2017 – 2018 Energy Report

PERIOD AUGUST 2017 TO JULY 2018

Contents

Executive Summary

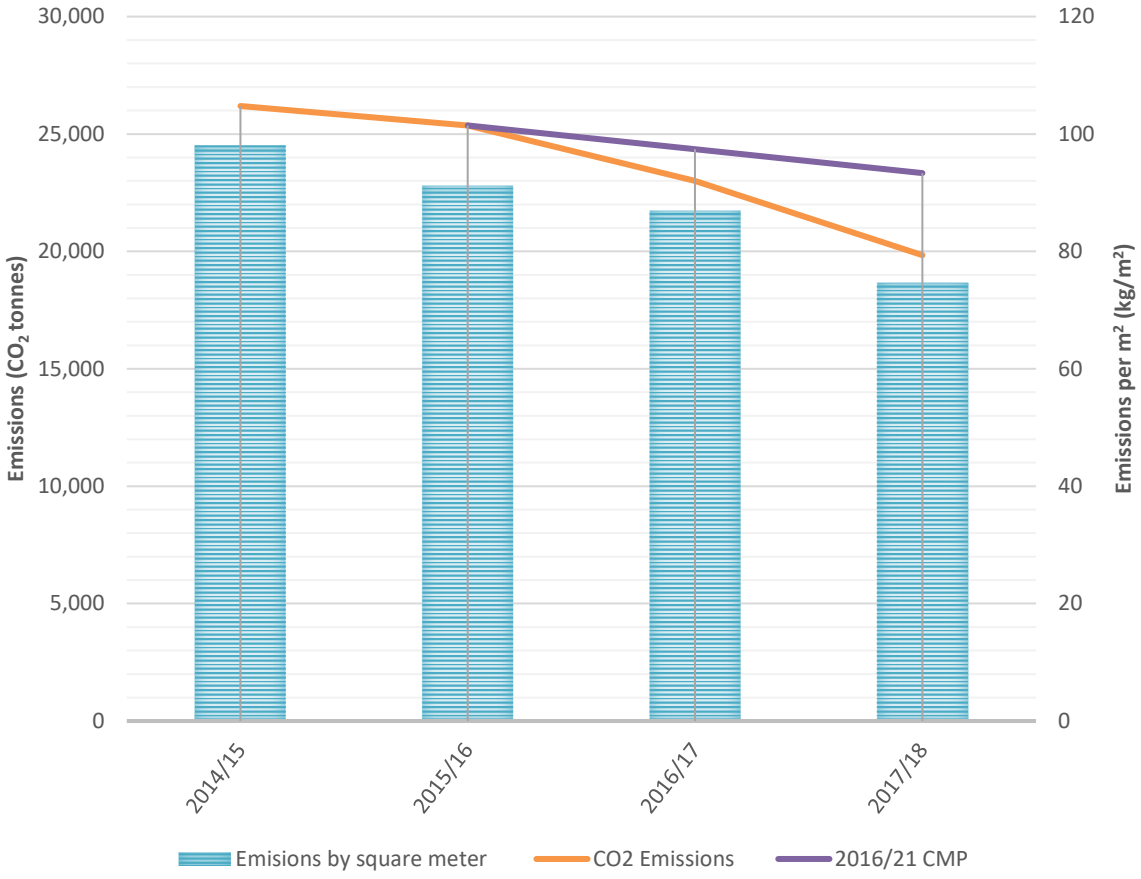
During academic year 2017/2018, the University purchased 95,683,202 kWh of energy for use across its residential and non-residential buildings at a cost of £3,723,698. This energy use resulted in 19,840 tonnes of CO_2 being emitted.

Once the consumption and cost of the University's water usage (231,111 m^3 and £582,997 respectively) is taken into account, the overall cost of this year's utilities was £4,306,695 (including VAT).

Overall, there was a decrease of 8.1% in energy consumption at the University compared to 2016/17 and a decrease of 13.8% or 3,165 tonnes in CO_2 equivalent emissions.

During this reporting period, 39 energy saving projects were carried out from the Carbon Management Plan (2016/21) Project Register. These projects resulted in estimated savings of 468 tonnes of emissions which equates to a 1.48% reduction from the baseline year.

A reduction of 2.86% in natural gas consumption was achieved despite a significant increase in heating days.



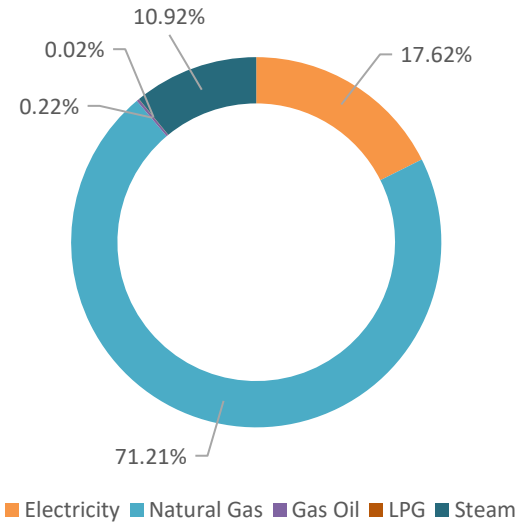
Energy Consumed in 2017/2018

In 2017/18, the University consumed 95,683MWh of energy at a cost of £3.72 million. Overall, the energy consumption has decreased by 8.07% but the cost of this energy increased by 9.37% from the previous year.

Table 1: Energy Consumption

Energy	Consumption (kWh)	Cost (£)
Grid Electricity	16,863,082	£1,844,367.45
Gas	68,139,028	£1,332,059.88
Gas Oil	210,608	£10,357.46
LPG	23,246	£995.80
Steam	10,447,237	£535,917.06
Total	**95,683,202**	**£3,723,697.64**

Figure 1: Energy Proportions



The University has a natural gas powered Combined Heat and Power (CHP) engine which generates electricity for the Old Aberdeen campus. The heat from the exhaust gases are also captured and used to provide heating to the campus. For more information about the generated electricity and heat, please see p17.

Grid Electricity

The grid electricity consumption for 2017/18 decreased by 1,154,766 kWh or 6.41% from last year. This reflects a large number of lighting projects, technology and controls upgrades, and general increased energy awareness engagement across the University.

Natural Gas

Natural gas consumption has decreased by 2,007,072 kWh or 2.86% despite 2017/18 having a colder and longer winter than 2016/2017. This reduction is in part due to the natural gas powered CHP engine being offline for longer periods time this year (e.g. for maintenance) something that is typical of ageing installations.

LPG and Gas Oil

The amount of LPG and Gas Oil supplied to a small number of outlying University sites increased by 8.9% and 4.6% respectively. This is in line with expectations given the significantly longer and colder winter than the previous year.

Steam

Steam consumption at the Foresterhill Campus shows a decreased of 11.9% from last year. This is largely due to an error being found in the consumption calculation for the IMS building. Actual meter reads for the site are now being be used.

The large difference between actual metered consumption and calculated consumption suggests there may be a leak in the system and efforts to identify that are being made.

Carbon Dioxide Emissions

Breakdown of Emissions

Our carbon dioxide emissions from energy use for 2017/18 are outlined in the table below.

Table 2: Carbon Dioxide Emissions

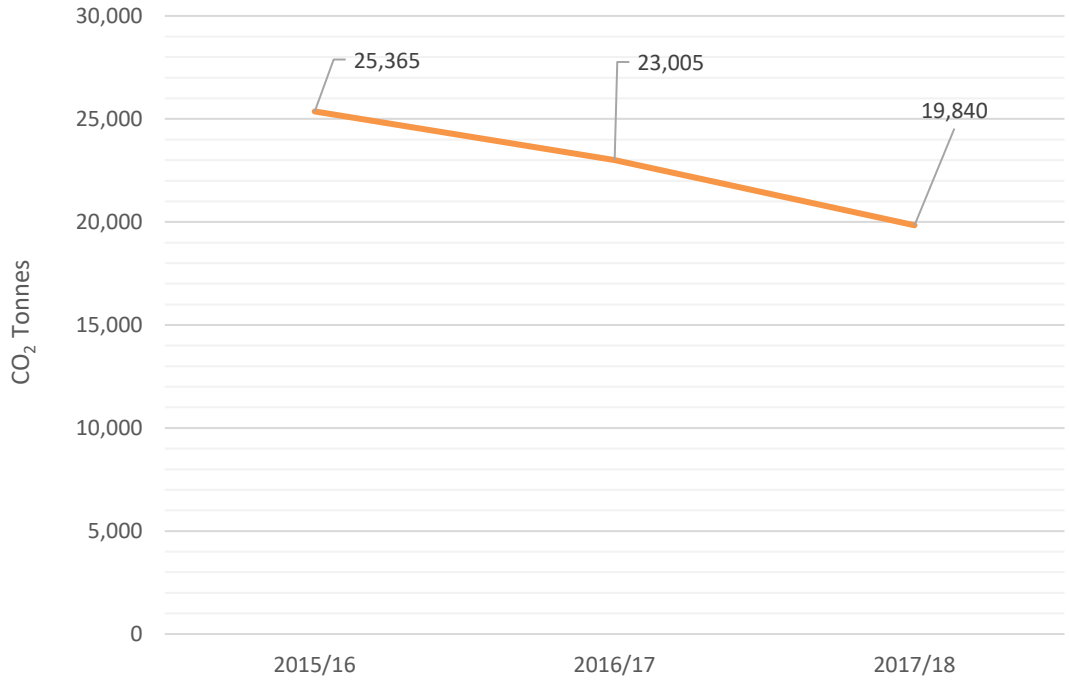
Energy	Consumption (kWh)	Emissions Factor ($kgCO_2/kWh$)	Tonnes (CO_2)
Electricity	16,863,082	0.30720	5,180
Gas	68,139,028	0.18396	12,535
Gas Oil	210,608	0.27652	58
LPG	23,246	0.21448	5
Steam	10,447,237	0.18746	2,062
Total	**95,683,202**		**19,840**

Performance Against Targets

Our 2016/21 Carbon Management Plan has a baseline year of 2015/16 with 25,365 tonnes of CO_2 emissions resulting from energy consumption.

This year's emissions are 19,840 tonnes, which is a 13.8% decrease on the previous year's emissions and a 21.8% reduction from the baseline in two years.

Figure 2: Historic and Present Carbon Emissions



It should be noted that the UK government has altered the carbon emission factors for 2017/18 and this has played a part in improving our performance against the targets.

Table 3: Changes to Carbon Emission Factors (kg CO_2/kWh)

	2016/2017	2017/2018	% Change
Natural Gas	0.184163989	0.18396	-0.11%
Grid Electricity (Generation and T&D)	0.38443	0.3072	-20.09%
Gas oil	0.27588	0.27652	0.23%
LPG	0.21451	0.21448	-0.01%
Purchased Steam	0.19741	0.19733	-0.04%

The 2017/18 emissions factors have, therefore, generated a 'bonus' reduction of 1,317 tonnes beyond the reductions achieved by managing and decreasing energy consumption. The majority of this has come via the large decrease in the grid electricity factor.

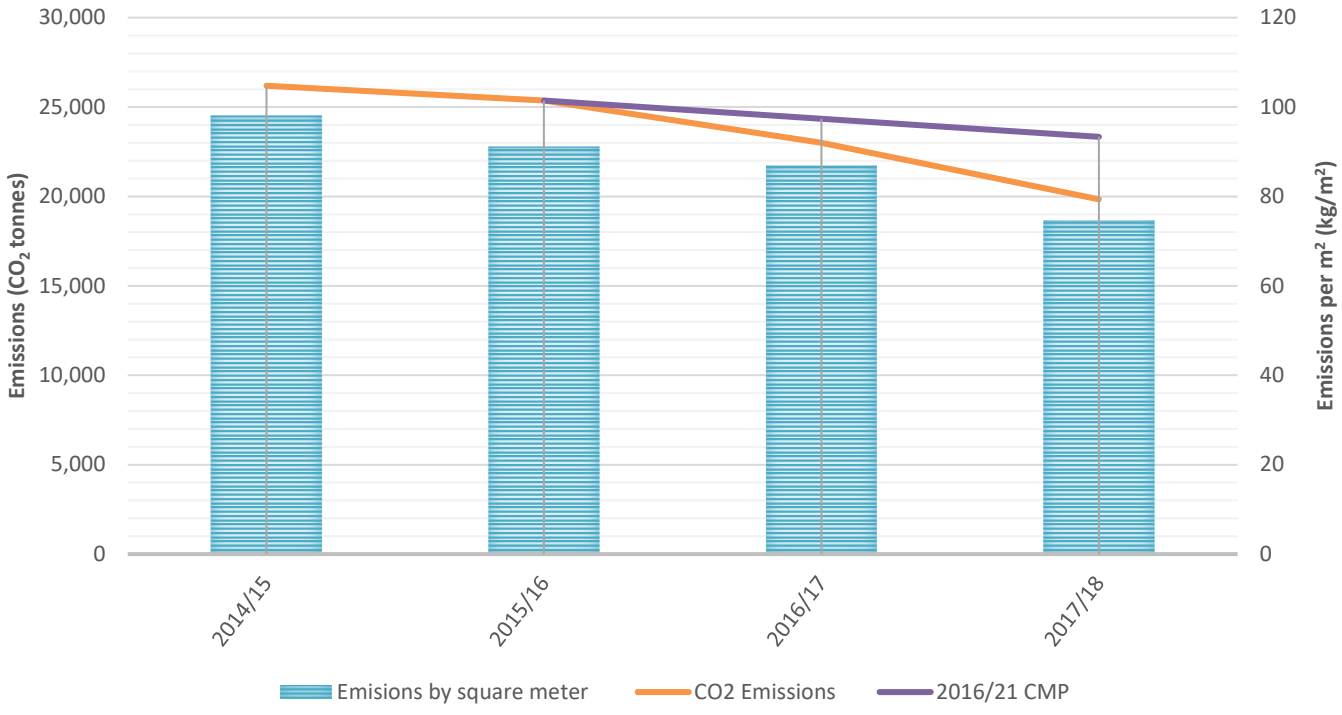
Occupancy of Buildings

The utilisation of buildings changes each year; with new buildings coming on line and old buildings closing. In 2016/17, the University occupied 264,681m^2, and this has slightly increased to 265,669m^2 in 2017/18. This represents an increase in floor area of 0.37%.

As any movement in the Estate size tends to result in associated movement in carbon dioxide emissions from the University's building stock, when new buildings are developed by the University, they are designed to be more energy efficient than those they are replacing.

The graph below demonstrates how the University is performing against the target for reducing carbon emissions and the effects of the changing size of the Estate.

Figure 3: Comparison of emissions with CMP target and campus size



The target for reducing carbon dioxide emissions is an absolute target, Any changes to the size of the estate, either an increase or reduction, will not result in a change to the target but will impact the total emissions.

The building changes that occurred in 2017/2018 are detailed below:

- 91 High Street was acquired.

European Union Emissions Trading Scheme (EU-ETS)

The Combined Heat and Power station exceeds 20MWth capacity and is covered by the EU-ETS. As a result, the University reports on emissions arising from its use of gas and oil in Old Aberdeen. Under this scheme, a number of allowances are allocated to the University for the site each year, with one allowance being equivalent to one tonne of carbon dioxide.

To establish the allocation, an average of 4 years emissions was assessed; this came to 8,148 tonnes. The allocation received under the scheme for 2017 was 7,115 allowances (a 12.7% reduction). The reporting year under EU-ETS is January – December.

- Historical Average Emissions 8,148 tonnes
- Actual Emissions 8,938 tonnes
- Allowances 7,115 tonnes
- Excess Emissions 1,823 tonnes

The University target for EU-ETS allocations is to reduce emissions in line with the number of allocations received.

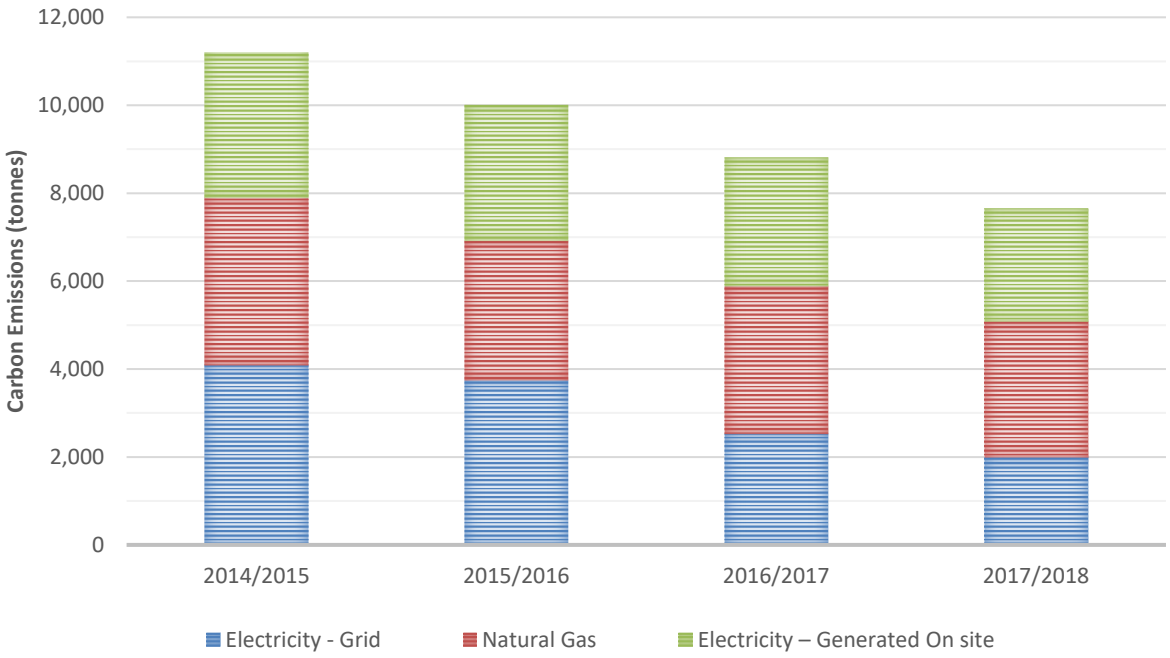
This is always challenging, as the targets for reductions are arbitrary and progressive in nature. Penalties are imposed on the University for failing to meet the target and this year the financial penalty was £8,513.

Carbon Reduction Commitment (CRC) scheme

The Carbon Reduction Commitment (CRC) scheme was in the 9th year of operation, covering the period 1st April 2017 to 31st March 2018. The total carbon emissions for the University falling within the boundaries of the scheme was 7,651 tonnes (note that the scheme excludes emissions reported under EU-ETS).

The total cost for carbon emissions for the year was £135k. These charges are in addition to the invoiced utility charges. This was a decrease in emissions of 1,162 tonnes or 13% against the previous year for the University's CRC obligation.

Figure 4: Historic and Present CRC Carbon Emissions



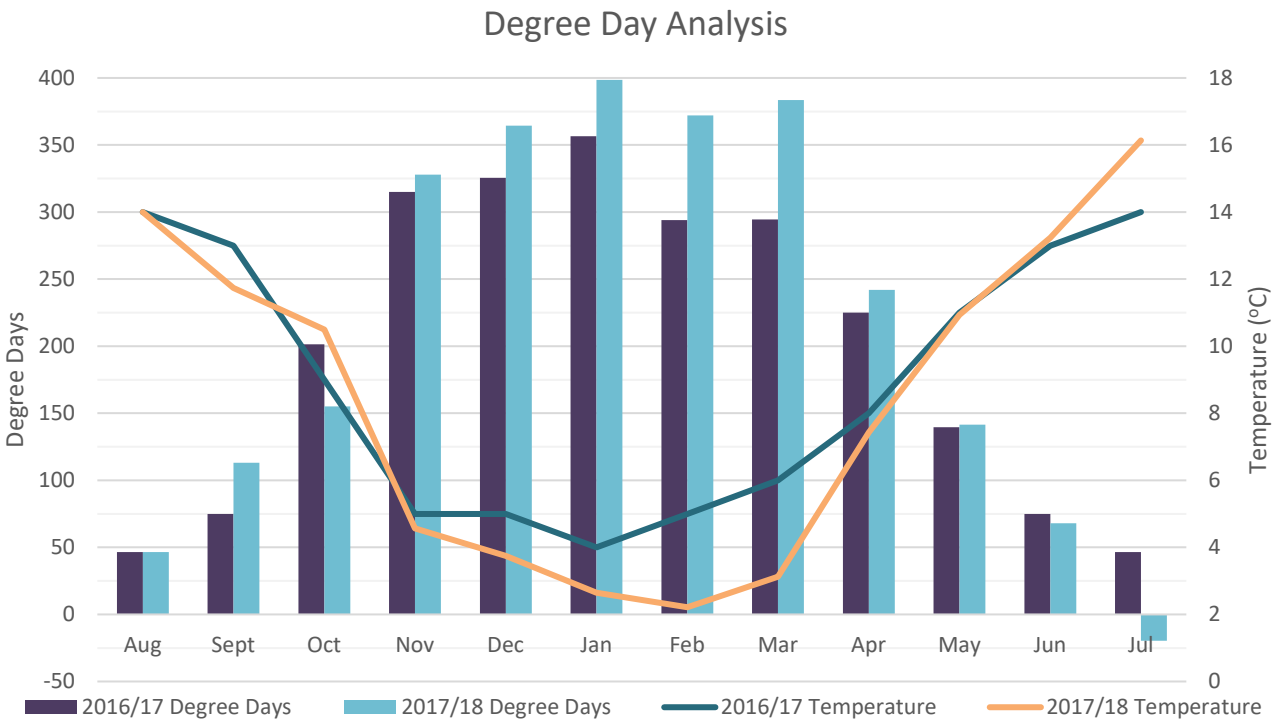
Degree Day Analysis

Degree days are a specialist type of weather data which are calculated from outside air temperature readings. They are a measure of variation (in degrees), and for how long (in days) the outside temperature was above or below a baseline temperature.

This is used to assess the expected increase or decrease in a building's heating consumption based on the outside air temperature. Additionally, they indicate how well a building's heat consumption matches the temperature throughout a year. They can also be used to assess the effectiveness of any heating efficiency projects that have been carried out in that period.

Assuming a baseline temperature of 15.5°C[1] throughout the year, in 2017/18 there was increase of 9.1% degree days on the previous year due to a significantly colder winter.

Figure 5: Historic and Present Monthly Degree Days



It would be expected that the natural gas consumption would increase by 9.1% in line with this analysis. However, compared to last year; the University consumed 2.86% less gas.

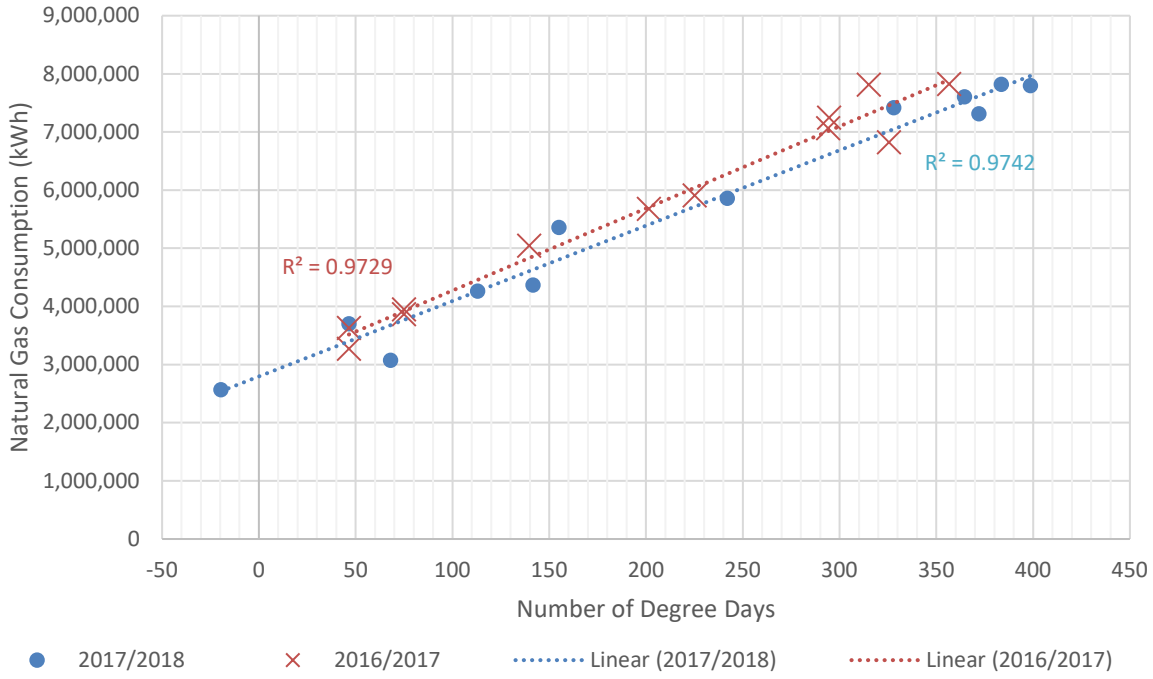
Despite what appears to be a large difference in the volume of natural gas, the University consumed and what it should have consumed (according to the degree day data); the correlation between the degree days and natural gas consumption for 2017/18 was 97.4%.[2]

This is a very slight increase from 2016/17's correlation of 97.3%, indicating that the control of heating systems remained fairly constant but with some scope for further improvements.

[1] UK standard baseline

[2] The closer to 100% the correlation is indicates that the natural gas consumption is directly related to the outside air temperature and shows a high level of heating control

Figure 6: Correlation between Degree Days and Natural Gas Consumption



It should be noted that when there is a cold winter and as a result, a higher number of degree days, the natural gas correlation tends to be better as the University is forced to utilise more gas. However, a significant amount of work was done to maintain this level of correlation despite an aging CHP engine.

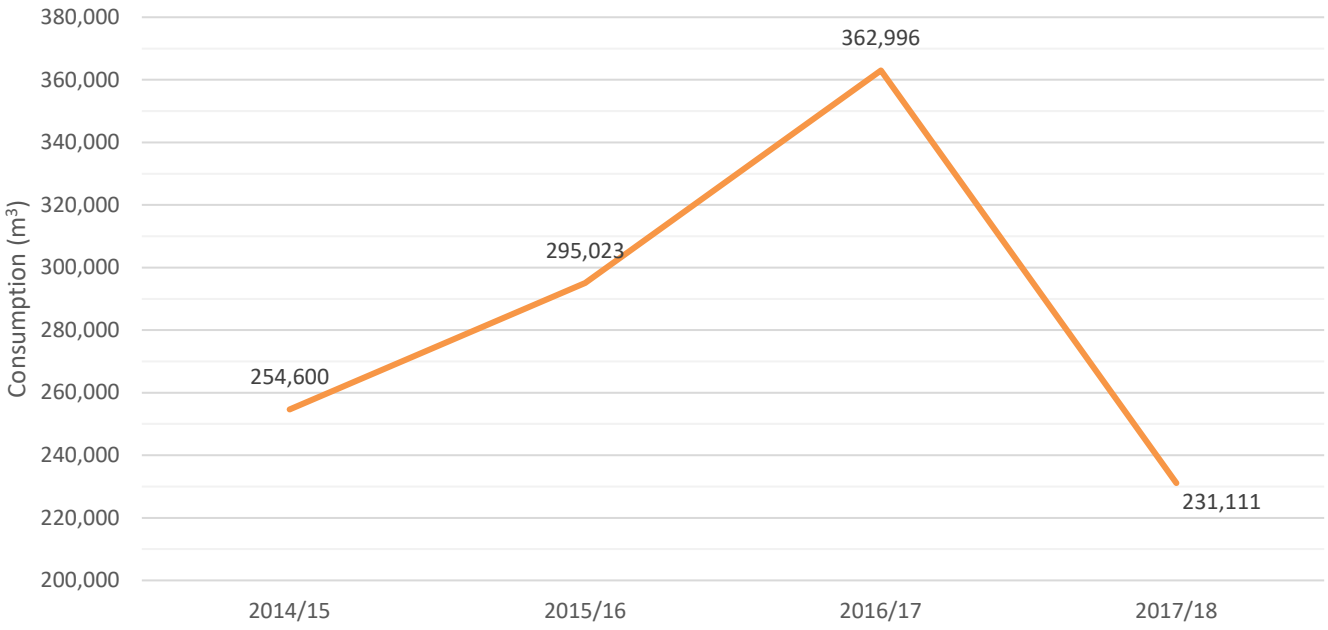
Water Consumption

The University aims to reduce water consumption by 2% year on year. In 2017/18 there was a significant decrease in water consumption at the University (36.3%). This reduction was mainly due to improved monthly meter readings which were also passed onto the University's water supplier.

Table 4: Water Consumption and Cost

Utility	Consumption (m^3)	Cost (£)
Water	231,111	£582,996.98

Figure 7: History of Water Consumption



Water Based Projects

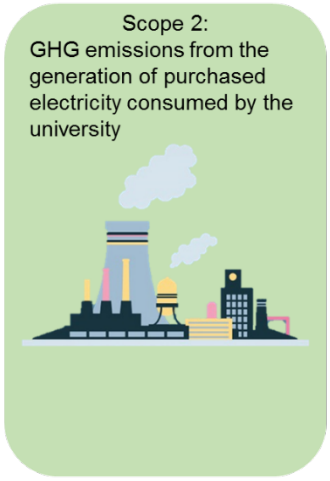
Meston Laboratory Chillers

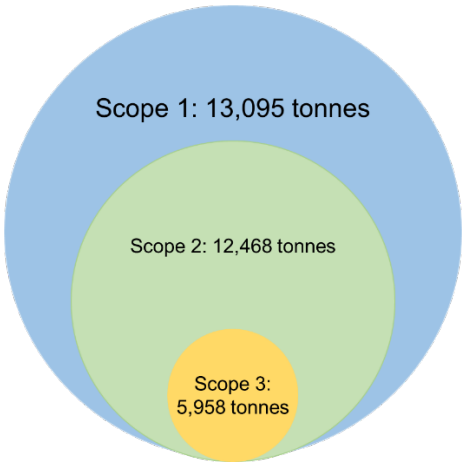
The aging network of chemically resistant glass drains and pipes were used to supply cooling for glass condensers in laboratories across Meston. Following several leaks that damaged vital and expensive equipment, the Energy Management Team was approached by the laboratory technicians with a proposal to install and use recirculating water chiller units instead of the network.

This project is expected to save up to 20,563m^3 and £26,956 a year

2016 – 2021 Carbon Management Plan Progress

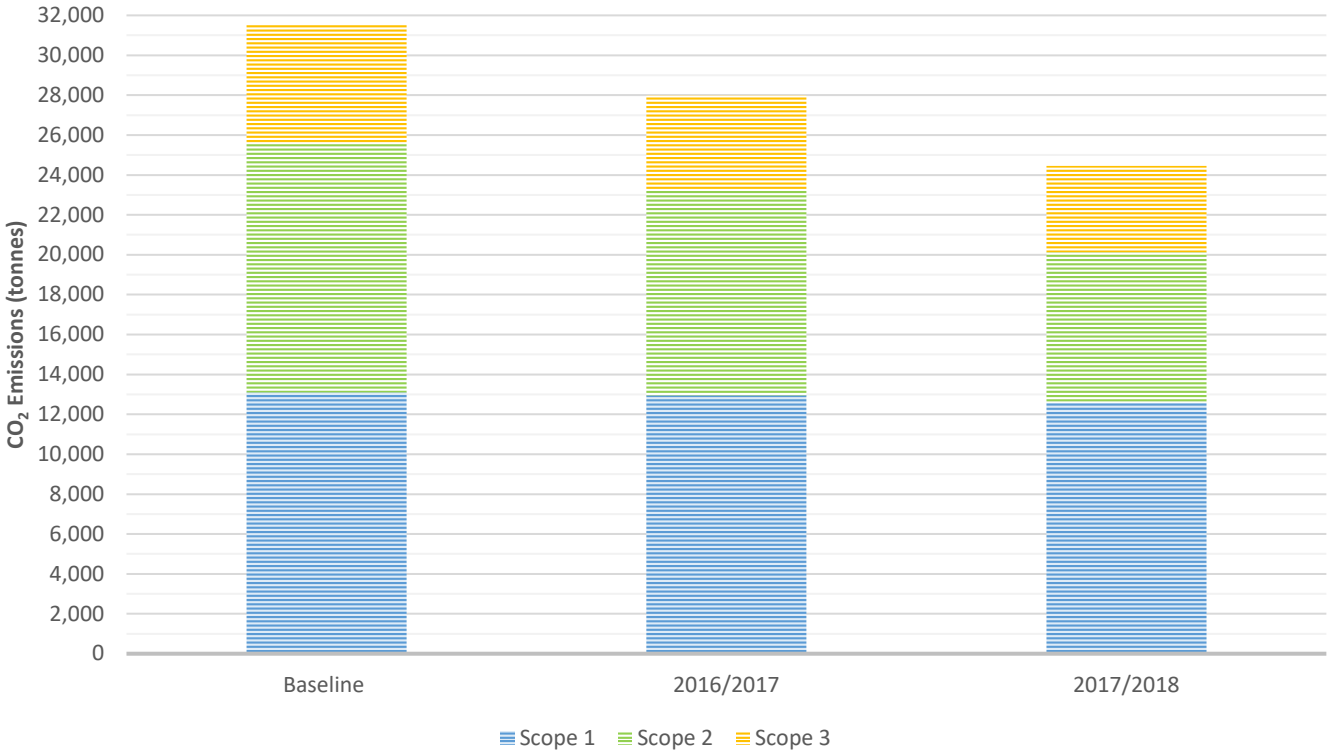
The 2016/21 CMP sets out an ambitious target of reducing the university's carbon emissions by 4% year on year from the baseline year of 2015/16. The 95 carbon saving projects identified in the CMP showed the University's potential to reduce emissions by more than 8,500 tonnes (or some 27.2% more than the target of 20%). The list of potential projects is constantly under review as new possibilities arise and certain projects are removed as being impractical for either technical or financial reasons. The images below show our baseline carbon footprint.





During the course of this year a number of specific energy saving measures have been implemented from the 2016/21 Carbon Management Plan. These measures have contributed to helping achieve a significant reduction in energy consumption and carbon emissions compared with last year.

Figure 8: Comparison of Carbon Emissions with the CMP Baseline



Total emissions have fallen to 24,455 tonnes from a baseline 31,520 in 2015/16 (and from 27,988 in 2016/17). Scope 2 emissions experienced the largest reduction i.e. 2,736 tonnes (26.62%), followed by Scope 3 (418 tonnes or 8.78%) and Scope 1 (380 tonnes or 2.93%)[3].

Energy and Water Based Projects

This year 39 energy based projects from the CMP were carried out across the various University campuses and sites:

Project Name	Description	Site	Carbon Emissions Saving (tonnes)
BUILDING FABRIC - 1	Chaplaincy - Install Draught Proofing	Chaplaincy	1.41
BUILDING FABRIC - 15	Wavell House - Install cavity wall insulation	Hillhead	49.16
BUILDING FABRIC - 16	Humanity Manse - Install Draught Proofing	Humanity Manse	1.69
BUILDING FABRIC - 2	46 - 48 College Bounds - Install Draught Proofing	46 - 48 College Bounds	1.96
BUILDING FABRIC - 20	MacRobert - Replace easily damaged window closers	MacRobert	15.18
BUILDING FABRIC - 22	Townhouse - Install Draught Proofing	Townhouse	1.64
BUILDING FABRIC - 23	Powis Gate - Install Draught Proofing	Powis Gate	4.86
BUILDING FABRIC - 25	St Mary's - Install Draught Proofing	St Mary's	22.31
BUILDING FABRIC - 3	5 Dunbar Street - Install Draught Proofing	5 Dunbar Street	2.33
BUILDING FABRIC - 9	Fyfe House - Install cavity wall insulation	Hillhead	40.30
CHP - 3	CHP Station - Install a VSD to one of the CHP distribution pumps	CHP Station	9.24
CONTROLS - 1	Bedford Road - Install controls onto the two radiators in the meeting room and implement heating time schedule	Bedford Road Yard	1.44
CONTROLS - 2	MRF - Change chiller controls so that the AHUs use outside air to cool supply air when outside air is below 10°C and chiller pumps turn off	MRF	89.05
CONTROLS - 3	Hub - Change chiller controls so that the AHUs use outside air to cool supply air	HUB	9.28

[3] Emissions data is derived from the University's yearly submission to the Public Bodies Climate Change Duties and uses the carbon factors supplied for the exercise.

	when outside air is below 10°C and chiller pumps turn off		
CONTROLS - 4	SDR Library - Change chiller controls so that the AHUs use outside air to cool supply air when outside air is below 10°C and chiller pumps turn off	SDR Library	3.09
EQUIPMENT - 11A & 11B	Meston - Upgrade lab glass condenser cooling drainage systems	Meston	21.63
HEAT - 10	Powis Gate - Install zone valves	Powis Gate	5.66
HEAT - 11	Edward Wright - Install TRVs onto 315 radiators	Edward Wright	20.91
HEAT - 12	Regent Building - Install TRVs onto 60 radiators	Regent Building	11.35
HEAT - 13	St Mary's - Install TRVs onto 155 radiators	St Mary's	21.89
HEAT - 8	Meston (Original) - Installing zone valves into the heating circuit in Meston Original	Meston	83.83
LIGHT - 21	KCCC - Upgrade the Auditorium Lighting	Kings College	6.19
LIGHT - 25	Medical Physics - Replace existing floodlights with LEDS	Med Physics	1.48
LIGHT - 28	Meston - Upgrade Meston Entrance Lights	Meston	0.27
LIGHT - 30	Old Brewery - Upgrade the lighting	Old Brewery	0.19
LIGHT - 38	William Guild - Upgrade corridor and office lighting in the Annex	William Guild	9.23
LIGHT - 39	Zoology - Upgrade Corridor Lights	Zoology	6.66
LIGHT - 40	Kings College - Upgrade the lighting in the Divinity Library	Kings College	0.58
LIGHT - 56	SDR Library - Upgrade of the downlights	SDR Library	1.08
LIGHT - 57	HUB - Upgrade stair lights	HUB	1.02
LIGHT - 58	MacRobert (Ground Floor) - Replace 80W corridor lighting with 25W	MacRobert	1.42
LIGHT - 6	Elphinstone Hall - Replace current candle lights with LEDs in Linklater Room	Elphinstone	1.64
LIGHT - 61	KCCC - Upgrade the desk lamp Lighting	Kings College	0.49

LIGHT - 63	Elphinstone Hall - Upgrade the Hall floodlights with LEDs	Elphinstone	5.99
LIGHT - 64	9a Dunbar Street - Upgrade staffroom ceiling spotlights with LEDs	9a Dunbar Street	0.19
LIGHT - 65	Townhouse - Upgrade toilet lights with LEDs	Townhouse	0.13
LIGHT - 67	Adam Smith - Upgrade corridor lighting	Hillhead	5.63
VSD - 11	HSB - Install VSD onto heating circuit pumps that are currently operated as a shunt pump (PT. 2)	HSB	2.78
VSD - 12	HSB - Install VSD onto heating circuit pumps (PT. 1)	HSB	4.62

For a more detailed description of the savings created by these projects, please see ***Appendix A – Breakdown of CMP Projects***.

CMP Projects - Overall Savings

The total reduction in carbon emissions arising from these measures is projected to be 468 tonnes p.a. This is equivalent to a 1.48% reduction in carbon dioxide emissions from the 2015/16 baseline.

As indicated earlier, this impact has also been influenced by the changes to the carbon emission figures. For more information please see Table 3 above.

It is worth noting that a number of other projects have been implemented by other sections of the University that are known to have had a positive effect on the energy efficiency of our buildings, but for which estimated or detailed emissions data is not currently available.

Staff Awareness and Monitoring and Targeting Projects

Aside from the technology-based carbon saving projects efforts were also made to improve staff awareness and to look at behaviour change throughout the year.

Energy Awareness Campaign

The Energy Management Team produces a weekly Energy Awareness segment for the Estates & Facilities section's sustainability themed Facebook page and once every two weeks for the campus-wide StaffNet Newsletter.

Energy Workshop

A lunchtime workshop run by the University's Energy Management Team was trialled, combining team games and presentations to explain the University's energy use, highlight examples of typical energy inefficiencies and to show staff how to reduce energy demand.

This workshop was oversubscribed and received extremely positive feedback from the attendees. As a result, the Energy Management Team was invited to run this workshop as part of the University's ILM course.

Overall saving from Staff Awareness/Good Housekeeping

As the awareness campaign includes advice for the workplace and home, it is difficult to quantify any savings made to date. The e-zine articles have generated significant interest and feedback from the University population and it is the intention that this will be sustained with further awareness campaigns in 2018/19 to highlight the importance of behaviour change as a component in our efforts to reduce energy use and associated emissions.

Sustainable and Environmental Technologies

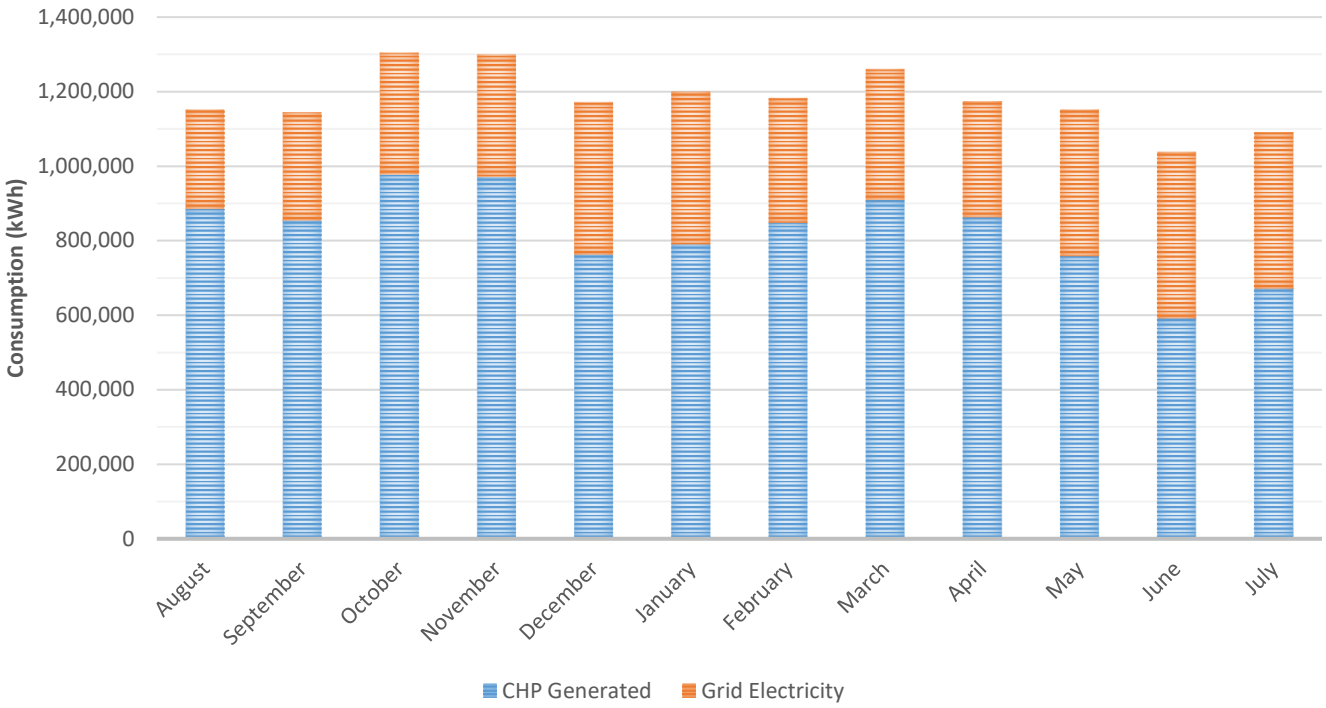
Combined Heat and Power Engine (CHP)

The CHP engine commenced operation in May 2007. The CHP engine uses natural gas to produce electricity and helps us to reduce carbon dioxide emissions from energy use by using the waste heat generated in that process to heat the University's buildings.

The result of this is that the CHP has a higher overall operating efficiency compared with that of a conventional power station. A further benefit is that it reduces the cost of electricity.

The CHP engine generated 70% of the electrical demand for our Old Aberdeen campus, as highlighted in Figure 9. Another key benefit of generating electricity in this way is to reduce the average overall price we pay for electricity on site (from 16.7p to 8.84p per unit in 17/18).

Figure 9: Old Aberdeen Campus electricity consumption for period 2017/2018

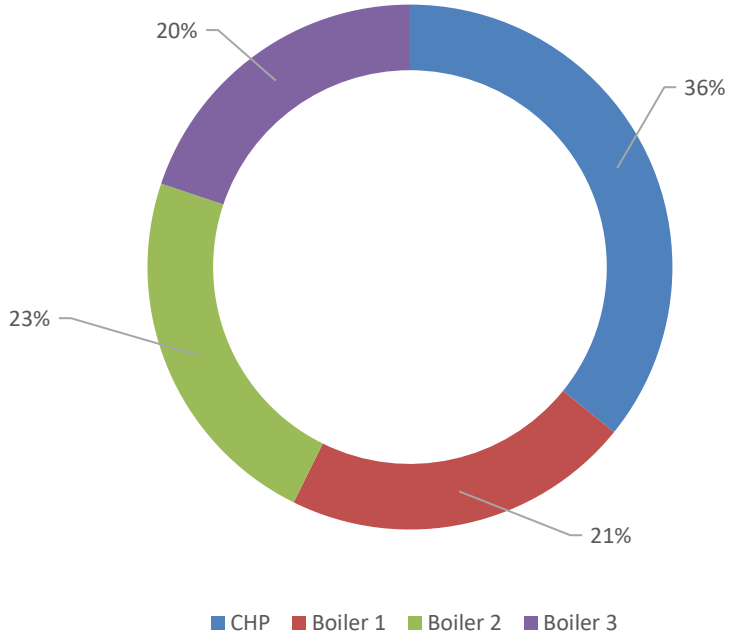


The amount of electricity generated by the CHP engine in 2017018 was 714,400kWh. This was down 6.74% on the previous year. As a result of the implementation of multiple energy efficiency projects, we have reduced electricity consumption across the campus. This means that during weekends and evenings, demand often drops below the engine's minimum generation capacity and it turns off. As the engine ages its electrical efficiency has also dipped resulting in it being taken offline for longer periods for maintenance.

The CHP engine shares the CHP Station with three supplementary boilers which provide additional heating to the campus during periods of higher demand i.e. the winter months.

In 2017/18, the CHP provided 8,952MWh of heat which was a reduction of 4.2% compared to the previous year. During the same period the three supplementary boilers increased their heat output by 20% (as would be expected with the CHP being offline for longer).

Figure 10: Proportion of Heat Generated by the CHP and Boilers

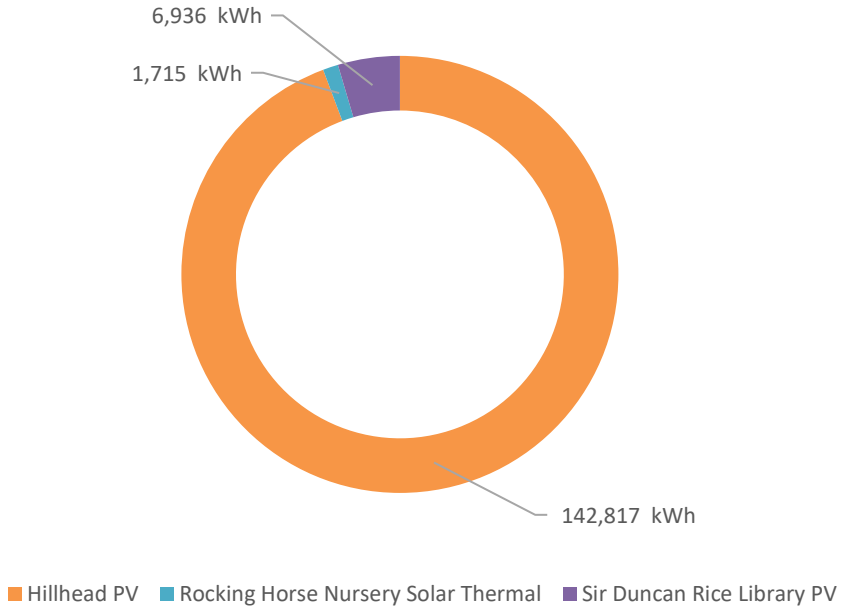


Renewable Energy Technologies

Renewable energy sources are a supply side measure that can be used to reduce carbon dioxide emissions from energy use. Although the current installed capacity is relatively low, there are plans to increase the use of renewables going forward.

The University currently has around 1,000m^2 of solar photovoltaic panels installed at the Hillhead Student Village and 40m^2 at the Sir Duncan Rice Library. There are 12m^2 of solar thermal installed at the Rocking Horse Nursery. The PV panels and solar thermal system are the total renewable technologies capacity at the university.

Figure 11: Energy Generated from Renewable Technologies



Note: an air source heat pump is also installed at the Rocking Horse Nursery but as it is not individually metered, the energy generated is not detailed further.

Compared to 2016/17, the Nursery solar thermal generated 21% more heat. The PV panels generated less electricity than previously, with output from the Sir Duncan Rice Library's panels down 4% and Hillhead's systems generating 3% less.

Rainwater Harvesting

There is a rainwater harvesting system in the SDR Library and the Rocking Horse Nursery. Metering of these systems has proven inaccurate due to faults with the meters and as a consequence the volume of greywater collected cannot be reported this year.

Energy Consumption League Tables

The energy use of each of our buildings has been recorded throughout the year to create energy consumption league tables. Full league tables can be found in ***Appendix B – Complete League Tables***

The 2016/21 Carbon Management Plan contains a list of energy saving projects, with a number of them focussing on the buildings with the highest energy consumption.

Electricity League Table[4]

Given their scale and usage, our IMS and SDR Library are the highest consumers of electricity.

There have been 13 projects identified in the Carbon Management Plan (CMP) that should reduce the electricity consumption of the top ten energy consuming buildings by an estimated total of 1,327,093 kWh.

Table 5: Top 10 Electricity Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	Institute of Medical Sciences	4,037,206	2	15.9%
2	Sir Duncan Rice Library	2,324,498	1	6.3%
3	Hillhead Halls of Residence	1,644,899	1	0.4%
4	Zoology Building	1,436,408	3	18.3%
5	Medical Research Facility	1,308,906	-	-
6	Rowett Building	1,275,435	-	-
7	MacRobert Building	1,157,838	5	19.5%
8	Hillhead Carnegie Halls of Residence	1,130,692	1	15.5%
9	Edward Wright	1,033,025	-	-
10	Meston Extension	926,335	1	1.7%

Natural Gas League Table

The CHP station is, as anticipated, the highest consumer of natural gas as it houses the CHP engine and utilises natural gas to generate electricity and heat. The station also houses the three supplementary gas boilers.

Hillhead Halls of Residence is the second highest natural gas consuming site.

[4] The grid electricity supply to the CHP Station, that covers the 30% of campus demand that the CHP cannot generate, has been excluded so sites that are supplied by the CHP can be included.

There is an opportunity to reduce this site's consumption by up to 469,384 kWh or 4.5% by implementing 4 projects in the Carbon Management Plan.

Table 6: Top 10 Natural Gas Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	CHP Station	45,853,183	2	1.6%
2	Hillhead Halls of Residence	10,528,443	4	4.5%
3	Foresterhill IMS	3,900,558	-	-
4	Medical Research Facility	3,214,460	-	-
5	Marischal College	1,736,496	-	-
6	Cruickshank Building	749,397	-	-
7	Oceanlab	392,133	-	-
8	Health Sciences Building	265,103	-	-
9	Unit 5 - Holland Street	220,331	-	-
10	Life Sciences Innovation 1	218,496	-	-

Steam League Table

A number of the buildings located at our Foresterhill campus have heating supplied via steam produced on-site (by the NHS) and purchased from the NHS. The MRF building is the highest consumer of steam, followed by the Rowett building.

There are currently no projects in the CMP that focus exclusively on reducing steam consumption at the Foresterhill campus. However, through effective building controls, the steam consumption can be maintained at current levels or lower. We also intend to work with our maintenance teams to undertake a comprehensive survey of steam traps with a view to assessing condition, functionality and effectiveness. It is anticipated that this will lead to some potential energy savings being identified.

Table 7: Top 10 Steam Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	Medical Research Facility	3,585,073	-	-
2	Rowett Building	2,294,919	-	-
3	Suttie Centre	1,041,892	-	-
4	Medical Physics	886,103	-	-
5	Medical Centre	774,586	-	-
6	Institute of Medical Sciences	616,510	-	-
7	Polwarth Building - North	444,460	-	-
8	Polwarth Building - South	418,812	-	-
9	West Block	370,542	-	-
10	Link Block	14,340	-	-

Heat League Table

The half-hourly heat consumption of sites supplied by the CHP engine is monitored and recorded using the University's Meterology real-time metering system.

The Meston Extension is the highest consumer of heat due to the building's less effective heating control, design, age and condition. The Sir Duncan Rice Library is the second highest consumer of heat because the building is heated constantly throughout the year.

Two projects have been identified which should reduce heat consumption of King's College by 21% if completed.

Table 8: Top 10 Heat Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	Meston Extension	2,582,900	-	-
2	Sir Duncan Rice Library	2,576,200	-	-
3	Zoology Building	1,891,700	-	-
4	Meston Original	1,710,800	-	-
5	Taylor Building	1,646,900	-	-
6	Fraser Noble Building	1,606,600	-	-
7	MacRobert Building	1,260,600	-	-
8	Johnston Building	967,800	-	-
9	King's College	928,850	2	21.0%
10	Kings College Conference Centre	925,400	-	-

Concluding Comments

The University has made significant progress in reducing its energy use and the resulting carbon emission levels. The considerable efforts of the Energy Management Team and colleagues across Estates & Facilities are to be commended for achieving this.

Progress against the targets set in the 2016/21 Carbon Management Plan has been encouraging. Our total emissions (all sources) for 2017/18 was 24,455 tonnes (as detailed in our Public Sector Climate Change Duties report). This represents:

- A 13.7% decrease from 2016/17;
- 761 tonnes less than our 2020/21 CMP target i.e. we have reached (and exceeded) our five year emissions target, 3 years ahead of schedule;
- While decarbonisation of the electricity grid has contributed to this performance, even if the 2016/17 emissions factors were applied to the 2017/18 consumption, emissions would still have fallen to 25,674 tonnes (or an 8.3% decrease) and would have put us below our 2019/20 target;
- Significant reductions have been made in our energy and transport use:

	Consumption Change	%	
Total Fleet Fuel Use (litres)	1,326.70	8.6%	Increase in Consumption
Water and Sewerage (m3)	87,670.94	24.2%	Increase in Consumption
Energy (kWh)	-8,404,724.56	-8.1%	Decrease in Consumption
Transport (passenger km)	-1,894,539.38	-7.4%	Decrease in Consumption
Fuel Claimed for Transport (litres)	-5,867.61	-15.2%	Decrease in Consumption
Total Waste (tonnes)	368.68	34.0%	Increase in Consumption

As can be seen we are significantly ahead of our planned reduction targets. This reflects concerted effort to improve the robustness of our data, to increase the accuracy of our Monitoring & Targeting, and significant efforts to tackle energy efficiency and improve operational control regimes across our estate.

We intend to continue tackling these issues but acknowledge that projects in the Carbon Management Plan will become increasingly complex and costly. It will, therefore, become ever more imperative that appropriate financial and staff resources are available to support energy efficiency if further savings are to be found and this key strategic issue is to continue improving.

It should also be noted that once the new Science Teaching Hub is built and becomes operational some of the savings made to date will be counteracted by increased consumption (at least until such time as consequential rationalisation of facilities is achieved).

As has been mentioned elsewhere in this report; the CHP engine is ageing and is approaching the end of its anticipated useful life (i.e. within 20,000 operational hours or around 2.5 years of use). This increases the prospect of the engine being offline for prolonged periods of maintenance and emphasises the importance of planning for its replacement or alternative measures to counteract its impending end of life.

Appendix

Appendix A – Breakdown of CMP Projects

Project Name	Description	Site	Energy Savings (kWh)	Unit	Saving (£)	Carbon Emissions Saving (tonnes)
BUILDING FABRIC - 1	Chaplaincy - Install Draught Proofing	Chaplaincy	7,638	Natural Gas (kWh)	£229.14	1.41
BUILDING FABRIC - 15	Wavell House - Install cavity wall insulation	Hillhead	266,925	Natural Gas (kWh)	£8,007.74	49.16
BUILDING FABRIC - 16	Humanity Manse - Install Draught Proofing	Humanity Manse	9,183	Natural Gas (kWh)	£275.49	1.69
BUILDING FABRIC - 2	46 - 48 College Bounds - Install Draught Proofing	46 - 48 College Bounds	6,373	Grid Electricity (kWh)	£573.56	1.96
BUILDING FABRIC - 20	MacRobert - Replace easily damaged window closers	MacRobert	82,500	Natural Gas (kWh)	£2,475.00	15.18
BUILDING FABRIC - 22	Townhouse - Install Draught Proofing	Townhouse	8,937	Natural Gas (kWh)	£268.11	1.64
BUILDING FABRIC - 23	Powis Gate - Install Draught Proofing	Powis Gate	26,436	Natural Gas (kWh)	£793.08	4.86
BUILDING FABRIC - 25	St Mary's - Install Draught Proofing	St Mary's	121,272	Natural Gas (kWh)	£3,638.17	22.31
BUILDING FABRIC - 3	5 Dunbar Street - Install Draught Proofing	5 Dunbar Street	12,686	Natural Gas (kWh)	£380.57	2.33
BUILDING FABRIC - 9	Fyfe House - Install cavity wall insulation	Hillhead	218,850	Natural Gas (kWh)	£6,565.49	40.30

CHP - 3	CHP Station - Install a VSD to one of the CHP distribution pumps	CHP Station	30,082	Grid Electricity (kWh)	£2,707.38	9.24
CONTROLS - 1	Bedford Road - Install controls onto the two radiators in the meeting room and implement heating time schedule	Bedford Road Yard	4,680	Grid Electricity (kWh)	£421.20	1.44
CONTROLS - 2	MRF - Change chiller controls so that the AHUs use outside air to cool supply air when outside air is below 10°C and chiller pumps turn off	MRF	289,863	Grid Electricity (kWh)	£26,087.70	89.05
CONTROLS - 3	Hub - Change chiller controls so that the AHUs use outside air to cool supply air when outside air is below 10°C and chiller pumps turn off	HUB	30,223	Grid Electricity (kWh)	£2,720.04	9.28
CONTROLS - 4	SDR Library - Change chiller controls so that the AHUs use outside air to cool supply air when outside air is below 10°C and chiller pumps turn off	SDR Library	10,074	Grid Electricity (kWh)	£906.68	3.09
EQUIPMENT - 11A & 11B	Meston - Upgrade lab glass condenser cooling drainage systems	Meston	20,563	Water (m3)	£26,955.94	21.63
HEAT - 10	Powis Gate - Install zone valves	Powis Gate	30,784	Natural Gas (kWh)	£923.52	5.66
HEAT - 11	Edward Wright - Install TRVs onto 315 radiators	Edward Wright	113,650	Natural Gas (kWh)	£3,409.51	20.91
HEAT - 12	Regent Building - Install TRVs onto 60 radiators	Regent Building	61,702	Natural Gas (kWh)	£1,851.07	11.35
HEAT - 13	St Mary's - Install TRVs onto 155 radiators	St Mary's	118,970	Natural Gas (kWh)	£3,569.10	21.89

HEAT - 8	Meston (Original) - Installing zone valves into the heating circuit in Meston Original	Meston	455,676	Natural Gas (kWh)	£13,670.28	83.83
LIGHT - 21	KCCC - Upgrade the Auditorium Lighting	Kings College	20,137	Grid Electricity (kWh)	£1,812.33	6.19
LIGHT - 25	Medical Physics - Replace existing floodlights with LEDS	Med Physics	4,818	Grid Electricity (kWh)	£433.62	1.48
LIGHT - 28	Meston - Upgrade Meston Entrance Lights	Meston	876	Grid Electricity (kWh)	£78.84	0.27
LIGHT - 30	Old Brewery - Upgrade the lighting	Old Brewery	631	Grid Electricity (kWh)	£56.79	0.19
LIGHT - 38	William Guild - Upgrade corridor and office lighting in the Annex	William Guild	30,030	Grid Electricity (kWh)	£2,702.70	9.23
LIGHT - 39	Zoology - Upgrade Corridor Lights	Zoology	21,665	Grid Electricity (kWh)	£1,949.85	6.66
LIGHT - 40	Kings College - Upgrade the lighting in the Divinity Library	Kings College	1,883	Grid Electricity (kWh)	£169.47	0.58
LIGHT - 56	SDR Library - Upgrade of the downlights	SDR Library	3,528	Grid Electricity (kWh)	£317.52	1.08
LIGHT - 57	HUB - Upgrade stair lights	HUB	3,326	Grid Electricity (kWh)	£299.34	1.02
LIGHT - 58	MacRobert (Ground Floor) - Replace 80W corridor lighting with 25W	MacRobert	4,620	Grid Electricity (kWh)	£415.80	1.42

LIGHT - 6	Elphinstone Hall - Replace current candle lights with LEDs in Linklater Room	Elphinstone	5,346	Grid Electricity (kWh)	£481.14	1.64
LIGHT - 61	KCCC - Upgrade the desk lamp Lighting	Kings College	1,589	Grid Electricity (kWh)	£143.03	0.49
LIGHT - 63	Elphinstone Hall - Upgrade the Hall floodlights with LEDs	Elphinstone	19,500	Grid Electricity (kWh)	£1,755.00	5.99
LIGHT - 64	9a Dunbar Street - Upgrade staffroom ceiling spotlights with LEDs	9a Dunbar Street	630	Grid Electricity (kWh)	£56.70	0.19
LIGHT - 65	Townhouse - Upgrade toilet lights with LEDs	Townhouse	413	Grid Electricity (kWh)	£37.13	0.13
LIGHT - 67	Adam Smith - Upgrade corridor lighting	Hillhead	18,317	Grid Electricity (kWh)	£1,648.54	5.63
VSD - 11	HSB - Install VSD onto heating circuit pumps that are currently operated as a shunt pump (PT. 2)	HSB	9,056	Grid Electricity (kWh)	£815.04	2.78
VSD - 12	HSB - Install VSD onto heating circuit pumps (PT. 1)	HSB	15,041	Grid Electricity (kWh)	£1,353.71	4.62

Appendix B – Complete League Tables

Electricity

Position	Location	Consumption (kWh)
1	Bedford Road Sub Station	4,273,130
2	Institute of Medical Sciences	4,037,206
3	Sir Duncan Rice Library	2,324,498
4	Hillhead Halls of Residence	1,644,899
5	Zoology Building	1,436,408
6	Medical Research Facility	1,308,906
7	Rowett Building	1,275,435
8	MacRobert Building	1,157,838
9	Hillhead Carnegie Halls of Residence	1,130,692
10	Edward Wright	1,033,025
11	Meston Extension	926,335
12	Hub Building	832,040
13	Fraser Noble	700,393
14	CHP Station	608,526
15	Polwarth	584,600
16	Suttie Centre	527,547
17	Cruickshank	463,891
18	Meston Original	388,735
19	Life Sciences Innovation 1	361,271
20	Taylor Building	316,341
21	Kings Quad	278,674
22	University Office	261,724
23	HSB	241,622
24	William Guild	210,943

25	Marischal College	185,149
26	Edward Wright Annex	180,242
27	Oceanlab	167,778
28	Crombie Hall	166,650
29	Liberty Safe Work Research Centre	158,528
30	Special Collections	142,294
31	Regent	140,042
32	Kings Hall	134,711
33	Library	128,446
34	23 St Machar Drive	126,960
35	Johnston Hall	89,815
36	New Kings	88,401
37	West Block	84,836
38	50/52 College Bounds	84,174
39	St Marys	80,112
40	Kings Elphinstone Hall	75,884
41	46/48 College Bounds	73,588
42	Elphinstone Road Flats	62,590
43	Butchart	59,016
44	MacRobert Orange Mast	50,327
45	Kings Pavilion	40,758
46	17 High Street	38,938
47	Powis Gate	37,231
48	Keith Park	35,349
49	Kings College Conference Centre	35,238
50	9A Dunbar Street	34,921
51	Med Physics	34,719

52	Eastside Of Craibstone	33,925
53	110 High Street	32,631
54	Cromarty Lighthouse	28,821
55	Crombie Annexe	23,789
56	Old Brewery	23,461
57	Balgownie Pavilion	21,745
58	90 High Street	21,235
59	Duthie Experimental Farm	20,028
60	Chanonry Lodge	15,528
61	Humanity Manse	15,019
62	Humanity MA	14,251
63	Chaplaincy - 25 High Street	13,937
64	Link Block	12,137
65	Cromarty Lighthouse	10,432
66	Funeratory House - Shoe Lane	9,380
67	Med Chi	9,006
68	Town House	7,994
69	Old School - Bettyhill	7,446
70	51a College Bounds	7,195
71	Cromarty Lighthouse	6,904
72	5 Dunbar Street	5,298
73	24 High Street - Elphinstone Institute	4,868
74	Alt-Na-Guibshaich - The Bothy Glenmuick	4,308
75	Boat House	4,300
76	Unit 5 - Holland Street	4,176
77	Greenburn Farm	3,919
78	Human Physiology	2,382

79	Med Chi	2,008
80	17 High Street	1,657
81	Wrights & Coopers Place	560
82	Old Aberdeen Campus - Lighting	529
83	Rowett Institute Pre School Nursery	468
84	Rowett Institute - Greenburn Road	297

Natural Gas

Position	Location	Consumption (kWh)
1	CHP Station	45,853,183
2	Hillhead Halls of Residence	10,528,443
3	Institute of Medical Sciences	3,900,558
4	Medical Research Facility	3,214,460
5	Marischal College	1,736,496
6	Cruickshank Building	749,397
7	Oceanlab	392,133
8	Health Sciences Building	265,103
9	Unit 5	220,331
10	Life Sciences Innovation 1	218,496
11	Keith Park	134,115
12	Liberty Safe Work Research Centre	123,720
13	Chanonry Lodge	105,624
14	5 Dunbar Street	96,787
15	51a College Bounds	95,016
16	Hillhead Halls of Residence	85,081
17	Town House	82,951
18	Humanity Manse - 19 College Bounds	73,605

19	Chaplaincy	65,687
20	HUB	57,452
21	9A Dunbar Street	46,288
22	24 High Street	34,081
23	Hillhead Halls of Residence	23,378
24	Edward Wright Building	18,240
25	Kings College	5,676
26	Suttie Centre	5,144
27	Polwarth Building	4,373
28	Meston Building	1,424
29	MacRobert Building	1,284
30	Zoology Building	291
31	Meston Building	191
32	New Kings	22

Heat

Position	Location	Consumption (kWh)
1	Meston Extension	2,582,900
2	Sir Duncan Rice Library	2,576,200
3	Zoology Building	1,891,700
4	Meston Original	1,710,800
5	Taylor Building	1,646,900
6	Fraser Noble Building	1,606,600
7	MacRobert Building	1,260,600
8	Johnston Building	967,800
9	Kings College	928,850
10	Kings College Conference Centre	925,400

11	William Guild Building	758,100
12	Crombie Hall of Residence	587,200
13	Edward Wright Building	550,020
14	University Office	545,000
15	Elphinstone Hall	512,920
16	HUB	512,900
17	St Marys	492,400 *Missing Data*
18	Cruickshank Building	449,140
19	Regent Building	305,980
20	Coopers Court	304,160
21	Elphinstone Road Flats	182,599 *Missing Data*
22	Powis Gate	106,690
23	50/52 College Bounds	28,991 *Missing Data*
24	CHP Office	12,286
24	Butchart	*No Data*