



Irish Heritage Trust



**Heritage Museum
Strokestown
Co. Roscommon
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Disclaimer

This report was prepared by SE Systems for Irish Heritage Trust. It reflects our professional judgement considering the information provided to us at the time of preparation. We have not verified the accuracy of this information. The savings calculations are estimates of savings potential based on various assumptions (including the information provided) and are not guaranteed. For example, the impact of changes in energy costs, building changes, building use changes, building population changes, additional equipment, and weather have not been considered in this document. This report is for Irish Heritage Trust. Without express written permission, any use which a party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such party. To the maximum extent permitted by law, SE Systems accepts no responsibility for any loss or damage suffered by a party as a result of decisions made or actions based on this report.

Glossary of Abbreviations

- CO₂ – Carbon Dioxide
- CRU – Commission for Regulation of Utilities
- DHW – Domestic Hot Water
- ENPI – Energy Performance Indicator
- GSORG - Grant Scheme Online Registration and Grant system
- HDD – Heating Degree Days
- HVAC – Heating, Ventilation and Air Conditioning
- ICT – Information and Communication Technology
- kW – Kilowatt
- kWh – Kilowatt hour
- LED – Light Emitting Diode
- MIC – Maximum Import Capacity
- MPRN – Meter Point Reference Number
- M&E – Mechanical and Electrical
- M&T – Monitoring and Targeting
- NCV – Net Calorific Value
- PIR – Polyisocyanurate
- PV – Photovoltaic (Solar)
- ROO – Register of Opportunities
- SEAI – Sustainable Energy Authority of Ireland
- SEU – Significant Energy User

1.0 Executive Summary

Strokestown Park Decarbonisation & Solar Integration

This proposal outlines a strategic investment in a bivalent heating and renewable energy solution for Strokestown Park, informed by comprehensive energy audits and modelling from SE Systems. By integrating high-efficiency R290 air-to-water heat pumps with a 85 kWp Solar PV system, the Irish Heritage Trust will achieve a significant reduction in annual carbon emissions, estimated at around 69 tonnes if both elements of the project are installed.

Scope of Proposed Works

R290 Heat Pump System: Installation of two 50 kW R290 air-to-water heat pumps designed to meet approximately 90% of the annual heating demand.

Solar PV Solution: An 85 kWp ground-mounted system (170 panels) with 126.6 kWh of battery storage to maximize self-consumption and provide approximately 65,606 kWh toward the site's energy needs, completely offsetting the electricity costs of the heat pump system.

Bivalent Integration: The heat pumps will provide the base load, while existing LPG boilers will be retained as backup to ensure reliability when temperatures drop below 4 degrees Celsius.

Specialist Heritage Design: The project includes modifying the existing piping network to integrate a new buffer tank and plate heat exchanger, with full integration into the Building Management System (BMS) for digital monitoring and optimisation.

Capital Summary (Excluding VAT)

The total net investment is significantly offset by SEAI grant support and long-term energy savings.

Financial Category	Gross Cost	Anticipated Grant	Net Cost to IHT
Heat Pump System	€286,700	(€100,345) [35%] SSRH	€186,355
Solar PV & Battery	€159,357	(€19,600) Microgen	€139,757
Design and Oversight Fees	€8,760	(€15,300) BEUS	(€6,540)
Total Project	€454,817	(€135,245)	€319,572

Operational Impact & Carbon Savings

The transition to a bivalent system dramatically reduces reliance on LPG, which is subject to price volatility and high carbon intensity.

Annual Heating Savings: 160,133 kWh.

Annual Solar Generation: 75,706 kWh

Total CO2 Reduction: 44.49 tonnes (Heating) + 24.32 tonnes (Solar) = 68.81 tonnes annually.

Project Payback: Estimated at 15.56 years for combined solar and bivalent solutions

Risks

The greatest risk to the progression of this project is around the granting of planning permission. We are mitigating that risk with our Conservation Architect, who is in regular communication with Roscommon County Council and is developing a pre-planning pack with the input of the county conservation officer. Should the council reject our planning application for solar panels, that will render the project unsuitable from a cost-savings perspective, as electricity costs would increase to power the heat pumps. The solar panels offset this cost difference, so if we could not install them, we would have to make a value decision whether we still install the heat pumps. Should we decide to not install the heat pumps either, we must be conscious of what the annual operating cost of the existing natural gas system would be. Here are how the costs compare:

€0.30/kWh electricity tariff)

€0.08/kWh Natural gas tariff)

Heating System	Annual Consumption
Annual heating demand	215,563 kWh/year
Heat pump consumption (SCOP 3.5)	55,430 kWh/year
PV contribution (85 kWp)	75,706 kWh/year
Heating System	Annual Running Cost (€)
Current heating system	€17,983.23
Heat Pumps with Solar	€0 (Completely covered by solar generated with additional to be used for other electrical consumption or sold to grid)
Heat Pumps without Solar	€18,353.50

Heat Pumps with Solar

Annual OPEX Savings €	€20,533.75
Pay Back Period (Years)	15.56

Heat Pumps without Solar

Annual OPEX Savings €	-€370.27
Pay Back Period (Years)	N/A (Impossible to quantify as operational cost savings is negative, but may go positive in future due to rising fossil fuel costs)

4. Recommendations

For maximum cost savings and carbon reductions, we recommend the installation of the heat pump and solar systems. This combined approach leverages the 85 kWp solar array to offset the electricity demand of the new heat pumps, ensuring Strokestown Park remains an environmentally responsible and cost-effective heritage site for the future.

2.0 Objectives

- Reduce LPG consumption by decarbonising the existing heating system while retaining boilers as backup.
- Lower CO₂ emissions via a low-carbon, high-efficiency heating system.
- Improve energy resilience and long-term operational efficiency.

3.0 Proposed Solutions

- Install two 50 kW R290 air-to-water heat pumps to meet approx 90% of the annual heating demand.
- Modify the existing piping network to integrate a new buffer tank and plate heat exchanger.
- Install new pumps, mixing valves, and system controls.
- Fully integrate the new heat pump system with the existing BMS.
- Include heat and electrical metering as required (locations shown in Appendix 3).

4.0 Project Outline

The building currently has two separate plant-room arrangements.

- The Primary plant room – which contains two De Dietrich MCA Pro LPG condensing boilers, each rated at 65 kW, and operating at an assumed seasonal efficiency of 94%.
- The Secondary plant room – which contains two older Potterton Prima-F boilers with nominal outputs reported in the range 30–100 kW. (No nameplates or manuals were available to verify the exact capacities of the boilers within the secondary plant room.)

To determine boiler performance where manufacturer data is unavailable, the iSBEM methodology has been applied: for an existing LPG boiler with unknown efficiency, a default seasonal efficiency of 80% has been assumed.

To meet the objective goals outlined in the project brief, the proposed solution involves the installation of two (50 kW) BA90iP R290 air-source heat pumps (ASHPs). These high-efficiency units are capable of operating at flow temperatures up to 75 °C, providing the flexibility required to meet both base and peak heating demands.

To avoid excessive cycling and efficiency losses as a result of oversizing, an internal control panel will manage the operation of the heat pumps, circulation pumps, and heating circuits in response to real-time system demand. This control panel will be fully integrated with the Building Management System (BMS), enabling digital monitoring, data logging, and system optimisation.

The heat pump lifespan is estimated at 20 years, subject to routine maintenance. A 3-year standard warranty applies, extendable to 84 (7 years) months when the unit is monitored and fitted with a MasterTherm NeoBox (internal control panel). The NeoBox must be permanently connected to the internet to allow full monitoring and control of the heat pump.

The existing heating infrastructure have been assessed and found to be in good condition, with necessary refurbishments and modifications included within the project scope.

Technical datasheets and Eco-design documentation for both the proposed heat pumps and the existing boilers, together with on-site photographic evidence of the current plant room setups, are provided in a subfolder within Appendix 2.

Floor plans and design drawings have been attached in Appendix 3 to show the size and scope of the building.

Existing Heating System Performance

The building is currently heated using an LPG-fired boiler system. Analysis of the 2024 fuel bills indicates annual LPG consumption of 215,563 kWh.

Consumption

Metric	Value
LPG heating consumption	215,563 kWh
Total heating energy	215,563 kWh

Cost

Metric	Value
Annual thermal heating cost	€17,983.23
Total Annual heating cost	€17,983.23

4.1 Sizing Calculations:

To evaluate the feasibility of the proposed heat pump solution, it was essential to determine the building's heating requirements. Consequently, a steady-state heat loss calculation was performed using DesignBuilder, leveraging its Energy Plus simulation feature. This approach provided a detailed analysis of the building's thermal performance, serving as a baseline for exploring effective decarbonisation strategies.

Figure 1 & 2 below shows the building that was modelled using DesignBuilder and the heat loss associated with the building's elemental fabric make-up, infiltration rate & weather data for the site.

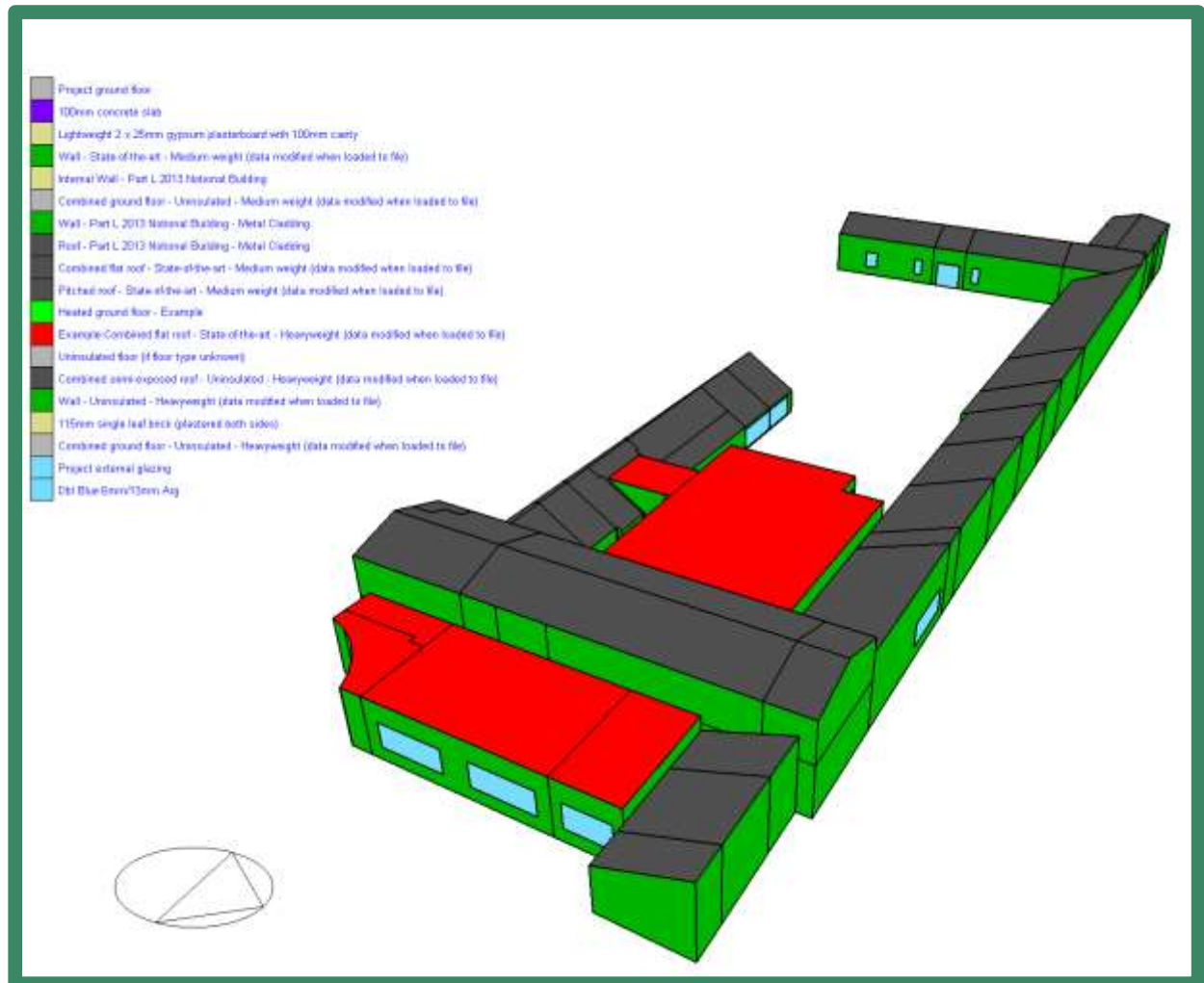


Figure 1: Building 3D energy model – IHT Strokestown Famine Museum

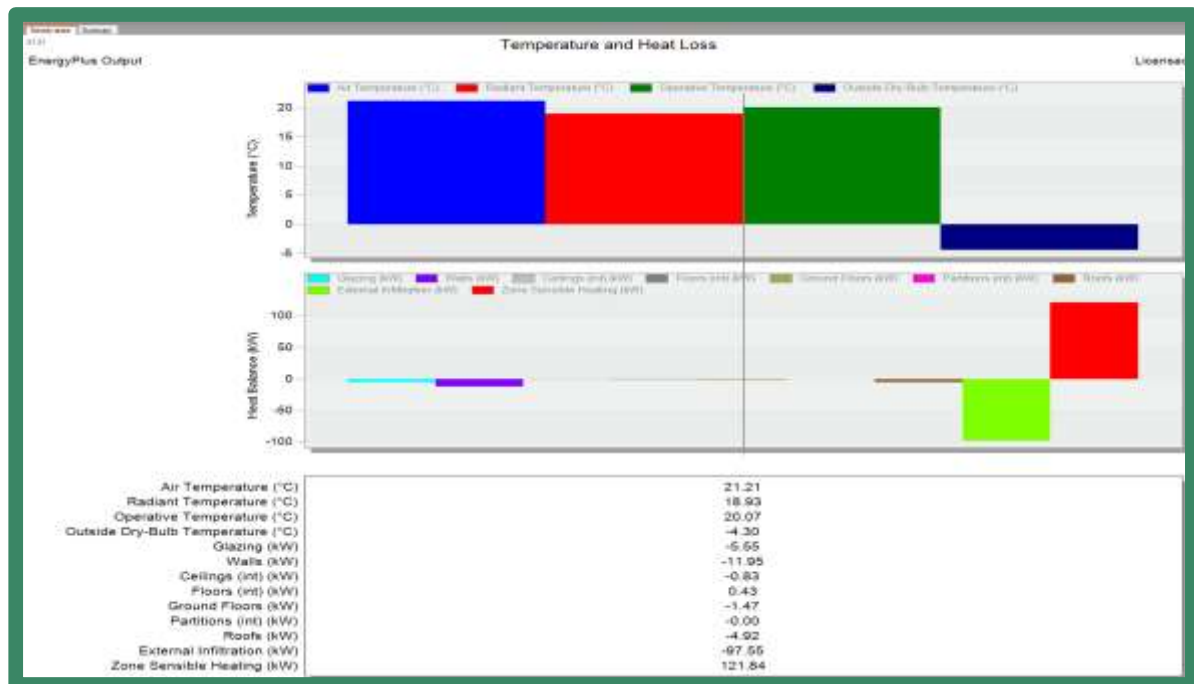


Figure 2: Building 3D energy model – Dynamic heat load summary

The overall heating design summary indicates a total heat loss of 121.84kW. The above results account for both fabric and infiltration losses.

5.0 Heating Profile & SCOP

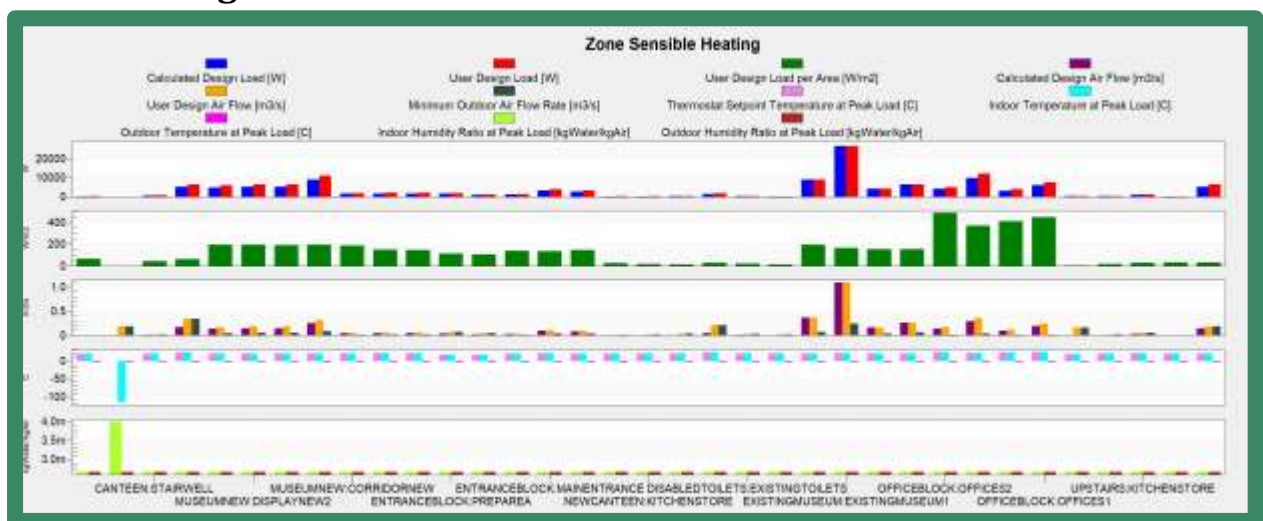


Figure 3: Building 3D energy model – Zone Activities heating profile

The heating profile for each of the different zone activities is shown above – displayed throughout the 1st bar chart.

We predict an annual space heating demand of 215,563 kWh and a peak heating load of 122 kW. The modelled heating demand closely matches the measured energy consumption, indicating that the model provides a reliable representation of building performance.

For the purpose of this exercise, for the proposed ASHP system we've used an efficiency of 350% (SCOP 3.5), the projected electrical consumption of the heat pump of this efficiency is 55,430 kWh/year. In practice, heat pump efficiency will vary depending on external air temperatures and operating conditions.

For this reason, the proposed heating strategy adopts a bivalent system design, whereby the new air source heat pump installation is supported by NG boilers retained as a back-up heat source. Under this approach, the renewable system is expected to meet approximately 90% of the annual heat demand, with the remaining 10% supplied by the LNG system. The LNG boilers will be fully operational in advance of the air source heat pump installation, ensuring continuity of heating throughout the transition period. It also ensures we maximise the efficiency of the heat pump system – maintaining a SCOP of 3.5 or greater.

The installation of the solar PV system will also further aid in minimising the operating costs of electrifying the heating at Strokestown Famine Museum. The proposed solar documentation has been provided separate to the heating project.

The projected solar contribution (by others) according to the proposal provided is estimated below.

Total PV Generation: 75,706 kWh

Direct Use: 30,376 kWh

Battery Use: 30,265 kWh

Export: 15,065 kWh

Total Self-consumed: 60,641 kWh

Heat pump demand fully covered by PV

Set out below are the projected annual running costs associated with the proposed bivalent heating system, comprising an air source heat pump supported by LNG boilers for peak demand and resilience, along with the PV electricity contribution.

1. Existing System (LPG Boilers)

Annual LPG Consumption: 215,563 kWh

Annual Cost: €17,983.23

Carbon Emissions (SEAI factor 0.2293 kgCO₂/kWh):

$215,563 \times 0.2293 = 49,428.6 \text{ kgCO}_2 = 49.43 \text{ tCO}_2/\text{year}$

2. Proposed System

Heat Pump serves 90% of the load:

$215,563 \times 0.90 = 194,007 \text{ kWh}$

Heat Pump Electricity (COP 3.5):

$194,007 \div 3.5 = 55,430 \text{ kWh}$

Remaining LPG (10%):

$215,563 \times 0.10 = 21,556 \text{ kWh}$

3. Solar PV Contribution (from Others)

Total PV Generation: 75,706 kWh

Direct Use: 30,376 kWh

Battery Use: 30,265 kWh

Export: 15,065 kWh

Total Self-consumed: 60,641 kWh

Heat pump demand fully covered by PV

4. Carbon Emissions

Remaining LPG emissions:

$$21,556 \times 0.2293 = 4,942.9 \text{ kgCO}_2 = 4.94 \text{ tCO}_2/\text{year}$$

Carbon Reduction:

$$49.43 - 4.94 = 44.49 \text{ tCO}_2/\text{year} (90\%)$$

24.32 tonnes (Solar)

Total 68.81 tonnes annually.

5. Financial Analysis

Energy Type	Usage kWh	% Usage	Annual Operating Cost
Electricity Generated (Personal Use)	-60641	-	-€18,192.30
Electricity Generated (Sold to Grid)	-15065	-	-€2,711.70
Electricity for Heat Pumps	55,430	90.0%	€16,629.00
LPG	21,556	10.0%	€1,724.48
Total	1,280	100%	-€2,550.52

Taken together, the savings and emissions reductions demonstrate that it is both feasible and appropriate to significantly reduce the carbon footprint of Strokestown Famine Museum while safeguarding its architectural and historic integrity.

By prioritising high-efficiency air source heat pumps to meet the majority of the annual heat demand, while retaining NG boilers to ensure resilience, peak-load capacity, and continuity of operation, the proposed system achieves meaningful reductions in energy use, operating costs, and carbon emissions without exposing the Trust to undue technical or conservation risk. This approach provides flexibility, future-proofing, and operational security, all of which are critical for a complex heritage asset of this scale.

The proposed investment aligns with the Irish Heritage Trust's long-term sustainability objectives, supports national decarbonisation goals, and represents prudent stewardship of both the building and financial resources. On this basis, the proposed bivalent heating strategy is recommended for approval and progression to procurement and implementation.

7.0 Estimation of the project Costs

Table 2: Estimated project costs (excluding ASHP compound)

Financial Category	Gross Cost	Anticipated Grant	Net Cost to IHT
Heat Pump System	€286,700	(€100,345) [35%] SSRH	€186,355
Solar PV & Battery	€159,357	(€19,600) Microgen	€139,757
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Heat Pumps with Solar

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Heat Pumps without Solar

Annual OPEX Savings €	-€370.27
Pay Back Period (Years)	N/A (Impossible to quantify as operational cost savings is negative, but may go positive in future due to rising fossil fuel costs)

8.0 Compliance with Building Regulations & Health and Safety

➤ Compliance with Health and Safety Regulations:

PSDP Appointment: SE Systems are appointed as PSDP. All required risk assessments and H&S considerations have been incorporated by way of a Designers risk assessment Appendix 4.

Health & Safety Integration: The design includes safe access points for maintenance, appropriate labelling of hazardous areas, and integration of safety features such as emergency shut-off valves.

➤ Compliance with Fire Safety Regulations

Fire Safety Certificate: A fire safety certificate is not required due to the non-invasive nature of the works.

➤ Compliance with Planning Regulations

Planning Permissions: Planning permission requirements have been assessed - Due to the classification of the building and surrounding area (Heritage), as the proposed works are non-invasive and avoids any disruption to the ground and building fabric for the installation of the new heat pump system. It is understood that there is no breach to the local environmental/planning policies.

➤ Compliance with Environmental Licensing

EPA Licence Compliance: N/A

Additional Licenses: No additional licenses are required. The installation will not trigger any new environmental licensing requirements.

9.0 Design Declaration by Design Engineer

“I, Caolan Gillespie, acting as nominated Competent Design Engineer, declare that all information submitted in this design report is accurate to the best of my knowledge and I warrant the design and all aspects of the Design of the Eligible Installation which includes the renewable heat, distribution, and heat-emitting equipment, and all supporting infrastructure, electrical installation for a period of five years. I declare that the heating installation design is ‘fit for purpose’ and can deliver the required heat. This will be validated during an on-site inspection following system commissioning.

I confirm that the project design has considered all regulatory requirements including:

- Relevant Building Regulations
- Relevant Planning Permissions (including change of use)
- Relevant Environmental Licensing
- H&S Legislation and
- Manufacturer’s Instructions

Documented confirmation of compliance with all regulatory requirements will be provided as part of the Completion Report.

Signed: _____ Date: _____

“I, [Applicant's Name], confirm that the Design Engineer has explained to me the impact of all the items listed as requirements of the Design Report and the GSORG and their implications for the applicant and for the project as addressed in the Design Report.”

Signed: _____ Date: _____

10.0 Appendices:

- Appendix 1: [Letter of appointment of Design Engineer, PI insurance and Engineers Ireland membership, engineering degree, letter of appointment from applicant]
- Appendix 2: [Datasheets, Product Warranty]
- Appendix 3: [Schematic/sitemap/floor plans/SCOP workbook]
- Appendix 4: [BER certs (pre & post) Designer risk assessment]
- Appendix 5: [Heat meter datasheet]
- Appendix 6: [Commercial cost breakdown]