LIVING FUTURE
EUROPE

Zero Carbon, Zero Energy. An accelerated path to the decarbonisation of the European built environment.

May 2023

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Front cover image: Google, 6 Pancras Square, London (UK), 1st Zero Carbon certified project in the world. Photo courtesy of Tim Soar

Back cover image: Casa SN, Arco, Trentino-South Tyrol (Italy), 1st Zero Energy certified project in Europe. Photo courtesy of Carlo Battisti

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Abbreviations

International Living Future Institute	ILFI
Living Future Europe	LFE
Zero Energy	ZE
Zero Carbon	ZC
Energy performance of buildings directive	EBPD
Zero Emission building	ZEB
Greenhouse gas	GHG
Carbon Risk Real Estate Monitor	CRREM
Life cycle assessment	LCA
Technical Screening Criteria	TSC
Forest Stewardship Council	FSC
Renewable Energy Certificate	REC

How to read this document

This document breaks down the certification requirements of the International Living Future Institute's (ILFI) Zero Carbon (ZC) and Zero Energy (ZE) building certification programs in order to show how they align with the European perspective towards a decarbonized built environment. Given the accelerated dynamics happening at the legislative and policy making levels, it is expected that a significant part of the here considered requirements to be further developed during the months to come. This document aims to explore the actual key aspects and anticipate the upcoming changes.

The report begins with an introduction to the ILFI's ZC and ZE protocols. Further, it presents the European Union's (EU) key regulatory frameworks for decarbonising the building stock, zooming in to the one for decarbonising materials. A section of the document is also dedicated to explore how some regulations and initiatives are addressing the carbon neutrality goals in the United Kingdom. In conclusion, comparative tables are presenting the level of alignment between the ILFI certification systems and the European key legislative mechanisms. As such:

Chapter 1 - the reader will be introduced to the scope of the ZC and ZE programs with key definitions on zero emissions and carbon neutrality.

Chapter 2 - provides a condensed overview of the EU regulatory frameworks for decarbonising the building stock with focus on new and existing buildings.

Chapter 3 - the focus shifts toward the EU regulatory framework for decarbonising building materials.

Chapter 4 - covers key UK regulatory frameworks for decarbonising the building stock.

Chapter 5 - the alignment tables aim to present the reader with key information on how the ZC and ZE certification requirements meet and exceed the Energy performance of buildings directive (EPBD) threshold for zero emission buildings today. It needs to be noted that this comparison is not a full and in depth analysis but it is based on the key targets and requirements of both ILFI programmes and EPBD targets.

Following Chapter 5, concluding remarks about the great benefits of implementing ZC and ZE certifications to building projects, are available. Both programs are a catalyst in breaking paradigms and could act as an accelerated pathway to the EPBD as well as UK current and future targets for a decarbonised and zero-emissions building stock.

References and glossary sections are also included at the end to assist you with key information for in depth reading as well as provide understanding on terms used in this publication.

Introduction

"If we are to stay below the targets set in the 2015 Paris Agreement – and thereby minimise the risk of setting irreversible chain reactions – we need immediate, drastic, annual emissions reductions on a scale unlike anything the world has ever seen". - Greta Thunberg [1]

The global discussion on the ecological transition is often limited to addressing the sole carbon neutrality, forgetting other environmental issues where we already exceeded the planetary boundaries, in some cases reaching a point of no return, e.g., biodiversity loss and extinctions, biogeochemical cycles of nitrogen and phosphorus [2].

But the dramatic increase of global CO2 and other greenhouse gases (GHG) emissions in the latest decades of the industrial era requires immediate concrete and effective actions, considering the remaining global carbon budget we have at disposal, if we want to keep the temperatures' level below the Paris targets.

What are the actions put in place by governments, policy makers, corporations, industrial and economic sectors, also considering the macroscopic differences between developed and emerging countries in considering this global issue under the lens of growth and development? Recently, a continuous flowering of pledges, road maps and plans has been present, with several countries and regions setting up targets for reaching 'net zero emissions'.

Considering the carbon budget spent between 2000 and 2018, if the business as usual paradigms do not change then we should not find ourselves within a linear emissions decrease process, to achieve net zero emissions by 2050. Examples from the most ambitious countries (such as Sweden and Germany) should be followed, as their plans to achieve carbon neutrality are set by 2045, the earliest.

How does the built environment fit in this discussion? The building sector has a carbon problem given that on average 39% of global CO2 is related to building operations, building materials and construction. This problem is exacerbated by the current growth pace of the global built environment. It is estimated that by 2060, 23 million hectares of real estate will be constructed or renovated. Equivalent to a new New York City every 34 days [3].

The 39% of global CO2 emissions is a large percentage of the challenge we are facing today. It's crystal clear that a radical change is needed in the way we design and build our buildings, as well as in the metrics we use and the approach in monitoring our building stock's real performances. This needed acceleration is the last call for the building sector to act effectively and create an even slightly visible slowdown in the GHG emissions increase.

Within the International Living Future Institute (ILFI) portfolio there are ambitious frameworks going beyond sustainability in the built environment. The Zero Carbon and the Zero Energy certifications are specifically addressing these issues. In particular, developed in 2018, the Zero Carbon standard is considered the most robust protocol tackling the climate neutrality topic. Together with ILFI's flagship program, the Living Building Challenge, Zero Carbon has been considered by an independent report as the only standard to fully decarbonise the built environment [4].

Zero Carbon Certification is a third-party verified industry recognized standard verifying that the operational and embodied carbon emissions of a built project have been neutralised. Zero Energy (ZE) Certification is the only global third-party verified standard that recognizes built projects with industry leading energy performance and a balance of renewable energy without the use of combustion.

Most importantly, these frameworks are based on real rather than modelled performance. The final certification is released after at least a 12-month monitoring phase, when the building is able to demonstrate its real compliance with the requirements in the operations phase. This approach is already ground-breaking, considering the usual gap we meet between the actual and designed performances of our buildings.

The scope of this document is thus to compare the Zero Carbon and Zero Energy frameworks with established and in progress regulations in Europe, both considering the robust programs the European Union is developing under the European Green Deal policy initiative umbrella, and the several initiatives under development in the United Kingdom. We can anticipate that these two frameworks are already fitting – and generally speaking even exceeding - the decarbonisation targets the EU, and the UK are setting up.

[1] "The Climate Book", Greta Thunberg, Penguin Random House (2022)
[2] The nine planetary boundaries, Steffen et al. 2015, Stockholm Resilience Centre (2015)
[3] Global Alliance for Buildings and Construction, IEA, and UNEP (2019).
[4] The Embodied Carbon Review – Embodied carbon reduction in 100+ regulations and rating systems globally, One Click LCA (2018)

Ultimately, this document developed by the Technical Advisory Group (TAG) of the Living Future Europe, following last year's first publication on 'Living Building Challenge as a path to the EU Taxonomy' [5], has the duo fold aim to introduce ILFI visionary programs to a larger audience of interested professionals, real estate developers and policy makers, as well as to summarise how the policy scenarios around the decarbonisation of the built environment are progressing in our continent.

[5] Battisti, C. Alameddine, Z. Galatoulas, A. (2022). Living Building Challenge as a path to the EU Taxonomy.

About Living Future Europe

Living Future Europe (LFE) is a non-profit association with the mission to make the world work for 100% of humanity, in the shortest possible time, through spontaneous cooperation without ecological offence or disadvantage of anyone, catalysing the transformation toward communities that are socially just, culturally rich, and ecologically restorative.

The International Living Future Institute (ILFI) is a non-profit US-based organisation working towards a society that is socially just, culturally rich, and ecologically restorative. As part of this work, it administers and evolves a number of sustainable building standards.

LFE plays an active role in championing the International Living Future Institute programs in Europe, focusing on educating and assisting a broader audience of interested practitioners on how to build Living Building Challenge, Core Green Building, Zero Carbon, Zero Energy projects and help spur demand for healthy, transparent materials and Declare and Living Products as well as socially Just organisations. LFE relies on a network of volunteers in Europe, including the Living Future Accredited professionals.

The LFE Technical Advisory Group (TAG) includes selected passionate experts from all over Europe and is working on analysing, comparing, and producing documents and reports on:

• specific regional standard changes for the adoption of ILFI certifications

• crosswalk documents on ILFI programs and other standards or policies relevant to the European Market

• harmonisation between ILFI programs and the existing / in progress regulations at a European or National level

1. Zero Carbon & Zero Energy Certification

In the decarbonization pathway, buildings play a key role as they account for 40% of energy consumed in the EU and 36% of energy-related greenhouse gas emissions. So that a shift from the “energy focus” to the “carbon focus” is happening at different levels.
The concept of “Zero Emission building” (ZEB) or “Carbon neutral building” is spreading in the market without a commonly agreed definition.

Many voluntary organisations and programs such as, World Green Building Council (WGBC), BREEAM, DGNB, ILFI and others, are pushing a whole carbon related life cycle analysis approach that addresses emissions from operational energy use in buildings, and from the embodied carbon which comes from building materials and construction or renovation processes.

For example, the WGBC, considers a zero carbon building to be one that is highly energy efficient and fully powered from on/off-site renewable energy sources. In other more rigorous definitions, a zero emissions building produces enough renewable energy to compensate for the building’s greenhouse gas (GHG) emissions over its lifespan.

From a regulatory point of view the EU is currently discussing the revision of the Energy Performance of Buildings Directive (EPBD) setting the vision for achieving a zero-emission building stock by 2050 and moving away from the current nearly zero-energy buildings, and going towards zero-emissions buildings by 2030.

According to the 2022 EPBD review proposal, a zero emission building is defined as a building with a very high energy performance, with a very low amount of energy still required, fully covered by energy from renewable sources and without on-site carbon emissions from fossil fuels. While the focus of the proposal is the reduction of operational GHG emissions, ZEB definition further includes the calculation of the life-cycle Global Warming Potential (GWP) and its disclosure through the building energy performance certificate.

In general, looking at the previous definitions, the variations are mainly referred to what follows:

1. Mandatory life cycle stages that should be included in the zero-emission balance.
2. Reference indicator (es. CO2 emissions alone or GHGs) and the characterization method to determine GHG emissions.
3. Acceptable lifespan of the building or acceptable methods/timing for offsetting accounting.
4. Accepted system boundaries to determine what can be considered in setting or offsetting compensation strategies.
5. Offsetting acceptance and related requirements.

As the public debate is informed using a diversity of terms, which refer to different definitions, it is suggested, when comparing different frameworks, to have clarity on the five points above, to avoid misunderstanding and lack of transparency.

ILFI’s Zero Carbon and Zero Energy certification programs

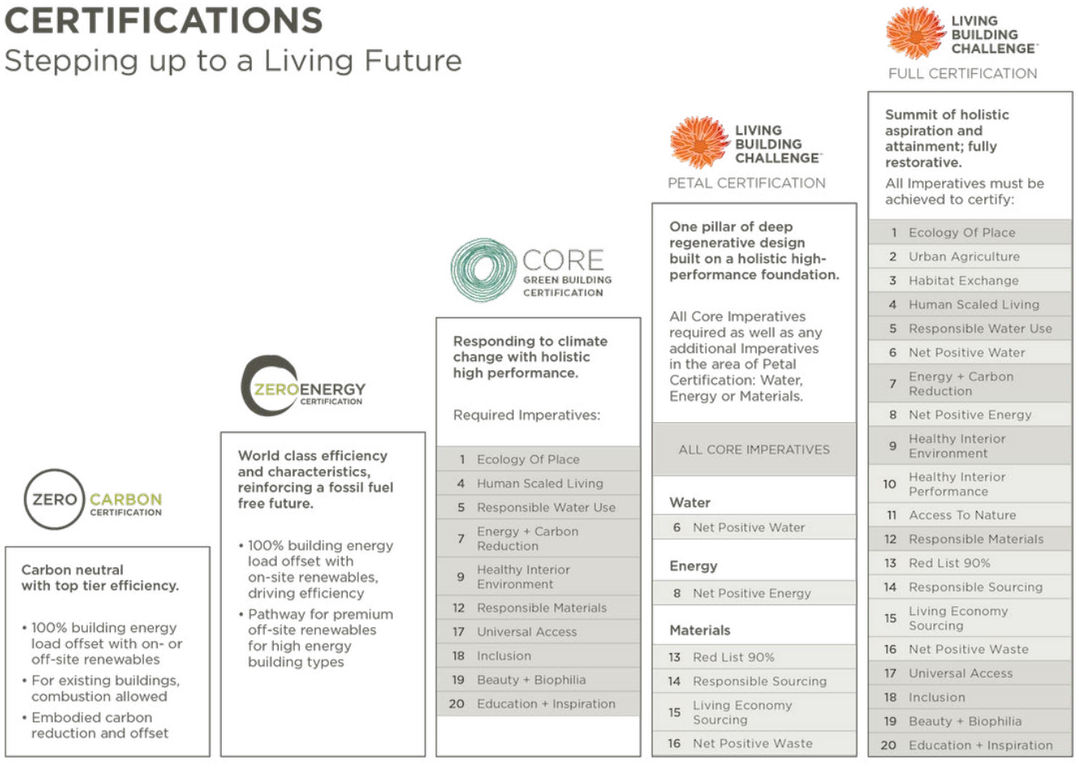

Figure 1.1: Scope of ILFI building certification programs

Zero Carbon

Zero Carbon Certification was developed by the International Living Future Institute (ILFI) in 2018 to directly address the building sector's role in the global climate crisis. The intent of the Zero Carbon program is to bring the vision of a fully decarbonized built environment into reality by evaluating, reducing, and offsetting both operational and embodied carbon impacts of buildings. This program fosters the development and use of carbon-free renewable energy resources and neutralises the impacts of building materials and construction.

Zero Energy

Zero Energy (ZE) Certification is a standard developed by ILFI that recognizes the highest levels of energy performance that can be achieved by built projects. The intent of the Zero Energy program is to verify projects that demonstrate net zero energy achievement based on actual, not modelled, performances, in order to build an advanced cohort of projects with the integrity of third-party certification.

2. EU regulatory frameworks for decarbonising the EU building stock

This chapter will cover the key regulatory EU frameworks. In (2.1), it will provide emphasis on new and existing buildings whereas in (2.2) a list with key regulations and practical tools will also be covered to provide the reader with further context, as the current frameworks span over different initiatives and the scope can be relatively wide.

The Directive of the European Parliament and of the Council on the Energy Performance of Buildings [EPBD] is a key legislative instrument for delivering on the 2030 and 2050 building stock decarbonisation objectives in the Member States. The core aim of this Directive is to systematically enhance the energy performance of buildings and to increase the level and depth of renovations according to the EU climate targets and their progressive evolution.

The first version of the EPBD was approved on 16 December 2002 and entered into force on 4 January 2003, having as a major point of focus the introduction of an energy performance certification system [EPC] and making a distinct separation between the interventions on existing buildings and the new ones, as well as between constructions owned by public authorities or addressing functions of public interest and the rest.

The Directive 2002/91/EC was replaced in 2010 by a recast version, the Directive 2010/31/EU, which introduced a commonly agreed definition of a 'nearly zero energy building' [nZEB], allowing each EU member state to set own metrics for nZEB standards. While for buildings occupied by public authorities and buildings frequently visited by the public was expected to become exemplary and become early adopters of energy efficiency improvements, for the housing sector and major renovations there were defined frameworks for financial incentives and structural funds.

The amended version, the Directive 2018/844/EU developed a more systemic take on the topic, introducing aspects related to electromobility and smart readiness alongside technical building systems.

A consolidated version of the EPBD was proposed in 2021 as part of the Fit for 55 package, 2021/0426 (COD). This is where minimum energy performance standards [MEPS] begin to be precisely set and significant emphasis is generated around renovations and housing sectors.

The latest proposal for a recast dates from October 2022 and is defined as a key component of the Renovation Wave Strategy and strongly connected with the REPowerEU Plan. In March, 2023, an updated version of the recast proposal was adopted by the European Parliament - P9_TA(2023)0068 .

The New European Bauhaus now takes a central role as a pathway towards achieving the Union's climate goals, nature based solutions and green infrastructure elements are newly introduced concepts with a notable point of focus, and an overall consistent structure is developed around the renovation mechanisms of the existing building stock.

"Buildings account for 40 % of final energy consumption in the Union and 36 % of its energy-related greenhouse gas emissions, while 75 % of Union buildings are still energy- inefficient. Natural gas plays the largest role in heating of buildings, accounting for around 42 % of energy used for space heating in the residential sector."[1]

[1] Energy performance of buildings (recast) - Amendments adopted by the European Parliament on 14 March 2023 on the proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (recast) (COM(2021)0802 – C9-0469/2021 – 2021/0426(COD)).

2.1 - Construction of new buildings vs. Renovation of the existing stock[2]

The main objectives of the latest revision of the EPBD, agreed by the Council of the EU on October 25, 2022, are meant to support all new buildings to be zero-emission by 2030, and all the existing ones to be transformed into zero-emission buildings by 2050.[3]
From 2030, all new buildings would be zero-emission buildings, noting that the target for the new buildings owned by public bodies would be 2028 and that exceptions will be possible for some buildings, including historical buildings, places of worship and buildings used for defence purposes.
With regard to the existing building stock[4], the member states agreed to introduce minimum energy performance standards that would correspond to the maximum amount of primary energy that buildings can use per sqm annually.

- For the non-residential sector, it was agreed to set maximum energy performance thresholds, based on primary energy use. A first threshold would draw a line below the primary energy use of 15% of the worst-performing non-residential buildings in a member state. A second threshold would be set below 25%. Member states agreed to bring all non-residential buildings below the 15% threshold by 2030 and below the 25% threshold by 2034.

- For existing residential buildings, it was agreed to set minimum energy performance standards based on a national trajectory, in line with the progressive renovation of the building stock into a zero-emission building stock by 2050, according to the national building renovation plans, noting that the national trajectory would correspond to the decrease of the average primary energy use in the whole residential building stock over the period from 2025 to 2050 with two control points to keep stock of member states' achievements.

- Will be excepted: historical buildings, places of worship, buildings used for defence or used by the armed forces, industrial sites and non-residential agricultural buildings, stand-alone buildings smaller than 50 sqm.

In addition, the EPBD tackles:

- *Greener energy for buildings* - with a particular focus on solar energy installation[5]

- *Infrastructure for sustainable mobility* - with significant developments in terms of infrastructure for electric vehicles (cables and recharging points) and parking spots for bikes[6]

- *EU incentives for renovations* - such as financial help, tax reductions, administrative support[7]

[2] According to the Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the energy performance of buildings (recast), Interinstitutional File: 2021/0426(COD), Brussels, 21 October 2022.

[3] 'Fit for 55': Council agrees on stricter rules for energy performance of buildings, Council of the EU Press release 25 October 2022

[4] 75% of existing buildings are inefficient in terms of energy and will require energy renovation on a large scale

[5] The article 9a on solar energy in buildings, was integrated in an adapted version from the REPowerEU proposal, with factors such as structural integrity, biodiversity, and stability of the electricity network to be considered.

[6] The Article 12, on *Infrastructure for sustainable mobility*

[7] The Article 15, on *Financial incentives and market barriers*

2.2 - List of regulations and practical tools:

Along with the EPBD framework CRREM and Level(s) are also key tools towards the decarbonisation as it is envisioned by the EU Commission targets.

EU Regulation-aligned decarbonization tools

- CRREM, Carbon Risk Assessment Tool
- Level(s)

CRREM Carbon Risk Real Estate Monitor

CRREM (Carbon Risk Real Estate Monitor) was developed as part of the European Union's Horizon 2020 research and innovation programme for the period 2018 – 2021 and subsequently funded with contribution from Laudes Foundation. CRREM is today the main and internationally recognized tool used by the Real Estate sector to guide decarbonization initiatives for the existing buildings stock. Initially developed for the European real estate industry, it has gradually become a recognized reference and decarbonization tool for other markets, especially North America and Asia.

Paris-aligned 1.5°C decarbonization pathways to 2050 are available for a number of different commercial asset classes including Office, Retail, Warehouse, Hotel, Health, Lodges & Leisure, Data Centers, among others, and for all European countries and several global locations. Specific pathways for the residential market are also available within the tool package.

"The objective of CRREM is to accelerate the decarbonisation and climate change resilience of the real estate sector by providing appropriate science-based carbon reduction pathways at property, portfolio and company level."[8]

The tool helps organisations and investors to easily analyse the transition risks connected with ownership and management of existing building portfolios or single assets due to low energy performance and quantifying the financial implications of a stricter regulatory environment regarding carbon intensity on the building stock.

The energy and GHG performance of existing assets and portfolios is visualised within the excel tool based on available data for each asset for a 12-month evaluation period, including energy bills, available renewable energy, renewable energy supply contracts, etc. The existing performance is compared to the reference decarbonization pathways for the specific asset class and a "stranding year" is determined when the GHG intensity due to the operation of the building exceeds the 1.5°C reference pathway.

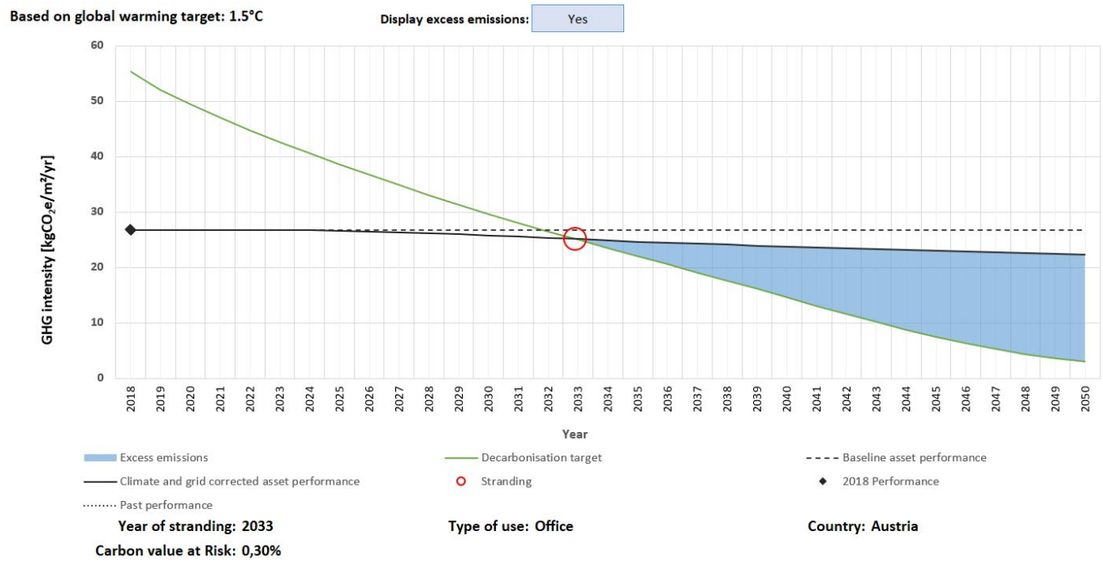

Figure 2.1: Example CRREM application for an office building located in Austria. The stranding year for this asset based on existing 2018 performance and a 1.5°C-aligned pathway is 2033.

Stranded properties are those that will not meet future energy efficiency standards and whose energy upgrade will not be financially viable. Excess carbon emissions may trigger carbon costs associated with penalties for each ton of emission above the limit for each year of ownership (e.g., in connection with EU ETS Emissions Trading Scheme if extended to buildings). Therefore, the need to invest in energy efficiency retrofit interventions reduces the asset and portfolio related transition risks.
The CRREM can also be used to analyse and visualise the impact of different retrofit scenarios at asset or portfolio level.

[8] ECRREM Risk Assessment Reference Guide

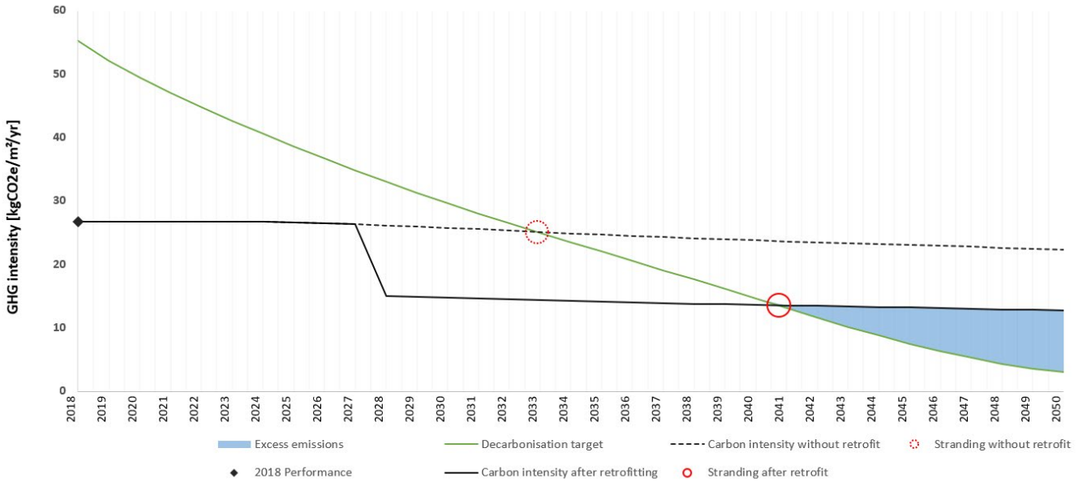

Figure 2.2: Example evaluation of retrofit scenario for an existing asset. With retrofit interventions the stranding year moves from 2033 to 2041, reducing transition risks associated with this asset.

Looking closer to CRREM tool and ILFI's ZC certification it can be seen that if an existing asset was to achieve the Zero Carbon certification it would automatically comply with the CRREM decarbonization pathways, ensuring no risks of stranding because the ZC certification is based on:

- a 12-month proven performance
- it evaluates operational carbon emissions of an existing buildings
- it recognizes on-site and off-site renewable energy production to reduce project carbon emissions

3. EU regulatory frameworks for decarbonizing building materials

Within the EU legislative framework, several key tools have been created and developed in order to ease the path towards a more sustainable European standardisation system for the decarbonisation of construction materials. The EU GPP Criteria, Level(s), the Construction Products Regulation, and the Ecodesign Directive are at the core of this sector and they are constantly under reviewing processes in order to better adapt to the EU's ambitions for a decarbonised and a more sustainable future.

The EU GPP criteria[9] have been developed for construction materials, services and works. It is a voluntary instrument, and it has a key role to play in the EU's efforts to become a more resource-efficient economy. It can help stimulate a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market.

Since 2004, Directives 2004/17/EC and 2004/18/EC, which constitutes the European framework for the procurement of public contracts, clarified how purchases can integrate an environmental dimension into the tendering process. Adopted in June 2006, the GPP regulations are constantly updated in order to reach a good balance between environmental performance, cost considerations, market availability and ease of verification.

Another framework that promotes the decarbonisation of construction materials is Level(s)[10], a common ground for assessing and reporting on the sustainability performance of buildings and applying circular economy principles in our built environment. It offers an extensively tested system for measuring and supporting improvements, throughout the whole life cycle[11]. Level(s) is based on six macro-objectives addressing key sustainability aspects, further on divided into separate core indicators. The first macro-objective "Greenhouse gas emissions along buildings life cycle" considers both the life-cycle emissions from the building as well the use stage energy performance. Level(s) can be applied at various stages of the project for both new building design and existing buildings renovations.

Although there has been recognition that the embodied carbon should be

[9] EU Green Public Procurement (GPP) criteria
[10] Level(s)
[11] The Level(s) framework is, in essence, a European Whole Life Carbon [WLC] methodology

further explored by having a Life Cycle Assessment (LCA), specific LCA limits have not been set yet.

In terms of Construction Products Regulation, the key legislative tool for building products is the Regulation (EU) No 305/2011, CPR, seeking to achieve a well-functioning single market for construction products and to support the achievement of the objectives of the green and digital transition, particularly the modern, resource-efficient and competitive economy[12]. Therefore, the manufacturers will have to comply to specific environmental obligations, such as:

- Designing and manufacturing a product and their packaging in such a way that their overall environmental sustainability reaches the state of the art level.
- Giving preference to recyclable materials and materials gained from recycling.
- Respecting the minimum recycled content obligations and other limit values regarding aspects of environmental sustainability.
- Making available, in product databases, instructions for use and repair of the products.
- Designing products in such a way that re-use, remanufacturing and recycling are facilitated.

The Regulation is currently undergoing a reviewing process[13].

The proposal for a new Ecodesign for Sustainable Products Regulation[14], published on 30 March 2022, is the cornerstone of the Commission's approach to more environmentally sustainable and circular products. The core of this legislative initiative will be to widen the Ecodesign Directive beyond energy-related products so as to make the Ecodesign framework applicable to the broadest possible range of products and make it deliver on circularity. As part of this legislative initiative, and, where appropriate, through complementary legislative proposals, the Commission will consider establishing sustainability principles and other appropriate ways to regulate the following aspects:

- improving product durability, reusability, upgradability and reparability;
- increasing recycled content in products;
- enabling remanufacturing and high-quality recycling;
- reducing carbon and environmental footprints;
- restricting single-use and countering premature obsolescence;
- incentivising product-as-a-service or other models where producers keep the ownership of the product or the responsibility for its performance throughout its lifecycle;
- mobilising the potential of digitalisation of product information[15], including solutions such as digital passports, tagging and watermarks;
- rewarding products based on their different sustainability performance, including by linking high performance levels to incentives.

Having in mind the EU legislative framework and the several key tools mentioned above, in Appendix A.1 of this report the similarities of the Level(s) framework and the ZC/ZE Certifications of ILFI are being highlighted.

Bear in mind that the ZC certification requires an embodied carbon calculation related to the first stages of the LCA life cycle, i.e., the Product (A1-A3) and Construction Stages (A4-A5), while Level(s) requires calculations A1-C4. The key similarities are found in the following Level(s) indicators:

- Indicator 1.1: Use Stage Energy Performance
- Indicator 1.2.: Life cycle Global Warming Potential (CO2 eq./m2/yr)
- Indicator 2.1: Bill of quantities, materials and lifespans
- Indicator 2.4: Design for deconstruction, reuse and recycling

[12] The Regulation is in line with the European Green Deal and the Circular Economy Action Plan

[13] Further information is available on the Commission's dedicated page: Review of the Construction Products Regulation and in the EPRS Briefing: Construction products regulation: revision of Regulation (EU) No 305/2011, Implementation Appraisal, March 2022.

[14] Ecodesign for sustainable products

[15] The new "Digital Product Passport" will provide information about products' environmental sustainability. It should help consumers and businesses make informed choices when purchasing products, facilitate repairs and recycling and improve transparency about products' life cycle impacts on the environment. The product passport should also help public authorities to better perform checks and controls.

4. UK regulatory frameworks for decarbonising the building stock

The UK is a signatory of the Paris Agreement and also was a member of the EU EPBD prior to January 2021. In 2019 the UK government introduced a legally binding target to reduce greenhouse gas emissions to net zero by 2050. In December 2020, the UK committed to an interim target to reduce economy-wide greenhouse gas emissions by at least 68% (compared to 1990 levels) by 2030 as part of its Nationally Determined Contribution towards delivering the goals of the Paris Agreement.

There are about 30 million buildings in the UK. In total, these buildings are responsible for around 30% of national emissions.

The Heat and buildings strategy[16] sets out how the UK will decarbonise homes, and its commercial, industrial and public sector buildings, as part of setting a path to net zero by 2050.

The policy around Net Zero buildings – including the definition thereof – is emerging. The UK's regulatory treatment of energy and CO_2 emissions in buildings was closely aligned with the EU EPBD, however in recent years it has lagged behind Europe in some areas of policy progression. The UK government has not yet committed to regulate real operational energy to close the 'performance gap' in buildings, nor give clear guidance on embodied carbon, although there is a commitment to consult on the latter this year.

Many groups in the UK have been calling for greater action and clarity on net zero buildings, and much good work on standards and guidance has been done and is underway. For example, the UKGBC has developed a widely supported framework[17] definition for net zero carbon buildings to provide the industry with clarity on how to achieve net zero carbon in construction and operation.

London Energy Transformation Initiative (LETI), an industry expert group served by volunteers has also published influential guidance. The Royal Institute of Chartered Surveyors (RICS) has produced a methodology[18] for assessing embodied carbon in construction which has been adopted by several governments and industries.
The scope of the ILFI ZE and ZC programmes broadly meets or exceeds in ambition the UKs current policy guidelines.

New Buildings

New buildings conform to the UK's Building Regulations. Performance targets for energy and CO2 emissions were introduced through Part L (Conservation of Fuel and Power) and Part F (Ventilation) in 1995 and subsequently improved at regular intervals.

The Future Homes Standard and Future Buildings Standard[19] (FHS- currently under consultation) are due to be introduced in 2025. New developments meeting these standards would produce 75- 80% less carbon dioxide emissions than those built to the 2013/14 Part L requirements. To achieve this, new gas boilers are to be banned and the final specification is likely to include low carbon heat technologies, such as heat pumps; waste-water heat recovery; and triple glazing and minimum standards for walls, floors and roofs that limit heat loss – potentially augmented by building-integrated photovoltaic (PV) power generation.

Homes built to FHS will be 'Net Zero Ready' i.e., the expectation is that with a future decarbonised electricity Grid, they will become net-zero carbon over time[20] , with no need for further adaptations or changes, as they will not be reliant on fossil fuels for their heating. New homes are required by law to be fitted with EV chargers.

Embodied carbon emissions are not required by current policy to be assessed or controlled, other than on a voluntary basis.

The UK government has undertaken[21] "to consult in 2023 on our approach and interventions to mainstream the measurement and reduction of embodied carbon in the built environment."

[16] Heat and buildings strategy
[17] Net Zero Carbon Buildings: A Framework Definition, UKGBC, April 2019
[18] Professional Standard RICS Whole Life Carbon Assessment for the Built Environment
[19] The Future Buildings Standard - GOV.UK (www.gov.uk)
[20] Module 161: Future homes standards for net-zero buildings – CIBSE Journal
[21] Building to net zero: costing carbon in construction: Government Response to the Committee's First Report, Third Special Report of Session 2022–23, 30 September 2022

Existing Buildings

Existing energy performance policy typically uses the energy performance certificate (EPC) rating system to indicate overall building performance. One mechanism to improve building performance across the stock is setting minimum energy performance standards across tenures and increasing these over time.

The ‘fuel poverty target’ is to move as many fuel poor homes as is reasonably practicable to a minimum of band C by 2030 with an interim milestone of band D by 2025.

The Energy White Paper[22] set a minimum energy efficiency standard of EPC Band B by 2030 for privately rented commercial buildings in England and Wales.

A consultation on improving the energy performance of privately rented homes has been undertaken, which proposes to bring the majority of privately rented properties in England and Wales up to at least EPC band C in the period from 2025 to 2028.

In addition to regulation, support and market mechanisms are deployed. The first Energy Company Obligation (ECO) scheme was introduced in 2013. The current ECO is an obligation on larger energy suppliers to provide energy efficiency and heating measures for fuel poor consumers across Great Britain. Since the programme began, over 3 million measures have been installed in over 2.2 million homes. The next iteration of ECO will run from 2022 to 2026 with an increase in value from £640 million to £1 billion per year. ECO will primarily focus on improving the worst-quality homes across Great Britain, helping as many to achieve EPC band C as is cost-effective and suitable for the property.

In November 2020, the UK Prime Minister announced £1 billion of funding to continue support for the decarbonisation of buildings through improved energy efficiency. This will be allocated across several existing government schemes, including the Green Homes Grant Voucher Scheme, the Public Sector Decarbonisation Scheme and Social Housing Decarbonisation Fund.

ILFI: ZERO CARBON and ZERO ENERGY program			**UK (For new and existing buildings)**
EMBODIED CARBON **(Material Produced)** **ONLY for ZC**	**REDUCE**	Reduce carbon in primary materials (new buildings).	Not defined yet in the UK for new buildings, hence ILFI’s requirement currently exceeds UK scope. Embodied carbon emissions are not required by current policy to be assessed or controlled, other than on a voluntary basis. The UK government has undertaken23 “to consult in 2023 on our approach and interventions to mainstream the measurement and reduction of embodied carbon in the built environment.” It has stated: “We agree with the Committee that whole life carbon assessments (WLCAs) are likely to have a significant role to play in delivering [decarbonisation]. WLCAs will help ensure that carbon is properly accounted for, encouraging the industry to use low carbon materials and to produce more efficient, low-carbon designs. This is why the Net Zero Strategy set out the Government’s ambitions to help the construction sector improve their reporting on embodied carbon in buildings and confirmed that we will explore the potential of a maximum embodied carbon level for new buildings in the future.”

[22] Energy white paper: Powering our net zero future - GOV.UK (www.gov.uk)

	DISCLOSE	Disclose reduction strategies and total embodied carbon.	ILFI's requirement is aligned with the UK. Whilst measurement of embodied carbon has been acknowledged as part of the plan, as yet a timeline for disclosure in new or existing buildings has not been set. The UK government has stated: "We are considering [the] evidence as we prepare to consult on a range of domestic measures, including emissions reporting and disclosure, by the end of 2022."
	OFFSET	Offset sequestering materials or carbon offsets (new materials only).	Not defined yet in the UK for existing buildings, ILFI's requirement exceeds UK scope.
OPERATIONAL CARBON (Energy Consumed) ZE and ZC	**REDUCE**	Reduce site energy consumption. Eliminate new combustion (new buildings).	The UK policy for net-zero new buildings is not yet defined. The UK building regulations require assessment of the notional operational CO2 emissions of all new buildings using a predictive model called the National Calculation Methodology. The government updated the Building Regulations to ensure new buildings from 2022 produce on average 31% less carbon emissions than previously required, without the use of offsets. In addition, minimum Fabric Energy Efficiency Standards (FEES) apply. The government has made no commitment to calculating or regulating actual operational energy of new buildings. Hence ZE/ZC currently exceeds the UK policy. The Future Homes Standard due to be implemented in 2025 bans new gas-fired boilers in homes. The Heat and Buildings Strategy also states that it's aiming to phase out the installation of natural gas boilers altogether beyond 2035.

			For existing buildings, regulatory policy relating to the net zero roadmap is based on minimum EPC levels for compliance.
	OFFSET	Offset with installed (ZC and ZE) or procured (only ZC) renewable energy.	The UK policy on the treatment of residual energy and CO2 emissions to achieve net zero is not yet defined, hence all onsite renewable energy technologies are possible. New homes and buildings in England are required by law to install electric vehicle charging points.

5. Alignment of ZC and ZE certification with EU Directives.

The purpose of the alignment tables is to provide context between the Proposal for a Directive European Parliament and of the Council on the energy performance of buildings (EPBD) and the ILFI's Zero Carbon (ZC) and Zero Energy (ZE) certification programmes. The measures in this proposal are coherent with policy and measures across EU instruments supporting a socially just transition.

The 2050 vision for a decarbonised building stock goes beyond the current focus on operational greenhouse gas emissions. The whole life-cycle emissions of buildings should therefore progressively be taken into account, starting with new buildings. Therefore, the main objectives of the EPBD revision are to reduce buildings' greenhouse gas (GHG) emissions and final energy consumption by 2030 and setting a long-term vision for buildings towards EU-wide climate neutrality in 2050. Zero-emission buildings will become the new standard for new buildings, the level to be attained by a deep renovation as of 2030 and the vision for the building stock in 2050.

The latest review of EPBD to be approved makes explicit reference to the Commission assessment of whether EU building related measures, including carbon pricing, will bring sufficient improvements to deliver a fully decarbonised, zero-emission building stock by 2050, or whether further binding measures at Union level, such as strengthened EU-wide minimum energy performance standards, need to be introduced.

The intention of the Commission to tackle and minimise operational and embodied carbon in construction is evident. ILFI's global presence has shown that ZC and ZE programs recognise and expand further from the framework of EPBD as it requires building projects to achieve zero emissions on the operational aspect of the project and significant embodied carbon reductions. All the above through proven and metered performance.

The alignment tables in Chapter 5 aim to communicate the extended scope of ILFI's programs in relation to EU Commission's revised amendments adopted by the European Parliament on 14 March 2023 on the proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (EBPD) and aid to accelerate the transition towards a decarbonised future.

Zero Carbon Certification recognizes projects with top tier efficiency, and 100% carbon neutrality (both operational and embodied carbon) through on, or offsite renewables. It has three main certification requirements for Operational Carbon (OC) and three main for Embodied Carbon (EC).

Zero Energy Certification certifies projects that meet at least 100% of their energy demand through on-site renewable energy on a net-annual basis. It has two certification requirements for OC only, which are also described as part of the ZC program. In essence, ZC scope on OC expands further from ZE's by one additional requirement.

Tables 5.1 and 5.2 provide a brief overview of the alignment of the ZC and ZE programs in relation to EPBD for new and existing buildings.

Table 5.3 presents the alignment between ILFI's ZC/ZE OC Requirements to the Scope of EPBD for New/Existing Buildings and, Table 5.4 presents the alignment between ILFI's ZC EC Requirements to the Scope of EPBD for New/Existing Buildings.

Lastly, Table A.2 in Appendix A.2, key EPBD Directives were handpicked and were aligned with the ZC/ZE Certification Clarifications to enhance the readers knowledge on how ZC and ZE can accelerate EPBD targets to meet the requirements for 2030 and 2050.

Table 5.1: ILFI ZC and ZE brief scope to EPBD.

ILFI: ZERO CARBON and ZERO ENERGY program			EPBD (For new and existing buildings)
EMBODIED CARBON **(Material Produced)** **ONLY for ZC**	**REDUCE**	Reduce carbon in primary materials (new buildings).	Not defined yet in EPBD for new buildings, ILFI's requirement currently exceeds EPBD scope. The life-cycle GWP should be calculated for each stage to prove alignment in the future. The life-cycle Global Warming Potential (GWP) of new buildings will have to be calculated as of 2027 in accordance with the Level(s) framework, thus informing on the whole-life cycle emissions of new construction. By 1 January 2027, to ensure reductions in greenhouse gas emissions, Member States shall publish a roadmap detailing the introduction of limit values on the total cumulative life-cycle GWP of all new buildings and set targets for new buildings from 2030. In setting maximum limit values on the total cumulative life-cycle GWP, Member States shall determine appropriate benchmarks based on reported data for the relevant building types. Not defined yet in EPBD for existing buildings. Article 10: By 31 December 2023, the Commission shall adopt delegated acts supplementing this Directive by establishing a common European framework for renovation passports. The renovation passport shall indicate the expected benefits in terms of energy savings, savings on energy bills and whole life-cycle greenhouse gas emissions reductions, with an indication of the renovation steps that are to lead to the relevant improvements.
	DISCLOSE	Disclose reduction strategies and total embodied carbon.	ILFI's requirement is aligned with the EPBD. Article 7: Member States shall ensure that the life-cycle GWP is calculated and disclosed through the energy performance certificate of the building as of 1 January 2027, for all new buildings. By 1 January 2027, to ensure reductions in greenhouse gas emissions, Member States shall publish a roadmap detailing the introduction of limit values on the total cumulative life-cycle GWP of all new buildings and set targets for new buildings from 2030, considering a progressive downward trend, as well as maximum requirements, detailed for different climatic zones and building typologies. Not defined yet in EPBD for existing buildings, ILFI's requirement exceeds EPBD scope. Article 10: The renovation passport shall comprise a holistic renovation roadmap indicating a maximum number renovation steps building upon each other in line with the energy efficiency first principle to achieve a deep renovation in line with the objective to transform the building into a zero-emission building by 2050 at the latest, outlining how to achieve minimum energy performance standards, and measures to reduce whole life-cycle greenhouse gas emissions in the renovation process.
	OFFSET	Offset sequestering materials or carbon offsets (new materials only).	Not defined yet in EPBD for existing buildings, ILFI's requirement exceeds EPBD scope. Paragraph 8a: The fact that buildings are responsible for greenhouse gas emissions even before their operational lifetime is the consequence of the carbon already embedded within all building materials. An increase in the use of sustainably and locally sourced nature-based building materials, in line with the principles of the New European Bauhaus initiative and the internal market, has the potential to substitute for more carbon intensive materials and to store carbon in the built environment via the use of wood based materials.

OPERATIONAL CARBON (Energy Consumed) ZE and ZC	**REDUCE**	Reduce site energy consumption. Eliminate new combustion (new buildings).	ZE/ZC and EPBD use a different approach to achieve zero-emission new buildings. The enhanced climate and energy ambition of the Union requires a new vision for buildings: the zero-emission building, the very low energy demand of which is fully covered by energy from renewable sources where technically feasible. All new buildings should be zero-emission buildings, and all existing buildings should be transformed into zero-emission buildings by 2050. Article 7 specifies that as of 2028, all new buildings must be zero-emission buildings; new buildings occupied, operated or owned by public authorities must be zero-emission as of 2026. A zero-emission building shall not cause any on-site carbon emissions from fossil fuels. ILFI's requirement exceeds EPBD scope for MEPs. ZE/ZC use a different approach for deep renovation that transform existing buildings into zero-emission ones. The introduction of minimum energy performance standards MEPs should lead to a gradual phase-out of the worst-performing buildings and a continuous improvement of the national building stock, contributing to the long-term goal of a decarbonized building stock by 2050. Residential buildings would have to achieve at least energy performance class E by 2030, and D by 2033. Non-residential and public buildings would have to achieve the same classes by 2027 and 2030

			respectively. Staged deep renovation can be a solution to address high upfront costs and hassle for the inhabitants that may occur when renovating 'in one go'. One-step deep renovation can be more cost-effective and result in lower carbon budget options to achieve a fully decarbonized and zero-emitting Union building stock. Deep renovation' means a renovation in line with the energy efficiency first principle and efforts to reduce whole life-cycle greenhouse gas emissions generated during the renovation, and which transforms a building from 1 January 2027, into a zero-emission building.
	OFFSET	Offset with installed (ZC and ZE) or procured (only ZC) renewable energy.	ILFI's requirement is aligned with the EPBD. Different options are available to cover the energy needs of an efficient building by energy from renewable sources: on-site renewables such as solar thermal, geothermal, solar photovoltaics, heat pumps hydroelectric power and biomass, renewable energy provided by renewable energy communities or citizen energy communities, and district heating and cooling based on renewables or waste heat recovery from waste water, sanitary hot water or air and renewable energy supplied from the energy grids. Article 9a (1) By … [24 months after the date of entry into force of this Directive], Member States shall ensure that all new buildings are designed to optimise their solar energy generation potential on the basis of the solar irradiance of the site, enabling the subsequent cost-effective installation of solar technologies.

			Article 9a (2) Member States shall encourage, through information measures and streamlined permitting schemes, the deployment of suitable solar energy installations in all buildings undergoing major renovation or deep renovation in combination with the renovation of the building envelope, with the replacement of technical building systems and with the installation of equipment with electricity storage, EV-charging infrastructure, heat pump technology, and building automation and control systems.

Table 5.2: ILFI ZC/ZE OC requirement Vs EPBD scope for New/Existing Buildings

ILFI ZC/ZE Program Requirements	EPBD Directives	
OC: ZC Requirement 1	**New Buildings**	**Existing Buildings**
Must meet an energy efficiency target over a 12-month period. The targets are specified based on building type, size, and location: New Buildings: 25% reduction of energy use intensity (EUI) from an equivalent new building that would comply with ASHRAE 90.1-2010. Existing Buildings: 30% reduction of EUI from a typical existing building of an equivalent type, size, and location. Note: ZE No requirements	ZE/ZC and EPBD use a different approach. • EPBD: Primary Energy Use according to ANNEX III • ZC: Energy Use Intensity (EUI) Article 7: Member States shall ensure that from the following dates, new buildings are zero-emission buildings in accordance with Annex III: (a) from 1 January 2026, new buildings occupied, operated or owned by public authorities; and (b) from 1 January 2028, all new buildings;	ZE/ZC and EPBD use a different approach. • EPBD: Primary Energy Use according to ANNEX III • ZC: Energy Use Intensity (EUI) Article 9: Minimum energy performance standards (MEPs). Member States shall ensure that all buildings comply with minimum energy performance standards, starting with the worst-performing buildings. 1a. Member States shall ensure that: (a) buildings and building units owned by public bodies, achieve
		at the latest: (i) from 1 January 2027, at least energy performance class E; and (ii) from 1 January 2030, at least energy performance class D; (c) residential buildings and building units achieve at the latest: (i) from 1 January 2030, at least energy performance class E; and (ii) from 1 January 2033 at least energy performance class D. In their roadmap, Member States shall establish linear trajectory for the progressive achievement of higher energy performance classes for buildings by 2040 and 2050, in line with the pathway for transforming the national building stock into zero-emission buildings and achieving the climate neutrality target. Zero-emission buildings will become the new standard for new buildings, the level to be attained by a deep renovation as of 2027 and the vision for the building stock in 2050. Primary energy use in kWh/m2.y is the indicator on the basis of which buildings are to be rated.

		Therefore, to be aligned with the requirements of zero-emission building and deep renovation please provide additional documentations for ZE and ZC: • Primary Energy Use that is below the thresholds in ANNEX III. To be compliant with the MEPs please provide an EPC that achieves Class D or better. Note: ZE/ZC buildings will easily achieve an energy performance class D or higher and will be presumably better than the worst-performing buildings of the national building stock. To be aligned with the requirements of renovated zero-emission building, please provide additional documentations for ZE and ZC: • Primary Energy Use that is below the thresholds in ANNEX III.

OC: ZC Requirement 2 (Also ZE)	**New Buildings**	**Existing Buildings**
No new sources of combustion may be added to the project.	ZE/ZC are aligned with EPBD. Member States should introduce measures to ensure that the use of fossil fuel heating systems in new buildings and buildings undergoing major renovation, deep renovation, or renovation of the heating system is not authorised from the date of transposition of this Directive and phase out the use of fossil fuel based heating systems from all buildings by 2035 and if not feasible as demonstrated to the Commission, by 2040 at the latest. ANNEX III: A zero-emission building shall not cause any on-site carbon emissions from fossil fuels.	ZE/ZC is currently aligned with EPBD. The use of fossil fuel heating systems shouldn't be authorised to prove alignment in the future. Member States should introduce measures to ensure that the use of fossil fuel heating systems in new buildings and buildings undergoing major renovation, deep renovation, or renovation of the heating system is not authorised from the date of transposition of this Directive and phase out the use of fossil fuel based heating systems from all buildings by 2035 and if not feasible as demonstrated to the Commission, by 2040 at the latest. ANNEX III: A zero-emission building shall not cause any on-site carbon emissions from fossil fuels. Note: ZC: Existing buildings may utilise existing forms of combustion (add note for phase out plan*) ZE: No combustion may be utilised to meet on-site energy demands.

OC: ZC Requirement 3 (Also ZE)	New Buildings	Existing Buildings
ZE: 100% of the building's energy needs on a net annual basis must be supplied by on-site renewable energy. ZC: 100% of the operational energy use associated with the project must be provided by new on- or off-site renewable energy.	ZE/ZC are aligned with EPBD. ANNEX III: The total annual primary energy use of a new or renovated zero-emission building shall be fully covered, on a net annual or seasonal basis, by: – energy from renewable sources generated or stored on-site and fulfilling the criteria of Article 7 of Directive (EU) 2018/2001 [amended RED], – energy for self-consumption and joined self-consumption within the meaning of Directive (EU) 2018/2001 [amended RED] or local sharing of renewable energyproduction, including through a third-party market actor, or from a renewable energy community within the meaning of Article 22 of Directive (EU) 2018/2001 [amended RED], or – renewable energy from district heating and cooling system or waste heat. Note for ZE: 100% net-annual energy must be supplied by on-site renewable energy. Article 9a (3) Member States shall ensure the deployment of suitable solar energy installations, if technically suitable and economically and functionally feasible, as follows:	ZE/ZC are aligned with EPBD. Article 2: deep renovation means a renovation which transforms a building or building unit (a) before 1 January 2027, into a nearly zero-energy building; (b) after 1 January 2027, into a zero-emission building'. Article 3: Each building renovation plan shall comply with the energy efficiency first principle and shall encompass: a roadmap with nationally established targets and measurable progress indicators, and specific timelines for all existing buildings to achieve higher energy performance classes by 2030, 2040 and 2050, with a view to the 2050 climate neutrality goal, in order to ensure a highly energy efficient and decarbonized national building stock and the transformation of existing buildings into zero-emission buildings by 2050. Article 9a (3) Member States shall ensure the deployment of suitable solar energy installations, if technically suitable and economically and functionally feasible, as follows: (a) by … [24 months after the date of entry into force of this Directive], on all new public and new non-residential buildings; (b) by 31 December 2026, on all existing public and non-residential
	(a) by … [24 months after the date of entry into force of this Directive], on all new public and new non-residential buildings; (b) by 31 December 2026, on all existing public and non-residential buildings; (c) by 31 December 2028, on all new residential buildings and roofed car parks; (d) by 31 December 2032, on all buildings undergoing major renovation.	buildings; (c) by 31 December 2028, on all new residential buildings and roofed car parks; (d) by 31 December 2032, on all buildings undergoing major renovation.

Table 5.3: ILFI ZC/ZE OC requirements Vs EPBD scope for New/Existing Buildings.

ILFI ZC/ZE Program Requirements	EPBD Directives	
EC: ZC requirement 1	**New Buildings**	**Existing Buildings**
The embodied Carbon emissions of primary materials must be reduced 10% compared to a baseline building of equivalent size, function, and energy performance.	The threshold is not defined yet in EPBD for new buildings. ILFI's requirement currently exceeds EPBD scope. The life-cycle GWP should be calculated for each stage to prove alignment in the future. Article 7: New buildings 2. Member States shall ensure that the life-cycle GWP is calculated in accordance with Annex III and disclosed through the energy performance certificate of the building as of 1 January 2027, for all new buildings. 2a. By 31 December 2025, the Commission shall adopt a delegated act to supplement the Directive by setting out a harmonised EU framework for the calculation of life-cycle GWP	Not defined yet in EPBD, ILFI's requirement exceeds EPBD scope. Paragraph 7: The whole life-cycle performance of buildings should be taken into account not only in new construction, but also in renovations through the inclusion of policies and reduction targets of whole life-cycle greenhouse gas emissions in Member States' building renovation plans. Paragraph 7a: A link should be made with the principles of the circular economy and the leading role of the New European Bauhaus initiative, which aims to promote greater circularity in the built environment, by promoting renovation and adaptive re-use over demolition and new build, as appropriate.

	developed in an inclusive stakeholder process and building on the LEVELs framework and standard EN 15978. 2b. By 1 January 2027, to ensure reductions in greenhouse gas emissions, Member States shall publish a roadmap detailing the introduction of limit values on the total cumulative life-cycle GWP of all new buildings and set targets for new buildings from 2030, considering a progressive downward trend, as well as maximum requirements, detailed for different climatic zones and building typologies. Annex III: Calculation of life-cycle GWP of new buildings pursuant to Article 7(2): For the calculation of the life-cycle GWP of new buildings pursuant to Article 7(2), the GWP is communicated as a numeric indicator for each life-cycle stage expressed as kgCO2e/m2 (of useful floor area) averaged for one year of a reference study period of 50 years. The data selection, scenario definition and calculations shall be carried out in accordance with EN 15978 (EN 15978:2011. Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method). The scope of building elements and technical equipment is as	Paragraph 7b: The introduction of requirements on whole life-cycle emissions will encourage industrial innovation and value creation, such as through an increase in the use of circular and natural materials. (8b) Circularity principles avoid the linear use of materials and goods by applying some of the sufficiency principles at the level of product and construction materials. Measures to use and extend the lifetime of secondary materials are essential to ensure that the Union building sector contributes its fair share to the achievement of the climate neutrality objective.

	is as defined in the Level(s) common EU framework for indicator 1.2. Where a national calculation tool exists, or is required for making disclosures or for obtaining building permits, that tool may be used to provide the required disclosure Other calculation tools may be used if they fulfil the minimum criteria laid down by the Level(s) common EU framework data regarding specific construction products and technical building systems as well as their environmental product declarations, and calculated in accordance with [revised Construction Products Regulation] shall be used when available.	
EC: ZC requirement 2	**New Buildings**	**Existing Buildings**
The total embodied carbon of the project building may not exceed 500 kg CO2e/m2.	The threshold is not defined yet in EPBD for new buildings. ILFI's requirement currently exceeds EPBD scope. The life-cycle GWP should be calculated for each stage to prove alignment in the future. Article 7: In setting maximum limit values on the total cumulative life-cycle GWP, Member States shall determine appropriate benchmarks based on reported data for the relevant building types.	Not defined yet in EPBD, ILFI's requirement exceeds EPBD scope.

EC: ZC requirement 3	New Buildings	Existing Buildings
100% of the embodied carbon emissions impacts associated with the construction and materials of the project must be disclosed and offset through the use of on-site carbon-sequestering materials or by a one-time purchase of carbon offsets from an ILFI-approved source.	The threshold is not defined yet in EPBD. ILFI's requirement exceeds EPBD scope. Paragraph 7c: It is crucial to promote and include the use of more sustainable construction materials, in particular bio- and geo-sourced materials. Paragraph 8a: The fact that buildings are responsible for greenhouse gas emissions even before their operational lifetime is the consequence of the carbon already embedded within all building materials. An increase in the use of sustainably and locally sourced nature-based building materials, in line with the principles of the New European Bauhaus initiative and the internal market, has the potential to substitute for more carbon intensive materials and to store carbon in the built environment via the use of wood based materials. Article 7: Member States shall address carbon removals associated to carbon storage in or on buildings.	Same as for new buildings: The threshold is not defined yet in EPBD. ILFI's requirement exceeds EPBD scope.

Table 5.4: ZC/ZE requirements vs EU Taxonomy criteria for New/Existing Buildings.

In Appendix A.2, more clarifications between ZC and ZE in comparison to EBPD are presented, to enhance the reader's understanding on the alignment between the two frameworks.

The tables show areas of aligned requirements between the first environmental objective of the EU Taxonomy and the ZE/ZC standards. They also highlight areas of requirements that substantiation is specific and driven by EU Taxonomy. Zero Carbon and Zero Energy are recognized worldwide as one of the highest aspirations in energy performance in the built environment. Projects must demonstrate actual net zero carbon operations based on a twelve-month performance period, during which time the project must be occupied consistently with its stated use.

Nr.	Technical Screening Criteria (TSC) Construction of new buildings	ZE and ZC Handbook ZE- October 2022 ZC- April, 2023	Alignment
1	**Substantial Contributing to climate change mitigation**		
1.1	The Primary Energy Demand (PED), defining the energy performance of the building resulting from the construction, is at least 10 % lower than the threshold set for the nearly zero-energy building (NZEB) requirements in national measures implementing Directive 2010/31/EU of the European Parliament and of the Council. The energy performance is certified using an as built Energy Performance Certificate (EPC). Note: The NZEB standard applies to all new buildings occupied after the 31st of December 2020.	Zero Energy: One hundred percent of the building's energy needs on a net annual basis must be supplied by on-site renewable energy. No combustion is allowed. Zero Carbon: Projects seeking Zero Carbon certification must meet an energy efficiency target over a 12-month period. The targets are specified based on building type, size, and location: • New Buildings: 25% reduction of energy use intensity (EUI) from an equivalent new building that would comply with ASHRAE 90.1-2010	Zero Energy and Zero Carbon use a different approach: The EU- taxonomy is based on the Primary Energy Demand as an indicator for the energy performance calculation of building; ZE and ZC sets the total net annual energy use as the basis for measurements. It is important to mention that these criteria will be highly achieved for ZE and ZC due to the fact that this building will be an NZEB. It will not have combustion-based heating and/or cooling building systems and 100% of its operational energy use must be provided by renewable energy. Note: ZE: only on-site renewable

		• Existing Buildings: 30% reduction of EUI from a typical existing building of an equivalent type, size, and location • No new sources of combustion may be added to the project. • One hundred percent of the operational energy use associated with the project must be provided by new on- or off-site renewable energy.	energy is accepted. ZC: The building must undergo a 25% reduction of its energy use. Please provide additional documentation for ZE and ZC: • Primary energy demand that is 10% below NZEB Standard.
1.2	For buildings larger than 5,000 m2, upon completion, the building resulting from the construction undergoes testing for airtightness and thermal integrity, and any deviation in the levels of performance set at the design stage or defects in the building envelope are disclosed to investors and clients. As an alternative, where robust and traceable quality control processes are in place during the construction process this is acceptable as an alternative to thermal integrity testing.		Please provide testing for airtightness and thermal integrity. The testing is carried out in accordance with EN13187 and EN 13829 or equivalent standards accepted by the respective building control body where the building is located: • Blower door test (differential pressure measurement according to DIN EN 13829/ EN ISO 9972) • Thermographic measurement (according to DIN EN 13187 or ISO 6781) In some countries, these criteria must be achieved by law.
1.3	For buildings larger than 5,000 m2, the life-cycle Global Warming Potential (GWP) of the building resulting from the construction has been calculated for each stage in the life cycle and is disclosed to investors and clients on demand.	Zero Energy: No requirements Zero Carbon: The embodied carbon emissions of primary materials must be reduced by 10% compared to a baseline building of equivalent size, function, and energy performance.	ZC is aligned with the Taxonomy if the GWP is calculated for each stage (A-D) and not only for A1-A5. Mandatory: The indicator is measured according to the Global Warming Potential (GWP) of the greenhouse gases emitted. The unit of measurement is kg CO2 equivalents per m2 useful

		• The total embodied carbon of the project building may not exceed 500 kg CO2e/m2. • One hundred percent of the embodied carbon emissions impacts associated with the construction and materials of the project must be disclosed and offset through the use of on-site carbon-sequestering materials or by a one-time purchase of carbon offsets from an ILFI-approved source.	internal floor area for a reference study period of 50 years. The results are to be reported for each life cycle stage, of which there are four – production (A), use (B), end of life (C) and additional benefits and loads (D). The system boundary is defined by EN 15978, i.e., from the production of building materials to the end of the building's useful life and the subsequent demolition and recovery of the building materials. Where a national calculation tool exists or is required for making disclosures or for obtaining building permits, the respective tool may be used to provide the required disclosure. Other calculation tools may be used if they fulfil the minimum criteria laid down by the Level(s) common EU framework. Please provide additional documentation for ZE: • Calculations of the life-cycle Global Warming Potential (GWP) in accordance with EN 15978 and the Level(s) framework.

Nr.	Technical Screening Criteria (TSC) Renovation of existing buildings	ZE and ZC Handbook ZE- October 2022 ZC- April 2023	Alignment
1	**Substantial Contributing to climate change mitigation**		
1.1	The building renovation complies with the applicable requirements for major renovations (as set in the applicable national and regional building regulations for 'major renovation' implementing Directive 2010/31/EU. The energy performance of the building or the renovated part that is upgraded meets cost-optimal minimum energy performance requirements in accordance with the respective directive.) Alternatively, it leads to a reduction of primary energy demand (PED) of at least 30%. The 30 % improvement results from an actual reduction in primary energy demand (where the reductions in net primary energy demand through renewable energy sources are not taken into account) and can be achieved through a succession of measures within a maximum of three years.	Zero Energy: One hundred percent of the building's energy needs on a net annual basis must be supplied by on-site renewable energy. No combustion is allowed. Zero Carbon: Projects seeking Zero Carbon certification must meet an energy efficiency target over a 12-month period. The targets are specified based on building type, size, and location: • Existing Buildings: 30% reduction of EUI from a typical existing building of an equivalent type, size, and location • No new sources of combustion may be added to the project. • One hundred percent of the operational energy use associated with the project must be provided by new on- or off-site renewable energy.	Zero Energy and Zero Carbon use a different approach: The EU- taxonomy is based on the Primary Energy Demand as an indicator for the energy performance calculation of building; ZE and ZC sets the total net annual energy use as the basis for measurements. Please provide additional documentation: • Energy Performance Certificates (EPCs) and calculation that shows at least a 30 % improvement of the PED. Please be aware that the initial primary energy demand and the estimated improvement is based on a detailed building survey, an energy audit conducted by an accredited independent expert or any other transparent and proportionate method and validated through an Energy Performance Certificate (EPC). • Alternative: Proof of compliance with the applicable requirements for major renovations as set in the Directive 2010/31/EU

Conclusions

The vision of the EU Commission to decarbonise the construction sector has been one of the primary focuses, due to the poor C02 footprint of the sector. All the key Directives, Frameworks and tools are pointing to a direction where stricter operational efficiency is required as well as reduction of C02 emissions from embodied carbon.

This process cannot happen overnight but the willingness and the determination of the Commission points to a direction that stricter and well-defined requirements will follow, as we move closer to 2050.

For investors and construction professionals this information can be overwhelming as well as it could increase transitional costs of their assets and/or their investments.

The ZC and ZE certifications are unique in nature as they are offering one of the most rigorous standards in the market whilst complimenting the continuously evolving efforts of the EU Commission's targets to reach Zero Emissions buildings. The fact that all of ILFI's are based on metered and proven performance can offer the investor peace of mind that their investments will be safeguarded during the transition towards a decarbonised future.
Moreover, pursuing the ZC and ZE certifications allow companies and their supply chains in their effort to address and reduce their Scope 1,2, and 3 emissions, thus are perfectly aligned with corporates' overall decarbonisation strategies.

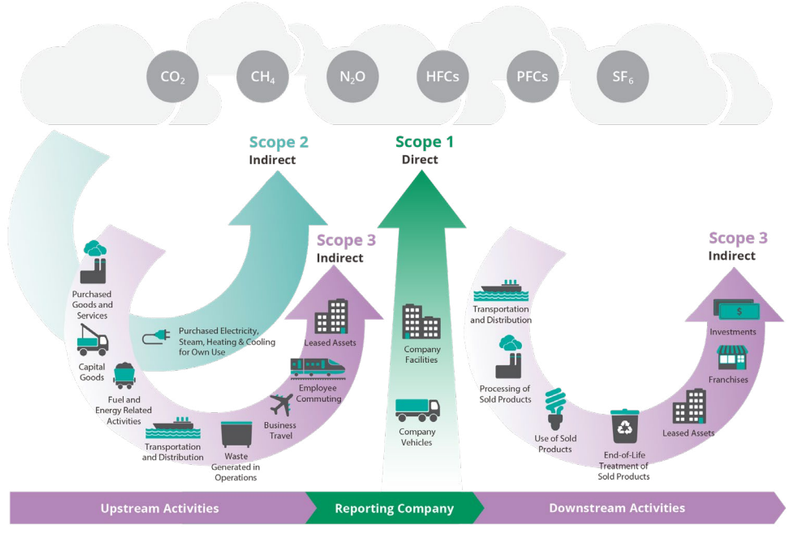

Figure: Overview of GHG Protocol scopes and emissions across the value chain [source: Corporate Value Chain (Scope 3) Accounting and Reporting Standard, World Resources Institute & World Business Council for Sustainable Development]

Appendix A.1: Similarity Tables between Level(s) and ZC/ZE Certification

Indicator 1.1: **Use Stage Energy Performance**	**ZC/ZE Certification:** **Operational Carbon Clarifications**
Level 1: Conceptual Design • Carry out testing of the building in use to identify any performance issues with the building fabric and technical services. • Know where they can focus attention to reduce the total primary energy use associated with the building's delivered energy needs during the use stage. This includes a checklist to inform on design energy. Level 2: Detailed design and construction • This level is for those users who are at the stage of needing to calculate the energy needs and primary energy use of a building for the purpose of design comparisons, building permitting or tendering. Level 3: As-built and in-use • Collect metered data to understand the energy needs associated with the building. • Carry out testing of the building in use to identify any performance issues with the building fabric and technical services.	Operational carbon is addressed by reducing building energy use intensity and then meeting any remaining energy needs with on- or off-site renewable energy sources. Renewable energy sources must be new and owned by or attributed solely to the project in question. Combustion is not allowed in new Zero Carbon buildings. As Zero Carbon is a performance-based standard, both the energy use of the building and the production of the renewable energy system(s) must be monitored to show that a net-zero energy balance is achieved over a continuous twelve-month performance period.

Indicator 1.2.: **Life cycle Global Warming Potential (CO2 eq./m2/yr)**	**ZC Certification:** **LCA clarifications**
Level 1: Qualitative assessments and reporting on the concepts • Incorporate some important life cycle concepts into design and, later, into detailed designs. • Interpret and use the results of previously carried out life cycle GWP assessments and Life Cycle Assessments that are based on the analysis of similar building types. Level 2. An intermediate level, quantitative assessment • Calculate the life cycle GWP emissions of their project and select software tools and databases according to the standard EN 15978. • Interpret and use the results from a 'hot spot' analysis. Level 3. Monitoring and surveying of activity • The same procedure as defined in Level 2 but supported by the certainty of materials procured and technical building systems installed.	Tools used for life cycle assessment calculations must have the capability to complete at minimum a cradle-to-gate analysis in alignment with ISO 14044. The Institute has approved the tools listed in Table ZC-1 for use by project teams to conduct LCA calculations for buildings, materials, and products. In order to increase industry understanding of the LCA process and facilitate more accurate evaluations, tools that reveal their methodology and encourage data transparency, such as the ones listed below, are preferred. The embodied carbon threshold (500 kg-CO2eq/m2) originates from the Carbon Leadership Forum's Embodied Carbon Benchmarking Study that analysed 1,000 building life cycle assessments (LCA's). Embodied Carbon calculations and approved carbon offsets must encompass life cycle stages A1-A5. All projects must account for the total embodied carbon emissions (tCO2e) from construction (including the energy consumed during construction) through the utilisation of carbon-sequestering materials and/or through a one-time carbon offset purchase through an ILFI-approved carbon offset provider. Therefore, ZC is aligned with the Level(s) if the GWP is calculated for each stage (A-D) and not only for A1-A5. Embodied carbon data should be sourced from Environmental Product Declarations provided by qualified program operators on behalf of product manufacturers or industry organisations. All EPDs referenced in calculations should meet the protocols for scope, preparation, and verification as outlined in ISO Standard 14025.

Indicator 2.1: **Bill of quantities, materials and lifespans**	**ZC Certification:** **Building or Material Reuse clarifications.**
Level 1. Qualitative assessments and reporting on the concepts • Be aware of six highly relevant aspects for optimising the consumption of construction materials and products. • Describe how these aspects were considered (or not) during discussions and decision-making at the concept design stage. Level 2. An intermediate level, quantitative assessment • Make an estimate of Bill of Quantities (BoQ) during the design stage that ensures that budgetary limits are respected. • Use an inventory template to insert and manage the BoQ data. Furthermore, by entering optional cost data and lifespans, the BoQ template can generate outputs that are useful for other Level(s) indicators. Level 3. Monitoring and surveying of activity • Register and log BoQ data as materials and products are procured and delivered to the site based on actual quotations and purchases. • Use an inventory template to centralise record of purchases to track spending in line with project budgets and schedules. • Compare with estimates during the design stage.	Projects must both reduce and offset embodied carbon. Reductions can be achieved through building or material reuse, material quantity reductions, or product alternatives. Projects must demonstrate reductions to primary materials through identified intentional actions and quantify reductions using a baseline specific to a typical design of that project's typology. An approved life cycle assessment software must be used in order to quantify the project's total embodied carbon and to verify claimed reductions to primary materials. The impacts of both the primary and interior materials must be included in the project's total embodied carbon, and subsequently, third-party verified carbon offsets must be procured based on this total quantity. Lifespan: All projects should use a standard 60-year lifespan when calculating embodied carbon for consistency to ensure buildings with longer lifespans are not penalised for the carbon impacts of replacing materials over time.

Indicator 2.4: **Design for deconstruction, reuse and recycling**	**ZC Certification:** **Building or Material Reuse:**
Level 1. Qualitative assessments and reporting on the concepts • Understand how the design of a building could facilitate ease of future deconstruction in order to access, disassemble and dismantle parts and materials. • Consider the extent to which these building parts may be recovered for either reuse and/or for recycling. Level 2. An intermediate level, quantitative assessment • This level is for those users who wish to set design targets or who are at the stage of making design decisions and wish to compare design options for their deconstruction potential. Level 3. Monitoring and surveying of activity • This level is for those users who wish to compare the final as-built design with the earlier detailed designs. It can also form the starting point for preparing the technical content of a building passport or building material bank record.	The reuse of buildings is the most effective means to reducing the overall embodied carbon of a project. Therefore, existing building projects may count any in-situ primary materials (foundation, structure, enclosure) against the required reduction percentage. The impacts of any new materials added to the reused building must also be calculated and offset. Similarly, the use of salvaged or recycled primary materials may contribute to meeting the reduction requirement for primary materials. This reduction can be quantified by removing the embodied carbon impacts of the materials that would have otherwise been sourced new. However, projects must still claim and offset all embodied carbon associated with the refurbishment, transport, and installation (i.e., life cycle stages A3-A5, see Figure ZC-1) of the salvaged or reused materials. Any reductions to the embodied carbon of materials are reflected in the embodied carbon offset calculation. Material Quantity reduction: • Building or material reuse • Advanced structural design for material efficiency • Prefabricated construction Material and product alternatives: • Natural/ carbon-sequestering alternatives • Salvaged products • Locally sourced products

Appendix A.2: Key EPBD Directives and alignment with the ZC/ZE Certification Clarifications.

ILFI - Description of Clarification		EPBD Directive
ZC/ZE OC: Energy Budget Clarification - Energy Targets	The Zero Carbon standard defines operational carbon as the total energy required to operate a building, without reference to how that energy is supplied. Accordingly, energy provided by renewable systems, either on-or offsite, may not be factored into achievement of the operational energy efficiency requirements under the Zero Carbon standard. During the twelve-month performance period, projects must perform at the established energy efficiency target.	ANNEX III: Requirements for zero-emission buildings. The total annual primary energy use of a new zero-emission building shall comply with the maximum thresholds indicated in the table of the Annex: Mediterranean: CY, HR, IT, EL, MT, ES, PT, Residential < 60kWh/(m2.y) Office < 70kWh/(m2.y) Oceanic: BE, DK, IE, DE, FR, LU, NL, Residential < 60kWh/(m2.y) Office < 85kWh/(m2.y) Continental: AT, BG, CZ, HU, PL, RO, SL, SK, Residential < 65kWh/(m2.y) Office < 85kWh/(m2.y) Nordic: EE, FI, LV, LT, SE. Residential < 75kWh/(m2.y) Office < 90kWh/(m2.y) For all EU Climatic Zones - Other non-residential building* < NZEB total primary energy use defined at national level. A zero-emission building shall not cause any on-site carbon emissions from fossil fuels.
ZC/ZE OC: Energy Budget Clarification - Metering	Projects must meter their project's energy and report it in the Energy Production and Demand Table. Although sub-metering is best practice and strongly encouraged, it is not required for Zero Carbon certification. Interior projects should only meter energy associated with their interior scope. In cases where that date is not available, energy metering data from the whole building – prorated by area – may be used.	ANNEX I: The energy performance of a building shall be determined on the basis of calculated or metered energy use and shall reflect typical energy use for space heating, space cooling, domestic hot water, ventilation, built-in lighting and other technical building systems. Member States shall ensure that the typical energy use is representative of actual operating conditions for each relevant typology and reflects the typical user behavior. Metered energy to be used for the purposes of calculating the energy performance of buildings shall require readings of at least hourly intervals and must differentiate between energy carriers. Member States may use metered energy consumption under typical operating conditions to verify the correctness of the calculated energy use and enable comparison between calculated and actual performance. Metered energy consumption for the purposes of verification and comparison may be based on monthly readings. The energy performance of a building shall be expressed by a numeric indicator of primary energy use per unit of reference floor area per year, in kWh/(m2.y) for the purpose of both energy performance certification and compliance with minimum energy performance requirements.

ZC/ZE OC: Energy Budget Clarification - Vehicle Charging Energy	The project energy budget may exclude any vehicle charging energy associated with the project, as long as separate metering is installed to accurately track the amount used for vehicle charging and thus excluded from the overall energy budget of the 12-month performance period is equal to that used for vehicle charging. This exclusion is intended to encourage projects to have public charging stations that support non-tenant-owned electric vehicles. If separate metering of charging stations is not feasible, project teams may track the miles driven by the vehicles over the performance period and convert miles driven into electricity using the rated mileage of the vehicles charged.	Paragraph 36: Electric vehicles are expected to play a crucial role in the decarbonisation and efficiency of the electricity system, namely through the provision of flexibility, balancing and storage services, especially through the development of smart charging and aggregation. This potential of electric vehicles to integrate with the electricity system and contribute to system efficiency and further absorption of renewable electricity should be fully exploited including through the installation of a public charging infrastructure in parking spaces. Charging in relation to buildings is particularly important, since this is where electric vehicles park regularly and for long periods of time. Slow smart and bidirectional charging is economical and the installation of recharging points in private spaces can provide energy storage to the related building. Combined with data provided by smart meters and data produced by the vehicle, charging infrastructure for electric vehicles could also provide flexibility solutions and integration of smart and bidirectional charging services and system integration services in general.

ZC/ZE OC: Renewable Energy Clarification - Attribution	Renewables for the project, whether on- or off-site, must be shown to be solely attributed to the project (not double-counted), through ownership or contractual agreement, for a period of at least 15 years. Payment for the renewable energy claimed, if not provided from the owner, must be made on behalf of the project. Renewable Energy Certificates (RECs) generated from the claimed systems: Must be retained or retired by the project, or on its behalf. Cannot be sold or transferred for the purpose of being claimed by another entity (except in the unique situations outlined in Exceptions EC-007 and EC-008. Cannot be purchased to satisfy the energy reduction requirements of Zero Carbon. It is not required that procured renewable energy have a direct electrical connection to the project; however, contractual attribution must be demonstrated.	Article 2: Energy from renewable sources' or 'renewable energy' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas; ANNEX III: The total annual primary energy use of a new or renovated zero-emission building shall be fully covered, on a net annual or seasonal basis, by: – energy from renewable sources generated or stored on-site and fulfilling the criteria of Article 7 of Directive (EU) 2018/2001 [amended RED], – energy for self-consumption and joined self-consumption within the meaning of Directive (EU) 2018/2001 [amended RED] or local sharing of renewable energy production, including through a third-party market actor, or from a renewable energy community within the meaning of Article 22 of Directive (EU) 2018/2001 [amended RED], or – renewable energy from district heating and cooling system or waste heat.

ZC EC: Embodied Carbon Calculations - Approved LCA tools	Tools used for life cycle assessment calculations must have the capability to complete at minimum a cradle-to-gate analysis in alignment with ISO 14044. If a project team uses an approved tool that only encompasses A1-A3, another approved tool must be used to calculate the emissions associated with stages A4-A5. Project teams are responsible for using the tools appropriately and accurately, reflecting the required level of analysis based on the project type. See Table ZC-1 Approved LCA Tools	Article 2: Whole life-cycle greenhouse gas emissions' means the combined greenhouse gas emissions associated with the building at all stages of its life-cycle, considering the benefits from reuse and recycling at the end-of-life, from the 'cradle' (the extraction of the raw materials that are used in the construction of the building) over the material production and processing, and the building's operation stage, to the 'end-of-life' (the deconstruction of the building and reuse, recycling, other recovery and disposal of its materials). Annex III: Where a national calculation tool exists, or is required for making disclosures or for obtaining building permits, that tool may be used to provide the required disclosure Other calculation tools may be used if they fulfil the minimum criteria laid down by the Level(s) common EU framework data regarding specific construction products and technical building systems as well as their environmental product declarations, and calculated in accordance with [revised Construction Products Regulation] shall be used when available.

ZC EC: Embodied Carbon Calculations - Embodied Carbon Scope	Embodied Carbon calculations and approved carbon offsets must encompass life cycle stages A1-A5. All projects must account for the total embodied carbon emissions (tCO2e) from construction (including the energy consumed during construction) through the utilisation of carbon-sequestering materials and/or through a one-time carbon offset purchase through an ILFI-approved carbon offset provider. Total carbon calculations must reflect the built condition of the project, including any substitutions during construction or otherwise that may have resulted in deviations from design calculations.	Annex III: Calculation of life-cycle GWP of new buildings pursuant to Article 7(2): For the calculation of the life-cycle GWP of new buildings pursuant to Article 7(2), the GWP is communicated as a numeric indicator for each life-cycle stage expressed as kgCO2e/m2 (of useful floor area) averaged for one year of a reference study period of 50 years. The data selection, scenario definition and calculations shall be carried out in accordance with EN 15978 (EN 15978:2011. Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method). The scope of building elements and technical equipment is as defined in the Level(s) common EU framework for indicator 1.2.
ZC EC: Embodied Carbon Reduction - Carbon Sequestering products and practices	Projects may claim a benefit from substituting a carbon-sequestering product for one that is carbon producing (e.g., wood vs. steel). Also, the specification of approved third-party certified sustainable harvesting strategies may be claimed as an additional product-specific embodied carbon reduction. The carbon-sequestering benefits of such a product must be described and calculated separately from the embodied carbon of the material itself, even if it is not clearly distinguished in the EPD. At this time, the Institute recognizes Forest Stewardship Council (FSC) certification as an approved third-party sustainable harvesting standard with scientifically verified carbon-sequestering benefits for wood products beyond the sequestration of standard harvesting practices.	Paragraph 7c: It is crucial to promote and include the use of more sustainable construction materials, in particular bio- and geo-sourced materials. Paragraph 8a: The fact that buildings are responsible for greenhouse gas emissions even before their operational lifetime is the consequence of the carbon already embedded within all building materials. An increase in the use of sustainably and locally sourced nature-based building materials, in line with the principles of the New European Bauhaus initiative and the internal market, has the potential to substitute for more carbon intensive materials and to store carbon in the built environment via the use of wood based materials. Article 7: Member States shall address carbon removals associated to carbon storage in or on buildings.

Glossary

ILFI: ZC/ZE certification programs

Combustion: Any burning or combustion of fossil fuels or wood products.

Cradle-to-Gate: Cradle-to-gate refers to a scope (or boundary) of a life cycle assessment. This scope usually represents the life cycle stages from raw material extraction through material processing and product manufacturing, before the product leaves the manufacturer "gate" at the final manufacturing facility or assembly location.

Cradle-to-Grave: Cradle-to-grave refers to a scope (or boundary) of a life cycle assessment. A cradle-to-grave assessment addresses a full product life cycle from resource extraction (cradle) to the end-of-use fate. The use phase and disposal phase of the product are included in this case. Cradle-to-grave assessments are sometimes the basis for environmental product declarations.

Embodied Carbon: Emissions The greenhouse gas emissions associated with the raw material extraction, manufacturing and processing, transportation, and installation of a building material.

Energy Needs: All electricity, heating, and cooling requirements, including resilience strategies, of either grid-tied or off-grid systems. Backup generators are excluded.

Energy Use Intensity (EUI): Energy use intensity expresses a building's energy use as a function of its size or other characteristics and is often expressed as energy (BTUs) per square foot per year.

Environmental Product Declaration (EPD): A transparent and objective report that communicates what a product is made of and how it impacts the environment across its entire life cycle. EPDs can be completed to various scopes (e.g., product-specific, facility-specific, industry-wide) based on availability of data. EPDs satisfy all of the requirements of relevant Product Category Rules (PCRs) for a given product category or type and follow international standards, including ISO 14044, ISO 14025, ISO 21930 and EN 15804.

Forest Stewardship Council (FSC): An independent, non-profit, membership-led organization that protects forests for future generations and sets standards under which forests and companies are certified. Certification consists of three equally weighted principles — environmental, economic, and social — to ensure balance and the highest level of integrity.

Life Cycle Assessment (LCA): A method to assess environmental impacts associated with all the stages of a product's life cycle (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair, maintenance, and disposal or recycling). Defined as compliant with the International Organization for Standardization's ISO 14044 standards.

Local: Of, relating to, or characteristic of a particular place: not general or widespread; primarily serving the needs of a particular limited district. ILFI programs may have more delimited definitions (e.g., of certain distances or qualities) articulated in program requirements.

Operational Carbon: The greenhouse gas emissions associated with the operational energy use of a building, or life cycle stage (B6 as defined by EN 15798). Operational Energy The energy used during the service life of a structure to power base systems, such as lighting, heating, cooling, and ventilating systems. Operational Energy is differentiated from Process Energy, which is energy used to support a manufacturing, industrial, or commercial process that may be housed in a building.

Operations and Maintenance Manual: A document containing information about the building's various systems, including any ongoing actions the owner or property manager must take to ensure continuous optimization of the building's function and performance.

Performance Period: A continuous 12-month period used for evaluating project performance. The performance period does not have to commence at the beginning of occupancy.

Primary Materials: The permanently installed building components that make up the majority of the structural, foundation and enclosure systems of a building.

Product: A finished good composed of one or more homogeneous materials that are in turn made up of chemical substances, or a combination of one or more materials and substance(s), or one or more substances. A product may be made of one or more homogeneous materials. A product may also be organized into parts, which are in turn made up of one or more homogeneous materials. A product may also function as part of another product (Health Product Declaration Collaborative).

Recycled Materials: Post-industrial or post-consumer materials that have been significantly processed or altered from their previous form before reaching their current form.

Renewable Energy: Energy generated through passive solar, photovoltaics, solar thermal, wind turbines, water-powered microturbines, direct geothermal or fuel cells powered by hydrogen generated from renewably powered electrolysis. Nuclear energy is not considered renewable for purposes of LBC or Core. Combustion-based sources are also neither renewable nor allowed in LBC/ Core projects without an Exception.

Renewable Energy Certificate (REC): Renewable Energy Certificates (RECs) are proof that energy has been generated from renewable sources and are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource.

Salvaged Materials: Used building materials that can be repurposed wholly in their current form or with slight refurbishment or alterations. Salvaged consumer goods that are reused as building, finish, or furniture at the end of their life may contribute to a project's salvaged count. Salvaged large furniture items or art elements listed in the specifications can count toward salvaged count when the product is being reused as a salvaged material.

EBPD: Article 2

Zero-emission: Building with a very high energy performance, as determined in accordance with Annexes I and III, which contributes to the optimisation of the energy system through demand-side flexibility, where any very low residual amount of energy still required is fully covered by energy from:

(a) renewable sources generated or stored on-site;

(b) renewable sources generated nearby off-site and delivered through the grid in accordance with Directive (EU) 2018/2001 [amended RED];

(c) a renewable energy community within the meaning of Directive (EU) 2018/2001 [amended RED]; or

(d) renewable energy and waste heat from an efficient district heating and cooling system within the meaning of Directive (EU) .../.... [recast EED], in accordance with the requirements set out in Annex III.

Worst performing building: Building classified in energy performance classes E, F or G.

Minimum energy performance standards (MEPs): Rules that require existing buildings to meet an energy performance requirement as part of a wide renovation plan for a building stock or at a trigger point on the market (sale or rent), in a period of time or by a specific date, in line with the energy efficiency first principle, thereby triggering renovation of existing buildings.

Energy performance of a building: The calculated or metered amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water, lighting and technical building systems.

Primary Energy: Energy from renewable and non-renewable sources which has not undergone any conversion or transformation process.

Renovation passport: Document that provides a tailored roadmap for the deep renovation of a specific building in a maximum number of steps that will transform the building into a zero emission building by 2050 at the latest.

Deep renovation: Renovation in line with the energy efficiency first principle and efforts to reduce whole life-cycle greenhouse gas emissions generated during the renovation, which focuses on essential building items, such as wall insulation, roof insulation, low floor insulation, replacement of external joinery, ventilation and heating or heating systems and treatment of thermal bridges, to ensure the necessary comfort of the occupants in summer and winter or a renovation resulting in a reduction of at least 60 % primary energy demand for worst-performing buildings for which it is technically and economically not feasible to achieve a zero-emission building standard, and which transforms a building or building unit:

(a) before 1 January 2027, into a nearly zero-energy building;

(b) from 1 January 2027, into a zero-emission building.

Staged deep renovation: Renovation carried out in a maximum number of steps, following the steps set out in a renovation passport in accordance with Article 10, which may include the use of energy performance contracts.

Whole life-cycle greenhouse gas emissions: The combined greenhouse gas emissions associated with the building at all stages of its life-cycle, considering the benefits from reuse and recycling at the end-of-life, from the

‘cradle’ (the extraction of the raw materials that are used in the construction of the building) over the material production and processing, and the building’s operation stage, to the ‘end-of-life’ (the deconstruction of the building and reuse, recycling, other recovery and disposal of its materials).

Energy performance certificate (EPC): Certificate recognised by a Member State or by a legal person designated by it, which indicates the energy and climate performance of a building or building unit, calculated according to a methodology adopted in accordance with Article 4.

Reference floor area: The floor area used as reference size for the assessment of the energy performance of a building, calculated as the sum of the useful floor areas of the spaces within the building envelope specified for the energy performance assessment.

On-site: The premises and the land on which the building is located and the building itself.

Energy performance of buildings (EPB) services: The services, such as heating, cooling, ventilation, domestic hot water and lighting and others for which the energy use is taken into account in the energy performance of buildings.

Energy use: Energy input to a technical building system providing an EPB-service intended to satisfy an energy need.

Secondary material: Material recovered from previous use or from waste which substitutes primary materials as defined in the construction framework standard EN 15643.

Circularity: The reduction of the need for extraction of virgin materials through the reduction of demand for new materials, through repair, reuse, repurposing, and recycling of used materials and through the extension of the lifetime of products and buildings.

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EU Ecodesign for sustainable products

A new Circular Economy Action Plan For a cleaner and more competitive Europe

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