

Proceeding Paper

Placing on the Market Modern Construction Products and Systems Contributing to Next Generation of Healthy, Nearly Zero-Energy Buildings [†]

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Abstract: In Europe, the construction sector currently generates more than a third of CO₂ emissions. Moreover, residential buildings consume about 40% of the energy that we are able to produce. Construction product manufacturers implement innovative solutions that give us a chance to achieve more widespread construction of zero-emission and zero-energy buildings. However, they face legal barriers related to the lack of standardization procedures enabling the rapid placing of innovative construction products on the market to be achieved. The MEZeroE project ("Measuring Envelope products and systems contributing to next generation of healthy nearly Zero Energy Buildings"), funded by European Union Horizon 2020, aims to create a platform combining science and business to facilitate the development of nearly zero-energy buildings. The aim of this paper is to present the European procedure for placing innovative construction products on the market under the MEZeroE project.

Keywords: innovative construction products; placing on the market; standardization procedures; a platform connecting science and business; MEZeroE; nearly zero-energy buildings



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1. Introduction

In accordance with the requirements of Directive 2010/31/EU [1], as amended, all buildings designed from 2021 onwards must be nearly zero-energy buildings (nZEBs). Buildings according to this standard should be characterized by low or zero demand for non-renewable primary energy and a high degree of use of energy from renewable sources produced on site or nearby. Climate-neutral construction is possible, but it requires innovative materials, construction techniques and legislation based on sustainable development. It also requires rising carbon costs to be reflected in building solutions, with no barriers to their adoption. Low-carbon solutions must become the norm and thus be more competitive than conventional solutions.

Demographic and urban trends indicate that over the next three decades, the number of people living in urban areas will increase by another two billion people and that 60% of the infrastructure that humanity needs is still to be built. In Europe, two-thirds of the population already live in cities. However, many urban centers are struggling with a housing shortage and the need to replace outdated infrastructure. Buildings are energy intensive and carbon intensive, and more than 30% of waste in European landfills comes from demolished buildings [2].

The challenge for the construction industry is to meet the growing demand for high-quality housing and infrastructure while transitioning to low-carbon construction and a circular economy. Currently, in Europe, the construction sector generates more than one-third of CO₂ emissions, and residential buildings consume around 40% of the energy that we are able to produce. Manufacturers of building materials implement innovative solutions

that have a chance to achieve the widespread construction of zero-emission and zero-energy buildings. However, they face legal barriers related to the lack of standardization procedures enabling the rapid placing of innovative construction products on the market to be achieved [3].

The aim of the paper is to present the European platform developed and tested under the “Measuring Envelope products and systems contributing to next generation of healthy nearly Zero Energy Buildings” (MEZeroE) project [3], which is financed by European Union Horizon 2020 and supports the placing of innovative construction products on the market.

2. The Procedure for Placing Construction Products on the Market in the EU

Regulation EU No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (CPR) [4] setting harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC [5] set out the conditions for placing construction products on the market or making them available on the market. It establishes harmonized rules for expressing the performance of construction products in relation to their essential characteristics and harmonized rules for the use of CE marking on these products.

In Poland, the regulation was introduced by the Act of 16 April 2004 on construction products [6], which defines the rules for placing construction products on the market. It approximates the executive acts and laws of all EU Member States relating to construction products. Pursuant to Article 5 of this Act, a construction product covered by a harmonized technical specification, i.e., a harmonized standard or European technical assessment (ETA), may be placed on the market or made available on the internal market only and exclusively in accordance with the provisions of the CPR [4].

According to the diagram in Figure 1, the European system [4] enables a construction product to be placed on the market on the basis of a harmonized standard or ETA. The CE marking and placing on the European market of construction products covered by harmonized standards have an established procedure and do not represent a problem for manufacturers. For construction products not covered or not fully covered by harmonized standards, an alternative route to CE marking is the route provided by the European Organization for Technical Assessment (EOTA). This route gives manufacturers the opportunity to apply for ETA. The manufacturer may issue a Declaration of Performance and affix the CE marking on the basis of the ETA. ETAs are issued by technical assessment bodies (TABs) on the basis of European assessment documents (EADs), developed by the EOTA and cited by the Commission in the Official Journal of the European Union.

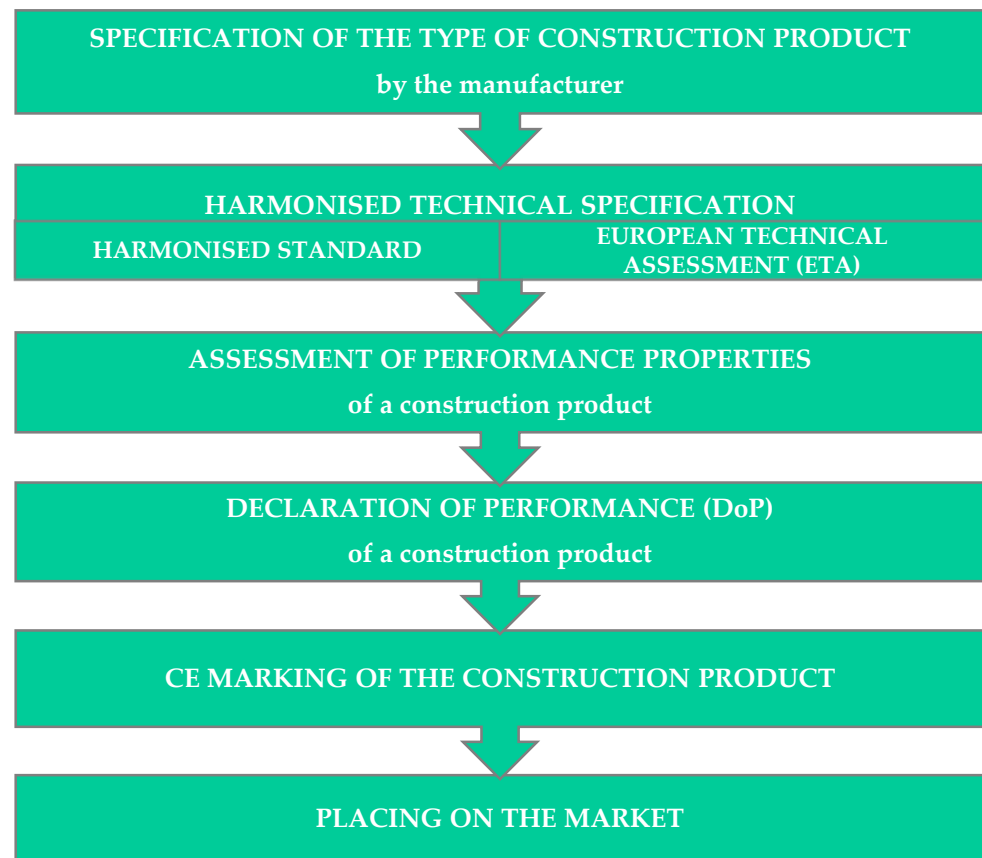


Figure 1. Diagram of placing construction products on the market [4].

3. Main Barriers to the Placing of Modern Construction Products on the Market

The Commission 2016 report on the implementation of the CPR identified some shortcomings in the process of implementation and significant challenges related to standardization, simplification for micro-enterprises, market surveillance and enforcement that merit further analysis and discussion. The evaluation of the CPR, the opinions of the REFIT Platform and the feedback from Member States and stakeholders have clearly identified barriers to the functioning of the single market for construction products and the ensuing failure to achieve the objectives of the CPR [2].

The “Clean energy for all Europeans” communication of November 2016 stresses the need to unlock the potential for growth and jobs by improving the functioning of the still fragmented single market for construction products. European Green Deal Communication, Circular Economy Action Plan and Renovation Wave Communication highlight the role of regulating the common provisions in the efforts towards energy- and resource-efficient buildings and renovations and in the sustainable development of construction products. The proposal for a revised directive on the energy performance of buildings emphasizes the importance of looking at the total greenhouse-gas emissions of buildings and construction materials throughout their life cycle in calculating the global warming potential of new buildings from 2030. EU Forest Strategy and Sustainable Carbon Cycle Communications were announced in the context of the revision of the regulation on construction products, developing a standard, robust and transparent methodology for quantifying the climate benefits of construction products and of carbon capture and utilization. In addition, both the European Parliament and the Council called for action to promote the circulation of construction products, to remove barriers to the single market for construction products and to contribute to the objectives of European Green Deal and the Circular Economy Action Plan [7].

Accordingly, two general objectives of the CPR review have been set [2]:

- Achieving a well-functioning single market for construction products.
- Contributing to the goals of the green and digital transitions, in particular, a modern, resource-efficient and competitive economy.

This review aims to address the following issues:

3.1. Lack of Harmonized Standards for Modern Products

So far, the standardization process underlying the CPR has not yielded satisfactory results. In recent years, draft harmonized standards developed by European standardization organizations have rarely been cited in the Official Journal of the EU, mainly due to legal issues such as contradiction with the requirements of the CPR or going beyond the scope of a mandate/request for standardization. The lack of citation of current harmonized standards for construction products is considered a key factor undermining the internal market, as outdated harmonized standards generate direct or indirect costs for businesses, especially SMEs. The standardization process is too slow to keep up with the development of the sector. The resulting standards may not always be appropriate for the market, nor may they meet the regulatory needs of Member States [2].

3.2. The EOTA Route

The EOTA route, which is the CPR alternative route for CE marking for construction products not covered, or not fully covered, by harmonized standards, also points to the poor performance of the standardization system. Poor performance results largely from long waiting time for the preparation of ETAs, as well as from problems with establishing EDOs for modern construction products [2].

3.3. Implementation Challenges at the National Level

The CPR Implementation Report identified some shortcomings in the functioning of Notified Bodies (NBs) and Notifying Authorities, indicating that the relevant provisions of the CPR would benefit from greater accuracy, among others, of requirements for NBs (Article 43), operational responsibilities of NBs (Article 52) and coordination of NBs (Article 55).

The simplification provisions in Annex 8 of the CPR, mainly aimed at small and medium companies, include Art. 5 (deviations from the preparation of the Declaration of Performance—DoP), Art. 36 (avoiding unnecessary repetition of tests), Art. 37 (simplified procedures for micro-enterprises) and Art. 38 (simplified procedures for products manufactured individually or to order in a non-series process). The use of these articles, with the exception of Art. 36, remains very limited. These provisions were intended to lead to a simplification effect, to reduce the administrative costs of placing construction products on the market without compromising the level of safety of construction works. However, various assessments and feedback from stakeholders indicate a low uptake of these simplification provisions, mainly resulting from the low awareness of their existence and from the lack of clarity, especially in specifying what “equivalent” documentation actually is. In conclusion, the attempt to level the playing field for smaller companies, especially through Art. 37, has failed. Additionally, the appropriateness of measures that allow certain manufacturers to implement such lighter procedures is questioned, given that this creates uncertainty for end-users who can reasonably expect that all CE-marked products conform to the same procedural requirements. The evaluation showed that while the CPR procedure was achieved, it did not meet expected levels.

While the CPR was expected to reduce costs and administrative burdens, it actually resulted in the opposite effect. The estimates from the study on the economic impact of the CPR show that the smallest businesses bear the greatest administrative burden.

Moreover, some provisions of the CPR are not sufficiently clear or overlap, either within the regulations themselves or between the CPR and other EU legislation. For example, Art. 9 sec. 2 of the CPR lists the information that must accompany the CE marking, most of which the manufacturer has already provided in the Declaration of

Performance (DoP). This has been the subject of strong criticism since the beginning of the implementation of the CPR. Overlap of the information required in the Declaration of Performance and CE marking creates unnecessary administrative and financial burdens and represents clear inefficiency. When it comes to clarity and coherence between the CPR and other EU legislation, there are a number of areas where they overlap or contradict each other, including Ecodesign Directive and several other product/technical directives. This results in a lack of clarity for the procedures established for construction products on the market, in particular with regard to parallel routes of CE marking [2].

3.4. CPR Misalignment on Green and Digital Transitions

In order to reduce emissions and achieve climate neutrality by 2050, the industry needs to be mobilized to make the transition to a climate-neutral and circular economy, especially in resource-intensive sectors such as construction. The building stock, which currently accounts for 40% of final energy and 36% of EU greenhouse-gas emissions, has a large cost-effective emission reduction potential. The European Climate Pact has recognized the need to use low-carbon materials to make buildings more climate friendly [2].

3.5. Fragmentation and Complex Structure of the Construction Market

The fragmentation and complex structure of the construction market are among the main barriers to technological innovation in this sector, due to the many disciplines involved. Design and production are typically distributed across a large number of enterprises, with a significant predominance of SMEs, and long and multi-faceted supply chains, making it difficult to bring together different specialists. The hallmark of an accepted technology is its inclusion in standards such as building codes and specifications, which provides designers, professionals, practitioners and contractors with certainty as to the profitability of the technology, the information necessary for its use and lower perception of the risk associated with its use [2].

4. Assumptions of the MEZeroE Platform [3,7]

The MEZeroE project aims to create an ecosystem combining infrastructural facilities and the knowledge of academic and research centers, and innovative solutions proposed by the industry in the form of a multilateral virtual market, open to the exchange and use of knowledge and experience between stakeholders from the construction industry. The ecosystem aims to provide ready-made services in the fields of modeling, testing and monitoring nZEB Enabler Envelope Technologies Solutions (nEESs), while creating a comprehensive knowledge management and training environment (Figure 2).

The task of the project is to take into account the trends of Industry 4.0 in the field of quick decision making and customer orientation open to innovation, with a focus on manufacturers of carbon-neutral construction products and a healthy indoor environment.

As part of the project, standard, modified and non-standard products are tested using state-of-the-art equipment. Support is also provided for manufacturers in the certification of the product and its placing on the market. Standard tests have been extended with tests in living laboratories located throughout Europe, where a new parameter of a variable expressing user feedback concerning the comfort of use has been introduced.

Access to MEZeroE is possible through the online platform (<https://www.mezeroe.eu/>, accessed on 1 December 2022), which is a multilateral virtual marketplace with a single entry point. This market includes nine pilot lines of measurement and verification (PM&VL) and three open innovation services (OISs) covering training, business model development, systematic intellectual property and knowledge management. The team of Cracow University of Technology constitutes the PM&VL7 line, which is composed of four sublimes performing tests on durability, mechanical, vibroacoustic and thermal performance. MEZeroE will accelerate the placing of prototypes on the market as certified construction products.

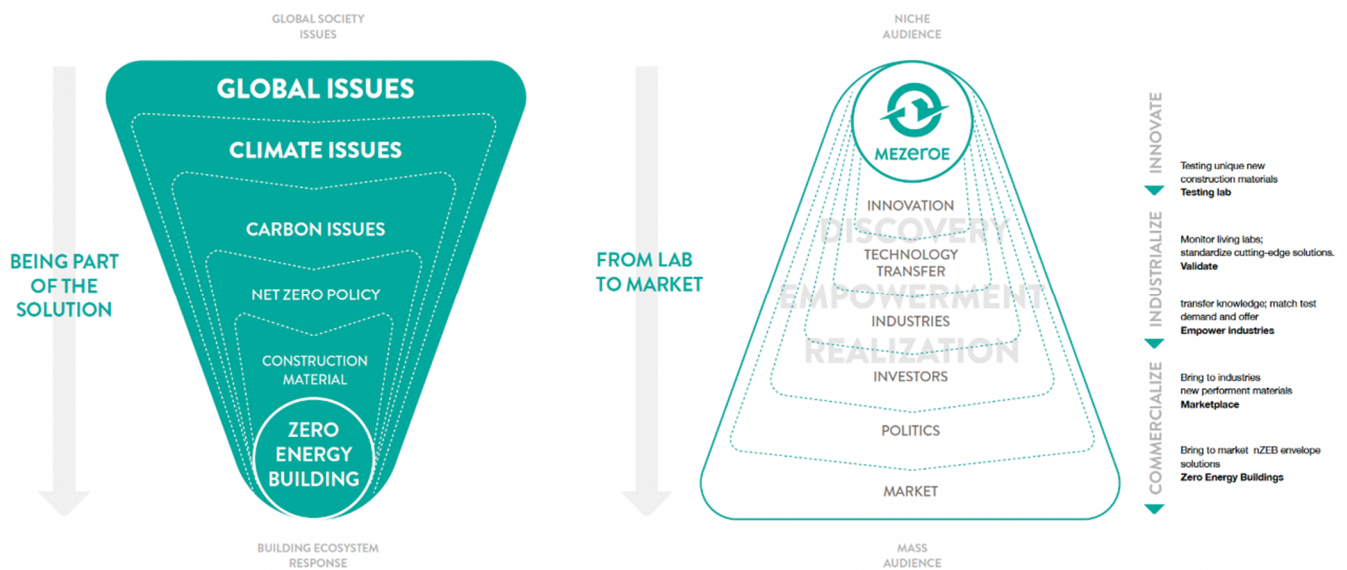


Figure 2. Diagram of the MEZeroE platform (schema by COMPAZ).

5. Open Innovation Services (OIS) in MEZeroE [3,7]

One of the key activities in the field of open innovation services of the OIS1 team is the creation of standard procedures for the certification and CE marking of construction products for modern construction products supplied by industrial partners. In addition, OIS1 is intended to create a roadmap for product certification and CE marking for groups of innovative products used in nZEBs and a general framework to support the creation of new roadmaps for specific products outside the consortium.

The innovation service is primarily addressed to manufacturers, but also in relation to ISO 17025, it aims to support laboratories through the standardization of performance evaluation. The service will enable the development of certification systems to be achieved in the field of technical guidelines, assessment and support in the certification of innovative construction products. The service is based on the following:

- Identifying the best methods for product characterization.
- Guiding product design by focusing on regulation.
- Defining lists of necessary tests for product certification.

These three pillars make a close link between OIS1 and construction product market possible.

The final goal of the project is to develop information paths in the field of the CE marking of various groups of construction products used in the building envelope. Tracks will include procedures in line with Regulation 305/2011 (CPR) [4] or its amendment, if approved before project completion [8], and ways to quickly standardize and place innovative products on the market using ETA. The tracks will include the following:

- Technical guidance for manufacturers and laboratories.
- Procedures for evaluating innovative products and (if provided for in CPR) possible product certification procedures.
- The service aims to provide support in the field of basic data to verify test results and assess the reliability of experimental methods, both when based on standards and other guidelines. Testing programs in the research and development phase will be verified in terms of the usability of the methods used for the subsequent certification process by including specific groups of stakeholders: certification bodies, technical assessment bodies and standardization bodies.
- Moving from sustainable structures to renewable buildings will be facilitated by providing ready-to-use approaches:
- Assessing the economic case for a circular economy.

- Environmental and social audits.
- Life cycle assessment (LCA).
- Life cycle cost analysis (LCC).

OIS1 is managed by specialists with experience in the European assessment of innovative products confirmed by participation in CEN and standardization in the national group, participation in numerous EOTA workshops and bodies, and development of EADs (European assessment documents) for individual innovative products for which there is a lack of coordinated technical references.

6. Summary

The article presents the European platform, developed and tested within the MEZeroE project, supporting the CE marking and placing of innovative construction products on the market.

The platform gives an opportunity to overcome legal barriers related to the lack of standardization procedures enabling the quick placing of innovative construction products on the market to be achieved. The platform is publicly available at <https://www.mezeroe.eu/>, accessed on 1 December 2022, where manufacturers of modern construction products can obtain additional information and join the MEZeroE community.

Funded by European Union Horizon 2020, the MEZeroE project aims to create a platform that combines science and business to achieve the development of nZEBs. The platform is building a comprehensive knowledge management environment as well as customized trainings. It will serve as an intermediary between stakeholder groups, from the design stage to the end user of nZEB envelope products.

Manufacturers of modern construction products implementing innovative solutions, through the MEZeroE platform, have a chance to speed up the process of marking their products with the CE mark and placing them on the market and thus facilitate the widespread construction of zero-emission and zero-energy buildings.

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Conflicts of Interest: The authors declare no conflict of interest.

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