

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 Environment 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.

## EV.1.3: Integrated heat management (including through waste heat utilization) in industry

### Scope:

To develop integrated heat management approaches (including through waste heat utilization and industrial symbiosis) exploiting the integration of energy and effluents management systems at site and/or local environment scale, taking advantage of community consumption or production to optimize the overall energy balance of, especially, energy-intensive industries.

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

- Tackle the “climate action, resource efficiency and raw materials” challenge, indirectly also contributing to addressing challenges such as “food security, sustainable agriculture, marine and maritime research and the bio-economy” and “health, demographic change and wellbeing”

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

- Manage environmental hazards and pollution
- Reduce processing costs through recovery (of both energy and resources) in industrial activities
- Minimize waste thereby reducing related management costs

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

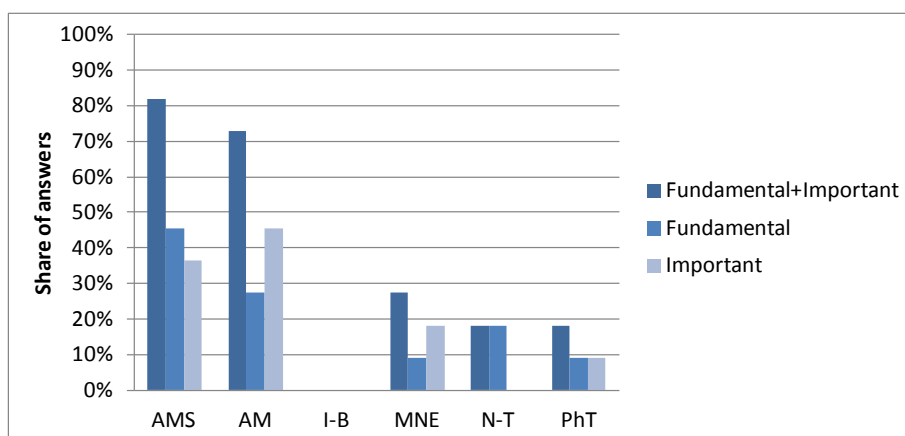
- Integration of energy and effluents management systems at site and/or local environment scale, taking advantage of community consumption or production to optimize the overall energy balance of the energy-intensive industries
- Reduction of processing costs through recovery (of both energy and resources) in industrial activities

### Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of more advanced integrated heat management approaches (including through waste heat utilization and industrial symbiosis) exploiting the integration of energy and effluents management systems at site and/or local environment scale, taking advantage of community consumption or production to optimize the overall energy balance of, especially, energy-intensive industries. To this end, the integration of KETs could particularly contribute to the development of enhanced materials addressing the important issues of durability, efficiency and cost of systems subject to the high temperatures, along with the development of specialized coatings improving heat transfer concepts.

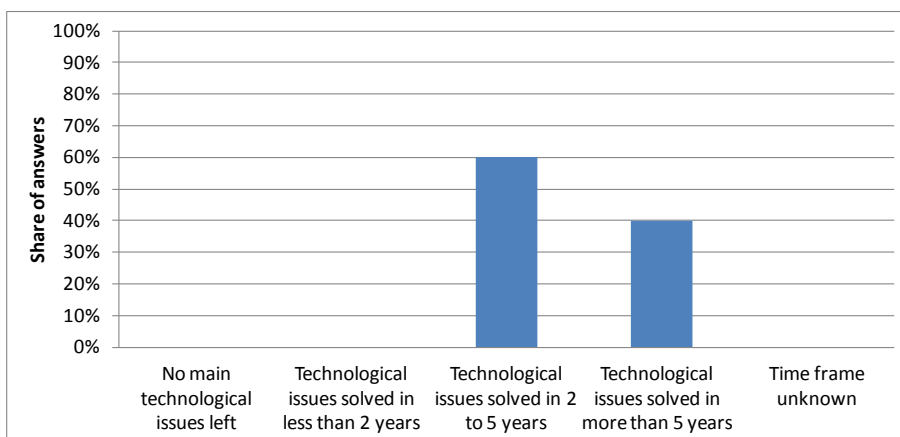
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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



### 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, yet significant consensus by experts indicates also longer periods being necessary:



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 to medium term should be taken into consideration within this framework.

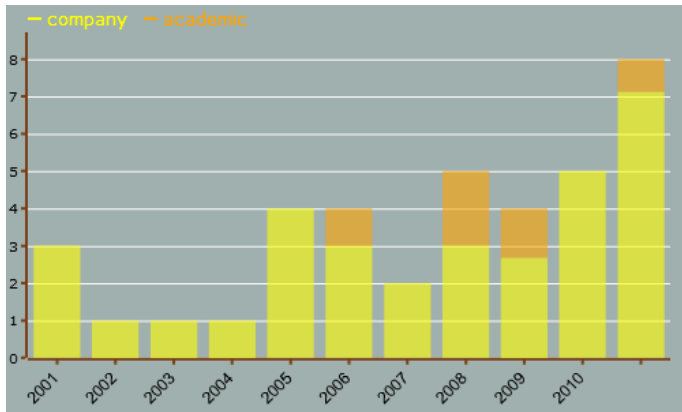
### Additional information according to results of assessment:

#### ➤ **Impact assessment:**

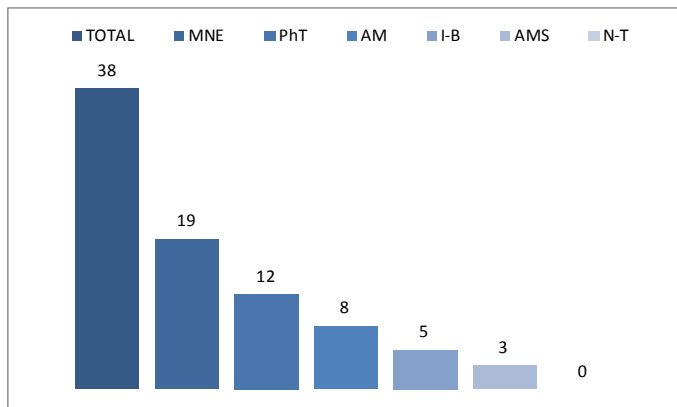
- The demand for waste heat recovery systems will continue to surge with the growing requirement for energy efficiency and rising environmental concerns regarding industrial waste heat emissions. Waste heat recovery is in fact being increasingly regarded by industry as offering energy savings thanks to effective utilization of the waste heat potential as a solution to the concerns over increasing energy and electricity prices. Technological improvement is as a major opportunity for the waste heat recovery systems market. The primary consideration in the R&D effort of this market lies in minimizing economic costs of waste heat recovery technologies.
- According to forecasts, the waste heat recovery market will reach 39 billion Euro by 2018. Europe dominates the market, accounting for a major share of about 38% in 2012. Asia-Pacific will experience highest growth rate of 9.7% in the next years from 2013-2018. Key regions in Asia-Pacific market are China and India, which will experience the highest installations of waste heat recovery systems.
- Source: Markets and Markets, Waste Heat Recovery Market by Application (Pre-heating, Steam Generation, Electricity & Others), and Industry (Petroleum Refining, Heavy Metal, Cement, Chemical, Natural Gas Compression, Pulp/Paper Industry & Others) - Global Trends & Forecast to 2018, 2014

➤ **Results of patents scenario analysis:**

- 38 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Increasing trend curve (number of patents per year)
- Highest share of industrial applicants with intermittent relevant patenting activity by academic applicants, most probably standing for new technologies having been patented in the corresponding periods:



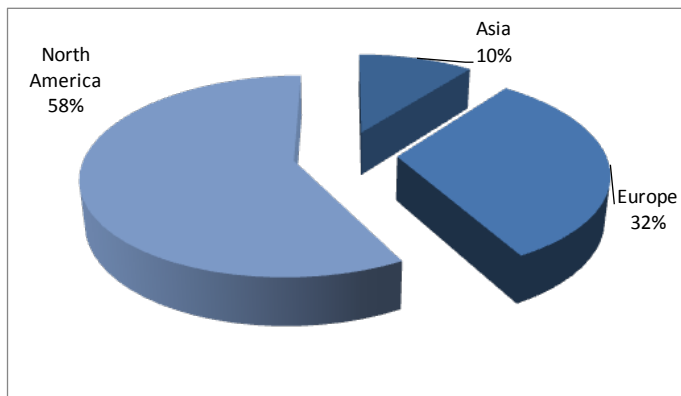
- Patents by KET(s):



- Patents by KET(s) and relevant combinations of KETs:

KET(s)	Number of patents
AM	8
AMS	3
IBT	5
MNE	19
MNE / PhT	9
PhT	12

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection:

