Deliverable 2.4.1: Collaborative report on energy monitoring and behavioural change for educational facilities

Interreg Co-funded by the European Union
Northern Periphery and Arctic

Content

Executive Summary

1 Introduction

This deliverable presents and discusses the first part of NCE Insulation's involvement in Activity 2.4. The work outlined here is an approach to educating local students about and engaging them in processes contributing to a community's green transition. To achieve a sustainable behavioural change and awareness for green transition-related topics, NCE Insulation organised a competition between schools, motivating them to reduce their energy consumption.

2 Methods, procedure, and finances of the Carbon Club's Schools Competition

2.1 Procedure of the Carbon Club's Schools Competition

The organiser of the Schools Competition was the newly founded non-profit initiative "The Carbon Club". By participating in the competition, schools had the opportunity to win a prize that would contribute to their green transition. The diverse array of schools each set up an Energy Team made up of one teacher and multiple students that would take over the responsibility for their school's involvement. Using newly installed monitoring systems, the Energy Teams tried to tackle challenges that would support their schools' efforts of reducing energy consumption.

3 Results and outcomes

All 10 participating schools completed the competition. Overall, the competition constituted a savings of 70,786 kWh of energy and 30.08 metric tonnes of carbon. The long-term educational impacts are not as easily quantifiable and require further visits and surveys to be undertaken at the schools.

4 Discussion

4.1 Challenges and variability in success

The schools experienced a varying degree of success, highlighting the capabilities and circumstances of the participating schools. These were either structural issues or obstacles related to human relations. Should further competitions be organised in future, support and resources should be tailored to each school's context.

An alternative would be to put in place a virtual-online building where the challenges would be the same for each school. This virtual-online site would have to accommodate individual approaches by each energy team.

4.2 Impact beyond immediate results

The format in the trial competition was also aimed at initiating and encouraging behavioural change in local communities, therefore it was necessary to create the conditions for students to have to engage with the topic at hand. The real value of these efforts will become clearer over time, as students carry forward the knowledge and habits they have acquired. These learnings are fundamental to raising awareness and instigating a cultural shift towards establishing sustainable practices as integral parts of everyday life. While the students involved share their knowledge and experiences with their surroundings, the learnings spread through communities.

4.3 Future directions and uncertain outcomes

The true extent of the competition's impact is still to be seen. Therefore, there are plans to conduct follow-up visits and potential similar competitions in future.

5 Conclusion

This deliverable presented and discussed an attempt by NCE Insulation to initiate behavioural change regarding energy consumption by organising a competition between schools in Cork, Ireland. Students and teachers at participating schools were forced to engage with topics related to green transition and raising awareness for it. In doing so, the schools experienced a net savings of energy and carbon emissions, proving the effectiveness of small, targeted actions in the short term. Whether or not long-term educational value contributing to general behavioural change was achieved is yet to be determined.

What can be extracted from the competition is there was an appetite within the 10 schools for green-transition and carbon-saving learning. It shows that there is also a potential to tap into this appetite across the national second-level school population.

There are however several impediments to a national rollout.

1. As was seen in the above project, there is a diversity in the quality and age of buildings.
2. Due to the large number of schools i.e. 500+ a competition would be difficult to manager and assess using the protocols of the trial competition.
3. The remedies proposed in the trial to reduce carbon consumption in any given school, in any given year, will need to be assessed on a yearly basis.
4. There will be a cost to installing monitoring equipment in each school. This will vary from school to school and there will be an issue about who bears the cost.

This should not be a deterrent for a project roll out. It is possible to create a virtual building with similar carbon issues to the real-life school buildings. By offering a range of proposed solutions to achieve carbon-saving remedies, each school could take a unique approach to solving the problems the virtual building.

1 Introduction

The green transition is a multi-generational effort that requires all parts of society to be involved. This means that communities must be educated not only about the relevance of green transition, but how they can be involved in the efforts as early as possible. Therefore, an essential part of HYBES is the introduction of educational modules for children and young adults. They are more likely to be affected by the results of climate change due to their young age, but that also makes them most likely to be able to contribute to the efforts against it.

Furthermore, educating children and young adults about green transition in schools can also support the education of the wider community, as this may also motivate or even force parents, grandparents, administrators, and teachers alike to engage with related topics. In the short term, this can result in greater awareness of, in this case, energy consumption, leading to a decrease in carbon emissions. In the long term, it can initiate behavioural change and a cultural shift toward sustainable practices. Therefore, this approach contributes to the overall objectives of HYBES and was developed as a part of Working Package 2.

This deliverable presents and briefly discusses the execution and results of Activity 2.4's first step: *The Carbon Club*, a newly founded initiative that organised a competition among schools in Cork, Ireland, aimed at educating pupils about green transition in a playful manner. Underlying this deliverable is the question of how effective this approach was in both the short and long term. In the short term, the output of the approach is quantity of energy and carbon emissions saved. In the long term, the output of the approach is the yet to be defined impact of education on the community's behaviour regarding energy consumption.

2 Methods, procedure, and finances of the Carbon Club's Schools Competition

2.1 Procedure of the Carbon Club's Schools Competition

The Carbon Club was initiated as a non-profit initiative by Secure and Fix It Enterprises T/A NCE Insulation and acted as the executor of NCE Insulation's first contribution to Activity 2.4. Carbon Club's main objective was to monitor energy consumption and initiate behavioural change related to energy consumption in educational facilities. To achieve this on a local level, Carbon Club set up an educational module over a 12-week term and a set of challenges that continued beyond the end of that. A detailed view of the project timeline is provided in the project planner in Appendix 1.

The module was organised in the format of a competition among the participating schools in Cork. To win the Schools Competition, schools had to reduce their energy consumption, the idea being that a prize could incentivise schools and students to get involved in climate action. By participating in the competition, schools had the opportunity to win a solar photovoltaic system to generate free renewable energy, or an electric vehicle charger for the second place. The Carbon Club partnered with the external service provider *DCSix Technologies* that had the technical expertise to oversee the Schools Competition and install the energy monitoring systems.

Interreg Co-funded by the European Union
Northern Periphery and Arctic

Together with CETB, CC sent emails out to post primary schools. 21 replied with the Expression of Interest-form, 10 were then selected for the competition in a manner that would ensure diversity in terms of size and location:

- Clonakilty Community College
- St. Colman's Community College
- Glanmire Community College
- Coláiste Pobail Naomh Mhuire
- Coláiste an Chraoibhin
- Coláiste Choilm
- Coláiste Fionnchua
- Coachford College
- Schull Community College
- Coláiste Treasa

Each participating school had to set up an *Energy Team* made up of one teacher who acted as the main point of contact about the competition, as well as multiple transition year students. The Carbon Club and DCSix Technologies regularly checked up on the Energy Teams and offered both support and advice on how to reduce energy consumption.

DCSix Technologies set the parameters for how the energy baseline in each school was to be established. An *energy baseline* is a reference point that reflects the typical energy consumption of a facility under standard operating conditions. In the context of schools, the energy baseline specifically refers to the energy usage during non-operational hours, such as the time between the end of one school day and the start of the next. This period, when the school is unoccupied and minimal activity occurs, provides a benchmark to assess energy efficiency and identify opportunities for reducing consumption during times when the facility is not in use. As well as that, DCSix Technologies also set the parameters for the competition, and, after the competition, advised the Carbon Club on the winner of the competition and the order of the runners up. Furthermore, DCSix Technologies also carried out an initial school site survey to determine the required measurements and strategic locations for the display screen and installed the energy monitoring system and monitors in ten post primary schools in Cork. The display screen was not only set up to track the progress, but it was also used to raise energy awareness within the schools. To enhance that effect, the display was optionally also accompanied by an LED light arrangement showing a traffic light system on energy performance. Similarly, schools could also track their progress compared to the other schools on the leader board on the Carbon Club website. The costs for both the monitoring system and the display were not carried by the schools, but by the Carbon Club.

The parameters for the competition were based on two categories: *Category 1: Carbon & Energy Reduction* and *Category 2: Best Energy Team*.

The first category had the objective to measure the decrease of carbon and energy usage on the electrical energy used at nighttime when the school is not operational (also referred to as the school's *parasitic load*). This was measured on a biweekly basis by using the following formula:

Baseline Carbon load reduced at night ÷ the number of students in the school.

After the measurement and a comparison with the energy utility bills, each school was given a rating of one to ten. The school that experienced the largest decrease in energy

Interreg Co-funded by the European Union
Northern Periphery and Arctic

consumption received ten points, while the school that experienced the smallest decrease received one. At the end of the term, the school with the largest number of points won this category.

Challenge no.	Month	Name	Objective	Execution
1	November	Best Energy Team Engagement Plan	To get the Energy Team to consider how they are going to engage with the rest of the school and put a plan in place to reduce carbon and energy usage.	Ideas for this challenge included an internal engagement campaign, creating posters and flyers, and documenting the actions they took with regards to liaising with staff and students to reducing energy consumption in the school.
2	December	Christmas Baseline Challenge	Evaluate how low each school can get their baseline energy load over the Christmas period.	Each school was required to make a big push across the school to make sure all non-essential appliances and lighting are turned off over the Christmas holidays. They were to highlight to everyone in school how much energy, money and carbon emissions they could save through simply turning everything off in the evenings or when the school is not in use.
3	February	Best Energy Team Energy Audit of significant energy users (SEUs)	Provide the transition year students with an insight into the amount of energy in Kilowatts (kWs) lighting and appliances use and what the financial cost of this is.	This was done as group projects where the students carried out an audit in certain rooms throughout the school which were identified by the Carbon Club. An audit template was provided by the Carbon Club to allow students to evaluate the energy consumption and cost within selected rooms (staff room, IT laboratory, home education room, canteen/kitchen, classroom) and any appliances found in them. They were then required to make suggestions specific to their school on how they could reduce the energy consumption for these SEUs.
4	April	Energy Team Solar Photovoltaic Report	Research how solar PV technology works on a school.	The project involved students in working teams. Each team wrote a 5-page report on solar PV to develop their understanding of the technology and highlight the benefits it would have to their school. The Carbon Club provided headings for the report. Sample headings were provided: What is Solar PV? How does Solar PV technology work? The advantages and disadvantages of installing Solar PV technology on a school; What size system would be best suited for the school? For the last heading, a rule of thumb template was provided by the Carbon Club.

Table 1: Category 2 Challenges in the Schools Competition.

The second category had the objective to award the schools for their engagement and behavioural change activities. This consisted of various challenges presented in Table 1 throughout the year (November, December, February, and April) that each offered the reward of up to 30 points. Carbon Club updated the participating schools on these challenges and timelines around them at applicable times throughout the year. The combined score of both points determined the results of the competition.

2.2 Finances of the procedure

NCE Insulation budget overview

Staff costs					
Staff function	**Comments**	**Unit type**	**No. of units**	**Price per unit (in €)**	**Total**
Project Manager	Period Salary	20 % of time	6.00	13,000.00	78,000.00
Project Assistant	Period Salary	100 % of time	6.00	3,600.00	21,600.00
Technical expertise	Period Salary	20 % of time	6.00	3,333.00	19,998.00
Communications Officer	Period Salary	10 % of time	6.00	1,666.00	9,996.00
					129,594.00
Office and administration					
Flat rate based on direct staff costs: 15 % of Staff costs (fixed rate)					**19,439.10**
Travel and accommodation					
Description	**Comments**	**Unit type**	**No. of units**	**Price per unit**	**Total**
Travel	Partner meetings	Flights and Substinence	6.00	3,750.00	**22,500.00**
External expertise and services					
Description	**Comments**	**Unit type**	**No. of units**	**Price per unit**	**Total**
Pilot costs	Development of an educational module	Total Costs	1.00	3,000.00	3,000.00
Seminars and meetings	Costs associated with hosting the consortium meeting and project seminar (and local meetings)	Total Costs	1.00	2,000.00	2,000.00
Energy expert consultation	Consultation on Monitoring programmes in schools	Total Costs	1.00	2,000.00	2,000.00
FLC costs	Finance and Audit	Total Costs	1.00	4,000.00	4,000.00
					11,000.00
Equipment					
Description	**Comments**	**Unit type**	**No. of units**	**Price per unit**	**Total**
Monitoring equipment	Hardware to gather data in schools and buildings	Total Costs	1.00	9,000.00	**9,000.00**
				Overall total:	**191,533.10**
Co-financing					
Source	Amount in €	Percentage			
ERDF	124,496.51	65%			
Partner contribution	67,036.59	35%		**Total eligible budget:**	**191,533.10**

Table 2: NCE Insulation budget overview (own figure, based on data from the application form).

Table 2 presents the distribution and sources of costs that NCE Insulation has encountered and has yet to encounter throughout the course of the whole project (HYBES). Relevant to the Carbon Club are costs in reference to the energy expert consultation (2,000 €), and the monitoring equipment (9,000 €). Additionally, an undefined percentage of the running costs (staff costs, office and administration, and FLC costs) has also been used for the Carbon Club.

3 Results and outcomes

All 10 participating schools completed the competition. The results of the competition can be seen in Table 3. The winning school received a free Solar PV system, and all ten schools received a free electric vehicle charger and energy audit report from an SEAI-registered energy auditor. According to the calculations made, the schools managed to save 70,786 kWh of energy and 30.08 metric tonnes of carbon (equivalent to approximately. 1,203 trees) over the course of the competition.

Place:	School:	Points:
1st	Clonakilty Community College	220
2nd	St. Colman's Community College	209
3rd	Glanmire Community College	194
4th	Coláiste Pobail Naomh Mhuire	143
5th	Coláiste an Chraoibhín	133
6th	Coláiste Choilm	122
7th	Coláiste Fionnchua	120
8th	Coachford College	105
9th	Schull Community College	104
9th	Coláiste Treasa	104

Table 3: Final scores and leaderboard of the competition.

The impacts of the challenges of the second category are less readily quantifiable, as they were also based on the active involvement of the Energy Teams and their creative interpretation and implementation of the tasks. This is especially apparent for the first challenge in November, where the teams were to inform and engage the rest of the school. Some of the promotional and informational material by the Energy Team at Clonakilty Community College can be found in Appendix 2. The primary output of this challenge included the development and distribution of posters and reminders to turn off technical appliances, and the organisation of or participation in awareness-raising events.

For the second challenge in December, the Energy Teams were asked to read a report on their progress so far produced by DCSix Technologies and plan accordingly on how to further decrease the baseline, especially over the upcoming Christmas holidays. The reports themselves can be seen in Appendix 8.

The third challenge in February required the Energy Teams to further expand their awareness for the extent of energy consumption, by identifying appliances that are potentially using unnecessary amounts of energy. These were referred to as *Significant Energy Users (SEUs)*, thereby providing students with technical terminology. The challenge paper is attached in Appendix 3, and the audit report of Glanmire Community College is attached in Appendix 4.

The fourth challenge in April required the Energy Teams to explore the technical implications and feasibility of installing a solar photovoltaic system in their school. The Energy Teams were given a template for the report that can be seen in Appendix 5 as well as technical details on their school buildings and the requirements for solar photovoltaic systems (Appendix 6). Only six schools completed this challenge. as no feedback was received from the other four schools regarding this last challenge.

4 Discussion

Although all completed the competition, they completed it with a wide range of success. Each school's Energy Team faced unique challenges and constraints, influencing their individual outcomes. However, all of them managed to lower their baseline and thereby contributed to the overall significant energy and carbon emissions savings. This truly reflects the potential of small, targeted actions within school environments.

4.1 Challenges and variability in success

As mentioned above, the schools experienced a varying degree of success. This highlights the capabilities and circumstances of the participating schools. While some schools may have been more affected by structural obstacles, such as the size of the buildings, a lack of suitable resources and working materials, others may have been more affected by human relations-related obstacles, such as the number of pupils at a school, a lack of motivation among the students, or a less experienced or resourceful teacher. Although a diverse array of schools was intended during the selection process of the schools, this variability underscores the importance of tailoring support and resources to fit each school's context in potential future competitions.

4.2 Impact beyond immediate results

The energy and carbon emissions saved throughout the course of the project are impressive in themselves, but the long-term impact of the competition lies in its role as an educational tool for fostering awareness of green transition and responsible energy consumption. Through this hands-on experience, this competition aimed at initiating and encouraging behavioural change that could have lasting effects beyond the immediate savings. The challenges of the second category arguably constituted the main contribution to the educational outcome of this competition, as the Energy Teams had to engage with the topic at hand. As can be seen in the December reports (Appendix 7), Energy Teams had to familiarise themselves with the relevant terminology to tackle the challenge, suggesting a strong potential for a sustainable learning outcome regarding the relevance of and processes behind responsible energy consumption. The real value of these efforts will become clearer over time, as participating students carry forward the knowledge and habits they have acquired.

Education and awareness-raising initiatives like this competition have the potential to instigate a cultural shift toward sustainability as an integral part of everyday life. By engaging the whole school community, the competition encouraged not only individual students, but also teachers, administrators, and parents to think critically about their personal behaviour regarding energy consumption. Continued engagement with these schools through regular visits and surveys, or similar competitions on an ongoing basis, could reinforce these shifts, embedding energy-conscious behaviours within school culture and the local community.

4.3 Future directions and uncertain outcomes

While the competition has laid a foundation for sustainable energy practices within these schools, the true extent of its impact is still to be seen. There are plans to conduct follow-up visits and potentially repeat the competition in future years, which could provide additional support and encourage schools to maintain and build upon their achievements. However, whether these efforts will result in sustained long-term behavioural changes and reductions in energy consumption remains uncertain.

5 Conclusion

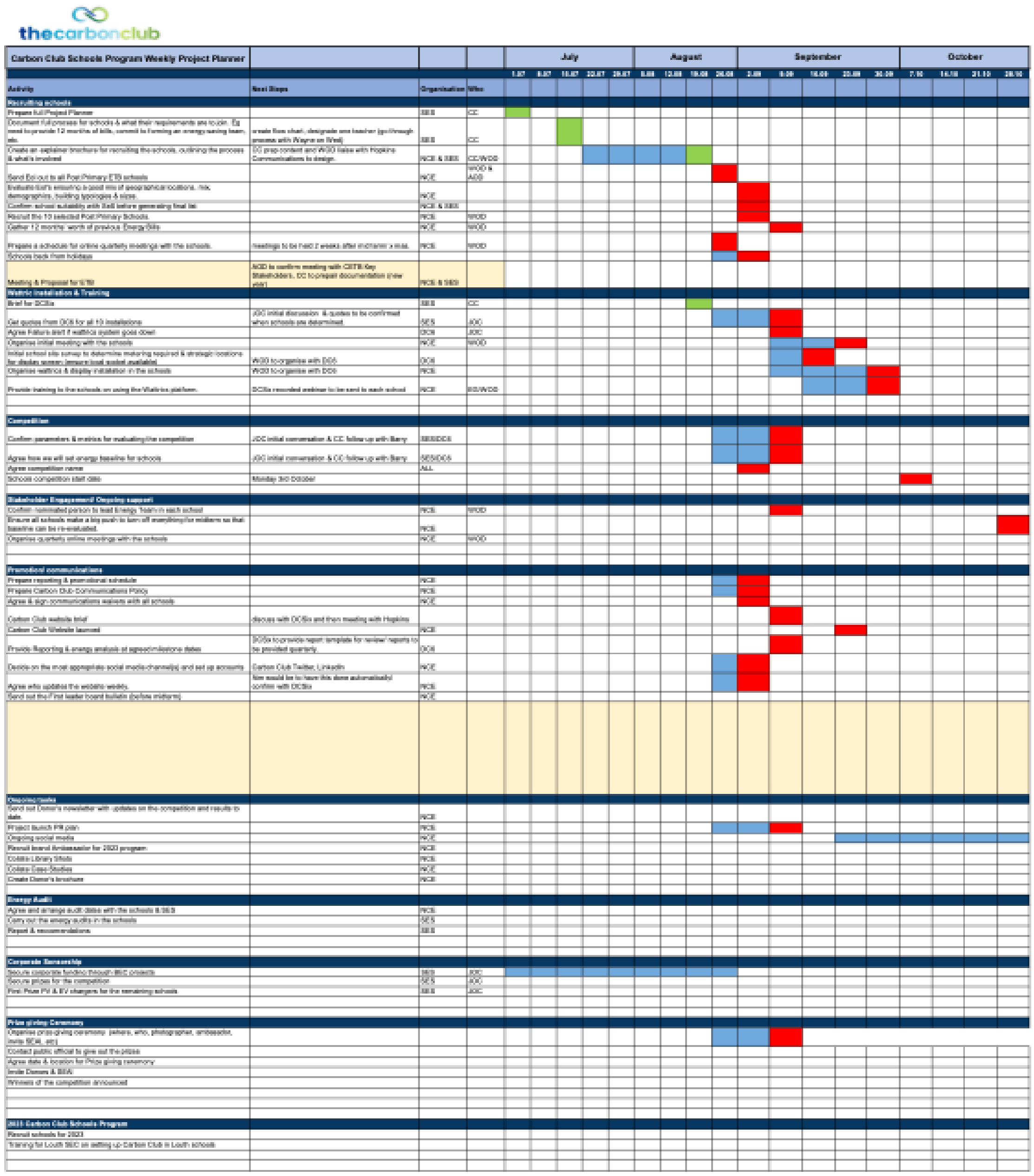
This deliverable presented and discussed an attempt to initiate behavioural change regarding energy consumption through the organisation and testing of an educational module for pupils at local schools in Cork, Ireland. To do so, NCE Insulation founded The Carbon Club, a non-profit initiative that acted as the executing entity in this process. The Carbon Club organised and held a competition (without exceeding the budget granted by the project consortium) between multiple schools, during which the participating pupils and teachers had to actively engage with the energy consumption of their school buildings. Throughout the course of the competition, the participants had to identify ways through which their schools could reduce energy consumption and try to raise awareness among their peers. Participants were therefore primarily confronted with highly technical aspects of energy management, while also having to engage in techniques of public relations and persuasion. This had the intended objectives of quantifiable short-term energy and carbon emissions savings, as well as long-term educational value contributing to behavioural change in the whole community.

While the first objective was met, proving the effectiveness of small, targeted actions, whether the second objective has been achieved is yet to be determined. The deliverable concludes that regular visits to these schools including surveys must be undertaken starting soon, if not even regular similar competitions themselves.

Appendix

Appendix 1: Detailed project planner

The detailed project planner is on the following four pages.

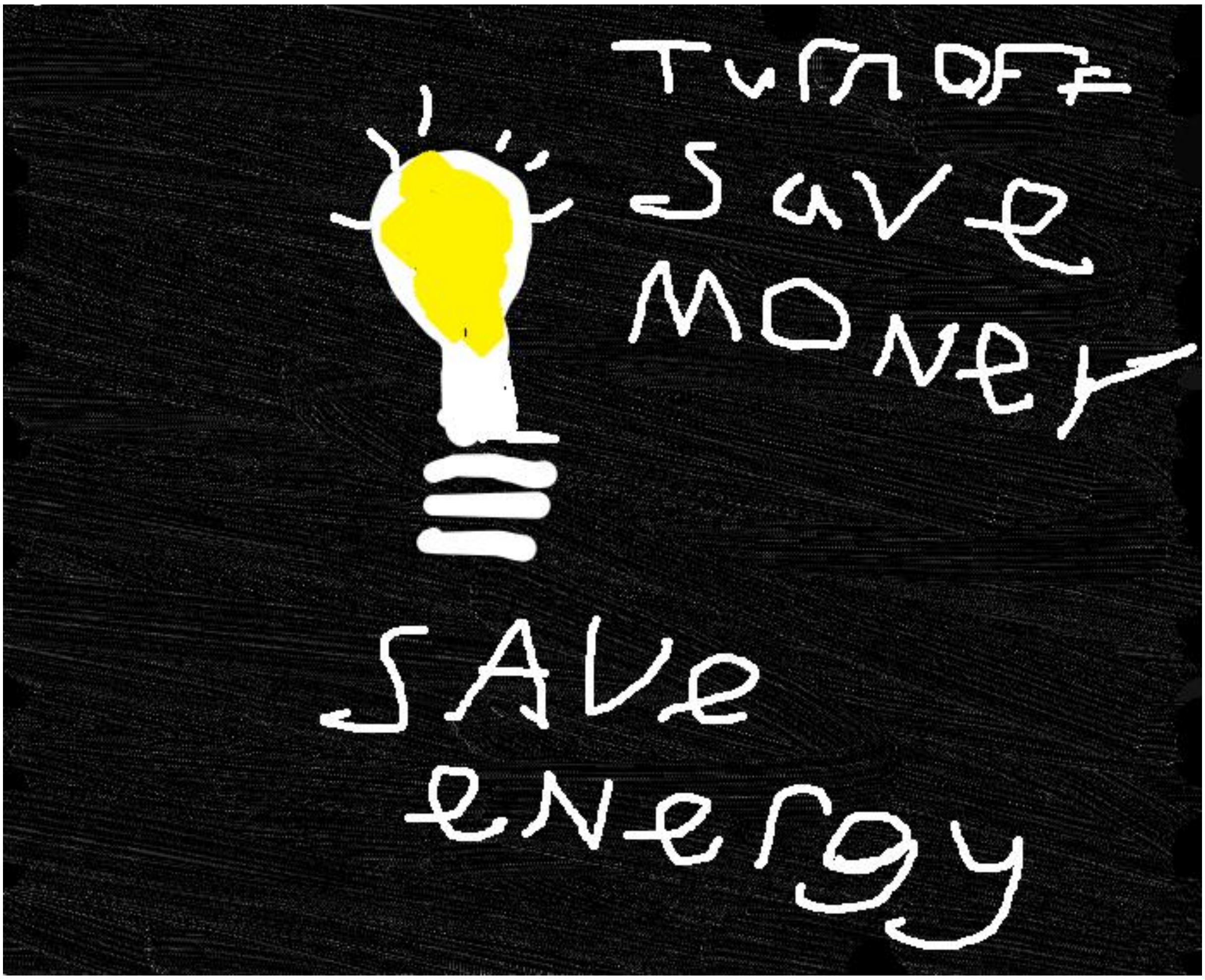


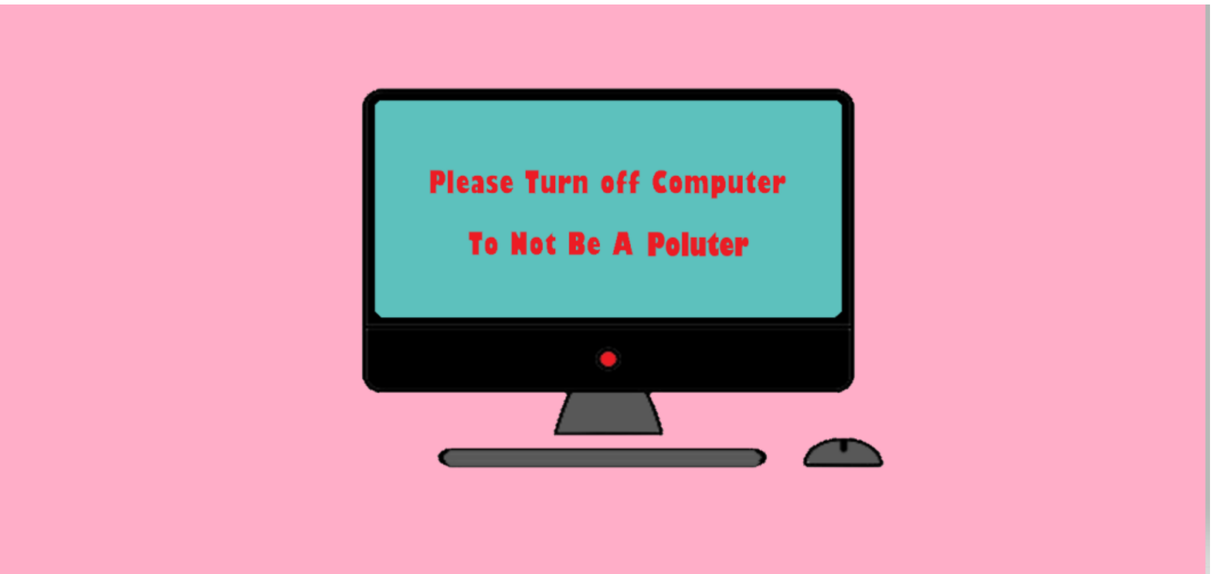
thecarbonclub

*EXAMPLE

Room	Appliance	Appliance kWh rating	No of appliances	Hours per day appliance is used	Number of Days a week appliance is used	Number of Weeks a year appliance is used	Total number of Hours a year appliance is used	Total annual kWh usage	£ cost / kWh	Total annual cost
Staff Room	Microwave	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
TOTALS		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Appendix 2: Promotional and informational material created by the Energy Team at Clonakilty Community College



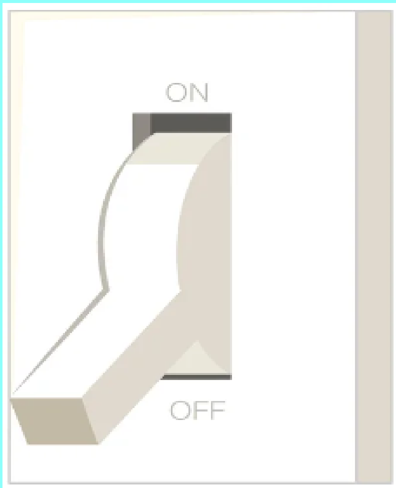


Dont leave it bright, Turn off the light!

Dont be mean save the earths really cool, and really usefull and we would all be done without it, energy!!!!

turn off the lights!
turn off the projector!
turn off the computor!
shut the door!

Turn off lights Before you go



Appendix 3: Audit challenge paper

The challenge paper can be found in the following two pages.

The Carbon Club Schools Competition - Best Energy Team Energy Audit of signification energy users (SEU's)

- **February: Best Energy Team Energy Audit of signification energy users (SEU's)**

Objective: Provide the transition year students with an insight into the amount of energy (kWs) lighting and appliances use and what the financial cost of this is.

This will be done as group projects where the students will carry out an audit in certain rooms throughout the school which will be identified by the Carbon Club closer to this challenge date. (Examples; 1) Staff room 2) It Lab, 3) Home EC room & 4) Canteen/kitchen).

An audit template will be provided by the Carbon Club to allow students to evaluate the energy consumption and cost within the selected rooms. They will then be required to make suggestions specific to their school on how they could reduce the energy consumption for these SEU's.

Potential appliances:

Staff room

- Kettle
- Toaster
- Microwave
- Toasted Sandwich maker
- Electric heater
- lights

IT Lab

- Desktop PC
- Interactive white boards
- Projector
- Electric heater
- lights

Interreg Northern Periphery and Arctic
Co-funded by the European Union

Home EC room

- Electric heater
- Lights
- Electric cooker
- Electric oven
- Kettle
- Hot plate

Canteen/kitchen

- Oven
- Kettle
- Electric cooker
- Electric heater
- Lights

Classroom

- Desktop PC
- Laptop
- Interactive white boards
- Projector
- Printer
- Electric heater
- Lights

Appendix 4: GCC Audit Report

The example for an audit report can be found on the next pages.

Watt Footprint

Energy Audit Report For:

Glanmire Community College

SESYSTEMS Energy Efficient Solutions

thecarbonclub

Notice for Applicant

This Energy Audit Report was prepared by a Registered Energy Auditor and recommends practical ways that you can improve the energy performance of your business, using information gathered from an assessment of your business's current energy performance. Please seek professional advice before undertaking any energy upgrade works.

www.wattfootprint.com

info@wattfootprint.com

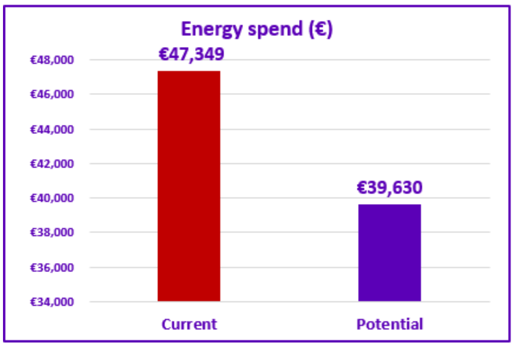
+353 87 294 8836

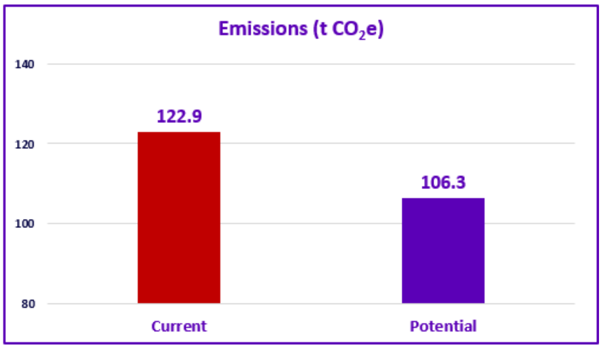
Energy Action Plan

Energy performance of your

	Current	Potential
Energy management	★★★★	★★★★★
Building fabric	★★★	★★★★★
Building services	★★★★	★★★★★
Manufacturing & processing equipment	N/A	N/A
Manufacturing & processing controls	N/A	N/A
Use of renewables	★★★	★★★★★

Compare your organisation's current and potential energy costs, before and after implementing the recommended actions identified below:





Recommended actions that will help reduce your organisation's emissions by 13.5% and annual energy spend by €7,719:

Action	Energy saving per yr (€)	Emissions reduction per yr (t CO_2e)	Cost of action (€)	Payback period (years)	First step
30 kWp Solar PV System	€ 5,088	8.57	€ 35,000	6.88	Non-Domestic Microgen Scheme
Install Additional Sub-Metering to the existing Monitoring and Targeting System	€ 2,515	7.84	€ 8,806	3.50	Communities grant
7-day Digital Timeclocks for Under-Sink Water Heater Control	€ 116	0.19	€ 750	6.47	Communities grant
Thermal Imaging Survey	Low Potential Savings	Low Potential Reductions	€ 4,000	0	Communities grant
Set up a Register of opportunities and set a formal target for Energy consumption Reduction.	High Potential Savings	High Potential reductions	€ 0	0	Energy Management Training
Purchasing only A-rated energy equipment when any of the appliances are due for replacement or upgrade	High Potential Savings	High Potential reductions	Cost May Vary	May Vary	Accelerated Capital Allowance
Upgrade existing windows to newer energy efficient equivalents	Low Potential Savings	Low Potential Reductions	850 per m^2	20+ years	Communities grant
Install additional levels of loft insulation	Low Potential Savings	Low Potential Reductions	15 per m^2	20+ years	Communities grant
Total	€ 7,719	16.60	€ 48,556		

Contents

1 Site description

This section provides an overview of your site and key information about the visit. A site tour checklist is provided in Appendix A.

Organisation name	Glanmire Community College
Site address	Brooklodge, Glanmire, Co. Cork
County	Co. Cork
Eircode	T45 W965
No. Students and Staff	1250
Is shift work carried out onsite?	No
Size of company fleet (no. of vehicles)	0
Typical operating hours per year	2,400
Sector	Education
Build date (estimate if necessary)	1990-1999
Facility owned or leased	Owned

5.1 Table 1a: Site information

Site Visit Date	06/07/2023
MPRN Number	10006709835
GPRN Number	0724769
Site Contact name	Wayne O'Donnell
Site Contact job title	Project Manager - The Carbon Club
Energy Surveyor Name	Kevin Butler
Energy Auditor Name	Paul O'Reilly
Energy Auditor company	Watt Footprint
Comments	None

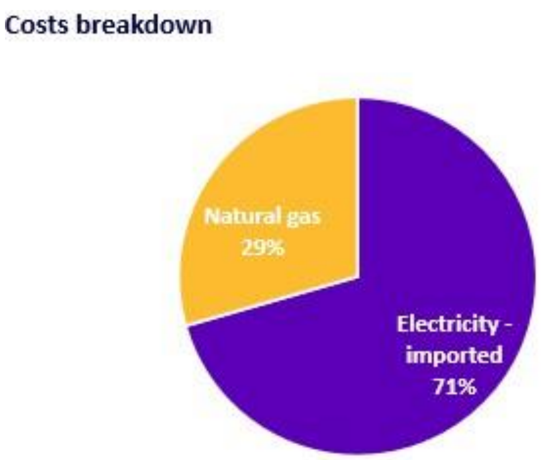
5.2 Table 1b: Visit information

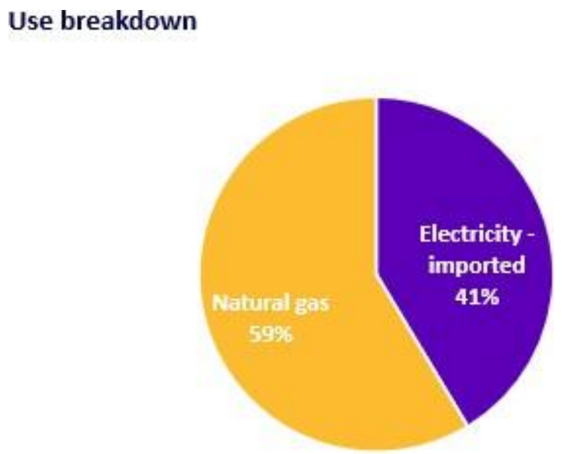
2 What fuels do you use?

A breakdown of the different types of energy used at your site is shown below in Table 2a.

		Reference year:	2022-2023	
Energy source	Annual Cost (€)	Annual Use (kWh)	Annual Emissions (t CO2e)	Information source
Electricity - imported	€ 33,413.85	199,649	64.79	Bill
Natural gas	€ 13,934.89	282,872	57.90	Bill
Total	€ 47,348.74	482,521	122.69	

Table 2a: Energy consumption onsite





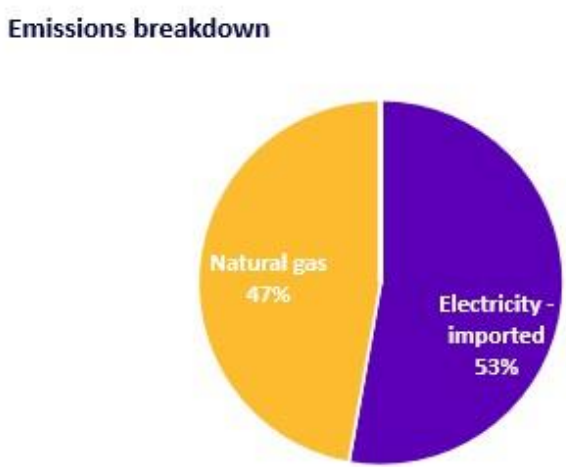


Figure 2: Breakdown of Costs, Usage and Emissions

2.1 Site energy consumption summary

Glanmire Community College has been educating the young people of Glanmire since the 1990's and additional construction works and renovations have been complete over the years including the most recent in the 2010's. Glanmire Community College receive grid supplied electricity and natural gas. Glanmire Community College are exploring options to implement several energy-saving measures and management are committed to becoming more energy efficient and reducing their carbon emissions. Grid electricity consumption can be reduced with means of self-generation and upgrades to equipment and building fabric may reduce the demand for natural gas.

Without the benefit of sub-metering information across the SEU's, it is not possible to say without absolute certainty what the complete breakdown of consumption is within the site. What follows is an estimate based on the available information combined with the considered opinions of the auditor and their experience in similar facilities. The expansion of the existing metering system to incorporate additional sub-meters in conjunction with an energy management system would allow for a greater level of precision, rather than estimation.

3 Understanding your energy bills

The auditor analysed your energy bills to determine whether there are easy changes you can make to help you save money.

	Yes/No	Comments
Is the client on an appropriate tariff/tariffs?	Yes	MCC04: Records imports of kWh for days and night times and wattless kVARh, all year.
Is max import capacity correct for client's requirements?	Yes	The current MIC remains suitable, and it has not been exceeded
Are there any other penalties?	No	None
Comment on day/night/weekend profiles		Day: 79% Night 21%
Comment on any trends or anomalies in the data		Usage drops during the summer when there are no pupils in the school. Gas usage is primarily in the winter months.
Has the client switched their electricity and/or gas contracts in the past 2 years?		Yes, the client tenders their energy bills annually.
Any other comments		*None*

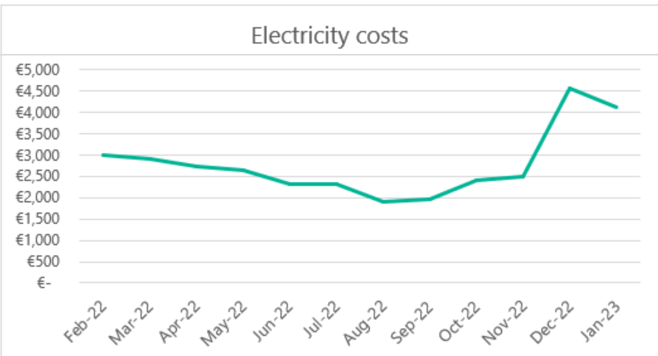
5.3 Table 3a: Energy bills analysis

3.1 Bills analysis summary

It appears the client is on the correct tariff and MIC from the bills analysis. It is recommended that they continue to tender their energy bills on an annual basis. Start this process ahead of contract expiry date to find the best deal as many providers will give discounts for new customers.

3.2 Monthly trends in energy use

Your energy use may change over the course of the year, for example your use of heating fuel may be higher in the winter months. Figure 3a shows the trends in cost for Electricity and Gas.



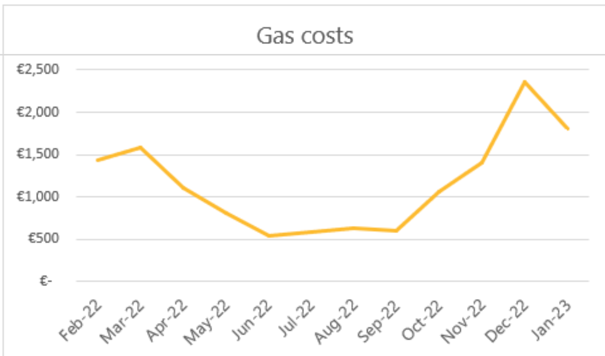
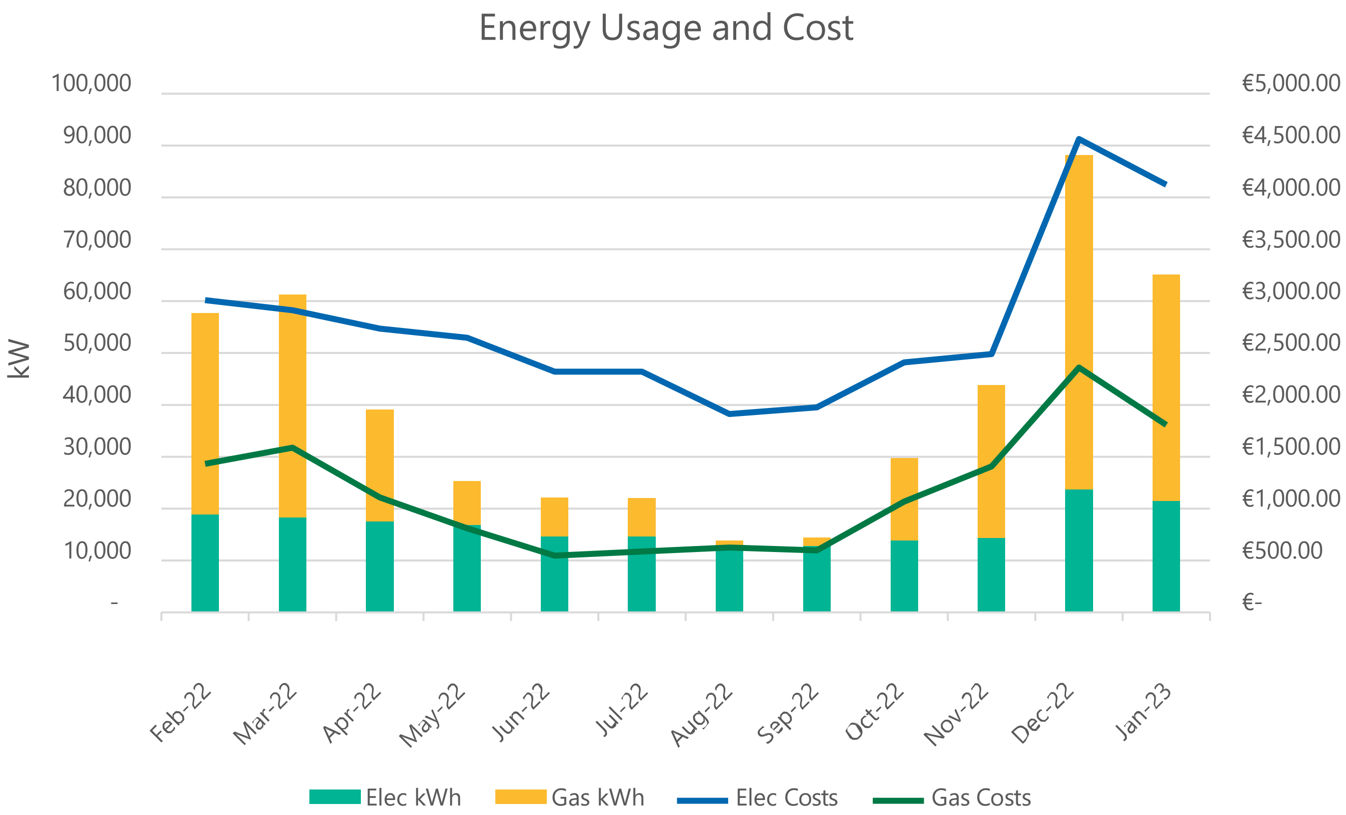


Figure 3a: Monthly trends in energy use

3.3 Monthly trends summary

Electricity and gas usage were highest during the winter months due to the increased demand in lighting and heating. Summer months had little activity as the occupancy levels dramatically dropped between June and September. Cost remained proportional to the usage levels throughout the analysis period.



4 Electricity, heat and transport

The most significant electricity, thermal (heat) and transport energy users at your site have been identified and are listed below.

Energy User	Cost per yr (€)	Usage per yr (kWh)	Usage (% of total)	Emissions per yr (t CO2e)	
Lighting	€ 11,016	65,684	32.8%	21.31	LEDs throughout the school with sensors and timers
Computer Systems	€ 11,789	70,290	35.1%	22.81	Computers in classrooms and offices
Specialty Equipment	€ 5,273	31,440	15.7%	10.20	Equipment in practical rooms and sports hall
Pumps	€ 1,948	11,615	5.8%	3.77	Variety of space heating, HVAC and water distribution pumps throughout the school boiler rooms with VSD controls
Small Power Appliances	€ 3,224	19,225	9.6%	6.24	Socket Appliances and lifts
Immersion Heaters	€ 336	2,003	1.0%	0.65	3no. Under sink water heaters
Total	**€ 33,586**	**200,256**	**100%**	**64.98**	

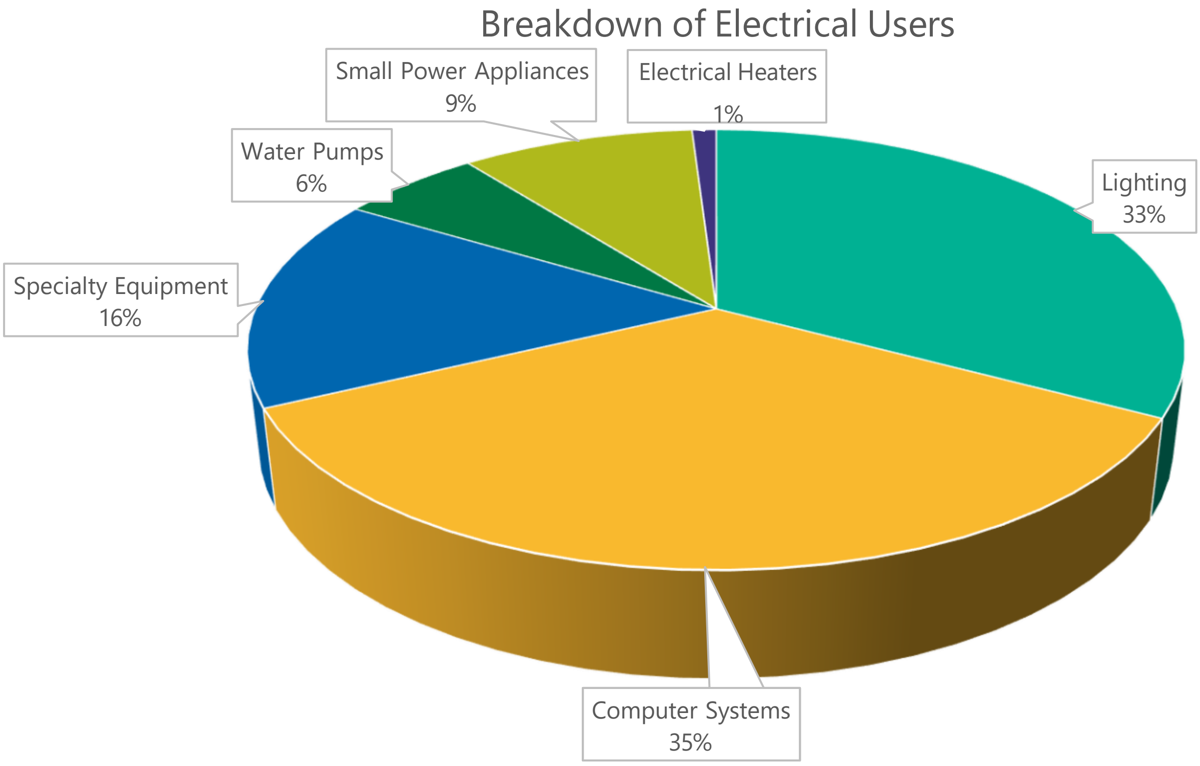
5.4 Table 4a: Significant Electrical Energy Users

Energy User	Cost per yr (€)	Usage per yr (kWh)	Usage (% of total)	Energy source	Emissions per yr (t CO2e)
1no. 300kW De Dietrich, 1no. 410kW Hogfros, 3no. Cascading 60kW Immergas Boilers and 1no. 150kW ACV	€ 13,934.89	282,872	100.0%	Natural gas	57.90
Total	**€ 13,934.89**	**282,872**	**100%**		**57.90**

5.5 Table 4b: Significant Thermal Energy Users

4.1 Where is your money going?

The following breakdown is focused on the electricity users within the facility from the data in Table 4a. Some of the data may be under/overestimated but nonetheless, this is a useful means to analyse the main areas savings can be made. Exact impacts of savings cannot be made until an accurate metering system is in place for the equipment. When it is better known what the breakdown of use is, it becomes easier to establish targets for energy reduction and to monitor the progress of any energy savings measures that are implemented.



5 Energy Management

The aim of Energy Management is to reduce energy use and improve energy efficiency. A structured approach to energy management that includes every aspect of an organisation – including finance, human resources, maintenance, purchasing and planning – is more likely to achieve significant, long-term savings than an unstructured, ad hoc approach.

An "energy management diagnostic" was carried out at your site. The purpose of the diagnostic is to assess your organisation's
approach to energy management, looking at 6 aspects of energy management and ranking each on a scale from 0 – 4.

Aspect of Energy Management	Description	Your score
Energy Policy	Whether your business has an energy policy, and the level of commitment to it	4
Organisation	The extent to which energy management is supported by senior management	3
Communication	How, and how often, staff are informed about energy issues	3
Information systems	How your business monitors energy consumption	2
Marketing	How staff are made aware of the benefits of energy management	4
Investment	How your business makes decisions around investing in energy efficiency	3

5.6 Figure 5a: Energy management scores

To view the complete diagnostic showing the various levels, please refer to Appendix B.

5.1 Site Energy Management Summary

The strength of the school's current energy management plan lies within the upper levels of management and their dedication to improving the facilities to become more energy efficient. This is seen through the investment the school's management are willing to make for future improvements highlights their commitment to improving the building's energy usage and reducing the carbon footprint of the facility. The most obvious step management have taken has been to work with The Carbon Club, a not-for-profit organisation, who aim to educate and empower young students to reduce their energy consumption and carbon emissions. This work has involved the school participating in The Carbon Club's inaugural Schools Competition against nine other schools to see who can save the most kilowatts of energy and reduce their carbon emissions. This was measured by installing a high-level energy metering system on the mains electrical boards.

The weak point, or gap left, in the school's energy management plan is a lack of a breakdown in energy consumption. This is why sub-metering is a recommended upgrade that can reduce energy consumption by approximately 5% to 10% across the site and combined with a meter on their boilers to track the fossil fuels, the school would have a complete overview of all energy consumers on site. Coupling this additional sub-metering system with the existing BMS would give greater understanding and control to management over the school's usage of energy.

The most obvious target for energy reduction is to raise awareness amongst the people that operate the main energy users and are drivers for energy usage on site, in matters relating to good practice around energy management. Without further monitoring and breakdown in consumption it is difficult to say how much energy each area consumes, but individual users should be tasked with reducing consumption in the areas not in use by ensuring all equipment is turned off when not needed. This low-cost method would effectively achieve the same as an implementation of controls but without the capital cost. As many services are essential, user reductions will only make a limited impact. This idea has been regularly reinforced by the school staff with the help of The Carbon Club's live energy consumption visuals.

6.2 Recommended actions to save energy

Your Auditor reviewed potential actions that your organisation can take to improve energy efficiency and generate renewable energy at your facility (specifically, through heat pumps, biomass, and photovoltaics). A list of actions is provided in Table 6a. Many organisations are interested in opportunities for generating renewable energy. a summary of your facility's suitability for both renewable heating and renewable electricity (solar) is provided below and in Appendices D and E.

6.2a Renewable Energy – heating

SEAI's Support Scheme for Renewable Heat supports renewable heating in businesses by offering a grant for heat pumps and a tariff for biomass/biogas boilers and CHP. As part of this audit, the auditor assessed your facility's suitability for converting to renewable heat. A summary of this assessment is provided below. The complete renewable heat assessment tool may be found in Appendix D.

Summary of facility's suitability for renewable heat:

Overall suitability of the facility for renewable heat.	A heat pump system can offer an alternative to the fossil fuel powered systems currently in place. It has not been recommended as many of the current boilers are condensing and relatively modern. Based on a whole system approach, it is not financially feasible to replace them currently.

Impact of Renewable Heat:

If facility is suitable for renewable heat:	
Estimated annual kWh savings	198,010
Type of energy saved	Natural gas
Estimated emissions saved (tCO2e)	40.53

5.7 Table 6b: Impact of Renewable Heat

6.2b Renewable Energy – photovoltaics (solar)

Photovoltaics generate electricity using solar energy from the sun, providing a completely renewable, clean source of electrical energy. As part of this audit, the auditor assessed your facility's suitability for generating electricity from solar energy. A summary of this assessment is provided below. The complete photovoltaic assessment tool may be found in Appendix E.

Summary of facility's suitability for photovoltaics:

Overall suitability of the facility for solar PV	There are multiple suitable roof spaces that can be used for solar PV which would contribute to reducing the amount of electricity demanded from the grid and would reduce the carbon footprint of the school.

Impact of Renewable Energy:

If facility is suitable for Solar PV:	
Estimated annual kWh savings	26,400
Estimated emissions saved (tCO2e)	8.57

5.8 Table 6c: Impact of Solar PV

6.3 Recommended actions

Your auditor has identified the top actions you should you take to improve the energy efficiency of your site and save on your energy costs. These actions are listed in Table 6c below.

Description	Energy savings (kWh per yr)	Type of energy saved	Cost savings (€ per yr)	Emissions reduction (t CO2e per yr)	Estimated cost of action (€)	Payback period (years)	Potential supports	Comments / Additional info
30 kWp Solar PV System	26,400	Electricity - imported	€ 5,088	8.57	€ 35,000	6.88	Non-Domestic Microgen scheme	The site is a considerable user of electricity, a suitable space exists on the facility roof area to implement solar PV with appropriate tilt angle, orientation and levels of shading. Non-Domestic Microgen Scheme | SEAI
Install Additional Sub-Metering to the existing Monitoring and Targeting System	24,157	Electricity - imported And Natural gas	€ 2,515	12.28	€ 8,806	3.50	Communities grant	Monitoring and Targeting is the cornerstone of any energy management programme or system and can help achieve the savings objectives identified in this report. Monitoring can save about 5% of energy bill annually. Additional sub-metering to the existing M&T system, would allow the school to see in detail the energy use of lights, boilers, equipment etc and allow management to take appropriate actions. Grants For Sustainable Community Projects | SEAI
7-day Digital Timeclocks for Under-Sink Water Heater Control	600	Electricity - imported	€ 116	0.19	€ 750	6.47	Communities grant	Installing 7-day digital timeclocks would reduce the standing losses of each of the under-sink water heaters during the evenings and weekend when there would be zero usage. Grants For Sustainable Community Projects | SEAI

Energy Audit

Thermal Imaging Survey	Low Potentia l Savings	Natura l gas	Low Potential Savings	Low Potential Reductions	€ 4,000	0	Communities grant	Upgrading the building fabric would reduce the demand on the boiler/electrical means of heating. The cost and payback are variable depending on the required upgrades to the various building fabrics that require attention. A thermal imaging survey is the first step to identify the required upgrades to fabric to improve the buildings overall energy performance. Grants For Sustainable Community Projects | SEAI

Set up a Register of opportunities and set a formal target for Energy consumption Reduction.	High Potential Savings	Natural gas	High Potential Savings	High Potential Reductions	€ 0	0	Energy Management Training	Use this Register of Opportunities as a starting point. Ask all staff for their ideas and circulate to all staff when complete. Update the register on an on-going basis and communicate progress to all staff. [Energy Efficiency Training for SMEs | Business | SEAI]
Purchasing only A-rated energy equipment when any of the appliances are due for replacement or upgrade	High Potential Savings	Natural gas	High Potential Savings	High Potential Reductions	Cost May Vary	May Vary	Accelerated Capital Allowance	Modern, energy efficient equipment can often be worth the investment when considering the life-cycle costs. [Accelerated Capital Allowance | Business Grants | SEAI]
Upgrade existing windows to newer energy efficient equivalents	Low Potential Savings	Natural gas	Low Potential Savings	Low Potential Reductions	€850 per m^2	20+ years	Communities grant	Upgrading the building windows would reduce the demand on the boiler/electrical means of heating. The payback is expected to be a long period of time due to fabric savings being difficult to quantify without using simulation tools. There would be immediate improvements to comfort levels for students. [Grants For Sustainable Community Projects | SEAI]
Install additional levels of loft insulation	Low Potential Savings	Natural gas	Low Potential Savings	Low Potential Reductions	€15 per m^2	20+ years	Communities grant	Upgrading the building insulation levels would reduce the demand on the boiler/electrical means of heating. The payback is expected to be a long period of time due to fabric savings being difficult to quantify without using simulation tools. There would be immediate improvements to comfort levels for students. [Grants For Sustainable Community Projects | SEAI]

5.9 Table 6d: Recommended actions

6 Appendix A – Site tour checklist

The table below shows which areas of your site the auditor checked on during the site visit.

	Yes	No	N/A	Observations & Comments
Physical Condition of Building(s)	☑	☐	☐	Building was in good condition
Insulation of Walls, Roofs	☑	☐	☐	Upgrades needed to loft insulation.
Windows and external doors	☑	☐	☐	Upgrades needed to aluminium windows
Space Heating	☑	☐	☐	Served by various natural gas boilers
Water Heating	☑	☐	☐	Served by various natural gas boilers
Heating Controls	☑	☐	☐	Variety of boilers controlled by zonal thermostats
ICT & office equipment	☑	☐	☐	Variety of computers throughout the school
Ventilation & Air Conditioning	☐	☐	☑	N/A
Lighting	☑	☐	☐	LEDs with sensors and timers
Refrigeration & Cooling	☐	☐	☑	N/A
Compressed air	☐	☐	☑	N/A
Pumps	☑	☐	☐	Space heating water distribution pumps
Industrial processes	☐	☐	☑	N/A
Transport	☐	☐	☑	N/A
Evidence of Energy Awareness (posters etc.)	☑	☐	☐	Greenflag campaigns and related material

7 Appendix B – Benchmarking

The table below provides a benchmark of your organisation performance against a range of energy performance metrics, with scores against each for your current and potential. The "potential" score is based on implementation of all the recommendations identified in this report.

	★ Very Poor	★★ Poor	★★★ Satisfactory	★★★★ Good	★★★★★ Excellent	Current score	Potential score
1. Energy Management	0 - 5	6 - 10	11 - 15	16 - 20	21 +	★★★★	★★★★★
2. Building fabric for areas with space heating	Uninsulated, single glazing Typical of BER F-G	No or partial insulation, single or poor double glazing Typical of BER D-E	Minimal insulation and double glazing Typical of BER C-D	High levels of insulation and high performing glazing Typical of BER B	NZEB equivalent building fabric Typical of BER A-B	★★★	★★★★★
3. Building services for areas with space heating	Low efficiency heating with minimal controls Very low efficiency lighting (T8s, T12s or incandescent) Typical of BER F-G	10+ year old oil or gas heating Low efficiency lighting (T5s or T8s) Typical of BER D-E	Modern <10 year old oil or gas heating with good heating controls/BEMs Efficienct lighting (LEDs or high efficiency T5s) Typical of BER C-D	New <5 year old condensing heating with modern controls and zoning High efficiency lighting (LEDs) Typical of BER B	Significant (>60%) space heating supplied by renewable heat with advanced heating controls High efficiency lighting (LEDs) with controls Typical of BER A-B	★★★★	★★★★★
4. Significant energy using equipment for manufacturing, processing, production etc.	Low efficiency, older equipment Heavy dependence on fossil fuels in production Evidence of poor operational control and energy wastage	Some lower efficiency equipment in use Medium dependence on fossil fuels	Modern, but not best in class equipment Some dependence on fossil fuels	Modern, best in class equipment Strong use of monitoring and automation Minor dependence on fossil fuels	Modern, best in class, equipment Heavy use of advanced monitoring, automation and energy saving techniques Minimal dependence on fossil fuels	N/A	N/A
5. Control and monitoring For manufacturing, processing, production etc.	No evidence of control or monitoring of equipment	Minimal control or optimisation at a local, but not centralised, level	Good level of control and optimisation in place, ideally centralised Minimal level of data analytics and performance indicators such as weekly reports	Centralised control and optimisation Good level of data analytics and performance indicators	Modern, best in class, centralised monitoring and control Heavy use of data analytics and performance indicators	N/A	N/A
6. Use of renewable energy	Zero use of renewable energy throughout the facility	Minimal use of renewable energy through green electricity purchasing etc.	Some use of renewable energy such as green electricity purchasing, renewable heat or renewable electricity production	Significant use (20%+ of total energy) of renewable energy via renewable heat or renewable electricity production	Best in class use (50%+ of total energy) of renewable energy via renewable heat or renewable electricity production	★★★	★★★★★

8 Appendix C – Energy Management matrix

The matrix below shows you how to interpret your Energy Management score. The Scores run from 0 to 4, where 4 is the best. Your facility was assessed according to the 6 aspects of energy management listed across the top. Use this matrix to see what you need to do to improve your Energy Management score.

Energy Management: Definitions of scores						
	Energy Policy	Organising	Communication	Information Systems	Marketing	Investment
4	Top management are actively committed to energy policy, action plan and regular review.	Energy management fully integrated into management structure.	Formal and informal channels of communication regularly at all levels in the organisation.	Comprehensive system sets targets, monitors consumption, identifies faults and quantifies savings.	Routine marketing of the value of energy efficiency and CO2 reduction internally and externally	Positive discrimination towards 'green' schemes; detailed appraisal, inc. energy, of all investment opportunities.
3	No active commitment from top management, but formal energy policy in place.	Energy committee representing all users in place, chaired by a member of the managing board.	Energy committee used as main communication channel with direct contact with major users.	Routine M&T reports for individual users based on sub-metering.	Programme of staff awareness and regular publicity campaigns.	Same pay back criteria employed as for all other investment.
2	Energy manager or senior departmental manager have set an un-adopted energy policy.	Energy manager in post, reporting to ad-hoc committee	Contact with major users takes place through ad-hoc committee.	Monitoring and targeting reports based on supply meter data. Energy unit has ad-hoc involvement in budget setting.	Some ad-hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten set of guidelines	Energy management is a part-time responsibility along with other responsibilities	Informal energy communication contacts between a few users.	Cost reporting based on invoice data for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low cost measures taken.
0	No explicit policy	No energy management or 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.

9 Appendix D – Renewable Heat Assessment

	Result	Comments
Is the client using fossil fuel for heating purposes?	Yes	Uses Natural Gas for heating purposes.
Suitability for heat pump		
Could a heat pump offer an alternative? e.g. does the facility have a steady low/medium heating requirement?	Yes	A heat pump system could replace many of the old boilers and lower the carbon footprint of the school.
o If yes for space heating: Is it likely that the building will achieve the required U values for a heat pump to operate effectively?	No	Upgrades would be required to the old windows and to the loft insulation.
o If yes for space heating: What fabric and ventilation upgrades may be required? If "Other" please specify in Comments	Other	Upgrades would be required to the old windows and to the loft insulation.
Rank heat pump readiness for space heating: 1 - major upgrades required to all/most building elements, 2- major upgrades required to one building element, 3 - minor upgrades required to all/most building elements, 4 - minor upgrade required to one building element, 5 - heat pump ready	1	Upgrades would be required to the old windows and to the loft insulation.
o If yes for process heating: Is it likely that a heat pump could deliver the heat requirement?	N/A	N/A
Estimate of emissions reduction for heat pump conversion	40.53 tCO_2e	Based on the assumption that all provided electricity was renewably sourced.

Suitability for biomass		
Could biomass/biogas offer an alternative? i.e. does the facility have high peak loads?	No	Heating load is medium and is not consistent enough for a biomass boiler.
o If yes, are there any space constraints, e.g. for the boiler/CHP unit, and the delivery and/or storage of fuel? If "other" please specify in comments	N/A - biomass not suitable	N/A
o If yes, are there any local supply of waste biomass or local biomass enterprises that can provide fuel stock? Please specify in comments	N/A	N/A
o If yes, are there dedicated maintenance personnel on site?	N/A	N/A

10 Appendix E – Solar photovoltaic assessment

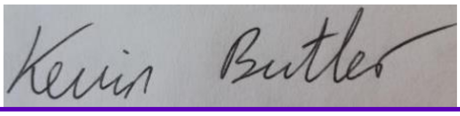
Suitability for solar PV	Result	Comments
Does the client use electricity from non-renewable sources?	Yes	Grid supplied electricity.
Does the client appear to have a suitable roof for the installation of solar photovoltaic panels? Consider size, tilt angle, orientation and shading.	Yes	There are multiple roof spaces with various tilt angle and orientation. There is little to no shading on many roof tops.
If the roof is not suitable, is there an alternative location available?	No	The site is in an urban setting
If solar PV is feasible, what is the client's estimated required power output?	25 kWp	Based on the monthly usage data from the bills analysis. 30 kWp has been recommended to account for inefficiencies and a larger system has not been recommended due to the reduction in usage during the summer months.
Estimate the proportion of the client's electricity requirements that could be met through installing solar PV	< 25%	Approx. 13% of overall usage.

11 Appendix F – Glossary of terms

Term	Definition
biogas	Biogas is a form of renewable energy. Biogas is produced through the anaerobic digestion or fermentation of organic feedstocks including biomass, sewage and agricultural and municipal wastes. The biogas can then be burnt as a renewable fuel.
biomass	Biomass fuel is a form of renewable energy generated from burning organic material such as wood, poultry litter, and straw
CHP	Combined Heat and Power: an energy efficient way to generate electricity whilst capturing and using the heat that would otherwise be wasted.
CO_2e	Carbon dioxide equivalent: a standard unit for measuring emissions by expressing the impact of all greenhouse gases (including carbon dioxide, methane and nitrous oxide) in terms of the amount of carbon dioxide that would create the same amount of atmospheric warming
electricity imported	Electricity that has been generated offsite for use at your facility
energy efficiency	Using less energy to perform the same task, i.e. reducing energy waste
fossil fuel	Carbon-based fuels from fossil hydrocarbon deposits, including coal, peat, oil, and natural gas. Fossil fuels produce carbon dioxide (CO_2) when burned, which is a greenhouse gas
GPRN	Gas Point Registration Number (GPRN): a unique reference number assigned to every gas point on the natural gas network. A gas point is a point where gas is taken from the gas network system, measured by a meter and consumed by an end user. Each individual gas point has its own GPRN. GPRNs have up to 7 digits.
heat pump	Electrical devices which convert energy from the air outside of your home into useful heat, in the same way a fridge extracts heat from its inside. Different types of heat pump draw heat from different sources: air, water or the ground.
kWh	Kilowatt hour: a unit of energy, equivalent to operating a 1,000-watt appliance running for one hour.
LPG	Liquefied Petroleum Gas is manufactured in oil refining, crude oil stabilisation and natural gas processing plants and consists of propane and/or butane gases. Typically used in boilers and for cooking.
Maximum Import Capacity (MIC)	The upper limit on the total electrical demand that a consumer can place on the network system.
MPRN	A Meter Point Reference Number (MPRN) is a unique 11-digit number assigned to every single electricity connection and meter in the country. Each individual meter has its own MPRN.
natural gas	Natural gas is a naturally occurring fossil fuel that is composed mainly of methane. It is piped through a national gas transmission & distribution network (in gaseous form, under pressure) directly to end users in the industrial, power generation, services and domestic sectors.
renewable energy	Energy from renewable non-fossil fuel sources, e.g. wind, solar (both solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, and biogas
solar photovoltaics	Also called "solar PV", solar panels that generate electricity when exposed to sunlight

thermal energy	Thermal energy refers to all solid, liquid and gas fuels used for non-transport purposes. This includes both fossil and renewable fuels used in boilers, space & process heating systems, catering, fuel-based electricity generators (onsite), CHP and in all plant, equipment & other non-road mobile vehicles.

12 Appendix G – Auditor Declaration

Auditor declaration	
By signing this Completion of Works, the undersigned states that: • The information provided in this Energy Audit is true and correct to the best of my knowledge.	
Signed	
Date	29/08/2023
Name	Kevin Butler
Signed	
Date	29/08/2023
Name	Paul O'Reilly
Date site visit was carried out	06/07/2023

12.1 Notice for Applicants

Applicants please note:
This document was prepared by a Registered Energy Auditor and recommends practical ways that you can improve the energy performance of your business, using information gathered from an assessment of your business's current energy performance. Please seek professional advice before undertaking any energy upgrade works.

Appendix 5: Template for the solar photovoltaic report

The template can be soon on the following three pages.

thecarbonclub

School Name

Report Title

Student Name 1
Student Name 2
Student Name 3
Student Name

Funded by
European Union

Headings 1

In this part, we want you to explain the technology in a short and simple way that anyone can understand, even if they haven't studied it before. The idea is to give a basic understanding without making it too complicated or long.

Your team should come up with a good **heading** too; here are some examples:

- What is Solar Photovoltaic (PV)?
- Introduction to Solar Energy and Solar PV

Heading 2

Compare the pros and cons of installing a Solar PV system in your school. Put them side by side and briefly explain each.

Pros	Cons

Heading 3

In this section, we want you to include the goals for this project. What are you trying to achieve? What do you need to do to make sure you achieve the goals? Choose two of the below options and write a short paragraph explaining these goals.

- Reduce the school's carbon footprint.
- Save electricity bills with Solar PV system.
- Minimum space for the installation
- Health and Safety when installing the system.
- Improve the aesthetic appearance of the school.

Interreg Co-funded by the European Union
Northern Periphery and Arctic

PV System Design

In this section you will be required to do your best at designing a suitable Solar PV System for your school. Please use the below headings when carrying out your design. A guidance document has also been provided.

1. Size of your Solar PV system
2. Solar PV panel wattage
3. Number of Solar PV panels and their surface area.
4. Location to install your Solar PV system, (rooftop, field, etc)
5. Where to locate the inverter?

Show pictures, calculation work and explain your choices.

Conclusion

Did you reach the goals you set earlier in the report? What did you learn from this project? (Please write a short paragraph.)

Appendix 6: Photovoltaic design guides

The design guides contain the technical details of all the schools and supported the Energy Teams in their work. They can be found in the following thirty pages.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%
Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

Electricity needed from *PV* system *per day* (kWh/day) = 36.5MW ÷ 365 = 0.1MW = 100kW

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

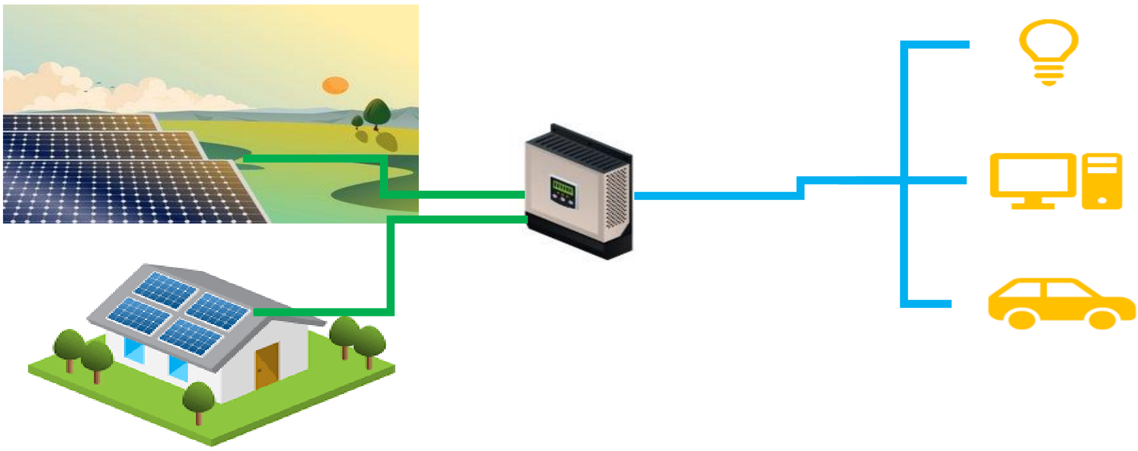
Figure 1 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 2 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

You can provide extra drawings or plots to support your design. E.g.,

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

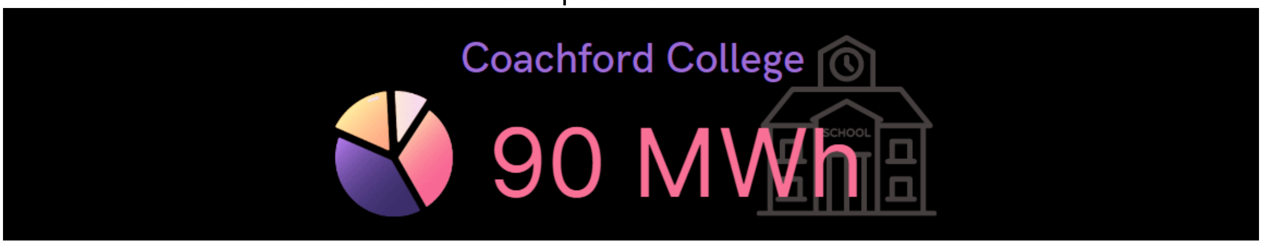
Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:



Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr)* *= 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

Electricity needed from PV system per day (kWh/day) = 36.5MW ÷ 365 = 0.1MW = 100kW

PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

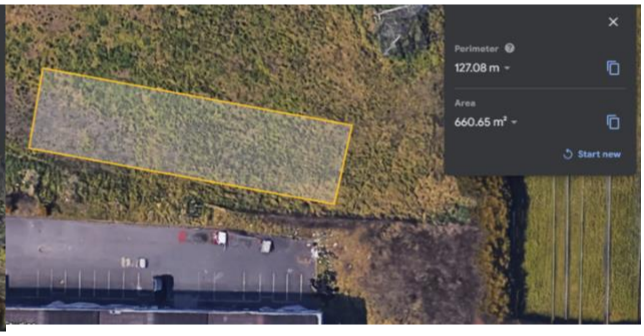
Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:



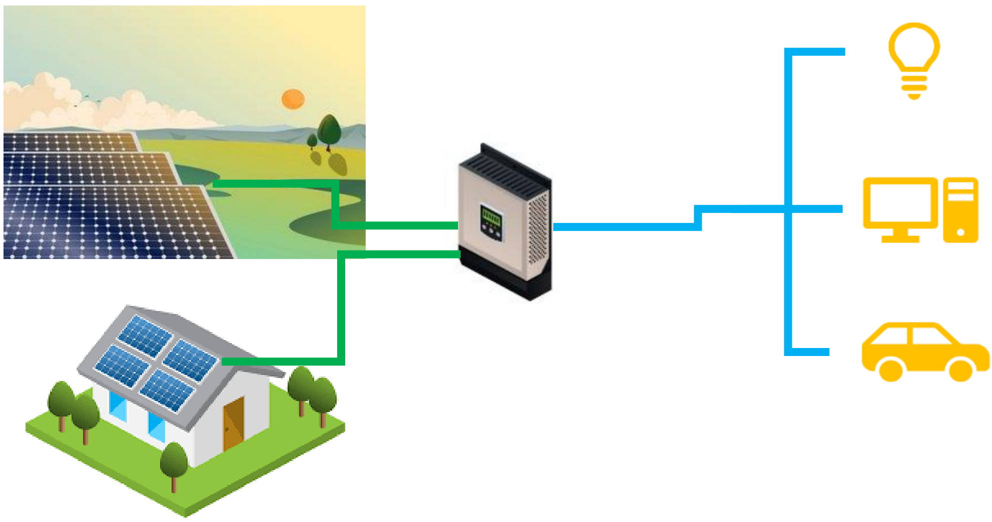
You can provide extra drawings or plots to support your design. E.g.,

Figure 3 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 4 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* = *36.5MW ÷ 365* = *0.1MW* = *100kW*

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Interreg Co-funded by the European Union
Northern Periphery and Arctic

Example:

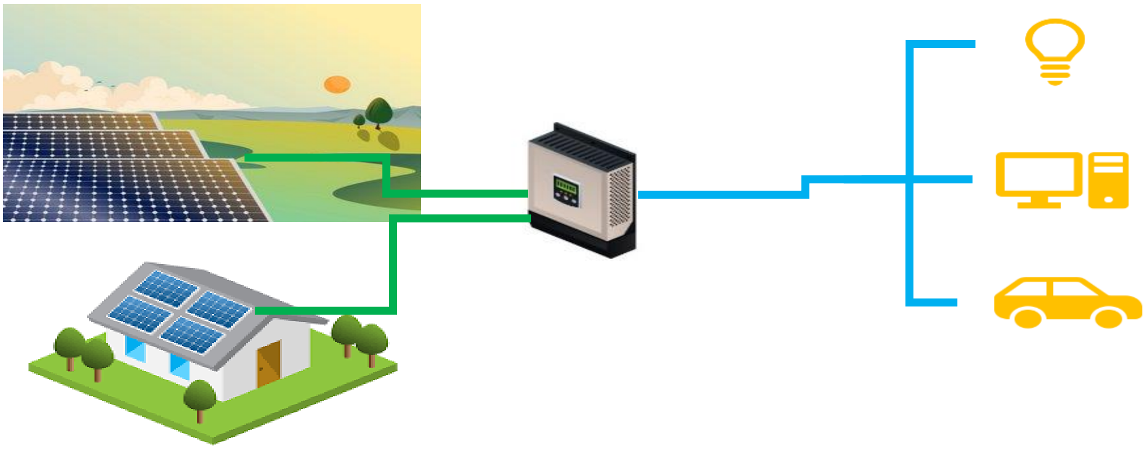
Figure 6 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 5 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

You can provide extra drawings or plots to support your design. E.g.,

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

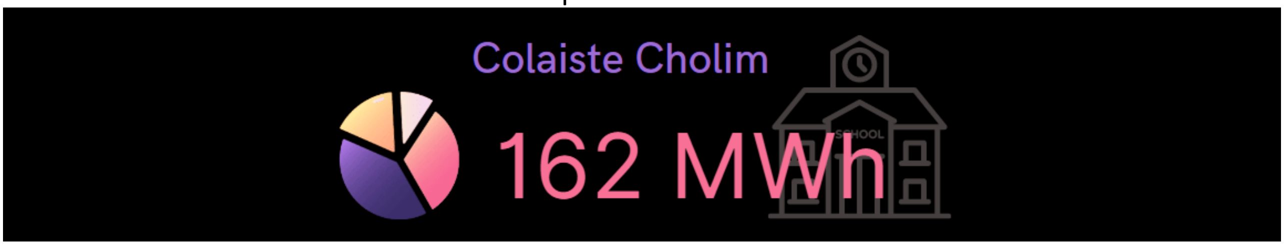
Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:



Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* *= 36.5MW ÷ 365* *= 0.1MW* *= 100kW*

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

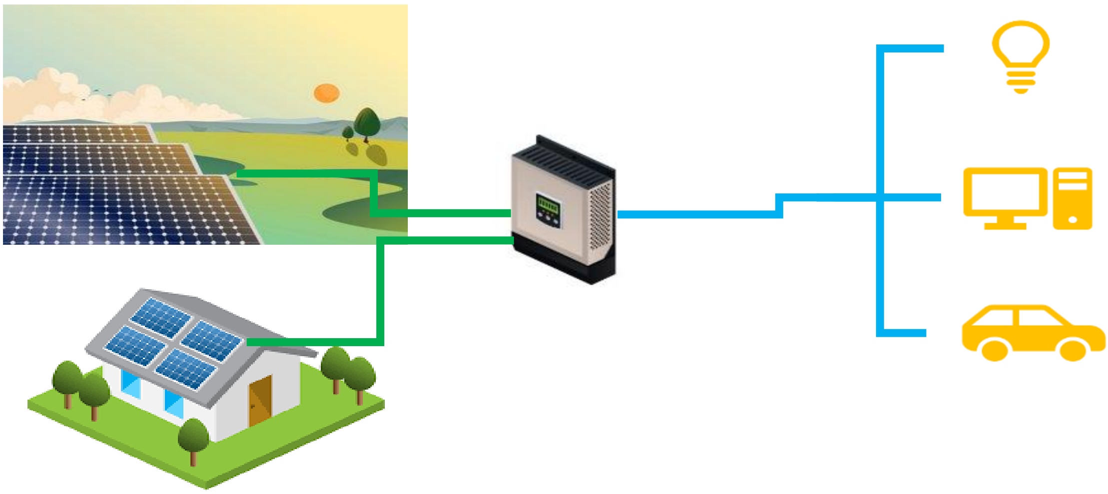
You can provide extra drawings or plots to support your design. E.g.,

Figure 7 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 8 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

5. here to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

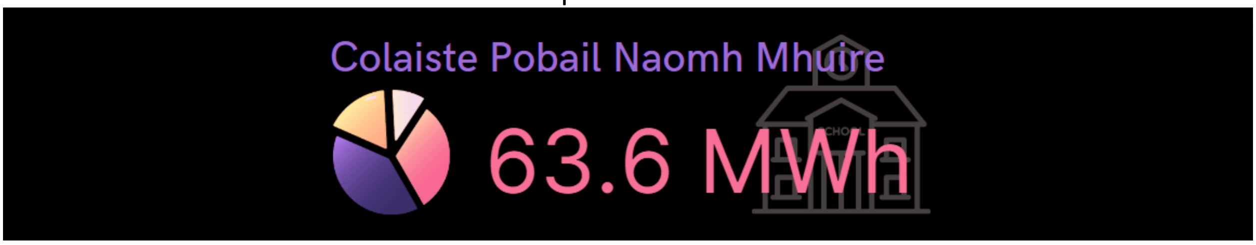
Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:



Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr)   = 182.5MWh/yr × 20%   = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* *= 36.5MW ÷ 365* *= 0.1MW*
= 100kW

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= 660m^2

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

Figure 9 shows side view of area for PV installation. Screenshotted from Google Earth

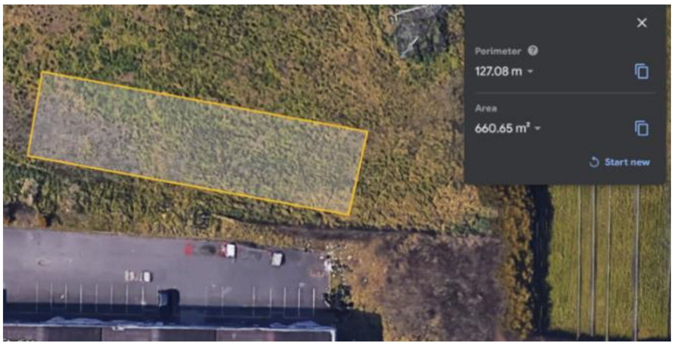
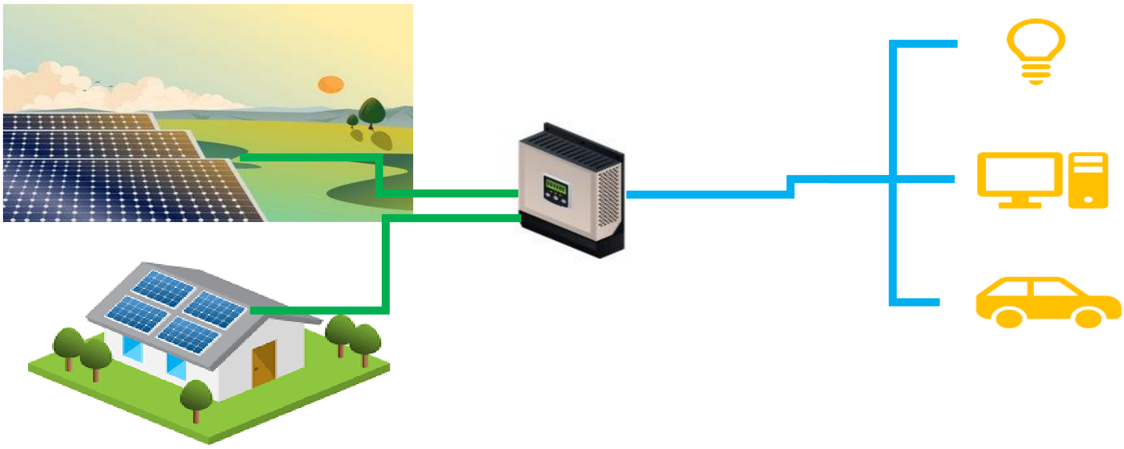


Figure 10 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

You can provide extra drawings or plots to support your design. E.g.,

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* *= 36.5MW ÷ 365* *= 0.1MW* *= 100kW*

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

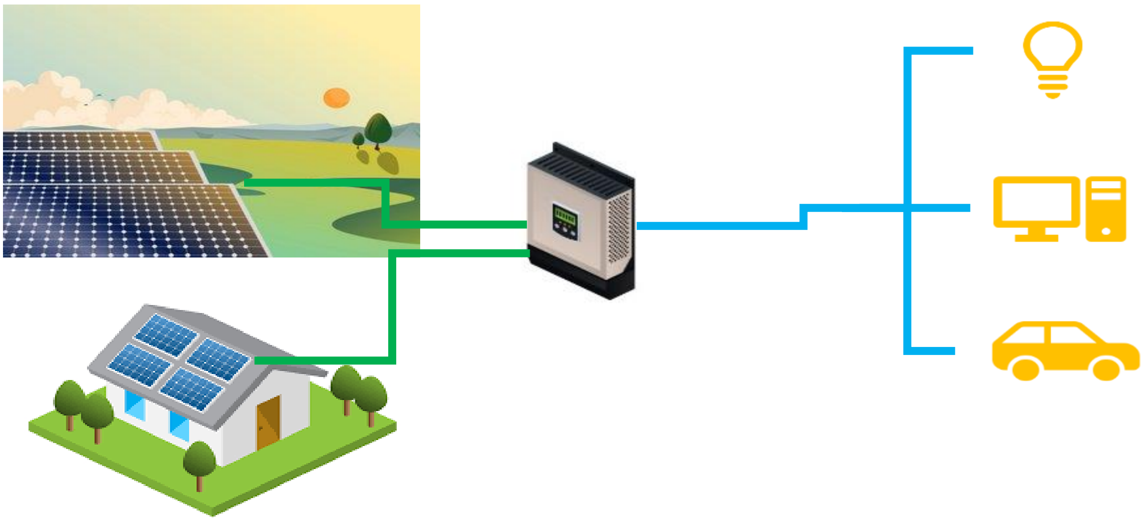
You can provide extra drawings or plots to support your design. E.g.,

Figure 11 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 12 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

5. here to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

Electricity needed from PV system per day (kWh/day) = 36.5MW ÷ 365 = 0.1MW = 100kW

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= 660m^2

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

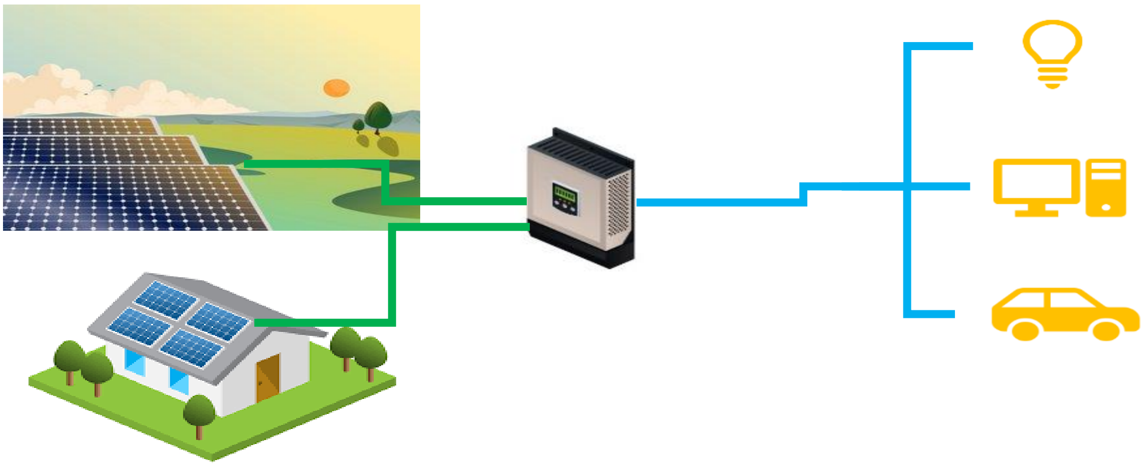
Figure 13 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 14 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

You can provide extra drawings or plots to support your design. E.g.,

5. here to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school’s total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* *= 36.5MW ÷ 365* *= 0.1MW*
= 100kW

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

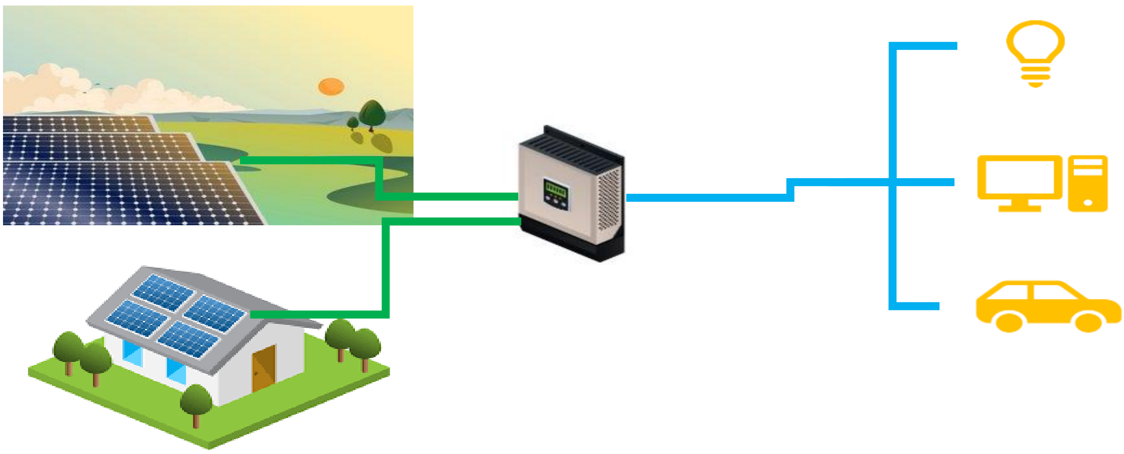
Figure 15 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 16 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

You can provide extra drawings or plots to support your design. E.g.,

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school's total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

***Electricity** needed from **PV** system **per day** (kWh/day)* *= 36.5MW ÷ 365* *= 0.1MW*
= 100kW

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= $660m^2$

4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:

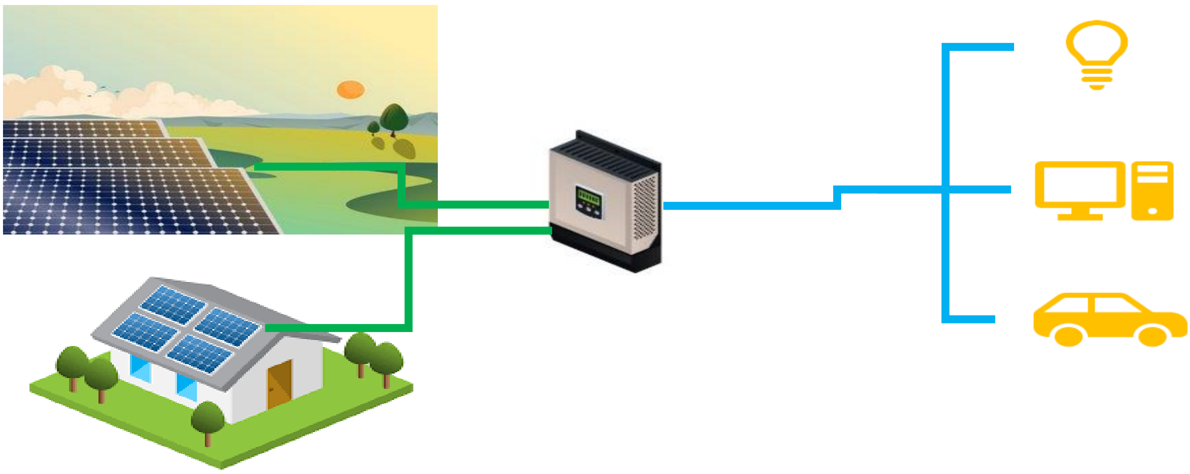
You can provide extra drawings or plots to support your design. E.g.,

Figure 17 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 18 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

How to design a PV system:

Assumption:

- Electrical output of the PV panel is the same everyday throughout the year. And they are all working 8 hours every day.
- The solar PV system has no energy lost.

1. Determine Power consumption demands.

The first thing you need to do is figure out how much power and energy all the things that need electricity will use from the power the solar panels generate. A well-designed solar PV system can meet around 10% - 30% of your electricity usage. For this report, we will use 20% as the amount of energy the Solar PV system can provide versus the electrical energy consumption of your school.

The school’s total annual electrical consumption is:

Useful calculations for your report:

Electricity needed from PV system per year (kWh/yr) = Annual electricity usage of school (kWh/yr) × 20%

Electricity needed from PV system per day (kWh/day) = Electricity needed from PV system per year(kWh/yr) ÷ 365

Example:
St. Diluc secondary school uses 182.5MWh every year

***Electricity needed from PV** system **per year** (kWh/yr) = 182.5MWh/yr × 20% = 36.5MW*

Now we know that we need a 36.5 MW Solar PV system. PV system size is determined by their electricity generation per year.

We need to know how much it needs to generate per day, for easier calculation.

Electricity needed from PV system per day (kWh/day) *= 36.5MW ÷ 365* *= 0.1MW* *= 100kW*

2. PV panel wattage

This depends on the model and size of the PV panel; Each panel can generate different electricity outputs based on their wattage.

Example Electricity output(W) of PV panels on market:

200W	225W	250W	275W
300W	325W	350W	375W
400W	425W	450W	475W

Choose your panel from the table above

3. Number of PV panels and their surface area

This panel electricity output will be used for this example

- No. of PV Panels

No. PV Panel = Electricity generation of PV system per day (kWh) ÷ 250W

Example:

No: PV Panel = 100kW ÷ 250W
**Convert kW to W (multiply by 1000) **
= 100,000 W ÷ 250W
= 400

- Surface area of PV

Average PV length = 1.65m
Average PV width = 1m

Surface area of the PV systems (m^2) = PV length (m) × PV width (m) × No. of PV Panels

Example:
Surface area of Diluc PV System = 1.65m × 1m × 400
= 660m^2

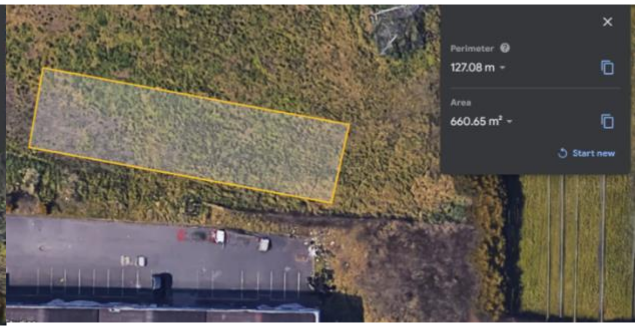
4. Location to install your PV panel

Use Google Earth to find a perfect space for installing the PV panels, could be the deserted field near your school, or on the roof.

Find the surface area available for your PV installation.

Make sure to install the PV in places that has sunlight.

Example:



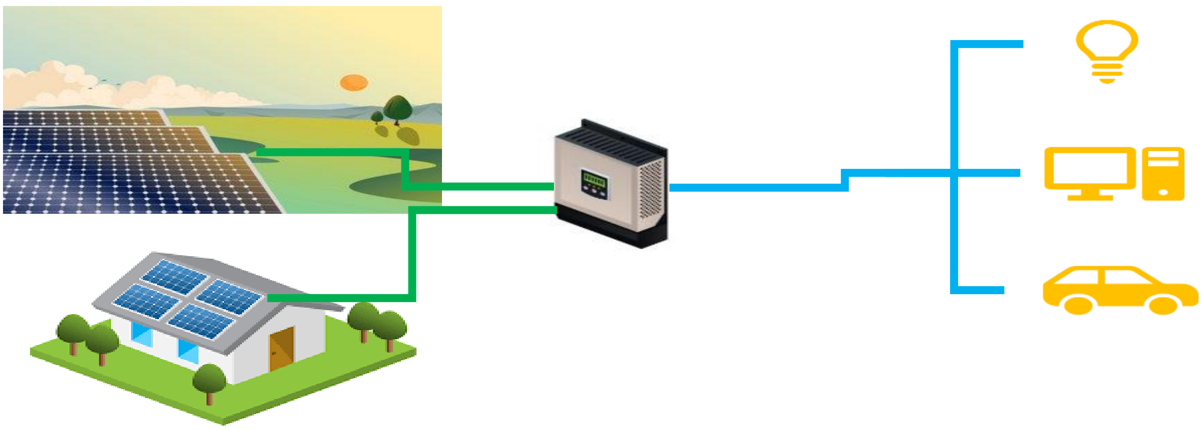
You can provide extra drawings or plots to support your design. E.g.,

Figure 19 shows side view of area for PV installation. Screenshotted from Google Earth

Figure 20 shows birds-eye view of area for PV installation. Screenshotted from Google Earth.

5. Where to locate the inverter?

An Inverter is a device where we collect all the electricity generated from the PV panels. The electricity is then connected to the school's electrical boards to use the power generated.



Hence, it should be in a safe place, far away from water and people so that accidents would not happen. But it should still be reachable so that electricians can come in and do checkups.

Example location:

- Beside your main electrical board
- a locked room, or
- a corner outside the building but with a waterproof box.

Appendix 7: December reports

These reports showcase the schools' progress until December and can be seen in the following pages.

Ballincollig December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the schools' parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	11.01	10.49	11.19	10.50
Reduction		0.52	-0.18	0.51
Ranking		3rd	4th	4th

Since the project began the average baseload in Ballincollig has gone from 11.01 kW down to 10.72 kW, a reduction of 0.73 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 0.73 kW over the entire year should result in a saving of 3,814 kWh, €420[1] and 1,586 $kgCO_2$. To offset the equivalent amount of CO_2 you would need to plant approximately 80 trees.

The best performing day at Ballincollig was unsurprisingly a weekend day, Saturday 26th of November where the baseload was down to 7.38 kW. The best performing midweek day was the 27th of October where the baseload was 8.7 kW. This tells us we can still improve further.

Opportunities For Further Improvement

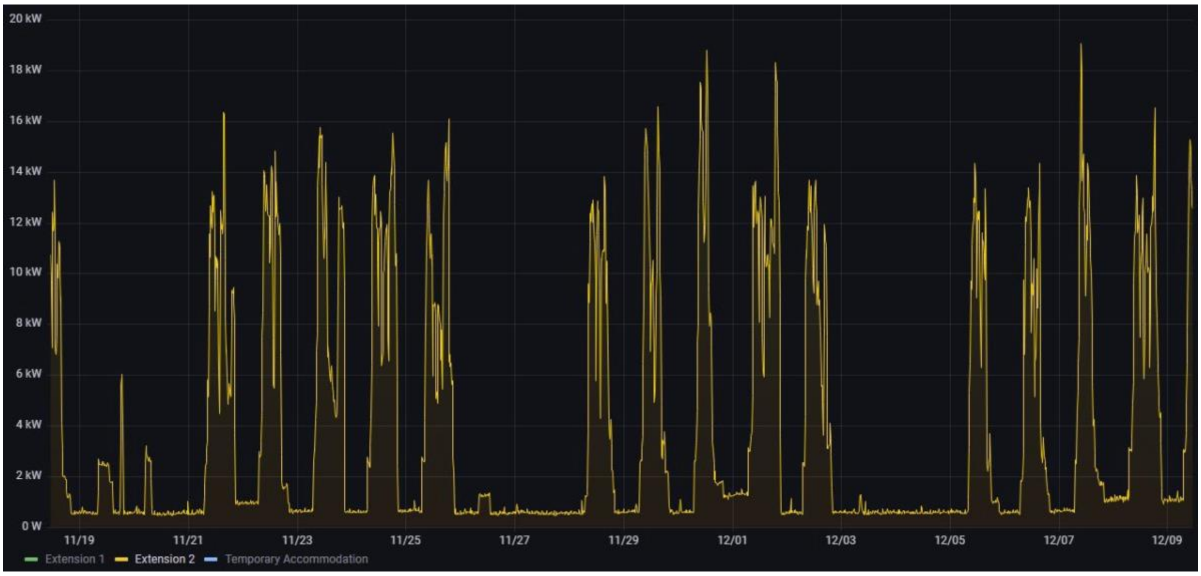
When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- Extension 1 (Main School)
- Extension 2 (Gael Scoil)
- Temporary Accommodation (Gael Pod)
- Extension 1 (Main School)

We can see using Wattrics that Extension 1's baseload drops down to around 2.5 kW on good night, however looking at the last 7 days, we can see that additional devices were consuming power in this part of the school on the 8th (7.2 kW) and 9th (8.5 kW) of December. This is a lot of power, the equivalent to about 2 electric kettles operating the entire night! This is the first time since the start of the project we have seen this phenomenon in Extension 1, could it potentially be someone plugged in an electric radiator, and it is being left on? Each school evening, they are left on they consume 72 kWh or almost €8 of electricity and contribute 30 $kgCO_2$ to the atmosphere, requiring 1.5 trees to be planted to offset each evening this happens.

Extension 2 (Gael Scoil)

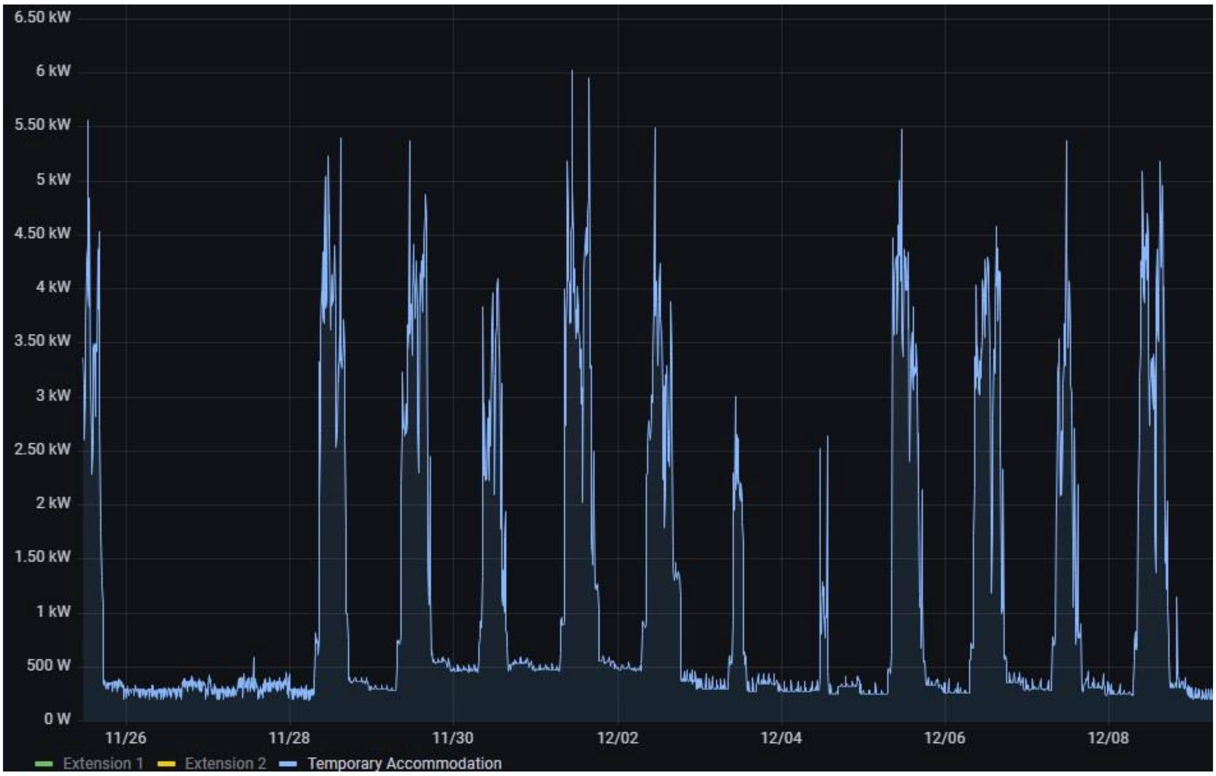
Extension 2 is a smaller consumer, but there is still opportunity to improve here. Baseload here drops down to around 0.5 kW most evenings but looking at the last 3 weeks, we can see some anomalies. We can see on 8th and 9th of December this rose up 1 kW, and 1.5 kW on December 1st. Because this area is so much smaller than Extension 1 it should be easier to identify the devices that are being left on, the 1 kW could likely be made up of a room or two full of PCs, projectors etc left on standby.



Temporary Accommodation (Gael Pod)

This part of the school consumes the least amount of electricity but again we have opportunity to improve. Good performing days drop down to about 0.2 kW, which is excellent, however just looking at the past two weeks we can see opportunity for improvement. This is the first weekend so far, we have seen energy consumption over the weekend, presumably there is a reason for this.

We can see that baseload for the entire school week starting November 28th was almost double that of the school week starting December 5th. The difference is only 0.25 kW and looking at the profile it was likely switched on Tuesday November 28th and not switched off until the evening of Friday December 2nd.



Summary Of Actions

1. Identify what is being left on in the Main School recently, this is something potentially triggered by the drop in temperature but is having a huge impact on the school's carbon emissions.
2. Equipment left on standby, although most obvious in Extension 2 and Temporary Accommodation it's likely happening in most classrooms, each PC or monitor might only be consuming 20 – 50 W, but when you have a classroom with 20 PCs and monitors this can add up very quickly.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.

Buttevant December Report

Methodology

'Baseload' is the parasitic energy the school consumes after hours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	4.48	4.00	4.54	4.07
Reduction		0.48	-0.06	0.41
Ranking		6th	7th	5th

Since the project began the average baseload in Buttevant has gone from 4.48 kW down to 4.20 kW, a reduction of 0.28 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 0.28 kW over the entire year should result in a saving of 1,468 kWh, €160[1] and 611 $kgCO_2$. To offset the equivalent amount of CO_2 you would need to plant approximately 31 trees.

The best performing day at Buttevant was unsurprisingly a weekend day, Saturday 6th of November where the baseload was down to 3.69 kW. The best performing school day was the 30th of November where the baseload was 4.33 kW.

Buttevant has a fairly consistent baseload, although it showed it was able reduce consumption further during the Halloween school break, so can this level be reached again, even if just at weekends?

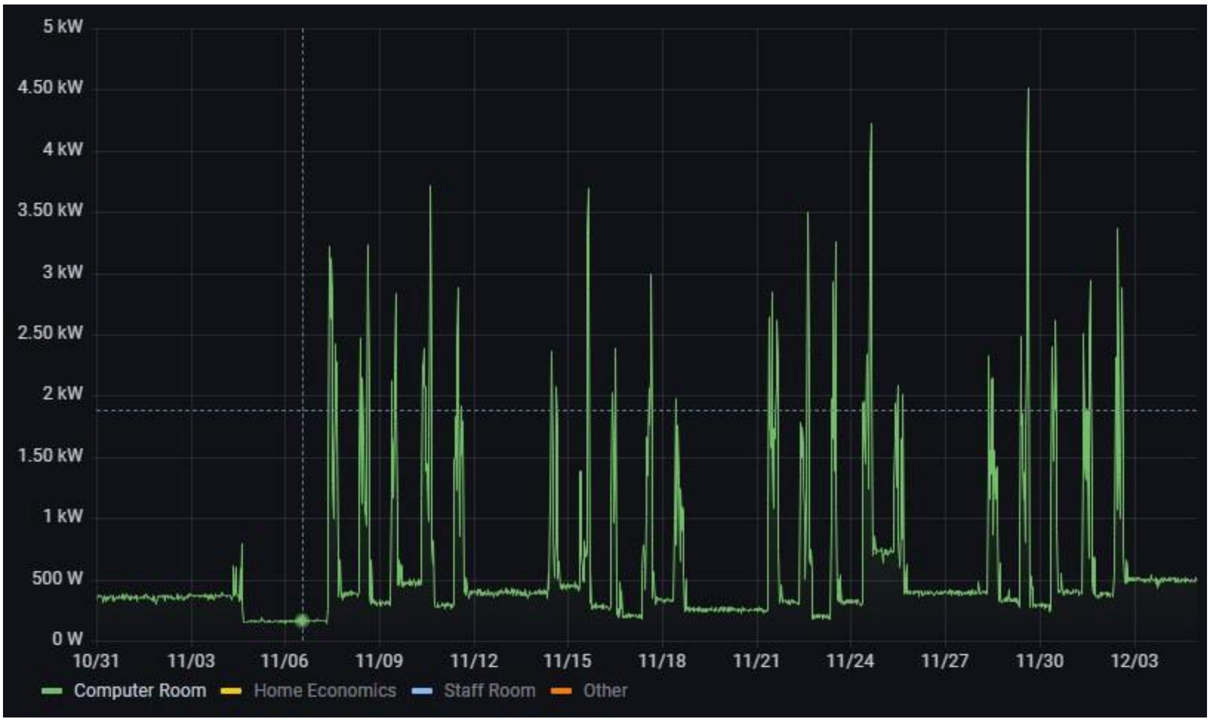
Interreg Co-funded by the European Union
Northern Periphery and Arctic

Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

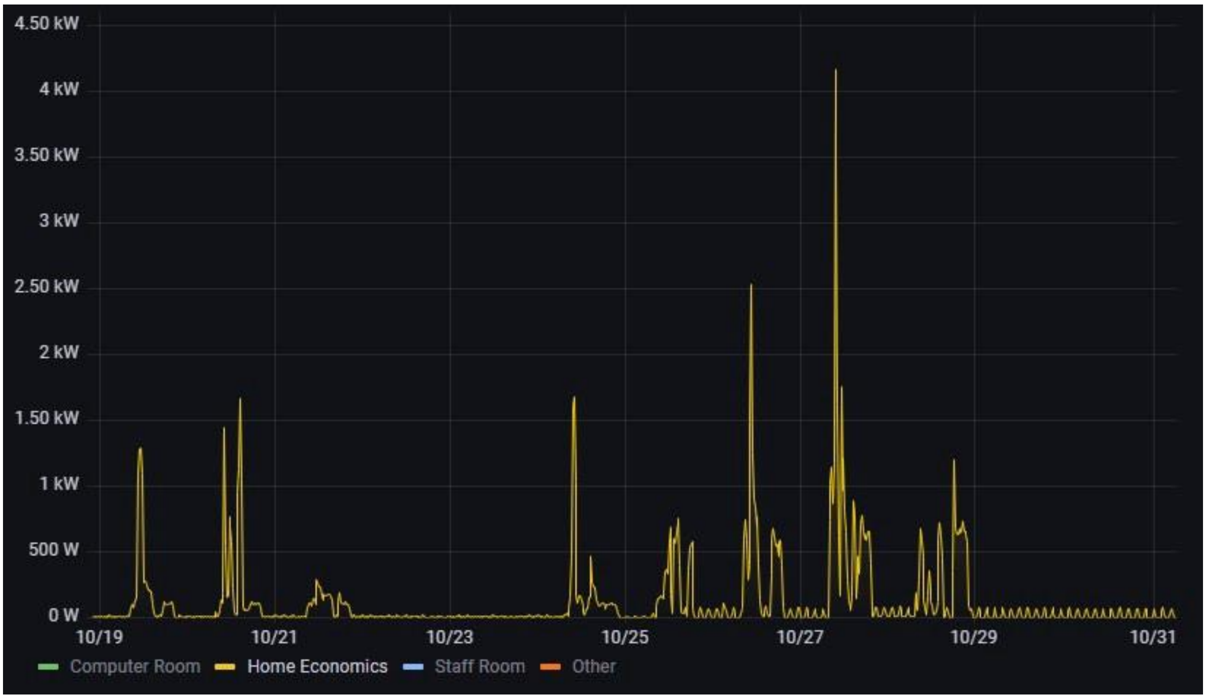
- Computer Room
- Home Economics Room
- Staff Room
- Computer Room

We can see using Wattrics that the Computer Room's baseload drops down to around 0.15 kW between the 4th & 7th of November, however looking at the 3 weeks after this we see an inconsistent baseload, averaging around 0.38 kW. Each week this additional load is present it consumes 25 kWh or €2.73 of electricity and contribute 10.4 kgCO_2 to the atmosphere, this alone requires a tree to be planted every fortnight to offset the emissions generated.



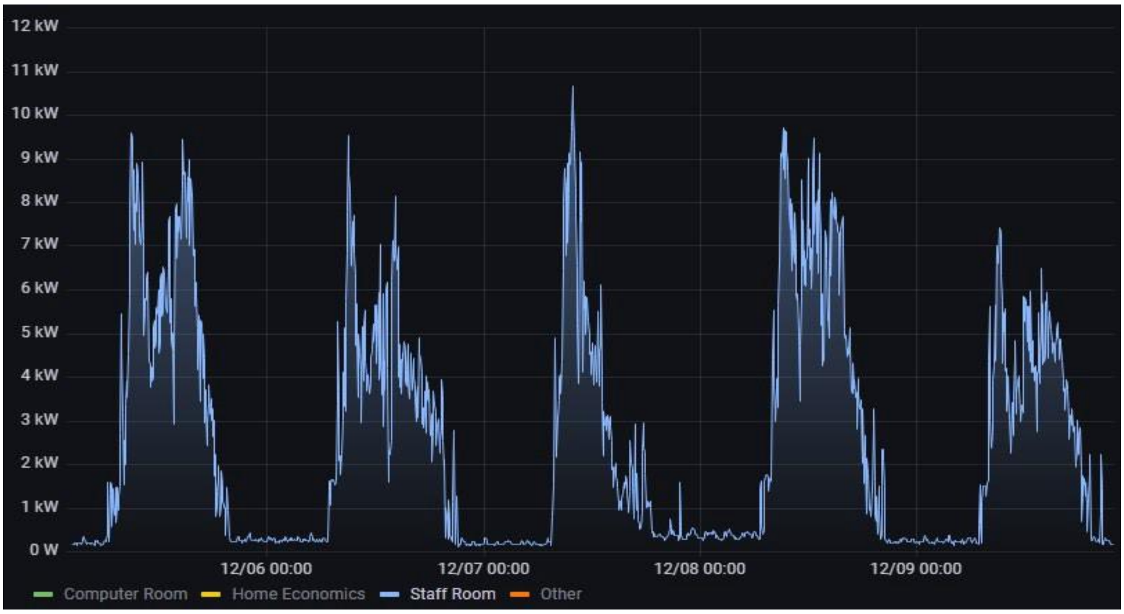
Home Economics

The Home Economics room doesn't consume a lot of energy, the only thing to report here is 75 W load appeared here on the 25th of November and has been on ever since, it runs for about 45 minutes and is then dormant for an hour and a half, this is almost certainly a refrigerator, only comment here was why was it not needed earlier and always now? It only consumes about 2.52 kWh each week so nothing to be too concerned about if it's serving a purpose.



Staff Room

Staff Room also has a consistently low baseload, not too easy to see on the graph below , but some additional baseload of about 0.15 kW appeared on the 8th of December. This has happened a few times in the past, the previous time was on Thursday the 24th of November, difficult to know what this is but it could be a printer or row of PCs on standby.



Summary Of Actions

1. Overall Buttevant is very consistent with its baseload, we would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Switch off equipment left on standby, although most obvious in the Computer Room let's try to improve everywhere.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.

Clonakilty December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	5.12	4.3	4.44	4.38
Reduction		0.82	0.68	0.74
Ranking		2nd	3rd	2nd

Since the project began the average baseload in Clonakilty has gone from 5.12 kW down to 4.37 kW, a reduction of 0.75 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/year and unoccupied 5,244 hours/year.

A reduction of 0.75 kW over the entire year should result in a saving of 3,933 kWh, €432[1] and 1,707 $kgCO_2$. To offset the equivalent amount of CO_2 you would need to plant approximately 85 trees.

The best performing day at Clonakilty was unsurprisingly a weekend, Saturday 5th of November where the baseload was down to 3.52 kW. The best performing school day was the Tuesday 8th of November where the baseload was 4.27 kW.

Overall looking at the data Clonakilty has been preforming well and is coming second overall, however there is always potential to improve further.

Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- Old School
- F08
- G08

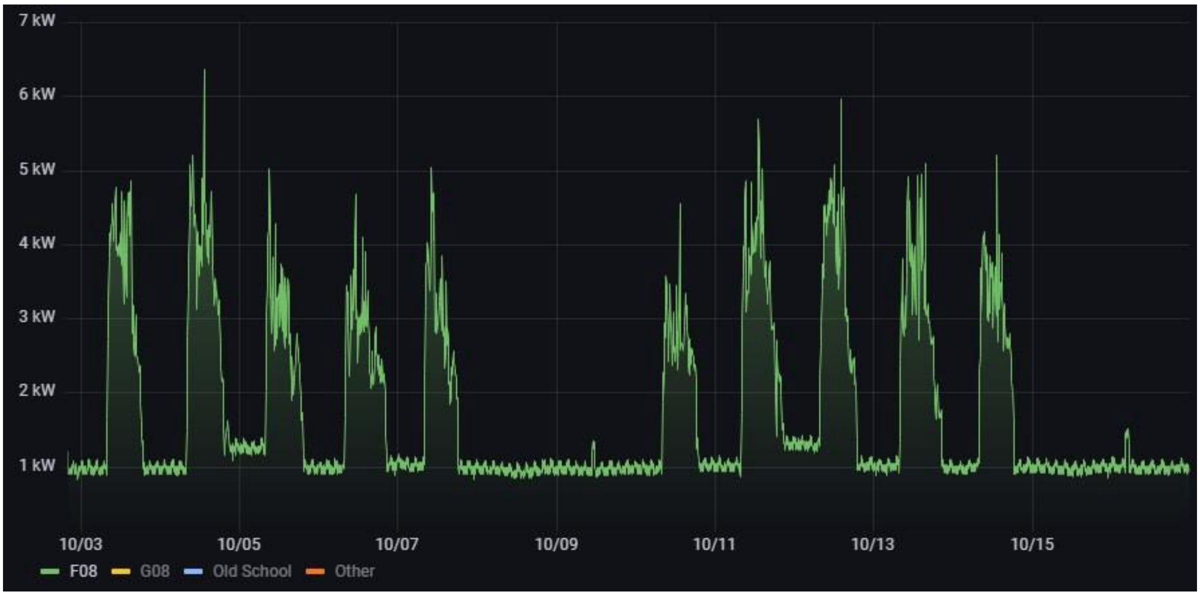
Old School

Baseload in the Old School is typically around 1.75 kW, but we can see in the screengrab below that on the 5th of December a 2-kW load appeared around midday until around midday the following day, it runs for a couple of minutes and then switches off for an equal length of time. This has only happened once, but each additional day it happens it will consume 12 kWh, costing the school €1.68 and producing 4.92 kgCO_2.

F08

F08 consistently has a baseload around of around 1 kW, however on October 4th and 10th, both Tuesdays, it was 1.25 kW, hard to say exactly what it is, but could be a few PCs and monitors left on standby. This is the only two times we have seen this occur in F08.

F08 chart



G08

G08 is one of the most consistent areas of all the schools being monitored in the project, no obvious fluctuations here.

Other

'Other' is everything in the school that isn't in Old School, F08 or G08. This is the area with which the school has reduced the most, but there looks to still be an opportunity to improve here. The graph below is showing school week starting December 5th, we can see the nighttime baseload is growing steadily over the week, starting around 1.3 kW, before increasing to 2.1 Thursday evening. This is likely down to a good effort being made on Friday evenings to switch everything off, but maybe not paying enough attention during the week and accumulating 0.8 kW of load, again this is likely small devices like PCs, monitors or projects being left on standby.

Summary Of Actions

1. Overall Clonakilty is performing well, we would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Equipment left on standby, although most obvious in the 'Other' section, let's try to improve here first.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Although most schools are being told be extra vigilant on Friday evenings as you'll make a big impact from a relatively small effort, Clonakilty is already doing this, so to keep improving we need to keep consumption down every evening.

Coachford December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	7.18	7.38	7.47	7.12
Reduction		0.82	0.68	0.74
Ranking		8th	9th	8th

Since the project began the average baseload in Coachford has gone from 7.18 kW up to 7.32 kW, an increase of 0.14 kW.

The best performing day at Clonakilty was unsurprisingly a weekend, Saturday 19th of November where the baseload was down to 5.52 kW. The best performing school day was the Thursday 1st of December where the baseload was 7.68 kW.

The worst performing day was 8.78 kW on the Thursday the 27th of October, for Coachford we need to understand what is causing this additional consumption.

Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

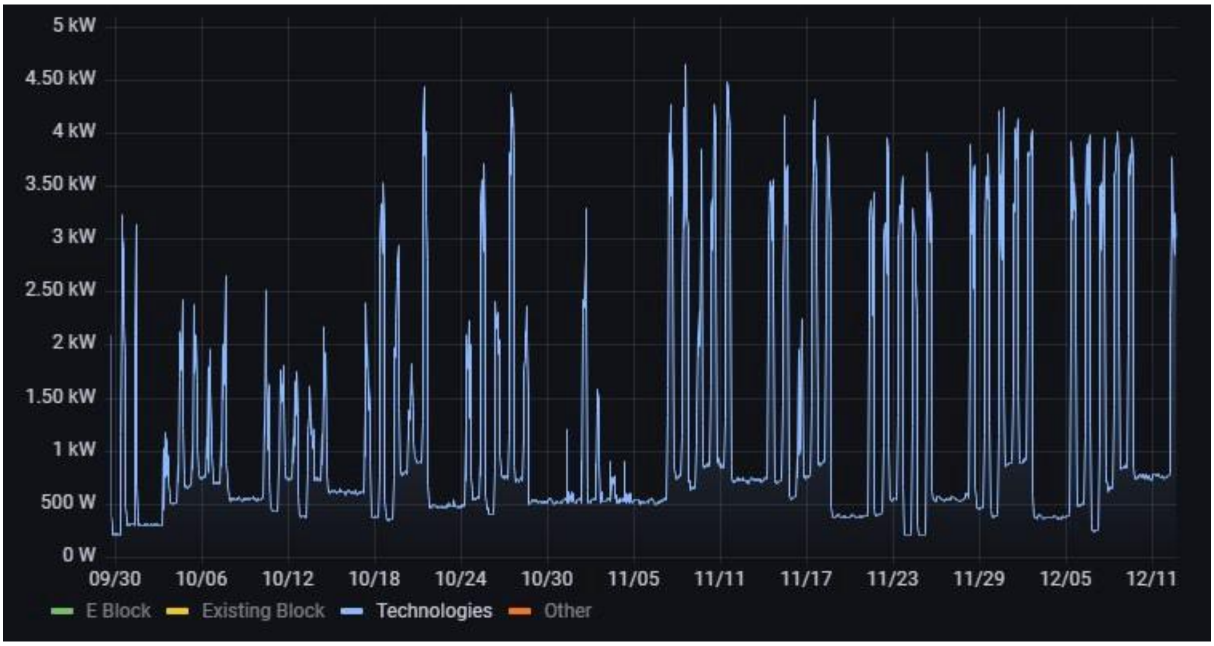
- Technologies
- E Block
- Existing Block

Technologies

Baseload in this part of the school is very inconsistent, we can see on its best performing days it drops down to 0.2 kW, but we can also see it regularly close to 1 kW, but on average is about 0.6.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 0.4 kW over the entire year, in just this part of the school should result in a saving of 2,097 kWh, €230[1] and 872 kgCO2. To offset the equivalent amount of CO2 you would need to plant approximately 43 trees. The likely culprits in this part of the school are PCs, monitors etc.



E Block

F08 consistently has a baseload around of around 1 kW, however on October 4th and 10th, both Tuesdays, it was 1.25 kW, hard to say exactly what it is, but could be a few PCs and monitors left on standby. This is the only two times we have seen this occur in F08.

G08

G08 is one of the most consistent areas of all the schools being monitored in the project, no obvious fluctuations here.

Other

'Other' is everything in the school that isn't in Old School, F08 or G08. This is the area with which the school has reduced the most, but there looks to still be an opportunity to improve here. The graph below is showing school week starting December 5th, we can see the nighttime baseload is growing steadily over the week, starting around 1.3 kW, before increasing to 2.1 Thursday evening. This is likely down to a good effort being made on Friday evenings to switch everything off, but maybe not paying enough attention during the week and accumulating 0.8 kW of load, again this is likely small devices like PCs, monitors or projects being left on standby.

Summary Of Actions

1. Overall Clonakilty is performing well, we would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Equipment left on standby, although most obvious in the 'Other' section let's try to improve here
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Although most schools are being told be extra vigilant on Friday evenings as you'll make a big impact from a relatively small effort, Clonakilty is already doing this, so to keep improving we need to keep consumption down every evening.

Fermoy December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	14.83	13.04	13.56	14.24
Reduction		1.34	1.27	0.59
Ranking		1st	2nd	3rd

Since the project began the average baseload in Fermoy has gone from 14.83 kW down to 13.61 kW, a decrease of 1.22 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 1.22 kW over the entire year should result in a saving of 6,397 kWh, €703[1] and 2,663 kgCO_2. To offset the equivalent amount of CO_2 you would need to plant approximately 133 trees.

The best performing day at Fermoy was unsurprisingly a weekend, Saturday 5th of November where the baseload was down to 10.7 kW. The best performing school day was the Thursday 24th of November where the baseload was 13.3 kW.

The worst performing day was 16.5 kW on the Thursday the 30th of November, for Fermoy we need to understand what is causing this additional consumption.

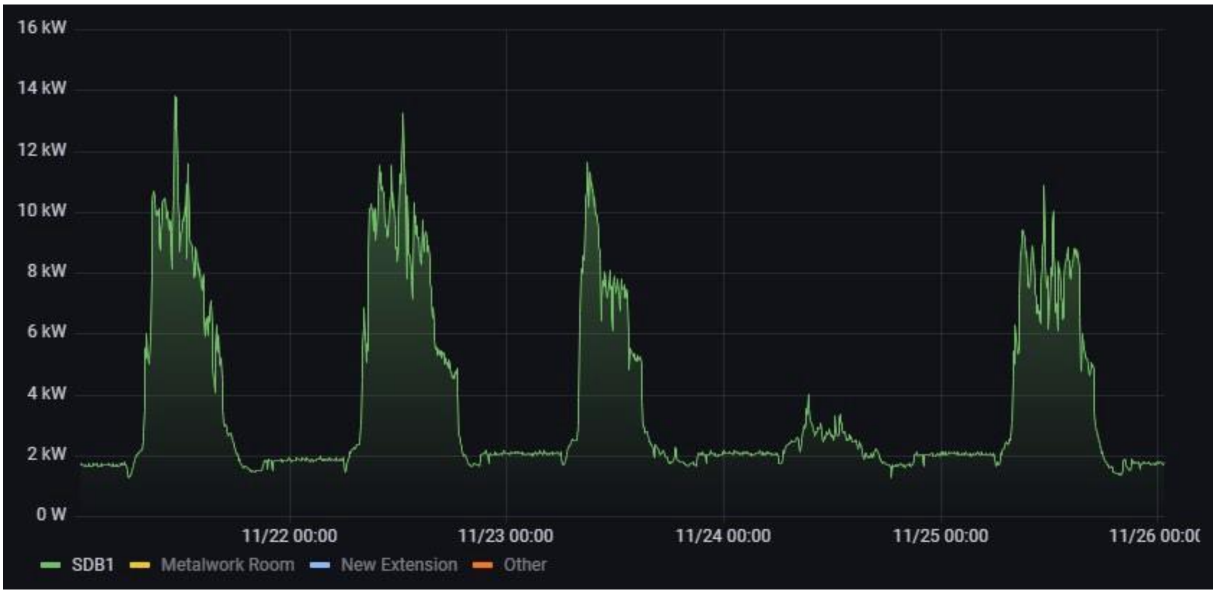
Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- SDB1
- New Extension
- 'Other'

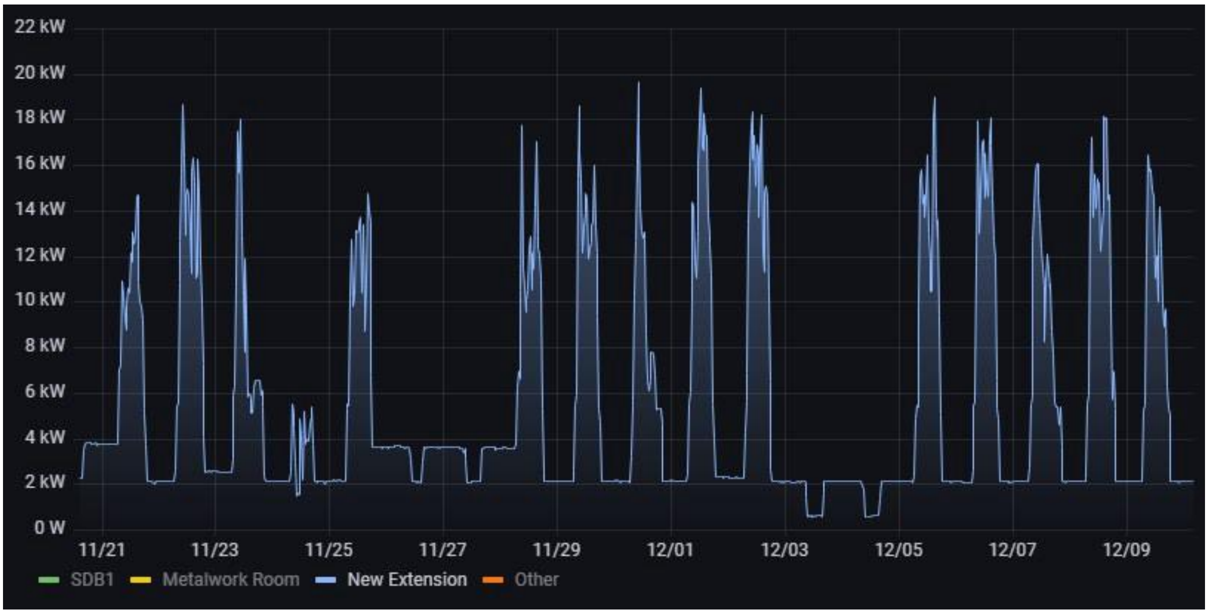
SDB1

Baseload in this part of the school is fairly consistent; we can see on the graph below school week starting November 21st. One thing we see here is a gradual build-up of the baseload during the school week, for example at the start of the week it was 1.65 kW but by Wednesday evening it had grown to
2.1 kW, then on Friday evening it returned to its original level, likely because of the school be extra vigilant with switching equipment off on a Friday evening.



New Extension

This was probably one of the poorer performing areas early in the project, however it has become much more consistent in the last few weeks. Below shows 3 weeks of data starting on November 21st we can see baseload during unoccupied hours regularly reaches 3.9 kW during the first week, but when if we look at the last week, we can see it's consistently 2 kW. Looking at data the load that causing this increase is likely from a single piece of equipment.



Other

'Other' is everything in the school that isn't in SDB1, Metalwork Room or New Extension. This is the area with which the school has been performing with most poorly with recently compared with earlier in the project.

If we take the same 3-week period we looked at with New Extension In the previous section, we can see how on week starting December 5th consumption is higher than the previous two weeks. There is up to 4 kW of additional baseload present here on poorer performing evenings. Each evening this happens the building consumes 48 kWh and €5.28 of electricity and produces 20 kgCO_2.

Summary Of Actions

1. Overall Fermoy is performing well as one of the top-ranking schools, we would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Equipment left on standby, although most obvious in the 'Other' section let's try to improve here, likely culprits are PCs, monitors etc.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Although most schools are being told be extra vigilant on Friday evenings as you'll make a big impact from a relatively small effort, Clonakilty is already doing this, so to keep improving we need to keep consumption down every evening.

Glanmire December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	11.23	10.45	11.06	10.86
Reduction		0.78	0.17	0.37
Ranking		4th	5th	5th

Since the project began the average baseload in Fermoy has gone from 11.23 kW down to 10.79 kW, a decrease of 0.44 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 0.44 kW over the entire year should result in a saving of 2,307 kWh, €254[1] and 960 $kgCO_2$. To offset the equivalent amount of CO_2 you would need to plant approximately 48 trees.

The best performing day at Glanmire was unsurprisingly a weekend, Saturday 3rd of December where the baseload was down to 9.43 kW. The best performing school day was the Thursday 27th of October where the baseload was 9.86 kW.

The worst performing day was 12.4 kW on Monday the 19th of November, for Glanmire we need to understand what is causing this additional consumption.

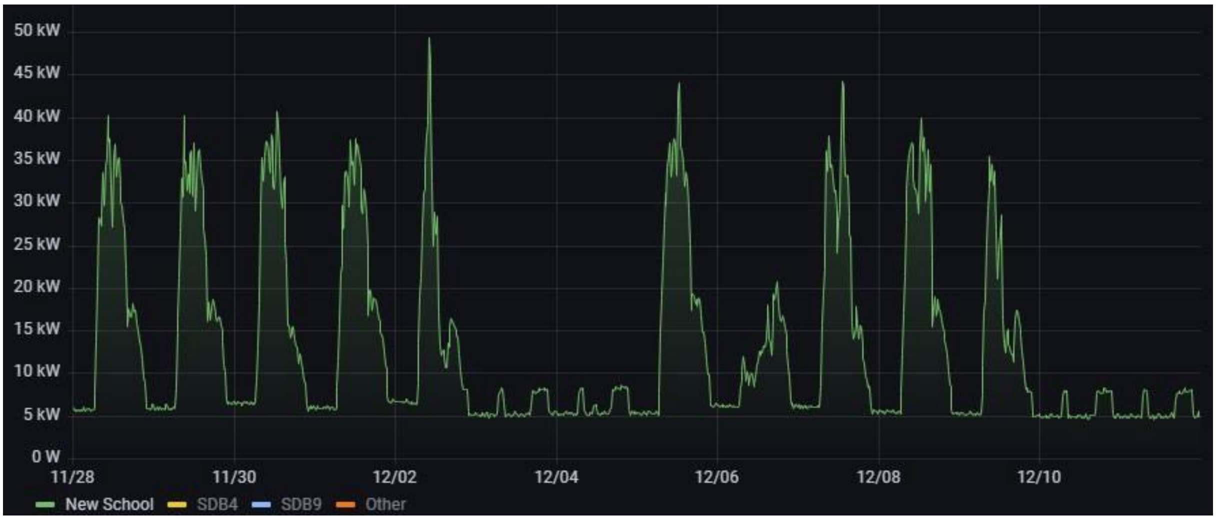
Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- New School
- SDB4
- SDB9

New School

New school is the majority consumer in Glanmire, baseload here might look consistent, but when we look closer, we can see opportunity for improvement. We can see good preforming days on the graph below result in a baseload of about 5 kW but following on from the evening of Thursday December 1st we can see it was closer to 6.5 kW. In an area of this size rooms with just a couple of devices left on standby can quickly add up to 1.5 kW, look for items such as PCs, monitors or projectors.

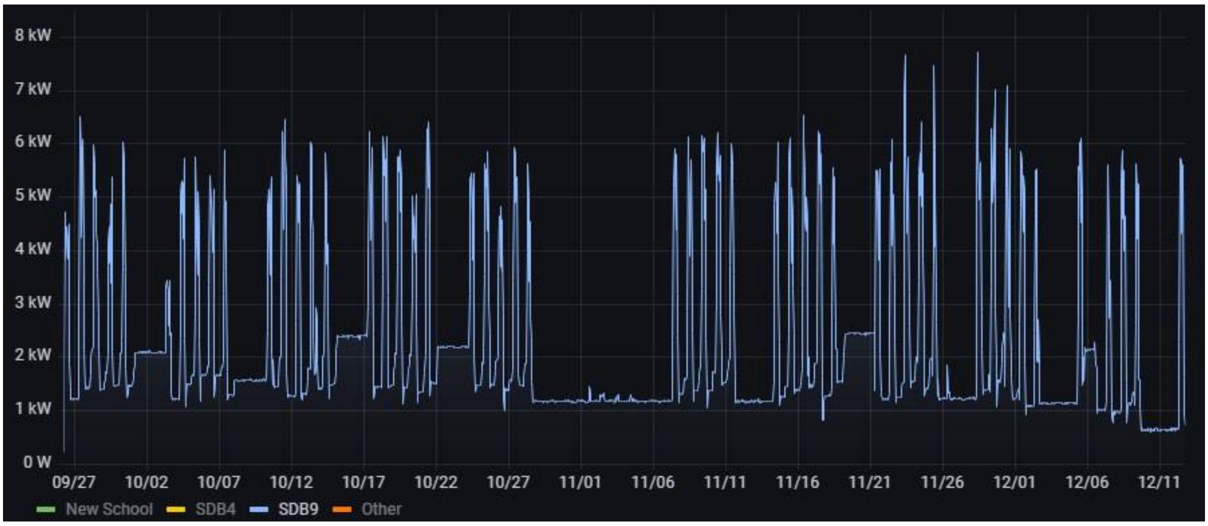


New Extension

SDB4 performs well, however we can still see some evidence of equipment being left on standby. The graph below shows school week starting November 21st. We can see on Monday evening baseload

SDB9

SDB9 is the smallest area withing the school we're monitoring but also one of the most interesting, below I'm showing all the data we've gathered here since September 26th.



First thing to be noticed is the best performing days, this was the weekend of December 10th where load dropped down to 0.65 kW. Ideally, we want to return to this every weekend as it's about half of the typical baseload we see here.

Also, out of the 10 school weeks' worth of data we have gathered so far, we can occasionally see a load appear at 3am on a Saturday morning, these appear as the small square parts of the graph above, shown in greater detail below. It's about 0.6 kW and runs over the entire weekend until 7am on Monday morning. It's too small to be a storage heater or immersion, which are typical items that can be on timers to come on early in the morning, could it be security lighting?

Summary Of Actions

1. Overall Glanmire is performing well, we would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Mystery load in SDB9, will be interesting to see if this happens again, keep an eye on Wattrics on a Monday morning to see if it happened the weekend gone by.
3. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.

Kanturk December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	3.22	3.16	3.55	3.16
Reduction		0.06	-0.33	0.06
Ranking				

Since the project began the average baseload in Fermoy has gone from 3.22 kW to 3.29 kW, a slight increase, but not a fair reflection on the overall efforts of the school.

The best performing day at Kanturk was unsurprisingly a weekend, Saturday 26th of November where the baseload was down to 2.9 kW. The best performing school day was the Thursday 1st of December where the baseload was 3.17 kW.

The worst performing day was 4.54 kW on Monday the 19th of November, for Kanturk we need to understand what is causing this additional consumption.

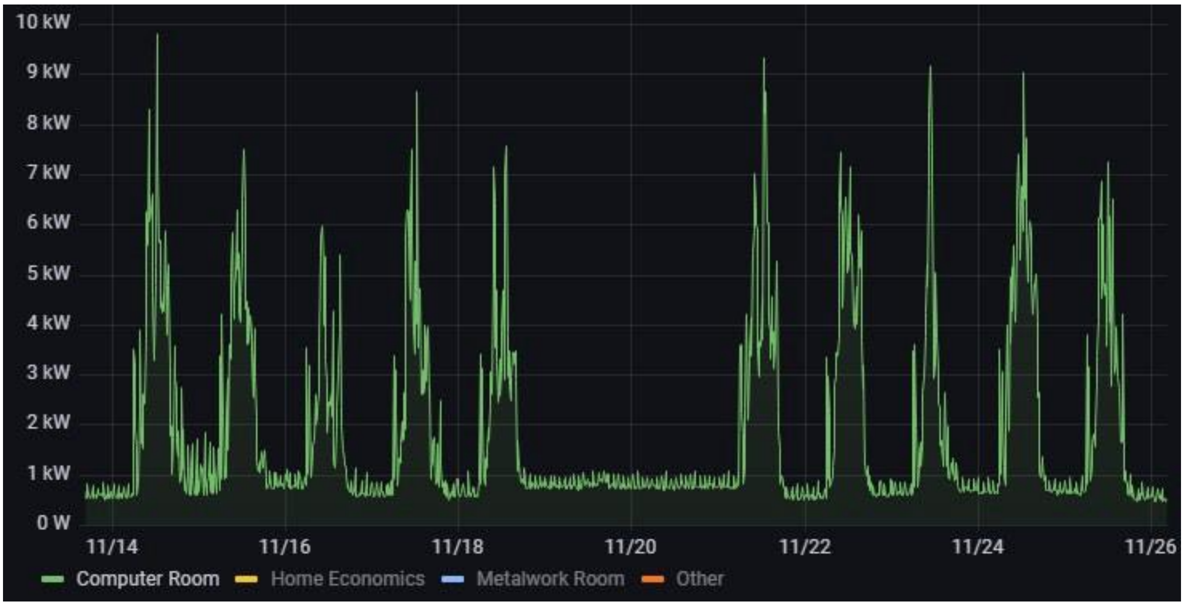
Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- Computer Room
- Home Economics
- Metalwork Room

Computer Room

In many schools the computer rooms are some of the biggest culprits when it comes to devices being left on standby, overall this area in Kanturk preforms fairly well, typically baseload in this area stays around 0.6 kW, but we can see in the graph below that on the weekend of November 19th it increased to about 1 kW. This extra 0.4 kW accounts for 24 kWh over the weekend and contributes 10 kgCO_2 to the atmosphere.



Home Economics

Home economics rooms typically only contributes around 0.15 kW to the schools baseload, but there are some instance where it was higher, below is the same two week period and again on the weekend starting November 19th

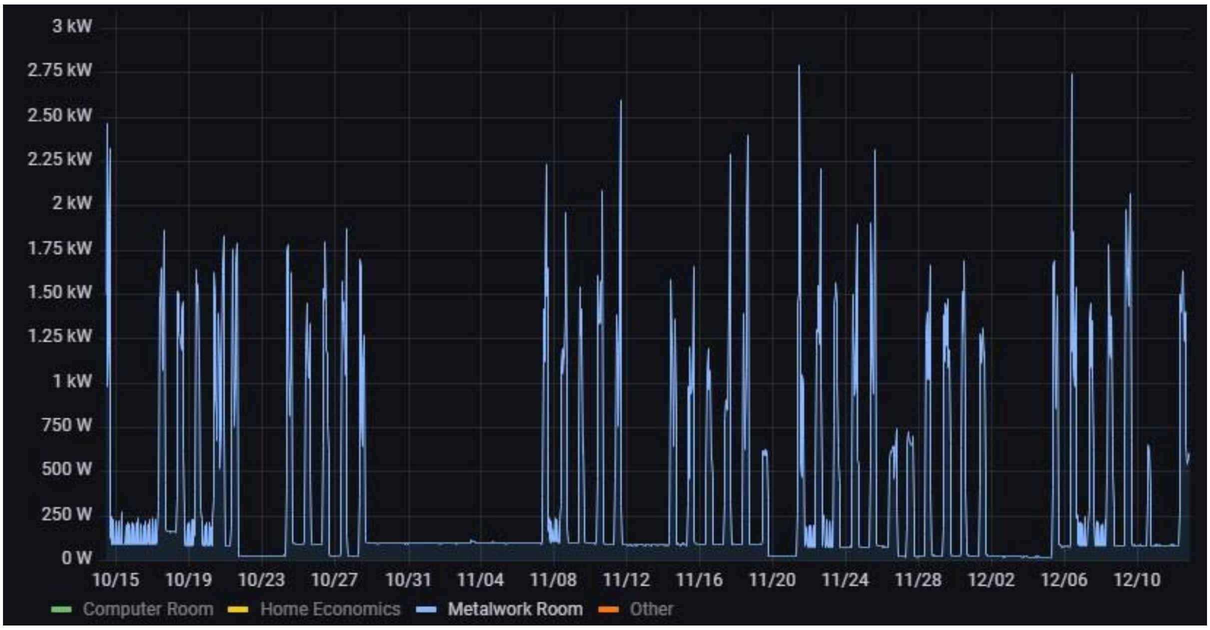
baseload was considerable higher over the weekend, increasing to 0.85 kW, this extra 0.7 kW accounts for 42 kWh over the weekend and contributes 17.5 kgCO2 to the atmosphere.

Metalwork Room

The metalwork room area consumes a relatively small amount of electricity, but we can still see anomalies in its consumption profile. We can see that the optimal baseline in this area is very close to zero, but it has only achieved this on two weekends, most of the time it is at about 0.1 kW, still a small amount of power.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 0.1 kW over the entire year should result in a saving of 524 kWh, €57[1] and 218 kgCO_2. To offset the equivalent amount of CO_2 you would need to plant approximately 10 trees. This load is likely a single device left on standby routinely, perhaps a project or printer?



Summary Of Actions

1. Overall Kanturk is performing well, we would suggest picking an evening to sweep through the

building and turn off anything that’s not needed to see how low we can get the baseload.

2. It’s small but getting on top of the device that’s left in the metalwork room is a single action that will have a measurable impact.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that’s left on you’ll be paying for all weekend, Kanturk would have scored better a couple of weeks only for baseload to increase at the weekend, most schools preform noticeable better at the weekend, where is Kanturk is very similar and on occasions slightly worse.

Midleton December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	14.99	14.0	13.11	12.77
Reduction		.99	1.88	2.22
Ranking		9th	1st	1st

Since the project began the average baseload in Midleton has gone from 14.99 kW to 13.29 kW, a decrease of 1.7 kW.

If the typical school year is from September 1st until June 30th and the school is open for 167 of these and closed the other 135 days and average school day the school is in use between 8am and 8pm, we find the school is occupied 2,004 hours/ year and unoccupied 5,244 hours/year.

A reduction of 1.7 kW over the entire year should result in a saving of 8,915 kWh, €980[1] and 3,709 kgCO_2. To offset the equivalent amount of CO_2 you would need to plant approximately 185 trees.

The best performing day at Midleton was unsurprisingly a weekend, Sunday 13th of November where the baseload was down to 11.3 kW. The best performing school day was the Thursday 1st of December where the baseload was 11.6 kW.

Midleton has been preforming really well, but scored poorly in the Week 1 & 2, this is because most of the other schools managed to reduce their consumption down for the October break significantly more than what they might do at a weekend, yet Midleton actually preformed slightly worse than they would have for a typical school weekend, something to keep in mind for Christmas break.

The worst performing day was 15.6 kW on Monday the 17th of September, for Midleton we need to understand what is causing this additional consumption.

Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- New School
- Old School
- Other

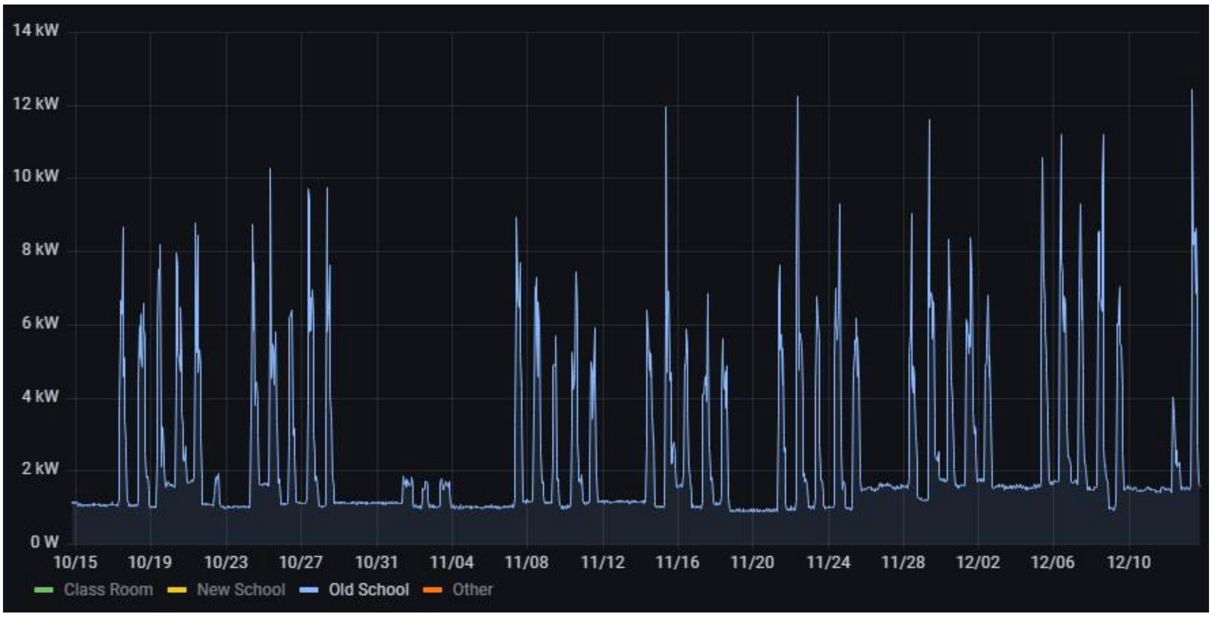
New School

The New School is the biggest are being sub metered, on a good preforming evening consumption comes down to 9kW, however look at two weeks of data below starting on November 27th, we can see several evenings where the baseload was closer to 10 kW. Each evening this happens it consumes 120 kWh and each weekend it happens it consumes 600 kWh, worryingly this part of the school doesn't preform that well on the weekend, which means it's paying for the device that's on over the entire weekend. Since this is such a large area it's hard to say exactly what this is, but highly likely it's several PCs, monitors or projectors left on standby.

Old School

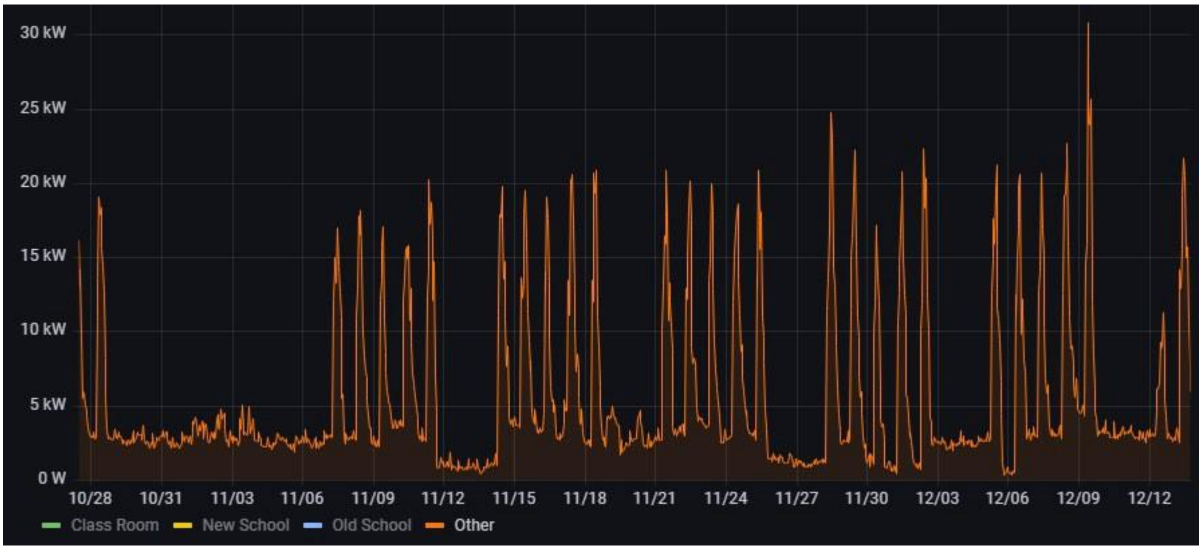
The Old School's baseload has increased since the project started, up until Friday the 25th of November its consumption stayed around 1 kW when the building wasn't occupied, but since it has been consistently around 1.6 kW. You can see it has occasionally returned to 1 kW on a couple of occasions but for the most part stayed at 1.6 kW.

Looking at how it's a step change in consumption it's likely that this is a single piece of equipment, looks like it could be a lighting circuit but it's unusual for one of those to be consistently be left on, it's also unlikely to be a plug in heater, immersion or refrigerator as those would all typically cycle on and off.



Other

'Other' is everything in that school that isn't supplied with electricity from either the New School or Old School distribution board. Looking at the past 50 days of data below we can see can drop down as far as 0.6 kW but is regularly as high as 3 kW. The first step here is to identify the areas within in the school that are being monitored under other and then work on reducing the baseload.



Summary Of Actions

1. Identify what is being left on in the Old School recently, this is a device that is likely left on 24/7.
2. Equipment left on standby, although most obvious in New School and Other it's likely happening in most classrooms, each PC or monitor might only be consuming 20 – 50 W, but when you have a classroom with 20 PCs and monitors this can add up very quickly.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.

Mitchelstown December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	4.84	7.52	4.91	5.56
Reduction		-2.68	-0.07	-0.72
Ranking		10th	6th	10th

Since the project began the average baseload in Mitchelstown has gone from 4.84 kW to 5.99 kW, an increase of 1.15 kW.

The best performing day at Mitchelstown was unsurprisingly a weekend, Saturday 12th of November where the baseload was down to 3.94 kW. The best performing school day was the Tuesday 15th of November where the baseload was 4.18 kW.

Mitchelstown has had mixed results, It scored poorly on Week 1 & 2, this is because most of the other schools managed to reduce their consumption down for the October break significantly more than what they might do at a week, yet Mitchelstown actually preformed significantly worse than they would have for a typical school week, something to keep in mind for Christmas break.

The worst performing day was 10.3 kW on 3rd, 4th & 5th of November, for Mitchelstown we need to understand what is causing this additional consumption

Mitchelstown had a particularly poor score on Week 1 & 2. This is because during the October break at 9am on the 1st of November a 5-kW load was switched on in the building and remained on until the school opened on the 7th of

November. During this time the device consumed 840 kWh of electricity the equivalent of €117.60 on the school's current electricity tariff and contributed 350 $kgCO_2$, it would take 17.5 trees an entire year of carbon sequestration to offset this amount of $C0_2$, something to keep in mind when switching equipment off over the midterm break.

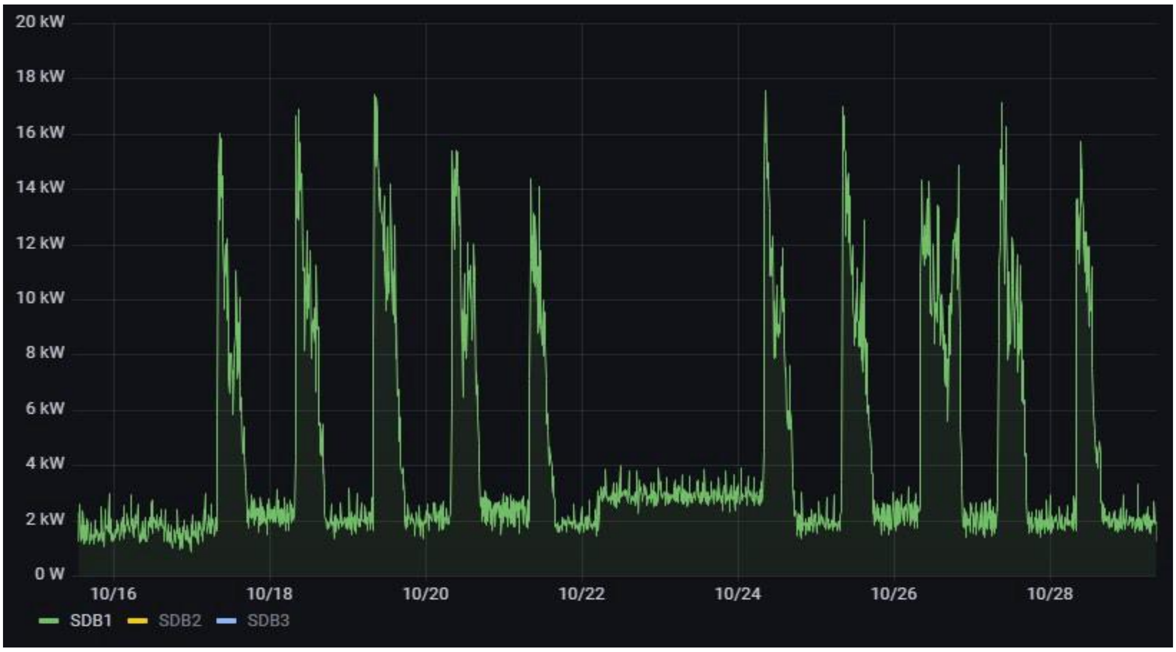
Opportunities For Further Improvement

When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- SDB1
- SDB2
- SDB3

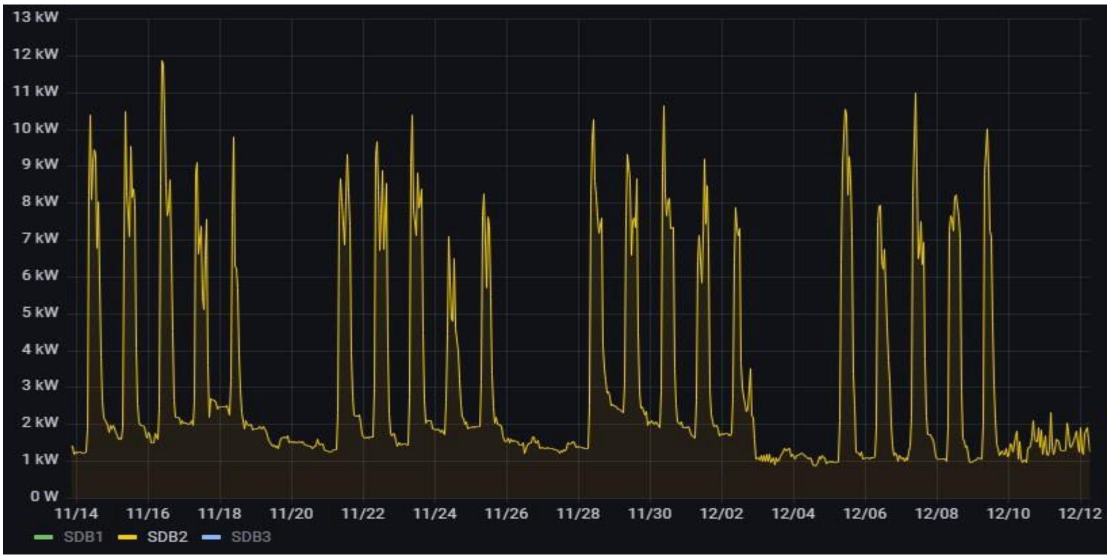
- SDB1

There are plenty of examples of equipment being left on in SDB1, the screengrab below shows data between the 15th & 29th of October, the best performing days were at the very start of this dataset where consumption was down to around 1.8 kW. We can also wee that something was switched on in the area on Saturday October 22nd around 6am and stayed on until the school opened on Monday morning, during the 50 hours it was on this 1 kW load consumed 50 kWh of electricity and produced 21 $kgCO_2$ the equivalent amount of $C0_2$ one tree sequesters from the atmosphere in an entire year.



SDB2

SDB2 is also displays a very inconsistent baseload, fluctuating between 2.5 kW and 1 kW. It must be noted that the week starting December 5th was the most consistently low baseload this area has achieved, however it was let down by its performance over the weekend, where some equipment was left on Friday evening, with even more being switched on and left on over the weekend.



SDB3

SDB3 is comfortably the best performing area in Mitchelstown, consistently sitting around 0.55 kW.

Summary Of Actions

1. We would suggest picking an evening to sweep through the building and turn off anything that's not needed to see how low we can get the baseload.
2. Equipment left on standby, although most obvious in SDB1 and SDB2 but it's likely happening in most classrooms, each PC or monitor might only be consuming 20 – 50 W, but when you have a classroom with 20 PCs and monitors this can add up very quickly.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.

Schull December Report

Methodology

'Baseload' is the parasitic energy the school consumes afterhours. Some of this is down to external security lighting or critical IT/security equipment, but much of it is often devices left on standby at the end of the day, common items will be PCs, smartboards, projectors etc.

Before the project started, we developed a baseline for the school's parasitic load, this was carried out between the 12th and 23rd of October. For each day we calculate the lowest average kW value over a two-hour period. Then every two weeks we recalculated the school's baseload and awarded it a score based on how much it has reduced compared to its baseline, we then rank the schools based on who has reduced the most per student and distribute points accordingly.

Results So Far

	Baseline [kW]	Week 1 & 2 [kW]	Week 3 & 4 [kW]	Week 5 & 6 [kW]
Average Baseload	2.57	2.34	2.67	2.68
Reduction		0.23	-0.1	-0.11
Ranking		5th	8th	9th

Since the project began the average baseload in Schull has on average stayed at 2.57 kW.

The best performing day at Schull was unsurprisingly a weekend, Sunday 23rd of October where the baseload was down to 2.16 kW. The best performing school day was the Friday 28th of October where the baseload was 2.17 kW.

Although Schull has struggled to score the top half of the table so far overall it's been performing well, what has been making it difficult for Schull to score highly is that it also performed well when we were developing the baseline, 2.57 kW is the lowest baseline of all the schools.

The worst performing day was 3.32 kW on Tuesday the 22nd of November, for Schull we need to understand what is causing this additional consumption

Opportunities For Further Improvement

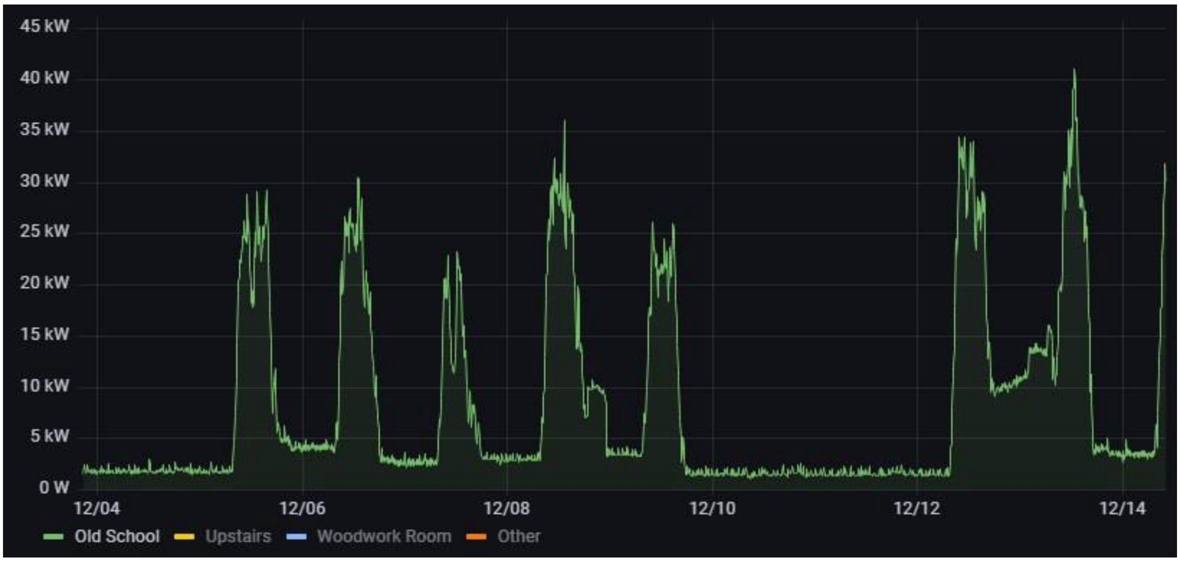
When looking at opportunities to improve it's best to look at the areas we're submetering in your schools, in this case it's.

- Old School

- Upstairs
- Woodwork Room
- Other

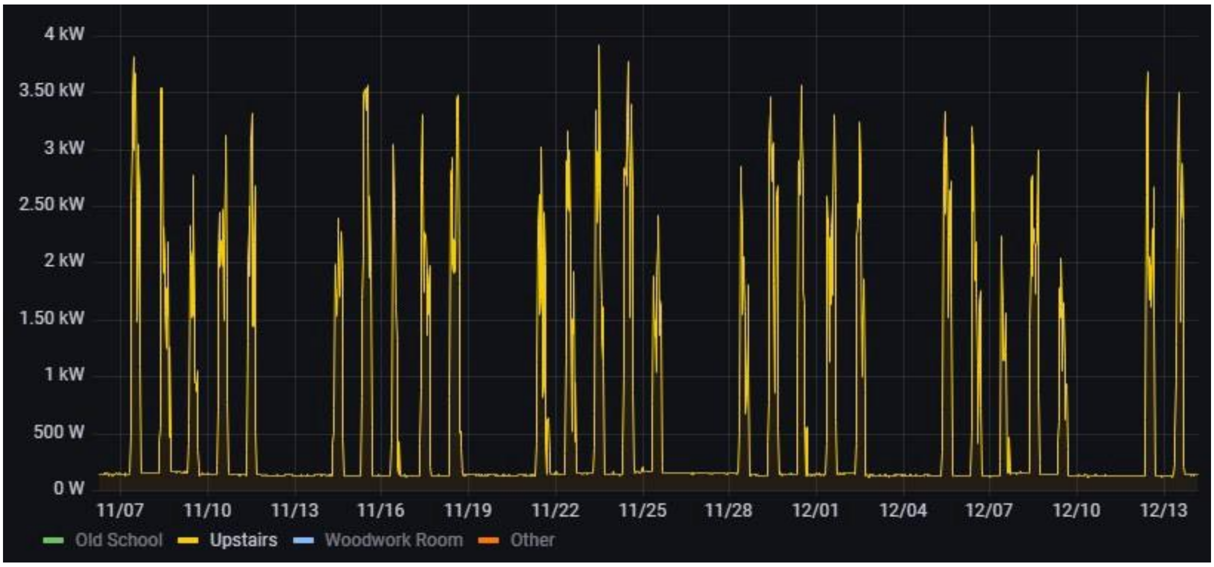
Old School

The Old School is the biggest area being sub metered, on a good preforming evening consumption comes down to 2 kW, however it's an area that was very consistent at achieving this baseload early in the project and has been getting progressively worse, take the past 10 days for example, starting on 3rd of December at the time of writing. We can see on the graph below that it increased to 4 kW on Monday 5th of December and then more recently on Monday 12th of December it increased to 10 kW. The latter for example consumed an additional 120 kWh, cost €13.20 and produced 50 $kgCO_2$, it would take 2.5 trees an entire year of carbon sequestration to offset this one evening. It's worth noting that Monday has been particularly poor the last few weeks, hard to pinpoint what is causing this, it's too large to be solely PCs, monitors etc. (although they could be contributing) maybe some plug in electric heaters?



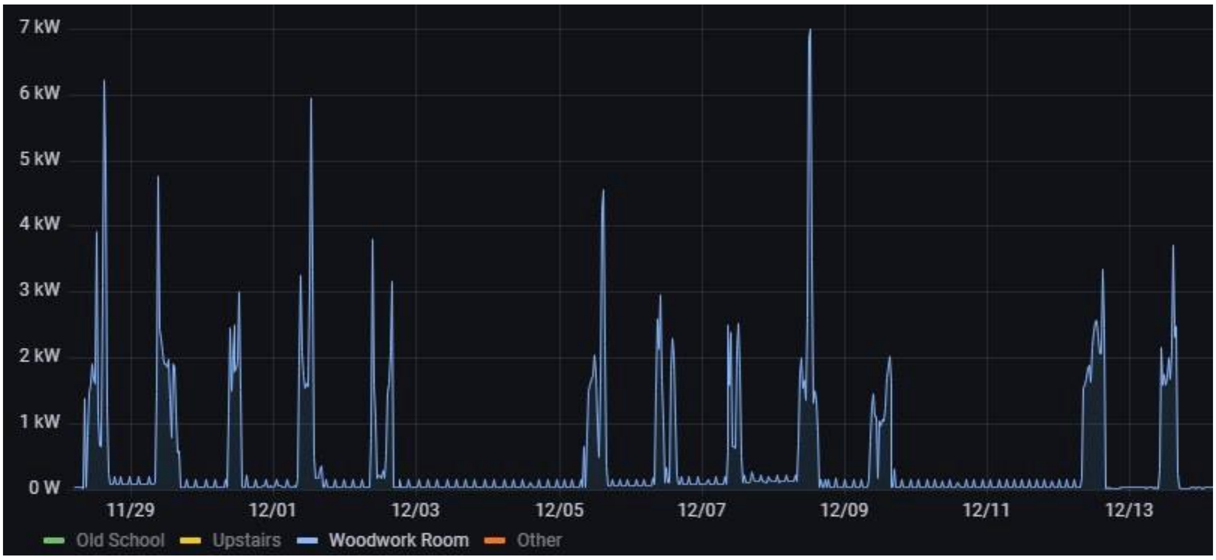
Upstairs

Upstairs is extremely consistent, probably no need to focus efforts in this area for now.



Woodwork Room

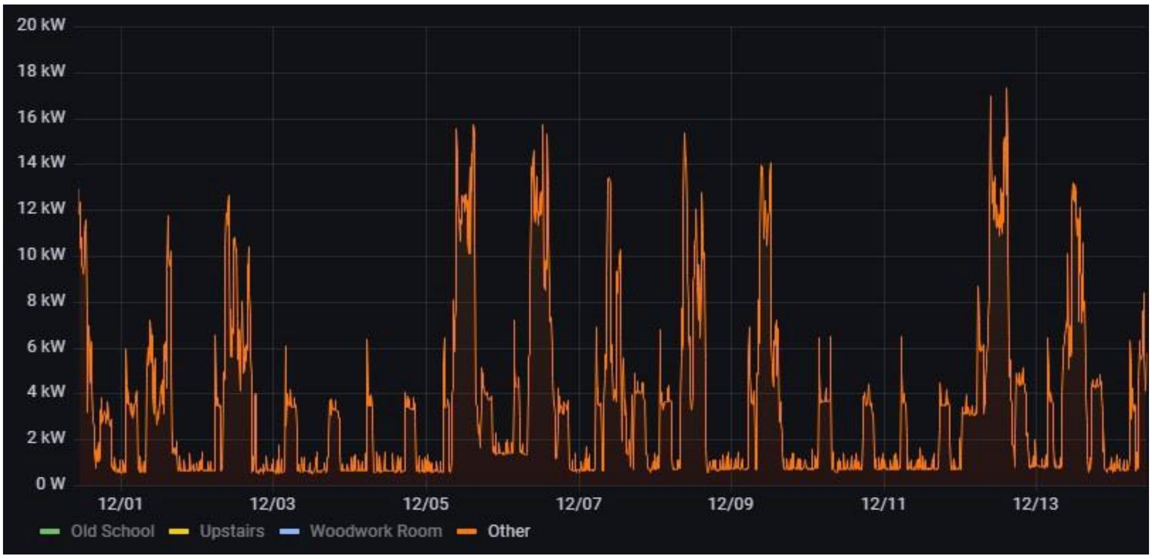
Woodwork Room as a very small baseload, worth pointing out that a small device was left on there for most of the project but was recently switched off on the 12th of December.



Other

'Other' is everything in the school that isn't in supplied from the Old School, Upstairs or Woodwork Room. This is the area with which the school has been performing with most poorly with recently compared with earlier in the project.

The graph below shows the previous two weeks of data, plenty of examples of inconsistent baseload here, things to watch out for are PCs, monitors, projectors etc. Also, there is a 3-kW load which comes on every 12 hours, could be an immersion if the school has one? Just to make sure that this is needed and if it can be put on a timer where it will run only at nighttime it will halve the cost of running this device.



Summary Of Actions

1. Identify what is being left on in the Old School recently, likely a large piece of equipment.
2. Equipment left on standby, although most obvious in Old School and Other it's likely happening in most classrooms, each PC or monitor might only be consuming 20 – 50 W, but when you have a classroom with 20 PCs and monitors this can add up very quickly.
3. Use the data from Wattrics to help you understand when and where you can improve, it will enable you to make a greater impact with less effort over all from the school by making more targeted actions.
4. Be extra vigilant on Friday evenings, any device that's left on you'll be paying for all weekend.