MISSION 2050 – DECARBONISING EUROPE

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Strategies and tools to meet the main challenges of the EU's new Energy Performance of Buildings Directive

On 12 March, the European Parliament ratified the final approval of the **new version of the Energy Performance of Buildings Directive** (EPBD).

As part of the European legislative package of **Fit for 55** measures and an essential element of the Renovation Wave Strategy, it sets out a solid roadmap towards sustainability, energy savings and energy efficiency in buildings. The EPBD thus stands as a crucial instrument in the transition to a **climate-neutral Europe by 2050**.

The legislative process was protracted and only accelerated following the publication of the REPowerEU Plan by the European Commission on 18 May 2022. This was accompanied by a legislative proposal proposing amendments to Directive (EU) 2018/2001, which promotes the use of energy from renewable sources, as well as amendments to Directive 2010/31/EU, which deals with the energy performance of buildings, and Directive 2012/27/EU, which focuses on energy efficiency.

The legislation will have to be **transposed into national law within 24 months at the latest**. Therefore, it is expected to be mandatory in 2026. In Spain, the transposition will be carried out through the revision of the Technical Building Code, among other reference regulations in the field of building. **It is in this national legislative design framework where the conditions of application of the European standard, and its potential for compliance by each Member State, will really be defined.**

What is clear, beforehand, is that it will be a key tool in the decarbonisation of the construction sector. In this regard, it should be noted that, according to a study by the Federación Nacional de Asociaciones Inmobiliaria S.A. at national level, more than 80% of the building stock is over 40 years old, which is significant given that these constructions contribute 25% of total greenhouse gas emissions. Therefore, **decarbonisation is not only an environmental imperative, but will be a decisive factor in economic competitiveness and, therefore, in the entire value chain of the construction sector**, including infrastructure, buildings and industry.

Although this is very good news, at this point, there are many questions and challenges that the final text raises for the different actors involved in the process. In a reflective and somewhat daring analysis, some of these challenges are identified below, and possible strategic solutions, methodologies and instruments existing in the market that encourage a correct and effective implementation are highlighted.

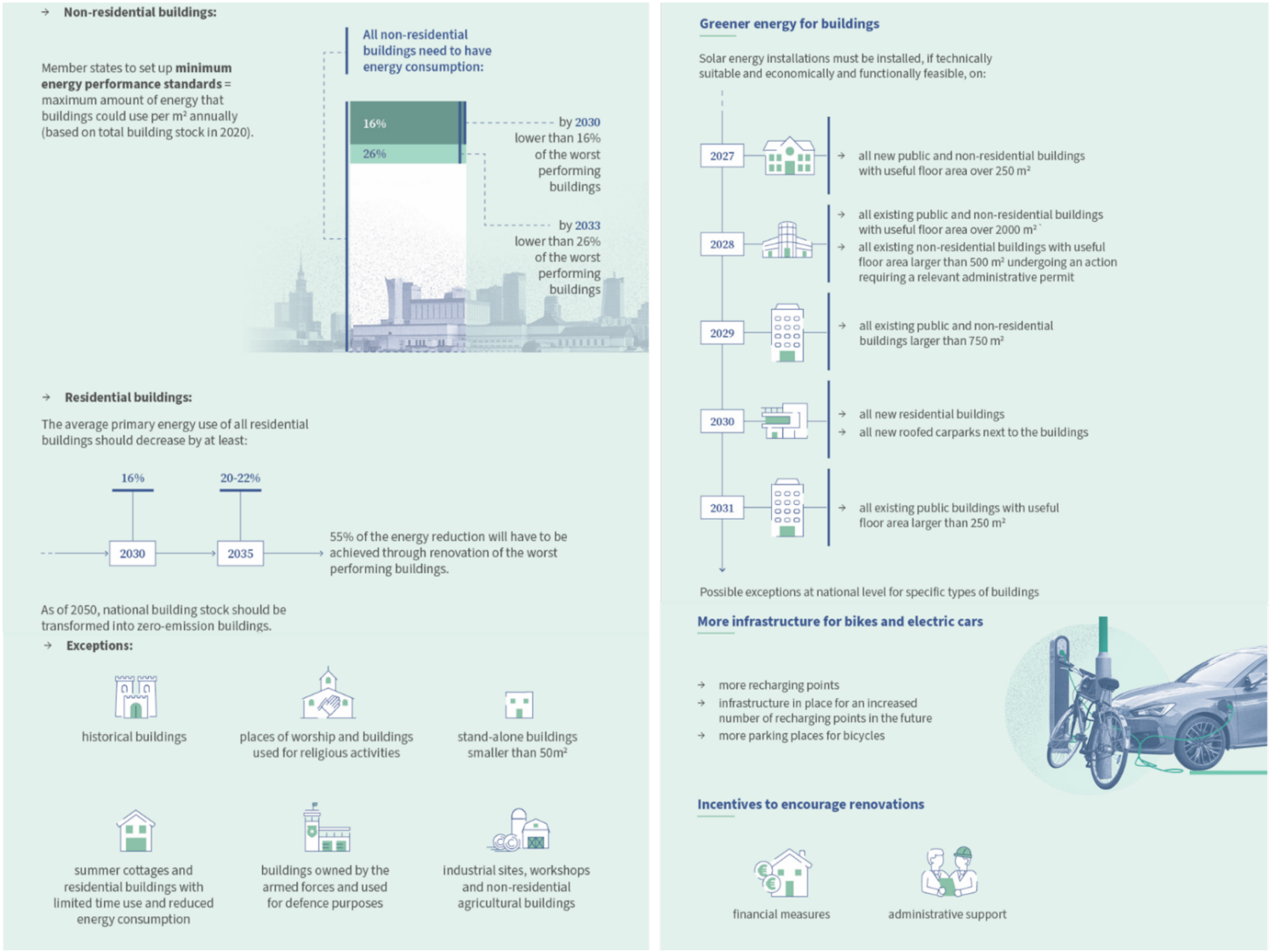

Figure 1. Infographic - Fit for 55: making buildings in the EU greener.
Source: European Council

General framework of the new EPBD

The final version of the Directive retains the key targets of previous drafts, but omits the definition of specific strategies for their implementation. Specific measures have been removed from the document, such as the restriction on renting or placing on the market properties with low energy performance from 2030 onwards. It will therefore **be the responsibility of each Member State to define the detailed action plan to achieve the final targets.**

The Directive sets important criteria for both new and existing buildings, with an emphasis on improving energy performance and incorporating clean technologies and energies, favouring a gradual transition away from fossil fuels.

The text also presents a number of tools, such as the digital register, the renovation passport, the new zero emission building standard, national building renovation plans, energy performance certificates and minimum energy performance standards (MEPS) for Europe as a whole. In addition, it focuses on the **comprehensive renovation of the building stock and the reduction of emissions throughout the building life cycle**, paying special attention to the materials used in the construction process.

These aspects are crucial to achieve decarbonisation goals from an environmental, economic and

social perspective, while preserving the built environment and cultural aspects of the urban landscape. In line with the European initiative of the New European Bauhaus, the Level(s) Framework and other regulatory developments that are also aligned with these efforts.

Full approved text of the New European Directive on the Energy Performance of Buildings

The highlights of the new directive are as follows:

Climate Neutral Buildings. The concept of Nearly Zero Energy Consumption Buildings (NECB) has been changed to **Zero Emission Buildings (ZEB)**. The maximum threshold for the energy demand of zero-emission buildings will be at least ten percent lower than the threshold for total primary energy use set in each Member State for ZEBs. From 2028 it will be mandatory for new public buildings, from 2030 for all other new buildings and from 2050 for all new and existing public and private buildings.

Life cycle approach. The **Global Warming Potential (GWP)** shall be calculated throughout the life cycle of each building, including the production and management of the products used to construct it, thereby promoting transparency and sustainability. To quantify these GHG emissions, both direct and indirect emissions will be taken into account. That is, **operational carbon** (the CO2 equivalent emitted in the operation and maintenance phase of the building) and **embedded carbon** (the CO2 equivalent produced by the materials in their extraction, manufacture, transport, installation and end of life). Until now, regulations have only focused on the calculation of direct emissions. This new approach will promote **life cycle analysis of materials (LCA), Environmental Product Declarations (EPD), and the use of low-carbon materials**, among others.

Urgency to renovate. The Directive distinguishes between the residential and non-residential sectors, establishing progressive retrofitting routes and minimum energy performance standards. For residential buildings there is no direct obligation to retrofit, instead Member States **must reduce average primary energy consumption by 16% by 2030, and by 20% to 22% by 2035**.

A crucial aspect is the creation of a **National Building Retrofit Plan** by Member States to replace the previous Long Term Retrofit Strategies. This plan should include specific targets for 2030, 2040 and 2050, focused on increasing the **annual rate of energy renovation** of buildings (between 0.2% and 1% at EU level in 2019), with an emphasis on renovating the worst performing buildings by 2030. To this end, each country will define the **minimum energy performance** standard. In this regard, the **Energy Performance Certificate (EPC)** will be unified across Europe, which could lead to changes in current ratings.

The concept of the **Renovation Passport** is introduced, a document that will provide a personalised roadmap for the renovation of each building, either in full or in several phases. It will be an instrument to stimulate the renovation of the building stock towards decarbonisation. The creation of "**One-Stop Shops**" (OSS), similar to the current renovation offices, is also encouraged.

Boosting renewables, electrification and phasing out fossil fuels. Measures will be taken to decarbonise air conditioning systems, with a view to **phasing out fossil fuel boilers completely** by 2040. **Solar energy** becomes more prominent, with specific requirements for the installation of solar systems on new and existing buildings under certain conditions, thus promoting **on-site renewable energy generation**.

Main environmental, economic and social challenges of the new EPBD

From an **environmental perspective**, it is anticipated that the new EPBD will contribute significantly to the decarbonisation of the EU building stock. In addition, buildings are expected to become more energy efficient and resilient to the effects of climate change, by implementing new tools that will improve the energy efficiency of buildings, directly reducing CO2 emissions and assessing their performance throughout their life cycle, from the extraction of raw materials to the manufacture of building products, the construction of the building and the management of its operational phase. Adopting a **systemic approach** will be key to achieving a more **sustainable, circular and regenerative** environment.

From a market and business perspective, the new legislative framework has the potential to stimulate the renovation market across Europe. Recent years have already seen a gradual and sustained shift from new building construction to retrofitting and conversion of existing buildings. Although the ideal rate is not yet reached, energy refurbishment now accounts for one third of all business activities in the construction sector at European level.

However, the EPBD **lacks clarity** on the key points on building retrofitting. Member States will have broad flexibility to set their own national trajectories to reduce average primary energy consumption in residential buildings and must meet certain minimum performance standards for non-residential buildings. However, there are numerous possible exemptions and **it is difficult to determine precisely how much and how exactly buildings will need to be renovated**. It is clear that the text does not provide sufficient planning certainties for all actors involved in the value chain. Therefore, the biggest challenge facing the EU in the coming years will be, on the one hand, **to define what is meant by less efficient or worse performing buildings and, on the other hand, to address the challenge of economic viability in terms of renovation.**

CHALLENGE 01.

DEFINITION OF COMMON METHODOLOGIES AND AVAILABILITY OF COMPARABLE DATA TO ADOPT A LIFE-CYCLE PERSPECTIVE AND INCORPORATE CLIMATE PARAMETERS

CHALLENGE 02.

IMPLEMENTATION OF STRATEGIES AT LOCAL LEVEL TO FIRST REFURBISH THE WORST ENERGY PERFORMING BUILDINGS AND TO DEFINE THE DEGREE OF INTERVENTION TO BE APPLIED TO THEM

CHALLENGE 03.

ENSURING FINANCIAL VIABILITY TO MAXIMISE THE POSITIVE IMPACTS ON BUILDINGS AND TO SUPPORT SOUND DECISION MAKING

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Limitaciones actuales para la implementación masiva del ACV

The **most popular LCA software tools**, such as SimaPro, GaBi, openLCA and Ecoinvent, provide databases together with advanced functions for the analysis and visualisation of environmental, economic and social impacts. However, their effectiveness depends on the **technical proficiency of the user** and the **accuracy of data handling**. This becomes particularly relevant when considering the methodological limitations of LCA, ranging from challenges associated with **data collection and quality** to those linked to the **interpretation and valuation of the impacts obtained.**

Firstly, the complex nature of LCA requires detailed and specific data to be collected at all stages of the life cycle of a product or service. Collecting such data can be an arduous and costly task, and is often hampered by the unavailability of up-to-date or geographically relevant data, which can lead to biased results. In addition, the choice of impact categories and assessment methods may vary, thus influencing the final results.

Secondly, once data is collected, interpretation of the results can be subjective, especially in the valuation phase where decisions must be made about the allocation of impacts in multifunctional systems. Comparing and aggregating different types of impacts involves subjective value judgements and often does not adequately reflect the complexities of the real world. For example, the assessment of toxicity and long-term impacts on human health and ecosystems present significant challenges due to scientific uncertainties.

These limitations emphasise the need to apply **expert judgement** and to interpret LCA results with a **critical and contextual approach.**

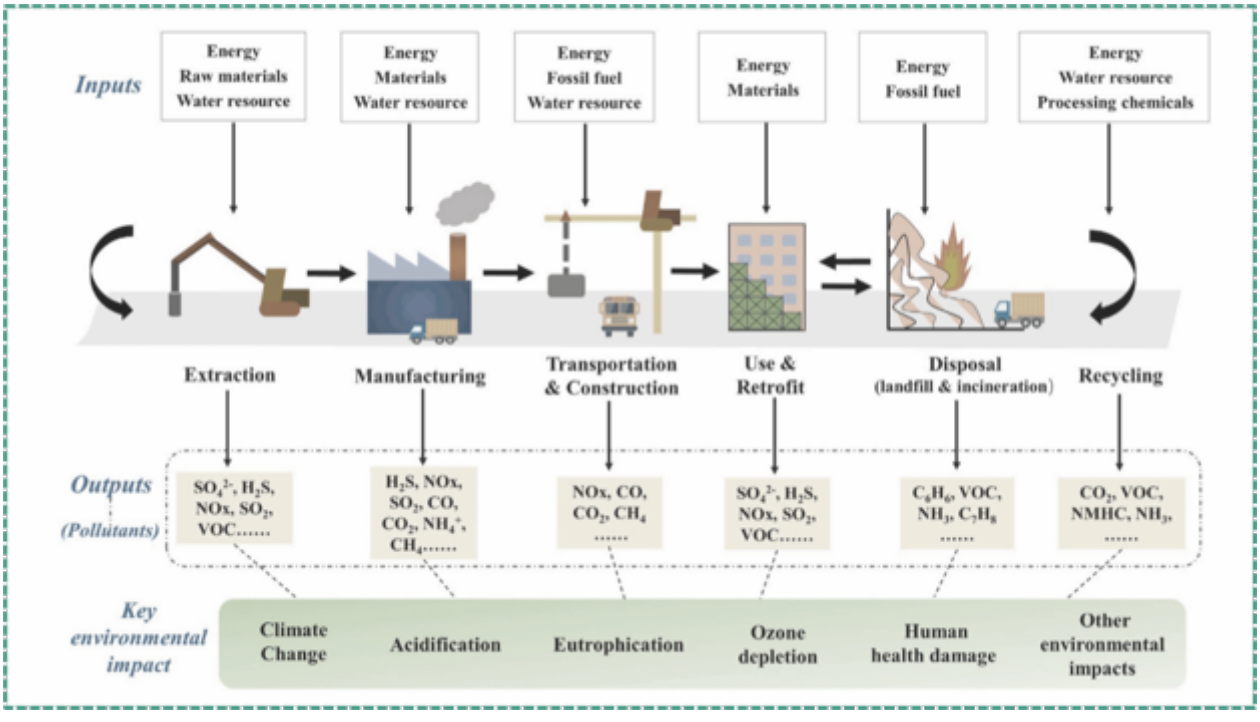

Figure 3. Key Environmental Impacts during the Life Cycle of Building Materials.
Source: A Life Cycle Thinking Framework to Mitigate the Environmental Impact of Building Materials

CHALLENGE 02.

IMPLEMENTATION OF STRATEGIES AT LOCAL LEVEL TO FIRST REFURBISH THE WORST ENERGY PERFORMING BUILDINGS AND TO DEFINE THE DEGREE OF INTERVENTION TO BE APPLIED TO THEM

Tools to Support the Energy Retrofitting and Decarbonisation of Urban Environments

In view of the magnitude of the challenge, and with the aim of supporting decision-making in the field of energy refurbishment of buildings and improving energy efficiency at a local level, Naider has developed the |ReHAB| tool. This allows an exhaustive knowledge of the current state of the building stock in each municipality, as well as the **identification of the possibilities and opportunities for refurbishment and energy improvement** available. Through |ReHAB|, the **costs and impacts associated with different options for action can be assessed**, both in total and in specific segments of each municipality.

The tool is crucial to **assist in the decision making process**, focusing efforts initially on those areas that perform worst. It also plays an important role in raising awareness and accompanying citizens throughout the improvement process. It provides a platform to **communicate** clearly and concisely the **current regulations**, **available funding options** and other particular aspects of each intervention.

Also conceived as a public resource, it allows communities of owners and residents to explore options for the energy retrofitting of their buildings. It facilitates the creation of municipal energy profiles and the implementation of energy retrofit roadmaps, articulated through the Building Retrofit Passport.

In parallel, it enables **detailed economic analyses** for the retrofitting of different building types and **scenario-based strategic planning** to reach decarbonisation targets in time.

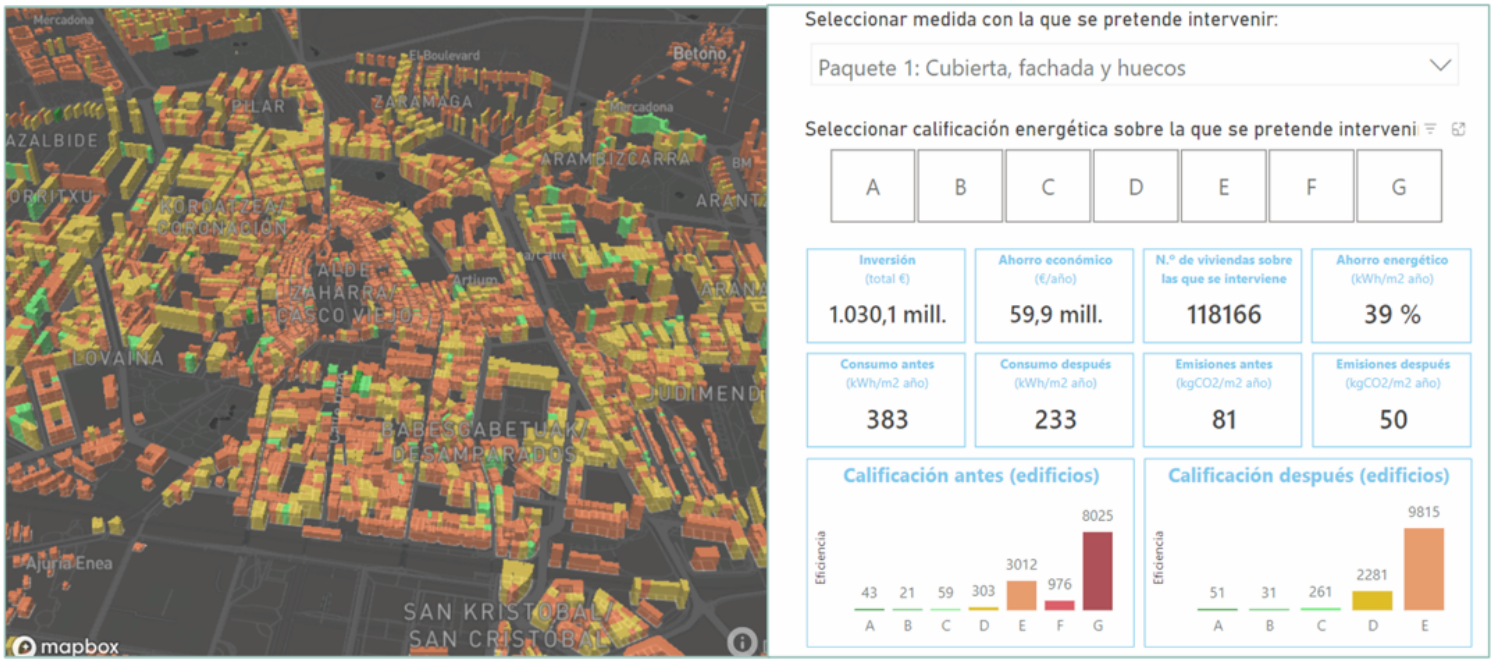

Figure 4. |Re*HAB*| Support tool for energy rehabilitation and decarbonisation of urban environments applied in Vitoria-Gasteiz. Source: own elaboration.

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ENSURING FINANCIAL VIABILITY TO MAXIMISE THE POSITIVE IMPACTS ON BUILDINGS AND TO SUPPORT SOUND DECISION MAKING

Innovative financial instruments for the rehabilitation of existing housing stock

Deep energy retrofits are **very complex processes, requiring technical, financial and management expertise**. In general, they are capital-intensive and although, except in conditions of energy poverty, they lead to savings in energy bills, their payback is long-term and uncertain. Moreover, the financial market often does not offer long-term loans at affordable interest rates.

In a context marked by instability and uncertainty, the EU-driven renovation strategy needs to be socially equitable. This means that it is imperative that low and middle income households receive financial support and technical advice for their energy renovation projects. It is a shared responsibility of Member States and financial institutions to provide such support. On the other hand, **it is essential to establish and maintain a favourable framework that promotes efficient renovations and to explore all the tools offered by the new EPBD.**

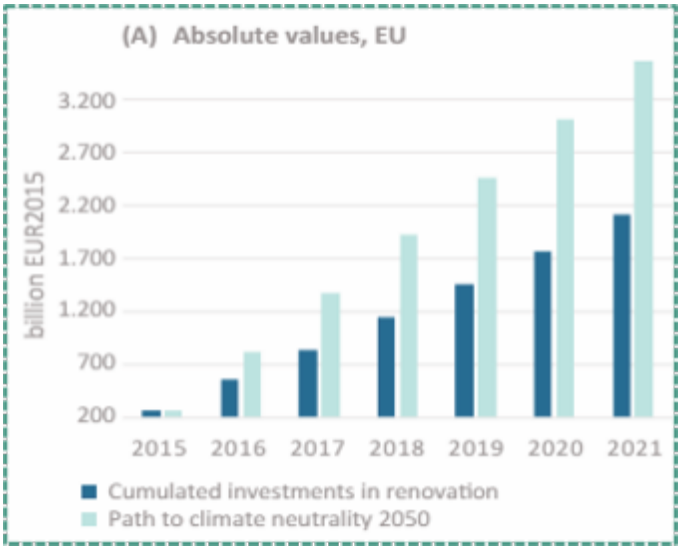

Figure 5. cumulative investment in building renovation in the EU (2015-2021). Source: BPIE

Given the key implications of the financial sector in supporting households and businesses, an important question arises: **are all actors in the construction value chain sufficiently informed about the financial tools and instruments available in the market?** This does not seem to be the case.

This component of knowledge and management of financial resources will be key in the coming years because, if investments and funds are not managed efficiently, they run the risk, at best, of being invested inefficiently.

One stop shops

Precisely to alleviate this lack of knowledge, the **One Stop Shops (OSS)** are a good solution. A rehabilitation support office that informs and accompanies households in vulnerable situations, as a one-stop shop for the identification of the actions to be carried out, their implementation and the processing of aid, attended by local social agents close to these groups who enjoy their trust and know their reality. Opengela could be a good example of this.

The challenge of breaking the status quo: innovative financial instruments based on Sufficiency and Circularity

As part of the report **Financing decarbonisation via innovative economic instruments based on Circularity and Sufficiency**. Financial instruments, economic incentives and drivers for a sustainable built environment 22 innovative instruments based on sufficiency and circularity were identified for the progressive, coordinated and multi-sectoral decarbonisation of the built environment in line with social and environmental objectives of the new EPBD. These instruments are divided into operational and enabling instruments. While the Operational Instruments are ready for use on their own in the current market scenario, they would be more impactful and feasible once the Enabling Instruments have been implemented.

List of innovative financial instruments and economic schemes based on sufficiency and circularity

OIS1 Cesión de uso para cooperativas
OIS2 Bonus de espacio residencial mediante oficinas ventanilla única
OIS3 Excepción de impuestos para viviendas multifamiliares
OIS4 Suficiencia energética vía impuestos de propiedad
OIS5 Hipotecas *Build to Rent* basadas en criterios ESG
OIS6 Política Catalizadora de edificios de cero emisiones (operacionales y embebidas)

OIC1 Valoración de edificios circulares
OIC2 Edificios adaptables
OIC3 Espacios flexibles
OIC4 Acreditación de Estándares de Alta Calidad Ambiental
OIC5 Green Neighbourhoods as a Service (*GNaaS*)
OIC6 Servitización de las partes del edificio. *BPaaS: Building Parts as a Service*

FI01. Facilidades de Financiación para la Economía Verde mediante instituciones financieras asociadas
FI02. Cambio de enfoque de hipotecas
FI03. Bonos climáticos locales a través de financiación colectiva
FI04. Esquemas de financiación on-bill
FI05. Esquema de repago diferencial on-bill
FI06. Programa PACE (Property Assessed Clean Energy)
FI07. Contratos de Rendimiento Energético (EPCs) y Compañías de Servicios Energéticos (ESCOs)
FI08. Acuerdos de Servicio Energético (ESAs) y Compañías de Servicios Energéticos (ESCOs)
FI09. Renovación Energética *Energiesprong*
FI10. Tecnología blockchain y su aplicabilidad en la contabilidad del entorno construido

Cost-benefit analysis applied to energy renovation of buildings

Cost-Benefit Analysis (CBA) is a framework for assessing whether, at a specific point in time, the cost of a particular measure is greater than the benefits from that measure. This tool is frequently used by governments, businesses and organisations to assess their investment decisions, the impacts of these decisions on society and to encourage a more efficient allocation of resources. The most widespread approach to quantify and compare the monetary value of these costs and benefits is the **Net Present Value (NPV)**. The NPV of a project can be defined as the difference between the total social costs and benefits, discounted over the time horizon of the project with a specific discount rate.

CBA offers significant advantages due to its **standardised** and widely recognised **approach** to project appraisal. The elements and rules it employs are well known and provide information in a standard format that benefits both decision-makers and stakeholders. The method is **notable for its flexibility and adaptability**, allowing it to incorporate impacts as diverse as income distribution effects, sustainability for future generations, financial efficiency and externalities into its analysis. It can also simplify the assessment of a project's environmental impact by **reducing it to a single financial indicator such as NPV**.

However, CBA has its limitations. On the one hand, it encounters obstacles when trying to quantify all the benefits of a project, which can restrict its scope. **Choosing an appropriate discount rate can also be a complex process**, as this decision significantly affects the calculation of the present value of future costs and benefits. In addition, the analysis may not fully reflect environmental benefits in the short and medium term, which is a limitation when considering projects with sustainable implications.

Faced with the urgent climate and environmental threat, in recent years, the conventions for conducting LCAs associated with energy retrofitting interventions **have undergone a remarkable evolution**. Some of the key drivers of this transformation, which are important in the transposition and implementation of the EPBD, are as follows:

Economic activities tend to cause **unwanted side effects**, such as pollution, resulting in negative external costs. Theory suggests that the solution would be to include these costs in market prices, although this is complicated in practice and has not yet been fully resolved. Currently, there is a move towards putting a **price on carbon to reduce greenhouse gas emissions**, although this does not yet cover all the associated external costs.

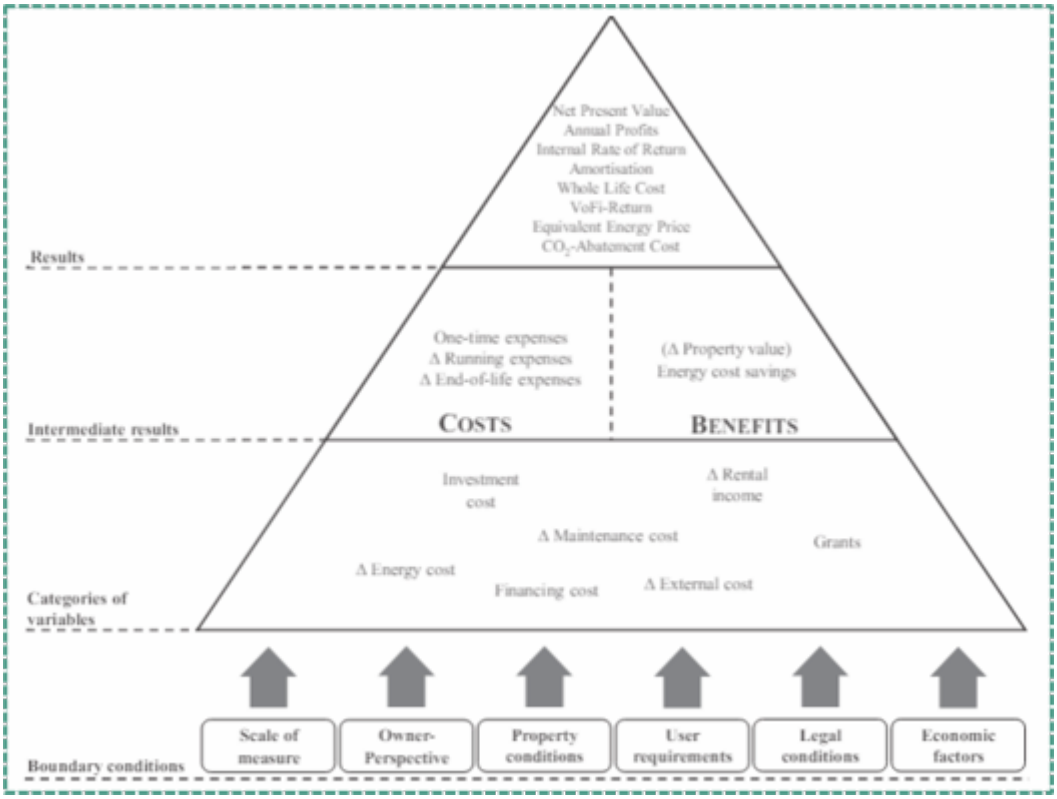

Figura 6. ACB aplicado a la rehabilitación energética. Jerarquía de variables seleccionadas en un análisis de coste-beneficio de renovaciones energéticas.
Fuente: M Buchholz et al 2022.

Non-monetary factors, such as social vulnerability, are crucial in investment decisions and can be integrated into assessment methods.

The need for specific cost-benefit analyses for different stakeholders related to energy efficiency in buildings is growing. Each actor has its own requirements and perspectives. This is driving the **adaptation of assessment methods for each group.**

Effective methods for assessing the risks and benefits of investing in energy retrofitting are essential, minimising uncertainty by taking into account the complexity of the factors and conditions that determine their economic returns. A useful tool for this purpose is **Monte Carlo Simulation (MCS)**, which provides probabilities instead of binary decisions and offers a clear view of risks by including more than 1,000 scenarios in its analysis.

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MAIN INSTRUMENTS OF THE NEW EPBD TO MOVE TOWARDS CLIMATE NEUTRALITY

ZERO EMISSION BUILDINGS (ZEB)	_ Buildings with no fossil fuel heating systems in new buildings _ The definition of ZEBs must have well-defined thresholds for the energy needs of each MS _ New buildings should be constructed as ZEBs as soon as possible	**Final energy consumption and reduction of CO_2 emissions**
LIFE-CYCLE APPROACH	_ Clear principles on how to measure, disclose and limit the full life-cycle carbon of buildings should be defined _ An implementation plan should be developed, including a clear timeline and incentives for data collection and generation	**Reduction of CO_2 emissions**
MINIMUM ENERGY PERFORMANCE STANDARDS (MEPS)	_ MEPS should be designed to address the worst performing buildings first, setting clear targets, milestones and timelines _ MEPS should be accompanied by an effective compliance and enforcement support system to monitor and track their deployment and impacts.	**Final energy consumption, energy costs and CO_2 emission reductions**
ENERGY EFFICIENCY CERTIFICATES (EPCs)	_ EPC thresholds and definitions should be aligned with ZEBs and MEPS _ Quality principles are required for EPCs as a decision support tool (buy/sell, trigger/renewal council, etc.) _ Greater implementation of EPCs and better national databases should be pursued	**Final energy consumption, energy costs and CO_2 emission reductions**
ECONOMIC AND FINANCIAL FRAMEWORK	_ Strategies should be developed to improve access to existing financing programmes _ Financing programmes should be designed and targeted to achieve the greatest energy savings and social benefits	**Investments in retrofitting for final energy savings, reduction of energy consumption**
RENEWABLE ENERGY SYSTEMS	_ Ambitious targets and clear roadmaps for decarbonising heating and cooling systems should be set in national building renovation plans	**Reduction of CO_2 emissions**
ENERGY REHABILITATION	_ Deep renewal should be a guiding principle reflected in the design of all policy measures and funding programmes _ Technical information to support initiatives should be accelerated, e.g. one-stop-shops and strategies to involve inhabitants _ Better schemes should be put in place to monitor the number and type of rehabilitation activities taking place	**Investments in retrofitting for final energy savings, reduction of energy consumption**

Main picture: Danist Soh in Unsplash