2021 Energy Review

National University of Ireland Galway

Prepared by NUI Galway's Energy Team
November 2021

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Executive Summary

This Energy Review is being carried out to comply with the requirements of the ISO5001: 2018 Energy Management System (EnMS) standard, clause is 6.3. The main purpose of this energy review is to analyse NUI Galway's energy usage and consumption based on measurement and other data i.e. the identification of current types of energy use, the evaluation of past and present energy usage and the analysis and identification of the Significant Energy Users (SEUs). For each SEU, the relevant variables and current energy performance is determined and the person(s) doing work under our control, which has an influence, or effect, on each of the SEUs, have been identified. Additionally, opportunities for improving the energy performance of the NUI Galway's SEUs are outlined and prioritised. Furthermore, the estimated future energy usage and consumption is documented.

Buildings that are included within the scope of the NUI Galway ISO50001 EnMS have been reviewed and are listed on the NUI Galway Energy Manual and Dashboard. There are fifty-eight buildings included that have a total internal floor area of 155,090 m^2.

Internal audits of the ISO50001 EnMS have been carried out during 2021 and there were no non-conformances found. The main observations are in relation to the pandemic, national guidelines, and resulting actions i.e. closure of the NUI G Campus during lock-downs, home working and facilitation of a temporary hospital to support the national pandemic programme. Covid-19 continues to have an impact on the energy performance of our buildings, and NUI Galway's ISO50001 Energy Management System, and accompanying documents/meetings /processes have been updated accordingly. NUI Galway's energy performance has continued to improve during the Pandemic, as expected.

The management team measure electrical and thermal energy performance using key performance indicators; kWh (e)[1] and kWh (th)[2] per metre squared of treated floor area per annum. These are termed Energy Performance Indicators, or EnPIs, and are being used to set targets for enhanced energy performance improvement plans.

NUI Galway operate a formal EnMS which is compliant with the requirements of ISO50001: 2018; Energy Management Systems Standard. The Energy Review is carried out once a year and in response to major changes in facilities, equipment, systems, or energy using processes. It is normally carried out during September/October, and compiled, reviewed, and reported during October/November, each year and this strategy has not changed.

The methods and criteria used to develop each of our Energy Reviews are outlined and the results are documented and retained/ maintained as records under our Document Control Procedure.

[1] kWh (e) relates to electricity related usage – the average unit price per kWh(e) used is €0.152c
[2] kWh (th) relates to gas usage – the average unit price per kWh(gas) used is €0.062c

1. Analyse Energy Use & Consumption

1.1 Current Types of Energy

The current types of energy being used at NUI Galway are outlined on table 1. In the main, the campus uses imported electrical and gas to sustain its operations. It also uses a considerable number of renewable energies such as combined heat and power plant, biomass boiler, solar thermal and solar photovoltaic systems. Over the past few years, the college has installed a number of solar photovoltaic electrical energy generation systems and these are proving very worthwhile. During this summer. The campus building's energy consumption during 2020 is set out in Table 1 and summarised in Figures 1, 2 and 3.

Table 1: Annual Energy Consumption, Energy Costs & CO2 Emissions (t)

Fuel	2020		
	Quantity [kWh]	Spend (Est.)	CO2 * Emissions [kg.]
Electricity Imports	12,940,939	€1,967,023	3,816,283
Electricity Generated on-site- PV.	31,300	-€4,758	-9,230
Gas Imports	11,764,416	€729,394	2,408,176
LPG	520,105	€27,826	119,260
Gasoil – Heating, Kerosene	617,665	€42,557	168,993
Wood pellets	235,008	€12,220	0
Solar Thermal	75,000	-€7,500	-15,353
Road Diesel	157,006	€16,250	39,550
Transport Biofuels	11,968	€1,239	3,015
Total	**26,353,407**	**€2,784,251**	**6,530,694**

***Referenced SEAI website on September 16th, 2021: SEAI's Emissions Factors - Sept 2021**

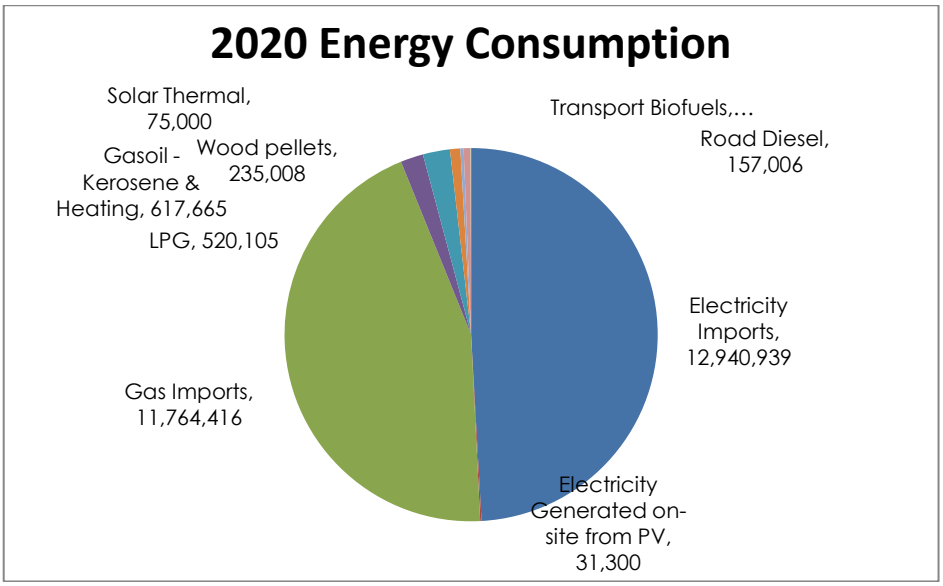


Figure 1: 2020 Breakdown of Energy Consumption (kWh)

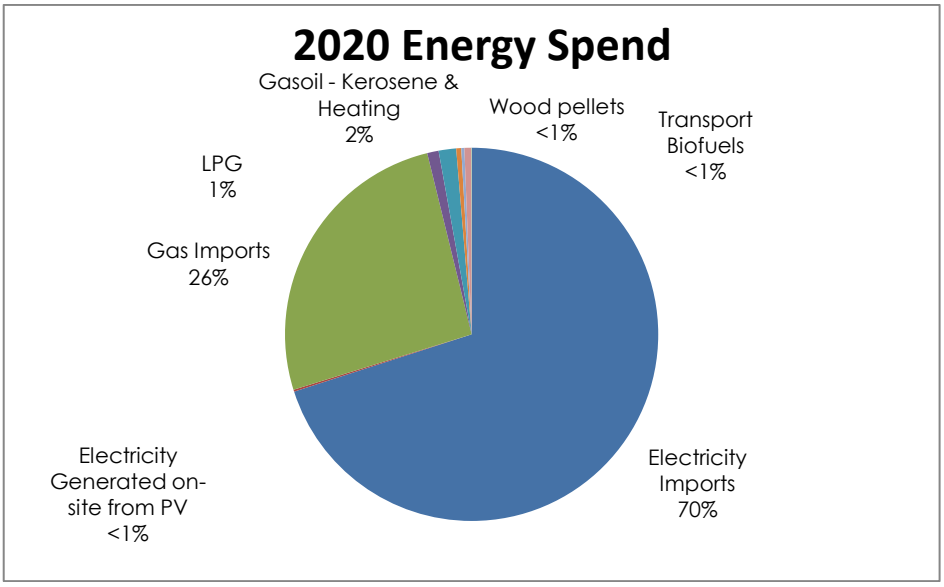


Figure 2: 2020 Breakdown of Energy Spend

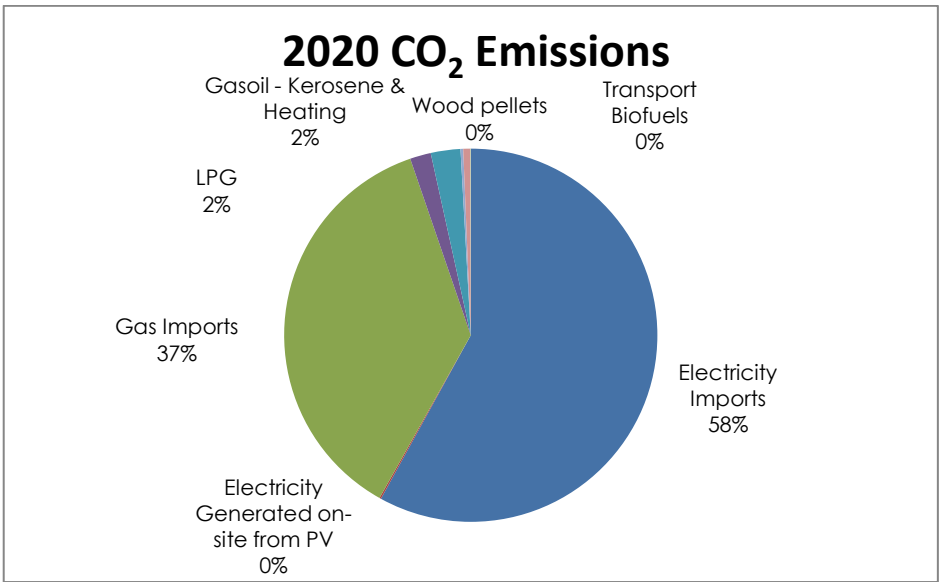


Figure 3: 2020 Breakdown of Energy Related CO_2 Emissions

1.2 Evaluation of past & present energy use & consumption

An evaluation of the past and present energy use and consumption was carried out using the SEAI's M&R System. This is the national database of all public sector organisations' energy profile. It is 'independently assessed' using a stringent quality assurance system and uses electricity and town's gas data, accessed from the national Meter Point Registration Operators. The M&R System is heavily referenced as it demonstrates that we are being independent in our assessment criteria. That

said, this data includes energy used to sustain science and research activities carried out at the SRB Building and that building is not included in NUI Galway's ISO50001 scope. An annual highlight of our energy performance from 2006 to 2020, inclusive, is outlined on Figure 4, below.

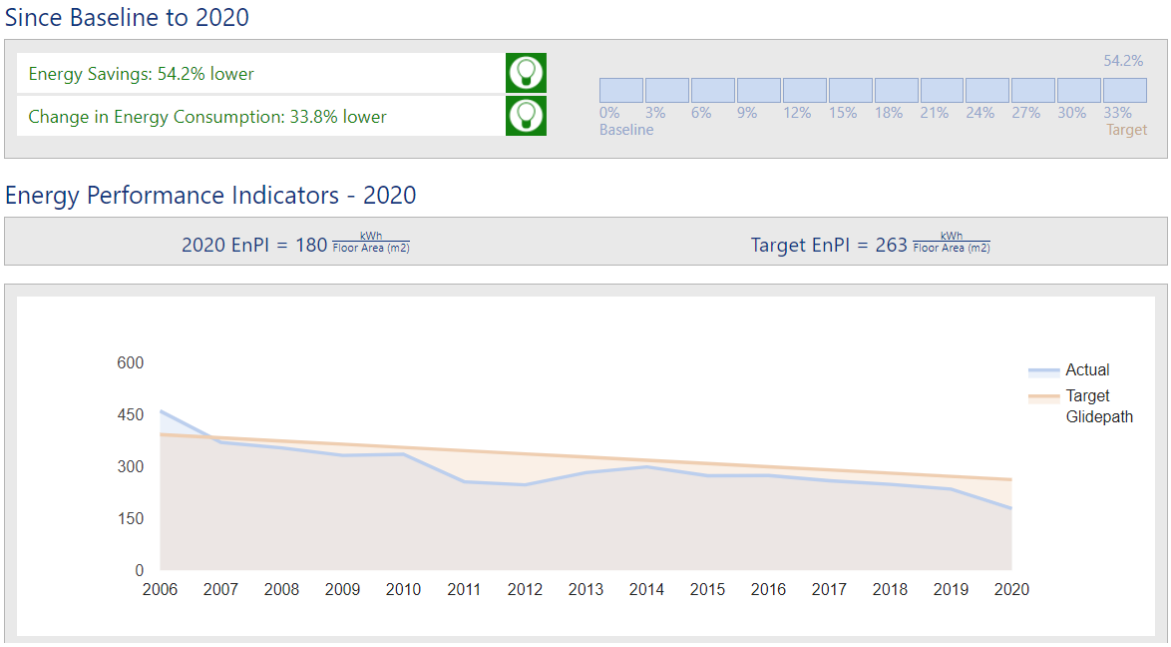


Figure 4: NUI Galway's actual energy performance Source SEAI's M&R System

Additionally, the energy performance of each of our buildings is being monitored daily and reported monthly. The Energy Team reviews the performance of each of our significant energy using buildings; using monthly cumulative electrical energy usage data and compares that to the cumulative electrical energy usage for the equivalent month, from the previous year. This is carried out to react to any untoward changes in a timely fashion. However, we have had to adjust our methodology to factor pandemic related issues and have increased lower-level energy performance tolerances, per building, accordingly. A proactive approach allows us to micro-manage each of our building's energy performance so that monthly and annual objectives and targets are continuously met.

Furthermore, the annual SEAI M&R Report is being used to review our past and present energy performance as outlined in figure 4. Our energy performance has steadily improved, and the downward trend has resulted in a 54.2% overall improvement in our energy performance, since our baseline year, which is 2006. The energy performance indicator used is kWh/TUFA (Treated Unit Floor Area).

A copy of the annual SEAI M&R Report is sent to our President, by SEAI, every year.

2. Identification and analysis of our Significant Energy Users

2.1 Significant Energy Users

The main energy consumers are summarised in Table 2 below. This table is based on the electrical energy using data obtained using the Building Energy Management System (BMS). It is used to prioritise opportunities and support cost accounting exercises. The Arts Science Building includes the Main Concourse, Chemistry/ Bio-Chemistry and Physics. As outlined previously, The Science Research Building (SRB) is outside the scope of the ISO50001 Energy Management System and is being managed by Neylons' FM. This table shows that the overall electrical energy usage has dropped significantly by 2,950,354 kWh, during 2020. There is one outlier and that is the HBB – Human Biology Building, which is the main medical building incorporating 'live' research laboratories, which have fully treated air and these laboratories are in the basement. The building has reached it full operating capacity during 2020. The reasons why this building's energy usage is growing is being investigated by the Energy Team and a Corrective Action Report has been raised in this regard.

Additionally, Sankey Diagrams are being used to display the energy usage of the significant energy users within buildings. An example of the Orbsen Building Sankey Diagram is outlined in Appendix E.

A table for primary thermal energy users is being developed to include information from the new thermal energy meters. Additionally, we have conducted a degree day regression analysis recently and the results are outlined in Section 2.2.2.

Table 2: Summary of top ten electrical energy consuming buildings

Name	Year	GIA[3]	2019 kWh (e)	2020 kWh (e)	Diff.
Arts Science Building – Main Meter	1970, 1973	31,312	1,764,035	1,329,721	(434,314)
Alice Perry - Engineering Building	2011	14,145	1,135,424	1,000,085	(135,339)
James Hardiman Library	1980	9,415	1,333,950	753,617	(580,333)
Science Research Building	2012	8,212	2,616,242	2,074,732	(541,510)
Arts Millennium Building (incl. AMBE extension)	2000, 2012	8,054	603,848	286,524	(317,324)
Human Biology Building	2017	8,000	1,545,019	1,979,611	434,592
Orbsen Building	2003	6,491	1,350,307	689,653	(660,654)
Arts, Humanities, Social Sciences Research Building (AHSSRB)	2013	5,436	791,001	460,941	(330,060)
Áras Na Mac Léinn / Cultural centre	1995	4,307	555,411	311,821	(243,590)
Áras de Brun, Anatomy & Terrapin	1960	2,426	548,698	406,876	(141,822)
Overall		97,798			(2,950,354)

[3] GIA – Gross Internal Floor Area

2.2 Relevant Variables

2.2.1 Baseline

The energy baseline used is the kWh (e) and kWh (th) per m2 of treated floor area. The baseline year is 2006 and NUI Galway's progress since then is plotted on Figure 4. Our energy performance during 2006 was 462.64 kWh per M2 of treated floor area. During 2020 that figure fell to 180 kWh per m2, which is a 54.2% improvement. The target set for 2020 was 263.27 kW per m2, and we have already surpassed that target, which is pleasing. However, COVID 19 did play a big part in that reduction as the campus was significantly affected by Government imposed 'Lock-downs'. Additionally, as expected our targeted performance will continue to be a challenge e.g. the Human Biology Building, is still reaching its full operational capacity and that building is a fully treated 8,000 m.2. building with exact heating, cooling & humidity control.

Also, it is worth noting that the M&R System is being changed to reflect the national and international climate change carbon emissions targets for public sector organisations outlined in the Climate Action Plan – 2021 (see Appendix F). Additionally, next year's M&R system will include annual targets and performance tracking for the period leading up to 2030.

As expected, the Climate Action Plan targets a 50% improvement in carbon[4] emissions performance compared to the baseline year; for all public sector organisations. Our baseline year is 2006. In preparation for the transition to Carbon and Green House Gas Emissions – GHGs, we are monitoring our CO_2 emissions every year, since 2006. We have placed more emphasis on this aspect since 2014 and are delighted to report that our primary emissions are on the wane, since then. See also Appendix C - Yearly CO_2 emissions.

2.2.2 Other Relevant Variables

There are a number of other relevant variables such as number of students and staff (and researchers), number of conferences, number of projects completed (including new or renovated buildings) and degree days[5]. Degree days and regression analysis exercises are being undertaken. The calculated regression or R value during 2020 is 0.754, which demonstrates a strong positive correlation between gas usage and outside ambient temperature. During 2019 the R-Value was 0.626. This is reassuring and demonstrates a 12% improvement in the correlation between thermal energy usage and outside ambient temperature.

[4] Carbon dioxide is abbreviated to carbon and is denoted by CO_2

[5] Degree days are a simplified representation of outside air-temperature data. "*Heating degree days*", or "*HDD*", are a measure of how much (in degrees), and for how long (in days), outside air temperature is lower than a specific "*base temperature*" (or "*balance point*"), which in our case is 15.5 deg C. Source www.degreedays.net

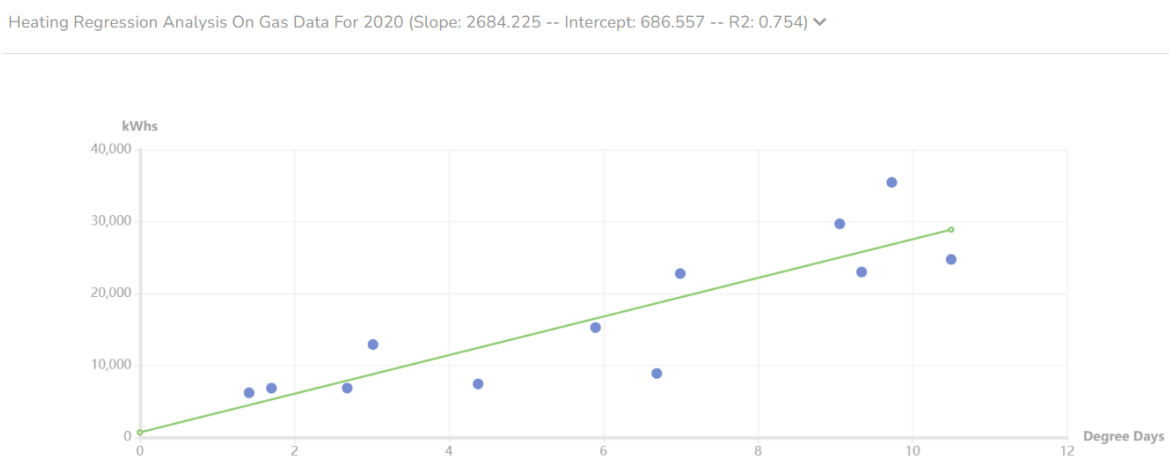


Figure 5: Degree Day Analysis

During 2019, as part of the Green Flag initiative, we began to report a carbon and energy per student related key performance metric, and this proved to be a very successful tool in engaging with students. We will continue this initiative during 2021/22 as this has enabled them to become more conscious of their impact on energy and carbon usage at our university. The use of carbon performance metrics will be more prevalent in future as this method compliments the move towards a more sustainable campus.

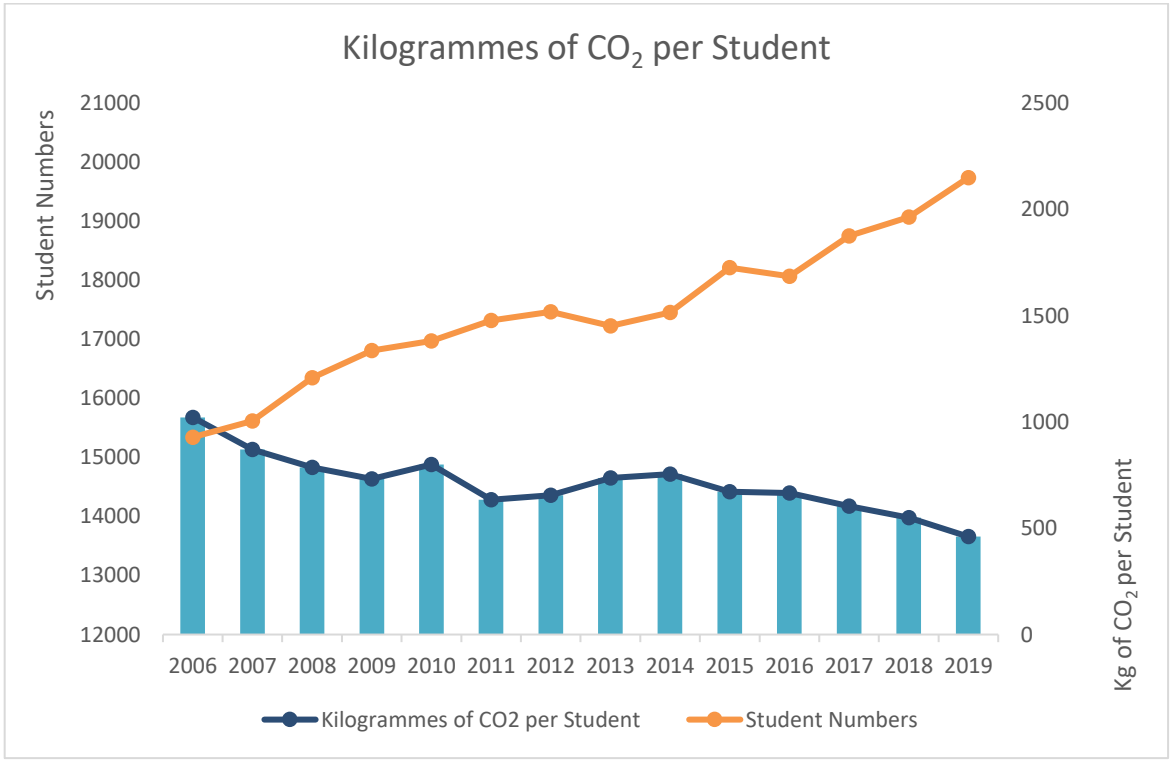


Figure 6: Kilogrammes of CO_2 per Student (2006-2019)

2.2.3 Legal & Other Requirements

Legal and other requirements are being evaluated on an ongoing basis. Since Q1 of 2017, NUI Galway has subscribed to an external register of energy legislation and staff has undergone training in its use, and the requirements of ISO50001: 2018 Clause 9.1.2.

The main pieces of legislation and other requirements that apply to NUI Galway on an ongoing basis are: -

- S.I. 426 of 2014 – European Union (Energy Efficiency) Regulations – that place responsibilities on public sector organisations to take an exemplar role in relation to energy efficiency and energy management.
- S.I. 292 & 183 of 2019, S.I. 243 of 2012, S.I. 872 of 2005 – European Union (Energy Performance of Buildings) Regulations 2005, 2012 & 2019
- Climate Action Plan – 2021 and previous National Energy Efficiency Action Plans – i.e. National Energy Efficiency Action Plans 1, 2, 3 & 4
- Building Regulations 2021: Technical Guidance Document L – Buildings other than Dwellings Published on 7th December 2020 and updated on 12th August 2021.

Finally, the Buildings and Estates team operate a comprehensive 'Statement of fundamentals' that is integrated into the college's purchasing procedure. This document obliges all interested parties to undertake life cycle assessments so that all new and refurbished plant, equipment, and projects undertaken include energy efficiency measures during the design, procurement, installation, and commissioning phases.

2.3 Current energy performance

The management team measure its electrical and thermal energy performances using key performance indicators; kWh (e) and kWh (th) per metre squared of treated floor area per annum. These are termed Energy Performance Indicators, or EnPIs, and are being used to set targets for enhanced energy performance improvement plans. Table 3, as below, gives an outline of the kWh usage of both electricity and thermal energy per m.2. of treated floor area per annum. This table demonstrates that our annual energy performance has continually improved over the past 4-years. Electrical and thermal energy related energy performance indicators (EnPIs) are also used to demonstrate compliance with and achievement of Public Sector 2020 targets, the use of EnPIs may be developed further to include performance monitoring of each of its significant energy users such as the chiller, IT equipment, catering, lighting, boilers, and CHP plant.

Table 3: 2006-20 Energy performance indictors

Year	Energy Performance Indicator (EnPI)	
2020	kWh (e & th) /m2	180.00
2019	kWh (e & th) /m2	237.06
2018	kWh (e & th) /m2	249.42
2017	kWh (e & th) /m2	259.85
2016	kWh (e & th) /m2	274.81
2015	kWh (e & th) /m2	274.20
2014	kWh (e & th) /m2	299.76

2013	kWh (e & th) /m2	283.71
2012	kWh (e & th) /m2	248.77
2011	kWh (e & th) /m2	256.77
2010	kWh (e & th) /m2	336.32
2009	kWh (e & th) /m2	334.55
2008	kWh (e & th) /m2	356.04
2007	kWh (e & th) /m2	371.86
2006	kWh (e & th) /m2	462.64

EnPIs (kWh (e)/m2 of treated floor area are being used to monitor the energy performance of each building and those are reported and discussed during monthly energy review meetings. In 'normal years', prior to and following the effects of Covid lockdown measures, buildings that are under performing by 10%, or overperforming by 20%, are highlighted for special attention. The reasons why the performance has improved or worsened are noted and follow-on actions are agreed. Those are then documented and followed up on during the next few days and reviewed again during the next scheduled energy review meeting. In this manner, the EnPI data is being used as a springboard for enhanced energy efficiency. NUI Galway are using EnPIs as an essential tool for developing an effective EnMS and are also using those as a method to demonstrate that it is achieving its targets for improvement.

Finally, we also use Display Energy Certificates (DECs) to report each publicly used building, to report the operational performance, in kilograms of CO_2 per m.2 of treated floor area. The DECs are a performance rating and demonstrate that we are compliant with the requirements of the European Union (Energy Efficiency) Regulations and the Irish Statutory Instrument; S.I. 426 of 2014. Copies of the ten most recent DECs are outlined on Appendix B.

2.4 The identification of person(s) that affect our SEUs

The persons that affect the energy performance of our SEUs are identified and outlined on Table 3: Periodic & Operational Tasks/Roles in our Energy Manual. These include the details of each role and the person or title of the person who has overall responsibility for carrying out the duties and associated tasks. Michael Curran, who is Head of Building Services, Energy & Utilities has overarching responsibility for the operational control of our SEUs. Michael has a team of electrical and mechanic personnel and several preferred contractors, and he manages these personnel so that each of our SEU buildings are controlled and operated to strict performance specifications. Additionally, there are a few buildings that are managed by external companies e.g. Apleona manage the HBB & ILAS and CTRF, Neylons manage SRB, but Michael has overarching responsibility for the performance of these buildings, as well.

3. Determining & Prioritising Opportunities for Improvement

3.1 Recent/Existing Energy Saving Initiatives

The NUI Galway Energy Team is doing great work in developing and using their ISO 50001: 2018 compliant energy management system, to achieve targets and

objectives, and to demonstrate compliance with its legal obligations. The Energy Team comprises of Lorraine Rushe (NUI Galway's Energy Manager), Noel O'Connor (Assistant Director, Estates Operations), Michael Curran (Head of Building Services, Energy & Utilities), Seán Farrell (Electrical Engineer), Anthony Nevin (Mechanical Supervisor), Kenneth O'Toole (Electrical Supervisor), Karl Byrne (Building Management Systems' Consultant) and John Harrington (Energy Management Systems' Consultant). Occasionally, other interested parties are invited to attend and to present to the EnMS Team. In general, the NUI Energy Team meet once a month to undertake a review of the EnMS and to review each of the significant energy using building's monthly energy performance data. Actions are taken to address any deviations that are found to be + 10%, and -20%, from the norm; see also Section 8.1. However, these tolerances are under review at present, considering Covid-19 related home working, on-line lecturing, reduced occupancy and increased ventilation rates across our buildings and campus.

Noel O'Connor has continued to lead the ISO50001 Energy Management System and represents top management. Noel has continually demonstrated his commitment to supporting the EnMS and is focused on delivering an effective system; by defining, implementing, and maintaining the NUI Galway Energy Policy. Lorraine Rushe is the Energy Manager, and she has provided the resources[6] needed to maintain and improve the EnMS and resulting energy performance, on a continual basis.

Lorraine has also been pivotal in the transition of our EnMS from compliance with the 2011 to the 2018 versions of the standard during the past few 'Pandemic' years. Additionally, she has continued to develop the legal and other requirements aspect using the external legal registrar, known as Pegasus. That registrar updates and advises NUI Galway on their Energy, Environmental, Health and Safety related legal obligations. Lorraine and the core Energy Team has received training in the use of the Pegasus System. The work carried out by Lorraine has ensured that NUI Galway is fully compliant with the Legal and other requirements outlined in Section 9.1.2 of the standard.

Michael Curran has led the way in terms of implementing major energy efficiency projects throughout the year. Over the past year he has spent €1.2 million on carrying out energy efficiency upgrade projects at NUI Galway. He has developed the deep retrofit of the Áras de Brun building and has been actively interacting with the HEA Pathfinder Programme to support this national pilot initiative. By using iSBEM modelling, and other building information, software applications, Michael has demonstrated the path towards this building achieving an A-Rating. Other projects include the installation of LED lighting and the upgrading of heating pumps. Furthermore, the Energy Team has continued to decarbonise the NUI Galway campus and now has 250 kWp (Peak electricity generation capacity). During the past year (to date 2021), NUI Galway has increased its PV generated electricity 6-fold when compared with 2019-20.

Karl Byrne has responsibility for developing and managing the Monthly Building Performance Reporting System. He presents the results to the energy team once a

[6] Resources include human resources, specialised skills, technology, and financial resources.

month and follows up on any metering related action(s) and updates the reports and corrective actions accordingly.

John Harrington has supported the team throughout and has carried out the 2021 Internal Audit Programme of the new EnMS system. Additionally, he planned and documented the internal audit schedule for 2022 which is contained in the NUI G EnMS Dashboard. John will continue to report any observations and/or non-conformances using the Internal Audit Report Feedback Forms. Lorraine and John will be responsible for following through, and closing out, actions required arising from those observations/ non-conformances, as applicable.

NUI Galway's main objective is to reduce electricity and thermal related energy consumption and to improve the overall energy performance of its buildings. During 2020, NUI Galway's energy performance improved by 14.5%. This is documented on the Sustainable Energy Authority of Ireland's M&R System, and it provides independent proof that NUI Galway's Energy Performance is continuously improving. However, we are proceeding with caution and results are being viewed with a 'Covid related lens' and Lock-down related gains and ventilation related losses are being factored into Energy Team Meeting/Conversations. We have formally identified the pandemic related issues in the 'Actions to address risks and opportunities' which is detailed in section 6.1 of our Energy Manual.

Additionally, NUI Galway received a major achievement by winning a gold star approval in the international Sustainability Tracking, Assessment & Rating System from the Association for the Advancement of Sustainability in Higher Education. A copy of this award certificate is attached in Appendix A and is particularly welcome during these challenging times.

Furthermore, the Energy Team are developing further energy efficiency projects and will use the results from the Áras de Brun deep retrofit project to roll out similar projects, on similar buildings, into the future. The Energy Team and indeed all of the Building & Estates Department also continues to identify potential boiler-house upgrade projects, LED lighting replacement projects, Set-back HVAC opportunities and pumps/ motors that could be replaced with modern energy efficient equivalents. It also is continuing to 'roll out' renewable energy projects such as the installation of large scale photovoltaic and solar hot water systems and biomass boiler and power plant upgrades and the combination of results will lead to the decarbonisation of the NUI Galway campus by 2030.

A list of completed projects are outlined in the next section, 3.2 ~Energy Management Action Plan.

By taking an energy management system's approach to reducing energy costs and usage, NUI Galway continually improve its energy performance and, in so doing, reduces its environmental burden.

3.2 Energy Management Action Plan

A number of opportunities for further energy savings have been carried out over the past year and €1.2 million has been spent. The most significant projects include

HVAC upgrades, the continued roll out of energy efficient space heating pumps and the ongoing replacement of florescent light fittings with LED equivalents.

Similarly, an ongoing list of opportunities for improvement and potential projects; for the current period, 2021-22, are outlined in the Register of Opportunities (ROO). The values quoted for energy savings are reasonable estimates and calculations, and any assumptions made, are carried out on the right-hand side of the ROO sheet.

One of the highlight action plans relates to the NUI Galway 2030 Zero Carbon Action Plan. The University is formulating a fully costed action plan to transition to a zero-carbon campus in the next decade. It includes the installation of two district heating networks with biomass related primary energy sources/ centres and this is estimated to cost in the region of €3.4 million to design, tender, install and commission. Other key actions relate to upgrading numerous fume cupboards; and retrofitting energy efficient motors, sensors and hoods/doors/screens, carrying out behavioural change campaigns to improve the energy efficiency of ICT equipment and reviewing the building fabrics with the view to improving U-values and the thermal mass of buildings. The latter action will lead to the reduction of unwanted draughts and ambient noise.

The Register of Opportunities - ROO is an active document with twenty-three opportunities in the 'Seeking Funding Category,' eleven opportunities have been recently approved, fifty-six have been completed and a further three are ongoing or nearly completed. There are also five opportunities that were reviewed again during Q3, 2021 and these did not gain approval. These are on hold and are categorised as 'Not Approved'. The ROO is a colour coded for ease of use. Table 5 below contains a summary of the potential projects and their expected savings. This table forms the basis for achieving energy efficient targets. Targets are reviewed during Annual Management Review Meetings.

Table 5: Summary of the 2021-2 energy efficient projects; either seeking approval, approved, or completed, and their respective kWh (t), kWh (e), Kilogrammes of CO2 and Cost Savings and the average payback periods

Status	kWh (t)	kWh (e)	KgCO2	Capital Cost (€)	Saving(€)	Pay-back
Seeking	4,832,755	2,067,708	7,491,992	€5,011,340	€1,541,368	3.25
Approved	182,551	400,908	138,649	€1,518,950	€65,884	23.06
Completed ~Approved-Ongoing	1,674,822	1,152,974	1,734,474	€1,361,915	€506,273	2.69
Total	**6,690,128**	**3,621,590**	**9,365,115**	**€7,892,205**	**€2,113,524**	**3.73**

Table 6, gives an outline of the opportunities for energy efficiency improvements and are categorised as Seeking Funding, Approved, Completed ~ Approved/Ongoing or Not Approved. These are colour coded in light brown, light green, dark green and red, respectively. The following tables should be read in conjunction with the Master ROO.

Table 6: Opportunities for Energy Savings and Action Plan (2021 -22)

NUI Galway OÉ Gaillimh	ISO 50001: 2018		2021 Rev 1		
			Michael Curran, Lorraine Rushe, Seán Farrell, John Harrington		
Building	**Opportunity - Objective**	**Energy**	**Reason Included**	**Comments - Potential Risks**	**Business Unit**	**Project Approval**
NUI Galway - Campus-wide	Decarbonisation Zone with Galway City Council	Therm/Elec	Behavioural opportunities. ARUPs has been appointed as the Consultants to Chair this.	Westside Decarbonisation Zone, Partners GCC, HSE, NUI G, Dunnes Stores & 2000 Home Owners. Seeking European and SEAI funding. Budget of €200 million available.	Buildings and Estates	SEEKING
Human Biology Building	Heating and Cooling Strategy Review	Therm/Elec	The energy performance of the HBB is poor. The energy rating for the period from July 2020 to June 2021 is an E2. The building has an actual Electrical kWh/m.2./yr result of 457.37 and Non-electrical kWh/m.2./yr result of 199.3. The typical energy usage for a building of this category should be 295.36 kWh (e) per m.2./yr and 246.93 kWh (ther) per m.2./yr.	There is an opportunity to carry out 3 actions to address or reduce energy usage. I.) carry out a review of the heating and cooling strategies with the Design and Build Teams. 2.) carry out training for the users of the HVAC Systems at HBB 3.) Review the dehumidifiers and consider replacing both. These appear to be inefficient, dumping hot water to drain.	Buildings and Estates	SEEKING
ISS	Review of all IT software and the use of PCs, Printers, electronic equipment, AV etc	Elec	NUI Galway must look at the behavioural requirements of all its staff in the use of IT equipment and also the cost of running of all equipment during the weekends and evenings. Green Procurement of all new equipment	Strategic alliance with ISS on the computer equipment. There may be risk that ISS may decide not to proceed with any energy efficiency improvements to its ISS. We will manage this risk accordingly.	Buildings and Estates /ISS	SEEKING

Digital Enterprise Research Institute - DERI Building	Deep Retrofit and add Photovoltaic Electrical Generation System	Therm/Elec	Mike to send on a copy of the application. This is under review.	Heat Pump, Radiators & Controls	Buildings and Estates /DERI	SEEKING
Fume Cupboards	Review the upgrade of older stock of Fume Cupboards with new energy efficient motors and use of new screens etc	Elec	Review the existing 180- plus Fume Cupboards and introduce new VSD on fans and replace aging stock.	Review with Science based units. There could be some risks associated with scientists having an insight into heightened health and safety issues associated with particular experiments e.g. fume cupboards not being allowed to go into set-back states or issues associated with changing over the equipment.	Buildings and Estates	SEEKING
FABRIC	The energy team need to review energy projects in the replacement of Fabric in buildings windows etc	Therm	Strategic review of the buildings to look at costs associated with Fabric upgrades to buildings	Building Engineer and Energy team. The costs associated with fabric upgrades are prohibitive. Additionally, fabric will have to be exactly specified and lessons learnt from the Grenfell Towers Tragic Fire, incorporated into the design process.	Buildings and Estates	SEEKING
Arts Science Building (Microbiology)	Window Upgrade	Elec	Single glazed units are not fit for purpose	Qty 50 * Metal framed, Single glazed units to uPVC double with an expected improvement of from 5 watts per m.2. K to 2.8 watts per m.2. K. Costs associated with fabric upgrades tend to prohibitive. Funding will be difficult to attain.	Arts Science	SEEKING
CHP Project 01	Supply and Installation of CHP to the Biomedical Research Building	Therm/Elec	New 140 kW units	Provision for CHP has been left for a unit in HBB. We have many years experience with installing and operating CHP systems. Lessons learnt over the past 12 years will be used to good effect. Optimising the use of thermal capacity and routine maintenance will be key	Biomedical Research Building	SEEKING

BOI Theatre	Upgrade the lighting to the BOI Theatre	Elec	The existing lighting is high bay light fittings and switch control.	Install new LED lighting to serve the BOI Theatre. An additional risk will be the H&S aspects associated with working at heights. This will also adversely affect maintenance and associated costs.	BOI Theatre	SEEKING
Campus Wide	Develop district heating networks for the North & South Campus	Therm	Installation of 2 comprehensive district heating networks linked to 2 energy centres.	Application made to the carbon fund and submitted in October 2018. The funding required is substantial. The risk is largely financial related. Funding is being sought via the EXEED Programme.	Campus Wide	SEEKING
Cultural Space	Replace two direct gas fired air handling units feeding student centre	Therm	Existing Direct gas fired units are not efficient and need to be replaced	Installation of new energy efficient Air Handling units. There is a risk associated with not replacing these units, as they continue to drag down our energy performance in Áras Mac Léinn.	Cultural Space	SEEKING
No. 12 Distillery Road	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation. We at NUIG have great experience with installing HP and distribution systems. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits. Financial risks may also apply.	No. 12 Distillery Road	SEEKING
No. 15 Distillery Road	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation. We at NUIG have great experience with installing HP and distribution systems. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits. Financial risks may also apply.	No. 15 Distillery Road	SEEKING
No. 17 Distillery Road	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation. We at NUIG have great experience with installing HP and distribution systems. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits	No. 17 Distillery Road	SEEKING

No. 19 Distillery Road	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation. We at NUIG have great experience with installing HP and distribution systems. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits. Financial risks may also apply.	No. 15 Distillery Road	SEEKING
The Gate lodge	Replace existing 25kw oil fired boiler with new Electric heat pump	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation. We at NUIG have great experience with installing HP and distribution systems. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits. Financial risks may also apply.	The Gate lodge	SEEKING
CHP Project 02	Supply and Installation of CHP unit to the Human Biology Building	Therm/Elec	new 140 kw units	Provision for CHP need to find space in SRB. We have many years experience with installing and operating CHP systems. Lessons learnt over the past 12 years will be used to good effect. Optimising the use of thermal capacity and routine maintenance will be key factors in this project's success.	Human Biology Building	SEEKING
Kingfisher	Upgrade of 2no existing natural sectional boilers to gas condensing boilers and controls	Therm	Installation of new wall hung gas condensing boilers and controls	New gas condensing cascading boilers and controls. There is a risk associated with not replacing these units, as they continue to drag down the energy performance of this building.	Kingfisher	SEEKING
Orbsen Building	Refurbishment of 10 no air handling units to the Biomedical section of the Orbsen building	Therm/Elec	Installation of new Energy efficient fans, controllers, filters and heater/cooling coils, resealing the air handling units	Masterair air handling units installed 16 years need to be upgraded. The risk is that the existing units will stop working altogether. Gaining access to funding is a risk.	Orbsen Building	SEEKING

Physics	Upgrade of 4no fume cupboards to the Physics department, central fan and ducting.	Elec	Installation of 4no fume cupboards and 4 separate fans and VSDs	VSDs on fans etc. As with all fume cupboards, there could be some risks associated with scientists having an insight into heightened health and safety issues linked to particular experiments e.g. fume cupboards not being allowed to go into set-back states or issues associated with changing over the equipment.	Physics	SEEKING
Engineering	Project to recommission and revisit the utilisation plan for the Biomass Boiler in the Engineering building, Adjust controls and link it to Kingfisher	Therm	Existing installation to be recommissioned and make adjustments for Kingfisher	Contractual agreement with Kingfisher is a barrier	Engineering	SEEKING
Arts Science	Replace two old air handling units and upgrade two direct air handling units	Therm	Existing gas fired units to be replaced due to problems with new LTHW boilers, install two new internal air handling units with thermal wheels and VSD.	Existing AHUs installed over 20 years, no control or VSDs installed	Arts Science	SEEKING

Aras De Brun	HEA /SEAI Decarbonisation project.	Therm /Elec	NUI Galway have been selected by HEA and SEAI to carry out a pilot project for the Decarbonisation study for the upgrade of services in the Aras De Brun building	Installation of new electric heat pump, PV and battery storage, new heating system, new pumps and LED lighting	Buildings and Estates	APPROVED-going to tender during Q4, 2021
ISS	Review of cooling strategies employed in ISS. Project to replace the 2 x 250 kW Chillers with a more energy efficient alternative arrangement	Elec	It appears that the chilled water load is overspecified for the current coolth load.	Seán - Michael to give a briefing on a potential replacement strategy. Carry out a before and after analysis and write a project brief. The contractor has been appointed and is commencing the replacement and installation Week	Buildings and Estates /ISS	APPROVED
NUI Galway - Campus-wide	Revisit the Ventilation Rates at each building to comply with Government & HSE COVID Requirements	Therm/Elec	Managing the COVID Risk - Students are back, the heating season has begun.	This is an on-going project - Regular meetings	Buildings and Estates	APPROVED
NUI Galway - Campus-wide	Routine Maintenance	Therm/Elec	Ongoing projects - Pumps refitted, AHUs replaced - upgraded, Floresent light fittings being replaced with LED equivalents	This is an on-going - Kenneth (Electrical) and Anthony (Mechanical)	Buildings and Estates	APPROVED
NUI Galway - Campus-wide	Building Energy Management - BMS upgrades	Therm/Elec	Karl has continued to update the BMS systems to keep pace with technology that maximises the effectiveness of energy using equipment with data/controls interfaces	This is on-going - Karl (BMS & Controls Expert)	Buildings and Estates	APPROVED

Biomedical Science Research Building	Replacemnent of steam boilers	Thermal	Health & Safety Issue in the main.		Buildings and Estates	APPROVED
Arts Science Concourse	Installation of 150sqm Solar PV to the roof of Arts Science Concourse Area	Elec	Installation of 150 SQ M of Solar Photovoltaic (PV) to the roof Arts Science Building	Panels installed to reduce electrical load of the arts science building. Risk is greatly reduced as we have pedigree in this 'space' and it aligns with our overall climate change - carbon neutral campus strategy.	Arts Science	APPROVED
O'Donoghue Theatre	Installation of 20sqm Solar PV to the roof of O'Donoghue Theatre	Elec	Installation of 20 SQ M of Solar Photovoltaic Panels to the roof O'Donoghue Theatre	Panels installed to reduce electrical load of the O'Donoghue. Risk is greatly reduced as we have pedigree in this 'space' and it aligns with our overall climate change - carbon neutral campus strategy.	O'Donoghue Theatre	APPROVED
Anatomy	Upgrade boiler house from oil to natural gas, new boiler and burner	Therm	Removal of oil off site, install new natural gas supply and boiler house	Energy efficient installation, new controls etc. Risks associated with health and safety, conservation measures, additional cost justification etc.	Anatomy	APPOVED
Arts Science Building (Physics)	1st Floor LED Lighting Upgrade	Elec	4*18 watt tubular floresent fittings to be replaced	Need an inventory of existing fittings	Arts Science	APPROVED
Tower 1 & 2	Upgrade existing lighting in both Towers to LED lighting inline with other buildings	Elec	Installation of LED panels, recessed lights and control sensors	LED Lighting and controls. The risk associated with this project is largely down to funding. However existing fitting are grossly inefficient and payback will be short i.e. < 3.1 years.	Tower 1 & 2	APPROVED

Shannon	Replacement Air Handling unit project in Shannon Catering Colleges	Therm/Elec	Existing Air Handling units installed around 1997, Masterair systems, controls not working and not efficient	Recommendations to replace air handling units with new packaged energy efficient units	Shannon	COMPLETED
AMB	Upgrade controls to the boiler house serving the arts millennium building	Therm/Elec	The existing control panel has had modification carried out and is installed a number of years, replace the panel and update controllers	Existing control panel needs to be changed out and new modern controls to be installed. Recommendation from controls specialist.	Arts Millennium Building	COMPLETED
Cairnes	Upgrade boiler house from Oil to LPG, new boiler and burner	Therm	Removal of oil off site, install new natural gas supply and boiler house	Energy efficient installation, new controls etc.	Cairnes	COMPLETED
Engineering	Installation of 50sqm Solar PV to the roof of Engineering	Elec	Installation of 50SQ M of Solar P to the roof Engineering Building	Panels installed to reduce electrical load of the engineering	Engineering	COMPLETED
Carna	Upgrade the existing oil fired water heater and the oil fired boiler in	Therm	Existing ACV water heater and oil fired sectional boiler	Install new LPG Gas to the site and replace burners only	Carna	COMPLETED
Carna	Replace existing oil fired boiler to the school and install new LPG Gas	Therm	Existing oil fired boiler/burner unit	Install new LPG Gas to the site and replace burners only	Carna	COMPLETED
Microbiology	Replace existing light fittings in 4 no labs areas with new LED	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	Microbiology	COMPLETED
Chemistry	Replace existing light fittings in 2 no labs areas with new LED	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	Chemistry	COMPLETED
Arts Millennium	Lecture theatre 150 and 120 seater	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	Arts Millenniums	COMPLETED
IT Building 250	Lecture theatre 250	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	IT Building	COMPLETED
IT Building 150	Lecture theatre 150	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	IT Buildings	COMPLETED
IT Building 100	Lecture theatre 100	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	IT Buildings	COMPLETED
Distillery Road lighting	Upgrade existing lighting in the houses with new LED Lighting	Elec	Installation of new LED Lighting and control sensors	LED Lighting and controls	Distillery Road	COMPLETED
No 14 University Road	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	No. 14 University Road	COMPLETED
Arts Science Building	Installation of 250sqm Solar PV to the roof of Arts Science Buildings	Elec	Installation of 250 SQ M of Solar Photovoltaic (PV) to the roof Arts Science	Panels installed to reduce electrical load of the arts science building	Arts Science	COMPLETED
The Quad	Installation of new natural gas	Therm/Elec	Replace the existing oil fired sectional	Installation of new natural gas supply from local	The Quad	COMPLETED

Park & Ride	Upgrade external Lighting to the PARK and RIDE Car park at North	Elec	Existing lighting are 250 Son-T lamps and running extensive hours, replacement costs	Recommendation from the external contractor to replace these with LED lamps.	Park & Ride Carpark	COMPLETED
Moffett's Restaurant	Replace existing fluorescent lighting with new LED Lighting	Elec	Installation of new LED Lighting	LED Lighting and controls	Moffatts Restaurant	COMPLETED
Kingfisher	Upgrade the lighting to the Kingfisher main Hall and support	Elec	Installation of new LED lighting to replace the existing high level light fittings.	Installation of new LED lighting to the Main Hall and support areas	Kingfisher	COMPLETED
Human Rights	Upgrade the existing oil fired 100kw boiler to new Condensing	Therm	Installation of new LPG Gas condensing boiler, pumps and controls.	Installation of LPG Gas condensing boiler	Human Rights	COMPLETED
Gweedore Site	Upgrade the existing Fluorescent lighting to new LED lighting	Elec	Install new energy efficient LED Lighting	LED Modular fittings	Gweedore Site	COMPLETED
No. 9 Distillery Road	Deep Retrofit project - Installation of new electric heat pump and	Therm	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	No. 9 Distillery Road	COMPLETED
Áras na Gaeilge	Boiler Upgrade	Elec	Boiler is inefficient and does require attention	Upgrade the existing thermal heating system to Condensing Gas Boiler & Cascade Control technology - Apportioned the capital cost as follows: €23k to space heating upgrade and €5k to DHW upgrade	Áras na Gaeilge	COMPLETED
Áras na Gaeilge	DHW Upgrade - Included in the boiler house upgrade project, as above	Elec	The capital cost includes boilers, pumps, calorifier & associated controls	See over & above	Áras na Gaeilge	COMPLETED
Áras de Bruin	Install new LED Lighting to the upper floors	Elec	Existing lighting is fluorescent lighting and should be replaced with LED Lighting	Existing lighting can be changed out with new LED panels and also install new Emergency Lighting	Áras de Brun	COMPLETED
Arts Science Building	Service and carry out works to CHP Unit	Therm/Elec	Annual service to the CHP unit	Manufacturer contract	Arts Science	COMPLETED

Biochemistry	Installation of VSD on the existing Fume Cupboard fan	Elec	The existing fan is a fixed speed fan and needs to be controlled better	Adjoining extract fan fitted with VSD and reduced energy costs	Biochemistry	COMPLETED
Block D & E	Replace existing oil fired boilers with new Gas fired boilers and reduce oil risk - multiple benefits include reducing/eliminating the risk of oil leaks	Therm	Existing 4 No. oil fired boilers to be replaced and install new wall hung gas condensing boilers and controls	Disconnection and removal of the existing oil tank install new Natural gas network points.	Block D and E	COMPLETED
Arts Science Boiler-house	Replace the existing two number existing natural gas burners and controllers	Therm	The existing burners and controllers are causing problems and installed a number of years, invertors overheating	Install new control panel for optimisation of the boilers, install new high efficiency burners and controls package to the two 1MW boilers.	Boiler-House	COMPLETED
Cairnes	Upgrade pump sets in the boiler house, replace current fixed speed	Therm/Elec	Replace pumps	In-house project which has been a great success already registered	Cairnes	COMPLETED
Engineering	Install water savings devices on the Urinals	Water	Existing water usage on 16 urinals is high and needs to be reduced	Existing urinals to be reviewed	Engineering	COMPLETED
Engineering	Service and carry out works to CHP Unit	Therm/Elec	Annual service to the CHP unit	Manufacturer contract	Engineering	COMPLETED
Library	Complete the upgrade of the heating installation in the Ground and First floor of the library area to match Summer 2016 project	Therm	Replace the existing radiant heaters with new panel radiators and TRVs	Works to be carried out to the existing installation.	Library	COMPLETED

Library	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	Therm/Elec	Replace pumps	In-house project, great success already registered	Library	COMPLETED
Library	Service and carry out works to CHP Unit	Therm/Elec	Annual service to the CHP unit	Manufacturer contract	Library	COMPLETED
Miscellaneous	Install new LED lighting to replace the existing fluorescent/ Metal halides	Elec	Existing lighting is fluorescent lighting and should be replaced with LED Lighting	This project is in relation to LED upgrade (x20 fittings) to offices and Replacement of external lamps with LED Equivalents	Miscellaneous	COMPLETED
Moyola	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	Therm/Elec	Replace pumps	In-house project, great success already registered	Moyola	COMPLETED
Nursing	Install new installation to the Nursing Library adjoining the Hardiman library, install new	Therm	Replace 5no pumps	In-house project	Nursing	COMPLETED
Orbsen	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	Therm/Elec	Replace pumps	In-house project, great success already registered	Orbsen	COMPLETED
Orbsen	Service and carry out works to CHP Unit	Therm/Elec	Annual service to the CHP unit	Manufacturer contract	Orbsen	COMPLETED
Shannon	Install new LED lighting throughout to replace the existing fluorescent	Elec	Existing lighting is fluorescent lighting and should be replaced with LED Lighting	Existing lighting can be changed out with new LED panels and also install new Emergency Lighting	Shannon	COMPLETED
Sports Pavilion	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	Therm/Elec	Replace pumps	In-house project, great success already registered	Sports Pavilion	COMPLETED
Áras na Gaelige	Installation of Solar PV to Áras na Gaeilge roof	Elec	Installation on flat roof	Assist reduction in electrical loading	Áras na Gaeilge	COMPLETED
Áras Uí Éimhigh	Replace the existing electric heating in the building with new heat pump, low temperature radiators & controls	Therm	Installation of and steel panel radiators	Heat Pump, Radiators & Controls	Áras Ní Éimhigh	COMPLETED
Arts Millennium Building	Upgrade lighting and lighting control to 3no lecture theatres	Elec	Installation of new LED lighting and controls for the 3 no lecture theatres	LED Lighting and controls	Arts Millennium Building	COMPLETED
AHSSRB	Upgrade existing fixed speed pumps with new energy efficient	Elec	Installation of new energy efficient pumps	Replace 10 No. pumps in plantroom	AHS SRB	COMPLETED
Block Q	Upgrade existing lighting and storage heating installations	Elec/Therm	Installation of new LED lighting and replace heaters with new energy efficient heaters	Installation of LED Lighting	Block Q	COMPLETED

Campus Wide	Develop EV Charging Point System	Elec	Develop and support a sustainable energy campus	Orbsen Bld - 2*2 Charging Points, Cairns Bld - 2*2 Charging Points, Aras na Cathal 1*2 Charging Point, Quad (Upgrade of existing Charging Point System, Park & Ride 1*1	Campus Wide	COMPLETED
Campus Wide	New EV Post Van - Renault Kangoo; located at the HBB Building	Elec	Develop and support a sustainable energy campus	EV Post Van - Quiet, Clean Delivery !	Campus Wide	COMPLETED
Campus Wide	Provision of Campus wide Energy Campaign to the students, staff and contractors	Therm/Elec	Energy awareness campaign and program of events	Provide energy awareness literature, campaigns, switch off days, green week etc.	Campus Wide	mpleted ~ ongoi
Campus Wide	Installation of additional metering to remaining buildings not connected to the BMS	Therm/Elec	Recording of energy usage and performance data and information. This provides the information which is reviewed daily, weekly and during our monthly	Provides Up To Date records of systems etc.	Campus Wide	mpleted ~ ongoi
Campus Wide	Maximum Import Capacity (MIC) Project	Elec	Review of existing bills to reduce the Import capacity charges	Review and collate	CAMPUS WIDE	COMPLETED
Engineering	Carry out a complete energy efficiency design review of the heating, cooling, ventilation and electrical supply strategies employed at the Engineering	Therm/Elec	Review the existing heating and cooling strategies, review times, air handling units and air balancing.	Specialist engineering review	Engineering	mpleted ~ ongoi
Human Biology Building	Installation of Solar PV to the Human Biology Building	Elec	Installation to the roof of the new Human Biology Building for creating electrical	High electrical loading to the building.	Human Biology Building	COMPLETED
Library	Upgrade the existing Lighting installation in parts of the Hardiman Library	Elec	Installation of new LED lighting an d controls to the library on Ground, first and second floor levels	Existing 4x18 fluorescent light fittings (with choke start ballasts factor of 1.2) replaced with new LED	Hardiman Library	COMPLETED
Moyola	Installation of LED Lighting to Block A, replace the existing	Elec	Installation of new LED Lighting	LED Lighting and controls	Moyola	COMPLETED

MRI Annex Heat Pump	HEA /SEAI Decarbonisation project.	Therm/Elec	NUI Galway proposed project 02 for the SEAI Pilot project for the HEA, this project wasn't successful so therefore we have put this forward as a project which could be undertaken as summer works project	Installation of a new electric heat pump, PV and battery system, new LED lighting to the Lecture theatre. Risk that summerworks funding may be reduced during 2021. We will manage this risk and may decide to resubmit an application during the 2021 round of HEA Pathfinder Programme	Building and Estates	NOT APPROVED
Biomedical Science Research Building	Replacement of existing Lighting to the complete building and update controls	Elec	Installation of LED panels, recessed lights and control sensors	Installation of LED panels, recessed lights and control sensors. Again funding it the major risk. However, we could also 'sell' this project as an essential lighting/ quality improvement measure.	Buildings and Estates	NOT APPROVED
Áras na Mac Léinn	Upgrade the heating system considering heat pump technology	Therm/Elec	Boiler is inefficient and does require attention	Upgrade the existing thermal hearing system to consider Heat Pump technology. This is tried and tested technology. There may be a risk associated with the increase loading on the electrical circuits. Financial risks also apply.	Áras na Mac Leinn	NOT APPROVED
Arts Millennium Building	Installation of Solar Panel to serve hot water in Arts Millennium Building	Therm	Hot water dual coil cylinder in place, install Solar Panels	Installation of Solar Panels 20m2. Risk is greatly reduced as we have pedigree in this 'space' and it aligns with our overall climate change - carbon neutral campus strategy.	Arts Millennium Building	NOT APPROVED
Arts Science Building (Biochemistry)	Window Upgrade	Elec	Single glazed units are not fit for purpose	Qty 80 * Metal framed, Single glazed units to uPVC double with an expected improvement of from 5 watts per m.2. K to 2.8 watts per m.2. K. Costs associated with fabric upgrades tend to prohibitive. Funding will be difficult to attain.	Arts Science	NOT APPROVED
An Bhialinn	Upgrade the existing air handling unit to make more	Therm	Adjustment of unit to make more efficient, review required.	Review required.	An Bhialinn	NOT APPROVED
Arts Science	Replace two old air handling units and upgrade two direct air handling units	Therm	Existing gas fired units to be replaced due to problems with new LTHW boilers, install two new internal air handling units with thermal wheels	Existing AHUs installed over 20 years, no control or VSDs installed	Arts Science	NOT APPROVED
HUB	Replace the existing Direct gas fired air handling unit with new energy efficient unit	Therm	Direct gas fired unit isn't efficient and dangers of poisoning	Install new packaged ahu with LTHW coil, Plug fan and invertor, install new control points in the space.	HUB	NOT APPROVED
Orbsen	Review of the existing air handling units serving the Orbsen building, units installed Masterair, no form of control on fans and controls	Therm/Elec	Provision for replacing the existing units with new packaged units, controllers and batteries, install invertors and new sensors on Fans.	New efficient air handling units.	Orbsen	NOT APPROVED

4. Estimate of NUI Galway's future energy use and consumption

An estimate of NUI Galway's future energy usage and consumption has been carried out. Historical data was collected over the past 10 years and used to carry out these estimates. The energy usage and consumption may increase during 2022 due to the projected growth in student numbers and research intensity. The expected energy usage and performance is used to carry out a budget for energy costs during 2022 and beyond. That increase is factored into the predicted energy use as outlined on the figures included in Table 7, as below. Additionally, the predicted energy consumption is itemised and potential factors that will increase energy usage (more students, research intensity and Covid related ventilation rate and occupancy strategies) are accommodated. We are predicting that energy usage during 2021 will be similar to 2020. We have increased the level of PV electricity production to reflect our year-to-date PV related energy production data. From 2022 on we are targeting a reduction in energy use and consumption by 3% per annum and are planning an increase in solar thermal by 5% per annum and an increase in PV electrical generation by 15% per annum; from 2021 onwards.

Table 7: estimate of future energy usage, generation, and consumption

Estimate of Future Energy Usage and Consumption			
MWh -Usage	2020*	2021*	2022
Electricity	12,941	12,941	12,553
Electricity Generated on-site from PV	31	250	288
Gas	11,764	11,764	11,411
LPG	520	520	505
Gasoil	618	618	599
Wood Fuels	235	235	228
Solar Thermal	75	75	79
Road Diesel	157	157	152
Transport	12	12	12
Total	26,353	26,572	25,826
EnPI -Consumption			
Total - KWh/M2	180.00	180.00	174.60
Conversion factors to calculate the Total Primary Energy Equivalent will change every year			

*2020 & predicted 2021 data is identical, as we do not envision any major changes

Appendix A: NUI Galway's Gold Star Achievement

National University of Ireland, Galway

Is hereby recognized by the Association for the Advancement of Sustainability in Higher Education as a STARS Gold Institution based on its reported accomplishments in campus sustainability.

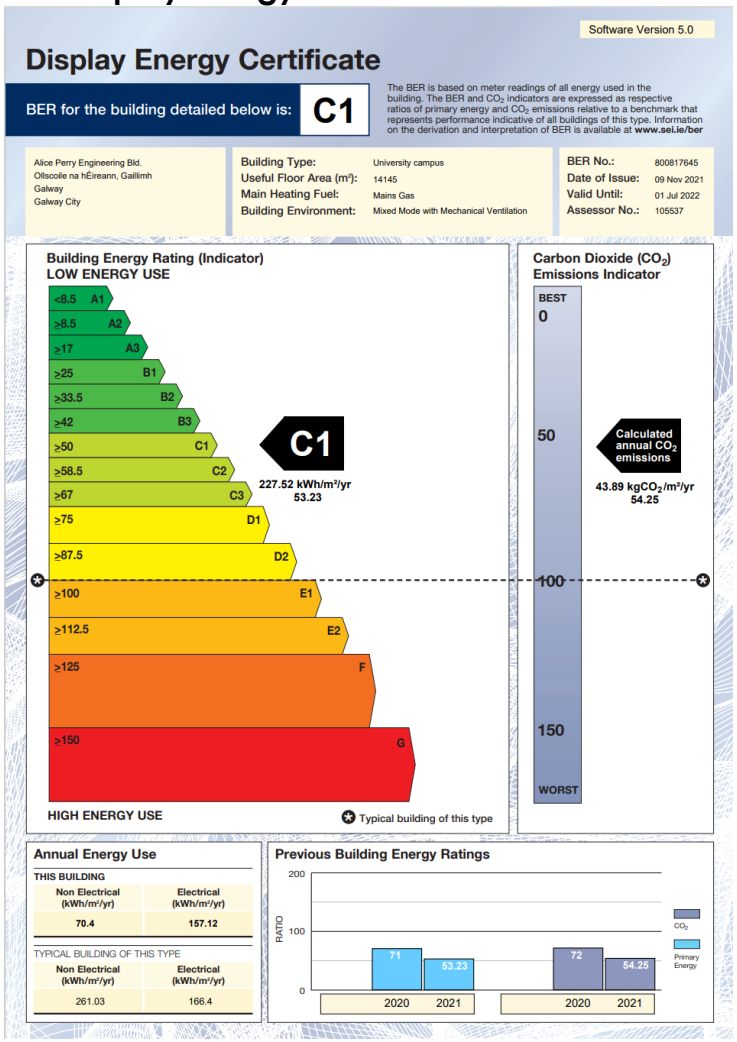
Valid through October 28, 2024.

aashe

Meghan Fay Zahniser, Executive Director

stars
a program of aashe

Appendix B: Display Energy Certificates



Software Version 5.0

Display Energy Certificate

BER for the building detailed below is: **C1**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Alice Perry Engineering Bld.
Ollscoile na hÉireann, Gaillimh
Galway
Galway City

Building Type:	University campus
Useful Floor Area (m^2):	14145
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817645
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537

Building Energy Rating (Indicator)
LOW ENERGY USE

<8.5 A1
≥8.5 A2
≥17 A3
≥25 B1
≥33.5 B2
≥42 B3
≥50 C1
≥58.5 C2
≥67 C3
≥75 D1
≥87.5 D2
≥100 E1
≥112.5 E2
≥125 F
≥150 G

C1
227.52 kWh/m^2/yr
53.23

HIGH ENERGY USE
Typical building of this type

Carbon Dioxide (CO_2) Emissions Indicator

BEST 0
50
100
150
WORST

Calculated annual CO_2 emissions
43.89 kgCO_2/m^2/yr
54.25

Annual Energy Use

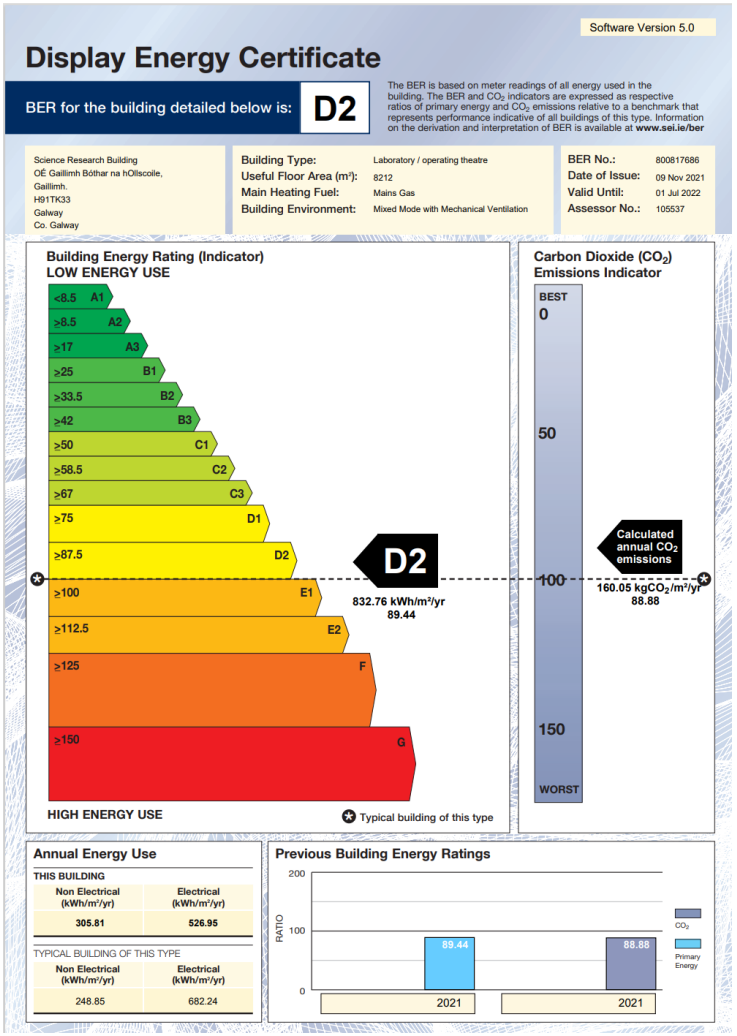
THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
70.4	157.12

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
261.03	166.4

Previous Building Energy Ratings



Software Version 5.0

Display Energy Certificate

BER for the building detailed below is: **D2**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Science Research Building
OÉ Gaillimh Bóthar na hOllscoile,
Gaillimh.
H91TK33
Galway
Co. Galway

Building Type:	Laboratory / operating theatre
Useful Floor Area (m^2):	8212
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817686
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537

Building Energy Rating (Indicator)
LOW ENERGY USE

<8.5 A1
≥8.5 A2
≥17 A3
≥25 B1
≥33.5 B2
≥42 B3
≥50 C1
≥58.5 C2
≥67 C3
≥75 D1
≥87.5 D2
≥100 E1
≥112.5 E2
≥125 F
≥150 G

D2
832.76 kWh/m^2/yr
89.44

HIGH ENERGY USE
Typical building of this type

Carbon Dioxide (CO_2) Emissions Indicator

BEST 0
50
100
150
WORST

Calculated annual CO_2 emissions
160.05 kgCO_2/m^2/yr
88.88

Annual Energy Use

THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
305.81	526.95

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
248.85	682.24

Previous Building Energy Ratings

Software Version 5.0

Display Energy Certificate

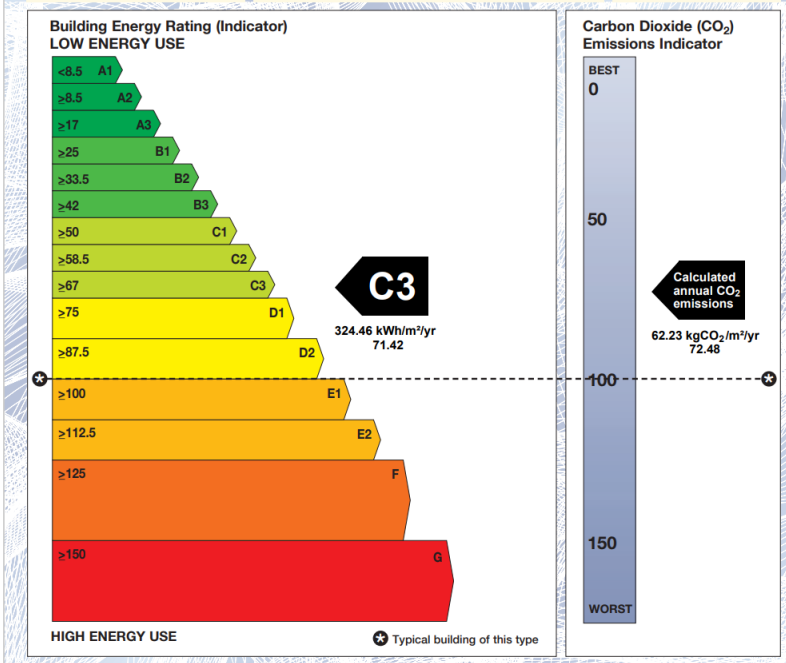
BER for the building detailed below is: **C3**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Martin Ryan Institute Annex
National University of Ireland Galway
Galway
Galway City

Building Type:	University campus
Useful Floor Area (m^2):	1246
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817694
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537



Annual Energy Use

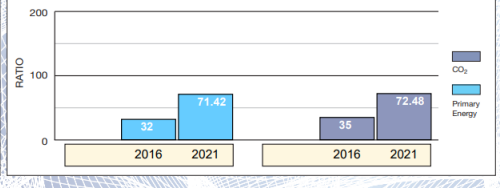
THIS BUILDING

Non Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
129.91	194.55

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
287.92	166.4

Previous Building Energy Ratings



Software Version 5.0

Display Energy Certificate

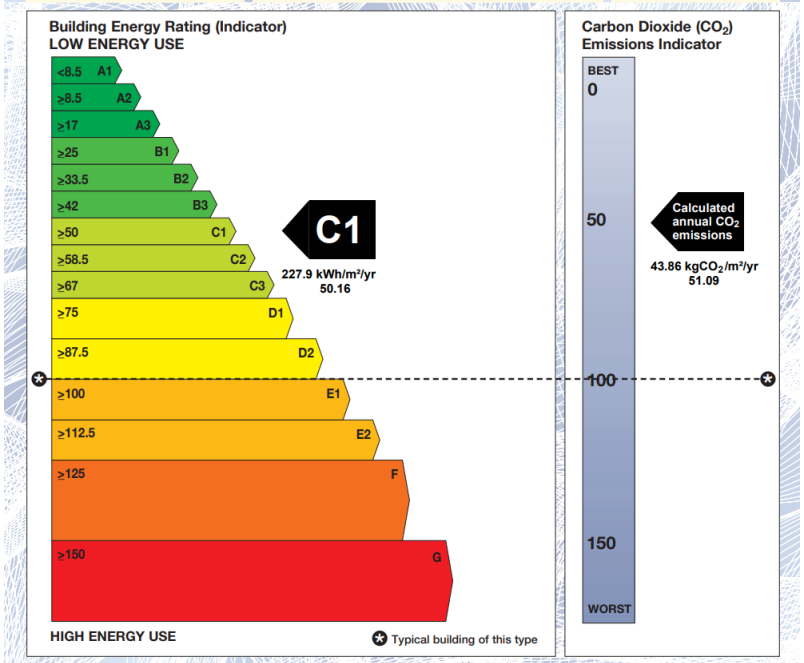
BER for the building detailed below is: **C1**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Martin Ryan Institute
National University of Ireland Galway
Galway
Co. Galway

Building Type:	University campus
Useful Floor Area (m^2):	3255
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817702
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537



Annual Energy Use

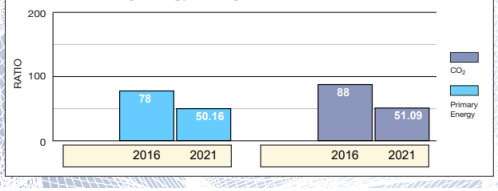
THIS BUILDING

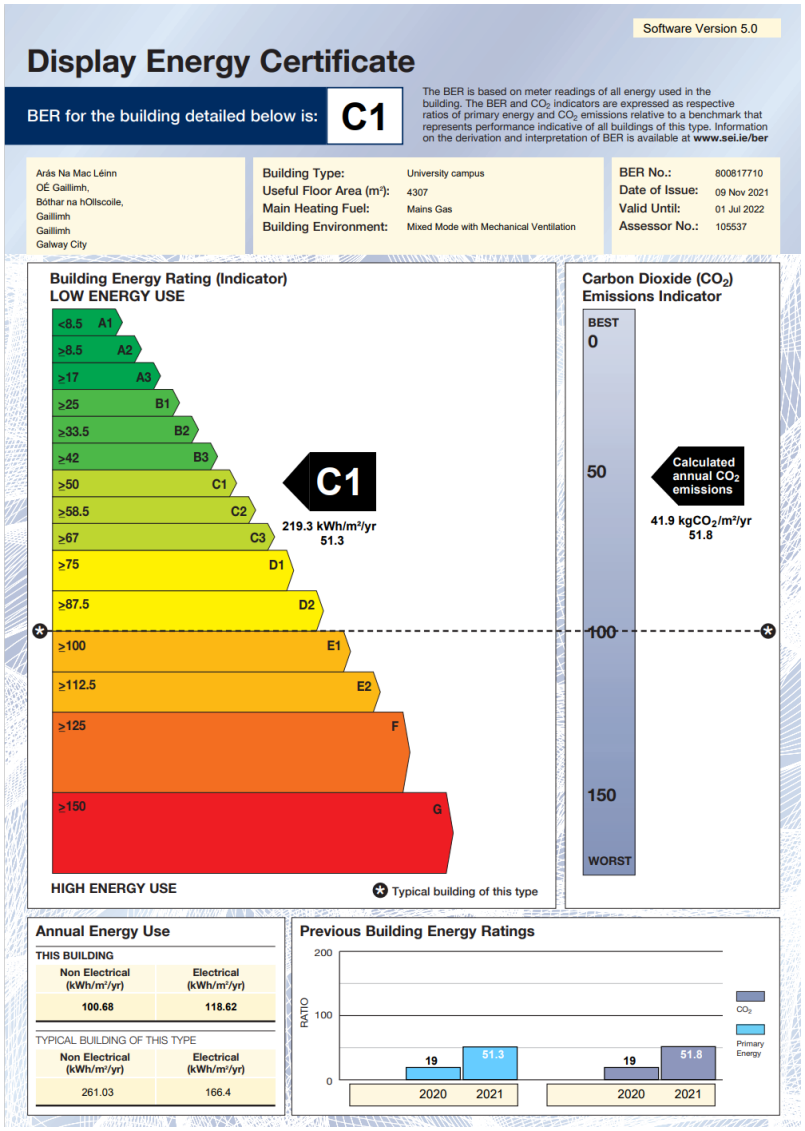
Non Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
78.95	148.95

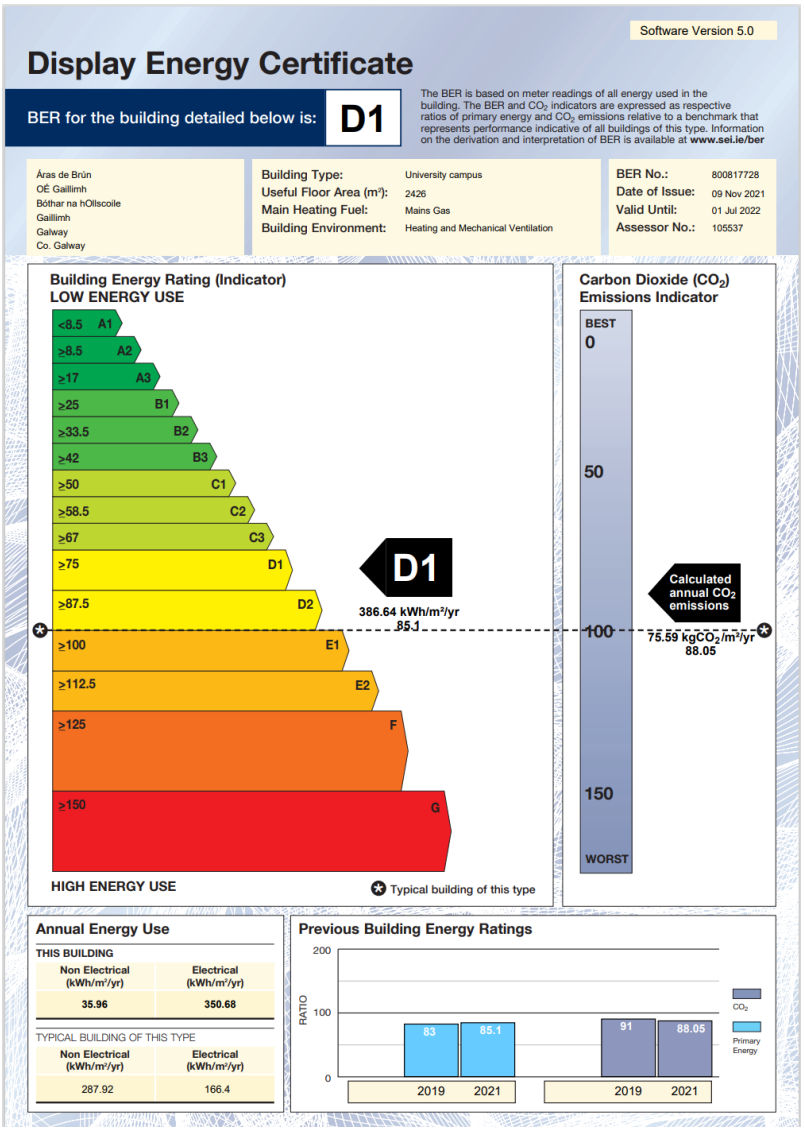
TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m²/yr)	Electrical (kWh/m²/yr)
287.92	166.4

Previous Building Energy Ratings




Software Version 5.0
Display Energy Certificate
BER for the building detailed below is: C1
The BER is based on meter readings of all energy used in the building. The BER and CO2 indicators are expressed as respective ratios of primary energy and CO2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at www.sei.ie/ber
Arás Na Mac Léinn
OÉ Gaillimh,
Bóthar na hOllscoile,
Gaillimh
Gaillimh
Galway City
Building Type: University campus
Useful Floor Area (m²): 4307
Main Heating Fuel: Mains Gas
Building Environment: Mixed Mode with Mechanical Ventilation
BER No.: 800817710
Date of Issue: 09 Nov 2021
Valid Until: 01 Jul 2022
Assessor No.: 105537
Building Energy Rating (Indicator)
LOW ENERGY USE
<8.5 A1
≥8.5 A2
≥17 A3
≥25 B1
≥33.5 B2
≥42 B3
≥50 C1
≥58.5 C2
≥67 C3
≥75 D1
≥87.5 D2
≥100 E1
≥112.5 E2
≥125 F
≥150 G
C1
219.3 kWh/m²/yr
51.3
HIGH ENERGY USE
Typical building of this type
Carbon Dioxide (CO2) Emissions Indicator
BEST
0
50
100
150
WORST
Calculated annual CO2 emissions
41.9 kgCO2/m²/yr
51.8
Annual Energy Use
THIS BUILDING
Non Electrical (kWh/m²/yr) 100.68
Electrical (kWh/m²/yr) 118.62
TYPICAL BUILDING OF THIS TYPE
Non Electrical (kWh/m²/yr) 261.03
Electrical (kWh/m²/yr) 166.4
Previous Building Energy Ratings
RATIO
200
100
0
19
51.3
19
51.8
2020
2021
2020
2021
CO2
Primary Energy


Software Version 5.0
Display Energy Certificate
BER for the building detailed below is: D1
The BER is based on meter readings of all energy used in the building. The BER and CO2 indicators are expressed as respective ratios of primary energy and CO2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at www.sei.ie/ber
Áras de Brún
OÉ Gaillimh
Bóthar na hOllscoile
Gaillimh
Galway
Co. Galway
Building Type: University campus
Useful Floor Area (m²): 2426
Main Heating Fuel: Mains Gas
Building Environment: Heating and Mechanical Ventilation
BER No.: 800817728
Date of Issue: 09 Nov 2021
Valid Until: 01 Jul 2022
Assessor No.: 105537
Building Energy Rating (Indicator)
LOW ENERGY USE
<8.5 A1
≥8.5 A2
≥17 A3
≥25 B1
≥33.5 B2
≥42 B3
≥50 C1
≥58.5 C2
≥67 C3
≥75 D1
≥87.5 D2
≥100 E1
≥112.5 E2
≥125 F
≥150 G
D1
386.64 kWh/m²/yr
85.1
HIGH ENERGY USE
Typical building of this type
Carbon Dioxide (CO2) Emissions Indicator
BEST
0
50
100
150
WORST
Calculated annual CO2 emissions
75.59 kgCO2/m²/yr
88.05
Annual Energy Use
THIS BUILDING
Non Electrical (kWh/m²/yr) 35.96
Electrical (kWh/m²/yr) 350.68
TYPICAL BUILDING OF THIS TYPE
Non Electrical (kWh/m²/yr) 287.92
Electrical (kWh/m²/yr) 166.4
Previous Building Energy Ratings
RATIO
200
100
0
83
85.1
91
88.05
2019
2021
2019
2021
CO2
Primary Energy

Software Version 5.0

Display Energy Certificate

BER for the building detailed below is: **B3**

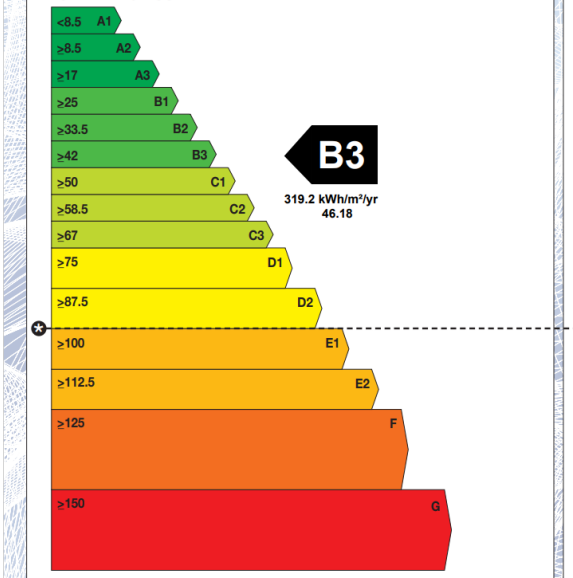
The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Anatomy Building
OÉ Gaillimh Bóthar na hOllscoile,
Gaillimh,
H91TK33
Galway
Co. Galway

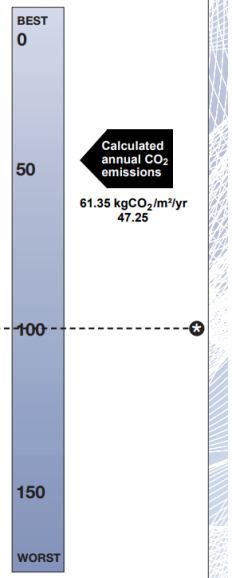
Building Type:	Hospital -clinical & research
Useful Floor Area (m^2):	998
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817736
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537

Building Energy Rating (Indicator)
LOW ENERGY USE



Carbon Dioxide (CO_2) Emissions Indicator



Annual Energy Use

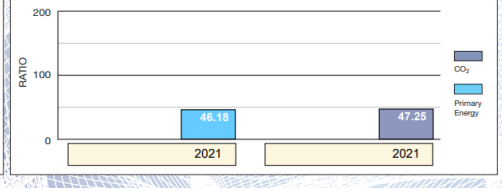
THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
117.22	201.98

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
504.07	187.2

Previous Building Energy Ratings



Software Version 5.0

Display Energy Certificate

BER for the building detailed below is: **A2**

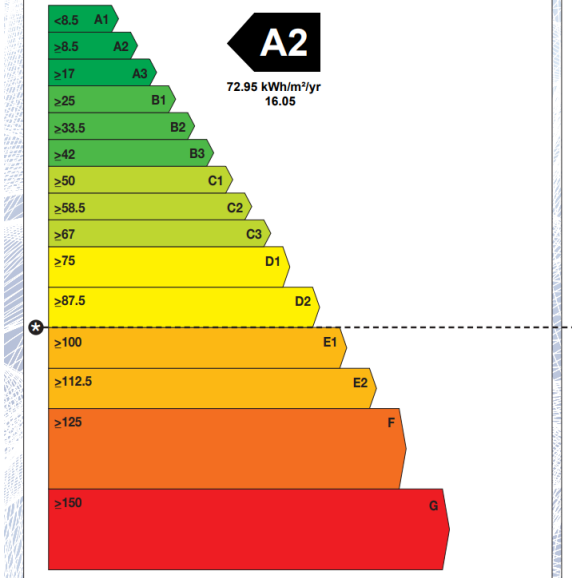
The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

J.E. Cairns School of Business
Ollscoile na hÉireann, Gaillimh
Bóthar na hOllscoile
Galway
Galway City

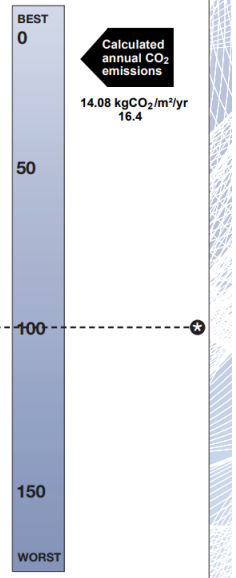
Building Type:	University campus
Useful Floor Area (m^2):	7213
Main Heating Fuel:	Mains Gas
Building Environment:	Heating and Natural Ventilation

BER No.:	800817744
Date of Issue:	09 Nov 2021
Valid Until:	21 Nov 2022
Assessor No.:	105537

Building Energy Rating (Indicator)
LOW ENERGY USE



Carbon Dioxide (CO_2) Emissions Indicator



Annual Energy Use

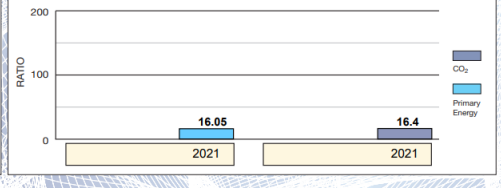
THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
21.6	51.35

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
288.04	166.4

Previous Building Energy Ratings



Software Version 5.0

Display Energy Certificate

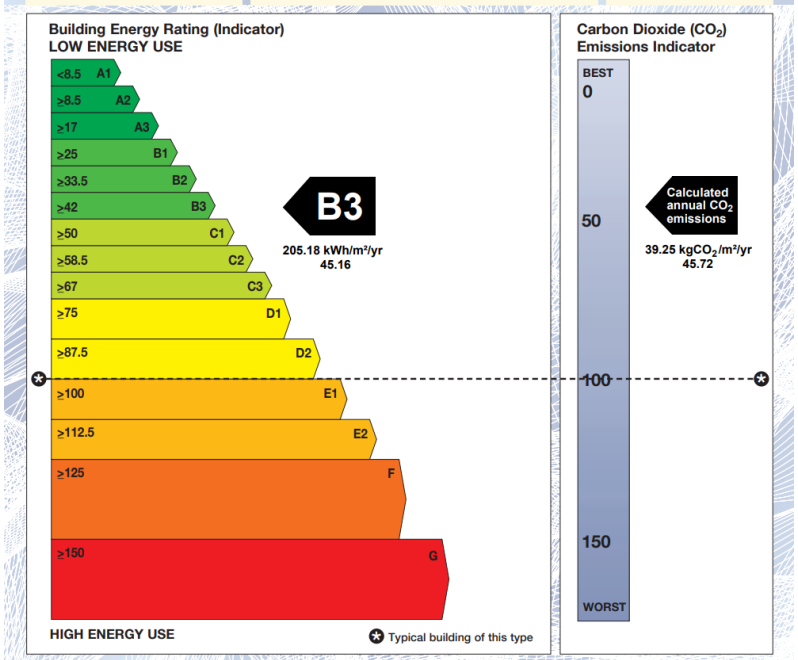
BER for the building detailed below is: **B3**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Arts Millennium Building
National University of Ireland Galway
Galway
Galway City

Building Type:	University campus
Useful Floor Area (m^2):	5210
Main Heating Fuel:	Mains Gas
Building Environment:	Mixed Mode with Mechanical Ventilation

BER No.:	800817751
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537



Annual Energy Use

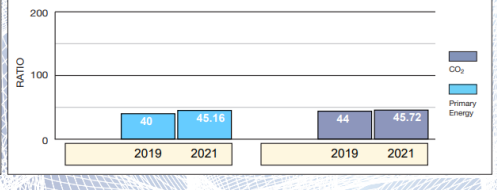
THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
90.48	114.7

TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
287.92	166.4

Previous Building Energy Ratings



Software Version 5.0

Display Energy Certificate

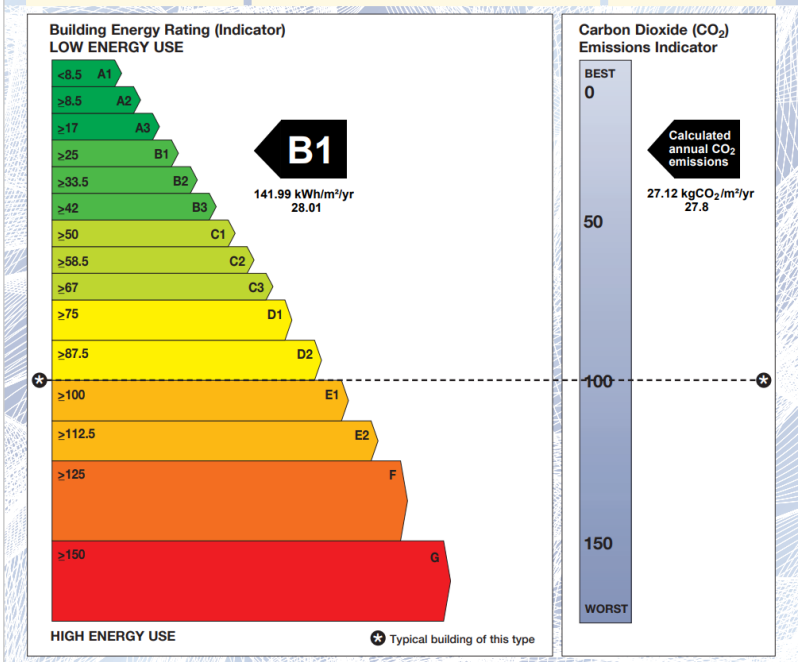
BER for the building detailed below is: **B1**

The BER is based on meter readings of all energy used in the building. The BER and CO_2 indicators are expressed as respective ratios of primary energy and CO_2 emissions relative to a benchmark that represents performance indicative of all buildings of this type. Information on the derivation and interpretation of BER is available at **www.sei.ie/ber**

Alan Hardiman Science Research
Science Research Building
Ollscoile na hÉireann, Gaillimh
Galway
Galway City

Building Type:	Laboratory / operating theatre
Useful Floor Area (m^2):	8274
Main Heating Fuel:	Mains Gas
Building Environment:	Air Conditioning

BER No.:	800817769
Date of Issue:	09 Nov 2021
Valid Until:	01 Jul 2022
Assessor No.:	105537



Annual Energy Use

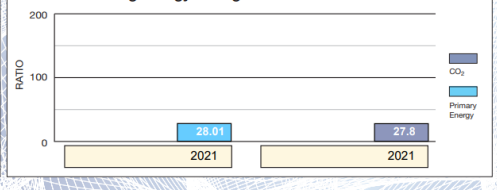
THIS BUILDING

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
66.07	75.92

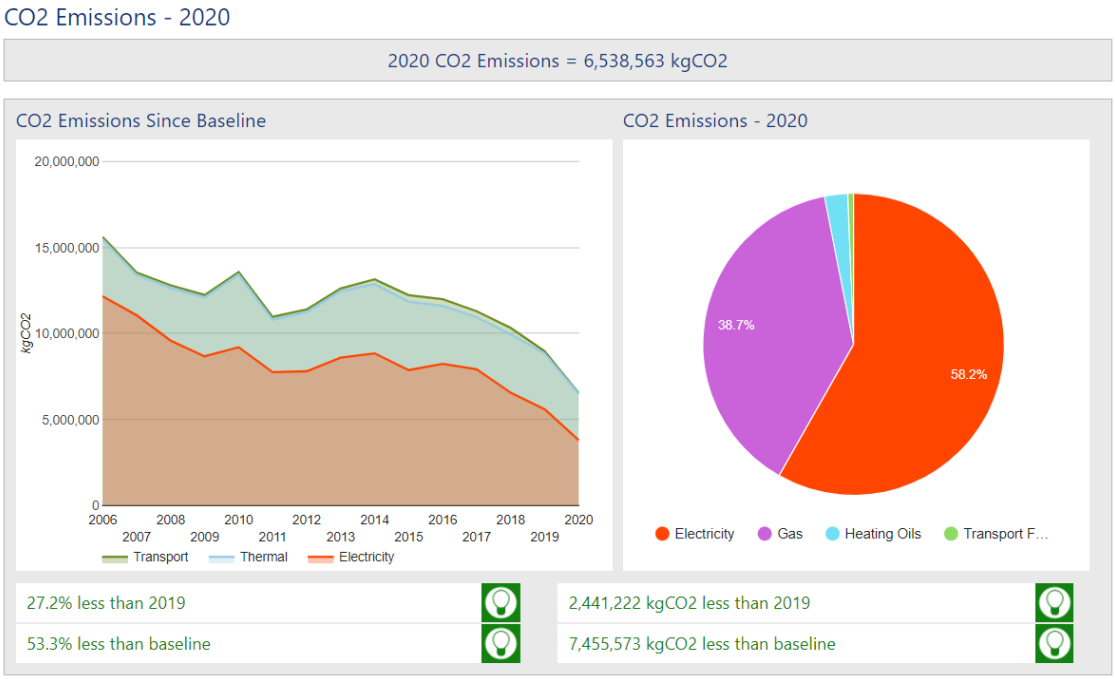
TYPICAL BUILDING OF THIS TYPE

Non Electrical (kWh/m^2/yr)	Electrical (kWh/m^2/yr)
174.02	332.8

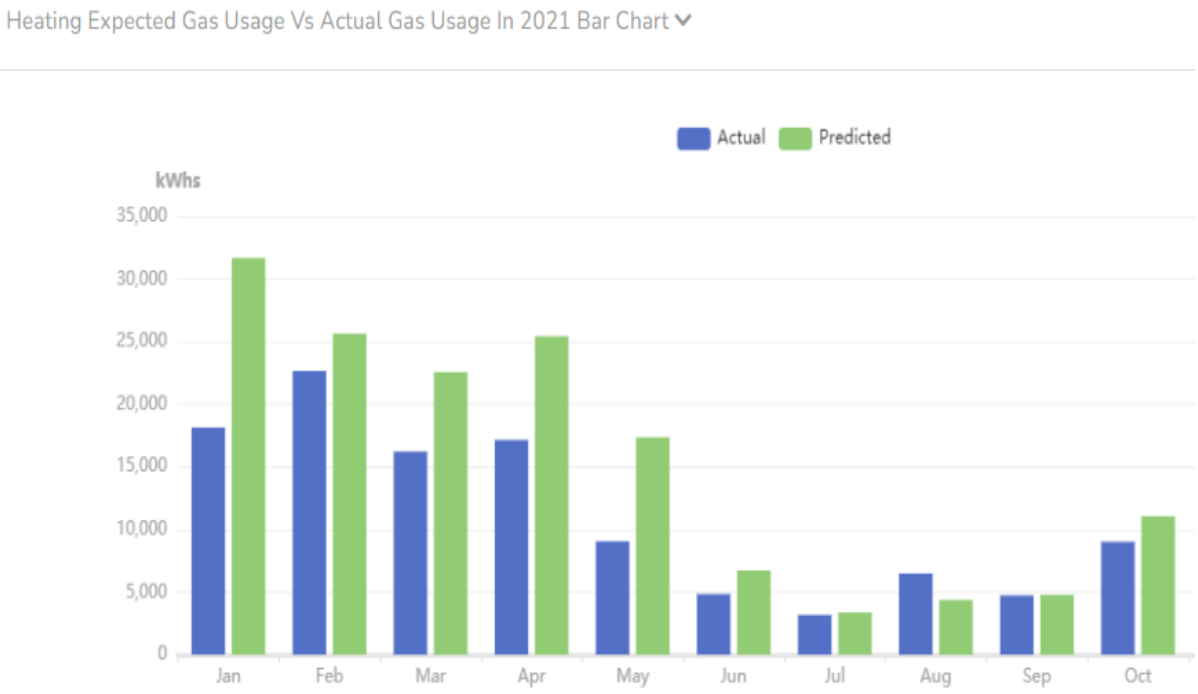
Previous Building Energy Ratings



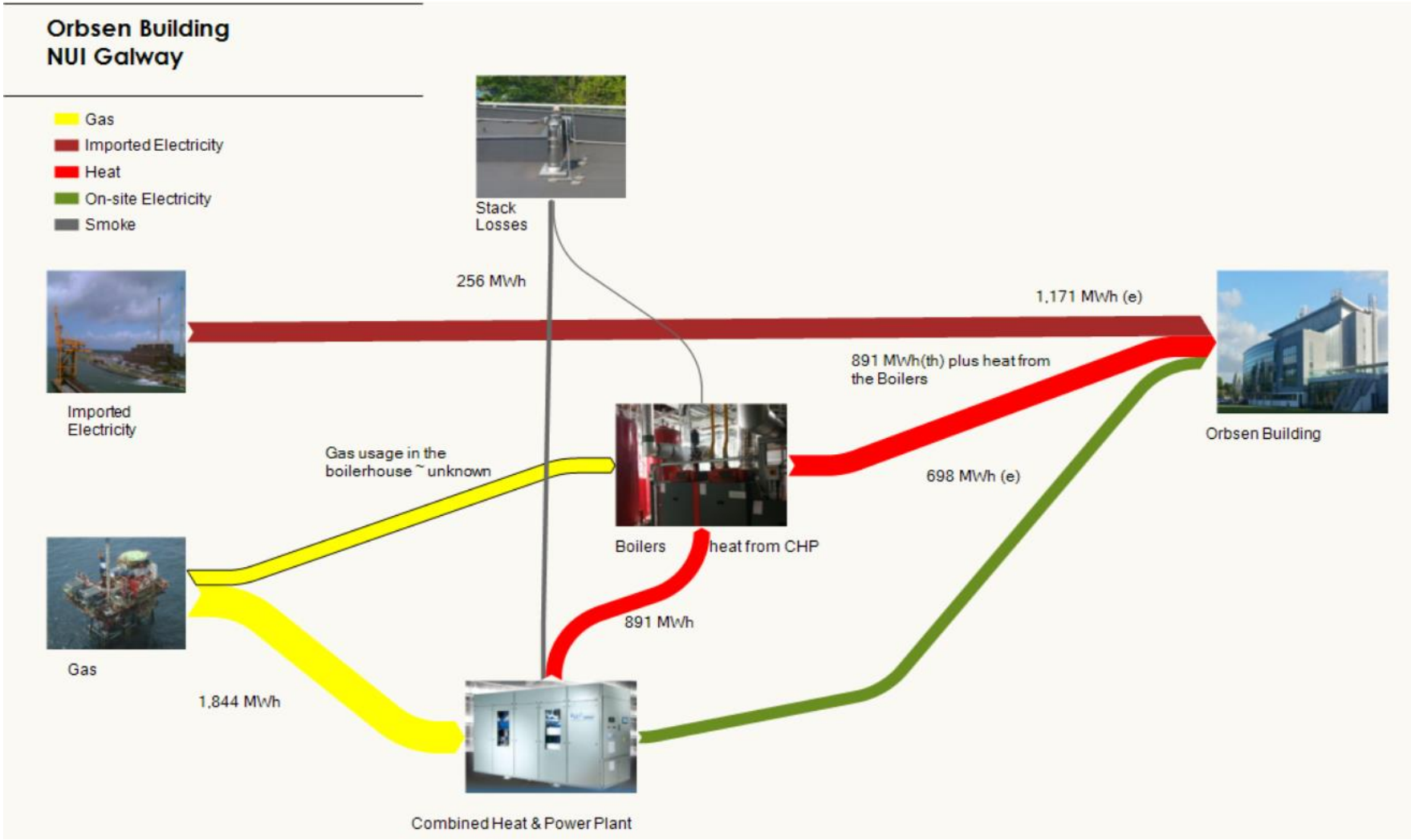
Appendix C: Yearly CO_2 emissions continue to fall



Appendix D: Actual versus Expected gas consumption Year to Date



Appendix E: Sankey diagram outlining the energy usage and consumption at the Orbsen Building



Appendix F: Climate Action Plan – 2021; Short-, Medium- and Long-term Objectives and Targets for the Public Sector

- The introduction of a Sustainable Mobility Policy,
- Reduce emissions by **51% by 2030** with **Green Teams** in every public body,
- **Prohibit** new fossil fuel heating systems in public buildings after 2023 (**No Fossil Fuels**),
- Mandate **all** new **fleet** purchases to be **electric** from **2023** (where vehicle type available),
- Improve energy efficiency from **33% in 2020 to 50% by 2030**.

Appendix G: Supplementary Energy usage information - 2020

Fuel	2020			Additional Information
	Quantity [kWh]	Spend (Est.)	CO2 Emissions (kg.)	
Electricity Imports	12,940,939	€1,967,023	3,816,283	AUP 15.2c per kWh (e)
Electricity Generated on-site from PV	31,300	-€4,758	-9,230	Credit by AUP of 15.2c per kWh (e). 31,300 kWh during 2020, Plus 190,157 kWh Year to date 2021
Gas Imports	11,764,416	€729,394	2,408,176	AUP 6.2 c per kWh(th)
LPG	520,105	€27,826	119,260	AUP 5.35c per kWh (th) @ a rate of 7.1 kWh per Litre
Gasoil - Kerosene & Heating	617,665	€42,557	168,993	AUP 6.28c per kWh (Kero) and AUP 6.89c per kWh (heating oil) @ a rate of 10.1 kWh per Litre
Wood pellets	235,008	€12,220	0	48 Tonnes @ €255 per tonne
Solar Thermal	75,000	-€7,500	-15,353	Negative cost @ say 10c /kWh
Road Diesel	157,006	€16,250	39,550	AUP 10.35 kWh/Lt 15,170 Lt @
Transport Biofuels	11,968	€1,239	3,015	AUP 10.35 kWh/Lt 1,156 Lt
Total	**26,353,407**	**€2,784,251**	**6,530,694**	
Total Primary Energy Consumption	38,471,087			