Glenstal Abbey
Energy Master Plan

GLENSTAL ABBEY SEC MURROE, Co. LIMERICK

JANUARY 2023

Rowan

BALLYHOURA DEVELOPMENT CLG

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

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Report Sign Off

REVISION	DATE	ORIGNATOR	REVIEWER
Draft for Client Review	13/01/2023	BOD	LMcN
1	17/01/2023	BOD	EG
2	17/01/2023	BOD	
Project Reference: GLE0003-1			

Acknowledgements

Luke Macnamara OSB – Lead liaison, Glenstal Abbey

Cuthbert Brennan OSB – Bursar, Glenstal Abbey

Paddy O'Connor and Robbie Burns – Maintenance, Glenstal Abbey

Oonagh Bermingham – Head of Hospitality, Glenstal Abbey

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Sustainable Energy Authority of Ireland

1. Executive Summary

The Glenstal Sustainable Energy Community (SEC) comprises the monks, staff, and students of Glenstal Abbey and Glenstal Abbey School. The objective of the Glenstal SEC is to contribute to Ireland meeting its national Greenhouse Gas (GHG) emission reduction targets by promoting recognition of climate change issues; raising awareness of how we are all part of the solution and to encourage involvement in behavioural changes and actions that can reduce our local carbon footprint, within the Glenstal community.

To this end all three populations (monks, staff, students) on campus have been involved in the process and representatives of all three groups sit on the Glenstal SEC committee. Given that every person is a consumer of energy, it is important that everyone is engaged in the process to achieve the best results.

"The world is not our property but held in trust for future generations", the world is, in the words of Pope Francis' encyclical *Laudato Si* 2015, "*our common home*", and "*its care is the duty of everyone. The effects of climate change have resulted in droughts and floods, wars and famines, population migration and the disappearance of islands under the rising seas. Everyone has a role in reducing carbon emissions and protecting the world and those threatened by the altered climate"*[1].

The students have led the way with initiatives to reduce litter and food waste since November 2021. Regular litter pick-ups were organised by the Transition Year group and following discussions with staff, extra bins were provided on the avenues with more bins installed indoors to enable the segregation of waste. Surveys have been completed on student behaviour, such as the number and length of showers taken per day. This has led to a campaign for students to shorten showers from an average of 10mins to 4mins, to reduce energy use for both heat and water.

An energy notice board was set up in November 2022 to keep monks, staff, and students aware of the energy use across both the monastery and the school. The energy usage from the monthly electricity bills have been posted on this notice board and compared with calendar year 2019, which was the most recent and representative year without covid restrictions in place. This allows everyone to observe the c.10% reduction in electricity which is attributed to the replacement of various fluorescent and incandescent bulbs with LED bulbs across much of the campus and multiple insulation upgrades.

The notice board also contains fun facts about how much energy a mobile phone charger uses all night while plugged in and to raise awareness about energy waste. Finally, behavioural practices have been advertised on the noticeboard and at key positions through the buildings reminding all to close windows and doors to conserve heat and energy, and to turn off lights to conserve energy.

A number of energy reduction projects are planned across the campus to improve the overall energy performance. These projects cover building fabric and glazing upgrades as well as continued lighting improvements. Renewable energy generation onsite has also been assessed for both wind and solar photovoltaics'. The wide-ranging set of energy reduction

[1] Encyclical Letter Laudato Si' of the Holy Father Francis on Care for Our Common Home

opportunities will also help to satisfy some of the criteria of available capital supports. They will also provide confidence to all stakeholders that the campus can build on successful energy projects from the past and continue to deliver environmental improvements and cost reductions into the future.

2. Introduction

Rowan Engineering Consultants Ltd (Rowan) were appointed to develop a comprehensive Energy Master Plan (EMP), including both a Baseline Energy Audit (BEA) and a Register of Opportunities (RoO) for the Glenstal SEC. Rowan's initial report outlined Glenstal Abbey SEC's energy baseline and detailed the methodology and criteria used to develop the review. It was compiled as part of the development and implementation of a formal Energy Master Plan (EMP) for Glenstal Abbey as per the requirements of the Sustainable Energy Authority of Ireland's (SEAI's) SEC Network who manage and support all of the EMPs across the country.

The purpose of the energy baseline is to:

- Set a baseline against which Glenstal Abbey SEC can measure progress with regards to future energy reduction,
- Identify the Significant Energy Users (SEUs)
- Identify opportunities to reduce energy consumption,
- Indicate the potential for renewable energy technology,
- Measure Glenstal Abbey SEC's carbon footprint.

2.1 Site overview

Glenstal Abbey is home to a community of Benedictine monks in Murroe, County Limerick, Ireland, and is a place of prayer, work, education and hospitality. The monastery sits alongside a popular guesthouse and a boarding school for boys, housed within a 19th century Normanesque castle amidst five hundred acres of farmland, forest, lakes, and streams.

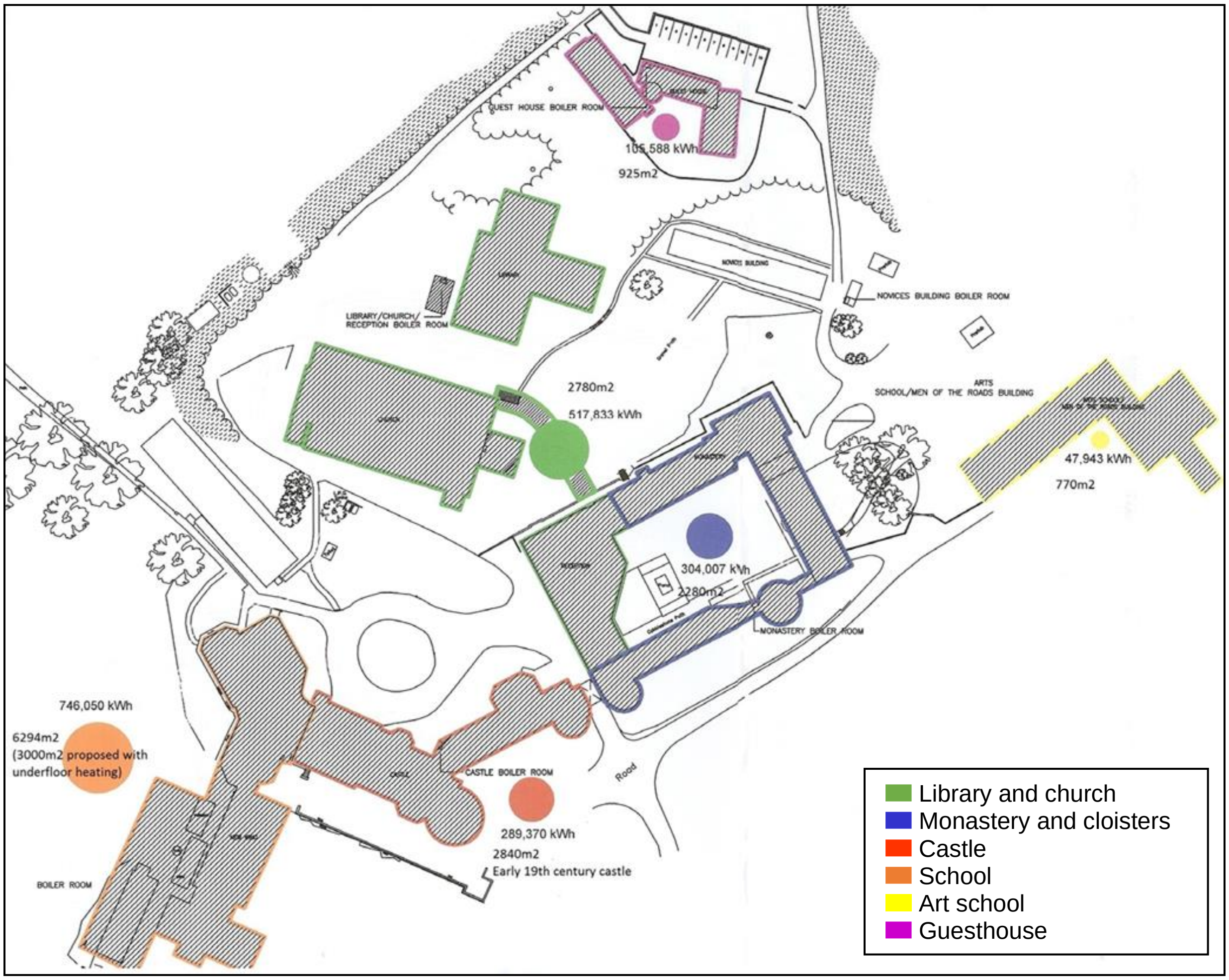
The Glenstal Abbey SEC includes both the monastic (monks & staff) and the school (students & staff) communities. The study area includes the monastic and school buildings and various guest accommodation as well as the water courses and lakes of the Abbey grounds, but not the farm.

Glenstal Abbey Monastery comprises 27 full-time monastic residents. Glenstal Abbey School typically comprises 220 students with the current number at 173 full-time boarders and 46 day-boarders. There are 183 days of teaching, which is longer than the standard school year. The full-time boarders spend some weekends at the campus with 25 weekends of residence for these students. 82 staff work across both the monastery and the school, however, there are 102 staff in total when contracted staff are included. Figure 2.1 presents the various buildings at Glenstal Abbey with an indicative energy demand.

A separate guesthouse is also situated on site with approximately 12 guests at any one time. There are also some satellite guest houses located around the grounds away from the main set of buildings which can bring the guests number up to 15 at any one time. Other guests and visitors make use of the campus as Glenstal hosts many courses, summer schools and camps as well as small conferences throughout the year.

There is an international language school each summer for 6 weeks and comprising up to 220 students. There is an art school for 50 adults across 14 days each summer. There are also between 30 and 50 people on retreat at weekends when all students are at home. Maintenance is also carried out in the summer, so the campus is quite active all-year round.

Figure 2.1 Glenstal Abbey and Glenstal Abbey School



Glenstal Abbey and Glenstal Abbey School are located within 250 acres of farmland and 200 acres of forestry. Glenstal Abbey is subject to a number of additional environmental obligations as the estate includes a Special Area of Conservation (SAC) for the Killarney Fern in the Glen[2] and part of the estate is included in the Slieve Felim Special Protection Area (SPA) for the Hen Harrier.[3] In addition, there is a proposed National Heritage Area which will link the SAC and SPA areas covering the forested area behind the Abbey and School buildings. The Abbey participates in the Native Woodland Conservation Scheme and also in the Rural Environment Protection Scheme which helps maintain the native woodland and surrounds. Glenstal provides an important habitat, and in particular its native woodland, for many plant and animal species, some of which are threatened and endangered species. Any initiatives must take these important natural heritage issues into consideration.

[2] NPWS (2018) Conservation Objectives: Glenstal Wood SAC 001432. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage, and the Gaeltacht.

[3] NPWS (2022) Conservation Objectives: Slievefelim to Silvermines Mountains SPA 004165. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.

The national inventory of architectural heritage list Glenstal Castle[4], Glenstal Castle Gate Lodge,[5] the front Gate Lodge,[6] and the rear Gate Lodge.[7] The Castle and the various lodges are subject to strict heritage regulations which limit the ability to render the buildings more energy efficient. The gate lodge and its accompanying towers and roofs, the great round tower, its roof and adjacent roof were restored under the supervision of CONSARC Conservation Architects through September 2021 to March 2022. The cap stones were lifted and lead lined underneath to reduce water ingress and the stones were treated to remove vegetation and stabilise them, with some degraded stonework replaced. A second section extending from the gate lodge to the gate keep on the inner courtyard side will have its cap stones lifted, lead lined underneath, and the stone facing treated or replaced as required. This second phase also under CONSARC is to go to tender imminently and is projected to be completed within 2023. The roof upgrades have improved insulation and damp issues but there are constraints on windows and other insulation options. However, the thickness of the walls of the castle does insulate against heat loss in winters and protect against heat ingress in hot summers.

The estate also includes a number of sites of archaeological significance, namely the 1680s walled garden, the Mass Rock with the late medieval wall panels, and the remains of Capercullen Castle all within or adjacent to the glen.[8]

2.2 Ireland's Climate Action Plan 2021

The Irish Government's Climate Action Plan 2021 sets out a detailed sectoral roadmap designed to deliver a 51% reduction in GHG emissions by 2030. Each sector in the Irish economy will have to undertake significant commitments to deliver this GHG reduction, as detailed in Table 2.1 below.

Table 2.1 Proposed Emission Reductions by Sector - Climate Action Plan 2021

Sector[3]	2018 emissions ($MtCO_2$eq.)	2030 target emissions ($MtCO_2$eq.)	% reduction relative to 2018[4]
Electricity	10.5	2-4	62-81%
Transport	12	6-7	42-50%
Buildings	9	4-5	44-56%
Industry	8.5	5-6	29-41%
Agriculture	23[5]	16-18	22-30%
LULUCF	4.8	2-3	37-58%
Unallocated Savings	N/A	4[6]	N/A

Many organisations are setting ambitious targets to reduce Scope 1 and Scope 2 GHG emissions by 51% by 2030 with a view to a carbon net-zero trajectory by 2040. Scope 1 emissions typically relate to emission from fossil fuel combustion on-site while scope 2

[4] See the enclosed link for the Glenstal Castle detailed entry in the inventory: https://www.buildingsofireland.ie/buildings-search/building/21900703/glenstal-abbey-garranbane-moroe-limerick

[5] See the enclosed link for the Glenstal Castle Gate Lodge detailed entry in the inventory: https://www.buildingsofireland.ie/buildings-search/building/21900704/glenstal-abbey-garranbane-moroe-limerick

[6] See the enclosed link for the Glenstal Front Gate Lodge detailed entry in the inventory: https://www.buildingsofireland.ie/buildings-search/building/21815014/glenstal-abbey-garranbane-moroe-limerick

[7] See the enclosed link for the Glenstal Front Gate Lodge detailed entry in the inventory: https://www.buildingsofireland.ie/buildings-search/building/21900701/glenstal-abbey-garranbane-moroe-limerick

[8] The monograph by Brian P. Murphy, *Glenstal Abbey Gardens*. Limerick: Papaver Editions, 2014 provides an excellent overview of this archaeological heritage.

emissions are the indirect emissions from electricity generation. There is another category of emissions, called scope 3, which are covered by all other upstream and downstream activity from the campus including purchased goods and services, waste disposal and commuting. Scope 3 emissions are not part of the EMP report.

A clear understanding of energy and water usage can help Glenstal to deliver structured and verifiable cost reductions while also achieving their required GHG emission reductions. Enhanced understanding of systems and processes can also help to effectively and accurately communicate resource efficiency improvements both internally and externally.

3. Energy Infrastructure

3.1 Energy type and suppliers

There are a number of energy types and sources at Glenstal Abbey. Thermal energy is the main energy demand on site, and this is supplied by a combination of gas oil, Liquefied Petroleum Gas (LPG), water source heat pump and solar thermal panels.

Gas oil is the main source of thermal energy and is supplied by Shreelawn Oil. Gas oil is used for central heating and hot water heating for amenities. LPG is supplied by Tervas Gas and is primarily used for cooking and laundry drying with some used for central heating and hot water heating. There are a variety of gas oil and LPG storage tanks spread around the Glenstal campus serving a number of boilers and other equipment to supply the different energy demands.

The water source heat pump takes energy from an onsite lake and boosts the temperature to the required level for the underfloor heating in the main reception, library and church. The heat pump consumes electricity. This heat pump was installed in 2007 and further modified in 2014 where it has since replaced a LPG boiler.

There are also two sets of solar thermal panels on two of the Abbey's roofs. One set of panels feed the monastery kitchen and some bedrooms/showers and acts as a top up to the LPG boiler in that area. The second set of panels feed other parts of the monastery residence acting as top up to the gas oil boiler in that area.

Electricity is another significant energy demand and is supplied by Electric Ireland to the main campus buildings including monastery, school and guesthouse. Bord Gais supply electricity to the satellite guesthouses. Electricity is used for lighting, heating, food storage and preparation, laundry, IT and communication services, electric vehicle charging and water pumping.

The power factor is an important aspect of the site's electricity infrastructure. The power factor is effectively a measure of the site's ability to take electricity from the grid. This number is measured between zero and one and should be as close to one as possible. The power factor is a unit-less number used in alternating current circuits, it can be used to refer to a single piece of equipment such as an induction motor or for the electricity consumption of an entire building. In either case it represents the ratio between true power in kilowatts (kW) and apparent power in kilovolt-amps (kVA).

This also links to the Maximum Import Capacity (MIC) for the site which is indicated on the electricity bill. The MIC is an agreement between Glenstal Abbey and the grid operator that a certain level of electricity will always be available each hour but also that Glenstal Abbey will not consume more than this amount of electricity in any hour. The MIC is the upper limit on the total electrical demand that can be placed on the network system, so it should be high enough to meet the requirements of the consumer. Capacity is measured in kVA.

Each connection point on the electricity network has a MIC associated with it. The network is designed to provide every consumer with an electricity supply that is in accordance with a specified MIC. Medium to large customers agree a level with ESB Networks according to their specific requirements.

These power factor and MIC values will be important if there are to be any significant changes to electricity consumption or even electricity generation at the site. The installation of more heat pumps or renewable electricity generation from wind turbines or solar pv panels could be impacted by the MIC in particular.

Diesel is also consumed on site with green diesel for farm vehicles and auto diesel for road vehicles. The diesel is supplied by Shreelawn Oil. Petrol is consumed for other road vehicles, but this is provided by local service stations.

3.2 Overview of operational activities

The majority of energy consumption is split between the monastery and the school. The monastery includes the main reception, cloister residence, library, church and kitchen. Energy is primarily used for lighting and space heating as well as a kitchen area and other services such as IT. The kitchen has a large walk-in fridge with LPG powered stoves.

Some of the monastery residence buildings are quite old with poor building fabric and single pane glazing. These buildings range in age with some built in the 1940’s, 1970’s and 1980’s with some more modern parts of the monastery.

The school includes the castle (which forms part of the junior students’ dorms), the refectories and kitchen, the senior students’ dorms and a relatively recent extension to the school which includes classrooms, atrium, and science labs. The school also has a sports hall with a separate heating system although this is quite a small energy demand.

The castle is almost 200 years old, and work is ongoing to improve the building fabric. This work must be done in line with strict heritage and preservation guidelines. There is also some single pane glazing in the castle, but this is difficult and expensive to replace while still maintaining the aesthetic of the original building. The senior students’ dorms were built in the 1950’s and 1960’s with poor insulation and bare concrete ceiling slabs.

Similar to the monastery, energy in the school is primarily used for lighting, space heating, and food preparation. The school kitchen is larger than the monastery kitchen with a walk-in freezer as well as a walk-in fridge. The stoves and hobs are also powered by LPG. There is extra dish washing equipment which is heated and operated electrically.

There is an in-house laundry service serving both the monastic and student residents. This laundry service operates Monday to Friday for approximately 12 hours each day and approximately 4 hours on Saturdays. Industrial sized washing and drying machines are continuously operating across these hours. The washing machines are powered by electricity while the dryers use LPG.

Glenstal provides a comfortable, purpose-built guesthouse for accommodating guests. The guesthouse is located separately in a quiet area of the grounds with car parking available. There are bedrooms on two floors, a sitting room, a small meeting room, a dining room and a small kitchen. There are 12 ensuite bedrooms (ten single and two twin rooms). Energy is primarily used for lighting and space heating in the guesthouse.

There are a number of vehicles that consume diesel at Glenstal. Some of these vehicles are conventional road vehicles and some are farm machinery. There are a selection of road vehicles powered by diesel, petrol, and electricity.

There are some buildings of low-occupancy and infrequent use, such as the art school, which have a low energy demand and will not be assessed under this report. The building fabric is typically quite poor with single pane windows, so significant refurbishment would be required to upgrade these buildings with limited energy reductions due to low usage.

There are two God Pods for guest accommodation located on the Abbey grounds. Each pod is a single, self-catering, open plan dwelling with a kitchenette, dining, sleeping space, and bathroom. They are equipped with a small fridge, electric hob, and microwave oven. Heating is electric with a wood stove.

There are also some other satellite guesthouses which are individual buildings located away from the main campus. These are small energy users and are not included in the energy baseline assessment.

Water is pumped from an onsite well at approximately 100,000 litres per day. This water is pumped to a storage tank and gravity fed to the required users.

3.3 Equipment

Table 3.1 outlines the fossil fuel boilers that are located across the Glenstal Abbey campus. Most of these boilers consume gas oil. Some of these boilers seemed to be in poor condition during the site visit and it was not immediately apparent if all of these boilers were operational. The “Men Of Roads” Grant 50/90 boiler and “The Huts” SIME IR4 boiler are located away from the main campus and will not be assessed in this project because these are small energy demands with marginal gains.

There is also a “Glow Worm” LPG boiler near the main reception, but the details were not recorded and are not included in this table. This LPG boiler is linked to one of the solar thermal panel systems. The gas oil boilers in the Monastery enclosure are linked to the other solar thermal system.

It was initially estimated that these boiler systems were operating at a relatively low efficiency down as low as 60%. No fossil fuel system will ever be 100% efficient and while a certain inefficiency is expected, this efficiency should be in the region of 90%. This estimated 60% value is not just the combustion efficiency of the burner but the overall efficiency of the heating system to then convert that heat into water and then distribute that heat to the end users.

A case study on the SEAI website for the Sligo Park Hotel Energy Savings project states that “*the oil boilers were over 16 years old with thermal efficiency (65-70%) well below that of modern condensing boilers (90%+)*.” Woolfoot heating state that “*usually, a new condensing oil-fired boiler will have an efficiency rating of 92% to 93%, when compared with 85% for other new non-condensing boilers and between 60% to 70% for most older systems.”*

However, an audit of the boilers was carried out in September 2022. The efficiencies of the boilers were found to be over 80% with some of the LPG boilers recording efficiency of over

90%. The audit report suggested that overall boiler efficiency is optimal with annual cleaning and servicing.

Table 3.1 List of Fossil Fuel Boilers (on site in 2022)

Location	Boiler Type	Burner Type	Fuel
Castle Boiler House	Hoval Unolyt 65	Elco 2A16	Gas Oil
Castle Boiler House	De-Dietrich	Riello RL 28	Gas Oil
Castle Boiler House	Heat master 100 N	BG 2000 M	Gas Oil
Castle Boiler House	Heat master 75 N	BG 2000 M	Gas Oil
New Wing	Buderas Lollar 6505	Riello Press 2G	Gas Oil
New Wing	Buderus	Riello RL 70	Gas Oil
Monastery Enclosure	Hoval Unolyt 92-110	Elco Elo 2.15	Gas Oil
Monastery Enclosure	Hoval Unolyt130-150T	Riello 40 G20	Gas Oil
New Library	De Dietrich	De Dietrich Spark gas	LPG
Sports Hall	Kersky	Riello 40	Gas Oil
New Guest House	SIME IR9	Riello 40 G10	Gas Oil
Boiler House	Firebird Popular	Riello G5T	Gas Oil
Men Of Roads	Grant 50/90	Riello RD3	Gas Oil
The Huts	SIME IR4	Riello 5M	Gas Oil

Some of the other key pieces of equipment include the heat pump that supplies the underfloor heating in the main reception, library and church. There are three 24kg washing machines in the laundry operating over 60 hours per week for most of the year. There are also three 24kg dryers in the laundry operating over a similar time and consuming LPG. There are some other pieces of equipment in the laundry, but they are quite small in comparison to the main washers and dryers.

There is a large kitchen in the school preparing three meals per day for all the student and teaching staff. The equipment is relatively standard and in fairly good condition. There are several ovens, fryers, hobs and stoves. There is one walk-in fridge operating at below 5°C and one walk-in freezer operating at -18°C. There is also a dishwasher operating at 80°C. The kitchen staff seem to operate the equipment efficiently in response to the demands of the day with good control of on/off times of the various equipment.

There is smaller kitchen in the monastery with some similar equipment to the school kitchen but operating far fewer hours and for less people. There is no walk-in freezer in the monastery kitchen.

4. Data Analysis

4.1 Data recording and availability

Glenstal Abbey has a Building Management System (BMS) that displays some current and historic electricity data for part of the campus called the "New extension". This BMS also displays a variety of other parameters such as temperature, air quality, time schedules and alarms. Remote access was granted to the BMS for this energy baseline report. The historic monthly electricity data for the "New extension" was used in this baseline energy report. Some of the other data such as temperature profiles will be used in the next phase of the assessment.

A thorough record of fuel consumption is maintained at Glenstal by the maintenance staff. Fuel deliveries are recorded for the various gas oil storage tanks spread across the campus. Gas oil delivery records have been maintained since 2007 and data up until July 2022 was provided for this baseline exercise. LPG data has been recorded since 2011 and this data was provided up until October 2017 with a more recent data set from July 2019 to July 2022.

No energy data from the solar thermal panels are recorded but it is expected that this amount of energy is small.

The heat pump data in this report is taken from other reports that were previously created indicating the heat pump's performance which includes electricity consumption and heat output. The current heat pump electricity consumption is available on the BMS and is provided as the "daily total" and the "weekly total". There are some issues with data quality due to the periodic archiving of data, but some historic usage is available for the heat pump electricity consumption and the heat pump output, but further analysis is required. Similar data is available on the BMS for the "Castle building".

The Climate Action Plan 2021 set a target for schools to improve their energy efficiency by 50%. As part of this, schools are required to report annually on their energy usage through SEAI's online Monitoring and Reporting (M&R) system. SEAI's annual report on energy efficiency in the public sector includes details of the energy performance of the school's sector. SEAI also make it possible for anyone to access energy data for all schools through their online data portal.

The M&R system helps to track Glenstal Abbey school's energy data annually as well as providing a scorecard that presents a powerful snapshot of the school's progress to date and online access to the school's annual electricity and fossil fuel consumption data. Glenstal submit annual data for electricity and fossil fuel to the SEAI portal – this excludes energy consumed in the Monastery or guesthouse.

4.2 Utility bills and invoices

A number of electricity utility bills were provided for all of 2019, 2020 and 2021. The June 2022 bill was also provided to indicate the most recent costs. An electricity summary spread sheet from 2014-2022 was also provided. This spread sheet provided monthly electricity consumption from February 2014 to July 2020 for the entire campus and also provided a breakdown of day and night electricity. Other electricity bills were also provided for the satellite guesthouses which are on a different electricity supply from a different provider.

Invoices for June and July 2022 were also provided for gas oil, diesel and LPG which gives an indication of the most recent energy prices. Historic cost information was also included with the gas oil and LPG usage spread sheets.

4.3 Methodology and criteria

The COVID pandemic had an impact on the activity at Glenstal since early 2020 in terms of student, staff, and guest presence on site. This in turn had an impact on both the energy demand and consumption in that time so in order to get a representative baseline year the data from 2019 and before was used.

Annual consumption is used to give the best baseline to measure against and calendar year data is the most suitable to use. Energy and emissions reporting typically use calendar year data which can be seen on the SEAI M&R portal.

There may have also been an impact from COVID on data collection, collation, and the subsequent data availability.

All energy information in this report is provided in kWh. All subsequent analysis will be carried out using kWh. Any capital funding and other incentives all require kWh for their evaluation. These kWh values can be easily converted to MWh if required. There are some fuel values provided in litres in this report, but they have been converted to kWh.

All energy data is also converted into the associated CO_2 emission. The conversion factors are taken from the UK government's Department for Environment Food & Rural Affairs annual publication. A new set of conversion factors are produced each year, together with a methodology paper explaining how the conversion factors are derived, and a paper explaining the major changes in the latest year's factors. The government conversion factors for greenhouse gas reporting are for use by UK and international organisations to report on greenhouse gas emissions[9].

All CO_2 emission information in this report is provided in kg of CO_2 equivalent ($kgCO_2e$). These $kgCO_2e$ can be easily converted to tonnes CO_2e if required.

4.4 Total energy baseline annual consumption

Table 4.1 Energy baseline annual consumption (2022)

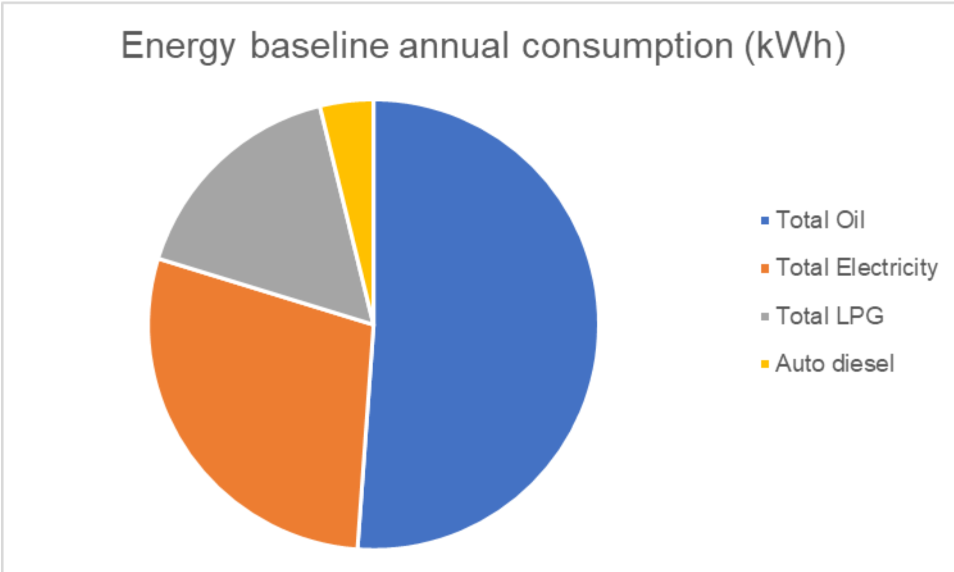
Energy Type	Energy (kWh)	% Energy split	Energy Costs	% Costs split
Total Gas Oil	1,556,913	51%	€ 172,014.28	46%
Total Electricity	870,849	29%	€ 135,068.70	36%
Total LPG	499,683	16%	€ 49,344.04	13%
Auto diesel	116,764	4%	€ 17,534.35	5%
TOTAL ENERGY	**3,044,210**		**€ 373,961.37**	

Table 4.1 outlines the energy baseline annual consumption for Glenstal Abbey covering the main energy types. It also indicates the % split of energy consumption and a breakdown of the

[9] Greenhouse gas reporting: conversion factors 2021: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

costs. Gas oil is the biggest source of energy consumption and the biggest energy cost at Glenstal. Figure 4.1 presents a pie chart of the baseline annual consumption for the main energy types.

Figure 4.1 Energy baseline annual consumption



4.5 Electricity baseline annual consumption

Table 4.2 outlines the breakdown of annual electricity consumption for the key areas detailed in the overview of operational activities. It also indicates the % split of electricity consumption and a breakdown of the costs. The electricity supply from Electric Ireland has no carbon footprint and as a result there are no CO_2 emissions associated with Glenstal Abbey's electricity consumption.

The electricity has traditionally been split 70/30 in favour of the school and this split has been used for the baseline energy assessment. There is a meter serving the "new extension" which covers the newest part of the school, the classrooms, atrium, science labs, changing rooms and laundry.

The washing machines are located in the laundry which can be apportioned to both the monastery and the school. The washing machines' electricity consumption can be estimated based on their kW energy rating and their annual hours of operation. The washing machines' electricity consumption can be subtracted from the new extension meter reading to give us the residual electricity consumption for those areas in the new extension.

The school electricity consumption in Table 4.2 is 70% of the total annual electricity minus the new extension meter reading. The school is the biggest electricity consumer, and this also includes the new extension which pushes the overall electricity consumption for the school to over 50%.

Interestingly, the heat pump consumes approximately 100,000kWh of electricity annually. However, it operates at a Coefficient of Performance (CoP) of about 5, so the heat output is approximately 500,000kWh per annum. This is presented later in Table 4.3 and Figure 4.3.

The Monastery and Guest House value in Table 4.2 is 30% of the total annual electricity minus the heat pump.

Table 4.2 Breakdown of annual electricity consumption (2022)

Area	Electricity (kWh)	% Elec split	Electricity Costs
School	417,546	48%	€ 64,761.45
Washing Machines	150,480	17%	€ 23,339.45
Monastery and Guest House	157,755	18%	€ 24,467.76
Heat Pump	103,500	12%	€ 16,052.85
New Extension	41,568	5%	€ 6,447.20
TOTAL	**870,849**		**€ 135,068.70**

Figure 4.2 presents a bar graph of the annual electricity consumption from 2014 to 2021. The impact from COVID can be clearly seen in 2020, with 2021 consumption returning to expected levels as activity increased on site. Further analysis is carried out in the "Energy baseline profile" section later.

Figure 4.2 Annual electricity consumption from 2014 - 2021

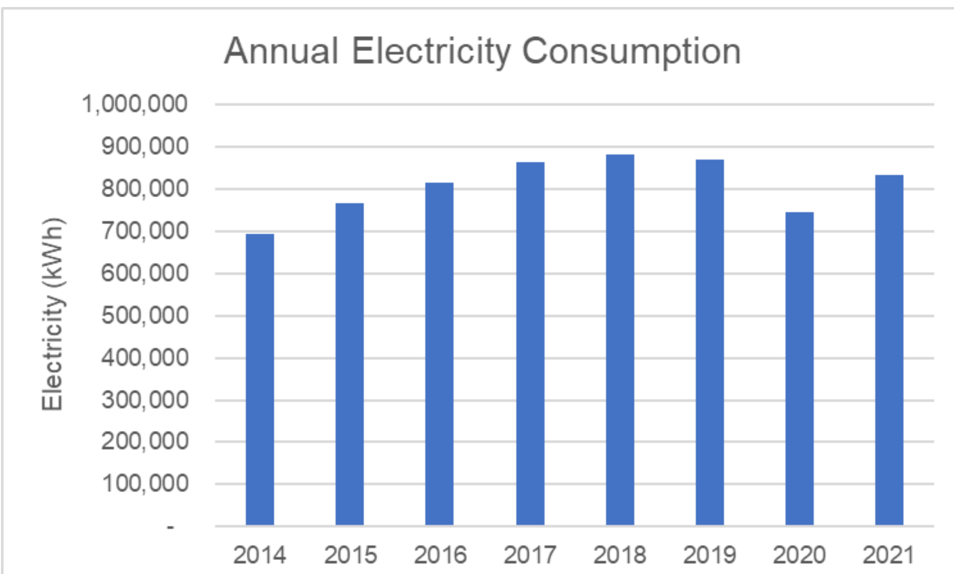
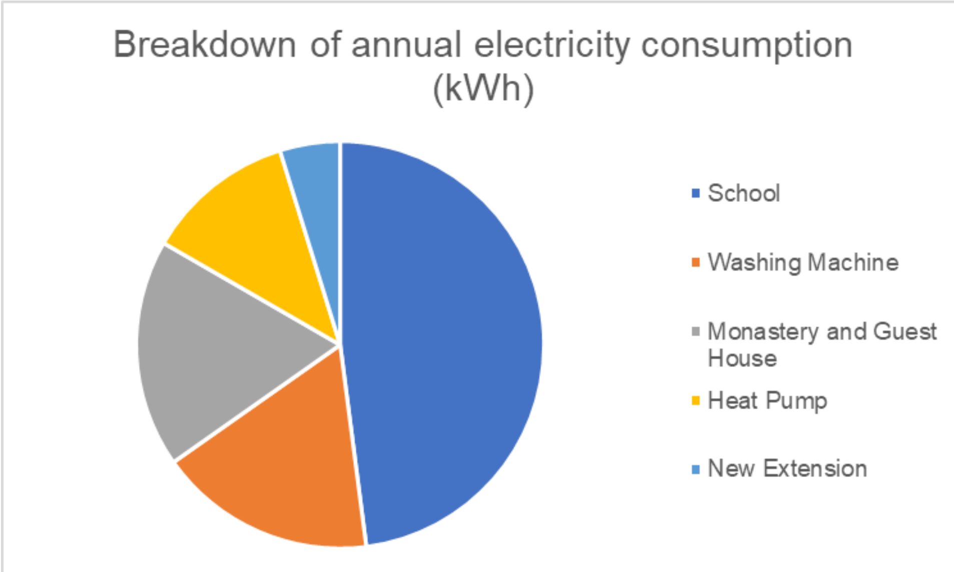


Figure 4.3 presents a pie chart of the breakdown of annual electricity consumption for the key areas outlined in the overview of operational activities.

Figure 4.3 Breakdown of electricity consumption



4.6 Thermal energy baseline annual consumption

Table 4.3 outlines the breakdown of annual thermal energy consumption for the key areas detailed in the overview of operational activities. It also indicates the % split of thermal energy consumption, the actual thermal energy demand, the associated carbon footprint and the total costs.

The actual demand is included to indicate the inefficiency of having various fossil fuel boilers spread across the campus; with the boilers themselves operating at approximately 60% efficiency. The actual demand also highlights the performance capability of the heat pump with 5% of the total thermal energy consumption from the heat pump providing 28% of the total energy demand.

The 2012 building, which incorporates older buildings dating from the 1950's and 1960's, constitutes the largest energy consumption and ultimately the largest cost. The poor building fabric of the senior student's dormitory from the 1950's and 1960's is likely leading to higher energy consumption in this area.

The CO_2 emission values are slightly skewed towards the gas oil which is clearly the biggest source of CO_2 emissions. This is mainly due to the fact that the electricity supply from Electric Ireland has no carbon footprint. The % energy consumption broadly matches the % cost despite each fuel having a different cost per kWh.

Figure 4.4 presents a bar chart of the % breakdown across each of the thermal energy users covering their energy consumption, their thermal energy demand, their CO2 emissions and their costs.

Table 4.3 Breakdown of annual thermal energy consumption (2022)

Location	Energy Usage (litres)	Energy Usage (kWh)	% Gas Oil	% LPG	% Total Energy (kWh)	Actual Energy Demand (kWh)	% of Total Energy Demand	Carbon Emissions (kg)	% of Total Carbon Emissions	Fuel Costs €	Carbon Tax €	Total Costs €	% of Total Costs
2012 Building	53,067	569,940	37%		25%	473,050	19%	146,389	29%	€56,967.35	€6,001.95	€62,969.30	27%
Residence Monastery	39,108	420,020	27%		18%	357,017	14%	107,882	21%	€41,982.38	€4,423.17	€46,405.55	20%
Castle	36,607	393,159	25%		17%	326,322	13%	100,983	20%	€39,297.56	€4,140.30	€43,437.87	18%
Guest House	14,357	154,194	10%		7%	127,981	5%	39,605	8%	€15,412.22	€1,623.80	€17,036.02	7%
Sports Hall	1,825	19,601	1%		1%	15,680	1%	5,034	1%	€1,959.13	€206.41	€2,165.55	1%
Total Gas Oil	**144,964**	**1,556,913**	**100%**		**68%**	1,300,050	**51%**	**399,893**	**79%**	**€155,618.66**	**€16,395.63**	**€172,014.28**	**72%**
Laundry	35,782	259,776		52%	12%	207,821	9%	55,716	11%	€23,258.18	€2,394.88	€25,653.06	11%
School Kitchen	11,019	80,000		16%	4%	80,000	4%	17,158	3%	€7,162.53	€737.52	€7,900.06	3%
Main Reception	9,035	65,594		13%	3%	62,314	2%	14,068	3%	€5,872.73	€604.71	€6,477.44	3%
School Labs	7,481	54,313		11%	3%	54,313	3%	11,649	2%	€4,862.74	€500.71	€5,363.46	2%
Monastery Kitchen	5,510	40,000		8%	2%	40,000	2%	8,579	2%	€3,581.27	€368.76	€3,950.03	2%
Total LPG	**68,827**	**499,683**		**100%**	**23%**	444,448	**20%**	**107,170**	**21%**	**€44,737.46**	**€4,606.58**	**€49,344.04**	**21%**
Heat Pump		103,500			5%	519,570	28%		0%	€0.00	€0.00	€16,052.85	7%
TOTAL Electricity		**103,500**			**5%**	**519,570**	**28%**		**0%**	**€0.00**	**€0.00**	**€16,052.85**	**7%**
Total Thermal Energy		**2,160,096**			**100%**	**2,264,069**	**100%**	**507,063**	**100%**	**€200,356.11**	**€21,002.21**	**€237,411.17**	**100%**

Figure 4.4 Energy baseline annual consumption (2022)

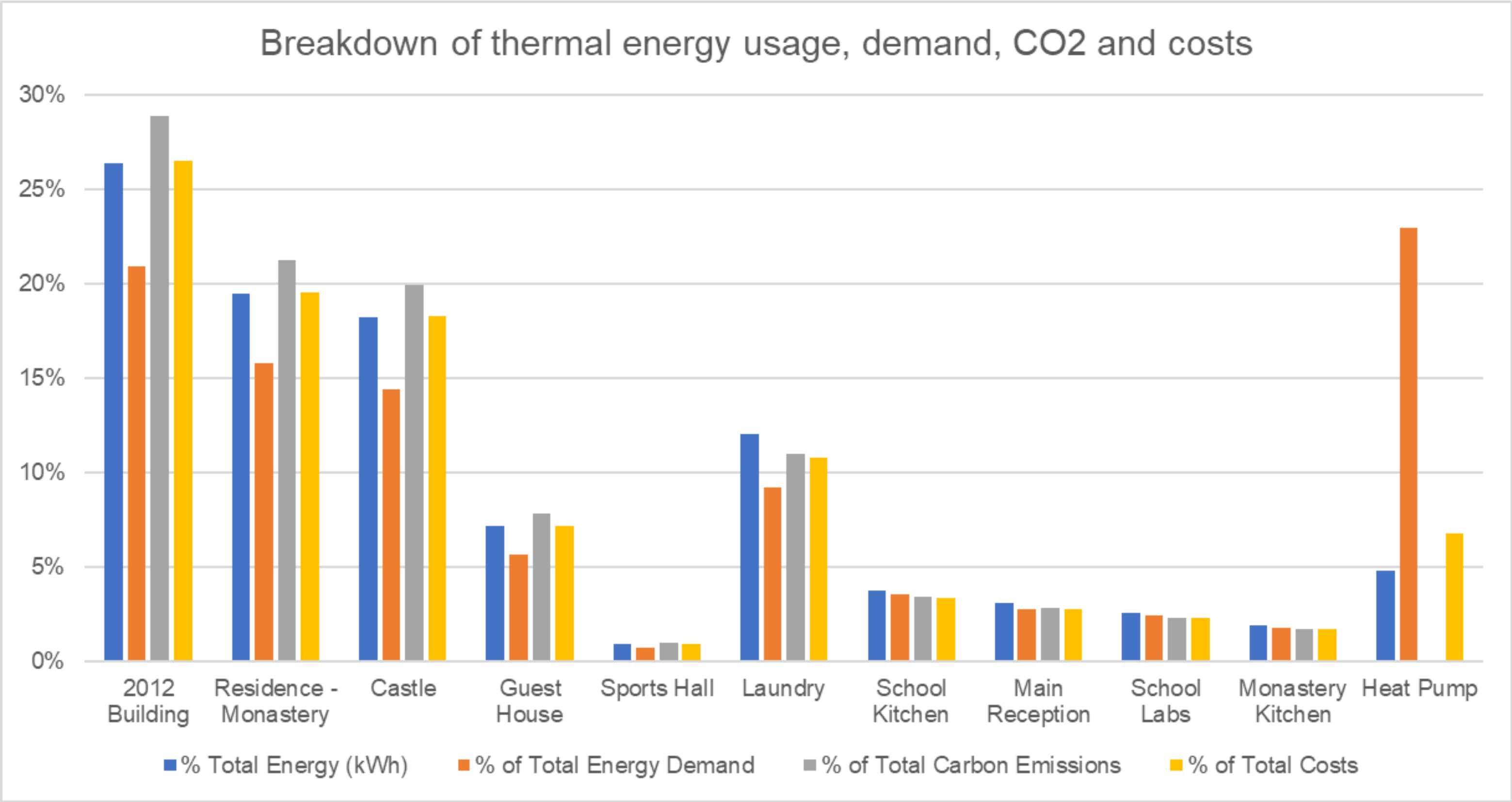


Figure 4.5 presents a bar graph of the annual gas oil consumption from 2014 to 2022, with the 2022 estimated value based on the consumption from January to July in 2022. Again, the impact from COVID can be clearly seen in 2020. However, there was only a slight increase into 2021 with 2022 consumption expected to return to pre-COVID levels as full activity returns to Glenstal.

Figure 4.5 Annual gas oil consumption from 2014 - 2022

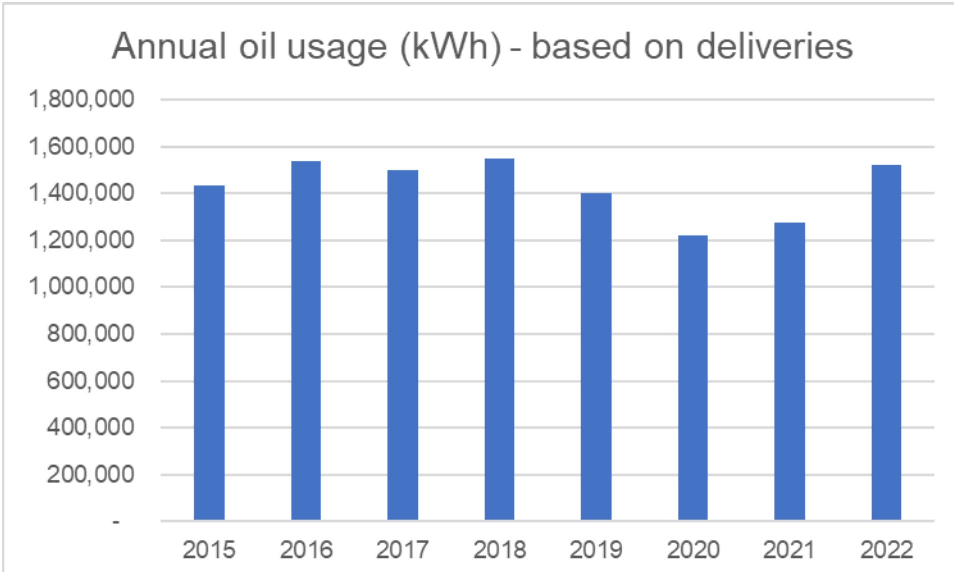
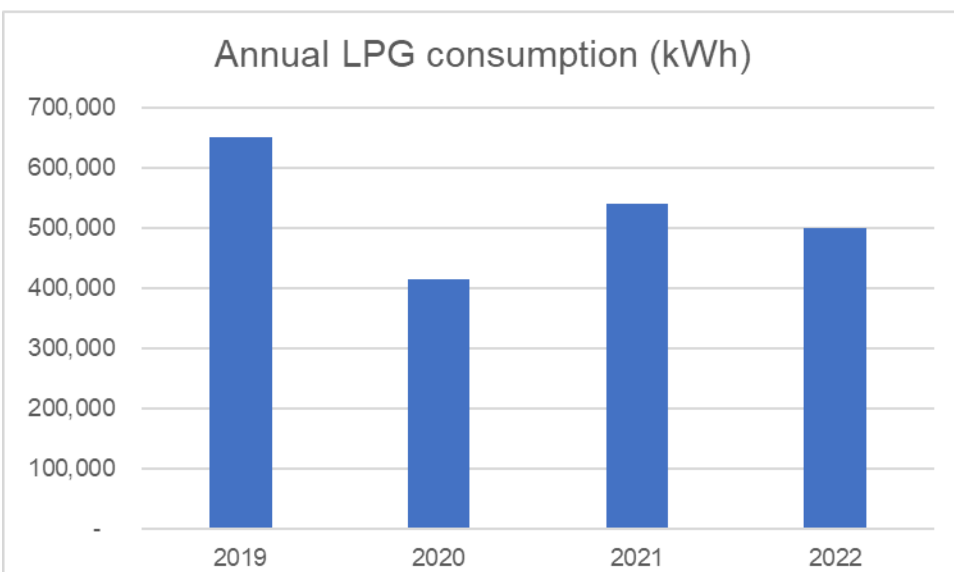


Figure 4.6 presents a bar graph of the annual LPG consumption from 2019 to 2022, with both the 2019 and 2022 values estimated because only part of the year's data was available. Again, the impact from COVID can be clearly seen in 2020. The 2019 LPG consumption is quite similar to consumption levels in 2015 and 2016 which suggests that a portion of the LPG demand has reduced in the last number of years as we can see 2021 and the projected 2022 values not returning to pre- COVID levels.

Figure 4.6 Annual LPG consumption from 2019 - 2022



4.7 Energy baseline profile

Figure 4.7 outlines the typical monthly profile of electricity consumption across the entire campus. This profile was assessed across a number of years prior to COVID to give as representative a profile as possible. The demand profile matches the expected seasonal effect with more heating and lighting required during the winter months in particular. This profile also follows the occupancy of the campus.

While there are always monks on site and some activity during the summer with guests and summer courses, the electricity demand reduces with no students in residence. Occupancy of the Castle during the summer was minimal before 2019 as it was only then that the summer language school began. The summer language school started in 2019 and it was due to run in 2020 and 2021 but it was cancelled due to COVID. However, the summer language school has up to 220 students for 6 weeks so the pattern of lower summer occupancy will no longer be true. The summer of 2022 will provide a good summer baseline.

Figure 4.7 Monthly electricity consumption profile (2022)

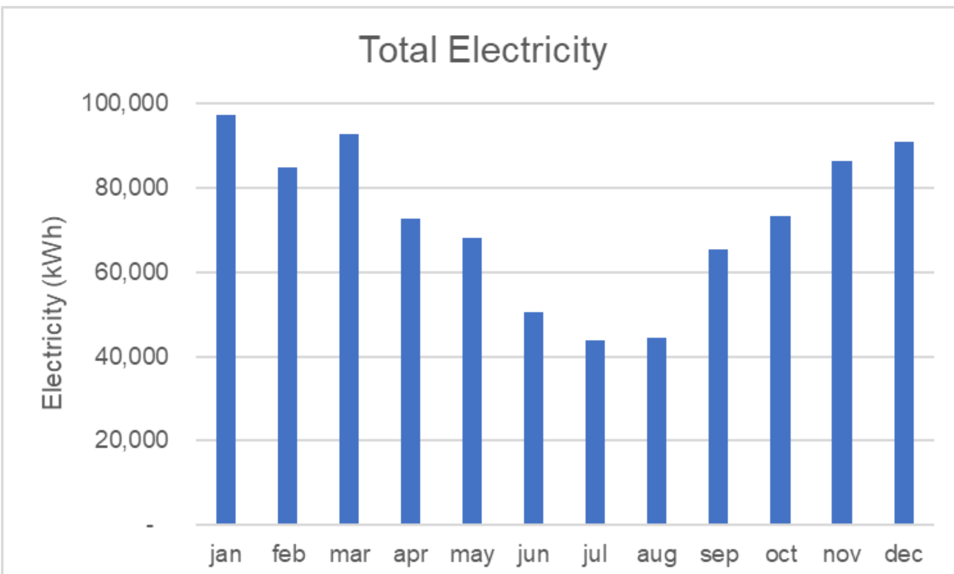
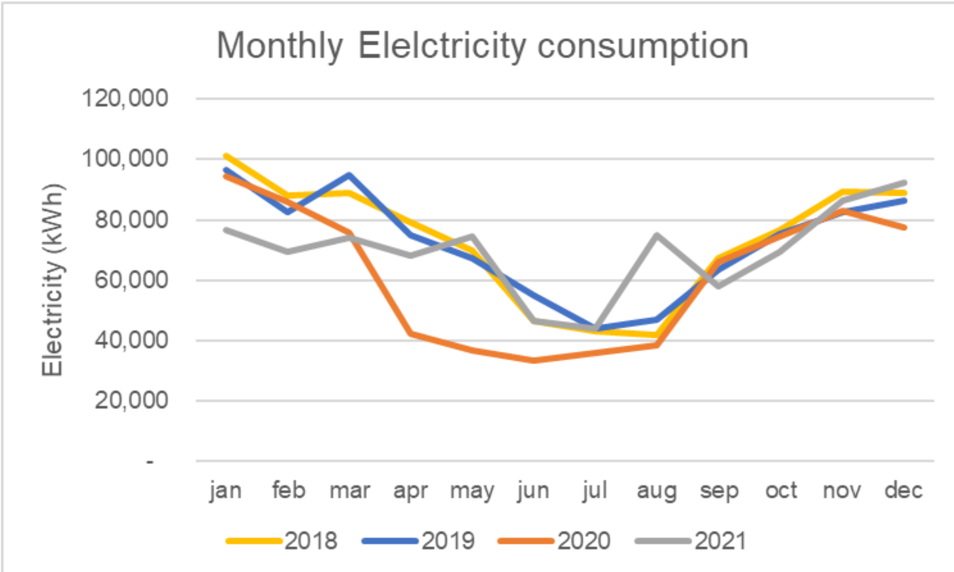


Figure 4.8 presents the monthly electricity consumption profile from 2018 to 2021 and indicates the impact from COVID on electricity consumption patterns. We begin to see a reduction in March 2020 and a clear impact into April, May and June 2020 as all students, staff and guests were not on site due to the government restrictions.

Figure 4.8 also highlights that approximately 40,000kWh per month is the effective electricity baseload at Glenstal. This level of consumption serves the monastic community and the underlying services which includes telecoms and security. We can also see an impact from COVID in early 2021 when there was a re-emergence of the virus and some government restrictions were reinstated

Figure 4.8 Monthly electricity consumption profile from 2018 to 2021



Day and night electricity consumption has been assessed by Glenstal for the period February 2014 to September 2017. This is important as there are different costs for day and night rate. There are also extra charges for peak rates during winter from around 5pm to 7pm each weekday. There was a very consistent split each month in this assessment with approximately 66% consumed during the day and 33% consumed during the night which suggest that the assessment may not be fully accurate.

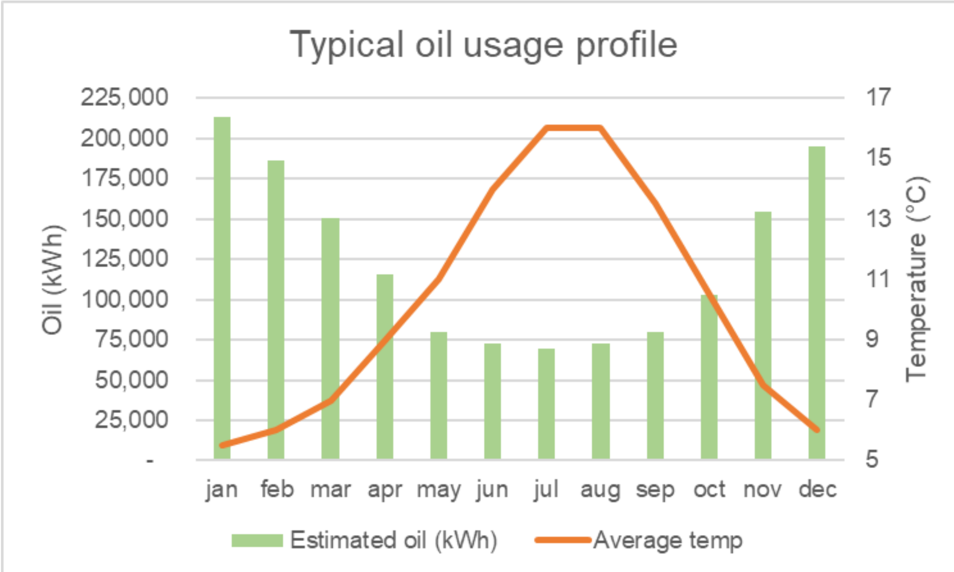
This split seems to directly match the actual hourly split between day and hight rates with day rate applied to 16 of the 24 hours and night rate applied to 8 hours, which is a 66/33 split. It would be expected that a greater % of electricity be used during the day and that the split could also vary from summer to winter. A quick assessment of the December 2021 and June 2022 bills suggest a split of 75% consumed during the day and 25% consumed during the night.

Figure 4.8 outlines the typical monthly profile of gas oil consumption across the entire campus. These gas oil consumption figures are estimated based on the delivery of gas oil to the campus. The average daily temperature across each month is also indicated on this graph.

The trend is very similar to that of the electricity in Figure 4.4. The demand profile matches the expected seasonal effect with more heating required during the winter months. As the average temperature decreases the demand for gas oil increases.

This profile also follows the occupancy levels of the campus. While there are always monastery residents and some activity during the summer with guests and with summer courses, the gas oil demand reduces with no students in residence. Between 75 and 80 exam year students are on site in June and then 200-220 for 6 weeks in July and first half of August.

Figure 4.8 Monthly gas oil consumption profile (2022)



The LPG trend was also assessed from the most recent available data between October 2016 and October 2017. The trend does not follow the same profile as electricity or gas oil above in Figure 4.4 or 4.5 respectively. However, it appears that there are two distinct sections in the year with lower demand from March to September and higher demand from October to February. It is expected to see relatively high demand across the year driven by the laundry service, and this laundry demand would be expected to increase in the winter months. Another driver of LPG consumption is the food preparation and this obviously reduces in the summer with the students on holidays.

5. Targets

Glenstal should consider a target of 100% reduction of carbon emissions by 2035 with a caveat that this will be done in the most sustainable approach, based on integrity and aligning with the wider ethos of Glenstal. The carbon target is effectively 100% reduction across the whole of society, so this is a suitable ambition for Glenstal to aspire towards. Glenstal should also consider milestone years in 2025 and 2030 to indicate the planned emission reduction projections.

The complete reduction of oil consumption should also be a key target from now until 2030. This will require investment in alternative technology such as heat pumps but may also requires the procurement of biofuels in due course as they become more readily available on the market. Electrification of heat is a viable option in terms of cost, energy security and emission reductions but Glenstal will need to assess the risk of total conversion to electrical energy and may wish to keep conventional fuels (or biofuels in the future) as part of their energy mix.

There are "get out of jail free cards" when it comes to carbon reduction – for example, the purchase "green" electricity. This routinely has limited environmental benefit and is usually a mechanism for organisations to sidestep the issue while maintaining a veneer of environmentally sound business practices. The procurement of electricity from offsite renewable sources may be a part of Glenstal's strategy but this must be done with due consideration of the environmental benefit.

One other item to consider is that technology will continue to improve through innovation, scale, and reduced costs, and some of the technology solutions for 2030 and beyond may not even be invented yet. Other policy decisions in Ireland and the wider EU can also impact progress, both positively and negatively, towards carbon reduction. Therefore, Glenstal does not need to have all the solutions for 2035 right now.

6. Register of Opportunities

The SEAI state that the Register of Opportunities is for recording all opportunities for energy savings at a location or across a SEC. The Glenstal SEC should continuously identify opportunities for energy savings and record them in the register. The register should be a 'live' document with new opportunities being added all of the time. It should include as much detail as possible and should contain a wide variety of opportunities:

- Short term and long term
- Low effort and high effort
- Low/no cost and higher cost
- Opportunities relating to organisational changes and people (e.g. employee behaviour) as well as technical measures

There should be a clear link between the opportunities and the SEUs.

6.1 Previously Implemented Opportunities

Glenstal have actively implemented a number of energy upgrade projects over the years. These projects have included all aspects of the campus and have engaged monks, students, and staff in their implementation. These projects indicate the ambition and enthusiasm of Glenstal to actively work towards reducing their energy consumption through energy efficiency upgrades.

6.1.1 Water Source Heat Pump

Glenstal installed a heat pump which used solar energy stored in the onsite lake in 2007. A liquid-filled collector hose was laid in the chapel lake 350m from the campus buildings. The heat pump got its energy by directly circulating the lake water at a coefficient of performance (CoP) of 1.5. This was replaced in 2016 with a new closed circulatory system in the chapel lake, removing the need for pumping liquid and resulting in a CoP of 5.5. This heat pump provides 25% of the campus heating needs and consumes only 5% of the energy demand.

6.1.2 Church upgrade

Glenstal Abbey Church was built between 1951 and 1956. The church was originally heated by radiators using a gasoil boiler. In the 1990s this system was replaced by suspended gas heaters. From 2007, the gas heaters were supplemented by the water source heat pump at a CoP of 1.5. In 2016 an underfloor heat delivery system was installed and the heat pump with the new CoP of 5.5 was used for heat generation and the gas heaters removed.

In addition, 20 large single pane windows were replaced with double glazed glass windows. The underfloor heating has eliminated the requirement for gas while also improving the comfort of those who use the church. Given the size and height of the building, it was not considered appropriate to pump insulation into the walls or attic space.

The church was reordered in 1979 with a vibrant painted ceiling designed by architect Jeremy Williams and new lighting for the building and surrounds. The ceiling contained 32 bulbs at

400 watts with a further 18 bulbs in the side aisles and sacristy at 65 watts with 10 further bulbs at 100 watts outside. Given that the church is used for 4 hours every day; the combined electricity consumption was 21,802kWh.

As part of the reordering of the church in 2016, under the supervision of architect Sean O'Laoire, LED lighting was installed throughout the building. The ceiling lights have reduced from 400 to 100 watts, those in the aisles from 65 to 3 watts and those outside from 100 to 6 watts. The combined electricity consumption is now 4,837kWh which represents a reduction of 16,963kWh, or a saving of €3,053 per annum. There are many churches and public buildings that might benefit from the installation of LED lighting resulting in savings on bills but more importantly reducing energy demands on our planet's limited resources.

6.1.3 LED upgrade

The Sports' Hall, built in 1985, had 20 ceiling light groupings at 300 watts, each including 6x50 watt bulbs. The cost of replacing the broken lights and fittings led to the decision in 2021 to replace all 20 light groupings with a single LED bulb at 98 watts, leading to a two thirds reduction in wattage. Each fitting and bulb cost €107 or €131.50 with VAT, totalling €2,630. This expenditure was easily recouped as the Sports' Hall lights runs for an average of 16 hours per day in term time – or 8 hours per day over the year. The total electricity consumption reduced from 12,000kWh to 3,920kWh. This represents a saving of 8,080kWh or €1,454 (at 18c/kWh) in a calendar year. The expenditure for the LED lights were repaid within 1 years and 6 months. In addition, the lights are now on a push button system and turn off automatically after 40 minutes avoiding wastage by failing to turn off lights at night or at school breaks.

6.1.4 TY Classroom Upgrade - Always Improving

The upgrading of two science classrooms, now functioning as Transition Year classrooms, has been a project ongoing since 2011. The building, first constructed in 1925 and badly needing a heating solution, underwent the installation of double-glazed windows and the pumping of insulation into the cavity wall in 2011.

In January 2022 the light fittings in each of the rooms were replaced. Room 1, the Molonium, previously held 12 bulbs at 55 watts each; they have now been replaced by five 60 watt bulbs. Consolidation of the fuse box and rewiring also took place in the Molonium. Room 2, the Green Room, previously held fourteen 55 watt bulbs; they were replaced by five 50 watt bulbs. These classrooms are used for an average of 10 hours a day over term time, consisting of 160 days. The total electricity consumption reduced from 2,288kWh to 880kWh. This represents a saving of 1408kWh or €253 (at 18c/kWh) per annum.

6.1.5 Guesthouse building fabric upgrade

The cavity walls of the residential block of the guest house were pumped with insulation in 2011 and the south facing simple timber wall of this block had an interior insulation layer installed in 2021 and in the attic space, the old, layered insulation has been replaced by tightly fitting pumped insulation. The lights in the Guest house have been replaced with LED fittings and bulbs. The plan is to replace the guesthouse gas oil boiler with a heat pump for maintaining heat and a condensing boiler for top up heating as required.

6.1.6 Refurbishment of 1950s and 1960s Block

A new school extension was built in 2013 alongside the existing 1950s and 1960s blocks with a gap between the new and old building covered by a roof forming an atrium space between them. During the work on site, the existing 1960s building had all of the single pane windows replaced with double glazed windows.

6.1.7 Solar Thermal Panels

Solar thermal panels were installed in two areas of the roof of the monastery cloister in 2002. The first set of panels feed the monastery kitchen and some bedrooms/showers and act as a top up to the LPG boiler in that area. The second set of panels feed other parts of the monastery residence and act as a top up to the gas oil boiler in that area.

6.1.8 Behavioural Modification – Student led

The students represent the largest population on campus and so for behavioural modifications to be effective, they must be implemented among this constituency. The students have developed a litter awareness campaign which has reduced litter on the avenues, coupled with the additional refuse bins that have been installed to promote good practice. They have also educated students about segregation of waste and bins in the refectories are provided for such segregation. Through discussions with the catering company, the students have identified and agreed menus that result in minimal food waste. The students have also surveyed the student population and discovered that usually showers lasted 10 mins and several showered three times a day. A practice of once daily showers of 4 mins is now being promoted among the student body to save water and thermal heat.

6.2 New Opportunities

A number of opportunities have been developed as part of the EMP. A collaborative approach within the campus has ensured that a wide-ranging set of opportunities have been addressed. These opportunities are available separately in the Register of Opportunities, but some of the key opportunities are detailed in the following sections.

6.2.1 Wind Turbine

During the EMP, the possibility of a installing a wind turbine was explored. A test mast had been set up in 2008 and there were readings for most of 2008-2009 which showed an average wind speed of 6.2m/s. The feasibility studies at the time questioned the financial viability. The figures and proposal were re-examined in the light of the current energy prices and in the light of the EMP.

The data showed that an Enercon E 40 turbine would at a conservative estimate produce 957,400kWh. The electricity usage profile on site peaks in the winter months which would have matched the peak production from the turbine. However, the project was associated with a number of planning costs. The initial site of the test mast now falls since September 2022 within the Slievefelim Special Protection Area for the Hen Harrier,[10] and a recent study conducted from July to October 2022 has confirmed the presence of important bat species on

[10] NPWS, Conservation Objectives: Slievefelim to Silvermines Mountains SPA 004165. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, 2022.

the estate.[11] Both of these environmental concerns make the granting of planning for a wind turbine unlikely and so this project has been abandoned.

6.2.2 Solar Photovoltaic

Based on both the electricity demand and the electricity capacity size feeding the campus, a 300kWp solar pv installation is considered the best option. A solar installation at this scale is estimated to generate approximately 270,000kWh per year (40-50% of daytime requirements) with peak generation capability of approximately 45,000kWh per month in the middle of summer. This electricity output could displace approximately 140 tonnes of carbon per year.

Not all of the electricity that could be generated by the solar installation will be consumed by the campus. The option to apply for a non-export agreement from ESB networks can be made immediately with a view to applying for a grid connection when the opportunity presents itself in the near future. The option for some battery storage is also a consideration and will be discussed in more detail.

6.2.3 Glazing upgrade

An assessment has been carried out of the glazing in the refectory and it has been found to be unsuitable. They are already double glazed; however, the plan would be to upgrade to triple glazing to improve the overall thermal performance of the building. The cost savings may be minimal, but the cost of replacement is relatively low at €11,500, given the size of the 12 windows.

Another assessment was carried out of the glazing in the 1950s dormitory accommodation area and again, it has been found to be unsuitable. These windows are also double glazed but they are old and no longer seal properly.

6.2.4 Metering and Building Management System

Good quality energy data will allow Glenstal to assess the correlation between energy consumption and parameters such as occupancy, activity and weather. The energy data will also help to identify the energy baseload at the site and compare actual with expected energy consumption.

A clear understanding of energy usage can help Glenstal to deliver structured and verifiable cost reductions while also achieving their required carbon emission reductions. Enhanced understanding of systems and processes can also help to effectively and accurately communicate resource efficiency improvements both internally and externally.

Some electricity metering is installed on site and linked to the current BMS. However, some of these meters are not reading accurately and may need to be replaced. The BMS itself is not very user friendly and the data display and data export are both time consuming and ineffective. Meters to divide the campus into relevant sections and linked to a data capture system would provide a beneficial breakdown of consumption to allow Glenstal to identify energy reduction opportunities and deliver ongoing energy reductions.

[11] Ruth Hanniffy, *Surveying for the lesser horseshoe bat in Glenstal Woods, Co. Limerick.* National Parks and Wildlife Service, Biodiversity Recorders Grant 2022. Vincent Wildlife Trust 2022.

Smart metering is proposed to be installed on the main electricity incomer to the site with. Smart meters have already been installed on some satellite users such as the various guest cottages on the estate; many of which are on separate electricity supplies with separate MPRNs. Other metering is proposed to either be installed or replaced to subdivide the campus and measure the energy consumption of various areas and sections.

6.2.5 Continued Refurbishment of 1950s and 1960s Block

The upgrades back in 2013 have improved the insulation of this buildings but both the 1950s and the 1960s segments of the building have only a concrete roof with no insulation. This is a high priority for the near future. The 32 old, double-glazed windows of the 1950s building's dormitory accommodation require replacement as most no longer seal properly.

6.2.6 LED lights

LED lighting will be installed progressively throughout the campus. In addition to the guest house, most of the library, the monastery reception and many of the classrooms have had LED lighting installed in the last 3 years. The plan is to continue with this process so that all lighting will be LED within 3-5 years. As with previous lighting upgrades, the plan for future lighting upgrades will be to implement as and when lights fail. The environmental impact and costs of replacing lights that are working, albeit inefficiently, is to be avoided where possible.

6.2.7 TY Classroom Upgrade - Always Improving

Looking to the future, the lowering of the ceiling and pumping of insulation into the cavity above the ceiling and below the floor is another possibility in how heating costs could be cut further. The estimated price for such work would work out at between €3,000 and €4,000. There are many schools across the country with similar classrooms, dating from the early to mid-twentieth century, that could take similar actions to not just cut down on heating and energy costs, but to also limit their impact on the environment.

7. Community Engagment

An information day was held at Glenstal on Monday 12th December. A 40 mins whole school assembly involving students, staff, and monks began the day with an overview of the key points of Laudato Si, Pope Francis's encyclical on care of our common home and climate change and a series of brief presentations by six Transition Year students on initiatives undertaken (heat pump and lake solar energy, solar thermal panels) or being considered (solar PV project) at Glenstal.

As part of the overall sustainability programme at Glenstal Abbey, the Green Logo in Figure 7.1 was developed by the Transition Year Art Class of 2021-2022, under the guidance of their Art Teacher, Ms. Dubheasa O Ceallaigh. This logo brings all of the sustainability elements together and is used within the awareness that is driving improvements in energy efficiency along with waste reduction and water management.

During the morning, students in religious education classes watched and discussed a brief summary video on Laudato Si, while students in science classes watched and discussed the film "the Letter" based on Laudato Si and more directly focused on climate change and just responses. In the afternoon the students' school council and a representative group of students from the school attended an afternoon seminar with the lead consultant from Rowan Engineering where the Energy Master Plan was presented and discussed. In addition, three student members of the SEC, gave presentations on the Baseline Energy Audit, Behavioural Approaches towards saving energy, and the Register of Opportunities.

Later in the evening, the three student members presented to the monastic community. The importance of having all constituent groups engaged in this initiative was highlighted at each stage and in particular the importance of engaging the youngest student cohorts so that sustainable practices and behaviours become embedded in the culture of the campus.

Figure 7.1 Glenstal Abbey Green Logo

GLENSTAL GOES GREEN
WITH THE GREEN SCHOOLS PROGRAMME

8. Conclusion

A number of energy reduction projects are planned across the campus to improve the overall energy performance. These projects cover building fabric and glazing upgrades as well as continued lighting improvements. While the planned solar pv project is anticipated to deliver significant cost savings by reducing the grid electricity consumption, it will not reduce the overall electricity at the campus, so it is important for Glenstal to continuously assess efficiency improvement projects.

Capital funding supports are available to facilitate these energy reduction projects. The wide-ranging set of energy reduction opportunities will help to satisfy some of the criteria of the capital supports. They will also give confidence to all stakeholders that the camps can build on successful energy projects from the past and continue to deliver environmental improvements and cost reductions into the future.

Additional energy metering will aid this focus on efficiency improvements and allow for in-depth assessment of energy consumption across different areas of the campus. This metering will indicate the level of energy consumption for each significant energy user while helping to build a more accurate energy consumption profile.

Better access to granular energy data will accurately inform decisions with regard to design, upgrades or replacements of energy equipment. Smart electricity meters should be considered because they will notify the Glenstal energy team as to when and where electricity is being consumed which will in turn provide further detail on energy saving options. The additional metering will also help the campus to measure and verify energy savings which will justify investments to all stakeholders and support any capital funding applications.

Better analysis and assessment of energy data would significantly improve the overall energy management of Glenstal and ultimately help to make energy reductions. The current BMS provides some good electricity data as well as other non-energy parameters, such as temperature and air quality but more frequent assessment of these parameters along with the energy consumption trends will provide a more holistic understanding of the drivers of energy consumption.

The responsibility for energy data analysis should not fall on one individual or even a small group of individuals. Understanding the weekly/monthly usage across each energy type and across the different areas of the campus would introduce an element of self-management as those responsible start to take ownership for the energy consumption in their respective areas. There is also an opportunity to include students in the data assessment; a number of students are already actively engaged in many aspects of energy management.