carrigaline Tidy Towns
SUSTAINABLE ENERGY COMMUNITY

Carrigaline Energy Masterplan
June 2023

Annex C:

Energy Audits of a Farm, Community Centre and a School

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Contents

Non-domestic audits

As part of the energy master plan for Carrigaline, two premises were audited an Ashrae level 1 standard to identify any opportunities within these premises for energy efficiency measures. The recommendations within the reports are based on utility data, a site audit, and related engineering calculations.

The site audit consisted of a walk-through of the facility and review of the electrical and mechanical systems and equipment. It is recommended that the organisations implement the measures identified in their reports to contribute towards the energy consumption reduction goals as set out in the Climate Action Plan.

The premises which were audited are detailed in the following list and a detailed report was provided to each of the property owners the results of which are located within this document

- Abbey Dairy Farm
- Carrigaline Community Complex

Also included in this document is the results of an audit carried out independent to the Carrigaline EMP, on Carrigaline Community School. The findings from the audits are contained within the pages that follow.

Executive Summary

Plan Energy consulting were commissioned by Carrigaline Sustainable Energy Community to conduct an energy audit on Abbey Farm in Carrigaline, Co. Cork. The following report details the findings of the Energy Auditor which is based upon a site visit and information provided by the building owners.

The purpose of the report is to identify opportunities within the operation or physical infrastructure of the building being audited to reduce its energy consumption and associated costs.

The audit for the building was carried out as per the requirements of ISO 50002 Type 1. The details included in the Audit are set out in Table 1.

Table 1 – Audit detail

Audit element	Details
Energy bills	• Review and analysis of energy billing information for a minimum of 1 year
Building operation	• Review of building operation (occupancy, opening times)
Significant energy users	• List of significant energy equipment or facilities • Estimates of associated energy demand with calculations
General building assessment	• Visual inspection of building envelope and services • Note significant energy related defects
Renewable energy potential	• Analysis of appropriate renewable technologies

Survey Methodology

Table 3 – Energy Audit Methodology Breakdown	
	SEC input
Audit Scoping and Planning	SEC detail their expectations for the Energy Master Plan and select options which influences the format in which they would like it to be carried out
Information request from Client	Those premises included within the domestic audit provide utility bills in advance and any supplementary info to assist in the audit. Where information has not being provided by the premises being audited, the scope of the audit is significantly reduced.
Site visit and walk through	Guidance provided from SEC on day of audits in order to aid with the data collection process
Analysis and Reporting	SEC available to take any queries fundamental to the completion of the Energy Master Plan.
Recommendations	SEC decide as a community which of the opportunities they would like to take forward to improve their energy efficiency.

Site Visit Notes & Observations

Site Name & Abbey Farm

Address: Kilmoney,

Carrigaline,

Co. Cork

Date of Visit: 12th of December 2022

Energy Auditor: David O Neill

Visit Hosted By: Joe Deane

Building Description

Abbey farm is situated in Carrigaline, County Cork. It is one of two farms that is currently being leased by Mr Deane. The farm is comprised of multiple different buildings including winter housing and a milking parlour. The sheds have a steel roof and would be suitable for mounting photovoltaic panels following a structural analysis. The hours of operation for the buildings vary depending on several factors including time of year and weather conditions, but the machines used for milking are in constant operation, 24 hours a day, 365 days a year.

There are three primary pieces of electrical equipment at the farm which dominate the energy usage. These are the milking machines, the milk cooling equipment, and water heater. The temperature of the milk is reduced using a flow through pipe yjat utilises cold well water to reduce the temperature of the milk.

The key details of the dairy farm are:

No. of cows	115
Size of farm	55 Hectares

Building Fabric

There are a number of buildings on this farm. These buildings were built at different stages, with some being quite old, whilst others are quite modern. Most of the buildings are steel frame shed constructions with a concrete wall up to the first storey. The milking parlour is a concrete block and plaster construction with a corrugated roof.

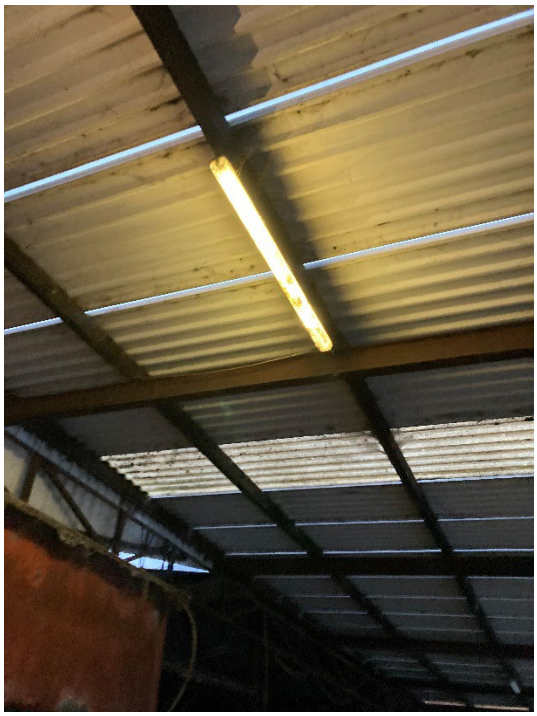
The roof of some of the buildings have a slight pitch, which is ideal for Solar PV panels.

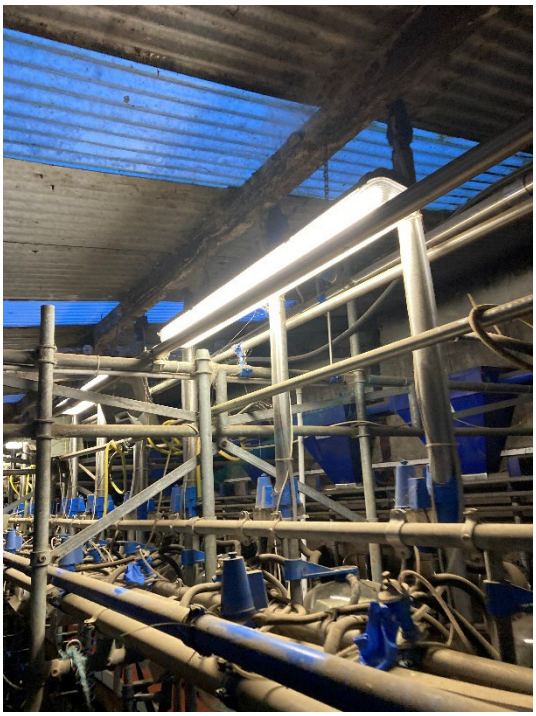
Cattle sheds

Milking Parlour

Lighting

The farms internal lighting is mainly 60W T8 fluorescent tubes. There are approximately 14 double tube lights in the different farm buildings. The lighting is controlled by on/off switches and there are no installed occupancy sensors. There are a number of fluorescent light fitting servicing the building, however the cost of replacing all the lighting to LED at the same time is probably unjustified. It is recommended that as the tubes fail, they are replaced with a new LED Luminaire. There is one fluorescent outside light, which is approximately 80W. Occupancy sensors are also worth considering if a full transition to LED lighting is considered financially unfeasible in the long term.





Significant Energy Users

There are a number of significant energy users on the farm. The following is a list of the most significant energy users on the farm:

- Milking Machines
- Milk cooling equipment – Milk is cooled using a solenoid
- Hot Water – 1 No. 200L boiler and 1 No. 100L boiler heated by electric immersion
- 2 No. Variable speed pumps

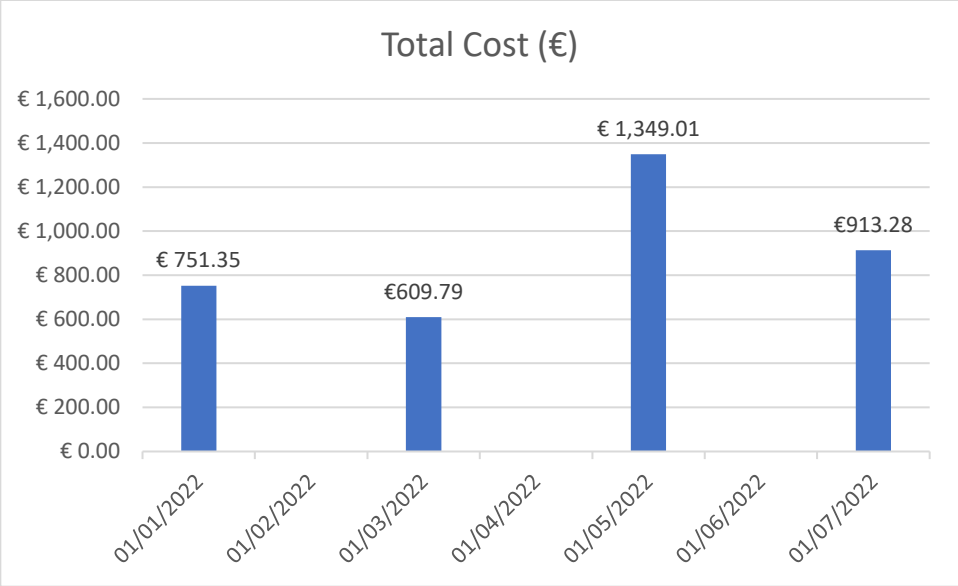
This equipment together accounts for the majority of the electricity consumed on the farm. The best way to reduce energy consumption is by looking at each of these and finding more efficient and less energy intense alternatives. Recommendations for reducing the energy use are noted in the Energy Saving Opportunities section.

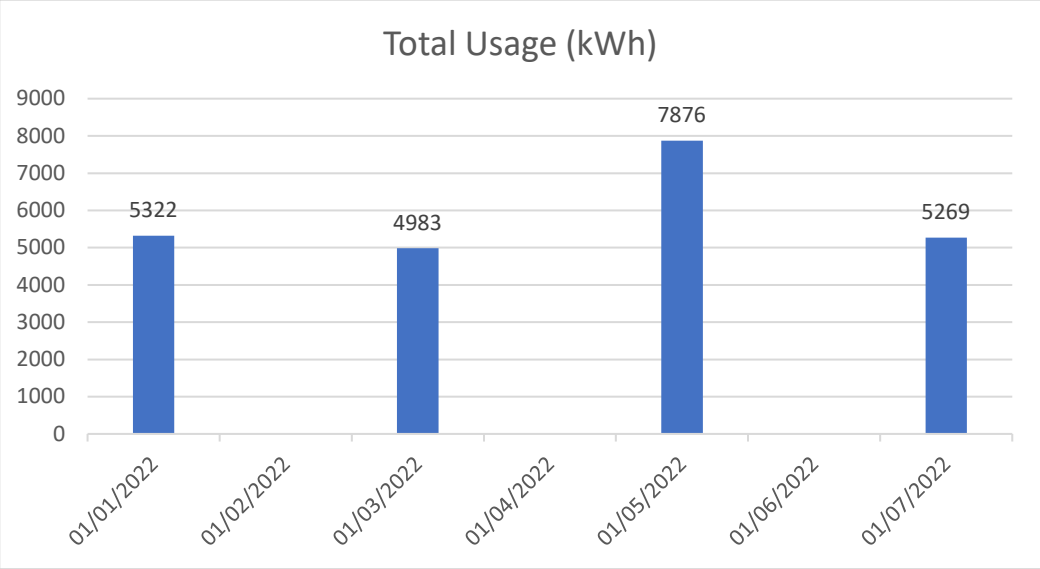
Energy Consumption Analysis

Electricity

- The electricity bills for the farm cover 4 billing cycles from the period 19/01/2022 to 21/07/2022
- The bills that were provided total €3,623 ex VAT over 240 days, with a total consumption of 23,450 kWh.
- From this the estimated annual cost of electricity for the dairy shed is €5,510 ex VAT; with an annual average consumption of 35,663 kWh

Billing Period	Days	Total Cost	Total Usage
19/01/2022	62	€ 751.35	5322
22/03/2022	64	€609.79	4983
25/05/2022	57	€ 1,349.01	7876
21/07/2022	57	€913.28	5269





Green Diesel

There was no recorded data or billing information available, but it was noted that approximately 700L of green diesel is used per annum. Our research shows that at the time of writing, this would cost somewhere in the region of €850-950 to purchase from a supplier.

Renewable Energy

There are significant opportunities for the production of renewable energy on the farm to offset the existing electrical consumption. The first of these opportunities is roof mounted Solar PV system with battery storage. This energy could be used for the milking or for a different milk cooling method, for example the power from the PV could be used to cool the milk from an ice bank. In conjunction with battery storage the PV panel array could be oversized to provide additional power which could be stored in batteries for nighttime consumption. Alternatively, the battery storage could be used to store power from night rate electricity during non-daylight hours outside of the night rate period. There may also be opportunity in the future to sell potential excess power to the grid as a revenue generator.

The second of the opportunities is the use of waste animal product in an anerobic digestion (AD) process for the production of biogas. The use of floor scrapers for the collection of animal waste provides a fresh product for the AD process on a continuous basis. The sizing of the AD plant should be matched to the herd size unless additional material is being imported on to the site. The gas product from the AD plant could be used for the production of electricity and heat utilizing a CHP plant. Alternatively, the gas could be sold as a product, for consumption offsite. An interesting use of the gas may be as a fuel alternative for agricultural vehicles although this would need to be investigated in more detail.

Behavioral Change Recommendations

It is also important to get to know the building's energy costs. This could be started through the creation of a file or folder with all the building's utility bills. This can be a paper file, especially if you receive all your bills by post or paper receipt. A paper file is particularly useful if any oil is delivered to the premises, as you can put the receipt into the file each time.

Alternatively, this energy tracking could be done with files on the computer, especially if you receive your bill online. Microsoft Excel can be particularly useful to see trends or changes over time with bills.

If you feel as if you are spending more than usual on your utility bills, then we would encourage that you utilize the multitude of online comparison websites in order to shop around for the best deal for your building. We advise that you collate all your bills together before commencing and save the results of your comparison. It is recommended that users change their energy supply annually in order to avail of new customer discounts.

It is recommended that electricity monitors are purchased and implemented so the most significant users can be identified, and the most inefficient appliances or processes can be amended.

Energy Saving Opportunities

To save money on energy bills the priority is to pay less for the energy you use (i.e. €/kWh), then energy conservation (i.e. turn off energy demand where possible), then energy efficiency and finally consider installing some form of renewable energy.

Opportunity	Recommendation
Electricity supply rates	Ensure to switch suppliers or renegotiate rates every 12 months. After 12 months most suppliers will automatically switch their customers rates from discount to standard, which means higher rates.
Green Diesel supply rates	Get several quotes for Green Diesel to ensure best value for money.
A rated appliances	As electrical appliances fail/need replacing, replace with A rated appliances only, to minimise electricity use. New appliances are rated A to G based on electricity use.
LED lighting	All lighting across the site should be upgraded to energy efficient LED light fittings. This can be done as a once off project or alternatively gradual replacement as light fittings fail.
Anaerobic Digestion System	The size and scale of the two farms may be suitable for anaerobic digestion where the bi-products are consumed on site.
Solar photovoltaic (PV) panels	Consider installing solar PV panels on the southerly facing part of the roofspaces. Solar panels will produce electricity during daylight hours, which will offset your electricity use. If any excess is produced it can be diverted to heat water or to battery storage.

Site Visit Notes & Observations

Site Name &	Carrigaline Community Complex
Address:	Church Road,
	Carrigaline,
	Co. Cork
Date of Visit:	12th December 2022
Energy Auditor:	David O Neill
Visit Hosted By:	Anne Garvin

Building Description

Carrigaline Community Complex is situated in Carrigaline, in county Cork. There is one building, which ran by the community complex, surrounded by a park and playground, which is under the authority of the council. Within the building, there is a large hall, office areas, a kitchen, and a preschool. The building was originally built in the late 1970's. The Community Complex is a valuable resource to the community. It offers a number of services to the community from classes and events to a Montessori and social spaces. The typical operating hours are from 8.30 a.m. to 10 p.m. and the building is open seven days per week.

Front Elevation

Building Fabric

The community complex has a steel frame construction with cavity block walls. There is a board insulation in the cavity, which was previously inspected. The roof on this building has recently been replaced and consists of insulated panels. This can be quite a cold building at times, based on user feedback. The community complex had previously looked into adding insulation in the form of external insulation or by pumping the wall cavities, but neither option was deemed feasible.

The windows and doors have all been upgraded within the last 5 years to energy efficient alternatives from the originals.

One of the issues faced in this building is the ventilation and access requirements. Because of this, the main entrance doors are usually kept open and so heat retention can be an issue and as a result the building itself can be quite hard to heat. Some of the rooms in this building, such as the hall and preschool classroom area are quite large spaces with high ceilings. The hall is used as a social space for different groups and activities and is located adjacent to the main entrance. This is also an area of concern in relation to heating and heat retention. The complex had looked at a heat recovery system but due to the user profile and the members coming and going, it was also deemed unfeasible.

Rear Exterior building façade

Front Exterior Building Facade

A significant physical intervention to the building greater than 25% of the building envelope would trigger the requirement to bring the building up to a B2 rating. Any proposed renovation work to the building fabric should be looked at from a holistic point of view rather than individual measures. Any improvement in the building fabric may not result in a significant reduction in energy spend based on an analysis of the utility bills.

Heating System

Throughout the building, there are different heating systems present for the different areas. The hall is heated by electric infrared panels, while the rest of the building is heated by electric storage heaters. There is one electric heater present in a studio area, which has replaced an electric storage heater. This is a modern electric radiator but seems incapable of heating the large space in comparison to the storage heater which was replaced. These radiators provide heat to everywhere except the hall. The heating units in the hall of the main building are roof mounted. There are also intake and extract fans present in the exterior walls of the hall to provide ventilation. Despite the seemingly poor heating performance of these heaters, given the intermittent usage of the building, a gas or oil boiler is not deemed to be worth the high investment.The heating is locally controlled for each of the different systems. There are switches on the wall for both the storage heaters and the infrared heaters in the hall.

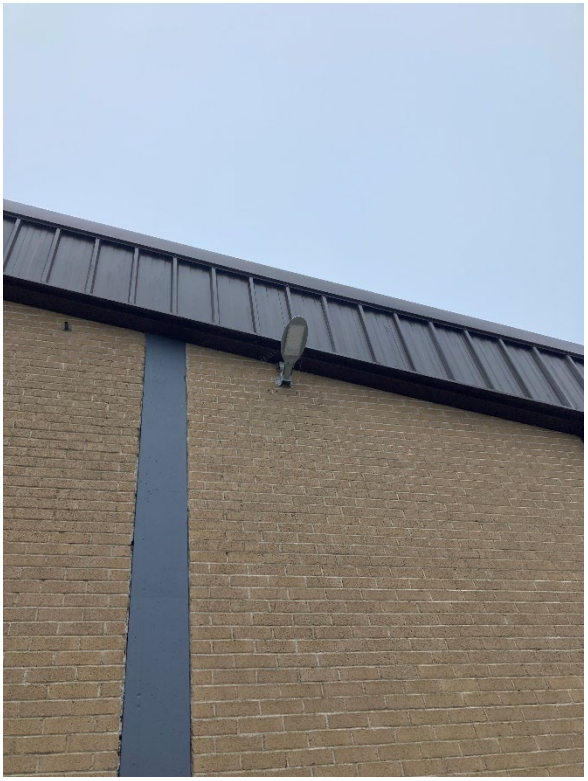
Infrared Heaters in hall

Storage Heater in Kitchen

Lighting

The building's internal lighting is mostly comprised of LED lighting which is an effective measure to reduce energy usage given the length of time lighting would be used for when the building in in use. The lighting is controlled by on/off switches and there are no installed occupancy sensors. Sensors are something that could be implemented for some of the lesser used areas of the hall in an effort to reduce energy use further. There are a very small number of fluorescent lights left but these are in rarely used areas such as the store. The complex does have some outside lighting also. These consist of LED lights which are fixed to the building.

LED Lighting in Preschool Classroom



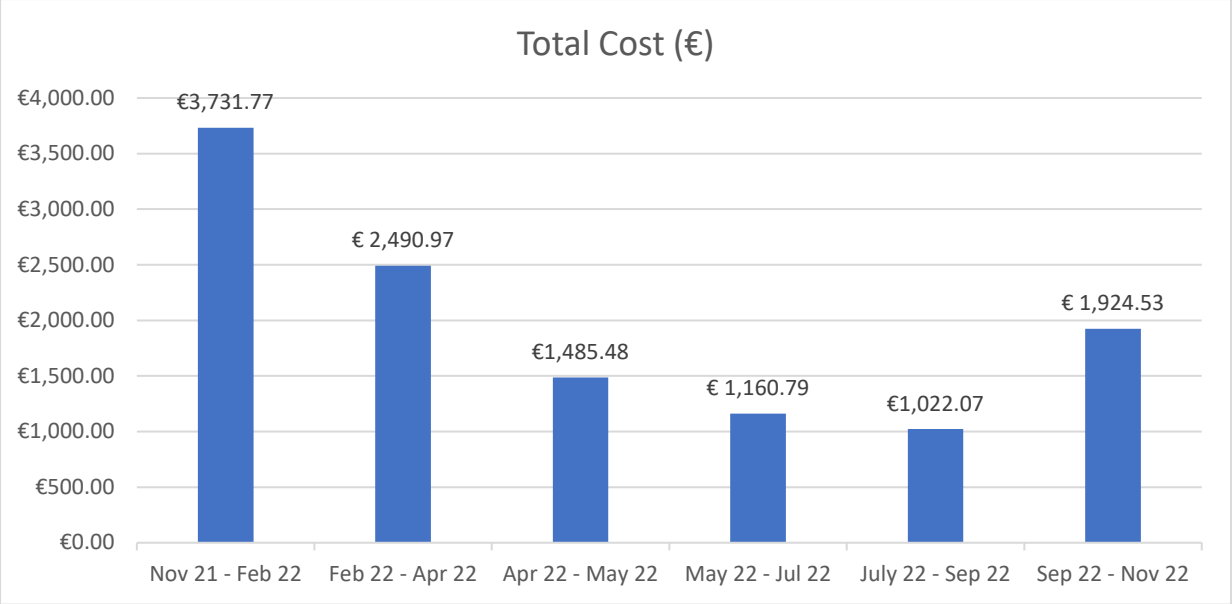
External LED Lighting

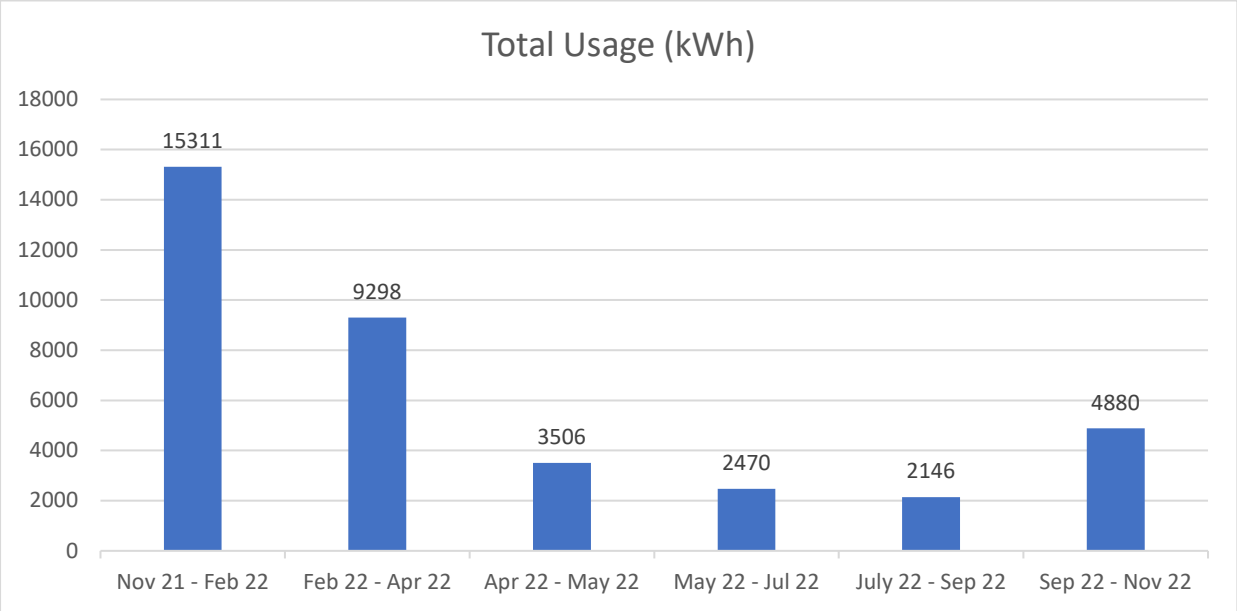
Energy Consumption Analysis

Electricity

- The building has one energy source, consisting of electricity only.
- The electricity bills for seven billing cycles covering 14 months were provided. The bills spanned from September 20212 to November 2022. The period from November 2021 to September 2022 was selected to analyse a 12 month period.
- From this analysis the total cost of the analysed period was €13,363.87 over 366 days.
- A detailed analysis of the electricity use is laid out below. Each bill covered a period of approximately two months, although the bill from November 2021 to February 2022 covers a larger period.
- Even though the period between November 2021 to February 2022 was larger, it is evident from the graphs that the electricity consumption during the winter months is much larger than that of the summer months.

Billing Period	Days	Total Cost	Total Usage
Sep 21 - Nov 21	62	€ 1,548.25	8442
Nov 21 - Feb 22	80	€3,731.77	15311
Feb 22 - Apr 22	49	€ 2,490.97	9298
Apr 22 - May 22	56	€1,485.48	3506
May 22 - Jul 22	61	€ 1,160.79	2470
July 22 - Sep 22	59	€1,022.07	2146
Sep 22 - Nov 22	61	€ 1,924.53	4880
Total	**366**	**€ 13,363.87**	**46,053**


Total Cost (€)
€4,000.00
€3,500.00
€3,000.00
€2,500.00
€2,000.00
€1,500.00
€1,000.00
€500.00
€0.00
€3,731.77
€ 2,490.97
€1,485.48
€ 1,160.79
€1,022.07
€ 1,924.53
Nov 21 - Feb 22
Feb 22 - Apr 22
Apr 22 - May 22
May 22 - Jul 22
July 22 - Sep 22
Sep 22 - Nov 22


Total Usage (kWh)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
15311
9298
3506
2470
2146
4880
Nov 21 - Feb 22
Feb 22 - Apr 22
Apr 22 - May 22
May 22 - Jul 22
July 22 - Sep 22
Sep 22 - Nov 22

Behavioral Change Recommendations

Energy Management

Energy management is an all-encompassing process that should include every aspect of a building's energy use. In order to build an effective energy management policy, it requires commitment from those who use the building on a regular basis. A good starting point for an effective energy management policy for a building of this size would entail:

- Start the energy efficiency conservation with staff.
- Identification of significant energy users (Fridges, cookers, electrical appliances)
- Set energy objectives and measurable targets (e.g. Reduce electricity usage by x% by July)
- Implement initiatives to meet these objectives and targets (Train staff on good energy saving practices)
- Take action where required (Replace old inefficient light bulbs with LED light bulbs on an incremental basis)
- Review and continuously improve the energy management policy where possible

User Training

Educating all users of the building on simple ways in which everyone can reduce their energy consumption is vital to improving a buildings energy efficiency. The Office of Public Works (OPW) has carried out research which shows that up to 25% of all energy spend in the public sector can be attributed to either lighting or plug in appliances left switched on during out of hour periods.

Simple measures, such as switching lights off when exiting a room, switching off computers rather than leaving on standby or switching off plug in appliances have proven to be successful. There should also be an effort to incrementally switch to LED lights across the building as older, less efficient bulbs die out.

Visual reminders in the form of signs across the building could be used to reinforce these energy saving habits on a consistent basis. Moreover, well-structured training events and classes delivered on semi-regular basis to users of the building have been shown to have a significant impact on reducing the energy usage within a building.

Energy Tracking

It is also important to get to know the building's energy costs. This could be started through the creation of a file or folder with all the building's utility bills. This can be a paper file, especially if you receive all your bills by post or paper receipt.

Alternatively, this energy tracking could be done with files on the computer, especially if you receive your bill online. Microsoft Excel can be particularly useful to see trends or changes over time with bills. It could be beneficial for staff to become involved in this process to gain an understanding of the energy use of a building of this size and provide an insight into how energy is used.

If you feel as if you are spending more than usual on your utility bills, then we would encourage that you utilize the multitude of online comparison websites in order to shop around for the best deal for your building. We advise that you collate all your bills together before commencing and save the results of your comparison. It is recommended that users change their energy supply annually in order to avail of new customer discounts.

Energy Saving Opportunities

To save money on energy bills the priority is to pay less for the energy you use (i.e. €/kWh), then energy conservation (i.e. turn off energy demand where possible), then energy efficiency and finally consider installing some form of renewable energy.

Opportunity	**Recommendation**
Electricity supply rates	Switch suppliers or renegotiate rates every 12 months. After 12 months most suppliers will automatically switch their customers rates from discount to standard, which means higher rates.
Label light switches	Include a map beside the bank of light switches explaining which switch turns on which lights.
A rated appliances	As electrical appliances fail/need replacing, replace with A rated appliances only, to minimise electricity use. New appliances are rated A to G based on electricity use.
Energy Monitoring Equipment	Install energy trackers throughout the building to monitor energy use throughout the building and across the day to see when and where the significant energy users are.
Solar Feasibility Study	It is recommended that the community centre approach a solar contractor about the possibility of adding solar PV to the roof of the community centre. If it is feasible, solar PV could be a great way of reducing the community centres energy bills.

Public Sector Programme

Advice, Mentoring & Assessment

Site Visit Consultation Report

Contact Information	
Organisation Name:	Carrigaline Community School Carrigaline. Co. Cork
Roll Number:	91388S
SEAI Client ID:	PB-06325
Participants:	Ms. Anne Guerin – Green Schools Co-Ordinator
SEAI Energy Advisor:	Full name: Liam Tolton Contact Details – liam@secondsighttechnical.com Tel: 087 2542969
Date of Consultation:	Date: 23/5/19
Workshop Attended:	West Cork Energy in Education
Workshop Trainer:	Liam Tolton

Consultation Summary

For the attention of Board of Management/Principal/Director

The site energy review was carried out based on a ca. half-day walkaround inspection. There are a number of potential opportunities for energy performance improvement. The main organisational improvements suggested are the formation of a small energy team and the preparation of an Energy Policy / Statement. The team can then drive a new energy awareness programme among the staff, students and other stakeholders. The main investment opportunity is to upgrade the lighting from T8 to LED standard in the old school. The school already has progressed this to a proposal and has some outline assessment already completed. This will provide improved lighting at lower energy consumption and lower overall cost. There were a number of improvements suggested including the upgrade of the site lighting and the investigation of the high relatively high electrical baseload during the silent hours. An investigation into the significant increase in gas consumption between 2017 and 2018 as well as balancing issues in the heating system. This has resulted in excessive heat input to satisfy the requirements of a small number of rooms adversely impacted by heat losses. The investigation of the relatively high energy baseload and the relatively high summertime usage are also recommended.

Energy Consumption

The annual energy bill for Carrigaline Community School for 2018 was ca. € 58.6k excluding VAT based on estimated of energy cost. The following table summarises the fuel types that are used at the site.

Table 1: Summary of Fuel Types

Fuel Type	2018		
	Quantity [kWh]	Spend (excl. VAT)	CO2 Emissions [t]
Electricity	175,250	€32,952	51.0
Natural Gas	502,160	€25,727	90.4
Total	677,410	€58,678	141.4

Energy Performance Indicators
Area = 10790 m2

Fuel Type	kWh/m2/year
Electric	16.24
Fossil Fuel	46.54
Total	62.78

No of Pupils = 1079

Fuel Type	kWh/pupil/year
Electric	162.42
Fossil Fuel	465.39
Total	627.81

Summary

The energy consumption and spend has increased significantly between 2017 and 2018 from 593,644 kWh to 677,410 kWh of total energy. This was due to the increase in Natural Gas consumption of ca. 20 % over a 12-month period. The weather was somewhat colder in 2018 compared to 2017 with ca. 10 % more heating degree days (A measure of how much extra heating should be required) in 2018. Therefore, it is likely that the change was not entirely weather related. This is a very significant increase and should be further investigated if it has been shown to persist into 2019 and 2020. It is likely that this additional thermal energy was added to the building to compensate for some colder rooms. This is likely to have then required students / teachers to open windows as the building was too warm.

Top Ten Opportunities: The top ten opportunities are summarised below with more details provide in Section 5:

- Set up a small energy team involving staff and senior pupils
- Write an Energy Policy / Energy Statement
- Set up a formal Register of opportunities (building on the one provided in this report)
- Use the team to drive a renewed energy awareness programme. This should yield savings of ca. 16,000 kWh worth ca. € 1350
- Consider a lighting upgrade project in the old school. This should yield savings of ca.37,000 kWh worth ca.€ 7 k. with the payback period expected to be ca. 7 years with a capital cost pf ca. € 50k. The school already has a proposal for this project which should be examined in more detail.
- Consider replacement of the site outside lighting. This is based on the pole mounted lights only. Building wall lights should be considered with the building lighting upgrade.
- Investigate the high baseload of energy at night, weekends and in the summer months when the college is largely closed. This may save ca. 40,000 kWh worth ca.€ 7 k
- Implement a strict shutdown protocol on PCs in computer rooms and classrooms.
- Carry out regular boiler efficiency tests as part of the boiler service. This may save 12, 500 kWh worth ca. € 600
- Investigate the issues around balancing of the heating system as it appears that excessive thermal energy may be expended attempting to keep all rooms at constant temperature. A local heating solution may be the most efficient for a small number of rooms.

If all of the above measures are carried out total savings could be as much as 84,000 kWh equating to an approximate saving per annum of € 12.3k This is approximately 12.5 % reduction in energy consumption and 21% reduction in costs. However, this assumes the lighting upgrade project proceeds. The prudent approach is to complete the low-cost opportunities first before tackling the larger capital projects.

These savings are based on high level estimates and each project should be separately costed before proceeding.

There is a wide range of resources tailored specifically for schools interested in managing their energy use on www.eneryineducation.ie including guides, factsheets, on-line tools, videos and information on energy management training for schools. Improved energy management can also assist schools working towards a Green Flag for Energy.

Contents

1 Introduction & Context

There are several obligations and targets on the public sector, including schools, with respect to energy efficiency arising from a range of legislation and initiatives.

The *European Communities (Energy End-use Efficiency and Energy Services) Regulations 2009* (SI 542 of 2009) now the *European Union (Energy Efficiency) Regulations 2014* (SI 426 of 2014) introduced several obligations on public bodies with respect to their "exemplary role" for energy efficiency. These include obligations with regard to energy efficient procurement, exemplar energy management practices, use of energy efficient buildings and reporting of energy data.

The *Second National Energy Efficiency Action Plan for Ireland* (NEEAP) re-affirms Government's commitment to a stretching 33% efficiency target for the sector:

> "*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.*"

The 33% target is an energy efficiency target and it applies to all public bodies, i.e. all public bodies must improve their energy efficiency by 33% by 2020, equivalent to 3,240 GWh[1].

Since the 1st of January 2011 all public sector bodies are required to report annually to SEAI on their energy usage, and actions taken to reduce consumption (in accordance with Statutory Instrument 542 of 2009). An on-line Monitoring and Reporting system has been developed so public bodies, including schools, can report their energy consumption for all fuel types (e.g. electricity, gas, and oil). Roll-out will commence with schools in 2014.

The latest updates on relevant policy and legislation are available from the Obligations & Targets page on the SEAI website.

2 Energy Consumption

The annual energy bill for school is ca. € 5,300. The following table summarises the fuel types that are used at the site.

Table 1: Summary of Fuel Types

Fuel Type	Details
Electricity	1975250 kWh costing €32,952
Natural Gas	502,160 kWh costing €25,727

[1] Primary energy equivalent

The main energy consumers at the site are summarised in Tables 2 & 3.

Table 2: Summary of Primary Electrical Energy Consumers

Electrical Energy Consumer	% of Total	Comments
Lighting	50	Based on similar school
Outside Lighting	10	7 % Pole Lights and the balance wall lights
Computer Rooms	10	Based on estimate from baseload
Sports Hall / Playing Area	6	Typical
Other power usage.	24	Estimated by difference but would include some higher use rooms e.g. Home economics / labs

Table 3: Summary of Primary Thermal Energy Consumers

Thermal Energy Consumer	% of Total	Comments
Space Heating/ Hot Water Main Building	90	Based on similar school.
Space / Hot Water Heating Sports Hall	10	Based on LPG M&R valve

The Energy Performance Indicators (EnPIs) below are estimated based on the M&R data submission. Further information on EnPI may be found on the Energy in Education, Energy Management Guide for Schools (page 14) http://www.energyineducation.ie/Energy_In_Education/Information_for_Schools/Resources_and_links/Energy_Management_Guide_for_Schools.pdf

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Energy Performance Indicators
Area = 10790 m2

Fuel Type	**kWh/m2/year**
Electric	16.24
Fossil Fuel	46.54
Total	62.78

No of Pupils = 1079

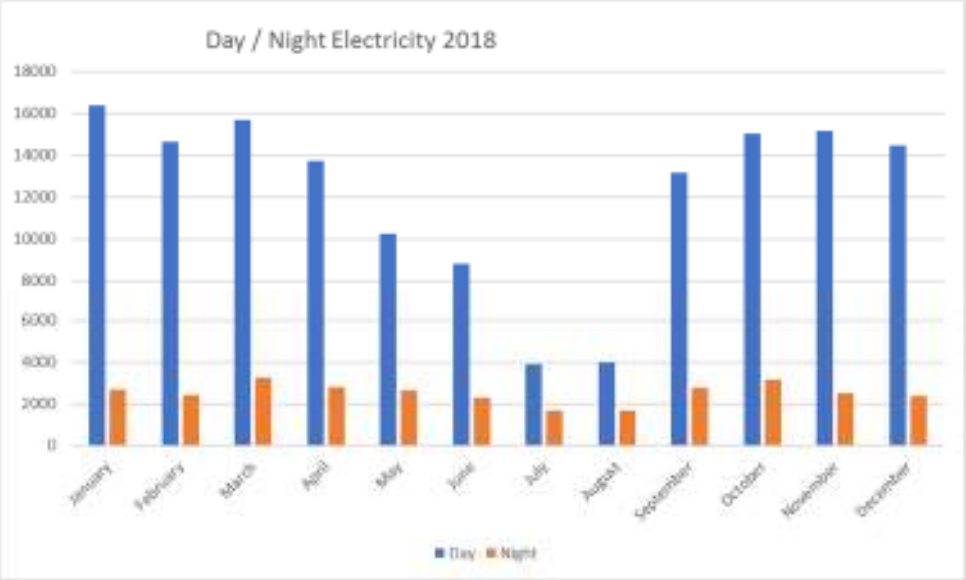
Fuel Type	**kWh/pupil/year**
Electric	162.42
Fossil Fuel	465.39
Total	627.81

Other Optional EnPIs may be developed by the school if these are found to be useful.

Energy use over time — kWh/period (day/week/month)

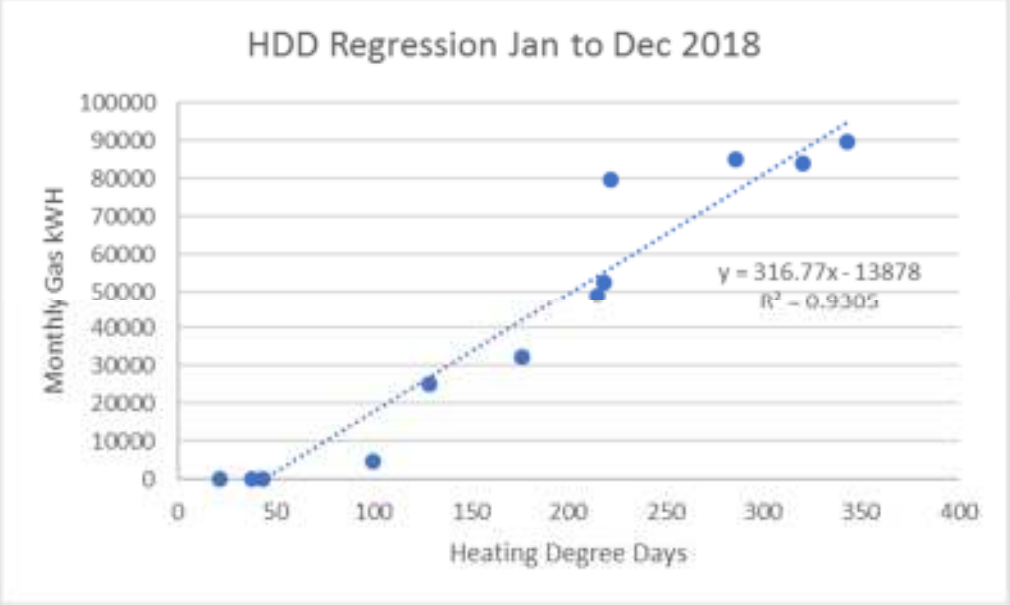
Energy cost per person — €/student/year e.g. in this case**: € 54.38**
Energy cost per class delivered per period — €/class/period (day/week/month)

The relatively high night-time component of electricity should be investigated as shown in the graph below:



This graph also shows the relatively high consumption in the June to August time period when the college is largely closed.

A Heating Degree Days regression analysis was completed and is shown below:



The high Coefficient of Determination at 0.93 shows that the heat requirement of the building is tracking the outside air temperature well, suggesting that the boilers are well controlled. However, this does not suggest that the set point may still be too high.

The fact that in two of the winter months the amount of thermal energy used is above the line suggests that some overheating may be going on.

3 Energy Management

Energy management is an all-encompassing process that should include every aspect of an organisation including students, staff, parents, Board of Management, Principal, administrative staff, caretakers and from maintenance to purchasing and planning. SI 542 of 2009 requires that all public bodies fulfil an exemplary role with respect to energy management. I completed a simple energy management diagnostic based on my site visit. The score achieved was 57 %. This is well above the average score for organisations which are starting formal structured energy management. This is mainly because the school is committed to the M&R programme and has already commenced some investigation of their lighting consumption as well as taking part in the Energy in Education programme.

Appendix B - Energy Management Diagnostic Questionnaire - Schools Version

Site Name:	Carrigaline Community School	SEAI Client ID:	PS-06326		
Participants:	Ann Guerin - Green Schools Co-ordinator	Score:	57%		
SEAI Energy Advisor:	Liam Tolton	Date:	28-May-19		

		Question		Assessment					Additional Comments
Energy Statement	1	Is there a co-ordinator appointed to manage energy management?		No	Informal appointment	Formal appointment but low priority	Y	Formal appointment	
	2	Is there an energy statement (or Energy Policy)?	N	No	Informal Statement	Incomplete Statement		Complete, formal, well-communicated Statement	
Find Saving	3	Have you identified significant energy users & factors that influence energy consumption?		No	Informally (no quantification)	Y Informally (some quantification)		Yes, Formally (quantified assessment)	An assessment of lighting has been completed with quantification
Make a Plan	4	Do you have an Energy Action Plan?		No (None)	Y Informal, Unwritten Plan	Informal, Written Plan		Formal Plan	They are working to do the right things
Take Action	5	Are energy efficiency awareness & practices promoted?		Not at all	Informally & infrequently	Y Informally but regularly		Formally & Regularly	Evidence of energy awareness posters / signs
Check Progress	6	Is there an energy measurement & monitoring system in place?		No (none)	Informal	Y Incomplete System		Formal System	Bills are checked and data is added to M&R system
M&R	7	Is the school M&R compliant for the previous period and the current period?		Y					
Barriers		What do you consider to be the 3 most important barriers to developing, implementing and maintaining a full and effective Energy Management Programme within your organisation? [e.g. resources, training budgets, capital budgets, management time]							
	i	The large scale of this school presents a challenge to co-ordinate the EM efforts							
	ii	Getting all the staff on board							
	iii								

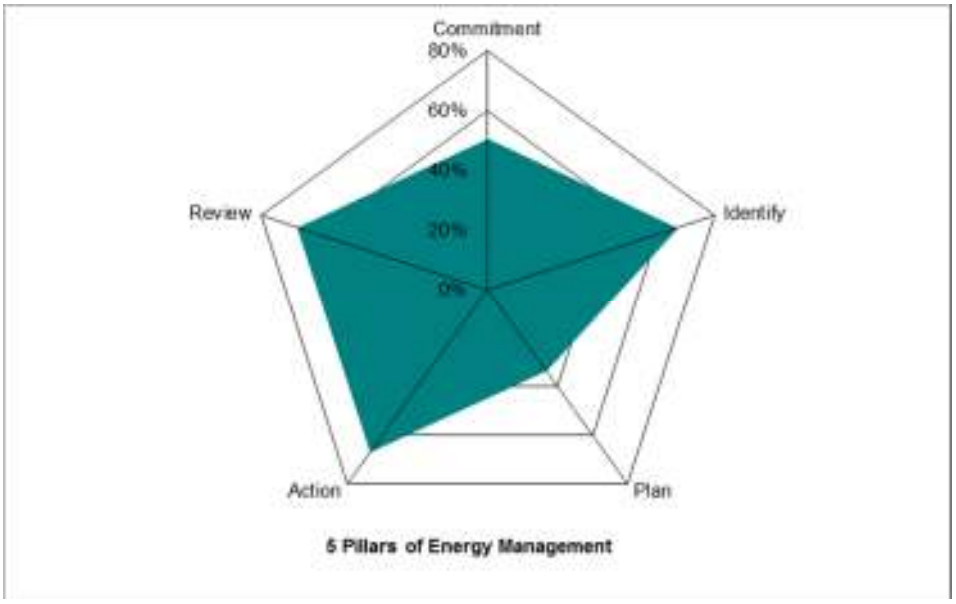


Figure 1: Breakdown of Energy Management Diagnostic Score

The breakdown of the diagnostic score above shows that the school is embracing the concepts of energy management with a very good 57 % score across the five pillars of energy management. (Commit, Identify, Plan, Take Action, Review).

I consider that if the school implements the relatively simple structured approach recommended in this report the scores above will improve further and the energy consumed in the school will drop accordingly.

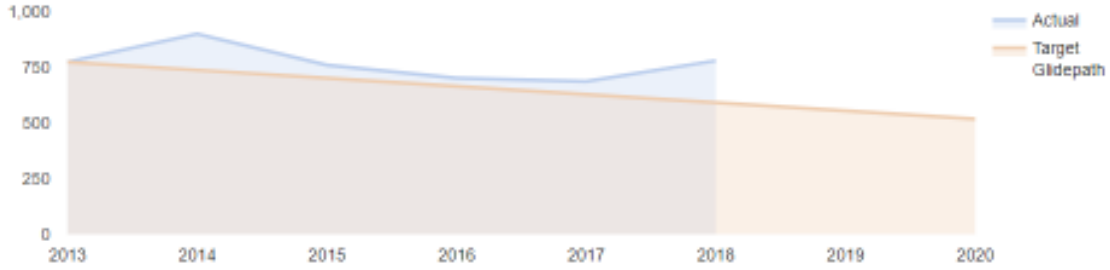
The following is a checklist of Energy Management opportunities that should be implemented in order to realise energy savings opportunities:

Energy Statement	
Assign an Energy Coordinator	Can be taken on by various people - the Principal, a caretaker (part time in this case), a parent, committee member, the Green-Schools coordinator, a board of management member, the deputy principal or a teacher are all potential candidates.
Assign an Energy Team	Comprising of the Energy Coordinator, Admin staff, Teaching staff member, Caretaker and pupils.
Write an energy statement for your school	Communicate it to staff at meetings and display it prominently in the school. Inform parents of the new energy policy through newsletters or a note and consider involving interested parents in the energy management process.

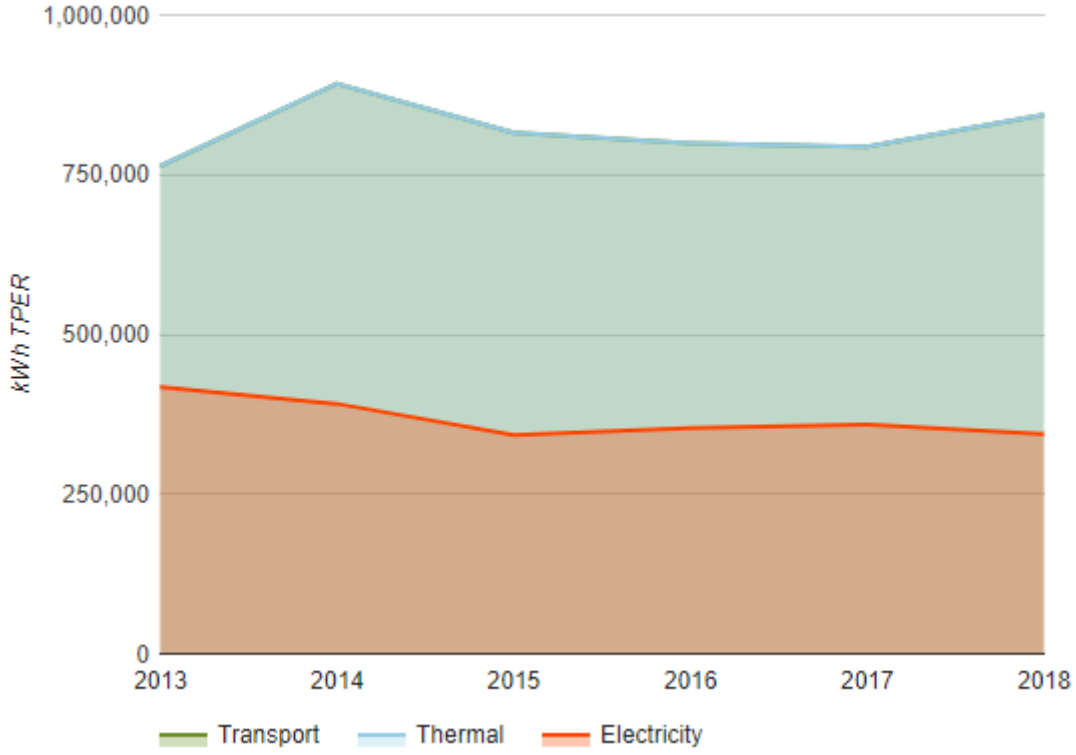
Find savings	
Overview of past & present energy consumption	Document energy bills and take meter readings to determine your energy usage and costs.
Take meter readings	You can use readings from electricity or gas meters to look at usage in a more detailed manner on a daily, weekly or monthly basis. This information also allows you to measure the success of the energy saving measures you are implementing.
Identify significant energy-using equipment	Identify energy-using equipment (lights, computers, heaters, kettle, dishwasher), the people who use it and if there are possible savings. In this school it is mainly lighting
Energy Saving Opportunities List	Fill out a list of opportunities to save energy and include opportunities in various areas. Build on the list provided in this report.
Make a Plan	
Make an Energy Action Plan	Choose five or six opportunities to focus on and develop an action plan. Set out targets to be achieved, which can ultimately be used as benchmarks of success. Include the following elements included in your Energy Action Plan: Targets and objectives; Cost / budget; Person responsible for each objective; Target dates **The main organisational opportunities are all no/ low cost and should be the starting point.** **The lighting upgrade is the main technical opportunity along with the heating system rebalance.** **The investigation into the high baseload electricity including the summertime consumption is the next most significant item.**

Take Action	
Implement the Energy Action Plan	Implement the Energy Savings Action Plan and promote energy efficiency.
Energy Awareness Campaign	Staff cooperation in support of energy management practices starts with effective communication. Develop staff awareness of energy waste by regularly communicating energy costs. An awareness campaign will improve awareness and motivation for staff and students using: Point-of-Use - Energy Posters/Stickers; Energy Notice boards; Cleaning staff awareness; Discuss energy consumption in staff meetings
Check Progress	
Track energy bills and analyse them	Recording energy consumption for the period. Compare to the same period the previous year and explain any deviations
Understand consumption trends	A reduction in energy consumption may be due to energy saving initiatives and an increase may be due to energy waste. It is important to look for the explanation in order to continuously identify opportunities
Produce regular energy reports	Discuss at staff meetings. Include energy cost reporting in any periodic cost reports. Ensure all staff are made aware of the M&R report.
Energy performance indicators	Start using energy performance indicators as explained in section 2.

The current M&R Glideslope is shown below:



It may be clearly seen on the M&R system that while the electricity usage is dropping slightly the thermal energy use has gone in the opposite direction.



This trend should be reviewed again when the 2019 data is entered.

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There is additional information available on energy management from www.energyineducation.ie

4 Building Survey Information

Building Details	Description
Building Age (add in dates of new extensions if applicable)	Built in 1983. This was a largely single glazed building. In 2009 a small extension comprising 7 classrooms was added with double glazing. During 2014, a multi-million euro refurbishment was completed on of much of the existing building, accompanied by the construction of a major three-storey extension, engineering block, purpose-built ASD Resource Centre and state of the art physical education hall and fitness suite; This increased the capacity from 810 students to ca. 1200. (the current number of students is 1079)
Building Area	10790 m2
Building Fabric (include main construction types and if insulation is present)	The campus comprises three separate buildings. The original school is a single storey building with pitched roof areas with full height rooms with no attic. The walls are rendered and have a mix of some single and mainly double-glazed windows / doors. The new sports hall is a North Lighting Roof construction. The new school is a three-storey modern building.
Building Services (including heating, domestic hot water and cooling if present)	All heating is by natural gas in a hot water heating system with boiler rooms in each building.
Ventilation (natural or mechanical)	Natural ventilation throughout.
Controls	Zone controls in the all buildings.
Lighting	Mainly T8 single and twin tube lighting in the old school and T5 lighting in the new school and sports hall.
External Lighting	Pole mounted conventional SON / metal halide fittings and standard wall mounted lighting.
IT Equipment including server rooms	2 No. PC rooms and a server / comms cabinet/.
Small Power Equipment	PCs. Printer, Copier, Screen projectors
Canteen/Kitchen/Dining Areas	Kettle, Burco Boiler, Fridge, Dishwasher
Gymnasium	Modern sports hall with associated changing rooms / showers etc.
Swimming Pool	N/A
Other	N/A

5 Opportunities for Energy Savings

Based on our understanding of the site and the energy consumption profile, we have identified a number of opportunities for further energy savings at the site; these are summarised in Table 4 overleaf.

Any values quoted for energy savings are estimates and would require further investigation to verify their accuracy.

Table 4: Opportunities for Energy Savings

Ref	Opportunity	Indicative Savings kWh	Budget Cost	Category	Target Date	Additional Information	Status
01	Develop a formal but simple energy policy and use it as the basis for the repeat of the awareness programme	Improved awareness	Low	Organisational	3 Months	This should be the first action	
02	Set up a small energy team involving staff and pupils	Increased awareness	Low	Organisational	3 Months	This small team can drive the awareness programme. Transition year students could benefit significantly from inclusion as would the school.	
03	Build on this Register of Opportunities to add further ideas for energy saving as they come up	Improved EM	Low	Organisational	3 Months	This will form part of the EM effort going forward	
04	Commence taking regular meter readings. (As a starting point: Weekly on Friday evening and Monday morning initially to determine if there are items left running at the weekends). Then consider Monday evening and Tuesday Mornings to determine what is left on at night.	Improved M&T	Low	Organisational	3 Months	This will focus everyone on out of hours usage.	
05	Investigate the Nigh time baseload as outlined above. It should be possible to get this down to 20,000 kWh from its current 30,000 by doing a silent hours walkaround at night and weekends.	10000	Low	Organisational	3 Months	This saving is worth c. 1,900 Euro p.a.	
06	Carry out a further formal energy awareness programme for the teachers and students to include formal 'switch it off' campaign.	16000	Low	People	6 Months	Typically, 2.5 % savings may be achieved with a follow up programme such as this with ca. 1350 Euro.	
07	Implement the findings of the LED lighting upgrade study in the old school	37000	High	Technical	6 Months	Annual Savings =7kEuro. Cost of replacement ca. 50 euro based on 7-year payback. Check the costs in the study. They look very high.	

Ref	Opportunity	Indicative Savings kWh	Budget Cost	Category	Target Date	Additional Information	Status
08	Upgrade all outside street pole mounted lights to LED	8600	5200	Technical	When Opportunity Arises	Based on ca. 80 W per unit saved for 26 units. Savings ca. 1000-euro p.a. Payback ca. 5 years due to lower cost of night energy (ca. 26 fittings at ca. 200 euro per unit installed.)	
09	Carry out an 'as found' and 'as left' test of all boilers for efficiency when these are maintained annually	12500	Low	Technical	12 Months	This should be part of the annual maintenance contract. Savings of ca. 600 Euro may be achieved.	
10	Review operation of computer rooms / classroom PCs. A small number of PCs /monitors left on.	No expected to be significant	Low	Organisational	3 Months	Most PCs were OFF during the visit.	
11	Consider insulation of walls	Low	High	Technical	When Opportunity Arises	This investment is not likely to lead to significant returns and should only be considered if a more significant fabric upgrade of the building is required for structural maintenance reasons.	
12	Investigate the relatively high energy use in the summer months when the school is largely closed.	5000 kWh	Low	Technical	3 Months	June, July and August accounts for 12.7 % of the total electricity usage which is relatively high considering the low outside lighting requirement in these months. Estimated saving potential here at 5000 kWh worth ca. 1000 euro	

Ref	Opportunity	Indicative Savings kWh	Budget Cost	Category	Target Date	Additional Information	Status
13	Investigate the reason for the relatively large increase in natural gas usage between 2017 and 2018. (ca.80,000 kWh or ca.20 %).	40000	Low	Technical	3 Months	The Heating Degree Days in 2018 was only 7 % higher than in 2017. It is possible that the controls have been set up too high in response to some short-term cold weather or excessive heat is required to ensure all areas are at acceptable temperature.	
14	Investigate the balance of the heating system in the old school. Some rooms are colder than others resulting in the increase in heat across the whole building to resolve some issues in a small number of rooms.	May be included above	Medium	Technical	6 Months	This may require some local electrical heating in some rooms to compensate for location / heat losses / inadequate heat.	
15	Continue the degree day analysis for monthly gas vs. heating degree days based on the spreadsheet supplied with this report.	Improved thermal energy monitoring	Medium	Technical	3 Months	Degree Day data from www.degreedays.net	

6 Next Steps

Three Months of Mentoring Support

- Carrigaline Community School should review this report and in particular the opportunities for energy savings identified in Table 4. Liam Tolton will contact Anne Guerin in about one week to briefly discuss this report and to provide any relevant clarifications.

- SEAI has appointed Liam Tolton to provide follow-up energy management mentoring to Carrigaline Community School over the **next three months**. He will contact Anne regularly over this period to assist, mentor and encourage Carrigaline Community School in progressing the opportunities for energy savings identified in Table 4 and in improving energy management. Carrigaline Community School should use this three-month period to kick-start progress on the energy savings opportunities and to improve on the priority areas identified in the Energy Management Diagnostic Questionnaire. Carrigaline Community School should contact Liam Tolton by email or by telephone over this period with any queries relevant to energy management.

- SEAI will contact Carrigaline Community School over the next few weeks with a request to fill out a short evaluation of SEAI's Advice, Mentoring & Assessments Programme for the Public Sector; we would be grateful for co-operation in completing this.

- Carrigaline Community School should ensure that the M&R submission is again completed this year with increased emphasis on the kerosene / gas oil consumption to ensure that the variations in this value in recent years is more fully understood and further investigated.

7 Best Practice Resources

Carrigaline Community School should review the following best practice materials that are particularly relevant to you:

Energy in Education Website – Everything you need to save energy in your school.

Completed Energy in Education Workbook - Use it as an example or even to get some ideas.

Energy Management Getting Started - To download energy management tools and templates.

Measure how much energy you are using - For information on reading meters and measuring your energy use

Understanding Your Bills – This factsheet explains the jargon of your Energy Bills.

One Good Idea Student Competition Link – a fun and educational way to involve your students in climate change awareness & energy efficiency. There are lots of prizes to be won too. Sample Energy Statement – Find an example in your completed Workbook or view this example from Chorus/UPC.

Videos – Interesting Videos explain how to save energy in schools.

Games – These are a lot of fun.

Energy Awareness Poster Templates – Samples for your Energy Awareness Poster Campaign.

SEAI Education Programme - Teaching resources – Energy related class work is relevant to a range of aspects of the curriculum from SESE at primary level to science, CSPE and Transition Year at post primary. Students can be directly involved in the process of energy monitoring and management by collecting and analysing data on where and how energy is used, and raising awareness of energy issues in the school. SEAI has a wide range of teaching resources including videos and lesson plans for teaching about energy. The resources are designed to be relevant to the curriculum.

Note there is a specific community of practice for teachers on Energy Link. Client Contact Name(s) should use SEAI's Energy Link network to benefit from the experience of others who have already implemented successful energy saving measures and initiatives, and to tap into the remarkable knowledge base of network members. There is a section of Energy Link specifically for schools to share information.

Appendix A Photographs from Site Visit

The following are a small selection of photographs from the site visit highlighting some specific issues identified in the report.

Photo 1. New Building Sub Meter - Showing ca. 9.3kW
(continue to read this meter to separate out consumption)

Photo 2 – Gas inlet point to boiler room. - Some tidying up required

Photo 3 – Energy Awareness Posters

Photo 4 –PC left on in Classroom