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Build Up Skills – Ireland 2030

Analysis of the National Status Quo

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Further information

More details on BUILD UP Skills can be found at www.build-up.ec.europa.eu

More details on the LIFE CET programme can be found at https://cinea.ec.europa.eu/programmes/life_en

Table of Contents

Table of Figures

Table of Tables

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Executive summary

Table 1 Executive Summary Table

Status Quo Report Quantitative Findings
There were 5,149,139 people in the State on Sunday, 03 April 2022, an 8% increase since April 2016.
The average age of the population was 38.8 in 2022.
The number of non-Irish citizens was 631,785. This is 12% of the usually resident population.
The number of retired people increased to nearly 658,000, up by 21% from 2016.
There are an estimated 164,398 workers currently in the construction sector workforce in Ireland, with an estimate 26,307 in the education system (Vocational Education Training and Higher Education) ready to enter the workforce by the end of 2026.
In the years 2021 – 2023, 10 x more students opted for Level 7/8s over crafts apprenticeships.
Over 60% of crafts apprenticeships are Electricians.
Number of apprenticeships for Bricklayers, plasterers, painters, and decorators is very low at just 482 nationally.
Construction and Engineering courses still have a relatively low intake of students and a have a high dropout rate compared to other courses.
Business, Health, and Arts Courses continue to be the most preferred course types for level 6-8 and account for over 40% of all students.
Energy Upgrades to Residential buildings is quite high at almost 27,000 upgrades in 2022, however there were only 1/3 the amount of retrofit to B2 (8,481), and even less heat pumps installed (2,272).
More information and data are needed to include the Non-residential retrofit
Total primary energy production in Ireland for 2021 was 3 million tonnes of oil equivalent (toe) Green House Gas emissions are estimated to be 62.11 million tonnes carbon dioxide equivalent (Mt CO2eq)
Housing for All is the Government's plan to increase the supply of housing to an average of 33,000 per year over the next decade, including the delivery of 90,000 social homes, 36,000 affordable purchase homes and 18,000 cost rental homes. Climate Action Plan 23 All new dwellings will be designed and constructed to Zero Emission Building standard by 2030.
Projection Analysis findings:
The estimated number of workers required to reach 2030 Housing for All and Climate Action Plan targets is 304,430 up 46% compared to estimated current workforce.
The forecasted number of workers in 2030 is 183,851, meaning an additional 120,579 workers will be required across all construction professions and trades.
The Retrofit Forecast shows that Ireland will only reach 31% of its intended 500,000 B2 retrofits by 2030.
The residential new build forecast shows that Ireland will meet and is on target to over-achieve its Housing for All targets for 2030 by 17% or by 70,000 houses.

Engineering workers are in high demand with a forecasted shortfall in the range of 30%-40% for Electrical, Structural, Civil, Energy Engineers and Quantity Surveyors. Forecasted Mechanical engineers based on the number of current students is the only profession that has estimated adequate numbers in the education system.
Quantity Surveyors and Engineers (listed above) are critical workers for the success in achieving 2030 targets.
Carpenters, joiners, bricklayers, plasterers, and machine drivers are all critical craft workers for the success in achieving 2030 targets. Workers within these trades account for over 50% of the predicted shortfall, and elementary workers accounting for a further 20%.
Qualitative Findings and Recommendations:
A database, held centrally, of the exact number of workers in the construction sector is urgently required to help monitor the construction sector and for future analysis.
Retrofit to B2 level will need to drastically increase in the coming years to reach 2030 targets.
Off-site construction can reduce time and cost of construction and will be needed to ramp up production of new build and retrofit building elements.
To ensure the increases in efficiency from off-site construction, better logistics of materials and transport management will become more important.
The establishment of a National Sustainable Home Building agency (Hearne, 2023, Home for Ireland) to directly build and retrofit vacant, derelict, existing buildings as homes (particularly), on behalf of state and employ all necessary professions, skills, and trades (in collaboration with local authorities and housing bodies) is required for social and affordable homes.
More emphasis in second level schools on encouraging student to consider engineering and construction courses and apprenticeships.
Greater emphasis at primary and second level on encouraging gender balance and greater diversity in construction jobs.
Improve career guidance knowledge on construction skills needs, upskilling and empowering the network of career guidance teachers in order to make construction more appealing to students as a career.
Dropout rates of engineering courses of 70%, shows a clear disconnect between Second and Third Level, Maths and Engineering.
More conversion pathways for people outside of the Construction Sector to enter the Sector, i.e., accountant to carbon accountant, economist to carbon economist, project management, procurement, marketing, business administration etc.
More professional development courses in Retrofit are needed to improve the entire workforce.
More flexible learning courses to enable workers to both earn and learn, i.e., Traineeships.
More Retrofit modules in undergraduate courses and apprenticeships.
Integrated tools/ digital maps of buildings that can help with multiple retrofit projects.
More financial support (100% funding, tax breaks, incentives etc) and technical support (knowledge hubs, etc) for lifelong learning within the construction sector at all levels.
Career guidance supports to identify appropriate career paths for those already in the construction sector who wish to advance, in order not to lose talent (through attrition).

More guidance and coordination across all levels in construction education for Recognition of Prior Learning (RPL) and Life Long Learning.
Recognition of Prior Experience (RPE) needs to allow more flexibility to facilitate the acquisition of qualifications, exemptions from some exams etc and allowances for expertise gained on the job. e.g., 10 plus years of experience = Crafts.
Construction Identification Card: A card that states you work in the construction sector and what professional qualification you hold. This will help with monitoring the future skills required in the sector, working off the already established chartered associations and Safe Pass system. It would entail multiple systems working together within GDPR.
Focus on upskilling traditional trades sector to ensure quality retrofit and sustainability of/in buildings.

Table 2 Overview of Workforce (Current, 2030 required, and forecasted)

Job Title	Current Workforce	Required for 2030 Targets	Workforce Forecasting Projection	Required
Site Manager / Supervisor	4,600	8,518	5,190	3,329
Project Manager	2,000	3,704	2,374	1,329
Architecture and construction	9,400	17,407	16,034	1,373
Architecture and town planning				
Civil Engineer	11,900	22,036	12,014	10,022
Quantity Surveyor	4,800	8,889	5,141	3,748
Electrical Engineer	5,429	10,053	6,582	3,472
Mechanical Engineer	3,692	6,837	7,235	-
Structural Engineer	384	712	570	142
Energy Engineer	5,893	10,913	6,174	4,739
Plumber	9,400	17,407	12,752	4,655
Electricians	38,800	71,849	49,590	22,259
Bricklayer & Plasterers	11,800	21,851	9,556	12,295
Painters & Decorators	6,600	12,222	5,124	7,098

Carpentry and Joiners	17,700	32,777	17,968	14,809
Other (i.e., Machine Drivers, Crane Drivers, General Operatives)	32,000	59,257	35,113	24,144
Total	**164,398**	**304,430**	**183,851**	**120,579**

1. Introduction

The Build Up Skills Ireland (BUSI) initiative which commenced in 2011 set out a clear roadmap of actions focussed on supporting the upskilling within the construction sector, and specifically the built environment. Since 2011 there has been significant and fundamental changes in EU and National policy and there is a necessity to reflect on achievements to date and plan in order to meet targets for the future.

The EU LIFE Programme, under the Clean Energy Transition Programme, aims to facilitate the rebooting of the National Qualification Platforms, Status Quo Analyses and National Roadmaps developed under the first phase of Build Up Skills (2011-2012, 'Pillar I') and to ensure alignment with the EU 2030 energy targets.

Build Up Skills Ireland 2030 (BUSI2030) is aligned to this ambition and has set two broad objectives in line with the call.

Firstly, BUSI2030 will refine and refresh the Irish National Platform to reflect the dynamic policy and sectoral changes which have occurred since 2013. Topics such as digitisation, circular economy, embodied carbon, and related fields have now emerged strongly as priority areas, which were not specifically addressed in the original BUSI initiative.

Secondly, BUSI2030 brings together relevant expertise and knowledge to produce an updated Status Quo Analysis (SQA) which will compile and reflect the education and training needs for the future. The SQA report will thus inform future actions and inform a National Roadmap. By engaging new stakeholders as the Construction Sector Group, BUSI2030 is confident of endorsement of the roadmap, which will be linked to key policy and programme initiatives in Ireland.

A particular focus of the revitalised platform will be placed on the financing and investment (public and private) required to deliver the education, training and skills required. BUSI2030 will set a clear pathway for upskilling building professionals and workers in Ireland thus ensuring that the built environment sector achieves Ireland's 2030 energy and carbon ambitions (and is on a trajectory to carbon neutrality by 2050). BUSI2030 will bring together, within one updated Status Quo report, the skills demand for both retrofit and new build, in line with Ireland's Climate Action Plan and Housing for All Strategy.

The work of BUSI2030 will be directly aligned with the ambitions of the Construction Sector Group (CSG) and build on the achievements of the Construction Blueprint within the Irish Context. The Status Quo Report will inform a new BUSI2030 Roadmap for Ireland which will be developed through consultation and engagement with industry stakeholders. The roadmap will present an action plan of measures, aligning with existing activities, while also identifying gaps and future synergies. BUSI2030 will place a specific focus on the identification of appropriate incentives and measures to finance the actions within the National Roadmap, and the long-term sustainability of the National Platform.

2. Objectives and methodology

2.1 Objectives

Objective 1: Quantify the scale, range and type of skills required within the Built Environment in the context of 2030 climate targets, and report this within a Status Quo Report.

Objective 2: Identify future education, training and skills demands beyond 2030 aligned with EU and National policy goals.

The outcomes of this report will act as the foundation for the National Roadmap which will act as the agreed vision for 2030 and beyond for the Irish built environment with key priority actions to be developed, responsibilities within the BUSI National Platform identified, and to implementation of review mechanism for the National Roadmap.

2.2 Methodology

This section will outline the methodology used to calculate the required workforce to reach the 2030 targets set out by the Irish Government within the 'Climate Action Plan', 'National Retrofit Plan' and 'Housing for All' strategies for 2030 and beyond. The following identified targets are directly affected by the construction sector:

1. 312,750 new build homes built between 2022 and 2030, including social homes (88,400), affordable homes (53,700), private ownership and rental (170,550). This figure is based on the projected housing output (New Build) table in the Housing for All for the years 2022 – 2030.

2. 500,000 B2-equivalent home upgrades by 2030 as part of National Retrofit Plan, emphasis has been placed on the upgrading houses to a B2-equivalent and delivering on average, 75,000 B2-equivalent home upgrades per year from 2026 to 2030.

3. Installation of 680,000 heat pumps in residential settings, installing 400,000 of these heat pumps in existing homes

Other targets that have been explored within the Climate Action Plan and Ireland's Long-Term Renovation Strategy (2020) that relate specifically to reducing CO2 emissions associated with operational energy use in Ireland. However, due to lack of publicly available information on the progress of these targets, this analysis (for now) will exclude them. These include:

- Commercial and Public buildings emission reduction of 370 ktCO2
- Installing 25,000 heat pumps in commercial buildings by 2030.
- 51% absolute carbon emission reduction, including direct emissions associated with thermal energy
- 50% improvement in energy efficiency
- 100% of public sector buildings (around 12,500) must achieve a BER B or higher by 2030
- retrofitting at least one-third of commercial premises to a BER of B by 2030
- All public sector buildings to be retrofitted to a minimum BER of B by 2030.
- 30% of commercial buildings to achieve a BER of B or higher
- 40% emissions reductions in large industry
- 50,000 commercial buildings to install renewable heating.[1]

1https://www.seai.ie/data-and-insights/seai-statistics/key-publications/energy-in-ireland/

By analysing the available data on the number of new build constructions (domestic and non-domestic) for years 2011-2022 and retrofit to BER level B2 numbers for residential only for 2019 – 2022 (due to lack of available data for non-domestic), a forecast based on the current completion rate can be made until 2030. A confidence interval[2] was used to showcase the range of values the forecasted completions are expected to fall in. As the forecast predicts further into the future the less certain the forecast becomes, and the wider the range of figures is. However, as more information becomes available i.e., 2024 completion data, the more accurate a prediction can be made.

The information for new residential buildings was collated from the Central Statistics Office (CSO) database called 'New Dwelling Completions' which includes single homes, scheme homes and apartments, and retrofit figures were taken from the SEAI National Retrofit Plan quarterly progress report 2023.

New non-residential constructions were also included for forecasting the number of total constructions/retrofits projected for 2030. Due to the steady year on year constructions from 2010, the same steady rate was applied to 2022 – 2030.

Non-residential retrofits are not included in this analysis, mainly due to lack of information on the reporting of public sector and commercial retrofits, the complexity of public sector and commercial retrofit may cause this issue or the defining of what constitutes a commercial retrofit. However, the model for forecasting is changeable and with the emergence of usable data, the forecast can include non-residential retrofit numbers.

For the purposes of this report, all buildings forecast to be renovated or new build were used as the basis for our methodology, although infrastructure projects such as road, rail and bridges or offshore wind projects were not included in our calculations. The National Development Plan (NDP) will require construction workers for other aspects of construction which will put pressure on the supply of the workforce.

In principle the overall methodology involved the following:

- Identification and analysis of the various targets, to 2030, which will be impacted by the built environment sector.
- Identification of current employment of 'traditional' workers in the built environment sector including professionals (e.g., engineers, architects), crafts (e.g. plumbers, electricians) and operatives (e.g. crane drivers, general operative).
- Projection of future building completions (retrofit and new build) based on the current available data.
- Projection of future employment numbers within the sector with a view to meeting the defined targets by applying expansion rates and contraction rates (retirements, etc.) on the built environment workforce. On the current trajectory without intervention, the projected workforce for 2030 is set to be 183,851 up 12% from current workforce.
- The Expansion rates are calculated for each profession from the number of students and graduates related to that profession (i.e., apprenticeships, courses, and undergraduates) compared to the number in the workforce. This will provide the 'traditional' expansion rate from 'traditional' methods of recruitment in the sector.

[2] A confidence interval is the mean of your estimate plus and minus the variation in that estimate.

- Workforce numbers are directly related to the number of completions per year. For the years 2019-2022, workforce estimates of 164,398 (based on published data) completed 112,388 constructions and domestic retrofits.
- The lower estimate forecast of total completions which is based on the 2019-2022 completion rate is 496,877 cumulative completions by 2030 or 54% of the 2030 targets.
- This forecast is linked to the number of workers in the workforce for 2019-2022, meaning that the current workforce is only 54% of the required workforce to achieve 2030 targets.
- The percentage breakdown of workers in the current workforce of 164,398 is then applied to the 2030 targeted workforce of 304,430 to give a breakdown of specific workers required.
- The predicted workforce based on retirement rates and expansion rates is then compared to the 2030 targeted workforce.

3. Characterisation of the building sector

3.1 Recent Trends in Irish Construction Sector

The global financial crash of 2008 severely impacted the Irish economy and construction sector. There was a significant decline in construction activity with widespread job losses. Many projects were cancelled or put on hold and the housing market experienced a huge decline from its peak in 2007 having 240,000 persons directly employed, in comparison to the lowest figure in 2012 of 81,300, a decline of 66%. The construction sector faced a prolonged period of recovery, but growth resumed in the economy between 2012 and 2019 and the sector grew by 80% in the same period as noted in the *Build 2022: Construction Sector Performance and Capacity* report.

The sector has returned to growth post Covid-19 as public capital investment is increased with The National Planning Framework & National Development Plan 2021-2030 combined to form Project Ireland 2040. The NPF sets the vision and strategy for the development of our country to 2040 and the NDP on providing investment to implement that strategy. Additionally Housing for All and Climate Action Plan 2023, which are government priorities for housing infrastructure, also support climate action mitigation- the objectives of all are outlined in section 4.1.1 below.

The contribution of the construction sector to the Gross Domestic Product (GDP) of Ireland decreased by over two billion euros from 2021 to 2022. Construction's GDP amounted to €11 billion in 2022. Gross Value Add (GVA) for the sector grew by 4.8% to €8.3 billion in 2022 and National accounts show that the official measure of construction investment, Gross Fixed Capital Formation (GFCF) in Building and Construction was valued by the Department of Finance at approximately €31.8 billion (in current prices) in 2022. AECOM's Ireland Annual Review 2022[3] estimated the value of construction output in 2022 at approximately €32billion, up 18% from 2021.

The cyclical or 'boom-bust' nature of the construction industry can lead to fluctuations in employment at any given point in time based on the underlying economy. The composition of employment across the construction sector has been changing in recent years reflecting emerging technological and environmental developments. Developments reflect the increasing importance of Building Information Modelling (BIM), off-site construction, and the additional upskilling needed to enhance the sector's response to the effects of climate change on the built environment. Change in the sector is being driven by the need to improve competitiveness, to address climate change and environmental challenges, and the need for dramatically improved sustainability.

The EPA latest projections Greenhouse Gas Emission Projections 2021 to 2040 June 2023 – Issue specific to the Built Environment include:

- Total greenhouse gas emissions are estimated to have increased by 6 per cent in 2021.
- Planned policies and measures, if fully implemented, could deliver up to 28 per cent (4 per cent per annum) emissions reduction up to 2030.
- Ireland can comply with 2030 EU emissions reduction target only if all planned measures are implemented and delivered as planned.
- The data projects that all sectors need to do significantly more to meet their 2030 National emissions reduction targets.
- Urgent implementation of all climate plans and policies, plus further new measures, are needed for Ireland to meet the 51 per cent emissions reduction target and put Ireland on track for climate neutrality by 2050

[3]AECOM's Ireland Annual Review 2022 available online: https://cloud.comms.aecom.com/ireland-annual-review/

Housing Crisis

According to the Peter McVerry trust[4] a leading homelessness support organization, the most recent figures are that over 12,000 people sought emergency accommodation in Ireland in May 2023 up 2,000 on the previous April (2022); just over 3,500 of which are children. A housing crisis occurs when the cost of housing, be it renting or buying, becomes higher than the income reasonably deemed adequate to meet it. Affordable housing has become a rarity. The housing crisis is a national emergency, successive governments have reduced the State's own capacity to deliver housing and handed housing supply over to the private market. These are the fundamental causes of the housing crisis. Most experts agree that the housing problems in Ireland started in the latter years of the Celtic Tiger, at the start of 2007.

Data collected has determined:

- Most recent numbers from the Central Statistics Office (CSO) place the average weekly earnings at €871.62. That is €3,486 a month which becomes €2,737 after taxes as the take-home average salary.
- The Housing Agency of Ireland recommends a maximum amount to pay towards rent or mortgage of 35% of your monthly disposable income. As the balance of the funds needs to be applied towards other necessities such as food, electricity and gas, transportation, etc.
- The average cost of renting in Ireland is now €1,447 a month.
- A recent report places the average cost of a new home at €262,000 and the average mortgage rate at 2.76%.
- Using a mortgage calculator with the minimum 10% home value deposit payment and the maximum 30-year mortgage brings the average mortgage cost for any new home buyer to €963.88 (including interest payments).

There was almost unanimous agreement among delegates at the 2023 National Economic forum that the lack of homes is one of the most urgent issues faced in Ireland. It was accepted that there is a shortage of serviced building land, a shortage of skilled construction workers, and a bureaucratic planning process which can delay and curtail many proposed housing projects. There is a call for a State-owned national sustainable home building agency, directly building homes, and employing all of the expertise required to satisfy our urgent housing requirements which can deliver housing on a major scale through local authorities and housing associations, Like a One Stop Shop department of housing delivery. It is estimated within three years, the agency should be aiming to directly deliver 10,000 social and affordable homes per year. This would be in addition to the current delivery by local authorities and Approved Housing Bodies, resulting in an overall build of 24,000 social and affordable homes per year - in contrast to just 8,500 social and affordable homes built in 2022 (which is 60 per cent below the Housing For All target of 14,000 per year). These 10,000 homes would include directly building 5,000; refurbishing another 2,000; delivering 3,000 through modular housing delivery, as well as a programme of retrofitting. This state construction entity could also provide the construction skills, co-ordination, and capacity to refurbish, retrofit and upgrade housing and non-domestic buildings. Which would deliver additional benefits of helping to achieve our climate targets in housing and bringing into use our significant vacant and derelict stock.

3.2 Supply Chain overview

The supply chain in the construction sector involves multiple stakeholders and activities to ensure the smooth flow of materials, products, and services from initial planning to project completion. The

[4] Homelessness in Ireland Homepage - Homelessness in Ireland

current material inflation is a result of many factors such as COVID-19, Brexit, supply chain disruptions, increased demand, and the war in Ukraine. International trade was affected because of the pandemic resulting in a restriction in supply and substantial price increases.

Brexit also had a major impact on the price and supply of building materials in Ireland along with delays in shipping and longer lead in times. There are challenges within the industry today with labour shortages and increased labour costs. The invasion of Ukraine has increased energy prices and further disrupted supply chains. According to the Construction Industry Federation's Economic Outlook Survey carried out by Accuracy Research on Construction Industry Federation (CIF) members in September 2022, 96% of construction companies reported a rise in the cost of building materials between June and August 2022. The increasing cost of materials was cited as the top concern for companies (86%), followed by access to skilled labour and cost of labour (both 72%), and the cost of fuel (67%).

3.2.1 Lumber / Timber

The Irish construction sector consumes up to 625,000 m^3 of sawn timber per year and is a mix of domestically grown and imported timber-made up by 387,000m^3 of coniferous sawnwood and 294,000m^3 of coniferous roundwood which supplies the sector from imported timber[5]. Most timber used in timber frame buildings is imported graded softwood from either Scandinavia or from mainland Europe, while most of the domestically grown timber is used for other construction purposes. [6]

According to CSO figures for Wood and Paper Exports and Imports 2021[7], there is significantly higher value of sawn wood and round wood being exported from Ireland than imported into Ireland:

Table 3 Timber Import/Export 2021

Product	Imported (2021)	Exported (2021)	Net Trade
Coniferous Roundwood	€38.08 million	€24.98 million	-€13.10 million
Coniferous Sawn wood	€133.32 million	€229.61 million	€96.29 million
Veneer Sheets and Wood Based Panels*	€174.67 million	€343.06 million	€168.39 million
Secondary Wood Products**	€607.78 million	€113.87 million	-€493.91 million
TOTAL	**€953.85 million**	**€711.52 million**	**-€242.33 million**

* Includes veneer sheets, plywood, particle board, oriented strand board, fibre board, hardboard, medium and high-density fibre board, and other fibre board.
** Includes further processed sawn wood, wood products for domestic use, for construction and for furniture making.

[5] https://www.cso.ie/en/releasesandpublications/ep/p-wpei/woodandpaperexportsandimports2021/#:~:text=Imports%20of%20wood%20and%20paper%20products%20were%20%E2%82%AC2%20billion%20in%202021&text=Exports%20of%20Coniferous%20sawnwood%20at,%E2%82%AC193%20million%20or%2019%25.

[6] Irish Construction News, 2021, Counting the building materials costs, article is available online here: https://constructionnews.ie/counting-the-building-materials-costs/

[7] CSO Database, Wood and Paper Exports and Imports 2021, available online: https://www.cso.ie/en/releasesandpublications/ep/p-wpei/woodandpaperexportsandimports2021/#:~:text=Imports%20of%20wood%20and%20paper%20products%20were%20%E2%82%AC2%20billion%20in%202021&text=Exports%20of%20Coniferous%20sawnwood%20at,%E2%82%AC193%20million%20or%2019%25.

This table provides an interesting insight into the types of wood products that are being produced in Ireland for the construction sector. With a large amount of sawn wood which includes sleepers, planks, beams, etc. and wood-based panels being exported from the country. Meanwhile the market is very reliant on imports of secondary wood products, and perhaps an opportunity to increase secondary wood products production in Ireland.

In attempting to quantify the volume of imported and exported roundwood figures, using CSO figures for 'Wood Input Purchases by Industry 2021'[8], 3.2 million m^3 of roundwood was purchased in 2021 in Ireland, up 4.8% from 2020, of which 64% was purchased from publicly owned forests. which is based on data collected from the 2021 Wood Inputs Survey conducted by the CSO. The survey was designed to capture information on purchases of roundwood and non-roundwood forest products from forests in Ireland.

The breakdown of wood purchases by product for 2021 is shown below:

Table 4 The breakdown of wood purchases by product for 2021

Product	% of Purchases	m^3	Description[9][10]
Large Sawlog	42%	1,343,000	Sawlog Is cut from the lower section of the tree at the later thinning. Large Sawlog is typically 4.9m in length with a minimum diameter of 20cm, small sawlog is typically 3.1-3.7m in length and has a minimum diameter of 14cm.
Small Sawlog / Boxwood / Pallet wood	26%	827,000	
Pulpwood	26%	819,000	Are cut from the top of the tree during the first and second thinning, pulpwood is used for Wall Panels.
Stake wood	2%	67,000	is cut from the middle section of the tree during the first thinning. It is used for stakes and fencing products.
For Biomass	5%	155,000	Cut during the first and second trimming or as waste products of other processes. Sometimes referred to as Energy wood.
TOTAL	-	**3,211,000**	-

Even with the larger export of sawn wood, according to the CSO's 'Wholesale Price Index', timber prices had an annual increase of 30% for rough timber (including plain sawn) from 2020 to 2021 and there was also an annual increase of 33.7% for other non-hardwood timber. This was stated to be mainly due to a backlog in the issuing of tree-felling licenses which contributed to a shortage of domestically grown

[8] CSO Database, Wood Input Purchases by Industry 2021, available online: https://www.cso.ie/en/releasesandpublications/ep/p-wipi/woodinputpurchasesbyindustry2021/

[9] VEON, 2022, Wood Products, Article, available online: https://www.veon.ie/wood-products.html

[10] Farmers Journal, 2022, Selling Timber: as the sawmillers sees it, Article, available online: https://www.farmersjournal.ie/selling-timber-as-the-sawmiller-sees-it-686037

timber, which led to sourcing timber from overseas, the issue is currently being reviewed by the Forestry Appeals Committee and the number of licenses increased in 2021.[11]

3.2.2 Iron / Steel

Domestically produced steel ceased in 2001, before which only one Electric Arc Furnace was in operation which produced steel from recycled and scrap steel[12] (Duffy et al., 2021), therefore after this all steel used in Ireland is imported. Steel commodities are categorised by shape rather than application. Architectural Research Ltd reported in 2021 that average Irish values of 737 kgCO2e/tonne for steel reinforcement and 2630 kgCO2e/tonne for cold rolled steel coil.

Irish construction is impacted and influenced by the global steel trade. As it is an essential building product, steel also underwent substantial price hikes during 2020 and to date in 2021. During 2020, steel was hit by shortages and price rises, with demand growing faster than the industry could produce product. In addition, the cost of iron ore used to make steel almost doubled, resulting in huge jumps in the price of steel products.

Recycling of steel in Ireland

EPA[13] figures for recycling of steel in Ireland 2020 demonstrate with an overall metal recycling rate of 71% - an increase from 69% in 2019. Ireland is already surpassing the 2025 EU recycling target of 50%. And that the recycling rate for ferrous metals was 79%, 37,966 tonnes, which surpassed the 2025 EU target of 70% but slightly below the future EU target of 80% for 2030.

Steel production is a significant part of global CO_2 emissions. It is estimated that steel is responsible for 11% of Global CO_2 emissions. It has been calculated that 1.78[14] tonnes of CO_2 is reduced for each tonne of scrap steel that is recycled in comparison to crude steel production

3.2.3 Concrete / Cement

The Irish Concrete Federation is the national representative organisation for the Irish aggregates and concrete products industry. It has 74 members and associate members operating at approximately 300 locations throughout the country. Concrete currently shapes the built environment around us, from schools, hospitals and housing to infrastructure. Concrete is the most used made material in the world, with three tonnes used annually for each man, woman and child. Indeed, there is twice as much concrete used globally when compared to of all other building materials combined, including wood, steel, plastic and aluminium.

[11] Irish Construction News, 2021, Counting the Building Materials costs, article, available online: https://constructionnews.ie/counting-the-building-materials-costs/

[12] Whole life carbon quantification of the built environment: Case study Ireland Richard O Hegarty, Oliver Kinnane- School of Architecture Planning and Environmental Policy, University College Dublin, Ireland

[13] https://www.epa.ie/our-services/monitoring--assessment/waste/national-waste-statistics/packaging/#:~:text=Metals%3A%20with%20an%20overall%20metal,2030%20EU%20target%20of%2080%25.

[14] https://www.sustainable-ships.org/stories/2022/carbon-footprint-steel#:~:text=Steel%20carbon%20footprint&text=The%20IEA%20estimates%20that%20direct,of%20CO2%20per%20ton%20steel.

ICF research carried out in 2021 shows that the basic construction materials supplied by quarry operators, ready-mix concrete suppliers and other concrete product suppliers accounted for less than 4% of the cost of building a three-bedroomed semi-detached house in the greater Dublin area.

The ICF aims to have a fully resourced sustainability function within the federation in the coming months. A series of environmental product declarations (EPDs) are currently in development, which the ICF hopes will inform and assist the construction sector when it comes to concrete design and construction.[15]

In 2021:

- aggregate amounted to approx. 38 million tonnes.
- ReadyMix concrete was 4.75 million m^3
- Concrete blocks were approx. 135 million units.
- Value of exports of pre-cast concrete was approx. € 135 million.

Table 5 Cement Import/Export 2021

Product	Imported (2021)	Exported (2021)	Net Trade
Cement	€200.4 million	€370.2 million	€169.8million
TOTAL	**€200.4 million**	**€370.2 million**	**169.8 million**

While Ireland's production industry has seen a decline in several sectors, the Irish cement industry has seen a positive increase in production figures and is now net exporter of cement. An EPA report regarding process-based emissions figures for cement including an IPCC conversion factor calculates, 0.507 kgCO2e per kg of cement produced. There are three key technologies that can provide more than four fifths of the concrete emissions savings that are possible by 2030:

1. The first is to replace clinker with substitute cementitious materials (SCMs), which include waste from steel production and coal-fired power stations, as well as limestone calcined clay, which requires a lot less heat to produce and can replace up to half of the clinker used to make cement.

2. The second and more significant savings come from using biomass, refuse-derived fuels (RDF) and municipal solid waste (MSW) as alternative fuels to heat the kilns. It is also possible to recover the waste heat from the production process to generate power that can be used elsewhere in the cement production process.

3. The final solution is applying AI to the cement production process, to ensure the most efficient use of energy and to blend SCMs into the mix. When it comes to introducing SCMs, the mix needs to be optimized as it is more variable than clinker, and AI is very well-suited to that. Another emerging technology is Biochar which is added and stored in the concrete removing carbon from the atmosphere for centuries. Concrete may thus no longer be a net emitter as this technology has the potential to become a carbon sink. Concrete containing plant carbon (Charcrete) can be used in all construction projects to improve their Life Cycle Assessment.

[15] Irish Construction News, 2022, Concrete – Irish Concrete Federation, Article, available online: https://constructionnews.ie/concrete-irish-concrete-federation/

Concrete therefore has the potential to not only can become carbon neutral in its carbon footprint, but even climate positive, and with improved material properties as well. This is possible by replacing the scarce and conflictual ingredients sand and gravel for concrete with locally and produced biochar. Just adding one percent by mass of biochar to concrete could sequester about 20% of the annual CO2 emissions caused by the cement industry.[16]

3.2.4 Labour

The construction sector is one of Ireland's biggest employers. In 2022, the industry supported over 220,000 jobs across the entire economy or 9% of the workforce, directly and indirectly, in small communities and urban centres across the country.

Table 6 Construction Statistics 2022

Construction Statistics	2019	2020	2021	2022
Direct employment in sector (thousand)	145,600	136,400	158,300	171,000 (Q3)
Direct and Indirect employment - Built Environment Sector - indirect employment equals 30% of total approximately (thousand)	205,400	177,320	205,790	222,300
Total employment	2,357,300	2,276,800	2,140,000	2,531,000
Proportion of construction employment v total employment in economy and expressed as a %	9%	8%	10%	9%

Skills and labour shortages are a key issue within the sector as companies struggle to recruit and retain skilled workers. Access to skilled labour and the cost of labour across all disciplines is a concern. A full analysis of the current labour force is outlined in section 8.3 Construction Sector Workforce.

Migrant workers play a key role in addressing skills and labour shortages in the sector. Future Building, an initiative operated through Intreo (part of the Department of Social Protection), SOLAS and Education and Training Boards aims to address construction sector capacity issues by matching vacancies to jobseekers seeking employment and referring to education and training, as required. This is achieved by driving national and international recruitment activities, with the support of the Intreo team and EURES who promote opportunities across the EU/EEA.

In Ireland, the work was initially focused on unskilled or low-skilled workers to attract them into jobs and training opportunities within the Irish construction sector. The Future Building team is now also focusing on construction recruitment opportunities for those with professional qualifications and

[16] https://biochar-zero.com/construction-industry/biochar-in-concrete/

experience. In June 2023, as part of Future Building recruitment campaign, approximately ten Construction Industry Federation (CIF) member companies travelled to South Africa to interview for a variety of vacancies as detailed in the following table. The outcome of the recruitment campaign is yet to be determined but it highlights the skills shortages that currently exist in the industry.

Table 7 Future Building recruitment campaign skills shortages overview

Role	No of Positions
Ancillary Support	2
Electrical	22
Engineering	74
Health & Safety	8
Project Manager	16
Qualified Trade	15
Site Manager	21
Surveyor	23
Grand Total	**181**

Work Permits

To assist with the skills and labour shortages, CIF are continuously reviewing occupations where skills and labour shortages exists with a view to moving them to the General Employment Permit list or the Critical Skills Permit list, as applicable. To address shortages in the construction sector an additional eight categories were made eligible for a general employment permit on 28 October 2021 which essentially ensured that almost all construction roles can access the employment permit system. Although the numbers are small, work permits are one of the ways of addressing skills and labour shortages in the industry.

Table 8 General Employment Permit 2022

Permits issued for Construction Roles				
	2020	**2021**	**2022**	**2023 (To May)**
Electrician and electrical fitters			13	2
Bricklayers and masons	7	21	90	26
Roofers, roof tilers and slaters			8	5
Plumbers and heating and ventilating engineers			47	10
Carpenters and joiners	131	117	184	55
Floorers and wall tilers			17	2
Painters and decorators			31	6
Construction and building trades supervisors	2	10	24	6
Total	**140**	**148**	**414**	**112**

Table 9 Top Ten Construction Occupations Issued in 2020

Top Ten Construction Occupations Issued in 2020
Civil engineers
Carpenters and joiners

Construction project managers and related professionals
Mechanical engineers
Welding trades
Plasterers
Quantity surveyors
Electrical engineers
Design and development engineers
Engineering professionals n.e.c.

Figures relating to the informal economy were not available. However, with the establishment of a new Statutory Register know as Construction Industry Register Ireland (CIRI), it will become mandatory for builders to join the Statutory Register, and this is seen as a mechanism to address this matter in the industry.

3.3 Market Trends

3.3.1 Tighter energy performance for New Build and Retrofit

There have been recent trends in the construction sector towards tighter energy performance for New Build and Retrofit. These include Part L - Conservation of Fuel and Energy for Dwellings and Technical Guidance Document Part L - Conservation of Fuel and Energy - Buildings other than Dwellings which sets out the minimum energy requirements for new builds, and for deep renovations.

There is evidence to suggest that if a significant retrofit is implemented without adequate ventilation there can be issues with indoor air quality.[17] This positive, raising of required retrofit standards as outlined in TGD Part L, through homeowners' feedback is, due to their cost benefit analysis which includes Internal Environmental Quality (IAQ) too, not just short-term financial savings. It is demonstrable that a holistic overview is now being taken of the overall benefits of deep retrofits.

3.3.2 Carbon cost of Materials

There is growing awareness to the amount of embodied carbon within construction materials and the need for Life Cycle Assessments (LCA) on buildings. Governments are creating policy and legislation in this area to achieve climate targets. Table 3 shows such examples:

Table 10 Policy / Legislation examples of LCA and embodied carbon actions

Country	Policy / Legislation Description
Denmark	The national strategy for sustainable construction is a government action plan which sets out a staged phasing in and tightening of targets combining embodied CO2 emissions and operational CO2 emissions for buildings between 2023 and 2030[18].

[17] IGBC, 2023, Healthy Homes Ireland call on Government to address poor indoor environments, article, available online: https://www.igbc.ie/healthy-homes-ireland-call-on-government-to-address-poor-indoor-environments/

[18] Passivehouseplus, "Passivehouseplus _ denmark sets out phased embodied carbon targets for buildings," [Online]. Available: https://passivehouseplus.co.uk/news/general/denmark-sets-out-phased-embodied-carbon-targets-for-buildings

France	The National Low Carbon Strategy is the French roadmap to climate neutrality by 2050. Within the building section the strategy will promote construction and renovation products and equipment with a lower carbon footprint (from the circular economy or bio-based) and high energy and environmental performance throughout their life cycle[19]
Netherlands	The 2012 National Building Regulations introduced mandatory LCA for new buildings[20]

There is currently no legislative approach in Ireland that deals with the carbon cost of material or life cycle analysis in new residential building or retrofitting. In an Irish context the decision to opt for a low or zero embodied carbon material remains with the client and/or specifier of the project.

3.3.3 Retrofitting Traditional Buildings

The 2018 Deep Energy Renovation of Traditional Buildings report[21] on behalf of the Heritage Council and ICOMOS Ireland state that one-sixth of Irish dwellings are traditionally built. These dwellings will require a different approach to retrofitting as there are risks to both the building and occupants if the same energy efficiency methods to modern construction are applied. The Department of Culture, Heritage and the Gaeltacht are leading the development of a retrofitting guidance document for traditionally built buildings, included are the Department of Housing, Planning and Local Government, the Department of Communications, Climate Action and Environment and the Sustainable Energy Authority of Ireland. For Traditional Buildings, a renovation can be grant aided by using certain measures that are installed by certified contractors. Various requirements must be adhered to, such as a Conservation Architect may be required to consult.

One of the key characteristics of traditional buildings is that they are constructed of solid masonry walls that are 'breathable', i.e., the building fabric allows moisture to be absorbed and released cyclically. This form of construction relies on vapour permeable materials and higher levels of ventilation to ensure the well-being of the building fabric and the internal environment. It is also recognized that moisture can damage the structure and internal environment of traditional buildings. Until recently, most standards for buildings have been primarily concerned with the design and construction of new buildings. Now more attention is focussing on the important aspect of retrofit and the renovation of existing buildings, especially older, solid-wall buildings, where issues of moisture movement and risk are of a different nature from those found in new cavity construction. DASBE (Digital Academy for Sustainable Built Environment) and other 3rd level educational institutes are currently providing training and upskilling to construction specialists in the field of conservation and energy efficiency. Currently there are over 250,000 traditional buildings in Ireland which can play a significant role in meeting our climate targets while retaining buildings of significant heritage value and supporting in decarbonisation efforts.

[19] UNFCCC, "UNFCCC Overview of revised national low carbon strategy of France," [Online]. Available: https://unfccc.int/sites/default/files/resource/en_SNBC-2_summary_4-pages.pdf

[20] EURIMA, "Life Cycle Assessment of Buildings," 2017. [Online]. Available: https://www.eurima.org/uploads/ModuleXtender/Publications/170/Eurima_LCA_WhitePaper_Final_20170915.pdf.

[21] C. E. Purcell, "Heritage Council Deep Energy Renovation of Traditional Buildings," March 2018. [Online]. Available: https://www.heritagecouncil.ie/content/files/Deep_Energy_Renovation_of_Traditional_Buildings.pdf

3.3.4 Indoor Air Quality and Radon Gas

In 2021, a team from the National University of Ireland Galway school of Physics conducted one of the first studies of its kind to quantify the impact of improved energy-efficiency, airtightness, and radon levels in buildings. The study showed that if appropriate ventilation measures were not considered during the retrofitting process there is a potential for radon levels to more than double[22] and noted 'It is important that in our drive to make our buildings more energy efficient and reduce greenhouse gas emissions that we do not introduce additional risks of negative outcomes. The research findings highlight that radon, and indoor air quality overall, needs to be given due consideration as a key element of any proposed retrofitting works'[23]

3.3.5 Heat Pump Refrigerants

Refrigerants are vital aspects within the operation of Heat Pumps. They are a critical component of Heat Pump technology as they can easily evaporate and condense in a continuous cycle which is essential for achieving the thermal efficiency of HP's. One important challenge to climate change is the measure of a refrigerant's Global Warming Potential (GWP) which describes the global warming impacts of different gases. "Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2)"[24]. The EU regulatory action is known as the F-Gas Regulation, it was adopted in 2006 and further updated in 2015. The goal of the regulation is by 2030 to cut EU F-gas emissions by two-thirds compared to 2014 levels. The F-gas goal and regulation will further impact the HP equipment market by:

- Phased down of virgin HFC's – Reused HFC's are not subject to the phasing down.
- Reduced charge – Charge is the term that refers to the amount of refrigerant in a HP.
- Use of lower GWP refrigerants.
- Use of refrigerants with zero GWP.
- Refrigerant re-use at end of equipment life.

3.3.6 Microgeneration Feed in Tariffs

The emergence of smart meters, microgeneration feed in tariffs and potentially demand response tariffs can lower utility bills for consumers and take pressure off the energy generation, transmission, and distribution systems. If significant portions of society shift part of their electricity demand towards night and non-peak hours, it can drastically reduce strain on public grids and it guarantees a steadier supply of both energy and balance the grid frequency without too much reliance on fossil fuels.

Energy storage systems will also have a major impact on grid stability. Residential battery storage systems can also help manage demand by making people more independent from the national energy supply and can also add to the grid by feeding back stored energy when demand is higher than supply. Tariffs will provide the opportunity for optimisation of offerings, for example when commissioning a heat pump system, it would be worthwhile liaising with the customer to set up the heat pump

[22]NUI Galway, "Nuigalway_News and Events_Researchers caution over retrofitting and radon," [Online]. Available: https://www.nuigalway.ie/about-us/news-and-events/news-archive/2021/march/researchers-caution-over-retrofitting-and-radon.html.

[23] J. McGrath, M. Byrne, J. O'Donnel and R. Aghamolaei, 2021 "Factors influencing radon concentration during energy retrofitting in domestic buildings: A computational evaluation," Building and Environment, vol. 194,.

[24] United States Environmental Protection Agency, "EPA GWP," [Online]. Available: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

according to their tariff, e.g., to charge the hot water tank at times of low electricity price, etc. also turn off a heat pump at times when the grid is under pressure by using digital software and set-points.

4. National policies and strategies to contribute to the EU 2030 energy and climate targets in buildings.

4.1 National Policies and Strategies regarding Energy

Since the previous (2014) Build Up Skills Roadmap, Ireland and the European Union have put in place a significant quantity of policies and associated strategies to address climate change. This section outlines the current and planned policies and strategies that relate to the built environment.

4.1.1. Key national policies

Under the Climate Action and Low Carbon Development (Amendment) Act 2021, Ireland has committed to reducing its greenhouse gas emissions by 51% by 2030, and to reach carbon neutrality by 2050. The act also introduced economy-wide carbon budgets and sectoral emissions ceilings.

Clean version 14 09 2022 Sectoral Emissions Ceilings Summary report - 2ebb2431-d558-4a54-a15c-605817c37b2f.pdf (www.gov.ie)

To deliver on these targets, Climate Action Plans (CAPs) have been developed since 2019. The Climate Action Plan 2023 (CAP23) was the first to be prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021. The plan was developed based on cross sector modelling and analysis and sets out a roadmap to halve Ireland's emissions by 2030 and reach net zero no later than 2050. A supplementary *Annex of Actions* (7th March 2023) outlines the actions required, outputs, lead departments, timelines, and stakeholders. CAP 23 sets out ambitious targets for energy efficiency regarding new build and renovation. There is also due regard for other key challenges, such as addressing, whole life carbon emissions, compact growth, circularity, and biodiversity loss. Responsibility for Implementation of CAP23 is distributed among all government departments, all reporting back to Department Environment, Climate and Communications within set timelines.
CAP23 includes key targets for the residential sector as follows:

1. All new dwellings to be designed and constructed to Nearly Zero Energy Building (NZEB) standard by 2025, and Zero Emission Building (ZEB) standard by 2030.
2. Equivalent of 120,000 dwellings retrofitted to BER B2 or cost optimal equivalent by 2025 and 500,000 dwellings by 2030.
3. Up to 0.8 TWh of district heating installed capacity by 2025, and up to 2.5 TWh by 2030
4. 170,000 new dwellings to be using heat pumps by 2025, and 280,000 by 2030.
5. 45,000 existing dwellings to be using heat pumps by 2025, and 400,000 by 2030.
6. Up to 0.4 TWh of heating provided by renewable gas by 2025, and up to 0.7 TWh by 2030

These targets are fully aligned with the targets included in Ireland's Long-Term National Renovation Strategy. However, the National Long-Term Renovation Strategy also includes a target of retrofitting a third of non-residential buildings to a BER B (or higher) by 2030.

The CAP23 includes several measures & actions which are directly relevant to BUSI2030 including:
Built environment:

- Implement an ambitious National Residential Retrofit Plan
- Strengthening existing Building Regulations.
- Supporting the growth and development of district heating, electrification of heating and geothermal energy.
- Developing a roadmap to support the decarbonisation of commercial buildings.
- Introducing additional supports for the public sector to decarbonise it's building stock.

De-carbonisation:

- Government has already committed to retrofit 500,000 homes by 2030.

- All new dwellings will be designed and constructed to Nearly Zero Energy Building standard by 2025, and Zero Emission Building standard by 2030.
- Whole Life Carbon: References to further measures from future EU Regulations.

Research & Innovation:

- Significant funding to research-performing organisations to carry out climate-relevant research.

Circular Economy:

- Implement the Waste Action Plan for a Circular Economy and the Whole-of-Government Circular Economy Strategy.
- Construction is one of the priority areas for prevention planning.
- Encourage recycling and reuse.
- Reduce emissions from F-gases.

Climate Adaptation:

- Every Local Authority will develop a Climate Action Plan covering mitigation and adaptation.

In relation to the public sector and as per developments at EU level (e.g., Energy Efficiency Directive), CAP23 highlights the importance for the public sector to lead by example on climate action across its buildings, transport, waste and energy usage, as well as wider society. More specifically, the following actions should be implemented: Strengthening climate governance frameworks in public sector bodies; Retrofitting public sector buildings (Deliver a strategy to achieve at least a 51% reduction in GHG emissions and a 50% improvement in public sector energy efficiency by 2030); Fully implementing green public procurement, as a way to drive changes in the market; Increasing climate literacy in the public sector. A Local Authority Planning Sector Learning and Development Strategy was prepared by the Office of Planning Regulator (OPR) & County and City Management Association (CCMA) & Local Government Management Agency (LGMA) in 2022. This report assessed the needs required, training plans for immediate, intermediate and Leadership Training provision for all staff involved in delivering planning functions in Local Authorities and elected members. Besides ambitious climate and energy targets, Ireland has set ambitious targets in relation to new build. This is to deal with a growing population and housing shortages.

The Government's Housing for All plan states that there are not enough houses to buy or rent in the private sector and not enough social housing being built. Under Housing for All, the Government has pledged to build an average of 33,000 new homes annually from 2021 to 2030. To reach these goals, the State intends to spend €4 billion a year to 2030 on various State interventions and capital investments. However, recent carbon modelling reports show that to meet Ireland's housing needs and climate targets, it would also be important to consider how additional high-quality housing can be delivered through the retrofit and renovation of derelict or underused properties. Delivering an average of 33,000 homes annually and retrofitting 500,000 homes by 2030, will require an expansion of the current workforce.

Other relevant policies include Project Ireland 2040 is the government's long-term overarching strategy to make Ireland a better country for all and to build a more resilient and sustainable future. The National Planning Framework (NPF) and the National Development Plan 2021-2030 (NDP) combine to form Project Ireland 2040.
The new NDP was created in alignment with the National Planning Framework (NPF) in order to deliver the correct type of housing to meet future needs. As part of the development of the new NDP a climate assessment was done to evaluate the impact each scheme would have on the planet. The assessment was done under: Climate Mitigation, Climate Adaptation, Water Quality, Air Quality, Waste and Circular Economy, Nature and Biodiversity, and Just Transition. Public funding to the amount of 165 billion euros has been allocated for the span of the 10 years to improve the national infrastructure and housing to facilitate the socio-economic growth to come over the next decade. There are ten main aims of NDP and three of them are relevant to the construction sector. 1 Compact Growth; 2 Strong Economy

Supported by Enterprise, Innovation and Skills; 3 Climate Action. There are competing priorities between the deliverables within Project Ireland 2040 and the CAP23 targets.

4.1.1 NECP and Long-Term Renovation Strategies

In accordance with the Governance of the Energy Union and Climate Action Regulation, Ireland's draft *National Energy & Climate Plan (NECP) 2021-2030* was submitted to the European Commission in December 2018. The draft NECP considered energy and climate policies developed up to that point, the levels of demographic and economic growth identified in the Project 2040 process and included all of the climate and energy measures set out in the National Development Plan 2018-2027.The NECP was prepared to incorporate all planned policies and measures that were identified up to the end of 2019, and which collectively deliver a 30% reduction by 2030 in non-Emissions Trading System(ETS) greenhouse gas emissions (from 2005 levels).

Under the *Programme for Government, Our Shared Future,* Ireland is committed to achieving a 7% annual average reduction in greenhouse gas emissions between 2021 and 2030. The NECP was drafted in line with the current EU effort-sharing approach, before the Government committed to this higher level of ambition, and therefore does not reflect this higher commitment. Ireland is currently developing those policies and measures and intends to integrate the revision of the NECP into the process which will be required for increasing the overall EU contribution under the Paris Agreement.

4.1.2 National Recovery and Resilience Plan

In 2021, Ireland published its Ireland's National Recovery and Resilience Plan 2021 is to contribute to a sustainable, equitable, green, and digital recovery effort, in a manner that complements and supports the Government's broader recovery efforts. The National Recovery and Resilience Plan represents a first step to significantly reform and direct relevant funding towards decarbonising projects such as retrofitting, ecosystem resilience and regeneration, climate mitigation and adaptation, and green data systems. Several reforms and investments supported by the Plan related to the built environment and skills including:

Priority 1: Advancing the Green Transition

1.1 De-risking a Low-Cost Residential Retrofit Loan Scheme
1.2 Accelerate Decarbonisation of the Enterprise Sector
1.3 Public Sector Retrofit Pathfinder Project and Public Sector Buildings' Energy Retrofit

Priority 2: ***Accelerating and Expanding Digital Reforms and Transformation***

2.7 - Addressing the Digital Divide and Enhancing Digital Skills

Priority 3: ***Social and Economic Recovery and Job Creation***

3.1 - Work Placement Experience Programme (WPEP)
3.2 - SOLAS Green Skills Action Programme
3.3 - Technological Universities Transformation Fund
3.8 - Increasing the Provision of Social and Affordable Housing

Additional key National Strategies and Plans include:

- Whole of Government Circular Economy Strategy 2022 – 2023
- National Retrofit Plan 2022
- Places for People: The National Policy on Architecture 2022
- Social Housing Strategy 2020
- Build 2022: Construction Sector Performance and Capacity

- Waste Action Plan for a Circular Economy Communications 2021
- The Circular Economy Programme 2021-2027: *(EPA) 2021*
- Future Jobs Ireland 2019
- Global Ireland: Ireland's Global Footprint to 2025
- 2022 - Energy Poverty Action Plan
- Slaintecare – Healthcare

In addition, a number of multi-disciplinary National Advisory Groups have been established to inform Central Government:

- Construction Sector Group: Open Dialogue between Government & Industry Expert Group on Future Skills Needs (From Department of Public Expenditure and Reform 2018); Within this advisory group there are cross industry sub-groups including Innovation & Digital Adoption; Sustainability & Climate Action;
- Climate Change Advisory Council (From Climate Action and Low Carbon Development Act 2015);
- Addition groups include Industry Capability Group; Housing MMC Leadership & Integration Group; Climate Ireland; proposed Working Group: Wood in Construction;
- National Skills Council; Expert Group on Future Skills Needs (EGFSN); the Skills and Labour Market Research Unit (SLMRU);
- Citizens Assembly (since 2016); e.g., Citizens Assembly on Biodiversity 2023
- The Climate Conversations forum are a core component of the annual National Dialogue on Climate Action (NDCA) programme, which now will feed into ongoing work on Climate Action Plan 2024.

Within industry there is there are a number of cross-disciplinary groups including: Construction Industry Council, MMC Ireland, Lean Construction Ireland, BIM Heros Network and Construction Information Services.

There are a number of national programmes & funding supports in place to address specific built environment challenges. Within the Sustainable Energy Authority of Ireland (SEAI) there are a number of initiatives in place for residential and commercial projects including:

Table 11 Overview of Schemes in Ireland

Name	Description
RESIDENTIAL	
SEAI Energy Academy	Offers free courses on a variety of energy and climate-related topics
Individual Homes Energy Upgrades Scheme	Grants to plan and manage home energy upgrade – up to 80% funded.
Fully Funded Homes Energy Upgrades Scheme	The scheme offers 100& funded energy upgrades for eligible homeowners who are most at risk of energy poverty.
Community Energy Grant Scheme	Engagement with schools and communities across Ireland to change the way your community thinks about energy
One Stop Shops	Offer homeowners all the services required for a complete home energy upgrade. Homes owned by private homeowners, non-corporate landlords and Approved Housing Bodies are eligible for the scheme
Local Authority Energy Efficiency Retrofit Programme	A range of measures aimed at driving demand for retrofit, expanding the size and capacity of the supply chain, as well as making retrofits more affordable
COMMERCIAL	
Energy Audits	A voucher of €2,000 towards a professional energy audit on your business premises
Community Energy Grant	For energy efficiency in community projects, including businesses, grants available of typically 30% of project costs
SSHR **(Support Scheme for Renewable Heat)**	For heat pumps & biomass in replacing fossil fuels. Investment aid, but also ongoing operational aid over 15 years available
EXEED (Excellence in Energy Efficient Design)	Certification & Grant scheme, standardising design & implementation approaches with up to €3M per project
Non-Domestic Microgen Scheme	For installation of Solar PV panels. Up to €2400 available
Accelerated Capital Allowance	A tax incentive scheme promoting investment in energy efficient equipment and products by businesses

4.1.3. The impact of EU Policies

The main driver for carbon related building regulation in Ireland to date has been the EU directives on energy, primarily the Energy Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED). Under the European Green Deal, the EU has agreed even more ambitious carbon reduction goals, with "Fit for 55" setting a target of a 55% greenhouse gas (GHG) emissions reduction by 2030 as a necessary intermediate step towards the long-term goal of Net Zero GHG emissions by 2050. In Ireland, the Department of Housing, Local Government and Heritage is the lead department for the implementation of the EU Energy Performance of Buildings Directive (EPBD) and Renewable Energy Directive (RED) / RES. The Department of Environment, Climate and Communications is the lead department for the implementation of the EED.

The following is a high-level summary of the EU Directives and relevant impact on Skills and the requirements for action by the Government of Ireland, in particular EPDB impacts.

Table EU Directives Overview

Directive/Regulation	Current version – Relevant Highlights	Potential revision – Relevant highlights
EED (Energy Efficiency Directive) IS 399:2014 (EED (2018/2002)	-Support public bodies, providing guidelines, promoting competence building, skills acquisition, and training opportunities (note: Article 6 re 3% floor area of public building stock renovation). -Establish a network ensuring EE professions match market needs -Promote participation in certification, training, and education programmes, in particular are GPP	Revision unknown
RED (Renewable Energy Directive):	-Create Certification schemes for installer and designers of all RES H&C systems -Training provider to ensure adaptation of training to new RES technologies in buildings	Revision unknown
EPBD (Energy Performance of Buildings Directive) EPBD (2018/844/EU)	-Collate Data (e.g., NZEB, BERs) on construction workforce and measures to upskill & education & training to ensure sufficient skilled workforce.	-A new ZEB standard which does not cause any on-site carbon emissions from fossil fuels -The inclusion of a Declaration of Global Warming Potential on Building Energy Rating Certificates -Mandatory Whole Life Carbon (WLC) assessment at building design stage -The introduction of Building Renovation Passports -The introduction in legislation of Minimum Energy Performance standards for all buildings

		-Mandatory installation of rooftop solar panels on all buildings, with earlier dates for public buildings -A rescaling of the existing Building Energy Rating (BER) scale, information on which will need to be shared with the general public, construction professionals and other stakeholders. -Establishment of supports for citizen led renovation initiatives

A number of other EU policies are also likely to have an impact on the built environment in the next decade. These include the Renovation Wave, the EU Taxonomy, the New European Bauhaus, the Climate Adaptation Strategy, the Construction Products Regulation, the EU Nature Restauration Law and the EU Framework for Sustainable Buildings Level(s). Level(s) is an EU initiative that joins up sustainable building thinking across the EU by offering guidance on the key areas of sustainability in the built environment and how to measure them during design and after completion.

Table Eu Policies levels

What is Level(s) and Why is it Important?	
Level(s) is the first-ever European Commission framework for improving the sustainability of buildings, living by the values of flexibility, resource efficiency, and circularity. Level(s) is mentioned in key EU Policy related to the built environment including the Renovation wave, the Circular Economy Action Plan, the New European Bauhaus, and the EU Energy Efficiency Directive, as a framework for construction and buildings to increase sustainability, and for use in Green Public Procurement. The draft Energy Performance of Building Directive (EPBD) will require disclosure of whole life carbon in accordance with the Level(s) framework by 2027 for large new buildings and all new buildings by 2030. Level(s) is included in national policy documents such as in Irelands' new National Policy on Architecture published in 2022 as 'essential in order to make comparable assessments, identify key performance indicators and understand the quality of development and its impact on natural and culturally significant sites'. The EPA Green Public Procurement Guidance for the public sector also references the use of EU Level(s) Framework.	Level(s) is based on 6no. overarching macro-objectives: 1. Greenhouse gas emissions along a building's life cycle. 2. Resource efficient and circular material lifecycles; 3. Efficient use of water resources; 4. Healthy and comfortable spaces; 5. Adaptation and resilience; 6. Optimised life cycle cost and value

Regarding Skills, the intent at EU level for funding pilot training modules, incentivising partnership creation and capacity building and mass-scale training targets will need to be prioritised and supported by National Initiatives. In addition, monitoring, maintenance, and repair services need an equal level of input within an overall improved fully digitalised procedure. Under the European Skills Agenda - Employment, Social Affairs & Inclusion - European Commission (europa.eu) the Pact for Skills - Employment, Social Affairs & Inclusion - European Commission (europa.eu) Initiative was launched in November 2020. In March 2023, the EU published Transition Pathway for Construction.

The Transition Pathway for Construction 2023 advises that as part of the Green Deal Industrial Plan, the EU Commission is planning to establish a Heat Pumps skills partnership, as well as a Net Zero Industry Academy to offer on-and offline trainings for sustainable construction with a focus on the use of biobased materials, circularity, and digital technologies.

4.1.4. National Building Regulations and RES Obligations

In Ireland, Building Standards are governed by the Building Control Acts of 1990 and 2007, the Building Regulations 1997-2022 and the Building Control Regulations 1997 - 2021. These pieces of legislation set out the minimum legal requirements for the design, construction, and certificate of buildings in Ireland and include guidance on construction products and materials.

The Building Regulations set out 12 Technical Guidance Documents (TGDs), (classified as Parts A to M with some having two parts), and cover a wide range of areas, including structural integrity, fire safety, energy and conservation, access for people with disabilities and ventilation. TGDs accompany each part of the Building Regulations indicating how the requirements of that part can be achieved in practice. Adherence to the approach outlined in a Technical Guidance Document is regarded, as evidence of compliance with the requirements of the relevant part of the Building Regulations.

The Technical Guidance Documents have developed over the years, since being introduced in 1991, to become a comprehensive suite of guidance documents encompassing the design, workmanship, materials, installation, testing, commissioning, and verification of construction related works. The Professional bodies and Construction industry have embraced this process and have produced a suite of Ancillary Certificates to certify the design, installation, testing, commissioning, and verification processes allowing for greater accountability and comfort for both Building Control and the end user.

The Building Regulations and specifically the Technical Guidance Documents (TGDs) are designed to move with the ever-changing construction industry and its practices, this results in the documents being under continuous review and subject to ongoing amendments and updating. The result of this is the requirement for continuous training for all construction professionals, trades, and product manufacturers to ensure that construction meets the minimum legal requirements as set down under the Building Regulations.

Compliance with these regulations requires a certain level of expertise and specific skills. Demonstrating compliance with the TGDs indicates ‘prima facie’ compliance with the Building Regulations.

Regarding the renewable energy systems (RES) obligations in buildings, the Building Regulations place an emphasis on energy conservation and. Part F and Part L were updated in 2019 to include the Energy Performance in Buildings Directive (EPBD) requirement for all new buildings and major renovations to achieve Nearly Zero Energy Buildings (NZEB).

Several reports have highlighted the need to review parts of the Buildings Regulations and TGDs to better support the decarbonisation of the built environment across its whole life cycle and use: Specific areas and topics to consider include:

- TGD B to reflect international research and developments in mass timber construction and best practice (Note: Under the recently published EU Forest Strategy for 2030, member states should be "encouraged to reflect best available scientific knowledge in the design of regulations favourable to long-lasting wood products, including acting on energy and environmental performance of building and construction products")

- TGD D, and more specifically the definition of "proper materials" -section D3 subsection (c), to clarify on alternative technical specification that 'provides in use an equivalent level of safety and suitability' to make it easier and faster for new innovative, low embodied carbon materials, to be placed on the Irish market without lowering standards.

- TGD G to integrate water efficiency requirement for sanitary ware to reduce energy use associated with hot water consumption.

- TGD K and M to better support reuse of existing properties.

It is worth noting that "Accommodation standards in the rental sector are protected by the Minimum Standards for Rented Accommodation guidelines issued by the Department of Housing, Local Government and Heritage in 2021. They include a high-level description of the expected quality of housing in both the private and social rental sectors. They stipulate that accommodation should be warm and well-ventilated, among other things, but does not provide specific performance targets, making it difficult to enforce a specific standard of IEQ. Local authorities are responsible for conducting inspections and enforcing housing standards under the Housing Miscellaneous Provision Act 1992.

Under Housing for All, a Building Regulations Advisory Body (BRAB), consisting of key construction industry stakeholders across private and public sectors will be re-established (previous BRAB abolished in 2012), to advise the Minister on matters relating to the Building Regulations.

4.2 National Policies & Strategies re Education and Training:

(See details Chapter 6,7,8)

4.2.1 Green Skills and Jobs:

Under the United Nations Framework Convention on Climate Change (Article 6) "Governments shall implement educational and public awareness programmes on climate change and its effects; "In addition Article 12 of the Paris Agreement notes that Parties shall." enhance climate change education, training, public awareness, public participation and public access to information".

CAP23 Principle 2 advises that "*People are equipped with the right skills to be able to participate in and benefit from the future net zero economy".* Ireland's National Skills Strategy (NSS) 2025 – Ireland's Future Report was published in December 2022 and within this short timeframe the OECD report (see below) from May 2023 reviews how Ireland's existing skills strategy (NSS) might need to be adapted to ensure that it is still fit for purpose. In addition, the Department of Further and Higher Education, Research, Innovation and Science (DFHERIS), published a report called Report on the Analysis of Skills for Residential Construction & Retrofitting, 2023 to 2030. The report highlights numbers required to deliver the Government's targets on new Housing and retrofitting.

OECD Skills Strategy Ireland Assessment and Recommendations report as published May 2023. The 4no. priority areas are: 1. securing a balance in skills through a responsive and diversified supply of skills; 2. fostering greater participation in lifelong learning in and outside the workplace; 3. leveraging

skills to drive innovation and strengthen firm performance; 4. strengthening skills governance to build a joined-up skills ecosystem. The recommendations within this report should inform projects (such as this BUSI2030) to set out implementation of the actions as identified.

The Expert Group on Future Skills Needs (EGFSN) advises the Irish Government on the current and future skills needs of the economy and on other labour market issues that impact on Ireland's enterprise and employment growth. It has a central role in ensuring that labour market needs for skilled workers are anticipated and met. The EGFSN report, Skills for Zero Carbon – The Demand for Renewable Energy, Residential Retrofit and Electric Vehicle Deployment Skills to 2030 *(November 2021)*, sets out the demand for, and nature of, the skills required to deliver on key elements of Ireland's Climate Action Plan (first version) over the period to 2030. It identifies the nature and quantifies the scale of the skills needs of enterprises supporting the transition to a low carbon economy. It develops a suite of recommendations that can be drawn upon to ensure that these future skills needs are fully addressed. In addition, further education and skills for climate action is being delivered through SOLAS Green Skills for Further Education and Training 2021-2030.

Within this FET context, the Regional Skills Fora continue to play an important role in identifying future skills needs emerging from a greener economy. These feed directly into the regional skills development pipelines through the Education and Training Boards. Each forum provides for ongoing regional engagement between the employment, enterprise, education, and skills sectors, such as Local Enterprise Offices, Enterprise Ireland, the Department of Further and Higher Education, Skillet, and the Education and Training Boards. Other CAP 23 proposed Actions relate to supports and initiatives through the education systems, through formal education (primary and secondary curriculum), non-formal education and through informal education.

At education policy level, there have been significant changes in anticipation of addressing the skills and labour shortages required to meet Climate Action Targets, including:

- Higher Education Authority Bill 2022 (Including Strategic Planning for third-level education)
- Department of Further and Higher Education, Research, Innovation and Science (Established 2021) (Combination sub-departments from Department of Education & Department Enterprise Trade & Employment)

A significant amount of education strategies and pilot programmes have been put in place.

Table Education Programmes overview

Name	Description
Human Capital Initiative (2020) (Refer 7.12)	Funded 24no. Industry & Academia Innovation projects e.g. Sustainable Futures, DASBE, Recognition of Prior Learning, Micro Credentials, Virtual Labs etc
National Training Fund **(National Training Fund Act 2000)**	Includes supporting Skillnet Ireland; SOLAS/ETB Framework etc
GREEN SKILLS for FET 2021-2030	Green Skills for Life / for Construction / for Careers
Ireland's National Skills Strategy 2025	Restore full employment and build a sustainable economy

Pathways to Work Strategy 2021-2025	Assist people back to work as the economy and labour market recovers from COVID-19
Skillnet Ireland National Agency for workforce learning (See below table)	Consists of groups of private sector businesses that collaborate cross networks, regions and sectors.
Enterprise 2025 Renewed	Building resilience in the face of global challenges
Future FET: Transforming Learning 2022	A strategy which aims to repair, repurpose and revive the economy and communities, based around the three core pillars of building skills, fostering inclusion, and facilitating pathways
Action Plan for Apprenticeships 2021-2025	The action plan aims to expand the types of programmes available and increase the number of apprenticeships to 10,000 per year by 2025.
Future Jobs Ireland 2019	Represents an integrated approach to prepare for the opportunities and challenges of the future economy
All Ireland Heritage Skills Programme	Full-time, 12-month course which gives practical experience in heritage building skills. Participants will also undertake a Level 3 NVQ Diploma in Heritage Skills (Construction)
Centralised portal for School Leavers (CAO)	Now includes Further Education and Training (FET) options
Development 5no.Technological Universities	
Research / Digitisation	Construct Innovate; Build Digital,
Training Centres of Excellence	6no. Centres of Excellence, MMC Demonstration Park

SKILLNET IRELAND is a national business support agency of the Irish Government, which works with companies of all sizes to identify and develop the talent they need to succeed.
Some Examples of SKILLNET IRELAND* Initiatives include:

Table SKILLNET IRELAND programme overview

Sample Programmes	Description
Green Tech Skillnet	Business network (renewable energy and green technology sectors)
Lean & Green Skillnet	Business network (environmental, water and energy management)

CITA Skillnet and Construction Professionals Skillnet	Training programs for professionals (PM, HR, BIM, Comms)
Springboard+	Free and subsidised courses at certificate, degree and masters' levels
NZEB Centres of Excellence for Green Building skills	Four centres to train 2,000 people in retrofit skills, including Near Zero Energy Buildings (NZEB) skills
Ireland's Renovation Upskilling Committee (Reno-NUC)	Provide high-level strategic and policy input to support large-scale upskilling of building professionals and construction workers in energy renovation in Ireland
Energy Renovation for Traditional Buildings, Continued Professional Development	Aim is to up-skill building professionals to develop knowledge and skills that allow them to design and deliver high-quality, energy-efficient renovations to existing traditional buildings
Just Transition Midlands	The fund will support communities most negatively affected by the move away from fossil fuels and the cessation of commercial peat extraction
Action Plan for Apprenticeship 2021-2025	Promotion of Training, Apprenticeships and Vocational Educational Training in the Built Environment Sector
Construction Industry Register Ireland (CIRI)	Private-sector Training programmes are also increasing in quantity and scope in parallel to public-sector offerings
Skillnet Irelands Future Dynamics, Co-Creation initiative	The initiative enables businesses to unlock their innovation potential through workforce design and development approaches that drive transformational change
Innovation Exchange	Multi-year program that facilitates collaboration between Irish SME's and large multinationals to boost innovation

Enterprise Ireland provides hands-on support to companies, promotes awareness of the benefits of innovation and provides important funding support. Some Examples of Enterprise Ireland Programmes include:

Table Enterprise Ireland supports overview

Sample Initiatives	Description

Lean Business Offer	Is designed to encourage clients to adopt Lean business principles in their organisation to increase performance and competitiveness
Digital Innovation	Digital Innovation is about redesigning your business to serve your customers better, starting with a deep understanding of your customer needs and your value stream and then using new technology to improve the customer experience
Green Transition Fund	Is designed to support companies, whether starting out or already on the journey, to act now and get ready for the low carbon, more resource efficient economy of the future.
Built To Innovate	Seeks to support Irish companies active within the residential construction sector who wish to enhance the operational performance of their business

In conclusion, although there are policies, strategies, and programmes in place regarding upskilling and addressing skills and labour shortages in Ireland, more action is critical for engagement with initiatives to meet our significant national targets.

4.2.2. Implementation of the European Qualifications Framework (EFQ):

After post-primary school many students move on to further education or third level. The National Framework of Qualifications (NFQ) provides a structure to compare qualifications from different awarding bodies across ten different levels based on nationally agreed standards knowledge, skill, and competence. This allows students to make informed decisions about their qualification choices and to consider progression opportunities available to them, and to benchmark both in Ireland and abroad, the qualifications that they hold or are studying for.

'Figure 1 NFQ Level 1 - 10 Visualised' shows the NFQ award scheme which showcases the various levels (1-10) and the various certificates, diplomas, and degrees relevant to each level. The figure also showcases the main actors that provide qualifications at the various levels.

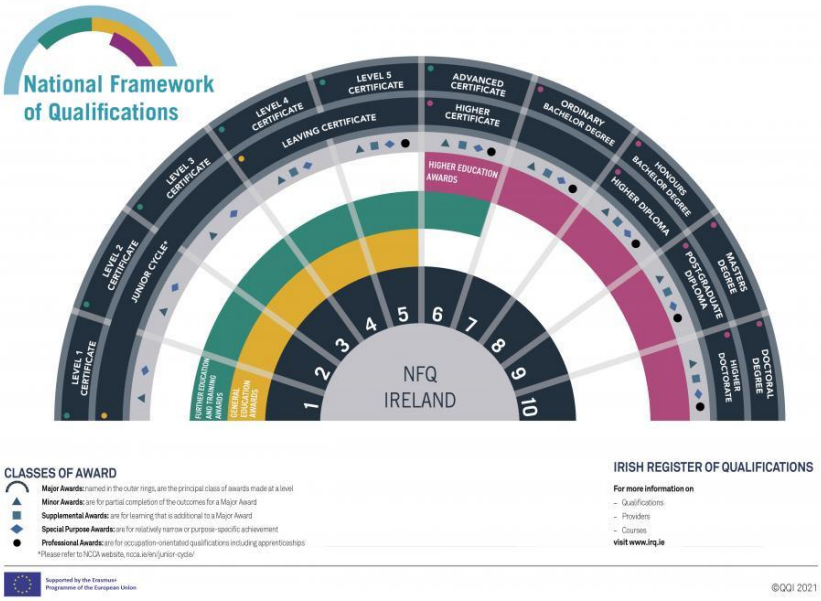

Figure 1 NFQ Level 1 - 10 Visualised

4.3 The International Context

Ireland has been actively seeking to establish links with other countries and education/training authorities to facilitate mutual recognition of Irish qualifications by international training collaborators and partners. Such mutual recognition is to facilitate mobility of labour, particularly in the EU countries.

The 3 European frameworks which deal with higher education (NFQ Levels 6 to 10) are:

1. The **'Bologna framework'**, created by the European Higher Education Area (EHEA), European Education Ministers have also adopted the Paris Communiqué which outlines the joint vision of education ministers from 48 European countries for a more ambitious European Higher Education Area by 2020. In addition, the Communiqué outlines the need for better support to enable vulnerable and underrepresented and groups to access and excel in higher education. These ambitions are in line with the goal of the EU to create a European Education Area by 2025, to promote mobility and the academic recognition of qualifications for all EU citizens.
2. The **European Qualifications Framework (EQF)**, which deals with all educational levels including schools, further education and training, and higher education and training. [25]
3. **The Europass Certificate Supplement**[26] is a document that provides information that makes it easier for employers and educational institutions to understand your vocational qualification.

Table Mapping of EQF, bologna framework and NQF

National Framework of Qualifications (NFQ) Level	EQF Level	EHEA Framework (Bologna)	NFQ Major Award-Types
NFQ Level 1	**EQF Level 1**	-	Certificate
NFQ Level 2		Certificate	
NFQ Level 3	**EQF Level 2**		Certificate; Junior Certificate

[25] EFQ Website: https://europa.eu/europass/en/europass-tools/european-qualifications-framework
[26] Europass Certificate Website: https://europa.eu/europass/en/learn-europe/certificate-supplement

NFQ Level 4	**EQF Level 3**		Certificate; Leaving Certificate
NFQ Level 5	**EQF Level 4**		Certificate; Leaving Certificate
NFQ Level 6	**EQF Level 5**	Short Cycle within First Cycle	Advanced Certificate (FET award); Higher Certificate (HET award)
NFQ Level 7	**EQF Level 6**	First Cycle	Ordinary bachelor's degree
NFQ Level 8		Honours bachelor's degree; Higher Diploma	
NFQ Level 9	**EQF Level 7**	Second Cycle	Master's Degree; Post-Graduate Diploma
NFQ Level 10	**EQF Level 8**	Third Cycle	Doctoral Degree; Higher Doctorate

4.4 Policies & Strategies on Digitalisation of Construction

Please also refer also to 8.5.7.

There is consensus that the digitalisation of the European construction sector is both inevitable and pivotal for the competitiveness and sustainability of the building sector and the challenges are aligning skills within the built environment sector with continuing and accelerating technological change. With the introduction of new European Standards such as EN ISO 19650 in December 2018, progress has been made in organisation and digitisation of Information from an international perspective. The publication of the National Standards of Ireland (NSAI) IS EN ISO 19650 in January 2019 has helped the digitisation of information nationally. At EU level there will be policy intervention to encourage training in digital construction with a particular focus on Geographic Information System (GIS), Building Information Modelling (BIM), Internet of Things (IoT) and Smart Sensors to correctly log and confirm post occupancy evaluation of buildings which will aim to address the performance gap. National policy has focused on Human Capital and Skills initiatives but more co-operative initiatives between industry and academia are clearly being developed.

Harnessing Digital: The Digital Ireland Framework is to drive and enable the digital transition by making connectivity available to everyone (e.g. National Broadband Plan, Remote Working Hubs and Broadband Connection Points); providing digital skills for all; ensuring widespread access and use of inclusive digital public services; helping small businesses benefit from digital opportunities by providing grants and assistance; investing in cyber-security; ensuring a modern and well-resourced regulatory framework playing a leading role in Europe right across the digital agenda. This digital strategy aligns with both EU priorities, under the Digital Decade, and national priorities, under the 2021 Economic Recovery Plan and Ireland's National Recovery and Resilience Plan. It also assists in working towards achieving Ireland's climate targets, with our green and digital ambitions re-enforcing each other.

The national Build Digital Project has been established in support of Project Ireland 2040 and the work of the Construction Sector Group (CSG) Innovation and Digital Adoption Sub-Group. The scope of the cross sectoral project will transform the Irish construction and built environment sectors by enabling all stakeholders, particularly SMEs, clients, and suppliers, to develop, maintain, and continuously improve their capabilities as digitally enabled, standards-based, agile, collaborative, and sustainable participants in the delivery of Project Ireland 2040. The Department of Enterprise, Trade and Employment supports the implementation of Ireland's Smart Specialisation Strategy (S3) for 2022 to 2027. S3 will assist leveraging opportunities for funding to give strengthened financial support to

enterprises in reducing their carbon emissions and integrating smart technologies for lower carbon processes. In addition, projects such as Construct Innovate, Ireland's construction technology centre / research aims to make Ireland a global leader for sustainable construction and built environment technology. Additional numerous industry Initiatives have been established in conjunction with Skillnet and Green Skillnet.

Smart Buildings

The use of smart technologies and upgrading of existing heating systems to modern equivalents will. play a significant role in reducing the overall energy requirements of a building. 'Smart homes' technologies, allowing automated management of energy use, enabled by high-speed broadband connectivity, will enable greater consumer control over their energy consumption and will play an important role in decarbonising the residential sector.

Under CAP23, the following supports re proposed to meet the required level of emissions reduction, by 2025: Residential: Support homeowners to better manage their energy demand through measures, Including:

- Initiatives such as the ongoing 'Reduce Your Use' campaign will also play a key role in helping consumers to reduce energy demand.
- The rollout of the Smart Meter Programme will allow homeowners to access the information they need to make more informed choices about energy consumption.
- The availability of SEAI supports for heating controls will also help homeowners to maintain comfort levels without wasting energy. This is particularly important in the context of the current high energy prices which are also impacting behaviour and energy demand

Commercial/Public: Promote and support building automation and control optimisation and smart building technologies to increase energy efficiency and monitoring, and the upgrade of existing building energy management systems to high-efficiency and zero-carbon equivalents

4.5 Policies & Strategies on Circular Construction

The concept of the circularity and its application to the built environment has gained considerable policy and industry support internationally and at EU-level over the past four years.
Key drivers have included:
The EU Action Plan for the Circular Economy (EC 2020), which proposes a restoratively designed economy to keep products, components and materials at their highest value at all times (Ellen MacArthur Foundation 2015);
The EC Communication on Resource Efficiency Opportunities in the Building Sector (EC 2014) which calls for more resource efficient design, planning, manufacturing and construction.
The EU Construction & Demolition Waste (CDW) Management Protocol (EC 2016), which highlights the need to increase confidence in construction and demolition waste management processes and C&D recycled materials.
The guidelines for the waste audits before demolition and renovation works of buildings (EC, 2018)
The 2019 EU Green Deal (EC 2019), which identified the key role of a more circular construction sector in the transition towards a climate-neutral Europe.
The 2020 Circular Economy Action Plan (EC, 2020), which highlighted the need to embrace a holistic approach to circularity.
These actions recognise the enormous challenge of decoupling of economic growth and output with the associated environmental impacts especially in relation to the built environment sector. In addition, recent events have also demonstrated the continuing fragility of the market economy in which the construction sector operates. It is estimated that circular economy could reduce global CO_2 emissions from building materials by 38% in 2050, through the reduction of the use of steel, aluminium, cement,

and plastic. It could also make the sector more resilient to supply chain disruptions and price volatility of raw materials.

The Whole of Government Circular Economy Strategy 2022 – 2023 'Living More, Using Less' (www.gov.ie) is Ireland's first national circular economy strategy. This Strategy was a specific commitment in the gov.ie - Waste Action Plan for a Circular Economy (www.gov.ie) The Waste Action Plan for a Circular Economy 2020-2025 (WAP) focuses on increasing recycling and minimising waste generation by prioritising the prevention of waste at every opportunity through eco-design, reuse, and repair; and increasing segregation. Fundamentally, the WAP commits to fully embracing the opportunities to become a circular economy in the decade ahead. The Whole-of-Government Circular Economy Strategy 2022-2023 builds on the approach set out in the WAP and codifies Ireland's strategic goal to be a circular economy leader among EU Member States by 2030. This first iteration of the strategy sets out an overall policy approach. Subsequent versions of the strategy will adopt an action-plan format, setting out key targets and metrics for the circular transition. Considerable progress was made in 2022 with the enactment of the Circular Economy and Miscellaneous Provisions Act 2022, which underpins Ireland's shift from 'take-make-waste' towards a circular economy by defining the circular economy in Irish law for the first time.

The Circular Economy Strategy is proceeding on a non-statutory / non-legal basis until the Circular Economy Bill is enacted. Annexe 8 of the report outlines a series of supports (financial grants & advisory) that are currently available to business, enterprise and third level regarding circularity including for activities such as Life Cycle Assessment, EcoDesign, Green Procurement and Energy / Carbon Management. Irelands current circularity rate is approximately 2% (EU average 12%) with the Netherlands leading currently at 31%. C+D waste in Ireland is 57.5% (Eurostat, 2021).
The strategy is a key addition to Government's drive to achieve a 51% reduction in overall greenhouse gas emissions by 2030. Regarding Construction the core element relates to funding to develop novel solutions for waste prevention, supporting initiatives to aim to reduce the volume and promote resource re-use.
Potential Actions for the Construction Industry noted include:

- Increased use of offsite design and manufacture
- Modular building design
- Refurbishment and retrofitting of existing stock.
- Tackling dereliction and bringing stock back into occupancy
- Increase use of Construction & Demolition Waste as a secondary construction material

4.6 Policies & Strategies on Green Public Procurement

The public sector has a responsibility to promote green procurement, in order to support Ireland's environmental and wider sustainable development objectives. This duty is highlighted in the Climate Action Plan (CAP) 2023 as it states that the public sector will lead by example, embedding climate actions as a central value, relentlessly focusing on continuous improvement that deliver real progress.

Every Public Body is required to have a Climate Mandate under the Climate Action Plan. Green Public Procurement is a key process to deliver on the required Climate targets. Circular 20/2019 promotes the use of environmental and social considerations for public procurement and outlines criteria across all procurement processes. Additional measures are outlines in Whole of Government Circular Economy Strategy 2022–2023 – Living More, Using Less strategy and in the Waste Action Plan for a Circular Economy; Ireland's National Waste Policy 2020–2025.

Green Tenders: Action Plan on Green Public Procurement 2021 assists public bodies to plan and implement green public procurement (GPP) processes by highlighting existing best-practice and

advising further supportive actions. Construction, Energy, Transport & ICT are included in the 8 priority groups for GPP. The focus on these areas is based on: quantum of public expenditure; scope for environmental improvement; potential impact on suppliers; potential for setting an example to private or corporate consumers; political sensitivity; existence of relevant and easy-to-use criteria; market availability and economic efficiency. This report highlights 6 key aspects through which GPP can be embedded in the Construction Sector: Design; Energy efficiency should be integrated into public sector construction projects in accordance with the three-part energy efficiency procurement framework (Energy Using Products; Energy Services; Capital Projects); Refurbishment; Materials; Ecology & Site Utilities; Specification. These issues will be further developed in a forthcoming OPW Guidance for GPP Report.

In addition, Green Procurement Guidance for the Public Sector 2021 by the Environmental Protection Agency (EPA – Independent Public Body) includes a toolkit for public procurers to include sustainable and green criteria in key sectors. It is critical that Ireland develop a strong GPP policy to support innovation and build capacity within the Construction industry to decarbonise Ireland's built environment. Public Buildings should adhere to higher sustainability standards. As part of the GPP, Public bodies should actively collect whole life carbon measurements, indicate carbon targets within Tenders, actively procure low carbon products and circular use of buildings and materials, in accordance with the EED. Regarding the European Framework for sustainable buildings, adopting Level(s) is key in supporting GPP.

5. Key data on building and energy sectors

5.1 Statistics on the building sector

The current status of the building sector is presented below including the size of the existing building stock, trends in the construction industry including, employment, production output, and energy consumption in both existing and newly constructed buildings. A total of 2,124,590 permanent dwellings were counted in Ireland during Census 2022. This is an increase of over 120,000 units (6%) between 2016 and 2022. The number of occupied households increased by over 150,000 (9%) to 1.86 million while the number of vacant dwellings fell by over 16,500 (-9%) to 166,752. Statistics from the Building Energy Rating (BER) are considered in terms of the analytical energy performance of new and existing dwellings and buildings other than dwellings. Analysis of residential building typology provides insight into the challenge that exists for the renovation of existing building stock to meet energy saving targets for 2030. The chapter will also provide an overview of the energy efficiency and renewable energy measures being supported through SEAI programmes for residential, public sector, industrial and commercial buildings and the level of their implementation is also provided.

5.1.1 Energy in Ireland

Ireland's greenhouse gas emissions increased by 4.7% in 2021 compared to 2020 and are now 1.1% above 2019 (pre-COVID restriction) levels. The provisional 2021 greenhouse gas emission numbers indicate that 23.5% of the Carbon Budget for the 5-year period 2021-2025 has already been used, requiring an 8.4% average annual emissions reduction from 2022-2025 to stay within budget. The Environmental Protection Agency (EPA) is the national body with responsibility to develop, prepare and publish projections of greenhouse gas emissions for Ireland. The EPA latest projections Greenhouse Gas Emission Projections 2021 to 2040 June 2023 – Issue specific to the Built Environment include:

- Total greenhouse gas emissions are estimated to have increased by 6 per cent in 2021.
- Planned policies and measures, if fully implemented, could deliver up to 28 per cent (4 per cent per annum) emissions reduction up to 2030.
- Ireland can comply with 2030 EU emissions reduction target only if all planned measures are implemented and delivered as planned.
- The data projects that all sectors need to do significantly more to meet their 2030 National emissions reduction targets.
- Urgent implementation of all climate plans and policies, plus further new measures, are needed for Ireland to meet the 51 per cent emissions reduction target and put Ireland on track for climate neutrality by 2050.

Regarding emissions from the Built environment, the EPA have analysed the following scenarios:

Residential sector:

- With Existing Measures Scenario: Projected decrease by 36% between 2021 and 2030;
- With Additional Measures Scenario: Projected decrease by 47% between 2021 and 2030 – (based on Full implementation of the relevant measures in the Climate Action Plan 2023)

Commercial & Public Services sector:

- With Existing Measures Scenario: Projected decrease by 19% between 2021 and 2030;
- With Additional Measures Scenario: Projected decrease by 49% between 2021 and 2030 – (based on Full implementation of a range of energy efficiency programmes to focus on decarbonisation)

Figure 7 below indicates the flow of energy from the inputs to electricity generation through to the final electricity used by the different sectors. The diagram demonstrates that a significant portion of the energy used to generate electricity is lost before the electricity reaches the end user, through a combination of:

- Transformation losses.
- Power plants own use of electricity.
- Pumped hydro storage losses.
- Transmission losses.
- Distribution losses.

It can also be deduced that the diagram indicates local and domestic produced energy- both electrical and heating- may be a pathway to reducing C02 emissions and Irelands over reliance on fossil fuels. It is now becoming apparent and recognised through research and the EPBD review that Life Cycle Analysis, embodied carbon and environmental impacts of these potential measures require accurate accounting, including Scope 1 -3 of all emissions which can then shift carbon reduction from the theoretical to the impactful.

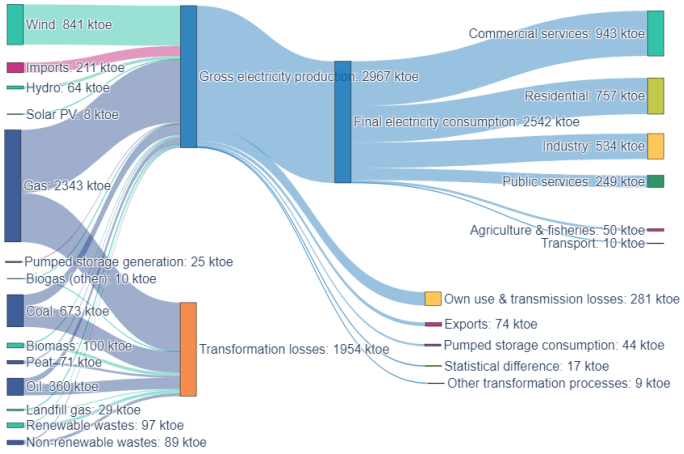

Figure 2 local & domestic produced energy both electrical & heating27

Figure 8 below shows the annual final energy demand by sector. The broad reduction in final energy use across all sectors from 2008 to 2012 is attributed to the international economic downturn, with the industry, transport and services sectors returning to growth after 2012, and growth in the residential sector delayed until 2014.

[27] Energy Ireland data https://www.seai.ie/publications/Energy-in-Ireland-2022.pdf

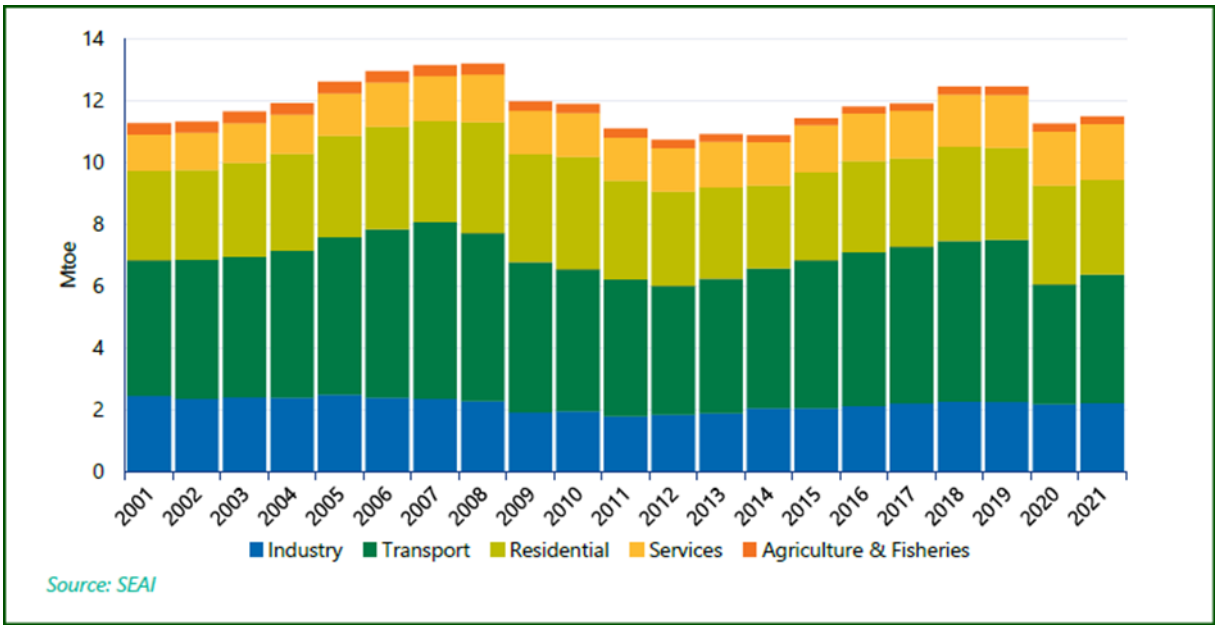

Figure Annual final energy demand by sector.

Provisional estimates for energy demand in 2022, based on extrapolations of January to September's monthly data suggest a strong rebound in 2022 of +6% in energy demand.

The following figures provide a summary of the energy profile within Ireland to provide context to energy use within the building stock in Ireland. Figure 2 outlines the direct link between the energy demand in Ireland and its economy growth. Previously GDP was the most commonly used indicator for economic growth but in Ireland GDP can be disproportionately affected by the accounting of large multinationals. Now an alternative measure of economic activity is Modified Domestic Demand (MDD), which has been developed by the Central Statistics Office (CSO), this metric is used to measure economic growth, as it gives a better reflection of activity in the economy that drives energy.

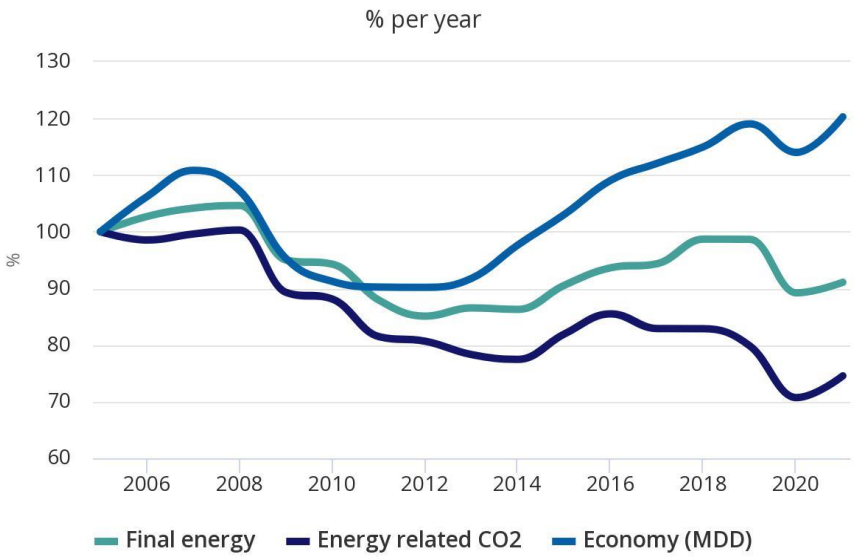

Figure Energy Overview 2006-2020

The Figure below shows the latest split of Ireland's indigenous primary energy production by fuel type.

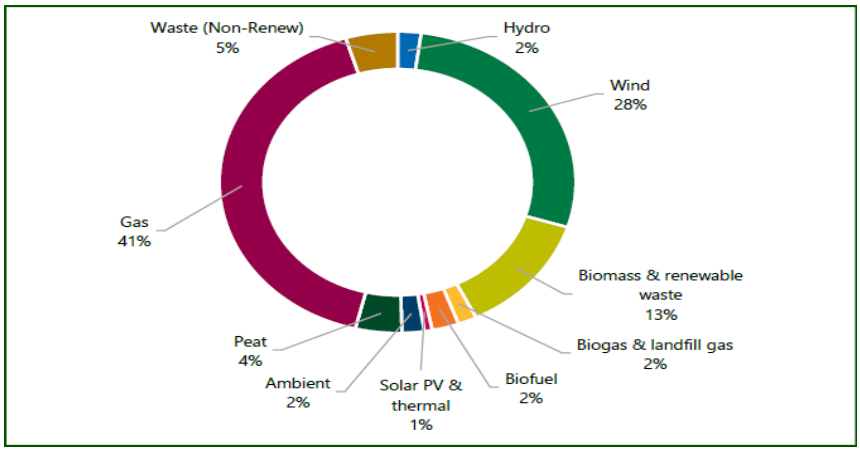

Figure primary energy production by fuel type

5.1.2 Domestic Building Stock

Greenhouse gas emissions in the Residential sector were 9.8 Mt CO_2 in 2021 which was 27% of Irelands total energy emissions, decreasing by 4.9% compared to 2020. However, emissions in 2020 had risen as a result of increase in working from home. Emissions are now 2.8% above pre-pandemic levels in this sector. A combination of warmer weather, rising fuel prices towards the end of the year and an easing of COVID restrictions contributed to substantial reductions in coal, peat, and kerosene use for home heating. However, since 2014, fuel use per household has increased by 12% with CO2 emissions per household at 3.8 t/CO_2 in 2021. Energy in Ireland report shows that Ireland's energy-related CO_2 emissions increased by 5.4% in 2021 due to an overall increase in energy use and the use of more carbon-intense fuels, particularly in electricity generation. Emissions are now returning to pre-Covid levels of 2019, and further increases of circa 6% are anticipated based on initial data for 2022.

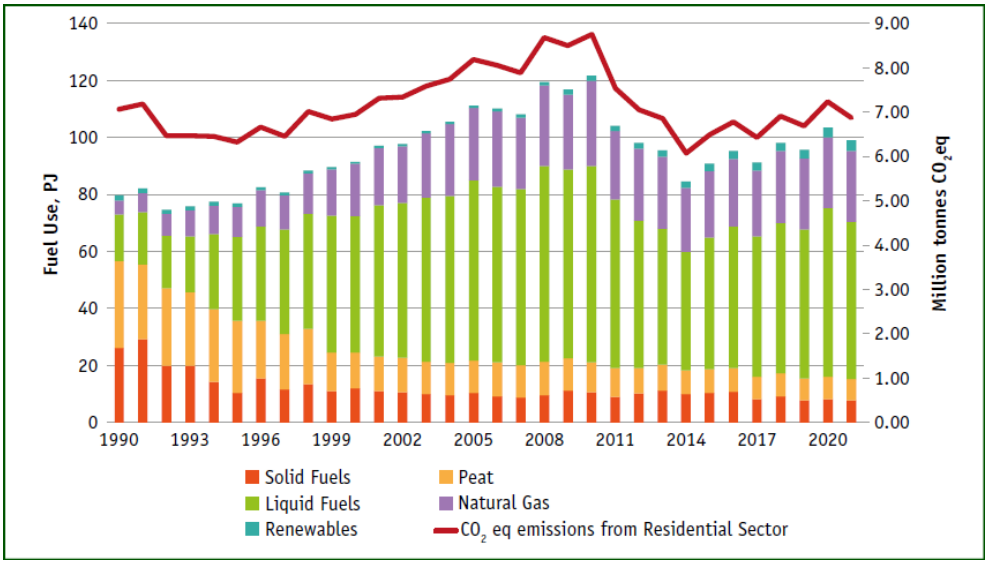

Figure Emissions trends in Residential 1990-2021

Statistics from the 2022 census projected a total housing stock of 2,124,590 with vacant dwellings numbering 166,752 amounting to a vacancy rate of 7.8%

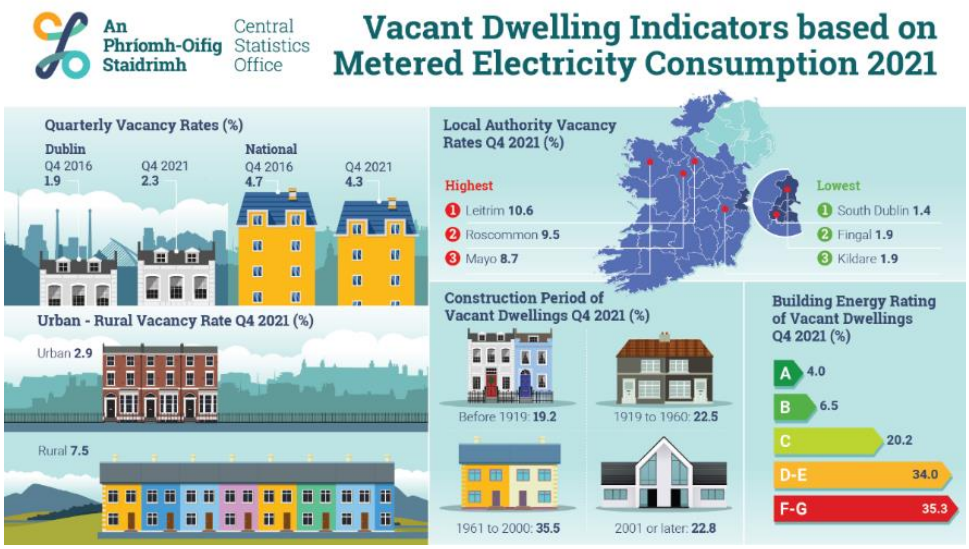

Figure Vacant Dwelling Indicators 2021[28]

In 2016 seven in ten households lived in either a 'detached house' (42.1%) or a 'semi-detached house' (27.8%). In 2021, there were 276,2235 private rental tenancies registered with the Residential Tenancies Board (RTB), down, while the number of new tenancies registered with the RTB in the second quarter of 2022 was 12,701. On the other hand, data shows that there has been an increase in the number of notices of termination (eviction) issued by landlords. In the first half of 2022, as there were 2,798 notices issued. [29]

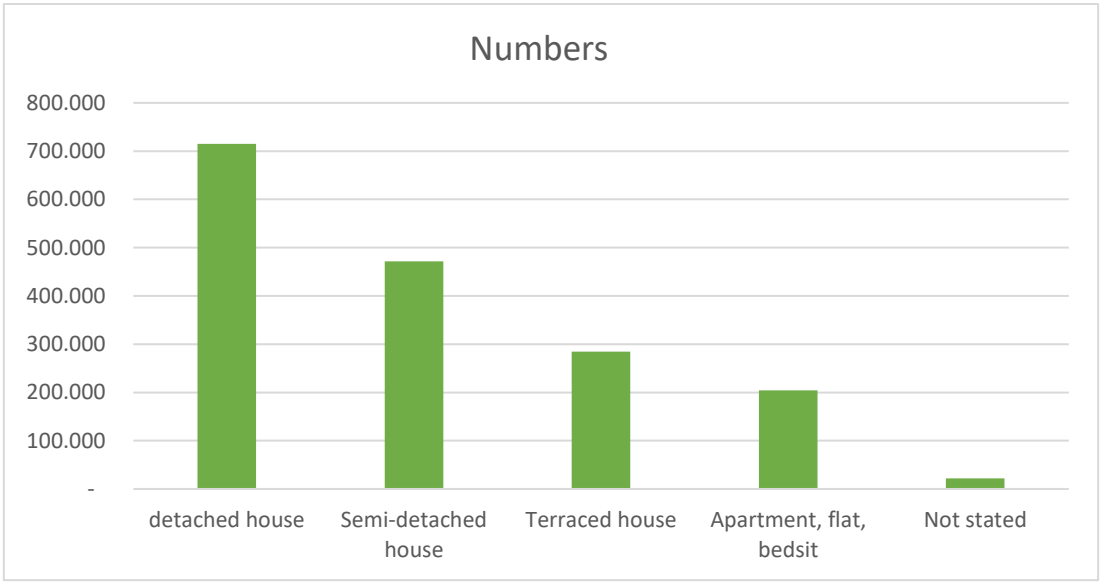

Figure : Private households in permanent housing units by type of accommodation 2016

[28] Vacant Dwellings data https://www.cso.ie/en/releasesandpublications/fp/fpviec/vacantdwellingindicatorsbasedonmeteredelectricityconsumption2021/

[29] National Econmic and Social Council, 2023, Private Rental in Ireland, available online: https://www.nesc.ie/app/uploads/2023/02/159_private_rental.pdf

The EU project "Tabula," which ran between 2009 and 2011, developed national building typology for each participating country which focuses on the characteristic energy properties of buildings. The data in Table 5.1 is taken from the project website country pages for Ireland. While this data was based on Census 2006 figures, it does illustrate the existence of a high proportion (60% or approximately 1,000,000 dwellings) of pre-1996 residential building stock, that were constructed with limited or no energy performance standards in place. The data from the Tabula project also indicates the magnitude of potential energy savings that could be achieved through retrofits, i.e., deployment of a package of measures for upgrade of the building's thermal envelope and heating systems have been published which state that domestic & non-domestic new buildings require to be A rated:

- TGD Part L - Conservation of Fuel and Energy – Dwellings (2022)
- TGD Part L- Buildings other than Dwellings (2021)

Table Residential Building Typology Ireland[30]

Dwelling Type	Detached	Semi-Detached	Terraced	Flat or Apartment in a Purpose-Built Block	Flat or Apartment in a Converted building	Bed-sit	Not Stated	Total
Before 1919	82,941	15,748	37,111	3,037	11,235	2,678	1,592	154,352
1919 to 1940	48,394	22,056	29,146	2,552	3,339	978	1,180	107,645
1941 to 1960	49,140	40,935	43,461	4,634	2,300	661	1,283	142,414
1961 to 1970	41,777	40,435	22,727	5,248	1,369	486	927	112,969
1971 to 1980	98,182	67,698	37,306	5,763	1,348	417	1,668	212,382
1981 to 1990	85,700	45,064	24,337	7,977	1,134	396	1,413	166,021
1991 to 1995	43,071	30,232	8,341	9,604	927	243	668	93,086
1996 to 2000	71,973	51,327	11,455	17,093	1,450	355	1,121	154,774
2001 or later	94,408	71,378	32,957	44,991	2,230	783	2,696	249,443
Not stated	10,392	13,487	10,681	8,967	4,674	1,754	19,255	69,210
Total	625,988	398,360	257,522	109,866	30,006	8,751	31,803	1,462,296

[30] Tabula www.building-typology.eu/country/typology-ie.html

Building Energy Rating (BER)

Energy Performance Certification through the Building Energy Rating legislation was adopted into Irish law in 2006 in response to the Energy Performance of Buildings Directive (2002) which led to the introduction of Building Energy Rating (BER) and certification the data in SEAI BER statistics up to 2022.

Electricity was the main space heating fuel used in 80% of the dwellings completed during 2020-2022 and with a Building Energy Rating (BER) audit. This was a substantial increase from 2015-2019 when 48% of dwellings with a BER audit used electricity. There was a contrasting trend for mains gas with 19% of 2020-2022 built dwellings using mains gas compared with 47% for dwellings built in 2015-2019. There was also a contrasting trend for heating oil with 1% of 2020-2022 built dwellings using heating oil compared with 5% for dwellings built in 2015-2019

There were 22,493 BER audits reported in quarter one 2022 compared with 14,585 in quarter one 2021. This is an increase of 54%. January 2022 was 64% higher than January 2021. February 2022 was a similar 62% above February 2021. The number of completed BER audits in March 2022 was 42% above the number in March 2021. In the period 2009 to March 2022 nearly 1.2 million BER audits have been undertaken.

Dwellings built in 2015-2019 and 2020-2022 were considerably more energy efficient than those built in earlier periods with 97% and 99% respectively given an "A" rating compared with 33% in 2010-2014 and 1% in 2005-2009.

The average floor area of all dwellings with a BER audit was 113 m2 This average size varied from 160 m2 for detached houses to 60 m2 for basement dwellings[31].

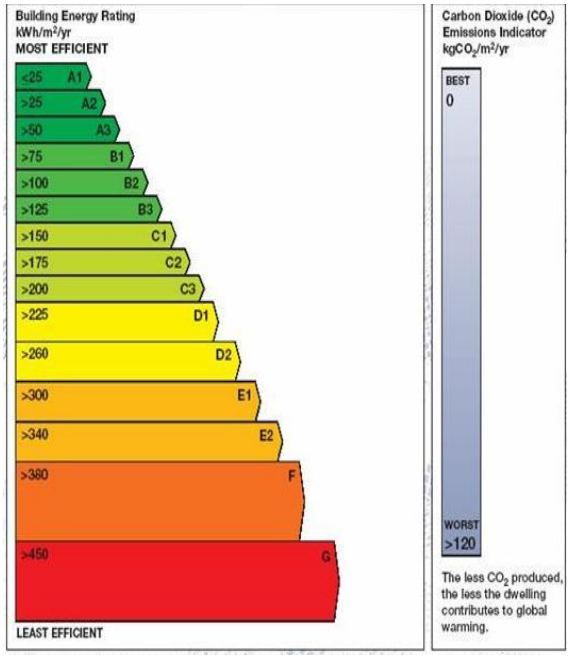

Figure BER Scale Diagram

[31] Data on BER assessments https://www.cso.ie/en/releasesandpublications/er/dber/domesticbuildingenergyratingsquarter12022/

Residential operational energy now accounts for 45% of all built environment related emissions, 75% of the housing stock is C rated or below, with operational emissions of >50 kgCO2e/m2/yr it is now evident that:

- ~70% of the average home's energy demand is from fossil fuels.
- The average floor area of an A-rated building ~132 m2 while the average floor areas of a G-rated building ~83 m2
- 97% of new dwellings built between 2015-2021 have "A" rating.

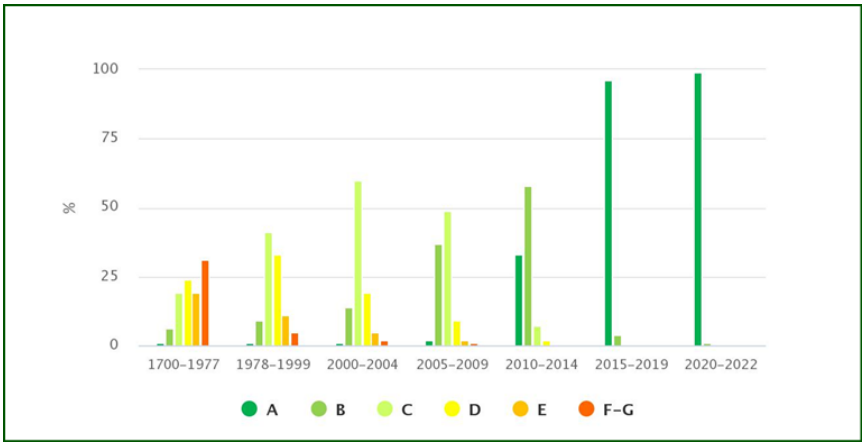

Figure BER ratings by period of construction

There were 29,851 new dwelling completions in the whole of 2022, an increase of 45.2% from 2021 and 41.3% up from 2019, pre-pandemic. In October, November, and December (Q4) 2022 there were 9,148 completions, a rise of 31.4% from Q4 2021.The number of apartments completed in 2022 was 9,166, up 78.7% from 2021. This is more than the number of apartments completed in 2020 and 2021 combined. There were 15,163 scheme dwelling completions in 2022, up 41.9% from 2021, while 5,522 single dwellings were completed, a rise of 16.6% from 2021.In 2022, 50.8% of completions were scheme dwellings, a further 30.7% were apartments and 18.5% were single dwellings.

Close to six in ten completions in Q4 2022 and the whole of 2022 were in Dublin or the Mid-East (Kildare, Louth, Meath, and Wicklow). All regions saw an increase from 2021 to 2022 and from Q4 2021 to Q4 2022. By Local Electoral Area, the most completions in 2022 were in Killiney-Shankhill with the most in Q4 2022 in Glencullen-Sandyford. There has been a small drop of 2.8% in seasonally adjusted new dwelling completions from Q3 2022 to Q4 2022.

5.1.3 Non-Domestic Building Stock

In Ireland, there are an estimated 124,026 buildings in the commercial and public sector, with offices and retail outlets accounting for the largest proportion of these 124,026 buildings, approximately 112,653 are categorised as 'commercial'. The commercial building stock falls into five categories:

- Office (45,683 buildings)
- Retail (39,559)
- Hospitality (i.e., restaurants, pubs) (16,377)
- Warehouse (7,464)
- Hotel (3,570)

BER audits were conducted for 1,440 non-domestic buildings constructed between 2020 and 2022. More than one-third (36%) of these buildings received an A rating compared with 21% of non-domestic buildings constructed during 2015 to 2019. The most energy efficient building types audited during 2009-2022 were Schools and Colleges with 38% awarded an A rating. The second most energy efficient buildings were Nursing Residential Homes and Hostels with 12% rated A. The least energy efficient building types, defined by a G rating, were Workshops and Maintenance Depots (23%) followed by Other Buildings (19%).

Annual primary energy demand in the commercial buildings sector is calculated to be around 18 TWh. has increased at approximately 3 times the rate of the domestic sector. The average floor area of all audited non-domestic dwellings was 699 m2. This average size varied from 3,197 m2 for hotels to 288 m2 for Restaurants and Public Houses. A wide variation in heating fuel was observed across five building typologies.

There was an 11% increase in the number of non-domestic Building Energy Rating (BER) audits reported in 2022 compared with 2020 of the non-domestic BER audits carried out since 2009, 2% were awarded an A rating, 14% a B rating, and 32% were given a C rating. More than one-third (36%) of non-domestic buildings constructed between 2020 and 2022 received an A rating compared with 21% built between 2015-2019. The highest proportion of A ratings for non-domestic buildings was in County Kildare at 6%. Looking at postal districts, Dublin had the highest proportion of A rated non-domestic buildings at 4%.

There were 70,877 non-domestic BER audits conducted in the period 2009 to 2022. Of the non-domestic BER audits conducted since 2009, 2% of buildings were awarded an A rating, 14% a B rating, and 32% were given a C rating.

It has been found that 80% of retail buildings are heated using electricity. In offices restaurants and public houses, the fraction drops to approximately to 50%. Most of the remaining offices restaurants and public houses were heated by oil, natural gas, or solid fuel.

Hotels were heated predominantly by oil, with only a low share of electrical heating. Warehouses were mainly either electrically heated or unheated. In almost all hotels surveyed (91%), 80–100% of the windows are double or triple-glazed. This fraction was 78% for offices, and only 54% for both retail premises and restaurants/public houses. In around half of the retail and restaurant/public house buildings surveyed, the windows are single glazed. This suggests that there remains significant potential for energy savings through double/triple glazing. 27% of all buildings are fitted with less than 20% low-energy lighting therefore there is a significant potential for energy savings in this area.

Almost half (49%) of buildings only have heating, no cooling, with natural ventilation. The highest share of heating and cooling was observed in restaurants/public houses (32%) and retail buildings (29%), and

those building types also showed the highest incidence of mechanical ventilation. 68% of warehouses are unheated. Centralised time controls for heating were in nearly half of the buildings surveyed. Room-by-room time and temperature controls were much less common, being present in only 9% and 15% of surveyed buildings. Ireland has a relatively unsophisticated commercial buildings stock, and a high incidence of buildings in which relatively basic upgrades could lead to significant energy savings.[32]

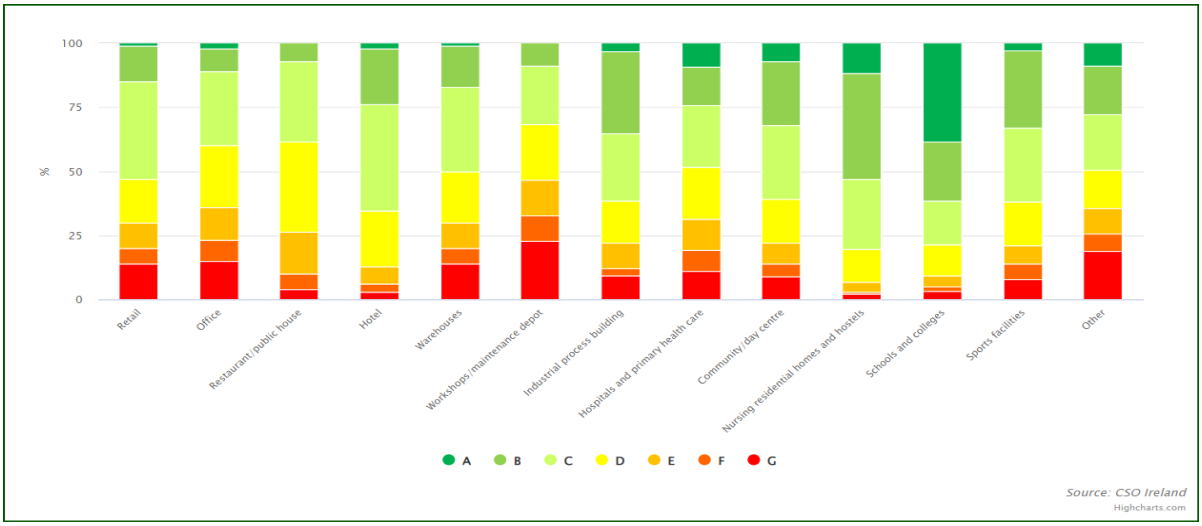

Figure : Non-Domestic BER Audits conducted by building typology 2009-2022

The building stock in Ireland includes approximately 15,000 public sector buildings and in or around 109,000 commercial buildings. In the commercial and public sectors, renovation targets consist of one-third of commercial buildings to be retrofitted to a BER of B by 2030. While no milestones have been formally set for 2040 and 2050, it is expected that an indicative milestone of two-thirds of commercial buildings retrofitted to a BER of B will be reached by 2040. The corresponding date for retrofitting of all commercial buildings to a BER of B is 2050. And Installing 25,000 heat pumps in commercial buildings by 2030[33].

New data released by the Central Statistics Office[34] show data centres' electricity usage in Ireland is surging at a time when the country is failing to meet its climate targets. Data centres used 18% of Ireland's electricity in 2022. This is the same amount used by all urban homes during the same period and nearly double of rural dwelling energy use. This was a 31% increase from 2021 and an increase of nearly 400 % since 2015. Data centre consumption increased from 290 Gwh in January to March 2015 to 1,450 GWh in October to December 2022. A steady increase from quarter to quarter. The increase in consumption was driven by a combination of existing data centres using more electricity and new data centres being added to the grid. Today there are 75 data centres operating in the country - with eight under construction and 30 in planning. This sector has become a contentious topic in Ireland due to the environmental impact and the toll that may be foisted on the country's energy supply and $C0_2$ emissions.[35]

[32] Extensive survey of the commercial buildings stock report (2015) https://www.seai.ie/publications/Extensive-Survey-of-Commercial-Buildings-Stock-in-the-Republic-of-Ireland.pdf)

[33] Ireland's Long-Term Renovation Strategy 2020

[34] https://www.cso.ie/en/releasesandpublications/ep/p-dcmec/datacentresmeteredelectricityconsumption2021/keyfindings/#:~:text=CSO%20Definition%20of%20a%20Data,with%20a%20high%20annual%20consumption.

[35] https://www.thejournal.ie/data-centres-2-5693974-Feb2022/

A Display Energy Certificate (DEC)-BER Cert for non-domestic buildings- is required to be on display in buildings over 1,000m^2 currently resided by any public body. The DEC must be visible to members of the public in an easy-viewing area, usually placed in the entrance. A DEC, for example, must be displayed in schools, libraries etc. This came in to affect as of 1st January 2009. This requirement is to serve as motivation for conscientious and environmentally friendly use of energy within the building by public authorities. Many non-public buildings such as offices currently also display their DEC.

5.1.3 Non-Domestic District Heating

A district heating system in South Dublin County that uses waste heat recovery from the local data centre has been opened to supply heat to new and existing County Council buildings and the TU Dublin-Tallaght campus through the network. There is also potential for other customers, such as the new residential development at Belgard Gardens, to connect to the network at a later phase. The scheme will operate as Ireland's first not-for-profit utility and will make a significant contribution to reducing carbon emissions in the area, saving almost 1,500 tonnes of CO_2 each year, and establishing Tallaght as a leader in innovation in the area of climate change.

District heating is a network of highly insulated pipes that delivers low-carbon heat from a central energy source to provide space heating and hot water to the buildings connected to the network. In the case of the Tallaght District Heating Scheme, this project will deliver a high level of innovation, as waste heat from the nearby Amazon data centre will supply the heat to the network. During normal operation, heat demand will be 100% covered from the data centre waste heat. District heating systems use a central heat source and distribute this heat through super-insulated pipes to the customer. This makes district heating a convenient and sustainable way of heating buildings and water. District heating schemes are completely fuel-agnostic, meaning that many multiple heat sources can feed into the grid.

Through the Pathfinder programme, SEAI partners with public bodies to achieve their retrofit goals, by building capacity and knowledge within the sector. SEAI's Pathfinder programme was set up in 2017, it builds on years of cooperation with forward-thinking public bodies to improve their energy performance and reach their targets. Year on year, the Pathfinder programme has increased its ambition to deliver sustainable solutions to public sector bodies. Following the programme's initial success, we are now trialling deeper retrofit and renewable heat solutions. This approach focuses on tackling decarbonisation of thermal demand towards our 2030 targets and sets a pathway towards net zero in 2050.

The programme's positive impact can be felt across the public, public sector, industry, academia, and the non-domestic supply chain. impacts include:

- Reduced energy and CO_2 emissions
- Increased comfort and indoor air quality
- Enhanced understanding of retrofit solutions
- Upskilling professionals and contractors in retrofit
- Peer-to-peer best practice exchange
- Lessons learned through pioneering approaches.
- Strategic plans which scale ambition
- Testing innovative procurement and finance

The Pathfinder Partners include the following:

- Office of Public Works
- Department of Education

- Health Service Executive
- Department of Further and Higher Education, Research, Innovation and Science and the Higher Education Authority

The programme adopts a highly holistic approach to improving the energy performance of public bodies and sectors so barriers and gaps to achieving energy saving and carbon reduction targets can be identified and removed. This is done through:

- levels of activity being increased.
- Piloting approaches to retrofit challenges.
- Apply learnings to deliver best practice solution and use case studies as part of the journey.

The programme follows a five-step, best practice approach to project delivery which includes:

1. Identifying objectives for the sector addressing stakeholder and operational needs
2. Defining technical requirements and develop sustainable solutions.
3. Providing capital and energy performance contracting support
4. Gathering insights and key learnings to share across the public and commercial sectors.
5. Assessing needs of the supply chain and developing capability

All public sector buildings will be retrofitted to a BER of B by 2030. This will include reducing emissions by 51% by 2030 and increasing the improvement in energy efficiency in the public sector from the 33% target in 2020 to 50% by 2030, as well as increasing the implementation of green public procurement and retrofitting public sector buildings.

5.2 Construction Sector Workforce

According to the CSO Structural Business Statistics 2020 published in September 2022, the number of enterprises in the construction industry in Ireland increased by 3,489 enterprises (+5.9%) in 2020 in comparison to 2019. Therefore, the number of enterprises in Ireland reached a peak in 2020 with 62,664 enterprises of which 62,640 were SMEs. The Construction sector made up the second largest contributor to the number of Irish SMEs, at 21.5% and generated the largest percentage share of turnover at 83.4%. Persons engaged in SMEs accounted for 91.6% of the total persons engaged in the Construction sector in 2020.

Table Building & Construction sector key variables, 2019 - 2020

		2019	2020	2019 – 2020 Percentage change
Building & Construction (F)				
Enterprises	**No.**	**59,175**	**62,664**	**5.9%**
of which: SMEs (<250 persons engaged)	No.	59,150	62,640	5.9%
Large (250+ persons engaged)	No.	25	24	-4.0%
Persons Engaged	**No.**	**158,227**	**157,349**	**-0.6%**
of which: SMEs (<250 persons engaged)	No.	145,813	144,126	-1.2%
Large (250+ persons engaged)	No.	12,414	13,223	6.5%

Source: CSO Structural Business Statistics 2020

As reported in the European Construction Sector Observatory published in December 2021, the number of enterprises in the broad construction sector in Ireland totalled 83,577 in 2020, representing

an increment of 13.1% over the 2010 level (73,881). Enterprises in the narrow construction sub-sector represented 52,653 (63%), real estate activities 18,722 (22.4%), architectural and engineering activities represented 10,614 (12.7%) and manufacturing 1,588 (1.9%)

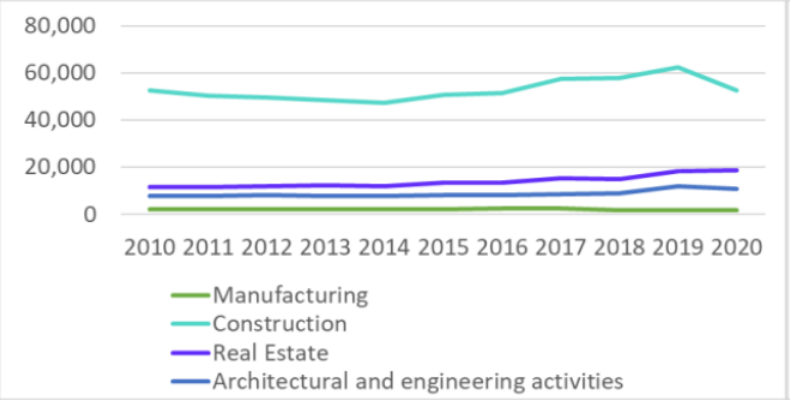

Figure Construction Sector by Enterprise type. Source: Eurostat, 2021.

There is a discrepancy in the 2020 figures from both reports which can only be attributed to the use of different source data. Ireland currently has the Voluntary Construction Register (VCR) which has over 700 members but with the establishment of a new Statutory Register know as Construction Industry Register Ireland (CIRI) will mean that accurate figures on the number of SMEs will then be available. The Regulation of Providers of Building Works Bill 2022 was enacted, signed into law by the President on 5 July 2022. The construction industry will require time to adapt to these new requirements so it is envisaged that it will become mandatory for builders to join the Statutory Register from 2025 on a phased basis.

Due to the impact of the pandemic on the construction industry, employment declined below the 2019 level in both 2020 and 2021. However, employment expanded significantly by 18,000 in 2022 compared to the pre-pandemic year of 2019. The expansion was made up of an estimated increase of 6,000 in the management, professional, associate professional, administration, and sales occupations; an estimated increase of 7,000 in the skilled trades, while an increase of roughly 6,000 was recorded for operatives and elementary workers.

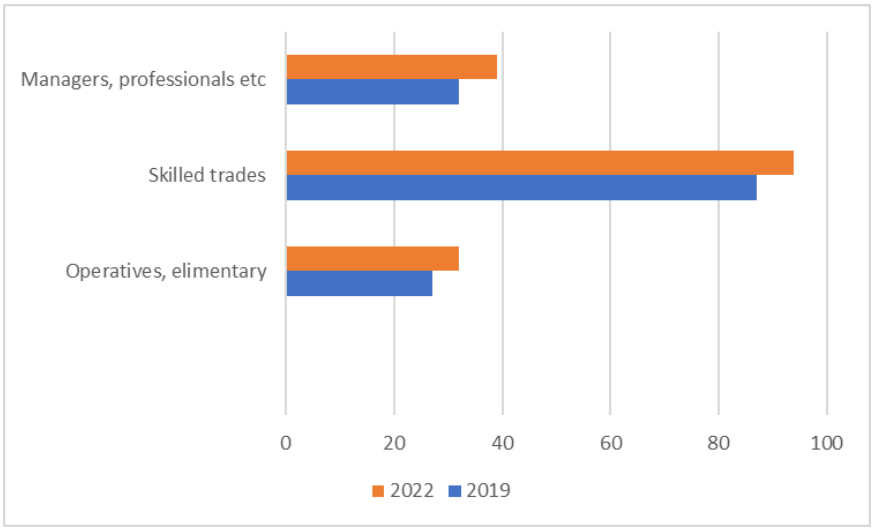

Figure employment growth in the main occupation groups in the construction industry between 2019 and 2022. Source: DFHERIS Estimates

There are however a significant number of professionals and associate professionals who work in the building industry in Ireland, who are not classified for statistical purposes as being employed in the construction sector and consequently are not included in Table below. The number of professionals and associate professionals working in the building industry but who are not classified as being in the construction sector are estimated to be roughly 20,000 in 2022, which is an increase of 3,500 on the estimated figure of 16,500 in 2019. There were also an estimated 500 construction managers and directors who were employed in the industry in both 2019 and 2022, but who were not classified as working in the construction sector. This means that the total number employed either as managers or professionals or associate professionals in 2022 is an estimated 28,000 which is 6,000 above the estimate for 2019.

Table Total estimated employment of construction managers and construction professionals and associate professionals who were classified as not working in the construction industry sector in 2019 and 2022.

Occupation	2022	2019	Difference
Production manager	8,000	6,000	2,000
Civil engineers	10,000	8,000	2,000
Professionals and associate professionals	20,000	18,000	2,000
	38,000	32,000	6,000

Source: DFHERIS Estimates

The Table below shows the estimated employment in the construction industry in both 2019 and 2022 in specific occupations and in groups of occupations. The most striking aspect of the figures is that employment in many of the craft occupations did not increase significantly over the period, despite the increase of over 40% in the number of house completions.

Table Estimated employment in the construction industry in 2019 and 2022 in selected groups of occupations and specific occupations. Source: DFHERIS estimates

Occupation	2022	2019	Difference
Production managers	7,500	5,500	2,000
Administration, sales etc.	21,500	18,000	3,500
Civil engineers	5,000	4,500	500
Professionals, associate professionals	5,000	5,000	0
Managers, admin. Prof. etc.	**39,000**	**3,000**	**6,000**
Welding trades, pipe fitters	4,000	4,000	0
Electricians and electrical fitters	19,000	14,500	4,500
Steel erectors, roofers, other trades etc.	17,000	16,000	1,000
Brick layers and masons	8,000	6,500	1,500
Plumbers, heating	10,000	10,000	0
Carpenters and joiners	18,000	18,000	0
Plasterers, floorers, wall tilers	9,000	9,000	0
Painters and decorators	9,000	9,000	0
Skilled trades	**94,000**	**87,000**	**7,000**
Operative building occupations	15,000	13,000	2,000
Elementary building occupations	17,000	14,000	3,000
Operative and elementary occupations	**32,000**	**27,000**	**5,000**

Grand total	**165,000**	**147,000**	**18,000**

Employment in construction peaked in 2007 at 240,000 persons directly employed, in comparison to the lowest figure in 2012 of 81,300, a decline of 66% because of the downturn during the global financial crisis of 2008. Growth resumed in the economy between 2012 and 2019 and the construction sector grew by 80% in the same period as noted in the *Build 2022: Construction Sector Performance and Capacity* report.

The most recent CSO Labour Force Survey data shows that the number of persons in employment increased across most economic sectors in the year 2022, most notably in construction. The number of persons directly employed in construction at the end of Q4 2022 was 163,200, with Skilled Trades being the highest occupational group at over 94,000. Of the 163,200 employed, just 9% were female. Women are under-represented in the construction industry and this figure needs to increase if Ireland are to meet its targets.

Approximately a further 50,000 people are employed in industries which serve the construction sector, such as architectural practices, engineering consultancies, legal and financial sectors, and agencies.

Table CSO Labour Force Survey Figures

CSO Labour Force Survey	
Year	**Persons Employed**
2007	240,000
2008	214,000
2009	132,800
2010	104,400
2011	86,800
2012	81,300
2013	86,200
2014	90,800
2015	109,000
2016	119,400
2017	128,000
2018	145,700
2019	145,600
2020	136,400

2021	158,300
2022	163,200

The *National Skills Bulletin (SOLAS 2022)* notes that in 2021 approximately 133,700 persons (95% male) were employed in the selected construction occupations, representing 5.6% of the national workforce. The strongest rate of employment growth was observed for bricklayers and plasterers (11.1%) during the period. The 25-54 age group accounted for the majority of persons employed, at 70%. The share aged 55 and over (21%) was slightly above the national average of 19%

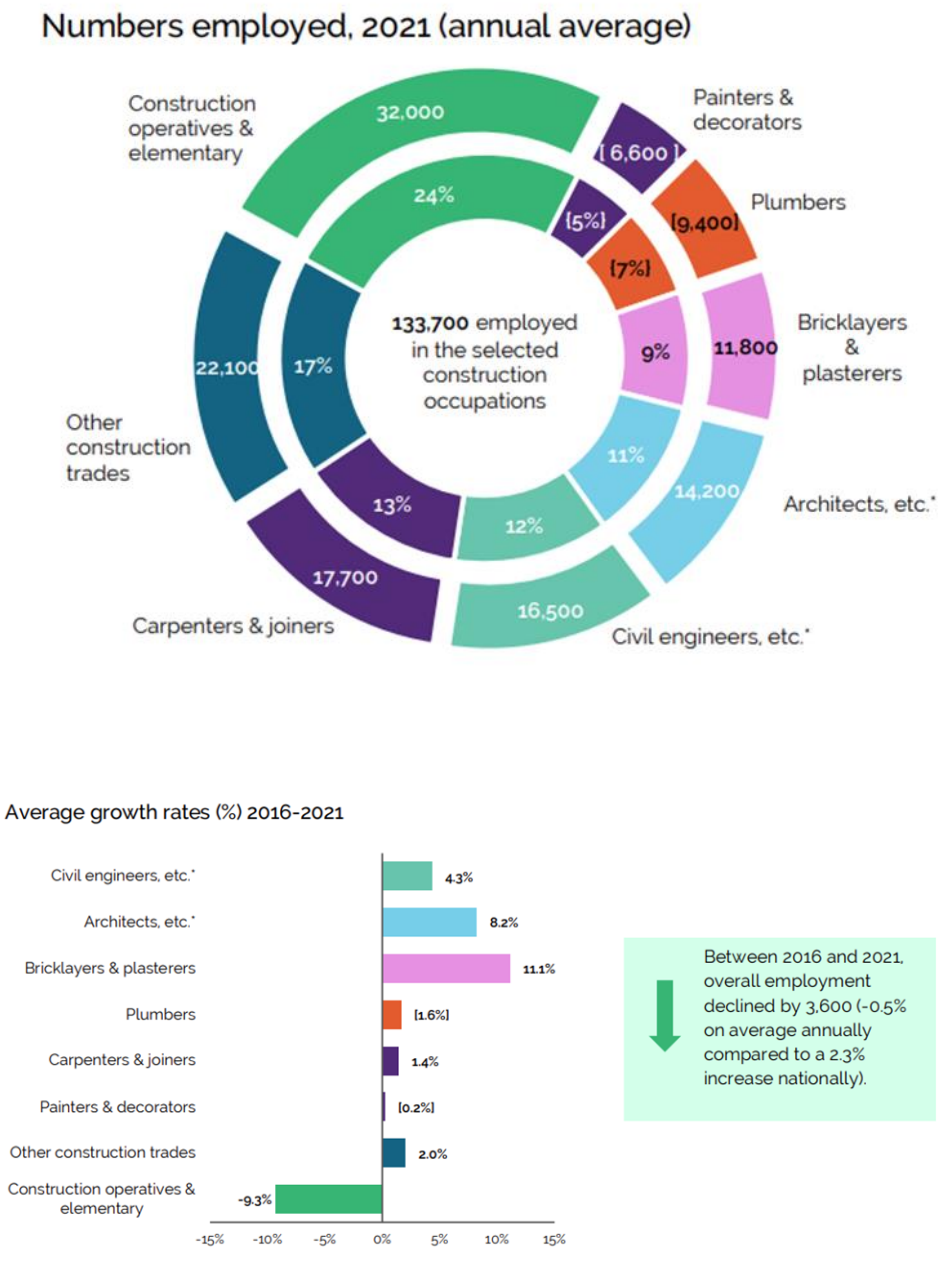

Figure 14 SOLAS The National Skills Bulletin (SOLAS 2022) Source: SLMRU (SOLAS) analysis of CSO data

6. National Education System

6.1 Overview of National Education System

6.1.1 Primary and Post-Primary Education

The Irish Education system is made up of primary education, post-primary education, further education and third level education. Primary education legally requires students to be enrolled above the age of 4 and required to start primary education by 6 years old. Primary education lasts for 8 years, and primary schools (excluding private primary schools) are completely free of charge with all current and capital costs of primary schools including salaries are funded by the Department of Education of the Irish Government. The number of enrolments in primary schools in 2021 was 554,788 students[6].

After primary education, students are required to attend post-primary education for at least 3 years. The minimum requirement of education in Ireland under the Education (Welfare) Act 2000 is from 6 years old until 16 years old. The number of enrolments of post-primary in 2021 was 391,698 students[36].

Post-Primary education has 2 main stages:

1. Junior Cycle: the initial 3 years of post-primary education and the legal minimum requirement of education.
2. Senior Cycle: Can last from 2 years to 3 years (there is an option for a Transition year to extend the cycle to 3 years).

Most undergraduate courses, tradesmanship or traineeships have entry requirements of at least a senior cycle certificate. There are 3 ways to receive a senior cycle certificate:

- The Leaving Certificate is obtained upon completion of the state-run exams, there are higher, ordinary and foundation levels to each subject that each carry 'Points' based on difficulty. Grades and levels are given 'CAO Points[37]' which is the main basis on which students are allocated places in universities, technological universities (TU), institutes of technology (IT) and colleges of education.
- The Leaving Certificate Vocational Programme has elements of the established Leaving Certificate but concentrates on technical subjects and includes additional modules with a vocational focus.
- The Leaving Certificate Applied Programme aims to prepare students for adult and working life through relevant learning experiences. It is for students who wish to follow a practical or vocational programme. It is not recognised for direct entry to third-level courses, but it can enable students to take Post-Leaving Certificate courses.

After completion of one of the leaving certificate programmes, students are able to apply for third level education, vocational, and further education.

[36] Statistics from Education Indicators for Ireland report published by the Department of Education on February 2023

[37] CAO = Central Applications Office, process applications for undergraduate courses in Irish Higher Education Institutions (HEIs). Decisions on admissions to undergraduate courses are made by the HEIs who instruct CAO to make offers to successful candidates. https://www.cao.ie/index.php

6.1.2 Youthreach

The 'Youthreach' programme is available for school leavers without any qualifications or vocational training between the ages of 15 and 20 years old. The programme usually provides two years integrated education, training, and work experience. Basic skills training, practical work training and general education are features of the programme, and the application of new technology is integrated into courses. On completion of the Youthreach programme, a student will receive a Foundation level certification and can progress to a Progression Programme like the Leaving Certificate Vocational or Leaving Certificate applied programmes.

There are almost 6,000 places available nationwide under the Youthreach programme provided by ETBs in over 100 Youthreach centres. Learners on the Youthreach programme are entitled to receive training allowances and additional allowances for meal, travel, and accommodation.

6.1.3 Post Leaving Certificate (PLC)

Post Leaving Certificate (PLC) courses are 1 to 2 years full-time programmes that for people who have completed their Leaving Certificate and adults returning to education. Most of the 1-year PLC courses offered by QQI will result in a NFQ Level 5 qualification (same level as the Leaving Certificate), while the more advanced 2-year courses result in an NFQ Level 6 Higher certificate. With this level 6, students can progress to further studies at third level. Most PLC courses are delivered by Education and Training Boards (ETBs).

In general, you should have finished your secondary education and completed your Leaving Certificate to be eligible for a PLC course. However, if you do not have a leaving certificate but have work experience relevant to the PLC course, exceptions can be made.

As of September 2022, the participant contribution fee of €200 has been removed. However, Colleges that offer PLC courses usually also have a 'course charge' to cover expenses of the course. For Asylum seekers, the International Protection Student Scheme (for Further and Higher Education Students) 2022-2023 provides supports in line with the Student Grant Scheme to students in the international protection system. Asylum Seekers must be accepted by an approved Post Leaving Certificate course or other qualifying course to apply for the support.

6.2 Vocational education and training System

The national system for vocational education and training (VET) for building professionals encompasses various qualifications and training programs. The responsibility for overseeing and implementing these programs lies with several authorities at different administrative levels. Quality and Qualifications Ireland (QQI) are the national awarding body for further education and training (FET) in Ireland, support the recognition of prior learning, and verify existing or emerging qualifications.

FET is primarily provided by the 16 Education Training Boards (ETBs) around the country and An tSeirbhís Oideachais Leanúnaigh agus Scileanna (SOLAS) is the state agency that oversees and leads the strategic development, initiatives, and programmes within the FET sector, including Skills to Advance, Safe Pass training and the Construction Skills Certification Scheme.

Traditionally, apprenticeship training in Ireland was conducted on a "time served" basis with little emphasis on the achievement of pre-determined standards of competence and knowledge. However, this has changed with the introduction of new "Standards-Based" programmes that were designed as a system of employment-focused training and education, and first implemented on a phased basis in 1993.

Each of the Apprenticeship Programmes for the "Standards Based" construction crafts were developed on the basis of industry surveys and research into the skills, knowledge and competence required by craftspeople. SOLAS has the statutory responsibility for the organisation and control of apprenticeships in Ireland and has responsibility for promoting and overseeing the training and education of all apprentices, including the construction related crafts.

Apprenticeship training programmes consist of alternating phases of 'On-the-Job' and 'Off-the-Job' training and education as outlined in Table 2 .The alternating phases of training generally consist of three Off-the-Job phases and four On-the-Job phases, although differences do occur in some apprenticeships. Generally, the first off-the-job training phase will take place in an Education and Training Board (ETB) while the subsequent off-the-job training phases will be in a Technological University or Institute of Technology.

Table Typical Apprenticeship Training Phase Duration

Phase	Duration/Weeks	Location
1 On-the-Job	12	Employer
2 Off-the-Job	20	Education and Training Board
3 On-the-Job	26	Employer
4 Off-the-Job	10/11	Institute of Technology, Technological University
5 On-the-Job	26	Employer
6 Off-the-Job	10/11	Institute of Technology, Technological University
7 On-the-Job	12	Employer

The apprenticeship Programme is deemed to be completed when the apprentices has reached the minimum qualifying standard in all modular and competency-based assessments and has completed the minimum duration of 4 years in employment as an apprentice in the specified trade (exception Print Media 3 years). On successful completion of an apprenticeship programme, candidates are

awarded a FETAC Advanced Certificate in a named trade at Level 6 on the NFQ. Such certificates may serve as an entry qualification for progression into appropriate degree level programmes.

The Housing For All initiative includes actions that directly impact on FET provision in Ireland, which include:

- Deliver an integrated education and training sector response Ongoing DFHERIS to align education and training provision for new and existing workers with the Labour Demand Estimates for Ireland's National Housing Targets, 2021-2030 and forthcoming Expert Group on Future Skills Needs (EGFSN) forecasts.
- Implement recommendations from the Expert Group on Q4 2021 DFHERIS, All Future Skills Needs (EGFSN) 'Building Future Skills' report and construction related recommendations from forthcoming EGFSN 'Skills to Enable the Low Carbon Economy to 2030' report.
- Implement the Action Plan on Apprenticeship 2021-25

The Expert Group on Future Skills Needs report, Skills to Enable the Low Carbon Economy to 2030, also outlines recommendations for consideration with regard to the overall delivery of the Climate Action Plan. However, as it was developed to support the implementation of the 2019's CAP, it primarily focuses on the energy efficient retrofit of 500,000 homes to a minimum B2 BER, and the installation of 600,000 heat pumps.

6.2.1 VET Stakeholder Overview

National Standards Authority of Ireland (NSAI):

The NSAI is the national standards body responsible for developing and maintaining standards across various sectors, including construction, and building professionals. It ensures that training programs align with national and international standards, providing a framework for quality and consistency.

Quality and Qualifications Ireland (QQI):

QQI is the national awarding body for further education and training in Ireland. It develops and validates qualifications, including those specific to building professionals, such as construction management, architectural technology, and engineering. QQI ensures that training programs meet national standards and are delivered by accredited providers.

Further Education and Training Authority (SOLAS):

SOLAS is the national authority responsible for funding, planning, and coordinating further education and training in Ireland, including craft apprenticeships. SOLAS collaborates with Education and Training Boards (ETBs) at the regional level to deliver apprenticeship training programs. As the governing body, SOLAS sets the standards and guidelines for craft apprenticeships, ensuring consistency, quality, and relevance to industry requirements.

Education and Training Boards (ETBs):

ETBs are responsible for delivering education and training programs at the regional and local levels in Ireland. They offer a variety of vocational training courses, including apprenticeships and specific building-related programs. ETBs work closely with industry partners, employers, and stakeholders to ensure that training programs are aligned with industry needs.

Professional Bodies and Associations:

Various professional bodies and associations in Ireland, such as the Royal Institute of Architects of Ireland (RIAI) and the Society of Chartered Surveyors Ireland (SCSI), play a role in the VET system for building professionals. These bodies often collaborate with educational institutions and contribute to the development of industry-relevant training programs and standards. It's important to note that while national-level authorities like NSAI, QQI, and SOLAS provide the overall framework and coordination, the implementation of training programmes involves regional or local ETBs and other training providers.

Craft Apprenticeships Overview:

All Craft Apprenticeships are QQI Level 6 Awards and are industry-focused training programs designed to develop skilled workers in various trades. They combine practical on-the-job training with classroom-based learning, providing a comprehensive learning experience.

Craft apprenticeships typically last for a specified duration, during which apprentices work under the guidance of experienced professionals while attending training centers or educational institutions to acquire theoretical knowledge.

Apprenticeship Standards:

SOLAS, in consultation with industry representatives and stakeholders, develops and maintains apprenticeship standards for various craft trades. These standards outline the specific skills, knowledge, and competencies required for each trade, setting a benchmark for apprenticeship training. The standards provide a framework that apprentices, employers, and training providers follow throughout the apprenticeship journey.

Traineeships and Apprenticeships:

A Traineeship combines learning in the classroom and experience in the workplace to improve employment outcomes for participants and increase retention and productivity in the sector. A traineeship is a much more agile and flexible form of learning, in an industry that needs to be flexible. Employers can identify skills gaps and through collaboration with Education and Training Boards (ETBs), develop a traineeship that addresses a key skill requirement that is not covered in the current apprenticeship programmes. Traineeships are a great mechanism to meet training needs, and this was achieved recently with the new Skilled Utilities Operator Traineeship, a 13-month training programme which provides the participant with the skills and knowledge needed to deliver infrastructure for utilities companies.

There is a renewed focus on Apprenticeships in Ireland with the establishment of the National Apprenticeship office in 2022 with the focus on the implementation of the Action Plan for Apprenticeship 2021-2025. The plan will work to ensure equity of access to ensure underrepresented groups are able to avail themselves of apprenticeships by creating simplified routes to entry, and improved flexibility within the system. One of the initiatives is the Facts, Faces, Futures campaign which aims to communicate the growing participation and leadership of women in careers available through apprenticeship and to ensure that students in girls' schools around the country are aware of the apprenticeship programmes now available. There will be additional support for those in the apprenticeship system, including for employers, who will be encouraged and supported to take on apprentices through financial assistance and other mechanisms.

The introduction of the Civil Engineering Apprenticeship has been developed to address the shortfall in the industry for qualified civil engineers. Atlantic Technological University (ATU) along with the Civil

Engineering Apprenticeship Consortium of key industry stakeholders and employers developed the apprenticeship programme. The development of the programme is supported and funded by the National Apprenticeship Office in a bid to attract new entrants into the profession and satisfy a growing demand for learning through apprenticeship. The first intake of apprentices is scheduled for September 2023.

There is a huge choice of courses and training programmes. Many of these programmes provide the same material but use different language which leads to confusion for people. There are not enough resources and guidance that would direct people to the courses and training most appropriate for their career needs. More courses should also be provided online and on part-time basis for higher access and engagement.

6.2.2 Craft Apprenticeships

SOLAS oversees the delivery of craft apprenticeship training through the network of ETBs and approved training centres across the country, while ETBs are responsible for coordinating and providing the necessary training infrastructure and support services for apprentices. ETBs and SOLAS both works closely with employers and industry experts to deliver training that aligns with the craft apprenticeship standards.

Craft apprenticeships involve continuous assessment to evaluate apprentices' progress and competency development. Assessment methods can include practical skills demonstrations, written examinations, and workplace assessments. Upon successful completion of the apprenticeship, apprentices are awarded a nationally recognized qualification, typically at QQI Level 6, certified by SOLAS.

Craft apprenticeships offer individuals valuable opportunities to gain practical skills and industry experience while earning a qualification – they are extremely important to this report and to the sector in general. Below is the listing of the traditional trades:

Overview Of Craft Apprenticeships		
Agricultural Mechanics	Industrial Insulation	Farriery
Aircraft Mechanics	Instrumentation	Stonecutting & Stonemasonry
Brick and Stone laying	M.A.M.F.	Toolmaking
Carpentry and Joinery	Metal Fabrication	Vehicle Body Repairs
Construction Plant Fitting	Motor Mechanics	Wood Manufacturing & Finishing
Electrical	Electrical Instrumentation	Electronic Security Systems
Heavy Vehicle Mechanics	Painting and Decorating	Pipefitting
Plastering	Plumbing	Refrigeration & Air Conditioning

Table Overview OF Craft Apprenticeships

6.2.3 Professional Associations

ETBs from time to time may offer qualifications from other accrediting bodies which map across to the NFQ. Below are some examples of these that offer qualifications in relevant areas and can be mapped across to the National Framework of Qualifications (NFQ) in Ireland:

Chartered Institute of Building (CIOB):

The CIOB is an internationally recognised professional body for the construction industry. It offers accreditation and recognition of construction-related courses and programs provided by educational institutions in Ireland. The CIOB's accreditation signifies that the programs meet industry standards and have met the rigorous criteria set by the institute.

Construction Industry Federation (CIF) and Construction Industry Training Board (CITB):

These organizations provide a range of industry-recognized certifications and qualifications specific to the construction and building sector in Ireland. These certifications often align with the relevant QQI Levels on the NFQ and are highly regarded within the industry.

City and Guilds:

City and Guilds is a well-known UK-based accrediting body that offers a wide range of vocational qualifications. Many City and Guilds qualifications align with industry needs in the building sector and can be mapped to the NFQ. For example, City and Guilds Level 3 Diploma in Construction and the Built Environment or Level 3 Diploma in Electrical Installations can be considered equivalent to QQI Level 6 qualifications within the building sector.

BTEC (Business and Technology Education Council):

BTEC is another prominent UK accrediting body that provides vocational qualifications in various sectors, including construction and engineering. BTEC qualifications, such as the BTEC Level 3 Extended Diploma in Construction and the Built Environment or BTEC Level 3 Extended Diploma in Engineering, align with QQI Level 6 qualifications in the building sector.

Professional Associations and Institutions:

Professional associations and institutions in the building sector, such as the Royal Institute of Architects of Ireland (RIAI) and the Society of Chartered Surveyors Ireland (SCSI), often play a role in certification and accreditation. These bodies typically establish their own standards and requirements for professional practice and membership. They may offer certification or chartered status to individuals who meet specific criteria, demonstrating their competence and expertise within the building profession.

Industry-Specific Standards and Certification Schemes:

Within the building sector, there are industry-specific standards and certification schemes that ensure compliance with quality, safety, and environmental regulations. For example, in the construction industry, there are standards like ISO 9001 (Quality Management System) and ISO 14001 (Environmental Management System).

Certification schemes, such as Safe-T-Cert, Construction Industry Register Ireland (CIRI), or Construction Skills Certification Scheme (CSCS), focus on verifying the skills, competence, and health and safety awareness of individuals working in the sector.

International Standards and Certifications:

International standards, such as those developed by the International Organization for Standardization (ISO), may also play a role in certification and accreditation within the building sector. Certifications like LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method) provide recognition for buildings that meet specific sustainability and environmental criteria.

Edexcel (Pearson Edexcel):

Edexcel, part of Pearson Education, is an awarding organization that offers a range of vocational qualifications. Edexcel qualifications in construction-related subjects, like the Edexcel Level 3 Extended Diploma in Construction and the Built Environment, can be considered equivalent to QQI Level 6 qualifications.

Institute of Leadership and Management (ILM):

The ILM is a professional body that offers qualifications in leadership and management. Some ILM qualifications, such as the ILM Level 5 Diploma in Leadership and Management, can be relevant for individuals seeking management roles within the building sector.

These UK accrediting bodies and qualifications can provide valuable recognition and demonstrate expertise within the building sector. While mapping these qualifications to the NFQ can be done, ETB's can have their own agreements in place with these providers and processes to ensure accurate equivalences within the Irish context.

6.2.4 Certificates Overview

The following table below showcases the number of certifications issued in each discipline for the year 2022.

Table Numbers of certificates issued in 2022 in each discipline: (Ref – SOLAS)

Certs Issued in 2022	2022				2022 Total
(Craft Trades)	Qtr1	Qtr2	Qtr3	Qtr4	
Agricultural mechanics	4	3	1	12	20
Aircraft mechanics	5	8	1	1	15
Brick and Stone laying	3	7	1	11	22
Cabinet Making					0
Carpentry and joinery	38	86	76	83	283
Construction plant fitting	11	9	12	9	41
Electrical	274	170	478	165	1,087
Electrical instrumentation	60	16	12	3	91
Electronic security systems	1	1	14	3	19
Farrier		1	1	3	5
Floor And Wall Tiling	-	-	-	-	0
Heavy vehicle mechanics	20	25	15	17	77
Industrial insulation	1	4	1	1	7
Instrumentation	-	-	5	3	8
M.A.M.F.	37	26	32	16	111
Metal fabrication	40	27	47	31	145
Motor mechanics	62	53	102	65	282
Painting and decorating	1		5	3	9
Pipefitting	1	7	12	1	21
Plastering	4	5	3	7	19
Plumbing	70	56	117	50	293
Print Media	-	1	-	-	1
Refrigeration and air condition	16	12	24	5	57
Sheet metalworking	6	2	9		17
Stonecutting and stonemasonry	-	-	-	2	2
Toolmaking	9	11	10	25	55
Vehicle body repairs	5	6	2	4	17
Wood manufacturing and finishing	16	9	20	2	47
Grand Total	684	545	1,000	522	2,751

The following table below showcases the number of registrations in each discipline the for the past four years leading to 2023:

Table 2019-2023 Apprenticeship Registrations

Apprentice Registrations from 2020 to end of April 2023 (Craft Trades)	2020	2021	2022	2023 (to end of April)	Grand Total
Agricultural Mechanics	52	90	58	19	219
Aircraft Mechanics	50	55	62	-	167
Brick and Stone laying	56	148	72	13	289
Carpentry and Joinery	563	847	713	211	2334
Construction Plant Fitting	63	81	73	27	244
Electrical	1740	2748	2648	965	8101
Electrical Instrumentation	62	103	120	39	324
Electronic Security Systems	45	61	86	17	209
Farrier	-	6	8	-	14
Heavy Vehicle Mechanics	135	194	162	70	561
Industrial Insulation	23	22	16	3	64
Instrumentation	11	12	13	9	45
M.A.M.F.	142	221	203	61	627
Metal Fabrication	198	340	252	84	874
Motor Mechanics	310	502	431	134	1377
Painting and Decorating	24	43	23	5	95
Pipefitting	52	98	114	30	294
Plastering	20	38	31	9	98
Plumbing	560	875	792	260	2487
Refrigeration and Air Conditioning	73	142	152	61	428
Sheet Metalworking	41	63	42	12	158
Stonecutting and Stonemasonry	3	9	8	-	20
Toolmaking	48	52	48	20	168
Vehicle Body Repairs	31	50	28	8	117
Wood Manufacturing and Finishing	75	155	144	44	418
Grand Total	4377	6955	6299	2101	19732

6.2.5 Future FET: Transforming Learning

The National Further Education and Training (FET) Strategy, *Future FET: Transforming Learning* includes an entire section devoted to meeting Ireland's "Critical Skills Needs". The strategy highlights the sectors focus on meeting Ireland's critical skills needs, that will be shaped and influenced by its employers, and will deploy accessible labour market intelligence to underpin smart choices by learners and those who advise them. It references the Skills and Labour Market Research Unit's (SLMRU) analysis of key skills gaps and labour market trends which is already influencing ETB and other FET providers' strategy and provision. The use of this data has been formally embedded within SOLAS/ETB strategic performance agreements and underpins the identification of the critical skills areas on which SOLAS requires ETBs to focus. T

The SLMRU will work on making this information more accessible to a wider audience, so that it can have a greater influence on potential learners, parents, guidance professionals and employers in

influencing smarter choices around education and skills development. Ensuring a focus on critical skills needs will require further development of skills specialisms by ETBs which reflect their capabilities and industry clusters within their catchment. There are already many examples of this, with particular ETBs specialising in areas like energy, media, aircraft maintenance and construction. ETBs taking the lead in developing 2016-plus 43 apprenticeships will further support the development of Centres of Excellence, and an approach to acknowledging, promoting, and rewarding such specialist excellence should be considered. In identifying traditional areas of FET strength that should be built upon, Construction is specifically referred to, so that future skills requirements are embedded in FET curricula to maintain it as the core pathway to successful careers in these sectors.

Climate change and sustainable development are cited as a critical focus for FET, with a strong contribution to the Government's call to action by building on FET's strong capabilities around energy, building and the environment. This, the strategy states "will be central to the modernisation of construction skills, as innovating access in construction and skills related areas is vital". There should be a national roll-out of Nearly Zero Energy Buildings (NZEB) construction skills centres, programme development across all green skills areas should be ramped up, and curricula across all relevant apprenticeships and other FET programmes should be updated to embed a sustainable development focus. Perhaps most critically, there should be emphasis on ensuring that all FET provision is used to develop critical climate change and environmental knowledge, and that FET campuses are based on a strong sustainability ethos.

6.2.6 Green skills for FET 2021-2030

This document, compiled by the Construction, Quality & Green Skills team in SOLAS – the state agency that aims to fund, coordinate, and monitor Further Education and Training provision in Ireland - sets out some key areas for the Further Education & Training (FET) sector and responds to the future skills requirements of the green economy. Under the headings of Green Skills for Life, Green Skills for Construction and Green Skills for Careers it builds upon the work already being undertaken by providers of FET to ensure that Ireland can meet its target of having net-zero greenhouse gas emissions by 2050.

Green Skills for FET 2021-2030 captures some of the key areas for the FET Sector in the transition to a green economy and responds to various EU and national directives. Climate justice, sustainable development and the bioeconomy represent significant global and national challenges. All 3 areas require appropriate technological and cultural change, transforming the way goods are produced and services delivered. That change requires the monumental development of the appropriate knowledge and skills to drive it forward and several industries served by FET (construction, agriculture, etc.) have central roles to ensure that employees and employers have the sufficient skills to thrive in the green economy.

Green Skills for Construction Objectives:

To train and upskill those in construction occupations in the latest green technologies.

a) Construction Apprenticeships Incorporate green skills and business training in curricula so the workforce remains equipped for technological advancement in the green economy

b) Developing Construction Skills Ensure that FET construction programmes (i.e. CSCS) include a focus on green, sustainable practices and technologies to remain industry relevant

c) NZEB Centres of Excellence Provide starter programmes, conversion courses, upskilling and post-apprenticeship courses in Near Zero Energy Building technologies in 6 Centres of Excellence nationwide

6.2.7 Continuous Learning and Innovation

The VET sector is continually working to build up specialised knowledge, new training opportunities, and ongoing professional development to support a workforce equipped to meet the challenges and demands of sustainable construction practices. It's difficult to capture a full listing – that will take time and pilot phases to complete. The 6 Centres of Excellence for NZEB and Retrofit are the beginning of standardising approach across the sector.

VET providers continue to collaborate with industry partners to develop training materials and practical exercises that teach students how to assess and reduce the carbon footprint of buildings, implement circular construction principles, and optimize resource efficiency. Continued collaborative projects between ETB's and industry partners expose students to real-world scenarios and enable them to apply BIM skills in energy-efficient building design and construction.

The VET sector is actively incorporating training programs and courses that address whole life carbon assessment, circular construction principles, and resource efficiency practices. While also recognising the importance of digital skills, specifically in Building Information Modelling (BIM), for enhancing energy performance in buildings. Across FET provision – there is a specific focus on Digitalisation and Sustainability in all provision.

Educational institutions, ETBs, and Universities are integrating sustainability-focused modules and qualifications into their construction and built environment curricula – and throughout. VET programs offer training in BIM software and methodologies, providing students with practical knowledge and hands-on experience in energy analysis, simulation, and optimization using BIM tools – MMC and Engineering in particular – recognising the difference that technological advances will make.

The VET sector is actively aligning its training programmes and offerings to address these points and meet the evolving needs of the construction industry. Through collaborations with industry partners, integration of sustainability-focused modules, and practical training opportunities, the VET sector plays a crucial role in equipping learners with the necessary skills to achieve whole life carbon reduction, circular construction, digital proficiency, smart building upgrades, and energy-efficient retrofits of historical buildings. A. ETB VET programmes incorporate specialised modules that cover energy upgrade strategies for heritage buildings, emphasizing the unique considerations and techniques required – again within the Centres of Excellence – taking cognisance of the existing housing stock make up.

6.2.8 Existing instruments to monitor market developments.

Within the existing built environment sector, there are several instruments and organisations that monitor market developments in terms of technology, skills requirements, and training. These instruments help identify emerging trends, skill gaps, and training needs. Here are some examples:

Sector Skills Councils/Observatories:

7. In Ireland, Construction Industry Federation (CIF) plays a crucial role in monitoring market developments within the built environment sector.

8. CIF serves as a representative body for the construction industry and provides insights into industry trends, skills requirements, and training needs.

9. CIF collaborates with industry stakeholders, educational institutions, and training providers to address skills gaps and develop relevant training programs.

Industry Associations and Professional Bodies:

- Industry associations and professional bodies in the built environment sector actively monitor market developments and trends.

- Organizations such as Engineers Ireland, Royal Institute of Architects of Ireland (RIAI), Society of Chartered Surveyors Ireland (SCSI), and Irish Green Building Council (IGBC) provide valuable information on technology advancements, industry best practices, and skills requirements.

- These bodies often offer professional development programmes, seminars, and conferences to disseminate knowledge and promote continuous learning within the sector.

Research and Policy Institutions:

- Research institutions and policy organizations, such as the Sustainable Energy Authority of Ireland (SEAI) and the Building Research Establishment (BRE), contribute to monitoring market developments.

- They conduct studies, collect data, and analyse trends related to energy efficiency, sustainable construction practices, and emerging technologies.

- The insights from these institutions inform policies, guidelines, and training initiatives to address evolving skills requirements and promote innovation within the sector.

Educational Institutions:

- SOLAS, ETBs, and universities, have a role to play in monitoring market developments through their research activities and industry collaborations.

- These institutions often engage in research projects, knowledge transfer partnerships, and industry advisory panels to stay informed about technological advancements, market demands, and skill requirements.

- By closely collaborating with the industry, educational institutions can align their training programs with the evolving needs of the built environment sector.

- Skills and Labour Market Reports – Skills and Labour Market Research Unit – SOLAS Skills bulletins etc. All form part of this data which informs provision. These insights and initiatives play a crucial role in ensuring that training programmes and skills development efforts align with the evolving needs of the industry.

6.2.9 Making the Construction sector more Applicable.

The FET Strategy has three clear pillars - Building Skills, Creating Pathways and Fostering Inclusion. ETBs and Industry are actively promoting diversity and inclusion, emphasising the importance of gender equality and equal opportunities within the sector. Awareness campaigns, workshops, and initiatives are being implemented to challenge gender stereotypes and encourage more women to consider careers in renovation and construction.

The promotion of inclusive work environments and diverse teams fosters an atmosphere that is welcoming and supportive of women and young talents.

a. ETBs career guidance services, and industry organisations are working together to provide information and guidance about the wide range of career opportunities available in the renovation and construction sectors.
b. Outreach programmes, school visits, and mentorship initiatives aim to spark interest and provide insights into the industry's potential for women and young talents.
c. Providing accurate and comprehensive information about career paths, training options, and success stories of women in the sector helps to break down barriers and attract more individuals to these fields.
d. Training programmes and apprenticeships are being designed with a focus on attracting and retaining women and young talents – the female bursary has been introduced for employers taking on female apprentices.
e. By implementing these measures, the renovation and construction sectors aim to create an inclusive and attractive environment that encourages women and young talents to pursue careers in these fields. Ongoing collaboration between industry stakeholders, ETBs, professional associations, and support networks is essential for achieving these goals and promoting diversity within the sector.

6.2.10 Reskilling workers and professionals

LOETB led the multi-agency response to Bord Na Móna workers whose jobs were, and are, at risk due to the company's decarbonisation process. This initiative involved GRETB – at Blackwater Bord Na Mona Works - and LWETB – who led it in Mount Dillon Bord Na Mona Works. Having offered Training Needs Analyses and Skills Audits to all Bord Na Móna staff who were availing of Voluntary Redundancy, LOETB engaged 450 Bord Na Móna training participants during 2020-2022 on a range of programmes from Bicycle Maintenance to Retrofit and NZEB provision, from Train The Trainer to Sustainable Agriculture, from Electrical Instrumentation to Horticulture at QQI Level 4.

The focus was originally on employees engaged in the Peat Climate Action Scheme (also known as Peatland Rehabilitation/Bog Rewetting) and those employed in Derrinlough Briquette Factory.

122 Bord Na Mona employees undertook the initial Skills Audits/Training Needs Analysis and Career Coaching with LOETB in 2022 – Blackwater (31), Boora (24). Derrinlough (22), Derrygreenagh (9), Kilberry (2), Mount Dillon (33). Newbridge (1).

15 of those employees have, to date, availed of the Bord Na Mona Employee Supports Training and Upskilling Project funded under the Irish Just Transition Fund to enable them avail of upskilling and reskilling programmes that are not available from the ETB's.

LOETB is continuing to ensure tailored provision throughout 2022 and is offering up to 300 current Bord Na Móna employees the opportunity to participate in Skills Audits and TNAs that will entitle them to benefit from Just Transition upskilling funding to enhance their employment potential post PCAS. Workers are supported to identify future employment career opportunities based on current skillsets and interests and advice and support on the upskilling pathway required. They can then apply to Bord Na Móna's Just Transition Upskilling Fund to support individual pathways or a FET Pathway, if more appropriate to their level of educational attainment. This action is reflected in Ireland's Climate Action Plan - *(CAP) Action 29 Enhance delivery of further and higher education in the Midlands region to equip*

people for future employment opportunities in green growth sectors - Education and Training Boards will undertake skills audits.

Indeed, LOETB's intensive work with Bord Na Móna (former) employees as part of the Just Transition process is mirrored in many of the ETB-related actions in the Government's Climate Action Plan 2023.

- *Climate Action Plan (CAP)Action 16 Promote timely and tailored activation and training responses for workers whose jobs are at risk by the decarbonisation process.*

LOETB led the multi-agency response to Bord Na Móna workers whose jobs were, and are, at risk due to the company's decarbonisation process. Having completed Training Needs Analyses and Skills Audits with all Bord Na Móna staff who were availing of Voluntary Redundancy, LOETB engaged 450 Bord Na Móna training participants during 2020-2022 on a range of programmes from Bicycle Maintenance to Retrofit and NZEB provision, from Train The Trainer to Sustainable Agriculture, from Electrical Instrumentation to Horticulture at QQI Level 4.

- *(CAP) Action 29 Enhance delivery of further and higher education in the Midlands region to equip people for future employment opportunities in green growth sectors.*

(1) *Education and Training Boards to offer deep retrofit training provision and renewable energy courses*

LOETB engaged 174 learners in Retrofit and NZEB provision in 2021 (66 of whom were Bord Na Móna employees). 136 learners engaged in Renewable Energy upskilling and reskilling provision – including Domestic Heat Pumps, Solar PV, Micro Gen and Domestic Gas Safety with a further 250 Renewable Energy Learners in 2022 focusing primarily on Domestic Heat Pump Installation.

(2) *Education and Training Boards to provide Bog Rewetting Programme Traineeship and the Sustainable Agriculture Traineeship.*

LOETB continues to engage with Bord Na Móna and 130 of their employees (all of those engaged operationally on the Peat Climate Action Scheme) in the **Peatland Rehabilitation Traineeship**. Despite experiencing some delays and interruptions due to COVID19 and the piecemeal nature of bog licensing for the national rewetting programme, 102 Bord Na Móna operatives participated on the Traineeship in 2021. LOETB has agreed to facilitate those yet to complete the programme during 2022 and have reoriented provision to upskill employees in the specific work being undertaken by the company on Peat Climate Action Scheme (PCAS) this year.

56 Bord Na Móna learners engaged in the **Certificate in Sustainable Agriculture** during 2021, with 48 Bord Na Mona beneficiaries the following year. LOETB is providing this programme in partnership with Teagasc and the Agricultural Colleges at Gurteen and Mountbellew. It is primarily aimed at Bord Na Móna seasonal employees and Bord Na Móna families aiming to enhance the agricultural landscape and support the farming community in its transition to a lower carbon environment and provide them with the skills to avail of likely green initiatives in new CAP reform policies as well as exploring diversification and off-farm income generation. The success of this initiative has resulted in the focus of the programme being expanded to the impacted families and communities in the Just Transition region in 2023.

LOETB in partnership with Offaly LEO and Bord Na Mona is offering a Start Your Own Business Programme – New Beginnings – to Bord Na Mona employees in 2023, resulting in QQI Certification and, crucially, a Business Plan that will attract seed funding from Bord Na Mona.

Bord Na Mona Learners with LOETB 2020/2021	
Programme	No. of Learners
NZEB Retrofit	36
Peatland Rehabilitation Traineeship	60
Sustainable Agriculture Traineeship	51
MIG Welding	38
Advanced Welding	16
Bicycle Mechanic	18
Industrial Electrical Systems	18
ICSE Door Security/Guarding Skills	13
Train The Trainer	16
Site Supervisor	7
HGV Artic/Rigid	14
Supervisory Management	22
Basic IT Skills	13
CSCS	
Telescopic Handler	43
360° Excavator	79
Site Dumper	5
Slinger/Signaller	1
Total	450

6.3 Higher Education System

Higher Education Authority (HEA) govern, regulate, oversee the strategic development and are responsible for funding for the Irish higher education institutes (HEIs). There is currently 19 HEI in Ireland, these can be further categorised as:

- Universities: Most universities in Ireland are State funded, but they are generally autonomous. The Royal College of Surgeons in Ireland (RCSI) is a private university.
- Technological Universities and Institute of Technologies: The Technological Universities Act 2018 allowed institutes of technology (IT) to apply to become a new type of higher education institution with technological university status.

HEIs provide programmes of education and training in areas such as business, science, engineering, linguistics, and music from higher certificate (NFQ level 6) to doctorates (NFQ Level 10). HEIs have started to roll out professional courses alongside their undergraduate and postgraduate offerings, these professional certificates also include Microlearning Modules. These modules are very short and may not carry any 'European Credit Transfer and Accumulation System' (ECTS) Credits or may not carry any accreditation. For this reason and for the purpose of this research, a scan of all courses available in Ireland provided under the Higher Education System was conducted, with the following scope:

- A Course must be equivalent to at least 5 ECTS credits or must be part of a progression towards an undergraduate or Postgraduate course.

- A Course must be listed and all information available on the Higher Education Institutes (HEI) or professional associations (PA) website.

- The Course must relate to the built environment and at least one of the following:
    a. Energy Efficiency
    b. Renewable Energy
    c. Embodied Carbon
    d. Circular Economy
    e. Digitalisation

Courses analysed in this study range from Undergraduates, Postgraduates, Continuous professional Development (CPD) courses, to certificates or diploma from the HEIs and Pas listed in Table 6. It is important to note that Technological Universities (TUs) are a combination of previous institutes of technologies (ITs), this sometimes leads to the same course being offered by a specific TU in multiple locations and with various entry and cost requirements.

Table Overview of HEIs and PAs that have been analysed. Note: There are 6 HEIs that were not included in this list, this is due to a greater focus on other sectors within these HEIs.

Higher Education Institute *	Professional Association
Atlantic Technological University (ATU)	Engineers Ireland
Dublin City University (DCU)	Climate Ready Academy
Dundalk Institute of Technology (DKIT)	ARUP
Maynooth University (MU)	Chris Mee Group
Munster Technological University (MTU)	BRE Academy
National College of Ireland (NCI)	Midlands Energy Training and Assessment Centre

Southeast Technological University (SETU)	Chevron College
Technological University Dublin (TUD)	Saint Gobain Academy
Technological University of the Shannon: Midlands, Midwest (TUSMM)	BIM Design Hub
Trinity College Dublin (TCD)	Ecological Building Systems
University College Cork (UCC)	MosArt
University College Dublin (UCD)	Partel
University of Galway (UG)	-
University of Limerick (UL)	-

6.3.1 Student Information

The Central applications office (CAO) has a database for student applications and offers for years 2020 -2022. How CAO applicants and offers work is that students that are completing their Leaving certificate will apply to join multiple courses via CAO application form. This will rank courses from 1 up to 10 preferences. If the student achieves the entry requirements (CAO points and class requirements), they are offered a position in the course, otherwise they must go through a second round for their next preference. The more technical the course has an effect on the number of places available in the course, this could be due to demand for these courses, however it could be due to the difficulty in teaching a larger group. It is worrying as the dropout rate for universities is quite high. It also shows that for level 7 courses there are more places available compared to Level 8.

Some Examples:

- Structural Engineering with Architecture typical course places available: 11
- Automation and Robotics typical course places available: 20
- Quantity Surveying typical course places available: 24
- Civil Engineering typical course places available: 24
- Mechanical Engineering typical Course places available: 40
- Energy Engineering typical Course places available: 40
- Electrical & Electronic Systems Level 7 typical Course places available: 60
- Sustainability with Environmental Sciences typical Course places available: 80
- Sustainability with Business & Economics typical Course places available: 80

Table CAO database for offers to students by Qualification.

Qualification Category	2020		2021		2022	
	Total	Offers	Total	Offers	Total	Offers
Mature Applicants (Over 23-years of age)	8,573	5,395	10,164	5,659	7,631	4,384
Applicants presenting any Leaving Certificate (LC) results	66,057	57,042	66,700	58,245	66,321	58,352
Presenting QQI FET/FETAC (NCVA)	11,188	8,334	11,719	8,135	9,213	6,752

Presented GCE and GCSE results	2,084	1,123	2,799	1,427	2,135	1,045
Presented with previous attendance at Higher Education	7,053	4,171	7,878	4,294	7,731	4,559
Presenting school leaving exams other than LC, QQI FET/FETAC, and/or GC(S)E	4,501	1,863	7,578	2,893	8,481	3,552
TOTAL	**99,456**	**77,928**	**106,838**	**80,653**	**101,512**	**78,644**

Leaving Certificate students represent on average 65% of total applications, and an average 73% of total offers. There has been a large increase (80%) in applicants from 2020 to 2022 who are presenting school leaving exams outside of the Irish education system and UK leaving exams. However, there is only a 40% success rate for these applicants. Overall, there has been a decrease of -5% in total applications in 2022 compared to 2021. The Higher Education Authority (HEA) has information on students and graduates that are within the higher education system. The enrolments for years 2016-2022 are listed below and are broken down by field of study:

Table Overview of Enrolments in Field of Study 2016-2022 (Source: HEA)

Field of Study	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	Total
Agriculture, forestry, fisheries and veterinary	3,660	3,795	3,895	3,885	4,020	4,210	23,465
Arts and humanities	35,185	35,315	34,155	34,130	33,895	34,150	206,830
Business, administration, and law	42,645	44,875	47,875	50,755	54,705	50,820	291,675
Education	13,325	14,510	15,605	16,465	16,045	17,030	92,980
Engineering, manufacturing, and construction	24,155	24,830	25,490	26,640	27,880	28,805	157,800
Generic programmes and qualifications	2,100	2,075	2,365	2,535	1,760	1,775	12,610
Health and welfare	37,545	38,635	39,645	40,340	42,470	43,130	241,765
Information and Communication Technologies (ICTs)	14,830	14,675	14,545	14,700	15,025	15,210	88,985
Natural sciences, mathematics, and statistics	21,950	22,315	22,750	23,225	24,510	25,445	140,195
Services	10,690	10,435	9,205	9,330	10,600	9,985	60,245
Social sciences, journalism, and information	12,170	12,280	12,975	13,695	14,750	15,745	81,615

Grand Total	218,245	223,745	228,505	235,695	245,665	246,300	1,398,155

A more detailed table of field of study from the HEA database for 2021 and 2022 is shown in appendix 1.

Comments on table 12 enrolments:

- Year on Year more enrol in Business, Administration and Law courses than any other field of study, followed by Health and Welfare.
- The total number of students in higher education have increased year on year also, with an increase of 13% in enrolments or 28,055 enrolments between the years 2021/2022 and 2016/2017.
- The Engineering, Manufacturing and Construction field of study has seen an increase in enrolments of 20% in the same period.
- The Engineering, Manufacturing and Construction field of study accounts for 12% of 2021/2022 enrolments, an increase of 1% since 2016/2017.

6.3.2 Graduate Information

The graduates for years 2016-2022 are listed below and are broken down by field of study:

Table Overview of Graduates by Field of Study 2016 - 2022 (Source: HEA)

Field of Study	2016	2017	2018	2019	2020	2021	Total
Agriculture, forestry, fisheries and veterinary	1,130	1,090	1,245	1,220	1,255	1,295	7,235
Arts and humanities	10,030	9,195	9,260	9,195	9,015	9,660	56,355
Business, administration, and law	16,110	16,330	17,200	18,740	20,200	22,625	111,205
Education	5,300	6,460	6,075	6,885	7,010	6,350	38,080
Engineering, manufacturing, and construction	6,865	7,150	7,135	8,115	8,895	9,165	47,325
Generic programmes and qualifications	500	230	665	710	690	610	3,405
Health and welfare	12,365	12,410	13,270	13,485	13,310	15,300	80,140
Information and Communication Technologies (ICTs)	4,220	4,320	4,320	4,915	5,650	5,870	29,295
Natural sciences, mathematics, and statistics	5,705	5,575	6,250	6,470	6,715	7,105	37,820
Services	3,390	3,285	3,395	3,140	3,595	5,245	22,050
Social sciences, journalism, and information	4,030	4,480	4,515	4,930	5,115	5,415	28,485
Grand Total	69,645	70,520	73,335	77,805	81,460	88,640	461,405

A more detailed table of field of study from the HEA database for 2021 and 2022 is shown in appendix 2.

Comments on table 13 yearly Graduate data:

- Year on Year there are more graduates in Business, Administration and Law courses than any other field of study, followed by Health and Welfare.
- Similarly, to a Civil Engineering technician only working in a structural engineering company.
- There has been a year-on-year increase in the number of higher education graduates, with a 27% increase or 18,995 more graduates in 2021 compared to 2016.
- A similar increase has occurred in the field of study 'engineering, manufacturing and construction' with 34% or 2,300 graduates.
- The engineering, manufacturing and construction graduates accounted for 10% of the total graduates in 2021, and 10% for the years 2016-2021.

An overview of collected information from HEIs for 2021 is shown below.

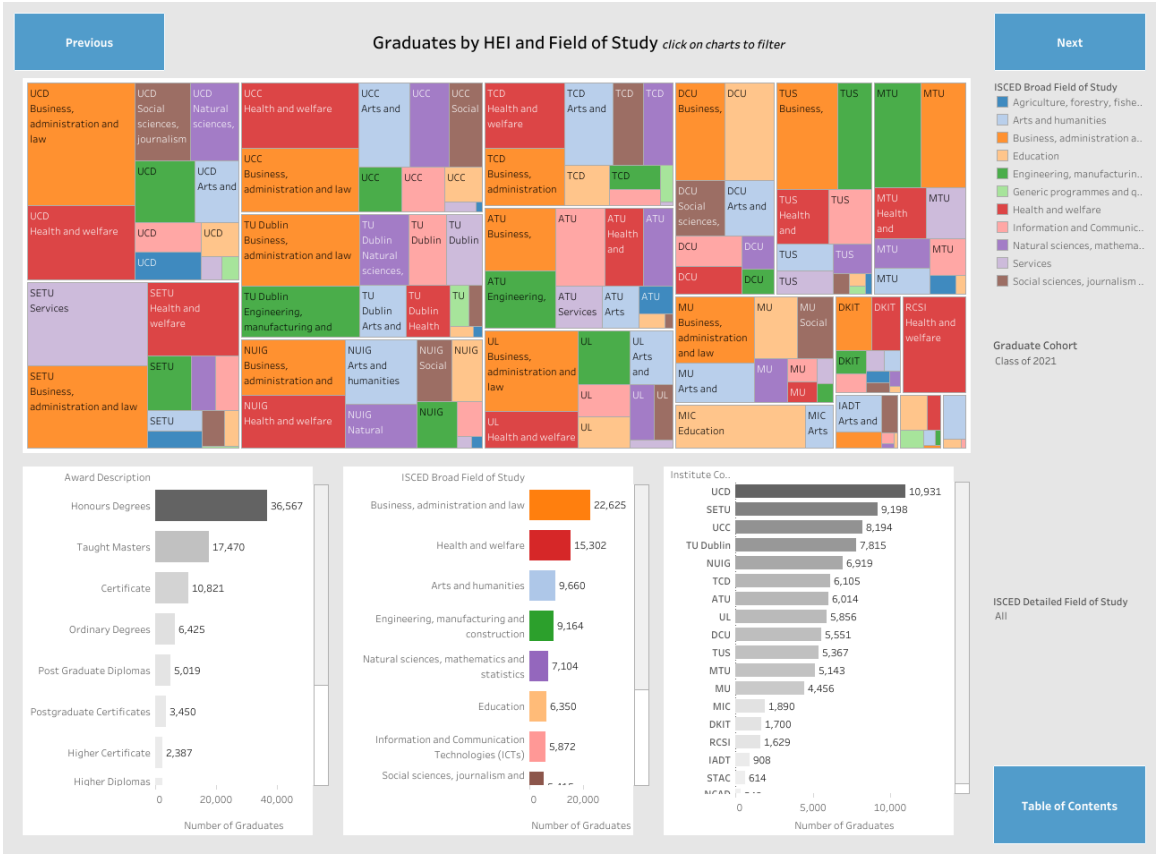

Figure Overview of HEI Graduate data 2021

Level 8 and taught masters account for 65% of all degrees, while the majority of total degrees and in most universities are in the Business, administration, and law (22,625) field of study.

6.3.3 Completion Rates

Another interesting element to note is that the enrolments in 2016/2017 and 2017/2018, who would have either graduated in 2019, 2020 or 2021 depending on the course they have chosen, was almost double the number of graduates in 2019, 2020, and 2021. Accounting for 48,985 Enrolments from 2016-2018 compared to 26,175 Graduates from 2019-2021, providing an assumed 47% dropout rate for construction. However, as seen from the graph below, the increase in construction graduates and enrolments has increased year on year since 2018.

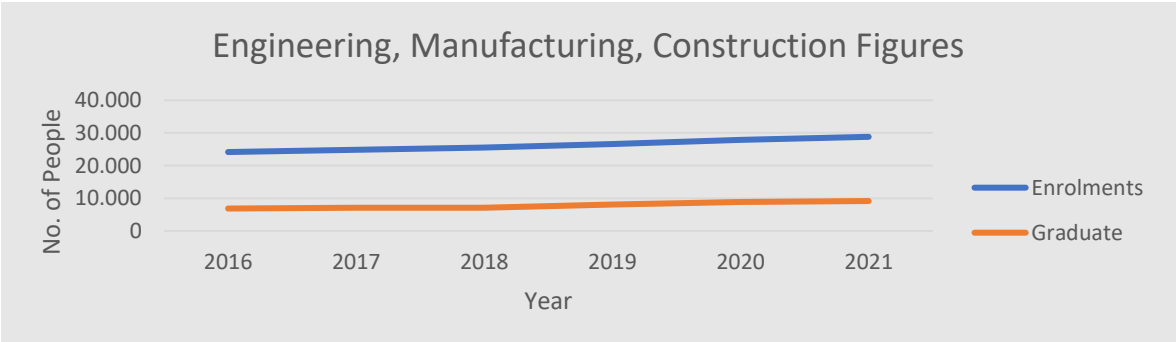

Figure Enrolments vs Graduates 2016-2021

The following information can be obtained from the HEA website[38] and shows the non-progression rates and the number of new entrants of varying NFQ level students. How the figures are calculated are as follows, for example 2016/2017 the % is the percentage of new Entrants in 2016/2017 that have not progressed to the following academic year of 2017/2018. From the data it appears that level 8s are witnessing a lower rate of non-progression, however the number of new entrants that do not progress to the following academic year in Level 8 is double that of level 7 and level 6 combined. This shows that there are issues with students progressing in Level 8s, further research into higher numbers of non-progression in level 8sis required to understand the reasons. The options that are available for progression from level 6 and level 7 up to level 8 and onwards are well established and recognised by industry leaders for most career choices, therefore more awareness of level 7 options or more level options in universities are options to alleviate drop out.

Table Yearly Number of New Entrants by NFQ Level

NFQ Level	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Level 6	1,865	1,640	1,435	1,380	1,270
Level 7	6,495	5,875	5,155	4,915	4,745
Level 8	34,310	35,445	34,940	36,590	39,490
Grand Total	42,670	42,960	41,530	42,890	45,505

Table Yearly Number Non-Progression Rates by NFQ Level

NFQ Level	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Level 6	23%	21%	22%	16%	20%
Level 7	23%	25%	24%	18%	25%
Level 8	10%	11%	10%	8%	11%
Grand Total	13%	13%	12%	9%	12%

Table Number of New Entrants that do not progress to the following academic year

NFQ Level	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Level 6	429	344	316	221	254
Level 7	1494	1469	1237	885	1186
Level 8	3431	3899	3494	2927	4344
Grand Total	5547	5585	4984	3860	5461

6.3.4 Higher Education System and Construction Careers

From cross referencing the UK GoConstruct[39] database, the Irish GradIreland[40] Database of listed professions in the construction sector and the course database created as part of this research we can identify the professions and careers in the construction sector and are widely available in the Irish higher education system across all programme types (undergraduate, postgraduate, etc) in Ireland and the gaps in the Irish Higher Education system that may need to be addressed.

Job Title	Description

[38] Available to view online: https://hea.ie/statistics/data-for-download-and-visualisations/students/progression-and-completion-dashboard/

[39] GoConstruct Database available online: https://www.goconstruct.org/construction-careers/browse-all-job-roles/

[40] GradIreland Database available online: https://gradireland.com/

Architect	Architects design buildings and collaborate with Civil engineers, M&E engineers along with others to ensure that designs are fit for purpose and safe. Architecture is usually a 4–5-year Level 8 degree however there are multiple pathways available in Architecture that include level 7 Architectural technologist and a follow-on level 8 course to become and Architect. Another aspect of Architects is that they must register or be chartered to be legally protected.
Town Planner / Master Planner	Master planners make the connection between buildings, social settings, and their surrounding environments. A master plan includes analysis, recommendations, and proposals for a site's population, economy, housing, transportation, community facilities, and land use.
Architectural Technician / Technologist	The architectural technician/technologist is involved with the technical issues of the architectural design process. As a technical designer they specialise in presenting building designs using technology, develop general drawings and details for projects
Building Surveyor	A building surveyor is responsible for advising the design, construction, maintenance, and repair of buildings. Building Energy Rating (BER) Assessor would fall under this category. Typically Building Surveyors are from an engineering or civil background and have additional training and/or recognition from a regulatory body, but there are dedicated courses for Building Surveying and other routes to obtain the title.
Building Services Engineer / Building Engineer / M&E Engineer	Building services engineers / Building Engineers / Mechanical and Electrical Engineers are involved in the planning, designing, monitoring, and inspecting of systems that make buildings comfortable and controllable. There are level 7 and level 8 courses available for Building engineering in Ireland, however there are other pathways to enter this specific market, either through mechanical or electrical engineering and then further specialisations.
Civil Engineer	Civil engineers are responsible for planning, designing and managing construction of projects. Projects can include bridges, buildings, and other major structures. They use computer modelling software and data from quantity surveys, tests, and maps to create blueprints for the construction project.
Construction Managers	Construction managers are responsible for planning, organising, and manage resources such as finance, labour, plant, and materials for construction projects. They ensure building projects are completed safely, within budget and on time. A construction manager schedules work and delegates tasks to contractors and employees.
Electrical Engineers	Electrical engineers design, develop and maintain electrical systems for buildings, transport systems and power distribution networks. Electrical engineers require an understanding of engineering science, mathematics, and computer skills.
Energy Assessors	Energy assessors calculate the energy efficiency of buildings. They provide assessment and audits that can be utilised by site managers and homeowners to make decisions on energy efficiency. Domestic energy assessors or Building Energy Rating (BER) Assessors survey, calculate and measure energy use of homes, apartments and other domestic buildings which will inform future energy efficiency upgrades or retrofits.

Ecologist	Ecologists study the relationship between plants, animals, and the environment. They look at diversity of climates, landforms, ecosystems and species, and also how human activity is impacting on these aspects and report on the likely impact of any proposed construction works.
Facilities Management	Facilities managers oversee the operation and maintenance of buildings and grounds. They are in charge of services including buildings, cleaning, catering, hospitality, security, or parking. They may also be in charge of building management systems (BMS)or energy management systems (EnMS).
Environmental Officer / Manager	Environmental officers / managers ensure that construction projects comply with environmental regulations and targets. More often, the role of environmental officer is combined with the health and safety officer.
Health and Safety Officers / Managers	Health and Safety officers ensure that construction projects comply with health and safety regulations.
HVAC Engineer	Heating, ventilation, and air conditioning (HVAC) engineers install, controlling and maintain air quality and temperature systems in buildings. These engineers can be part of a team of M&E engineers/consultants, but they are can also be responsible for the control of larger HVAC systems.
Land Surveyor	Land surveyors measure and map the shape of land. They gather data for civil engineering and construction projects so that accurate site plans can be drawn.
Quantity Surveyor	Quantity surveyors estimate and control costs for large construction projects and ensure structures meet legal and quality standards.
Project Manager / Site Manager	Project managers oversee the planning, delivery, and conclusion of construction projects. They organise logistics, delegate work and keep track of spending.
Renewable Energy Engineer / Analyst	Renewable energy engineers design, monitor, analyse and control the efficiency of renewable energy systems and develop sustainable energy models for buildings.
Structural Engineer	Structural engineers ensure structures can withstand the stresses and pressures. They calculate stability, strength and rigidity and ensure the correct materials are used for projects.

6.3.5 Progression Pathways

Of the total of 650 courses that have been identified, analysed, and categorised as part of this research within the defined scope. In order to manage the vast number of courses available, each course was categorised into the following Pathways, each pathway representing an important aspect of the built environment from manufacturing and procurement to construction, management, and digitalisation:

Progression Pathway	Description
Architectural and Modelling	This pathway includes architecture, architecture technology, building information modelling (BIM), computer-aided design (CAD) courses.
Civil / Construction	This pathway includes civil engineering, construction material technology, structural engineering, and construction management courses.
Energy Efficiency & Renewable Energy	This pathway will relate to any building management, energy management, energy engineering, renewable energy, and sustainable energy courses.
Logistics, Operations and Management	this pathway includes construction economics, project, contracts, operations, logistics and supply chain management courses.
Manufacturing & Automation Pathway	this pathway includes manufacturing, mechatronics, robotics, precision engineering and instrumentation courses.
Mechanical and Electrical Services	This pathway includes mechanical, electrical & electronic, mathematical, climate action, and building services engineering courses.
Policy, Procurement and Planning	This pathway includes sustainability, climate action health & Safety, and regulatory policy, along with procurement, cost analysis and sustainability in construction and sustainability and Environmental planning and management.
Surveying and Building Assessment:	This Pathway includes quantity, building, geospatial, and geological surveying.

6.3.6 Professional Chartership and Registration

Within Professional Organisations, addition education provision is required. For example, In Ireland the title 'Architect' is protected by legislation. This means that if a person wishes to describe themselves as an Architect they must be admitted to the Register for Architects. There are a number of routes to registration, but typically if you are studying in Ireland you will: Graduate with a prescribed degree in Architecture; followed by completion of at least two years of approved post-graduate training (professional); followed by successful completion of a Professional Practice Examination specified and accredited by the RIAI.

Similar processes and assessment are relevant for other professional roles and duties.

6.3.7 The National Tertiary Office

The National Tertiary Office was established with the goal of creating a more unified tertiary education system and is part of a wider reform agenda aimed at ensuring that Ireland's further and higher education system is well-equipped to meet the challenges of the 21st century.

The creation of the National Tertiary Office was a significant development in Ireland's further and higher education landscape and plays an important role in shaping the future of the country's tertiary education system. The National Tertiary Office is responsible for coordinating and supporting the development of policy in relation to further and higher education progression pathways for students. Collaborations between Higher Education Institutions and Education and Training Boards will see students commence their third level experience in further education and complete it in a partner higher education institution.
The National Tertiary Office is jointly managed by the HEA and SOLAS.

7. Relevant Building Skills Projects

7.1 Overview

A number of important Irish and European funded construction skills projects have informed our work and have relevance to building skills development, as such the following as presented in acknowledgement of their contribution and by way of information.

Project	**Timeframe**	**Budget and funding source**	**Partners**	**Brief description**
QualiBuild	2013 - 2016	€1,162,627	IGBC, IT Blanchardstown, CIF, DIT	The **QualiBuild** programme, as part of wider efforts to create employment in the sector and to assist Ireland in achieving the EU 2020 energy efficiency target, designed and delivered training aiming to make it a requirement for all Irish building construction workers to undergo training and up-skilling at a National Level.
BUNRS	2018-2020	€120,000 SEAI	TUS and IGBC	Deep renovation, upskilling, quality and standards for Irelands renovation programme
BIMzeED	2018-2022	€1m ERASMUS KA	Led by TUS, partners from Croatia, Spain and Hungary	BIM and zNEB skills mapping, skills needs assessment, creation of 12 new learning units for BIM and NZEB.
BUSLeague	2021-2023	€1m Horizon	TUS and IGBC as partners, led by ISSO in Netherlands, partners from Spain, France, Bulgaria, Austria.	Energy efficiency qualifications framework, BUS app and training for front line DIY, Hardware store workers.
HP4ALL	2020-2023	€1m Horizon	Led by TUS, partners from Spain, Austria	Skills for HP installation and maintenance
BUSGoCircular	2021-2024	€1m Horizon	Led by ISSO in Netherland, TUS is a partner along with Spain, Bulgaria, Hungary,	TUS have led on skills mapping in circular economy tasks for the construction industry and the development of a train the trainer programme

			Belgium Croatia, Czech Republic and Germany.	
BUS2014	2011-2014	Intelligent Energy Europe	TUS (LIT) Institute of Technology Blanchardstown, DIT, ICTU and CIF	Establish capacity, meet renovation targets, identify skills gaps and establish a strategy for upskilling.
GUPP	2020-2022	260,000E ERASMUS	Led by Corsican partners, TUS along with Greek and Slovenian partners.	Green public procurement for local authorities for construction projects
Construction Blueprint	2019-2023	4mE ERASMUS	LED by FLC in Spain, 12 partner countries, 24 partners	TUS led on the interactive map of best practice, Moodle eLearning platform, MOOCs and the development of new VET content piloted to 1000 apprentices in Europe
HumanTech	2022-2025	10mE Horizon	Led by DFKI in Germany, TUS is a project participant	TUS will lead on a series of human robot collaboration, AT, VR, exoskeleton suits and wearables micro learning units for construction workers
BuildingLife	2021-2022	283,267E Laudes and Ikea	UCD Building in a Climate Emergency (BIACE)	Building Life is a project commissioned by the World GBC. At IGBC we were able to create a roadmap on the necessary steps Ireland must take to decrease carbon emissions in the built environment to zero by 2050.

7.2 BUNRS (Building Upon Ireland's National Renovation Strategy 2020)

The aim of the BUNRs project is to work on concerted and targeted actions to build on stakeholders' capacity and appetite for renovation, while de-risking energy renovation investments and accelerate the rate of energy renovation and the 'depth' of energy efficiency upgrades in Ireland. This will be carried out by supporting the development of energy efficient mortgages in Ireland and provide policy insights that will inform the next phase of energy renovation.

7.3 BIMzeED

The BIMzeED project focuses on the training needs for the current and future construction industry with the main purpose to encourage 1) better employability 2) low-carbon growth, 3) green and NZEB skills 4) increase in youth employment. The challenge of the BIMzeED project is to overcome skills

mismatching and improve employability in the current European construction market by improving and extending the existing skills of Trainers, SMEs, site managers, craftworkers and other experienced operatives.

7.4 BUSLeague

BUSLeague is an international project co-funded by the European Union's Horizon 2020 framework programme for research and innovation (LC-SC3-2018-2019-2020 – Building a Low-Carbon, Climate Resilient Future: Secure, Clean, and Efficient Energy) under grant agreement No. 892894. Since 2010, the need to upskill the construction sector to deliver quality nearly zero-energy buildings (nZEB) and deep energy renovations has been highlighted as one of the main challenges to the sector. Through the BUILD UP Skills initiative and the consequent Construction Skills projects under the Horizon 2020 program, major successes in member states have been achieved. Examples include roadmaps for upskilling based on analysis of the status quo, initiation and continuation of National Qualification Platforms and development of qualification and training schemes. The overall aim of BUSLeague is to address and overcome the challenges of the stimulation of demand for energy skilled workforce (demand side), along with hands-on capacity building to increase the number of skilled workforce across the building design, operation and maintenance value chain (supply side). BUSLeague will achieve this objective by developing and implementing a cross European recognition of energy skills, together with upscaling successful training methods and techniques which have already been developed in previous EU and National initiatives such as BUILD UP Skills, Construction Skills. BUSLeague focusses on a blend of four elements: mutual recognition of energy skills, awareness raising, capacity building and legislative changes.

7.5 Heat Pump 4 All (HP4ALL)

Led by TUS, HP4All brings together leading experts across Europe to enable capacity and skills development within the Heat Pump sector and to ensure that the energy efficiency gains afforded by heat pumps are realised. HP4All will develop the HP4All package, a set of innovative tools and resources to be used by the different related stakeholders. The package includes:

- A HP Competency Framework to facilitate Mutual Recognition of HP Skills across Europe and the construction sector.
- A digital HP Knowledge Hub will be created to provide guidance, support and tools e.g., technical information, case studies, procurement guidance to increase the demand for HP skills and knowledge.
- A HP Benchmarking Tool enabling end users to consider options and performance of HP technologies within different building types.
- The HP4All Package will be validated through 3 regional plans being implemented (AT, ES and IE) with the ambition of driving market change, influencing end user decisions and planning for new innovations. The implementation plans will be informed by extensive stakeholder engagement to map current and future barriers to HP market exploitation and skills development.

7.6 BUSGoCircular

The overall aim of BUS-GoCircular is to address and overcome the challenges of the stimulation of demand for green energy skilled workforce, along with hands-on capacity building to increase the number of skilled workforces across the value chain. BUS-GoCircular will achieve this objective by developing and implementing a circular construction skills qualification framework with a focus on multifunctional green roofs, façades and interior elements.

This is worked out in the following five specific qualitative objectives:

— Developing a circular construction skills qualification framework.
— Stimulating market demand for circularity skills.
— Developing recognition schemes and conducting pilot courses.
— Improving the reputation of the construction sector and attracting women and youth to circular skills professions.
— Expanding BUS-GoCircular at national and EU-level by developing and implementing a communication and replication strategy.

7.7 BUS 2014

A similar process was completed 10 years ago, also led by TUS, on the first Build up Skills in Ireland and lessons from that process have informed our work in BUSI2030.
The aim ten years ago was to develop a National Qualification Roadmap for each Member state (including Ireland), which was endorsed by all relevant stakeholders, that contributed to the achievement of the 2020 sustainable energy targets.
Objectives 1. Initiate national processes that brought together all relevant stakeholders on training and qualifications of the building workforce on energy-efficiency and renewable energy; 2. Identify and quantify for all relevant professions and skills levels the need for a workforce qualified in energy efficiency and renewable energy in each Member State by 2020 (and beyond) and discuss necessary changes to the current system as well as concrete training measures to meet the need; 3. Set up and agree national qualification roadmaps to achieve the sustainable energy policy objectives for 2020; 4. Support concrete qualification schemes on the basis of roadmaps to 2020 with identified needs and priorities. BUSI2014 led onto Qualibuild and train the trainer programmes.

7.8 GUPP

The overall aim of GUPP (Green Public Procurement) funded though ERASMUS was to address the green challenges in the construction sector, by responding to current, emerging and growing needs of the sector for accelerating transition to a resource efficient and circular economy, towards EU's energy and environmental goals. In parallel, the expected impact was to enhance the education sector's capacity by integrating innovative learning tools and resources and facilitating the supply of a high quality flexible training for public authority staff and professionals. The GUPP project worked to enable behavioural changes of key stakeholders involved in a Public Procurement (PP) process towards a sustainable, greener and circular economy, creating new opportunities for public authorities to stimulate resource efficiency and green growth, facilitate knowledge transfer between key stakeholders involved in PP processes, as well between practitioners and the educational sector and raise awareness of the lifecycle environmental impacts of projects, strengthen synergies and empower transnational social dialogue between all relevant stakeholders.

Outcomes from the project:

- IO1. Green Handbook: An instrument on GPP Regulatory Framework and Practice on Construction Works that will provide a guidelines of the GPP process and challenges faced upon its implementation on construction works.
- IO2. Development of the GUPP capacity building program will provide stakeholders (public procurement staff, professionals of construction works), with up-to-date knowledge, advanced aspects of GPP in construction works, facilitating deeper knowledge and familiarity with GPP.
- IO3. Development of the GUPP Web Platform is an online hub for GPP that will serve as an innovative networking and e-learning tool and bring together the latest news, events and

resources on GPP, enhance retention and learners engagement, as well enable social dialogue and knowledge transfer on the subject matter.

- IO4. Engagement with GPP in construction works delivering all data and information collected in the project and relative policy recommendations to a growing number of key stakeholders and public authorities (target min. 40). The target groups include Public Authorities, contracting Authorities at local, regional, National level, Public procurement staff, the construction sector, policy makers, social partners, entities involved in procurement processes and educational sector.

7.9 Construction Blueprint and Construction Skills Observatory

Construction Blueprint is a European project, belonging to the Erasmus+ Programme, for implementing a new strategic approach to sectoral cooperation on skills. It comprises a partnership formed by 24 partners from 12 countries, led by Fundación Laboral de la Construcción (Spain). This Blueprint (currently completed) arranged through a Sectoral Skills Strategy, that will bring together lessons learned from other initiatives and will be outlined from a holistic approach, identifying political, economic, social, technological, legal and environmental factors which may be affecting sector skills and training offer.

Encompassed with activities, milestones, outcomes and outputs, the following activities will be developed during the course of the project:

- Collecting good practices at national and regional level to illustrate and promote other initiatives addressing skill gaps, integrated in an Interactive Map.
- Designing and piloting training curricula for Energy Efficiency, Circular Economy and Digitalisation for the construction industry; also, different online trainings (Massive Open Online Course -MOOC-) on these topics will be available.
- Creating a tool (Observatory) to provide valuable information about particular skill needs at regional/national level.
- Identifying and selecting occupational profiles that should be updated in terms of Energy Efficiency, Circular Economy, and Digitalisation.
- Carrying out an outreach campaign for the Construction industry to promote its attractiveness among youngsters and women, identifying and promoting solutions to facilitate mobility of construction workers in Europe.
- Creating a new virtual tool (website) where all project outputs will be available for stakeholders, as well as a Sector Skills Alliance platform for collaborative work.

Blueprint was deployed by getting main market players involved (Education-Economic-Political-Environment-Civil Society/Cultural) taking up opportunities to make the best of their talents. They will constitute together with the partnership, the Sector Skills Alliance, the necessary driver to push a sustainable sectoral strategy and Blueprint implementation.

7.9 Blueprint- Construction Skills Observatory

Blueprint - Construction Skills Observatory This Skills Observatory has been created as a tool for observation and monitoring of skills needs expressed by construction companies of different countries of the EU, allowing users to have a closer approach to anticipation of skills at national/European levels. The Construction Skills Observatory aims to serve as a complement of the data and information provided on construction ecosystem by the European Construction Sector Observatory (ECSO). To be a channel for transnational knowledge sharing and sectoral enrichment, providing relevant information for all those active in the construction sector, for companies, and especially VET providers, who will find significant and up-to-date information on current and future skills needs to support them matching their training offer. This facility can be filtered online by partner country.

7.10 Humantech

HumanTech addresses the most important challenges faced by the European construction industry today — making it safer, greener, and more efficient.
Construction is responsible for:

- 40% of global energy consumption,
- 38% of global greenhouse gas emissions,
- 12% of global potable water use,
- and 40% of solid waste generation in developed countries.

Decarbonising the sector is critical to achieving the Paris Agreement commitment and the United Nations Sustainable Developments Goals.

Today, design and construction processes are planned to compensate for errors that may arise with manual execution, for which a considerable number of resources are used. HumanTech technology will enable the automation of these processes, increasing their accuracy and making more efficient use of materials. Construction remains a male-dominated industry. Women make up only 9-10% of its total workforce worldwide and those on the front line are even fewer, approximately only one for every 100 employees in the industry. HumanTech will deploy and validate its technical approach in five different large-scale construction demonstration sites in Europe and Japan. These will generate a wide range of user-centric requirements, deployment blueprints, integration plans, testing scenarios and performance monitoring to evaluate preliminary designs and feed the project's technical developments.

7.11 BuildingLife

The Building Life: Zero Carbon roadmap looks at the impact of the construction and built environment in Ireland across its whole life cycle. It shows that the construction and built environment sectors account for 37% of Ireland's carbon emissions, equalling agriculture. Just under two thirds (23%) of these emissions come from operating buildings but more than a third (14%) comes from the manufacture, transport, and installation of building materials themselves – usually referred to as 'Embodied Carbon'. Policies and regulation to date have mainly focused on reducing operational emissions, however, without urgently addressing these embodied carbon emissions, the construction and built environment sector will exceed its carbon budget.

7.12 Human Capital Initiative Projects

'Collaboration Nation': The Higher Education (HEA): Human Capital Initiative (HCI) Pillar 3 projects are aimed to be focused on innovation and agility, and to be aligned with various national strategic objectives, higher education system objectives and, more broadly, future skills needs for society and the economy. Projects included are:

Name	Description
Advance Centre	The Advance Centre offers a wide range of accredited modules and programmes across its three partner colleges UCD, ATU Sligo & TU Dublin and is a centre of excellence for teaching and learning.

Creative Futures Academy (CFA)	A partnership between three leading creative institutions: The National College of Art and Design, UCD, and the Institute of Art Design + Technology, which offer new skills, fresh networks and opportunities for learning throughout your life and career.
Designing Futures	Designing Futures has been developed to enhance the employability of University of Galway graduates by offering additional practical and creative teaching, learning and skills development alongside traditional degree studies.
The iEd Hub	The mission of team based at University College Cork, Munster Technological University and multiple Life Science & MedTech industry partners is to equip a new generation of graduates with technical, interpersonal, and lifelong learning skills.
REEdI	The project is a collaboration between the Munster Technological University and the University of Limerick. Our approach aims to be positively disruptive and transformative.
UL@Work	UL@Work (University of Limerick) offers a range of online programmes co-designed with industry to enable upskilling and reskilling for your professional development.
AMASE	Is designed to allow people currently working in an additive manufacturing to upskill in the advanced additive manufacturing applications across multiple industry sectors including Med-Tech, Biopharma, Aerospace, Agri-Tech and Precision Engineering. (SETU, HEA, HCI, SEAM, Government of Ireland, Design +, 3DWIT)
Cyber Skills	Three of Ireland's universities, MTU, University of Limerick and TU Dublin are collaborating to provide pathways and micro-credentials to address skill shortages in the area of Cyber Security.
Enabling Future Pharma	The programs under the Enabling Future Pharma project have been specifically designed to meet the new needs driven by a major shift in the bio/pharmaceutical sector such as precision medicine, bioinformatics, immunotherapeutic, AI, and digital and connected health. (HCI)
MicroCreds	Our aim is for MicroCreds to address the barriers to participation in lifelong learning, including time constraints for learners and inflexibility in current programme provision and delivery. (IUA)
Building Change	Reconfiguring and revising our curricula to enable our graduates to help society address the sustainability challenges. (TU Dublin, UCD, CCAE, SAUL, SETU, ATU)
Virtual Laboratories in higher education	Design of an agile and responsive curriculum where students are afforded the opportunity to experience a real-work environment through virtual training and engagement with enterprise partners and industrially relevant workplace problems. (TUS, DkIT, UCC, DCU)

CIRDAS	CIRDAS provides a unique and compelling opportunity to avail of subsidised education delivered by panel of industry and academic experts, whilst networking with peers. (SETU)
DASBE	DASBE is enabling learners to undertake a range of programmes focusing on specific topics, needs and requirements in the construction sector. (TUS, IGBC, ATU, TEA)
GROWTH hub	The GROWTH HUB project mission is to encourage growth and entrepreneurial mindsets among students. (TU Dublin)
Next Generation Teaching and Learning	The project is designed to maximise benefits for industry and society by addressing crucial skills shortages and upskilling needs while driving system change within Trinity College and the higher education sector through comprehensive and targeted innovation initiatives in teaching delivery and opening the university to new learner groups.
Sustainable Futures	The Sustainable Futures Lab at University College Cork is a convening point for cutting-edge knowledge and thought leadership, innovation, learning, communication, and dialogue on sustainability.
IKC3	IKC3 offer a range of flexible learning pathways to support and enable industry, enterprise, and the community transition to a carbon neutral society. (MTU, UCD, Trinity College Dublin)
CONVENE	Working to address both culture change and system change within Irish higher education to increase our agility and make it easier for enterprise to engage with us. (TU Dublin, UCD, HCI)
DCU Futures	All of it`s courses focus on getting you career-ready and equipping you with the skills you need to take on an ever-changing world.
Higher Education 4.0	Provides RPL and careers/study advisory services via mycareerpath.ie, focused on accessibility and future proofing learners with industry relevant skills. (HEA, HCI)
Innovative Materials for Industry 4.0	The course will link traditional and state-of-the art Industry 4.0 technologies with materials selection and sustainability, in design and manufacturing. (SETU)
The Funds Academy	The aim is to impact the national discourse on investment fund education and to develop expertise in executive education and development in the investment fund sector. (SETU, MTU)
National RPL in Higher Education Project	Work with employers to increase access and progression opportunities in areas of skills needs. (University of Galway)

7.13 Build Up Skills Advisor App

The **Build Up Skills advisor application** has evolved through various EU and Irish funded projects and is available to download on all app platforms. It has been designed to make finding tailored training

courses on energy efficiency (so far) in construction accessible. For workers the app is designed to direct users to suitable training in a manner which is clear, straightforward, and fast. Courses can be searched on the app based on profession or skills users would like to learn such as airtightness, ventilation and more. A wide range of courses for all construction professionals and construction workers are available, most entries are sign posts to in-person, hybrid or synchronous training provided by training institutes. The app hosts courses provided by Universities, Further Education Institutes, and other training providers. The app can be accessed without logging in or by registering basic personal details, the user can track their personal educational journey. In 2023, the completed BIMzeED learning units (designed by TUS and project partners and funded by ERASMUS KA) designed to be used by all workers in the construction value chain, are being uploaded to the app for self-directed learning. The app was supported in Ireland by BUSLeague (IGBC and TUS) and is currently supported for circular economy in construction training by BUSGoCircular (TUS).

7.14 QualiBuild

Duration: 33 months (November 2013 - July 2016)
Total Project Budget: €1,162,627

QualiBuild followed on from the BUSI BUILD Up Skills Irish Roadmap project which was completed in 2013. It was part of a European wide initiative to develop National Roadmaps on training and upskilling construction workers, so that Member States could meet their 2020 energy targets.

The BUSI II BUILD UP Skills QualiBuild project was developed with the principal focus on upskilling and training, craft workers and general operatives in the building construction sector, regarding energy-efficient buildings in Ireland.

The QualiBuild project developed a train the trainers programme in the energy and construction sector and upskilled building construction workers in this vital field. Further actions were in the form of a national skills registration system which assisted construction workers in profiling their skills and qualifications relevant to quality low energy building.

8. Skills gaps between the current situation and the needs for 2030

8.1 Construction Rates

The Central Statistics Office (CSO) publish quarterly reports on the number of new dwelling completions in Ireland and have available data going back as far as 2011, this information is openly available on the CSO website and the yearly completion for dwellings is summarized below:

Table Yearly New Dwelling Completions Overview

Year	Number of New Dwelling Completions	Compared to 2011
2011	6,994	100%
2012	4,911	70%
2013	4,575	65%
2014	5,518	79%
2015	7,219	103%
2016	9,821	140%
2017	14,296	204%
2018	17,872	256%
2019	21,126	302%
2020	20,574	294%
2021	20,553	294%
2022	29,822	426%
2023 (Q1 Only)	6,716	96%
TOTAL	**169,997**	-

The number of new dwellings accounts for single houses, scheme houses and apartments and can be further broken down into each, the below table highlights the increase in new dwelling completions across the different categories in 2023 Q1 compared to previous years:

Table Quarter 1 New Dwelling Completions by House type

Q1 Completions	Single house	Scheme house	Apartment	All house types
2011	1,156	447	272	1,875
2012	797	211	123	1,131
2013	638	174	77	889
2014	625	309	160	1,094
2015	659	606	106	1,371
2016	693	932	333	1,958
2017	871	1,415	472	2,758
2018	964	2,010	475	3,449
2019	1,089	2,564	589	4,242
2020	1,107	2,841	1,003	4,951
2021	977	2,260	730	3,967
2022	1,111	2,808	1,721	5,640
2023	1,197	3,092	2,427	6,716
TOTAL	**11,884**	**19,669**	**8,488**	**40,041**

Another aspect of the Status Quo report is to look at the commercial and non-residential public sector as well as the residential sector. In Ireland, there are an estimated 124,026 buildings[41] in the commercial and public sector, with offices and retail outlets accounting for the largest proportion of these buildings. The breakdown is as follows:

Table Breakdown of Non-Residential Buildings in Ireland

Building Type	Total	Commercial	non- Commercial
Office	45,683	45,683	-
Retail	39,559	39,559	-
Hospitality	16,377	16,377	-
Warehouse	7,564	7,564	-
Education	5,335	-	5,335
Other	3,705	-	3,705
Hotel	3,570	3,570	
Healthcare	2,122	-	2,122
Leisure	111	-	111
Total	124,026	112,753	11,273

An estimated 8,682 or 7% of total commercial and non-residential public buildings were constructed between the years 2010 and 2022, of which a steady rate of between 480-500 constructions per year may be applied in the time 2019-2022. Compared to new build figures, the figures for retrofit to BER B2 for the years 2011 to 2019 are not as well documented as that of 2019 to 2022 as the uplift of houses to a B2 or higher became a key target/message of the Climate Action Plan in 2019. It is important to note that a property upgrade or deep retrofit or heat pump installed in existing dwellings are completely different metrics from a B2 equivalent retrofit as outlined in the table below:

Table Breakdown of upgrades to Existing Buildings

CONSTRUCTION RATES	Property upgrades	Retrofit to BER B2	Deep Retrofit	Heat Pumps Installed
2019	23,923	2,423	1,996	1,130
2020	18,400	3,278	2,300	1,454
2021	15,246	4,345	2,690	1,972
2022	27,199	8,481	3,439	2,272
TOAL	84,768	18,527	10,425	6,828

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Using available figures for new constructions (RES & Non-RES), and for retrofit the 'Construction Rate' for the years 2019 to 2022 as shown below as a reference point for the current construction sectors abilities, we can forecast the construction rates up until 2030:

Table Overview of Construction 2019-2022

CONSTRUCTION RATES	2019	2020	2021	2022
NEW BUILD (RES)[42]	21,126	20,574	20,553	29,822
RETROFIT to BER B2 (RES)[43]	2,423	3,278	4,345	8,481
Non-RES New Build	462	440	443	440

[41] AIB, IGBC, 2022, Sustainability and Commercial Real Estate
[42] Central Statistics Office (CSO) New Dwelling Completion Database
[43] SEAI, 2022, National Retrofit Plan Quarterly Progress Report Full Year 2022, pages 7-10, available online here: https://www.seai.ie/publications/SEAI-Retrofit-Annual-Report-2022.pdf

Non-RES Retrofit	ND	ND	ND	ND
TOTAL	24,011	24,292	25,341	38,743

*ND = No Data there are currently no figures available completed for non-domestic retrofits as this metric is not used. The general metric for BERs is by Year for (Non-Domestic) 2009-2023 not available.

8.2 Construction Forecasting

Using the above information gathered, a forecast of construction rates can be made, with the use of additional lower confidence boundary and an upper confidence boundary approach to provide a range of potential construction rates for each sub sector of construction. Each Forecast table can be found in Appendix A – Forecast Tables.

8.2.1 New Build Forecasting

For number of new dwellings completed per year the following forecast is presented, with a 95% confidence interval and a 23.36% lower and higher confidence boundary applied:

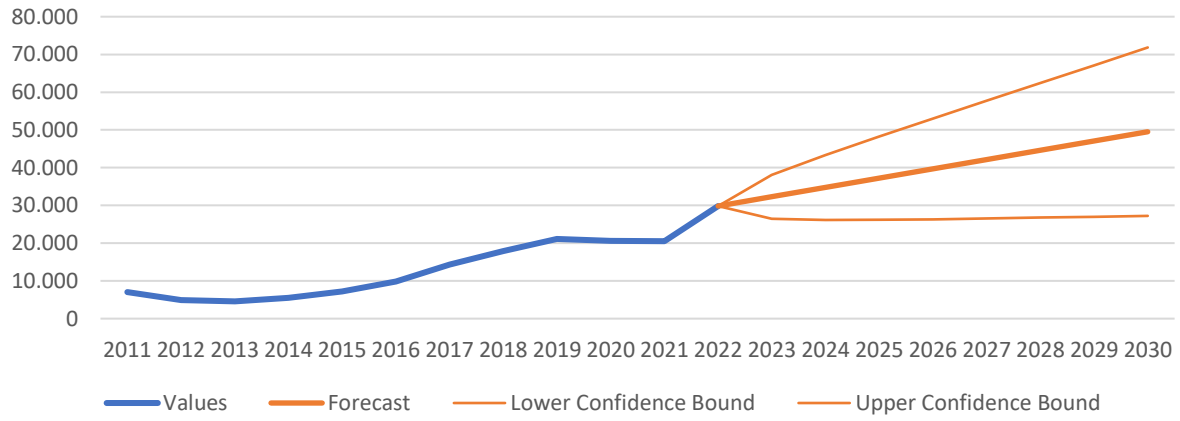

Figure Yearly New Build figures Forecast

The cumulative new dwelling completions forecast compared to the cumulative Housing for All projected housing output (2022-2030) is shown below, showcasing that the forecast is significantly higher (+17%) than the targets set out in the Housing for All Strategy.

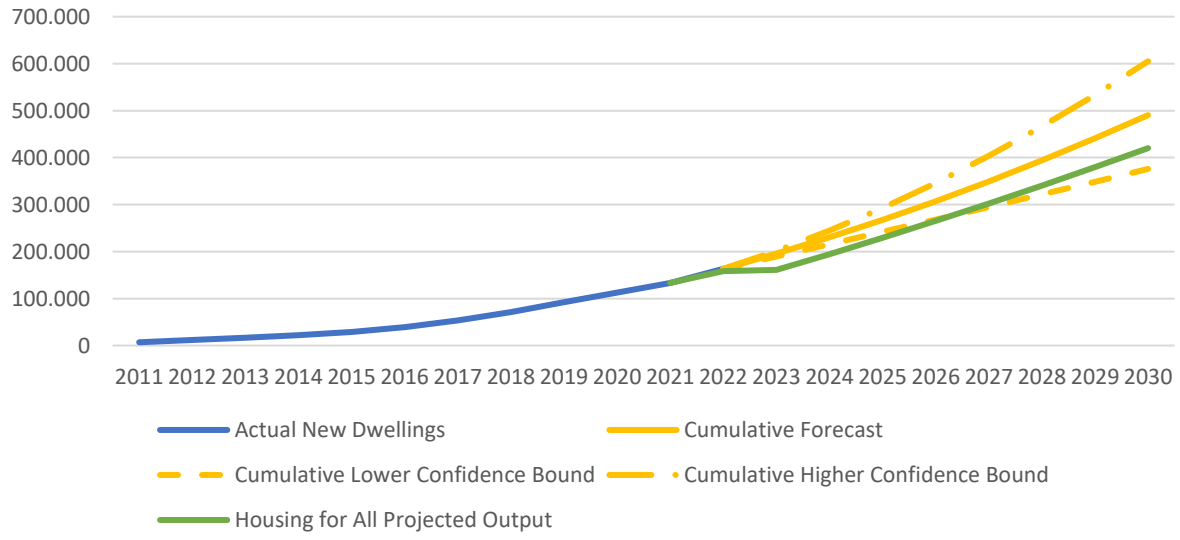

Figure Cumulative New Build Forecast

8.2.2 Retrofit Forecasting

For the number of retrofits completed per year the following forecast is presented, with a 95% confidence interval and a 11.22% lower and higher confidence boundary applied. It is important to note that the number of B2 retrofits is used in this analysis and not the number of property upgrades.

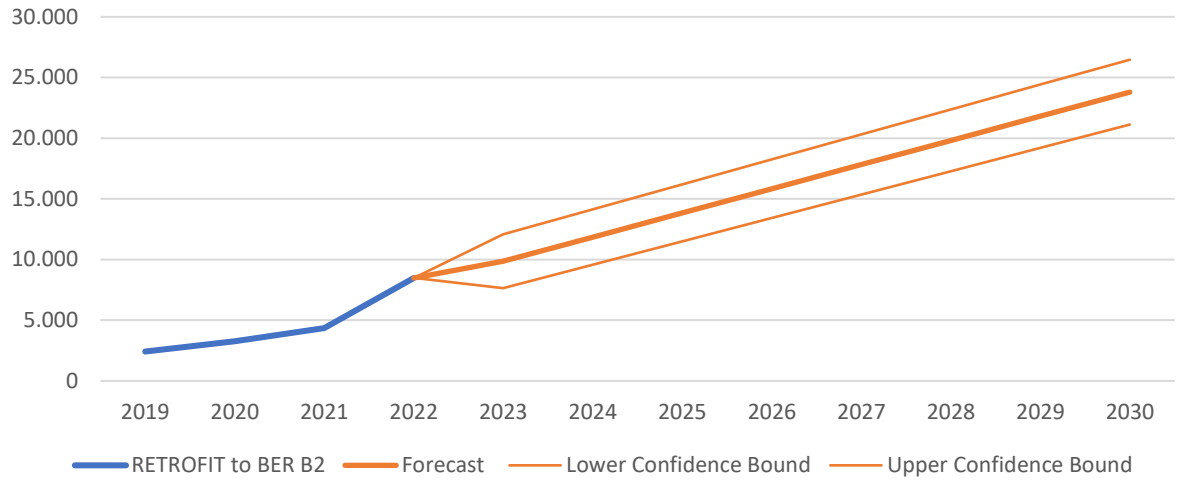

Figure Yearly Retrofit figures Forecast

The cumulative number of retrofits to BER B2 forecast is shown below, comparing to the Climate Action Plan target of 500,000 BER B2 retrofits by 2030, Ireland will significantly miss this target, indicating a need for more retrofits needed in the coming years, further indicating that the skills required for retrofitting at a larger scale will need to increase.

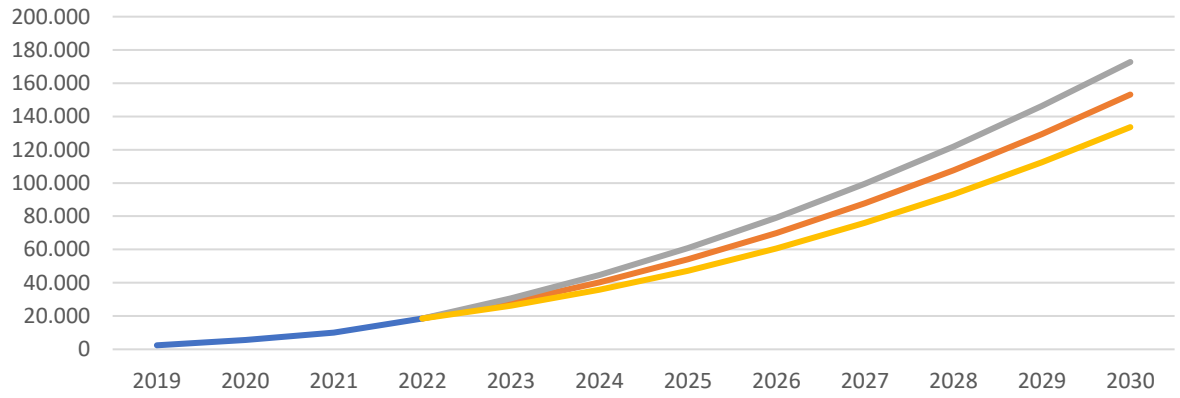

Figure 25 Cumulative number of Retrofits forecast.

8.2.3 Non-Residential Forecasting

Information on the number of non-residential new build completions from the central statistics office (CSO)[44] and is shown as an index. The index was then converted into numbers by looking at the IGBC

[44] Non-RES database: https://www.cso.ie/en/releasesandpublications/ep/p-pbci/productioninbuildingandconstructionindexq12022provisionalq42021final/

and AIB report[45] which provided the following information and the figure of 7% being built since 2010 (8,682). The figures were then plotted and forecasted.

Type	Total	Commercial	non- Commercial
office	45,683	45,683	
retail	39,559	39,559	
hospitality	16,377	16,377	
warehouse	7,564	7,564	
education	5,335		5,335
other	3,705		3,705
hotel	3,570	3,570	
healthcare	2,122		2,122
leisure	111		111
Total	124,026	112,753	11,273

Figure 26 Non-Residential building breakdown

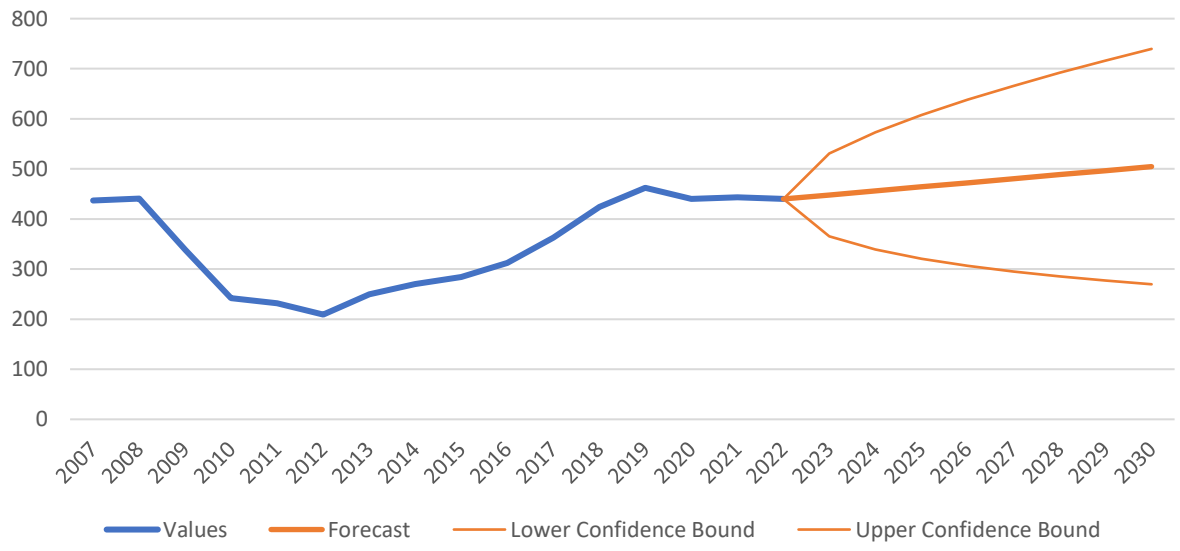

Figure 27 Non-Residential yearly figures forecast

8.2.4 All Construction Forecasting

With the above information we can create a forecast of 'Total Constructions' and provide an overview of all metrics and their projected progress towards national targets. The % difference between the forecasted figures and the national targets is highlight beside each figure.

[45] IGBC, AIB, 2022, Sustainability and Commercial Real Estate available here: https://www.igbc.ie/wp-content/uploads/2022/05/aib-igbc-sustainability-and-commercial-real-estate-may-2022.pdf

Table Overview of Forecasted Constructions

Retrofit Completions	% Diff	New Build Completions	% Diff	Total Completions	% Diff
Current Construction 2019-2022					
18,527	4%	92,075	18%	112,388	22%
Cumulative Forecast (2019 - 2030)					
153,169	31%	490,424	117%	575,267	63%
Cumulative Lower Estimate (2019 -2030)					
133,585	27%	375,848	89%	496,877	54%
Cumulative Higher Estimate (2019 - 2030)					
172,753	35%	605,000	144%	653,657	71%
B2 Retrofit Targets 2030		*New Build Targets*		*2030 Total Completions*	
500,000		*420,109*		*920,109*	

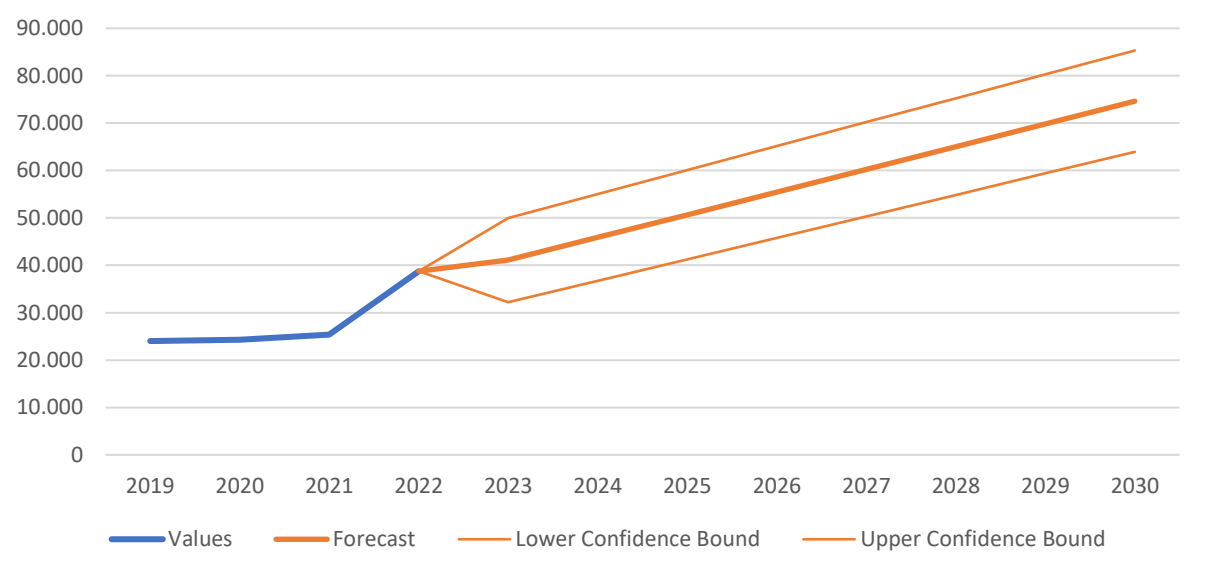

Figure 28 Confidence bands

8.3 Construction Sector Workforce

According to the *SOLAS National Skills Bulletin 2022*, six occupations relevant to the industry, were identified as being in short supply or potential short supply in 2022. These are detailed in the follow table as shown by a traffic light system.

- Red for the existence of specific shortages within a broader occupational group.
- Orange for the existence of potential shortages within a broader occupational group.
- Green for no shortages within a specific group.

The final column of the table details the specific occupations that are in short supply.

Occupation Group	Shortage Indicator	Occupation Shortage Detail
Civil Engineers & Construction Project Managers		- Civil Engineer - Construction Project Managers
Architects & Town Planners, Architectural Technologists, & Surveyors		- Quantity Surveyors
Bricklayers and Plasterers		
Plumbers		- Plumbers
Carpenters and joiners		- Carpenters
Painters and Decorators		
Other Construction Trades		
Construction Operatives and Elementary		
Electrical and Electronics Trades etc		- Electricians

Source: National Skills Bulletin (SOLAS, 2022)

The findings of the Recruitment Agency Survey conducted in October 2022 by the Skills and Labour Market Research Unit (SLMRU) in SOLAS found that demand for skills in the sector continued in 2022. The report found that 28% of vacancies in the industry were difficult to fill. The vacancies were in:

Project/ Site Managers	Construction Drivers
Civil / Site Engineers	Carpenters
Quality Surveyors	Ground Workers / Banksman
Electrical Engineers	Electricians
Safety Officers	Steel Erectors / Fixers
BIM	Scaffolders
Site Administration	Welders
Maintenance Technicians	Glazers / Fitters
EHS Engineers	Foremen / Supervisors
Mechanical Engineers	Curtain Wallers
	Pipe Layers

Public investment remains an important stabiliser for construction demand and employment. Based on the strategic investment priorities in the National Development Plan, public capital investment of almost €165 billion will be committed between 2021 – 2030. According to the *Build 2022: Construction Sector Performance and Capacity Report*, analysis shows that this investment will support approximately 80,000 direct and indirect construction jobs. The report also observed that approximately 45 percent of the 2021 construction workforce is over 45 years old, so it is crucial that the sector has the necessary pipeline of skills to account for replacing the existing workforce.

This pipeline is produced through the apprenticeship system for construction trades and through higher education for constructions professionals. In 2021 there were a total of 4,944 new construction apprentice registrations which was the highest level of registrations since 2007. In 2022 the number was 4,504, a slight decrease due to uncertainty in the current climate. It is forecasted to increase again between 2023 and 2025 and these increases will be required to meet additional demands arising from Government ambitions. There were 5,399 undergraduate new entrants in engineering, manufacturing, and construction (including architecture) in 2020/2021 representing 12 percent of all undergraduate new entrants in 2020/2021. Architecture and construction courses saw the largest number of students enrol in recent years.

Apprenticeship Registrations					
	2018	**2019**	**2020**	**2021**	**2022**
Brick & Stonelaying	81	80	56	148	72
Carpentry & Joinery	591	597	563	847	713
Painting & Decorating	30	31	24	43	23
Plastering	29	36	20	38	31
Plumbing	653	628	560	875	792
Stonecutting & Stonemasonary	7	3	3	9	8
Wood Manufacturing & Finishing	95	102	75	155	144
Electrical	1,841	1,949	1,740	2,748	2,648
Construction Plant Fitter	71	73	63	81	73
Total	**3,398**	**3,499**	**3,104**	**4,944**	**4,504**

Source: SOLAS

To understand the number of workers and the skills required for the construction sector of 2030. We must first look at the current workforce compared to the construction sector output. From the 'Skills for Zero Carbon the Demand for Renewable Energy, Residential Retrofit and Electric Vehicle Deployment Skills to 2030 report', 2021 Labour Workforce Statistics and 2022 Labour Workforce Statistics an estimate for each 'traditional' construction worker is shown in the following table:

Job Title	Current Workforce
Architecture and construction	9,400
Architecture and town planning	
Civil Engineer	11,900
Quantity Surveyor	4,800
Electrical Engineer	5,429
Mechanical Engineer	3,692
Structural Engineer	384
Energy Engineer	5,893
Plumber	9,400
Electricians	38,800
Bricklayer & Plasterers	11,800
Painters & Decorators	6,600
Carpentry and Joiners	17,700
Other (i.e., Machine Drivers, Crane Drivers, General Operatives)	32,000
Site Manager / Supervisor	4,600
Project Manager	2,000
Total	**164,398**

Figures for some professions were difficult to find, as the numbers were either aggregated into groups like 'Professionals' or as 'Engineering', or they weren't mentioned in reporting. This is why multiple sources were used to create estimates. The estimates are either directly from a report (i.e., 11,900 Civil Engineers, 11,800 Bricklayers and Plasterers) or they were estimated using the 'detailed field of study approach'.

The detailed field of study approach was an approach created by the partners to try to estimate where there were gaps in information. The approach used the number of places in each profession related to undergraduate, gathered through engagement with Technological Universities and Universities for over 600 undergraduate courses available in Ireland.

The Higher education authority database uses the 'International Standard Classification of Education' (ISCED) detailed field of study as produced by UNESCO[46] for its student and graduate information. This provides an amalgamation of different courses in higher education for example:

- (0732) Building and civil engineering: This detailed field of study includes construction management, civil engineering, structural engineering, and quantity surveying.

[46] ISCED Fields of Education and Training 2013 (ISCED-F 2013)

The total number of places available for all courses under each detailed field of study applicable to the built environment and the number of profession-based undergraduates shown below:

Detailed Field of Study	Course(s)	No. of Places (Undergraduates)	% of Field of Study
(0710) Engineering and engineering trades not further defined or elsewhere classified	Mechanical Engineer	986	62%
	Manufacturing Engineering / Manager	586	37%
	Fire Safety Engineering	20	1%
(0713) Electricity and energy	Electrical Engineering	484	61%
	Energy Engineering	315	39%
(0714) Electronics and automation	Automation and Robotics	338	31%
	Electronics	742	69%
(0730) Architecture and construction not further defined or elsewhere classified	Architecture, Architectural Technology, Interior Architecture, Landscape Architecture, Town planner	622	-
(0731) Architecture and town planning			
(0732) Building and civil engineering	Construction Management	530	33%
	Civil Engineering	653	41%
	Structural Engineering	66	4%
	Quantity Surveyor	348	22%

The percentage of the detailed field of study was then applied to the number of students and graduates for each detailed field of study, along with

- the calculated dropout rate (based on 2019-2021 graduates and 2016-2019 student enrolments for NQF level 7 and level 8),
- and applying a relevance rate of 71% based on a HEA Report 'What do Graduates Do the Class of 2016' which states the relevance of undergraduates' qualifications as relevant or most relevant to their area of employment,

To produce a 'Pipeline' of each profession and is shown in the following table:

Career	Total Graduates Number (HEA Detailed Field of Study)	Total Students Number (HEA Detailed Field of Study)	Dropout Rate	Number for Students Available	Detailed Field of Study % Split based on Places	Number for Graduates for Construction	Number for Future Graduates for Construction	Pipeline to work in Construction
Architecture and construction	145	2,485	24%	1,888	N/A	103	1,340	1,443
Architecture and town planning	400	7,855	70%	2,383	N/A	284	1,692	1,976
Civil Engineer	365	14,295	67%	4,742	41%	106	994	1100
Quantity Surveyor					22%	56	530	586
Structural Engineer					4%	11	100	111
Electrical Engineer	275	3,400	39%	2,061	61%	118	886	1005
Energy Engineer					39%	77	577	654
Mechanical Engineer	555	14,110	78%	3,127	62%	244	1375	1619
Manufacturing Engineering / Manager					37%	145	817	962
Fire Safety Engineer					1%	5	28	33
Automation and Robotics	585	9,725	63%	3,560	31%	53	323	376
Electronics and Controls engineer					69%	117	709	826
Construction Waste Manager / Circular Economy	-	-	-	-	-	-	-	-
Transport & Logistics Manager	-	110	-	-	-	0	78	78
Environmental Officer	25	295	67%	98	100%	18	70	88

From looking at the pipeline of workers entering the workforce we can predict an annual expansion rate for each profession, by comparing the number in the pipeline (over four years) and the workforce number estimates. An annual replacement rate was also used to predict the number of people leaving each profession.

The annual replacement rates from CEDEFOP which are recommended for the forecast of the skills requirements of the Irish construction industry to the end of the decade. It is assumed that in general those employed at management level and in the professional and associate professional categories will have a third level qualification (i.e., ISCED 5+); those employed in the skills trades will have a medium level craft qualification (i.e., ISCED 3-4) and those employed at operative level or in elementary jobs will have a low level of qualification (i.e., ISCED 0-2). The following table shows the replacement rates used:

Occupation categories	Education	Replacement rate
Production managers	High	3.4%
Professionals	High	2.5%
Associate professionals	High	3.3%
Building and related Trades	Medium	4.0%
Metals, machinery, and related trades	Medium	3.6%
Electricians	Medium	3.2%
Stationary plant and machine operatives	Low	2.3%
Drivers and mobile plant operators	Low	3.8%
Construction labourers	Low	2.1%

The expansion rate was applied to the workforce numbers for each profession and then the replacement rate was applied to the 'expanded' workforce figure up to 2030. The expansion rates and replacements rate are shown side by side below:

Profession/Trades	In Pipeline Available to Work in 2026	Estimated Workforce Numbers	Annual Expansion Rate	Annual Replacement Rate
Project Manager	412	2,000	5.15%	3.40%
Site Manager / Supervisor	0	4,600	4.50%	3.40%
Architecture and construction	1,443	3,968	9.09%	2.50%
Architecture and town planning	1,976	5,432	9.09%	2.50%
Civil Engineer	1,100	11,900	2.31%	2.50%
Quantity Surveyor	586	4,800	3.05%	2.50%
Electrical Engineer	1,005	5,429	4.63%	2.50%
Mechanical Engineer	1,619	3,692	10.96%	2.50%

Profession/Trades	In Pipeline Available to Work in 2026	Estimated Workforce Numbers	Annual Expansion Rate	Annual Replacement Rate
Structural Engineer	111	384	7.23%	2.50%
Energy, Materials and Wind Engineer	654	5,893	2.77%	2.50%
Manufacturing Manager	962	3,600	6.68%	2.50%
Automation and Robotics	376	808	11.64%	2.50%
Electronics and Controls engineer	826	1,773	11.64%	2.50%
Environmental Officer	88	1,207	1.81%	2.50%
Plumber	2,780	9,400	7.39%	4%
Electricians	9,188	38,800	5.92%	3.20%
Bricklayer & Plasterers	428	11,800	0.91%	4%
Painters & Decorators	104	6,600	0.39%	4%
Carpentry and Joiners	2,617	17,700	3.70%	4%
Construction operatives, & elementary	-	32,000	4.50%	3.80%

8.4 Overview of 2030 Workforce

The predicted 2030 workforce (using aforementioned methodology), the 2030 target workforce requirement (based on 2030 targets, see section 11.2), the difference between target workforce and predicted workforce and the current workforce is shown in the following table. As stated before, this provides a scenario for 2030 if the traditional construction sector continues and there are no interventions:

Job Title	Current Workforce	Required for Targets	Workforce Forecasting Projection	Needed
Architecture and construction	9,400	17,407	16,034	1,373
Architecture and town planning				
Civil Engineer	11,900	22,036	12,014	10,022
Quantity Surveyor	4,800	8,889	5,141	3,748
Electrical Engineer	5,429	10,053	6,582	3,472
Mechanical Engineer	3,692	6,837	7,235	-398
Structural Engineer	384	712	570	142
Energy Engineer	5,893	10,913	6,174	4,739
Plumber	9,400	17,407	12,752	4,655
Electricians	38,800	71,849	49,590	22,259
Bricklayer & Plasterers	11,800	21,851	9,556	12,295
Painters & Decorators	6,600	12,222	5,124	7,098
Carpentry and Joiners	17,700	32,777	17,968	14,809
Other (i.e., Machine Drivers, Crane Drivers, General Operatives)	32,000	59,257	35,113	24,144
Site Manager / Supervisor	4,600	8,518	5,190	3,329
Project Manager	2,000	3,704	2,374	1,329
Total	**164,398**	**304,430**	**183,851**	**120,579**

8.5 Skills Needs for 2030

8.5.1 Energy Calculation Tools

In order to improve the buildings in Ireland, energy calculations will be required to ensure that adequate improvements are made to reduce the buildings energy usage. Tools have been developed by SEAI that are used to calculate energy usage and produce a Building Energy Rating (BER), these tools being the Dwelling Energy Assessment Procedure (DEAP) and Non-Domestic Energy Assessment Procedure (NEAP). Adequate skills to use these tools will be required for engineers, so further investment into free accessible training on these tools is required. There is also no centralised Irish approved methodology for measuring carbon in the built environment. The Climate Action Plan (Action 198) requires the establishment of a standard methodology re carbon calculation, materials data base.

DEAP is the official Irish methodology for calculating the energy performance and associated carbon dioxide emissions for the provision of space heating, ventilation, water heating and lighting in dwellings. The main output of DEAP is the BER rating which is key to the SEAI (Sustainable Energy Authority of Ireland) grant process. DEAP requires performance data for each type of technology from the most readily available sources. An overview of technologies, the information required, and the most readily available source is shown below:

Table DEAP source information

Source	Technology	Information provided
HARP Database	Heat Pump	Manufacturer, model, type, SPF, rated capacity, EN test methods, F-gas name, F-gas quantity
NSAI Agrément Cert Database	PV systems	Product description, certification, technical specs and control data, technical investigations, conditions of certification
NSAI Agrément Cert Database	Mechanical extract ventilation	Product description, certification, technical specs and control data, technical investigations, conditions of certification
NSAI Agrément Cert Database	Thermal Insulation	Product description, certification, technical specs and control data, technical investigations, conditions of certification
NSAI Agrément Cert Database	External Insulation	Product description, certification, technical specs and control data, technical investigations, conditions of certification
NSAI Agrément Cert Database	Dry Lining Systems	Product description, certification, technical specs and control data, technical investigations, conditions of certification
DEAP internal library	Windows & Doors	Product description, certification, technical specs and control data, technical investigations, conditions of certification

For technologies that are not listed in the above databases the SEAI have provided details on how to substantiate the technology for entry into DEAP in the DEAP manual Version 4.2.2[47]. For example, to enter an insulation system that has not got an NSAI Agrément Certificates the following is stated:

[47] SEAI, "Domestic Energy Assessment Manual Version 4.2.2," July 2020. [Online]. Available: https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/domestic-ber-resources/deap4-software/DEAP-Manual-Version-.pdf.

It should be noted that the SEAI offer a Helpdesk where test certificates on products can be sent to see if they meet the DEAP requirements. DEAP can become more and more accurate to actual performance, which will help the construction sector

The Non-Domestic Energy Assessment Procedure (NEAP) is Ireland's official methodology for calculating a Building Energy Rating or Energy Performance Certificate for non-domestic buildings, using the Simplified Building Energy Model (SBEM): a software calculator created by the British Research Establishment (BRE) which assesses the energy consumption in a non-domestic building (non-residential). It is used to demonstrate compliance with TGD Part L 2022 Conservation of Fuel and Energy -Buildings other than Dwellings.

SBEM identifies ways to improve a building's energy performance and considers anything from fabric u-values, air tightness, HVAC, renewable technology through to summer overheating. These calculations also determine the CO_2 emissions and fuel costs of a building and what action needs to be taken to achieve a certain level to pass Part L compliance.

A non-domestic BER is calculated by the actual building's performance being divided and compared by the performance of the notional building. Therefore, a BER of 1.5, indicates that the actual energy use is 1.5 times that of the notional buildings' energy use would be within a D2 EPC.

8.5.2 Building Deep Renovation

Building deep renovation refers to extensive energy-efficiency upgrades and improvements in existing buildings and the main aim is to significantly reduce energy consumption, enhance thermal performance, and integrate renewable energy technologies.

The future skills required for building deep renovation include knowledge of energy-efficient building techniques, retrofitting methods, and the ability to assess and analyse existing building conditions. The FET Sector led by the Steering Committee of the 6 Centres of Excellence for NZEB and Retrofitting is working with Industry to deliver certified programmes in these areas to both current workforce and new entrants. However, more programmes across all levels are required alongside further financial and technical supports for construction sector workers.

8.5.3 Modular and Industrialized Solutions:

Reskilling and upskilling of construction sector workers as well as a change in mindset is required to implement more modular and industrial construction. Modular and industrialised solutions offer benefits such as shorter construction times, improved quality control, and reduced environmental impact. Modular construction involves assembling prefabricated components or modules off-site, which are then transported and assembled on-site. Industrialised construction emphasises the use of advanced manufacturing processes, automation, and standardised components to streamline construction workflows.

The FET sector is working with Industry both locally and nationally to develop training programmes and deliver awareness programmes in all areas of MMC. The National Construction Training Centre in Mount Lucas Co Offaly will house the National MMC Demonstration Park. The Centre, under the guidance of LOETB, and collaboration with Industry leaders and CIF is piloting and rolling out programmes in all areas of MMC.

8.5.4 Overview of Technologies

The following list of technologies and skills requirements have been identified as part of this research that are either existing in the construction sector or are planned to become more common in the construction sector. The skills required to implement these emerging technologies will require upskilling or re-skilling of workers.

Category	Skill / Technology
Space Heating	Heating System installation: - Pipe installation - Unit installation - Electrical Connection - Radiator installation - Underfloor heating installation - Heat Pump Systems - Biomass systems Heating System Design: - Commissioning - Customer Handover - Cost analysis of different heating systems - Modes of heat transfer - Distribution and storage losses - Efficiency of appliances - Hydraulic balancing - Integration of systems - Heating Controls - Ventilation & condensation - Building regulations and DEAP / NEAP requirements - Multifunctional heat pumps
District Heating	District Heating System Technician - Operation and Maintenance of District Heating system District Heating System Manager - Contract Management - Compliance - Operations - Customer Relation
Renewable Energy	Renewable Energy Installation - Installation of PV or Wind - Electrical Wiring - Component connections - Integration Renewable Energy design - Feasibility Studies - Cost analysis - Integration - Control Strategy Community PV array management - Contracts Management - Financial Management

Circular Economy	- Supply Chain Logistics - Inter-company relations - Macro and Microeconomics - Embodied Carbon calculations and Carbon Accounting - Life Cycle Analysis of building elements
Monitoring & Controls	Controls installer - Electrical Connections - Lighting controls - Heating Controls - Alarms and Security
Lighting	- Lighting Controls - Factors affecting energy use for lighting. - Efficacy, colour rendering, colour temperature - Lamp types - Energy saving potential of lamp replacement. - Building Regulations
Building Modelling	- BIM and CAD - Electrical drawings - Mechanical Drawings - Water Services Drawings - 3D Modelling - Virtual Reality and Augmented Reality - Drone Mapping - Photogrammetry
Ventilation	- Building regulations for ventilation - Air infiltration and air tightness - Analysis of ventilation rates - Design and selection of ventilation systems - Location and maintenance of mechanical units - Fire safety regulations - Building Regulations - Controls for mechanical ventilation systems - Ventilation requirements for combustion appliances - System efficiency - Heat recovery - Ducting (i.e., positioning, insulating, jointing, sealing and moisture control).
Insulation	- External Wall Insulation - Internal Wall Insulation - Natural Insulation - Modes of heat transfer. - Properties, selection & positioning of insulation materials. - Continuity of insulation layers. - Thermal bridging. - Low Carbon Insulation
Air tightness	- Selection & positioning of building membranes. - Ventilation, vapour control & condensation.

	- Air infiltration, exfiltration, and air tightness.
Air Conditioning / Air Handling	- Refrigeration Cycle - Air Con components - Air Handling Unit components - Ventilation rates - Air Quality - F-gas Regulation - Heat transfer modes - Chillers
Off-site Construction	- Robotics construction, programming, operation, and maintenance. - 3D Modelling and Printing. - Concrete Shuttering
Construction Management	- Construction technology, - Building Physics, energy use, - Principles of space and water heating systems and controls - Renewable energy technologies, - Thermal bridging, - Air permeability - Insulation materials, - Building Regulations, - Energy conservation - Building renovation - communication skills - Calculation of energy use and cost savings, - Energy performance assessment tools and procedures, - Entrepreneurship skills and project management - Interpersonal skills - Customer Relations - Public relations - Finance - Modern Methods of Construction - Supply Chain Logistics - Design and Commissioning
Building Management	Energy Management System - ISO50001, - ISO50002, - Monitoring and Control - Legislation, Regulation - Resource management Building Management System operation and maintenance - Control Strategies - Fault Diagnosis - BMS Networks - System Integration - User Interface - Indoor Environment and Quality

Supply Chain Management	- Supply Chain Logistics - Micro / Macroeconomics - Transport Management - Regulation and Health and Safety - Logistics

8.5.5 Gaps Identified in Irish Higher Education System

The Following careers have been identified as careers that will become more in demand up to 2030.

Role / Job Title	Description
ICT Technician	ICT professionals design, build, test, and deploy all kinds of systems including smart cities, smart homes, social networks, manufacturing, finance, education, medicine, transport, and entertainment. The construction sector is becoming increasingly dependent on computer systems, networks, and data science alongside the advancements in control systems, strategies, and monitoring systems.
Robotics Technician	Robots will become an integral part of offsite construction and on-site construction in the coming years, this will require a specialised technician to be able to design, set up and operate the robot. There are various robotics and mechatronics courses available in Ireland, however industry and manufacturing are the main career pathways for graduates. A coordinate approach is needed to incentivise graduates to enter the construction market.
Manufacturing Engineer	As off-site construction will lead to a reduction in construction waste and a smoother construction, this will ensure that the manufacturing industry and the construction industry will be in contact more and more. Innovations in construction materials whether it be new products, more efficient production, or faster production. This will ensure that Manufacturing will be an integral part in the mass rollout of retrofits and new builds.
Sustainability Manger / Analyst	Sustainability Manager / Analyst is responsible for sustainability strategies for a construction project. This will include the environmental impacts of the construction work, the embodied carbon of construction, and the life cycle analysis of the construction. Another aspect that Sustainability managers will be involved in is ensuring sustainability of construction materials. They will be working hand in hand with the design team to ensure sustainable construction.
Logistics and Transport Management	Logistics and transport management will become more important as the mass rollout of retrofits and new builds continues. Ensuring a stable supply of construction materials and an environmentally friendly and sustainable transport of those construction materials.

The following is a list of roles/job titles that have very little courses or no courses available in Ireland:

Role / Job Title	Description
Building Information Modelling Technician and Manager	Although Architects, architectural technicians and Structural Engineers are familiar with BIM and other computer aided design (CAD) software, more and more buildings will need to be modelled before construction in order to reduce waste of materials, reduce risk through design. This will require more technicians that are competent in BIM and CAD. As more BIM technicians enter the workforce this will require a manager to allow for career progression and mentoring for technicians. BIM is introduced to students of many construction type courses such as Architecture, and engineering, but there are currently 17 BIM and CAD courses available in Ireland. All of these courses are part-time courses, although some have full-time options available. Almost all of the courses are level-8 and level-9 and have requirements that applicants should hold a minimum of a level-7 or level-8 degree to enter the course. There are 4 BIM courses that are level 7 and below. These courses entry requirements are either previous knowledge of BIM, leaving certificate and minimum grades, completion of other training courses or holding a Level-6 higher certificate.
Civil Engineering Technician	As the need for civil engineers is increasing as the construction industry continues to grow, a new position that may be worth exploring is a Civil Engineering Technician. Their role will mirror that of an internship in a Civil engineering company. There will be a lower technical competency required for this position lending to lower entry requirements for courses and allowing further opportunities for the construction sector. The clear progression pathway would be to work up to a Civil engineer course.
Contracts Manager / Procurement Officer / Documents Controller / Administration	There are some professional courses that are available in Ireland that provide procurement and contract training for professionals working in the construction sector, however there may be a requirement for an entirely new position in construction companies. An Administration position that looks after contracts, tendering and procurement for current and future projects.
Circular Economist / Carbon Accountant	There are some courses that have modules that touch on circular economy and carbon accounting (carbon life cycle analysis) such as Civil or Environmental science, however there is no course (within the scope outlined) that covers this aspect.
Structural Engineering Technician	Similarly, to a Civil Engineering technician only working in a structural engineering company.
M&E Engineering Technician	Similarly, to a Civil Engineering technician only working in a M&E engineering company.
Landscape Architect	Landscape architects design habitats for humans and non-humans: homes for city birds, playgrounds for children, rooftop gardens, streetscapes, city parks and even cities themselves. There is only 1 course of this kind in Ireland.
District Heating Technician / Manager	With the current developments in District Heating in Ireland, the expertise to manage, and maintain these systems needs to be accounted for. This may be a clear pathway for plumbers and heating professionals to re-skill to become district heating technicians and finally managers.

	Within Renewable energy and energy engineering course, DH is touched upon but only in concept and theory.

8.5.6 Digitalisation of construction

The national Build Digital Project is the central focus from government regarding digitisation and digitalisation for construction.

The current lack of a skilled workforce is affecting the rate of greater BIM implementation, adoption of Artificial Intelligence, Extended Reality, and the industrial Internet of Things (IOT) in the construction sector, which are required for the development of construction technologies and smart infrastructure. The key requirements going forward will continue to be the provision of focused upskilling initiatives to address immediate industry needs and multi-disciplinary courses which contain both methodological skills (mathematics, computation, building-physics, manufacturing, structural mechanics, etc) technological skills (programming languages, software applications and cross disciplinary collaboration and information management skills.

TUS have been a partner in a very successful EU project called BIMzeED, whose strategy was to improve the human-capital basis of the construction sector, through Higher Education Institutes and Vocational Education & Training systems in Europe. The project supported the construction industry through creating new educational content and resources with 16 Learning Units addressing the knowledge and skills required in the field of Building Information Modelling (BIM) & net Zero Energy Buildings (nZEB) within existing construction training curricula, thus capitalizing on the opportunities that environmental protection can offer to the labour force through education and training to upskill on technical innovation and digitalization.

With the publication of new Standards in the UK for Digital Management of Fire Safety information and the new working group set up for Manufacturers Product Data, there will be a new set of digital skills required for construction teams throughout Ireland.

8.5.7 Smart buildings, including e-mobility

The building sector accounts globally for 40% of energy consumption and 36% of greenhouse gas emissions. Decarbonising the built environment is fundamental to achieving the EU's reduction of greenhouse gas emissions targets, energy, and environmental goals. The International Energy Agency has estimated that a global net zero target will require CO2 emissions associated with buildings to decline by over 95%.[1] Globally, one third of energy use in residential buildings is space heating and a further 25% is for domestic hot water (DHW). Smart buildings can contribute significantly to reduce energy consumption through the integration of digitalisation, open innovation, and data sharing which are key new technologies that can be used to decarbonise the building sector. This includes developing interoperable solutions which can then connect smart homes, buildings, and grids to communicate and achieve electric and other load peak shaving through production and consumption monitoring which will maximise on-site and locally produced Renewable Energy consumption. This will be achieved by correct setpoints and their observance/monitoring automated response and assessing flexible tariffs.

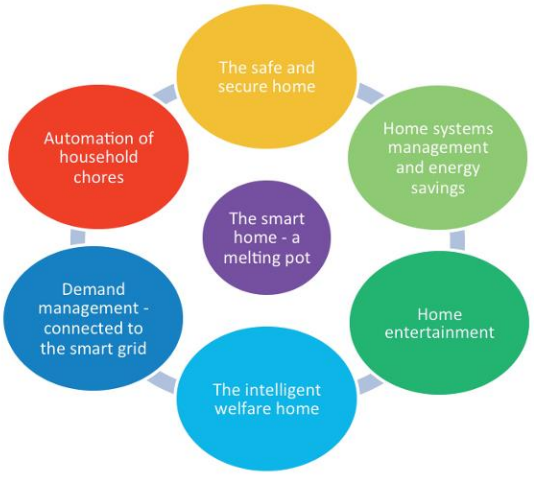

Fig 29 the melting pot of the smart home
https://www.researchgate.net/publication/261613800_Energy_impacts_of_the_smart_home_-_conflicting_visions

Smart Homes and buildings development should also involve and induct the building owners by showing them how smart Energy Management and Building Management Systems work and how the various interfaces and equipment work. This will then provide homeowners with the ability to monitor the Energy, CO_2 emissions and costs from their consumption and, consequently, turn their residence into an energy-efficient smart home.

Additionally access to confidential discoverable, reliable, ubiquitous real-time data from buildings, will allow rapid scaling, address any issues and widely disseminate the energy efficiency knowledge and technical solutions options that will be available.

Software-as-a-Service and intelligent data-driven building automation can also be future developments in order to reduce energy use in buildings and enable buildings to participate as distributed energy resources in support of increased use of variable renewable electricity sources.

This could allow buildings located closely to each other to send and receive energy to each other when excess energy is being produced in one and required in another. For example, if the water has reached its setpoint on one house and the other house needs it heat pump on or EV charged. Smart controls could harness the PV, wind generation electricity from battery storage and when Vehicle to Grid & Home is integrated, some of the electricity stored in the EV battery.

The way this will work correctly is different buildings having different setpoints which will then trigger energy export or import. For example, if one house needs 20KW left in the EV battery another may need 5 KW for the same period therefore the two EVs may help with peak load shaving when fully charged by offering, for house 1: 20kWh and house 2: 35kWh to the grid and local loads where feasible.[48]

[48] https://www.iea-ebc.org/

The Building Performance Institute of Europe (BPIE) created Ten interrelated principles of how smart buildings can effectively function as micro energy-hubs.

The electrification of mobility is often considered an essential component in combatting climate change as Irelands transport emissions are estimated to be 17% of total emissions 10.55 million tonnes/$C0_2e$

https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/latest-emissions-data/#

One additional possibility is use of bidirectional charging technology to add to the capabilities of smart homes. Bidirectional charging systems not only allow energy to be drawn from the grid or a generation plant to charge the electric vehicle, but they can also allow the energy from the vehicle to be fed back in to the grid and the building they may connected to. That means during periods of inactivity and where setpoints of battery capacity required has been communicated to the BMS (e.g., 5 KW or 60 KM range required to be left in the battery). The vehicles can also be used in conjunction with a stationary battery, this solution can contribute to grid stability and peak shaving through an aggregated demand and frequency response system- service. By combining thousands of connected EVs into a virtual power station. For example, if 100,000 EVs were connected to the grid with a potential to supply 7 KW each that could reduce grid load by 700MW and supply 700mWh to the grid per hour. This can give financial benefits for EV owners. Also, vehicle-to-home (V2H) can optimize use of locally generated renewable energy while also saving cost of buying electricity from the grid if it's sitting in the EV battery, and also optimise the TOU principal

https://cris.vtt.fi/en/publications/flexibility-of-electric-vehicles-and-space-heating-in-net-zero-en

The study above has demonstrated that smart and bidirectional charging can save 8–33% of annual electricity costs compared to an unmanaged charging strategy in a household fitted with a photovoltaic (PV) system. The interaction of smart equipment in a household, such as heat pumps, washing machines dishwashers, fridges with RE and battery storage can significantly limit the amount of electricity bought from the grid. Battery storage and EV2G arbitrage (the ability to fill the battery at times of low tariff rates and discharge during peak tariff times) also works well with self-consumption optimization. Combined use of V2H and V2G has been found to lead to additional revenues but does increase operating hours of the EV by more than 5 h/d and equivalent full cycles (EFCs) by as much as 270 EFCs/ a. therefore the balance between battery life and optimisation needs to be input to management systems.

The combination of smart buildings and e-mobility will contribute to the roll out buildings as micro energy hubs, which will consume, produce, store and supply energy, making the distribution system more flexible. This technological innovation will help balance the grid with demand & frequency response and has the potential to play a leading role in transforming the EU energy market, shifting from centralised, fossil-fuel based, national systems towards a decentralised, renewable, interconnected, and variable system.

8.5.8 Embodied Carbon

Built environment emissions are divided in the first instance into embodied (EE) and operational (OE) emissions. These are further subdivided into emissions related to different materials and construction stages, and to the operation of varied building types/sectors. In the baseline year of 2018 operational related emissions accounted for 62% of all BE emissions, and 23% of national emissions. In the same year capital or embodied related emissions accounted for 38% of all BE emissions, and 14% of national emissions.[49]

8.5.9 Modern Methods of Construction

The transition from traditional construction methodologies to off-site manufacturing processes and other MMC solutions is still relatively new and an emerging industry in Ireland. MMC is identified in many reports as one of the key areas that will transform productivity and efficiency of the construction sector in Ireland. Significant additional engagement, commitment, education, training, and delivery around MMC solutions is required within a short timeframe to contribute to meeting our Climate targets. Efficiencies generated by off-site design and manufacturing includes modularisation, material waste reduction, reduce labour costs, improved timelines, innovation opportunities and improved quality control. Some of the advantages of MMC in terms of sustainability include:

- minimising wastage through mass production and repeat processes; a study by KLH Sustainability indicated that modular construction results in over 45% reduction in material use and over 50% reduction in waste generation.

- modular units can also be disassembled and re-used which can reduce the demand for raw materials and promotes recycling repurposing and reusing e.g., materials used in panelised and volumetric modular systems can be more readily reused in comparison to the materials used in traditional construction such as brick and concrete.

- off-site manufacturing minimises pollution and disruption on-site.

[49] More information can be found in the IGBC Building-Zero-Carbon-Ireland report (igbc.ie)

- labour is generally located near the relevant manufacturing site or factory, which minimises the need to commute to work and therefore reduces traffic and carbon footprint.

- products can be tested and improved more regularly which significantly increases product improvements including sustainability, energy efficiency and embodied carbon[50]

Other benefits of MMC are economic and social as it can also generate 70% more local activity per m^2 than a big store or generate three and a half times more wealth for the local economy compared to chain-owned businesses and it can be re-spent locally, raising the overall level of economic activity, paying more salaries, and building the local tax base. This re-circulating of money leads to an increase of economic activity, with the degree of expanse entirely dependent on the percentage of money spent locally. Better Customer Service is also another key element with nearly 60% of workers at local businesses report a high commitment score to the business compared to only 39% at chains, which results in better customer service and an improved buying experience.

- Increase in Community Investment: locally owned businesses contribute more to local charities and fundraisers.
- Give more Consumer Choices: hundreds of small local businesses can ensure innovation and low prices over the long term.
- Promotion of Entrepreneurship: Local economic growth will attract new talent and professionals, who may, in turn, create businesses of their own, enhancing a local economy.[51]

8.5.10 Strategy for Addressing Biodiversity Concerns:

Opportunities to enhance biodiversity exist at all stages of a building life cycle, meaning that everyone in the value chain can contribute to a positive outcome by focusing on impacts. Nature-based solutions (NBS) (sic. within the built environment) can strengthen resilience and promote better health and well-being. Based on the density recommendations included in the National Planning Framework and current trends, it is estimated that a land surface equivalent to a third of County Dublin will need to be urbanised by 2030 to deliver the 400,000 homes planned in Ireland 2040 - an estimate which does not even include the land required to build associated infrastructure. Reusing what has already been built, and transitioning to more compact forms of development, is hence essential to reduce habitats loss and fragmentation. It is critical to educate and upskill all disciplines within the built environment sector to gain a better understanding of how you can embed biodiversity in your work design, delivery, and operations of new and refurbished projects.[52][53]

8.5.11 Continuous Professional Development:

The role of Professional Registration Bodies is critical at effecting change within the Construction Industry. Institutions such as RIAI, ACEI, EI and SCSI have carried out their own sector reviews and published outcomes and targets for their members. For example, the Royal Institute of Architects of Ireland (RIAI) Strategy 2023-2027 has been directly informed following assessment of member's needs, including current and future actions regarding adopting Climate Action mitigation practises. In addition,

[50] A&L Goodbody, 2021, Modern Methods of Construction (MMC) – the future of construction in Ireland? article.
[51] Construction Professionals Skillnet, 2022, Modern Methods of Construction: Defining MMC Business
[52] IGBC, 2019, Biodiversity and the Built Environment

[53] More information can be found within Citizens assembly 2023 report on Biodiversity: Report-on-Biodiversity-Loss_mid-res.pdf (citizensassembly.ie)

the RIAI 2030 Climate Challenge sets out specific actions and targets for design and delivery of projects in the built environment. Responding to climate change is both a great challenge and opportunity. The new RIAI Strategy 2023-2027 promotes how Architects can respond by inspiring excellence in architecture to deliver a sustainable and resilient future.
The strategy has been developed:

- to promote sustainable, creative and resilient architecture for society and environment.
- to support members in the practice of architecture and their career progression; and
- to protect standards through registration, continuous professional development and learning within the architectural profession

Specific actions and Deliverables for Future Skills / addressing current Gaps include:

Section	Description of Actions
Leadership:	Support the professions in the transformation of the Irish construction industry required to meet our Climate Action targets. Continue to work on behalf of the members with Government to ensure that the regulatory systems have a balance of environmental, social, governance responsibility and liability.
	Work on behalf of members to ensure that public procurement systems are appropriate to demand, equitable and deliver quality outcomes for society.
	Promote architects as the leading profession in the delivery of sustainable buildings and places.
	Champion the importance of the architects and architectural technologists in the design and construction processes.
Education & Training:	Continuously improve the standard and input into the content of the education programme at both undergraduate and post-graduate level in architecture, architectural technology, and professional practice exams.
	Deliver CPD to enable members to improve and develop their professional knowledge including specialist competencies, and to equip members to meet the challenges of changing regulatory, legal, and technological environments.
	Create platforms and develop resources that enable and support members' leadership role in the design, delivery, and management of a sustainable built environment.
	Implement change by supporting members in delivering on the ambitions in the RIAI Sustainable Pathways and RIAI Climate Challenge 2030 publications.
	Support members in the integration of sustainable design standards in the practice of architecture.

Similar Assessments and Strategies are being developed within other comparable Professional Membership Institutes. The level of changes that are required to meet the Climate Action targets in many areas are not yet formalised within a regulated context. This is resulting in an imbalance within various sectors and organisations at public and private level regarding awareness, upskilling and practices to align with EU requirements and anticipated future legislation. These initiatives from such organisations assist in supporting members to address the challenges.

8.6 Monitoring

This section examines structural measures to monitor developments in skills requirement, potential early-warning systems on risks of skill mismatch and gaps for some occupations.

The National Skills Council is the high-level platform for partnership between the education and training system, and industry representatives. It's made up of officials from public and private organisations, who participate voluntarily.

The council brings together education and training providers with representatives from business, to effectively respond to skills needs. They advise the minister and the Department of Further and Higher Education, Research, Innovation and Science *(*DFHERIS) on priority skills needs, the direction of skills and knowledge development in line with emerging global trends and the opportunities and challenges for learning and work. They also oversee research, and approve reports and publications, by the Expert Group on Future Skills Needs (EGFSN) and the Skills and Labour Market Research Unit (SLMRU) of SOLAS.

There are two entities that research Ireland's skills needs:

- the Skills and Labour Market Research Unit (SLMRU)
- the Expert Group on Future Skills Needs (EGFSN)

8.6.1The Skills and Labour Market Research Unit (SLMRU)

The Skills and Labour Market Research Unit (SLMRU) is part of SOLAS and gathers, collects, and analyses a range of datasets on skills demand and supply in Ireland. Datasets include demand indicators (such as employment, job vacancies, employment permits) and supply indicators (such as education and training awards, unemployment).

Each year, the SLMRU produces a report called the National Skills Bulletin. This report summarises the SLMRU's data on skills demand and supply in Ireland. It also identifies where skills shortages and difficult-to-fill vacancies are happening.

The SLMRU also has a labour market intelligence portal (under 'LMI' tab). The work of the SLMRU

informs skills policymaking at national and regional level, allows education and training providers in Ireland to make data-informed decisions on course content, provides relevant labour market information for school-leavers and jobseekers making career decisions

The SLMRU's reports also inform the work of:

- Department of Further and Higher Education, Research, Innovation and Science
- Department of Social Protection
- Department of Enterprise Trade and Employment
- National Skills Council
- Regional Skills Fora
- Expert Group on Future Skills Needs
- SOLAS
- Educational and training boards
- Higher Education Authority

8.6.2 The Expert Group on Future Skills Needs (EGFSN)

EGFSN was established in 1997 and is tasked with advising Government on future skills requirements and associated labour market issues that impact on the national potential for enterprise and employment growth. Membership includes, Government Departments, Enterprise Development Agencies, Business, Unions, Further Education and Training and the Higher Education Authority.

EGFSN reports combine research, analysis, and horizon-scanning in relation to emerging skills requirements at thematic and sectoral levels. These studies involve complete reviews of international and domestic trends and data thorough engagement with stakeholders from across Government, industry and the education and training system and identifying the nature and likely scale of skills needs over a 5 to 10-year time period, using skills demand forecasting.

Based on the findings of these studies, the EGFSN recommends how the education and training system, as well as other sources of labour supply, can resolve skills needs.

The role of the EGFSN is to:

- Advise Government on projected skills requirements at national and sectoral levels and make recommendations on how best to address identified needs.
- Make recommendations on how existing education and training systems and delivery mechanisms might be adapted to better effect. Also, the role that enterprise can play in the shaping of the skills of their workforce.
- Advise on any skills requirements that cannot be met internally at a given time and so must be met through inward migration.
- Ensure that recommendations made are assessed by the relevant authorities.

EGFSN submit findings of their research and the agreed Action Plans to the National Skills Council prior to their publication. Once reports are published, their findings are disseminated to the Regional Skills Fora and other key stakeholders across education, industry, and Government.

8.6.3 Construction Industry Register Ireland

In 2014, the Construction Industry Federation CIF established a voluntary registration scheme for builders known as CIRI – the Construction Industry Register Ireland, to support standards across the industry and to foster vigilance and adherence to compliance and regulatory requirements. This voluntary register was supported of the Minister for Housing. The Regulation of Providers of Building Works and Miscellaneous Provisions Act 2022 now provides for the statutory registration of builders. The legislation aims to benefit consumers and the general public by giving those who engage a registered builder the assurance that they are dealing with a competent and compliant operator. To avoid public confusion, the existing voluntary CIRI registration scheme has now been rebranded as Voluntary Construction Register, known as VCR.

The Act requires all entities providing building services to register with CIRI. Approximately 800 building and contracting entities are currently included on the voluntary register. When the register operates on a statutory footing, it is expected that initially at least 5,000 entities will be required to register. It is envisaged that it will become mandatory for builders to join the Statutory Register from 2025 and the first categories required to register will likely be house builders and non-residential builders accepting an appointment as builder under the Building Control Amendment Regulations (BCAR). Registration for various trades will happen subsequently. Eligibility for registration can be achieved through qualifications, experience or a combination of both. The criteria required for registration will be clear and transparent and will be set out in regulations.

As the appointed Registration Body for CIRI, the CIF will establish an Admissions and Registration Board consisting of a chairperson and 10 ordinary members appointed by the Minister and will undertake to support the Board in performing the functions outlined in the Act.

8.6.4 Ongoing Skills Monitoring to 2030

In addition to skills (re-skilling, upskilling and new skills) in VET, FET and higher education, skills documenting and monitoring through Continuous Professional Development (CPD) and training provided through registered bodies such as RIAI, SCSI ACEI and EI and by private trainers (CIF, IGBC, Chevron, health and safety training etc) are a vital part of the overall upskilling process.

Lifelong learning is a key take away from our research and 'on the job' training provided by materials suppliers and products manufacturers are equally relevant to primary qualifications as innovations in technology are rapidly advancing. For example, upskilling in installing technologies such as heat pumps or solar panels by manufacturers, of which there are many, or using insulation products properly to ensure optimum performance, should be documented to ensure not only quality but also acknowledgement of varied competencies of workers allowing for greater mobility within the industry.

Often this training is provided in-house and informally. A simple smart phone app, for example the Build Up Skills Advisor app could host all of this information on a personal profile made visible to the public for marketing purposes for SMEs or sole traders. Clients could then view the app and sort by trades people or professionals as required in confidence that skills are verified by a central source such as educational institutions and government departments. The back end of the app would then host all of the data on skills acquired making it easy for government bodies to flag early warning signs in skills shortages. The most logical approach to monitoring this in Ireland is through the CIRI register but numbers undertaking up-skilling and the types of upskilling undertaken must be made available for review, even if names and personal information are not provided due to GDPR, so that areas of priority such as around decarbonization, circularity or digitisation etc can easily be flagged and interventions crafted. Details of gender participation and basic age profiles on the app would help to ensure visibility of both these importance cohorts for the construction sector again acting as early warning signals for administrators and government.

The recently (2023) published OECD report Skills Strategy Assessment and Recommendations project reviewed how Ireland's existing skills strategy – the National Skills Strategy (NSS) 2025 – might need to be adapted to ensure that it is still fit for purpose. Through desk research and active engagement with government and stakeholder representatives in multiple workshops, group discussions and bilateral meetings, the project identifies priority areas for action and provides tailored recommendations for improving Ireland's skills outcomes. This report is timely given 2023 is the European Year of Skills and will directly inform the next steps and focus for upskilling in Ireland. Political appetite for monitoring and intervening, when necessary, in skills provision, across all levels, is strong. The OECD report recommendations coupled with the Build-up Skills Status Quo Analysis (SQA) (leading on immediately to a roadmap design phase), are the course of great interest amongst the many construction skills committees in operation nationally. It is expected that BUSI 2030 SQA forecast figures along with the ongoing skills monitoring work of DFHERIS and a separate special piece of research commissioned by SOLAS on green skills for VET, will collaboratively lead to a robust skill monitoring strategy, overseen by government.

9 Barriers

The findings in this report highlight overall significant skills and labour shortages at all levels of construction workers and professionals, across public and private new build and retrofit sectors. As part of BUSI2030, a series of interviews; workshops; attendance at industry conferences; engagement with relevant cross disciplinary parties; analysis of public discourse has informed the collation of the following barriers.

There are a broad range of relevant policies, strategies and programmes regarding education and upskilling provision within the construction industry. However, there are still several impediments and barriers at all levels (supply, operative, management and professional roles) regarding:

- implementation of new up-skilling initiatives to address the 2030+ targets;
- lack of statutory accreditation for green skills;
- effective adaptability for strategies and technologies progressing at a fast rate;
- provision of incentives to upskill, facilitation of participation for an already stretched;
- workforce due to workloads and labour shortages;

The scale of the challenges for ALL involved in the construction industry are significant. Solutions will need to be multi-faceted across numerous sectors and impacted by and for Policy, Education, and Industry stakeholders, while also ensuring high standards of Quality Control are maintained. Significant coordination, investment of resources and financial supports will be required to ensure full implementation of the proposed BUSI2030 National Roadmap for Upskilling. The following high-level categories have been identified regarding barriers:

POLICY AND CONTEXT: There are numerous reasons for upskilling within any trade / profession, including market differentials, CPD requirements, general interest in topics and specializations. However, unlike areas such as Health and Safety, there are minimal mandatory drivers to encourage and promote compulsory Green Skills.

To date there has been a significant focus on Energy Efficiency policies and strategies with nZEB and retrofit courses being rolled out across the country. This now needs to be strengthened and extended to fully reflect developments at national and European levels. More specifically, issues regarding de-carbonisation (Embodied & Operational), Digitalisation, Circularity, Biodiversity and Social Value must be addressed in greater details.

In addition, there has been significant focus on the residential sector (new builds and retrofit). This should be supplemented to address all other sectors. CAP23 and EU policies require the Public Sector to lead by example. To achieve this, a specific focus on upskilling public sector staff at a faster rate is needed.

In recent years there has been a significant increase in the provisions of new education initiatives, courses, alternative pathways and establishment of Training Centers of Excellence, University Research projects and cross-industry Green Skillnet projects. The Policy, Standards, Education and Guidance context is extremely complex and can be a deterrent to engage at any level and leading to many industry participants missing these education and upskilling opportunities and ‘reinventing’ the wheel for each project.

There is a tendency to wait for new policies and legislation to be passed before developing new relevant training programmes, but some people in the industry want to move faster and be ready for the next policy change. Between the waiting period for new policies and legislation to be passed and the time it takes for new programmes to be developed, the current training programmes are already out of date.

Taking some specific examples, with Modern Methods of Construction (MMC), to date there is a low adoption rate in Ireland. Architect and Designers questioned for the MMC report commissioned by Skillnet stated that only 10% of their outputs are MMC (Searson and Esposita, 2022).

Some other significant reasons for low adoption of technology and MMC are high upfront costs, the currently fragmented value-chain and concern regarding focus on R&D to attract FDI rather than for improvement of domestic industries. Since the publication of this report, several supporting programmes have been made available through Enterprise Ireland e.g., Built to Innovate.

Regarding digitisation, according to Fox (July 29, 2022) 60% of the interviewed companies said they will not be investing in digital technologies at all such as AI, data analytics, 3D printing and more.

Significantly more needs to be addressed by Industry regarding design, supply and material technologies. Specific areas for further development include, circularity quality approval processes, efficiencies regarding manufacturing, supply chains, prefabrication and aim for reduction of imports. The use of materials with low embedded carbon, bio-based materials is not being adopted for most projects. Plus, there is no requirement for reporting / reducing / tracking carbon outputs, use of materials with EPDs or Circular Economy strategies.

In relation to Timber, as we transition to a low carbon culture, we need to increase knowledge and skills, and to develop consistent and clear guidance on the safe use of timber structures to ensure all timber framed buildings are properly designed, constructed and maintained.

There are missed opportunities within procurement processes for alignment of existing Climate Action Targets and contractual arrangements in public and private sector for contractors and professionals. For example, there is no minimum requirement for Carbon reporting or use of materials with EPDs. Provision of these issues would promote industry wide engagement with Upskilling to be better placed to tender for such projects.

There is additional detailed green expertise required within procurement bodies who can correctly set out requirements and adjudicate on the tender's submission including the skills of the proposed teams.

QUALITY CONTROL AND INFORMATION MODELLING: There is a fear that, given the extensive number of training programmes available, there is a lot of poor education, potentially leading to unintended consequences. It is hard to verify the quality of uncertified courses and trainers providing these courses. There needs to be a greater emphasis on ‘Training the Trainers’ and establishing quality datum of education programmes to ensure that the correct skills are taught, monitored, and continually improved and to avoid ‘greenwashing’.

In addition, there is insufficient feedback post training, lack of case studies for initiatives like buddy system or shadowing.

There is also minimal or no tracking of operational / post-occupancy evaluations to upskilling Facility Managers to improved operational efficiencies.

Increased quality of consistent data can help show the reduced climate impact and the increased value for the businesses through life cycle cost analysis and more. There is an inherent lack of consistent & detailed data within the construction sector at all levels.

For instance, there is no centralized Irish approved methodology for measuring carbon in the built environment. The Climate Action Plan (Action 198) requires the establishment of a standard

methodology re carbon calculation, materials data base. However, in the interim, several different tools are being used within the industry with a huge variation in outputs (based on initial comparative studies).

There are also numerous processes and systems operated across all construction disciplines which could be further streamlined, e.g., Registration systems, proof of competence, licensing requirements, registers of relevant personnel, architectural BIM models and yet separate daylight / sunlight models. Existing processes and systems could also be further optimized e.g., Display Energy Certificates (DEC) procedures. There are lessons to be learned and mirrored from other processes in the Industry like Health and Safety, Building Control (Amendment) Regulations BC(a)R.

There is insufficient engagement with the Circular Economy and Miscellaneous Provisions Act 2022. There is insufficient requirement, time, or core knowledge to implement circular economy principles from early design stage.

Finally, there is a significant gap within the public Building Control areas regarding monitoring and enforcement.

COMMUNICATION AND AWARENESS: Whilst the level of awareness of the need for upskilling, amongst SME's has increased due to Ireland's climate action targets, there is still a significant amount of additional work required to act upon this awareness.

This applies on national level and individual level. Corporations must also engage all their stakeholders within the organisation, in particular the board members and senior management. Lack of culture and commitment to green upskilling within the company may lead to lack of resources, slow decision making and lack of solid strategy regarding upskilling.

Change adaptation is slow in most organisations, SMEs, and large organisations alike. Lack of common company culture and lack of efficient change adaptation strategy can slow down the integrations of sustainability and continuous upskilling.

Awareness of the benefits of green skills in the construction industry must be created amongst the public too, as many of them are potential future customers.

The business opportunities for companies (building owners / developers and construction members) need to be further highlighted to attract more adoption of best practice solutions and delivery of projects beyond minimum standards.

Barriers related to retrofitting (as identified in SEAI Report) are outlined below:

Capability barriers, which affect the homeowners' psychological and physical ability to retrofit. These include lack of awareness, difficulty in navigating the large number of options and decisions, and lack of financial literacy.

Opportunity barriers, which refer to environmental factors that can discourage homeowners from retrofitting. These include high costs, split incentives between landlords and tenants, a lack of skilled installers, and a lack of visibility of retrofitting.

Motivation barriers, which affect our mental processes and ultimately drive homeowners' decision to retrofit. These include friction costs and hassle, moderate perceived benefits of retrofitting, aversion to risk, and low consumer trust.

However, retrofit benefits have been identified in the UK which address fuel poverty, bring significant reduction in ill health to the individual and wider benefits such as reduced NHS spending (between £1.4-£2.0bn pa). As well as less easy to quantify benefits including children doing better at school, bringing friends to their home rather than hanging out on streets and people feeling happy about where they live and taking pride in it.

We also acknowledge that Retrofitting homes where residents are in fuel poverty is important for climate and social justice and an essential step in a just transition.

WORKFORCE: A key motivation for an individual to engage with an Upskilling programme is to improve their prospects for gaining or sustaining employment. There are high targets set for both new build and retrofit, while upskilling to deliver high quality retrofit is important, finding workforce for new builds is also important. Any national programme of training will have to clearly identify a relationship with existing or upcoming job opportunities and career progression. There is a need to incentivise upskilling and attract more people across a broad diverse range into this sector. This needs to be done for all, undergraduates, the unemployed, and working professionals.

At times of high employment and minimal choice in qualified workforce, voluntary upskilling is not a priority even if the training is readily available and free. There is a huge gap regarding diversity within the Construction Industry. Diversity regarding numerous issues such as age, gender, and disability. There is a significant body of work required to address the negative perceptions of the industry and the lack of opportunities for engaging with and working in the construction industry, which are impeding employment uptake in the sector.

Perceptions, lack of structures, formal accreditation and opportunities regarding 'non-formal' learning (Flexible / Informal / Blended learning) needs to be addressed and supported to promote learning and upskilling while working. There is not enough feedback for informal training to change perception and determine the quality and the success of these programmes.The average age of construction workforce is 45. Many may consider leaving the workforce before retirement age due to the physical nature of some of the jobs. Transition programmes into different types of jobs should be considered as well as non-monetary incentive e.g: more time off, flexible working hours etc.

New and existing workforce aims for better transferability of skills and flexibility in their job opportunities. It has been shown that the average gen Z will change jobs every three years or so (O'Dea, 2022). To attract new workers into the Construction Sector and retain current employees, education providers and the industry must be ready for more interdisciplinary practices and education.

In addition, there are countless job titles in the industry so many are left unsure how their job title translates to other jobs. Need to address the specific specialists required at supply, contractor and professional levels and promote registration systems to ensure quality measures are adopted. Language barriers from non-nationals may be a consideration, plus procedures for recognition of approved courses and methods of training from other countries.

Many large companies rely on sub-contractors and / or agency staff. Furthermore, there is a high rate of bogus-self-employment, this refers to someone being self-employed in essence but contracted by a larger organization and becoming an "employee". Employers do not have the same responsibilities to subcontracted workers resulting in a less secure job positions. Neither the staff nor the employers can afford or are willing to invest in upskilling and further training of staff, knowing that the employment is only temporary (CIOB, 2021).

A factor less considered but relevant, is the inability to upskill due to physical issues or mental health issues such as burnout, stress and more (Mooney and O'Rourke, 2017). This issue can be improved with better access to resources and help via employer, unions, professional organisations and more.

Financial: There is significant movement at EU level to promote the European Green Deal with EU Taxonomy systems. Current ESG requirements target larger scale operators. Similar incentives across all sectors and specifically for SMEs, will need to be provided to encourage momentum in the industry for Upskilling to assist in meeting climate targets.

According to research employees are not being paid enough to take time off work for training (Jammet and O'Brien, 2022). The white-collar workers are on par with rest of the Europe in terms of income while blue collar-workers are below the EU average (Chartered Institute of Building, 2021). This, combined with the lack of job safety, makes freeing up time for upskilling a low priority.

In addition, there is only a gradual awareness of available "earn as you learn" schemes which would show the increased pay scale plus benefits to the industry by those upskilling. These areas need to rapidly increase. Hidden costs and friction costs refer to the costs incurred as an indirect result of upskilling, costs not considered previously and opportunity costs of training.

Upskilling can result in loss of wages, loss of paying customers, additional travel costs, childcare, accommodation if training takes place in different locations and more. In addition to financial costs, time is also an issue. Frequent travel and training during personal time may not be possible for many.

Of concerns is the minimal awareness of these initiatives and requirements to participate amongst SME's either as procurer, building owner, contractor, or service provider.

Incentives are required for small and medium sized enterprises (SMEs) to support and engage in the required up-skilling training processes. Financial incentives are currently limited to course fees only and not available to cover friction and hidden costs associated with upskilling, particularly the time associated with training.

In the climate of significantly reduced profit margins, loss of productivity because of employee absence from work to attend training is a major barrier to participation. This is even more true for SMEs or solo-employed that do not have options to spread out the workload across the rest of the staff.

Financing innovative solutions for low embodied carbon and bio-based products within the construction supply chain within an Irish context needs to be developed further to reduce some dependency on imports.

There is a significant amount of time, effort and cost put into the initial stages for projects that are never fully realised. One Stops Shops for domestic retrofit works, tend to experience this the most. Clients will call them in for consultations and assessments but not commit to the projects in the end, despite detailed assessment and/or initial studies. Loss of time in these instances is another impediment for taking time to upskill.

The rise in costs of materials, running of the business as well as living costs prevent upskilling due to financial and time restraints. (Taggart, 2022) cited that 55% of Irish millennials are concerned with the cost of living as opposed to the global average of 36%. Inflation also causes migration within the country and emigration of skilled workforce to other countries. This causes further de-incentivisation of investment in upskilling.

According to (Brennan, 2022) 85% of Irish construction firms state that the rising costs of materials and the sheer level of demand are major challenges facing the industry. Additionally, energy costs, labour

costs and taxes such as increasing carbon taxes. There are many incentives and initiatives available however, the landscape of the initiatives and the application processes are complex. There is a lack of consistency, comparable quality assessment or centralised platform to assess where the many opportunities are across Policy, Education and within Industry and Private operators. Consideration is being given to easy to access schemes such as a sliding scale grant system to incentivise and grant fund retrofitting. Where the grant funding is 50%, or even more, dependent on citizens ability to afford the best retrofit measures.
But it is acknowledged that all in the sector need to be aware of the building physics and best options for a particular building to produce high quality results.

There is an Industry wide emphasis on initial build costs and a lack of appropriate focus on long term financial, operational implications and the benefits of LifeCycle Analysis.

Current financial supports are directed towards the Residential Retrofit sector but not to the same scale for Commercial Retrofit.

Many training initiatives target unemployed people or school leavers, with a growing support for up-skilling those in employment. Both approaches need support regarding the practical implementation to follow through on policies.

TRAINING AND EDUCATION: Due to a cultural lack of cross-sector education opportunities and integration of soft skills like teamwork and communication in training, people from varying disciplines have different priorities which can lead to miscommunication and missed opportunities for broader learning **(**Jammet and O'Brien, 2022) and there is insufficient focus on critically needed skills. The realities of collaborative working within Industry should be reflected within the education sector and training programmes.

Multidisciplinary skills and cross-sector approaches are critical to minimise faults and failures at all project stages.

The large number of construction industry stakeholders directly or indirectly involved in the implementation of the climate action initiatives are often not communicating to share resources, lessons learned and showcasing the specifics regarding exemplar projects.

Furthermore, there is only a limited amount of higher education courses that offer work placements or internships within the course offering.

[1] https://www.leti.uk/ecp

10 Conclusions

In Ireland, the construction industry and the built environment account for 37% of national emissions, which is equivalent to total emissions resulting from agriculture. This is made up of around 23% operational emissions associated with energy used to heat, cool, and light buildings. A further 14% of emissions are accounted for by embodied carbon emissions from the production and transportation of construction materials, construction processes, and the maintenance, repair, and disposal of buildings and infrastructure (Kinnane, 2022).

Assuming a rapid decarbonisation of the electricity grid takes place as envisaged in the Government's Climate Action Plan, as well as the implementation of Nearly Zero Energy Building (NZEB) and Zero Emission Buildings (ZEB) standards by 2030 (European Commission, 2021), Ireland's ambitious National Retrofit Plan should lead to an overall decrease in operational emissions by 2030, provided new builds and renovations perform as per design (Kinnane, 2022). However, this reduction could be negated by a significant increase in embodied carbon emissions associated with the housing to be built under the Housing for All Strategy if Embodied Carbon emissions are not addressed.

Our research has found that the construction workforce of the years 2021, 2022 is relatively consistent, strong, stable and similar at roughly 160,000. We await the full census 2022 results later in 2023. Our methodology assumes the 'Pipeline' of graduates from 2022, the number of students in the next 7 years that will be coming into the workforce along with dropout rates, other employment, replenishment rates and expansion rates of the workforce. This workforce is responsible for the number of constructions and retrofits (to B2 level) across the Residential and Non-residential sectors which was ~ 183,755 for 2019-2022 (awaiting Non-RES retrofit figures).

We produced a forecast using the previous yearly data to understand the number of constructions that will occur yearly up to 2030 and compared to 2030 Targets. Looking at Traditional Building Professions and Crafts and a 'Status Quo' approach (No change in training, tactics, etc.) we can predict the number of workers in the construction sector up to 2030.

We then used the current workforce numbers to predict the number of workers required for each profession and craft in order to reach the 2030 Targets. Based on the methodology discussed previously, using educational provision across the entire sector benchmarked against climate action and housing targets, we have forecast a shortfall of at least 100,000 people in the construction labour market over the coming years. The breakdown of these figures lies across a number of trades, crafts and so-called 'professionals' such as architects, engineers, surveyors including energy systems engineers and modelers. Although we acknowledge all actors in the construction value chain are professional and most have qualifications and credentials. Technicians are required at all grades to support in installation, optimisation, management and maintenance of installed technologies and digitisation of planning processes.

In addition to new entrants into the construction sector the existing workforce needs to adopt a life-long learning approach, if targets have a chance of being achieved. Analysis has also been conducted into how new skills, upskilling and re-skilling can become a normalised aspect of the construction building professional's work life.

The BUSI2030 results are stark although not particularly surprising. The construction of 30,000 new homes in 2022 was a positive step, and our forecast shows that new build housing targets to 2030 should be met, based on current projections, however retrofitting will fall far short, somewhere in region of 30% of the targets.

We have been unable to provide an estimate for embodied carbon associated with the overall delivery of the Government's Housing for All plan, demonstrating that more research is required in this area but also rapid action, to ensure we meet greenhouse gas reduction targets simultaneously; the two sets of targets are not natural allies.

Construction works on buildings in Ireland over the coming 6 to 7 years to meet energy efficiency targets before 2030, as outlined in the National Development Plan (NDP), the Housing for All policy and the Climate Action Plan proposal including those for the renovation of 500,000 homes to B2 standard will (if not counteracted) lead to a significant increase in carbon emissions and embodied carbon, arguably negating the savings in operational carbon.

Some commentators have suggested that it would be a better use of resources to focus on renovating existing building, dwellings and vacant properties rather than on the scale of new builds proposed. Our figures show a total number of buildings (inclusive of public, commercial, housing etc) proposed as the subject of construction works to 2030, of 900,000.

Our focus in BUSI2030 was to examine skills, labour units and a break down by trade, professional etc and EQF level needed to meet these targets. Focusing on domestic new builds, is possibly easier particularly where new and modern methods of construction are gaining traction and proving their place in the mainstream construction sector and culture. Architects, Planners, Quantity Surveyors (also Building Surveyors, Chartered Surveyors) and Engineers (all disciplines in engineering including energy engineers) are urgently required. Our forecasts show up to 25,000 additional personnel in these roles alone will be required immediately to meet 2030 and onto 2050 zero carbon targets. Upskilling & reskilling the current workforce (at least 35,000 people) is equally urgently required, not only in the guise of lifelong learning but through flexible, accessible and fully financed and incentivised approaches to upskilling. In terms of educational provisional for those currently in the system, across all NQF levels and those entering in the coming years, relevant, innovative and new tailored content must be added to existing courses to reflect emerging technologies and methods such as BIM, circular economy, green public procurement, Life Cycle Assessment, Life Cycle Costing, whole life carbon, indoor air quality, water usage, biodiversity etc.

In terms of craft trades, we focused our work on plumbers, electricians, carpenters, where we forecast an additional 25,000 will be required to meet targets. 'Other' is a catch all category which contains a lot of professional roles and following CEDEFOP and John McGrath's[54] methodologies, we project an additional 25,000 machine operators, crane drivers but other also new and emerging professionals. Increasing demand for digital project delivery across all levels of workers needs to be managed and met. Awareness raising of good practice within the industry e.g. case studies of SMEs using MMC or digitisation or circular economy in construction on work sites, would be helpful if disseminated though a dedicated social media channel. New case studies would also be helpful for the design of up to date training modules and for tool box talks.

Retrofitting 500,000 homes to 2030 will require the efforts of traditional trades or so-called wet trades, plasterers, bricklayers, painters and decorators using external and internal wall insulation, but also in understanding heritage, traditional and conversation in order to work with that building type, structure and physics, to apply modern materials in air tightness and ventilation and breathability. Site managers and project managers will be needed across both new build and retrofitting of homes and of course in public, private non-domestic and commercial retrofits, which are conservatively projected at 480 buildings a year. In total, we project that over 300,000 people will be required in meeting these targets

[54] gov.ie - Report on the Analysis of Skills for Residential Construction & Retrofitting, 2023 to 2030 (www.gov.ie)

just in the construction sector alone, leaving a shortfall from current provision and graduates of over 100,000.

Key actions to address this challenge include:

- *Upskilling* of existing workforce in relevant areas of energy efficiency, digitisation, circular economy and decarbonisation (emphasis on where relevant)

- I*ncentivising* upskilling through 100% grants, tax emptions etc

- Attracting up to 100,000 additional *new entrants* to the construction sector on a pro rata basis over the coming 5 years

- Attracting *younger people* into trades and into construction in general

- Attracting greater numbers of *women* into construction roles particularly as new roles emerge

- Construction roles, as with all industries, need to meet 2023 *lifestyle expectations*, family friendly work times, work life balance etc

- Better use of the *existing building stock* (prioritise renovating derelict and vacant properties over new builds)

- Start *measuring whole life carbon* - we can't manage what we do not measure – through a universal system applied by all in Ireland

- Transition to *low embodied carbon construction* processes and technologies

Further research and monitoring is required in many aspects of what we covered in this report but overall the content of the Status Quo Analysis is robust and will contribute productively to a new roadmap in 2024 to deliver on skills to meet our 2030 targets for Ireland.

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Abbreviations

Abbreviation	Description
CAO	Central Applications Office
CE	Circular Economy
DASBE	Digital Academy for Skills in Built Environment
DFHERIS	Department of Further and Higher Education, Research, Innovation and Science
EGFSN	Expert Group on Future Skills Needs
EE	Energy Efficiency
EI	Engineers Ireland
EHEA	European Higher Education Area
EmC	Embodied Carbon
EQF	European Qualifications Framework
FÁS	Foras Áiseanna Saothair
FET	Further Education and Training
HEA	Higher Education Authority
HCI	Human Capital Initiative
HEI	Higher Education Institute
IT	Institute of Technology
NFQ	National Framework of Qualifications
PLC	Post Leaving Centre
QQI	Quality and Qualifications Ireland
RES	Renewable Energy Systems
RIAI	The Royal Institute of Architects Ireland
SCSI	Society of Chartered Surveyors Ireland
SEAI	Sustainable Energy Authority of Ireland
SOLAS	An tSeirbhís Oideachais Leanúnaigh agus Scileanna
TU	Technological University
VET	Vocational Education and Training
Project Partners:	
TUS	Technological University of the Shannon Midlands Midwest
IGBC	Irish Green Building Council
LOETB	Laois Offaly Education and Training Board
CIF	Construction Industry Federation

*Not an exhaustive listing

Appendix A – Forecast Tables

Residential New Build Forecast Tables

Table Yearly New Dwelling Completion Forecast Table:

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound	Housing for All Projected Output
2011	6,994				
2012	4,911				
2013	4,575				
2014	5,518				
2015	7,219				
2016	9,821				
2017	14,296				
2018	17,872				
2019	21,126				
2020	20,574				
2021	20,553				
2022	29,822	29,822	29,822	29,822	24,600
2023		32,270	26,481	38,060	2,900
2024		34,734	26,141	43,327	33,450
2025		37,198	26,162	48,233	34,600
2026		39,661	26,320	53,002	36,100
2027		42,125	26,533	57,717	36,900
2028		44,588	26,761	62,415	38,100
2029		47,052	26,983	67,120	39,500
2030		49,515	27,186	71,844	40,500

Table Cumulative New Dwelling Table of figures

Timeline	Cumulative Forecast	Cumulative Lower Confidence Bound	Cumulative Higher Confidence Bound	Housing for All Projected Output
2011	6,994	6,994	6,994	6,994
2012	11,905	11,905	11,905	11,905
2013	16,480	16,480	16,480	16,480
2014	21,998	21,998	21,998	21,998
2015	29,217	29,217	29,217	29,217
2016	39,038	39,038	39,038	39,038
2017	53,334	53,334	53,334	53,334
2018	71,206	71,206	71,206	71,206
2019	92,332	92,332	92,332	92,332
2020	112,906	112,906	112,906	112,906
2021	133,459	133,459	133,459	133,459
2022	163,281	163,281	163,281	158,059
2023	195,551	189,762	201,341	160,959
2024	230,285	215,903	244,668	194,409
2025	267,483	242,065	292,901	229,009
2026	307,144	268,385	345,903	265,109
2027	349,269	294,918	403,620	302,009
2028	393,857	321,679	466,035	340,109
2029	440,909	348,662	533,156	379,609
2030	490,424	375,848	605,000	420,109

Retrofit Forecast Tables

Table Yearly number of Retrofit Forecast Table

CONSTRUCTION RATES	RETROFIT to BER B2	Forecast	Lower Confidence Bound	Upper Confidence Bound	Climate Action Plan Target
2019	2,423				
2020	3,278				
2021	4,345				
2022	8,481	8,481	8,481	8,481	
2023		9,862	7,646	12,079	
2024		11,853	9,568	14,139	
2025		13,844	11,491	16,197	
2026		15,835	13,416	18,254	
2027		17,826	15,342	20,309	
2028		19,816	17,270	22,363	
2029		21,807	19,198	24,417	
2030		23,798	21,127	26,469	500,000

Table Cumulative Retrofits Forecast Table

CONSTRUCTION RATES	RETROFIT to BER B2	Forecast	Lower Confidence Bound	Upper Confidence Bound	Climate Action Plan Target
2019	2,423				
2020	5,701				
2021	10,046				
2022	18,527	18,527	18,527	18,527	
2023		28,389	26,173	30,606	
2024		40,243	35,741	44,745	
2025		54,087	47,232	60,942	
2026		69,922	60,648	79,195	
2027		87,747	75,990	99,504	
2028		107,564	93,260	121,868	
2029		129,371	112,458	146,284	
2030		153,169	133,585	172,753	500,000

[i] https://www.seai.ie/grants/home-energy-grants/home-upgrades/