



## CULTURAL-E

Climate and cultural based design and market valuable technology solutions  
for Plus Energy Houses

**Position Paper on the impact of Plus Energy Buildings on  
the community**

The European Commission adopted on 15 December 2021 its legislative proposal for the revision of the Energy Performance of Buildings Directive (EPBD). The Cultural-E project welcomes the Commission’s aspiration to deliver on the Renovation Wave by improving the energy performance of buildings and promoting the reduction of greenhouse gas emissions from buildings.

The EU H2020 project [Cultural-E](#) is going a step beyond the concept of Nearly Zero Energy Buildings (nZEBs), by proposing the concept of *Plus Energy Buildings* (PEBs). The goal of the project is to account for climatic and cultural differences in the definition of the first generation of European PEBs. Previous studies have shown how socio-cultural and climatic features can have a significant impact on the building users’ everyday practices and energy-related behaviours, as well as on their comfort expectations, preferences and requirements regarding the indoor environment. A great variety of factors play a key role in the process, ranging from climatic differences and personal climatic history to social norms, cultural habituation, contextual boundaries, social dynamics, etc. These aspects shall be considered and become an integral part of the design process and of the identification of operational strategies. However, they are currently generally neglected, both in common practice and in the guidelines and standards commonly consulted by professionals, leading to a recognized gap in the buildings’ performance between the design and the operational phase.

**Cultural-E acknowledges the new definition of Zero-Emission Building, proposed by the EU Commission in Article 2**, to become the new standards by 2030: *‘A building with a very high energy performance in line with the energy efficiency first principle, and where the very low amount of energy still required is fully covered by energy from renewable sources at the building or district or community level where technically*



*feasible (notably those generated on-site, from a renewable energy community or from renewable energy or waste heat from a district heating and cooling system).'*

Nevertheless, the introduction of the new concept of Zero Emissions Buildings, which will progressively replace the existing Nearly Zero Energy Buildings, will create new requirements for Member States to implement and the sector to adapt to, whereas the logical future step would have been to go beyond and pave the way for Plus Energy Buildings, which have several advantages:

- producing more energy than they consume and feeding RES-based (renewable energy source) energy to the grid, PEBs represent a key step towards the decarbonization of the building sector and energy independence. In this way, PEBs can support e.g., older/ historic buildings, where the transition to zero energy state would not be possible or cost-efficient.
- PEBs contribute to reducing the energy grid congestion by providing a flexible energy asset that allows buildings and energy communities to act as integrated parts of the energy system and exchange energy (electrical, thermal energy, or other future energy carriers) among them or with the grid.

Furthermore, the Cultural-E project refers to Plus Energy Buildings instead of Positive Energy Buildings, in order to include additional aspects to the positive energy balance relevant for the final users' satisfaction such as accessible, comfortable, and healthy indoor environments. We strongly promote a paradigm shift from 'less impacting' to 'more providing'. As a result, **it is vital to support Plus Energy Buildings with adequate policies such as the EPBD** as, besides the direct benefits i.e. energy consumption and GHG emissions reduction, they additionally bring various indirect effects or co-benefits to the district and community. According to Cultural-E, *co-benefits are the added positive values that can be obtained, in addition to the direct and measurable impacts which derive from high-efficiency energy buildings or from the energy renovation of existing buildings and their technologies. They can be household co-benefits if they have an effect on the user's well-being and household economy, or community co-impacts if they have wider economic, social and environmental effects.*

In this regard, the project's research team has identified various co-benefits that range from the user's wellbeing to the economic sector, the social and environmental sphere, e.g.:

- **public health:** local pollution reduction and improved Indoor Environmental Quality (IEQ) leading to reduced costs for public health/ reduced morbidity;
- **energy security and alleviation of energy poverty:** reduced electricity consumption and costs, relief of external grid through contribution to the energy grids, eventually leading to a reduction of dependency on fossil fuels and reduction of import costs;
- **energy transition:** building decarbonization and increased share of electro mobility;
- **sustainability:** reduction of CO<sub>2</sub> emissions and environmental resource protection, increased resilience to climate change mitigating urban heat island effects.



Thus, the Cultural-E project would like to put forward the following **definition of Plus Energy Buildings to be included in the EPBD**:

*A Plus Energy Building is an energy efficient building that **produces more final energy than it uses** via locally available renewable sources over a time span of one year. Building uses include both building operation and user related energy consumption. The positive balance shall be reached while ensuring the **lowest greenhouse gas emissions** and a **good dynamic matching** between load and generation, according to economic affordability and to technical viability.*

*The definition applies to all-electric buildings and the energy balance is based on **measured or predicted final energy** between load and generation (1).*

*The energy generation shall be performed by **renewable energy systems located within building footprint** and can be extended to adjacent lots as long as there is a physical connection and direct control of renewable energy generation system relying on ownership of the buildings or lots, neighborhood grid infrastructure and building management. Besides the plus energy balance verification, PEBs shall ensure an added value i) to the context by providing **building flexibility and easy access to e-mobility** and ii) to final users by providing **accessible, comfortable, and healthy indoor environments**.*

- (1) In case of new buildings electrification is an inevitable process. In case other renewable energy vectors are used in the building (i.e., biomass, biogas...), final energy balance shall be zero.

This definition is the result of a systematical analysis on the key aspects of the energy balance definition (metric, period of balance, energy uses included in the balance, type of balance and boundaries) and their practical implications, in particular:

- Final energy as a metric is directly measurable and predictable, and therefore easier to understand for final users.
- Including all energy uses in the balance ensures that the building has an energy production surplus to be shared with other buildings. The full impact of the users is included by considering the plug-loads (i.e., the building appliances). This would contribute to empowering building energy end-users to reduce energy consumption and to change the mindset of designers from performance-driven to user-centered design.
- A time span of one year for energy balance evaluation is the most feasible to evaluate the energy balance and verify the plus energy target.

Currently investors lack guidelines on how to monetize the co-benefits. In fact, such side effects are generally addressed in a qualitative way, and thus they are neither properly integrated in a comprehensive evaluation of the building's performance nor in business models. A step forward in this direction could in the future significantly support the promotion, acceptance and spread of Plus Energy Buildings among the community. To evaluate in monetary terms the co-benefits from Plus Energy buildings, it is useful to integrate direct costing with stated preference methods, and in particular, with the discrete choice experiment approach. While for some co-benefits a "price tag" can be inferred from their direct or indirect relation with goods and services for which a market exists, some co-benefits are highly subjective and have no market price or substitute goods that can be used to estimate their value: this is the case for instance, for the economic value of improved indoor environmental quality. Such exercise will provide a



more comprehensive picture of how people may benefit from Plus Energy Buildings and reduce the risk of biased decisions about the social opportunity of investing in this kind of buildings in terms of their potential to improve public health, increase energy security, alleviate energy poverty, aid in the energy transition, and increase sustainability.

Furthermore Cultural-E would like to respond to elements relating to **Indoor Environmental Quality (IEQ) and the way it is perceived by users as an essential feature of PEBs**. Cultural-E supports the various mentioning of the importance of a healthy indoor environment for European citizens. We specifically welcome **Article 11** on technical building systems: *‘Member States shall require zero-emission buildings to be equipped with measuring and control devices for the monitoring and regulation of **indoor air quality**. In existing buildings, the installation of such devices shall be required, where technically and economically feasible, when a building undergoes a major renovation.’*

While this attempt goes in a good direction, the project’s team recommends that IEQ is more strongly acknowledged in the further implementations and more extensively exploited. Moreover, even though indoor air quality is a key share of IEQ -especially recognized after these latest years of pandemic- it is necessary to endorse that it is just one of four parameters necessary for the achievement a healthy indoor environment. In fact, **indoor environmental quality is defined by 1) thermal, 2) visual, 3) acoustic, and 4) air quality**. As a result, we would welcome a replacement of Indoor Air Quality in the EPBD with Indoor Environmental Quality.

