internationally.

As such, this Carbon Management Plan (CMP) has been developed to enable the University to meet a carbon dioxide emissions reduction target of 4% year on year for the next five years.

To facilitate the achievement of that target, a comprehensive CMP Project Register has been compiled. It provides the University with a selection of carbon saving projects that have the potential to significantly reduce CO_2 emissions and, if implemented in full, to exceed the reduction target. These projects are centred on:

- Maximising the energy efficiency of existing equipment and plant;
- Small scale renewable energy systems;
- Improving building energy efficiency (e.g. installing wall and loft insulation);
- Optimising building management controls.

In total, the project list envisages investment of more than £4.5 million over 5 years to implement all of the projects. While several of the projects are funded or form part of existing budget commitments, not all are. Projects assessed as being likely or very likely to proceed within proposed budgets have the potential to deliver two thirds of the projected savings. One major project (a localised combined heat and power project) has the potential to deliver in excess of half the total reduction. It will, however, require a separate business case to be made and approved for the projected capital spend, with further infrastructure costs likely on top of the cost of the new CHP engine.

The listed projects have the potential to produce significant reductions in CO_2 emissions and financial savings. It is estimated that, in total, the projects have the potential to reduce emissions by over 8,500 tonnes and to result in financial savings of nearly £1.75m by the end of 2021.

An annual report will be produced to monitor and report on the progress of the plan and to provide an update on the project register (including identifying any projects undertaken that were not included in the register). This will be included as part of the University's annual Energy and Utilities Report.

Carbon Management Plan 2009/14

Target

In 2009, the University of Aberdeen produced its first Carbon Management Plan in collaboration with the Carbon Trust. The main target of the CMP was to reduce CO_2 and equivalent emissions by 20% over a five year period.

Status of Projects

The 2009/14 Carbon Management Plan contained 70 projects intended to help reduce the University's carbon emissions. The plan estimated that the implementation of all these projects would achieve 117% of the emissions reduction target.

By 2016, 53% of the projects had been completed with 6% still ongoing. Of the incomplete projects, a variety of factors had led to them not being taken forward, most notably budgetary constraints.

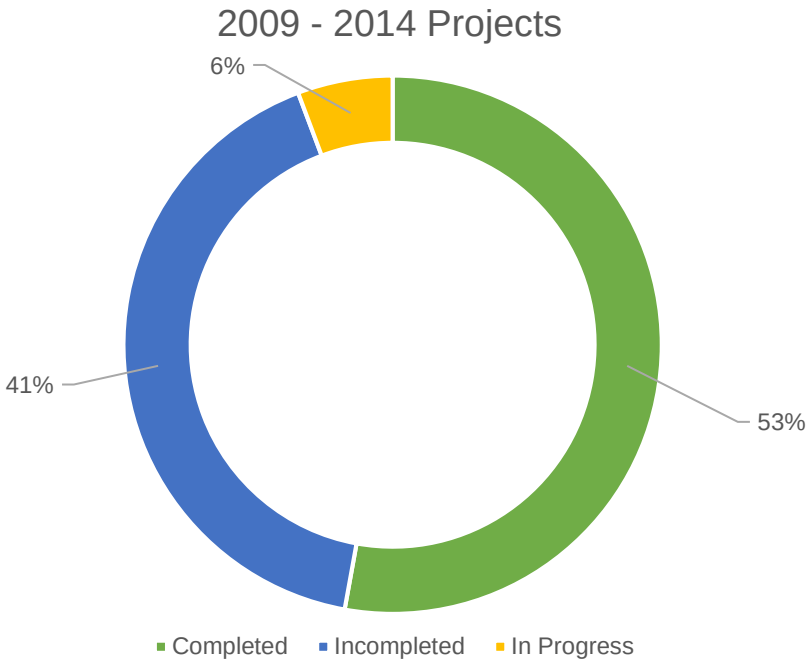


Figure 1: Ratio of complete, incomplete and ongoing projects

CO_2 Emissions Levels

Figure 2 presents the emissions targets for 2009/14, the predicted emissions and the actual emissions for the period.

After the implementation of the 2009/14 projects, the CO_2 emissions were expected to fall below the emission targets. However, despite the successful implementation of a range of projects, overall emissions levels ended up increasing slightly, with 2013/14 levels 608 tonnes greater than those in 2008/09.

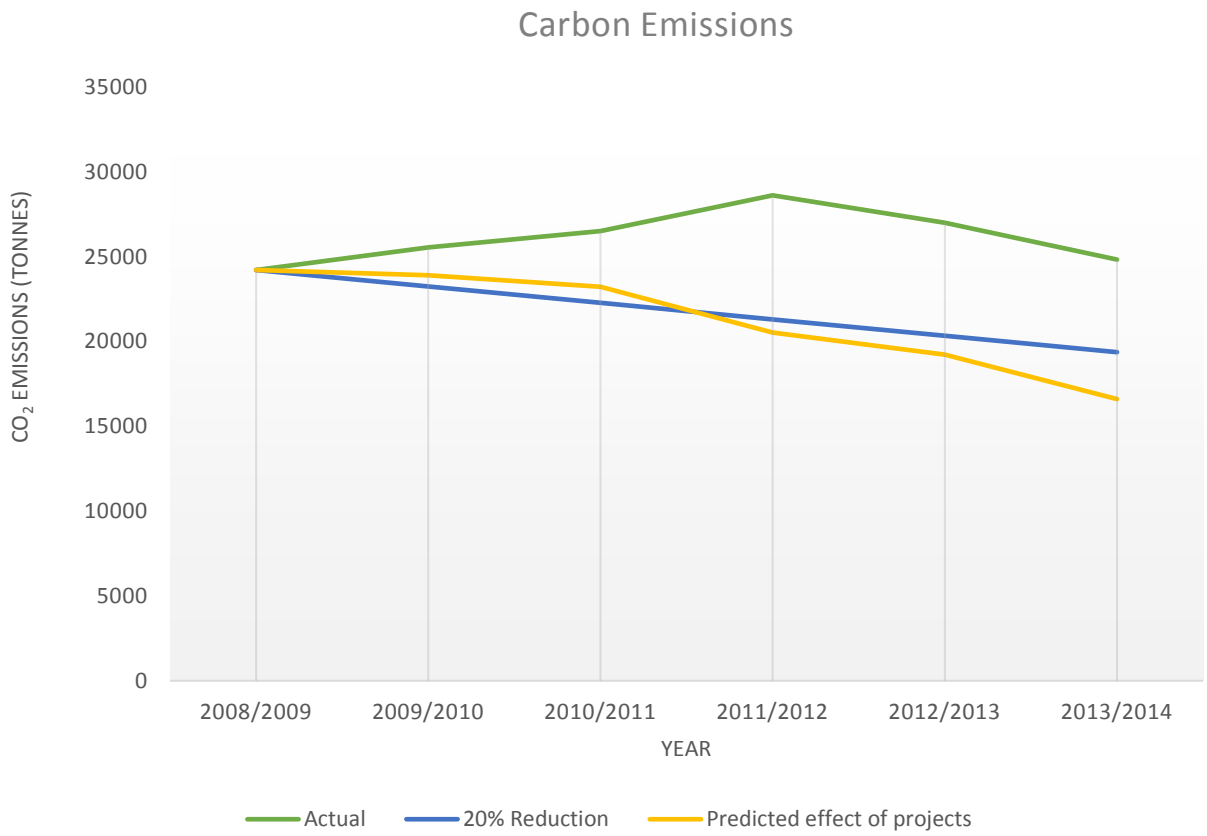


Figure 2: This graph presents the emissions levels from the 2009/14 Carbon Management Plan.

This rise in emissions levels can be largely attributed to a substantial increase in the campus size of some 40,481 m^2 (or 18%) during the 5 year period. In particular, the spike in emissions noted in 2011/12 coincides with the opening of the University's new Sir Duncan Rice Library.

Thus, despite a substantial increase in the size of the University's estate, over the course of the previous Carbon Management Plan, emissions remained roughly the same as they had been during the baseline year.

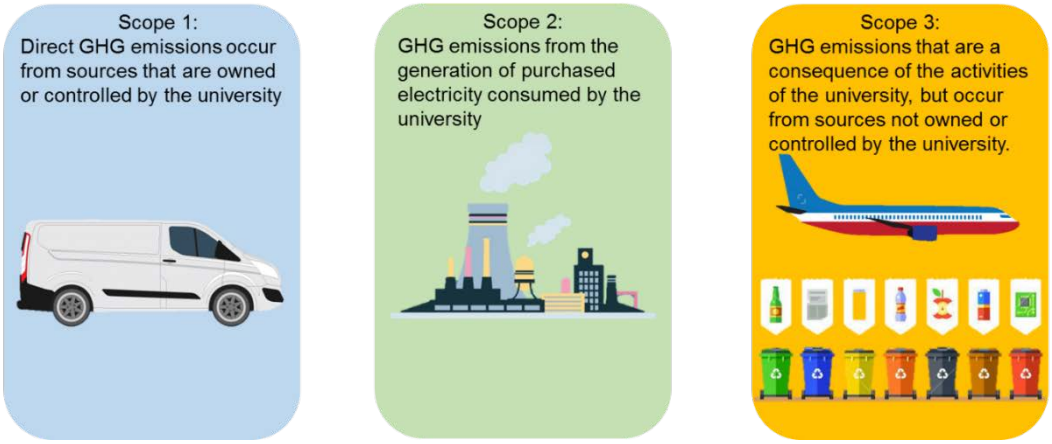
Emissions Baseline and Scope for 2016/21

Baseline

The baseline year for the new Carbon Management Plan will be 2015/16. This coincides with the University's first compulsory submission as part of the Scottish Public Bodies Duties Climate Change reporting mechanism. The total emissions for the baseline year were 31,522 tonnes CO2, broken down by scope as shown in Figure 3. The full breakdown of emissions for 2015/16 is included at Appendix 1.

Scopes

The Scottish Public Bodies Duties Climate Change report uses the three widely accepted emissions scopes taken from the Greenhouse Gas Protocol. This outlines three main types of emission sources which can be categorised as:



Emissions

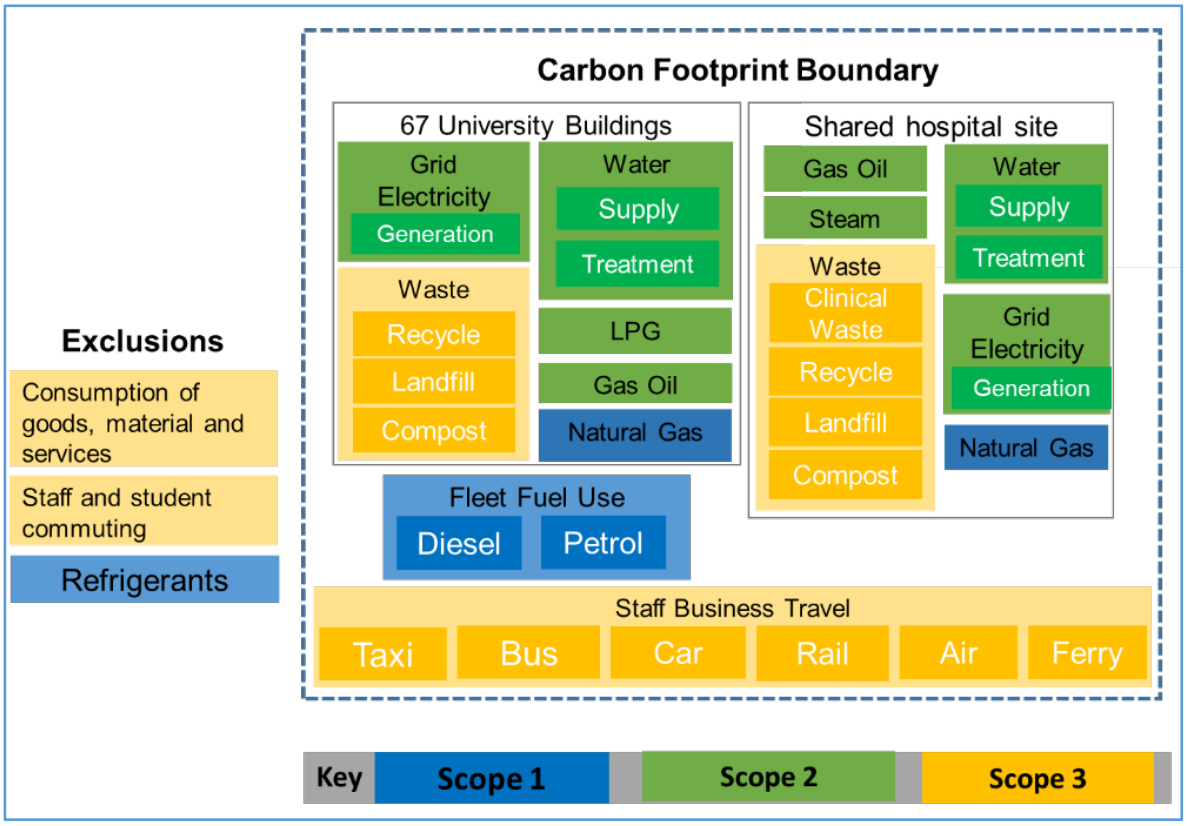
Using these scopes, the University's emission sources for 2015/16 can be categorised as follows:

Figure 3: CO_2 emissions for each scope

Scope Boundaries

Scope 2 emissions (including electricity use) for the baseline year form a significant part of the total, with Natural Gas consumption in our main Combined Heat and Power station responsible for the bulk of our Scope 1 emissions.

The graphic below indicates the emissions included within scope as part of our baseline year reporting:



The nature of the projects identified mean that the majority of our emissions reductions efforts will be linked to tackling emissions from Scope 2 sources.

Carbon Management Projects

To enable the University to reduce its CO_2 emissions levels, a list of potential projects has been compiled. The majority of these projects focus on Scope 2 emissions with a smaller number focusing on Scopes 1 and 3.

The full list of emissions reduction projects is at Appendix 2.

Results of the Carbon Management Plan

Predicted Carbon Emissions

If completed in full, the project list has the potential[1] to reduce annual carbon emissions by 8,568 tonnes by 2021. This level of emissions reduction is equal to a 27.2% reduction on total emissions and would exceed the 20% target by over 2,250 tonnes.

	Baseline (tonnes)	Project Register Impact (tonnes)	% Reduction
Scope 1	13,095	11,090	15
Scope 2	12,468	6,147	51
Scope 3	5,958	5,716	4

Figure 4: Predicted scope emissions levels after projects

The majority of the projects are focused on reducing Scope 2 emissions (principally reducing grid electricity use) and have the potential to result in a decrease of 6,321tonnes of CO2 (or 51%) in this category alone.

There are a number of projects aimed at reducing Scope 1 and 3 emissions. These would result in a reduction in Scope 3 emissions by 242 tonnes (4.1%) and Scope 1 emissions by 2,005 tonnes (15.3%).

Prioritisation of Projects

With a wide range of projects and an even wider range of associated costs, some projects will have to be prioritised over others. Some projects may not be funded, others will be deemed too complex to take forward, while others may deliver insufficient emissions reductions to justify.

An exercise to prioritise the projects was undertaken, with each project scored against three criteria: cost, complexity and projected carbon impact. That exercise resulted in a project prioritisation matrix that will assist us in focussing on the projects that can do the most to reduce emissions at the lowest cost and complexity.

When projects that are deemed **likely** or **very likely** within the CMP period are taken alongside projects already **committed** or for which funding has been made available, indications are that 66% of the necessary emissions reductions are possible from these three categories alone. These projects have a projected cost of some £1.3m.

One further major project, with the potential to deliver over 56% of the total emissions reduction target but at an estimated cost of £2m, will require a stand-alone business case to be made.

[1] The projected savings assume that the University estate does not grow and that there is no energy intensity change.

Figure 5 provides detail of the outcomes of the project prioritisation exercise, while Figure 6 gives an indication of the scale of each project category by cost, number and assessed impact on emissions reduction.

Status	Number	CO_2 Impact	Cost
Committed	19	32.27%	£526,895
Very Likely	12	19.07%	£123,548
Likely	30	17.79%	£643,744
Possible	11	5.83%	£277,448
Unlikely	7	3.86%	£555,570
Very Unlikely	6	0.86%	£445,000
Separate Business Case	1	56.21%	£2,000,000

Figure 5: Number of projects and projected CO_2 savings for each prioritisation level

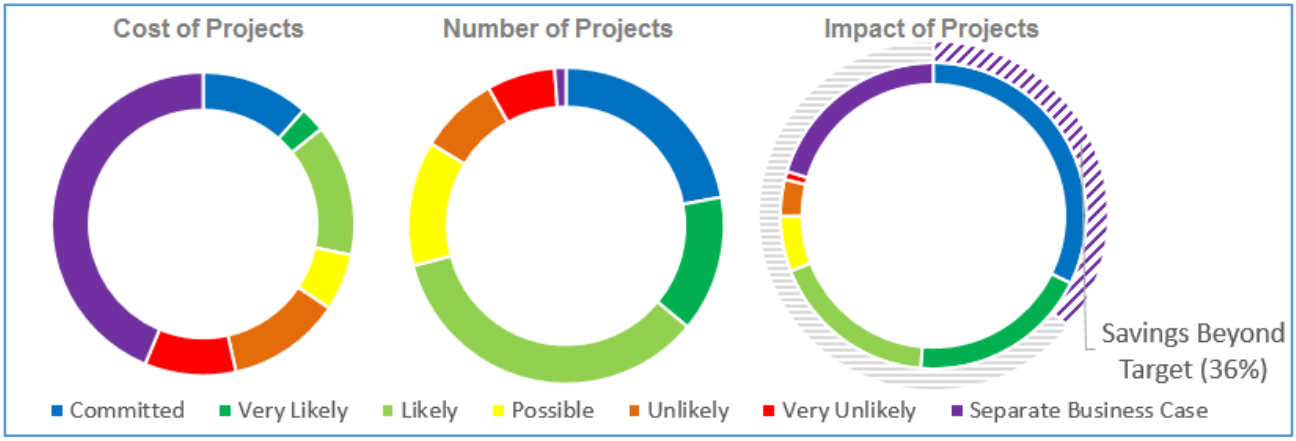


Figure 6: Cost, Number and Impact of Projects by Category

The prioritisation of the projects may change through the plan's timeframe as possible grants and funding becomes available.

Funding

To complete all of the emissions reductions projects identified would require over £4.5 million of capital investment over the course of the Plan. An annual Carbon Reduction budget of up to £250,000 has been identified to help fund energy efficiency projects, while some projects will be taken forward as embedded elements of programmed capital projects.

Additionally, it is proposed that where there is a shortfall in available funding the replacement of equipment or plant with more energy efficient alternatives, consideration will be given to funding the shortfall from within the Energy Manager's budget.

Yearly Reporting

The progress of the Carbon Management Plan will be documented each year in the University's annual Energy Report. Any changes to the CO_2 emission levels and energy consumption will be charted and compared.

Additionally, regular updating of the Carbon Management Plan and Project Register will take place as projects are started, completed or replaced.

Conclusions

The CMP Project Register has identified over 80 potential carbon reduction projects.

Collectively these projects have the potential to reduce CO_2 emissions by 8,568 tonnes by the end of 2021 which equates to a 27% reduction. We believe that around two thirds of the target can be achieved through projects that are likely or very likely to be completed. These projects should be possible within the level of funding already allocated to energy efficiency measures.

Lessons have been learned from the first Carbon Management Plan (2009/14), including the need for annual assessment of the CMP's progress. This will form part of an annual Energy and Utilities Report. The CMP Project Register will also be updated to reflect progress against each project with further projects added as they are identified.

Appendix 1. Full break down of baseline emissions

Emission source	Scope	Consumption data	Units	Emission factor	Units	Emissions (tCO2e)
Diesel	Scope 1	14,528	litres	2.676	kg CO2e/litre	39
Petrol	Scope 1	2,328	litres	2.197	kg CO2e/litre	5
Natural Gas	Scope 1	70,928,835	kWh	0.184	kg CO2e/kWh	13,051
Grid Electricity (generation)	Scope 2	20,321,521	kWh	0.449	kg CO2e/kWh	9,131
Gas oil	Scope 2	840,707	kWh	0.276	kg CO2e/kWh	232
LPG (kWh)	Scope 2	24,829	kWh	0.215	kg CO2e/kWh	5
Water - Supply	Scope 2	150,462	m3	0.344	kg CO2e/m3	52
Water - Treatment	Scope 2	144,561	m3	0.708	kg CO2e/m3	102
Purchased Heat and Steam	Scope 2	13,695,370	kWh	0.215	kg CO2e/kWh	2,945
Domestic flight (average passenger)	Scope 3	3,414,291	passenger km	0.279	kg CO2e/passenger km	951
Short-haul flights (average passenger)	Scope 3	6,529,128	passenger km	0.168	kg CO2e/passenger km	1,100
Long-haul flights (average passenger)	Scope 3	16,438,312	passenger km	0.192	kg CO2e/passenger km	3,150
Rail (National rail)	Scope 3	1,617,772	passenger km	0.049	kg CO2e/passenger km	79
Bus (local bus, not London)	Scope 3	226,748	passenger km	0.120	kg CO2e/passenger km	27
Business travel - car	Scope 3	1,301,516	passenger km	0.187	kg CO2e/passenger km	243
Ferry	Scope 3	49,208	passenger km	0.116	kg CO2e/passenger km	6
Taxi (regular)	Scope 3	187,743	passenger km	0.163	kg CO2e/passenger km	31
London Underground	Scope 3	19,767	passenger km	0.058	kg CO2e/passenger km	1
Diesel Claimed (Business Travel)	Scope 3	17,718	litres	2.612	kg CO2e/litre	46
Petrol Claimed (Business Travel)	Scope 3	31502	litres	2.197	kg CO2e/litre	69
Construction (Average) Recycling	Scope 3	26	tonnes	1.400	kg CO2e/litre	0
Refuse Municipal to Landfill	Scope 3	546	tonnes	421	kgCO2e/tonne	230
Organic Food & Drink Composting	Scope 3	37	tonnes	6	kgCO2e/tonne	0
Paper & Board (Mixed) Recycling	Scope 3	305	tonnes	21	kgCO2e/tonne	6
WEEE (Mixed) Recycling	Scope 3	7	tonnes	21	kgCO2e/tonne	0
Glass Recycling	Scope 3	1	tonnes	21	kgCO2e/tonne	0
Plastics (Average) Recycling	Scope 3	5	tonnes	21	kgCO2e/tonne	0
Metal Cans (Mixed) & Metal Scrap Recycling	Scope 3	29	tonnes	21	kgCO2e/tonne	1
Refuse Mun/Comm/Ind to Combustion	Scope 3	129	tonnes	21	kgCO2e/tonne	3
Clinical waste - orange stream	Scope 3	114	tonnes	114	kgCO2e/tonne	13
Organic Garden Waste Composting	Scope 3	139	tonnes	6	kg CO2e/tonne	1
Total						**31,520**

Appendix 2. CMP Projects - Prioritisation Matrix

Project Name	Project Description	Location	Capital Cost (£)	Complexity	Financial Saving (£)	Emissions Saving (etonnes)	% of target	Payback (years est.)	Priority
M&T Programme - Gas	Implementation of effective Monitoring & Targeting regime	Campus	25,000.00		79,795.02	506.28	8.03	0.31	10
M&T Programme - Electricity Imported	Implementation of effective Monitoring & Targeting regime	Campus	25,000.00		98,296.59	460.07	7.30	0.25	10
Maximise CHP Secondary Pumps Control	Fit a new sensor before the dump radiator valve to control the secondary pumps off the exact water temperature	CHP Station	1,500.00		49,437.09	313.66	4.98	0.03	10
Divert Landfill	Change Landfill to Energy from Waste	Campus			66,584.00	241.65	3.83	0.00	10
Connect PHE into District Main		Campus	12,106.00		33,494.36	212.51	3.37	0.36	10
William Guild Loft Insulation	Install loft insulation	William Guild	16,342.00		8,027.37	50.93	0.81	2.04	10
Hillhead Adam Smith Wall Insulation	Install cavity wall insulation	Hillhead	22,206.00		3,375.44	21.42	0.34	6.58	10
Macrobert Window Closers	Replace easily damaged window closers	Macrobert	100,000.00		2,392.50	15.18	0.24	41.80	10
Upgrade West Block AC and condensors	Upgrade West Block AC and condensors to energy efficient alternatives	West Block	22,207.04		3,022.94	14.15	0.22	7.35	10
Replacement of campus printers	Replace old printers	Campus			2594.64	10.32	0.16	0.00	10
Valve and Flange Insulation	Insulation of exposed pipes in boiler room	William Guild	2,251.20		659.63	8.37	0.13	3.41	10
Replace corridor lighting in Fife House	Replace existing corridor lighting in Fife House with LEDs	Hillhead	1,220.00		789.76	3.14	0.05	1.54	10
Upgrade Arts Lecture Theatre Lighting	Upgrade the Arts Lecture Theatre Lighting	William Guild	100,000.00		608.03	2.85	0.05	164.47	10
Meston Buildings Draught Proofing	Install Draught Proofing	Meston	65,123.00		22,185.81	140.76	2.23	2.94	10
8W Maintained Fittings	Upgrade the maintained fittings to 2W	Campus	6,000.00		2,405.27	11.26	0.18	2.49	10
University Office Wall Insulation	Install cavity wall insulation	University Office	20,000.00		2,576.42	16.35	0.26	7.76	10
William Guild - Upgrade Corridor Lighting	Upgrade corridor lighting	William Guild	100,000.00		493.41	2.31	0.04	202.67	10
University Office Lighting Upgrade	Upgrade lighting	University Office	6,000.00		489.89	2.29	0.04	12.25	10
Meston Corridor Lights	Replace existing ceiling and wall lighting	Meston	1,939.95		185.93	0.74	0.01	10.43	10
Building Supply Voltages	Reduce the lower transformer tappings on teaching and accommodation blocks to 220V	Campus	9,000.00		172,275.27	806.32	12.79	0.05	8
Johnston Lighting	Replace GLS bulbs	Johnston	21,297.00		22,328.06	104.50	1.66	0.95	8
Zoology Pumps VSD	Replace fixed speed pumps for variable speed	Zoology	16,800.00		18,255.07	85.44	1.36	0.92	8
Polwarth Building - Upgrade Corridor Lighting	Upgrade corridor lighting	Polwarth	20,000.00		14,978.40	70.11	1.11	1.34	8
Butchart hot water services	Resize domestic cylinder	Butchart	10,000.00		5,320.22	33.76	0.54	1.88	8
Zoology Shunt Pump	Resize pump	Zoology	15,000.00		5,870.59	27.48	0.44	2.56	8
St Mary's Draught Proofing	Install Draught Proofing	St Mary's	7,239.00		3,021.97	19.17	0.30	2.40	8
Upgrade Greenhouse Grow Lights	Replace grow lights with LEDs	Greenhouse	8,000.00		3,913.73	18.32	0.29	2.04	8
Upgrade Marischal Building Lighting	Replace old lighting	Marischal	4,677.32		2,386.39	11.17	0.18	1.96	8
Lecture Theatre Exit Lighting	Add additional light switches by exits in all lecture theatres	Campus	3,535.00		2,072.56	9.70	0.15	1.71	8
Upgrade KCCC Lighting	Upgrade the KCCC Auditorium Lighting	KCCC	5,000.00		1,933.15	9.05	0.14	2.59	8
Marischal VSD	Installation of speed drivers to existing pumps	Marischal	3,000.00		1,569.41	7.35	0.12	1.91	8
IMS - Upgrade Laboratory Lighting	Upgrade corridor lighting	IMS	150,000.00		61,440.00	287.56	4.56	2.44	7
Clean CHP Heat Exchanger	Cleaning out of the CHP Heat Exchanger	CHP Station			34,791.82	220.74	3.50	0.00	7
Installation of Reflectors to Radiators	Install reflectors behind all radiators	Campus	100,000.00		43,200.00	202.19	3.21	2.31	7
BMS Review of Control Strategies		Campus	50,000.00		17,400.00	110.40	1.75	2.87	7
Replace Security Lighting / Car Park Lighting	Upgrade Lighting	Campus	20,000.00		12,841.92	60.11	0.95	1.56	7
Biodiesel fleet	Use biodiesel in all fleet vehicles	Campus	8,000.00		21,040.80	38.88	0.62	0.38	7
Macrobert Lighting	Replace current lights with LEDs	Macrobert	137,025.00		8,919.94	41.75	0.66	15.36	7
Bedford Road Yard Insulation	Insulation of buildings	Bedford Road Yard	40,000.00		8,272.51	38.72	0.61	4.84	7
External Lighting Control	Dawn/Dusk Controls	Campus	10,000.00		4,935.68	23.10	0.37	2.03	7
Edward Wright Lighting (Excluding LG Floor)	Replace current lights with LEDs	Edward Wright	22,140.00		2,750.40	12.87	0.20	8.05	7
Regent Building Wall Insulation	Install cavity wall insulation	Regent Building	10,000.00		1,791.10	11.36	0.18	5.58	7
Keith Park Football Pitch Light	Replace current metal halide lamps with LEDs	Keith Park	12,000.00		2,180.82	10.21	0.16	5.50	7
Keith Park Hockey Pitch Light	Replace current metal halide lamps with LEDs	Keith Park	12,000.00		2,180.82	10.21	0.16	5.50	7
Elphinstone Hall Lighting	Replace current lights with LEDs	Elphinstone	11,999.76		1,555.20	7.28	0.12	7.72	7
Meston CT Pumps	Replace old pumps	Meston	20,000.00		1,499.23	7.02	0.11	13.34	7
Powis Gate Draught Proofing	Install Draught Proofing	Powis Gate	3,403.00		833.81	5.29	0.08	4.08	7
Linklater Candles	Replace current lights with LEDs	Campus	1,500.00		952.47	4.46	0.07	1.57	7
23 St Machar Lighting	Replace GLS bulbs	23 St Machar	918.00		918.76	4.30	0.07	1.00	7
New Kings Draught Stripping	Reseal old windows using Quattroseal	New Kings	3,278.00		614.67	3.90	0.06	5.33	7
New Kings CT Pump	Install VSD pumps	New Kings	5,500.00		785.28	3.68	0.06	7.00	7
25 High Street Draught Proofing	Install Draught Proofing	25 High Street	3,474.00		447.38	2.84	0.05	7.77	7
Chaplaincy Loft Insulation	Insulation the Chaplaincy loft	Chaplaincy	5,000.00		416.79	2.64	0.04	12.00	7
Draught Proof Chaplaincy Windows and Doors	Draught proof all the windows and doors	Chaplaincy	3,000.00		387.03	2.46	0.04	7.75	7
Old Townhouse Draught Proofing	Install Draught Proofing	Old Townhouse	2,163.00		328.14	2.46	0.04	6.59	7
Humanity Manse Draught Proofing	Install Draught Proofing	Humanity Manse	2,888.00		302.50	1.92	0.03	9.55	7
46 - 48 College Bounds Draught Proofing	Install Draught Proofing	College Bounds	3,245.00		300.73	1.91	0.03	10.79	7
5 Dunbar Street Draught Proofing	Install Draught Proofing	5 Dunbar Street	2,010.00		242.03	1.54	0.02	8.30	7
University Office Corridor Lighting Control	Installation of automatic lighting controls	University Office	2,200.00		299.13	1.40	0.02	7.35	7
IMS Lighting	Remove unnecessary atrium spotlights	IMS	500.00		106.83	0.50	0.01	4.68	7
Green Waste	Campus wide green waste collections	Campus	1,500.00		1,728.00	0.10	0.00	0.87	7
Public Area Lighting	Replace existing lighting with LEDs	Campus	100,000.00		43,068.82	201.58	3.20	2.32	6
Kings internal wall insulation	Insulate internal Walls	Kings College	17,120.00		6,786.91	43.06	0.68	2.52	6
Hillhead Wavell House Wall Insulation	Install cavity wall insulation	Hillhead	27,084.00		4,116.93	26.12	0.41	6.58	6
Hillhead South House Wall Insulation	Install cavity wall insulation	Hillhead	23,904.00		3,633.55	23.05	0.37	6.58	6
Hillhead Fyfe House Wall Insulation	Install cavity wall insulation	Hillhead	22,206.00		3,375.44	21.42	0.34	6.58	6
Hillhead North Court Wall Insulation	Install cavity wall insulation	Hillhead	20,934.00		3,182.09	20.19	0.32	6.58	6
IMS Freezers	Replace 10 of the oldest freezers	IMS	50,000.00		5,586.90	19.31	0.31	8.95	6
110 High Street Heating	Replace electric heating with gas fired boiler / radiators	110 High Street	10,000.00		1,634.69	7.65	0.12	6.12	6
University Office External Lighting	Replace current external lighting with LEDs	University Office	5,000.00		908.54	4.25	0.07	5.50	6
Hillhead North Laundry Wall Insulation	Install cavity wall insulation	Hillhead	600.00		91.20	0.58	0.01	6.58	6
Hillhead South Laundry Wall Insulation	Install cavity wall insulation	Hillhead	600.00		91.20	0.58	0.01	6.58	6
Hillhead New Carnegie External Wall Insulation	Install external wall insulation	Hillhead	194,970.00		11,854.64	75.21	1.19	16.45	5
23 St Machar CHP	Connect building to CHP	23 St Machar	100,000.00		13,938.14	59.61	0.95	7.17	5
Kings College Lighting Upgrade	Upgrade existing lighting	Kings College	50,000.00		8,732.91	40.87	0.65	5.73	5
Kings College Loft Insulation	Install loft insulation	Kings College	33,600.00		4,524.61	28.71	0.46	7.43	5
46/48 College Bounds Heating	Replace electric heating with gas fired boiler / radiators	College Bounds	26,000.00		4,666.46	21.84	0.35	5.57	5
DPCV Valves Across Kings	Fit DPCV valves in each heat centre	Campus	150,000.00		2,610.00	16.56	0.26	57.47	5
Street Lighting	Replace current lights with LEDs	Old Aberdeen	1,000.00		176.60	0.83	0.01	5.66	5
Building Integrated PV	Install PV panels	Kings College	200,000.00		3,840.00	17.97	0.29	52.08	4
Meston Cold Water Pumps	Change the current cold water system to a pressurised system with no return to the water tank	Meston	50,000.00		2,663.04	12.46	0.20	18.78	4
William Guild - Installation of PV Panels	Install PV panels	William Guild	55,000.00		2,304.00	10.78	0.17	23.87	4
Polwarth Building Auditorium Lighting Upgrade	Upgrade Auditorium Lighting	Polwarth	100,000.00		1,654.85	7.75	0.12	60.43	4
Installation of Communal Water Boilers	Replace kettles with communal water boilers	Campus	10,000.00		172.27	0.81	0.01	58.05	4
Dry lining Chaplaincy Walls	Dry line the Chaplaincy walls	Chaplaincy	30,000.00		744.29	4.72	0.07	40.31	3
Hillhead CHP	Install a CHP station at Hillhead	Hillhead	2,000,000.00		757,051.20	3543.32	56.21	2.64	0
Total			4,572,205		1,752,212	8,568	135.91		