European Commission

This fiche is part of the wider roadmap for cross-cutting KETs activities

'Cross-cutting KETs' activities bring together and integrate different KETs and reflect the interdisciplinary nature of technological development. They have the potential to lead to unforeseen advances and new markets, and are important contributors to new technological components or products.

The complete roadmap for cross-cutting KETs activities can be downloaded from:

http://ec.europa.eu/growth/industry/key-enabling-technologies/eu-actions/ro-ckets

Potential areas of industrial interest relevant for cross-cutting KETs in the Construction domain

This innovation field is part of the wider roadmap for cross-cutting KETs activities developed within the framework of the RO-cKETs study. The roadmap for cross-cutting KETs activities identifies the potential innovation fields of industrial interest relevant for cross-cutting KETs in a broad range of industrial sectors relevant for the European economy.

The roadmap has been developed starting from actual market needs and industrial challenges in a broad range of industrial sectors relevant for the European economy. The roadmapping activity has focused on exploring potential innovation areas in terms of products, processes or services with respect to which the cross-fertilization between KETs can provide an added value, taking into account the main market drivers for each of those innovation areas as well as the societal and economic context in which they locate.

Taking the demand side as a starting point, cross-cutting KETs activities will in general include activities closer to market and applications. The study focused on identifying potential innovation areas of industrial interest implying Technology Readiness Levels of between 4 and 8.

CS.1.2: Insulating materials and components for the energetic improvement of the building envelope

Scope:

To develop cost-effective and environmentally sustainable insulating materials and components for the energetic improvement of the building envelope.

Demand-side requirements (stemming from Societal Challenges) addressed:

- Tackle the "Climate action, resource efficiency and raw materials" societal challenge as well as the "Secure, clean and efficient energy" societal challenge in the first instance, thanks to lowering the amount of embodied energy in materials used during the construction process and the energy demand during the use-phase of buildings
- Contribute to achieve net zero-energy buildings in the future, serving as driver to boost the market for novel renewable energy applications in the residential sector (according to the Energy Performance of Buildings Directive (2010/31/EU))
- Contribute at the same time to the "Health, demographic change and wellbeing" societal challenge thanks to providing comfortable, well-designed, and energy efficient living spaces for all

Demand-side requirements (stemming from market needs) addressed:

- Enhance competitiveness of the construction sector
- Optimise the life-cycle cost of the built environment
- Provide comfortable, well-designed, energy efficient living spaces for people
- Reduce energy consumption (resulting in savings over the conventional energy purchase for private end-users and in the overall reduction of the energy demand on a global scale)
- Enhance the urban environment, creating a built environment that is accessible and usable for all
- Improve health, safety and security of the built environment
- Make construction activities more efficient, precise and with greater risk avoidance
- Improve health and safety conditions during construction processes

Specific technical / industrial challenges (mainly resulting from gaps in technological capacities):

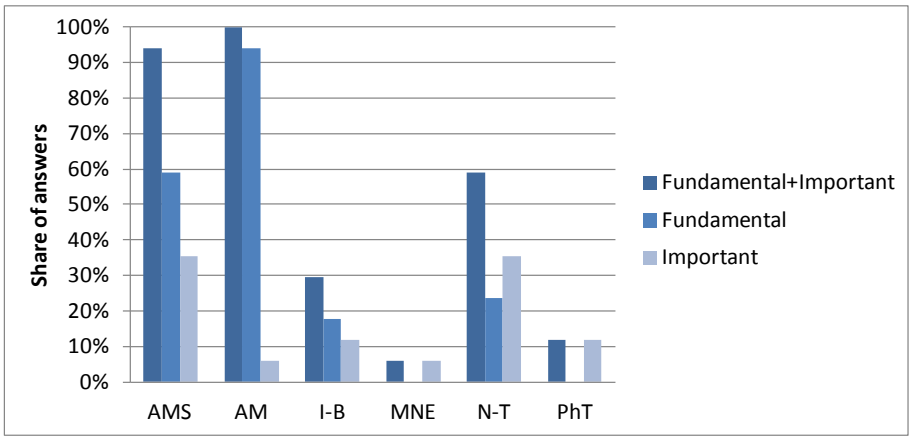
- Development of new cost-effective energy efficient insulating materials from renewable sources or waste materials
- Development of low thickness high insulating and easy to install insulation materials for building refurbishment
- Improvement of thermally and / or acoustically insulating materials and foams providing enhanced thermal / acoustic insulation and a higher degree of energy conservation
- Development of materials with thermal conductivity $\lambda<0.03$ W/mK based on nano-foams, silica aerogels or mineral foams, capable to both retain and reflect heat from inside or outside or integrate other functions with solutions for both new buildings and for energetic improvement of existing ones
- Development of windows and other glass surfaces with a high insulating power and a low emissivity, whilst keeping high transparency performances and adaptive to different building structures and orientations
- Development of bio-based materials like natural fibres or foams for insulation with high durability
- Creation of innovative materials for barriers, pipes etc. for easy integration and reduction of thermal bridges
- Improvement of technical properties (e.g. fire resistance) of organic materials
- Development of chemical coupling agents and binders
- Development of new masonry based building components with integrated high-efficient insulation materials
- Development of low-CO_2 advanced concrete available for durable building envelopes
- Development of basement insulation, moisture protecting systems and new building materials for draining

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of solutions such as more advanced insulating materials and components for the energetic improvement of the building envelope, including from renewable sources or waste materials, the improvement of thermally and/or acoustically insulating materials, and the development of windows and other glass surfaces with a high insulating power and low emissivity, whilst keeping high transparency performances.

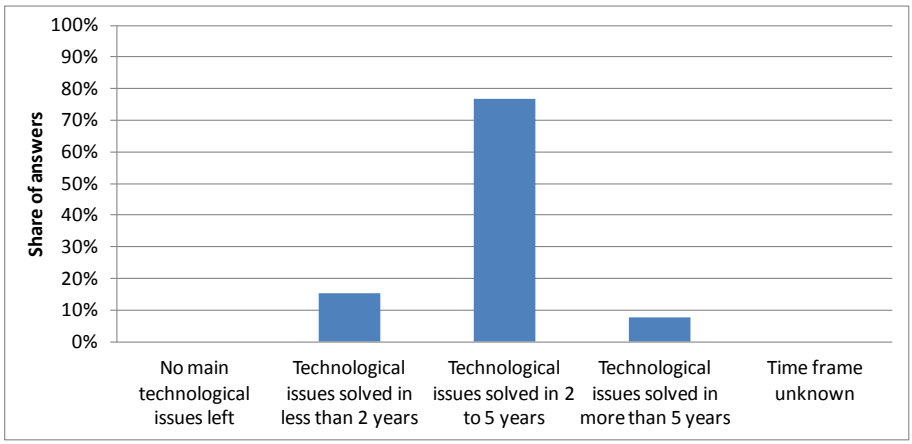
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong interaction of KETs with respect to this Innovation Field, with either fundamental or important contribution mainly by the following KETs:

- Advanced Manufacturing Systems (AMS)
- Advanced Materials (AM)
- Nanotechnologies (N-T)



Timing for implementation:

According to the majority of KETs experts' opinions (whose result is depicted in the below bar chart), desk research, and in line with the KETs-related patenting activity in this field, it is considered that the main technological issues holding back the achievement of cross-cutting KETs based products related to this Innovation Field could be solved in a time frame of 2 to 5 years:



Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework.

Additional information according to results of assessment:

- ***Impact assessment:***
  - The construction of new buildings offers the best opportunity to deploy passive heating and cooling designs, which make use of energy-efficient building materials to minimise energy required for heating and cooling. Energy consumption for cooling is expected to increase sharply by 2050 – by almost 150% globally, and by 300% to 600% in developing countries. In hot climates, low-cost solutions such as reflective roofs and walls, exterior shades, and low-emissivity window coatings and films can curtail energy consumption for cooling. In cold climates, passive heating contributions can be increased by optimising building design and using advanced window and glazing systems (Source: Technology Roadmap – Energy efficient building envelopes; International Energy Agency (IEA), www.iea.org).
  - At the European level, the Energy Performance of Buildings Directive (Directive 2010/31/EU) is the central piece of regulation. This directive has far-reaching implications for home-owners and the construction sector. It has helped turn attention towards the energy efficiency of construction products, especially insulating products.
  - The insulation market is a mature market, with a large number of technologies available. However, innovative technologies represent a small share of the total turnover of the insulation market in the European Union (around 5%). Some Member States dominate the innovative market: these are particularly Nordic countries, Germany and Austria. With policy makers and civil society increasingly focusing on energy efficiency and the environmental impact of construction products, more innovative products are entering the market. Due to the highly competitive nature of the market, there is an innovation push for highly energy-efficient technologies. The new building business relies increasingly on green-oriented products, and the same process is starting in the retrofit sector – even though retrofit activities are less targeted by regulation. Potentially, the market for new high efficiency technologies in the insulation sector is unlimited. Even when taking into account the diversity of insulation needs across Europe (depending for instance on climate specificities), all individual homes, buildings and industries could be the target of these technologies. Growing environmental regulation is likely to provide producers with great opportunities to expand this market. Overall, the market opportunity for EU producers of new insulation technologies is high. With energy efficiency being a European flagship action in the EU 2020 strategy, awareness among producers and end users should rise, and drive the market to further take into account the environmental-related performance of the products (Source: EPEC, Detailed Assessment of the Market Potential, and Demand for an EU ETV Scheme, 2011).

- ***Results of patents scenario analysis:***
  - 14 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
  - No significant patent-related figures can be reported in this field