European Biofuels Technology Platform

Strategic Research Agenda
Strategic Deployment Document

Draft for public consultation

Update 2010

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Outline

European Biofuels Technology Platform: innovation driving sustainable biofuels

The European Biofuels Technology Platform (EBTP) was established in 2006 to contribute to the development of cost competitive world class biofuels technologies and accelerate the deployment of sustainable biofuels in the European Union, through a process of guidance, prioritisation and promotion of research, development and demonstration activities (R&D&D).

It brings together the knowledge and expertise of stakeholders active in the biofuels value chains: biomass resources providers, biofuels and bio-energy producers, technology vendors, transportation fuels marketers, transport industry, research and technology development organisations and NGO's. It is managed by a Steering Committee and supported by a Secretariat, the European Commission being an active observer. Stakeholders can register and share access to key contacts, internal and external reports, events, opinions and expertise on biofuels R&D. Platform activities are carried out through five working groups (Biomass, Conversion, Logistics and End-use, Sustainability, and Markets and Regulations) and Task Forces on specific topics (European Industrial Bioenergy Initiative (EIBI), Algae).

For more information on the European Biofuels Technology Platform please visit www.biofuelstp.eu

Preface

In January 2008, EBTP presented a collective view[1] of the main Research, Development and Demonstration (R&D&D) priorities and accompanying deployment measures required for a successful implementation of sustainable and competitive biofuels in the EU.

This document identified the 3 critical areas in which technology development should play a key role (feedstocks, conversion processes, end-use technologies) and highlighted clearly that the winning options would be the pathways (combination of feedstock, conversion and end products) best addressing combined strategic and sustainability targets: environmental performances (green house gas reduction, biodiversity, water, local emissions), security and diversification of energy supply, economic competitiveness and public awareness.

This 2010 update is strongly rooted in these core findings which remain fully valid. The purpose of the update is to present a synthetic view of the most significant recent developments (technical and non technical) of relevance to biofuels and to highlight corresponding R&D&D priorities. The format is deliberately concise, aiming at presenting a simple view of this complex area and not claiming an exhaustive coverage. It is based on the broad basis of collective expertise of EBTP working groups, gathering actors across the biofuels value chains: feedstock providers, biofuels and bio-energy producers, technology vendors, transportation fuels marketers, automotive industry, aviation industry, research & technology development organisations and NGO's.

Over the last 2 years the EBTP has actively contributed to shaping the European Industry Bioenergy Initiative (EIBI[2]), which will support demonstration[3] and reference plant[4] projects for innovative bioenergy value chains with large market potential via public private partnerships.

The EIBI proposal of the EBTP and the present document share common foundations and essential key messages. However, their respective purposes and scopes are distinct. The EIBI proposes a new programme to select and fund projects to accelerate industrial deployment of promising new technologies. The 2010 SRA update, on the other hand, presents a synthetic view on the key issues which drive, shape and enable biofuels developments (regulations, sustainability, feedstocks, technology) to highlight priority areas were further R&D&D is needed.

The 2010 update will be open to public consultation on EBTP's web site for 5 weeks starting on 16 April 2010.

[1] European Biofuels Technology Platform Strategic Research Agenda & Strategy Deployment Document (EBTP SRA/SDD): available on www.biofuelstp.eu

[2] Boosting the contribution of bioenergy to the European Union Climate & Energy ambitions: a proposal for a European Industrial Bioenergy Initiative (EIBI): Executive summary: available at www.biofuelstp.eu

[3] Demonstration plant: demonstrates the performance and reliability of all critical steps of the value chain so that the first commercial unit can be designed and performance guaranteed from the outcome of the Demo unit.

[4] Reference Plant: first commercial scale unit

1. Executive summary

The aim of this update is to present most significant recent evolutions of relevance to biofuels and to highlight corresponding R&D&D priorities

Facts

- Strong growth of biofuels production and consumption worldwide continued over the last 2 years, including in Europe. This growth is driven by regulations.
- Biofuels economics have been strongly exposed to swings in oil and bio-feedstock prices: spike in crude oil prices did not allow biofuels to become competitive with fossil fuels.
- Biofuels deployment still directly dependant on adequate regulatory framework, both for current biofuels and new value chains[5].
- New EU legislation (Renewable Energy Directive and Fuel Quality Directive) introduces regulatory framework for sustainability and sets 2020 targets for share of renewable in transport fuels and Green House Gas emission reduction.
- Sustainability and public awareness, already identified in 2008 SRA/SDD as critical, have growing importance.
- New topics for biofuels R&D have emerged:
  - New resources: algae and other aquatic biomass
  - New technology "bricks": synthetic biology, catalytic chemical conversion
  - New demand: biofuels for air, marine and rail transport

Observations and recommendations

The fundamentals for biofuels have not changed. As highlighted in the 2008 SRA, the winning options will be the pathways (combination of feedstock, conversion and end products) best addressing combined strategic and sustainability targets: environmental performances (green house gas reduction, biodiversity, water, local emissions), security and diversification of energy supply, economic competitiveness and public awareness.

Currently commercially deployed feedstocks and conversion technologies should provide a significant contribution to the EU 2020 targets but will probably not be sufficient. It is necessary to enlarge the feedstock basis and enhance conversion efficiency. These broad objectives were at the core of the 2008 SRA/SDD findings and remain fully valid.

- R&D on sustainability related tools and data, need higher priority and increased public funding, to ensure that sustainability related legislation, standards and certification schemes are rooted on sound science, based on transparent and relevant data, using practical tools.
- Sustainable and reliable supply of feedstocks will be a critical success factor for the long-term perspective of biomass-based technologies on a large scale. This relates to efforts in improving productivity in these sectors, in developing reliable supply chains that open up the feedstock potentials, certification issues, and prevention of excessive disturbances in agricultural and forest commodity markets. These challenges which are not specific to bioenergy and biofuels use of biomass should be addressed in a coherent effort shared with the relevant stakeholders and initiatives.
- For currently industrially deployed value chains and technology, R&D focus is on improvement of environmental and economic performances.

[5] Value Chain: specific combination of feedstock, processing technologies and marketable end products

- For innovative biofuels value chain (not yet commercially deployed) short/mid term (2020 horizon) applied R&D should be focused mostly on supporting pilot, demonstration[6] and first industrial deployment of technologies (reference plants[7]) allowing feedstock flexibility and/or higher added value end products, in full compliance with EU sustainability targets.
- Because of the variety of potential feedstocks, at world and EU levels, different conversion technologies are needed based on mechanical, thermochemical, biological and chemical processes.
- The winning options can only be identified taking into account the full value chain from feedstock to end products, for well defined context of raw materials, regulations and potential industrial synergies (The "Value Chain" approach, closely related to the "Biorefining" concept); To develop and optimise the use of the European "basket of feedstocks", a "toolbox of technologies" is needed.
- Algae, synthetic biology[8], chemical/catalytic conversion technologies are offering new feedstock and/or technical options for biofuels value chains. They deserve full recognition in the public funded R&D programmes. They already receive considerable attention and funding in North America.
- Biofuels share of the EU market for road transport fuel is rising, with an increasing appetite for distillates to serve markets for transport fuels (road, aviation, marine): research for_feedstocks and/or conversion technologies to serve these fast growing needs should get enhanced priority.
- Basic research is needed both to support the science underlying ongoing technology developments and to prepare for future, longer term, breakthrough options.
- Value chains leveraging on industrial synergies with existing facilities deserve priority attention as they might offer the best economic and industrial framework to manage the high risk/high cost of deploying promising new technologies, helping the transition from conventional to advanced biofuels.
- European Industrial Bioenergy Initiative (EIBI), aiming to select and fund demonstration and first industrial deployment of innovative biofuel/bioenergy technologies with large market potential, is critical to boost the commercial deployment of promising value chains to meet the EU 2020 targets.
- To prepare the Implementation Plan for EIBI, it is essential to identify realistic and meaningful public funding sources, to develop pragmatic and efficient governance principle to allow rapid and transparent implementation and give a clear signal to private actors that early movers to industrialise promising but risky technologies will be supported.

2. Introduction

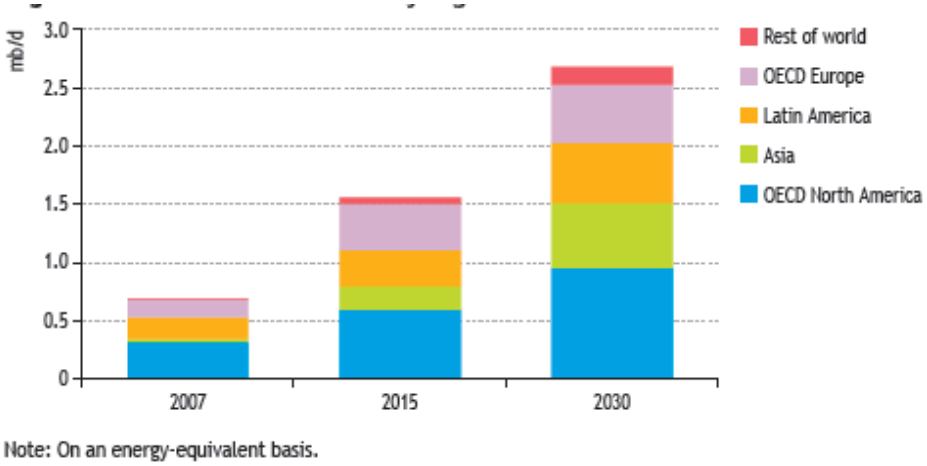
Since the publication of the 2008 SRA/SDD, the overarching fundamentals for biofuels have not changed and its core findings remain fully valid. However significant evolution is ongoing and new topics have emerged, with meaningful influence on biofuels developments and corresponding R&D needs. The purpose of this update is to present a synthetic view of these issues and topics.

Highlighting sustainability, policy framework and public awareness as critical for shaping biofuels markets, this document is first presenting the most significant recent developments in these areas.

[6] Demonstration: demonstrate the performance and reliability of all critical steps of the value chain so that the first commercial unit can be designed and performance guaranteed from the outcome of the Demo unit.
[7] Reference Plant: first commercial scale unit
[8] Synthetic biology: rational design of the metabolism of a micro organism to produce a desired molecule with high yield, and productivity, using modern biotechnology tools.

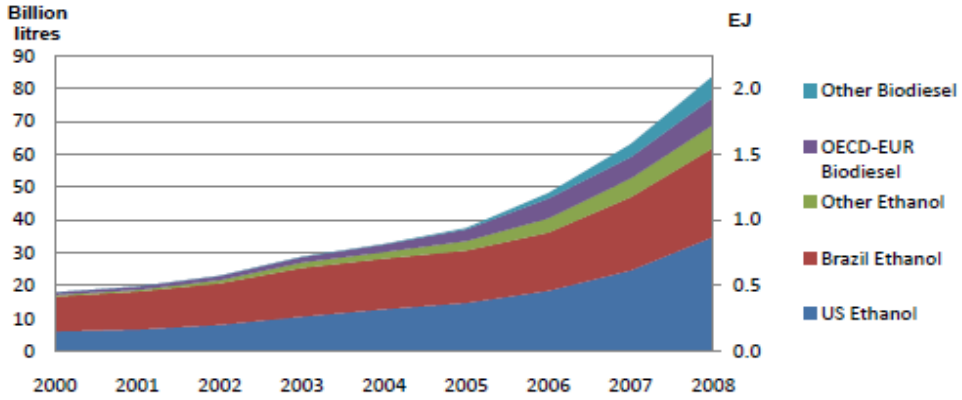
The last two years witnessed ***strong growth in biofuel production and consumption*** – not only in Europe but in several regions of the world. A further increase of the global biofuels demand is anticipated because of the biofuels regulations being introduced or pursued in many countries (see figure 1).

Figure 1: Biofuels demand by region (Source: World Energy Outlook 2009, p. 8)



Ethanol accounted for two-thirds and biodiesel for one-third of the total biofuels production (see figure 2)

Figure 2: Global biofuel production 2000-2008 (Billions of litres of respective commodity; Source: Sustainable production of second generation biofuels. Potential and perspectives in major economies and developing countries, IEA, 2010, p. 22)



At the same time, biofuel markets experienced full ***exposure to volatilities in crude oil and bio-feedstocks prices.***

The fundamentals have not changed: biofuels commercial deployment still depends very much on appropriate ***regulatory frameworks,*** both for existing biofuels and for innovative value chains.

Two ***recent EU legislations*** (Renewable Energy Directive, Fuel Quality Directive) will have considerable impact on the biofuels landscape in Europe over the next decade. These Directives set

targets for the share of renewable energy and Green House Gas /GHG emissions reduction for transport fuels. They are also framing the basis for sustainability based criteria. They validate the urgent need for adequate technologies to broaden the feedstock base and to maximise the biomass-to-end products economic and environmental efficiency for current and new feedstocks (biorefining[9]). These goals were already highlighted in the 2008 SRA.

Sustainability and public awareness, topics already presented in 2008 by EBTP as critical, have since attracted the full spotlight. This is a reflection of the complexity of biofuels issues, at the convergence of agricultural, energy, climate, environment, transport, trade and local development policies. As for other low carbon and renewable energy options, they do not provide a simple and unique solution to the world's Climate and Energy challenges, but they are a vital part of the solutions, provided their limitations are recognised and potential drawbacks addressed in the regulatory framework.

New R&D topics have also emerged:, upstream with algae as a potentially significant additional contributor as a bio feedstock, mid stream around the conversion technologies "tool box" with the emergence of synthetic biology[10] and catalytic process applications for biofuels and downstream with new end markets requesting biofuels: air, marine and rail transportation.

In line with the recommendation of the 2008 SRA/SDD to accelerate efforts towards implementation, EBTP has been very active over the last two years to shape the ***European Industrial Bioenergy Initiative/EIBI*** in the framework of the SET Plan[11]. In this context, the Value Chain Approach was developed by EBTP. This approach makes it possible to identify critical technologies and focus on relevant priorities for public and private actors willing to accelerate the deployment of advanced and sustainable bioenergy. Scope, objectives and activities currently under preparation within EIBI are presented in the final chapter of this document.

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[9] Biorefining is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat) [IEA Bioenergy Task 42 on Biorefineries]

[10] Syntetic biology: rational design of the metabolism of a micro organism to produce a desired molecule with high yield, and productivity, using modern biotechnology tools.

[11] SET Plan : In November 2007, the European Commission presented the European Strategy Energy Technology Plan, hence called the SET-Plan, COM(2007)723, which was adopted by the Energy Council of Ministers in February 2008 as a basis for the energy technology policy for Europe, aiming at the wide-scale application of low carbon technologies. The SET-Plan calls for strategic planning and new governance to align technology development with energy policy goals. Among the tools envisaged for the implementation of the SET-Plan, European Industrial Initiatives are expected to play a critical role. The key features of a European Industry Initiative as presented in the SET-Plan are the following:

- The initiative should not be realistically feasible at national level and should clearly leverage on European scale capability for additional resources and added value.
- It should be industry led, pool public and private financing and share risk via public-private partnership.
- It should be based on the definition and achievement of clear targets with quantified objectives.
- It should boost research and innovation in order to deliver results beyond business as usual.

Bioenergy is one of the 6 priority European Industrial Initiatives proposed initially.

3. Sustainability

Sustainability was already identified as a key issue by EBTP in the 2008 SRA/SDD
Main recent evolutions, facts

- Over the last 2 years full recognition of overarching dimension of sustainability has considerably developed
- First introduction of legal requirements for sustainability in the EU biofuels legislation in June 2009, with the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD). Quantitative targets are set for Green House Gas (GHG) emissions reductions. RED and FQD are presented in more detail in chapter 4.
- Certification criteria still under development with many open questions (direct and indirect land use, definition of biodiversity, soil, water, social criteria, etc.)
- It is increasingly recognised that sustainability requirements for bioenergy/biofuels use of biomass is further restricting its availability, as do competing usages (food, feed, fibre). It is also recognised that adequate sustainability requirements is critical to ensure the long term availability of biomass.

Policy recommendations

- Greater EU regulatory clarity and coherence across member states is necessary.
- Continued dialogue at international level is needed to achieve compatible standards.
- Ensure sustainability criteria shall apply across all biomass uses to allow a level playing field and avoid poor sustainability performances in some sectors.

R&D recommendations

- Practical implementation of sustainability requirements in the legislation and market place must be based on relevant, transparent and science based data and tools:
- Since sustainability of biofuels is still a "loosely defined" topic from a scientific point of view, it is essential to accelerate the development of science based, rational and transparent:
    - Criteria, indicators, methodology (LCA and others) and data,
        - ➢ across the full value chains, from feedstocks to end uses
        - ➢ for EU relevant geographies, for both domestic and imported feedstocks or biofuels
        - ➢ for the three dimensions of sustainability:
            - environmental (GHG (CO_2N_2, CH_4), water, biodiversity, local emissions, soil, etc.)
            - social
            - economic
    - Models, monitoring and impact assessment tools to
        - ➢ help assess implementation of enacted legislation,
        - ➢ prepare public (policy) and private (investment) decisions,
        - ➢ better asses the issues around direct and indirect land use change and to
        - ➢ help manage the issues of competing uses of arable land and biomass.
- A better understanding of sustainability aspects of biofuel value chain versus other economic "value chains" as well as non-market "common goods" is needed, in particular to include systemic impacts over short versus long term time lines.
- Sustainability related tools and data should be a priority for public funded R&D at EU and national level

4. Markets, regulatory framework and public awareness

Main recent evolutions, facts

- Sharp increase in biofuels production and consumption in the EU and worldwide, despite public controversy over potential pitfalls of biofuels such as “food vs. fuel” and GHG balance.
- Despite high oil prices, biofuels have not become competitive with fossil fuels because agricultural commodity prices also followed the price surge. Biofuels still require regulatory support to compete on the market.
- The Renewable Energy and Fuel Quality Directives provide regulatory framework for biofuels in 2020 in the EU.
- Member States implementation of the above directives is expected to provide greater clarity on renewable fuel and energy mix targets at national levels, however, the current lack of clear EU sustainability requirements creates investment and market uncertainty.
- Different regulatory frameworks including sustainability requirements and supporting advanced technologies are being more actively developed in some countries (The Netherlands, UK, Germany, US/RFS2, California...). Low carbon requirements and market incentives focus, so far, essentially on GHG performance
- The complexity of biofuels issues is not yet fully understood by the wider public.

Recommendations

- Favour a pragmatic approach to EU biofuels legislation, starting with simple, meaningful, quantifiable and verifiable criteria, based on sound science. Ensure a swift implementation at Member States level.
- To support the RED and FQD, land use change and other sustainability criteria must be further clarified.
- For innovative biofuel technologies ensure continued R&D support through existing EU and national instruments, and develop relevant investment schemes (grant, loans, fiscal incentives) to allow funding of risky demonstration and reference units via public/private partnerships (see chapter 8 on EIBI).
- Increase public funding and strengthen support of R&D on sustainability related tools and data (see chapter 2)
- Encourage and support initiatives to inform and explain to the wider public the benefits of biofuels and the ongoing efforts to minimise their pitfalls.

Renewable Energy Directive 2009/28/EC (Official Journal 5 June 2009)

- By 2020, mandatory targets of 20 % share of RES in final energy consumption, 20 % increase in energy efficiency and 10 % of RES in transport in each Member State
- Harmonised approach with Fuel Quality Directive
- No biofuels from carbon rich or bio-diverse land; EC has to report on compliance with environmental and social sustainability criteria of major biofuel exporting countries
- Minimum GHG reduction for biofuels 35 % and 50 % from 2017 on; 60 % for new installations from 2017 on. For plants operating in January 2008 GHG requirement will start in April 2013
- Bonus of 29 g CO2/MJ for biofuels from degraded/contaminated land
- Biofuels from waste, residues, non food cellulosic material, and lignocellulosic material will count twice for RES transport target
- Member State Implementation into national legislation by December 2010

Fuel Quality Directive 2009/30/EC

- Further tightening environmental quality standards for a number of fuel parameters,
- Enabling more widespread use of ethanol in petrol (E10) with transitory regulations (protection grade E5) for older cars and derogations for petrol vapour pressure subject to EC approval
- Increase of allowed biodiesel content in diesel to 7% (B7) by volume, with an option for more than 7% with consumer info
- Introducing a mechanism for reporting and reduction of the life cycle GHG emissions from fuel
- Reduction in life cycle GHG emissions from energy supplied. Binding target of 6% between 2011-2020 as first step, while leaving open the possibility to increase the future level to 10%.
- To that effect, in a 2012 review, the Commission will need to assess a further increase of the ambition level of 2% from other technological advances, such as the supply of electricity for use in transport. A further 2% is envisaged to be achieved by the use of CDM credits for flaring reductions not linked to EU oil consumption.

5. Biomass availability and supply

Increasing the amount of biomass available under sustainable conditions was already identified as a critical challenge for biofuels in the 2008 EBTP SRA/SDD.

Main recent evolutions, facts

- Wider recognition that availability of sustainable and competitive biomass supply is a first priority issue for biofuels (towards the EU 2020 targets). This is true for all value chains, because no EU feedstock source has been identified that could satisfy all EU requirements.
- Similarly, it is now widely recognised that growing biomass as feedstocks for current and advanced biofuels can compete for land with a range of other end uses (feed, food, paper, wood products, biomaterials, heat, electricity ...)
- The RED directive gives residual feedstocks and wastes (agricultural, forestry, industrial and municipal) an advantageous profile, as they provide GHG emissions savings without competing for finite land resources.
- Global trade in unrefined feedstocks grows.

Policy recommendations

- Future policy & implementation strategies should enhance complementarity and synergies among different sectors using arable land and/or biomass.

R&D recommendations

- Develop a common view on sustainable biomass availability across different sectors, shared with all relevant stakeholders
- Develop cost supply curves for existing and new feedstocks and given timeframes, regions and demand types. Identify obstacles to mobilization.
- Develop new plant/ tree varieties (crop/tree breeding and physiology); improve cultivation and management practices (propagation, cultivation systems, etc.) to optimise water and other inputs and increase productivity
- Optimise associated equipment to minimise logistics chain costs and to meet conversion requirements (integrated harvesting, collection and transport solutions for fibre/bio-materials and energy).
- Develop large-scale logistics for new feedstocks or underutilised resources, optimise along the supply chain
- Competition in biomass use: research should focus on defining the ways and the criteria to assess which biomass can contribute to a sustainable biofuels market without directly competing with other uses (esp. food).
- Use of wastes and residues – maximising efficient closed loop cycles and biorefining

6. Biofuels from algae (micro and macro)

Algae have recently emerged as a promising additional/complementary feedstock source for biofuels. This potentially new bio-feedstock also requires specific conversion technologies. This chapter summarises the current algae-derived biofuel pathways, as well as relevant R&D recommendations.

Facts

- Until recently, industrial use of algae was focussed solely on high-value products. Both micro and macro algae have attracted attention from a biofuels perspective.
- Very little is known so far about the more than 30.000-40.000 classified species of micro-algae
- Theoretical calculations show attractive potential for future algae-based biofuels, but cost reduction and scale-up are critical challenges.
- Commercialisation of algae co-products is seen as a necessary complement for algae based biofuels (algae cultivation for new high-value products will reach commercial viability before biofuel production from algae)
- A number of pilot and a few demonstration facilities have been built or are in the planning stage, but no industrial-scale plant for biofuels from algae yet
- Extensive R&D&D underway on algae biofuels worldwide, especially in North America and Europe with a high number of start-up companies developing different options
- Lipid-rich algae have the potential for use as feedstock for diesel and jet fuels

R&D recommendations

- As for other biofuels value chains, it is necessary to take a complete chain/biorefining approach with an integrated appreciation of economic, social, technical and environmental issues.
- R&D (Short/mid-term applied and long-term fundamental research) efforts should target efficient, sustainable and integrated growing, harvesting, logistics, conversion and by-product utilisation (similar biorefining approach to other biofuel value chains)
- Fundamental R&D on identification and optimisation of algae strains (micro and macro algae) is needed. Optimisation does not only refer to yield rates, but also to increased tolerance of contaminants.
- Applied R&D on conversion processes, leveraging on existing biofuels conversion technologies where possible.
- Work on sustainable industrial scale algae production techniques and best practices is required. Main challenges: ensure cost-competitiveness with fossil fuels, improve energy balance, manage large quantities of water, prove scalability.
- LCA and energy balance of algae-to-biofuel production chains, with compatible approach to other biofuel value chains.
- Identification and management of environmental externalities of large-scale algae cultures
- Evaluate advantages and disadvantages of open pond systems versus closed loop bioreactors.
- Evaluate benefits and risks of GMO, including public awareness as well as potential impact on biodiversity.

7. Conversion processes

The key objectives for biofuels conversion technologies were already highlighted in the 2008 SRA: developing energy and carbon efficient biomass-to-fuel processes which are flexible with regard to feedstocks and which result in high-quality end products.

Main recent evolutions, facts

- Due to the many different potential feedstocks, different processing technologies are needed. It is not possible identify "best" technologies outside of a specific value chain and context (e.g. available feedstocks,targeted end products, industrial synergies).
- In the "tool box" of technologies for biomass conversion into biofuels, new tools (previously developed for other applications in the pharmaceutical and chemical industries) have emerged: synthetic biology[12] and catalytic/chemical conversion. They target higher added value biofuels, fully compatible at high blend with existing fuel infrastructures.
- New biofuel technologies have entered the market place in the EU over the last years; hydrotreatment of vegetable oil.
- Several new pilot and demo units for advanced biofuels have been built and started up since 2008 SRA/SDD, much more in North America than in the EU, whose technology leadership on this topic is increasingly being challenged.

Specific R&D messages

- Key priority for commercial biofuel technologies: improve environmental (GHG, energy balance, water, inputs…) and economic performance
- For advanced biofuels (not yet commercially deployed), the focus is on:
  - Ability to process a wide range of sustainable feedstocks while ensuring energy and carbon efficient process and selectivity towards higher added value products.
  - Biofuels which perform at least as well as, but preferably better than existing ones. Full compatibility with existing fuel infrastructures at increasing blend rates must be aimed at.
- Conversion technologies targeting distillates for transport fuels deserve priority attention because of increasing demand (heavy duty road transport, air, marine)
- For advanced biofuels, activities on process optimisation/integration should focus on specific value chains such as those identified for the European Bioenergy Initiative, with ongoing pilot, demo and reference plant projects.
- Value chains leveraging on industrial synergies with existing facilities deserve priority attention as they might offer the best economic and industrial framework to manage the high risk/high cost of deploying promising new technologies, helping the transition from conventional to advanced biofuels.
- New "tools" need to be further evaluated and developed/adapted for EU feedstock applications:
  - Synthetic biology to produce "drop in" biofuels (biofuels with chemical and physical properties fully compatible with current fuel infrastructures)
  - Catalytic and chemical biomass conversion (i.e. catalytic conversion of sugars to furanics)
- Aviation and marine fuels: no specific technical challenges for processing technologies, but mostly (downstream) fine-tuning of processes already developed for road transport fuels.

[12] Synthetic biology: rational design of the metabolism of a micro organism to produce a desired molecule with high yield, and productivity, using modern biotechnology tools.

8. Product distribution and use

Recent evolutions, facts

- Biofuels share of the EU market for road transport fuel is rising, with an increasing appetite for distillates to serve markets for transport fuels (road, aviation, marine)
- Higher levels of biofuel blends due to increased biofuel targets create new challenges with regard to specifications/standards.
- RED and FQD provide incentives for RES across all transport sectors, including aviation and marine, overall increasing the demand for biofuels.
- Development of specific infrastructure for gaseous fuels and liquified biofuels such as methane/SNG and DME is ongoing in the EU on a local basis for fleets.
- New scenarios for road transport needs have recently been developed (ERTRAC[13]); Biofuels represent one of several solutions, together with increasing energy efficiency, inter modality, electrification and non-technical measures to encourage changes in consumer choices and behaviour.

R&D priorities

- 2008 priorities remain valid: continuous improvement of fuel-engine environmental, energetic and economic performance ensuring compatibility with existing and future infrastructure and vehicles, in optimized value chains.
- The Renewable Energy Directive 10 % target confirms the relevance of tackling the challenges posed by higher blends for fuel distribution and for end use in vehicles.
- For marine and particularly aviation applications, fuel specifications as well as current and future fuel/engine compatibility need to be tackled.

[13] ERTRAC: European Road Transport Research Advisory Council, Road transport Scenario 2030 + « Road to Implementation » www.ertrac.org

9. The European Industrial Bioenergy Initiative

Key messages

- After SET Plan proposal in 2007, 6 Industrial Initiatives were developed, including one on bioenergy. Over the last 2 years EBTP has been actively contributing to the shaping of the European Industry Bioenergy Initiative (EIBI).[14]
- EIBI's purpose is to accelerate the commercial deployment of advanced technologies to boost the contribution of sustainable bioenergy to EU 2020 Climate and Energy targets.
- EIBI targets on innovative bioenergy value chains which are not yet commercially available and which could be deployed at large scale.
- Key objective of EIBI is to enable commercial availability of advanced bioenergy at large scale by 2020, aiming at production costs[15] to allow competitiveness with fossil fuels at the prevailing economic and regulatory market conditions, and advanced biofuels[16] covering up to 4 % of EU transportation energy needs by 2020.
- EIBI also aims for strengthening the EU world technology leadership for renewable transport fuels for diesel and jet engines[17], serving the fastest growing area of transport fuels in the world.
- A set of innovative[18] industrial bioenergy value chains could be successfully deployed in Europe provided supportive framework is available to manage high cost and risk of industrial deployment.
- The focus of EIBI should be on those value chains, which could bring large volume contributions, and which are too costly to be developed and funded at national level.
- Seven such innovative bioenergy value chains, that could bring significant contributions to EU ambitious objectives, in addition to the existing bioenergy value chains, have been identified. The following list is not exhaustive.

7 "generic" value chains

A) Conversion paths based on thermochemical processes:

(1) Synthetic fuels / hydrocarbons from biomass via gasification (main markets: renewable transportation fuels for jet and diesel engines)

(2) Bio-methane and other gaseous fuels from biomass via gasification (substituting natural gas and other gaseous fuels)

(3) High efficiency power generation via gasification of biomass (main markets: electricity for large scale plants, CHP for smaller plants (below 20 MWel)

(4) Bioenergy carriers from biomass via other thermochemical processes like pyrolysis, torrefaction etc. (main markets: fuels for heating, power generation or intermediate for further upgrading into transportation fuels.)

[14] Boosting the contribution of bioenergy to the European Union Climate & Energy ambitions: a proposal for a European Industrial Bioenergy Initiative (EIBI): Executive summary: available at www.biofuelstp.eu

[15] Production cost of biofuels depends heavily on investment intensity, on the degree of utilization of primary energy and on feedstock price, with significant differences across geographic areas and specific feedstock types.

[16] Sustainable biofuels with a broader raw material base and/or better end product properties than the biofuels currently on the market

[17] This comprises fuels for the transport needs of diesel fuelled cars, trucks & buses, off road vehicles, ships and airplanes

[18] Innovative for the purpose of EIBI means not yet commercially available (thus excluding current biofuels, heat & power, biogas …)

B) Conversion paths based on biological and chemical processes:

(5) Ethanol and higher alcohols from sugars containing biomass[19] (main market: renewable transportation fuels as gasoline components, E85)

(6) Renewable hydrocarbons from sugars containing biomass via biological and/or chemical process (main markets: renewable transportation fuels for jet and diesel engines)

(7) Production of bioenergy carriers from CO2 & sunlight through micro-organism based production (algae, bacteria etc.) and further upgrading into transportation fuels and valuable bio-products (main market renewable transport fuels for jet and diesel engines)

- Within each of these 7 "generic" value chains, different paths based on significantly different fossil feedstocks (including fossil co-processing) technological and/or industrial options are possible. Combinations of thermochemical and biological processes are also possible. They all correspond to different types of energy-driven biorefineries[20].
- Demonstration of the sustainable performance of these technologies over the complete value chain is critical for securing financing for commercial large scale deployment and gaining social acceptance.
- The selection and funding of demonstration[21] and/or reference plants[22] projects will constitute the core activity of EIBI. With an estimated budget of 8 Billion € over 10 years 15 to 20 demonstration and/or reference plants could be funded.
- Governance, funding and definition of eligibility and selection criteria for projects are being currently actively discussed with the European Commission and the Member States.
- Selection of projects will be managed by calls; first calls to be published together with the official launch of the EIBI expected in November 2010.

[19] Biomass containing monosaccharides (e.g. glucose), disaccharides (e.g. sucrose) and polysaccharides (e.g. starch and cellulose) with the main focus on lignocellulosic biomass

[20] Biorefinery: Biorefining is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat) [IEA Bioenergy Task 42 on Biorefineries]

[21] Demonstration: demonstrate the performance and reliability of all critical steps of the value chain so that the first commercial unit can be designed and performance guaranteed from the outcome of the Demo unit.

[22] Reference Plant: first commercial scale unit.