

RHC-ETIP input paper to SET-Plan Action n° 5

Develop new materials and technologies for energy efficiency solutions for buildings

Introduction

This input paper summarises the main comments and recommendations from the European Technology and Innovation Platform on Renewable Heating and Cooling (RHC-ETIP).

General comments

Some general recommendations from the RHC-ETIP to the issue paper from the European Commission focus on the general structure and content of the issue paper:

- The ‘issues paper’ very well summarises the obstacles to increase energy efficiency in buildings. Several of them are non-technological barriers (social, financial **as well as** barriers related to the structure of the construction business and construction processes). It is important to underline that R&I addressing these non-technological issues (e.g. process innovation) is also essential to reach the projected goals (even though non-technological R&I is not part of this ‘issues paper’).
- It should be mentioned, that the **overall target is to reduce CO₂ emissions and fossil fuel dependency**, which can either be achieved by the increase of energy efficiency of buildings or by substituting fossil fuels by renewable energy sources. However, the best solution can be achieved by combining both measures in a well balanced way. In fact, energy efficient buildings are required to achieve high shares of renewable energy sources in most cases. This means that building efficiency strategies should take the use of renewable energy sources better into account. In addition, buildings are increasingly integrated in district energy systems. This means that solutions of building efficiency measures optimized to integrate buildings into small and large district heating networks should be mentioned as well. In addition, solar panels as an integrated building skin for heat and electricity production should be mentioned explicitly.
- **Fuel substitution** : In this issue paper it is not highlighted that 80% of the building stock is still using fossil fuels for heating and that this situation makes it very difficult for the EU to achieve 2030 and 2050 decarbonisation targets. Fuel substitution is necessary, but a substitution with electricity will neither reduce the non-renewable primary energy needs nor the carbon footprint, if the primary energy factor and CO₂ emissions for electricity production are not reduced dramatically at the same time. Thus, a substitution with renewable energies should be the main target, and not primarily a substitution with electricity. The research agenda should be elaborated in line with the objectives of the EU Commission heating and cooling strategy.

Specific recommendations on R&I targets for the SET-Plan action 5

| Main targets/priorities | Specific recommendations on the priorities/targets proposed in the issue paper |
|---|---|
| <p>By 2025, R&I will lead to the development and demonstration of highly replicable and standardised refurbishment packages tailored to the main building typologies in Europe, including historical buildings. These solutions should lead to at least 60% of primary energy-reduction. They should be based on a systemic approach, they should be reliable, easy to install and have a payback time of below 10 years. Based on interoperability among systems, they should combine together existing and emerging technologies and materials to address energy efficiency throughout the building envelope, energy systems (including renewable energy technologies and storage) and improved operation.</p> | <p>The term ‘package’ should be clarified. Does it imply ‘guidelines and best-practices’ for owners, investors, developers, architects, construction companies etc. on how to refurbishment a specific building typology in an (energy- and cost-) efficient way or does it refer to prefabricated construction elements (e.g. prefabricated façade elements with integrated HVAC components). Both approaches are very important and deserve action. It should be underlined, that a many buildings require individual refurbishment solutions due to their originality. It should therefore be specified whether these buildings are part of ‘packaged solutions’ or whether this concept solely applies to buildings for which refurbishment solutions based on standardised prefabricated elements are applicable.</p> <p>It should be specified if this is a specific target for each refurbishment case or something like an ‘average number’ over many refurbishments.</p> <p>It should be mentioned, that the materials must be proven long-lasting, sustainable, and recyclable.</p> |
| <p>By 2025, R&I will contribute to reduce the cost of Nearly Zero Energy Buildings (NZEB) by 10% in average.</p> | <p>What is the baseline for this number? Inflation and the increase of the building-cost index are going to lead to more expensive buildings in 2025.</p> |
| <p>By 2025, R&I on construction process will contribute to reduce the average construction works duration by at least 20% compared to current practices, with solutions capable of being adapted to the final conditions with a lower execution time.</p> <p>R&I will contribute to reduce the gap between the predicted and the actual energy performance to 10% by 2025.</p> <p>R&I will support the reduction of the % of new and renovated buildings failing on-site commissioning tests by less than 5% by 2025.</p> | <p>Missing: R&I on improved modelling and planning, monitoring of the construction process, optimized control and operation, and monitoring of the performance of the building and its energy system by using new digital technologies is needed to further increase its efficiency.</p> |

Specific recommendations on concrete ideas for cooperation based on the Integrated Roadmap

| Main research and innovation areas | High potential technologies and solutions | Recommendations from RHC-ETIP |
|------------------------------------|---|--|
| Envelope & Structure | <ul style="list-style-type: none"> - Higher performance insulation with e.g. lower lambda values and reduced thickness - Innovative cladding materials and systems (e.g. advanced multi-functional systems) - Highly reflective surfaces for roofing materials - Increased energy storage density using phase change materials (PCM) and thermochemical materials (TCM) - Air-Sealing system technologies for new and existing buildings (e.g. new joining materials, self-healing materials) - High performance glazing systems and windows including active and dynamic systems, and advanced manufacturing methods (low-cost smart window coatings) - Envelope solutions appropriate for historic buildings | <p><u>Additional points</u></p> <ul style="list-style-type: none"> - Proven long-lasting, sustainable, and recyclable insulation materials - Energy equipment integrated in the building envelope to simplify refurbishment of buildings |
| <i>Energy equipment/ systems</i> | <ul style="list-style-type: none"> - Advanced control/ monitoring systems going beyond current Best Available Technologies - Next generation of high performance heat pumps for buildings with COPs >5 - Efficient and smart cogeneration (CHP) for buildings (e.g. micro and small scale CHP) - innovative heating and cooling systems Highly efficient combined thermal energy transfer and storage, including more compact systems suitable for retrofitting - High efficient lighting systems, e.g. green LEDs, advanced sensors and controls and lower cost retrofit solutions for lighting fixtures - <i>ventilation products tailored to the renovation market</i> | <p><u>Comments</u></p> <ul style="list-style-type: none"> - Control and monitoring systems should be able to control all technical systems in a building to increase system performance - not only the COP should be mentioned, but the more important seasonal COP (SPF) - in addition to high performance heat pumps, the improved cost to performance relation should be set - special attention on cooling should be given to decarbonise this sector too. <p>To be added to existing points:</p> <ul style="list-style-type: none"> - Innovative heating and cooling systems with higher efficiency and improved integration of renewable energy sources - Innovative, highly efficient, easy to install and operate ventilation systems to the renovation market <p><u>Additional points</u></p> <ul style="list-style-type: none"> - Low-temperature heat utilisation technologies on building and district level - Advanced technologies connecting buildings with efficient envelopes and control systems to community solutions utilising locally available recoverable or renewable heat and cold |

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|------------------------------------|--|--|
| Construction Process | <ul style="list-style-type: none"> - Mass manufactured, modular, “plug and play” components and systems - Construction materials and processes with reduced embodied energy - Innovative automated/robotised construction processes, tools and mobile factories - Information to <i>support decision making</i>: assessment, simulation and visualisation techniques to support decision making. <p>Improved construction skills and processes both on and off site for higher quality and compliance of construction work, including innovative workmanship training processes.</p> | |
| Design | <p>Cost-effective and easy to install EE "kits" or packages compatible with various equipment and design for different building typologies based on a systemic approach and adapted to each environment</p> <ul style="list-style-type: none"> - Accurate simulation tools to evaluate the expected impact of new systems and solutions in buildings in order to bridge the performance gap. - Enhanced Building Information Modelling (BIM) and integration of design, operation and maintenance of buildings - Improved design tools and processes including closer collaboration for Integrated Energy Design (IED) across disciplines - ICT platforms and interoperable tools for integrated energy design, grid integration - Advanced IT tools to support NZEB construction and renovation addressing different building typologies and climatic zones. | <p><u>Additional point</u></p> <ul style="list-style-type: none"> - Improved modelling and planning tools for renewable energy systems integrated in building modelling tools to allow a fair assessment of different measures to achieve CO2-reduction targets |
| Operation | <ul style="list-style-type: none"> - Optimised automation and control, energy management systems and continuous commissioning ensuring energy performance during service life - Enhanced Building Energy Management tools | <p><u>Additional point</u></p> <ul style="list-style-type: none"> - Fully connected energy monitoring and management solutions with self optimization functions to enhance efficiency and comfort of the user (Based on Internet of Things solutions) |