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 Chemical Processes, Chemicals, Chemical Products and Materials 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.

CH.3.1: Processes for the cost-efficient conversion of various biomass to biofuels

Scope:

Bio-chemical and thermo-chemical conversion processes for the cost-efficient conversion of biomass (e.g. agro-biomass, organic waste, forestry and aquatic biomass) to biofuels.

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

- Tackle the “climate action, resource efficiency and raw materials” challenge, indirectly also contributing to address challenges such as “smart, green and integrated transport” and “secure, clean and efficient energy”

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

- Reduce dependency on hydrocarbon-based propulsion, subject to a long term price increase tendency, and related operational costs
- Enable short term transport greening without waiting for full scale mature and financeable revolutionary propulsion means, allowing to make best use of retrofit and improvement capabilities of existing fleets of vehicles and vehicle production capabilities
- Support the transition from our current fossil fuel-based industries to bio-based industries

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

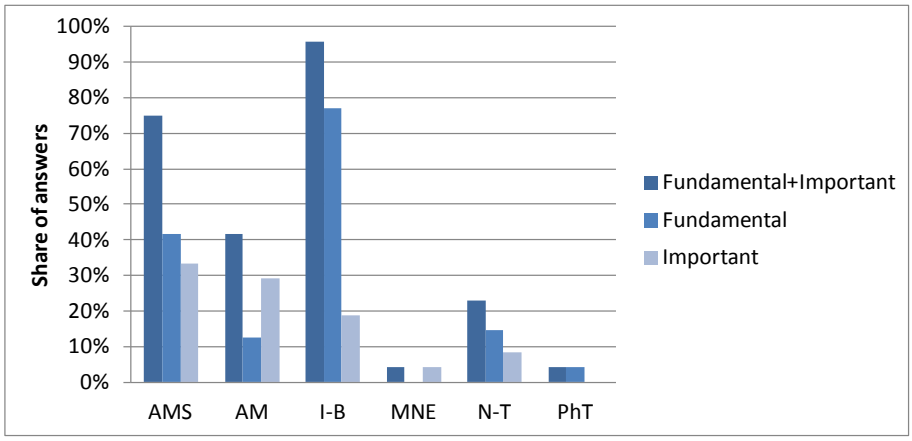
- Development of availability-cost curves for different sources of biomass (energy crops, forestry and agriculture residues, wastes) and geographical locations
- Development of efficient biomass logistic systems (harvesting/collection/storage) for different conversion concepts at different scales
- Development of integrated biorefinery concepts making full use of a variety of biomass feedstocks to obtain diverse high-value bio-products
- Improvement of current conversion processes to their full potential (feedstocks for biorefinery) for higher GHG reduction, increased flexibility for different raw materials and lower cost
- Development and demonstration of advanced cost-efficient high quality solid and liquid biomass fuels from agro-biomass, organic waste, forestry and aquatic biomass
- Identification of a simple, coherent and global certification system to assure environmental sustainability of biofuel production chains
- Establishment of conditions for compatibility of biofuels and biofuel blends with existing logistics, as well as existing and new powertrains
- Development of a biological route / process based on lipase enzymes for the production of biodiesel

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 bio-chemical and thermo-chemical conversion processes for the cost-efficient conversion of various types of biomass to biofuels, which are characterized by high performance, stability and selectivity, thanks to the integration, into the industrial production within integrated biorefineries, of novel bio, chemical and catalytic processes allowing for the introduction of novel, improved synthetic routes for production.

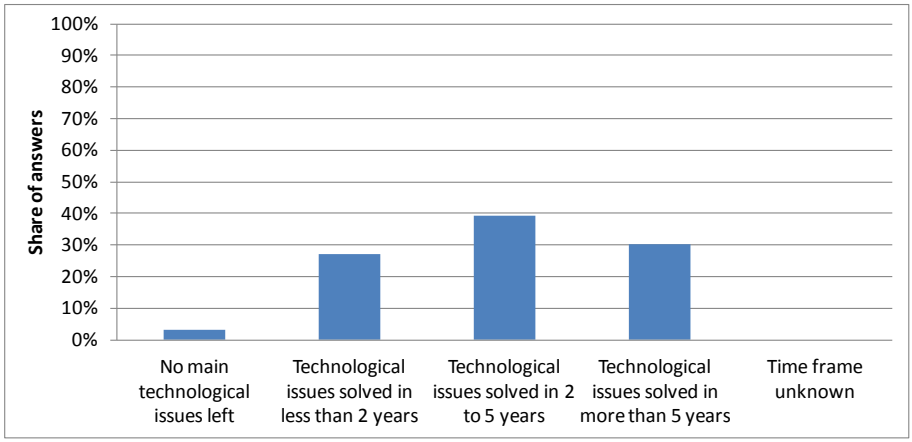
To this aim, the combination of KETs experts’ opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong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

- Advanced Manufacturing Systems (AMS)
- 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 2 to 5 years, yet significant consensus by experts indicates also both shorter as well as greater 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 term should be taken into consideration within this framework.

Additional information according to results of assessment:

- ***Impact assessment:***
  - Global biofuel development and production continues at a strong pace from the past years. Several European companies are producing biodiesel at commercial scale and cellulosic ethanol at either commercial or large demonstration scale, yet reductions in biofuel production costs must still occur thanks to optimization in conversion processes and feedstock exploitation (especially waste biomass or algae), while more advanced biofuels are being developed. The Spanish headquartered Abengoa has for instance recently completed a demonstration unit in Spain for ethanol production from Municipal Solid Waste, while Beta Renewables, a joint venture between Chemtex and TPG, has begun shipping ethanol fuel produced from wheat straw from its Italian facility in June 2013. Clariant produces ethanol from agricultural residues, running both a pilot and a demonstration facility in Germany, and has an annual capacity of 1 000 tons of ethanol/year. Inbicon/DONG, headquartered in Denmark, currently operates a large-scale pilot plant in Denmark and has formed several strategic partnerships to develop new projects in Denmark, China, and North America.
  - Despite there has been a tense relationship over the past decade between oil companies and the biofuels industry, oil companies are currently slowly becoming major investors in biofuel production, as

global policy moves towards assigning costs to carbon emissions. In Europe, for instance, Shell (The Netherlands) has entered a joint venture with the Brazilian energy company Cosan, which is called Raízen, while Eni (Italy) is in the process of converting a traditional refinery to a biorefinery close to Venice, in partnership with UOP. The plant will begin producing green diesel in 2014 and be fully operational by 2015. The Norwegian company Statoil provides ethanol at 1 300 stations in six countries (Norway, Sweden, Denmark, Lithuania, Latvia and Poland), while they are investing R&D efforts in investigating the potential of algae as a feedstock for production.

- Drop-in renewable hydrocarbons, which may be blended directly into standard gasoline, diesel, or jet fuel are also being developed.
- Sources: Environmental Entrepreneurs (E2), Advanced Biofuel Market Report 2013, Capacity through 2016, 2013

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

- 5 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- No significant patent-related indicators can be reported in this field