Pilot Case Factsheet	Implementing EE1st in Heating and Cooling Plans	Greece

November 2025

Background and objectives

The main aim of the Greek pilot case was the formulation of **heating and cooling strategies** and the development of the respective **investment plans** at the different administrative levels (e.g. national, regional and local/municipal) through the implementation of the EE1st (Energy Efficiency First) principle.

The Greek pilot case facilitated the compliance with the provisions of **Article 3 of the EED** (Energy Efficiency Directive (EU) 2023/1791) in regards the assessment of the different planning, policy and major investment decisions for the promotion of energy efficient heating and cooling technologies through the application of the EE1st principle. Moreover, the Greek pilot case provided useful insights and a robust methodological basis for the effective implementation of **Article 25 of the EED** in order to carry out the foreseen heating and cooling assessment and planning at national and local level in accordance with the EE1st principle. Another objective of the Greek pilot case was to enhance the utilised procedure within the framework of the **National Energy and Climate Plan** (NECP), ensuring that the most effective heating and cooling technologies will be promoted.

More specifically, the **comprehensive assessment on heating and cooling**, which is foreseen within the framework of Article 25(1) of the EED, should be carried out according to the developed methodological approach. The role of the **CBA (Cost-Benefit Analysis)** methodology is essential due to the fact it will facilitate the identification of the most resource- and cost-efficient solutions to meeting heating and cooling needs, taking into account the EE1st principle as stated in Article 25(3) of the EED. It should be noted that the comprehensive assessment covers all the administrative levels of the Greek territory. Moreover, the developed methodological approach will be utilized for preparing also the **local heating and cooling plans**, which are foreseen in Article 25(6) of the EED for the case of municipalities with a total population more than 45,000 people.

The Greek pilot case assessed the contribution of the energy efficiency and RES (Renewable Energy Sources) interventions compared to additional investments for natural gas or other conventional fuel infrastructure in terms of costs and benefits, to **avoid potential stranded assets** and other negative consequences when natural gas or other conventional fuel infrastructure cannot be justified by the cost-benefit analysis. In addition, the Greek pilot case facilitated the **identification of demand-side resources** that could partly or fully substitute natural gas or other conventional fuel infrastructures and compare them with other types of planned infrastructures more energy efficient and beneficial for the whole society.

Methodology

The methodological approach, which was developed within the framework of the Greek pilot case, is fully aligned with the provisions of the EED as regards the conduction of the **comprehensive assessment** on heating and cooling. Emphasis was given on integrating the developed methodological approach into the foreseen procedure for the effective implementation of the comprehensive

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assessment as will be outlined within the expected guidelines by the European Commission. To this direction, the Commission Recommendation (EU) 2019/1659 of 25 September 2019 on the content of the comprehensive assessment was taken into consideration.

The main outcome of the methodological approach was the improvement of the current energy planning procedure resulting in the **selection of the most cost-benefit technical solutions** and in the identification and design of the required policy measures for their unhampered promotion (such as the imposition of a regulation or the provision of an incentive). Moreover, the necessity to continue the development of energy infrastructure and/or conventional energy systems was assessed also.

The main steps of the developed methodological approach include:

- **Step I**: Specification of the **geographical and system boundaries** (e.g. national, regional, local/municipal levels) and other details of the analysis (e.g. timeline).
- **Step II**: Identification of **all the available energy efficiency options**, which can be assessed through the application of the EE1st principle, combining energy efficiency heating and cooling technologies with interventions in the building envelope and RES technologies.
- **Step III**: Selection of the **conventional/baseline options**
- **Step IV**: Selection of the **applicable energy efficiency options**, assessed through the application of the EE1st principle and considered as alternative options based on technical criteria and specification of the required data for the estimation of the triggered costs and benefits.
- **Step V**: **Quantification and monetization** of the triggered costs and benefits (considering also the distribution of costs and benefits along the timeframe of the analysis).
- **Step VI**: Conduction of the **financial CBA**, which took into account the **private investor's perspective**, using the conventional discounted cash flow approach to assess net returns.
- **Step VII**: Conduction of the **economic CBA**[1], which took into account the **society's perspective**, i.e. with socioeconomic and environmental factors and covering changes in the welfare of society as a whole (i.e. level of prosperity and standard of living).
- **Step VIII**: Conduction of **sensitivity analysis** for determining the fluctuation of the obtained results due to the most uncertain parameters (e.g. changes in investment and operating costs, fuel and electricity prices, CO_2 quotas; and effects on the environment).
- **Step IX**: Design the required **policy measures** taking into consideration the obtained results from the financial and economic CBAs.

The EE1st principle also implies a **broad discussion and cooperation** (e.g. for data collection, agreeing on key assumptions). The involved stakeholders include the Ministry of Environment of Energy, Regulatory Authority of Energy, Regional Authorities, Association of Greek Regions, Local Authorities, Central Union of Municipalities of Greece, CRES, Technical Chamber of Greece, Hellenic Agency for Local Development and Local Self-Government, National Technical University of Athens, National Observatory of Athens, Natural Gas Transmission and Distribution Network Operators and NGOs.

[1] The CBA adopting the society's perspective is sometimes also called SCBA (Social Cost-Benefit Analysis).

Main results

The analysis was carried out at national level in order to assess thirteen different energy efficiency options in typical buildings of the residential and tertiary sectors.

The analysis led to the conclusion that:

- **All the examined energy efficiency options in residential buildings have a benefit-cost ratio higher than one, with the exception of efficient biomass and natural gas boilers**, demonstrating their positive impact to the social welfare.
- The installation of **aerothermal heat pumps only for the coverage of the heating demand**[2] has the **highest performance** compared to the interventions in the building envelope and the other alternative systems.
- The potential **combination of aerothermal heat pumps with interventions in the building envelope and PV systems** leads to slightly similar results demonstrating that its potential selection is **fully justified from the social perspective**.

Furthermore, an additional scenario was examined for the case of the heat pumps so as to satisfy also the cooling needs (cf. **reversible heat pumps**), assuming an increased investment cost for upgrading the existing distribution network and installing fun-coils units. The obtained results showed that the **additional investment cost** is **counterbalanced by the additional benefits** due to the coverage of both the heating and cooling demand. This solution is therefore cost-effective.

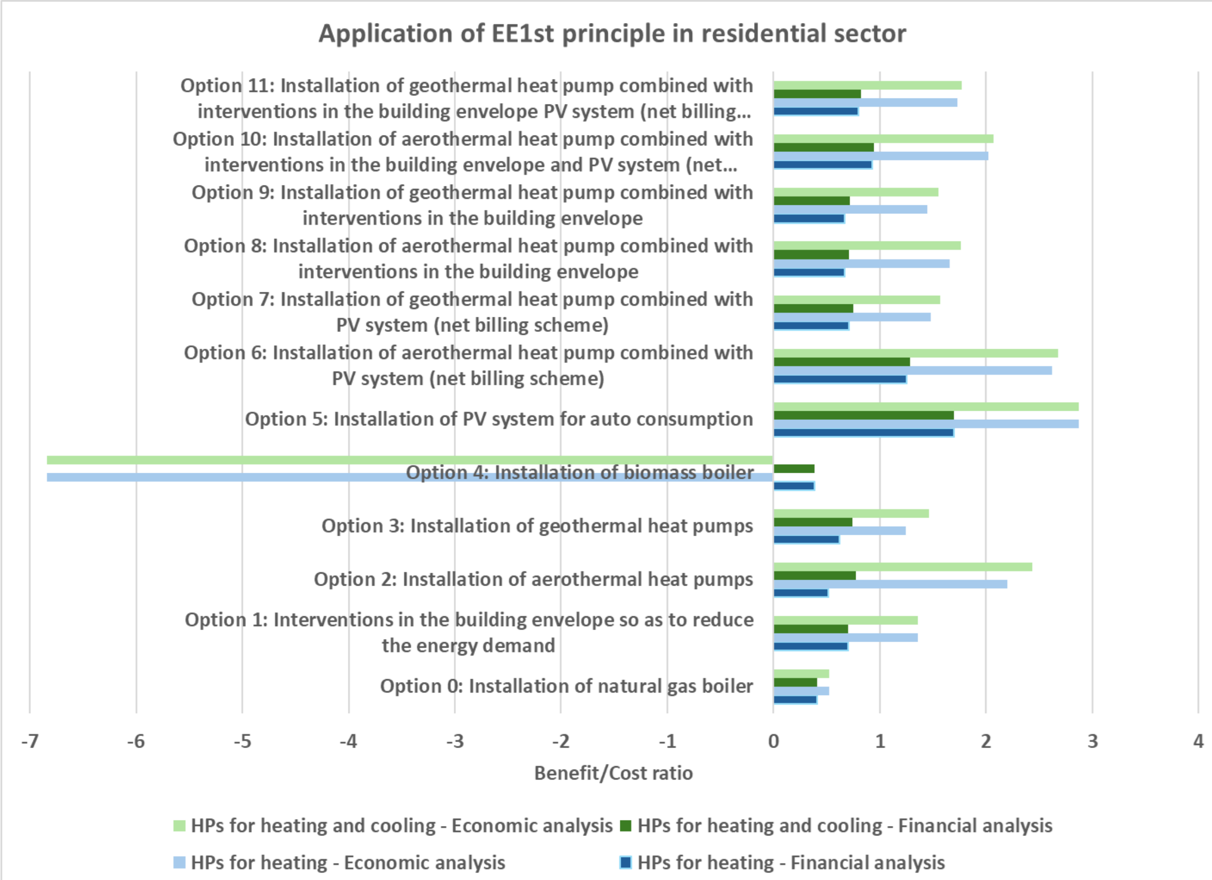
For the case of the buildings in the **tertiary sector**, similar conclusions were derived for the case that the heating oil is used in the baseline. The installation of aerothermal heat pumps seems to be the most beneficial option for maximizing the social welfare, while all the examined energy efficiency options have positive outcome with the exception of efficient biomass and natural gas boilers. However, the social profitability of the natural gas boilers is improved considerably in the case that electricity is considered as a baseline fuel, mainly due to the fact that the electricity price in Greece is considerably higher compared to natural gas. Nevertheless, the alternative of the aerothermal heat pump continues to be more efficient from societal point of view compared to the natural gas boilers.

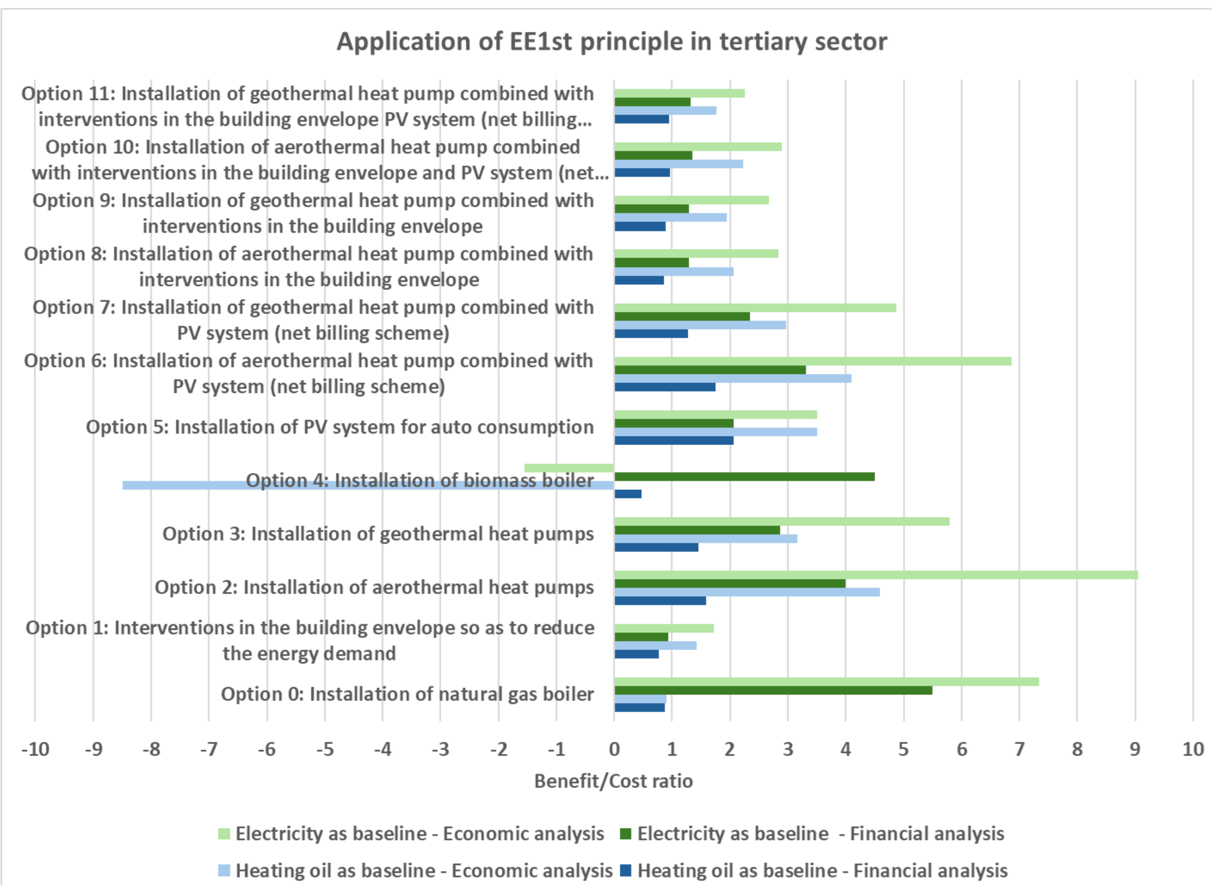
Finally, the analysis of the examined energy efficiency options in the **industry sector** confirmed their positive contribution to the social welfare leading to the conclusion that they should be promoted within the framework of the EE1st principle.

The **detailed analytical results** are presented in the following diagrams (next page) for the residential and tertiary sectors separately, showing the benefit/cost ratio for each of the 11 options assessed in the CBA:

- The higher the ratio, the more beneficial the option, for the investor (financial CBA, lighter colours) or the society (economic CBA, darker colours). Options are considered beneficial when the ratio is higher than 1.
- The results also distinguish the assumption about the use of heat pumps, for heating only (in blue) or for both, heating and cooling (in green).

[2] Differentiated here from reversible heat pumps that can be used for both, space heating and space cooling.


Application of EE1st principle in residential sector
Option 11: Installation of geothermal heat pump combined with interventions in the building envelope PV system (net billing...
Option 10: Installation of aerothermal heat pump combined with interventions in the building envelope and PV system (net...
Option 9: Installation of geothermal heat pump combined with interventions in the building envelope
Option 8: Installation of aerothermal heat pump combined with interventions in the building envelope
Option 7: Installation of geothermal heat pump combined with PV system (net billing scheme)
Option 6: Installation of aerothermal heat pump combined with PV system (net billing scheme)
Option 5: Installation of PV system for auto consumption
Option 4: Installation of biomass boiler
Option 3: Installation of geothermal heat pumps
Option 2: Installation of aerothermal heat pumps
Option 1: Interventions in the building envelope so as to reduce the energy demand
Option 0: Installation of natural gas boiler
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4
Benefit/Cost ratio
HPs for heating and cooling - Economic analysis
HPs for heating and cooling - Financial analysis
HPs for heating - Economic analysis
HPs for heating - Financial analysis


Application of EE1st principle in tertiary sector
Option 11: Installation of geothermal heat pump combined with interventions in the building envelope PV system (net billing...
Option 10: Installation of aerothermal heat pump combined with interventions in the building envelope and PV system (net...
Option 9: Installation of geothermal heat pump combined with interventions in the building envelope
Option 8: Installation of aerothermal heat pump combined with interventions in the building envelope
Option 7: Installation of geothermal heat pump combined with PV system (net billing scheme)
Option 6: Installation of aerothermal heat pump combined with PV system (net billing scheme)
Option 5: Installation of PV system for auto consumption
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Option 3: Installation of geothermal heat pumps
Option 2: Installation of aerothermal heat pumps
Option 1: Interventions in the building envelope so as to reduce the energy demand
Option 0: Installation of natural gas boiler
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
Benefit/Cost ratio
Electricity as baseline - Economic analysis
Electricity as baseline - Financial analysis
Heating oil as baseline - Economic analysis
Heating oil as baseline - Financial analysis

Where/how implementing EE1st makes a difference

The EE1st principle reshapes the framework for conducting CBA by **broadening the range of options considered**. Whereas a “classical” CBA would typically focus on comparing supply-side technologies—such as boilers, heat pumps, or district heating expansions—EE1st also requires examining demand-side measures like insulation, energy-efficient building envelopes, and the integration of renewable self-consumption systems. This wider scope ensures that reducing demand is properly assessed alongside improving supply, often revealing that energy efficiency measures can provide equal or greater benefits at lower cost and risk.

Another important difference lies in the **broader scope of impacts assessed**. A classical CBA generally focuses on the examination of direct investment, operation, and energy costs or savings. By contrast, EE1st pushes for the inclusion of externalities and co-benefits, such as reductions in greenhouse gas emissions, improvements in air quality and related health benefits, enhanced energy security, and even macroeconomic impacts like GDP growth or job creation. These additional dimensions allow decision-makers to see the full value of efficiency-oriented strategies rather than focusing narrowly on financial flows.

EE1st also emphasizes on a **longer-term perspective**. Traditional CBAs might evaluate projects over relatively short horizons, such as 10 years, potentially underestimating the long-lived benefits of efficiency measures in buildings or infrastructure. Under EE1st, assessments are encouraged to apply global cost analysis over longer periods, often 20 years or more, capturing lifecycle savings, technology evolution, and enduring societal benefits. This approach aligns investment decisions with long-term energy and climate policy goals.

Moreover, the EE1st principle embeds **procedural and governance differences**. EE1st requires public authorities to adopt methodologies that make these wider benefits transparent, consider impacts on vulnerable groups (such as energy poverty), and integrate stakeholders in co-design processes, as shown in the Greek pilot case. A classical CBA tends to be a more technical, isolated exercise, while EE1st transforms it into a **participatory and policy-aligned** tool that better supports integrated energy planning and the achievement of climate neutrality.

The implementation of the developed methodological approach within the framework of the Greek pilot case will ensure that all the relevant policy documents (e.g. NECP, comprehensive assessment and local heating and cooling plans) will be **consistent and streamlined** leading to the effective achievement of the specified energy and environmental targets. Obviously, the application of the EE1st principle will facilitate the identification of the most viable heating and cooling options for the whole society, so as to be included into the policy documents to be drafted.

Moreover, valuable insights can be obtained about whether the investments promoted within the framework of the natural gas development plans and the NECP would comply with the EE1st principle, and about recommendations for the promotion of the most effective options.

Considering that the regional and local authorities are responsible for the compilation of the local heating and cooling plans and the comprehensive assessment will cover at least the national level, it can be concluded that the EE1st principle can be applied to the different administrative levels (e.g. national, regional, local/municipal), facilitating the selection of the most socially viable heating and cooling solution.

All the end-use sectors will benefit also from the developed methodological approach for the coverage of the heating and cooling needs. Even if the emphasis will be given initially on the building sector (residential and tertiary sectors), the industrial and agricultural sectors will be further explored according to the requirements of the Article 25 of the EED.

Finally, the potential implementation of interventions to **reduce the heating and cooling demand** (mainly in the building envelope) along with the promotion of energy efficient heating and cooling technologies will be explored also providing indications if it is more beneficial to combine interventions in the building envelope with energy efficient heating and cooling options or the sole installation of heating and cooling technologies (e.g. heat pumps) should be prioritized.

Stakeholder's experience: Vicky Sita (Ministry of Environment and Energy)

1. **What criteria are used to compare energy efficiency technologies (e.g. heat pumps, insulation, district heating) with conventional options such as gas boilers?**

In Greece, energy efficiency technologies that address heating and cooling demand (e.g., heat pumps, solar thermal systems, etc.) are evaluated against conventional options (e.g., natural gas or heating oil boilers) within the framework of the National Energy and Climate Plan (NECP) and the Comprehensive Assessment in line with the provisions of the Energy Efficiency Directive (EED). These assessments, based on identifying technologies that minimize overall energy costs, support the prioritization of policy measures and investment actions.

In addition to cost considerations, the analyses account for several other factors, including energy prices —which differ across electricity, natural gas, heating oil, LPG, and biomass— and key technological characteristics such as the coefficient of performance (COP) for heat pumps and the efficiency ratio of boilers. Climatic conditions are also a major determinant, as Greece is divided into four climate zones with distinct heating and cooling requirements, influencing the performance of different technologies across regions.

Moreover, upfront investment costs —covering equipment purchase and installation— are integral to the comparison. Finally, long-term economic and environmental aspects are also evaluated, such as operation and maintenance expenses and the anticipated reduction of greenhouse gas (GHG) emissions, as Greece strives to meet EU climate targets and enhance air quality.

2. **How does the application of the EE1st principle change the results of the cost-benefit analysis compared to a traditional approach?**

In Greece, the implementation of the Energy Efficiency First (EE1st) principle is expected to reshape the decision-making approach by shifting the focus from supply-side to demand-side solutions. Under the existing framework, priority is typically given to conventional heating systems or additional energy production capacity, with decisions based primarily on direct financial costs and returns. This approach often undervalues energy efficiency measures, as their broader multiple benefits —such as job creation, reduced energy imports, and improved thermal comfort— are not fully integrated into the decision-making process.

By introducing cost-benefit analyses, the EE1st principle ensures that these wider impacts are systematically accounted for, making energy efficiency investments appear more favorable compared to conventional options. Measures that may have previously seemed costly or less attractive under traditional assessments become more advantageous from a societal perspective once avoided energy supply costs, environmental benefits, and social gains are included in the analysis.

Consequently, this approach provides stronger justification for subsidies, financing mechanisms, and regulatory support aimed at promoting efficient technologies. In practice, the EE1st principle can reorder investment priorities, guiding households, businesses, and policymakers toward solutions that maximize long-term societal value rather than short-term financial returns.

3. How are social, environmental, and economic co-benefits (e.g. reduced emissions, improved air quality, job creation) integrated into the planning?

Social, environmental, and economic co-benefits should be integrated into energy planning to expand the scope of evaluation beyond direct financial costs and energy savings through a well-balanced approach based on the positive and negative externalities for all the examined heating and cooling options. For example, the reduction of both greenhouse gas emissions and air pollutants constitutes a fundamental component of the assessment, as it contributes to lower mortality and morbidity rates. Furthermore, indicators such as GDP growth and job creation should be incorporated into the analysis to capture the broader economic impacts.

Energy security is also a critical factor for Greece, given the country's high import dependency and reliance on fossil fuels. In addition, particular attention should be paid to the effects associated with alleviating energy poverty and the link between energy renovation and the increased market value of buildings.

These co-benefits should be quantified and monetized within a transparent analytical framework that enables the implementation of comprehensive cost-benefit analyses. Such an integrated approach ensures that decision-making reflects not only immediate financial returns for investors but also long-term societal benefits, allowing policymakers and stakeholders to prioritize solutions that deliver the greatest overall value.

4. What policies or incentives are recommended to ensure the uptake of the most cost-effective heating and cooling solutions?

To promote the adoption of the most cost-effective heating and cooling solutions in Greece, a combination of financial incentives and regulatory measures is recommended. Subsidies and grants can reduce the upfront costs of energy-efficient technologies, making them more affordable for households and businesses. Low-interest loans and preferential financing schemes can further mitigate financial barriers, enabling users to invest in high-efficiency systems without bearing significant immediate expenses. Additionally, tax credits or rebates for energy-efficient installations can accelerate market uptake.

Regulatory measures complement financial incentives by shaping the market framework and ensuring long-term energy efficiency improvements. For instance, phasing out or restricting the installation of oil and conventional gas boilers strengthens the incentive to adopt cleaner alternatives. Building codes and energy performance standards can mandate higher efficiency levels in new constructions and renovations, securing sustained energy savings over time. Furthermore, information campaigns and technical assistance programs can raise awareness of the benefits of efficient technologies and help consumers navigate available support schemes, thereby maximizing the overall effectiveness of policy interventions.

It is also important to note that economic and financial cost-benefit analyses (CBAs) are applied from both the investor's and the broader societal perspectives. Specifically, when financial returns are negative but economic benefits are positive, subsidies represent the most appropriate policy instrument to encourage adoption. When both financial and economic CBAs are positive, the investment is profitable for private investors and generates net benefits for society. In such cases, the project is financially viable on its own, but access to financing tools —such as low-interest loans or dedicated credit lines— can accelerate deployment and alleviate liquidity constraints.

Conversely, if the financial CBA is positive but the economic CBA is negative, the investment may yield private profits while imposing net costs on society, for example through increased emissions, environmental degradation, or other negative externalities. In these cases, public policy typically seeks to discourage such investments through measures like taxes, penalties, or restrictions on financing access. Finally, when both financial and economic CBAs are negative, the investment is neither profitable nor socially beneficial and is therefore deemed unviable, as it fails to deliver either financial returns or societal value.

About Enefirst Plus

Enefirst Plus is a 3-year project (November 2023 – October 2026) co-funded by the EU LIFE programme. Building on the previous Horizon 2020 Enefirst project, the aim of Enefirst Plus is to provide key stakeholders in all Member States with the technical support needed to effectively implement Energy Efficiency First across various sectors, particularly focusing on key decision-making processes.

Energy Efficiency First (EE1st) is an overarching principle for planning, policies and major investments having an impact on energy consumption. EE1st is about considering **energy efficiency and demand-response as energy resources** in the energy system, just as supply-side resources (e.g. generation capacities, network infrastructures). Implementing EE1st means that in planning exercises, policy design or decision-making about investments, the options considered include energy efficiency and demand-response, and that these options are compared with supply-side options on a **fair basis**, considering **multiple impacts and a long-term perspective**.

Implementing EE1st is easier said than done. Therefore, the general approach of Enefirst Plus is to complement existing resources to **plug EE1st in the decision making** for investments in energy infrastructure, energy planning, and designing incentives and policies.

Enefirst Plus is testing this approach in four countries (Croatia, Italy, Greece and Poland) and scrutinise the implementation of EE1st with **pilot cases** in each country. Two cycles, with four pilot cases each, will provide a diversity of **real-life examples** addressing typical situations where EE1st should be implemented. The new resources and pilot cases produced by the project, as well as experiences from other countries, serve as foundational elements for capacity building and experience sharing activities, and for the development of a community of practice.

Enefirst Plus' partners

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