

UTILITIES REPORT
PERIOD AUGUST 2011 TO JULY 2012
University of Aberdeen

Contents

1	Executive Summary	3
2	Energy as Supplied Summary	3
3	Carbon Dioxide Emissions – Actual for 2011/2012	4
4	Carbon Dioxide Emissions – Performance against Targets.....	4
5	European Union Emissions Trading Scheme (EU-ETS)	6
6	Carbon Reduction Commitment (CRC) scheme.....	6
7	Combined Heat and Power Station (CHP).....	6
8	Energy as Used	7
9	Energy Saving – Using Technology	8
10	Energy Saving – Staff Awareness/Good Housekeeping.....	10
11	Installation of Renewable Energy Technology	11
12	Water Consumption	12
13	Water Saving – Using Technology	12
14	Water Saving - Staff Awareness/Good Housekeeping	12
15	Grey water/Rainwater harvesting	12

Utilities Report in Numbers – This separate document contains the breakdown of the utility consumption by individual buildings.

Figures

Figure 1	Energy as Supplied.....	3
Figure 2	Carbon Emissions Graph based on CMP	4
Figure 3	Old Aberdeen Campus electricity consumption for period 2011/12	7
Figure 4	Energy as Used	8
Figure 5	Library Solar PV Electricity Output	11

Tables

Table 1	Energy as Supplied	3
Table 2	Carbon Dioxide Emissions.....	4
Table 3	Carbon Emissions History.....	4
Table 4	Energy as Used.....	7
Table 5	- Water Consumption and Cost.....	12

1 Executive Summary

The Utilities Report has been expanded to include figures for energy and water use at the Rowett site. For the financial year 2011/2012, the University purchased 100,514,573 kWh¹ of energy, for Academic and Campus Services buildings, at a cost of £4,549,860. This energy use resulted in emissions of 28,635 tonnes of Carbon Dioxide. Further the University used 268,369 m³ of water at a cost of £679,417. The overall cost for utilities for the year was £5,229,277. For gas and oil there was a reduction in consumption due mainly to the milder winter. Electricity consumption increased due mainly to the new library development. Overall there was a net reduction in energy consumption at the University. Similarly there was an overall reduction in carbon emissions compared with 2010/2011 this equated to a reduction of 1.9% or 555 tonnes.

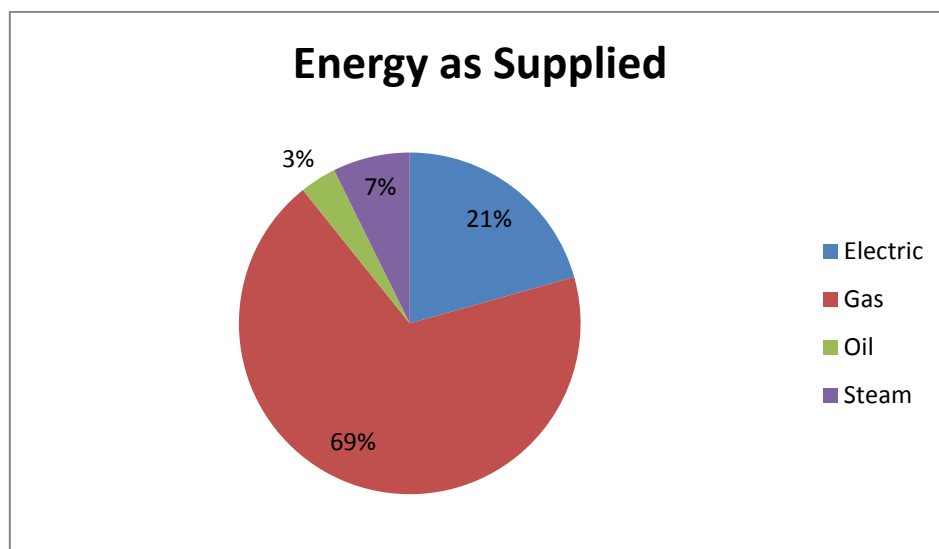
2 Energy as Supplied Summary

The information on energy is reported on two separate bases. The first is the energy supplied to the University. The second is the actual energy use on site. The reason for this is because the University uses a Combined Heat and Power station to generate electricity on site. Therefore some of the 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. The actual energy use within buildings is detailed in the separate document Utilities Report in Numbers. Overall energy consumption as supplied reduced by 1.1%, while the actual cost of energy increased by 11.7%.

Table 1 Energy as Supplied

Energy	Consumption, kWh	Cost, £
Electricity	21,401,213	2,146,444
Gas	68,398,021	1,794,849
Oil	3,438,359	227,955
Steam	7,276,980	380,612
Total	100,514,573	4,549,860

Figure 1 Energy as Supplied



¹ kWh equates to Kilo Watt Hour

3 Carbon Dioxide Emissions – Actual for 2011/2012

There is an ever increasing focus on the need to reduce carbon dioxide emissions. In addition to the European Union Emissions Trading Scheme the University is now included in the Carbon Reduction Commitment (CRC) scheme. To address this increasing need to reduce carbon emissions the University has developed a 5 year Carbon Management Plan 2009-2014. Arising from developing the plan it was identified that energy use in buildings contributes over 80% of the University's carbon dioxide emissions. Based on the energy as supplied to site the associated Carbon Dioxide emissions for 2011/12 are calculated as per the table below. (Note figures now include the Rowett Institute which was taken over in 2008.)

Table 2 Carbon Dioxide Emissions²

Energy	Consumption, kWh	kgCO ₂ /kWh	Tonnes CO ₂
Electricity	21,401,213	0.53700	11,492
Gas	68,398,021	0.20600	14,090
Oil	3,438,359	0.26500	911
Steam	7,276,980	0.29430	2,142
Total	100,514,573		28,635

4 Carbon Dioxide Emissions – Performance against Targets

The Carbon Management Plan (CMP) sets targets reducing carbon emissions by 20% over 5 Years. For the year 2011/12 there has been a reduction in carbon dioxide emissions, arising from energy use in buildings, of 555 tonnes.

Figure 2 Carbon Emissions Graph based on CMP³

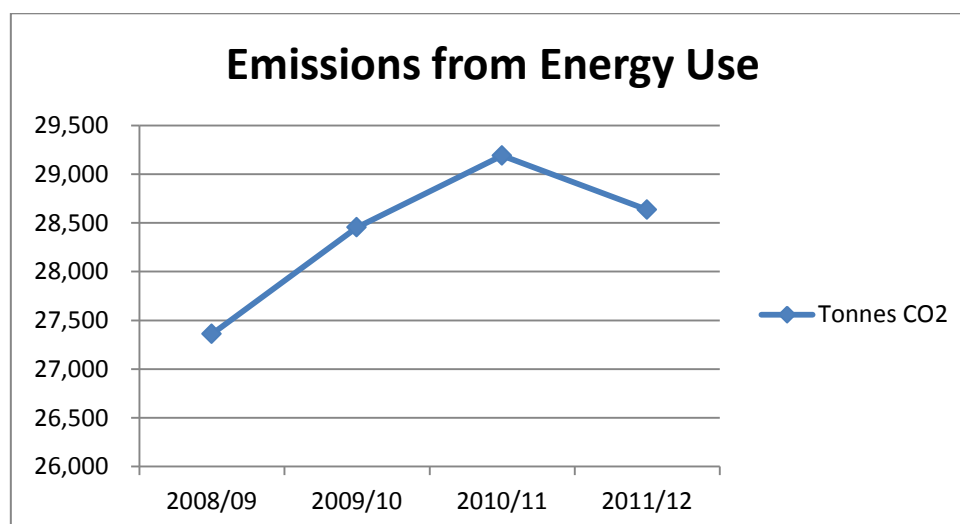


Table 3 Carbon Emissions History

Year	2008/09	2009/10	2010/11	2011/12
Tonnes CO ₂	27,361	28,455	29,190	28,635

² The conversion factors used (kgCO₂/kWh) are based on those quoted in the "Guidelines to Defra's Greenhouse Gas (GHG) conversion factors for company reporting".

³ 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.

The reduction in carbon emissions of 555 tonnes corresponds to a reduction of 1.9%. This is compared to the required reduction rate of 4% p.a. The following sections on occupancy of buildings (720 tonnes carbon dioxide), and increases in energy use (24 tonnes carbon dioxide) highlight why it is very difficult to achieve reductions in absolute carbon dioxide emissions. This issue was noted in response to the interim carbon report, and two sets of consultants have been appointed to identify additional measures to reduce carbon dioxide emissions from the Universities activities.

Occupancy of Buildings

Where buildings start operation from new, are closed, or re-commence operation, then depending on the size this can have a significant impact on the University's carbon dioxide emissions. The buildings where this type of change has occurred during the previous year, or will be happening during the current year are detailed below.

50/52 College Bounds was unoccupied, during the year while it was being refurbished. The works have been completed and the building was re-occupied in September 2012. There is no addition to emissions for the current year.

Life Sciences No1 building was handed back to the University in April 2012 and has started operation again. For the year to date this has increased carbon emissions from the University by 23 tonnes.

The major building change affecting the reporting period was the closure of the QML, and the opening of the New Library. For the year to date the operation of New Library has increased carbon dioxide emissions by 697 tonnes.

Increases in Energy use

There are times when for research and teaching the University purchases additional equipment, and changes to the buildings are required in terms of ventilation and air-conditioning as a result. This will generally increase energy consumption within buildings, and increase the associated carbon emissions. A summary of some of these changes, for the current year, are shown in the table below:

Building	Activity	Carbon Dioxide increase, tonnes
Cruickshank	Installation of growth lamps	12
Liberty Building	Installation of an electric autoclave	1
Fraser Noble	22kW motor for work on cement	4
IMS	Installation of 8 fume cupboards and some fridges	7
Total		24

These will only account for some of the changes that result in increased emissions from University activities.

5 European Union Emissions Trading Scheme (EU-ETS)

The Combined Heat and Power station exceeds 20MW 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. To establish the allocation, an average of 4 years emissions was assessed, this came to 8,148 tonnes. The allocation received under the scheme was 6,924 allowances (a 15% reduction). The reporting year under EU-ETS is January – December.

• Historical Average Emissions	8,148 tonnes
• Actual Emissions 2011	7,832 tonnes
• Allowances 2007 basis	6,924
• Excess Emissions	908 tonnes

The University target for EU-ETS allocations is to reduce emissions in line with the number of allocations received. For the calendar year 2011 the University exceeded the number of allowances by 908 tonnes. It was necessary to purchase allowances to make up the shortfall and this cost £4,743. The UK in conjunction with the European Union has recently introduced an Opt Out Scheme for small emitters that are sites that have an installed thermal capacity of less than 35MW. The site capacity for the CHP station is less than this threshold and the University is due to move in to the opted out scheme from 1st January 2013. This is expected to reduce costs, and reporting requirements.

6 Carbon Reduction Commitment (CRC) scheme

The Carbon Reduction commitment Scheme was in the second year of operation covering the period 1st April 2011 to 31st March 2012. This was the first charging year of the scheme and the total carbon emissions for the University falling within the boundaries of the scheme (the scheme excludes emissions reported under EU-ETS) was 21,667 tonnes. The charging rate to purchase allowances to cover these emissions was £12/tonne. The total cost for carbon emissions for the year was £260,004. These charges are in addition to the invoiced utility charges.

7 Combined Heat and Power Station (CHP)

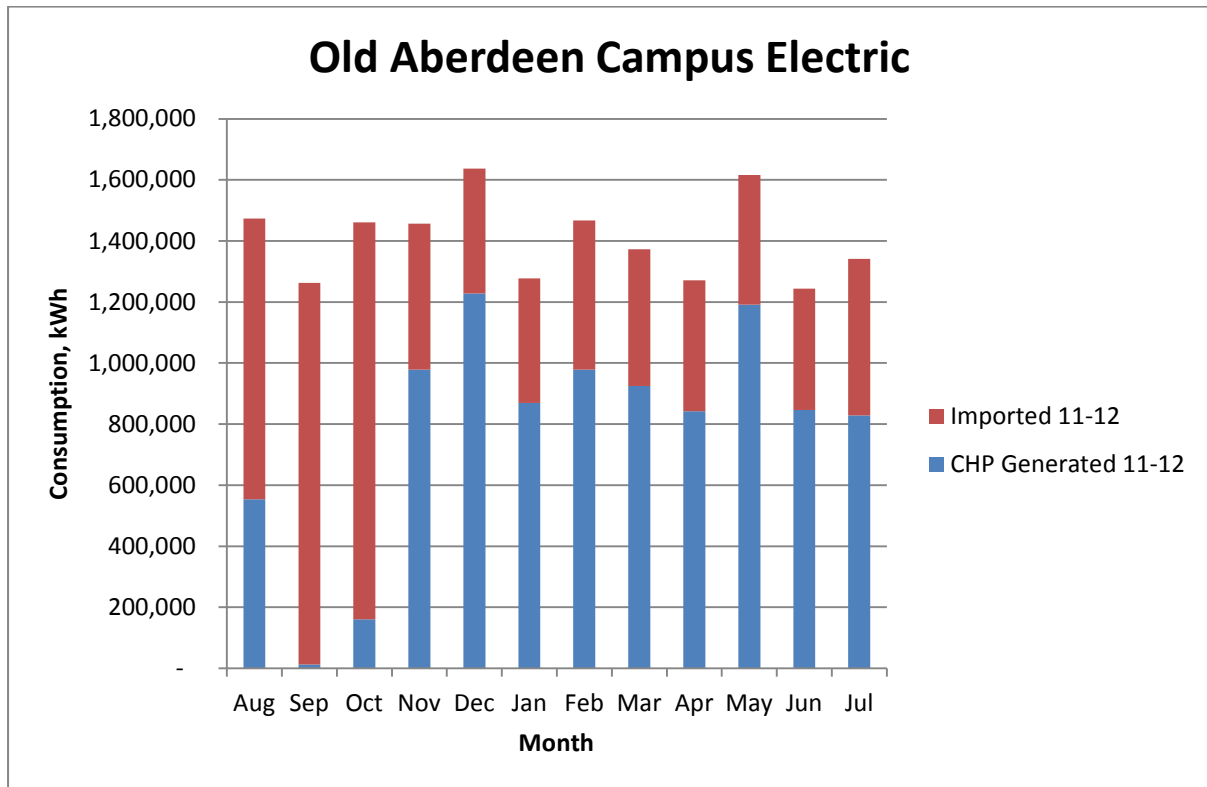
The Combined Heat and Power station commenced operation in May 2007 and has been operational during the 2010/2011 financial year. There are two main benefits from having the CHP station. The first is it gives a reduction in carbon dioxide emissions due to overall operating efficiency compared with a power station. The second is that it reduces the cost of electricity.

The CHP engine was operated for longer hours during the year 11/12, producing more electricity and reducing carbon emissions. There were 2 reasons why it was possible to run the engine in this way. One factor was the summer in 2012 was cooler than 2011. The second factor was the revisions to the building heating controls resulting in lower return temperatures to the CHP station increased the ability to use the CHP engine in times when the heating demand was less.

The CHP engine generated 55% of the electrical load for the Old Aberdeen Campus compared with 50% in the previous year. This is shown in the figure 3. The effect of generating electricity using the CHP engine was to reduce the average overall price for electricity at the site from 11.9p/unit to 7.96p/unit.

Overall the implementation of the CHP scheme has resulted in a cost saving of £332,000, and a reduction in emissions of 2,208 tonnes, for the year.

Figure 3 Old Aberdeen Campus electricity consumption for period 2011/12



8 Energy as Used

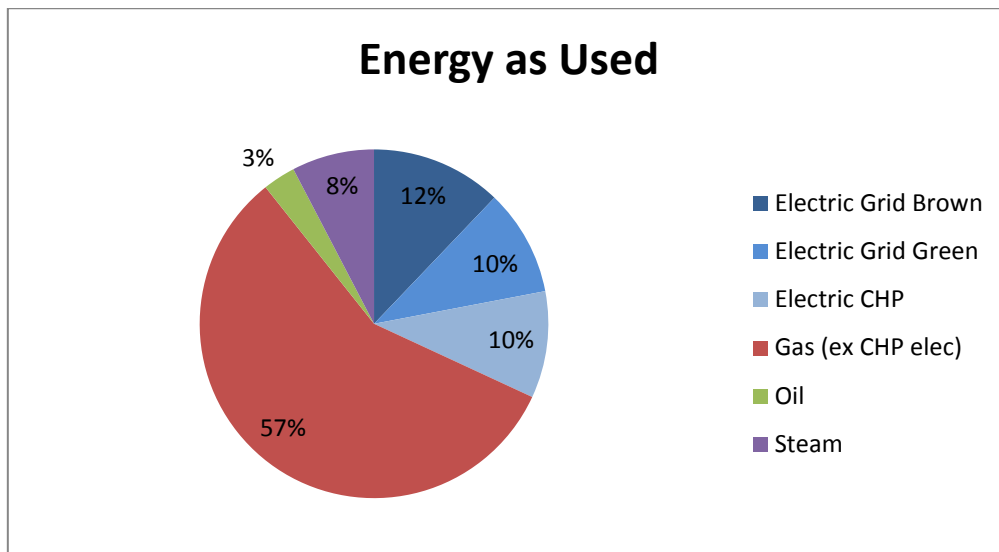
The University has a range of different size buildings that have varying uses. The University has increasingly moved to using systems to remotely read energy and water meters to obtain better data on how the buildings are performing. In the case of new buildings to enable the building's overall load to be broken down additional sub-meters are fitted on specific building loads. Overall there are now in excess of 200 meters that are automatically logged. This has allowed for better identification of areas where there are issues like over consumption of utilities within buildings, and to readily quantify them.

In the case of the buildings supplied with electricity and heat from the CHP station, it is necessary to discount the gas used to generate electricity, and add in the amount of electricity generated by the CHP station. The effect of this is detailed in the table 4 and figure 4:

Table 4 Energy as Used

Energy as Used	Consumption, kWh	Percent of Overall Consumption
Electricity Grid - Green	9,381,457	10%
Electricity Grid - Brown	12,019,757	12%
Electricity CHP – Generated On site	9,414,000	10%
Gas	54,578,448	57%
Oil	3,438,358	3%
Steam	7,276,980	8%
Total	96,109,000	100%

Figure 4 Energy as Used



There has been a change in percentage terms for the amount of green electricity purchased by the University. This has arisen from the fact that the Rowett site is included in the figures, and the supplies for this site are from 100% green sources.

9 Energy Saving – Using Technology

During the course of the year a number of specific energy saving measures have been implemented. Some of these have been funded through Salix, and some are through core budgets. These measures have contributed to helping achieve an overall reduction in energy consumption and carbon emissions compared with last year. The total reduction in carbon emissions arising from these measures is projected to be 379 tonnes p.a.

Replacement of Single Glazing with double glazing

This measure was undertaken as an Estates Project to upgrade the windows in the Taylor building.

Actual Savings: tonnes 184,837 kWh, 74 tonnes CO₂, £10,598 p.a.

Installed Cost: N/A Part of a refurbishment project

Payback: N/A years

Replacement of lighting in Regent Lecture Theatre

The lighting in the Regent building lecture theatre was replaced, and automatic lighting controls were fitted to reduce energy consumption.

Projected Annual Savings: kWh, 6 tonnes CO₂, £11,025

Installed Cost: N/A Part of a refurbishment project

Payback: N/A years

Actual Performance Estimated as projected

Replacement of Electric Heating, and upgrading of lighting

During the year the refurbishment of Fraser Noble west wing was completed. This wing of the building had been using electric heating, and this was changed out for a wet system. In addition the old outdated lighting system was changed out for a more energy efficient alternative.

Actual Annual Savings: 168,550 kWh, 91 tonnes CO₂, £15,169

Installed Cost: N/A part of a refurbishment package

Payback: N/A

Foresterhill CHP Connection

Historically a number of the University Buildings at the Foresterhill campus have been connected to the NHS Trust for supplies of steam and hot water. The NHS Trust has upgraded the central heating station in to a Combined Heat and Power (CHP) Station. Some of the University buildings have recently been connected to the CHP station to additionally take supplies of electricity. This will result in a reduction in carbon dioxide emissions associated with energy use in these buildings. The Buildings connected are; 17th June 2012 Polwarth, Link Block, Med Centre, Library Med Physics, HSB, Suttie ; and 18th July 2012 IMS Building. Based on the fact that the changeover is recent the savings will be reported in next year's report.

Lecture Theatre Ventilation Control

The main lecture theatres have ventilation systems that are automatically controlled by the Building Management System. These systems were controlled based on occupancy times, but this can result in energy being wasted when the areas are unoccupied during these periods. To overcome this carbon dioxide sensors and variable speed drives were fitted to the fans. When there is no occupancy carbon dioxide levels fall and the fan speeds are reduced. When they are occupied the carbon dioxide levels go up and the fan speeds are increased.

Projected Annual Savings: 1.829.313 kWh, 161 tonnes CO₂, £28,826

Installed Cost: £105,715

Payback: 3.7 years

Actual Performance: The measure was applied to lecture theatres in 12 buildings which mean the energy saving is generally only a small part of the load. From reviewing the buildings where this measure was implemented the electricity consumption has decreased in eleven of these buildings, which would tend to confirm it is working

Insulation of Hot Water Pipe work – William Guild

This was a relatively small job where insulation on a section of hot water pipe work at William Guild needed to be replaced.

Projected Annual Savings: 25,019 kWh, 5 tonnes CO₂, £813

Installed Cost: £3,600

Payback: 4.4 years

Loft Insulation St Marys

The loft was found to be requiring additional insulation and this was installed to reduce heat loss from the building.

Projected Annual Savings: 96891 kWh, 18 tonnes CO₂, £3,149

Installed Cost: £14,105

Payback: 4.5 years

Actual Performance: The observed heating reduction was 52,840 kWh

Loft Insulation 23 St Machar Drive

The roof was not fully insulated and the remaining areas were fitted with insulation to reduce the heat loss from the building. The work was not completed until June 2012 and the savings will be recorded in next year's report.

Lighting Replacement William Guild

Some of the lights were refurbished in the William Guild building. The opportunity was taken to replace these with more energy efficient alternatives.

Projected Annual Savings: 10,701 kWh, 6 tonnes CO₂, £963

Installed Cost: £4,147

Payback: 4.3 years

Actual Performance: The saving is too small to observe when compared with the overall building energy load.

Lighting Replacement Fluids Lab, Meston

The fluorescent lighting in the fluids lab was of an age where lighting technology has advanced significantly since it was installed. By replacing the existing lighting a significant reduction in electrical load could be achieved.

Projected Annual Savings: 35,196 kWh, 18 tonnes CO₂, £3,168

Installed Cost: £14,352

Payback: 4.5 years

Actual Performance: A reduction in the electrical consumption for the Meston Extension of 36,180 kWh was observed when compared with the previous year.

10 Energy Saving – Staff Awareness/Good Housekeeping

The development of the remote meter reading system with web based display has made it possible to provide access for staff and students to real-time data for energy use in buildings. A web page has been produced to enable staff and students at the University to see electrical energy consumption in the majority of buildings at the Old Aberdeen Campus. The link for this is: <http://www.abdn.ac.uk/estates/environment/energy/index.php> One of benefits is that it can clearly be seen how much energy is still being used over night and during other unoccupied periods.

More generally the issue of carbon dioxide and the need to reduce emissions is being increasingly promoted at the University. As part of Green week in February this year a “Carbon Cube” was set up in Alfies at Butchart. This was a visual representation of what one tonne of carbon dioxide would look like occupying a cube 7m x 7m x 7m and providing information on carbon arising from personal behaviour, and savings achieved by specific measures at the University.

The University signed up to, and took part in Earth Hour with decorative lights being turned off around King’s College. The event was expanded this year, in partnership with the Climate Challenge Project, to include a showing of a film Belleville Rendezvous using a Bike Powered cinema, and this was well attended.

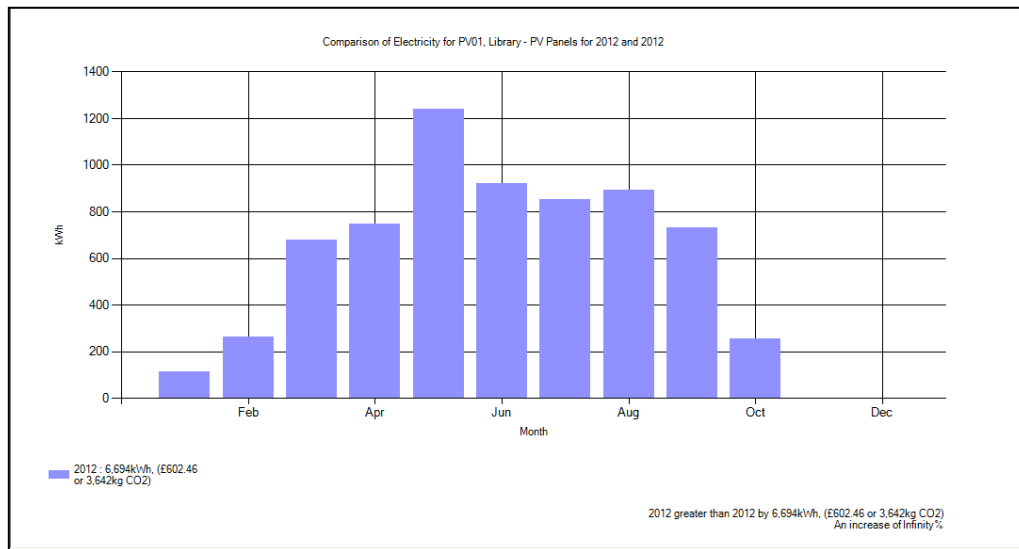
Again working in partnership with the Climate Challenge Project a series of talks called Carbon Conversations is being undertaken. Training for the facilitators was done earlier in the year and the first group comprising mainly Post Grad students have done the first two out of six sections of the talks.

The Environment Office has trialled a pilot on creating Local Sustainability Advisers. The initial assessment, focused primarily on identifying areas for reducing carbon dioxide emissions in the first instance, has been completed ready for submission to the AGSSR.

11 Installation of Renewable Energy Technology

The University has installed 50m² of solar photovoltaic panels on the roof of the New Library. The energy generated from these is recorded on the remote meter reading system and this is displayed in the graph below.

Figure 5 Library Solar PV Electricity Output



The graph shows that in what has been a relatively poor summer the solar panels are on target to generate the majority of the projected 7,768 kWh of electricity for the year, reducing carbon emissions by 4 tonnes.

Going forwards the University is looking at 3 possible renewables projects:

- 1) **Solar Panels for Burnett and Esselmont**
Here the proposal is to put solar panels on each block. These will generate approximately 75,000 kWh p.a. in total. This equates to about 30% of the electricity used in these residential blocks, and corresponds to a reduction in carbon emissions of 40 tonnes.
- 2) **Wind Turbines offsite**
There is a proposal to install wind turbines off site in a joint venture with RGU. The costs for connecting to the grid have proven to be too high at the sites evaluated to date, but further sites are being investigated.
- 3) **Hydro Electric**
There is potential for the University to connect to a hydro electric scheme being developed by Tenants first. The scheme will produce between 540,000-740,000 kWh of electricity. This could possibly be linked to the Electricity supply at Hillhead. Prior to this it would be necessary to do a feasibility study to determine whether the system can meet both Tenants First, and the University's requirements, and what the costs would be.

The most likely of these projects to proceed is the solar panel project for Burnett and Esselmont.

12 Water Consumption

The University aims to reduce water consumption by 2% year on year. There has been progress in reducing water consumption at the University during 2011/12. The water consumption has fallen by 2.1%. The main area where water consumption has fallen is in the buildings supplied off the main water meter off Bedford Road.

Table 5 - Water Consumption and Cost

Utility	Consumption, m ³	Cost, £
Water	268,369	211,406
Sewerage	-	468,010
Total	268,369	679,416

Water consumption 2010/2011 274,023 m³
Water consumption 2011/2012 268,369 m³
Reduction 5,654 m³ (2.1%)

The 2% target has been achieved during 2011/2012.

13 Water Saving – Using Technology

Leaks

There have been a few water issues identified and fixed in terms of leaks during the course of the year. These include repairing the tank in the basement of Zoology, changing out the water supply tank in the Polwarth building, and repairing a leak on the heating system at Kings. These leaks combined were equivalent to the observed reduction in consumption above.

Projected Annual Savings 5,654 m³, £11,308

Toilet Flushing – New Library

The New Library had sensors to operate the flushing mechanism for the toilet cisterns in the building. These were found to be too sensitive, resulting in the toilets flushing day and night. There is a dedicated meter for the water use in the toilets and this showed the problem clearly. The flush controllers were changed out for manually operated controls and it is anticipated that this made the following savings, some of which will reduce consumption in 2012/13.

Projected Annual Savings 12,000 m³, £24,000

14 Water Saving - Staff Awareness/Good Housekeeping

The example of the New Library above shows how water can be wasted out of hours. A key factor for water is that if a building is unoccupied, then in the majority of cases the water consumption can be expected to drop to close to zero. As the metering data is reviewed, there will be potential to discuss with staff if there is out of hours requirements for water use in buildings, possibly leading to the identification of leaks, if there is no such of hours use.

15 Grey water/Rainwater harvesting

Now that the issue with the sensors for the toilet cisterns in the New Library has been fixed, the rain water harvesting system is operating much better and is contributing approximately 10% of the buildings water needs.