



Retrofitting Existing Buildings for Energy Efficiency: Challenges, Skills, and Real-World Solutions

While sustainable new construction receives significant attention, the real challenge for Europe lies in upgrading its existing buildings. Across the EU, nearly 75% of the building stock is considered energy inefficient, and many buildings were constructed decades before modern energy standards existed. Since buildings are responsible for approximately 40% of Europe's energy consumption and 36% of greenhouse gas emissions, improving existing structures has become a major priority within European climate policy.

The European Commission's Renovation Wave strategy aims to at least double renovation rates by 2030, potentially leading to the renovation of 35 million buildings across Europe. The initiative is closely linked to the revised Energy Performance of Buildings Directive (EPBD), which promotes deep renovation, energy efficiency improvements, and the gradual transition toward zero-emission buildings. Retrofitting existing buildings, however, is rarely straightforward. Unlike new construction, renovation projects must work within the physical, structural, and regulatory limitations of existing architecture. Older buildings often have poor insulation, outdated heating systems, limited installation space, and structural constraints that complicate the integration of modern technologies. In some cases, heritage or landscape protection rules add additional complexity, particularly in historic urban areas or protected coastal zones.

One of the most important technical challenges involves balancing energy efficiency improvements with the preservation of the existing building fabric. For example, external insulation may not always be possible due to architectural restrictions or environmental exposure. In such cases, innovative solutions such as high-performance internal insulation materials, low-temperature heating systems, and compact mechanical equipment become essential.

Modern retrofit strategies increasingly rely on integrated solutions that combine renewable energy production with efficient heating and cooling systems. Heat pumps, photovoltaic panels, radiant systems, fan coil units, solar thermal collectors, and smart controls are now commonly used to reduce dependence on fossil fuels while improving occupant comfort. However, integrating these technologies into older buildings requires careful design, coordination, and technical expertise.

Moisture control and condensation prevention are also critical aspects of renovation projects. Poorly installed insulation or incorrectly designed vapor barriers can lead to mold growth, material degradation, and reduced indoor air quality. Acoustic performance presents another challenge, especially when new piping systems or mechanical equipment are introduced into residential buildings. These issues demonstrate that sustainable renovation is not only about energy efficiency, but also about ensuring long-term durability, comfort, and building health.

Beyond technical difficulties, retrofit projects also involve economic and social considerations. Many property owners are concerned about upfront investment costs, despite the long-term savings associated with lower energy bills. At the same time, energy-efficient renovation can significantly improve thermal comfort, reduce energy poverty, and increase property value. According to the European Commission, improving the energy performance of buildings can also strengthen Europe's





energy independence and reduce reliance on imported fossil fuels.

The growing demand for renovation is also transforming the construction workforce. Professionals today need a combination of practical and interdisciplinary skills, including knowledge of insulation systems, HVAC integration, renewable energy technologies, digital controls, and sustainable construction principles. The sector increasingly requires technicians capable of understanding entire building systems rather than isolated components.

The OASIS project contributes directly to this transition by supporting the development of green construction skills related to sustainable heating and cooling technologies. Through practical learning materials, technical presentations, and real-world case studies, OASIS helps prepare current and future professionals for the complex realities of energy-efficient building renovation across Europe.

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