INTRODUCTION

The Irish Green Building Council (IGBC) welcome the opportunity to provide feedback on the Climate Action Plan 2021.

The Irish Green Building Council (IGBC) provides leadership for a sustainable built environment. IGBC is a registered charity with nearly 200 corporate members drawn from all parts of the value chain, from occupiers, design professionals, contractors, suppliers, academics and public authorities and affiliated with a global network of 70 national councils within the World Green Building Council. This allows us to create workable solutions and tools to deliver transformative change towards a sustainable built environment.

This submission is based on reports produced by the IGBC over the last three years on renovation, whole life carbon and sustainable housing[1]. More specifically, to prepare this submission the IGBC organised an online workshop with its members on Wednesday, 12th May. The workshop was attended by retrofit companies, architects, engineers, developers, as well as construction product manufacturers and distributors. Our comments reflect this discussion.

EXECUTIVE SUMMARY

- Better alignment between the NPF and Ireland's climate ambitions is vital.
- The NPF standard of 40% of development within existing settlement boundaries should be increased in all areas but particularly in areas that are subject to urban-generated development pressure with associated high demand for housing.
- To mitigate against continued rise in national emissions, there needs to be a significant investment in the renovation of underutilised and vacant buildings in city, town and village centres. This requires technical and financial support, as well as better enforcement of existing legislation on vacant properties.
- Whole life carbon must be regulated within the next 3-4 years, but the following actions should be taken immediately:
    - All publicly funded construction projects (NDP and otherwise) should be required to undergo a whole life carbon assessment (covering both operational and embodied carbon).
    - Whole life carbon assessment should be mandated as part of public procurement and planning process for buildings over a certain size.
- Review the nZEB standard for non-residential buildings as this is not ambitious enough.
- Support energy renovation by making it more affordable, accessible and affordable. In particular:
    - Introduce a stable and long-term framework to provide all players with certainty and generate confidence.
    - Launch a sustained national awareness campaign to promote energy efficiency
    - Launch a network of skilled, trusted local intermediaries (Renovation Advisor)
    - Ensure the launch of a loan guarantee scheme for energy renovation is a priority
    - Ensure the B2 target does not lead to lock-ins or unintended consequences. This could be done through the introduction of Building Renovation Passports promoting a holistic approach to energy renovation.
    - Consider introducing Minimum Energy Performance Standards, especially for some segment of the market (e.g. private rental market)

[1] These reports can be accessed here.

    - Ambitious renovation targets for public sector and social housing are included in Ireland's Long-Term Renovation Strategy, but the current budget set for retrofit of social housing is insufficient to undertake the level of retrofits required to achieve the 2030 target. This must be addressed urgently as social housing retrofit could also work as a testbed for projects aggregation, hence reducing costs and improving qualities, and be used to develop exemplar projects
- New built:
    - **Use the financial system to encourage home builders to go beyond building regulation**s, and build the greenest, healthiest, zero carbon homes. In particular, it should **promote the EU Taxonomy Regulation**. This **will strengthen the Irish banking system by ensuring that their loans are climate proofed.**
    - **Ensure any public lands that are sold and released to private developers include a requirement to reach the net zero carbon standard** (i.e. to be Paris compatible) **and/or higher environmental criteria**, such as the ones included in the Home Performance Index.
    - **Require European Water label A rated water efficient taps and showers** are installed.

- Ensure the public sector lead by example:
    - Through commitment to net zero carbon buildings by 2030.
    - Ensuring any public lands that are sold and released to private developers include a requirement to reach the net zero carbon standard (i.e. to be Paris compatible) and/or higher environmental criteria, such as the ones included in the Home Performance Index.
    - Mandate the use of wider sustainability criteria (beyond the BER) to include walkability, access to amenities and public transport, embodied carbon, water efficiency and biodiversity loss, etc for new housing development in Development plan.
    - Mandate life cycle assessment as part of public procurement and planning process.
    - The public sector must also lead by example in relation to energy renovation. The diversity of public buildings means that it's a microcosm of what will need to happen in other sectors. It is hence critical that the public sector reaches its renovation targets and use these projects as case studies to engage with the wider public.
- Support the development of low carbon materials through specific programme for enterprises and public procurement.

GENERAL PRINCIPLES

In the context of climate emergency, all the plans should incorporate the following 'first principles':

1. **Avoid relying on Business as Usual technological solutions** - The new climate action plan should focus less on a business as usual of trying to reduce carbon with expensive technology substitutions in each individual sector and; more on cost effective cross sectoral solutions that first make the problem smaller and therefore easier to solve. For example, industry, transport and buildings are three fully interconnected sectors and need to be solved together not separately. There are a number of examples below of how this can be done.

2. **Zero Carbon Buildings –** All new development must move towards Zero Carbon across the full life cycle by 2030 or earlier. This is via optimising energy efficiency first, and meeting balance with

renewables on site or contracted offsite for denser development. Embodied carbon must be measured and reduced as far as possible and the balance offset.

3. **Embodied Carbon in construction** - Embodied carbon is not just about low carbon materials. Potential annual reductions are cost free and often involve just smarter design, better space optimization, smaller homes, reuse of existing structures and simple substitution of widely available materials. The low hanging fruit becomes obvious once we start measuring and regulation. Inovation will follow regulation. **Embodied carbon = Carbon intensity of the material x quantity of materials**. Additional information can be found in Appendix A and Appendix B setting out more detail and the potential savings.

4. **New homes or buildings must not be car dependent –** Every new home and building must be assessed for accessibility by public transport, walking and cycling infrastructure.There should be less reliance on substitution of fossil fuel cars with electric cars and more on reducing the absolute number of cars. This will create a number of co-benefits such as further reductions in embodied carbon for infrastructure and for manufacture of cars.

5. **Resource efficiency and circularity should be integrated–** All development must integrate circularity and resource efficiency principles. Avoid unnecessary demolition, encourage space optimisation, design for long life and flexibility, design for disassembly and reuse of components.

6. **Water efficiency first –** All new development and refurbishment must integrate water efficiency measures, and certain high flow taps and showers need to be regulated or banned.

7. **Require Energy and Carbon disclosure** all large buildings should publicly disclose their emissions each year. Once this is a requirement action will quickly follow.

8. **Think Mitigation** – how best to ensure that the plan mitigates against increasing the carbon load of the plan over its lifetime and beyond .

9. **Think Adaptation** - how best to 'design-in' adaptation for climate change in buildings and infrastructure.

10. **Biodiversity –** Every development must have a biodiversity plan. Land sealing must be minimised, minimum density guidelines must be followed.

11. **Comply with the 'do no harm' principle i.e., no action should undermine environmental objectives** and diminish ecosystem services within the county.

12. **Encourage 3rd party verification of all principles above and go beyond minimum standards - Lead by example -** Councils have a responsibility to lead by example. Encourage use of tools such as Home Performance Index, Passive House, BREEAM and LEED certifications on all developments.

CALL FOR EXPERT SUBMISSIONS

We set out our responses to the Q&A provided for in the Climate Conversations portal. All answers reflect IGBC members positions and are directly related to climate mitigation and adaptation of the Built Environment sector (residential and non-res).

CARBON PRICING AND CROSS-CUTTING ISSUES

Q1. What further opportunities exist within our taxation system, beyond measures already implemented and planned, to promote emissions reductions, either on an economy-wide basis, or in specific sectors?

Several actions could be taken to reduce emissions in the built environment. These relate to better use of the existing stock, as well as supporting energy renovation and the construction of greener homes and buildings.

Encouraging a better use of the existing stock
The greenest buildings are almost always the ones that already exist. Yet, too often out city, town and urban centres are blighted with abandoned and underutilised buildings. By bringing these properties back into use through high quality renovations we can tackle several challenges at once. First, we can cut Ireland's buildings and transport related emissions through high quality energy upgrades of these properties[2]. Second, it represents a unique opportunity to make our city, town and village centres more vibrant and to restore the cultural and aesthetic value of these areas.

The following changes in our taxation system could support this transition:

- Better connect **retrofit grants and tax incentives** with **other schemes such as the Living City Initiative** to encourage investments in town and city centres.
- Consider **introducing higher tax on vacant and under-used properties**, as this is done in Denmark. An alternative is to **introduce site area or site-value based taxes** to encourage owners to bring to market corner sites, back lands, etc.

Supporting energy renovation
Further actions could also be considered to incentivise energy renovation, make it more affordable and improve quality assurance. These include:

- **Restructuring energy tariffs** to increase weighting between consumption and standing charge, hence incentivising energy conservation.
- **Reducing VAT on professional services offered for advice on home energy renovation** and **encourage the use of quality, tax compliant contractors by reducing VAT for renovation**. Quality retrofit is dependent on professional impartial advice. Next to the availability of finance, homeowners are often confronted with a lack of understanding of the process - what to do, where to start, and which measures to implement and in which order. This often leads to inaction, delays, or sub-optimal outcomes. These professionals should be responsible for developing a roadmap of measures to be taken either in a one-off or phased manner (Building Renovation Passports).

55% of private rented dwellings have a BER of D or lower. To further encourage small landlords to retrofit their properties, the government should **explore the opportunity of opening the Accelerated Capital Allowance scheme to landlords** or to **reduce the property tax for landlords who invest in retrofit**. In the commercial sector, **coordination with local**

[2] As people living in central locations are usually less reliant on cars, this would also reduce our fastest growing source of carbon emissions, transport.

authorities is needed to ensure improvement in energy efficiency don't lead to higher council rates.

Encourage the development of greener buildings

First, the public spending code should be revised to include a shadow price of carbon across the full life cycle of a building and better reflect the cost of carbon. Read more.

Secondly, it may be appropriate to consider a scaled 'climate contribution' on a per sqm basis under the development contributions scheme to cover costs associated with local climate adaptation and mitigation such as greening and micro forestry, sustainable mobility infrastructure and carbon sequestration. The contribution would be calculated on the basis of embodied carbon and operational emissions estimates of new buildings.

Q2. What supporting policies might be required to offset the impact of any taxation changes on low income households or those most at risk from fuel poverty?

Any increases in the carbon tax should be used to support those that cannot afford energy renovation.

Energy poor homes will be most impacted by climate change and the transition to a low carbon economy, they also have most to gain in terms of additional benefits of energy saving (health, wellbeing, etc.). If we are to reach our renovation targets, it's key to support those that cannot afford the retrofit. Other sectors should be capable of financing retrofit from their own means provided there are the right combination of financing mechanisms, regulation, tax incentives, and if necessary, grants, those in fuel poverty have no means even with this help.

Q3. What further measures might be required in the planning system to realise the objectives of the National Planning Framework in respect of climate action?
Role of NPF in directing planning strategy at a national level.
Better alignment between the NPF and Ireland's climate ambitions is vital. To mitigate against continued rise in national emissions, there needs to be a significant investment in the renovation of underutilised and vacant buildings in city, town and village centres. This would increase energy efficiency, reduce embodied carbon and transport emissions, while creating new residential opportunities that will revitalise existing towns and deliver on balanced regional development. The NPF must remain steadfast and maintain housing densities and compact growth across Ireland: for sustainability and for housing affordability.
The NPF should be reviewed and revised to fully take account of the requirement for the planning system to manage both adaptation (as is does currently) **as well as mitigation** against climate change. This means pressing for more compact growth, doubling effort in retrofit, avoiding demolition to reduce embodied carbon and supporting the development of more net zero carbon buildings. In this regard the NPF should be more prescriptive on climate action measures for example:

- Requiring that County Development Plans:
    - make explicit preferable sustainability mobility hierarchies for developments and delivery of same via Mobility Management Plans
    - ensure that all new development meet newly established residential[3] benchmarks for carbon management, for walkability and public transport access
    - similar benchmarks should apply for all non-residential development

[3] The Home Performance Index is Ireland's first national certification for quality and sustainability in new residential developments. Besides the BER, the HPI takes into account some of the biggest environmental impacts of new homes, such as the production of building materials, biodiversity loss, water consumption and flood risks. Read more.

- Requiring whole life carbon assessment – at the very least for buildings over 5000sqm in line with the EU taxonomy requirements.
- Requiring that whole life carbon is considered in spatial planning strategies. This needs to consider impact of embodied carbon and resource consumption from:
    - Soil types whether certain zones with poor bearing soils will require more carbon intensive foundations.
    - Impact of density on infrastructure. Development that is 4 times as dense can use up to 16 times less infrastructure.
    - Impact of form factor on embodied carbon.

The **planning system, as a unit of the NPF, must support climate adaptation and mitigation**. In this regard the IGBC is proposing that the Planning and Development Act is revised and amended as follows:

- The Planning & Development Act should be amended to move away from the current shallow focus on 'adaptation' alone to one that also references and embeds the need for 'mitigation'. The Development Plan strategy as provided for under the Act[4] should be widened to cover 'proper planning and sustainable development **and** **[new]** ***mitigation and adaptation to climate change'.*** This should also be included in the listed requirements for the 'content of the development plan[5]'.
- Matters relating to the NPF of the Act[6] should require the promotion of measures that will ensure both **mitigation and adaptation vis-à-vis the built environment**:
- The remit of Regional Assemblies for reviewing DPs should also provide for *commenting on the efficacy of both adaptation* **and mitigation** measures.
- It may also be appropriate to consider a scaled 'climate contribution' on a per sqm basis under the **Development Contributions scheme** to cover costs and offset measures associated with local climate adaptation and mitigation such as greening and micro forestry, and sustainable mobility infrastructure. The contribution being calculated on the basis of the embodied carbon and operational emissions estimates of new buildings.

Q4. What specific additional measures might be required to promote sustainable growth in our urban centres, including to realise the potential of a "15-minute city"?

Compact growth and 15-minute cities are critical in advancing sustainability. It can reduce our second biggest and fastest source of carbon emissions - transport, while preventing the negative environmental impacts of urban sprawl (soil sealing, biodiversity loss, etc.). Furthermore, it presents an opportunity to create a new vibrancy in our town and city centres, and suburbs.
For urban areas this will require better support for the re-use and energy renovation of existing buildings. In particular better links between the Living in City[7] initiatives and SEAI grants for building retrofit should be provided. New schemes could be designed with more flexibility and workability so that grants are made available for the conversion of a wider range of valuable, yet underused buildings for habitable and commercial purposes. Small landlords should be incentivised to bring these buildings back to life. This could be supported by a capital allowance scheme for these improvements. In brief, all appropriate property related reliefs and incentives should be fully aligned with the objectives of the CAP and climate neutrality. Setting up a one-stop-shop specialising in this type of retrofit would be useful to better target this segment. Some changes in Part M may also be appropriate, based on specific criteria.
A compact sustainable city should not be confined to the city core. The occupancy ratio of our city's outer suburbs is falling with declining household size. A range of different housing options are needed in areas with aging populations. New planning zones for novel densification design should be included in low carbon zones and Decarbonisation zones in Development Plans. This

[4] Article 10
[5] Article 10(2)
[6] S20C
[7] Read more

should invite innovation on how densification could be achieved whether through infill or creating densification hubs in each neighbourhoods.

The IGBC is concerned that the National Planning Framework's National Policy objective 3a - deliver at least 40% of all new homes nationally, within the built-up envelope of existing urban settlements is being threatened by recent changes in guidance on residential density[8]. IGBC believes that this is an extremely low target to begin with and should be set at 60% minimum. Given that the National Development Plan proposes to 500,000 new homes there needs to be certainty around the management of growth that is consistent with the objectives of CAP.

- The NPF standard of 40% of development within existing settlement boundaries should be increased in all areas but particularly in areas that are subject to urban-generated development pressure with associated high demand for housing.
- There must be a commitment to ensure that growth is carbon proofed so that car dependency is not locked into future housing delivery. Development Plans should specify policy supports for the delivery of this aim. Under the CAP, they should be required to designate areas within cities/towns within 15-minute zones that will be given supports so to encourage renovation of particular areas and/or existing buildings/buildings of importance for the maintenance of local heritage and character, as well as maintaining the embodied carbon of building stock. Incentives should be put in place to support infill and brownfield development. For instance, the French Climate Law (2021) introduced a carrot in the form of a fast track planning process for this type of development.

- Applicants should be required to demonstrate the measurable carbon benefits of renovation/conversion utilising LCA as part of planning consent requirements (e.g. embodied carbon vs potential loss through demolition; optimisation of building stock and/or related to the energy efficiency of building post renovation). This should be attached to any related relief.
- It may be necessary to consider higher tax on vacant and under-used properties (See Danish example), and/or additional site area or site-value based taxes to encourage owners to bring to market corner sites, back lands etc. An alternative would be to introduce CPO of vacant properties and wasteland after a number of years[9].

Q5. What specific additional measures might be required to promote sustainable growth in rural areas?

IGBC is concerned about the recent push back on the NPF housing density policy as provided for under the new circular to Local Authorities[10]. There is an unwarranted and unjustified perception that greater efficiencies in the use of land with a higher number of units per hectare will lead to city level densification in rural areas and a decline in housing quality[11]. The underpinning climate, sustainability and housing delivery objectives of the need for more compact growth needs to be more widely explained to Councillors and the public and taxation measures should be directed to support these objectives. The IGBC suggests:

- Tax measures and grants should aim at encouraging the renovation and reuse of buildings in **existing rural settlements** for both housing and commercial purposes.

[8] Read more.

[9] In Catalonia, municipalities can take control of properties that have been left without tenants for more than two years. The French Climate Law (2021) allows public bodies to seize sites that have been vacant in wastelands in urban area for 10 years or more.

[10] https://www.opr.ie/wp-content/uploads/2021/04/21-04-21-NRUP-02-2021-Circular-Application-of-Residential-Densities-in-Towns-and-Villages.pdf

[11] https://www.businesspost.ie/houses/coalition-relaxes-housing-density-planning-rules-on-urban-sites-7eda4b0e?auth=login?auth=login

- **A first time buyers' scheme** modelled on the Living in the City initiative should be made available to supports for renovation of existing stock in rural areas. This would spur on construction renovation employment, increase the viability of existing housing stock and contribute to the renovation wave in Ireland. As before, all appropriate property related tax reliefs and incentives should be aligned with the CAP.
- New incentives and grants should be designed with more flexibility and workability so that grants are made available for the conversion of a wider range of valuable, yet underused, buildings (not just shops) across the country. These schemes should be linked to SEAI grants to further support renovation of town and village centres. These measures should increase the opportunity to live in rural settlements; enhance rural vibrancy and populations and go some way to reduce reliance on private transport associated with dispersed rural housing pattern.

To reduce the carbon and environmental footprint of new housing developments, County Development Plans should mandate the use of wider sustainability criteria (beyond the BER) to include walkability, access to amenities and public transport, embodied carbon, water efficiency and biodiversity loss, etc. This could be supported by the use of the Home Performance Index, or by some of the HPI's 35 indicators covering environment, health and wellbeing, economic and QA.

Q6. Are there further measures that the Government should take to channel private finance into low-carbon investments in Ireland?

In the built environment, the launch of a **loan guarantee scheme for energy renovation** as it exists in Germany should be a priority. This should complement existing grant schemes and provide loans at low interest rates (0.5 to 1%).

The government should **use the financial system to encourage home builders to go beyond building regulation**s, and build the greenest, healthiest, zero carbon homes. In particular, it should **promote the EU Taxonomy Regulation**. This **will strengthen the Irish banking system by ensuring that their loans are climate proofed.** Home Building Finance Ireland (HBFI) already offer lower rates for the development of Home Performance Index certified homes. The HBFI Green Funding Product is the first Irish green financial product fully aligned to the Paris Agreement and EU taxonomy regulations**. The approach taken by HBFI should be extended to other governmental agencies, including finance provided by local authorities, and banks in which the state has shares**. The green mortgages for new homes currently available on the Irish market do not finance Paris compatible homes.

Finally, and given the state must lead by example, **any public lands that are sold and released to private developers should include a requirement to reach the net zero carbon standard** (i.e. to be Paris compatible) **and/or higher environmental criteria**, such as the ones included in the Home Performance Index.

Q7. Are any changes required in Ireland's research policy to channel research funding into climate action-related topics?

To achieve climate neutrality and support Ireland's competitiveness, a percentage of research funding should be allocated to climate action, with the remaining funding complying with the 'do no harm' principle (i.e. not undermining environmental objectives).

Although this should not lead to "analysis paralysis", further energy renovation research on the existing building stock, actual building performances, as well as human behaviours and deep renovation co-benefit is needed. A focus on digitalization along the value chain to upscale the delivery of energy retrofit projects, increase productivity and reduce costs, and underly quality outcomes is also needed. Furthermore, there is a need to rapidly increase the level and quality

of data on construction products particularly for high-impact product such as cement. Likewise, there is no data for common bulk materials for building aggregates which make up by far the greatest mass in Irish buildings. Finally, and as a growing number of countries introduce whole life carbon regulation, innovation on biobased low carbon materials should be further supported.

Q8. Is there any additional information you would like to submit in relation to Carbon Pricing and Cross-Cutting Issues?

Globally Buildings account for **39% of global carbon emissions** of which 28% arises from the **operation of the buildings** and **11% from the embodied carbon**[12] associated with the transport, manufacture of products, materials and site operations over the building life cycle [13]. In Ireland it somewhat less due to the much higher levels of transport emissions due to development sprawl and agriculture. Embodied carbon from the construction and maintenance of buildings and infrastructure probably accounts for between 8-10% of carbon emissions with a further 12-15 % from the operation of buildings.

At present there are two twin tracks of carbon pricing in Ireland: carbon tax – applicable to carbon intensive fuels, the cost of which is passed down to consumers at point of consumption; and carbon pricing under the Emissions Trading Scheme (ETS) – applicable to certain high-intensive producers who pay for carbon allowances traded within the system. The carbon tax is fixed nationally at €20/per tonne C02eq, whereas the ETS fluctuates depending on ETS market conditions (2019 @ €23.60/per tonne C02eq).

Unfortunately, the pricing signal under both mechanisms is not triggering the desired level of action i.e. driving down emissions. In fact it is has been found that the ETS has had limited impact with annual reductions of 0%-1.5% recorded per annum[14]. This is a problem for the Built Environment sector because of the embodied carbon[15] of construction products, for which there is no accounting for as current pricing models only place a shadow price on *operational* energy. Most producers of construction materials in Ireland fall under the ETS and are therefore considered to have 'paid' for their carbon emissions already. A further accounting at the national level in the form of shadow pricing is, therefore, currently considered 'double counting' and not included in DPER's public spending code. IGBC believe that both the costs of operational and embodied carbon should be regulated and accounted for in all investment appraisals.
However in order to create effective change, responsibility must also be placed on the demand side namely those who create the demand for the materials. In the same way that it is accepted that it is not enough to decarbonise heat and electricity to operate buildings but they must be renovated to make more energy efficient, the same principle should be applied to the construction of new buildings, in that they must become more resource efficient and less carbon intensive and this can only be determined by measurement. This action would make clear the true cost of carbon intensive projects on exchequer financing.

More specifically, IGBC proposes that all publicly funded construction projects (NDP and otherwise) should be required to undergo a whole life carbon assessment (covering both operational and embodied carbon).

Other countries such as Holland, France, Sweden, Denmark, Finland have accepted that the ETS is an ineffective driver for more carbon efficient buildings and are or already have introduced regulations on whole life carbon. Holland introduced a total carbon price for construction based

[12] International Energy Agency
[13] Bringing embodied carbon upfront – World Green Building Council
[14] https://iopscience.iop.org/article/10.1088/1748-9326/abdae9
[15] Embodied carbon is defined as defined as carbon emissions from manufacture, transport, use and end of life of materials, including construction materials (Climate Neutral Cities Alliance & One Click LCA. City Policy Framework for Dramatically reducing embodied carbon. 52 Detailed Policies to reduce embodied carbon
[15] https://b80d7a04-1c28-45e2-b904-

on impact irrespective of whether ETS non ETS or non national emissions[16] This is the correct approach.

IGBC suggests that Life Cycle Analysis should be mainstreamed in public spending practices and procurement and all guidance on this should promote LCA as the gold standard[17] this will ensure that embodied carbon impact is fully factored into appraisals. This is in line with the government's new **Circular on Green Procurement** which is a priority area for the delivery of the Climate Action plan[18].

ELECTRICITY

Q1. What options are available to increase the penetration of renewable electricity beyond the 70% committed to in Climate Action Plan 2019?

Introducing **stricter renewable ratio in the Building regulations (TGD Part L)** would drive demand for renewable electricity. Likewise, if the **public sector were to commit to net zero carbon buildings by 2030**, this would increase the penetration of renewable electricity. A net zero carbon building is 'a building that is highly energy efficient and fully powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset'. This is fully aligned with the exemplary role to be played by the public sector in tackling climate change. A number of countries and cities have already committed to net zero carbon buildings, and the IGBC could support that transition. The IGBC and its members have developed a voluntary net zero carbon standard for homes and is in the process of developing guidance documents for net zero carbon residential buildings.

The **micro-generation scheme** if properly implemented could also increase the penetration of renewable electricity – See IGBC's submission on the scheme.

Q4. What role could carbon, capture and storage have in decarbonising our power sector?

This is technological solution that is considered highly investment intensive; requires appropriate geological storage capacity and may have significant marine biodiversity and safety issues. The priority should be to improve energy efficiency and support renewables. Given Ireland's competitive advantage in off-shore wind and its ambitious energy renovation and decarbonisation targets, its use does not seem appropriate here for the power generation sector. Furthermore, it may cause an unwanted and unintended diversion of investment from other important technologies and solutions to address power-gen emissions.

Q5. What other opportunities exist to support the decarbonisation of the electricity sector?

As previously mentioned, buildings have a role to play in enabling greater penetration of variable renewables such as wind and solar. We can also **use our buildings to even out variable renewable energy generation**. This can be via simple approaches such as storage (e.g. hot water storage) or demand response via smart meters which turn on or off non-critical equipment to match the generation demand profile. This approach will enable further penetration of variable renewables such as wind. The roll out of smart meters (which would also support micro-generation) should hence be accelerated. Electric vehicles have large battery storage which can also be used to store electricity when peak renewable production. However, these ideally would be in shared ownership – See section on transport for more details.

[16] https://www.oecd.org/governance/procurement/toolbox/search/green-public-procurement-netherlands.pdf
[17] https://ogp.gov.ie/circular-20-2019-promoting-the-use-of-environmental-and-social-considerations-in-public-procurement/
[18] Read more

ENTERPRISE

Q3. What measures can be introduced to reduce to F-Gases in the Enterprise sector?

A key measure to lessen the use of F-Gases in the enterprise sector is to **reduce our reliance on cooling in non-residential buildings**. Ireland's mild climate means that cooling should be achieved by largely passive means.

The current Irish definition of nZEB for non-residential buildings is a relative benchmark, comparing Air Conditioned (AC) buildings to AC buildings rather than an absolute energy benchmark based on function. This means the nZEB definition for AC buildings which is a 60% improvement over 2008 regulations is nowhere close to 'nearly Zero'. The IGBC recommend a review of the current regulations and propose that a more ambitious definition of nZEB for non-residential buildings be implemented within 2-3 years.

Where cooling is needed, passive cooling through high quality design and renovation should be the preferred option. It is suggested to introduce a "comply or explain" approach whereby organisations opting for AC should explain why a similar result could not be achieved through passive means.

Q4. How can we encourage the diversification away from cement in construction?

Cement is one of the most prolific indigenous building materials in Ireland with between 70-73% of houses alone being built of concrete[19]. It is also a high emitting sector that participates, along with other Irish industries, in the EU ETS. Based on IGBC calculations, in 2019 it accounted for 2.85 MtC02eq or 4.75% of all Built Env (BE) emissions (Res and Non-Res) and latest projections show these will increase by 33% between now and 2030 under EPA WEM scenario (see Appendix). Curiously, however, the EPA sectoral emissions inventory does not include embodied carbon or cover the Built Environment as a standalone sector, other than residential sectoral emissions. This means that one significant sector is, in effect, not being fully monitored in terms of measurement and reporting.
The most effective way to encourage diversification from carbon intensive products is similar to the way that Government increased the energy efficiency of new buildings by 70% over the past 10 years through Building regulations TGD Part L. The regulations are not prescriptive, but they drive change by setting limits to energy and carbon use.

The same must happen with carbon associated with the construction of materials, i.e. **1)measure 2) regulate 3)reduce.**
It is only by introducing a requirement to measure, regulate and reduce at the building level as other countries have, will we see innovation in materials.
In Appendix A - accompanying IGBC (2021): ***Scenarios for the reduction in embodied carbon associated with the NDP submission paper*** we set out detailed calculations on how embodied carbon from the construction sector can be reduced by least 60% by 2030.
Given the carbon intensity of the Built Environment sector IGBC is also proposing a **structural change to the reporting framework and a range of design measures** to support diversification from the dominance of cement, an embodied carbon emission, in Irish building design, these include:
Built Environment sector (covering both Residential and non-Residential) should be accounted for as a single sector in the EPA emissions inventory data. This should cover both operational and embodied carbon emissions to get a true picture of the carbon load from this sector
See accompanying IGBC (2021): ***Scenarios for the reduction in embodied carbon associated with the NDP submission paper***

[19] Cambridge Architectural Research (2021) and https://www.infuturewood.info/five-questions-for-ireland/#:~:text=In%202019%2C%205500%20houses%20were,of%20Irish%20new%20houses3.&text=%E2%80%9Ctimber%20frame%20housing%202002%20consortium,2020

In order to address embodied carbon of the construction sector a signal is required to trigger a change in design and built new development. This means taking a whole life carbon approach. This can be achieved by means of:

- Requiring developers, through the planning process, to measure and **manage carbon emissions throughout the whole life cycle of buildings** from sourcing of materials, through to construction (i.e. **embodied carbon)**, operational life and end of life disposal. This will highlight the carbon hotspots within building design and will trigger a review of construction elements and product switching
- Require developers to demonstrate the life cycle cost of buildings as part of planning using tools such as One-Click LCA, LCC
- Placing a shadow carbon price on the embodied carbon at the building level so that there is a clear understanding of the monetary value and cost of carbon within construction and financing.

Q5. What role could Carbon Capture and Storage (CCS) have in industry, and what steps would encourage its deployment?

As per Q4: (Electricity), this is a technological solution that is considered highly investment intensive; requires appropriate geological storage capacity and may have significant safety and marine biodiversity issues. It might be considered appropriate, as a last resort, for certain categories of high emitting industries in countries that do not have alternative energy power. However, IGBC does not believe this is an appropriate solution in the Irish case, requires full CBA and may cause an unwanted diversion of investment from other important clean technologies and solutions that could help to reduce emissions at source. It is unlikely to provide any significant contribution up to 2030.

Q6. What other opportunities exist to support the decarbonisation of the enterprise sector?

The large enterprise or commercial sector has taken various steps to decarbonise from carbon reporting to the use of BREEAM and LEED in building energy performance management. This has been driven by ESGs, CSR and has been supported by the state through programmes such as SEAI/EXCEED. The EU has also recognised the need for common rules around reporting under the new taxonomy for the classification of environmental activities to guide green investments[20]. For SMEs, which make up the majority of Irish businesses, the road to decarbonisation can seem daunting and costly. A range of different measures will be needed to support this target group.

SMEs & Energy Renovation

When it comes to energy renovation, SMEs are very similar to residential end users. They require financial and technical support. These include grants, tax exemptions and low-rate loans. Coordination with local authorities is needed to ensure improvement in energy efficiency does not lead to higher council rates. Given a significant proportion of SMEs rent their place the split incentive issue will need to be addressed. The landlord and tenant (amendment) Act 1980 should be updated to incorporate Green clauses as a basic provision and raise awareness about environmental issue. The introduction of Minimum Energy Performance Standards in the commercial private rental sector should also be considered, but this should be introduced alongside supporting financial and technical measures, including the launch of a Building Renovation Passport to avoid lock-ins[21]. One-stop-shops have a role to play, but SMEs would also benefit from the development of a network of skilled, trusted, independent local intermediaries who could support them at all stages of the renovation process[22].

[20] https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[21] For further information on how to address the split incentive in the commercial market, please see IGBC (2019) report on the topic.

[22] See IGBC and LIT (2020) report on the role of Energy Renovation Advisors and how a network of advisors could be set up.

- In the commercial sector, explore with local authorities, opportunities for temporary reductions in rates payable during the period of retrofit or energy efficiency improvements by SMEs.
- Restructuring energy tariffs (standing charge vs. consumption)
- Expand the optimisation of EPDs by working with manufactures to reduce the carbon load of their production cycle or value chain, including suppliers
- Enterprise Ireland and LEOs should promote and advise SMEs on new market opportunities in Green Procurement and low embodied carbon products (such timber) in both the export market or emerging markets in Ireland
- State enterprise bodies and SEAI can support SME sectoral decarbonisation through lighthouse demonstration projects[23] funded through the Climate Action Fund.
- All Data Centres permissions should require plug into District Heating to help reduce energy costs and decarbonise SMEs, as well as from compact residential areas.

Environmental Product Declarations

The introduction of financial support to develop Environmental Product Declarations (EPDs) so manufacturers reduce the carbon load of their production cycle or value chain. A growing number of countries are regulating embodied carbon this is likely to be regulated at European level in the near future[24], this would support Irish SMEs' competitiveness.

Finally, all data centres permissions should require plug into District Heating to help and decarbonise industry and residential areas.

BUILT ENVIRONMENT

Q1. Can Ireland exceed the target of retrofitting 500,000 homes by 2030? If so, how?

Exceeding the residential retrofit target set for 2030 seems extremely unlikely. Approximately 3,000 homes were retrofitted to a BER B2 in 2020. In the current context (housing crisis, skills and labour shortage, etc.) retrofitting more than 50,000 homes per year is extremely challenging. The focus should hence be on **enabling actions to deliver on the existing target to a high standard**.

First, a stable and long-term framework is required to **provide all players with certainty and generate confidence**. The target provides some certainty, but a 10-year ring fenced budget for retrofit consistent with that goal is also needed. To scale up deep energy renovation and create employment, businesses need to train staff, build new business models and guarantee long term work for their reskilled employees. Individuals must see that it is worth training in this area and that there is a career in renovation. This will only happen with **a long-term financial commitment from the Government**.

Actions are also needed to make energy renovation more **desirable, accessible and affordable**. A **sustained national awareness campaign to promote energy efficiency** at the same level as the drink driving and anti-smoking awareness campaigns will be required if we are to communicate and drive the acceptance and necessity of retrofits and ensure it achieves social acceptance as normal. Energy renovation should also be made easier for homeowners. The **one-stop-shops** currently being set up should help. But homeowners and small landlords would also benefit from the **development of a network of skilled, trusted local intermediaries** who could support them at all stages of the renovation process. Quality assurance and independent advice are both critical to build trust in the outcomes of energy renovation[25]. To **ensure the B2**

[23] Lighthouse projects is a short-term, well defined, measurable project that serves as a model or 'lighthouse' – they require more visibility than research pilots with dissemination and communications a large part of the Terms of Reference.

[24] See EU's Renovation Wave and Circular Economy Action Plan.

[25] IGBC and LIT, with support from SEAI, developed a comprehensive set of recommendations on how a Renovation Advisor Register could be set up. Read more.

target does not lead to lock-ins or unintended consequences a holistic approach to energy renovation is needed. This could be done through the introduction of **Building Renovation Passports**, which would also support homeowners' decision-making. The idea is that the homeowner should get a clear plan to improve their home that they can implement over a number of years. If they don't have the money to do all the work now, they can do it bit by bit in a way that works to an end goal of a super energy efficient and comfortable home. Finally, energy renovation must be made more **affordable**. **Aggregation** has a role to play, and **grants** are needed. These must be available all year long. If someone buys a house and wants to renovate their home, they should not have to wait a number of months for the grant scheme to open. The scale of the challenge also means that **private investment must be mobilised**. In particular, the launch of a **loan guarantee scheme for energy renovation** (at a 0.5 to 1% rate) should be a priority.

Q2. How should Ireland's training and education system scale to meet the skills requirements to achieve this target?

The retrofit industry is competing with new built and is facing both **skills and labour shortages**.

Actions are needed to **attract more people to the industry**. Providing long-term financial certainty on renovation would show young people this is a sustainable career path. Rebranding the renovation industry as a modern, green industry that helps tackling climate change might also help in attracting more people within that cohort. We must ensure that within 3 to 4 years **all graduates emerge from third level institutions with the right skillset**. Retrofit concepts, including Indoor Air Quality and embodied carbon must be mainstreamed in all relevant third level programmes. Furthermore, **all construction related apprenticeships must cover renovation concepts** and **new heat pump and retrofit apprenticeships** should be introduced[26].

The retrofit industry operates at low margins. Actions are needed to **facilitate and incentivise upskilling** of building professionals and construction workers. **Short and flexible training courses** are needed. To make it easier for building professionals and construction workers to identify training courses that truly suit their needs the IGBC, in partnership with LIT, launched the Build Up Skills Advisor App. The **roll out of the nZEB training courses developed by WWETB must be accelerated.** The courses must be available across the country and in blended formats. Existing programmes for building professionals are relatively long courses run by third level institutions. There is an urgent need to **develop shorter and more flexible retrofit courses for building professionals**. Courses that are part of Masters' could for instance be delivered as stand-alone modules. The opportunity of launching a shorter course similar to the Retrofit coordinator course that exist in the UK should also be explored. Actions are also needed to **better incentivise retrofit upskilling of building professionals and construction workers**. To increase transparency in the market and improve quality assurance, the IGBC suggest **launching a register of energy renovation advisors and installers**. This in turn should increase trust in energy renovation[27]. **Public procurement could also be used to drive upskilling**. More specifically, the IGBC suggest public bodies use "**training clauses" for all large scale nZEB projects (new and retrofit).** Training clauses allow public procurers to require companies winning nZEB projects to train their staff (construction workers and site supervisors) in energy efficiency. This type of clause is currently in-use in the Hauts-de-France region (France), where it has led to significant improvement in quality[28].

[26] IGBC and LIT, with support from SEAI, have recently published a list of key energy renovation knowledge, skills and competences for construction workers and building professionals. Read more.
[27] For further information on the benefits of the register and how it could work, please click here.
[28] As part of the H2020 BusLeague project the IGBC can support Irish public bodies interested in piloting training clauses.

Q3. Should Government consider bringing forward a phase out of the installation of fossil fuel boilers?

The **installation of fossil fuel boilers should be banned as soon as possible in new built**. We have the technology and installing heat pumps and solar PVs is cheaper when constructing a new building.

While **moving away from fossil fuel boilers should be the medium-term objective in existing buildings, we are unsure a ban is the answer**. Replacing fossil fuel boilers can for instance be challenging in traditionally built buildings if it is not part of a wider retrofit strategy. **The focus should be on better insulating these buildings first and in developing renovation roadmaps** (Building Renovation Passports) so that building owners have a clear idea of the steps to take. The Department should also research the impact of this ban in countries that have introduced it[29]. If such a ban is introduced in Ireland, it must be flagged early and introduced alongside financial and technical support. It may also make sense to ban oil boilers prior to gas boilers.

Q4. Should further specific changes be made to Ireland's building standards be introduced to support the decarbonisation of Ireland's private and commercial building stock?

Yes, several changes to Ireland's building standards should be made to support the decarbonisation of our private and commercial building stock.

First, as it takes lots of energy to heat water, **regulations on water use should be introduced for all buildings** (new and existing). As an example, hot water is already responsible for approximately 70% of all regulated energy in nZEB apartments. It is hence recommended to **require European Water label A rated water efficient taps and showers** are installed. **Wastewater heat recovery should also be mandated in new built**.

Secondly, and with 500,000 homes to be built by 2040, it is **urgent to regulate embodied carbon**. These emissions result from mining, quarrying, transporting and manufacturing building materials, in addition to constructing buildings. A growing number of European countries are regulating embodied carbon[30], and we encourage the Department to take a similar approach. To address these emissions, **life cycle assessment and/or a reuse potential assessment could first be introduced as part of planning permission** and pre-demolition audit for buildings over a certain size[31].

The **nZEB standard for non-residential buildings is not ambitious enough and must be improved**. The implementation of nZEB through Building Regulations TGD Part L Conservation of fuel and energy - Buildings other than dwellings came into force on the 1st of January 2019. This is 10 years after the previous regulations from 2008 and long after the technology had already moved on. Furthermore, the Irish definition of nZEB is a relative benchmark, comparing Air Conditioned (AC) buildings to AC buildings rather than an absolute energy benchmark based on function. This means the nZEB definition for AC buildings which is a 60% improvement over 2008 regulations is nowhere close to 'nearly Zero'. Ireland's mild climate means that heating and cooling can be achieved by largely passive means. The "if feasible" loophole should also be removed. Furthermore, commercial buildings, particularly offices receive frequent refits with significant waste of materials but they often avoid any formal energy upgrades as Part L does not apply to fit outs where no material change is made to the fabric. It is suggested t**o introduce minimum energy standards for all fit out projects in Part L**. This would represent an

[29] E.g., coal and oil boilers will be banned in existing homes in France from 2030.
[30] E.g., Denmark, Finland, France and the Netherlands have already regulated embodied carbon.
[31] Under the EU Taxonomy Regulation, LCA is required for buildings over 5,000 sqm. The French Climate Law (2021) mandate a reuse potential assessment as part of planning permission to demolish.

opportunity to divert some of the funds spent on fit out projects to environmental measures that would partly offset the embodied energy impact of the fit outs. The IGBC **recommend a review of the current regulations and propose that a more ambitious definition of nZEB for non-residential buildings be implemented within 2-3 years.**

Finally, regulations addressing wider sustainability issues (e.g., biodiversity loss, climate resilience, and health and wellbeing) and better taking into account actual energy use should be introduced. This could be done through smart meter or in Situ U-value testing immediately after installation and then after 5 years to monitor performance.

Q5. What emerging technologies (e.g. in relation to heating, lighting, and/or building fabric) should be considered for use in Ireland's construction industry to promote further decarbonisation?

A number of emerging technologies should be considered for use in Ireland's construction industry to promote further decarbonisation. These include the European Water label A rated water efficient taps and showers, biobased low carbon materials and Cross Laminated Timber (CLT), as well as prefabricated and modular construction. Whole Life Carbon Assessment should also be mainstreamed.

As highlighted in Electricity – Question 5, the roll out of smart meters should be accelerated, so that buildings can better support the decarbonisation of the grid. To ensure new built and retrofit deliver real savings (beyond the BER calculated savings), more actual performance assessments are needed. Indoor Air Quality monitoring should also be normalised so that homeowners are notified when there is an issue, or a filter must be changed. Retrofit apps that allow better coordination between designers and contractors should also be supported.

Finally, it can be very difficult to incorporate new technologies in SEAI – DEAP software database. There is a significant delay in gaining approval for new technology products and uploading them onto the database, which act as a barrier to innovation. As this could slow down further decarbonisation, introducing a fast track for new products and technologies should be considered. Alternatively, SEAI could be mandated to update the database quarterly or biannually. There is also a need to more proactively enable newer technologies, making it faster for them to get the required agrément certificates.

Q6. What supports can we provide to assist the greater use of low-carbon building materials? How much consideration should be given to embodied carbon in construction materials?

In the same way that regulation drove a 70% improvement in energy efficiency of new houses between 2008 and 2019 and the resultant innovation from manufacturers in products to create more energy efficient products and solutions, greater use of low carbon materials will also result from regulation.

The application of LCA and LCC in construction design and procurement will drive the market development of low-carbon materials. Chatham House (UK) has found that the market for these materials is growing but uncertainty about product use is hindering commercialisation at scale. A growing number of investors are asking for evidence of low carbon building design, ensuring that buildings don't become stranded assets. But to support a greater use of low-carbon building materials embodied carbon must be regulated in Ireland within 4 years. LCA should also be mandated as part of planning process as soon as possible. In addition, LCA and EPDs should be required as part of public procurement[32].

[32] For further information on these actions, see IGBC's Towards a Fully decarbonised built environment report.

The development of low embodied carbon products, including bio sourced materials, could be supported through public procurement and research grants. As a growing number of countries are regulating embodied carbon this would support Ireland's competitiveness and may support the diversification of the agriculture sector and jobs creation in rural area.

IGBC are currently developing a Whole Life Carbon Roadmap to decarbonise the built environment and is hosting a series of workshops with industry and the public sector to develop same in advance of presentation at COP26.

One barrier to innovative construction materials is TGD Part D if the building regulations and the costs of introducing new materials to the very small Irish market. For example in the renovation sector none of the newer low carbon insulations that are recommended for use in traditional buildings can actually be used without additional hygrothermal analysis work to prove at the building level that they are fit for use. This is despite the fact that they already have an European Agrément from country of origin. Any additional requirements to demonstrate fitness for use in Irish climate must be proportional to the market and cost effective, if we are to see more innovation and uptake of innovative materials.

Finally, the IGBC strongly encourage the Department to further consult with the industry on this topic.

Q7. Are there specific technologies that should now be prohibited?

The Department should consider banning inefficient water use products such as rainfall showers with flow rates over a certain threshold, as it takes lots of energy to heat water.

At European level, the Department should support a ban on inefficient white goods, and white goods with a short lifespan (or unrepairable).

Better quality data on the environmental impact of construction products across their lifecycle (e.g. heat pumps, PVs) is needed to support better decision making. Once this data is available, there is a need to better communicate on real impact of technologies on CO2 emissions. eeded. Homeowners are too often confused about what they can do to reduce CO2 emissions and the cost of each technology

Finally, we should be extremely cautious about supporting hydrogen for heating. There are lots of issues with green hydrogen in buildings, and we would be better off using that hydrogen for transport.

Q8. What trade-offs between decarbonisation and air quality may need to be further considered in policy design?

There **should not be any trade-offs between decarbonisation and air quality**. Good quality energy renovation should improve both indoor and outdoor air quality.

These unintended consequences can be avoided through good quality energy renovation. This requires:

- Upskilling of building professionals and construction workers (see Q2 – Renovation Advisor)
- Designed and commissioned post renovation ventilation for all major renovation
- Improved communication with homeowners on how to use the building, etc. This information could for instance be included in a building renovation passport or a digital logbook.

It is also suggested to better monitor Indoor Air Quality post renovation, and to notify homeowners when there is an issue or when filter needs to be changed, etc.

Q9. Are there specific household behaviour changes that should be considered? Should such changes be mandated by way of regulatory changes?

The following household behaviour changes should be considered: Encouraging retrofit and reuse of existing buildings, raising awareness about embodied carbon and the environmental impact of oversized house.

This will require a **sustained national awareness campaign** at the same level as the drink driving and anti-smoking awareness campaigns. This is needed if we are to **communicate and drive the acceptance and necessity of retrofits and reusing buildings**, as well as considering the appropriate size of the building and ensure it achieves social acceptance as normal. Transparency on the scale and importance of the task, including cost in relation to energy renovation, is needed.

When it comes to energy renovation, besides financial and technical support previously mentioned, Building Renovation Passports should be introduced. Mandating the development of a Building Renovation Passport when a house is sold or to access grants, would make it easier for the new homeowner to renovate and would support quality phased renovation. The introduction of **Minimum Energy Performance Standards (MEPS)** as suggested in the EU's Renovation Wave should be considered, especially for certain segments of the market, such as the residential and non-residential private rental market. This would need to be flagged early and introduced alongside supporting financial and technical measures[33].

Grants and tax incentives should also be better aligned to support reuse of existing buildings and reduce embodied emissions. High quality case studies on how town and village centres buildings cab be reused should also be made available. For larger projects, reduction in embodied emission can be achieved through the planning process (requiring LCA or reuse potential assessment).

Besides strengthening the planning process, further communication on the environmental impact and operational cost of over-sized single house is needed. For instance, 5,000 single house represented 25% of completed houses in Ireland in 2020, but 38% of embodied emissions associated with housing.

Q10. What specific further measures should be considered to promote decarbonisation of Ireland's existing commercial buildings?

This sector is highly diverse and needs to be broken down further (e.g., owner occupied vs. rented properties, SMEs vs. large multinationals, one tenant vs multi let). Most large enterprises and multinationals are already decarbonising their building stock, but further support is needed for SMEs, which account for most companies in Ireland.

When it comes to energy renovation, SMEs are very similar to residential end users. They require financial and technical support. These include grants, tax exemptions and low-rate loans. Coordination with local authorities is needed to ensure improvement in energy efficiency does not lead to higher council rates. One-stop-shops have a role to play, but SMEs would also benefit from the development of a network of skilled, trusted, independent local intermediaries who could support them at all stages of the renovation process[34].

[33] For further information please see IGBC's (2019) report on the topic.
[34] See IGBC and LIT (2020) report on the role of Energy Renovation Advisors and how a network of advisors could be set up.

Given a significant proportion of companies rent their place the split incentive issue will need to be addressed. The landlord and tenant (amendment) Act 1980 should be updated to incorporate Green clauses as a basic provision and raise awareness about environmental issue. The introduction of Minimum Energy Performance Standards in the commercial private rental sector should also be considered, but this should be introduced alongside supporting financial and technical measures, including the launch of a Building Renovation Passport to avoid lock-ins[35]. This approach has been taken in a number of countries, including the Netherland. By 2023, office buildings there will be required to have an energy label of C or better by the 1st January 2023. Although the legislation will only come into force in 3 years' time, ING, Rabobank and ABN AMRO, three leading financial institutions in that country, have indicated they will stop financing office buildings with a D label or worse. Additionally, ING Real Estate Finance is no longer refinancing clients lacking a plan to get at least a C label for their office.

Finally, better quality data on the energy performance of non-residential buildings, including data on actual performance is needed. The **BER database for non-residential buildings should be publicly available.** Larger buildings should have to disclose actual energy consumption and this information should be publicly available (a DEC database). Sweden already has a publicly available database of the energy use for every building. This accurate data would make reporting under GRESB etc, easier - saving time and energy for building owners trying to report to funds pushing for ESG targets. Publishing this data could act as a precursor to introducing regulations on actual energy performance.

Q11. Is there scope to further develop and deploy district heating opportunities in Ireland?

Yes, especially to decarbonise existing buildings. A key criteria for developing and deploying district heating systems is measuring the 'heat demand density' – a common planning approach taken in many EU countries when planning local heat supply. Given the large capital cost associated with the transmission infrastructure, the heat demand density of the areas to be served by district heating systems allows us to examine their economic viability. Research undertaken for the Irish District Energy Association shows that 35% of the heat demand in Ireland is at a sufficient heat density for district heating to be feasible to highly feasible with current technology[36]. Therefore, the '40 by 30' Renewable Heat Plan published by Renewable Energy Ireland recommends a target for district heating to meet 10% of the national heat demand in Ireland, which can be achieved cost-effectively in high heat density areas, using low-carbon, low-cost surplus heat from a wide range of resources including waste to energy plants, data centres, power plants, industrial processes, excess wind electricity, etc. Furthermore, all new data centres should be located in area where heat demand intensity is high enough to support district heating.

Q12. What specific approaches should be taken to accelerate decarbonisation of Ireland's public sector building stock?

The public sector must lead by example and have a leadership role to play in promoting deep energy renovation. Public buildings targets must at the very least be aligned with Ireland's international commitment – Carbon neutrality by 2050, and a roadmap to achieve this target must be developed for both social housing and other public buildings.

The public sector should move to net zero carbon buildings by 2030. A net zero carbon building is 'a building that is highly energy efficient and fully power from on-site and/or off-site renewable

[35] For further information on how to address the split incentive in the commercial market, please see IGBC (2019) report on the topic.
[36] https://heatroadmap.eu/

energy sources, with any remaining carbon balance offset'. This is fully aligned with the exemplary role to be played by the public sector in tackling climate change. A number of countries and cities have already committed to net zero carbon buildings, and the IGBC could support that transition. The IGBC and its members have developed a voluntary net zero carbon standard for homes and is in the process of developing guidance documents for net zero carbon residential buildings. Any public lands that are sold and released to private developers should include a requirement to reach the net zero carbon standard (i.e. to be Paris compatible) and/or higher environmental criteria, such as the ones included in the Home Performance Index. Furthermore, the public sector should take a whole life carbon approach to public procurement (through LCA and LCC) and through development management (for local authorities).

The public sector has a leadership role to play in promoting deep energy renovation (SI No. 426/2014). The diversity of public buildings means that it's a microcosm of what will need to happen in other sectors. Retrofit must be seen as a priority by all public bodies and increase support for energy managers/project officers is needed.

Ambitious renovation targets for public sector and social housing are included in Ireland's Long-Term Renovation Strategy, but the current budget set for retrofit of social housing is insufficient to undertake the level of retrofits required to achieve the 2030 target. This must be addressed urgently as social housing retrofit could also work as a testbed for projects aggregation, hence reducing costs and improving qualities, and be used to develop exemplar projects. It would also provide an opportunity to conduct post-occupancy evaluation and to gather data on co-benefits, including health. A multi-year stable fund for social housing should be set up.

All local authorities need dedicated retrofit teams. It would also make sense to better coordinate smaller local authorities at regional level so that some people can become real experts on specific themes – e.g. Part L, B(C)AR, and share this expertise.

Public Procurement could also be used to better support upskilling (e.g., through training clause) and the decarbonisation of the built environment (e.g., by mandating LCA).

Q14. Are there further specific measures and policies, including through planning and building regulations, that might improve the resilience of our building stock to climate change?

As the impacts of climate change are increasing, it will be essential to align adaptation and mitigation measures in the built environment. Climate resilience considerations must be integrated into the construction and renovation of buildings and infrastructure. In particular, in relation to flooding and heat. Building regulations should be further modified, based on Level(s) and the EU taxonomy. It should better take into account of heating and cooling requirements and this should be reflected in Building Regulations.

In the short term, climate resilience should be improved through the use of certification such as the Home Performance Index (HPI) standard that covers a full range of indicators including flooding and over heating. Besides using the HPI, the planning system could be used to reduce soil sealing, flooding risk and heat island effect. For instance, through the promotion of blue and green infrastructures, green roofs, and net zero soil sealing targets. For instance, since 2002, building regulations in Basel require that all new and renovated flat roofs must be greened. In Munster (Germany), a stormwater fee was introduced, based on amount of impervious surface on a property.

TRANSPORT

Q1. What further policy measures might be required to enable Ireland to meet the CAP 2019 target of 936,000 electric vehicles on the road by 2030?

Transport is Ireland's second and fastest growing source of carbon emissions. This is predicted to grow significantly by 2030. While support for EVs is welcomed, we do not believe this is the single silver bullet.

All urban areas should prioritise mobility solutions, in which walking comes first, bicycles second and public transport third. Cars, including EVs should only come in fourth place but preferably only in 'pay per use' schemes such as carsharing. Privately owned cars EV or otherwise should be strongly discouraged in urban areas.

Housing since the 1930 has largely been planned around the car leading to huge inefficiency in land use. Technology is now enabling a transition to shared ownership and 'pay for use' potentially allowing a 90% cut in cars numbers in urban areas if the right policies and incentives are put in place.

Current transport proposals propose to have 900,000+ EVs as part of an emissions mitigation policy by 2030. However, this policy needs to avoid unintended consequences. Having invested in an EV owners will want to recoup the investment, so are unlikely to shift to alternative transport. EVs increase lock-in to private transport and road building and the resulting congestion and continued road safety issues, puts people off more active transport modes.
Those who borrow money for cars are logically less likely to have the capacity to also borrow for a deep energy home renovation.

It would make more sense if the current grant for EVs was also available to those who shed car ownership altogether for five years or to trade their car for a bike.

To make our urban areas work effectively we must take away space from the car in order to build high quality walkways, segregated cycleways and high-quality rapid transit corridors.

However, the main benefit is spatial. Each car creates the need for 3–7 car spaces in an urban area located either in surface parking or basement/multi-storey parking. Each car space occupies 12.5 sqm meters plus additional space for access. A halving of the national fleet of cars from 2.1 million would free up 8,000-10,000 hectares of space. As a measure of the scale, this is more than enough land to accommodate the entire 500,000 home building requirements of the National Development Plan up to 2040.

Alternatively, this area would sequester 70,000 tonnes of carbon per annum if afforested. Freeing up car spaces in cities creates space for tree planting improving air quality and sequestrating carbon. It also frees space for walking and cycling paths, allowing people to safely access school and work.

There are multiple benefits for the built environment of eliminating cars. It will reduce the need for underground car parking in apartments potentially reducing costs by up to €36,000 per apartment[37]. This approach is already supported by Dublin City Council through reduced car parking requirements where 'pay for use car sharing clubs' are available on site.
Secondly, this would reduce one of the most significant proportion of embodied carbon for built area – approx. 1 tonne per square meter of underground carparking.
Most of all car that are not owned are not driven.

[37]The Real Costs of New Apartment Delivery - Analysis of Affordability and Viability - SCSI Report sets out the cost reductions where car parking requirements are reduced.

Q2. Is there scope to increase this target for 2030? What should the new target be?
As per above, we are really concerned that this is not the right target. At the very least, a target aiming at reducing the car private car fleet, as well as targets for each active travel modes are needed. The focus on reducing the total number of cars will deliver much higher carbon reduction at negative cost to Government and people allowing the saved money to be invested in further carbon reduction measures.

Q4. What additional measures should be considered to promote greater use of public transport or active mobility options?
The following actions are suggested:

- All new developments, urban and rural, should be walkable to the nearest neighborhood or District Centre
- No new home should be provided with a dedicated car space and this should be seen as akin to providing a chimney.
- TII should review signaling management in cities and give pedestrians and cyclists priority over other users as this is done in cities like Freiburg.
- Trialling of novel solutions under BETA programmes similar to that of Dublin City Council[38] to encourage active mobility. This includes road closures, traffic calming and reducing speed limits to make the city more pedestrian and bike safe and friendly. All signal points should have co-located bike signals.
- Development Plans and Decarbonisation Zones could identify pocket 'car free zones' at weekends.

Q5. What specific policies might be required to reduce overall passenger kilometres driven within the private car fleet?

- Require carbon design-planning in all Development Plans (i.e. permeability, using desire lines to guide pedestrian routeways, build-in-the-bike; use of mobility management and sustainable travel hierarchy.
- Direction to all Local Authorities to adopt the '**Avoid Shift Remove' approach to transport**[39] to limit, as far as possible, private car-based transport across the county.
- National promotion and support for active travel modes.
- Changing the ratio of public investment road to rail and cycle and path infrastructure.
- Focus on reducing the total car fleet. Cars that are not owned are not driven.
- Eliminate all free car parking for the public sector. Eliminate all free parking wherever possible in the public realm.

Q6. Is there scope to effect a change in the composition of the private car fleet to shift the vehicle mix away from higher emitting classes?

Higher emitting classes should not be permitted in cities and built up areas for safety, congestion and carbon consumption reasons. The use of private cars above 1,400kg should be virtually eliminated through prohibitive taxation (e.g. higher car park charging or much higher motor taxes, VRT linked to car rather than engine size or year).

Q8. Are there any specific obstacles in the planning system preventing greater modal shift?

Density, housing typology, scale and proximity are key to public transport efficiencies. Ireland needs to decouple development and increasing transport emissions. Over the next 10 years the government is faced with the delivery of 2 key national objectives: dramatic increase in housing (26,500 homes each year until 2030); while at the same time, dramatically decreasing transport emissions. It is imperative that TII and the planning authorities work together to tackle urban-generated unsustainable transport emissions. One of the key obstacles to preventing greater

[38] http://dccbeta.ie/
[39] Introduced in the recent Dun Laoghaire Rathdown Draft Development Plan (2021)

modal shift is lack of in-built design for modal shift.

- The **planning framework is a key tool** to achieve decoupling. It is vital that all residential schemes and large trip-generating developments (retail parks, offices, industry, education) '**design-in' carbon limiting controls** to enable behavioral change. The Home Performance Index (HPI) is a tool that can be used and mandated to track the carbon and sustainability performance of residential schemes across 11 indicators[40].
- Housing schemes should be assessed against **sustainable mobility criteria** for walking and cycling (for example using the Home Performance Index) for climate and health reasons as active mobility has huge health benefits, including on obesity[41].
- New national bike related standards should be devised taking in covered bike parking (and storage) standards based on a percentage of occupancy/customers/staff, alongside standards for **shower rooms/drying areas in offices/schools and retail centers**. Furthermore, all development should be required to demonstrate good permeability.
- The Office of the Planning Regulator should develop guidance for same and all developments over a minimum number of units should be required to submit a Sustainable Mobility Strategy as part of the planning application.
- Councils should be required to publish a national standard for **sustainable mobility hierarchy:** walking, cycling, public transport, EV car sharing, car sharing, private EVs, other private vehicles.

Q9. Are there specific further measures that should be undertaken to increase the availability of electric vehicle charging points, whether in public areas or on private property?

As per Q1/Q2 (Transport) we are concerned with the focus on EVs. However if this target is desired proper charging infrastructure must be rolled out nationally. This includes:

- Requiring all garage forecourts to make provision to meet the future demand.
- Requiring all new residential and high trip generating sectors (offices, schools, hospitals, industry) to have sufficient quantity of household or communal charging points measured against predicted user numbers.

Q13. What specific measures could be undertaken in transport infrastructure to address existing and future locked-in climate change impacts?

Future lock-in is a worrying aspect of investment in the context of meeting the CAP objectives. All infrastructure which is delivered through the NDP and other public agents must be climate fully proofed and shadow priced, not just transport projects. For this to occur it is essential the LCA and LCC are required for all public investment projects. Shadow pricing must apply to both operational and embodied carbon and must reflect the true rising cost over time. All transport and mobility infrastructural investments must be compared for their final shadow price (road, rail, cycleways, pathways, EV charging infrastructure), from cradle to cradle and all transport investment must not give rise to requirements for future adaptation (i.e. ensuring that investments are not built near coastlines, on floodplains, near rivers, estuaries that are vulnerable to sudden climate weather events etc…).

[40] http://homeperformanceindex.ie/wp-content/uploads/2020/09/HPI-technical-Manual-v2.0_with_corrections_since_publication.pdf

[41] https://www.dropbox.com/s/earh0wezr1zqc6l/Sarah%20Rock_TUDublin_Better%20Homes%20Conference.pdf?dl=0

AGRICULTURE, LAND USE, FORESTRY AND MARINE

Q2. What policies and measures would be needed to support farmers diversify their farm activities to include opportunities such as bioenergy, vegetable growth, forestry, organic farming, etc?

Mandating whole life carbon assessment in the built environment should drive demand for low carbon intensity construction product materials, including biosourced materials[42].

The development of a bio economy is dependent on supporting farmers and foresters to grow a greater range of crops that can be used for construction materials. To date the emphasis has been on growth of biomass for fuel. Projects such as the H2020 Agri4valor have highlighted the potential for agriculture-based construction products. There is currently almost no production of bio-based materials for construction apart from OSB boards and MDF. There is a wide range of materials that can be developed in the construction sector, including fibre insulation board from wood and hemp fibre, bio fibre reinforcing to replace plastic fibres, cross laminated timber construction, etc.

The development of these materials should be further supported through public procurement and the development of "bio-hub" for training and innovation in this sector. As a growing number of countries regulate embodied carbon this would support Ireland's competitiveness. These actions would support diversification of the agriculture sector and make it more sustainable.

Q4. What specific measures can be taken in agriculture, forestry and land use to adapt to climate change?

In relation to LULUC, the following measures should be included:

- Limit dispersed development and sprawl. All new residential developments should be within existing built up areas.
- Local Authorities should be required, as part of forward planning, to develop a Green Infrastructure & Ecosystem Services Plan every six years alongside the Development Plan. This should comprise a comprehensive strategy for both climate adaption and mitigation and the protection and enhancement of ecosystem services (including biodiversity). It should cover, but not be limited to, carbon sequestration, local food production, pollination, biodiversity, urban forest planting, development of ecological networks covering both natural areas as well as domestic gardens, public land banks and verges.
- Restrict urban soil sealing (such as conversion of gardens to patios and driveways) to avoid storm runoff into sewage treatment plants and to prevent localised flooding. Consider introducing net zero soil sealing targets as this is done in France and Germany.
- Develop a plan for NBS for Ireland including the rehabilitation of peatlands and wetlands to protect and buffer flood prone areas.

[42] Anecdotal evidence from our colleagues in Dutch and French GBCs indicate this is what has happened in their market.

WASTE AND THE CIRCULAR ECONOMY

Q1. How can we ensure that measures support sustainable economic models (for example by supporting the use of recycled over virgin materials)?

Globally Buildings account for 39% of global carbon emissions of which 28% arises from the operation of the buildings and 11% from the embodied carbon[43] associated with the transport, manufacture of products, materials and site operations over the building life cycle [44]. The built environment also accounts for 50% raw materials used, 40% solid waste and 30% water used (Source: European Union). Given this huge environmental impact, there is an urgent need to focus more on buildings as part of the Circular Economy Action Plan.

As previously mentioned actions are needed to address vacant and under-used buildings. This requires supporting measures (financial – e.g. as tax incentives and grants, and technical – e.g. through a one-stop-shop for retrofit and reuse of buildings in our town and village centres), but also greater focus on enforcement and legislation, as the vacant site levy is not currently working – See our comments on cross-cutting issues. Good quality case studies should also be made available.

Mandating a reuse potential assessment and/or a Whole Life Carbon assessment as part of planning permission would also support reuse and reduce embodied emissions.

New built must be constructed with reuse and disassembly in mind. This could be supported through:

- The use of universal design to ensure long term flexibility
- The introduction of digital logbooks that include passports materials[45], at least initially for new built to support reuse.

Finally, it would be worth exploring the opportunity of mandating that materials are connected mechanically in buildings so that they can easily be disassembled. Glues are often used because aesthetically they give clean lines, but prevent the reuse of materials.

PUBLIC SECTOR LEADING BY EXAMPLE

Q1. What opportunities exist for the public sector to step up its climate ambition?
The public sector must lead by example.

In the built environment it should do so by committing to net zero carbon buildings by 2030. Any public lands that are sold and released to private developers should also include a requirement to reach the net zero carbon standard (i.e. to be Paris compatible) and/or higher environmental criteria, such as the ones included in the Home Performance Index. To reduce the carbon and environmental footprint of new housing developments, County Development Plans should mandate the use of wider sustainability criteria (beyond the BER) to include walkability, access to amenities and public transport, embodied carbon, water efficiency and biodiversity loss, etc.

To reduce embodied emission and drive demand for low carbon intensity construction materials, the public sector should mandate life cycle assessment as part of public procurement and planning process.

The public sector must also lead by example in relation to energy renovation. The diversity of public buildings means that it's a microcosm of what will need to happen in other sectors. It is hence critical that the public sector reaches its renovation targets and use these projects as

[43] International Energy Agency
[44] Bringing embodied carbon upfront – World Green Building Council
[45] For further information on Passport materials, please see the H2020 Buildings as Material Bank project

case studies to engage with the wider public. See Q12 of the built environment for further information.

Q3. How can the public sector support wider society to change? In the short-term, medium-term, long-term?

As previously mentioned, the public sector must lead by example in relation to climate action. In the built environment, this would require committing to net zero carbon buildings for its own building stock and going beyond building regulations. For instance, mandating whole life carbon assessment as part of public procurement or of the planning process. Or using the Home Performance Index for new social housing developments to address the whole environmental impacts of these developments. It should play an exemplary role in showcasing good high-quality solutions in public buildings and social housing. Local authorities are responsible for 144,000 homes. These homes offer a unique opportunity to deliver deep retrofit at scale, as well as to showcase its potential. Retrofitting schools to high quality standards could also have a multiplier effect on the level of deep retrofit awareness in Ireland.

The public sector must also enable low carbon lifestyle. For instance, by using the planning system to ensure all new housing development support compact growth and are walkable. This can also be done through national communication campaign on the importance of retrofit, and by making energy renovation more accessible and affordable. Grants, tax incentives and low interest loans are required. Besides one-stop-shops, the public sector should also provide technical support, including through the development of an energy renovation register and Building Renovation Passports.

Finally, the public sector must be transparent on progress in relation to climate action and targets. For instance, local authorities could use the energy renovation Framework developed as part of the H2020 Build Upon project to track retrofit progress and the impact of energy renovation on CO2 emissions, but also health and wellbeing, job creation, etc. This could support citizen engagement and raise awareness about the co-benefit of energy renovation[46].

Q2. What sort of practical changes would you expect the public sector to make in leading and delivering Ireland's climate ambition?

The public sector must also lead by example. To do, the public sector should move to net zero carbon buildings by 2030. A net zero carbon building is 'a building that is highly energy efficient and fully power from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset'. This is fully aligned with the exemplary role to be played by the public sector in tackling climate change. A number of countries and cities have already committed to net zero carbon buildings, and the IGBC could support that transition. The IGBC and its members have developed a voluntary net zero carbon standard for homes and is in the process of developing guidance documents for net zero carbon residential buildings. Any public lands that are sold and released to private developers should include a requirement to reach the net zero carbon standard (i.e. to be Paris compatible) and/or higher environmental criteria, such as the ones included in the Home Performance Index.
Furthermore, the public sector should take a whole life carbon approach to public procurement (through LCA and LCC) and through development management (for local authorities).This would require:

- Adopting a **renovate first approach to avoid demolition of publicly owned own building stock (including housing) and to require reported LCA assessment of same by public bodies.**

[46] The Framework is currently piloted by Dublin City Council, Cork City Council. Laois and Kilkenny Councils. The IGBC would be delighted to provide more information on the Framework and how it can support Ireland's LTRS to the Department.

- Signalling, through the planning system, that demolition is not acceptable in development, unless there is a clear case to do so and the carbon metrics both stack up and are reported upon. In the UK for example, the London Borough of Camden's Development plan[47] **provides that a case must be made by applicants, by way of comparison of the full Whole Life Carbon calculation, of the impacts of renovation against the proposed new build,** as well as other criteria such as threshold of density achieved. It is significant to note that Dublin City Council, from its own analysis, found that renovating existing social housing has 1/8 of the embodied carbon footprint of constructing new homes[48]. Local authorities can take the following actions.
- Local Authorities should be aiming for a 'Whole Life Carbon' approach to all their capital programmes.
- Development Plans should include a new development control standards to account for net zero by attaching a condition to permission within specifically zoned sites or areas, that require carbon measurement of all developments.
- Details of the operational and embodied carbon of buildings should be available on a publicly held database to increase awareness, measurement, management and tracking of carbon in the built environment.

Ambitious renovation targets for public sector and social housing are included in Ireland's **Long-Term Renovation Strategy**, but the current budget set for retrofit of social housing is insufficient to undertake the level of retrofits required to achieve the 2030 target. This must be addressed urgently as social housing retrofit could also work as a testbed for projects aggregation, hence reducing costs and improving qualities. It is suggested **to set up a multi-year stable fund for social housing**

Q3. How can the public sector support wider society to change? In the short-term, medium-term, long-term?

As previously mentioned, the public sector must lead by example in relation to climate action. In the built environment, this would require committing to net zero carbon buildings for its own building stock and going beyond building regulations. For instance, mandating whole life carbon assessment as part of public procurement or of the planning process. Or using the Home Performance Index for new social housing developments to address the whole environmental impacts of these developments. It should play an exemplary role in showcasing good high-quality solutions in public buildings and social housing. Local authorities are responsible for 144,000 homes. These homes offer a unique opportunity to deliver deep retrofit at scale, as well as to showcase its potential. Retrofitting schools to high quality standards could also have a multiplier effect on the level of deep retrofit awareness in Ireland.

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Finally, the public sector must be transparent on progress in relation to climate action and targets. For instance, local authorities could use the energy renovation Framework developed as part of the H2020 Build Upon project to track retrofit progress and the impact of energy

[47] https://www.camden.gov.uk/documents/20142/3912524/Local+Plan+Low+Res.pdf/54bd0f8c-c737-b10d-b140-756e8beeae95
[48] https://www.igbc.ie/wp-content/uploads/2020/11/Towards-a-fully-decarbonised-built-environment_Report.pdf

renovation on CO2 emissions, but also health and wellbeing, job creation, etc. This could support citizen engagement and raise awareness about the co-benefit of energy renovation[49].

Q4. What are the biggest barriers for the public sector in reducing greenhouse gas emissions and how can they be overcome?

Resources, lack of awareness, some institutional inertia and siloed thinking have impacted historically.
As the public sector must lead by example, public servants must become the champions of climate cultural change. This means that they must be the first movers and adopters of both technology and behavioural change:

- Incorporating LCC and LCA into their financial models.
- Committing to net zero for all buildings.
- Sending right signals to the market on procurement methods and in criteria for selection not just for 'green' procurement but for all procurement.
- Talking the talk as well as walking the walk. All CEOs and Secretary Generals and senior management must undergo immersive training in strategic climate management so that they can fully understand the challenge and the actions required for delivery.
- Retrofit must be seen as a priority by all public bodies and increase support for energy managers and project officers is needed.
- Public servants are the foot soldiers. They can be incentivised or penalised or they can co-create solutions, however leading by example means visible action. Clear and concise goals can help with visualizing the scale of the task ahead. A plan for visible action and supports must be put in place for all public and civil servants across their various departments and bodies. Each department/organisation must have clear target, create a plan, with specific actions and a timeline that is visible on their website. Reporting on the plan should be required annually.

To achieve their climate targets Local Authorities need certainty – multi-annual stable funding, clear technical guidance, case studies and upskilling.
More specifically, all LAs need dedicated retrofit teams. It would also make sense to better coordinate smaller local authorities at regional level so that a number of LAs can group together and become exemplars or centres of excellence on specific themes. This would provide a structure for scaling up knowledge and expertise which could be delivered through local government management.
Once LAS have upskilled and gained strong social housing retrofit experience, they should engage with local communities to support private retrofit.

Q6. What practical steps should the public sector take to adapt to climate change?

Several actions can be taken by the public sector to support climate adaptation.For instance, climate resilience considerations must be integrated into the construction and renovation of buildings and infrastructure. In particular, in relation to flooding and heat. The planning system could be used to reduce soil sealing, flooding risk and heat island effect. For instance, through the promotion of blue and green infrastructures, green roofs, and net zero soil sealing targets.

[49] The Framework is currently piloted by Dublin City Council, Cork City Council. Laois and Kilkenny Councils. The IGBC would be delighted to provide more information on the Framework and how it can support Ireland's LTRS to the Department.

Appendix A: IGBC (2021): (2021): ***Scenarios for the reduction in embodied carbon associated with the NDP submission paper***

Scenarios for carbon emissions from Embodied carbon associated with the National Development Plan (DRAFT).

In order to inform the Climate Action Plan on the potential impact of the National Development Plan on national emissions IGBC has carried out the following initial modelling. This is not a detailed study but based on order of magnitude. It is based on best available data for both areas for residential and non-residential buildings and based on carbon intensity figures calculated for typical Irish construction or using international benchmarks.

One of the difficulties for measuring potential reduction is determining the baseline of carbon intensity for Irish Construction. We would advise that a detailed carbon assessment should be carried out on the National Development Plan as increased levels of construction will lead to increased carbon emissions. This would require a detailed inventory of all buildings and infrastructure both public and private proposed to be built under the National Development Plan and more detailed analysis of construction techniques used for different building types.

The Irish Green Building Council alongside ten other countries across Europe is developing National Whole life carbon roadmaps. These will be available in the first quarter of 2022.

Currently the 2019 Government Climate Action plan considers embodied carbon purely from the supply side of reducing the carbon intensity of cement. This however addresses only a part of the emissions associated with the construction sector.

Summary

- CO_2eq emissions associated with the embodied carbon for the construction of buildings will rise over the next 10 years linked to an increase in home building from **21,000 in 2019 to 29,000** or more as required to meet housing demand, unless action is taken now.
- Despite this increase in housing output, **it is possible to reduce emissions** from construction activity and embodied carbon **by up to 60%** or more per annum by 2030 as set against the 2019 baseline saving nearly 2 millions tonnes of carbon per annum through largely cost free measures.
- These reductions can be **achieved through a combination of measures** including space optimization of homes and other non-residential space, better optimized design including avoidance of carbon intensive development such as sites with difficult soil conditions, underground structures, optimized form factor and finally substitution of building products with products with a lower GWP.
- The greatest savings up to 2025 will come from **encouraging measurement and disclosure** and **putting in place incentives** for buildings and homes that meet lower carbon thresholds such as through reduced planning levies, introduction of Green Public procurement.
- **Optimisation of space is critical**. Embodied carbon = Carbon intensity of materials x quantity). Effective reduction must deal with both sides of the equation. Based on CSO figures for 2019 detached homes made up 38% of built residential area but only 25% of completed homes in 2019 making a disproportional contribution to embodied carbon associated with construction in Ireland.
- In order to achieve deeper reductions in carbon associated with construction up to 2030 **stronger limits set by building regulations will be required,** as is already in place or planned in Holland, Denmark, Sweden, France and Finland.

- **A series of scenarios** are set out demonstrating the impact of different measures. These rely on incomplete data therefore figures should be treated as very rough estimates intended to start the conversation. The figures are based on upfront embodied carbon A1-A5 i.e. to completion of construction. It is estimated that approximately 60-65% of these emissions are linked to Irish national emissions mainly within the ETS. The remainder are linked to imported products used in the construction sector.

How is Embodied carbon measured?

Embodied carbon is measured in Kg/CO_2/M^2 of built area in accordance with EN 15978. This requires creating a full inventory of materials and products used in the construction and applying their Global Warming Potential (GWP) either taken from their environmental product declarations (EPD) or applying the closest matching generic data.

The production of materials i..e. A1- A3 modules the Cradle to Gate accounts for approximately 80% of emissions. This total impact is a simple equation:

Total impact A1 -A3 = total quantity of materials X carbon intensity of materials.

Strategies to reduce embodied carbon

There are three main strategies to reduce embodied carbon from the construction sector.

Dematerialization – Avoiding the need to construct, i.e. by **favouring renovation over new build, optimization of space**, i.e. reducing the area that needs to be built.

Design optimization – designing buildings to be **more resource and materials efficient**. This can be achieved by:

- **Soil conditions –** Avoiding development land with requirements for extensive foundations such as piling which can result in greatly increased use of concrete and steel.
- **Optimised form factor-** simpler compact shapes require less materials.
- **Simple and optimised structural design** - simpler structural design requires less cement content and steel reinforcing. It also includes designing for optimum loading factors and avoiding over design. This paper[50] makes the case that the typical building frame could have 40-60% less embodied carbon and be 10-20% cheaper to construct even without material subsitution.

Material substitution - This involves substituting construction products and materials for materials with lower GWP. This can include

- **Use of recycled binders in cement –** This involves using replacement binders in lieu of standard Portland cement such as GGBS binders. Currently anything between 40-50% of all concrete products can be replaced, however lower carbon cements will become available allowing replacement of 70-80%
- **Increased use of timber in construction .**This includes low rise timber frame but also Cross Laminated Timber(CLT) which has been used in buildings up to 22 stories.
- **Use of biobased materials –** Specifically in Ireland there are opportunities to transition away from imported insulations to use of biobased insulation such as sheep's wool, hemp and wood fibre from native agriculture and forestry.

swapping a proportion of standard Portland cement in concrete with recycled binders such as GGBS or swapping concrete construction with lower carbon alternatives such as timber.

[50] Good early design stage design decisions can halve embodied CO_2 and lower structural frames cost. Cyrille f et al. (2021)

National and international origin of carbon emissions.

Materials used in Irish Buildings are manufactured both nationally and internationally meaning a proportion of carbon emissions are national and proportion are international. Cement is manufactured in Ireland. Steel, glass, aluminum, some brick etc. are imported. Some insulations such as mineral fibre insulations are imported while others such as EPS and PIR are manufactured in Ireland using raw materials sourced outside of the state meaning 50-70% of the emissions associated with them occur outside the state. Higher rise development such as offices, apartments, hotels will have a higher proportion of steel glass and aluminum curtain walling. Based on this we estimated that the proportion of emissions from **embodied carbon emissions produced within the state at approximately 65%.**

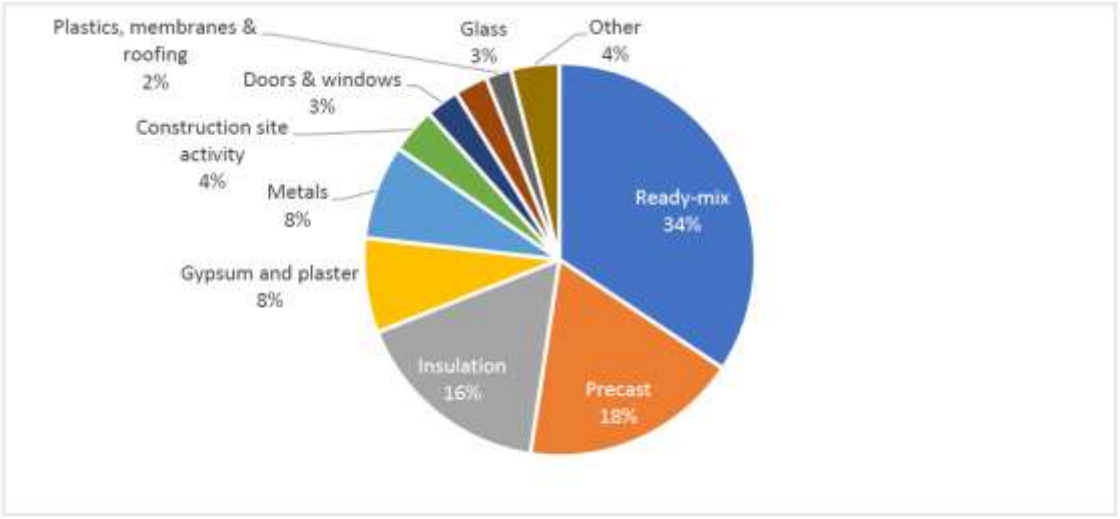

Figure 1: Breakdown of Embodied Carbon in a model house of aerated concrete block construction
Source: IGBC modelling

Modelled Scenarios

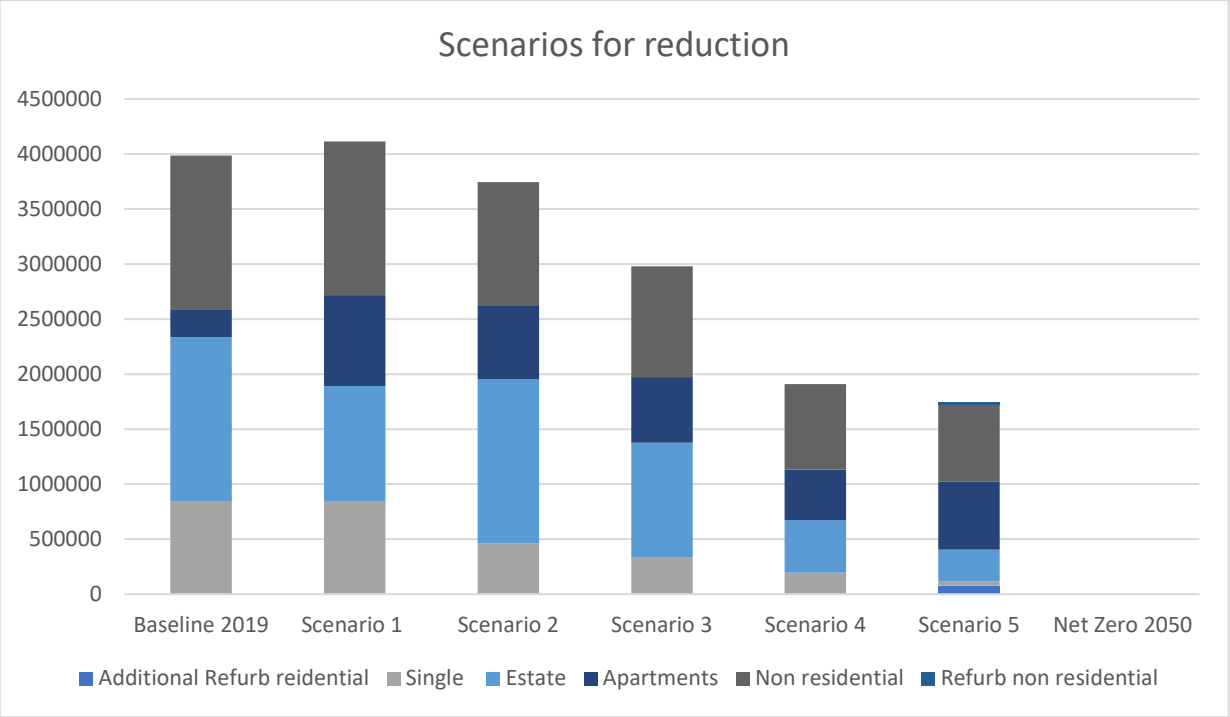

Figure 2: Scenarios for reduction in embodied carbon in construction up to 2050
Source: IGBC modelling

In Figure 2 we model a combination of potential options to measure their impact on embodied carbon emissions. Each scenario follows on the previous, to achieve a total of 60% reduction by 2030.

The numbers shown here are for A1-A5 which represent 80-84% of whole life carbon emissions. 60-65% of these emissions relate to emissions generated within Ireland which are mainly in the ETS sector.

	Policy Scenario	$MtCO_2eq$ Saving by measure	**Total Carbon emissions** A1-A5	**% baseline**
Baseline	**Based on 2019 CSO statistics for housing completions.** and areas, detached 5067 dwellings average 233 m², with average 12513 average area 127 m², and 3507 apartments average area 80 m². Built non residential area assumed at 1,550,000 m² .	0	3.18 $MtCO_2eq$	100%
Scenario 1	**Increased level of construction driven by NDP** The level of housing completion increases to 29,000 units per annum in line with the NDP. The difference in the number of units delivered, is made up of apartments of average area 80sqm and the number of estate houses and single dwellings remains the same. No policy measures are undertaken to reduce carbon intensity per of m² built area.	+ 0.48 $MtCO_2eq$	3.64 $MtCO_2eq$	115%
Scenario 2a	**Minor caps introduced at planning stage**	0.652 $MtC0_2eq$	2.99 $MtCO_2eq$	93%

	A cap is placed on carbon emissions from non- residential construction. This would be similar to caps introduced in Denmark for non-residential buildings over 5000sqm. This would aim to save 10% over the commercial baseline. The cap would be achieved by design and material efficiencies with no materials substitution. An interim cap is placed on carbon emissions per dwelling unit at planning permit stage of 100tonnes/dwelling. The cap is based on the size of the average estate home of 127sqm built with standard materials i.e. standard concrete cavity block. i.e. only homes in excess of 127sqm would need to measure and reduce their carbon emissions, all others would be deemed to comply.			
Scenario 3	**Regulatory limits introduced based on good practice** This would be achieved with a combination of readily available zero cost measures such as • including 40% replacement recycled binder included in the standard precast concrete construction • some increase in timber construction in low rise residential • additional efficiencies in design and optimization.	0.610 $MtCO_2eq$	2.38 $MtCO_2eq$	75%
Scenario 4	**Tougher regulatory but achievable limit values** An average limit value of 500 kg/msq is applied for non residential buildings and apartments and 300 kg/msq for single and estate houses. These numbers align with the RIBA climate challenge targets. This requires a: • a greater penetration of newer low carbon technologies such as CLT for apartments and non residential. • Avoidance of underground parking structures and soil conditions • A move away from standard concrete block construction to much lower carbon construction methods such as timber frame, bio based construction or very low carbon cement.	0.858 $MtCO_2eq$	1.52 $MtCO_2eq$	48%
Scenario 5	**Sourcing more space from existing stock** In this scenario more aggressive policies are introduced that require more homes to be sourced from existing vacant space reducing the need for new homes to 24,000 and 15% of total floor area needs for non-residential space must be sourced from converting existing vacant space[51] rather than new build.	0.131 $MtCO_2eq$	1.39 $MtCO_2eq$	38%

Table 1: Scenarios and assumptions for construction design and policy interventions.
Source: IGBC modelling

Assumptions

We have made the following assumptions on modelling these scenarios

[51] https://www.geodirectory.ie/getattachment/Knowledge-Centre/Reports-Blogs/GeoView-Commercial-Vacancy-Report-Q2-2019/Geoview_Commercial_Q2_2019_FINAL.pdf?lang=en-IE

- Single and estate house types were modeled in the One Click LCA Carbon designer tool in compliance with EN 15978 across the full life cycle using typical Irish construction buildups for modules A-A5, B1-B5 and C1-C4. These are emissions for embodied carbon across a 50 - year life span. To provide the numbers above we discounted these numbers by 80% to provide only upfront carbon A1-A5 which represent approximately 80-84% of these whole life carbon emissions. This set a whole life carbon baseline average of 716kg CO_2eq/m² for single detached dwellings and 933kg for estate homes. For the baseline of 2019 it was assumed for single detached and estate homes that 27% of these are timber frame and 73% cavity wall construction for with standard concrete blocks with no recycled low carbon binder.
- The embodied carbon for apartments was based on data from the Carbon Heroes programme provided by One Click LCA for apartments in the UK and Ireland of 900kg/msq.
- A figure of 150kg/CO_2eM² was used for renovation of existing stock.
- **Housing** projections based on the National Development Plan to construct 500,000 new homes by 2040. Baseline numbers for dwelling completions and areas from CSO 2019[52]
- **Non-residential development** – a assigned a global figure 1,550,000 sqm for total built[53] areas per year accounting for all non-residential building types.
- For the purposes of this study for end goal targets we used international figures for embodied carbon for building such as RIBA climate challenge.

Definitions

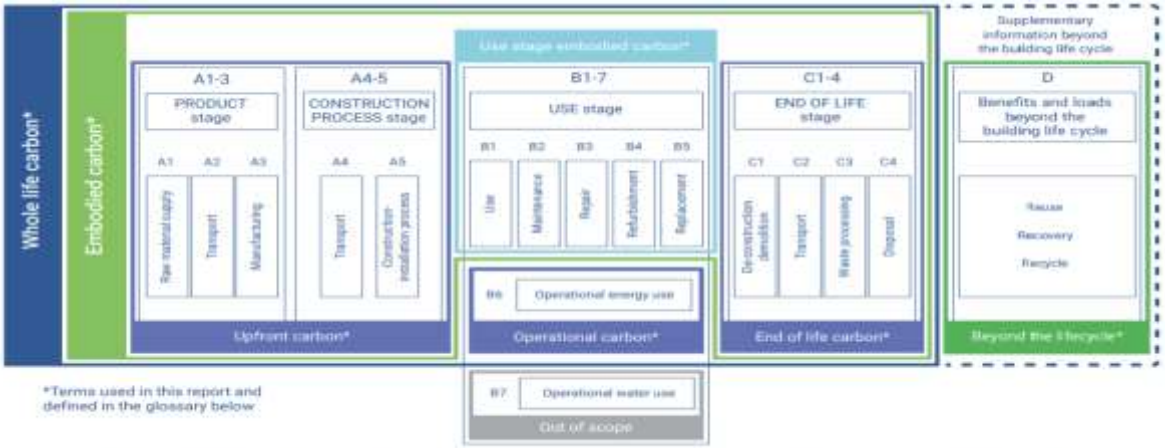

Figure 1: Terminology used in this report cross-referenced to terms and lifecycle stages defined in EN 15978

Carbon emissions Used in this report to refer to all emissions of greenhouse gases. Their global warming potential (GWP) is quantified in units of carbon dioxide equivalent. A kilogram of carbon dioxide therefore has a GWP of 1 kgCO2e.

[52] https://www.cso.ie/en/statistics/construction/newdwellingcompletions/
[53] https://ireland.aecom.com/industry-spotlight-2021

Embodied carbon Carbon emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure. As per CEN TC350 standard, embodied carbon therefore includes: material extraction (module A1), transport to manufacturer (A2), manufacturing (A3), transport to site (A4), construction (A5), use phase (B1, e.g., concrete carbonation but excluding operational carbon), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5), deconstruction (C1), transport to end of life facilities (C2), processing (C3), disposal (C4). Benefits beyond the system boundary (D) should also be reported separately to modules A-C. In the report we refer to the embodied carbon of both buildings and infrastructure as well as the embodied carbon of individual materials.

End of life carbon The carbon emissions associated with deconstruction/demolition (C1), transport from site (C2), waste processing (C3) and disposal (C4) phases of a building or infrastructure's lifecycle which occur after its use.

Operational carbon The emissions associated with energy used (B6) to operate the building or in the operation of infrastructure.

Upfront carbon The emissions caused in the materials production and construction phases (A1-5) of the lifecycle before the building or infrastructure begins to be used. In contrast to other categories of emissions listed here, these emissions have already been released into the atmosphere before the building is occupied or the infrastructure begins operation.

Use stage embodied carbon Emissions associated with materials and processes needed to maintain the building or infrastructure during use such as for refurbishments. These are additional to operational carbon emitted due to heating, cooling and power etc.

Whole life carbon Emissions from all lifecycle phases, encompassing both embodied and operational carbon together (i.e. modules A1 to C4, with module D reported.

Appendix B: **Briefing Paper: National Technical Committee on Whole Life Carbon: Carbon Calculations, Assumptions and Scenarios**

National Technical Committee – Briefing Paper
Workshop #2 30.04.21

Introduction

Thank you for joining the NTC, a panel of industry experts set up to provide input into the development of ideas, data, tools, guidance, benchmarks, and targets that will assist in defining a roadmap to net-zero in the built environment.

#BuildingLife is a regional initiative administered by the World Green Building Council (WGBC). It brings together a coalition of Green Building Councils across Europe with the aim of driving the decarbonisation of the building sector through private sector action and public sector policy.

The intention of this paper is to set out Ireland's current position with regard to **embodied carbon (EC)** and the outlook under a business-as-usual (BAU) scenario for embodied carbon in the built environment. It will also compare this within the context of the constraint of building within two five year carbon budgets intended to achieve a 51% reduction in carbon by 2030, and carbon neutrality by 2050, to comply with the forthcoming Climate Act and Climate Action Plan (CAP, 2021).

There is currently **no specific target set for embodied carbon of buildings** within the Government 2019 CAP. However, all the actions of the current plan would only achieve approximately a 3% reduction per annum whereas a 7% reduction is required under the revised plan which is currently out to consultation[54]. Furthermore, given the difficulty in achieving the reductions in the agricultural emissions other sectors may be required to deepen their effort to reduce their own emissions to remain within any future carbon budget set by the Climate Change Advisory Council.

Therefore there will be a gap between the BAU scenario allowing for increased levels of construction in Ireland over the next decade (e.g. public sector NDP projects, private residential and commercial/industrial) and the proposed carbon budget that needs to be reduced. The key question that will be discussed at the workshop will be how to bridge this gap. Questions will be asked about what measures and actions are needed to be taken over time in compliance with a declining budget trajectory to 2030 and 2050. In considering these questions, we are encouraging participants at the workshop to think freely and not be limited by current construction and design practices – as you will see, business-as-usual will not be enough.

In this regard, the new Chair of the Climate Advisory Council, Marie Donnelly, has invited the IGBC to propose what can be achieved by setting out a roadmap for a reduction in embodied carbon in the Built Environment (all building types, public and private).Your responses will feed into work on the submission on the new Climate Act and CAP for 2021 and will inform IGCB'S national roadmap for a fully decarbonised and resource efficient built environment in Ireland (to be published in May 2022).

Political Context

The development of a **National Whole Life Carbon Roadmap** is particularly relevant in the context of the current EU and national policy and political context.

Both European Climate Law and the Climate Action Bill require Ireland and the EU to achieve climate neutrality by 2050. The EU Green Deal sets out an action plan to achieve this goal. Of

[54] https://www.gov.ie/en/consultation/5bd95-climate-conversation-climate-action-plan-2021/

particular relevance to the construction sector is the Circular Economy Action Plan (CEAP) - Section 3.6 (see Appendix), which promises a **Strategy for a Sustainable Built Environment.** The CEAP also includes:

- the review of the Construction Product Regulations, including the possible introduction of recycled content requirements for certain construction products
- promoting measures to improve the durability and adaptability of built assets and developing digital logbooks for buildings
- using Level(s) to integrate life cycle assessment in public procurement
- using the EU sustainable finance framework to explore the appropriateness of setting carbon reduction targets
- considering a revision of material recovery targets set in EU legislation for construction and demolition waste and its material-specific fractions. The Commission will pay special attention to insulation materials, which generate a growing waste stream.
- promoting initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable, and circular use of excavated soils.

Further, the **Renovation Wave[55],** a flagship policy of the Green Deal, aims to "at least double or even triple" the renovation rate of buildings and specifically mentions "sustainable renovation" – i.e. going beyond operational energy.

In Ireland, the Climate Action Plan and the Programme for Government set out accelerated ambition and specific actions on Green procurement. The Climate Action Bill is expected to be enacted in summer 2021, followed by carbon budget setting at a sector or, more likely, department level, based on Climate Change Advisory Council recommendations.

Built environment: current and projected emissions

The EPA estimates Ireland's GHG emissions in 2019 were 59.9MtCO_2eq. The inventory of sectoral emissions however excludes the Built Environment, other than Residential which accounts only to emissions from the operations of buildings. IGBC estimates 12.3 MtCO_2eq attributable to all Built Environment activity in 2019, including commercial, public and residential projects (see Table 1, over). This amounts to 20% of the overall 59.9 million total emissions for Ireland.

[55] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

Table 1; Estimate of current annual Built Environment Emissions (Operational (0E)+ Embodied Carbon (EC))

	Sector	Total (MtCO2eq)	BE Activity	BE Total (MtCO2eq)	Source
1.	Manufacturing combustion	4.6	**EC of** Combustion for cement (A1-3)	**1.15**	EPA
2.	Industrial Processes	2.3	**EC of** Cement processing (A1-3)	**1.7**	EPA
3.	Imported building materials	-	**EC of** imported steel, glass, brick and timber products (A1-3)	**0.31**	Calculated[56]
4.	Transport	12.2	**EC of** Mining, quarrying and building construction transport (A4)	**0.1**	Calculated[57]
5.	Construction	-	**EC of** Construction activity (A5)	**0.5**	Calculated[58]
6.	Landfill (waste)	0.7	**EC of** Construction landfill waste (C1-4)	0.3	Assumed 39%[59]
7.	Residential	6.5	**OE of** Domestic space and water heating (B6)	6.5	EPA
8.	Commercial & Public Services	1.8	**OE of** Commercial & institutional space and water heating (B6)	1.8	EPA
	TOTAL			**12.3**	
	TOTAL EC (Total minus Operational Emissions (7+8))			**4.1**	

In 2019, total emissions (combustion and process) from the cement sector were 2.85 Mt CO2eq, or 4.75% of national total emissions. Cement sector emissions have increased by 87.3% from 2011 to 2019. Latest projection figures show emissions from Industrial processes are projected to increase by 33% between 2021 and 2030 to 3.2 Mt CO2eq2 under the EPA's 'With Existing Measures' (WEM) scenario (this is the only emissions scenario for Industrial Processes, based on available data). The majority of emissions come from cement and lime industries and projections are largely underpinned by projected GDP growth (EPA).

From above, it can be seen that the main contributor **to operational emissions** is the heating of space and water in residential stock, underscoring the urgency to implement the Renovation Wave for energy efficiency.

Embodied carbon (EC) accounts for **4.1MtCO₂eq** and is the therefore the largest single contributor in Built Env sectoral emissions. Industrial and materials **production being the main**

[56] Calculated based on CSO import figures for steel, glass, brick and timber products (2019) and applied average carbon factors from the ICE Database (Bath University).

[57] Calculated based on CSO transport figures of 550m tonne-kilometres attributable to Mining & Quarrying (including merchants) and Building & Construction (TFA01 - Road Freight Transport Activity) and EU statistical recommendation of 0.14kgCO2/tonne-kilometre.

[58] Calculated from SEAI energy balance and conversion factors at https://www.seai.ie/publications/Previous-Energy-Balances.xlsx and https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/

[59] 39% of waste disposal at landfill was attributable to C&D waste in 2018 https://www.epa.ie/nationalwastestatistics/firstlook/

contributor. According to the EPA, cement accounted for 2.85MtCO_2e[60], over half of the Built Environment estimate. This equates to 4.75% of all national CO_2 emissions in 2019.This is likely to increase further given that housing completions has gone from a high of 90,000 houses at peak[61] to 21,000 in 2019. As the economy comes out of the current COVID crisis it is expected that the construction sector will scale up, increasing both delivery and embodied carbon emissions.

Projections

With an estimated population growth of 1.1 million by 2040, the National Development Plan notes the need to create accommodation for 550,000 new households by this time. The specified aim of the National Planning Framework is to meet this need with an average of 80% of new homes being created within the existing urban and suburban footprints of our cities and towns, with 50% within existing city footprints and 30% in other existing built-up settlements– see Table 2.1 below, taken from the NPF:

Table 2.1 | The NPF at a Glance: Targeted Pattern of Growth, 2040

National Policy Objective	Eastern and Midland	Southern	Northern and Western
1. Growing Our Regions	+ 490,000 - 540,000 people (2.85m total) +320,000 in employment (1.34m total)	+ 340,000 - 380,000 people (2m total) +225,000 in employment (880,000 total)	+160,000 - 180,000 people (1m total) +115,000 in employment (450,000 total)
2. Building Stronger Regions: Accessible Centres of Scale[20]	Dublin City and Suburbs: +235,000 - 290,000 people (at least 1.41 million total) Regional Spatial and Economic Strategy to set out a strategic development framework for the Region, leading with the key role of Athlone in the Midlands and the Drogheda-Dundalk-Newry cross-border network	Cork City and Suburbs: +105,000 - 125,000 people (at least 315,000 total) Limerick City and Suburbs: +50,000 - 55,000 people (at least 145,000 total) Waterford City and Suburbs: +30,000 - 35,000 people (at least 85,000 total) Regional Spatial and Economic Strategy to set out a strategic development framework for the Region	Galway City and Suburbs: +40,000 - 45,000 people (at least 120,000 total) RSES to set out a strategic development framework for the Region, leading with the key role of Sligo in the North-West, Athlone in the Midlands and the Letterkenny-Derry cross-border network
3. Compact, Smart, Sustainable Growth	50% of new city housing within existing Dublin City and suburbs footprint 30% all new housing elsewhere, within existing urban footprints	50% new city housing on within existing Cork, Limerick and Waterford Cities and Suburbs footprints 30% all new housing elsewhere, within existing urban footprints	50% of new city housing within existing Galway City and suburbs footprint 30% all new housing elsewhere, within existing urban footprints

Achieving this requires almost 29,000 new homes per year, every year to 2040. **Under a BAU we would therefore expect to see the 4.1MtCO_2e of embodied carbon to increase year on year to meet demand**. Additional to this would be **embodied carbon due to surrounding infrastructure upgrades** and replacement cycles.

Carbon Budgets

[60] Although Ireland is a net exporter of cement, analysis of Comtrade import/export flows suggest the effect of export is very small (a balance of 0.16Mt CO_2e).

[61] https://www.cso.ie/en/releasesandpublications/ep/p-mip/measuringirelandsprogress2012/economy/economy-housing/ and https://www.cso.ie/en/releasesandpublications/er/ndc/newdwellingcompletionsq42019/

The Climate Action & Low Carbon Development Bill, as amended in 2021, requires that carbon budgets are set for two 5-year period beginning 1st January 2021 up to 2030 and to 2050. It states the first two carbon budgets proposed by the Climate Change Advisory Council shall provide for a reduction of 51% in the total amount of greenhouse gas emissions up to 31 December 2030, from the annual greenhouse gas emissions reported for the year ending on 31 December 2018, as set out in the national greenhouse gas emissions inventory prepared by the Environmental Protection Agency (EPA).

The bill is expected to be enacted around June or July 2021, with further details on individual sector budgets to follow, based on recommendations from the Climate Change Advisory Council. According to the EPA, 2018 emissions were 62.7 $MtCO_2e$. A reduction of 51% gives a target of 30.7MtCO2e in 2030. The total in 2019 was 59.9Mt, a reduction of 4.5% on 2018. Following this trajectory means that Ireland would miss the target (Figure 1 below). Therefore, what is now required across all sectors is a reduction rate of 7% per annum.

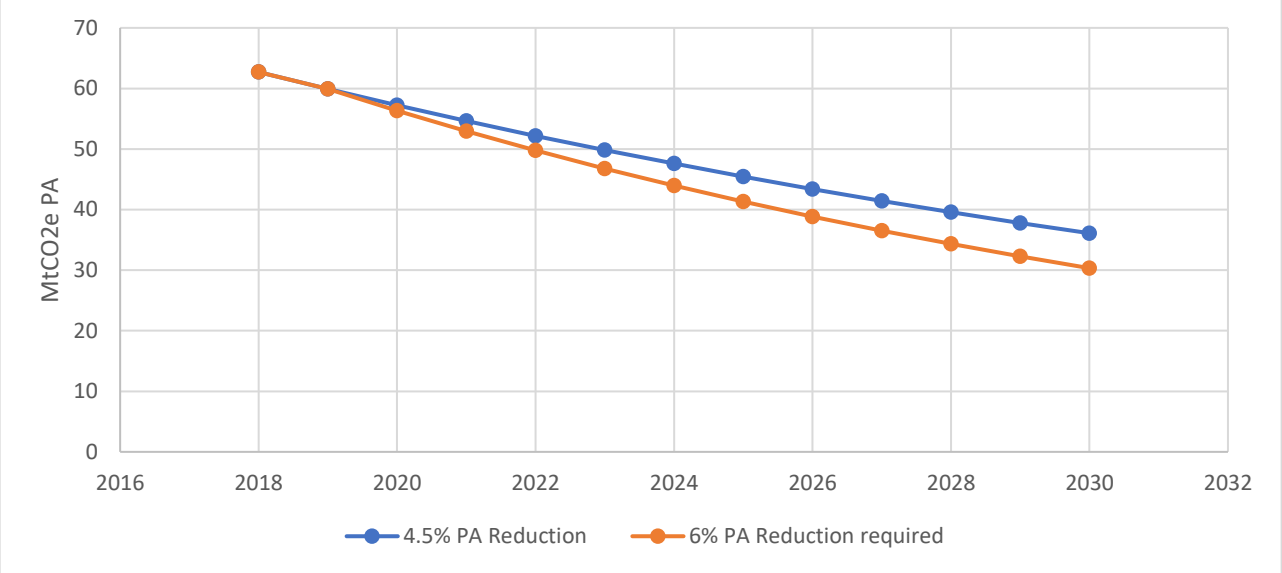

Figure 1 Current and required CO2e emissions reduction pathways to Climate Action Bill requirement of 51% reduction by December 2030

If a 7% per annum reduction was applied from 2021 to the Built Environment this leaves a carbon **budget in 2030 of 6.3MtCO2e, including operational heating, and a budget of 2.1MtCO2e for embodied carbon alone**. See Figures 2 and 3 below.

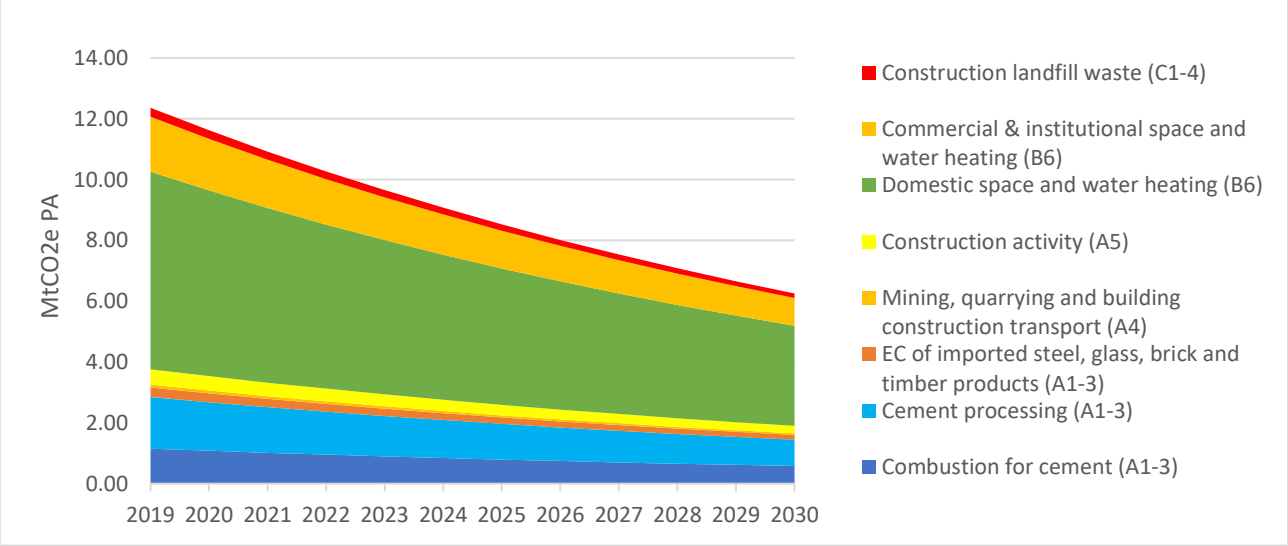

Figure 2 The required 6% per annum reduction rate applied to Built Environment related activities including heating during operational phase (B6)

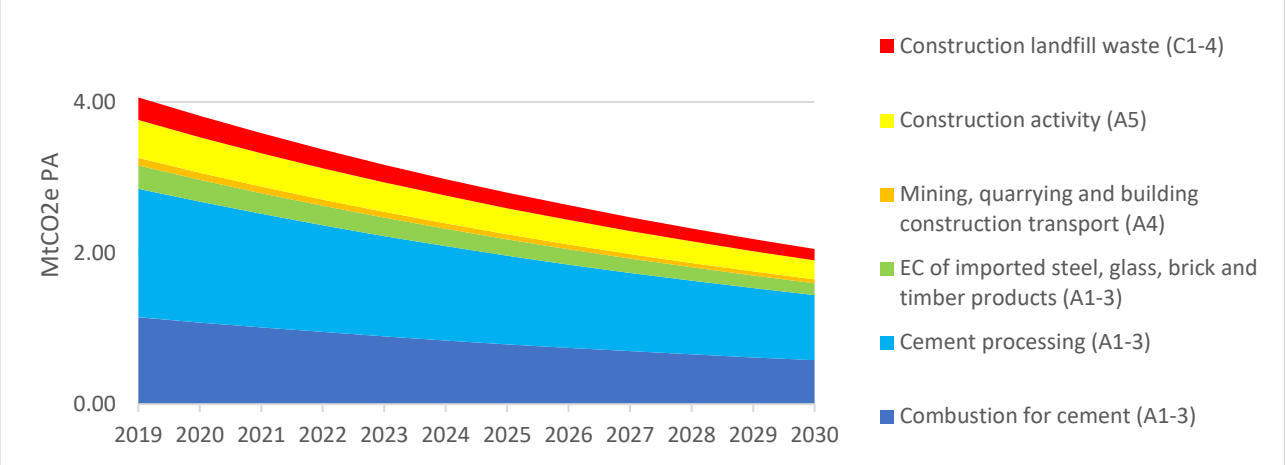

Figure 3 The required 6% per annum reduction rate applied to building construction and deconstruction only

In order to estimate the embodied carbon of the Built Environment sector, the following two estimates are presented based on the projections in the National Development Plan:

Residential

Building homes of the same average size as 2020[62] (134.4m^2) optimized for material efficiency, such as good wall to floor ratios but continuing to use the same materials (primarily cavity block walls with partial fill insulation) will see an emissions rate of around **725kgCO_2e/m^2** at completion. If the rate of home construction is increased to 29,000 homes per annum in line with NDP requirements, this equates to 2.8MtCO_2eq per year from the material production, transport and construction (A1-5).

Non-Residential

In the non-residential sector, IGBC estimated there are 150 public projects valued at €20m and above identified in the NDP up to 2040. According to a spotlight report by Aecom (2021) on the status of the building sector[63] there were around **3.1 million m^2 non-residential planning permissions granted in 2019**. If we assume the same average of 725kgCO_2e per m^2, some higher (hospitals, research centers) and some lower (warehousing) and assuming 50% of permissions reaching completion, then the non-residential sector will add a further **1.12MtCO_2eq per** year.

The above estimates **exclude surrounding infrastructure**. They also rely on assumptions, including completion rate, building materials used, and offer only a general indicator of the building sector's emissions. The total of **4.2MtCO2eq EC** and is equivalent to **7% of Ireland's greenhouse gas emissions**. This figure is in line with global estimates of embodied emissions of between 5-20% of all emissions.

Embodied Carbon

Therefore, IGBC estimate that the **carbon budget for embodied carbon within the Built Environment sector for 2030 is 2.1MtCO_2eq,** if a 50% reduction from the built environment sector is required. From 2030 onwards further reductions will be needed. However, because of the increase in construction required to meet housing targets, this equates to more than a 50% reduction in embodied carbon intensity per square meter of constructed area.

- **Total estimated Embodied Carbon for all buildings in Business as Usual = 4.2MtCO2eq**
- **50% reduction in Embodied Carbon for all buildings in Business as Usual = 2.1 MtCO2eq**
- **Carbon intensity per square meter constructed area = > 50%**

[62] Table 6 https://www.cso.ie/en/releasesandpublications/er/ndc/newdwellingcompletionsq42020/
[63] https://ireland.aecom.com/industry-spotlight-2021#ROI