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Energy Audit



Strokestown Park

Strokestown

Co. Roscommon

June 2025

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1.0 Executive Summary

Strokestown Park is a nationally significant heritage estate in County Roscommon, encompassing the 18th-century Strokestown House, the National Famine Museum, a modern visitor centre, and associated facilities. The estate's mixed energy profile reflects the challenge of providing visitor comfort and operational services across a blend of protected historic fabric and newer infrastructure. This audit evaluates the energy consumption between November 2023 and October 2024 and identifies strategic opportunities to reduce energy use, lower carbon emissions, and future-proof energy systems.

During the audit period, the estate consumed approximately 373,694 kWh of energy, incurring a cost of €72,505.19 (ex. VAT) and generating an estimated 89.9 tonnes of CO₂ emissions. Of this, 147,803 kWh was electricity (40.7% of energy, but 74.8% of cost), with the remainder made up of LPG and oil-based fossil fuels. Energy demand peaks in winter, especially in the electrically heated heritage house, while consumption at the museum and visitor centre remains relatively consistent year-round. A 12 kWp solar PV array on site currently offsets some daytime grid electricity in summer, although its contribution is not reflected in the billing records.

There is significant potential to reduce emissions through better energy management and renewable integration. Targeted actions—such as zoning controls, improved heating schedules, and the introduction of a site-wide monitoring and targeting (M&T) system—could reduce electricity use by more than 10%. More substantially, the estate has capacity for two additional 30 kWp solar PV arrays, which together could generate up to 80,000 kWh/year, displacing a further 20.8 tonnes of CO₂. Introducing R290 high-temperature heat pumps in a bi valent configuration could potentially eliminate approximately 117,277 kWh/year of fossil fuel use, saving an additional 25 tonnes of CO₂.

One of the most promising opportunities is the refurbishment of the estate's historic hydroelectric plant. If brought back into service with modern controls, generator, and water management, the hydro system could contribute around 87,600 kWh/year of clean base-load electricity, offsetting approximately 22.6 tonnes of CO₂ annually. When combined, the solar, heat pump, and hydro interventions have the potential to reduce emissions by more than 68 tonnes of CO₂ per year, representing a 75% reduction from current levels.

While heritage constraints limit deep retrofit options, Strokestown Park remains well placed to deliver impactful, conservation-sensitive energy improvements. Continued investment in smart controls, electrification, on-site renewables, and performance tracking—benchmarked against CIBSE TM46 guidance—will help safeguard the estate's sustainability while maintaining its cultural legacy.

2.0 Introduction

The site survey was carried out by Mark Skerritt, Energy Engineer, along with Gavin Meally and Danny Gallagher, Intern Energy Engineers. The site contact was Jakob Wood, Project Manager for the Irish Heritage Trust.

This report presents a comprehensive energy audit of the Strokestown Park, located in Co. Roscommon, conducted on behalf of the Irish Heritage Trust. The estate comprises several heritage and modern buildings including the house itself, National Famine Museum and the visitor centre with Restaurant and office block. This audit evaluates the estate's energy consumption over the 2023-2024 and identifies opportunities for cost and carbon savings through energy efficiency and low-carbon technology adoption.

The report includes detailed analyses of electricity and thermal energy use, benchmarking against CIBSE TM46 standards, review of building fabric and services, assessment of renewable energy potential, and a comprehensive register of recommended upgrades. Each building is assessed individually for its energy profile and potential improvements.

Facility Information	
Facility:	Strokestown Park Estate
Address:	Famine Museum, Strokestown, Co. Roscommon
Eircode:	F42 H282
Survey Date:	13/05/2025
Auditor:	Mark Skerritt
Site Contact:	Jaykob Wood
Build Date:	17-18 th Century
Number of Floors:	Multiple
Floor Area (m²):	Circa 3,200

Table 1: Facility Information

All electricity and thermal data have been compiled from available bills and delivery dockets for the period of **November 2023 to October 2024**. The significant energy users on site have been determined through assessment of equipment power ratings and operational hours indicated to us by the facility.

Glossary of Abbreviations

- CO₂ – Carbon Dioxide
- COP – Coefficient of Performance
- CRU – Commission for Regulation of Utilities
- DHW – Domestic Hot Water
- ENPI – Energy Performance Indicator
- EPS – Expanded Polystyrene Insulation
- EV – Electric Vehicle
- EWI – External Wall Insulation
- HVAC – Heating, Ventilation and Air Conditioning
- ICT – Information and Communication Technology
- kW – Kilowatt
- kWp – Kilowatt peak
- kWh – Kilowatt hour
- LED – Light Emitting Diode
- MIC – Maximum Import Capacity
- MPRN – Meter Point Reference Number
- M&T – Monitoring and Targeting
- NCV – Net Calorific Value
- NSAI – National Standard Authority of Ireland
- OAT – Outside Air Temperature
- PV – Photovoltaic (Solar)
- ROO – Register of Opportunities
- SEAI – Sustainable Energy Authority of Ireland
- SEEU – Significant Electrical Energy User
- SEEU – Significant Thermal Energy User
- SEU – Significant Energy User
- SEU's – Significant Energy Users
- STEU – Significant Thermal Energy User
- TGD – Technical Guidance Document
- TRV – Thermostatic Radiator Valve
- VAT – Value Added Tax

3.0 Energy Consumption

The total energy consumption, costs and carbon emissions are shown in Tables 2 - 5 below.

Total Energy Consumption Strokestown Park					
Energy Type	Usage (kWh)	% Usage	Cost (€) (ex VAT)	% Cost	Tonnes CO ₂ [1]
Electricity	147,803	40.7%	€53,361.12	74.8%	37.66
Heating (LPG)	215,563	59.3%	€17,983.23	25.2%	49.42
Heating Oil	4,220	1.2%	€531.72	0.7%	1.13
Heating Oil (Kerosene)	6,108	1.7%	€629.12	0.9%	1.69
Total	373,694	100%	€72,505.19	100%	89.9

Table 2: Strokestown Park Energy Consumption

The table presents Strokestown Park's total energy consumption, costs, and associated CO₂ emissions. In the reporting period, the site used 373,694 kWh of energy at a total cost of €72,505.19 (ex VAT), producing 89.9 tonnes of CO₂. Electricity accounted for 40.7% of usage but made up 74.8% of costs, indicating a higher unit price. LPG was the main energy source at 59.3% of usage but only 25.2% of costs. Heating oil contributed a small share of both usage (2.9%) and cost (1.6%). This breakdown highlights electricity as the most cost-intensive energy source and LPG as the largest carbon emitter, indicating a strong case for decarbonisation through improved efficiency, renewable electricity sourcing, or alternative low-carbon heating systems

Energy Consumption Visitors Centre & Famine Museum MPRN 10015805982					
Energy Type	Usage (kWh)	% Usage	Cost (€) (ex VAT)	% Cost	Tonnes CO ₂ [1]
Electricity	92,885	30.1%	€27,291.17	60.3%	23.67
Heating (LPG)	215,563	69.9%	€17,983.23	39.7%	49.42
Total	308,448	100%	€45,274.40	100%	73.09

Table 3: Visitors Centre & Famine Museum Energy Consumption.

The combined Visitors Centre, Office and Museum recorded a total energy use of 308,448 kWh. Electricity accounted for 30.1% of consumption (92,885 kWh) but represented 60.3% of total energy costs (€27,291.17 ex. VAT) and produced 23.67 tonnes of CO₂ emissions. Heating (LPG) comprised 69.9% of usage (215,563 kWh), contributed 39.7% of costs (€17,983.23 ex.

VAT), and resulted in 49.42 tonnes of CO₂, based on SEAI's 2023 emission factors. This demonstrates that both electricity and LPG are significant contributors to carbon emissions.

Energy Consumption Strokestown Park House MPRN 1039283885					
Energy Type	Usage (kWh)	% Usage	Cost (€) (ex VAT)	% Cost	Tonnes CO ₂ [1]
Electricity	54,918	84%	€26,069.95	95%	13.99
Heating Oil	4,220	6%	€531.72	2%	1.13
Heating Oil (Kerosene)	6,108	10%	€629.12	3%	1.69
Total	65,246	100%	€27,230.79	100%	16.81

Table 4: Strokestown House Energy Consumption

The table shows that at Strokestown Park, electricity comprises 84% of energy use but 95% of costs. Heating oil and kerosene account for 16% of use and 5% of costs. Total consumption is 65,246 kWh, costing €27,230.79 and emitting 16.81 tonnes CO₂.

Strokestown Park House Total Energy Consumption					
Energy Type	Usage (kWh)	% Usage	Cost (€) (ex VAT)	% Cost	Tonnes CO ₂ [1]
Electricity	147,803	39.6%	€53,361.12	73.6%	37.66
Fossil Fuels	225,891	60.4%	€19,144.07	26.4%	52.24
Total	373,694	100%	€72,505.19	100%	89.9

Table 5: Strokestown House Energy Consumption

Strokestown Park House's total energy consumption for the reporting period was 373,694 kWh, costing €72,505.19 (ex VAT) and resulting in 89.9 tonnes of CO₂ emissions. Electricity accounted for 39.6% of the energy used but made up 73.6% of the cost and contributed 37.66 tonnes of CO₂. Fossil fuels (including kerosene) represented 60.4% of total energy usage, 26.4% of costs, and were responsible for 52.24 tonnes of CO₂ emissions. It should be noted that these figures are based solely on billing data and do not account for the contribution of the existing on-site solar PV array, which comprises approximately 30 ground-mounted panels (circa 12kWp). The energy generated by this system offsets a portion of the site's electricity demand, thereby reducing actual grid electricity consumption and associated emissions, although this benefit is not reflected in the consumption and emissions totals presented here.

¹The carbon emission factors for electricity (254.8 gCO₂/kWh (NCV)) & oil (kerosene) (257 gCO₂/kWh (NCV)) are taken from the most recent SEAI figures (2023).

3.1 Strokestown House Electricity Consumption

Strokestown House, is a heritage building entirely dependent on electricity for space and water heating, and exhibits a clear seasonal demand profile because of this. Peak consumption occurs during the winter months, with January 2024 reaching 9,773 kWh, before dropping significantly in summer falling to just 900-1,109 kWh in the months of July to October.

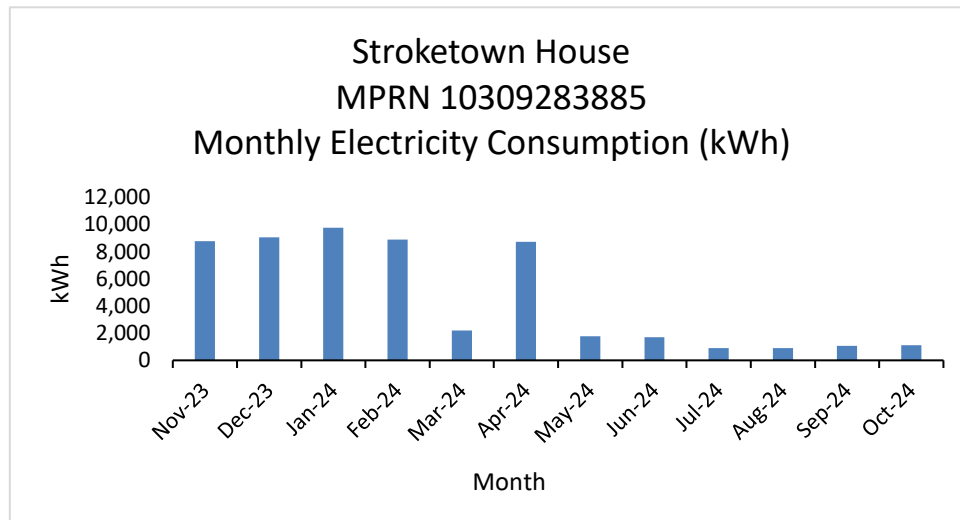


Figure 1: Strokestown House Electrical Consumption

The day-to-night consumption ratio across the year is 60:40, but interestingly, during the summer months, night consumption occasionally exceeds or nearly matches daytime usage. For example: In June 2024, night consumption was 921 kWh vs 772 kWh during the day. In August 2024, night usage was 546 kWh vs 360 kWh (Figure 2).

This reversal of the typical day-night ratio is explained by the ground mounted solar PV supplying a portion of the building's daytime energy needs, thereby reducing the recorded grid import during daylight hours. The 30-panel (12 kWp) ground-mounted solar PV system appears to be well matched to summer electrical loads, although the benefit is not visible in billing data due to the absence of a metering system capturing on-site generation.

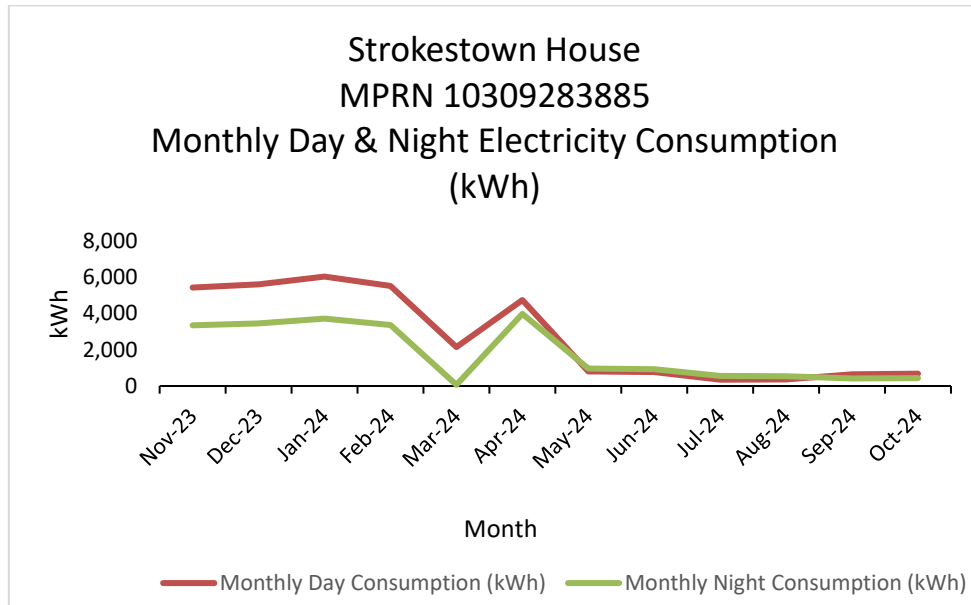


Figure 2: Strokestown House Day & Night Electrical Consumption

3.2 Visitors Centre & Famine Museum Electricity Consumption

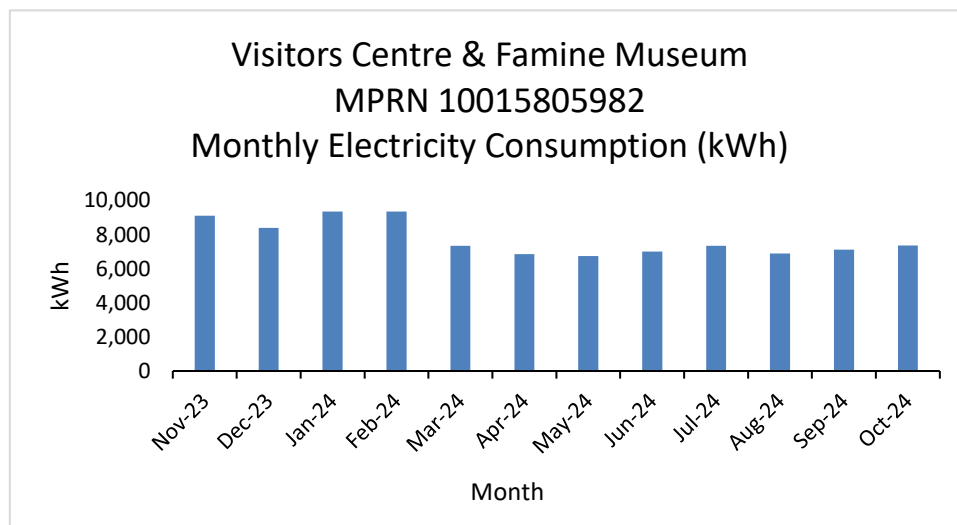


Figure 3:Visitors Centre& Famine Museum Electrical Consumption.

The Visitors Centre and Famine Museum exhibit a consistent and well-balanced electricity consumption profile, with a total annual usage of 92,885 kWh and an average of 7,740 kWh per month. Electricity use is predominantly concentrated during the day, with 77% of consumption occurring in daytime hours, which reflects the facility's operating schedule. As a public-facing building that accommodates daytime visitor activity, staff presence, and catering operations.

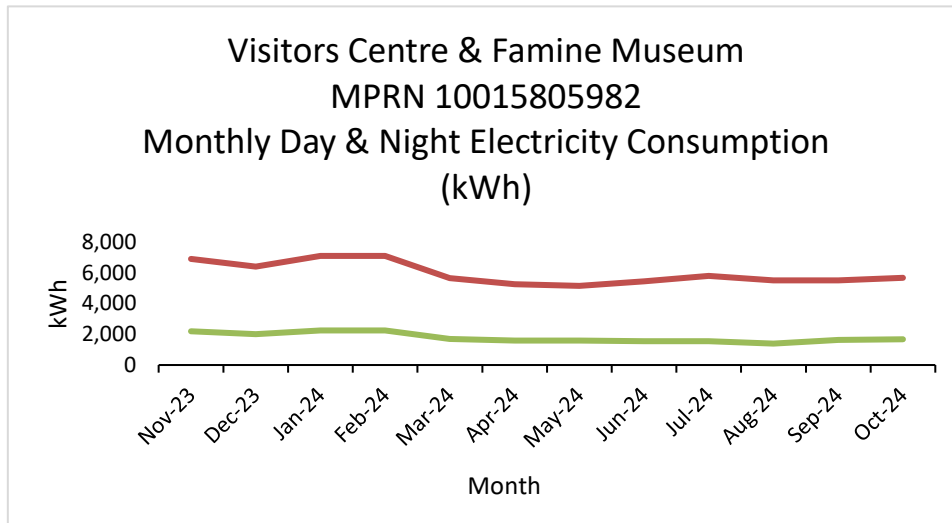


Figure 4: Visitors Centre& Famine Museum Day & Night Electrical Consumption.

Interestingly, electricity demand in this building remains relatively stable across all seasons. During winter months such as January and February 2024, daytime consumption is around 7,100 kWh, while in the summer months of June through August, daytime usage still remains in the range of 5,450 to 5,800 kWh. The electrical load is largely made up of lighting, catering equipment, mechanical ventilation, and other consistent operational systems, rather than space heating. The building's load profile indicates limited sensitivity to external temperature variation.

Night-time consumption is also highly stable, averaging 1,783 kWh per month and varying only slightly throughout the year. This stable base load is likely due to background equipment such as refrigeration units, IT servers or network systems and emergency lighting. The stability of night usage suggests effective load control and minimal unnecessary overnight consumption, further indicating good operational energy practices.

Overall, the Visitors Centre and Famine Museum demonstrate a predictable and efficiently managed energy profile although efforts should be made to reduce the day and night consumption profiles. While the site currently relies entirely on grid electricity and does not benefit from on-site solar generation, the consistent load and large daytime demand make it a strong candidate for future solar PV installation. This would improve energy resilience and support the broader sustainability goals of the park.

3.3 Strokestown Park Total Electrical Consumption

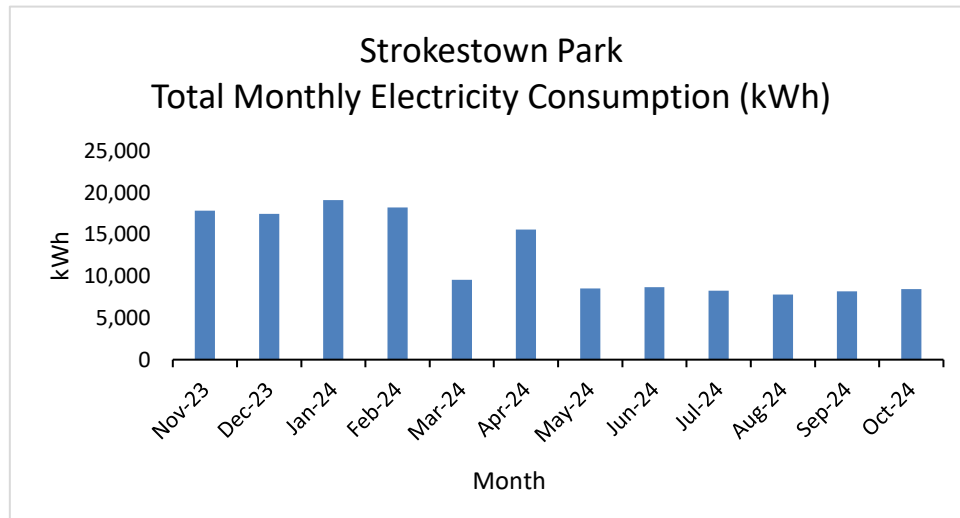


Figure 5: Strokestown Park Total Monthly Electrical Consumption

Across both MPRNs, the total annual electricity consumption at Strokestown Park is 147,803 kWh, with an associated cost of €53,361.12 (ex VAT). The combined day-to-night usage ratio is 71:29, reflecting a mix of heritage residential and modern visitor-centre operations.

A clear seasonal pattern is present — with peak electricity use in the winter months driven primarily by the electric heating systems in the heritage house, while the museum maintains a relatively steady load year-round. Summer usage is notably lower, especially in the heritage building, where solar PV generation appears to offset much of the daytime load, occasionally resulting in higher night-time consumption than daytime during summer (e.g. June and August). This supports the interpretation that the solar system (12 kWp) is effectively reducing grid demand during daylight hours.

A notable drop in total site electricity use is seen in March 2024, where consumption dips significantly across both MPRNs. This anomaly may correlate with a change of electricity supplier from Electric Ireland to Flo gas during this period. It's possible that this transition involved adjustments to metering, billing periods, or operational patterns that affected recorded usage.

Overall, the combined consumption profile is consistent with the nature of the two buildings: a seasonally variable, electrically heated heritage house supplemented by solar PV, and a consistently active visitor centre with modern lighting and appliances, but without renewables. Opportunities exist to reduce grid reliance further by extending on-site solar generation and optimising heating controls, particularly in the heritage building.

3.4 Visitors Centre & Famine Museum Thermal Consumption

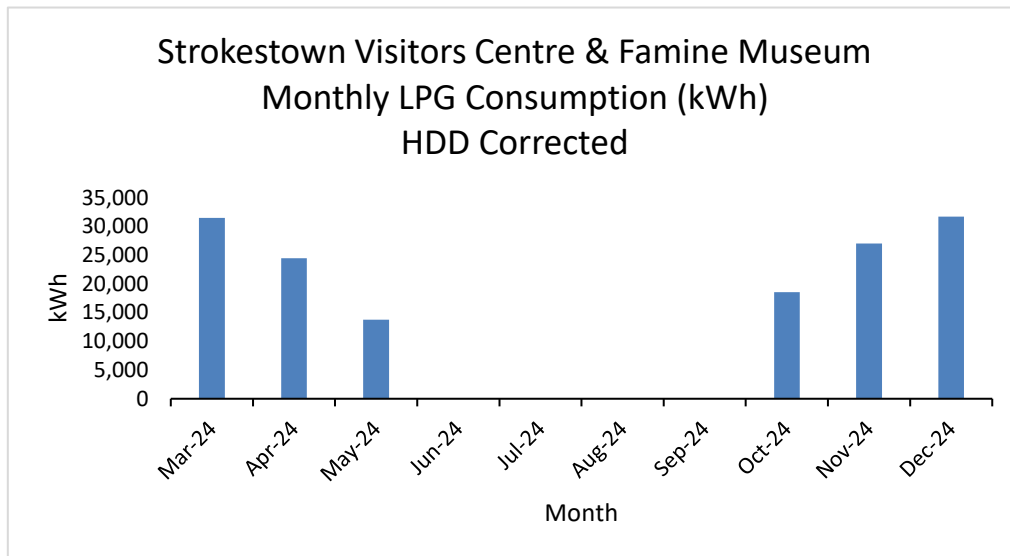


Figure 6: Visitors Centre & Famine Museum Thermal Consumption

The LPG consumption profile for the Strokestown Visitors Centre and Famine Museum, corrected for Heating Degree Days (HDD), illustrates a clear, seasonally responsive heating pattern. Consumption is concentrated entirely in the colder months, with significant usage in March and December 2024, and no recorded gas use from May through September.

Space heating for the Visitors Centre and approximately half of the Famine Museum is provided by two modern De Dietrich AMC boilers, located in the new boiler house. These systems are equipped with weather compensation and zoning, enabling them to respond intelligently to external conditions and indoor heating demands. The data pattern strongly suggests that these controls are functioning well, as consumption tracks closely with seasonal need and shuts off reliably during the non-heating period.

The remainder of the museum—specifically the converted stable buildings that now function as a museum and office space—is served by a separate pair of older LPG Potterton Prima 100F boilers. These units are housed in a different boiler room and are not equipped with modern control systems; instead, they are controlled only via a basic time clock. At the time of inspection, only one of these boilers was operational, with the second noted as out of service. This limited control setup may reduce efficiency, as it lacks the dynamic responsiveness of weather-compensated systems and may result in unnecessary heating during programmed times if not frequently monitored.

Importantly, both the De Dietrich and the older boilers draw from a single LPG storage tank, and there is no sub-metering in place to distinguish consumption between the two systems.

As a result, it is not possible to apportion LPG use between the public areas of the Visitors Centre and museum and the back-of-house office spaces. The total recorded LPG use reflects the combined heating demand of both areas.

In summary, while the newer systems are well-controlled and demonstrate effective seasonal operation, the older office boilers represent an area of inefficiency due to limited control and partial functionality. Introducing sub-metering and upgrading the control strategies—or replacing the legacy systems—would improve accountability, enable targeted energy management, and support future decarbonisation goals.

4.0 Benchmarking

When benchmarked against the CIBSE TM46 energy performance guidelines, the total energy consumption of both Strokestown Park House and the Visitors Centre & Famine Museum provides useful insight into the operational efficiency of the site. TM46 benchmarks for historic buildings and museum centres with catering functions suggest typical energy use in the range of 200–400 kWh/m²/year, with office spaces potentially falling slightly lower. Based on a total energy use of approximately 33 kWh/m²/year, Strokestown House performs significantly below this range. While this low intensity could imply exemplary efficiency, it is more likely attributable to underutilisation and limited heating zones.

In contrast, the Visitors Centre & Famine Museum, with an estimated floor area of 1,200 m² and a benchmarked energy use of 257 kWh/m²/year, aligns well with CIBSE TM46 guidance for modern museum and catering facilities. This part of the site is served by modern De Dietrich boilers with zoning and weather compensation, good building fabric, and a building management system. These features support efficient operation across a consistent year-round occupancy profile. The stability in both thermal and electrical consumption throughout 2024 further supports the conclusion that this building is functioning within its expected energy envelope, with no major inefficiencies or anomalous loads observed.

TM46 Benchmark Comparison				
Building	Floor Area (m ²) *	TM46 Typical Total Energy (kWh/m ² /yr)	Benchmark Total Energy (kWh/m ² /yr)	TM 46 Category
Strokestown Park House	2,000	200-400	33	Historic Building/Office
Visitors Centre & Famine Museum	1,200	200-400(Museum) 180-300 (Office)	257	Museum Centre / catering

Table 6: TM46 Benchmark Comparison

5.0 Energy Overview

This chapter presents a detailed breakdown of energy consumption across the Johnstown Castle Estate, focusing on the identification and analysis of Significant Electrical Energy Users (SEEU) and Significant Thermal Energy Users (STEU) within each building. The aim is to establish where and how energy is consumed on-site to inform targeted efficiency measures and decarbonisation strategies. Data from 2024 electricity and fuel bills have been used to calculate total energy usage, which is then disaggregated by system and end-use based on-site surveys, equipment inventories, and engineering assumptions in line with CIBSE and SEAI methodologies. Understanding these load profiles is crucial to prioritising retrofit actions, enhancing energy performance, and meeting Ireland's carbon reduction targets. Pie charts and tabulated breakdowns illustrate the proportion of energy attributed to lighting, HVAC, catering, hot water, and other end-uses, helping to contextualise the proposed opportunities presented in later sections of the report.

5.1 Significant Electrical Energy Users (SEEU) Strokestown Park House

The electrical infrastructure within Strokestown Park House supports a range of heritage, administrative, and environmental functions. The main consumers are the wall mounted electric heaters, hot water, environmental control equipment, and lighting. The total estimated electrical consumption is 65,118 kWh/year, which exceeds the metered grid electricity total (54,918 kWh/year), highlighting the contribution of the site's 12 kWp ground-mounted solar PV system, which offsets a portion of daily demand. A breakdown of key energy users is provided below in relation to the billed data.

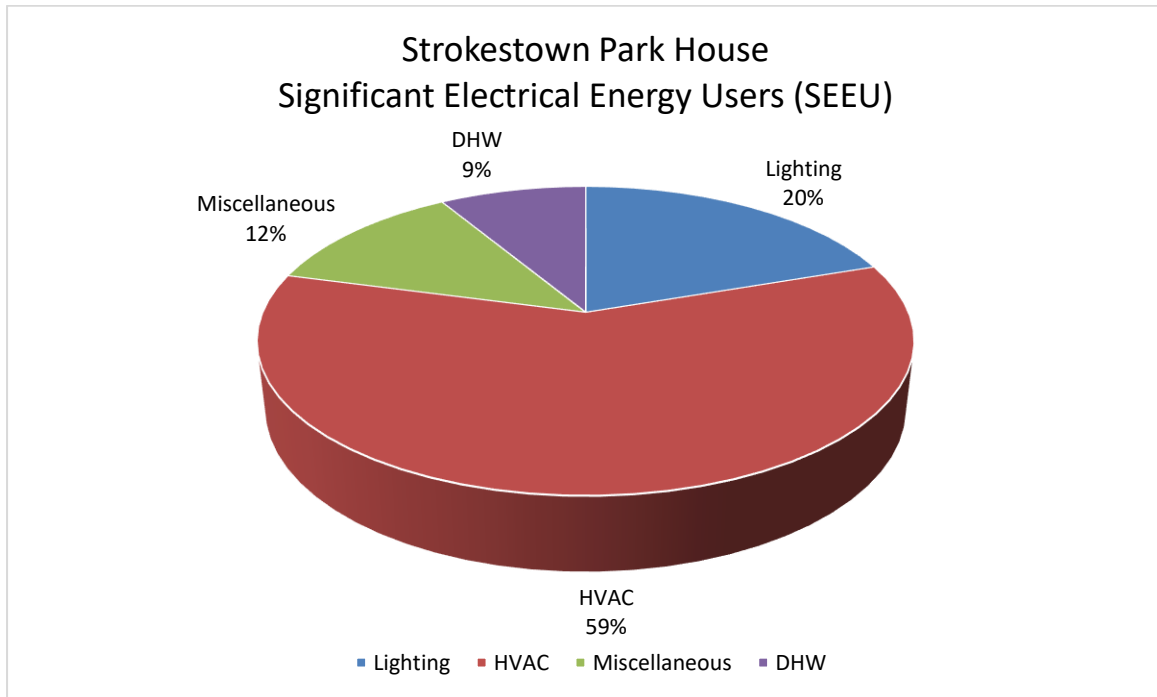


Figure 7: Strokestown Park House SEEU

5.1.1 Lighting

The lighting inventory across the Old House includes a range of LED E27 and E14 bulbs, installed in heritage fixtures and circulation areas. Lighting demand was benchmarked using CIBSE best practice guidelines for historic buildings, estimated at 20% of total electricity use, or approximately 10,865 kWh/year. Lighting circuits are controlled manually, with a master switch at the main entrance used to shut down all lighting when the building is not in use. This simple but effective control strategy helps reduce overnight losses.

5.1.2 HVAC

The most significant category of electrical energy use in Strokestown Park House is HVAC, which includes both space heating and environmental control via dehumidification. Together, these account for approximately 32,595 kWh/year, or 59% of the building's total estimated electricity consumption.

Space heating is provided by a distributed system of fixed, wall-mounted ATC electric panel heaters, installed throughout heritage rooms and circulation spaces. The inventory includes 13 ATC Type 1 units (2 kW), 18 Type 2 units (1 kW), 14 Type 3 units (1.5 kW), one Toshiba split-unit (5 kW), and three plug-in heaters. These are typically operated for 4 hours per day during the heating season.

Humidity control is delivered via six Secco prof 30P dehumidifiers, which are used in winter months to preserve finishes and collections. Assuming a 50% operational load and seasonal usage, the estimated energy demand for dehumidification is 3% of the total.

In total, HVAC systems represent the largest category of electricity use at the site. While basic digital controls are available, the absence of centralised zoning or thermostatic coordination limits overall efficiency. Opportunities exist to improve control granularity and introduce lower-energy alternatives where appropriate.

5.1.3 DHW & Domestic Hot Water

Domestic hot water at Strokestown Park House is provided by a single 10-litre Atlantic under sink water heater, rated at 2 kW. This unit operates continuously throughout the year and lacks any timer or advanced control. Despite low demand-limited mainly for handwashing- the heater remains powered at all times, resulting in continual standing losses. The total estimated energy consumption is 4,736 kWh/year, accounting for approximately 9 % of the house's annual electrical consumption. This system presents a clear opportunity for efficiency improvements through timer installation.

5.1.4 Miscellaneous

Miscellaneous electrical loads account for an estimated 12% of the building's total electricity use, or approximately 6,722 kWh/year. These include: extractor fans, small refrigeration units, display equipment, security lighting, and various plug loads used during seasonal events. While individually modest, these devices contribute to the site's year-round base load. Incorporating plug-level timers or improved standby control could further reduce waste in this category.

5.1.5 Summary

Strokestown Park House's electrical energy profile is strongly influenced by fixed electric space heating and continuous water heating losses. Environmental control systems such as dehumidifiers, along with lighting and miscellaneous loads, contribute to the remainder. The analysis demonstrates the total electrical demand, but grid import levels due to the on-site 12 kWp solar PV system, which supplies conservatively 10,200 kWh/year have not been factored in as there is no measurable data.

5.2 Visitors Centre & Famine Museum SEEU

The electrical consumption at the Strokestown Park Visitors Centre and Museum reflects the diverse operational demands of a modern public-facing facility. With an annual electricity use of 92,885 kWh, the building supports a range of services including catering, heating, ICT infrastructure, exhibition displays, and staff functions. This section identifies and evaluates the key categories of electrical load, highlighting those with the most significant impact on overall consumption.

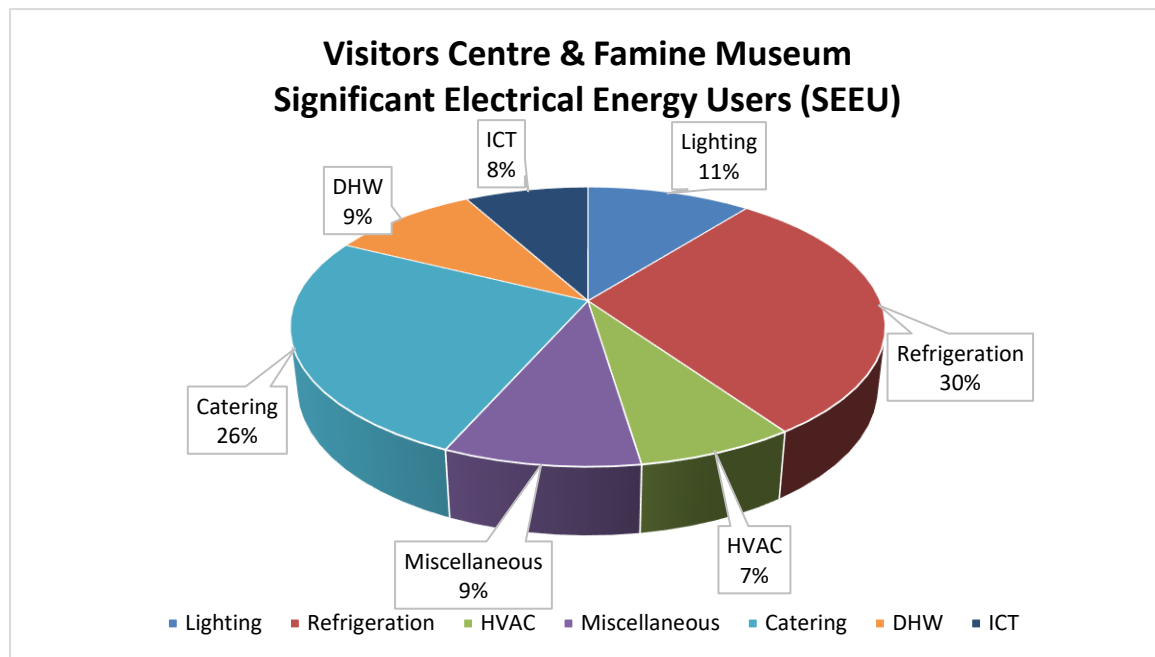


Figure 8: Visitors Centre Famine Museum SEEU

5.2.1 Lighting

The lighting installation across the Strokestown Park Visitors Centre and Famine Museum is a well-specified, contemporary LED-based system, designed to meet both the visual and operational demands of a modern museum and visitor facility. The system employs a variety of luminaire types; each selected for its specific function and application within the building. These include 20W LED compact downlights (REF A1) in public areas such as circulation spaces and exhibit zones, 40W linear suspended luminaires (REF L1-L7) in café and reception areas for ambient lighting, and 7W–15W wall-mounted and track spot fittings (REF B1, R3) used extensively for exhibition highlighting and vertical illumination of displays. Bathrooms, corridors, and back-of-house areas feature 8W and 10W recessed or surface-mounted LED fittings (e.g. REF F9, H3), supporting uniformity and low-maintenance operation.

From a control perspective, the system is primarily based on manual switching circuits, with light groups zoned by area and purpose. The design drawings also indicate the presence of presence-detection controls (PIR) in select locations such as toilet blocks and circulation corridors. This zoning strategy supports basic energy efficiency but leaves scope for improvement through wider adoption of automated controls such as daylight sensing in naturally lit zones (e.g. glazed café), and time-based scheduling in staff and office areas.

Based on the lighting schedule and usage assumptions (e.g. 10–12 hours/day across open zones), the total annual energy consumption attributed to lighting is estimated at approximately 9,900 kWh. This is a significant portion of the site's electrical load and reflects both the extensive lighting coverage and the operational demands of a publicly accessible space.

5.2.2 HVAC

The HVAC-related electrical energy use in the Strokestown Park Visitors Centre and Famine Museum is limited to support systems, as the primary space heating is provided via LPG-fired boilers. The main electrical contributors in this category are the circulation pumps serving the wet heating distribution system, including zones for underfloor heating and radiators. These pumps—primarily high-efficiency variable-speed units such as Grundfos MAGNA3s—are estimated to consume approximately 4,500 kWh/year, depending on modulation and seasonal operation. Additional HVAC-related loads include mechanical extract systems in the kitchen and dishwasher area, which operate intermittently but are expected to contribute a further 1,050 kWh/year. Toilet extract fans located in both the men's and women's washrooms and standalone electric heaters contribute further to consumption. In total, the electrical HVAC load is estimated to be in the region of 6,758 kWh/year.

5.2.3 Catering Equipment

The catering area within the Visitors Centre represents a substantial portion of the site's electrical energy consumption, primarily due to the operation of fully electric appliances. Central to this is the Schott Ceran glass-ceramic induction hob, which has an estimated power demand of 7 kW. This unit enables efficient and responsive cooking but contributes significantly to the electrical load, especially during periods of sustained use.

In support of broader cooking operations, a Palux combi-oven is installed, which typically draws between 6–10 kW depending on cooking mode and cycle length. Together with the induction hob, this forms the core of the site's high-intensity cooking load. The kitchen also includes a commercial dishwasher, kettles, heated serving gantries, and extract systems. Lighting within the cold rooms is controlled by PIR sensors, helping to reduce unnecessary usage, though the main kitchen appliances are not subject to load-shedding or timer-based control.

The total estimated annual energy uses attributable to catering equipment in the Visitors Centre is approximately 23,900 kWh/year. This figure highlights the importance of this end-use category within the building's overall energy profile. Opportunities for future reduction include better refrigeration zoning, deployment of standby timers or energy monitoring systems for key cooking appliances, and maintenance strategies to improve cold room efficiency.

5.2.4 Refrigeration

The refrigeration system comprises a walk-in cold room and walk-in freezer room, each fitted with Friga-Bohn evaporator fan units and digital control panels. These systems operate continuously to maintain temperature, and due to the absence of cold-air curtains, may experience elevated cooling losses. Two commercial fridges are also in the kitchen area. Total refrigeration consumption is 27,561 kWh per year and is the largest electrical energy consumer.

5.2.5 Domestic Hot Water (DHW)

Domestic Hot Water (DHW) demand at the Visitors Centre and Famine Museum is met by a 300-litre ESP400-010-300(LD) air-to-water heat pump. This high-efficiency system is ErP-rated Class A and operates primarily with a 2.31 kW heat pump circuit, supported by a 2.0 kW auxiliary immersion heater. It is designed to serve both the public toilets and the on-site café's catering facilities, delivering hot water at temperatures up to 55 °C. Based on CIBSE profiles for water usage in catering and visitor toilets, the system is estimated to deliver 400 m³ of hot water annually. Taking into account a typical seasonal COP of 3.0, the resulting electrical energy consumption is estimated at 8,967 kWh per year. This represents a notable portion of

the building's electrical demand and should be considered a significant electrical energy user (SEEU), though it is considerably more efficient than direct electric heating alternatives.

5.2.6 ICT and Office Equipment

This category accounts for approximately 7430 kWh per year 8% of the site's total electricity usage. Key contributors include IT equipment such as PCs, monitors, and printers. Comms racks typically draw a continuous base load, as these systems remain powered on 24/7 throughout the year. Power demand for fully populated mid-size racks (such as these) is conservatively estimated at 300–350 watts per rack under normal conditions. This includes network gear, UPS losses, cooling fans, and standby server use.

5.2.7 Miscellaneous

In reconciling the total estimated energy use with actual metered electricity data for the Visitors Centre and Museum, a significant portion—approximately 8,369 kWh per year, or 9% of the site's total electrical consumption—remains unallocated. This considerable portion of unaccounted electrical consumption needs to be addressed by the introduction of a metering programme.

5.3 Significant Thermal Energy Users (STEU) – Strokestown Castle

Thermal energy usage at Strokestown Park House is primarily associated with space heating and catering operations, delivered through two oil-fired appliances: the Firebird Flue Popular 90 boiler (Army Gym) and the AGA range cooker (Katherine’s Kitchen). These systems operate independently and represent the core thermal energy demands of the facility.

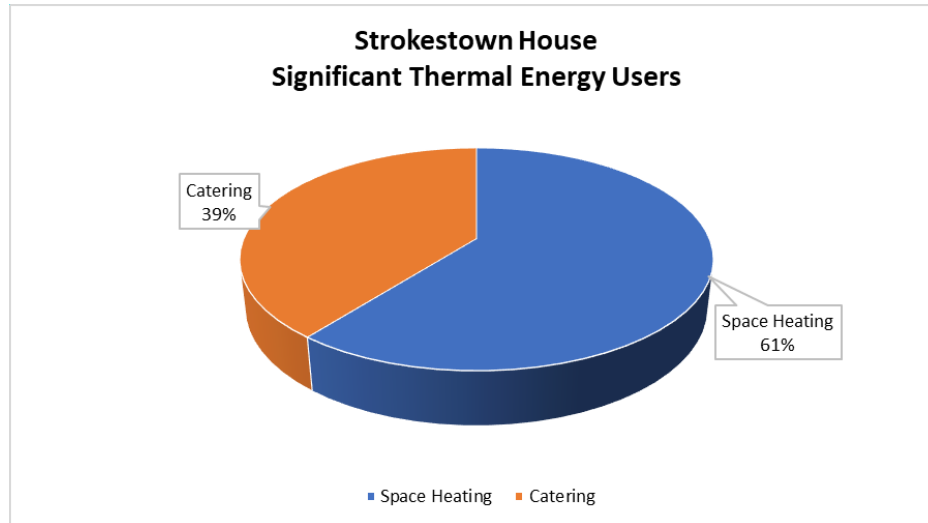


Figure 9: Significant Thermal Energy Users – Strokestown House

The heating and catering thermal energy system comprises the following:

A Firebird R.S. Balanced Flue Popular 90 oil-fired boiler, located in the first floor Army Gym, supplying 26 kW of thermal output. Operating at a seasonal efficiency of approximately 85%, this boiler provides space heating to the zone over a defined 26-week heating season. Based on runtime of approximately 390 hours per year, the boiler consumes approximately 6,108 kWh annually.

An AGA oil-fired range cooker, installed in the Katherine’s kitchen, serving cooking functions has a rated thermal input of 15.7 kW, the AGA operates for approximately 315 hours per year, consuming an estimated 4,220 kWh annually.

Both the Firebird boiler and AGA cooker are existing systems with limited control functionality. Their continued operation contributes significantly to fossil fuel use and elevated carbon emissions relative to modern alternatives. Both units are stand-alone and lack integration with a central control system, such as a Building Management System (BMS) or smart timeclocks.

A recommended intervention is the replacement of the Firebird boiler with a high-efficiency air source heat pump (ASHP) ideally using R290 refrigerant for low environmental impact.

Additionally, the current oil-fired AGA range cooker should be replaced with a modern electric equivalent—such as the AGA Total Control series—which retains the heritage aesthetic while offering programmable oven zones and significantly improved energy efficiency. These measures would eliminate fossil fuel consumption from Strokestown park house. These targeted interventions would reduce operational emissions. This would align Strokestown Park House with national energy performance and decarbonisation objectives, all while maintaining compatibility with the operational requirements and heritage character of the estate.

5.4 Significant Thermal Energy Users (STEU) – Visitors Centre & Famine Museum

Thermal energy use at Visitor centre and famine museum is driven by the need for space heating, with a mix of modern and older heating systems still in operation across the site. In the Museum and Visitor Centre, newer areas benefit from efficient underfloor and radiator heating that’s managed through a Building Management System (BMS), which allows for centralised control and scheduling. However, parts of the museum and offices still rely on older heating circuits with analogue time controls.

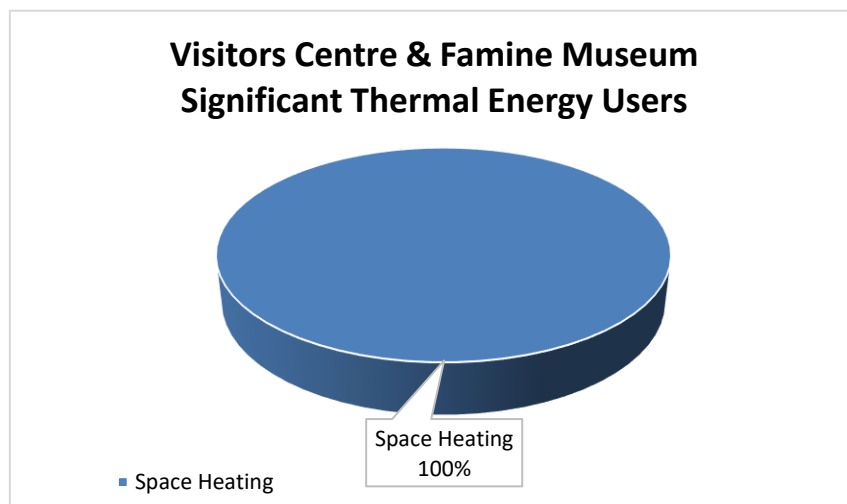


Figure 10: Visitors Centre STEU

The current thermal energy system includes:

- Two De Dietrich AMC 65 condensing LPG boilers, operating with a seasonal efficiency of 95%, integrated into the BMS for precise control and demand scheduling.
- One operational Potterton Prima 100F LPG boiler, a non-condensing unit with 79% efficiency, serving the office area and a portion of the museum via radiators.

The addition of renewable heating technologies like air source heat pumps (ASHPs) will increase performance, optimisation and decarbonise the overall thermal load.

6.0 Building Fabric – Strokestown Park

6.1 Building Fabric – Strokestown House

Strokestown Park House is a nationally significant Georgian Palladian house, with construction originating in the 17th century and extensive redevelopment completed in the mid-18th century. The building retains its original form and fabric across most elevations and interiors, including solid masonry walls, timber sash windows, and original floors. As a protected structure, its conservation status places strict limitations on the scope of thermal upgrades, yet a review of the existing fabric reveals key areas where thermal performance could be improved in a heritage-sensitive manner. Recent photographic records confirm the architectural integrity of the house, while also highlighting thermal vulnerabilities and maintenance challenges.

Wall Construction

The external walls are composed of solid stone masonry with lime mortar, typical of Georgian country houses. These walls are uninsulated and extremely thick (often >500 mm), offering high thermal mass but very poor insulation performance. Based on CIBSE Guide A and relevant historic building studies, the U-values are estimated between 1.7-2.0 W/m²·K, significantly above current regulatory standards. Heat loss through walls represents a major component of the space heating demand, particularly during long heating seasons. Survey of exposed interior stonework reveals historical plaster-on-lath detailing, confirming the traditional construction and further underlining the absence of cavity insulation or vapour barriers.

Windows and Glazing

The house retains a large number of original single-glazed timber sash windows, many of which have not been modernised. These units are aesthetically and culturally valuable but are thermally inefficient, with U-values in the range of 4.5-5.0 W/m²·K. Air leakage is also common due to aging joinery, missing draught seals, and settlement of frames. Where sensitive, secondary glazing could be used internally to improve thermal resistance and reduce infiltration while maintaining the visual integrity of the façade. Internal images confirm the presence of deep window reveals and historic shutters, indicating potential for concealed secondary glazing installations.

Roof Construction

The pitched roof structure consists of traditional timber rafters and appears to be largely uninsulated, especially in attic and roof voids above the primary reception rooms. Where insulation is present, it is patchy or non-continuous. CIBSE data suggests U-values of 2.0-2.3 W/m²·K for uninsulated pitched roofs, compared to 0.16 W/m²·K for modern standards.

There is scope for breathable insulation to be introduced in attic spaces where conservation constraints allow. From aerial and interior images, it is likely that the roof includes traditional slate covering with minimal upgrades beneath.

Floors and Basement Areas

The lower-ground floor of the house includes stone slabs laid directly to earth, lime screeds, and suspended timber floors in reception rooms. These floors are uninsulated, and cold bridging to ground can be extensive. Floor U-values are estimated at 0.7-1.2 W/m²·K, depending on construction detail. Dampness and high thermal losses are common, especially in ground-contact rooms and storage areas. The age and condition of these floors-evident from inspection-preclude most forms of intrusive insulation, though breathable systems could be considered in service areas.

Air Tightness and Thermal Bridging

The building is highly permeable to air, with clear infiltration paths around windows, original doors, roof junctions, and chimneys. Air changes per hour (ACH) are estimated between 10-15, compared to CIBSE guidance of 3-5 for older buildings. This contributes to elevated heating demands, inconsistent room temperatures, and poor comfort levels during winter months. Observations confirm drafts around heritage joinery, timber floors, and even redundant chimneys, which remain open to ventilation paths.

Retrofit Opportunities

Any improvements must respect the heritage value and meet conservation guidelines. Nonetheless, targeted measures could be introduced without compromising architectural integrity:

- Secondary glazing to enhance window performance.
- Discreet internal wall insulation using breathable, vapor-open materials in non-decorative areas.
- Draught-proofing to reduce infiltration via door and window seals.
- Attic insulation upgrades in non-visible voids using wood fiber or mineral wool with vapor control.

6.2 Building Fabric – Visitor Centre and Museum

The Strokestown Park Visitor Centre and National Famine Museum occupy a combination of modern construction and sensitively restored historic stable blocks that once formed part of the estate's working courtyard. These buildings have been adapted to house exhibition spaces, a reception area, gift shop, catering facilities, and support services. The integration of new architectural elements with the original stone structures presents a unique combination of construction methods and thermal performance considerations.

Wall Construction

The historic stable blocks are built from thick solid stone masonry with lime mortar, representative of 18th and early 19th-century agricultural buildings. These walls are uninsulated and estimated to have U-values in the range of 1.7-2.0 W/m²·K. While they offer substantial thermal mass, their insulation performance is poor, and they are highly susceptible to heat loss and internal condensation. The new-build entrance and circulation spaces, however, are constructed with modern insulated cavity wall, meeting U-values in the region of 0.18-0.22 W/m²·K.

Windows and Glazing

Fenestration varies across the complex. In the converted stable areas, windows are generally modest in size and have been replaced or upgraded with thermally broken double-glazed units, which significantly improve insulation while respecting the building's character. The contemporary visitor centre features expansive clerestory glazing and large-format insulated glass doors with aluminium framing. These are likely low-emissivity (low-e) coated units with solar control properties and U-values near 1.4-1.6 W/m²·K.

Roof Construction

The roofs of the original stable blocks are steeply pitched and covered in traditional slate. It is likely that some insulation has been added beneath the roof deck during conversion; however, exact continuity and thickness may vary. CIBSE guidance suggests U-values of 2.0-2.3 W/m²·K for uninsulated roofs, while retrofitted roofs with partial insulation may achieve 0.25-0.35 W/m²·K. The new-build roofs incorporate high-performance insulation layers and ventilation detailing, meeting modern standards of 0.16-0.20 W/m²·K.

Floors and Substructures

The flooring in the historic stable blocks has likely been upgraded with new concrete slabs incorporating insulation and damp-proof membranes during refurbishment. The museum's modern extensions use insulated slab-on-grade construction, complying with typical U-values of 0.11-0.15 W/m²·K.

Air Tightness and Thermal Bridging

The combination of old and new fabric leads to varying levels of air permeability. The modern extension is assumed to have good airtightness (approx. 3-5 m³/h·m² at 50 Pa), while the original stable areas may be less airtight, particularly at junctions between new and old construction. The design of the new elements appears to manage thermal bridging through modern detailing, though the historic envelope remains vulnerable to cold bridging around lintels, eaves, and floor-wall junctions.

Retrofit Opportunities

While much of the building has been recently refurbished, ongoing improvements could include:

- Further draught-proofing in stable block window and door openings.
- Thermal bridge reduction at new-to-old junctions.
- Investigation of insulation continuity in sloped roof voids.
- Maintenance of modern glazing seals and ventilation controls.

The hybrid nature of the structure-historic masonry interfacing with contemporary high-performance fabric-presents both opportunities and challenges. Continued monitoring and targeted fabric enhancements, particularly in the older portions of the museum, will be vital in maintaining comfort and supporting the efficiency of HVAC systems installed to serve exhibition and public spaces. The contrast between old and new construction is visible in both the architectural expression and thermal performance of the overall complex

The Visitor Centre at Johnstown Castle, is a modern building designed in line with contemporary building regulations. As a relatively new development, the building envelope meets or exceeds the insulation and air-tightness standards outlined in Part L of the Building Regulations (2019). It is assumed the building fabric achieves or outperforms the following typical U-values referenced in CIBSE Guide F and Part L:

- Walls: 0.18 W/m²·K
- Roof: 0.16 W/m²·K
- Floor: 0.18 W/m²·K
- Windows (double-glazed): 1.40 W/m²·K
- Doors: 1.80 W/m²·K

7.0 Renewables

Strokestown Park, with its range of historic and modern buildings—including the House, Museum, Café, Visitor Centre and Army Gym, offers a strong opportunity to embrace renewable energy in a phased and practical way. Right now, the site relies on a mix of heating systems: oil-fired boilers, LPG condensing boilers, and older units. The visitors Centre already benefits from weather-compensated controls and a central BMS, but many of the older systems still use high-temperature heating with limited controls.

To move toward lower-carbon heating, the estate could begin integrating R290 air-to-water heat pumps. These work well with low-temperature systems such as underfloor heating and modern radiators.

In terms of renewable electricity, Strokestown has a 12-kWp ground mounted solar PV system currently in place although it was not possible to ascertain its output during the audit due to the absence of a suitable meter behind the main incoming meter. The Visitor Centre and the house itself lend themselves for further expansion of this system due to both buildings having a robust 70 kVA MIC. Expanding the system to include an additional 50-70 kWp could significantly boost the estate's ability to produce clean energy. Pairing this with battery storage would allow the site to use more of its own electricity, cut down on grid use, and improve resilience during outages.

Another exciting opportunity lies in bringing back the estate's historic hydroelectric system. The old Penn Stock and its related mechanical components are still visible on site. With proper study and restoration, a small run-of-river hydro plant could be refurbished to provide clean electricity in a way that respects and highlights the site's heritage. This would not only power the estate but also serve as a valuable educational and cultural asset.

Together, these strategies solar PV (both existing and expanded), battery storage, modern heat pumps, a bivalent heating system for the Visitors Centre and Famine Museum, and a revitalised hydroelectric plant—could dramatically lower the site's carbon footprint. They would also make Strokestown Park more energy-independent and future-ready. Expanding the BMS to cover more areas and improving heating controls would help optimise output, making sure the estate remains both energy efficient and historically preserved for years to come.

8.0 Register of Opportunities

The site survey identified several opportunities that could be completed, which would make an impact on energy consumption and reducing carbon emissions (Table 9).

The main inhibitor to the successful implementation of these opportunities is the large pay back periods involved. This is mainly due to the cost per unit kWh of electricity compared to oil (kerosene). At the moment electricity is over three times greater than oil (kerosene) per kWh consumed.

Opportunity	Electrical Savings (kWh)	Thermal Savings (kWh)	Energy Savings (kWh)	CO ₂ Savings (T)	Monetary Savings (€)	Project Cost (€) (ex VAT)	SPB Year	Potential Funding	Comments
Implement an Energy Management Programme Estate Wide	7,390	11,294	18,684	4.3	11,692	N/A	N/A	SEAI Energy Academy	This opportunity relates to implementing an energy management programme onsite targeting energy awareness amongst staff
Install a M&T system to track energy usage Estate Wide	4,434	6,777	11,211	2.62	2,138	18,750	9	SEAI CEG	Installing a Monitoring & Targeting system with a visual display of real-time energy usage associated with the ESB meter would be worthwhile. This system can highlight any patterns of energy wastage and anomalies. Case studies have shown that implementing an energy management programme in tandem with an M&T system can achieve savings from 5% to 30%. A conservative 3% electrical and thermal savings are assumed
Centralise and expand the BMS systems to all buildings to optimise control and	10,984	5,311	16,294	4.0	3,500	35,500	10.14	SEAI CEG	Installing a user friendly BMS system to provide greater control over the space heating and humidity with features

Opportunity	Electrical Savings (kWh)	Thermal Savings (kWh)	Energy Savings (kWh)	CO ₂ Savings (T)	Monetary Savings (€)	Project Cost (€) (ex VAT)	SPB Year	Potential Funding	Comments
zoning within the house museum and offices, etc									such as time scheduling, set point adjustment & outside air temp hold off (OAT)in the house
R290 Bivalent Heat pump integration. Install high-efficiency R290 (propane) air-to-water heat pumps alongside existing LPG boiler in a bivalent configuration.	-37,617	154,894	117,277	25.0	7,125.12	150,000	21	SEAI CEG	This system replaces the old LPG Potterton boilers with a bivalent system and adds a further heat pump to the modern condensing boilers significantly reducing carbon emissions and modernising the space heating for all the museum
R290 Heat pump replacement Install high-efficiency R290 (propane) air-to-water heat pump in the military Gym	-1,222	6,108	4,886	1.24	500	15,000	30.00	SEAI CEG	This would eliminate fossil fuels from the military Gym building. And further decarbonise the site.
Install Digital time clocks on instantaneous DHW electric water heater	781	N/A	781	0.2	95.00	250	2.6	SEAI CEG	This opportunity relates to the USWH in Katherines kitchen

Opportunity	Electrical Savings (kWh)	Thermal Savings (kWh)	Energy Savings (kWh)	CO ₂ Savings (T)	Monetary Savings (€)	Project Cost (€) (ex VAT)	SPB Year	Potential Funding	Comments
Install a 30 kWp solar PV system in Strokestown House	20,088	N/A	20,088	5.2	€7,232	€47,500	6.57	Non-Domestic Microgen Grant (NDMG) Scheme	The electricity generated by the PV panels can be utilised onsite. Contributing to space heating DHW and lighting
Install a 30 kWp solar PV system in Museum	20,088	N/A	20,088	5.2	€7,232	€47,500	6.57	Non-Domestic Microgen Grant (NDMG) Scheme	The electricity generated by the PV panels can be utilised onsite. Contributing to space heating DHW and lighting
Refrigeration Cold Stop Curtains	1,378	N/A	1,37,8	0.35	496	1,200	2.5	SEAI CEG	This opportunity is to fit cold stop curtains to the Walkin refrigeration units to minimise heat gain
Refurbish the Micro hydroelectric plant. This is a conservative estimate of costs and outputs assuming a 3-5m potential Head and 8-10kW output	87,600	N/A	87,600	22.6	24,528	150,000	6	SEAI CEG	This opportunity relates to refurbishing the old hydroelectric plant which will provide electricity and increase renewable reliability all subject to considered investigation and design

Opportunity	Electrical Savings (kWh)	Thermal Savings (kWh)	Energy Savings (kWh)	CO ₂ Savings (T)	Monetary Savings (€)	Project Cost (€) (ex VAT)	SPB Year	Potential Funding	Comments
Install EV charger with dynamic load management	N/A	N/A	N/A	N/A	N/A	€ 5,750	N/A	SEAI CEG	Installing an EV charger with dynamic load management would allow visitors and staff to charge their electric vehicles. The site itself does not have any transport usage so while no direct savings, this opportunity would help towards overall sustainability goals and green credentials.

Table 7: Register of Opportunities

NOTE: the costs per unit kWh used in the above table for electricity and oil (kerosene) are €0.36 & €0.08 respectively. The heat pump opportunity factors in night time electricity rates and utilisation of the solar PV and battery load shifting.

9.0 Potential Supports

There are supports from local authorities and the SEAI towards energy management and energy efficiency projects. Each of these potential supports, applicable to charity organisations, is outlined in this section.

- **Community Climate Action Programme:** This Programme is to support and empower communities. This is achieved in partnerships with county councils, to shape and build low carbon, sustainable communities in a coherent way to contribute to national climate and energy targets. The Programme aims to support small and large, rural and urban communities to take positive climate action. The funding is for investment in small, medium, and large-scale community climate action projects.
- **SEAI Communities Energy Grant (CEG):** This scheme supports energy efficiency community projects through capital funding, partnerships and technical support. It's open for applications every year and is aimed at businesses including public buildings, communities and residents who want to participate in a cross-sectoral partnership approach to saving energy.
- **SEAI Energy Academy:** The energy academy is a free, online, e-learning platform designed to help businesses increase their energy efficiency and reduce their energy-related costs. The SEAI Energy Academy allows anyone to learn with short, interactive, animated modules. It is mobile friendly and offers flexible, self-paced learning with access available 24/7.
- **SEAI Non-Domestic Microgen Grant (NDMG) Scheme:** This scheme provides financial assistance to help businesses and other sectors to install solar PV panels to generate electricity on site. This technology reduces commercial electricity costs and increases security of supply while enhancing a positive sustainability image. Grant funding is available for systems up to a maximum 1000 kWp.