Attachment G1 Raw Materials, Product and Ancillary Materials

Table G.1 outlines the raw materials and energy that are consumed at the facility on an annual basis. These figures are based on data compiled for 2011. The water supply to the site is from the local Ballinagar private group water scheme. Usage is not metered and the figures presented are best estimates.

Table G.1: Raw Material Consumption 2009 - 2011

Resource	2009	2010	2011	Average
Gas Oil (Green Diesel)	104,151 Litres	100,316 Litres	111,654 Litres	105,374 litres
Electricity	401,940 KWh	414,000 KWh	418,440 KWh	411,460 KWh
Water (estimate)	3,000 m3	3,000 m3	3,000 m3	3,000 m3

AUDIT OF ENERGY EFFICIENCY AS REQUIRED BY CONDITIONS 7.1 AND 7.2 OF WASTE LICENCE REG NO. W104-02 FOR ADVANCED ENVIRONMENTAL SOLUTIONS (IRELAND) LIMITED (CAPPINCUR, TULLAMORE, CO.OFFALY.)

For the Attention of:
Mr. Paul Hennessey
Advanced Environmental Solutions
Cappincur,
Tullamore,
Co. Offaly.

Prepared by:
Adele Woods
Environmental Consultant

Reviewed by:
Sean Creedon
Senior Environmental Consultant

Report No: ECS 3321
Date: January 2010

Executive Summary

As part of the implementation of the Waste Licence W0104-01 at the Advanced Environmental Solutions facility, at Cappincur an Energy Audit was carried out on the 26th June 2009 by Bord Na Móna Environmental Consultancy Services. The scope of the audit involved an assessment of the site with respect to energy consumption and subsequently identifying opportunities for energy use reduction and efficiency.

Following this audit, it was considered that given the processes undertaken at the site and the energy performance at the facility, an energy management plan would facilitate the company with assessing ongoing energy consumption. Ongoing attention to non-production items for example lighting, will identify areas where improvements can be continuously made.

An energy matrix demonstrates that some improvements in the practice of the Energy Policy are required to ensure that best practice is delivered across all areas of energy management. This is particularly important in the area of accountability and Monitoring and Targeting.

Implementation of the recommendations outlined in this report will assist in improving energy performance at the site. The recommendations included in this audit should be implemented over a reasonable time frame, with the recommendations incorporated into the facility's EMS and the Schedule of Objectives and Targets included in the AER.

Respectfully submitted,

Adele Woods
Environmental Consultant

Mr. Sean Creedon
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1.0 INTRODUCTION

Bord na Móna Environmental Consultancy Services was commissioned by Advanced Environmental Solutions (Ireland) Ltd to complete an Energy Audit for their waste transfer station at Cappincur, Tullamore, County Offaly.

The audit was conducted on the 26th of June 2009 by two Environmental Consultants from Bord Na Móna Environmental Ltd. Assistance was provided by the Facility manager Mr. Paul Hennessy. The scope of the audit was to examine the site with respect to energy consumption and subsequently identify opportunities for energy use reduction and efficiency.

This report presents the main findings of the audit and outlines the current status of the site in terms of its potential for a reduction in energy consumption. A schedule for the implementation of energy efficiency measures should be set out to achieve energy reduction goals.

2.0 OBJECTIVES

The objectives of the energy audit were as follows:

- To gain an overall impression of the energy status of the AES Cappincur facility;
- To establish the main energy consumers at the site;
- To evaluate the carbon emissions for the site from energy sources; and
- To propose energy efficiency measures and outline a schedule for the implementation of these measures.

3.0 DESCRIPTION OF ACTIVITIES AT THE ADVANCED ENVIRONMENTAL SOLUTIONS FACILITY AT CAPPINCUR.

3.1 Facility Background

Advanced Environmental Solutions Ireland Ltd is a waste management company who provide waste management services for both residential and commercial customers primarily in the Midland Region. The AES Facility at Cappincur is licensed by the Environmental Protection Agency under Waste Licence Register Number W104-2. The principle classes of activity at the facility are as follows:

4.2 'Recycling or reclamation of organic substances which are not used as solvents'

4.3 Recycling or reclamation of metals and metal compounds

4.47 Recycling or reclamation of other inorganic materials

3.12 Repackaging prior to submission to any activity

The facility at Cappincur is a waste transfer station. The facility is licensed to accept 24,000 Tonnes of waste per annum. The facility is licensed to accept 6,500 tonnes of Municipal Solid Waste, 14,100 tonnes of Commercial and Industrial Waste(C&I), 3,300 of Construction and Demolition (C&D) waste and 100 tonnes of Household Hazardous Waste.

The waste activities at the facility consist of sorting and segregating the wastes with recycling potential via a picking line, optical and mechanical sorters. Bulking and bailing of wastes and finally forwarding the remaining wastes to other sites for further processing. Waste deemed unsuitable for recycling and recovery is segregated and compacted and sent for disposal off-site.

Currently, thirty people are employed at the facility. The facility operates Monday to Friday 8 a.m. to 5.30 p.m. and from 8 a.m. to 12 p.m. on Saturdays.

3.2 Production Process

3.2.1 Raw Materials

The following raw materials are used at the AES Waste Transfer Facility at Cappincur:

- Electricity – power supply for the processing plant the offices & Canteen etc

- Diesel – to power the on site plant & equipment and the 100kVA generator

3.2.2 Storage and Transport of Raw Materials

(i) Diesel was supplied by Suttons and stored in a 1,100 litre diesel tank, which is used to fuel all the on-site mobile plant & equipment. This tank is located to the eastern side of the waste processing building. There is also a second diesel storage tank (1000 litres), located within the diesel generator.

(ii) Three phase electricity is supplied to the site by the ESB. There is a 200 kVA substation at the site

(iii) Water is supplied to the AES Cappincur facility by Ballingar Group water scheme. There are no water meters installed at the facility to monitor water usage. Water is used on site for domestic purposes only.

3.2.3 Processing Building

The waste processing building is powered directly from the electricity supply (ESB).

The processing building is constructed of half cladding and half block work. This building is approximately 10% open to the outdoors. There is approximately 6 inches of fibreglass insulation on the building, which is serviced by 63 skylights. The building can be divided into two different areas:

1. General Waste Sorting Line
2. Mixed Recyclables Line

<u>General Waste Sorting</u>

Waste Tipping and segregation are the main activities that occur within this area. General Waste consists of mainly construction and demolition wastes and domestic wastes. Material generally accepted for recycling are metals (Steel, Iron), green waste, plastics, glass, cardboard and timber. These materials are recovered from the tipped waste, segregated, bulked and bailed for recycling off-site. Construction and Demolition wastes are sent on to AES Portlaoise for further processing in the trommel to remove the fines. Any residual wastes not suitable for recycling are sent for landfilling at Drehid Waste Management Facility.

<u>Mixed Recovery Facility (MRF line)</u>

The main activities that occur in this area are mixed dry recycables tipping and sorting. The waste is mainly from domestic sources (approximately 80%) but will also include commercial wastes. The MRF line has mechanical, optical and manual sorters.

The wastes are initially placed onto a conveyor by the grab lift. This material then passes on to a picking deck. The first pick is used to take out all large items. The material then passes through a star screen. The star screen separates the large items such as newspaper, cardboard and plastic. There are emergency stops in place on the lines. Smaller items are removed by a banana screen and a loophole screen. These remove primarily medium sized pieces of newspaper and plastic. The material then passes on to the second picking line.

There is a second stream from the banana screen which processes all the smaller items. The stream passes through two large magnets which removes all the steel and tin from the stream. The material passes through a finger screen to remove all the fines. An Eddie current removes all the aluminium cans. The remaining material in the stream at this point is mainly plastic and papers. This material is passed through an optical sorter which blows off all the plastic and gravity pulls the paper. There is also a manual quality check in place which ensures that all contaminants and materials that should not be there are removed.

The remaining material on line at this point is small pieces of plastics. A second optical sorter removes plastics such as High Impact Polystyrene and Polyethylene terephthalate bottles. The remaining material is recycled back into the sorting line for a second time. All remaining residues are sent to a landfill site.

All the equipment in the Processing building was in operation at the time of the audit. The facility manager informed the auditors that the processing building equipment operates from 7.00 a.m. to 12 midnight. Occasionally the line may be operated on a single shift from 7 am to 6 pm.). All of the equipment is powered off during staff breaks. (Staff lunch breaks are from 12.30 p.m. to 1.00 a.m. and from 20.30 p.m. to 21.00 p.m., there are also 2 fifteen minute tea breaks and shut down for cleaning between 2.45 p.m. and 3.30 p.m.). The facility manager informed the auditors that one employee is charged with powering down and up the equipment before and after staff breaks

The equipment used in this process includes the following: Mc Donald 12 x 4 single deck finger screen (4 Kw), Transfer Conveyor no. 1 (3 Kw), Eddy Current Separation Unit (2 motors 2.2 Kw and 3 Kw), Drive motor (7.5 Kw), Transfer conveyor No. 2 (5.5 Kw) Acceleration belt no. 1 (7.5 Kw), belt feeder no. 1 (2.2 Kw), Transfer Conveyor no 3 (5.5 Kw), acceleration belt no.2 (5.5 Kw), Belt Feeder no. 2 (2.2 Kw). All this equipment was in good condition and was approximately 2 months old. There are also 2 compressors 22kW and 30 kW which were powered by the diesel generator (100kVA). There was also a Bollegraaf Bailer (80kW), a conveyor (5.5kw) an industrial shredder (30kW) and an industrial Hoover (Nilfisk 2400 Watts). The Hoover is used to clean out the panels on the compressors once a week. The entire processing line is regularly maintained by the maintenance department. There are daily and weekly check sheets for all the processing equipment. The diesel generated is leased and serviced by external contractors on a monthly basis. The two compressors are also serviced by eternal contractors, Harold Engineering.

The lighting in the processing building is supplied from 31 halogen lamps (35 watt), two of which were turned off at the time of the audit. There were also 42 Fluorescent lights (58 Watt), 5 of which were off at the time of the audit.

3.2.4 Administration Offices

The administration offices are located at the front of the facility on the North-west side of the waste processing building. The administration offices are housed within a temporary portacabin building. The portacabin comprises of a wooden floor, flat roof, steel cladding and double glazing windows. The building integrity is good, however the insulation properties of the building would be considered poor. Details of each of the individual offices are given below.

Finance Office

The main energy usage in this office was from a convection heater (2000watt), a 58 watt fluorescent light (on) and a PC. There were two doors one of which was an external fire exit. There were 4 double glazed windows all of which were closed at the time of the audit.

Invoicing office

This office was unoccupied as the staff have been relocated the head office in Newbridge. The temperature in the room was 24°C. The door was opened into the main corridor. There were two 58 watt fluorescent lights, both of which were turned off. There was also a 2000 watt heater which was also turned off as the room is not in use.

Sales Office

The Sales office was unoccupied at the time of the audit. The door was open and the temperature in the room was 26°C. There were 2 double glazed windows, both of which were closed. The main energy consumer in the office were two 58 watt fluorescent tubes (1 on), Photocopier, 2000 watt Convection heater (off). The heating in the room is manually operated as there is no timer switch on it.

Facility Managers Office

The facility mangers office was occupied at the time of the audit. The temperature in the room was 24°C. There were two double glazed windows both of which were closed. The room is heated by a 2000 watt convection heater that was turned off. The heater is not controlled on a timer.

Boardroom

This room was unoccupied at the time of the audit. The temperature in the room was 23°C. The room is heated by two 2000 watt convection heaters (one on and one off). There were two 58 watt fluorescent lights in the room, both of which were on. There were three single glazed windows in the room, two of which were opened at the time of the audit.

Production Managers Office

The room was occupied by two employees at the time of the audit. The temperature in the room was 25°C. There were three single glazed windows in the office, two of which were open. The main energy consumers in this office are two fluorescent lights (58W), two 2000W convection heaters (off), an air-conditioning unit (48W), radio (10W), the controls for 16 CCTV cameras (1.4W), and a battery charger (10.8W).

Main Office & Hallway

The temperature in the main office was 25°C. The room was occupied by three employees during the audit. This open-plan office has 10 internal doors, six of which were open. There were six double glazed windows in the office all of which were closed. The office is heated by four 2000W convection heaters (3 off). Two of the heaters had timer switches, the remaining two were manually controlled only. The main energy consumers in the room are 14 58W fluorescent lights (3 off), four PCs, label printer, and a photocopier.

Weighbridge Offices

The temperature in the offices was 25°C. There were 2 employees in these offices at the time of the audit. There were six windows in the offices, three of which were open. The office is heated by two 2000W convection heaters (off), both of which are manually controlled. The main energy consumers are six 58 watt fluorescent lights (on), two fans (45 watts), two 2000 watt convection heaters (off) which is manually controlled and four personal computers.

Staff Canteen

The main electricity users in the canteen were a 2 x fluorescent tubes (58 Watts) both of which were on, a convection heater (2000W) which was off, a kettle (2200W), an electric grill (750 watt), a microwave (1200 Watts), a toaster (700 Watt), a hot water boiler (2000W). The occupancy of the building at the time of the audit was zero.

3.2.5 Canteen Building

The Canteen building is located at the North-east side of the waste processing building. The canteen building is a portacabin which comprises of a wooden floor, flat roof, steel cladding and five double glazing windows (4 open). The main energy consumers in the canteen are a coffee machine (2000 watts), a radio (15 watts), two microwaves (700 & 750 watts), a water boiler (2000 watts), four fluorescent lights (58 watts), and a 2000 watt convection heater (off). The heater is manually controlled.

3.2.6 Mobile Plant

The AES facility at Cappincur has the following mobile plant which is used by both the Mixed Recovery Line and the general waste sorting area:

- 2 x Bobcats,
- 3 x diggers (Katamuso & 2 x Caterpillar)
- forklift,
- 2 x grab lift
- Roadsweeper

The mobile plant is powered with diesel, which is stored in the 1,100 litre which is located to the eastern side of the waste building. The mobile plant receives regular maintenance checks which are conducted approximately once every 500 hours of use.

4.0 ENERGY CONSUMPTION AT THE AES CAPPINCUR FACILITY

4.1 Audit Details

The Audit was carried out on the 26th June 2009. The visit involved a tour around the site through each structure, operational area and surrounds. This tour included assistance from facility manager, Mr. Paul Hennessey. Potential areas for improvement and reduction in energy consumption were identified and discussed during the energy audit.

There have been no previous energy audit reports to incorporate in this report. This audit can therefore be used as a baseline study to establish energy consumption and efficiency for this site. This data can then be used to assess future energy programmes.

The electricity invoices were made available for the purpose of this report. Also made available was an excel spreadsheet detailing the diesel usage. At the end of the site visit a meeting was convened with Mr. Paul Hennessey.

During the site visit, a list of potential items to be investigated was considered to this particular site. The list of items was taken from Appendix III – Energy Audit Checklist outlined in the Guidance note on Energy Efficiency Auditing published by the EPA. The following topics were determined to be relevant to the existing facility.

- *Energy inputs*
- *Buildings*
- *Space Heating*
- *Waste*
- *Domestic hot water*
- *Lighting*
- *Electrical power*

As part of the audit, energy efficiency measures already in place at the site were noted. These are summarised in Section 4.5.

The audit period covered is from June 2008 to June 2009. Waste Acceptance figures for the AES facility at Cappincur indicate that the energy consumed during the audit period is considered to be representative of the full production capacity of the facility at this time.

4.2 Main Energy Consumers at the Facility

Energy consumption at the site can be divided into three main types:

1) *Electricity to power the processing building including the processing lines the administration buildings, the convective heaters and the domestic appliances.*

2) *Diesel to power the mobile plant unit and the diesel generator that powers the two compressors.*

4.3 Amount of Energy Consumed at the Facility

The most significant energy inputs into the existing facility are electricity supplied by ESB, and diesel supplied by Sutton Oil Ltd. Table 4.1 below outlines these inputs.

Figure 4.1 Percentage Distribution of Energy Costs for the AES facility at Cappincur during Audit Period June '08 to June '09

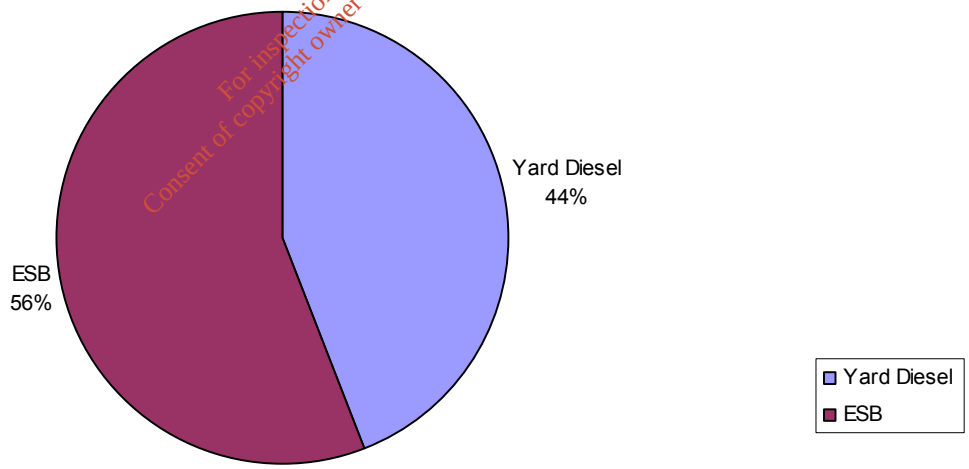


Table 4.1 Energy Usage (Electricity)						
Electricity Usage Period	**Cost per unit (c/kWh)**		**Total units (kWh)**	**Total cost (€)**	**Wattless units (kVARh)**	**Cost of wattless units (€)**
10 Jul 08 – 5 Sept 08	Day	0.1650	2882	475.53	28260	123.55
		0.1550	7558	1171.49		
		0.1949	4716	919.15		
		0.1831	12504	2289.48		
	Night	0.0690	3600	248.40		
		0.0844	6000	506.40		
6 Sept 08 – 6 Nov 08	Day	0.1949	8122	1582.98	36060	148.20
		0.1831	32018	5862.50		
	Night	0.0844	11040	931.78		
7 Nov 08 – 12 Jan 09	Day	0.1949	7205	1404.25	31860	87.18
		0.1831	33475	6129.27		
		0.1946	1572	305.91		
		0.1828	7368	1346.87		
	Night	0.0844	10380	876.07		
		0.0872	2280	198.82		
13 Jan 08 – 9 Mar 09	Day	0.1946	7336	1427.59	26640	69.50
		0.1828	35804	6544.97		
	Night	0.0872	11040	962.69		
10 Mar 09 – 11 May 09	Day	0.1946	6812	1325.62	29940	0
		0.1828	58948	10775.69		
		0.1711	1441	246.56		
		0.1607	12539	2015.02		
	Night	0.0872	12960	1130.11		
		0.0767	2760	211.69		
12 May 09 – 9 Jul 09	Day	0.1711	7729	1322.43	88260	551.61
		0.1607	40931	6577.61		
	Night	0.0767	11820	906.59		
Total			**360,840**	**57695.47**	**241,020**	**980.04**
Total Cost including Standing Charges, Capacity Charges and VAT						**€65,805**

Table 4.1 Continued Energy Usage (Diesel)			
Diesel			
Period	**Cost per Litre (€)**	**Total Litres**	**Total Cost**
July 08	0.83	7,135	5,152.16
August 08	0.98	6,235	5,825.00
September 08	0.81	5,945	5,332.84
October 08	0.70	6,613	3,852.30
November 08	0.64	5,481	3,449.45
December 08	0.49	5,416	3,586.92
January 09	0.38	7,382	3,436.21
February 09	0.40	8,993	4,309.29
March 09	0.35	10,717	3,429.34
April 09	0.36	9,860	3,078.16
May 09	0.38	8,591	3,102.31
June 09	0.39	8,253	3,179.87
Total		**98,859**	**52,340**

Based on the above figures the total energy bill for the site was €118,145 over the audit period. As shown in Figure 4.1, the electricity bill accounts for €65,805 or 56% of the total cost. Diesel accounts for €52,340 or 44%.

4.4 Emissions Summary

Estimates of carbon dioxide (CO_2) produced by facility operations are based on the energy consumption information in Table 4.1 and are shown in Table 4.2. Figure 4.2 shows the percentage of CO_2 produced by consumption of the individual energy types at the site. As shown in Figure 4.1, Electricity represents 56% of the total cost of energy at the site. It is also the main CO_2 producer at the site at 58% as shown in Figure 4.2 below.

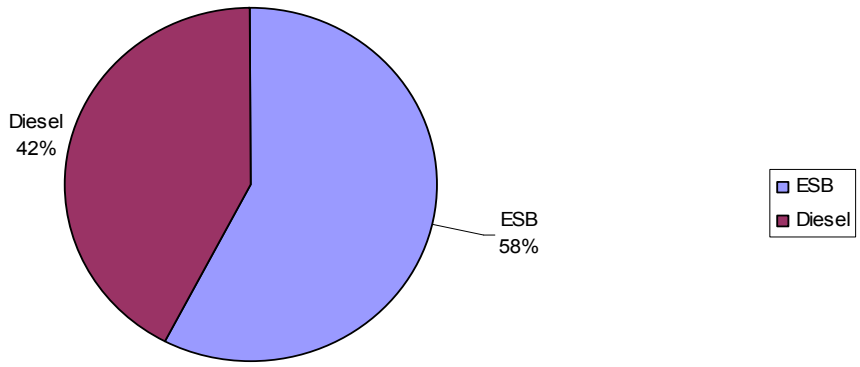
Table 4.2 Estimates of Carbon Dioxide Produced by Facility Operation			
Fuel	**Units (kWh)**	**Conversion Factor**	**CO_2 Produced (kg)**
Electricity	601,860	0.601 kg CO_2 / kWh [1]	361,718
Diesel	98,859	2.7 kg CO_2 / lt [2]	266,919

[1] Sustainable Energy Ireland, Emission Factors 2006 (average value). This is an indirect emission from the site

[2] Smith, A. Browne, K., Ogilvie, S., Rushton, K., Bates, J., (2001*) Waste Management Options and Climate Change. 2001,* European Commission: Luxembourg. P. 224

[3] A Primer on Green house Gas Emissions from Energy and Transportation: http://www.klima.ph/ghg_calculator/primer/primer.html

Figure 4.2 Percentage Distribution of CO_2 Produced by Energy Users at AES Cappincur



4.5 Energy Savings Measures Installed to Date

The following energy efficiency measures are in use at the site:

- There are timers on the external lightening
- There are skylights in the waste processing building and in the picking deck which reduce lighting usage and costs
- There are timers on a number of the heaters within the administration building
- Routine maintenance and upkeep of machinery
- There is surge protection on the processing line equipment
- There are double glazed windows in the majority of the offices.
- There are skylights in the processing building which reduce the lighting requirement and subsequent costs.

The weather conditions on the day of auditing were light showers, mostly dry. The outdoor temperature was 22°C. The indoor temperature range was between 23°C and 27°C. The site audit visit was carried out between the hours of 10am-5pm.

4.6 Basic Energy Savings

Based on implementation of low cost management systems, typically it is possible to save between **2 to 3% of a facility's energy costs (Sustainable Energy Ireland), this could equate to up to €3,544 for AES Cappincur**. Reductions are not necessarily associated

with technical changes, and therefore financial savings can be made as a result of better organisation and management of improved economic efficiency.

5.0 ELECTRICITY

5.1 Energy Supply

The AES facility at Cappincur has a maximum import capacity of 150kVA (kilovolt-Ampere). The site is set up with a general purpose night saver tariff.

5.2 Consumption

The AES facility at Cappincur consumed a total of 360,840 kWh (kilo Watt Hours) during the audit period of June 2008 to June 2009.

Electricity supply from the ESB is used to power the material recovery lines and the administration offices including the conveyors, bailer, shredder, external lightening, domestic lighting, Domestic appliances; convective heaters, CCTV cameras, water coolers, and water heaters.

A diesel generator was required to be added to the site following the upgrade of the MRF line. The generator is used to power the two compressors. The facility Manager also advised that there was a peak overload at the site, which occurs when the bailing machine is pressing in on a bale. This is reported to last 4-5 seconds every cycle (3-4 minutes)

5.3 Maximum Import Capacity (MIC)

The MIC is the level of electrical capacity agreed between the business owner and ESB network. The AES facility at Cappincur has a contracted MIC value established in their connection agreement. A site's MIC value represents the extent to which the transmission network has been designed to serve the consumer and places an upper limit on the total demand that a consumer can place on the network. The MIC value for the AES facility at Cappincur is 150 kVA. If the MIC is too high a higher PSO levy than necessary is charged. If the MIC is too low for a facility's needs, technical/safety problems can occur for the business. Unauthorised use charges will be incurred to discourage use above the MIC. There were no unauthorised use charges charged during the reporting period. However the ESB have not measured whether the usage is higher or alternatively much lower that the MIC level for the site.

The site has a requirement for an increased MIC value, in order to supply enough electricity to run the two compressors. Currently the two compressors are powered from the diesel generator, which is not ideal. However a review and an upgrade of the network would be required to facilitate this.

5.4 Wattless Charges

Electric power consists of two components, **'active power'** and **'reactive power'**. Active power is recorded on the normal electricity meter and appears on the electricity bill as general day and night units. Reactive power is also recorded by the electricity meter for large industrial and commercial business customers. Reactive power units are usually referred to as 'wattless units'. All businesses consume reactive power in their business operation. Equipment such as motors and fluorescent lights require reactive power to operate. If the number of wattless units exceeds a limit of one-third of all general units (day and night units) in the billing period then a charge will apply to the excess wattless units. The number of wattless units consumed over the audit period was 241,020 kVARh. The charge incurred to the facility for wattless units was €980. Wattless charges could potentially be eliminated from the site by ensuring that there are sufficient power factor corrector capacitors in place on site.

5.5 Recommendations

An increased MIC is required at the site as was advised by the electrical engineers following a review of the new loads required following the upgrade of the MRF line. An increased MIC rating may be requested from the ESB, who then would advise if there are upgrades required at the site to accommodate this.

A change in MIC value will incur a change in tariff with the ESB; at this point the package for the site should be reviewed. The site may benefit from a maximum demand tariff, which would offer lower unit price costs for the electricity. There would however be charges for exceeding the MIC value set.

Additional Recommendations to help improve energy efficiency and reducing costs include:

- Upgrade the canteen and office appliances to A-grade to improve energy efficiency
- Power off all office equipment overnight
- Switching off or placing PC monitor's on standby over lunch and any other time when not in use. (Two thirds of the energy used by a typical PC is consumed by the monitor).
- A review of the power factor corrector capacitors in place on site should be conducted. The review should advise if there are sufficient capacitors on site and if are running correctly. This should eliminate the costs associated with the Wattless charges on the ESB bill which came to a total of €980 for the audit period June 2008 to June 2009.

6.0 Lighting

6.1 Audit Observations

Lighting is supplied in the processing building, administration offices, weighbridge offices and in exterior areas of the site. Fluorescent lights are mainly used to illuminate the office and canteen interiors (58W). The lighting in the processing building was supplied by both florescent lights (58W) and by Halogen lamps (240 Watt). The lighting in the processing building is turned on and off based on demand. It is manually switched on at 7 am and switched off when the second shift finishes at 12.30am.

Floodlighting is used to light the exterior of the building. (240W and 400W lights) The external lighting was off at the time of the audit and are operated on a timer.

The lighting has not been assessed to determine if illumination is sufficient for work practices, however the area was observed to be adequately lit during the audit.

It was noted that energy saving light bulbs are not used at the facility. It was also noted that, although no formal procedure has been out into place to ensure that lights are switched off after use, lights in most of the unoccupied rooms was found to be off.

Also noted was the absence of sensors for any of the indoor lights. In addition, the external lighting is on a timer switch they do not contain photodiode sensors which would aid additional control and save energy on exterior illumination.

It was also noted that the skylights (69 in total) in the processing building were not clean on the day of the audit. Clean skylights would optimise the availability of natural light and reduce the requirement for lightening in the processing area. There is no maintenance programme in place for cleaning of the skylights.

There is no signage in place to remind employees to switch off lights.

6.2 Recommendations

Recommendations to help improve energy efficiency include:

- Assess the feasibility of replacing the lights with energy saving alternatives. A low energy lamp gives the same light output but consumes 80% less electricity and can last 10 times longer.(Ref: ESB report: Energy Efficiency Made Easy)
- Access the feasibility of replacing the lights in the processing building with energy saving alternatives which contain daylight linking sensors to harness the daylight available in the building through the skylights and doors. Switching to lights of this kind can significantly reduce the connected load and increase lighting levels

(ref: http://www.patinalighting.ie/applications/index.php)

- Access the feasibility of installing occupancy sensor lighting in some areas of the facility, such as the toilets and canteen areas. Occupancy sensor lighting can provide savings of between 10% and 80%.(Ref: ESB Report: Energy Efficiency Made Easy)
- Clean skylights on a regular basis to optimise availability of natural light into the main production building. Reflectors and louvers which are not cleaned on a regular basis will reduce light output by 20%. (Ref: ESB report: Energy Efficiency Made Easy)
- Standard fluorescent lamps should be replaced after 8,000 hours of use as old lamps give about 30% of full output (Ref: ESB report: Energy Efficiency Made Easy)
- A simple check list created for each building, with a designated person or persons on a rota could perform routine visual checks on light fittings at no financial cost to the company; this would demonstrate good practice and raise awareness about energy efficiency
- Report action items to a co-ordinator
- Create check sheets, for convenience, for specific areas should be drawn up and be filed in a central documentation area for review
- Although it appears that good practices are in place it is recommended that light switches be clearly labelled with notices to encourage regular energy saving and the staff energy awareness programme discussed in the following sections should stress the importance of switching off lights as a way to reduce energy use.
- Access the feasibility of long life energy bulbs in the light fixtures.

7.0 Hot Water

7.1 Audit Observations

The AES facility at Cappincur has a number of manually operated hot water boilers in its buildings. Each of these hot water boilers is 2000W and they are all manually controlled.

7.2 Recommendations

Recommendations to help improve energy efficiency include:

- Boil only the minimum amount of water and use tight fitting lids
- Ensure that the boiler is well insulated so that water stays hotter for longer
- Install a timer device and a thermostat and identify when hot water is required for the canteens.
- Switch off the boiler at night

8.0 Heating

8.1 Audit Observations

The administration building and canteens are heated by 2000W convective heaters, the majority of which are controlled by timers. There is currently no programme in place at the facility to audit heating within the buildings. In most of the unoccupied rooms, the heating was found to be off.

Some of the heaters in the administration building are on timer controlled devices. Each timer switch would normally be manually set and controlled by the occupants of the room. This needs to be reviewed. Also there are a significant number of heaters which were manually controlled, this also need to be reviewed. In addition, there are no thermostats on any of the radiators at the facility.

8.2 Recommendations

Recommendations to help improve energy efficiency include:

- Use electronic thermostats in preference to mechanical ones as they provide a faster response to changing temperatures
- Timers should be place on all heaters. Consider having standardised heating hours on the timers
- Reduce heating during non-working hours (bank holidays or weekends) by ensuring that all convection heaters are turned off.
- Reducing the heat setting by 1°C can save up to 8% on energy costs (Ref: ESB report: Energy Efficiency Made Easy)
- Ensure that heat energy escape is minimised by closing doors and windows and insulating non-insulated areas. Up to 20% heat can be lost through an un-insulated ceiling. Floor insulation is just as important. (Ref: ESB report: Energy Efficiency Made Easy)

9.0 DIESEL

9.1 Supply

The diesel was supplied by Suttons Oil Ltd. It is used to power the mobile plant unit and the generator. The diesel generator is used to produce electricity for two compressors. The generator is serviced by a contractor (Electrogen International Limited) based on the hourly usage of the generator. The generator appeared to be in good condition at the time of the audit.

The onsite plant mobile plant is serviced on a regular basis by the maintenance team. The maintenance is scheduled based on hours of use of each of the machines.

9.2 Consumption

The facility consumed 98,859 litres of diesel during the audit period. The diesel was used to supply both the mobile plant and the on-site generator. The cost of this was €52,340 during the audit period of June 2008 to July 2009. Diesel accounts for 44% of the total energy spend.

It was not possible to separate the costs of running the diesel generator and cost of running the mobile plant in the yard. Therefore it is not possible to determine if the impact of the diesel cost at the site would be reduced if the decision was taken to power all the processing building including the two compressors from the electricity supply rather than the current fuel (diesel). There are however a number of measures that can be taken to help improve the energy efficient of the diesel plant.

9.3 Recommendations

Recommendations to help improve energy efficiency include:

Mobile Plant

- Switching off engines when vehicles not in use
- Do not leave vehicles/machinery idling
- Reduce unnecessary revving up of engines
- Routine servicing of vehicles to ensure optimum operation
- Consider alternatives fuel sources including renewable energy sources and those fuels with incentives and grant schemes attached

Diesel Generators

- Routine servicing of generator to ensure optimum operation
- Consider a long-term solution of changing from the diesel generator to an electricity supply from the ESB to power the compressors.

10.0 ENERGY MANAGEMENT AND REPORTING SYSTEMS

10.1 Reporting/Performance Management

At present there is no documented energy reporting system or policy in place at the site, with the utility bills forming the only basis for energy reporting/performance management. The consumption of electricity and diesel is traceable by means of billing. An operational maintenance programme of on-site plant to help improve the efficiency of equipment at the facility has been put into place.

10.2 Monitoring and Targeting

There is currently no automated Monitoring and Targeting system in place at the site. Monitoring of energy use helps to identify waste and has other benefits such as the ability to spot the deterioration of machine performance. The installation of a monitoring and targeting system will also assist in maintaining costs for energy at as low as possible a level. The monitored levels of usage of diesel and electricity can for a given period of time be directly related to productivity.

The advantage of Monitoring and Targeting is that it is the best defence against avoidable waste occurring at random and remaining undetected, which a one-off survey would miss. Monitoring and Targeting works by combining regular consumption data (usually weekly or monthly) with corresponding data on production throughput, weather or other driving factors. The deviation between actual and expected consumption indicates the extent of any unexpected loss, which can then be converted into implied cost in order to establish significance. This system can also be used to evaluate the impact of energy saving actions or faults in equipment and its operation and set realistic targets for improvement.

Part of an effective Monitoring and Targeting System is the establishment of a representative energy performance indicator, which can be expressed as:

Energy per unit produced = energy used / saleable product
Or
Product per unit energy = Product / energy used

These are simple means of assigning energy use to some unit of output and do not necessarily mean that energy is related to output, as in some cases some or all of a facility's energy is independent of production (e.g. a facility's fixed energy component)

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10.3 Staff Involvement/Training

There is currently no specific staff training at the site directed at reducing on-site energy consumption.

10.4 Matrix Assessment

As part of the energy audit, the site's energy management system was reviewed against best practice. This involved comparison of the existing activities at the site against the energy management matrix included in Appendix II of the EPA's Guidance note. Level 4 of the matrix represents Best Practice in the field. It is recommended that site operators should strive to develop their energy management systems on a prioritized basis as part of a continuous and cyclical process of improvement.

A comparison of existing site practice and best practice is outlined in the matrix table overleaf.

Energy Management Matrix

LEVEL	ENERGY POLICY	ORGANISING	MOTIVATION	INFORMATION SYSTEMS	MARKETING	INVESTMENT
Level 4	Energy policy, action plan and regular review have commitment of top management as part of environmental strategy	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels	Comprehensive system sets targets, monitors consumption, identifies faults, quantifies savings and provides 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
Level 3	Formal energy policy, but no active commitment from top management	Energy manger accountable to energy committee representing all users chaired by a member of the managing board	Energy committee used as main channel together with direct contact with major users	M&T reports for individual premises based on sub-metering, but savings not reported effectively to users	Programme of staff awareness and regular publicity campaigns	Same pay back criteria employed as for all other investment
Level 2	Un-adopted 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
Level 1	An unwritten set of guidelines	Energy management is the part-time responsibility of someone	Informal contacts between engineer and a few users	Cost reporting based on invoice data. Engineer compiles reports for internal use within technical department	Informal contacts used to promote energy efficiency	Only low cost measures taken
Level 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

10.5 Recommendations

(1) It is recommended that AES initiate an in house awareness training programme for all staff to raise consciousness of energy issues. A small contribution from staff towards energy savings can contribute greatly to overall efficiency in general.

(2) It is recommended that a Monitoring and Targeting System be installed at the site to assist in establishing energy costs attributable to the individual energy consumers at the site. This will allow targeted reductions in energy use at the site and should lead to reduced costs and environmental effects.

(3) As part of the EMS for the facility a representative energy performance indicator should be developed and tracked to determine if energy efficiency at the site is improving. This would be linked to the Monitoring and Targeting System recommended above which would allow the costs of the energy supplies to be monitored and the costs for the same over given periods to the attributable to productivity.

11.0 ENERGY PERFORMANCE OF THE SITE

The standard approach to assessing the energy performance of the site is to investigate the appropriate energy performance indicators. In this case, the site energy performance is generally good and the management at the site has actively demonstrated a desire to improve energy performance through operational practices at the site (e.g. the use of timers on the heating and outdoor lighting etc).

However, it is possible to implement a series of recommendations as previously outlined which will assist in improving energy performance at the site. The most important of these is the Monitoring and Targeting program. Correlation of accurate energy use figures with the level of occupancy, production demands, time of day and external weather will aid in the development of a more accurate picture of the sites activity, and also monitor the effectiveness of the planned efficiency measures as well as those already in place.

12.0 COMMENTS AND CONCLUSIONS

Energy consumption has previously been recorded but an in-depth analysis of usages has not been performed at the AES facility in Tullamore. However, the company has demonstrated initiative to reduce energy consumption on an environmental and financial basis. Based on the Energy Audit there are a number of comments on the site as a whole.

Monitoring of energy use for diesel and electricity will be very beneficial for the company. When the facility understands where it lies in terms of energy consumption and become aware of the need to monitor energy users at the site improvements and targets are realistic and achievable.

AES Cappincur should consider a permanent move from diesel generated power from their 100kVA generator to electricity.

Consideration should be given to monitoring and improving on the existing infrastructure at the site. All the office buildings are designed to be temporary buildings and would not be very energy efficient (poor insulation and poor heating distribution systems). AES Cappincur should review the condition and energy efficiency of the buildings at their facility and implement improvements as part of their annual performance objectives.

Although not documented, it was evident from the audit that staff takes responsibility for lights, machine maintenance and general energy savings that will make a difference in the long-term.

As there is no explicit policy set out as yet, the company is showing to be low in the matrix averaging out around level 2. The energy management matrix indicates that management should initiate policy that will drive an energy management programme for the facility.

It is recommended that the results of this audit are implemented over a reasonable time frame and are prioritised as part of the annual Targets and Objectives.

Attachment G.2 Energy Efficiency

An energy efficiency audit was carried out in 2009 and the recommendations were implemented in 2011. A copy of the report is included in this Attachment.