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OLLSCOIL LUIMNIGH
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ENERGY EFFICIENCY REPORT

FOR

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

PRODUCED BY

MARY IMMACULATE COLLEGE
SOUTH CIRCULAR ROAD,
LIMERICK.

PROJECT TEAM:

BRIAN KIRBY – BUILDINGS MAINTENANCE MANAGER MIC

PJ RYAN – SPECIALIST SUPPORT, VARMING CONSULTING ENGINEERS

REGINA GORMLEY – BUILDING SERVICES TEAM

MARY KEANE – BUILDING SERVICES TEAM

LINKED PRACTICES

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ENERGY EFFICIENCY REPORT

MARY IMMACULATE COLLEGE LIMERICK

1. EXECUTIVE SUMMARY

1.1. Mary Immaculate College has already made significant energy savings over the past few years with major upgrading of lighting systems and replacement of boilers. These savings have been made against a backdrop of increasing student numbers and increasing floor area. The area of campus buildings now stands at 28,807m^2 with student enrolment of 3,027 students which is up significantly from 2005.

1.2. Highlights

1.2.1. Lighting upgrades in 2010 and 2011 are estimated to save 100,594 kWh of electricity or 4.7% as a percentage of the 2010 total electricity usage.

1.2.2. The boiler replacement in Summerville house will realise boiler gas savings of 14% due to improved efficiency and this could amount to almost 32,100 kWh of gas. A 10% saving in gas energy can be expected from the boiler replacements in the Foundation buildings main boiler house and in the Courtyard boiler house.

1.2.3. The Tara building (8,550 m^2) was opened in 2010. This building incorporates the latest in energy efficient design such as gas condensing boilers and high efficiency lighting and controls.

1.2.4. The student canteen has been refitted with energy efficient appliances and kitchen extract canopies.

1.2.5. Submetering of the main buildings is currently been rolled out on campus.

1.2.6. The campus operates a successful marketing campaign which ensures utilisation of the campus facilities during holiday periods.

1.2.7. All toilet areas have been fitted with self closing percussion taps which will reduce the consumption of hot water.

1.2.8. Demolition of inefficient Prefab Classrooms 2-6 with an area of 772 m^2

1.3. Display Energy Certificates demonstrate above average results and the certificates are attached in Section 23 of this report with a brief summary below.

1.3.1. The Main campus has a rating of C3 with a primary energy use of 324kWh/m^2/year and 70kgCO_2/m^2/year.

1.3.2. Courtbrack student accommodation has a rating of B2 with a primary energy use of 223kWh/m^2/year and 53kgCO_2/m^2/year.

1.3.3. Summerville House has a rating of B3 with a primary energy use of 327kWh/m^2/year and 68kgCO_2/m^2/year.

1.4. 2005 & 2010 Energy Trend

1.4.1. Energy Performance Indicators (EPI) (which are not adjusted for degree days) demonstrate a reduction in the energy usage from 240 kWh/m^2/a in 2005 to 227 kWh/m^2/a in 2010. This corresponds to a 5.4% reduction in energy use per square meter.

1.4.2. The EPIs also demonstrate that the electrical energy usage has remained constant at 74 kWh/m^2/a and that the fossil thermal energy usage has fallen by 8.3% from 167 kWh/m^2/a in 2005 to 153 kWh/m^2/a in 2010.

1.4.3. Carbon emissions have been reduced by 3% from 80.02 kgCO_2/m^2/annum in 2005 to 77.67 kgCO_2/m^2/annum in 2010.

1.4.4. The energy cost per square meter has decreased by €1.19 from €13.32 in 2005 to €12.13 in 2010 or by 8.9% (excluding VAT).

1.5. Conclusion:

1.5.1. Mary Immaculate College (MIC) is taking the correct steps in order to achieve the 2020 vision of 33% primary energy reduction by public sector bodies. Adoption of a structured energy management programme such as SEAIs Energy Map or ISO16001 coupled with new information gleaned from the campus submetering project will help identify new areas for savings in the future. Assuming these initiatives are followed through and implemented, then MIC should be in a position to reap the benefits of significantly lower running costs and carbon emissions and demonstrate exemplary energy management practices in the University sector.

2. PROJECT TEAM

2.1. The project team consists of the following:

2.1.1. Brian Kirby – Buildings Maintenance Manager, Mary Immaculate College

2.1.2. PJ Ryan – Specialist Support - Varming Consulting Engineers

2.1.3. Regina Gormley - Building Services Team, Mary Immaculate College

2.1.4. Mary Keane – Building Services Team, Mary Immaculate College

3. OVERVIEW OF ENERGY USAGE IN 2010:

3.1. The main energy users at the Mary Immaculate College campus, Limerick are the Main Campus which accounts for the vast majority of Buildings on the campus. This is due to single gas and electricity meters serving most of the campus. These meters account for over 91% of all energy used by the college. Two-thirds of the energy consumption on the campus is fossil fuel derived and used for space heating, air conditioning, hot water and catering. The remaining one-third is derived from electricity and is used for lighting, office equipment, auxiliary energy for pumps, fans and controls. Some cooling is also provided to data centres.

3.2. In 2010, Mary Immaculate College consumed 6,548 MWh of energy, consisting of:

3.2.1. 2,145 MWh of electricity

3.2.2. 4,403 MWh of fossil fuels including 4,399 MWh of natural gas and 4.4 MWh of transport fuels (diesel).

3.2.3. There was no consumption of renewable fuels.

4. ACTIONS UNDERTAKEN IN 2010

4.1. Projects to date have been focused on the energy efficiency upgrading of lighting systems and boiler plant in a number of buildings on the campus. These projects focus on the energy, environment and economy with an overall goal of saving money and reducing CO_2.

4.2. The energy efficiency lighting upgrade in a number of buildings on campus uses a mix of technologies namely:

- Occupancy / presence detection / daylight controls
- Lamp and fitting replacement (T8 with T5)
- Lighting automation to replace manual control with automated time, daylight and infra red detection
- Power conditioning on fluorescent lighting circuits

4.3. Library Building LG9 Lecture Theatre

4.3.1. Lights Removed: 48no. 150W Par 38 lights with a total wattage of 7,200W

4.3.2. Lights Installed: 48no. 1x26W recessed PL lights with highly polished reflector and with a total wattage of 1,268W

4.3.3. This results in a saving of 5,952W per hour or approximately 17,344kWh per annum.

LG9 Lecture Theatre lighting

4.4. Library Building Ground Floor

4.4.1. Lights Removed: 15no. 4x36W fittings with wire-wound ballast units which were drawing a total current of 25.5A (1.7A per fitting).

4.4.2. Lights Installed: 15no. 4x36W fittings with high frequency electronic ballast units drawing a total current of 9A (0.6A per lamp approx)

4.4.3. This results in a saving of 16.5A or 3,630W per hour or approximately 10,578kWh per annum.

Library Building Ground Floor lighting

4.5. Library Building 1st Floor

4.5.1. Lights Removed: 10no. 4x36W fittings with wire-wound ballast units which were drawing a total current of 17A.

4.5.2. Lights Installed: 10no. 4x36W fittings with high frequency electronic ballast units drawing a total current of 6A.

4.5.3. This results in a saving of 11A or 2,420W per hour or approximately 7,052kWh per annum.

Library Building 1st Floor lighting

4.6. Foundation Building 3rd Floor Room 309

4.6.1. Lights Removed: 9no. 8 foot (2x125W) fittings with wire-wound ballast units which were drawing a total current of 16.7A (1.8A per fitting approx).

4.6.2. Lights Installed: 18no. Philips 2x49W fittings with high frequency electronic ballast units and T5 tubes drawing a total current of 8.1A.

4.6.3. This results in a saving of 8.6A or 1,892W per hour or approximately 3,633kWh per annum.

Room 309 Foundation Building

4.7. Foundation Building Reception, Corridors and Chandeliers

4.7.1. Lights Removed in Reception: 28no. Par38 light fittings with a total power consumption of 4,200W.

4.7.2. Lights Removed in Chandeliers: 6no. Chandeliers with 10no. 60W incandescent bulbs with a total power consumption of 3,600W

4.7.3. Lights Installed in Reception & Corridors: 48no. 2x18W fittings with 18W PL lamps with a power consumption of 1,728W.

4.7.4. Lights installed in Chandeliers: 6no. Chandeliers with 10no. 8W Compact fluorescent lamps with a power consumption of 480W.

4.7.5. This results in a saving of 5,592W per hour or approximately 8,744kWh per annum.

Foundation Building Reception

Foundation Building typical Chandelier

4.8. Lighting has been upgraded in Gerard House

Typical Corridor in Gerard House

4.9. Total savings energy savings made in 2010 due to lighting upgrades is in the order of 56,094kWh or 2.61% of total electricity consumed.

4.10. The college has also undertaken a programme of boiler replacement and these are listed below. Boilers have been replaced with high efficiency cast iron boilers.

4.10.1. Summerville House:

	Before	After
Boiler type	Ferroli F3N/255	DeDietrich GT338
Year	1973	2010
Boiler efficiency	78.9%	92.9%
Water content	211 litres	176 litres
Electrical kW rating	0.77kW	0.48kW
Flue Gas Temperature	211.3°C	184.4°C

Summerville House Boiler Replacement

4.11. The main canteen kitchen has been re-fitted by Kaneco with energy efficient appliances and kitchen extract canopies.

New Kitchen Extract canopies

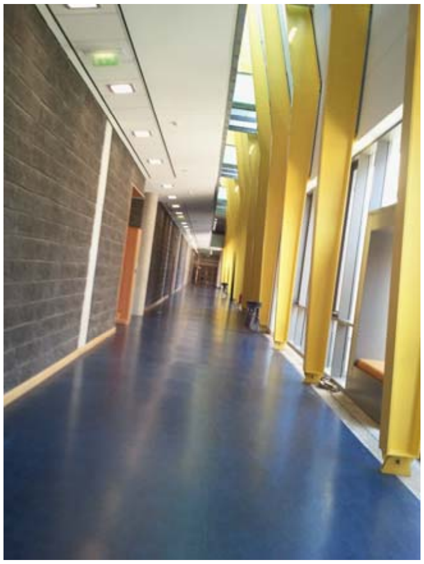
4.12. All toilet areas have been fitted with self closing percussion taps and urinal controls to reduce cold and hot water consumption.

Toilet self closing percussion taps

Toilet Urinal control

4.13. Energy management practices have been implemented e.g. Security guards patrol the buildings every 2 hours and switch off lighting in unoccupied areas.

4.14. Opening of the new Tara Building in September. This building added an additional 8,550 m^2 of space to the campus with total space now at 29,500m^2. This building includes the latest in energy efficient lighting and fully modulating condensing boilers.



Images of Tara Building

4.15. Demolition of Prefab Classrooms 2-6 with an area of 772 m^2.

4.16. Mary Immaculate College is part of the Shannon Consortium Procurement Network and the 2011 electricity contract has been awarded to Airtricity with savings accrued to the campus.

4.17. As the campus increased in size significantly during the year, it is not envisaged that there will be a reduction in energy usage. However, without the efficiency measures listed above, the energy use would be even higher. As there is no submetering

installed, it is not possible to quantify the savings due to the measures in the individual buildings. Submeters are being currently installed.

4.18. It should be noted that campus activities continue to increase year on year. Student numbers have increased from 2,655 students in Semester 2 of 2005/2006 to 3,027 students in Semester 2 of 2010/2011. This corresponds to a 14% increase in student numbers over 2005. The Tailteann Sports Building (2,208m^2) which is a dry sports facility was also opened three years ago.

4.19. Bernie Hurley in the Marketing Department has programmes in place on campus during the summer holidays to maximise the use of the facilities and bring in much needed revenue. Examples include the following:

4.19.1. Learning Language International

4.19.2. Shannonside Astronomy club

4.19.3. Bruno Groning Circle of Friends

4.19.4. Institute of Taxation Exams

4.19.5. Door of Hope

4.19.6. Zambia Ireland Teacher Education Partnership

4.19.7. Valentina / Russian Language School

4.19.8. Frontline Stage School

4.19.9. Limerick Camera Club

4.19.10. Limerick Philosophical Society

4.19.11. Chartered Accountants of Ireland

4.19.12. Institute of Physical Therapy

5. ACTIONS PLANNED FOR 2011

5.1. Continuation with the Installation of energy efficient lighting and advanced lighting controls in parts of the Foundation Building and the Library Building.

5.2. Foundation Building 3rd Floor Room 309 Language Lab

5.2.1. Lights to be Removed: 9no. 8 foot (2x125W) fittings with wire-wound ballast units which were drawing a total current of 16.7A (1.8A per fitting approx).

5.2.2. Lights to be Installed: 18no. Philips 2x49W fittings with high frequency electronic ballast units and T5 tubes drawing a total current of 8.1A.

5.2.3. This will result in a saving of 8.6A or 1,892W per hour or approximately 3,633kWh per annum.

5.3. Foundation Building 2nd Floor Rooms 201, 202, 203, 206, 207

5.3.1. Lights to be Removed: 18no. 8 foot (2x125W) fittings with wire-wound ballast units which were drawing a total current of 32.4A (1.8A per fitting approx).

5.3.2. Lights to be Installed: 18no. Philips 2x49W fittings with high frequency electronic ballast units and T5 tubes drawing a total current of 13.05A.

5.3.3. This will result in a saving of 19.35A or 4,257W per hour or approximately 8,173kWh per annum per room or 40,867kWh for 5no. rooms.

5.4. Old Hogfors Boilers serving the Quad, the Main Reception and the Halla will be replaced with a high efficiency cast iron gas fired boiler.

5.4.1. Courtyard:

	Before	After
Boiler type	Hogfors H21-8	DeDietrich GT337
Year	1979	2011
Boiler efficiency	81.9%	92.8%
Water content	234 litres	156 litres
Electrical kW rating	1.1kW	0.48kW
Flue Gas Temperature	236.9°C	178.6°C

Old Hogfors Boiler

New DeDietrich Boiler

5.4.2. Main Boiler house (Foundation building): Hogfors boiler replaced with high efficiency DeDietrich gas fired boiler.

	Before	After
Boiler type	Hogfors H25/14	DeDietrich GT449
Year	1979	2011
Boiler efficiency	82.9%	93.1%
Water content	560 litres	409 litres
Electrical kW rating	1.8kW	1.4kW
Flue Gas Temperature	265.8°C	187.4°C

Foundation Building Boiler Replacement

5.5. Submetering of the main buildings is currently been rolled out on campus. These submeters will include for both gas and electricity and these will be hardwired into the IT network. The meters will give a pulsed output using Modbus technology and will make possible the future Monitoring and Targeting of building energy usage. Future DECs will also be more realistic. Submeters will be installed for the following Buildings

5.5.1. Tailteann Sports Building

5.5.2. Tara Building

5.5.3. Library Building

5.5.4. Summerville House is currently has its own gas and electricity meters.

5.5.5. Courtbrack has electric storage heating and also has its own submeters.

5.5.6. The main student canteen and kitchen is also submetered for water, gas and electricity.

5.6. Thermostatic Radiator Valves will be installed in the Quad building.

5.7. A professional stage lighting system will be installed in the Main Auditorium (500 seater) of the new Tara Building which will be energy intensive. However, this increase in energy will hopefully be offset by savings in energy elsewhere on campus. The stage lighting system will be submetered for energy reporting, monitoring and targeting. Stage lighting design will used luminaries compliant with SEAI Triple E product register of energy efficient products.

5.8. The quantity of diesel purchased for the college van should be recorded. Currently, just the value of fuel purchased is recorded.

6. 2010 DETAILED ENERGY USAGE

6.1. The 2010 energy usage is detailed below in table format and in pie chart format.

2010 Campus Electricity Summary						
Electricity Summary						
2010	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Main Campus	1,814,917	€125,133	€40,545	€165,678	€0.0913	1,156.1
Summerville House	63,260	€8,644	€325	€8,970	€0.1418	40.3
New Classrooms	5,548	€847	€174	€1,022	€0.1841	3.5
Gerard House	40,457	€5,665	€191	€5,856	€0.1447	25.8
Richmond House	1,147	€162	€101	€262	€0.2288	0.7
4 O'Curry Street	68,219	€5,301	€184	€5,485	€0.0804	43.5
Front Lodge	345	€49	€83	€132	€0.3813	0.2
Pitch	673	€103	€174	€277	€0.4118	0.4
Security Gate	826	€126	€181	€307	€0.3713	0.5
Courtbrack	149,772	€16,941	€3,397	€20,338	€0.1358	95.4
Total	2,145,164	€162,971	€45,355	€208,326	€0.0971	1,366.5

2010 Campus Gas Summary						
Natural Gas Summary						
2010	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Main Campus	3,949,806	€59,511	€63,933	€123,444	€0.0313	782.1
Summerville House	210,547	€4,785	€3,028	€7,814	€0.0371	41.7
M1 M2 M3	35,633	€1,424	€60	€1,484	€0.0416	7.1
Gerard House	138,936	€3,121	€2,739	€5,861	€0.0422	27.5
Canteen	63,840	€2,225	€299	€2,524	€0.0395	12.6
Total	4,398,762	€71,066	€70,060	€141,126	€0.0321	871.0

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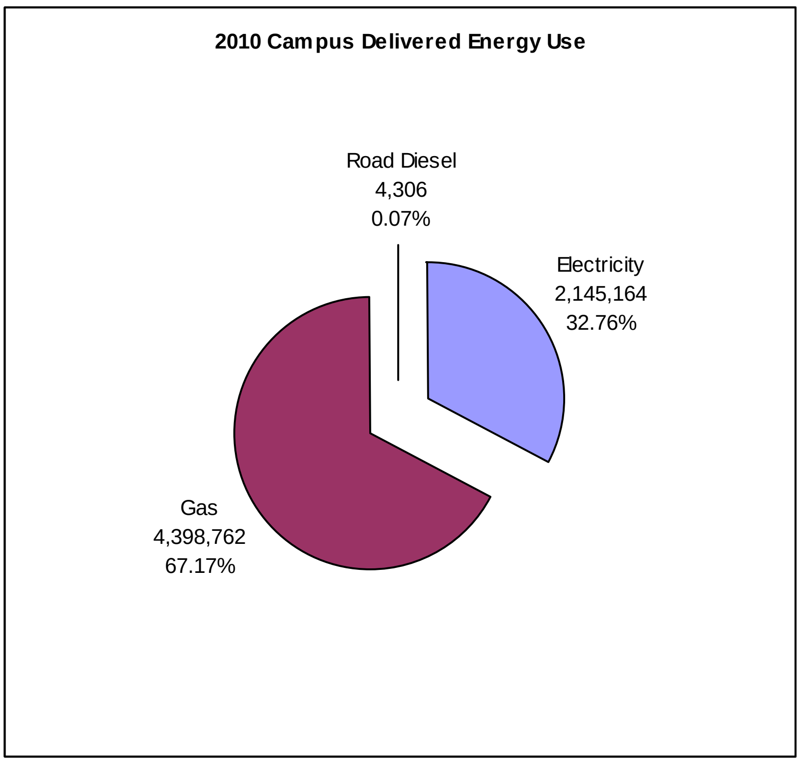
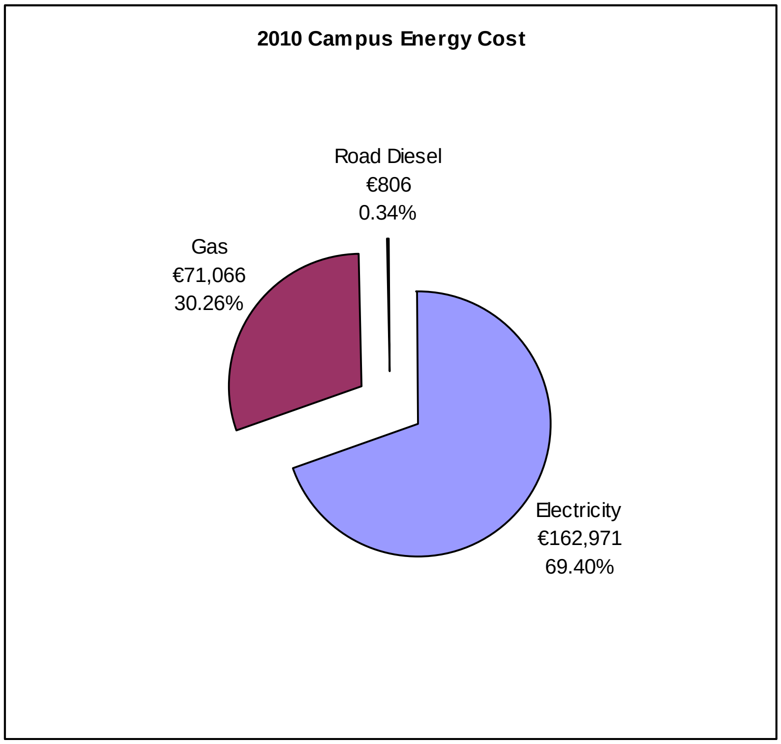
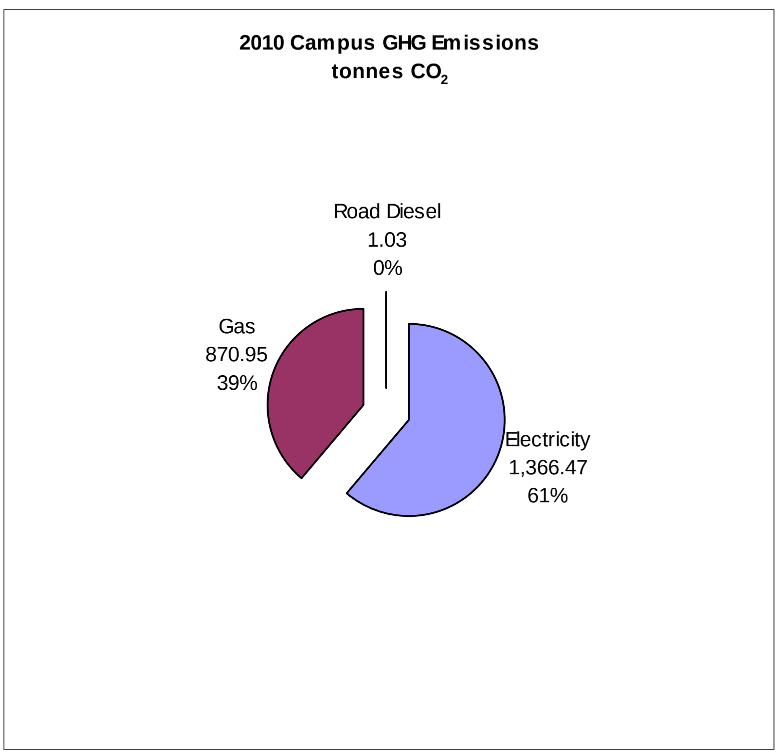
2010 Campus Energy Summary						
All Sources						
2010	**Total Cons-umption**	**Total Unit Cost**	**Total Other Charges**	**Total Cost**	**Average Unit Cost**	**GHG Emissions**
	[kWh]	**[€]**	**[€]**	**[€]**	**[€/kWh]**	**[tCO2]**
Electricity	**2,145,164**	**€162,971**	**€45,355**	**€208,326**	**€0.0971**	**1,366.47**
Gas	**4,398,762**	**€71,066**	**€70,060**	**€141,126**	**€0.0321**	**870.95**
Road Diesel	**4,306**	**€806**	**€0**	**€806**	**€0.1871**	**1.03**
Total	**6,548,232**	**€234,843**	**€115,415**	**€350,258**	**€0.3163**	**2,238.46**




2010 Campus Energy Cost
Road Diesel
€806
0.34%
Gas
€71,066
30.26%
Electricity
€162,971
69.40%


2010 Campus GHG Emissions
tonnes CO_2
Road Diesel
1.03
0%
Gas
870.95
39%
Electricity
1,366.47
61%

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7. 2005 DETAILED ENERGY USAGE – BASE YEAR

7.1. The 2005 energy usage is detailed below in table format and in pie chart format.

2005 Campus Electricity Summary						
Electricity Summary						
2005	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
MAIN BUILDING	1,084,450	€129,678		€129,678	€0.1196	690.8
PITCH	2,266	€547		€547	€0.2414	1.4
GERARD HOUSE	54,814	€8,018		€8,018	€0.1463	34.9
SUMMERVILLE	105,800	€14,205		€14,205	€0.1343	67.4
NEW CLASSROOMS	5,934	€1,144		€1,144	€0.1928	3.8
COURTBRACK	137,737	€17,628		€17,628	€0.1280	87.7
Total	1,391,001	€171,220		€171,220	€0.1231	886.1

2005 Campus Gas Summary						
Natural Gas Summary						
2005	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
MAIN BUILDING	2,781,410	€66,660	€0	€66,660	€0.0240	550.7
CANTEEN	52,988	€2,264	€0	€2,264	€0.0427	10.5
GERARD HOUSE	96,570	€2,889	€0	€2,889	€0.0299	19.1
SUMMERVILLE	174,933	€6,738	€0	€6,738	€0.0385	34.6
M 1, 2, 3	33,906	€1,195	€0	€1,195	€0.0352	6.7
Total	3,139,807	€79,745	€0	€79,745	€0.0254	621.7

2005 Campus Energy Summary						
All sources						
2005	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Electricity	1,391,001	€171,220	€0	€171,220	€0.1231	886.07
Gas	3,139,807	€79,745	€0	€79,745	€0.0254	621.68
Total	4,530,808	€250,965	€0	€250,965	€0.0554	1,507.75

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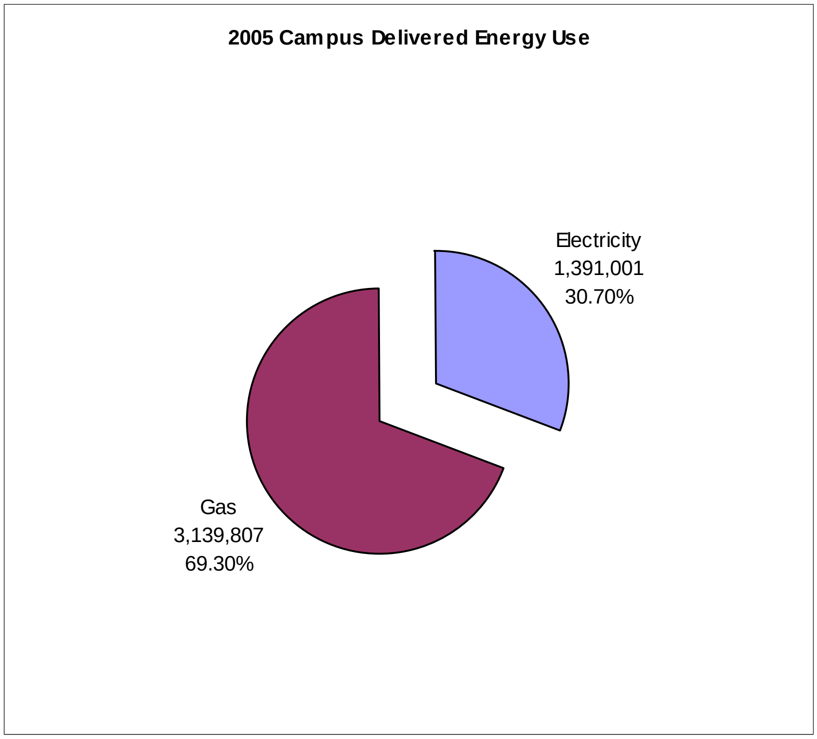
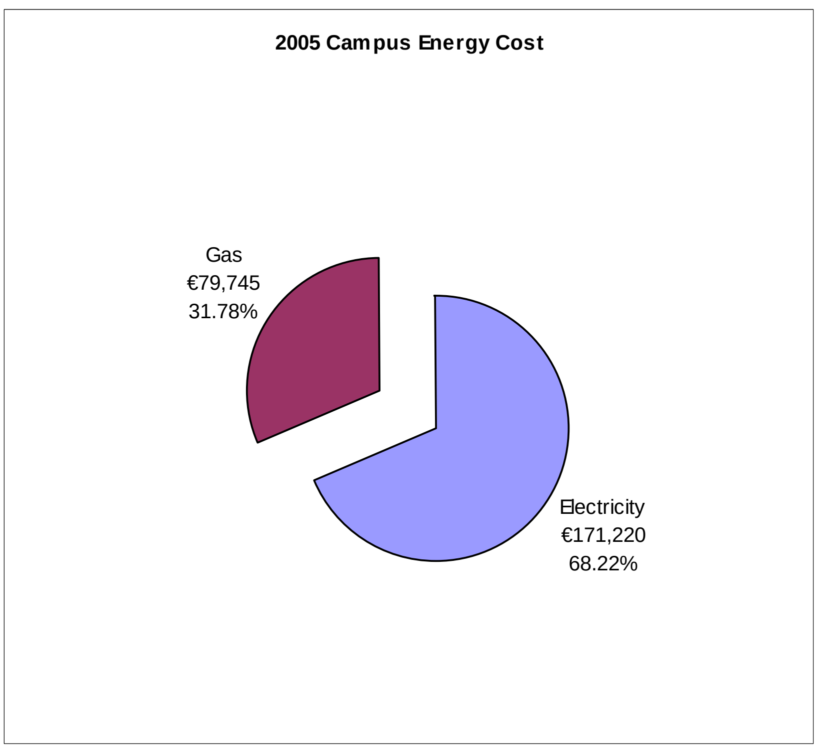

2005 Campus Delivered Energy Use
Electricity
1,391,001
30.70%
Gas
3,139,807
69.30%


2005 Campus Energy Cost
Gas
€79,745
31.78%
Electricity
€171,220
68.22%

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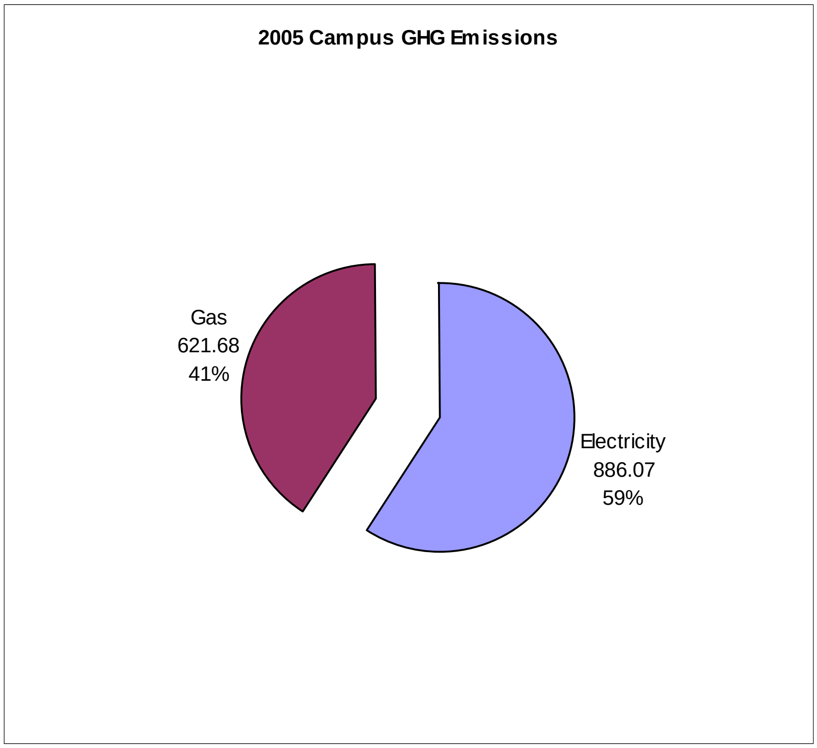

8. 2005 – 2010 TREND ANALYSIS

8.1. The results show an overall increase in energy use of 44% between 2005 and 2010. This is composed of a 54% increase in electrical energy usage and a 40% increase in gas energy. Costs however did not increase at the same rate with only a 39% increase due to decrease in the average unit cost from €0.0554 per kWh to €0.0534 or 3.49%. Carbon emissions increased 48% from 1508 tonnes in 2005 to 2237 tonnes in 2010.

8.2. The increase is due in part to an increase in the floor area of the campus from 18,841m^2 in 2005 to 28,807m^2 in 2010. This represents a 53% increase in floor area. This was due to the addition of the Tailteann dry sports facility (2,835m^2) and the Tara Auditorium Building (8,550m^2). Prefabs (772m^2) were removed with opening of the Tara building during 2010.

8.3. Student numbers have increased from 2,655 students in Semester 2 of 2005/2006 to 3,027 students in Semester 2 of 2010/2011. This corresponds to a 14% increase in student numbers over 2005.

8.4. Energy Performance Indicators (which are not adjusted for degree days) are illustrated in the table below. They demonstrate a reduction in the energy usage from 240 kWh/m^2/a in 2005 to 227 kWh/m^2/a in 2010. This corresponds to a 5.4% reduction in energy use per square meter. It is also demonstrated that the electrical energy usage has remained constant at 74 kWh/m^2/a and that the fossil thermal energy usage has fallen by 8.3% from 167 kWh/m^2/a in 2005 to 153 kWh/m^2/a in 2010.

8.5. Carbon emissions have been reduced by 3% from 80.02 kgCO_2/m^2/annum in 2005 to 77.67 kgCO_2/m^2/annum in 2010.

8.6. The energy cost per square meter has decreased by €1.19 from €13.32 in 2005 to €12.13 in 2010 or by 8.9%.

2005 Campus Energy Performance Indicator					
2005	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	GHG Emissions
18,841m^2	[kWh/m^2]	[€]	[€]	[€]	[kgCO_2/m^2]
Electrical	74	€9.09	€0	€9.09	47.03
Fossil Thermal	167	€4.23	€0	€4.23	33.00
EPI	240	€13.32	€0	€13.32	80.02

2010 Campus Energy Performance Indicator					
2010	Total Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	GHG Emissions
28,807m^2	[kWh/m^2]	[€]	[€]	[€]	[kgCO_2/m^2]
Electrical	74	€5.66	€1.57	€7.23	47.44
Fossil Thermal	153	€2.47	€2.43	€4.90	30.23
EPI	227	€8.12	€4.01	€12.13	77.67

9. ESTIMATED ENERGY CONSUMPTION BY END USE

9.1. In order to target areas for energy reduction, it is useful to have an overview of where energy is used in a typical education facility. The table below gives a breakdown of the energy use based on end use.

9.2. It is important to note the difference between Delivered Energy and Primary Energy.

9.2.1. Delivered Energy is energy used on site and paid to the utility suppliers. This is the energy supplied to a building and its systems to satisfy the relevant energy uses e.g. space heating, water heating, cooling, ventilation and lighting.

9.2.2. Primary Energy is energy that has not been subjected to any conversion or transformation process. For a building, it is the delivered energy plus the energy used to produce the energy delivered to the building. For example, one unit of delivered electrical energy requires roughly 2.7 units of primary energy to be generated by Ireland's inefficient power stations.

9.3. When Delivered Energy is considered, it is clear that Space Heating (47.4%), Lighting (13.8%), Ventilation (10.1%), Cooling (9.6%) and Water Heating (7%) are the top five energy consumers. When Primary Energy is examined, the top five are Space Heating (29.4%), Lighting (20.9%), Ventilation (15.4%), Cooling (14.6%) and Computers (5.9%).

9.4. This shows a shift in emphasis where gas consumed end uses decreases from 58% of overall usage of Delivered energy to 37% of overall usage of Primary Energy

9.5. Energy consumed by end used that use electricity increases from 42% of Delivered Energy to 63% of Primary Energy.

9.6. Pie charts are provided below in order to illustrate where efforts should be focused. It can be seen that Space heating (29.4%) and Lighting (20.9%) account for half of all energy used on the campus.

9.7. Electrical consumption is dominated by Lighting, Ventilation and Cooling and this amounts to almost 51% of all energy consumption

2010 Campus Energy Consumption by end use (typical)							
Electricity + Gas							
2010	**Delivered Energy**	**Total Unit Cost**	**Total Other Charges**	**Total Cost**	**GHG Emissions**	**Delivered to Primary**	**Primary Energy**
	[kWh]	**[€]**	**[€]**	**[€]**	**[tCO2]**	**Conversion**	**[kWh]**
Space Heating	3,104,375	111,025	54,752	€165,777	1,061	110%	3,414,812
Cooling	630,451	22,547	11,119	€33,667	216	270%	1,702,219
Ventilation	662,373	23,689	11,682	€35,371	226	270%	1,788,407
Water Heating	454,883	16,268	8,023	€24,291	156	110%	500,371
Lighting	901,785	32,251	15,905	€48,156	308	270%	2,434,819
Cooking	63,843	2,283	1,126	€3,409	22	110%	70,227
Refrigeration	127,686	4,567	2,252	€6,819	44	270%	344,753
Office Equipment	31,922	1,142	563	€1,705	11	270%	86,188

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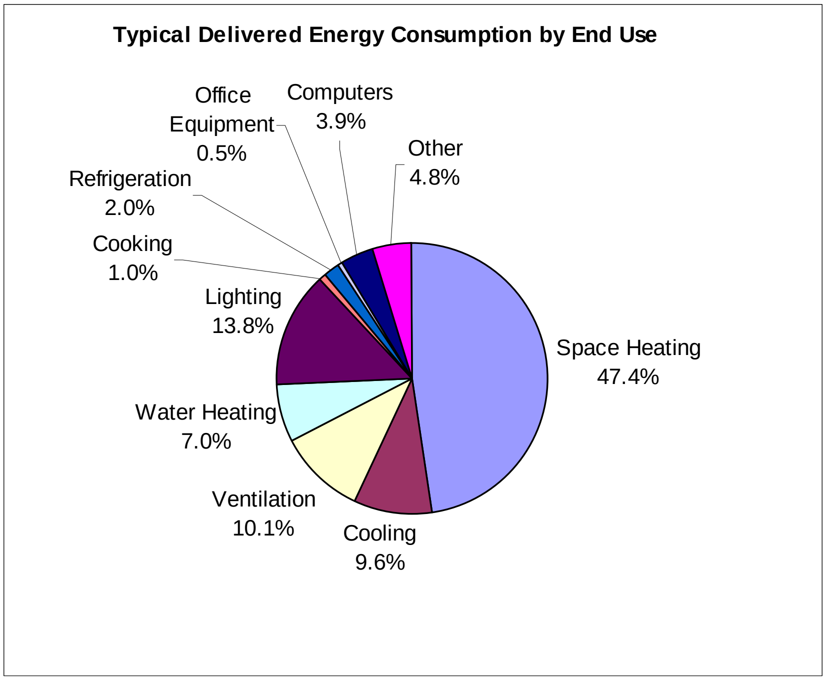
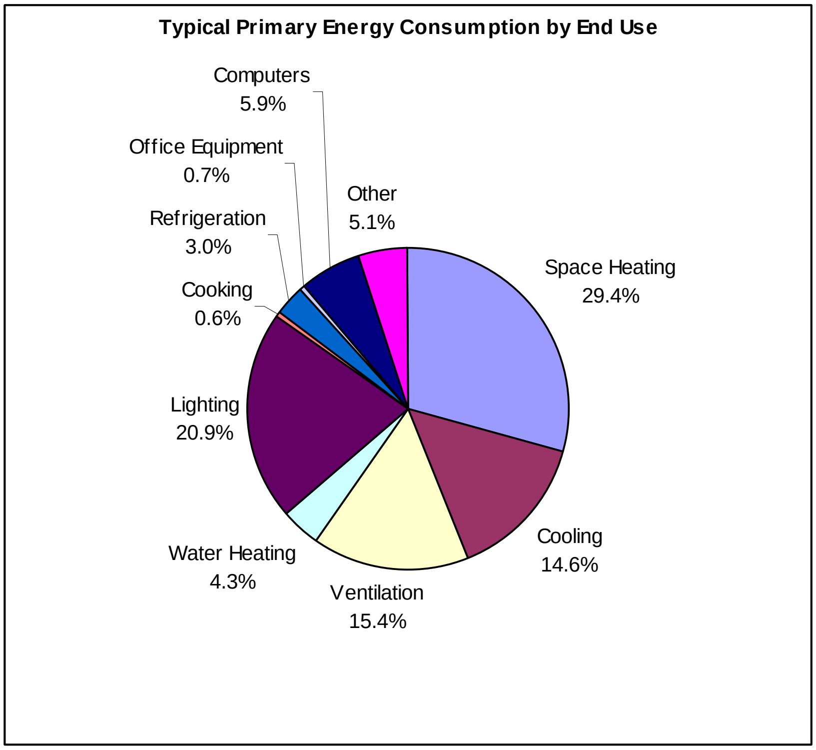
Computers	**255,373**	**9,133**	**4,504**	**€13,637**	**87**	**270%**	**689,506**
Other	**311,236**	**11,131**	**5,489**	**€16,620**	**106**	**190%**	**591,347**
Total	**6,543,926**	**234,037**	**115,415**	**€349,452**	**2,237**		**11,622,651**





10. TOWARDS 2020 AND 33% PRIMARY ENERGY REDUCTION

10.1. The National Energy Efficiency Action Plan 2009-2020 (NEEAP) and the European Communities (Energy End-use Efficiency and Energy Services) Regulations 2009 (SI 542 of 2009) set out several obligations on public bodies with respect to their 'exemplary role' for energy efficiency. These include obligations with regard to energy efficient procurement, energy management practices, use of energy efficient buildings and annual reporting on actions being taken to improve energy efficiency.

10.2. For the year 2020: The National Energy Efficiency Action Plan 2009-2020 states that: "The public sector will improve its energy efficiency by 33% and will be seen to lead by example – showing all sectors what is possible through strong, committed action". This is an aggregate target across the whole Public Sector.

10.3. Organisation-level targets will be developed by SEAI and DCENR (Department of Communications, Energy and Natural Resources) in co-operation with Public Sector organisations over a three year period between 2010-2012. The targets will be ambitious and will stretch organisations. They will use a baseline period 2001-2005, so energy saving actions taken since the baseline will count as progress towards the targets. Certain energy saving actions taken before the baseline that can be demonstrated to have a lasting effect extending into the target period will also count.

10.4. An order of magnitude estimate of the energy saving required can be deduced from the Energy Performance indicators previously calculated. These were calculated at 240 kWh/m^2/a in 2005 to 227 kWh/m^2/a in 2010. Taking 66% of these figures will give an estimate of the range in campus energy consumption required by 2020. The results are summarised in the table below.

2020 Target Range	2010	2005
2010 & 2005	Total Consumption	Total Consumption
28,807m^2	[kWh/m^2]	[kWh/m2]
EPI	227	240
2020 Target	150	159
	[kWh]	[kWh]
2020 Energy Use	4,318,991	4,572,078
Energy Savings	2,224,935	1,971,848

10.5. It can be seen that energy usage will need to be in the range 150 to 159 kWh/m^2/a. This will result in a reduction in energy use of between 68 and 77kWh/m^2/a.

10.6. Delivered energy could be expected to be reduced by between 1,971MWh and 2,224MWh.

10.7. An indication of the levels of reduction by end use is illustrated below. It may not be possible to reduce gas consumption for Cooking and its reduction may need to be made up elsewhere.

2020 33% Energy Reduction Target - Estimated Electricity + Gas				
2010	Delivered Energy	Primary Energy	Primary Energy Reduction 33%	Delivered Energy Reduction 33%
	[kWh]	[kWh]	[kWh]	[kWh]
Space Heating	3,104,375	3,414,812	1,126,888	1,024,444
Cooling	630,451	1,702,219	561,732	208,049
Ventilation	662,373	1,788,407	590,174	218,583
Water Heating	454,883	500,371	165,122	150,111
Lighting	901,785	2,434,819	803,490	297,589
Cooking	63,843	70,227	23,175	21,068
Refrigeration	127,686	344,753	113,769	42,136
Office Equipment	31,922	86,188	28,442	10,534
Computers	255,373	689,506	227,537	84,273

Other	311,236	591,347	195,145	102,708
Total	6,543,926	11,622,651	3,835,475	2,159,496

The 'Other' Category is assume to contain 50% Electrical and 50% Gas usage

10.8. This can be viewed in terms of kWh/m^2/year which may be more useful. This shows the heating needs to be reduced by approximately 36 kWh/m^2/year, Lighting by 10 kWh/m^2/year, Ventilation by 7.6 kWh/m^2/year and Cooling by 7.2 kWh/m^2/year.

2010	Delivered Energy Reduction
	[kWh/m^2/year]
Space Heating	35.6
Cooling	7.2
Ventilation	7.6
Water Heating	5.2
Lighting	10.3
Cooking	0.7
Refrigeration	1.5
Office Equipment	0.4
Computers	2.9
Other	3.6

11. ROADMAP TO 2020

11.1. The implementation of a structured energy management programme should be continued by MIC in order to achieve the 2020 33% energy savings goal. MIC could engage with the SEAIs Energy MAP process as this would provide a step by step guide to energy management. SEAI will facilitate this process.

11.2. The success of an Energy Management Programme is contingent on a cultural change in attitude among all MIC stakeholder including students. Full stakeholder buy-in is required to ensure success with any programme of this nature. Top management need to commit to the programme right from the start. This would appear to be the case in MIC and this commitment to change will need to be maintained over the coming years.

11.3. The various steps in the Energy MAP process contain useful tools, wizards, templates and Excel spreadsheets for analysing bills, recording and presenting energy data in more user friendly ways.

11.4. An important step in the process is the detailed energy survey of all energy uses in order to understand current energy usage. One approach is to use 'bottom-up' surveys of end-use technologies, e.g. a lighting survey. The output will be a master list of all energy using equipment on site, with their rated loads recorded. Again, SEAI have a template spreadsheet for recording this information – 'Significant Energy Users Tool'. This would include a survey of all energy consuming equipment e.g. HVAC, Motors and drives, Lighting, Boilers, IT equipment etc

11.5. Use should also be made of the self assessment matrices (detailed in Section 16) of this report for setting Energy management priorities.

11.6. Varming Consulting Engineers can examine the feasibility of energy saving options such as:

11.6.1. Integrated Control of Energy (ICE) by Lightwave Technologes

11.6.2. Wireless system platform for metering using EpiSensor SiCA solution

11.6.3. Boiler Load Optimisation e.g. Fuel Stretcher / Sabien M2G

11.6.4. Pump replacement with latest ErP compliant 'A' rated pumps

11.6.5. 'Switch Off' download for all PC for systematic power offs

11.6.6. Consideration of renewable technologies such as CHP, Biomass, Heat Pumps, Solar Thermal and PV.

11.6.7. Monitoring and Targeting Systems

11.6.8. Adoption of Energy Management Standard EN16001 / ISO50001

12. ENERGY MANAGEMENT STRATEGY – ENERGY MAP

12.1. What is Energy MAP?

12.1.1. Energy MAP is the Energy Management Action Plan from SEAI. It is an online tool which provides a step by step guide to creating a best practise action plan for your business. The 20 steps of Energy MAP are divided into of five pillars of excellent energy management: Commit, Identify, Plan, Take Action and Review. By registering online, you can create your own personalised Energy MAP plan which allows you track your progress through the 20 steps.

12.2. What's involved in Energy MAP?

12.2.1. The effort required to manage energy effectively will vary depending on company size, energy costs and energy intensity. However energy costs can be controlled, and often reduced, by implementing measures that do not require significant investment.

12.2.2. Although it is best practise, it is not absolutely necessary to complete all steps in the plan in sequence. Any of the 20 steps or 5 pillars can be completes on their own, or for more specific practical actions see the energy saving wizard. Technical knowledge, whilst an advantage, is not required.

12.3. What are the Pillars and steps in Energy MAP?

12.3.1. Energy MAP consists of 5 pillars of excellent energy management. The pillars are the five main themes of energy management. Each pillar is made up of a number of steps. Some of the steps also have "guides" associated with them which provide more detailed information about how to complete that step.

12.3.2. The 5 pillars and 20 steps of Energy MAP

Commit

- Step 1: Senior management commitment
- Step 2: Appoint senior manager to Energy MAP
- Step 3: Appoint Energy MAP coordinator
- Step 4: Establish an Energy MAP team
- Step 5: Establish an Energy MAP Policy

Identify

- Step 6: Develop and overview total energy consumption

- Step 7: Survey energy use & identify significant energy users
- Step 8: Identify key factors that influence energy consumption & Energy Performance Indicators
- Step 9: Identify energy saving opportunities

Plan

- Step 10: Set objectives and targets
- Step 11: Establish Programme Plan
- Step 12: Formally allocate sufficient human, financial & systems resources

Take Action

- Step 13: Implement the Programme Plan
- Step 14: Promote energy efficiency awareness and practices amongst employees
- Step 15: Train key personnel in energy efficient practices
- Step 16: Operate, maintain, purchase & design significant energy users efficiently

Review

- Step 17: Continuously measure & monitor energy performance & check against targets
- Step 18: Identify & implement corrective and preventative actions
- Step 19: Periodically review Energy MAP and identify improvements
- Step 20: Management Review of Energy Map

13. GET COMMITMENT

13.1.1. Commitment to energy management is vital to its success. When senior management commits to the process then you can make formal plans and secure the correct resources. Without this support there is a risk that any actions you take will be less effective.

13.1.2. You need a formal policy to make this commitment clear to staff at all levels and explain to them how they are involved. This pillar covers the essential steps in assigning the key roles. It also gives guidance for creating a policy that will suit your specific aims and needs.

13.1.3. To complete this pillar you must take a number of steps...

- Step 1: Senior Management Commitment
- Step 2: Appoint senior manager to Energy MAP
- Step 3: Appoint Energy MAP coordinator
- Step 4: Establish an Energy MAP team
- Step 5: Establish an Energy MAP Policy

14. IDENTIFY & UNDERSTAND THE ISSUES

14.1.1. After you have secured Commitment and the resources necessary to manage energy use, it is essential to develop an understanding of energy use and the factors that drive it. This will help focus attention and resources where the greatest impact is to be had. You will Identify what energy use is, what the main energy users are, the drivers of energy use (e.g. weather, production), and energy saving opportunities. Once you have identified the energy saving opportunities, you are ready to Plan implementation.

14.1.2. To complete this pillar you must complete a number of steps…

- Step 6: Develop and overview total energy consumption
- Step 7: Survey energy use & identify significant energy users
- Step 8: Identify key factors that influence energy consumption & Energy Performance Indicators
- Step 9: Identify energy saving opportunities

14.2. Energy Survey Checklist

14.2.1. Step 3 recommends you evaluate each equipment category, and gives some general recommendations on the things that you might look at. The checklist suggests specific things you should look at in each category.

14.2.2. Lighting

Although lighting is often taken for granted, it accounts for 20% of national electricity use, and can account for up to 40% of electricity use in offices. The electricity it consumes becomes a source of heat gain, which can result in overheating or increase cooling load.

Identify the different lamps that are in use, and their wattage. If you can’t see the rating by inspecting the lamps, then ask whoever is responsible for maintaining them.

Key questions to consider:

- Is the lighting performing its task?
- Are the luminaries clean and lamps in working order?
- Are the luminaries effective at casting light into the occupied space, or do they waste light?
- Has light output deteriorated with age, suggesting lamps need to be replaced?
- How are the lights controlled/switched?
- Do operating hours match occupancy hours?
- Are they on when daylight levels would be adequate for requirements?
- Are lighting levels adequate or excessive for requirements? Recommended LUX levels
- What do you hear most often regarding lighting in this building from the occupants?
- Do fluorescent lamps have electro-magnetic or high frequency control gear? If they flicker when they are switched on, then they have electro-magnetic gear.

Consider the suitability of the following energy saving technologies:

- Occupancy based controls
- Daylight linking (auto switch off or dimming when daylight is sufficient)
- Replace traditional bulbs/candle lamps with look-a-like CFLs
- Replace low voltage halogen lamps with Infra Red Coating halogen lamps or, where appropriate, mains voltage mini-CFL fittings.
- Replace high bay fittings in warehouses with automated “Patina” fittings
- Replace outside lights with SON or CFLs
- If replacing fittings use electronic gear, consider dimmable (with associated controls), fittings with reflectors that cast the light into the occupied space, and try to achieve a lower installed watts/sqm.

14.2.3. Evaluate Office Equipment

Office equipment typically accounts for more than 20% of total energy consumption in offices. The electricity they consume becomes a source of heat gain, which can result in overheating or increase cooling load. Despite having built-in powersave features, a recent UK survey found that these are only activated in 25% of cases.

- How many computers are there?

- What proportion of PCs and monitors automatically switch into standby if left idle, and what is the time delay? Note that “screensave” generally doesn’t save energy.

- What proportion of computers are switched off by the users at night?

- What other office equipment is used, and does it switch into standby?

Consider the following energy saving measures:

- Enable powersave features:
    - Blank screensave after 3 minutes
    - Standby after 10 minutes
    - Hibernate after 65 minutes

- If powersave features not available, consider use of timeswitches to switch off at night and weekends

- Procurement and installation practices should purchase Energy Star computers with flatscreens, and ensure powersave features are enabled as above.

14.2.4. Evaluate IT & Comms Rooms

Although not much can be done about direct electricity use by this equipment, there is often opportunity to reduce electricity use associated with cooling plant. A recent study we undertook found that 40% of the electricity consumed by a high performance server room was by the cooling plant and associated circulation fans.

Key questions to ask yourself

- Is the temperature in this room maintained below the prevailing temperature in the building (21°C)? Often IT rooms are maintained at 18°C, which results in heat flow from surrounding rooms through the walls into the IT room; this increases both your heating and cooling load. Each 1°C increase in cooling temperature setpoint will reduce energy use by 2-4%.

- If room temperature falls below setpoint, will the cooling plant operate in heating mode to warm the room? If a split a/c unit is being used “Auto” mode will enable heating!

- Are there unnecessary sources of heat gain (solar, warm air supply duct, unlagged radiator pipes)?

- Is the cooling plant efficient and in good condition? Assessing efficiency is dealt with below in the section on A/C units. Because a/c units in IT applications/comms rooms run continuously, energy efficiency is critical.

14.2.5. Evaluate Boiler Plant

Key questions

- What is the age and condition of the plant?
- Are boilers regularly maintained and air/fuel ratios tuned?
- What is the combustion efficiency? This should be available from the maintenance record.
- Are there separate heating and hot water boilers?
- Is the boiler and pipework insulation present and in good condition?
- If there is more than one boiler, are sequence controls fitted?
- Are extra boilers turned off in mild weather and the summer?

14.2.6. Heating, Cooling and Ventilation

Key questions

- Do heating, cooling and ventilation hours match occupancy in the different zones/areas?
- Are the space temperature setpoints for comfort heating at or below 21°C?
- Are the space temperature setpoints for comfort cooling at or above 23°C?
- Is there potential for simultaneous heating and cooling? Consider split air conditioning units operating in conflict with heated supply air; consider fan coil units operating in conflict with fresh supply air.
- Are portable electric space heaters in use? These are very energy intensive, but their use suggests a broader heating system issue.
- Are toilet and other extract fans switched off during unoccupied hours?
- Are there large fans/motors in use (air handling units)? If so, check operating hours, conditions and controls.
- Do the radiators have thermostatic radiator valves, and are they operated correctly?

- Are frost protection thermostats/controls set correctly?
- If radiant heating is used, does a black-bulb thermostat control it?
- Are building controls such as weather compensation and optimum start present?

Consider following energy saving measures:

- Variable speed drives on ventilation motors above 5kW in size. A 20% reduction in speed can deliver a 50% reduction in power.
- Consider the following boiler controls:
- Lead/lag or sequence control
- Inhibit operation in mild weather (outside air temperature > 16°C)
- Inhibit short cycling of boilers when there is not a genuine heat deman
- Boiler flow temperature weather compensation
- If heavyweight boilers are used, identify options to minimise standing losses, e.g. back-end isolation valves, burner or flue dampers.

14.2.7. Split air-conditioning units

Small packaged air-conditioning units are proliferating. They are often referred to as DX (direct exchange) units, or split a/c units. Each unit has an indoor unit (evaporator) and outdoor unit (condenser). They are generally installed to provide cooling, but are generally capable of heating too.

- Where are they used and is their function comfort cooling or IT equipment cooling?
- Are they required to maintain comfort? Frequently they are installed to offset heat gains associated with poor housekeeping of lights and office equipment.
- Are they switched off when not required?
- Are the temperature settings appropriate? Cooling temperature setpoint should not be below 21°C in either a comfort or IT application. Each 1°C increase in cooling temperature setpoint will reduce energy use by 2-4%.
- Is the condenser coil clean, and situated in a well-ventilated (preferably shaded) location?
- Is the pipe insulation in good condition?
- What is the Coefficient of Performance (COP) in cooling mode?

- Are they equipped with variable speed inverters, which improve part load operating efficiency?
- Is energy efficiency a factor considered in the procurement process?
- Procure A-rated appliances
- Procure appliances with variable speed inverters
- Procure appliances with a high COP (2.0 is poor, 4.0 is good).
- Due to the continual operation of a/c units in IT applications, if the unit has a low COP (2.5 or lower) consider replacing the unit with a high efficiency model.

Coefficient of Performance (COP) is a measure of the effectiveness of an air conditioning unit (or chiller) in converting electricity into cooling or heat. Once you buy a unit, the COP cannot be changed. For a given appliance, the COP in cooling mode will differ from the COP in heating mode. Usually the COP will be supplied with an appliance's technical literature. If it is not given it may be calculated simply:
COPcooling = rated cooling output [kW] / rated electricity input [kW].

14.2.8. Domestic Hot Water (DHW)

Instantaneous undersink heaters are effective where there are limited hot water requirements (e.g. hand washing only). Check the temperature setting for these units is 60°C.

For a boiler heated system, key questions to consider

- Do operating times for the circulating pump (on the secondary side) match occupancy?
- If the boilers are off at night, are the electric immersions inhibited?
- Is the water maintained between 55 and 60°C? Lower runs the risk of legionella, higher increases standing losses.
- Is the water pressure appropriate? High water pressure increases use.
- Is there adequate lagging on the calorifier and pipes?
- If the space heating boilers are also used for DHW, consider switching off the boilers in mild weather and using the electric immersion on night-rate electricity to heat water.

14.2.9. Catering

Key questions to consider:

- Is equipment switched off when not in use? This is a significant source of waste in kitchens.
- Is there speed control of the extract fan, and is speed reduced when full speed not required?
- If there is a supply air handling unit, what is the supply air temperature? 14°C often used for kitchens.
- Are supply and extract fans switched off when not required?
- Is the dishwasher plumbed with hot water from the central system?
- Are energy efficient appliances purchased?
- Are gas appliances favoured over electric appliances? Gas is cheaper as a source of heat.

For refrigeration equipment, specific issues are:

- In cold stores the evaporator should not be obstructed, the door should be left closed and the light should be switched off.
- The condenser should be mounted in a shaded, well ventilated area, and be in good condition.
- Check the refrigerant sight glass to ensure adequate charge.
- Check the pipe insulation is in good condition.
- Are the temperature settings appropriate?
- For display fridges, are the blinds pulled down at night?

15. PLAN AND ORGANISE

15.1.1. Having drawn up your Energy Policy and identified significant energy users and savings opportunities, you must now plan how you are going to put your policy goals and savings opportunities into action. The first step is to set clear objectives and targets. This is followed by an Energy MAP plan that will spell out how you are going to achieve them. The plan must also be backed up with sufficient resources approved by top-management, along with a system for measuring and monitoring success.

15.1.2. To complete this pillar you must complete a number of steps:

- Step 10: Set objectives and targets
- Step 11: Establish Programme Plan

- Step 12: Formally allocate sufficient human, financial & systems resources

15.1.3. Energy Policy

The commitment of the senior management team is essential to achieving increased energy efficiency in your organisation and should be documented in an Energy Policy. The Energy Policy is a one-page document that clearly and explicitly states the management team's commitment to:

- Continually improve energy efficiency
- Establish a framework for setting and reviewing objectives and targets
- Comply with all applicable requirements, either legal or agreed to by the organisation, with respect to energy aspects
- Investigate renewable and alternative sources of energy
- Communicate the Energy Policy to all employees and subcontractors, and interested parties
- Make the policy available to the public

16. IMPLEMENTATION

16.1. The 'people-factor' is key to the implementation of your Energy MAP. If people within your organisation are not aware of the opportunities and motivated to act, then the programme runs the risk of failure. You will have identified certain key people who are crucial to putting your plan into action. Gaining their commitment is important to making it a success. However, beyond these key players, people throughout your organisation must be aware of energy issues and motivated to save energy. This can be achieved through awareness campaigns and training activities.

16.2. The energy savings opportunities identified in Pillar 2 and documented in an 'Energy Savings Register' provide a reference for all the people in your organisation to work with. To help maintain the momentum in achieving these savings, it is also crucial to feedback the success of savings initiatives to all staff, including management. The achievement of monetary savings and other non-monetary benefits will help maintain the support of senior management, the enthusiasm of an energy management team, and contribution from all employees.

16.3. To complete this pillar you must complete a number of steps...

- Step 13: Implement the Programme Plan
- Step 14: Promote energy efficiency awareness and practices amongst employees

- Step 15: Train key personnel in energy efficient practices
- Step 16: Operate, maintain, purchase & design significant energy users efficiently

17. MONITOR ONGOING PERFORMANCE

17.1. Monitoring and reviewing are vitally important stages in closing the loop in the Energy MAP process. With energy performance indicators in place, information obtained from measuring and monitoring energy use can be used to review and modify the on-going Energy MAP system. The final step - the Management Review - ensures that senior management are responsible for assessing the overall Energy MAP performance and recommending changes. This helps achieve continual improvement in the management of energy.

17.2. To complete this pillar you must complete a number of steps...

- Step 17: Continuously measure & monitor energy performance & check against targets
- Step 18: Identify & implement corrective and preventative actions
- Step 19: Periodically review Energy MAP and identify improvements
- Step 20: Management Review of Energy Map

18. ENERGY MANAGEMENT PRIORITIES – A SELF ASSESSMENT TOOL

18.1. The Carbon Trust in the UK has used self assessment matrices for setting energy management priorities in the past. While these are no longer published, they do offer another perspective on the status of energy management in MIC. These simple matrices are easily filled in and can offer an immediate insight for the facilities manager on where efforts should be focused in the future. For these reasons, Varming Consulting Engineers believe that they are still relevant today and have included them in this report as another method to measure excellence in energy management.

18.2. Levels of Energy Management Excellence are quantified from 0 to 4.

18.3. Energy management priorities can be assigned using simple energy management Matrices. Each matrix has up to six columns, each of which covers a discrete topic related to energy management performance. The ascending rows, from levels 0-4, represent increasingly sophisticated handling of these topics. In general terms, the levels can be interpreted as follows.

18.4. Level 0 applies to sites where energy management is virtually non-existent. There is no energy policy, no formal delegation of energy management responsibilities, and there is no programme for promoting energy awareness within the organisation. Any equipment is unlikely to be energy efficient or to include any energy-efficient features.

18.5. Level 1 generally indicates that, although there is no specific energy policy, some energy management activities are in place, albeit in a rudimentary or informal fashion. Reporting procedures and awareness matters are undertaken on an ad hoc basis. Some plant and equipment will include energy-efficient features.

18.6. Level 2 suggests that the importance of energy management is recognised at a senior management level, but there is little active support for energy management activities. Energy staff are likely to, be based in a technical department, and the effectiveness of energy management is restricted to the interests of a limited number of employees. The majority of plant and equipment will be energy efficient.

18.7. Level 3 indicates that energy management is treated seriously at a senior level, and is incorporated within formal management structures. Consumption is likely to be assigned to cost centre budgets, and there will be an agreed system for reporting energy consumption, promoting energy efficiency and investing in energy efficiency. Plant and equipment selection will be based on energy efficiency.

18.8. Level 4 is indicative of clear delegation of responsibility for energy consumption throughout the organisation. Energy efficiency is regularly promoted both formally and

informally. A comprehensive monitoring system is in place, and performance is closely monitored against targets. Plant and equipment will be selected for energy efficiency and its operation will be closely monitored.

18.9. As a guide to the impact of energy efficiency, each level typically represents a change in consumption of 8-10%, or 30-40% overall. Levels 3 and 4 will generally represent realistic levels of best practice. Level 3 is likely to be appropriate for smaller organisations, where level 4 would not be viable. Larger organisations may find it appropriate to operate at level 4.

18.10. COMPLETING THE MATRICES

18.10.1. Follow these steps to complete the matrices and get an overview of energy management in your organisation.

- Make several photocopies of the organisational matrices.
- Consider each column, one at a time. On one photocopy, mark the place in each column which best describes where you are currently located. Place your mark in the appropriate cell, or between cells if you think this is more accurate.
- Join your marks across the column to produce a graph line. The profile will give an indication of how balanced energy management is in your organisation. Don’t worry if a profile is uneven. This is the case in most organisations. The peaks indicate where your current effort is most sophisticated, the troughs where you are least advanced.
- On other photocopies, get other people involved with the services you offer to complete the process, marking it up in the same way. Other people you could ask are your line manager, staff that directly report to you, and managers and staff from other departments. It is important to get as wide a spread of people as possible, as this gives you an idea as to how energy management is perceived throughout the organisation.
- Transfer the results to one photocopy, making clear the origin of each point – yourself, your line manager, your staff, other staff and managers.
- Try to draw a composite line from the results. It is likely that different groups will produce significantly different results. By discussing the results with each group you may be able to reach an agreed profile. Do not worry if you can’t. The fact that you are discussing the results with each group will help you understand the barriers and obstacles to effective energy management in your organisation, and will help you understand the appropriate actions to improve the situation.

18.11. PRIORITISING ACTIONS

18.11.1. Having established an overview of the existing energy management practices within your organisation, you will now need to target a number of activities for follow-up action.

18.11.2. For matrices at the second level (ie energy management, financial management, awareness and information and technical matrices), the aim should be to have a balanced profile, and to then move up the matrices in a balanced way. Decide which columns contain issues that are most important in your situation. Choose two columns where you would most like to see an improvement, ideally making sure that your matrices become more balanced. Often these will be the columns in which your score is lowest, but not always so. There may be obstacles which seem insuperable, in which case it is better to concentrate on areas where there is a good chance of success. Then decide on what actions are needed to make the improvements you have identified. Discuss these with your manager, and use them as the basis for developing a costed action plan. The aim should be to move up through these levels toward current best practice and, in so doing, develop or maintain a balance across the columns. For example, it is not so effective having high levels of investment without adequate reporting on achieved performance (and vice versa). Without reporting there is a reduced justification for future investment (and without investment there will be little to report on).

18.11.3. Once a priority has been set. there is often a temptation to concentrate on that activity until it meets the level 4 requirement of the matrix. This should be avoided. A deviation of plus or minus one level about the mean is acceptable. Any results significantly above the mean are unlikely to contribute to the current energy efficiency status. For the third-level matrices, attention should be focused on the columns with the poorer performance. The aim should be to improve the performance of these columns as much as possible within working constraints (eg budgetary, staff resources, etc). Once again, the aim is not necessarily to meet the level 4 requirement. There is no specific need for the matrices to be balanced.

18.12. The purpose of each matrix

18.12.1. THIRD LEVEL – DETAILED MATRICES

These matrices provide underpinning evidence for the four organisational matrices, particularly on technical matters. They should be used as appropriate to support and guide planning for investment in energy-saving opportunities. It is not as important to maintain a level profile in these matrices, as energy savings can be more substantial if improving a single aspect to a higher level.

18.12.2. **Space heating**: This matrix can be used to assess the technical capabilities of the overall heating system and its control. A further assessment takes account of circuit operating temperatures and the levels of space heating achieved. The operation of the heating system is also considered.

18.12.3. **Lighting:** This matrix provides a mechanism for measuring the suitability of selected lamp types, associated control gear and diffusers for general applications. The switching arrangements are assessed, along with their operation in practice. The replacement strategy is also considered.

18.12.4. **Hot water:** This matrix assesses the relative performance of the systems for providing domestic hot water. It is assumed that where there is a high demand for hot water, this is generated at a central point and stored. Where

the demand for water is low or intermittent, it is assumed that water is heated at the point of use.

18.12.5. **Small power equipment:** This matrix is to be used when assessing the selection and operation of portable power consuming equipment, including PCs, photocopiers and other office equipment.

18.12.6. **Boilers:** This matrix can be used to assess the energy performance of boilers, the way they are connected, and the way they operate together. Consideration is given to the way they operate at different times of the year, and the pumping regimes that have been adopted.

18.12.7. **Monitoring and targeting**: This matrix assesses the way in which data is gathered and analysed in order to improve energy performance. Data, sources and administrative procedures are assessed, together with the information that is disseminated. An assessment is also made on procedures for auditing this information.

18.12.8. **Air-conditioning systems**: This matrix can be used to assess the appropriateness of the selection and design of air-conditioning controls. An assessment is also made of the controls, with particular regard to simultaneous operation of heating and cooling plant in a single system.The performance of fans and cooling systems is also analysed.

18.12.9. **Building fabric:** This matrix should be used to assess the energy performance of windows, floors, doors and roof insulation. Factors which affect the thermal performance of each element are considered, along with draught-stripping of windows and doors.

18.12.10. **Building energy management system:** This matrix allows an assessment to be made of the performance of the building energy management system (BEMS), and reviews and audits its operation. Hardware and software performance are also assessed, including general operation of controls, reporting, and sensor calibration.

19. ENERGY MANAGEMENT SELF ASSESSMENT MATRICES

ENERGY MANAGEMENT PRIORITIES

TOP-LEVEL MATRIX – ENERGY PERFORMANCE
(using results from the four 'organisational matrices')

Date .... Completed by ....

Level	Column 1 score	Column 2 score	Column 3 score	Column 4 score	Column 5 score	Column 6 score
Energy management						
Financial management						
Awareness and information						
Technical						

SECOND-LEVEL MATRIX – ENERGY MANAGEMENT

Level	Energy policy	Organising	Motivation	Information systems*	Marketing	Investment
4	Energy policy, action plan and regular review have commitment of top management as part of an environmental strategy.	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption. Energy Committee chaired by board member.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive systems set targets, monitor consumption, identify faults, quantify savings and provide budget tracking.	Marketing the value of energy efficiency and the performance of energy management both within the organisation and outside it.	Positive discrimination in favour of 'green' schemes with detailed investment appraisal of all new-build and refurbishment opportunities.
3	Formal energy policy, but no active commitment from top management.	Energy manager accountable to energy committee representing all users.	Energy committee used as main channel together with direct contact with major users.	M&T reports for individual premises are based on sub-metering. Achieved performance against targets reported effectively to users.	Programme of staff awareness and regular publicity campaigns.	Same payback criteria employed as for all other investment.
2	Unadopted energy policy set by energy manager or senior departmental manager.	Energy manager in post, reporting to ad hoc committee, but line management and authority are unclear.	Contact with major users through ad hoc committee chaired by senior departmental manager.	Monitoring and targeting reports based on supply meter data. Energy unit has ad hoc involvement in budget setting.	Some ad hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten or uncoordinated set of guidelines.	Energy management is the part-time responsibility of someone with limited authority or influence.	Informal contacts between engineer/technical staff and a few users.	Cost reporting based on invoice detail. Engineer compiles reports for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low-cost measures taken.
0	No explicit policy.	No energy management or any formal delegation of responsibility for energy consumption.	No contact with users.	No information system. No accounting for energy consumption.	No promotion of energy efficiency.	No investment in increasing energy efficiency in premises.

* Refer to third-level matrix: 'monitoring and targeting' for information to support this column.

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SECOND-LEVEL MATRIX – FINANCIAL MANAGEMENT

Level	Identifying opportunities	Exploiting opportunities	Management information	Appraisal methods	Human resources	Project funding
4	Detailed energy surveys are regularly updated. Lists of high- and low-cost opportunities already costed and ready to proceed immediately.	Formal requirement to identify the most energy-efficient option in all new- build, refurbishment and plant replacement projects. Decisions made on the basis of life cycle costs.	Full management information system enabling identification of past savings and further opportunities for investment meeting organisation's financial parameters.	Full discounting methods using internal rate of return and ranking priority projects as part of an ongoing investment strategy.	Board take a proactive approach to a long-term investment programme as part of a detailed environmental strategy in full support of the energy management team.	Projects compete equally for funding with other core business investment opportunities. Full account taken of benefits which do not have direct cost benefit, eg marketing opportunities, environmental factors.
3	Energy surveys conducted by experienced staff or consultants for buildings likely to yield largest savings.	Energy staff are required to comment on all new-build, refurbishment and plant replacement projects. Energy efficiency options often approved but no account is taken of life cycle costs.	Promising proposals are presented to decision-makers but insufficient information (eg sensitivity or risk analysis) results in delays or rejections.	Discounting methods using the organisation's specified discount rates.	Energy manager working well with accounts/finance department to present well-argued cases to decision makers.	Projects compete for capital funding along with other business opportunities, but have to meet more stringent requirements for return on investment.
2	Regular energy monitoring/analysis identifies possible areas for saving.	Energy staff are notified of all project proposals with obvious energy implications. Proposals for energy savings are vulnerable when capital costs are reduced.	Adequate management information available, but not in the correct format or easily accessed in support of energy-saving proposals.	Undiscounted appraisal methods – eg gross return on capital.	Occasional proposals to decision makers by energy managers with limited success and only marginal interest from decision makers.	Energy projects not formally considered for funding from capital budget, except when very short-term returns are evident.
1	Informal ad hoc energy walkabouts conducted by staff with checklists to identify energy-saving measures.	Energy staff use informal contacts to identify projects where energy efficiency can be improved at marginal cost.	Insufficient information to demonstrate whether previous investment in energy efficiency has been worthwhile.	Simple payback criteria are applied. No account taken of lifetime of the investment.	Responsibility unclear and those involved lack time, expertise and resources to identify projects and prepare proposals.	Funding only available from revenue on low-risk projects with paybacks of less than one year.
0	No mechanism or resources to identify energy-saving opportunities.	Energy efficiency not considered in new-build, refurbishment or plant replacement decisions.	Little or no information available to develop a case for funding.	No method used irrespective of the attractiveness of a project.	No-one in organisation promoting investment in energy efficiency.	No funding available for energy projects. No funding in the past.

SECOND-LEVEL MATRIX – AWARENESS AND INFORMATION

Level	Energy management responsibilities	Energy efficiency awareness	Reporting procedures	Review of energy performance	Ongoing training	Market awareness
4	Lists of responsibilities and their assignment exist and are comprehensive and regularly reviewed. All staff have responsibilities.	Energy efficiency performance regularly presented to all staff. Full use made of publicity. Advantage taken of all available dissemination routes for promoting new measures for saving energy.	Comprehensive reporting of current status compared with best practice, on regular basis and geared at a variety of audiences. Full support to public statements.	Energy and water efficiency regularly reviewed. Performance compared against internal and external references or benchmarks. Ideas actively sought.	Continuous professional development properly resourced for technical and premises staff. Active technical library. All staff have ready access to domestic and non-domestic energy efficiency information.	Keep abreast of technological developments by ongoing monitoring of trade journals, literature and other sources on issues affecting energy efficiency.
3	Lists of responsibilities and their assignment exist for key energy staff and all departments.	Energy efficiency status presented to all staff at least annually. Occasional but widespread use of publicity to promote energy-saving measures.	Current status reports issued annually to shareholders and staff. Impartial reporting of performance to staff and departments on a regular basis.	Frequent energy efficiency reviews using monitored consumption and cost data. Analysis is regular, wide-ranging but ritualistic.	Continuous professional development for technical and premises staff. All staff are aware of and have access to an energy efficiency library.	Regular studies carried out on trade journals, literature and other sources to assess current developments impacting on energy efficiency.
2	Some staff and departments have written responsibilities.	Energy performance presented to staff on a regular basis. Occasional use of publicity for promoting energy-saving measures.	Occasional issue of energy efficiency status reports. Concentrates on good news.	Occasional technical energy efficiency reviews. Regular cost checks with exception reporting. Analysis of limited scope.	Technical and premises staff development mainly via professional and technical journals. Occasional initiatives to train staff in energy efficiency.	Trade journals, literature and other sources scanned on an ad hoc basis for information on the latest developments relating to energy efficiency.
1	Unwritten set of responsibility assignments.	Energy performance occasionally reported and known to very few staff. Energy-saving measures are rarely promoted.	Reports only issued if prompted by a business need. Most reports will contain only good news.	Energy review activity based on revenue costs. Limited exception reporting only.	Energy efficiency awareness generally low. A few staff have knowledge of energy efficiency techniques and facts. Little, if any, training in energy efficiency for staff.	Trade journals, literature and other sources studied for energy implications when a purchase is imminent.
0	No evidence of assignment of energy efficiency tasks and duties.	No staff have explicit responsibilities or duties.	No reporting.	No monitoring activity to underpin review processes.	Little, if any, knowledge of energy efficiency amongst staff. No attempt made to inform staff of techniques and benefits of energy efficiency.	Energy efficiency not a consideration when keeping up to date on products or technology.

SECOND-LEVEL MATRIX – TECHNICAL

Level	Existing plant and equipment*	Plant and equipment replacement	Maintenance procedures	Operational knowledge	Documentation and record keeping	Operational methods
4	The majority of existing equipment (fixed plant and portable appliances) incorporates best practice energy-efficient features, is correctly commissioned for energy efficiency and well maintained.	Equipment is selected to be the most appropriate to the application. Life cycle costs and energy efficiency are taken into account. Energy saving is a major consideration in product selection.	Maintenance is based on needs, with formal condition appraisal methods being performed for all equipment and fabric elements affecting energy efficiency. Results acted upon where necessary.	All staff understand how their roles impact on energy efficiency and take positive steps to minimise energy use. Staff receive targeted training in energy efficiency.	Fully detailed descriptions of system concepts, plant control and operation. Detailed schedules of all plant, instrumentation and controls.	Operation methods and settings for energy efficiency defined and implemented. Full utilisation of feedback from monitoring.
3	Equipment and plant is appropriately selected, energy efficient, commissioned for low energy consumption and well maintained.	Equipment is selected to be appropriate to the application with energy-saving features taken into consideration. Life cycle costs and energy efficiency are evaluated.	Condition surveys carried out regularly on equipment and fabric elements affecting energy efficiency. Action undertaken for most defects identified.	Staff are aware of how they affect energy use and take all good housekeeping measures to save energy. Further training received on a regular basis.	Detailed descriptions of plant control and operation, and outline system concepts. Reasonably detailed schedules of all plant instrumentation and controls.	Delivered conditions and operating methods for energy efficiency defined and implemented. Informal use of information from monitoring.
2	Most equipment is not specifically energy efficient, but either was commissioned or is being regularly maintained for low energy consumption.	Equipment selected to be fit for purpose, bearing in mind likely life cycle costs and energy efficiency factors.	Condition surveys carried out regularly on all equipment and fabric elements affecting energy efficiency. Remedial work constrained by budgets.	Most good housekeeping practices are adhered to in an attempt to reduce energy usage. Occasional energy efficiency training received.	Basic descriptions of plant control and operation. Basic plant instrumentation and control schedules for most control systems.	Targets set against realistic budgets, and maintained through financial procedures.
1	Equipment is not energy efficient, but has been commissioned for economy and undergoes periodic maintenance.	Power efficiency data on products obtained as part of selection process.	Condition surveys and occasional activity, often prompted by plant failure or safety considerations. Remedial work only carried out on major defects.	Energy-saving techniques are only adopted where they can be easily accommodated within traditional working practices.	Minimal, or poor plant control and operation. Plant instrumentation and control schedules for only some of the plant and control systems.	Targets set by default through budget setting procedures.
0	Energy performance has not been considered during the procurement, commissioning or maintenance of existing plant and equipment.	No consideration of energy efficiency in product selection.	No regular surveys or maintenance carried out.	No consideration is given to energy efficiency during working operations.	None available.	No targets set.

* Where necessary, refer to further detail technical matrices for information to support this column.

THIRD-LEVEL MATRIX – SPACE HEATING

Level	Time control	Boiler output controls	Heat emitters	Operation of heating systems	Heating levels and balance	Zoning
4	Space heating is controlled by a sophisticated system such as a BEMS, programmed for weekends and holidays, and with self-learning optimum start and stop functions.	Effective automatic control of boiler standing losses. Only those boilers whose output is required are hot, all others cold or cooling. Boilers and manifolds are well insulated.	Radiators have thermostatic valves, fan convectors have individual controls and different areas of the building each have internal temperature sensors or thermostats.	Rigorous checking of controls function, settings, and system balance carried out once per year. Documented procedures and comprehensive records of results.	Temperatures are even throughout the building – within the range 18°C to 20°C during the periods of occupancy, and reducing to lower temperatures outside those periods.	Objective zoning for occupancy, solar gain, equipment gain, emitters, structure, etc, where appropriate. Adequate means for controlling temperature in each zone.
3	An optimum start controller varies the start time of the heating according to outside temperatures, and an optimum stop does the equivalent at the end of the day.	Effective manual isolation of boilers to reduce standing losses when full output is not required. Boiler and manifolds are well insulated.	Radiators and fan convectors have individually operated controls. The temperature of radiator circuits is hotter in mid-winter and cooler in autumn and spring.	Full checking of controls function, controls settings, and system balance carried out once per year. Documented procedures exist for each check. Some results on record.	Temperatures are even throughout the building, but in some parts they occasionally rise over 20°C during spring or autumn. 20°C is maintained only during the hours of occupancy.	Extensive zoning, approximately reflecting occupancy time and temperature requirements. Temperature controls exist for each zone.
2	There is an optimum start controller fitted to the heating system. Holiday periods can be programmed in advance.	All boilers become hot only when boiler output is required. Boilers are cold at all other times (eg overnight).	Radiators and fan convectors have individually operated controls but water temperature to the radiators is the same all year round.	Informal checking of controls function and system balance carried out once per year. Schedule of checks exists but no proof of occupancy.	Temperatures above 20°C during spring and autumn, and the building is warm for more than an hour before or after the occupied periods.	Limited zoning, perhaps led by building expansion, but zones approximately reflect the need for separate occupancy times and temperatures.
1	The heating system has a simple timer that can be easily set. Timer settings are adjusted manually to suit seasonal heating requirements.	All boilers remain hot during pre-heat and building occupation hours during summer and winter.	Radiators and heat emitters have basic controls, and there is only one internal temperature sensor to control them.	Annual functional checks carried out although these are not well documented.	Temperatures vary and they are frequently above 20°C for long periods – including outside periods of occupancy.	Limited zoning or inappropriate zoning of circuits.
0	The timer is in a poor state of repair and cannot be easily adjusted. The controller may not recognise days of the week.	All boilers remain hot regardless of whether or not there is a demand for heating.	Radiators and heat emitters have no controls and get hot together. Radiator temperatures appear to be the same all year round.	Maintenance is on breakdown basis and controls are checked only when things go wrong.	For much of the building temperatures are frequently too hot, particularly in spring and autumn.	No zoning where zoning desirable, or inappropriate zoning.

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THIRD-LEVEL MATRIX – LIGHTING

Level	Strip lights	Small lights	Switching equipment	Replacement policy	Lighting diffusers and shades	Operation in use
4	A high proportion of strip lights are 16mm diameter high-efficiency (T5) tubes with high-frequency ballasts*.	A high proportion of small lights are compact fluorescents. Tungsten bulbs (GLS) are only installed in areas that are used very infrequently.	Lights are switched in separate banks whose locations correspond to activity and available daylight. Switches are clearly labelled to show which lamps they operate.	Light fittings, including diffusers, reflectors and ballasts, are updated on a planned basis. Specular reflectors** are widely used.	Diffusers and shades are selected for their high utilisation factor and are cleaned on a scheduled basis.	Lights operate only as required. Where daylight is available, light output is adjusted to the minimum required. There is a routine for regular checking of artificial lighting usage.
3	A high proportion (>75%) of strip lights are 16mm diameter high-efficiency (T5) tubes.	Most are compact fluorescent with tungsten bulbs (GLS) in remainder.	Lights are switched in separate rows with switches located near the lights they operate. Switches are clearly labelled.	Light fittings, including diffusers, reflectors and ballasts are periodically upgraded when opportunities allow.	Diffusers and shades are selected for their high utilisation factor and are cleaned occasionally.	Lighting levels and hours of operation are well controlled. Checks are undertaken periodically on an ad hoc basis. Cleaners light their current working area only.
2	Most strip lights are 16mm diameter (T5) tubes	Approximately half are compact fluorescent, with the remainder tungsten bulbs (GLS).	Lights are switched in rows and switches are in the same space as the lights they operate. But rows do not necessarily correspond with daylight, nor are switches labelled.	Light fittings, including diffusers, reflectors and ballasts are upgraded on an ad hoc basis.	Diffusers and shades are of high utilisation factor, but are not regularly maintained.	Lighting levels are partially controlled. Lights are switched on only when they are required, and switched off at the end of the occupation period. No routine for checking usage.
1	Strip lights are predominantly (>75%) 38 mm diameter (T12) tubes.	A few are compact fluorescent with the remainder tungsten.	Lights have the potential to be switched on in banks, but in practice all go on together.	Lamps and ballasts are sometimes upgraded to high-efficiency types when they are replaced.	Diffusers and shades are of fair translucency but are rarely cleaned.	Lighting levels are partially controlled. All lights are switched on at the beginning of the day and typically operate continuously whenever the building is occupied, whether required or not.
0	Strip lights are all 38 mm diameter (T12) tubes.	Traditional tungsten filament general lighting system (GLS) lamps are installed more or less throughout.	Lights are switched from central locations and all go on together.	Lamps are replaced upon failure with 'like-for-like' lamp types.	Diffusers and shades are not selected for translucency/light transmitting properties. There is no programme for cleaning.	Lighting levels are uncontrolled. Lighting is frequently left on 24 hours per day whether the building is occupied or not.

THIRD-LEVEL MATRIX – HOT WATER

Level	Type of installation (low water use applications)	Timer/programmer settings	Calorifier* installation (high water use applications)	Pipework insulation	Actual water temperature at taps
4	Instantaneous local point of use water heaters or water heaters with localised storage and time controls.	Two or more visual and functional checks made each year against a formal document and results recorded. No pump or heating fuel used when building is unoccupied.	The calorifier/hot water boiler is correctly sized, appropriately located, designed to eliminate stratification**, and insulated to its optimum thickness based on best practice calculations.	All pipework is well insulated, and both insulation and any finishes (eg reflective coatings or waterproof finishes) are in prime condition. Flanges, valves and other fittings are insulated.	Water circulation temperatures are hot throughout (ie >50°C) and where there is risk of scalding, outlets are fitted with blenders to mix with cold water for comfort.
3	Instantaneous local point of use water heaters or water heaters with localised storage without time controls.	Annual visual checks made using formal procedures and results recorded. No pump power or heating fuel used when building is unoccupied.	The calorifier/hot water boiler is correctly sized, and insulated to an economic thickness calculated using local criteria. Calorifier appropriately located to meet demand for hot water.	All pipework in both unheated and heated spaces is well insulated and insulation feels cool to the touch. Flanges, valves and other fittings are insulated.	Water circulation temperatures are hot throughout (ie >50°C) and some automatic blenders are fitted to mix with cold water for comfort.
2	Hot water is provided from dedicated central plant with seven-day timer/programmer that allows heating and hot water services to operate independently.	Times of availability closely matched to demand. Regular checks on time switch settings.	The calorifier/hot water boiler is well insulated with insulation known to be more than 50 mm thick.	All pipework in both unheated and heated spaces is well insulated and insulation feels cool to the touch.	Water circulation temperatures are hot throughout (ie >50°C) Water temperature at the taps is hand hot and cold water has to be added regularly for comfort.
1	Hot water is provided from central plant, with timer/programmer serving both heating system and hot water.	Times of availability not specifically checked.	The calorifier/hot water boiler is insulated with 25-50 mm insulation.	Pipework in unheated spaces is well insulated and cool to the touch.	Water temperature at the taps is variable, and is often less than 50°C or greater than 60°C.
0	The only controls are on/off and the primary circuit thermostat.	Times of availability not specifically checked. Strong possibility of availability when building unoccupied.	The calorifier/hot water boiler is incompletely insulated and is subject to significant heat loss.	Pipework generally is not insulated or the insulation is thin, damaged or in poor condition.	Water temperature at the taps is regularly below 50°C or greater than 60°C.

* Calorifier – a heat exchanger, usually with storage capacity, used to generate hot water.
** Stratification – the process whereby hot water rises to the top of a storage, and the temperature steadily decreases towards the bottom.

THIRD-LEVEL MATRIX – SMALL POWER EQUIPMENT

Level	Purchasing policy	Operational policy	Operational compliance	Audit	Energy-saving features
4	Equipment selected to be the most appropriate to the application, bearing in mind life cycle costs and energy efficiency. Energy-saving features a major consideration in product selection.	Initial assessment and regular re-assessment of each situation to determine the most energy-efficient operating mode commensurate with business needs. Time switches and other devices installed where appropriate.	Regular checking of time switches and automatic controls to ensure equipment powered down to lowest consumption mode whenever possible.	Documented routine of regular checks to ensure equipment only powered up when necessary.	All energy-saving features (eg automatically reverting to standby after pre-determined time) are enabled and optimised.
3	Equipment selected to be energy efficient. High-energy-label products selected (where appropriate) Energy-saving features taken into consideration in product selection.	Initial assessment of each situation to determine the most energy-efficient operating mode commensurate with business needs.	Equipment only switched on when needed. Power-saving set-ups employed whenever possible to minimise waste.	There is a routine of regular checks to ensure equipment only powered up when necessary.	All energy-saving features are enabled and reviewed against likely criteria for efficient operation.
2	Equipment selected to be suitable for the application, bearing in mind life cycle costs and energy efficiency.	Departmental responsibilities exist for ensuring that equipment is switched off when not in use.	Equipment switched off when not needed.	Checks regularly carried out to determine whether equipment is switched off out of hours.	Energy savings settings are enabled for equipment with high electricity consumption.
1	Power efficiency data on products obtained as part of selection process.	Users instructed to only have equipment switched on when required.	All equipment switched on at start of day and remains on whenever building occupied.	Ad hoc checks carried out to determine whether equipment is switched off out of hours.	Some energy-saving features are enabled but there is no clear strategy, and settings are ad hoc and diverse.
0	No consideration of energy efficiency in product selection.	No policy for ensuring equipment switched off when not in use.	Equipment frequently left running even when building unoccupied.	No checks to determine whether equipment is left on even when building is unoccupied.	Pre-delivery settings are unchanged by users.

THIRD-LEVEL MATRIX – BOILERS

Level	Boiler selection	Multiple boilers	High/low fire boilers	Pumps
4	Very low standing loss boilers – typically less than 0.5% of rated output. Condensing boilers chosen for low-temperature applications.	Score '4' if requirements of '3' are satisfied and formal documentation exists on design intent and control settings.	High fire correctly integrated into burner sequence control, and operation well documented.	Variable speed controlled from representative load, reducing pump differential pressure with demand. Records kept of pump control and operation.
3	Low standing loss boilers with losses down to 0.75% of rated output, common primary pump. Condensing or high-efficiency boilers for low-temperature applications.	Heat losses from idle boilers are automatically minimised by reducing or restricting the water flow through boilers that are not firing.	High fire correctly integrated into sequence control.	Variable speed controlled from representative load, reducing pump differential pressure with demand.
2	High standing loss boilers with losses in the range of 2% to 5% of rated output, fully isolated and cold when off line.	Boiler operation dictated by automatic sequence controls. Redundant capacity capable of manual isolation.	Sequence control achieved by boiler thermostats. High fire control typically set at lower temperature than low fire by margin of at least 6°C to ensure most efficient boiler acts as lead.	Variable speed pumps controlled at constant pump differential pressure. Records kept of pump control and operation.
1	High standing loss boilers with losses greater than 5% of rated output, isolated and cold when off line.	Winter/summer conditions can be manually altered – eg by allowing a dedicated boiler to heat the primary DHW* circuit during summer.	Sequence control achieved by boiler thermostats, although margin may be less than 6°C, and relative efficiency of boilers has not been considered.	Variable speed pumps controlled at constant pump differential pressure.
0	High standing loss boilers greater than 7% of rated output, not isolated when off line.	Operation of multiple boilers does not change with changes in demand – warm return water is circulated through idle boilers, and flow rates are constant.	Inadequate control procedures for burner sequencing (eg high fire control setting set at higher, or same, temperature as low fire).	Constant speed pumps.

* DHW – Domestic hot water.

THIRD-LEVEL MATRIX – MONITORING AND TARGETING

Level	Operational requirements	Data sources	Administration	Analysis	Outputs	External audit
4	All data obtained up to date and competently analysed with minimum delay. Management and operational efficiency information provided in timely manner and appropriate detail.	Details of premises and occupancy database updated regularly. Consumption data routinely obtained. Internal and external temperatures logged as required to establish changes between shifts or other working practices.	All meter readings taken in accordance with a written plan, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis made with respect to fuel costs, building usage and other relevant parameters. Accuracy of energy targeting and normalisation formally assessed against business needs.	Reports prepared and provided to managers in a concise form allowing both technical and financial data to be effectively utilised. Data normalised for ease of comparison. Impact of any uncertainties defined.	Premises database checked annually for accuracy. Instrumentation calibration verified. Market fuel prices checked. Reports analysed for significant trends and anomalies.
3	All data obtained up to date and analysed so as to provide management information in adequate detail.	Premises inventory and occupancy database updated regularly. All data sources calibrated. Internal and external temperatures logged regularly and energy usage recorded on a shift by shift basis.	All meter readings taken regularly, temperature and other recorder data collated and combined with relevant trading and business data recording.	Energy usage analysis undertaken with respect to fuel costs, business usage and other parameters, including prevailing weather. Comparisons possible with previous periods.	Reports prepared and provided to managers in a concise form allowing both technical and financial data to be effectively utilised, with deviations from budget and comparisons with previous period.	Premises database checked annually for accuracy. Instrumentation calibration verified. Market fuel prices checked.
2	Provision of budgetary figures based on usage in corresponding periods adjusted for changes in base data (eg weather corrected).	Most data sources calibrated. Internal and external temperatures logged routinely and energy usage recorded on a routine basis.	All meter readings taken frequently, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis with respect to fuel costs, building usage and other parameters undertaken as required.	Reports prepared and provided to managers incorporating both technical and financial data together with deviations from budget and comparisons with previous period.	Premises database checked annually for accuracy. Ad hoc cursory check on reports and comparison with previous year.
1	Provision of budgetary figures based on usage in corresponding periods.	Records kept of consumption based on bills from suppliers.	Occasional meter readings taken, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis with respect to fuel costs, building usage and other parameters undertaken occasionally in response to adverse trends.	Reports prepared and provided to managers incorporating both technical and financial data for the period.	Ad hoc checks on premises database. Ad hoc cursory check on reports and comparison with previous year.
0	No information of energy efficiency or consumption available.	No measurements taken and no records kept.	Information not collected.	No energy analysis prepared.	No management reports prepared.	No auditing function.

THIRD-LEVEL MATRIX – AIR-CONDITIONING SYSTEMS

Level	System selection	System design	System control	Fan power	Cooling systems
4	Appropriate system selected with delivered air volumes to match the need at all times. Includes energy-saving features such as heat recovery or controlled partial recirculation based on air quality.	System design well matched to user needs and building type. Temperature and humidity requirements achieved with minimum energy consumption.	Wide deadband for control limits on setpoints for temperature and humidity (where appropriate). Occupancy-based control, likely to be via BEMS with extensive operator facilities.	High-efficiency fans selected, and system designed for low pressure loss along ductwork. Control by variable speed drive. Power consumed less than 1 W for each 1/s of air delivered.	Most efficient means selected for providing cooling. Chillers have variable speed compressors. Flow rates and/or temperature of cooling medium is variable depending on demand.
3	Appropriate system selected with carefully delivered air volumes to match the need. Energy-saving features such as run-around coils for heat recovery.	Good system design with all expected energy efficiency measures, such as free cooling control and night purge during summer. Temperature and humidity requirements achieved with reasonable energy consumption.	Automatically controlled but variable conditions for common supply ducts. Modern electronic or electro-mechanical controls. Communication between controllers.	Good fan selection, combined with good ductwork design. Likely to include either VSD or high-efficiency motor.	Efficient means provided for cooling, eg good use made of evaporative cooling*. Chillers selected and sequenced to be able to match demand across load range.
2	Air-conditioning necessary but inappropriate system(s) and/or features selected. Effects are excessive air change rates and unnecessary cooling or humidity control.	Designed to reasonable standard but lacks consideration for energy efficiency other than limited measures, eg free cooling control.	Fixed common supply duct conditions are chosen to limit the duty on terminal units** but do not optimise energy performance. Modern electronic or electro-mechanical controls with time programming.	Reasonable fan selection and ductwork design, although energy efficiency was not a prominent factor during selection.	Cooling provided using efficient chillers. Outputs specifically chosen to minimise energy consumption, particular over the full range of operating loads. Fixed delivery temperature.
1	Air-conditioning only necessary for parts of building, yet other areas are air-conditioned.	Poorly designed – oversized plant, lack of expected energy efficiency measures. Reasonable functional control of plant. Lack of expected energy efficiency features, such as free cooling control.	Unnecessarily close control of heating and cooling (to within 2-3°C, 10% RH***). Stand-alone time control without convenient means for omitting operation during holiday periods.	Either oversized fans or poor ductwork design.	Reasonable chiller performance, but poor performance characteristics at low operating loads. Fixed delivery temperature, lower than strictly required.
0	Air-conditioning not necessary, yet air-conditioning presence is significant.	Very poor design – likely to be oversized for application, etc. No energy-saving features.	Close control of heating and cooling in space and within supply ducts (to within less than 1°C, 5% RH) where not appropriate. Poor time control of plant.	Oversized, poorly selected fans, poor ductwork design.	Poor chiller performance, providing a constant temperature output, at a much lower level than necessary to match loads.

* Evaporative cooling – cooling effect achieved by the evaporation of water.
** Terminal units – components of air-conditioning systems that are close to the point of delivery.
*** RH – relative humidity.

THIRD-LEVEL MATRIX – BUILDING FABRIC

Level	Windows	External doors	Pitched roof insulation	Natural ventilation
4	All windows are double glazed, and draughtstripped. Window catches hold them tightly shut.	All external doors are draughtstripped and have self-closing devices. Draught lobbies are provided for frequently operated doors.	Roof insulation is at least 150 mm thick and continuous over whole roof area.	Users have control over ventilation, providing adequate ventilation during occupancy. Much reduced overnight and weekend ventilation serving only to prevent condensation.
3	All windows are double glazed, and draughtstripped.	Most external doors are well-fitting draughtstripped and have self-closing devices. Door locks hold them tightly closed.	Roof insulation is at least 100 mm thick and continuous over whole roof area.	Reasonable degree of user control over natural ventilation. Adequate ventilation during occupancy, with significantly reduced air changes outside of working hours.
2	Windows generally are single glazed and draughtstripped. Window catches hold them tightly shut.	External doors are well-fitting and generally draughtstripped.	Roof insulation is 150 mm to 100 mm thick generally, but there are visible gaps in the insulation.	Some degree of user control over ventilation rates during occupancy, although excessive during winter and inadequate during summer.
1	Windows are single glazed but fit well with minimal draughts.	External doors fit well.	Parts of the roof are insulated.	Higher than necessary rates of ventilation during occupied periods, with minimal reduction outside of occupancy.
0	Windows are single glazed and poorly fitting with gaps visible around the edges.	External doors are poorly fitting and gaps are visible around the edges.	There is no roof insulation installed.	Unnecessarily high air change rates with no variation between air change rates inside and outside of occupancy.

THIRD-LEVEL MATRIX – BUILDING ENERGY MANAGEMENT SYSTEM

Level	Operation of BEMS	System accuracy	Response to alarms	Optimising operating efficiency	Reporting	External aids
4	BEMS installed correctly and regularly checked to ensure that it is operated in the most effective and efficient manner at all times to take into account variations in ambient conditions, occupancy and workload.	All sensors regularly checked and accurately calibrated. All externally owned meters verified to be within calibration.	Out of limit alarms flagged immediately for sensors which affect energy efficiency. Maintenance status report generated on a planned basis to reflect known needs.	Ensure that desired temperature profiles are maintained in accordance with space occupancy and shift patterns.	Concise management reports prepared to show deviation from optimum in both technical and financial terms, analysed to highlight peak/worst hour performance.	Portable monitors and recorders regularly used in both occupied and unoccupied areas to verify that temperature profile is maintained.
3	BEMS installed correctly and operated in an effective and efficient manner at all times to take into account variations in ambient conditions, and occupancy.	All sensors regularly checked and carefully calibrated.	Operation critically reviewed on a regular basis. Maintenance status report generated regularly.	Ensure that desired temperature profiles are maintained in accordance with shift patterns.	Concise management reports prepared to show deviation from optimum in both technical and financial terms.	Portable monitors and recorders used on a seasonal basis in both occupied and unoccupied areas.
2	BEMS operated in the most effective and efficient manner at all times to take into account variations in ambient conditions.	All sensors checked seasonally and calibrated annually.	Occasional review of operation. Maintenance status report generated occasionally.	Periodic review of temperature profiles.	Summary report of BEMS data.	Ad hoc use of thermometers and monitoring equipment in both occupied and unoccupied areas.
1	Temperature controlled by local space thermostats.	Ad hoc checking of sensors.	Ad hoc checks on space temperatures undertaken.	Ensure heating is turned off at weekends and in the summer.	Weekly report by maintenance department of daily space temperatures.	Ad hoc hand checking of radiator temperatures.
0	No BEMS. Temperature controlled using integral plant controls (eg boiler thermostat).	No procedure for sensor checking, setting or calibration.	No ability to measure or check operating efficiency.	None – heating may even be allowed to remain on for seven days/week.	No measurements taken and no reports prepared.	No auditing or monitoring.

20. REFURBISHMENT FOR IMPROVED ENERGY EFFICIENCY

20.1. The Chartered Institute of Building Services Engineers have published guide KS12 on building Refurbishment called "Refurbishment for improved energy efficiency: an overview. This guide contains a flow chart which illustrates the various refurbishment procedures and options. This flow chart is illustrated below.

20.2. The Guide also contains a Pre-refurbishment energy checklist which is detailed further down.

20.3. CIBSE divides the options into two categories – Low Cost options and Higher cost options including low or zero carbon technologies.

20.4. Lower cost refurbishment options include examining the following:

20.4.1. Changing space layout to aid air flows in naturally ventilated areas.

20.4.2. Zoning

20.4.3. Improved natural lighting

20.4.4. Improved artificial lighting

20.4.5. Reducing solar gain

20.4.6. Improved controls

20.4.7. Heat recovery

20.4.8. Motors

20.4.9. Domestic Hot water

20.5. Higher cost refurbishment options include the following;

20.5.1. Building fabric (examined in more detail below)

20.5.2. Air conditioning and mechanical ventilation

20.5.3. Free cooling

20.5.4. Passive cooling and ventilation techniques

20.5.5. Space heating systems

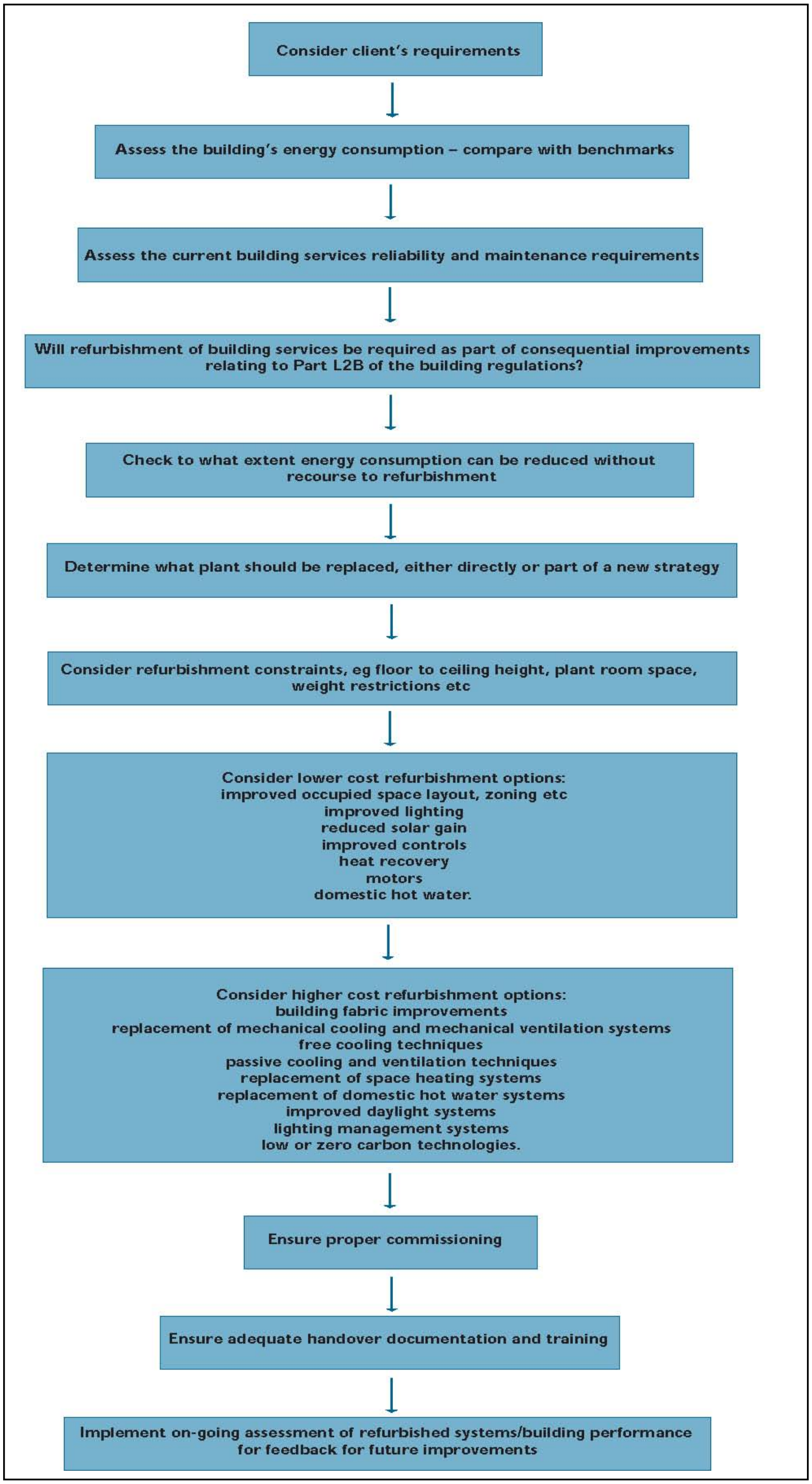
20.5.6. Lighting management systems

20.6. Pre refurbishment Energy checklist

Good housekeeping and maintenance	Adjust controls to match heating, cooling and lighting use to occupancy periods Establish responsibility for control setting, review and adjustment Check that security and cleaning staff practice 'switch-it-off' policy Switch off supply and extract fans when the building is unoccupied (unless part of a night cooling routine) Make regular checks that the occupation hours for every zone are appropriate, especially if occupiers are in the habit of working late; it is very easy to miss resetting back to standard hours Experiment with minor changes to heating and cooling set points; if there are no complaints this indicates that energy savings are available Ensure that non-essential IT equipment is switched off out of office hours.
Building fabric	Re-hang misaligned doors and windows Replace damaged weather stripping and sealant round windows and doors Keep curtains and blinds clean and in good working condition Check openable windows can be properly closed and latched with a good seal.
Controls	Check and maintain to ensure correct setting and operation Check zone controls meet needs of occupants with no overheating, undercooling or other annoyance Check central plant is modulating/sequencing to match the load.
Ventilation systems	Check systems are clean and balanced with all controls functioning correctly Check window ventilation fittings operate correctly Check motor drives operate correctly, alignment correct, drive belt tension correct and bearings not worn.
Refrigeration systems	Check refrigerant is free of moisture, system is fully charged with refrigerant and filters are clean Check the expansion valves are correctly set Check insulation on suction and liquid lines is in good order Check condenser water temperature and/or flow rate is kept to a minimum.
Lighting	Check that a lamp and luminaire cleaning programme is in place When replacing items, check that efficient lamps and ballasts are used Check controls are effective and match user requirements, and switched off when not required.
Heating and hot water systems	Check boiler operating pressures, temperatures, fuel consumption and investigate variations from the norm Check flue gas analysis, adjust burners to achieve most efficient flue gas temperature, CO^2, O^2 and excess air settings Check proper air venting of radiators, convectors, fan coil units.
Motors and drives	Lubricate bearings in accordance with manufacturer's recommendation Check motor fan inlets and frame surfaces are clean Check worn belts, sheaves, bearings are replaced Check loads are balanced across three phases.

20.7. Refurbishment Procedures and Options flow chart

20.7.1. See below.


Consider client's requirements
Assess the building's energy consumption – compare with benchmarks
Assess the current building services reliability and maintenance requirements
Will refurbishment of building services be required as part of consequential improvements relating to Part L2B of the building regulations?
Check to what extent energy consumption can be reduced without recourse to refurbishment
Determine what plant should be replaced, either directly or part of a new strategy
Consider refurbishment constraints, eg floor to ceiling height, plant room space, weight restrictions etc
Consider lower cost refurbishment options:
improved occupied space layout, zoning etc
improved lighting
reduced solar gain
improved controls
heat recovery
motors
domestic hot water.
Consider higher cost refurbishment options:
building fabric improvements
replacement of mechanical cooling and mechanical ventilation systems
free cooling techniques
passive cooling and ventilation techniques
replacement of space heating systems
replacement of domestic hot water systems
improved daylight systems
lighting management systems
low or zero carbon technologies.
Ensure proper commissioning
Ensure adequate handover documentation and training
Implement on-going assessment of refurbished systems/building performance for feedback for future improvements

20.8. Building fabric

20.9. Building Fabric.

Although not classed as building services, the building fabric has a profound effect on the operation of services. In addition, the building services engineer may often have the opportunity to influence changes to the building fabric. Indeed where the refurbishment includes the adoption of passive ventilation, cooling and lighting techniques this will be essential. Potential fabric refurbishment options include:

20.9.1. **Windows:** replacing existing windows with double- or triple-glazed units. The relatively high cost of triple-glazed windows can, in some circumstances, be offset by the benefits of greater noise attenuation. Windows incorporating low emissivity coatings that reflect heat can reduce energy consumption and improve occupant comfort conditions near the window. Solar control films are available for application onto existing windows.

20.9.2. **Doors:** in addition to replacing existing doors with ones with better thermal insulation characteristics, the inclusion of draught lobbies will be beneficial. Where large doors are to be used, for example providing vehicle access for loading purposes, options such as warm air curtains, PVC curtains or high-speed motorised doors with automatic controls can be considered.

20.9.3. **Walls:** cavity walls can be filled with suitable insulation proving the building is not susceptible to rain penetration. Alternatively, insulation board can be fixed to the external fabric and protected by a specialist render. Another option is internal wall insulation, although while usually cheaper than external insulation, disruption is high and heavy items such as radiators will require supporting and service penetrations, so electric sockets and pipework should be minimised to maintain the integrity of the insulation.

20.9.4. **Roofs:** for pitched roofs additional insulation can be added. For flat roofs, insulation can be applied internally, externally or above a suspended ceiling. Improving insulation between floors reduces overheating on the upper floors of a building, and prevents the lower floors from feeling too cold.

With increasing levels of thermal insulation, the proportion of heat loss in a heated building, and subsequent impact on heating load, due to air infiltration increases. This also applies to heat gain and cooling loads in the summer. There are four main air leakage paths that result in air infiltration:

- joints around components such as windows
- gaps between one element and another, such as wall to floor interfaces
- gaps around services passing through the construction

- permeable building materials

The potential for reducing infiltration in an existing building will depend on the level of the refurbishment and the type of construction. In refurbishment applications, the following sealing materials can be used:

- gun-applied sealants (elastic and elastomer types) including mastics, polyurethane and silicone sealants
- expanding foam sealants
- gaskets for movement joints, including solid and foam strip types
- draught stripping
- sealing fibre
- membranes or films.

21. SEAI GRANTS – BETTER ENERGY WORKPLACES

21.1. SEAI Under the Government's Jobs Initiative, the 'Better Energy – The National Upgrade Programme' was launched by the Minister for Communications, Energy & Natural Resources on 11th May 2011. This new programme aims to deliver a major increase in the pace, scale and depth of sustainable energy investments in upgrading existing buildings and facilities.

21.2. Within this programme, financial support is available through the Better Energy Workplaces scheme, for implementing a wide range of qualifying sustainable energy upgrading projects in the public, commercial, industrial and community sectors.

21.3. Such projects may comprise individual or packaged measures aimed at achieving lasting savings in energy usage for thermal, electrical or transport purposes. The main focus of the support will be on achieving delivery in 2011 of sustainable energy (mainly energy efficiency) investment projects of differing sizes and complexities.

21.4. Projects need to be completed in 2011 with the grant application submitted by December 31st, 2011. Projects need to include an efficient and effective mechanism for energy use data collection, monitoring and/or verification of savings.

21.5. Scheme Objectives:

21.5.1. Achieve significant, measurable and verifiable energy performance gains in the public and private sectors that yield value for money cost savings and contribute to meeting national energy policy targets.

21.5.2. Stimulate employment activity through relatively labour-intensive sustainable energy upgrading projects.

21.5.3. Support the installation of both individual sustainable energy measures and packages of such measures – including encouraging the implementation of deeper and more technically/ economically challenging measures.

21.5.4. Build and develop the value-chain that can deliver sustainable energy projects, particularly relating to procurement and contracting arrangements between partners.

21.5.5. Develop and showcase the impact of sustainable energy services provided by or on behalf of energy suppliers designated as Obligated Parties.

21.5.6. Develop and showcase innovative delivery models, including the associated contractual and procurement mechanisms based on the principles of energy performance contracting, which in turn will inform other longer term initiatives for activating sustainable energy retrofit investment.

21.5.7. Build capacity and test the scalability of projects from which we can identify, quantify and prove potential energy saving opportunities and delivery models through exemplar projects, thereby facilitating widespread replication.

21.5.8. Support the collection of public sector energy use data in fulfilment of the public sector energy reduction target of 33%.

21.6. What Types of Project are eligible?

21.6.1. Support is available for sustainable energy upgrades to buildings, services, facilities and processes, involving investment actions comprising individual or packaged measures, aimed at achieving ongoing and lasting energy savings. Projects entailing upgrades to thermal, electrical or transport energy performance are all considered eligible.

21.6.2. Where the project involves purchase of plant, machinery or equipment in the product / technology categories listed on the 'Triple E' register (http://www.seai.ie/Your_Business/Triple_E_Product_Register),then generally such products will be required to be drawn from that register. For grantees eligible to claim the Accelerated Capital Allowance (ACA) linked to the Triple E register, it should be noted that any ensuing claim to the Revenue Commissioners for the ACA should be made on the basis of costs net of the Better Energy Workplaces grant. Where relevant, public sector organisations should meet their obligations to procure products that meet Triple E criteria, in accordance with SI 151 of 2011.

21.6.3. In addition to achieving significant and verifiable annual energy savings and offering opportunities for replication, projects must include an efficient and effective mechanism for energy use data collection, monitoring and/or verification of savings. In this regard, projects employing the International Performance Measurement & Verification Protocol (IPMVP) to monitor and verify energy savings, especially for large or complex projects, are particularly encouraged (see www.evo-world.org).

21.6.4. Projects containing at least two of the following features are particularly encouraged:

- Include retrofitting of one or more energy services within a cohort of buildings or facilities to best in class performance.
- Incorporate innovative delivery facilitation and financing models, especially those drawing on the principles of energy performance contracting.
- Involve the services of Obligated Parties as a mechanism to deliver the projects.
- Incorporate an innovative energy saving technology, or application.
- Incorporate a range of energy efficiency actions of varying complexity and investment attractiveness.
- Involve multiple project/ technology elements across single or multiple sites (or organisations) that are coordinated through a central body or organisation.
- Utilise the International Performance Measurement & Verification Protocol (IPMVP) to monitor and verify the energy savings from the project.

21.7. What level of support is available?

21.7.1. The Scheme offers support up to the following grant levels depending on the nature of the project and sectoral category outlined below:

- Non-commercial public sector: Support of typically 50% of eligible costs is available; although in some cases public bodies may qualify for support of up to 80%. Only projects which score highly under the criteria outlined in section 6b below can avail of funding greater than 50%.

21.7.2. In general, grant support per project will not be less than €20,000 and will not exceed €500,000.

21.8. Eligible Costs:

- Costs of external labour required to install and commission the energy efficiency project, i.e. to implement the project.
- Costs of materials, equipment, hardware or control systems necessary to implement the project.

- Additional specialist costs, which in relevant circumstances may relate to design, procurement and contracting activities, will be considered on a case by case basis but these should be clearly specified in the project application.

21.9. Eligibility Criteria

21.10. The application must comply with the Scheme funding levels.

21.11. The application must be submitted by the energy end user organisation ('Client Organisation') responsible for making or procuring the proposed investment, or by an entity (which may be an Obligated Party) authorised to act on its behalf.

21.12. The site must be located in the Republic of Ireland.

21.13. Except in the case of non-commercial public sector applications, the project should not be in receipt of any other State Aid.

21.14. The project must include an efficient and effective mechanism for energy use data collection, monitoring and/or verification of savings.

21.15. In the latter regard, please note that for **all public sector buildings and facilities in the relevant organisation's estate,** Meter Point Reference Numbers (MPRN) and Gas Point Reference Numbers (GPRN) and access to time series data from such meters will be required to be made available in due course to SEAI as part of a wider data collection exercise being undertaken by SEAI under SI 542 of 2009.

21.16. In general, projects are required to be physically completed and claims for grant payment are required to be received by SEAI by 1st December 2011 except in the cases where authorisation has been given to extend a phase of a project into 2012, in which case the relevant portion of the grant pertaining to this phase can be claimed in 2012.

21.17. On completion of the works: Following one year of operation in the case of buildings, or of 3 months operation in the case of facilities or processes, monitored results must be made available within a reasonable (generally 3 month) time frame to SEAI for verification and dissemination purposes. **Failure to comply with this condition may lead to grant support being partly or wholly recouped by SEAI.**

22. SEAI ENERGY CONSUMPTION CALCULATOR 2010

Energy Consumption Calculator

Enter data in the normal consumption units in the Green cells only. The tool will automatically calculate the consumption by fuel type in kWh. For help and additional information click here.

1. Enter your Electricity Consumption here

Electricity	Quantity	Unit	Electricity Consumption		
			kWh	MWh	GWh
Electricity Purchased (Imported)	2,145,164	"Units" or kWh	2,145,164	2,145.16	2.15
Electricity Sold[1] (if any, e.g. CHP)	0	"Units" or kWh	-	-	-
Net Electricity Consumed			**2,145,164**	**2,145.16**	**2.15**

2. Enter your Fossil Fuel Consumption here

Fossil Fuels		Quantity	Unit	Fossil Fuel Consumption		
				kWh	MWh	GWh
Gas	Natural Gas[3] *(if recorded in kWh)*	4,398,762	kWh	4,398,762	4,398.762	4.399
	Natural Gas[3] *(if recorded in m3)*		Cubic Meter (m3)	-	-	-
	LPG[4] *(if purchased by volume)*		Litre (l)	-	-	-
	LPG *(if purchased by weight)*		kilogram (kg)	-	-	-
Heating Oils	Kerosene		Litre (l)	-	-	-
	Heating & Other Gasoil		Litre (l)	-	-	-
	Diesel		Litre (l)	-	-	-
	Fuel Oil *(if recorded in litres)*		Litre (l)	-	-	-
	Fuel Oil *(if recorded in tonnes)*		Tonne (t)	-	-	-
	Residual Fuel Oil *(if in litres)*		Litre (l)	-	-	-
	Residual Fuel Oil *(if in tonnes)*		Tonne (t)	-	-	-
Transport	Road Diesel (DERV)	424	Litre (l)	4,306	4.306	0.004
	Gasoline (Petrol)		Litre (l)	-	-	-
	Kerosene (Jet Fuel)		Litre (l)	-	-	-
Solid Fuels	Petroleum Coke		Tonne (t)	-	-	-
	Coal		Tonne (t)	-	-	-
	Anthracite		Tonne (t)	-	-	-
	Lignite / Brown Coal		Tonne (t)	-	-	-
	Milled Peat		Tonne (t)	-	-	-
	Sod Peat		Tonne (t)	-	-	-
	Peat Briquettes		Tonne (t)	-	-	-
Other	Other				-	-
	Other				-	-
Total Fossil Fuels				**4,403,068**	**4,403.07**	**4.40**

3. Enter your Renewable Fuel Consumption here

Renewable Fuels		Quantity	Unit	Renewable Energy Consumption		
				kWh	MWh	GWh
Wood	Wood Chips (35% moisture)		Tonne (t) wet	-	-	-
	Wood Pellets		Tonne (t)	-	-	-
	Wood Briquettes		Tonne (t)	-	-	-
Biofuels	Biodiesel		Litre (l)	-	-	-
	Pure Plant Oil / Rapeseed Oil		Litre (l)	-	-	-
	Biogasoline / Ethanol		Litre (l)	-	-	-
Other	Wind (onsite generation only)		kWh electricity	-	-	-
	Hydro (onsite generation only)		kWh electricity	-	-	-
	Other				-	-
	Other				-	-
Total Renewable Energy				**-**	**-**	**-**

Energy Consumption Summary (for use in Annual Report)

Energy Type	Energy Consumption		
	kWh	MWh	GWh
Electricity	2,145,164	2,145	2.15
Fossil Fuels	4,403,068	4,403	4.40
Renewable Fuels	-	-	-
Total Energy Consumed	**6,548,232**	**6,548.23**	**6.55**

Notes

1. "Electricity Sold" is any electricity generated by your Organisation that is then sold by (or "exported" from) your Organisation, e.g. excess electricity from a CHP plant or from an onsite generation plant.

2. All conversion factors in this tool are based on *Net Calorific Values* except for Natural Gas (see Note 3 below).

3. Natural Gas conversions are based on *Gross Calorific Value* . Natural Gas is sold and billed in gross kilowatt hours (kWh) and the conversion figure from cubic meters shown in row 14 is also based on a *Gross Calorific Value* .

4. All conversion factors are as used by SEAI EPSSU for national statistical purposes.

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23. SEAI ENERGY BILL TRACKER TOOL 2010 (FOR MAIN CAMPUS)

Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Instructions: Enter data in yellow cells only
Do not include VAT
Sample (completed) at bottom of sheet
If you are not billed separately for Week / Weekend units, leave Weekend section bla

	Electricity Summary							Day Units (Week)					Night Units (Week)				
2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions	No. Units	% Units	Cost / Unit	Total Cost	% Cost	No. Units	% Units	Cost / Unit	Total Cost	% Cost
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]	[kWh]	[%]	[€/kWh]	[€]	[%]	[kWh]	[%]	[€/kWh]	[€]	[%]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9	113,363	68%	€0.0791	€8,966	76%	54,510	32%	€0.0508	€2,767	24%
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9	125,926	70%	€0.0791	€9,959	79%	52,953	30%	€0.0508	€2,688	21%
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8	134,484	70%	€0.0791	€10,636	77%	56,705	30%	€0.0571	€3,237	23%
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3	109,348	69%	€0.0734	€8,026	77%	48,183	31%	€0.0506	€2,437	23%
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5	89,548	69%	€0.0734	€6,573	76%	39,943	31%	€0.0506	€2,020	24%
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3	64,884	69%	€0.0734	€4,762	76%	29,719	31%	€0.0506	€1,503	24%
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8	75,225	70%	€0.0734	€5,522	77%	32,839	30%	€0.0506	€1,661	23%
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2	72,625	69%	€0.0734	€5,331	76%	32,904	31%	€0.0506	€1,664	24%
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2	114,331	76%	€0.0734	€8,392	82%	36,690	24%	€0.0506	€1,855	18%
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3	123,915	74%	€0.0734	€9,095	81%	43,000	26%	€0.0506	€2,175	19%
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7	143,567	75%	€0.0791	€11,355	82%	49,031	25%	€0.0508	€2,489	18%
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1	117,490	69%	€0.0791	€9,292	77%	53,734	31%	€0.0508	€2,728	23%
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**	**1,284,706**	**-**	**-**	**€97,910**	**-**	**530,211**	**-**	**-**	**€27,224**	**-**

Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO_2 / kWh	**Account No.:**	9136786651

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	Electricity Summary							Weekend Units				
2010	**Total Cons-umption**	**Target Cons-umption**	**Total Unit Cost**	**Total Other Charges**	**Total Cost**	**Average Unit Cost**	**GHG Emissions**	**No. Units**	**% Units**	**Cost / Unit**	**Total Cost**	**% Cost**
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]	[kWh]	[%]	[€/kWh]	[€]	[%]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9				€0	
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9				€0	
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8				€0	
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3				€0	
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5				€0	
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3				€0	
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8				€0	
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2				€0	
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2				€0	
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3				€0	
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7				€0	
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1				€0	
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**	**0**	**-**	**-**	**€0**	**-**

Energy Bill Tracker Tool - Electricity

SEI Sustainable Energy Ireland

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Note: Not all of the 'Other Charges' below are relevant to all tariff structrues - complete as much as is relevant

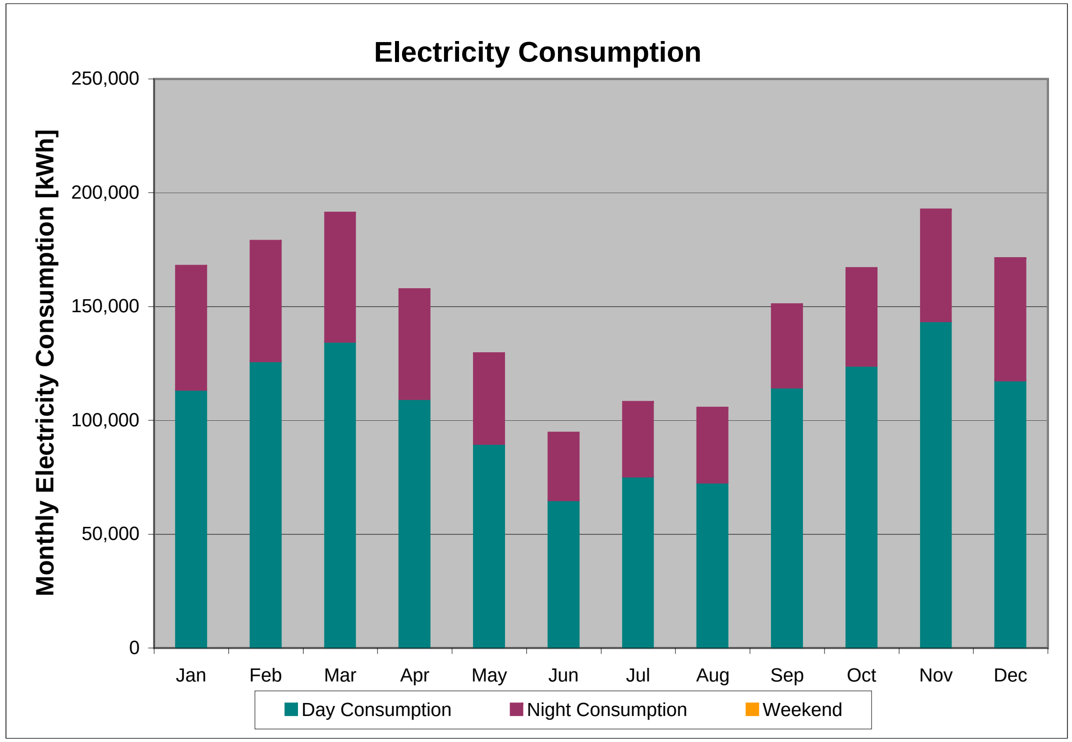
	Electricity Summary							Other Charges									
2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions	Maximum Import Capacity	Import or Service Capacity Charge	Excess Capacity	Excess Capacity Charge	Maximum Demand (MD)	Maximum Demand (MD) Charge	Wattless Charge	PSO Levy Charge	All Standing Charge(s)	Total Other Charges
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]	[kVA]	[€]	[kVA]	[€]	[kW]	[€]	[€]	[€]	[€]	[€]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9	645	€2,600			466				€844	€3,444
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9	645	€2,642			491				€1,205	€3,847
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8	645	€2,848			469				€1,114	€3,962
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3	645	€2,488			441				€326	€2,814
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5	645	€2,253			388				€253	€2,506
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3	645	€1,889			269				€169	€2,058
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8	645	€2,054			277				€163	€2,217
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2	645	€2,026			309				€170	€2,195
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2	645	€2,481			445				€589	€3,070
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3	645	€1,510			471			€742	€2,342	€4,594
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7	645	€1,647			491			€742	€2,981	€5,370
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1	645	€1,501			479			€742	€2,224	€4,467
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**	**-**	**€25,939**	**-**	**€0**	**-**	**€0**	**€0**	**€2,225**	**€12,381**	**€40,545**

Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Electricity Summary

2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**

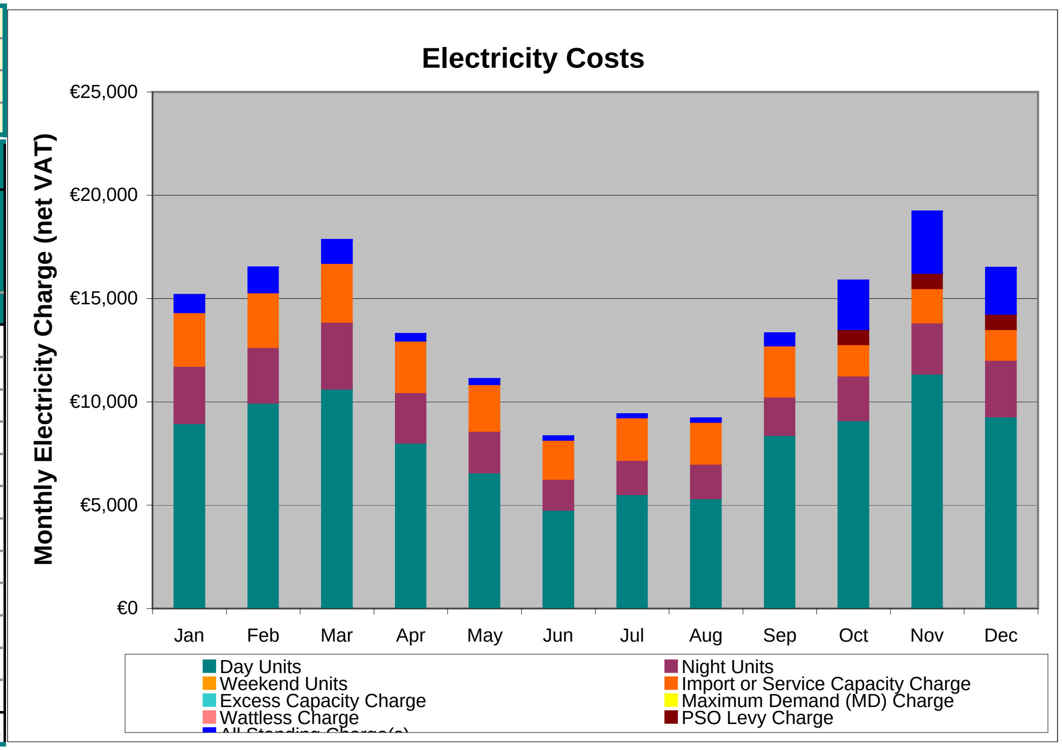


Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Electricity Summary

2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**

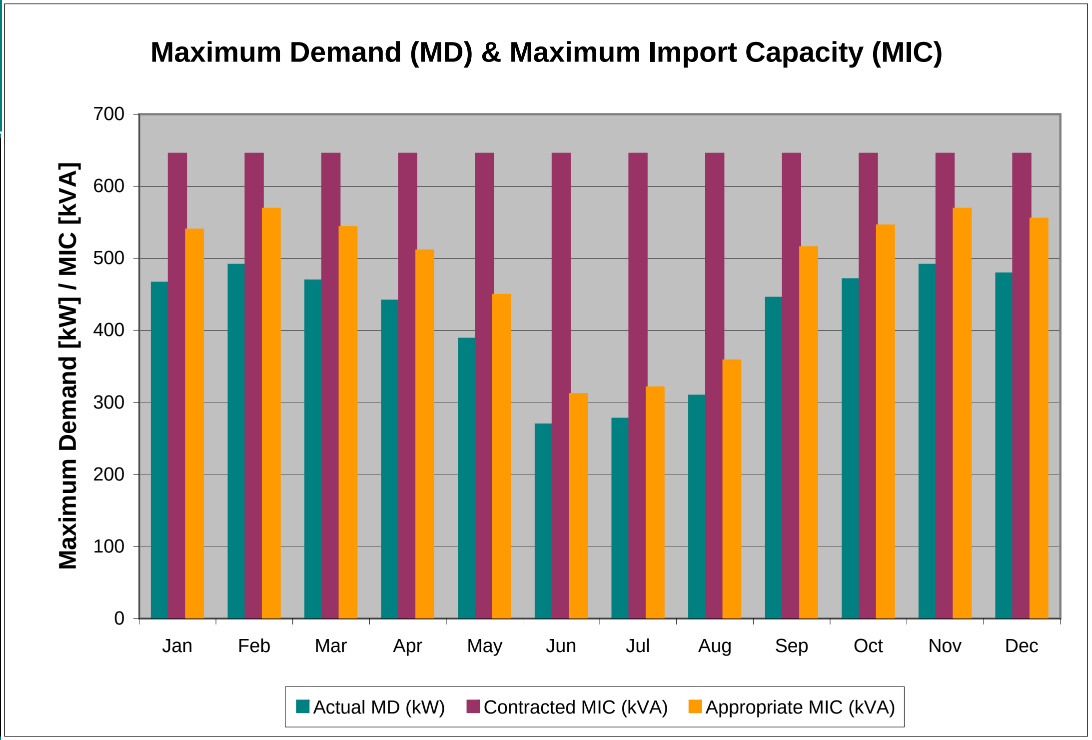


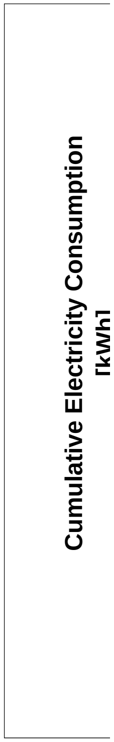
Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Electricity Summary

2010	Total Consumption [kWh]	Target Consumption [kWh]	Total Unit Cost [€]	Total Other Charges [€]	Total Cost [€]	Average Unit Cost [€/kWh]	GHG Emissions [tCO2]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**



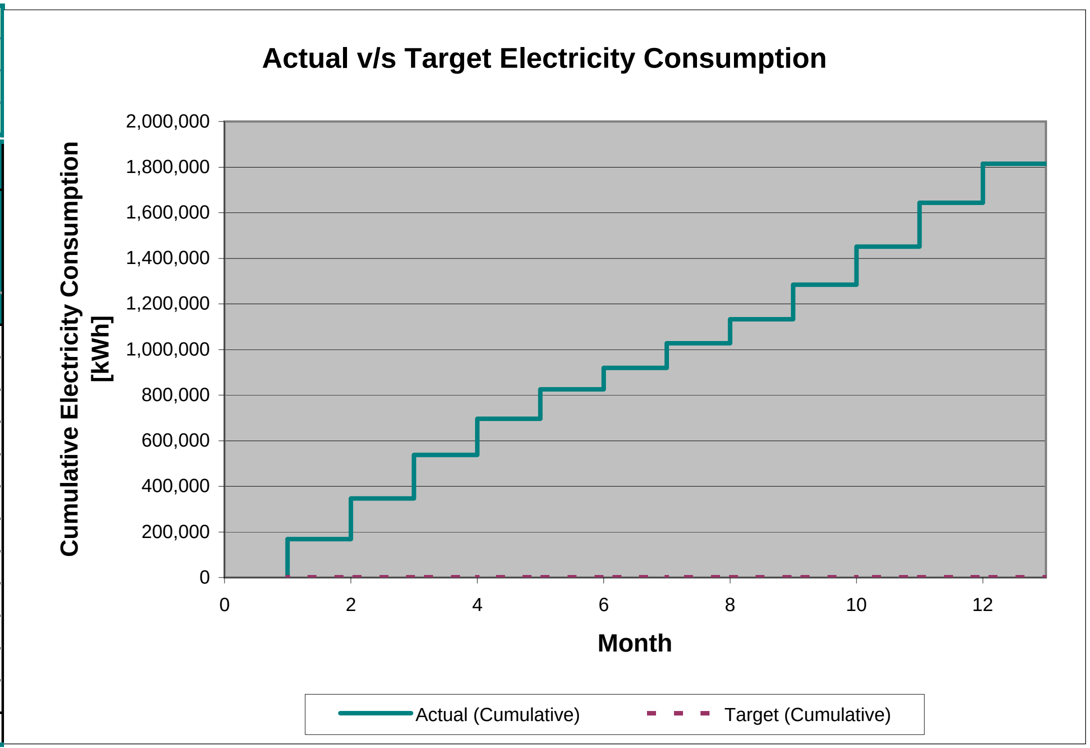


Energy Bill Tracker Tool - Electricity

Year:	2010	**Supplier:**	Energia
Renewable:	No	**Tariff:**	Industrial (LEU)
Average Unit Cost:	€0.091 per kWh	**MPRN:**	1000057088
GHG Emission Factor:	0.000637 tCO2 / kWh	**Account No.:**	9136786651

Electricity Summary

2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Jan	167,873		€11,733	€3,444	€15,177	€0.0904	106.9
Feb	178,879		€12,648	€3,847	€16,495	€0.0922	113.9
Mar	191,189		€13,873	€3,962	€17,835	€0.0933	121.8
Apr	157,531		€10,463	€2,814	€13,277	€0.0843	100.3
May	129,491		€8,593	€2,506	€11,099	€0.0857	82.5
Jun	94,603		€6,265	€2,058	€8,323	€0.0880	60.3
Jul	108,064		€7,182	€2,217	€9,399	€0.0870	68.8
Aug	105,529		€6,995	€2,195	€9,190	€0.0871	67.2
Sep	151,021		€10,247	€3,070	€13,317	€0.0882	96.2
Oct	166,915		€11,270	€4,594	€15,864	€0.0950	106.3
Nov	192,598		€13,844	€5,370	€19,214	€0.0998	122.7
Dec	171,224		€12,020	€4,467	€16,488	€0.0963	109.1
Total	**1,814,917**	**0**	**€125,133**	**€40,545**	**€165,678**	**€0.0913**	**1,156.1**



Energy Bill Tracker Tool - Natural Gas

Year:	2010	Supplier:	Bord Gais Energy
		Tariff:	Fuel Variation Tarriff
Average Unit Cost:	€0.031 per kWh	GPRN:	0660663
GHG Emission Factor:	0.000198 tCO2 / kWh	Account No.:	8112658000

Instructions: Enter data in yellow cells only
Do not include VAT
Sample (completed) at bottom of sheet

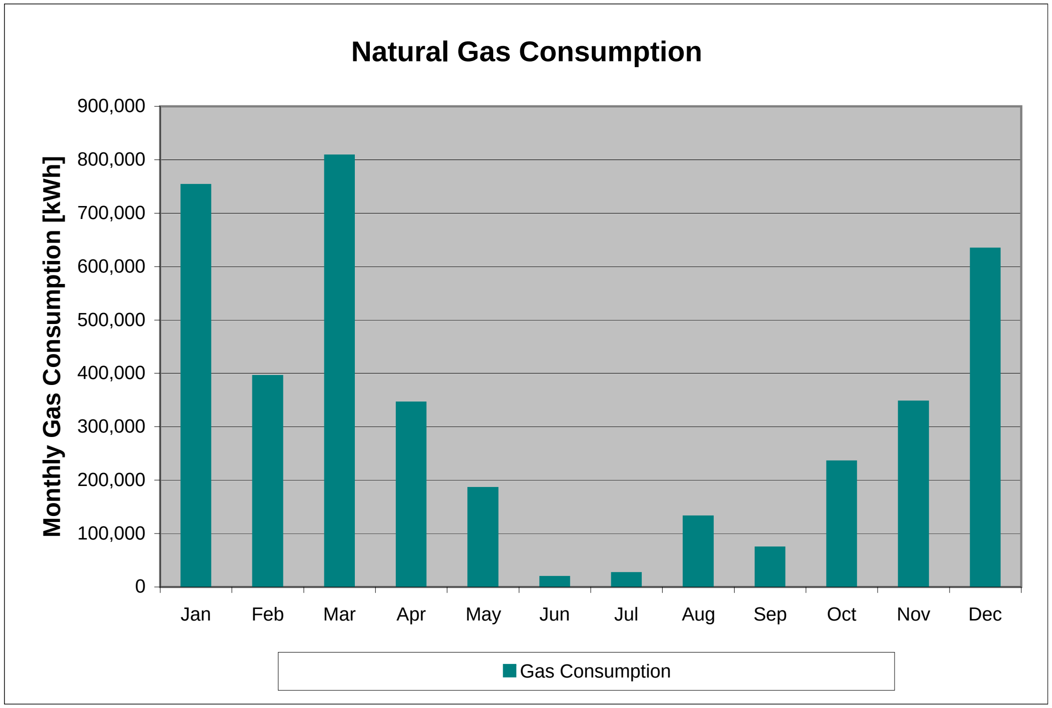
	Natural Gas Summary							Gas Units			Standing Charge
2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions	No. Units	Total Cost	Cost / Unit	Standing Charge
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]	[kWh]	[€]	[€/kWh]	[€]
Jan	752,347		€9,502	€5,652	€15,154	€0.0201	149.0	752,347	€9,502	€0.0126	€5,652
Feb	395,045		€5,958	€5,501	€11,459	€0.0290	78.2	395,045	€5,958	€0.0151	€5,501
Mar	807,679		€10,203	€6,598	€16,801	€0.0208	159.9	807,679	€10,203	€0.0126	€6,598
Apr	345,026		€4,044	€4,794	€8,837	€0.0256	68.3	345,026	€4,044	€0.0117	€4,794
May	185,299		€2,464	€4,350	€6,814	€0.0368	36.7	185,299	€2,464	€0.0133	€4,350
Jun	18,288		€282	€3,881	€4,162	€0.2276	3.6	18,288	€282	€0.0154	€3,881
Jul	25,841		€461	€3,561	€4,022	€0.1556	5.1	25,841	€461	€0.0178	€3,561
Aug	131,885		€2,204	€4,353	€6,557	€0.0497	26.1	131,885	€2,204	€0.0167	€4,353
Sep	73,830		€1,164	€4,434	€5,599	€0.0758	14.6	73,830	€1,164	€0.0158	€4,434
Oct	234,597		€4,208	€5,403	€9,610	€0.0410	46.5	234,597	€4,208	€0.0179	€5,403
Nov	346,780		€6,425	€7,653	€14,078	€0.0406	68.7	346,780	€6,425	€0.0185	€7,653
Dec	633,189		€12,596	€7,754	€20,349	€0.0321	125.4	633,189	€12,596	€0.0199	€7,754
Total	**3,949,806**	**0**	**€59,511**	**€63,933**	**€123,444**	**€0.0313**	**782.1**	**3,949,806**	**€59,511**	**-**	**€63,933**

Energy Bill Tracker Tool - Natural Gas

Year:	2010	**Supplier:**	Bord Gais Energy
		Tariff:	Fuel Variation Tarriff
Average Unit Cost:	€0.031 per kWh	**GPRN:**	0660663
GHG Emission Factor:	0.000198 tCO2 / kWh	**Account No.:**	8112658000

Natural Gas Summary

2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Jan	752,347		€9,502	€5,652	€15,154	€0.0201	149.0
Feb	395,045		€5,958	€5,501	€11,459	€0.0290	78.2
Mar	807,679		€10,203	€6,598	€16,801	€0.0208	159.9
Apr	345,026		€4,044	€4,794	€8,837	€0.0256	68.3
May	185,299		€2,464	€4,350	€6,814	€0.0368	36.7
Jun	18,288		€282	€3,881	€4,162	€0.2276	3.6
Jul	25,841		€461	€3,561	€4,022	€0.1556	5.1
Aug	131,885		€2,204	€4,353	€6,557	€0.0497	26.1
Sep	73,830		€1,164	€4,434	€5,599	€0.0758	14.6
Oct	234,597		€4,208	€5,403	€9,610	€0.0410	46.5
Nov	346,780		€6,425	€7,653	€14,078	€0.0406	68.7
Dec	633,189		€12,596	€7,754	€20,349	€0.0321	125.4
Total	**3,949,806**	**0**	**€59,511**	**€63,933**	**€123,444**	**€0.0313**	**782.1**



Energy Bill Tracker Tool - Natural Gas

Year:	2010	**Supplier:**	Bord Gais Energy
		Tariff:	Fuel Variation Tarriff
Average Unit Cost:	€0.031 per kWh	**GPRN:**	0660663
GHG Emission Factor:	0.000198 tCO2 / kWh	**Account No.:**	8112658000

Natural Gas Summary

2010	Total Cons-umption	Target Cons-umption	Total Unit Cost	Total Other Charges	Total Cost	Average Unit Cost	GHG Emissions
	[kWh]	[kWh]	[€]	[€]	[€]	[€/kWh]	[tCO2]
Jan	752,347		€9,502	€5,652	€15,154	€0.0201	149.0
Feb	395,045		€5,958	€5,501	€11,459	€0.0290	78.2
Mar	807,679		€10,203	€6,598	€16,801	€0.0208	159.9
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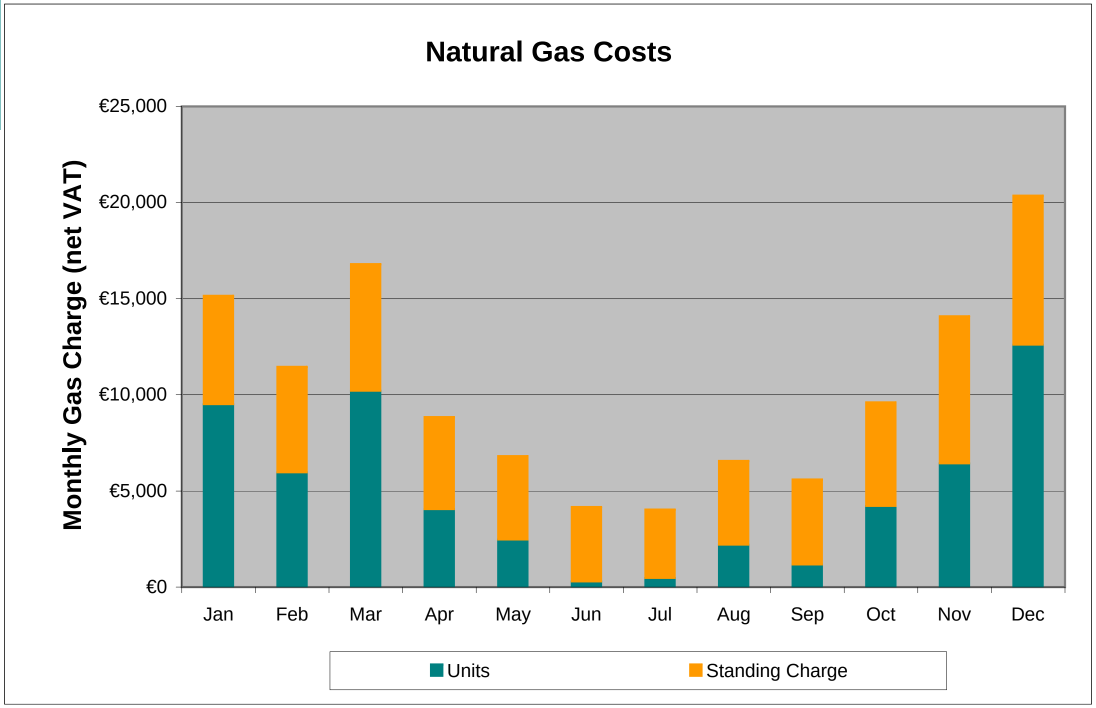
Nov	346,780		€6,425	€7,653	€14,078	€0.0406	68.7
Dec	633,189		€12,596	€7,754	€20,349	€0.0321	125.4
Total	**3,949,806**	**0**	**€59,511**	**€63,933**	**€123,444**	**€0.0313**	**782.1**



Energy Bill Tracker Tool - Natural Gas

Year:	2010	**Supplier:**	Bord Gais Energy
		Tariff:	Fuel Variation Tarriff
Average Unit Cost:	€0.031 per kWh	**GPRN:**	0660663
GHG Emission Factor:	0.000198 tCO2 / kWh	**Account No.:**	8112658000

Natural Gas Summary

2010	Total Cons-umption [kWh]	Target Cons-umption [kWh]	Total Unit Cost [€]	Total Other Charges [€]	Total Cost [€]	Average Unit Cost [€/kWh]	GHG Emissions [tCO2]
Jan	752,347		€9,502	€5,652	€15,154	€0.0201	149.0
Feb	395,045		€5,958	€5,501	€11,459	€0.0290	78.2
Mar	807,679		€10,203	€6,598	€16,801	€0.0208	159.9
Apr	345,026		€4,044	€4,794	€8,837	€0.0256	68.3
May	185,299		€2,464	€4,350	€6,814	€0.0368	36.7
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Sep	73,830		€1,164	€4,434	€5,599	€0.0758	14.6
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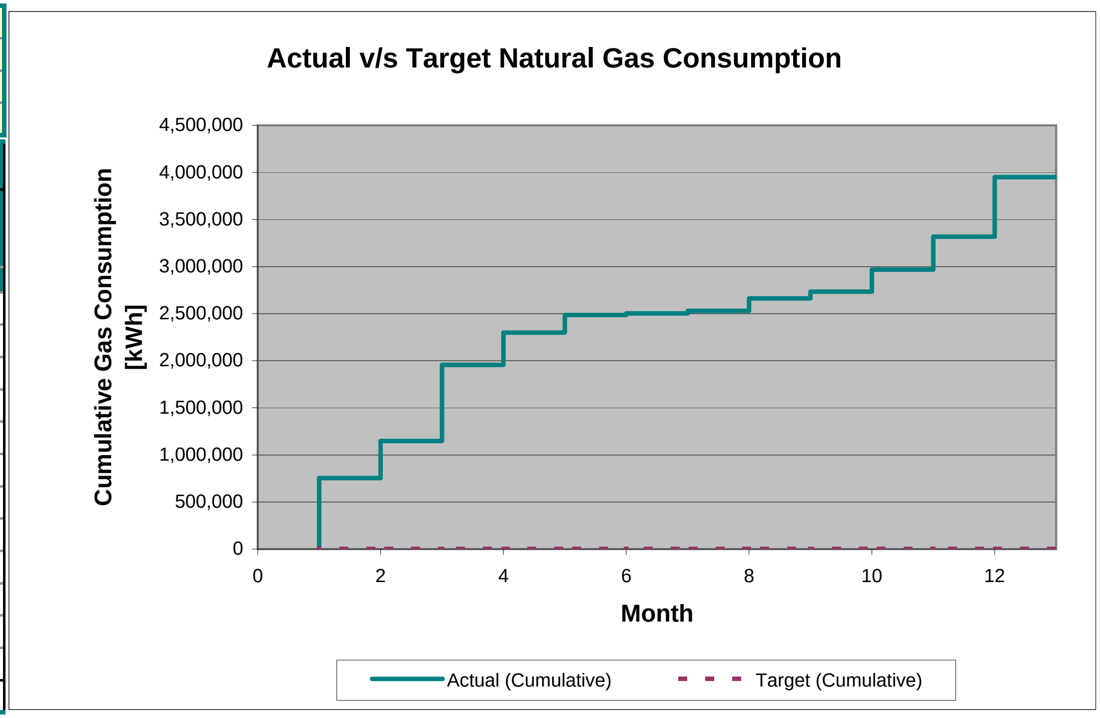
Dec	633,189		€12,596	€7,754	€20,349	€0.0321	125.4
Total	**3,949,806**	**0**	**€59,511**	**€63,933**	**€123,444**	**€0.0313**	**782.1**



24. CAMPUS DECS 2010

Display Energy Certificate

BER for the building detailed below is: C3

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Main Campus

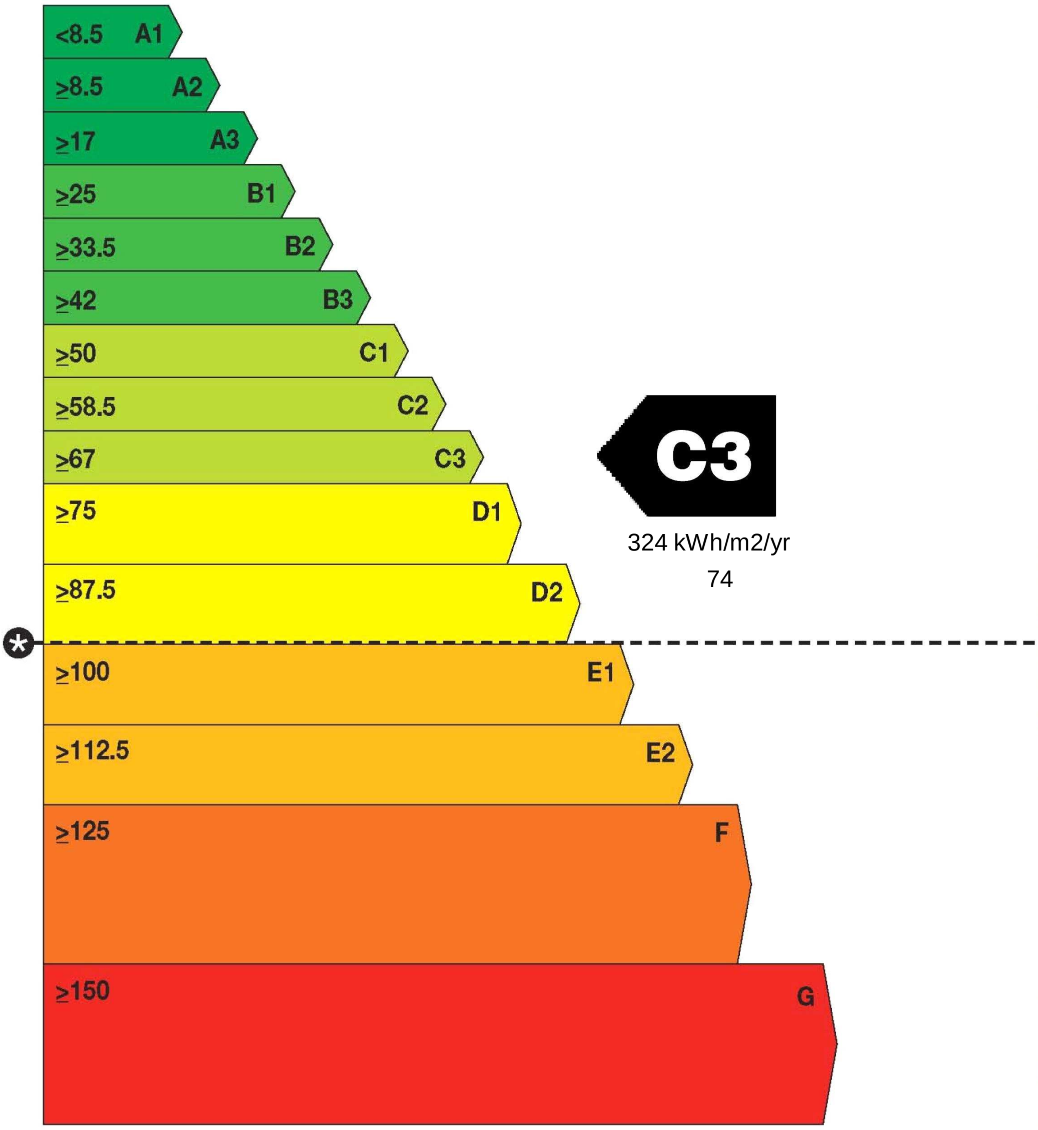
Mary Immaculate College
South Circular Road, Limerick
Co. Limerick

Building Type:	University campus
Useful Floor Area (m²):	24882
Main Heating Fuel:	Mains Gas
Building Environment:	Heating and Natural Ventilation

BER No.:	900003411
Date of Issue:	30/03/2011
Valid Until:	01/04/2012
Assessor No.:	900072

Building Energy Rating (Indicator)

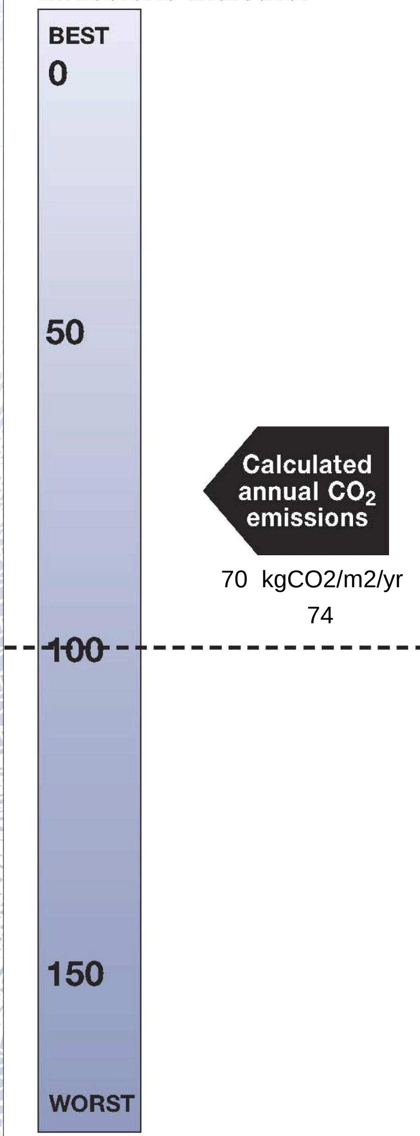
LOW ENERGY USE



HIGH ENERGY USE

Typical building of this type

Carbon Dioxide (CO_2) Emissions Indicator



Annual Energy Use

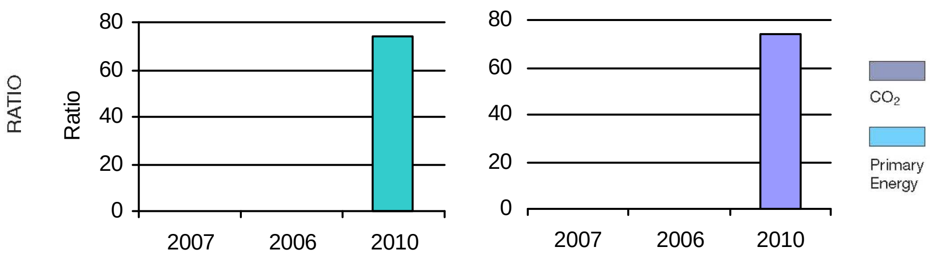
THIS BUILDING

Non-Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
127	197

TYPICAL BUILDING OF THIS TYPE

Non-Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
159	276

Previous Building Energy Ratings



Software Version 3.0

Display Energy Certificate

BER for the building detailed below is: B2

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Courtbrack Student Accomdn

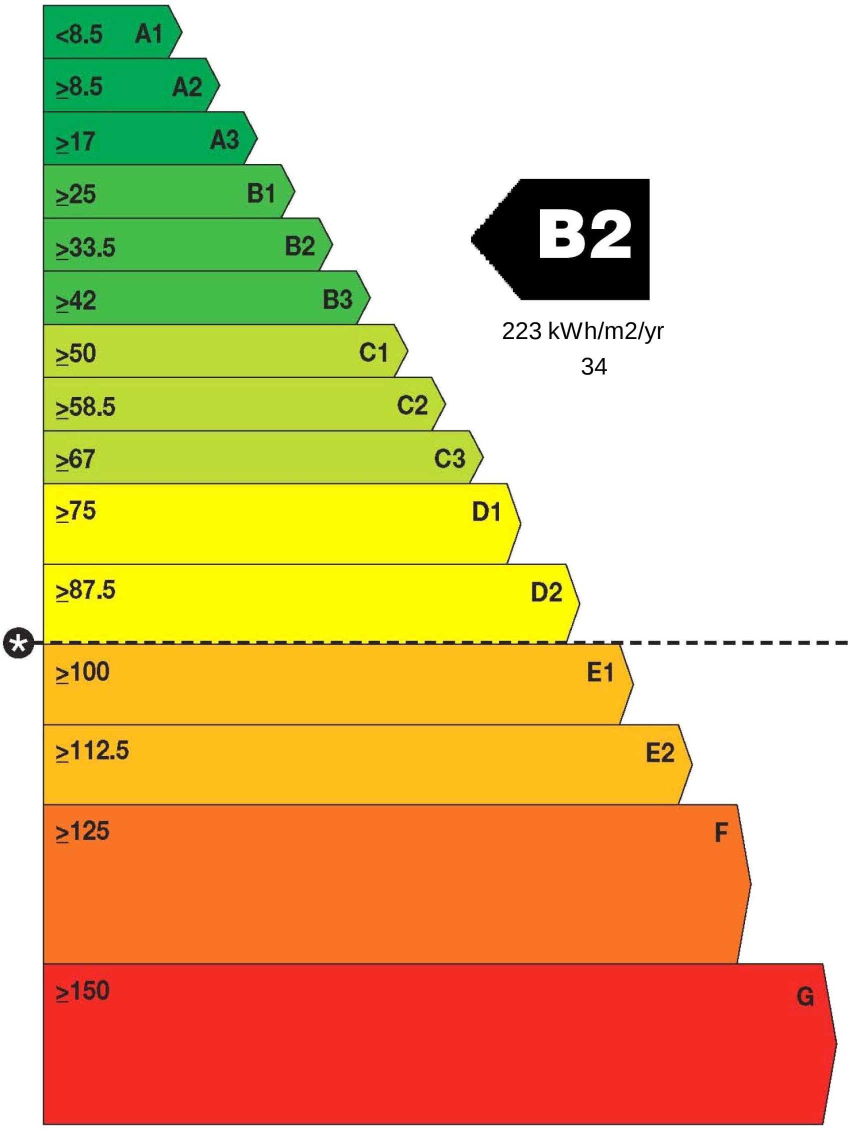
Mary Immaculate College, SCR,
Limerick
Co. Limerick

Building Type:	General accommodation
Useful Floor Area (m²):	1845
Main Heating Fuel:	Electricity
Building Environment:	Heating and Natural Ventilation

BER No.:	900003499
Date of Issue:	21/06/2011
Valid Until:	01/01/2012
Assessor No.:	900072

Building Energy Rating (Indicator)

LOW ENERGY USE

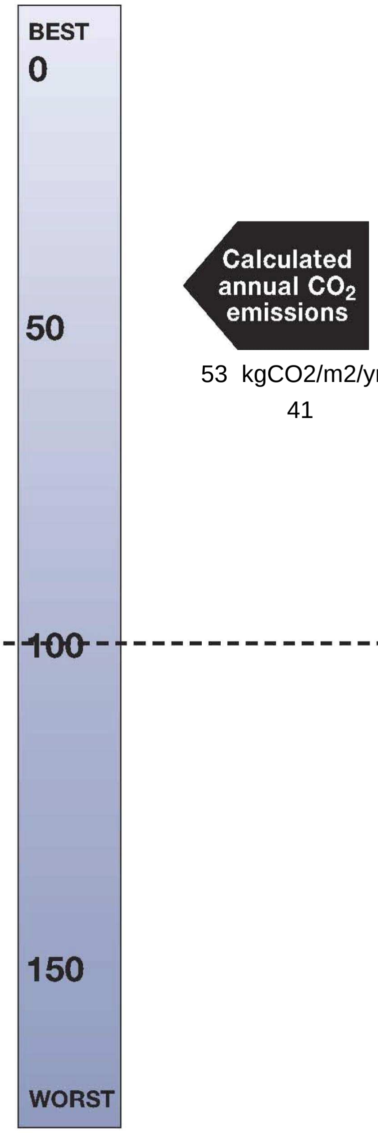


223 kWh/m2/yr
34

HIGH ENERGY USE

Typical building of this type

Carbon Dioxide (CO_2) Emissions Indicator



53 kgCO2/m2/yr
41

Annual Energy Use

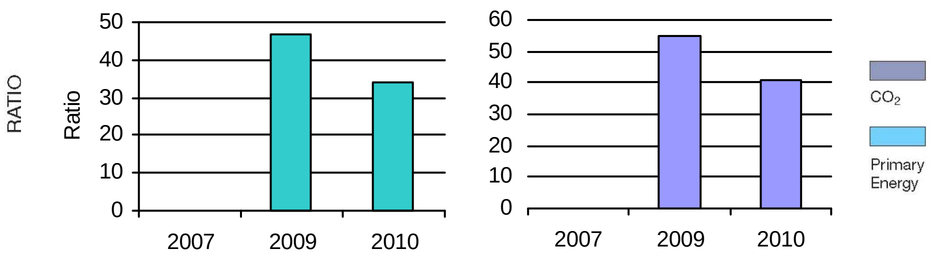
THIS BUILDING

Non-Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
223	0

TYPICAL BUILDING OF THIS TYPE

Non-Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
499	162

Previous Building Energy Ratings



Software Version 3.0

Display Energy Certificate

BER for the building detailed below is: B3

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Summerville House,

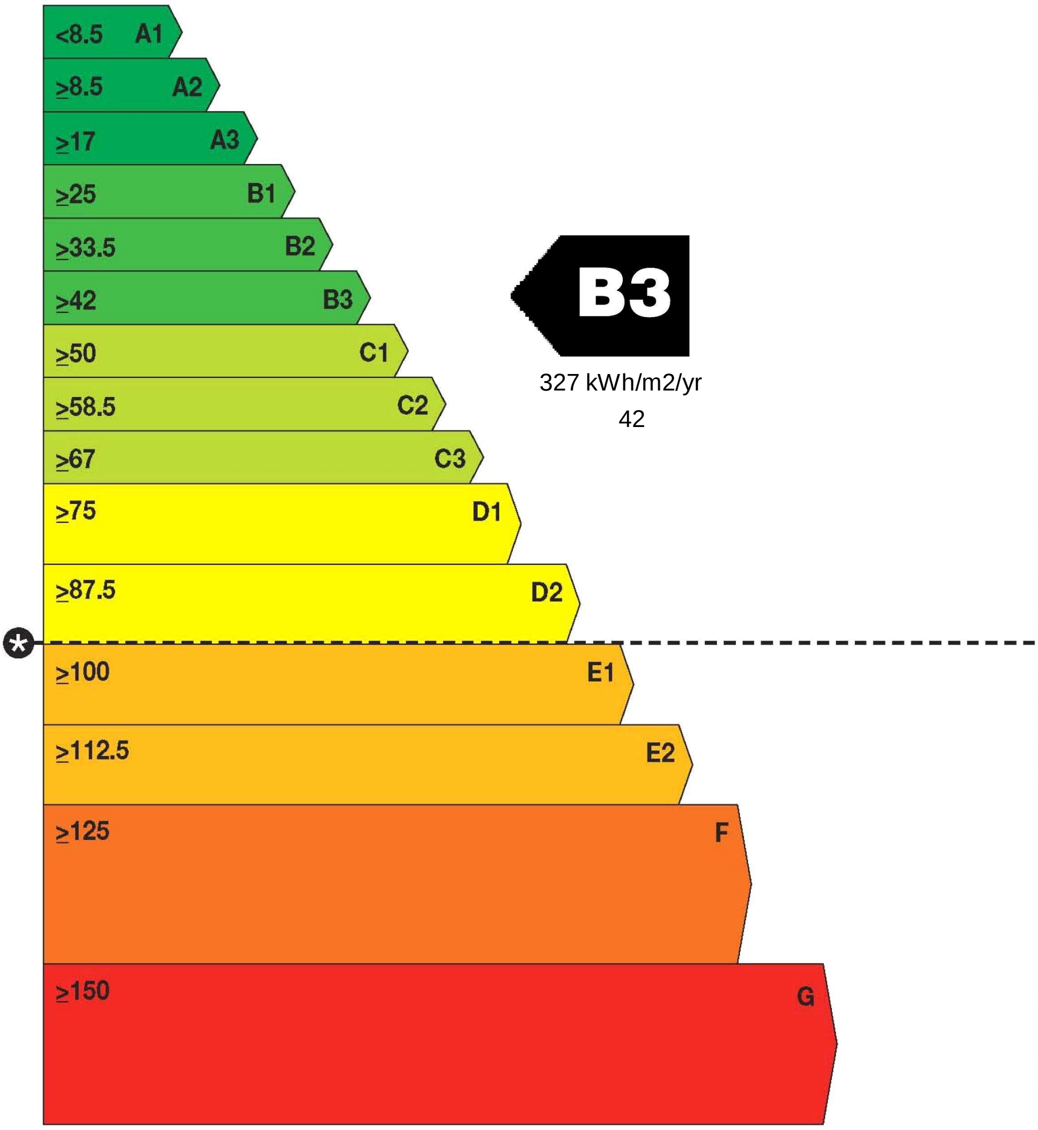
Mary Immaculate College, SCR,
Limerick
Co. Limerick

Building Type:	University campus
Useful Floor Area (m^2):	1315
Main Heating Fuel:	Mains Gas
Building Environment:	Heating and Natural Ventilation

BER No.:	900003500
Date of Issue:	21/06/2011
Valid Until:	01/01/2012
Assessor No.:	900072

Building Energy Rating (Indicator)

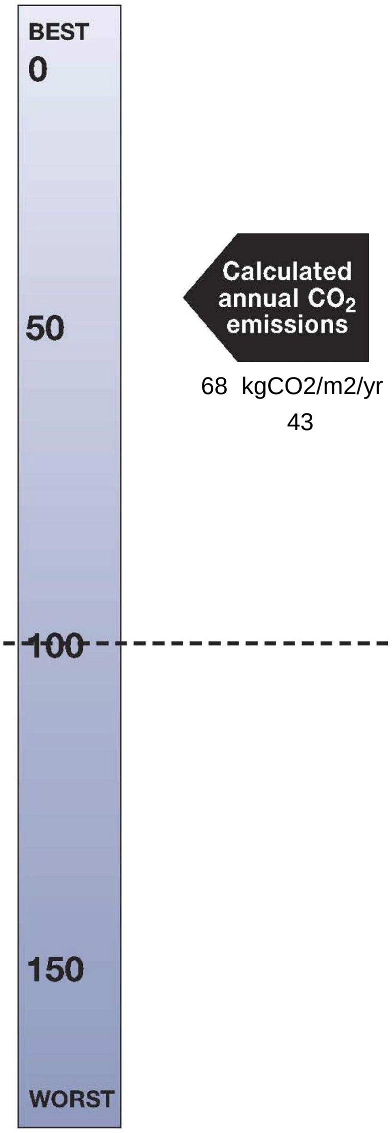
LOW ENERGY USE



HIGH ENERGY USE

Typical building of this type

Carbon Dioxide (CO_2) Emissions Indicator



Annual Energy Use

THIS BUILDING

Non- Electrical ($kWh/m^2/yr$)	Electrical ($kWh/m^2/yr$)
191	137

TYPICAL BUILDING OF THIS TYPE

Non- Electrical ($kWh/m^2/yr$)	Electrical ($kWh/m^2/yr$)
467	307

Previous Building Energy Ratings