

**UTILITIES REPORT**  
**PERIOD AUGUST 2010 TO JULY 2011**  
**University of Aberdeen**  
**(Rev 12<sup>th</sup> April 2012)**

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

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## 1 Executive Summary

For the financial year 2010/2011, the University purchased 94,470,930 kWh<sup>1</sup> of energy, for Academic and Campus Services buildings, at a cost of £4,181,970. This energy use resulted in emissions of 26,532 tonnes of Carbon Dioxide. Further the University used 240,498 m<sup>3</sup> of water at a cost of £591,819. The overall cost for utilities for the year was £4,773,789. For gas and oil there was an increase in consumption influenced by the colder winter. Electricity consumption increased due to construction of the new library, and reduced operation of the Combined Heat and Power engine. Overall there was a net increase in energy consumption at the University. Similarly there was an overall increase in carbon emissions compared with 2009/2010 this equated to an increase of 3.8% or 971 tonnes.

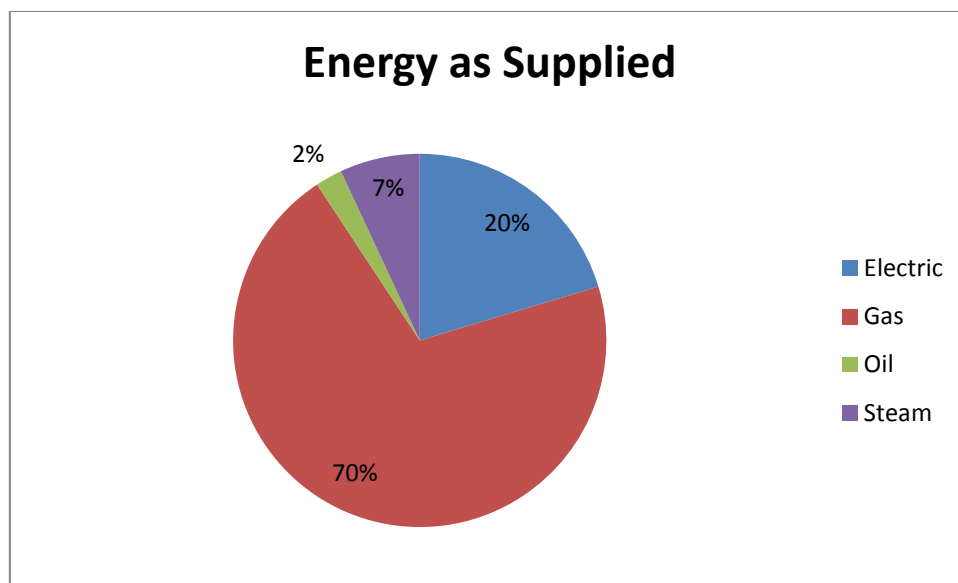
## 2 Energy as Supplied Summary

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 increased by 2.3%, and the actual cost of energy reduced by 0.5%.

**Table 1 Energy as Supplied**

| Energy      | Consumption, kWh | Cost, £   |
|-------------|------------------|-----------|
| Electricity | 19,218,371       | 1,676,197 |
| Gas         | 66,493,654       | 2,065,304 |
| Oil         | 2,198,487        | 121,840   |
| Steam       | 6,560,418        | 318,629   |
| Total       | 94,470,930       | 4,181,970 |

**Figure 1 Energy as Supplied**



<sup>1</sup> kWh equates to Kilo Watt Hour

### 3 Carbon Dioxide Emissions – Actual for 2010/2011

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 2010/11 are calculated as per the table below. (Note these emissions figures do not include the Rowett Institute which was taken over in 2008.)

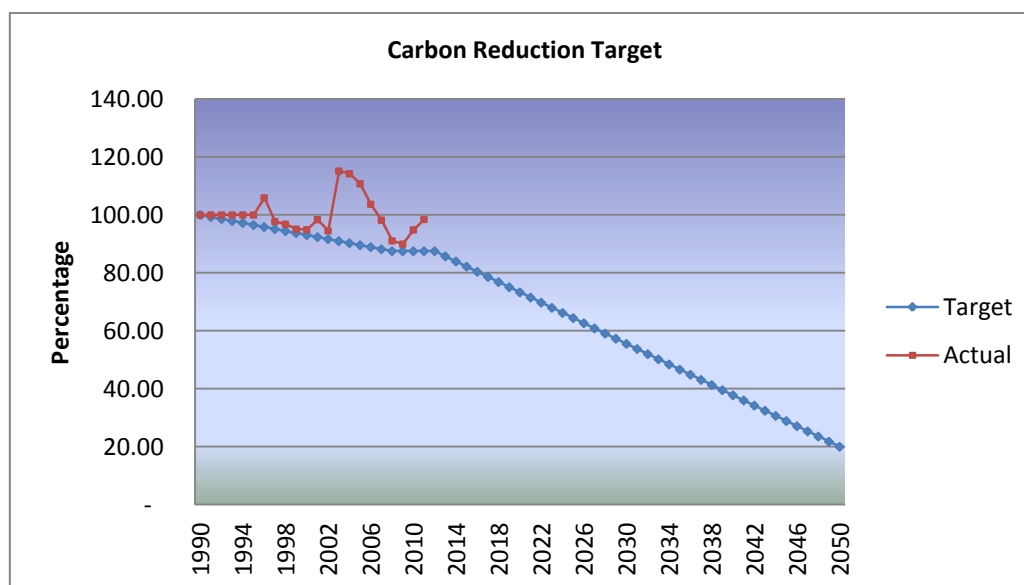
**Table 2 Carbon Dioxide Emissions<sup>2</sup>**

| Energy      | Consumption, kWh | kgCO <sub>2</sub> /kWh | Tonnes CO <sub>2</sub> |
|-------------|------------------|------------------------|------------------------|
| Electricity | 19,218,371       | 0.53700                | 10,320                 |
| Gas         | 66,493,654       | 0.20600                | 13,698                 |
| Oil         | 2,198,487        | 0.26500                | 583                    |
| Steam       | 6,560,418        | 0.29430                | 1,931                  |
| Total       | 94,470,930       |                        | 26,532                 |

### 4 Carbon Dioxide Emissions – Performance against Targets

The new Carbon Management Plan sets targets reducing carbon emissions by 20% over 5 Years. This target aligns well and is in addition to those required under Kyoto protocol. The long term target is to reduce carbon dioxide emissions by 80% by 2050. Figure 2 below shows the target line for reducing emissions and the actual performance for the University. There has been an increase in carbon dioxide emissions for the current year of 971 tonnes.

**Figure 2 Carbon Reduction Target<sup>3</sup>**



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

<sup>3</sup> The reason for the peak in the graph was due to the following factors 1) The merger with Northern College (2003-06), 2) the start of operation of the MRF (2003), and 3) the start of operation of Oceanlab (2003). 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.

## 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 2010        | 9,196 tonnes |
| • Allowances 2007              | 6,924        |
| • Excess Emissions             | 2,722 tonnes |

The University target for EU-ETS allocations is to reduce emissions in line with the number of allocations received. For the calendar year 2010 the University exceeded the number of allowances by 2,722 tonnes. These figures apply to the previous winter which was the coldest for 100 years. Note; the improvement in heating controls was not made till after this time period. It was necessary to purchase allowances to make up the shortfall and this cost £25,916.

## 6 Carbon Reduction Commitment (CRC) scheme

The University submitted its first CRC return this year, and covered the period 1<sup>st</sup> April 2010 to 31<sup>st</sup> March 2011. The total carbon emissions falling within the boundaries of the scheme (the scheme excludes emissions reported under EU-ETS) was 21,937 tonnes. There is no payment to make for the first year of the scheme. Thereafter the government will be charging based on £12/tonne. If the emissions are the same for the second year, the cost to the University will be 21,937 tonnes @ £12/tonne equalling £263,244 p.a.

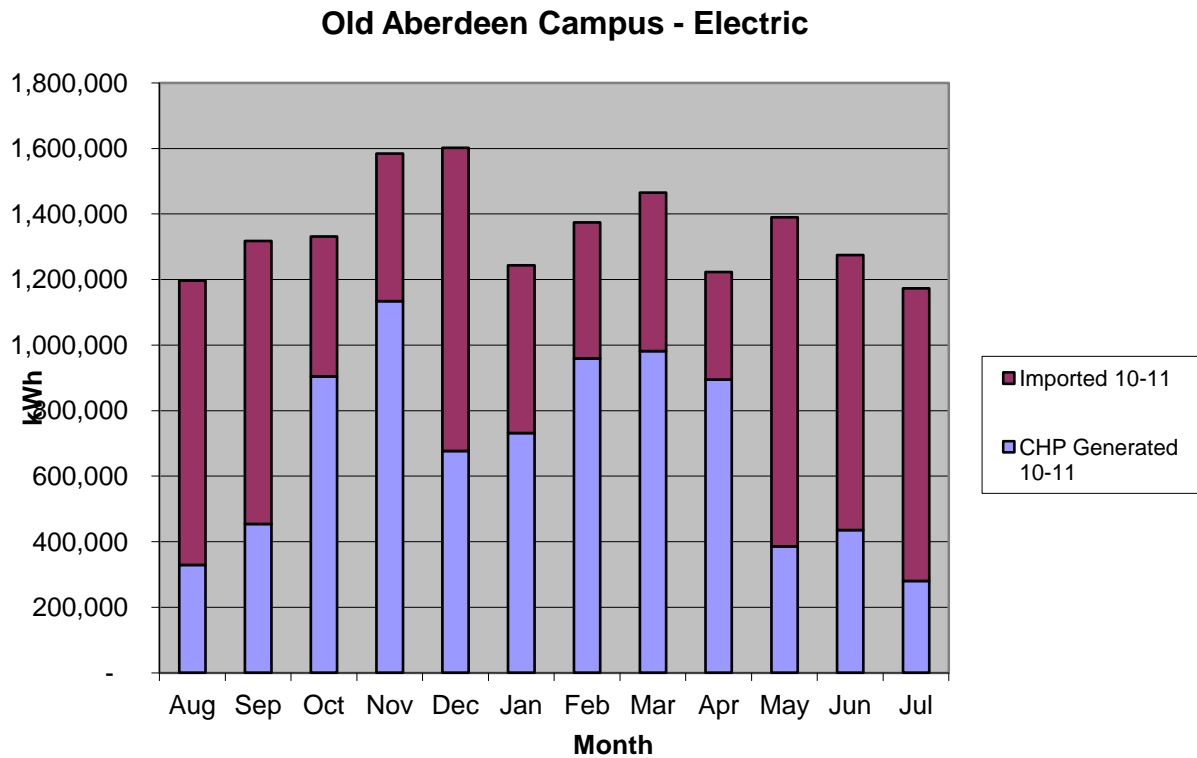
## 7 Combined Heat and Power Station (CHP)

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 operation of the CHP engine was reduced because of the particularly cold weather in December resulting in the gas supply being interrupted. With the gas shut off it the heating boilers changed over to operating on oil, but the CHP engine is only able to use gas and had to be turned off.

The CHP engine generated 50% of the electrical load for the Old Aberdeen Campus as 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 10.54p/unit to 9.05p/unit.

Overall the implementation of the CHP scheme has resulted in a cost saving of £193,000, and a reduction in emissions of 1,877 tonnes, for the year. Part of the cost savings are due to the fact that the CHP station qualifies as good quality CHP under the CHPQA (Combined Heat and Power Quality Assurance) scheme, and is exempt from CCL (Climate Change Levy) for gas used.

Figure 3 Old Aberdeen Campus electricity consumption for period 2010/11



## 8 Energy as Used

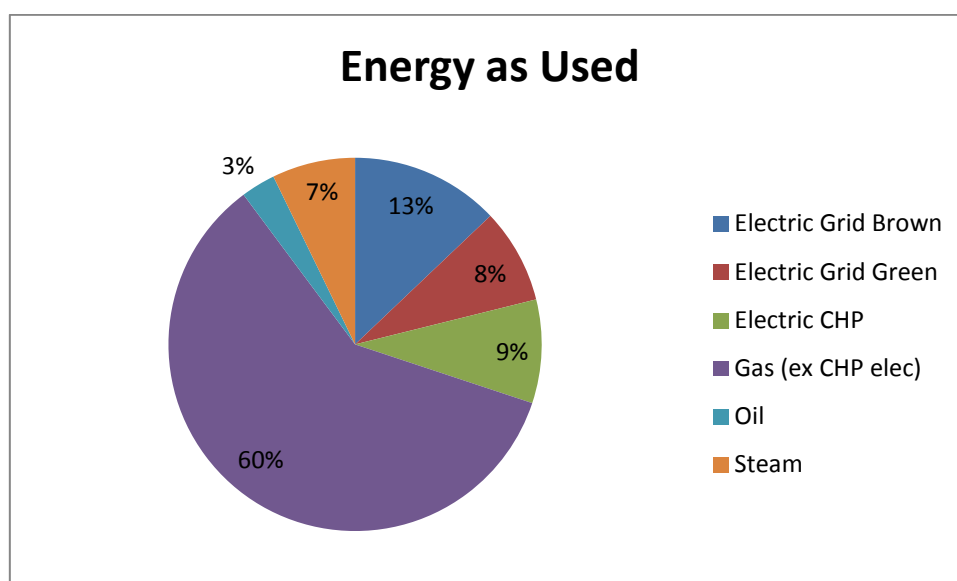
The actual energy used within the buildings is metered, and currently this information is recorded to generate consumption data on a monthly basis. The University is moving from manual meter readings to automatically read meter readings. This will allow usage of energy to be assessed in much more detail as consumption will be displayed on a half hourly basis during a day.

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 3 and figure 4:

Table 3 Energy as Used

| Energy as Used                      | Consumption, kWh | Percent of Overall Consumption |
|-------------------------------------|------------------|--------------------------------|
| Electricity Grid - Green            | 7,472,904        | 8%                             |
| Electricity Grid - Brown            | 11,745,468       | 13%                            |
| Electricity CHP – Generated On site | 8,162,000        | 9%                             |
| Gas                                 | 54,328,657       | 60%                            |
| Oil                                 | 2,198,487        | 3%                             |
| Steam                               | 6,560,418        | 7%                             |
| Total                               | 90,467,934       | 100%                           |

**Figure 4 Energy as Used**



By quantifying the energy as used by the larger buildings it is possible to generate energy consumption trends in the form of graphs for each building. These graphs can be used to raise awareness by demonstrating energy use in buildings to occupants. In addition this information can be used to identify areas that may benefit from energy conservation projects.

## **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. Measures completed during 2010/2011 include:

### Insulation of heating pipe work

Where plant rooms had been upgraded and large runs of heating pipe work in the ducts were un-insulated, insulation was fitted reducing heat losses.

Projected Annual Savings 1,228,698 kWh, 253 tonnes CO<sub>2</sub>, £39,932

Installed Cost £33,219

Payback 0.9 years

Actual Performance – One of the factors that demonstrates this measure is working is where installed in plant rooms these are now much cooler. In addition the overall efficiency of the heating system has improved.

### Change in heating control strategy

The main heating supply for the Old Aberdeen Campus is provided by the Combined Heat and Power (CHP) Station. This was originally set up with the temperature set-point based on the return temperature to the buildings of 75 deg C. The result was that the return temperature in the circuit was coming back at 75 deg C. To obtain the best energy efficiency from the CHP, the return temperature should be as low as practicable. The controls were reset with the temperature based on the return temperature in each individual building. The effect was to reduce the return temperature by 5-10 Degrees C.

Projected Annual Savings 2,200,000 kWh, 453 tonnes CO<sub>2</sub>, £51,000

Installed Cost £1,000  
Payback 0.1 years

Actual Performance – The combined gas and oil consumption only marginally higher than for the previous year, even though the weather was colder, demonstrating that a reduction has been achieved

#### BMS System – 23 St Machar Drive

The Building Management System has been expanded to include 23 St Machar Drive; this will provide optimum start control, and zoned time control to reduce energy use by improving time control of pumps, fans, and the heating in the building.

Projected Annual Savings 179,016 kWh, 45 tonnes CO<sub>2</sub>, £7,006  
Installed Cost £27,623  
Payback 4.0 years

Actual Performance – Some reduction in consumption is apparent for the first few months that this system has been in operation, a year's worth of data is not available.

#### BMS Medical Library

The Building Management System in the Library was old and needed to be upgraded. This will improve the operational efficiency of the system.

Projected Annual Savings 331,000 kWh, 85 tonnes CO<sub>2</sub>, £14,965  
Installed Cost £68,394  
Payback 4.6 years

Actual Performance – No reduction is currently apparent.

#### Lecture Theatre Lighting – 23 St Machar Drive

The lighting in the lecture theatre at 23 St Machar Drive was by tungsten bulbs. These have been replaced with fluorescent lighting that uses over 75% less electricity

Projected Annual Savings 8,755 kWh, 5 tonnes CO<sub>2</sub>, £788  
Installed Cost £2,350  
Payback 3.0 years

Actual Performance – Electricity consumption has reduced in line with predicted savings.

#### Installation of Boiler Controls - IMS

New boiler controls were fitted to improve control of the boilers at the IMS Building to reduce fuel particularly when the heating demand is low.

Projected Annual Savings 125,000 kWh, 26 tonnes CO<sub>2</sub>, £4,062  
Installed Cost £7,775  
Payback 2.0 years

Actual Performance – This is a new technology, some reduction in consumption is apparent, further checks to be done.

#### Double Glazing - Hillhead Halls

Hillhead Halls provides accommodation for 1,632 students. During the summer three of the accommodation blocks Fyfe, Adam Smith, and Wavell were partially refurbished. As part of these works the old single glazing was replaced with sealed double glazed units.

Projected Annual Savings 1,200,000 kWh, 247 tonnes CO<sub>2</sub>, £24,000

Actual Performance - While the winter was colder than the previous year, heating consumption dropped at the site by 11%.

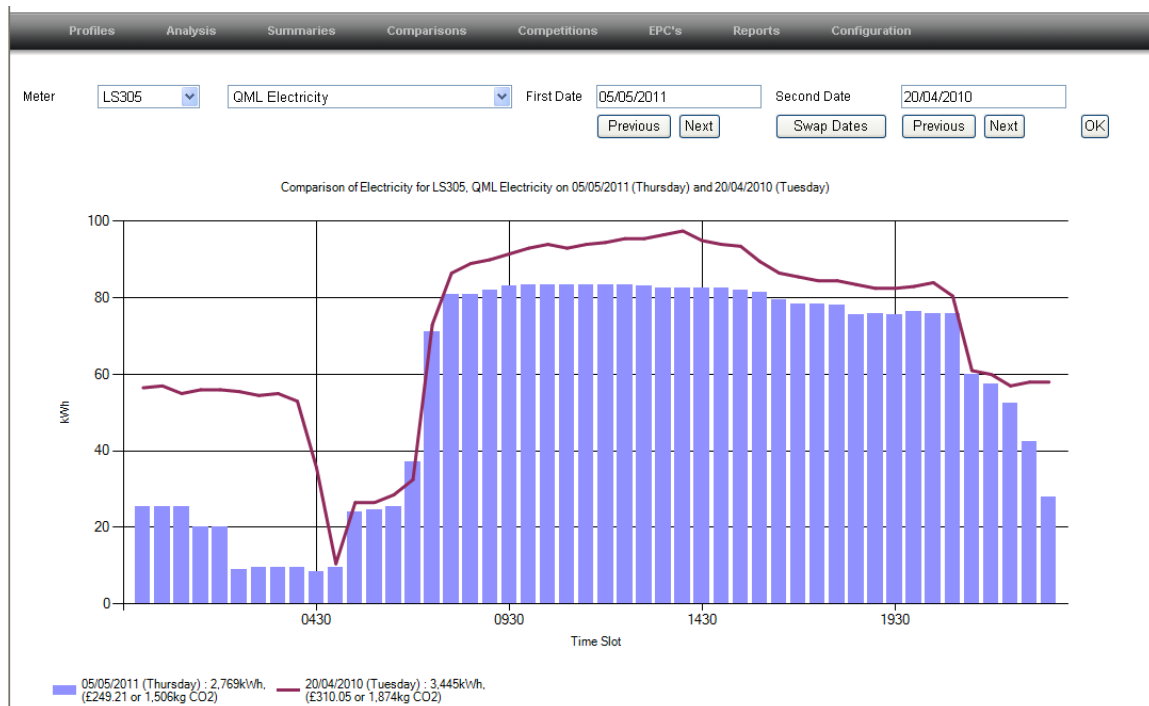


## 10 Energy Saving – Staff Awareness/Good Housekeeping

The main focus for raising energy awareness at the University during the course of the year has been to develop a remote meter reading facility with a web display to make information on energy consumption readily available to building users. The system will allow users to see how much energy is being used, when it is being used, and how much it costs financially and in terms of carbon emissions. The key feature is the building energy graphs.

### Improved Awareness Saving

During the development of the system one area was identified where awareness raising led to a reduction in energy consumption. When the Queen Mother Library electricity meter was connected to the remote meter reading system this identified that there was an unusual pattern of consumption for the building. The energy consumption for this building would remain high overnight, only dropping to 13% of the peak for a single half-hour period between 0430 and 0500 (Red line on graph).



A simple “out of hours” site visit identified that this building was being cleaned overnight by two cleaners. While they cleaned the building all lights, on all floors, were left on. The cleaners were asked to turn the lights off as they worked their way through the building (Blue bars on graph). This has delivered significant savings. The daily saving of £60.84 represents an annual saving of more than £15,000 p.a.

## 11 Installation of Renewable Energy Technology

The University has one renewable project nearing completion. The new library which is due to open September 2011 has solar panels on the roof. When these are operational, the output from these will be displayed on the web.

Further the University is investigating in partnership with Robert Gordons University, the possibility of installing some windmills on land off the main University campuses.

In respect of low carbon technology the University is proceeding on a project working in partnership with the Grampian NHS Trust on a Combined Heat and Power scheme. This is due to commence operation in January 2012 with the University taking electricity and heat.

## 12 Water Consumption

The University aims to reduce water consumption by 2% year on year. There has been significant progress in reducing water consumption at the University during 2010/11. The water consumption has fallen by 9.5%. The main area where water consumption has fallen is in the buildings supplied off the main water meter off Bedford Road.

**Table 4 – Water Consumption and Cost**

| Utility  | Consumption, m <sup>3</sup> | Cost, £ |
|----------|-----------------------------|---------|
| Water    | 240,498                     | 188,095 |
| Sewerage | -                           | 403,724 |
| Total    | 240,498                     | 591,819 |

Water consumption 2009/2010 265,714 m<sup>3</sup>  
Water consumption 2010/2011 240,498 m<sup>3</sup>  
Reduction 25,216 m<sup>3</sup> (9.5%)

The 2% target has been exceeded during 2010/2011.

## 13 Water Saving – Using Technology

### Toilet Refurbishments - Standards Manual

The Estates Building Standards Manual details a set of water-saving measures for washrooms. As areas are refurbished, water consumption is minimised. Buildings off the Bedford road water supply including Fraser Noble have had these features included as they have been refurbished.

Projected Annual Savings 25,016 m<sup>3</sup>, £50,000

### Leaks

Water leaks have been identified and repaired during the course of the year. These leaks were equivalent to 5,813 m<sup>3</sup> of additional consumption.

Projected Annual Savings 5,813 m<sup>3</sup>, £11,626

### Installation of Automatic Flush Controller

There was a problem at Butchart with a urinal flushing too often, wasting water. A controller that uses occupancy sensing to flush the urinal as required was installed.

Projected Annual Savings 200 m<sup>3</sup>, £400  
Installed Cost £300  
Payback 0.8 years

## 14 Water Saving - Staff Awareness/Good Housekeeping

General awareness raising has been done during the course of the year to promote the need for minimising water use. More information on water consumption based on automatic meter readings will become available during 2012/2013, and this will be used in part to help increase awareness.

## 15 Grey water/Rainwater harvesting

The New Library has been fitted with a rain water harvesting system. Water from the roof is collected in a tank in the basement plant room and is used for flushing toilets.