European Commission

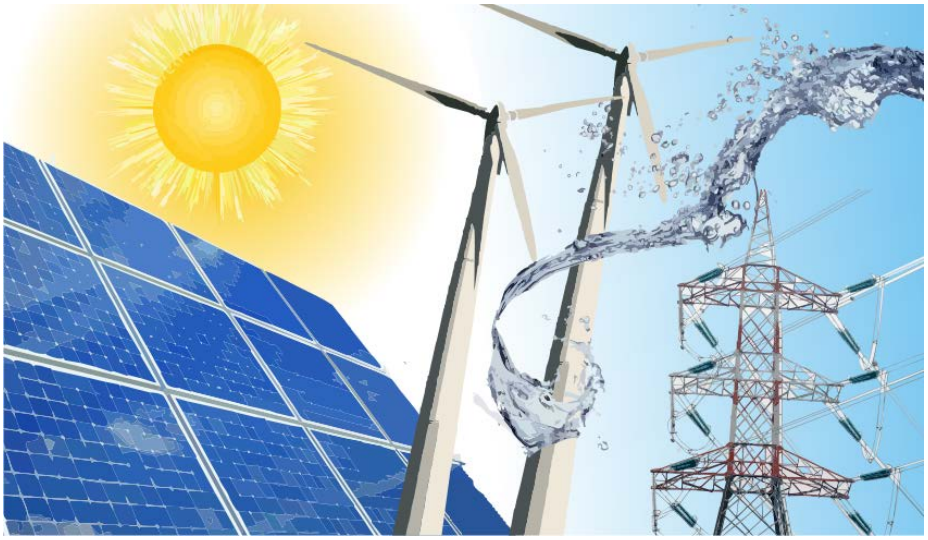
This fiche is part of the wider roadmap for cross-cutting KETs activities

'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 Energy 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.

E.3.3: Flexible, high-speed, self-healing AC power transmission / distribution

Scope:

To develop flexible AC power transmission/distribution systems based on high-speed power routing equipment and systems, allowing for self-healing grids.

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

- Contribute to achieving competitive, sustainable and secure energy
- Cope with the various European efforts (directives, policies as well as initiatives) aimed at deploying Smart Grids
- Cope with the various European efforts (directives, policies as well as initiatives) aimed at developing a single energy market for Europe
- Cope with the increasing levels of renewable energy deployment within the European Union (the Renewable Energy Directive (2009/28/EC) mandating to achieve levels of renewable energy consumption of 20% by 2020)

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

- Reduce energy consumption (resulting in savings over the conventional energy purchase for private as well as industrial end-users and in the overall reduction of the energy demand on a global scale)
- Provide for easier integration of renewables in general with existing energy distribution networks and with other energy generation systems
- Increase use of effective energy storage systems into existing energy distribution networks (to resolve the mismatch issue between energy generation and demand)
- Increase electricity usage flexibility in order to cope with today's lifestyles

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

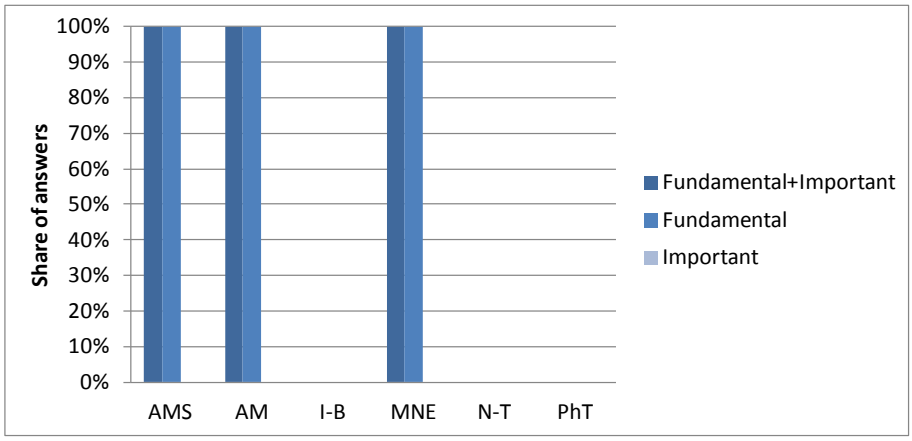
- Integrate electricity transmission, distribution and storage while keeping or increasing reliability and quality
- Provide for standards, protocols and control architectures to communicate network elements

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of more flexible AC power transmission/distribution systems based on high-speed power routing equipment and systems and thanks to intelligent digital systems capable of providing self-checking and self-healing, moreover allowing for bidirectional communication and huge information and data flow, highly benefitting for this also from information and communication technologies.

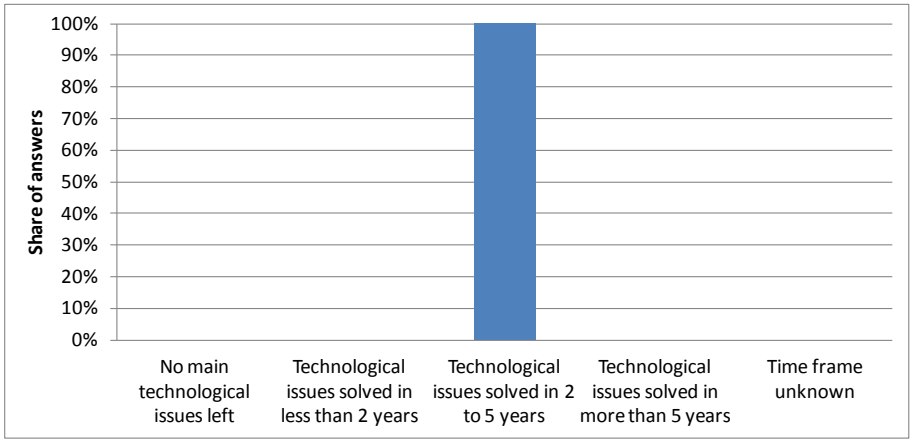
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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



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:

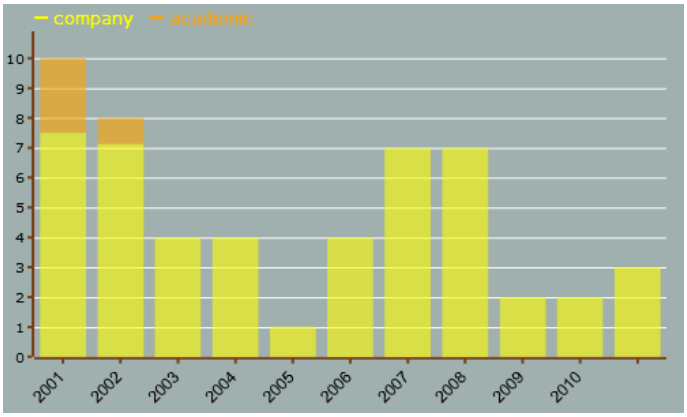
- ***Impact assessment:***
  - Power system reliability is key to avoiding failures potentially resulting in blackouts that can have social and economic burdens for billions of Euro every year. The likelihood of blackouts has been increasing because of various physical and economic factors, and, as the portion of electricity in the total energy consumption continues to grow, the value of power system reliability is also increasing. Yet, as the digital age prevails, more efficient systems based on computers and power electronics have come to dominate the scene.
  - Self-healing grids will require a high performance IT infrastructure to address gaps in the geographical and temporal coordination of power system monitoring and control. Considerable improvements are required at various hierarchical levels, including substations, control areas, regions and the grid. Temporal coordination will require improvements in adapting the faster and often local controls to the slower global controls (ABB, Vision for a self-healing power grid).
  - Global demand for electric transmission and distribution equipment is forecast to rise of 6.7% per year to nearly 131 billion Euro in 2017. Sales growth will accelerate relative to the 2007-2012 period, aided by both continued strong growth in electricity consumption in developing regions and economic recovery in developed countries. China, which accounted for 32% of global demand in 2012, will

continue to be the largest and fastest growing national market for electric transmission and distribution equipment (Source: Freedonia Group, World Electric Distribution Equipment & Power Transmission Market 2017, 2013).

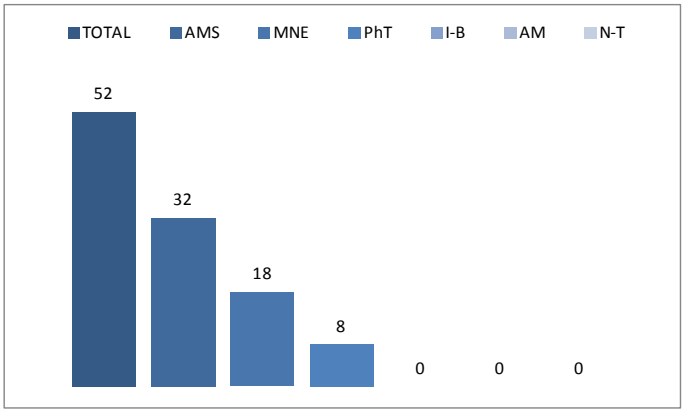
- As reported for Innovation Field E.3.3, in Europe, leading multinational suppliers of electric transmission and distribution equipment are particularly ABB, Alstom Grid, Arteche, EFACEC Engenharia, Philips, Schneider Electric, Siemens and Siemens Energy, SGB-SMIT International, and SMIT Transformatoren, STMicroelectronics.

➢ ***Results of patents scenario analysis:***

- 52 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Decreasing trend curve (number of patents per year)
- Exclusive share of industrial applicants in most recent years:



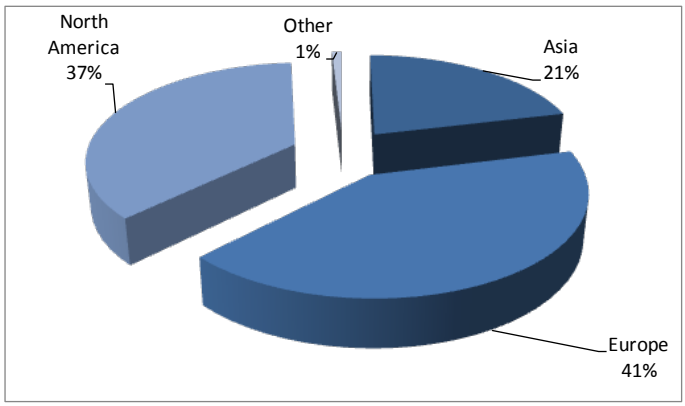
- Patents by KET(s):



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

KET(s)	*Number of patents*
AMS	32
AMS / MNE	3
AMS / MNE / PhT	1
AMS / PhT	1
MNE	18
MNE / PhT	3
PhT	8

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: