

## 2020 Energy Review



National University of Ireland Galway

Prepared by NUI Galway's Energy Team

October, 2020

## 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, that 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 outlined.

Buildings that are included within the scope of the NUI Galway ISO50001 EnMS are documented and included in a thorough review and updated on the NUI Galway Energy Manual and Dashboard. There are 58 buildings included that have a total internal floor area of 155,090 m<sup>2</sup>.

Internal audits of the ISO50001 EnMS have been carried out during 2020 and a number of observations were noted. Those observations coupled with resulting actions taken, compliment the continuous improvement statement as outlined in the NUI Galway Energy Policy.

The management team measure electrical and thermal energy performance using key performance indicators; kWh (e)<sup>1</sup> and kWh (th)<sup>2</sup> 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 also in response to major changes in facilities, equipment, systems or energy using processes.

As there has been a couple of major changes since last year's energy review, i.e. Covid-19 related impacts on the energy performance of our buildings and the transition to the new standard, NUI Galway's ISO50001 Energy Management System, and accompanying documents, have been updated accordingly. The Energy Review is normally carried out during September, and compiled, reviewed and reported during October, 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.

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<sup>1</sup> kWh (e) relates to electricity related usage – the average unit price per kWh(e) used is €0.132c

<sup>2</sup> kWh (th) relates to gas usage – the average unit price per kWh(gas) used is €0.068c

## 1. Analyse Energy Use & Consumption

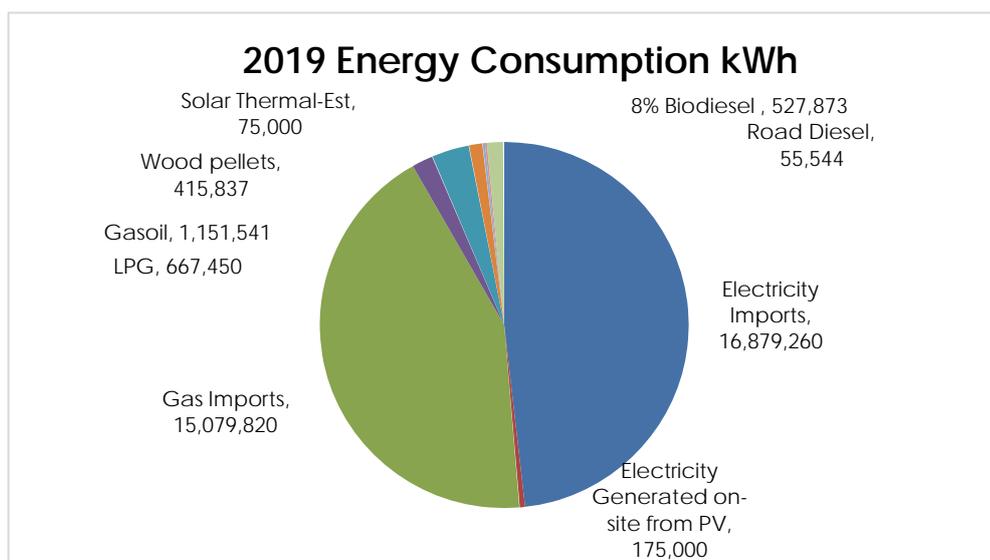
### 1.1 Current Types of Energy

The current types of energy being utilised 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 amount 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 2019 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	2019	
	Quantity [kWh]	CO2 * Emissions [t]
Net Electricity Imports	16,879,260	5,593.8
Net Electricity Generated on-site- Est.	175,000	-69.9
Gas Imports	15,079,820	3,086.8
LPG	667,450	153.0
Gasoil	1,151,541	290.1
Wood pellets	415,837	0
Solar Thermal	75,000	-19.8
Road Diesel	55,544	14.7
Biodiesel Litres/% biodiesel	527,873	128.2
<b>Total</b>	<b>35,027,325</b>	<b>9,176.9</b>

\*Referenced SEAI website on September 16<sup>th</sup>, 2020: [SEAI's Emissions Factors - Sept 2020](#)



**Figure 1: 2019 Breakdown of Energy Consumption (kWh)**

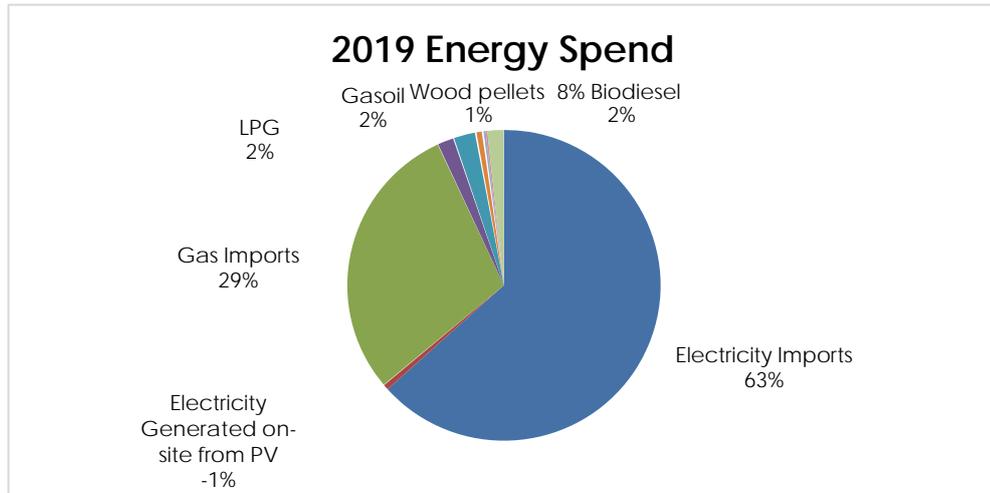


Figure 2: 2019 Breakdown of Energy Spend

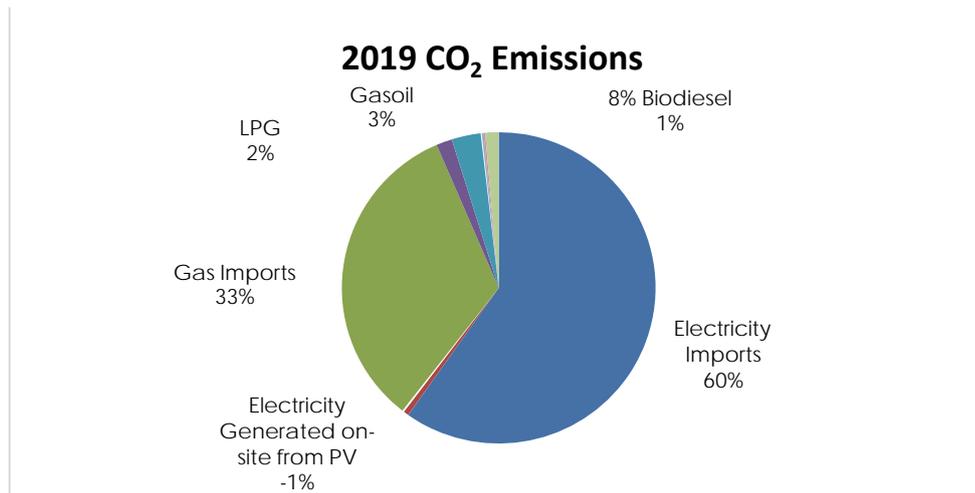


Figure 3: 2019 Breakdown of Energy Related CO<sub>2</sub> Emissions

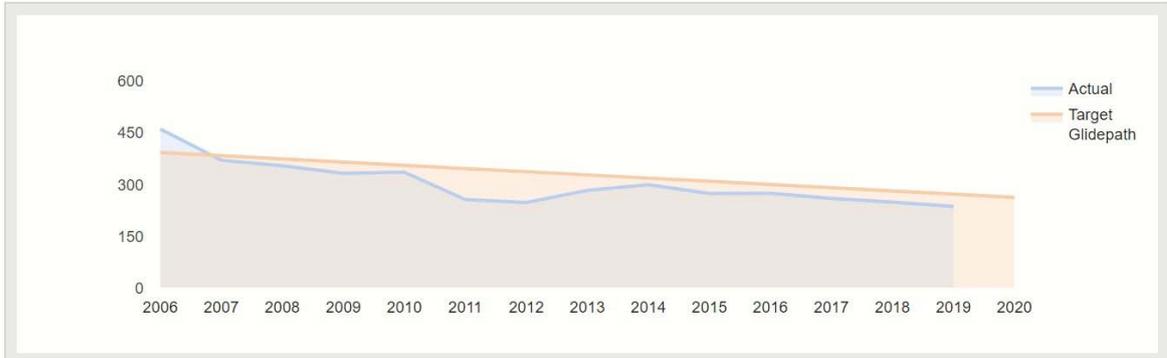
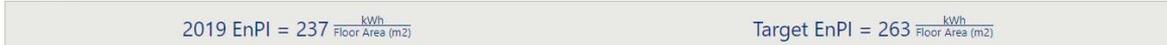
## 1.2 Evaluation of past & present energy use & consumption

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' independently assessed energy profile. It is being referred to as it demonstrates that we are being independent in our assessment criteria. However, 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.

Since Baseline to 2019



Energy Performance Indicators - 2019



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

Additionally, the current energy performance of our buildings is being monitored daily and being reported on a monthly basis. 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. This 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 39.7% 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). This table is being used to prioritise opportunities and to support cost accounting exercises. The Arts Science Building includes the Main Concourse, Chemistry/Bio-chemistry and Physics. Also note that the Science Research Building (SRB) is outside the scope of the ISO50001 Energy Management System, and is being managed and operated by Apleona.

Additionally, Sankey diagrams are being used to display the energy usage of the significant energy users within buildings. An example of the Arts Millennium Building Sankey Diagram is outlined in Appendix F.

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 10 electrical energy consuming buildings**

Name	Year	GIA <sup>3</sup>	2018 kWh (e)	2019 kWh (e)	Diff.
Arts Science Building – All Departments	1970, 1973	31,312	4,839,060	4,545,941	(293,119)
Science Research Building	2012	8,212	2,543,815	2,616,242	72,427
Human Biology Building	2017	8,000	1,422,039	1,545,019	122,980
James Hardiman Library	1980	9,415	1,412,322	1,333,950	(78,372)
Orbsen Building	2003	6,491	1,372,751	1,350,307	(22,444)
Alice Perry - Engineering Building	2011	14,145	1,193,122	1,135,424	(57,698)
Arts, Humanities, Social Sciences Research Building (AHSSRB)	2013	5,436	843,520	791,001	(52,519)
Arts Millennium Building (incl. AMBE extension)	2000, 2012	8,054	575,260	603,848	28,588
Áras de Brun, Anatomy & Terrapin	1960	2,426	601,259	548,698	(52,561)
Áras Na Mac Léinn / Cultural centre	1995	4,307	591,808	555,411	(36,397)
<b>Overall</b>		<b>97,798</b>			<b>(369,115)</b>

## 2.2 Relevant Variables

### 2.2.1 Baseline

The energy baseline used is the kWh (e) and kWh (th) per m<sup>2</sup> 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 M<sup>2</sup> of treated floor area. During 2019 that figure fell to 237.06 kWh per m<sup>2</sup>, which is a 39.7% improvement. The target set for 2020 is 263.27 kW per m<sup>2</sup>, and we have already surpassed that target, which is pleasing. However, it is expected that our targeted performance will continue to be a challenge e.g. the Human Biology Building, is now fully operational and that is a fully treated 8,000 m<sup>2</sup>. building with exact heating, cooling & humidity control. However, due to Covid-19, and a substantial reduction in occupancy during 2020, overall, we are expecting a significant decrease in our energy usage.

Also, it is worth noting that the M&R System is being substantially changed to reflect the national and international climate change carbon emissions targets for public sector organisations. The publication has been postponed until at the end of this year to factor in the effects of reduced occupancy and home working as a result

<sup>3</sup> GIA – Gross Internal Floor Area

of the Coronavirus pandemic. Additionally, next year's M&R system will include annual targets and performance tracking for the period leading up to 2030.

We reached our 33%, 2020 target in 2017 and the team has decided to introduce a 40% target by 2020; and we are well on the way to achieving that target as our performance during 2019 is 39.7% better than our baseline year. It is expected that SEAI's 2030 targets will be a 40% improvement in carbon<sup>4</sup> emissions performance compared to the baseline year; which in our case is 2006. In preparation for that transition we are monitoring our CO<sub>2</sub> 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<sub>2</sub> 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<sup>5</sup>.

Degree days and regression analysis exercises have been carried out recently and we have plotted the gas usage with degree days from May 2019 to September 2020, as outlined on Figure 5 below. The calculated regression or R value is .63. This demonstrates a strong positive correlation between gas usage and outside ambient temperature and this is very reassuring. See also Appendix D – Aggregated gas consumption versus degree days.

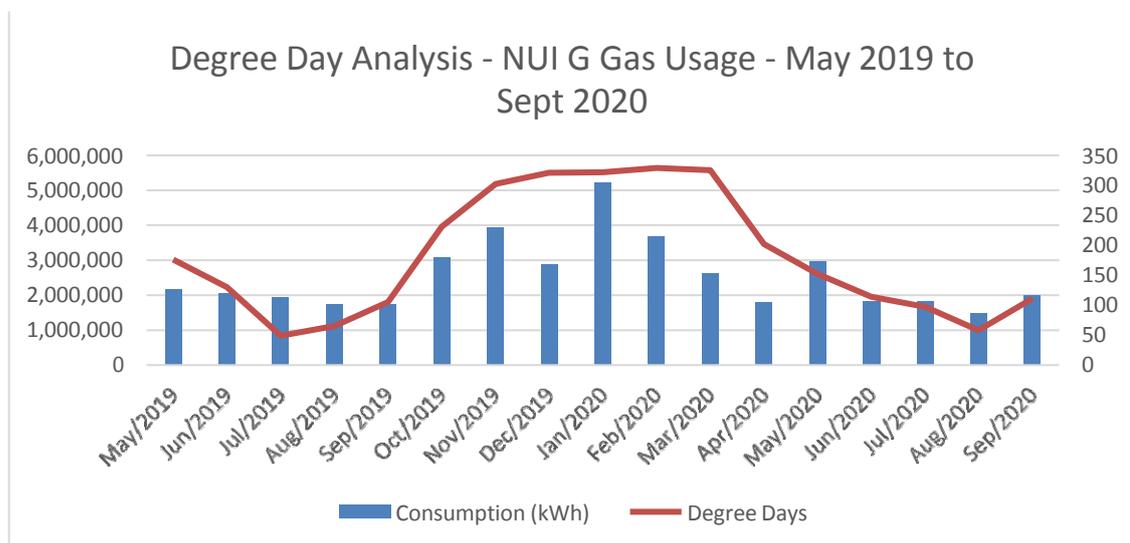


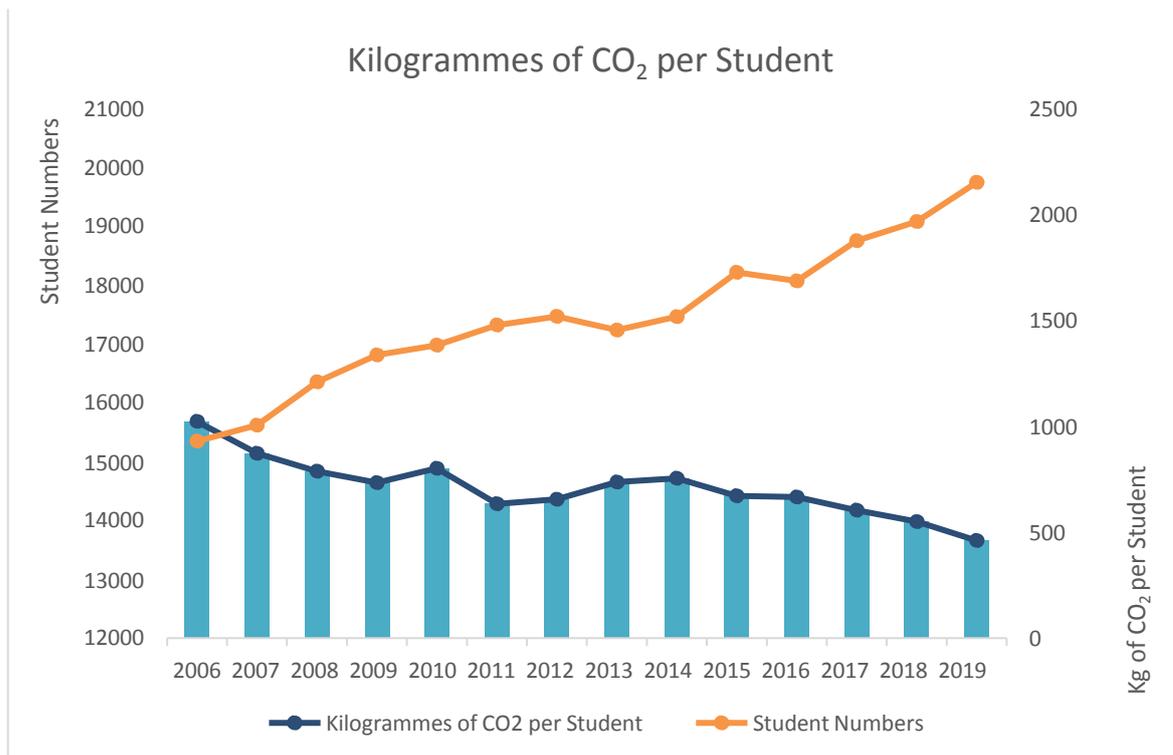
Figure 5: Degree Day Analysis

Last year and 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 are continuing this initiative into 2020

<sup>4</sup> Carbon dioxide is abbreviated to carbon and is denoted by CO<sub>2</sub>

<sup>5</sup> Degree days are essentially 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](http://www.degreedays.net)

as this has enabled them to become more conscious of their impact on energy and carbon usage at our university. However, due to COVID -19, the 2020 data, once it becomes available will be skewed. That said, the 2019 performance in terms of number of students and the attributable energy and carbon emissions continue to be reported and graphed. 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<sub>2</sub> per Student (2006-2019)**

It is also worth noting that deep retrofit building works carried out (e.g. Áras de Brun), will have a negative impact on the energy performance of the campus; as construction related energy usage (generally electricity) is supplied using the campus' main incomers.

### 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: 2011 Clause 4.4.2. Furthermore, both Lorraine and Michael have undergone ISO50001:2018 training in the past year, in preparation for NUI Galway transitioning over to the 2018 version of the standard.

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
- NEEAP 4, NEEAP 3, NEEAP 2, NEEAP 1 – National Energy Efficiency Action Plans.
- Public Sector Energy Efficiency Strategy – January 2017 – to drive the extra effort needed to realise the energy efficiency potential of the public sector and gain a 33% improvement compared to 2009 levels, by 2020.
- Technical Guidance Document Part L – Conservation of Fuel and Energy – Buildings other than Dwellings. The current edition is operative up to 31<sup>st</sup> December, 2018. The new/future Edition TGD Part L – Conservation of Fuel and Energy (2017) is effective from 1<sup>st</sup> January 2019.

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<sup>2</sup>. 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: 2009-18 Energy performance indicators**

Year	Energy Performance Indicator (EnPI)	
2019	kWh (e & th) /m <sup>2</sup>	237.06
2018	kWh (e & th) /m <sup>2</sup>	249.42
2017	kWh (e & th) /m <sup>2</sup>	259.85
2016	kWh (e & th) /m <sup>2</sup>	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)/m<sup>2</sup> 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 the case where buildings are under performing by 10%, or overperforming by 20%, 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 course of 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<sub>2</sub> per m<sup>2</sup> of treated floor area. The DECs are a performance rating and also 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. Examples of 2 DECs carried out at The Alice Perry and Áras Cairnes 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 role and the person or title of the person who has overall responsibility for that role 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 a number of 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 few buildings that are managed by external companies e.g. Apleona manage the HBB & 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**

Noel O'Connor, Lorraine Rushe, Michael Curran and the energy team at NUI Galway are doing great work in implementing and using their ISO 50001 compliant energy management system, to achieve targets and objectives, and to demonstrate compliance with its legal obligations. Lorraine is the acting Energy Manager and she manages the entire ISO50001 System. The energy team comprises of Noel O'Connor (Assistant Director, Estates Operations), Michael Curran (Head of Building Services, Energy & Utilities), Seán Farrell, 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 team meet once a month to undertake a review of the EnMS and in particular to review each of the significant energy using building's monthly energy performances. 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; in light of the unprecedented Covid-19 related reduced occupancy, across our 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. He has appointed Lorraine Rushe as the Energy Manager and has provided the resources<sup>6</sup> needed to maintain and improve the EnMS and resulting energy performance.

Lorraine has been pivotal in the transition of our EnMS from compliance with the 2011 to the 2018 versions of the standard. 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 and health and safety legal obligations. Lorraine and her team have 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 (4.2) and Evaluation of legal requirements and other requirements (9.1.2) clauses of the standard.

Michael Curran has led the way in terms implementing major energy efficiency projects throughout the year. He applied for and was successful in achieving grant funding for a number of high-profile projects such as the HEA Pathfinder Funding to

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<sup>6</sup> Resources include human resources, specialised skills, technology and financial resources.

carry out a deep retrofit of the Áras de Brun building which will achieve a performance improvement of 42% in electrical and 91% in thermal energy related usage. Other projects include the installation of a 650-kW modulating gas condensing boiler in both Cairnes & Moyola Buildings and the upgrading of heating pumps in the Psychology, Biochemistry and Hardiman Buildings. Furthermore, we have continued to decarbonise our energy usage and have installed a further 250 kW(peak) solar photovoltaic systems across our campus. See also Appendix A.

Karl Byrne has responsibility for developing and managing the Monthly Building Performance Reporting System. He presents the results to the energy team once a month and follows up on any metering related action(s) and updates the reports and corrective actions accordingly.

John Harrington has supported the team in transitioning our EnMS to the 2018 version of the standard. He has commenced the Internal Audit Programme of the new EnMS system and has set out the schedule for 2020-21. He 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.

NUIG's main objective is to reduce electricity and thermal related energy consumption and to improve the overall energy performance of its buildings. The energy performance improvement results during 2019; taken from the Sustainable Energy Authority of Ireland's M&R System proves that NUI Galway's EnMS is being implemented effectively.

Dr. Eoghan Clifford, who works at the NUIG Engineering School, won the much sought-after Research and Innovation Award. Eoghan is the Programme Director of the BSc Project & Construction Management and the Academic Director of the CEIM Programme. NUIG also won a silver medal in the National Public Sector Leadership category and this was in recognition for its continued leadership in energy management practices.

Additionally, the Buildings & Estates Team are doing great work on developing further energy efficiency projects and will use the results of the Áras de Brun deep retrofit project to roll out similar projects on similar buildings. It 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 combined heat 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. The most significant projects include Boiler-house upgrades; moving from oil to condensing gas/heat pump technology, 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, 2020-21, 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 2030 Zero Carbon Action Plan. NUI Galway is formulating a fully costed action plan to transition to a zero-carbon campus in the next decade. It includes the installation of 2 district heating networks with a biomass energy centres which is estimated to cost in the region of €3.4 mio. Other key actions relate to the numerous fume cupboards; and retrofitting new energy efficient motors and new screens to same, 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 thermal mass of buildings and reducing unwanted draughts and noise.

The ROO is an active document with 26 opportunities in the seeking funding category, 1 opportunity that has been approved recently, 56 that have been completed and a further 3 that are ongoing. \*The opportunity that has been approved was subject to a successful HEA's Pathfinder Fund Programme, which is a significant achievement (50% of the capital cost was granted, therefore the payback period is, in theory 7.3 years). There are also 6 opportunities that have not garnished approval and these are on hold. The ROO is a colour coded document 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; that are set at the annual management review meetings.

**Table 5: Summary of the 2020-21 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 (€)	Payback
2020-2021	Seeking	5,717,685	2,208,143	7,660,416	€5,421,040	€1,638,110	3.31
	Approved *	97,393	218,996	102,148	€650,000	€44,500	14.61
	Completed ~	1,674,822	1,152,974	1,734,474	€1,361,915	€489,178	2.78
	Approved-Ongoing						
	<b>Total</b>	<b>7,489,900</b>	<b>3,580,113</b>	<b>9,497,041</b>	<b>€7,432,955</b>	<b>€2,171,788</b>	<b>3.42</b>

Table 6, gives an outline of the opportunities for energy efficiency improvements and are categorised as Seeking Funding/Approval, 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 (2020 -21)

NUI Galway OE Gaillimh		National University of Ireland, Galway		ISO 50001		Register of Opportunities 2020/2021									
NUI GALWAY		Michael Curran / Lorraine Rushe / John Harrington		Noel O'Connor											
						Estimated Annual Savings									
Building	Opportunity/Objective	Energy	Reason Included	Comment	Business Unit	Project Approval	Fuel Type	KWh (t)	KWh (e)	KgCO2	Capital Cost (€)	Saving (€)	Payback	Comment	
NUI Galway	2030 Carbon Zero Planning, Strategy document for January 2020 costed for the complete campus.	Therm/Elec	NUI Galway must meet the challenges set out by the Government Climate Action Plan	MC to attend briefing with Department of Climate, this shall include a complete review of all the existing mechanical and electrical equipment and check inefficiencies	Buildings and Estates										
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 running of all equipment during the weekends and evenings. Green Procurement of all new equipment	Strategic alliance with ISS on the computer equipment	Buildings and Estates /ISS										
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 new electric heat pump, PV and battery system, new LED lighting to the Lecture theatre	Building and Estates	Seeking	Thermal	155,290	26102		280,000.00	18000	7	This project will be reviewed for 2021.	
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	Buildings and Estates	Seeking	Electrical		95000		110,000.00	12000	5	Project could be considered as SEAI BEC	
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	Arts Science	Seeking	Electrical		122520		230,000.00	10000	5	Possible Grant SEAI application	
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	Buildings and Estates										

<b>FABRIC</b>	The energy team need to review energy projects in the replacement of Fabric in buildings windows etc	<b>Therm</b>	Strategic review of the buildings to look at costs associate with Fabric upgrades to buildings	Building Engineer and Energy team	Buildings and Estates										
<b>Anatomy</b>	Upgrade boiler house from oil to natural gas, new boiler and burner	<b>Therm</b>	Removal of oil off site, install new natural gas supply and boiler house	Energy efficient installation, new controls etc.	<b>Anatomy</b>	<b>SEEKING</b>	<b>Thermal</b>	<b>28,000</b>		<b>5,768</b>	<b>(35,000)</b>	<b>(3,797)</b>	<b>9.2</b>	Additionalty: Replacing oil use on campus Health, Safety & Environmental risk mitigation	
<b>Áras na Mac Léinn</b>	Upgrade the heating system considering heat pump technology	<b>Therm/Elec</b>	Boiler is inefficient and does require attention	Upgrade the existing thermal heating system to consider Heat Pump technology	<b>Áras na Mac Leinn</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>602,784</b>	<b>-172,224</b>	<b>123,390</b>	<b>(78,000)</b>	<b>(41,472)</b>	<b>1.9</b>		
<b>Arts Millennium Building</b>	Installation of Solar Panel to serve hot water in Arts Millennium Building	<b>Therm</b>	Hot water dual coil cylinder in place, install Solar Panels	Installation of Solar Panels 20m2	<b>Arts Millennium Building</b>	<b>SEEKING</b>	<b>Thermal</b>	<b>5,901</b>		<b>1,208</b>	<b>(15,000)</b>	<b>(406)</b>	<b>36.9</b>	Would require a grant to justify	
<b>Arts Science Building (Biochemistry)</b>	Window Upgrade	<b>Elec</b>	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.	<b>Arts Science</b>	<b>SEEKING</b>	<b>Thermal</b>	<b>69,552</b>		<b>14,237</b>	<b>(100,000)</b>	<b>(4,785)</b>	<b>20.9</b>	Payback is quiet high	
<b>Arts Science Building (Microbiology)</b>	Window Upgrade	<b>Elec</b>	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.	<b>Arts Science</b>	<b>SEEKING</b>	<b>Thermal</b>	<b>55,642</b>		<b>11,390</b>	<b>(100,000)</b>	<b>(3,828)</b>	<b>26.1</b>	Payback is quiet high	
<b>CHP Project 01</b>	Supply and Installation of CHP to the Biomedical Research Building	<b>Therm/Elec</b>	New 140 kW units	Provision for CHP has been left for a unit in HBB	<b>Biomedical Research Building</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>686,040</b>	<b>686,040</b>	<b>356,054</b>	<b>(267,750)</b>	<b>(124,026)</b>	<b>2.2</b>	E-Tender requirement (140 kW E & 187 kW G)	
<b>BOI Theatre</b>	Upgrade the lighting to the BOI Theatre	<b>Elec</b>	The existing lighting is highbay light fittings and switch control.	Install new LED lighting to serve the BOI Theatre	<b>BOI Theatre</b>	<b>SEEKING</b>	<b>Electrical</b>	<b>3,585</b>	<b>3,585</b>	<b>1,861</b>	<b>(3,500)</b>	<b>(478)</b>	<b>7.3</b>		
<b>Campus Wide</b>	Develop district heating networks for the North & South Campus	<b>Therm</b>	Installation of 2 comprehensive district heating networks linked to 2 energy centres.	Application made to the carbon fund and submitted in October 2018	<b>Campus Wide</b>	<b>SEEKING</b>	<b>Thermal</b>	<b>2,493,600</b>		<b>5,676,970</b>	<b>(3,552,090)</b>	<b>(1,117,095)</b>	<b>3.2</b>	<a href="#">Link to the Application Document, Calculations sheets and application details.</a>	
<b>Cultural Space</b>	Replace two direct gas fired air handling units feeding student centre	<b>Therm</b>	Existing Direct gas fired units are not efficient and need to be replaced	Installation of new energy efficient Air Handling units	<b>Cultural Space</b>	<b>SEEKING</b>	<b>Thermal</b>				<b>(70,000)</b>			Additionalty; is also a Health and Safety related Project	
<b>No. 12 Distillery Road</b>	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>No. 12 Distillery Road</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>30,973</b>	<b>-8,849</b>	<b>6,340</b>	<b>(36,000)</b>	<b>(2,131)</b>	<b>16.9</b>	SEAI Better Energy Grant, Insulation etc - Need to carry out a BER and establish the EE measures and resulting improvements	
<b>No. 17 Distillery Road</b>	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>No. 17 Distillery Road</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>35,610</b>	<b>-10,174</b>	<b>7,289</b>	<b>(35,000)</b>	<b>(2,450)</b>	<b>14.3</b>	SEAI Better Energy Grant, Insulation etc - Need to carry out a BER and establish the EE measures and resulting improvements	
<b>No. 5 Distillery Road</b>	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>No. 15 Distillery Road</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>33,755</b>	<b>-9,644</b>	<b>6,910</b>	<b>(30,000)</b>	<b>(2,322)</b>	<b>12.9</b>	SEAI Better Energy Grant, Insulation etc - Need to carry out a BER and establish the EE measures and resulting improvements	
<b>The Gate Lodge</b>	Replace existing 25kw oil fired boiler with new Electric heat pump.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>The Gate Lodge</b>	<b>SEEKING</b>	<b>Elecf Thermal</b>	<b>33,755</b>	<b>-9,644</b>	<b>6,910</b>	<b>(20,000)</b>	<b>(2,322)</b>	<b>8.6</b>	SEAI Better Energy Grant, Insulation etc - Need to carry out a BER and establish the	

<b>Tower 1 &amp; 2</b>	Upgrade existing lighting in both Towers to LED lighting inline with other buildings	<b>Elec</b>	Installation of LED panels, recessed lights and control sensors	LED Lighting and controls	<b>Tower 1 &amp; 2</b>	<b>SEEKING</b>	<b>Electrical</b>	57,158	57,158	29,655	123,950	17,622	3.1	surface fittings requirements
<b>CHP Project 02</b>	Supply and Installation of CHP unit to the Human Biology Building	<b>Therm/Elec</b>	new 140 kw units	Provision for CHP need to find space in SRB	<b>Human Biology Building</b>	<b>SEEKING</b>	<b>Elec/ Thermal</b>	686,040	686,040	356,054	1267,750	1124,026	2.2	E-Tender requirement (140 kW E & 187 kW G?)
<b>Kingfisher</b>	Upgrade of 2no existing natural sectional boilers to gas condensing boilers and controls	<b>Therm</b>	Installation of new wall hung gas condensing boilers and controls	New gas condensing cascading boilers and controls	<b>Kingfisher</b>	<b>SEEKING</b>	<b>Thermal</b>	720,000	720,000	148,320	152,000	18,657	6.0	
<b>O'Donoghue Theatre</b>	Installation of 20sqm Solar PV to the roof of O'Donoghue Theatre	<b>Elec</b>	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	<b>O'Donoghue Theatre</b>	<b>SEEKING</b>	<b>Electrical</b>		2,234	1,078		1272		
<b>Orbsen Building</b>	Refurbishment of 10 no air handling units to the Biomedical section of the Orbsen building	<b>Therm/Elec</b>	Installation of new Energy efficient fans, controllers, filters and heater/cooling coils, resealing the air handling units	Master air handling units installed 16 years need to be upgraded.	<b>Orbsen Building</b>	<b>SEEKING</b>	<b>Electical</b>							Application to be made to SEAI as part of funding
<b>Physics</b>	Upgrade of 4no fume cupboards to the Physics department, central fan and ducting.	<b>Elec</b>	Installation of 4no fume cupboards and 4 separate fans and VSDs	VSDs on fans etc.	<b>Physics</b>	<b>SEEKING</b>	<b>Electrical</b>	20,000	20,000		165,000			Health and Safety project
<b>Aras De Brun</b>	HEA/SEAI Decarbonisation project.	<b>Therm/Elec</b>	MUI 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	<b>Buildings and Estates</b>	<b>COMPLETED</b>	<b>Thermal</b>	97,393	218,396	102,148	1650,000	144,500	10.0	This project has been approved and will be in
<b>Shannon</b>	Replacement Air Handling unit project in Shannon Catering Colleges	<b>Therm/Elec</b>	Existing Air Handling units installed around 1997, Master air systems, controls not working and not efficient	Recommendations to replace air handling units with new pack aged energy efficient units	<b>Shannon</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>			8,956	145,000	12,259	19.9	Existing system to is redundant and needs to be replaced urgently. No works were done previously and there is a legacy issue.
<b>AMB</b>	Upgrade controls to the boiler house serving the arts millennium building	<b>Therm/Elec</b>	The existing control panel has had modification carried out and is installed a number of gears, 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.	<b>Arts Millennium Building</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	259,661	0	53,153	138,000	117,865	2.1	Thermal savings are estimated. There will be additional electrical savings accrued, but these are difficult to estimate
<b>Cairnes</b>	Upgrade boiler house from Oil to LPG, new boiler and burner	<b>Therm</b>	Removal of oil off site, install new natural gas supply and boiler house	Energy efficient installation, new controls etc.	<b>Cairnes</b>	<b>COMPLETED</b>	<b>Thermal</b>	179,379		36,719	138,000	112,341	3.1	
<b>Engineering</b>	Installation of 50sqm Solar PV to the roof of Engineering	<b>Elec</b>	Installation of 50SQ M of Solar P to the roof Engineering Building	Panels installed to reduce electrical load of the engineering	<b>Engineering</b>	<b>COMPLETED</b>	<b>Electrical</b>		11,169	5,392		11,360		
<b>Carna</b>	Upgrade the existing oil fired water heater and the oil fired boiler in the Research building	<b>Therm</b>	Existing ACV water heater and oil fired sectional boiler	Instal new LPG Gas to the site and replace burners only	<b>Carna</b>	<b>COMPLETED</b>	<b>Thermal</b>							
<b>Carna</b>	Replace existing oil fired boiler to the school and install new LPG Gas fired burners only	<b>Therm</b>	Existing oil fired boiler/burner unit	Install new LPG Gas to the site and replace burners only	<b>Carna</b>	<b>COMPLETED</b>	<b>Thermal</b>							
<b>Mircobiology</b>	Replace existing light fittings in 4 no labs areas with new LED lighting	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>Mircobiology</b>	<b>COMPLETED</b>	<b>Electrical</b>	21,497	10,050	18,000		12,618	3.0	Recessed fittings
<b>Chemistry</b>	Replace existing light fittings in 2 no labs areas with new LED lighting	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>Chemistry</b>	<b>COMPLETED</b>	<b>Electrical</b>	15,045	7,034	16,000		11,832	3.2	Recessed fittings
<b>Arts Millenium</b>	Lecture theatre 150 and 120 seater	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>Arts Mileniums</b>	<b>COMPLETED</b>	<b>Electrical</b>	20,002	9,351	16,500		12,436	2.6	New Recessed fittings
<b>IT Building 250</b>	Lecture theatre 250	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>IT Building</b>	<b>COMPLETED</b>	<b>Electrical</b>	13,110	6,129	18,000		11,597	4.0	Recessed fittings
<b>IT Building 150</b>	Lecture theatre 150	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>IT Buildings</b>	<b>COMPLETED</b>	<b>Electrical</b>	13,110	6,129	18,000		11,597	4.0	Recessed fittings
<b>IT Building 100</b>	Lecture theatre 100	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>IT Buildings</b>	<b>COMPLETED</b>	<b>Electrical</b>	13,110	6,129	18,000		11,597	4.0	Recessed fittings

<b>Distillery Road lighting</b>	Upgrade existing lighting in the houses with new LED Lighting	<b>Elec</b>	Installation of new LED Lighting and control sensors	LED Lighting and controls	<b>Distillery Road</b>	<b>COMPLETED</b>	<b>Electrical</b>	16,972	7,934	18,455	12,045	4.0	Replace all open lamps	
<b>No 14 University Road</b>	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>No. 14 University Road</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	33,755	-9,644	6,910	130,000	12,322	12.9	SEAI Better Energy Grant, insulation etc - Need to carry out a BER and establish the EE measures and resulting improvements
<b>Arts Science Building</b>	Installation of 250sqm Solar PV to the roof of Arts Science Buildings	<b>Elec</b>	Installation of 250 SQM of Solar Photovoltaic (PV) to the roof Arts Science Building	Panels installed to reduce electrical load of the arts science building	<b>Arts Science</b>	<b>COMPLETED</b>	<b>Electrical</b>	27,923	13,481		13,401		170KW INSTALLED	
<b>The Quad</b>	Installation of new natural gas condensing boilers and controls to the Quad boiler houses	<b>Therm/Elec</b>	Replace the existing oil fired sectional boilers, capacity 650kw, 550kw and 150kw boilers, new controls etc.	Installation of new natural gas supply from local network, remove existing 5000litre oil tanks, installation of new gas condensing	<b>The Quad</b>	<b>COMPLETED</b>	<b>Thermal</b>	180,835	0	37,017	1200,000	112,441	16.1	E-Tender requirement - Multiple Benefit including H&S and Environmental risk mitigation
<b>Park &amp; Ride</b>	Upgrade external Lighting to the PARK and RIDE Car park at North Campus	<b>Elec</b>	Existing lighting are 250 Son-T lamps and running extensive hours, replacement costs and running costs are expensive	Recommendation from the external contractor to replace these with LED lamps	<b>Park &amp; Ride Carpark</b>	<b>COMPLETED</b>	<b>Electrical</b>	2,787	2,787	1,410	14,000	1356	11.2	SON are inefficient - multiple benefit for CCTV Cameras
<b>Moffett's Restaurant</b>	Replace existing fluorescent lighting with new LED Lighting	<b>Elec</b>	Installation of new LED Lighting	LED Lighting and controls	<b>Moffetts Restaurant</b>	<b>COMPLETED</b>	<b>Electrical</b>	14,986	14,986	7,778	112,000	12,248	5.3	decorative fittings
<b>Kingfisher</b>	Upgrade the lighting to the Kingfisher main Hall and support rooms	<b>Elec</b>	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	<b>Kingfisher</b>	<b>COMPLETED</b>	<b>Electrical</b>	62,042	62,042	32,199	145,000	18,273	5.4	
<b>Human Rights</b>	Upgrade the existing oil fired 100kw boiler to new Condensing Gas boiler.	<b>Therm</b>	Installation of new LPG Gas condensing boiler, pumps and controls.	Installation of LPG Gas condensing boiler	<b>Human Rights</b>	<b>COMPLETED</b>	<b>Thermal</b>	27,597		5,649	13,000	11,899	2.0	Additionally, Replacing oil use on campus Health, Safety & Environmental risk mitigation
<b>Gweedore Site</b>	Upgrade the existing Fluorescent lighting to new LED lighting	<b>Elec</b>	Install new energy efficient LED Lighting	LED Modular fittings	<b>Gweedore Site</b>	<b>COMPLETED</b>	<b>Electrical</b>	27,868	27,868	14,463	18,000	13,716	2.2	
<b>Engineering</b>	Project to recommission and revisit the utilisation plan for the Biomass Boiler in the Engineering building. Adjust controls and link it to Kingfisher	<b>Therm</b>	Existing installation to be recommissioned and make adjustments for Kingfisher	Contractual agreement with Kingfisher is a barrier	<b>Engineering</b>	<b>SEEKING</b>	<b>Thermal</b>			906,985	150,000	1152,420	0.3	no confirmation from Kingfisher - Mostly Cost and Environmental Savings
<b>No. 9 Distillery Road</b>	Deep Retrofit project - Installation of new electric heat pump and associated works, new radiators and controls. Installation of insulation in cavities.	<b>Therm</b>	Existing heating installation not efficient and heating in house is very poor	Installation of Electric Heat Pump and radiators/insulation	<b>No. 9 Distillery Road</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	33,755	-9,644	6,910	130,000	12,322	12.9	SEAI Better Energy Grant, insulation etc - Need to carry out a BER and establish the EE measures and resulting improvements
<b>Áras na Gaeilge</b>	Boiler Upgrade	<b>Elec</b>	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: 123k to space heating upgrade and 15k to DHV upgrade	<b>Áras na Gaeilge</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	241,114	4,140	51,355	123,000	117,093	1.3	Reviewed on 30th Oct and this project is almost complete. Pumps have been upgraded, Boilers are in place, Being commissioned.
<b>Áras na Gaeilge</b>	DHV Upgrade - Included in the boiler house upgrade project, as above	<b>Elec</b>	The capital cost includes boilers, pumps, calorifier & associated controls	See over & above	<b>Áras na Gaeilge</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	-48,223	60,480	13,411	15,000	14,049	1.2	Reviewed on 30th Oct. Calorifier has been delivered and will be installed over the next few days.
<b>Áras de Bruin</b>	Install new LED Lighting to the upper floors	<b>Elec</b>	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	<b>Áras de Bruin</b>	<b>COMPLETED</b>	<b>Electrical</b>	0	55,276	26,687	17,000	16,733	1.0	Successful project which has complimented the PV Project
<b>Arts Science Building</b>	Service and carry out works to CHP Unit	<b>Therm/Elec</b>	Annual service to the CHP unit	Manufacturer contract	<b>Arts Science</b>	<b>COMPLETED</b>	<b>Elec/ Thermal</b>	54,320	27,160	24,232	165,000	17,045	9.2	Completed by PSE
<b>AMB</b>	Update the insulation in the boiler house	<b>Therm</b>	Changes to pipework and pumps new insulation to be installed to reduce losses	Internal works to be carried out.	<b>Arts Millennium Building</b>	<b>COMPLETED</b>	<b>Thermal</b>	37,094	0	7,593	15,000	12,552	2.0	Existing insulation to be removed and replaced with new insulation and valve jackets.
<b>Arts Science</b>	Upgrade the remaining Fluorescent lighting in the Arts Science building with new LED lighting	<b>Elec</b>	A number of areas require the upgrade of fluorescent lighting with new LED	Works to be carried out by Engineering Services in house, survey to be carried out.	<b>Arts Science</b>	<b>COMPLETED</b>	<b>Electrical</b>		26,527	12,807	110,000	13,231	3.1	Project Completed
<b>Biochemistry</b>	Installation of VSD on the existing Fume Cupboard fan	<b>Elec</b>	The existing fan is a fixed speed fan and needs to be controlled better	Adjoining extract fan fitted with VSD and reduced energy costs	<b>Biochemistry</b>	<b>COMPLETED</b>	<b>Electrical</b>	0	23,126	11,165	15,000	12,817	1.8	1 large motor serving multiple fume cupboards
<b>Block D &amp; E</b>	Replace existing oil fired boilers with new Gas fired boilers and reduce oil risk - multiple benefits include reducing/eliminating the risk of oil leaks	<b>Therm</b>	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.	<b>Block D and E</b>	<b>COMPLETED</b>	<b>Thermal</b>	103,864	0	21,261	110,000	17,146	1.4	Approximate
<b>Arts Science Boiler-house</b>	Replace the existing two burner existing natural gas burners and controllers	<b>Therm</b>	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.	<b>Boiler-House</b>	<b>COMPLETED</b>	<b>Thermal</b>	74,189		15,186		15,104		One burner and VSD has been replaced, second tender this summer to replace No 2 Burner and VSD

<b>Cairnes</b>	Upgrade pump sets in the boilerhouse, replace current fixed speed pumps	<b>Therm/Elec</b>	Replace pumps	In-house project which has been a great success already registered	<b>Cairnes</b>	<b>COMPLETED</b>	<b>Electrical</b>	17,511	11,979	120,000	13,022	6.6	Project Completed	
<b>Engineering</b>	Install water savings devices on the Urinals	<b>Water</b>	Existing water usage on 16 urinals is high and needs to be reduced	Existing urinals to be reviewed	<b>Engineering</b>	<b>COMPLETED</b>	<b>Water</b>	0	0	0	13,720	122,008	2.9	Tender review with specialist
<b>Engineering</b>	Service and carry out works to CHP Unit	<b>Therm/Elec</b>	Annual service to the CHP unit	Manufacturer contract	<b>Engineering</b>	<b>COMPLETED</b>	<b>Eleef Thermal</b>	59,656	29,828	26,613	145,000	17,737	5.8	Completed - Schmitt-Enertec CHP by PSE 255 kW; PF
<b>Library</b>	Complete the upgrade of the heating installation in the Ground and First floor of the library area to match Summer 2016 project	<b>Therm</b>	Replace the existing radiant heaters with new panel radiators and TRVs	Works to be carried out to the existing installation.	<b>Library</b>	<b>COMPLETED</b>	<b>Thermal</b>	55,642		11,390	130,000	13,828	7.8	
<b>Library</b>	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	<b>Therm/Elec</b>	Replace pumps	In-house project, great success already registered	<b>Library</b>	<b>COMPLETED</b>	<b>Electrical</b>	49,622	23,958		145,000	16,044	7.4	Project Completed
<b>Library</b>	Service and carry out works to CHP Unit	<b>Therm/Elec</b>	Annual service to the CHP unit	Manufacturer contract	<b>Library</b>	<b>COMPLETED</b>	<b>Eleef Thermal</b>	50,532	25,266	22,542	15,000	16,554	0.8	Completed by PSE
<b>Miscellaneous</b>	Install new LED lighting to replace the existing fluorescent/Metal halides	<b>Elec</b>	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	<b>Miscellaneous</b>	<b>COMPLETED</b>	<b>Electrical</b>	0	86,982	41,995	1,000	110,594	0.1	At approximately 150 per fitting
<b>Mogola</b>	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	<b>Therm/Elec</b>	Replace pumps	In-house project, great success already registered	<b>Mogola</b>	<b>COMPLETED</b>	<b>Electrical</b>	29,109	14,263		140,000	13,588	11.1	Project Completed
<b>Nursing</b>	Install new installation to the Nursing Library adjoining the Hardmann library, install new pumps	<b>Therm</b>	Replace 5no pumps	In-house project	<b>Nursing</b>	<b>COMPLETED</b>	<b>Electrical</b>	2,509	1,211		16,500	1306	21.3	Project Completed
<b>Orbsen</b>	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	<b>Therm/Elec</b>	Replace pumps	In-house project, great success already registered	<b>Orbsen</b>	<b>COMPLETED</b>	<b>Electrical</b>	41,544	20,057		128,000	15,060	5.5	Project Completed
<b>Orbsen</b>	Service and carry out works to CHP Unit	<b>Therm/Elec</b>	Annual service to the CHP unit	Manufacturer contract	<b>Orbsen</b>	<b>COMPLETED</b>	<b>Eleef Thermal</b>	109,721	54,860	48,946	165,000	114,231	4.6	Completed - Schmitt-Enertec CHP by PSE, 169 kW (e) output
<b>Shannon</b>	Install new LED lighting throughout to replace the existing fluorescent	<b>Elec</b>	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	<b>Shannon</b>	<b>COMPLETED</b>	<b>Electrical</b>	15,036	15,036	8,661	133,940	113,604	2.3	To be completed by VERDE, funding secured through energy savings on other projects.
<b>Sports Pavilion</b>	Upgrade pump sets in the boiler-house, replace current fixed speed pumps	<b>Therm/Elec</b>	Replace pumps	In-house project, great success already registered	<b>Sports Pavilion</b>	<b>COMPLETED</b>	<b>Electrical</b>	17,529	7,500		119,000	12,135	8.9	Project Completed
<b>Áras na Gaeilge</b>	Installation of Solar PV to Áras na Gaeilge roof	<b>Elec</b>	Installation on flat roof	Assist reduction in electrical loading	<b>Áras na Gaeilge</b>	<b>Completed</b>	<b>Electrical</b>	12,500	55,000		138,000	11,905	3	ACA /SEAI Grant
<b>Áras Uí Éimhígh</b>	Replace the existing electric heating in the building with new heat pump, low temperature radiators & controls	<b>Therm</b>	Installation of and steel panel radiators	Heat Pump, Radiators & Controls	<b>Áras ní Éimhígh</b>	<b>Completed</b>	<b>Thermal</b>	15,483	7,475		122,000	11,886	11.7	Daikin Altherma Monobloc EDLQ07CAV3 used. New low temperature radiators installed. Heating control system upgraded.
<b>Arts Millennium Building</b>	Upgrade lighting and lighting control to 3no lecture theatres	<b>Elec</b>	Installation of new LED lighting and controls for the 3 no lecture theatres	LED Lighting and controls	<b>Arts Millennium Building</b>	<b>Completed</b>	<b>Electrical</b>	22,105	36,990		130,000	19,332	3.2	
<b>AHSSRB</b>	Upgrade existing fixed speed pumps with new energy efficient pumps	<b>Elec</b>	Installation of new energy efficient pumps	Replace 10 No. pumps in plantroom	<b>AHS SRB</b>	<b>Completed</b>	<b>Electrical</b>				125,000			Grundfos Engineer to review in January
<b>Block Q</b>	Upgrade existing lighting and storage heating installations	<b>EleefTherm</b>	Installation of new LED lighting and replace heaters with new energy efficient heaters	Installation of LED Lighting	<b>Block Q</b>	<b>Completed</b>	<b>Electrical</b>	57,158	57,158	29,655	126,000		3	Replace old fittings and heaters
<b>Campus Wide</b>	Develop EV Charging Point System	<b>Elec</b>	Develop and support a sustainable energy campus	Orbsen Bld - 212 Charging Points, Cairnes Bld - 212 Charging Points, Áras na Cathal 12 Charging Point, Quad (Upgrade of existing Charging Point System, Park & Ride 11	<b>Campus Wide</b>	<b>Completed</b>	<b>Electrical</b>							Link to Green Campus and NUI Galway's Sustainable Campus Strategy. This project also demonstrates that NUIG is committed to reducing carbon emissions by promoting and facilitating Electric Vehicles (EV's)

<b>Campus Wide</b>	New EV Post Van - Renault Kangoo; located at the HBB Building	<b>Elec</b>	Develop and support a sustainable energy campus	EV Post Van - Quiet, Clean Delivery!	<b>Campus Wide</b>	<b>Completed</b>	<b>Electrical</b>								Linked to Green Campus and NJJ Galvag's Sustainable Campus Strategy
<b>Campus Wide</b>	Provision of Campus wide Energy Campaign to the students, staff and contractors	<b>Therm/Elec</b>	Energy awareness campaign and program of events	Provide energy awareness literature, campaigns, switch off days, green week etc.	<b>Campus Wide</b>	<b>Completed ~ ongoing</b>	<b>Elect Thermal</b>			360,099	<b>150,000</b>	<b>1103,724</b>	<b>0.5</b>		Awareness Campaign - See also Energy Review Document 2018Link to the Green Campus Application
<b>Campus Wide</b>	Installation of additional metering to remaining buildings not connected to the BMS	<b>Therm/Elec</b>	Recording of energy usage and performance data and information. This provides the information which is reviewed daily, weekly and during our monthly energy review meetings.	Provides Up To Date records of systems etc.	<b>Campus Wide</b>	<b>Completed ~ ongoing</b>	<b>Elect Thermal</b>			360,099	<b>150,000</b>	<b>1103,724</b>	<b>0.5</b>		E-Tender requirement - Ongoing and active monitoring is helping us to reduce energy usage by 3%
<b>Campus Wide</b>	Maximum Import Capacity (MIC) Project	<b>Elec</b>	Review of existing bills to reduce the Import capacity charges	Review and collate	<b>CAMPUS WIDE</b>	<b>Completed</b>	<b>Elec</b>				<b>115,000</b>				the summer of 2018. Ongoing monitoring of
<b>Engineering</b>	Carry out a complete energy efficiency design review of the heating, cooling, ventilation and electrical supply strategies employed at the Engineering Building	<b>Therm/Elec</b>	Review the existing heating and cooling strategies, review times, air handling units and air balancing.	Specialist engineering review	<b>Engineering</b>	<b>Completed ~ ongoing</b>	<b>Elect Thermal</b>				<b>125,000</b>	<b>10</b>	<b>N/A</b>		Review by Energy Specialist - Ongoing- carry this out during the heating season of 2018-19
<b>Human Biology Building</b>	Installation of Solar PV to the Human Biology Building	<b>Elec</b>	Installation to the roof of the new Human Biology Building for creating electrical energy.	High electrical loading to the building.	<b>Human Biology Building</b>	<b>Completed</b>	<b>Electrical</b>		<b>15,500</b>	<b>70,002</b>	<b>145,000</b>	<b>12,381</b>	<b>3</b>		ACA /SEAI Grant was awarded to this project that reduced the payback to 3 years
<b>Library</b>	Upgrade the existing Lighting installation in parts of the Hardmann Library	<b>Elec</b>	Installation of new LED lighting and controls to the library on Ground, first and second floor levels	Existing 4x18 fluorescent light fittings (with choke start ballasts factor of 12) replaced with new LED	<b>Hardiman Library</b>	<b>Completed</b>	<b>Electrical</b>		<b>181,336</b>	<b>87,549</b>	<b>122,000</b>	<b>122,087</b>	<b>1.0</b>		Good data available - discussed at September 2018 Monthly Energy Meeting
<b>Mogola</b>	Installation of LED Lighting to Block A, replace the existing fluorescent	<b>Elec</b>	Installation of new LED Lighting	LED Lighting and controls	<b>Mogola</b>	<b>Completed</b>	<b>Elec</b>	<b>42,054</b>	<b>42,054</b>	<b>22,000</b>	<b>135,000</b>	<b>15,122</b>	<b>5</b>		

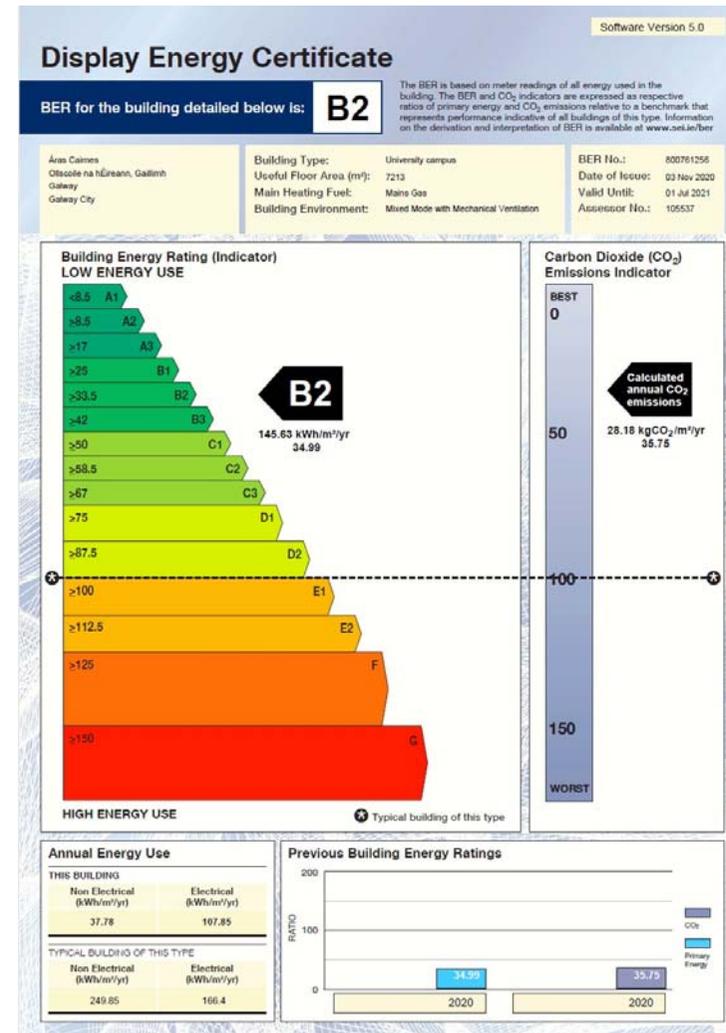
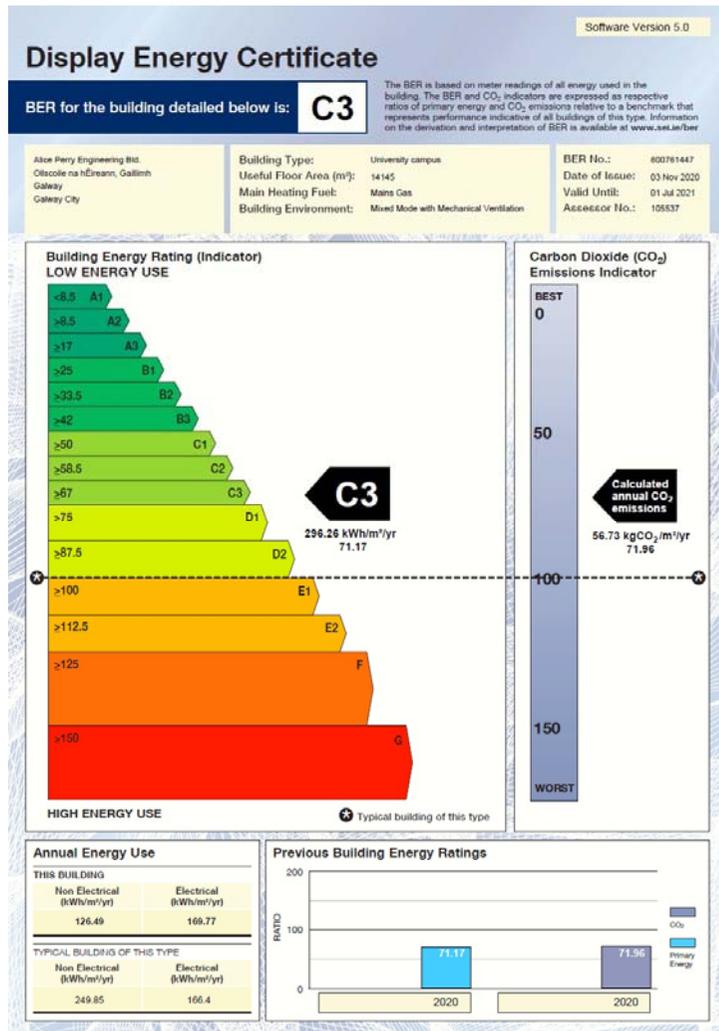
#### 4. Estimate future energy usage and consumption

An estimate of the college's future energy usage and consumption was 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 2019 mainly due to the projected growth in student numbers and research intensity. The expected energy usage and performance is used to budget for energy usage, consumption and costs over the next period. That increase is factored into the predicted energy use as outlined on the figures included in Table 4 as below. Additionally, the predicted energy consumption is itemised and that factors in energy increases due to factors outlined above and also our energy reduction target; which as stated previously, is 40% up to 2020 or 3.7% between now and the end of 2020.

<b>Estimate of Future Energy Usage and Consumption</b>			
MWh -Usage	2020	2021	2022
Electricity	18,595	18,037	17,496
Gas	16,630	16,131	15,647
Heating Oils	759	737	714
Wood Fuels	436	423	410
Solar Thermal	65	63	61
Bio Diesels	1,516	1,470	1,426
<b>Total</b>	<b>38,000</b>	<b>36,860</b>	<b>35,754</b>
EnPI -Consumption			
<b>Total - KWh/M2</b>	<b>177.57</b>	<b>172.24</b>	<b>167.08</b>
Conversion factors to calculate the Total Primary Energy Equivalent will change every year			

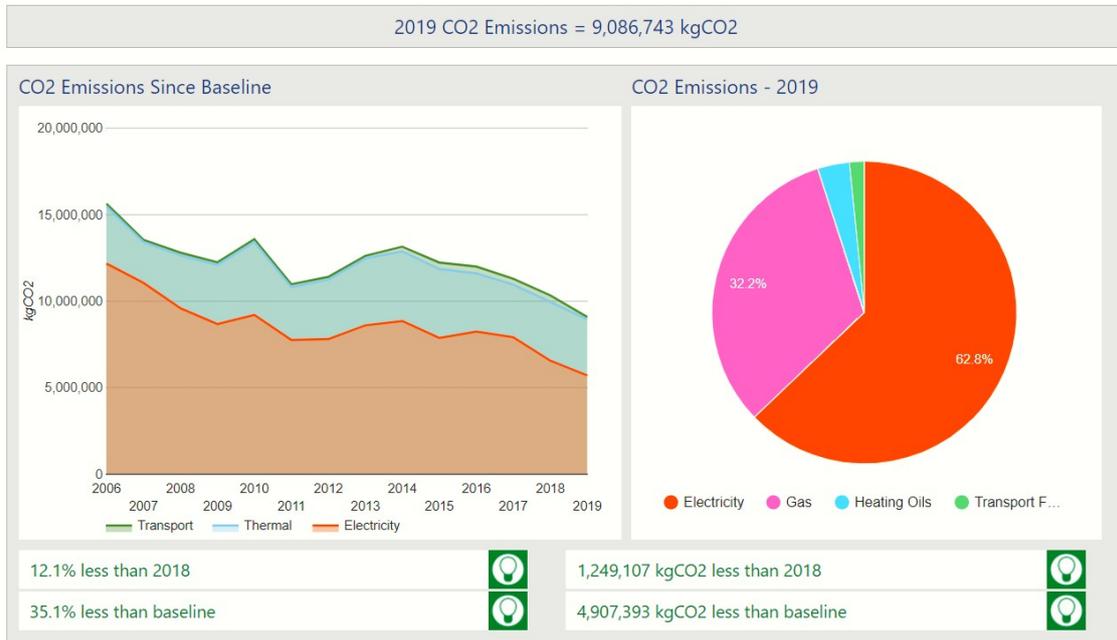


## Appendix B: Display Energy Certificates



## Appendix C: Yearly CO<sub>2</sub> emissions continue to fall

CO<sub>2</sub> Emissions - 2019



## Appendix D: Aggregated gas consumption versus Degree days

Aggregated Gas Consumption Data - NUI Galway		
Date scale	Consumption (kWh)	Degree Days
May/2019	2,187,083.00	176
Jun/2019	2,040,197.00	130
Jul/2019	1,935,130.00	49
Aug/2019	1,742,092.00	65
Sep/2019	1,737,135.77	105
Oct/2019	3,084,451.23	231
Nov/2019	3,926,264.00	302
Dec/2019	2,886,944.00	321
Jan/2020	5,230,528.00	322
Feb/2020	3,692,995.00	329
Mar/2020	2,614,935.42	325
Apr/2020	1,798,841.37	202
May/2020	2,963,638.21	152
Jun/2020	1,841,556.00	114
Jul/2020	1,814,994.00	97
Aug/2020	1,479,031.00	58
Sep/2020	1,991,304.89	111
<b>NUI Galway demonstrating a strong Positive Correlation between Gas usage and Ambient Temperature deg C. - Source Degree Day Data from MACE HEAD</b>		0.626

Appendix E: Sankey diagram outlining the energy usage and consumption at our Engineering Building (Alice Perry)

