ENERGY REPORT

PERIOD AUGUST 2016 TO JULY 2017

University of Aberdeen

Contents

Executive Summary

For the academic year 2016/2017, the university purchased 104,087,926 kWh of energy, for Academic and Campus Service buildings, at a cost of £3,404,813. This energy use resulted in 24,270 tonnes of CO_2 being emitted. Once the consumption and cost of the university's water usage (362,996 m^3 and £641,399.75 respectively) is taken into account, the overall cost of this year's utilities was £4,046,213 (excluding VAT).

Overall there was a decrease of 3.3% in energy consumption at the university and a decrease of 5.45% or 1,399 tonnes in CO_2 emissions.

During this period, 27 energy saving projects were carried out from the 2016/2021 Carbon Management Plan Project Register that resulted in a saving of 870 tonnes of carbon emissions which equates to a 2.76% reduction from the baseline year.

The reduction in heating demand as a result; gas consumption, has also been influenced by a reduction of 177 heating days (6.9%) on the previous year.

Energy as Supplied in 2016/2017

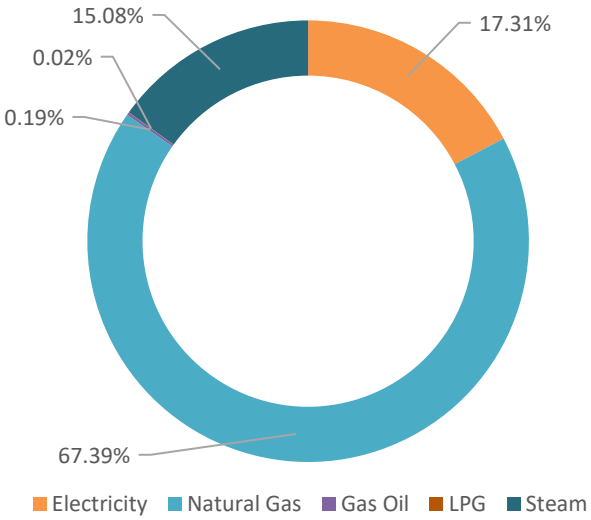
The information on energy is reported against two separate bases. The first is the energy supplied to the University and the second is the actual energy used on site. The reason for this is that the University uses a Combined Heat and Power station to generate electricity on site. Gas supplied to the site is used to generate electricity. The result is that there is less apparent gas use for the energy used by buildings than that supplied to site, while at the same time there is more apparent electricity use.

The table below details the energy as supplied to the site. Overall energy consumption as supplied decreased by 3.3%, and the cost of this energy increased by 7% from the previous year.

Table 1: Energy as Supplied

Energy	Consumption (kWh)	Cost (£)
Electricity	18,017,848	1,769,830
Gas	70,146,100	1,118,950
Gas Oil	201,432	8,718
LPG	21,356	791
Steam	15,701,190	506,525
Total	**104,087,926**	**3,404,813**

Figure 1: Energy as Supplied



Carbon Dioxide Emissions

Total Emissions for 2016/2017

Based on the energy as supplied to site, the associated Carbon Dioxide emissions for 2016/17 are calculated as per the table below.

Table 2: Carbon Dioxide Emissions

Energy	Consumption (kWh)	$kgCO_2/kWh$[1]	Tonnes (CO_2)
Electricity	18,017,848	0.4493	8,095
Gas	70,146,100	0.1840	12,907
Gas Oil	201,432	0.2763	56
LPG	21,356	0.2146	5
Steam	15,701,190	0.2043	3,208
Total	**104,087,926**		**24,270**

Carbon Dioxide Emissions – Performance against Targets

The 2016/21 Carbon Management Plan has a baseline year of 2015/16 with 25,669 tonnes of CO_2 emissions resulting from energy consumption.

This year's emissions are 24,270 tonnes, which is a 5.45% decrease on the baseline and on the previous year's emissions. This year has produced significant savings from 2015/2016, a portion of this is due to a reduction in campus size and the progression of the Carbon Management Plan.

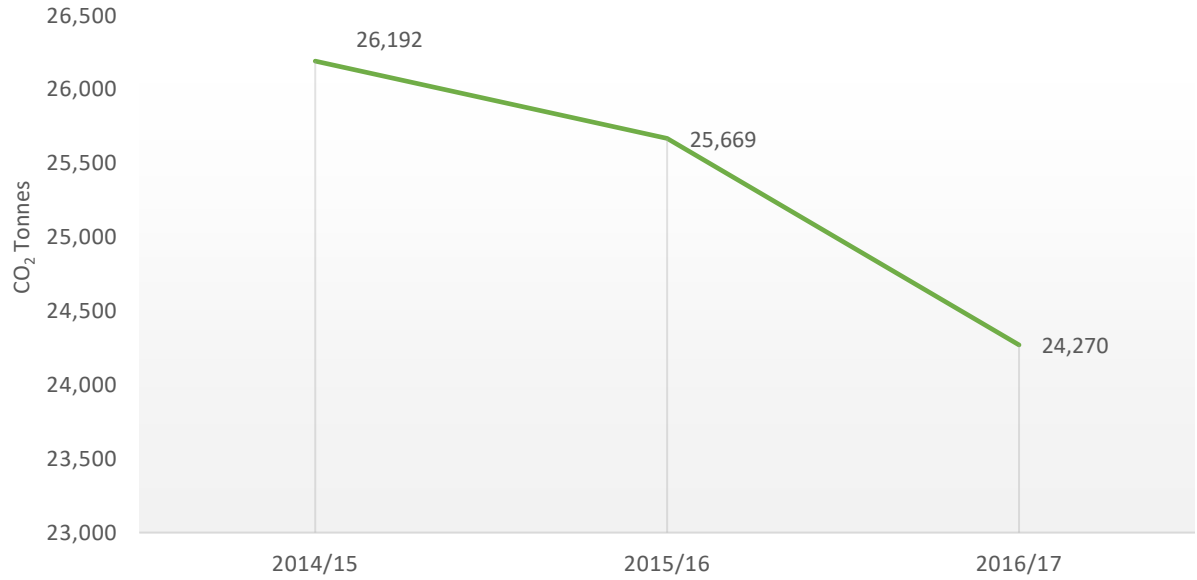


Figure 2: Historic and Present Carbon Emissions

[1] The emission factor are updated yearly to reflect government guidance. Previous years emissions are not altered

It should be noted that if the Carbon Management Plan baseline year's emission factors were applied to this year's energy consumption, the reduction in emissions would be 4.86% or 1,247 tonnes.

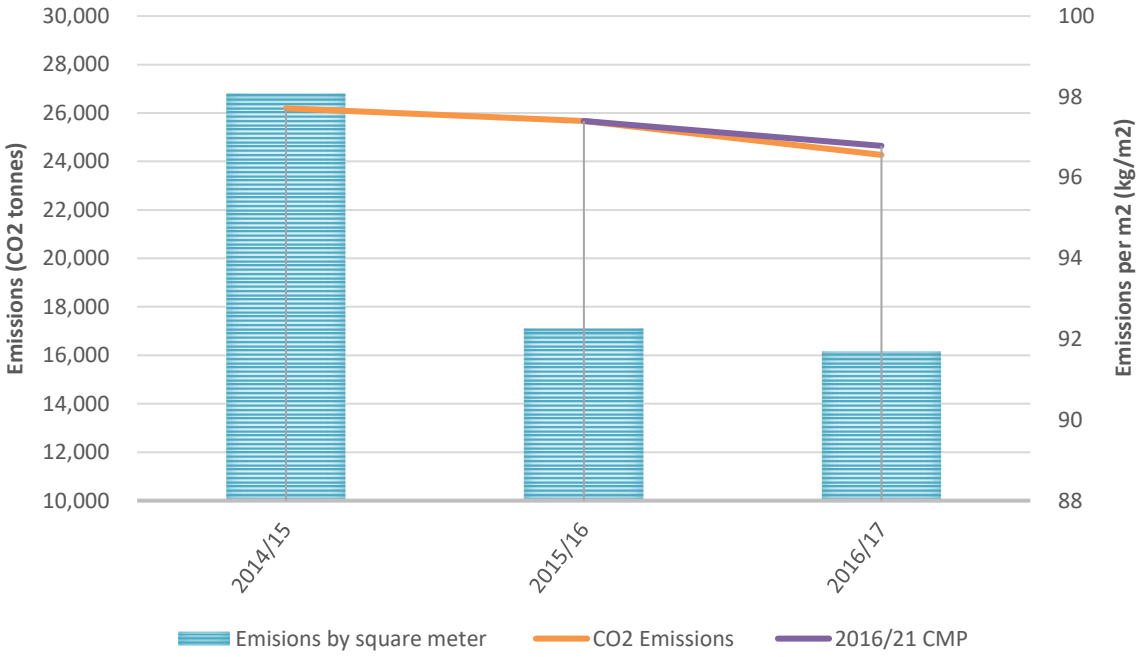
Occupancy of Buildings

The buildings that the University uses changes each year with new buildings coming on line, and old buildings closing. In 2015/16 the University occupied 278,211m^2, and this has decreased to 264,681m^2 in 2016/17. The result is a decrease in floor area of 5%.

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 required to be more energy efficient than previous buildings.

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[2]



The building changes that occurred in 2016/17 are detailed below:

- Opening of the Rowett building in the Foresterhill campus
- Closure and sale of a large proportion of the original Rowett site

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 use of gas and oil at the Old Aberdeen Campus. Under this scheme a number of allowances are allocated to the University for this Site each year, with one allowance being equivalent to one tonne of carbon dioxide.

[2] The target for reducing carbon dioxide emissions is an absolute target and changes to the size of the estate, either increase, or reduction will affect the actual emissions, but will not result in a change to the target.

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 2016 was 7,256 allowances (a 10.9% reduction). The reporting year under EU-ETS is January – December.

- Historical Average Emissions 8,148 tonnes
- Actual Emissions 8,503.5 tonnes
- Allowances 7,256 tonnes
- Excess Emissions 1,247.5 tonnes

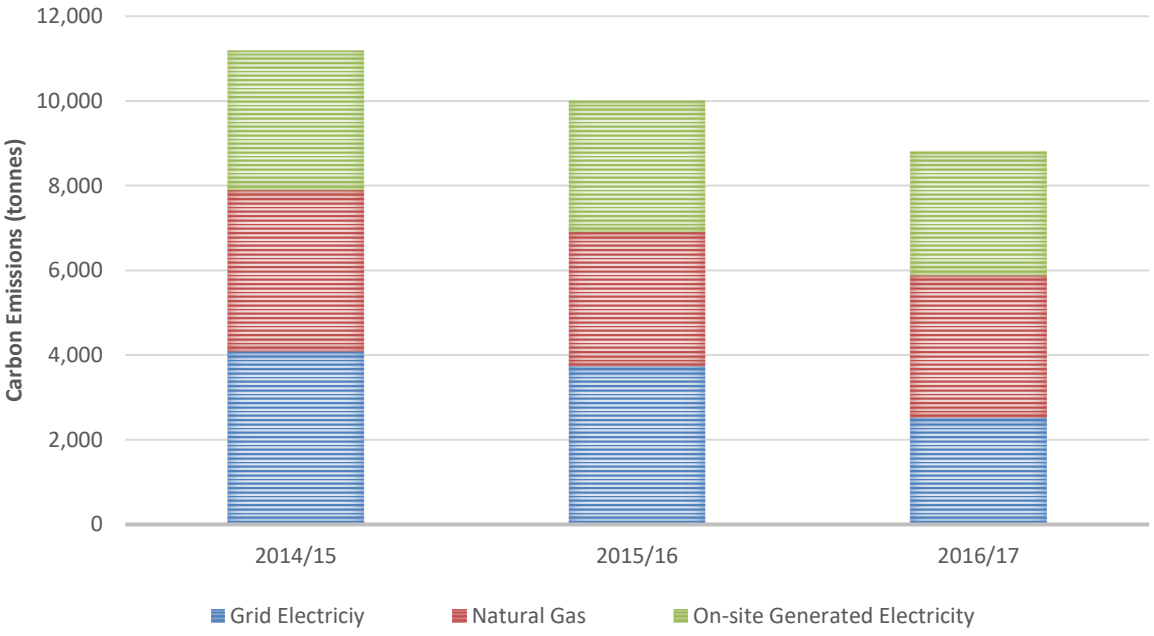
The University target for EU-ETS allocations is to reduce emissions in line with the number of allocations received.

This is always challenging as the targets for reductions are arbitrary in nature. Civil penalties are imposed on the University for failing to meet the target and this year the financial penalty was just short of £10,000.

Carbon Reduction Commitment (CRC) scheme

The Carbon Reduction commitment Scheme was in the 8th year of operation covering the period 1st April 2016 to 31st March 2017. The total carbon emissions for the University falling within the boundaries of the scheme (the scheme excludes emissions reported under EU-ETS) was 8,813 tonnes.

The total cost for carbon emissions for the year was £141k. These charges are in addition to the invoiced utility charges. This was a decrease in emissions of 1,196 tonnes or 12% against the previous year for the University's CRC obligation.



Emission Factors

For the purposes of in-year reporting and our annual Energy Report, we use the emissions factors applicable at the start of the academic year. However, for the purposes of our Public Bodies Climate Change Duties (PBCCD) reporting, we are obliged to use the emissions factors for the subsequent year.

When factors change significantly (as was the case for electricity factors this year) this can result in an apparent discrepancy in our reporting. To that end, our PBCCD report for 2016/17 declares electricity related emissions of 6,926 tonnes (as opposed to 8,095 tonnes). The PBCCD reporting informs our analysis of progress against our Carbon Management Plan (CMP) and related reporting of progress against the CMP for the Scottish Funding Council.

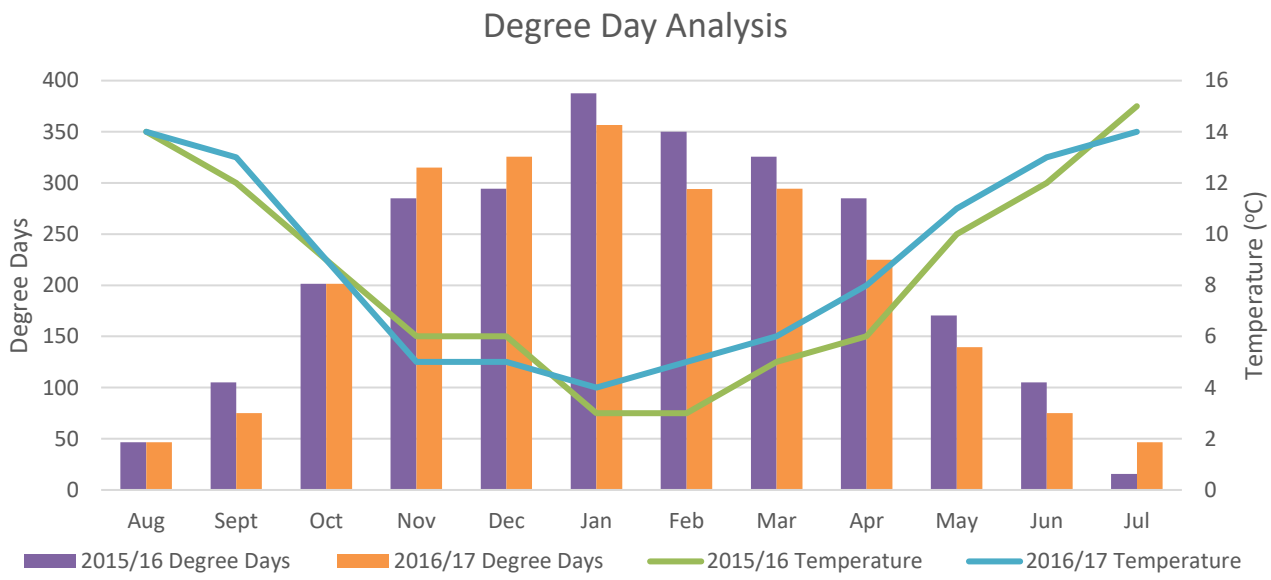
From 2017/18 onwards, the annual Energy Report will use the same emission factors as the PBCCD and use 2015/16s and 2016/17s PBCCD submissions for comparison.

Degree Day Analysis

Degree days are a measure of how much (in degrees), and for how long (in days) the outside temperature was above or below a baseline temperature. They are used to highlight any expected increases or decreases in a building's heating consumption because of the outside air temperature. Additionally they indicate how well a building's heat consumption matches the temperature throughout a year. Equally they can be used to assess the effectiveness of any heat reducing projects that may have been carried out in that period

Assuming a baseline temperature of 15.5˚C throughout the year, in 2016/17 there was 2,395 degree days; which is a decrease of 6.9% on the previous year.

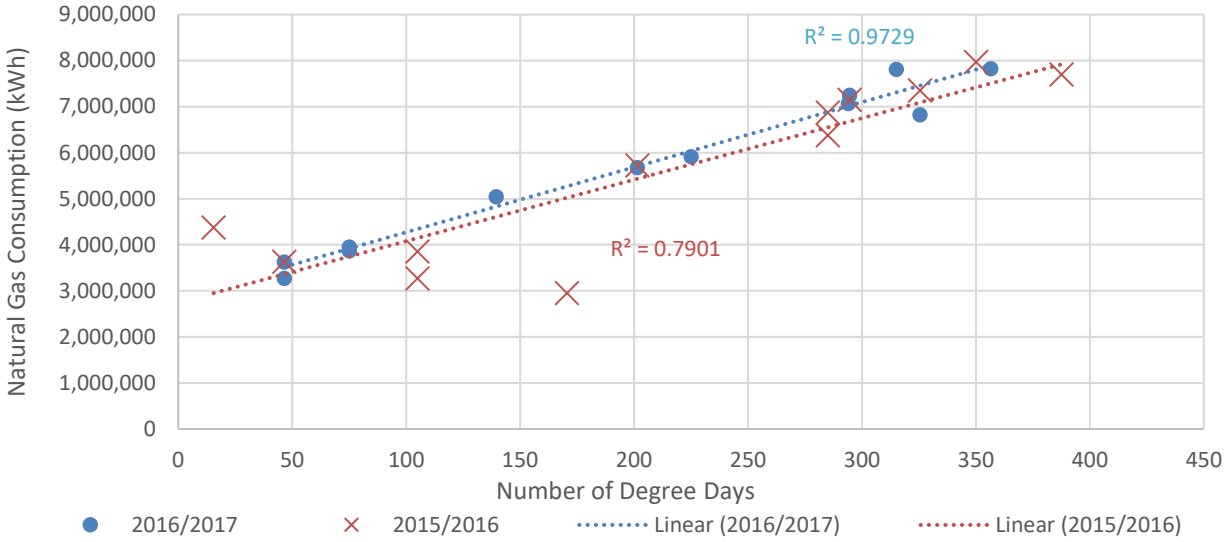
Figure 4: Historic and Present Monthly Degree Days



It would be expected that the heating consumption of the University will also have reduced by 6.9%, however compared to last year, the University consumed 4% less heat.

Despite the reduction in heating consumption being less than expected, the correlation between the degree days and natural gas consumption for 2016/17 was 97% which is an increase from 2015/16's correlation of 79%, indicating that the control of heating systems is improving albeit with some scope for further improvements.

Figure 5: Correlation between Degree Days and Heating Consumption



It should be noted that the Combined Heat and Power (CHP) engine in the Old Aberdeen CHP Station was not in operation for large periods of time in 2015/16 and not generating heat. As a result the three boilers, also located in the Old Aberdeen Station, were running to meet the heating demand.

The distinct difference in correlations suggest that there was poor control of the CHP station boilers and as a result low natural gas to heat conversion efficiency levels. This has a significant impact on the degree day correlations as the CHP Station is the highest consumer of natural gas.

Energy as Used in 2016/2017

Energy used at the University has decreased by 14.5% overall in this financial year. This significant reduction is due to efficiency projects and improved control of the CHP engine and the reduction in the number of sites being supplied with gas oil.

Electricity

The electricity consumption for 2016/17 decreased by 59,272 kWh or 0.21% from last year's consumption.

Natural Gas

The gas consumption used for heating has decreased by 12,843,653kWh or 35% since last year. This is due to improved CHP servicing regimes and operational changes which have resulted in less heat being dumped, more heat being generated and as a result less gas is required to match heat demand across the Old Aberdeen campus.

Steam

Steam consumption at the Foresterhill Campus has increased by 15% from last year due to the new Rowett building opening this year. Despite the Rowett opening in February 2017, it is already the third highest consumer of steam. There are a number of historical charging mechanisms in place at the Foresterhill Campus which are inaccurate and it is proposed that further improvements will be made in this regard.

Metering

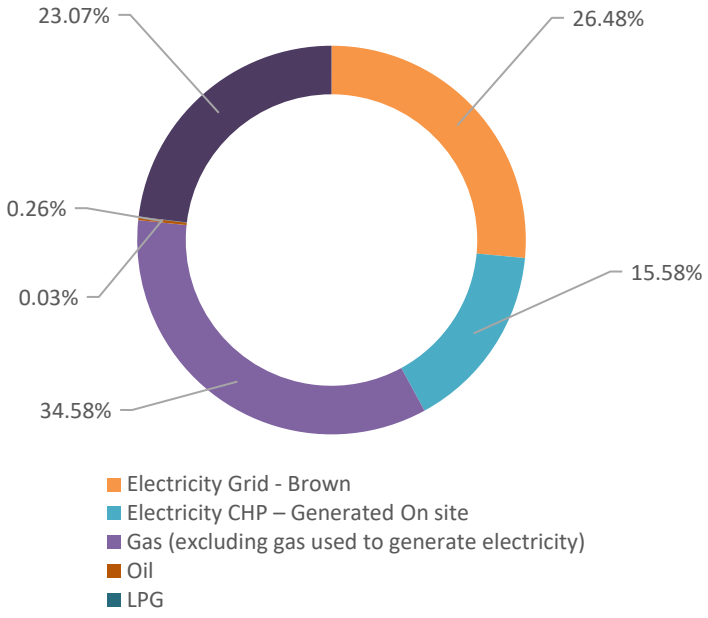
The University has continued to move to using systems to remotely read energy meters to obtain better data on how the buildings are performing. This has allowed for better identification of areas where there are issues over consumption of utilities within buildings. This data is used to inform our M&T system which we have continued to fine tune this year

The actual energy use on site, and the relative proportions of the utilities used are detailed below in Table 3 and Figure 6:

Table 3: Energy as Used

Energy as Used	Consumption (kWh)
Electricity Grid - Brown	18,017,848
Electricity CHP – Generated On site	10,601,200
Gas	23,533,786
Oil	201,432
LPG	21,356
Steam	15,701,190
Total	**68,076,811**

Figure 6: Energy as Used



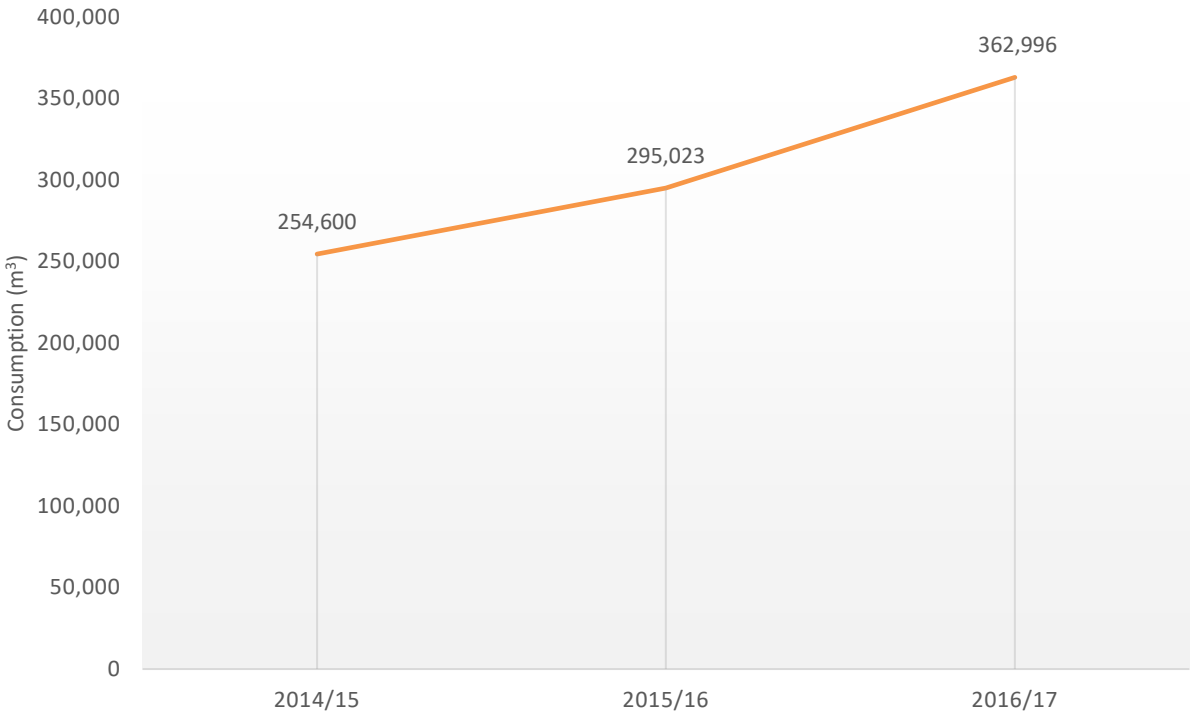
Water Consumption

The University aims to reduce water consumption by 2% year on year. There has been significant increase in water consumption at the University, this is mainly due to several buildings, such as the Rowett, opening this year. It is important to note here that the university changed water supplier in March 2016 which has presented some issues with accurate billing; having said that, we were in a position by year end to commence thorough validation and uploading of invoices. It is anticipated the accuracy of billing this utility and the University's position to query invoices will be significantly improved.

Table 4: Water Consumption and Cost

Utility	Consumption (m^3)	Cost (£)
Water (and Sewerage)	362,996	641,399.75
Total	**362,996**	**641,399.75**

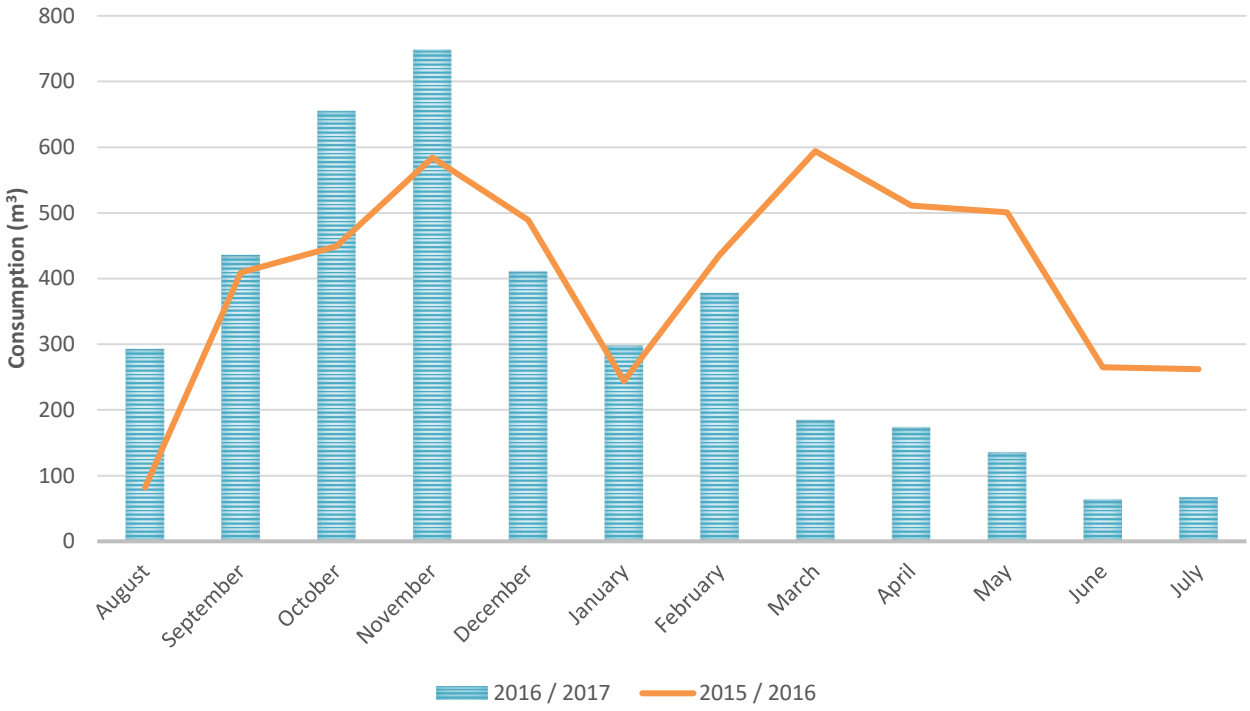
Figure 7: History of Water Consumption



Water Based Projects

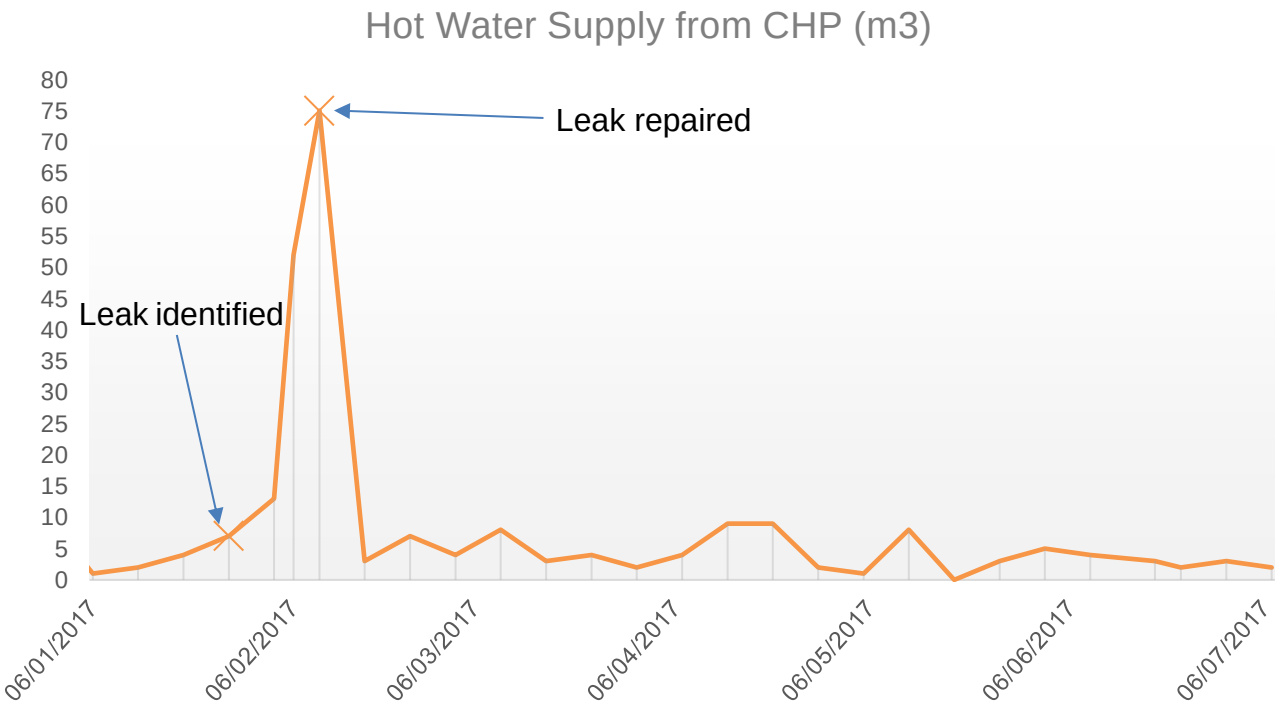
Sir Duncan Rice Library Toilet Upgrade

43 nine litre toilets in the Sir Duncan Rice Library were replaced with Propelair toilets midway through February 2017. The Propelair toilets require just 1.5 litres of water to operate and have resulted in a decrease of an average of 72% in the following months following installation in toilet water consumption from 2015/2016.



Crombie Halls Hot Water Leak Repair

A hot water pipe developed a leak in Crombie Halls at the end of January 2017 and over two weeks increased the supply from the CHP by 2000%, it was quickly repaired and we are currently seeking a burst allowance from Scottish Water for excess drainage charges incurred as a result.

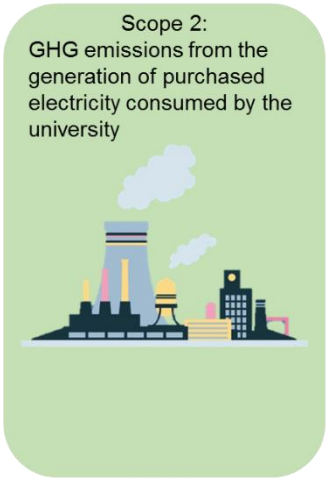


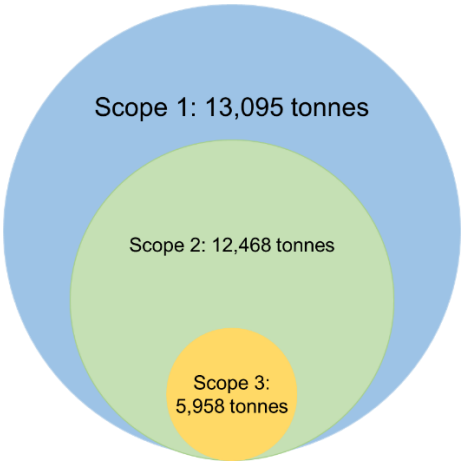
Overall Saving from technology

For the months following the installation of the Propelair toilets at the Library, the toilet water consumption was reduced by an average of 72% and reduced the annual consumption by 981 m^3. It is expected that the reduction in water consumption will continue into next year

2016 – 2021 Carbon Management Plan Progress

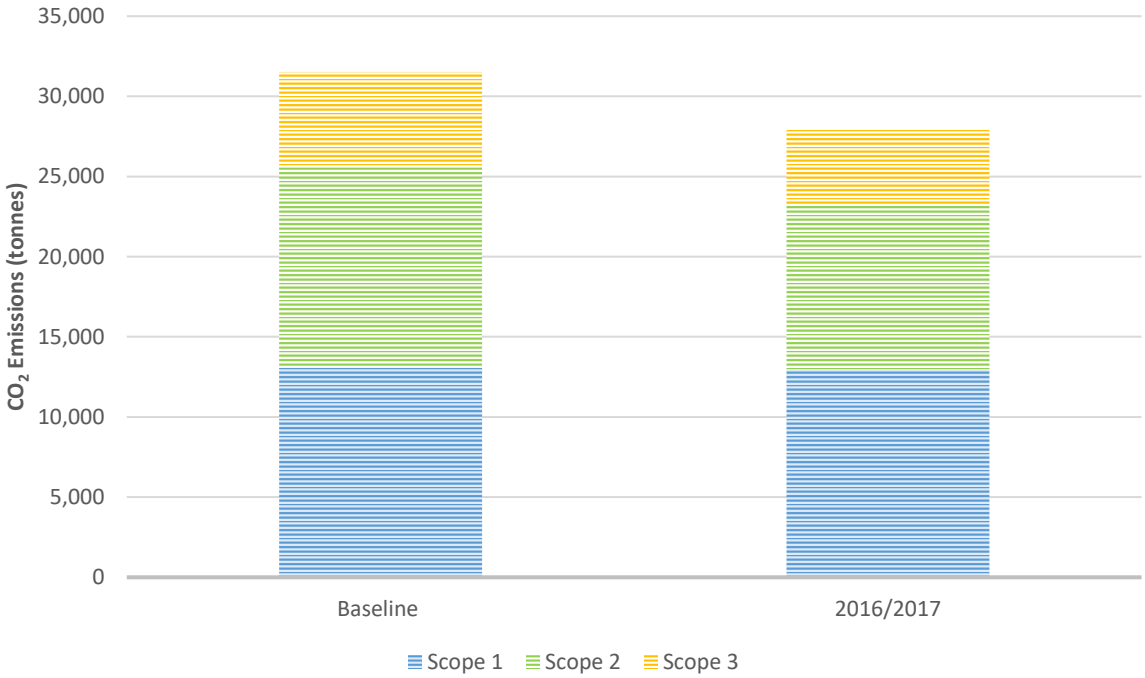
The 2016 – 2021 CMP sets out an ambitious target of reducing the university's carbon emissions by 4% year on year from the baseline year of 2015/16. The 95 identified carbon saving projects have the potential to reduce emissions by more than 8,500 tonnes, which is 27.2% more than the target. The list of potential projects is constantly changing as new possibilities arise and certain impractical projects are removed.





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



The combined impact of the energy projects and projects implemented by the Transport and Waste Manager has resulted in an 11.2% reduction in emissions from the baseline[3].

It should be noted that the University's travel data supplier initially significantly over-estimated the volume of plane travel carried out during the reporting year. The 2015/2016 baseline data for flights may also have been overestimated but this cannot be verified. As a result all future flight data will reported with caution.

Technology Based Projects

This year 27 energy based projects from the CMP where carried out across the various university campuses and sites

Project Name	Description	Site	Carbon Emissions Saving (tonnes)
Replacement of campus printers	Replace old printers	Campus	8.83
8W Maintained Fittings	Upgrade the maintained fittings to 2W	Campus	9.63
Clean CHP Heat Exchanger	Cleaning out of the CHP Heat Exchanger	CHP Station	220.94
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	313.95
Edward Wright Lighting (Excluding LG Floor)	Replace current lights with LEDs	Edward Wright	11.01
Elphinstone Hall Lighting	Replace current lights with LEDs	Elphinstone	6.23
Install VSD in Fraser Noble	Install a VSD in Fraser Noble plant room	Fraser Noble	2.96
Replace lighting in the old Hillhead shop	Replace the existing T5 lights with more efficient models	Hillhead	6.02
IMS Freezers	Replace 10 of the oldest freezers	IMS	16.52
Install VSD in the Conference Centre	Install a VSD in the KCCC	Kings College	2.96
Meston Corridor Lights - Part 1	Replace existing ceiling and wall lighting	Meston	0.63
Install VSD in Meston Extension	Install a VSD in Meston Extension plant room	Meston	2.96

[3] Emission data is from the University's yearly submission to the Public Bodies Climate Change Duties and uses the carbon factors supplied

Meston Buildings Draught Proofing	Install Draught Proofing	Meston	140.89
Install VSD in Regent Building	Install a VSD in the Regent Building	Regent Building	0.15
Install VSD in Taylor	Install a VSD in Taylor plant room	Taylor Building	0.81
Install VSD in University Office	Install VSD in University Office	University Office	0.30
University Office Lighting Upgrade	Upgrade lighting	University Office	1.96
University Office External Lighting	Replace current external lighting with LEDs	University Office	3.64
Upgrade West Block AC and condensers	Upgrade West Block AC and condensers to energy efficient alternatives	West Block	12.11
Install VSD in William Guild	Install a VSD in William Guild	William Guild	0.59
Upgrade Arts Lecture Theatre Lighting	Upgrade the Arts Lecture Theatre Lighting	William Guild	2.43
Valve and Flange Insulation	Insulation of exposed pipes in boiler room	William Guild	8.38
William Guild - Upgrade Corridor and office Lighting	Upgrade corridor and office lighting (EXCL. Annex)	William Guild	37.21
William Guild Loft Insulation	Install loft insulation	William Guild	37.43
Hillhead Adam Smith Wall Insulation	Install cavity wall insulation	Hillhead	21.44
Replace corridor lighting in Fife House	Replace existing corridor lighting in Fife House with LEDs	Hillhead	2.69
Meston Corridor Lights - Part 2	Replace existing ceiling and wall lighting	Meston	3.81

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

Overall saving from Technology Based Projects

The total reduction in carbon emissions arising from these measures is projected to be 870 tonnes p.a. This is equivalent to a 2.76% reduction in carbon dioxide emissions from the 2015/16 baseline.

It is worth noting at this juncture that a number of other projects have been implemented by the projects department and many of these have had a positive effect on the energy efficiency

of our buildings – unfortunately a comprehensive list of projects carried out was not available at the time of writing.

Staff Awareness and Monitoring and Targeting Projects

Aside from the technology based carbon saving projects, staff behavioural projects were also implemented throughout the year.

Energy Awareness Campaign

The Energy Management produces a weekly Energy Awareness segment to be included in the weekly Estates Newsletter and once every two weeks in the StaffNet Newsletter.

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 articles have generated significant interest from the university population and it is the intention that this will be sustained with further awareness campaigns in 2017/18 to highlight this important issue to the wider University population.

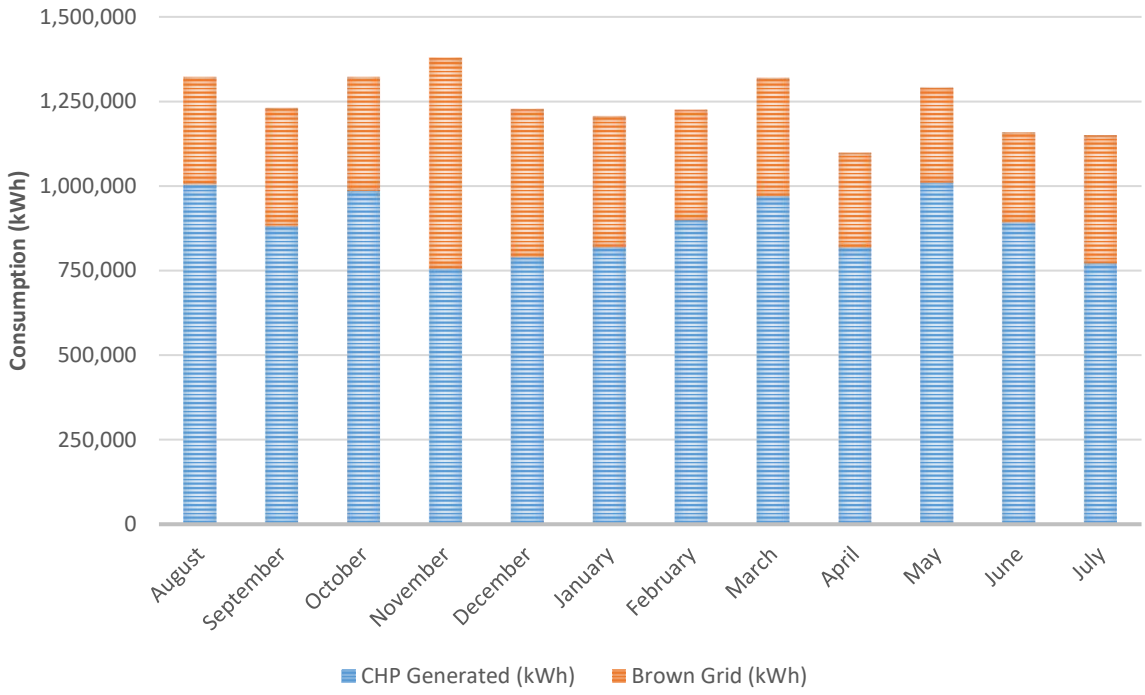
Sustainable and Environmental Technologies

Combined Heat and Power Station (CHP)

The Combined Heat and Power station commenced operation in May 2007. The CHP station is a supply side measure to reduce carbon dioxide emissions from energy use at the University. The CHP station reduces carbon dioxide emissions by using the waste heat from generating electricity 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 71% of the electrical load for the Old Aberdeen Campus, as highlighted in Figure 9. The effect of generating electricity using the CHP engine was to reduce the average overall price for electricity at the site from 11.06p/unit to 8.53p/unit.

Figure 9: Old Aberdeen Campus electricity consumption for period 2016/2017



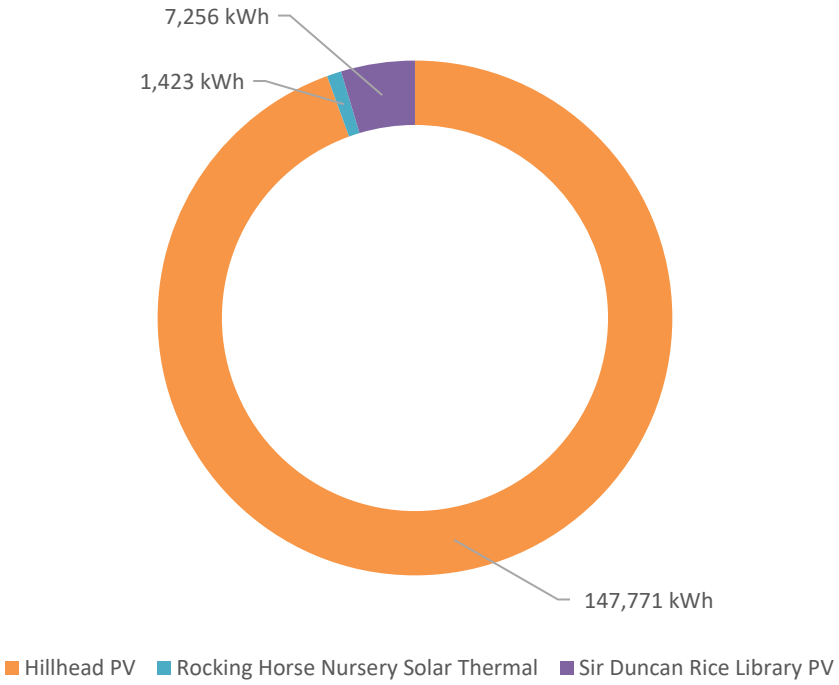
Renewable Energy Technologies

Renewable energy sources are also a supply side measure that can be used to reduce carbon dioxide emissions from energy use at the University. The installed capacity is currently very low, but there are plans to increase the use of renewables going forward.

There is currently 1,000m^2 of solar photovoltaic panels installed at the Hillhead Student Village and 40m^2 at the Sir Duncan Rice Library, and 12 m^2 of solar thermal installed at the Rocking Horse Nursery. The PV panels, air source heat pump[4] and solar thermal system are the total renewable technologies capacity at the university.

[4] The air source heat pump is not individually metered and as a result the energy generated is not detailed in this chapter

Figure 10: Energy Generated from Renewable Technologies

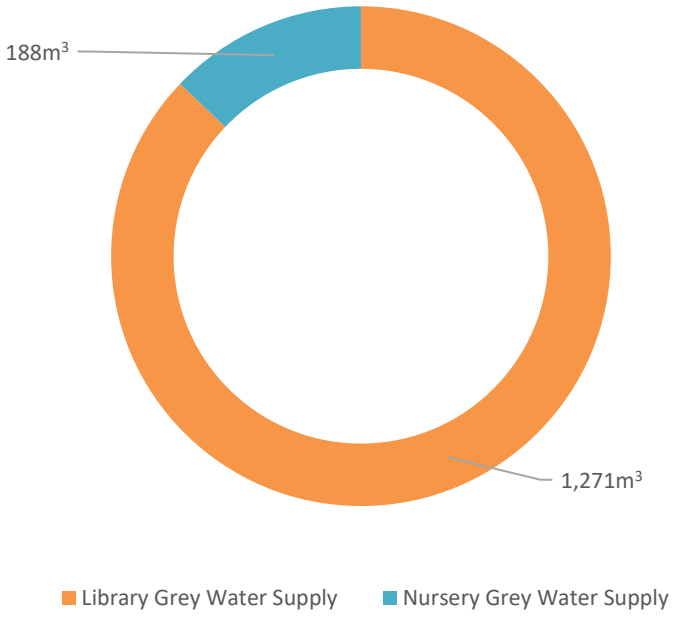


Compared to 2015/2016, all three of the renewable technology systems generated more electricity and heat this year. The Hillhead and Sir Duncan Rice Library PV systems generated 83% and 5% more electricity this year, respectively. The solar thermal system located at the Rocking Horse Nursery generated 19% more heat than in 2015/2016.

Rainwater harvesting

There is a rain water harvesting system in the SDR Library and the new Rocking Horse Nursery. Rain water contributed approximately 26% of the nursery's water needs and 20% of the library's needs.

Figure 11: Volume of Grey Water Harvested



Energy Consumption League Tables

This year £3,404,813 was spent on supplying electricity, steam and natural gas to university buildings throughout the North East of Scotland.

Each building's energy consumption has been recorded throughout the year to enable an energy consumption league table of all the university buildings to be compiled.

The 2016/21 Carbon Management Plan contains a list of energy saving projects, with a number of them applying to the 10 highest energy consumers.

Following the League Tables in 2015/16 Energy Report, one of the highlighted potential electricity CMP projects was carried out at the Zoology building and has helped Zoology drop from 3rd highest consumer to 5th.

Electricity League Table

The IMS and SDR Library are the highest consumers of electricity on campus, and with no energy saving projects being identified for the library in the Carbon Management Plan there is no indication that this site will drop down the list in the coming year.

There have been 8 projects identified in the Carbon Management Plan (CMP) that will reduce the electricity consumption across the top ten University buildings by a total of 1,146,387 kWh.

Table 5: Top 10 Electricity Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	Institute of Medical Sciences	3,714,693	2	17.3
2	Sir Duncan Rice Library	2,229,349	-	0
3	Hillhead Halls	1,760,640	-	0
4	Rowett	1,729,549	-	0
5	Zoology	1,534,523	1	12.4
6	MacRobert	1,464,220	2	6.6
7	Medical Research Facility	1,382,396	-	0
8	Hillhead Carnegie	1,249,926	1	14.0
9	Edward Wright Data Centre	991,148	-	0
10	Meston Extension	944,985	2	4.6

Natural Gas League Table

The CHP station is expected to be one of the highest consumers as it requires natural gas to generate electricity and heat.

The Hillhead Halls of Residence is the second highest natural gas consumer in the university. There is an opportunity to reduce this consumption by up to 499,670 kWh or 4.7% by implementing 6 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	46,612,314	-	0
2	Hillhead Halls of Residence	10,543,291	6	4.7
3	Institute of Medical Sciences	3,588,728	-	0
4	Medical Research Facility	3,385,936	-	0
5	Marischal College	2,297,860	-	0
6	Health Sciences Building	1,026,559	-	0
7	23 St Machar Drive (incl. Greenhouse)	715,422	-	0
8	Life Sciences Innovation 1	502,186	-	0
9	Oceanlab	387,044	-	0
10	Unit 5 - Holland Street	174,831	-	0

Steam League Table

The buildings located at the Foresterhill campus are supplied heating via steam produced on-site. The IMS is the highest consumer of steam, followed by the MRF building.

It should by highlighted that the Rowett building started consuming steam in February 2017 and managed to become the third highest consumer for 2016/2017. It is expected that the Rowett will be the second highest consumer next year.

There aren't currently any projects in the CMP that focus on reducing steam consumption in the Foresterhill campus. However, through effective building controls, the steam consumption could be maintained at the current levels or reduced. Having said that, working with the Maintenance section we will undertake a comprehensive survey of steam traps with a view to assessing condition, functionality and effectiveness. On the back of this it is anticipated that some energy savings can be made.

Table 7: Top 10 Steam Consuming Sites

Position	Location	Consumption (kWh)	Number of CMP Projects	% Saving
1	Institute of Medical Sciences	6,147,862	-	0
2	Medical Research Facility	2,667,909	-	0
3	Rowett	1,336,659	-	0
4	Suttie	1,238,231	-	0
5	Medical Centre	1,185,089	-	0
6	Medical Physics	1,091,966	-	0
7	West Block	713,162	-	0
8	Polwarth South	673,937	-	0
9	Polwarth North	627,389	-	0
10	Link Block	18,987	-	0

Concluding Comments

This is a comprehensive analysis of the data available to the university. Over the course of the last two years the Energy Management Team has invested considerable resource into fine tuning the reliability and visibility of our Energy Data through the use of our Monitoring and Targeting system (Optima). As a result, the reliability and consistency of our data is more robust than it has ever been making for efficient, consistent and accurate reporting and budgeting.

Progress against the 2016-21 Carbon Management Plan has been encouraging and the efforts of the Energy Management Team and the wider Estates section should be commended. Significant progress has been made this year and with continued investment and driving the plan forward the University should be in a position to deliver significant carbon and energy savings in the coming years.

Appendix

Appendix A – Breakdown of CMP Projects

Project Name	Description	Site	Energy Savings (kWh)	Unit	Saving (£)	Carbon Emissions Saving (tonnes)
Replacement of campus printers	Replace old printers	Campus	22,961	Grid Electricity (kWh)	2,066.53	8.83
8W Maintained Fittings	Upgrade the maintained fittings to 2W	Campus	25,055	Grid Electricity (kWh)	2,254.94	9.63
Clean CHP Heat Exchanger	Cleaning out of the CHP Heat Exchanger	CHP Station	1,199,718	Natural Gas (kWh)	35,991.54	220.94
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	1,704,727	Natural Gas (kWh)	51,141.82	313.95
Edward Wright Lighting (Excluding LG Floor)	Replace current lights with LEDs	Edward Wright	28,650	Grid Electricity (kWh)	2,578.50	11.01
Elphinstone Hall Lighting	Replace current lights with LEDs	Elphinstone	16,200	Grid Electricity (kWh)	1,458.00	6.23
Install VSD in Fraser Noble	Install a VSD in Fraser Noble plant room	Fraser Noble	7,709	Grid Electricity (kWh)	693.81	2.96

Replace lighting in the old Hillhead shop	Replace the existing T5 lights with more efficient models	Hillhead	15,659	Grid Electricity (kWh)	1,409.31	6.02
IMS Freezers	Replace 10 of the oldest freezers	IMS	42,977	Grid Electricity (kWh)	3,867.93	16.52
Install VSD in the Conference Centre	Install a VSD in the KCCC	Kings College	7,709	Grid Electricity (kWh)	693.81	2.96
Meston Corridor Lights - Part 1	Replace existing ceiling and wall lighting	Meston	1,645	Grid Electricity (kWh)	148.09	0.63
Install VSD in Meston Extension	Install a VSD in Meston Extension plant room	Meston	7,709	Grid Electricity (kWh)	693.81	2.96
Meston Buildings Draught Proofing	Install Draught Proofing	Meston	765,028	Natural Gas (kWh)	22,950.84	140.89
Install VSD in Regent Building	Install a VSD in the Regent Building	Regent Building	385	Grid Electricity (kWh)	34.65	0.15
Install VSD in Taylor	Install a VSD in Taylor plant room	Taylor Building	2,102	Grid Electricity (kWh)	189.18	0.81
Install VSD in University Office	Install VSD in University Office	University Office	771	Grid Electricity (kWh)	69.39	0.30
University Office Lighting Upgrade	Upgrade lighting	University Office	5,103	Grid Electricity (kWh)	459.27	1.96
University Office External Lighting	Replace current external lighting with LEDs	University Office	9,464	Grid Electricity (kWh)	851.76	3.64

Upgrade West Block AC and condensers	Upgrade West Block AC and condensers to energy efficient alternatives	West Block	31,489	Grid Electricity (kWh)	2,834.01	12.11
Install VSD in William Guild	Install a VSD in William Guild	William Guild	1,542	Grid Electricity (kWh)	138.78	0.59
Upgrade Arts Lecture Theatre Lighting	Upgrade the Arts Lecture Theatre Lighting	William Guild	6,334	Grid Electricity (kWh)	570.02	2.43
Valve and Flange Insulation	Insulation of exposed pipes in boiler room	William Guild	45,492	Natural Gas (kWh)	1,364.75	8.38
William Guild - Upgrade Corridor and office Lighting	Upgrade corridor and office lighting (EXCL. Annex)	William Guild	96,780	Grid Electricity (kWh)	8,710.20	37.21
William Guild Loft Insulation	Install loft insulation	William Guild	203,253	Natural Gas (kWh)	6,097.60	37.43
Hillhead Adam Smith Wall Insulation	Install cavity wall insulation	Hillhead	116,395	Natural Gas (kWh)	3,491.84	21.44
Replace corridor lighting in Fife House	Replace existing corridor lighting in Fife House with LEDs	Hillhead	6,989	Grid Electricity (kWh)	629.01	2.69
Meston Corridor Lights - Part 2	Replace existing ceiling and wall lighting	Meston	9,920	Grid Electricity (kWh)	892.80	3.81