

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/rockets>

Potential areas of industrial interest relevant for cross-cutting KETs in the Transport and Mobility 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.

T.1.1: Advanced on board energy generation or recovery

Scope:

To develop systems and solutions for the generation or recovery of energy on board vehicles, from internal (motion, heat) as well as ambient sources (solar, wind, etc.) in order to improve the overall energy consumption of the vehicle and power embedded systems.

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

- Tackle the “Smart, green and integrated transport” societal challenge
- Contribute to the achievement of the EU Transport 2050 strategy (COM/2011/0144 final) objective of a 60% reduction of CO₂ emissions from transports, at least 40% for shipping
- Support the Smart Vehicle initiative of the i2010 strategic framework on the innovation society (COM(2005) 229 final)
- Continuously enhance safety, resistance/resilience and security of vehicle operation all along end-to-end transport chains
- Increase recyclability of vehicles and systems and resource efficiency in the manufacturing processes and reduce dependency to rare or foreign controlled materials and components (as per the Raw Materials Initiative (COM(2008)699) and numerous waste management regulations)

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

- Reduce vehicle operation costs, including through increasing energy efficiency and reducing final vehicle energy bill, but also through optimising overall vehicle lifecycle cost of ownership, including maintenance, repair and overhaul
- Reduce or maintain numbers and rates of accidents in Europe at an acceptable number, whatever traffic growth
- Enable new transportation services dealing with changing mobility and transportation needs, changing trade patterns as well as citizen and logistic chains request for affordable, timely, comfortable, seamless and ubiquitous transport services
- Enable time to market reduction and production ramp up / adaptation so as to cope with European and global market requests on new vehicle supply

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

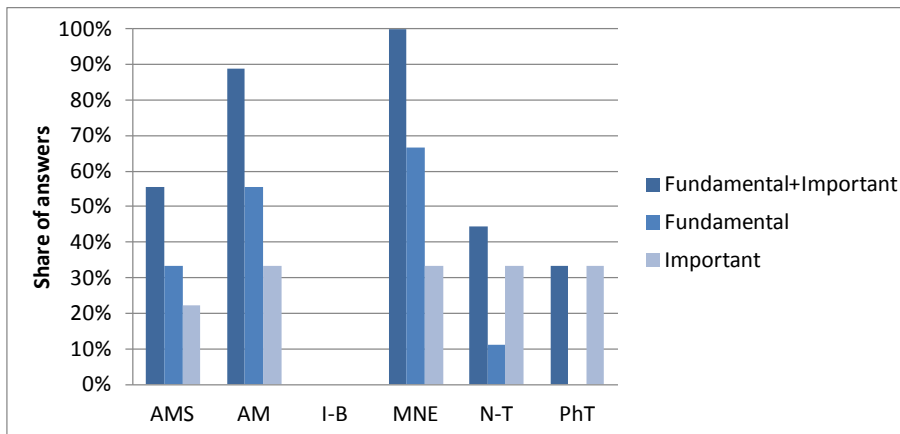
- Development of solar modules of high energy efficiency, light-weight, easy to integrate and resistant to harsh operational conditions, able to remain in operation all along vehicle campaign life
- Integration of advanced kinetic and breaking energy recovery means and energy storage or power generation means
- Development of long-life low volume low weight capacitors and other power electronics
- Development of efficient embedded heat exchangers, thermo-electric generators and integrated heat-to-power systems taking advantage of all vehicle heat losses for generating power
- Investigation of the interest for regenerative fuel cells for power generation
- Enabling of optimal on board power management taking advantage of various power sources

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 solutions for the generation or recovery of energy on board vehicles, both from internal (e.g. motion, heat) and ambient sources (e.g. sun, wind). Solutions may consider advanced kinetic and breaking energy recovery and energy storage, thermo-electric generators and integrated heat-to-power systems, or, for example, (flexible) solar modules having high efficiency.

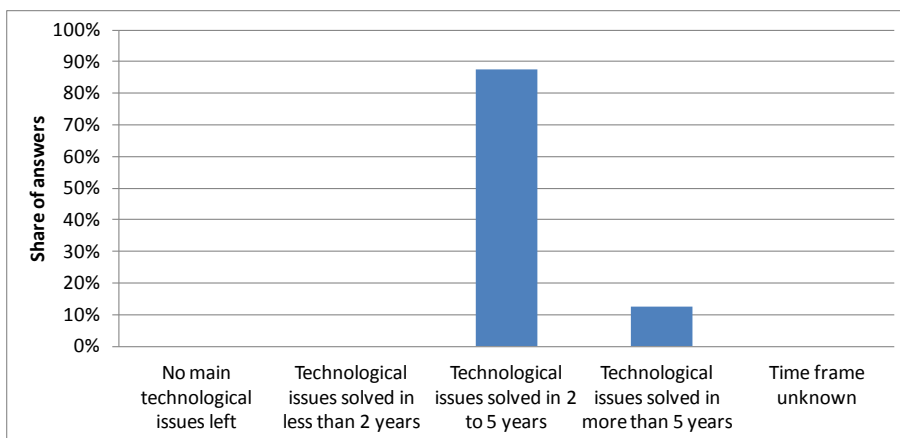
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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

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



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:

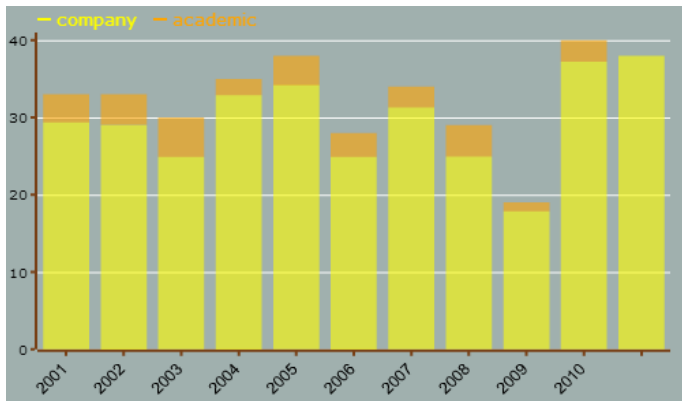
➤ Impact assessment:

- On board energy generation or recovery systems have a key role to play into the new vehicle energy architectures, including urban e-Mobility, Green Cars, more electric or even all electric aircraft, electric boats.
- The electronic components involved in such Innovation Field will be operated in constrained environments and will benefit from high quality, high-energy efficiency electronics technologies, taking place in the high added-value part of such market.
- The space sector has a significant experience in vehicle autonomy optimisation and advanced on board power generation, recovery and management, enabling cross-cutting opportunities on these technologies.

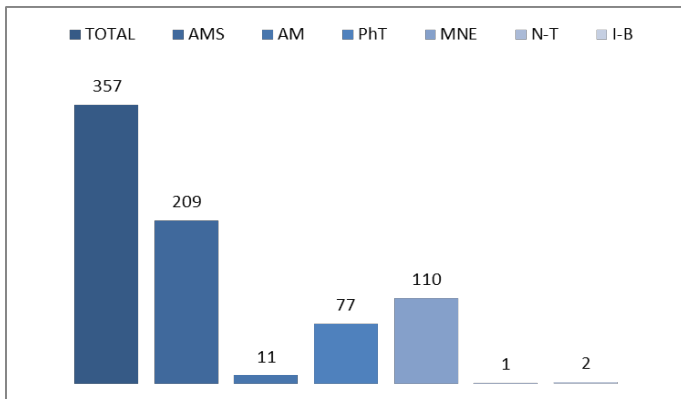
- Considering its knowledge base on related topics, value chains and strengths in the transportation industries, Europe is in a position to be a major player in this Innovation Field, calling for actions on related KET and cross-cutting KET components.
- In the patents scenario analysis, main applicants dominantly come from the automotive industry, mainly European and Japanese (top 10 patent applicants are Robert Bosch, Toyota, Michelin, Siemens, Honda, Nissan, Continental, Hitachi, Valeo, Pirelli).

➤ **Results of patents scenario analysis:**

- 357 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Stable trend curve (number of patents per year)
- Highest share of industrial applicants:



- Patents by KET(s):

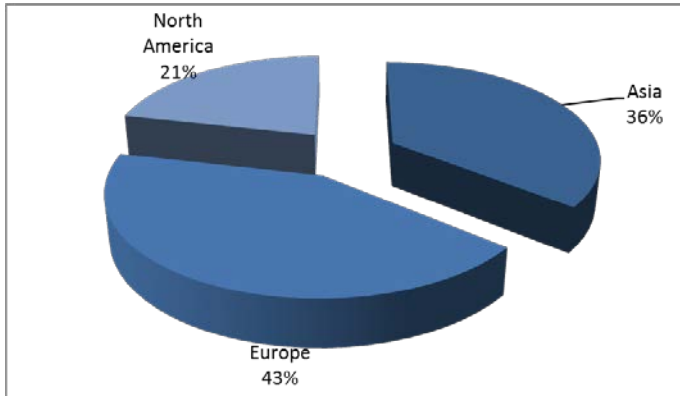


- Patents by KET(s) and relevant combinations of KETs:

KET(s)	Number of patents
AM	11
AM / MNE	1
AM / PhT	1
AMS	209
AMS / MNE	15
AMS / MNE / PhT	2
AMS / PhT	5
IBT	2
MNE	110
MNE / N-T	1
MNE / PhT	32
N-T	1

<i>KET(s)</i>	<i>Number of patents</i>
PhT	77

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection:

