

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.1.4: Integrated gaseous effluents management aimed at emissions control, compounds and energy recovery

Scope:

To develop advanced integrated gaseous effluents management approaches aimed at both improved emissions control in industrial plants as well as transport means (e.g. ships), and compounds and energy recovery in industrial facilities.

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):

- Combination of optimized CCS technologies to allow carbon capture and storage (CCS) from carbon gas emissions all over the cokemaking, sintering, ironmaking and steelmaking processes (especially from blast furnace gas)
- Development of advanced filters and adsorbers, catalysis, plasma post-treatment and other ways for oven and furnace top gas recycling and dust emission control, so as to capture CO₂, filter out dust and pollutants (SO_x, NO_x and dioxins from sintering, heavy metals, etc.), extract calories and/or produce power (e.g. burn blast furnace and coke oven gases into an advanced combined cycle power plant)
- Integration of gas separation plants to blast furnace facilities so as to enable Top Gas Recycling (i.e. reuse useful components as Carbon Monoxide (CO) as a reducing agent into the furnace, reducing the need for coke, and inject Oxygen (O₂) instead of preheated air, removing unwanted Nitrogen (N₂) and facilitating CCS)
- 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
- Fuel quality improvement and integration of environmental protection measures into the transport and energy sectors

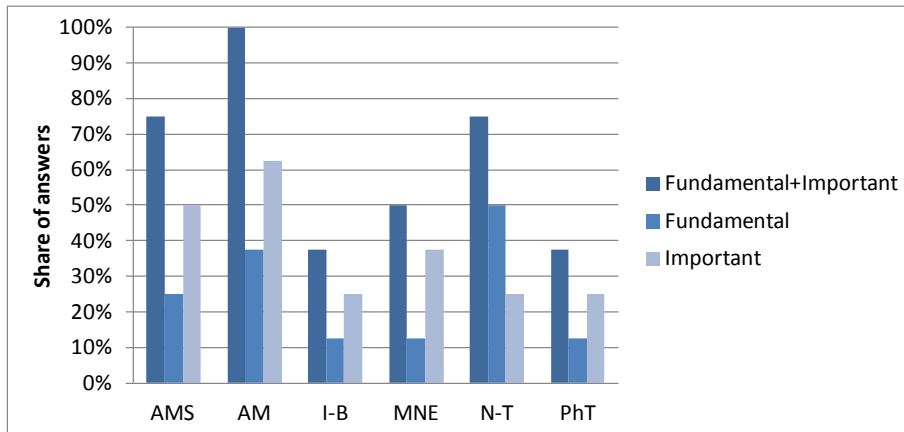
Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of more advanced integrated gaseous effluents management approaches aimed at both improved emissions control in industrial plants as well as transport means, and compounds recovery in industrial facilities. The integration of KETs could particularly contribute to the development of solutions such as advanced filters and adsorbers, improved catalysts, plasma post-treatments and other ways for oven and furnace top gas recycling and dust emission control allowing to capture CO₂, filter out dust and pollutants, and recover materials.

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:

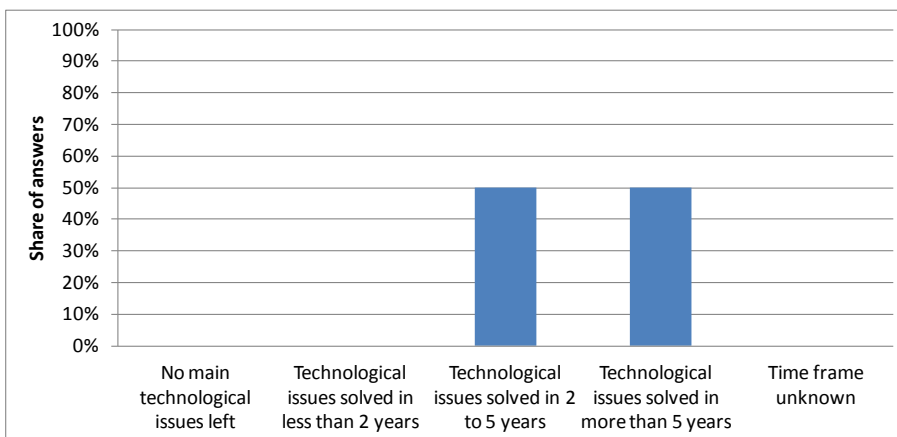
- Advanced Manufacturing Systems (AMS)
- Advanced Materials (AM)
- Nanotechnologies (N-T)
- Micro- and Nano-Electronics (MNE)

- To a less important extent, Photonics (PhT) and Industrial Biotechnology (I-B)



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 either 2 to 5 years or more than 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 to medium term should be taken into consideration within this framework.

Additional information according to results of assessment:

➤ **Impact assessment:**

- Drivers for gaseous effluents management and emissions control technologies are dominated by increasingly strict regulation in sectors where gaseous emissions are among the major issues, being mainly power generation, industrial processing, transport in its various forms (land, marine, air) and space heating.
- The specific requirement for reducing air-polluting emissions represents hence the most significant driver for the European end-of-pipe emissions control equipment market. End-of-pipe emissions control equipment is installed in order to comply with legislative requirements, thus avoiding penalties.
- As a result, the end-of-pipe emissions control equipment market in Europe has been estimated by Global Industry Analysts to reach 4 billion Euro by 2015.
- In the longer term, developments in air pollution prevention strategies are moreover reported to be likely to displace conventional use of end-of-pipe pollution control equipment, which is traditionally expensive. This thereby will also open up opportunities for mitigation-at-source technologies. In addition to environmental performance, air pollution prevention technologies in this regard have the added advantage of being economical in the long run in comparison with end-of-pipe technologies.

- Key players dominating the European market were reported to include AAF International, ALSTOM SA, A-TEC Industries AG, AE&E Lentjes GmbH, Balcke Duerr GmbH, Clyde Bergemann EEC, Donaldson Company Inc, EWK Umwelttechnik GmbH, Energomontaz-Polundine SA, Fabryka Elektrofiltrow "Elwo" SA, Impregilo Group, Fisia Babcock Environment GmbH, FLSmidth Airtech Company, Foster Wheeler Ltd, Fujian Environmental Protection Co. Ltd, Haldor Topsoe A/S, Hamon Group, Hitachi Zosen Corporation, Hosokawa Micron Group, Johnson Matthey, Mitusi Mining Company Limited, Polimex-Mostostal SA, Rafako SA, Termokimik Corporation, Wahlco Inc. ZVVZ AS, and ZVVZ-Enven Engineering AS, among others.
- Source: Global Industry Analysts Inc., End-of-Pipe Air Pollution Control Equipment: A European Market Report, 2009
- **Results of patents scenario analysis:**
 - No significant patent-related indicators can be reported in this field