European Technology and Innovation Platform Bioenergy

Biomass for growth: potentials and challenges of bioenergy in the Danube Region

Dina Bacovsky
Bratislava, 30 November 2016

ETIP Bioenergy –
European Technology and Innovation Platform Bioenergy

- Based on the European Commission's Energy Union strategy
- Is a continuation of
  - the European Biofuels Technology Platform (EBTP, launched 2006) and
  - the European Industrial Bioenergy Initiative (EIBI, launched 2010)
- Established in April 2016

What are European Technology Platforms (ETPs)?

- ETPs are **industry-led stakeholder fora recognised by the European Commission** as key actors in driving innovation, knowledge transfer and European competitiveness.
- ETPs **develop research and innovation agendas and roadmaps for action** at EU and national level to be supported by both private and public funding. They mobilise stakeholders to deliver on agreed priorities and share information across the EU.
- By working effectively together, they also help deliver solutions to major challenges of key concern to citizens such as the ageing society, the environment and food and energy security.
- ETPs are independent and self-financing entities. They conduct their activities in a transparent manner and are open to new members.

What are European Industrial Initiatives (EIIs)?

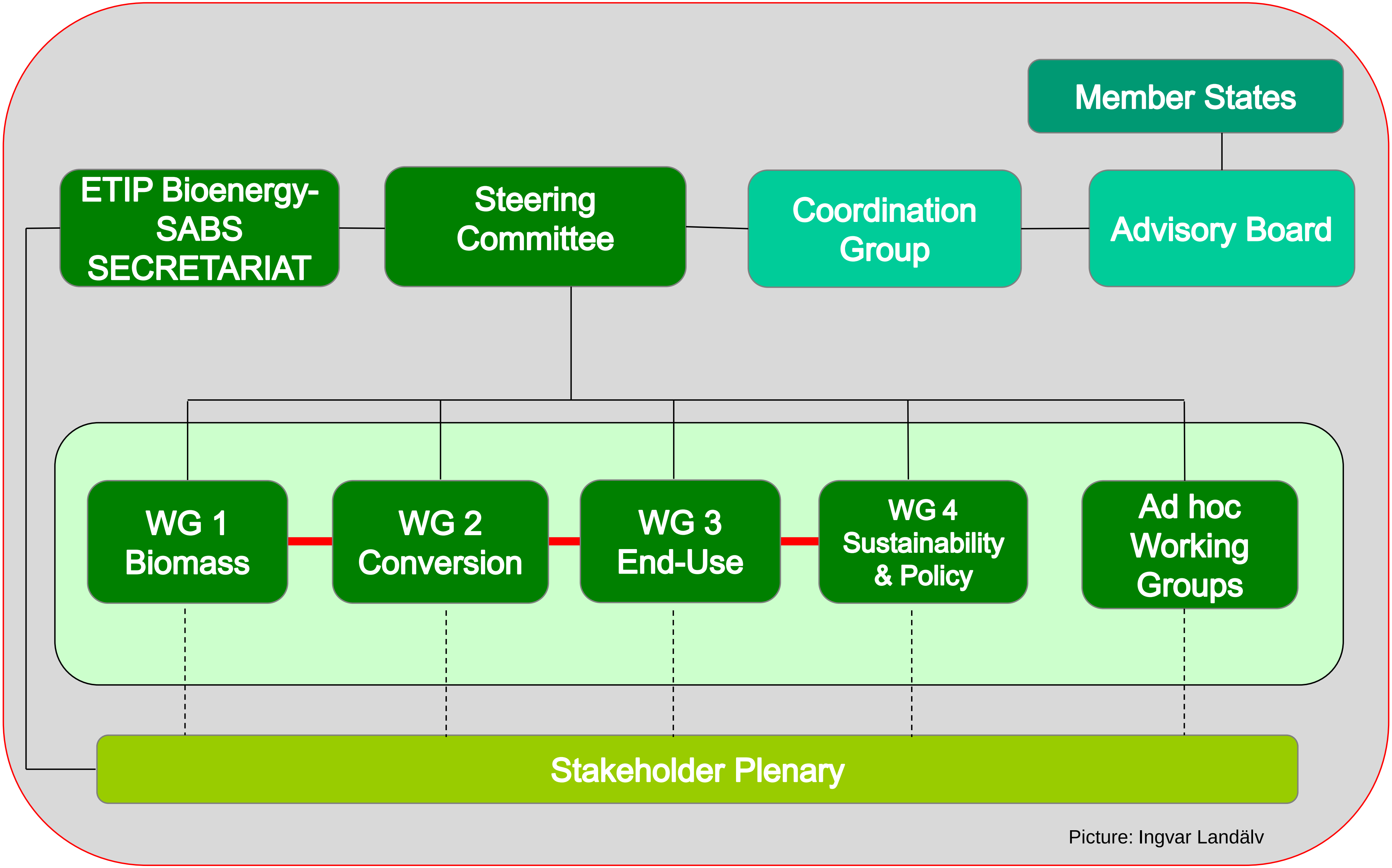
- EIIs are **joint large scale technology development projects between academia, research and industry**. The goal of the EIIs is to focus and align the efforts of the Community, Member States and industry in order to achieve common goals and to create a critical mass of activities and actors, thereby strengthening industrial energy research and innovation on technologies for which working at the Community level will add most value.
- EIIs will be integrated into the new Technology and Innovation Platforms (ETIPs)

ETIP Bioenergy Mission

The mission of the European Technology and Innovation Platform is to contribute:

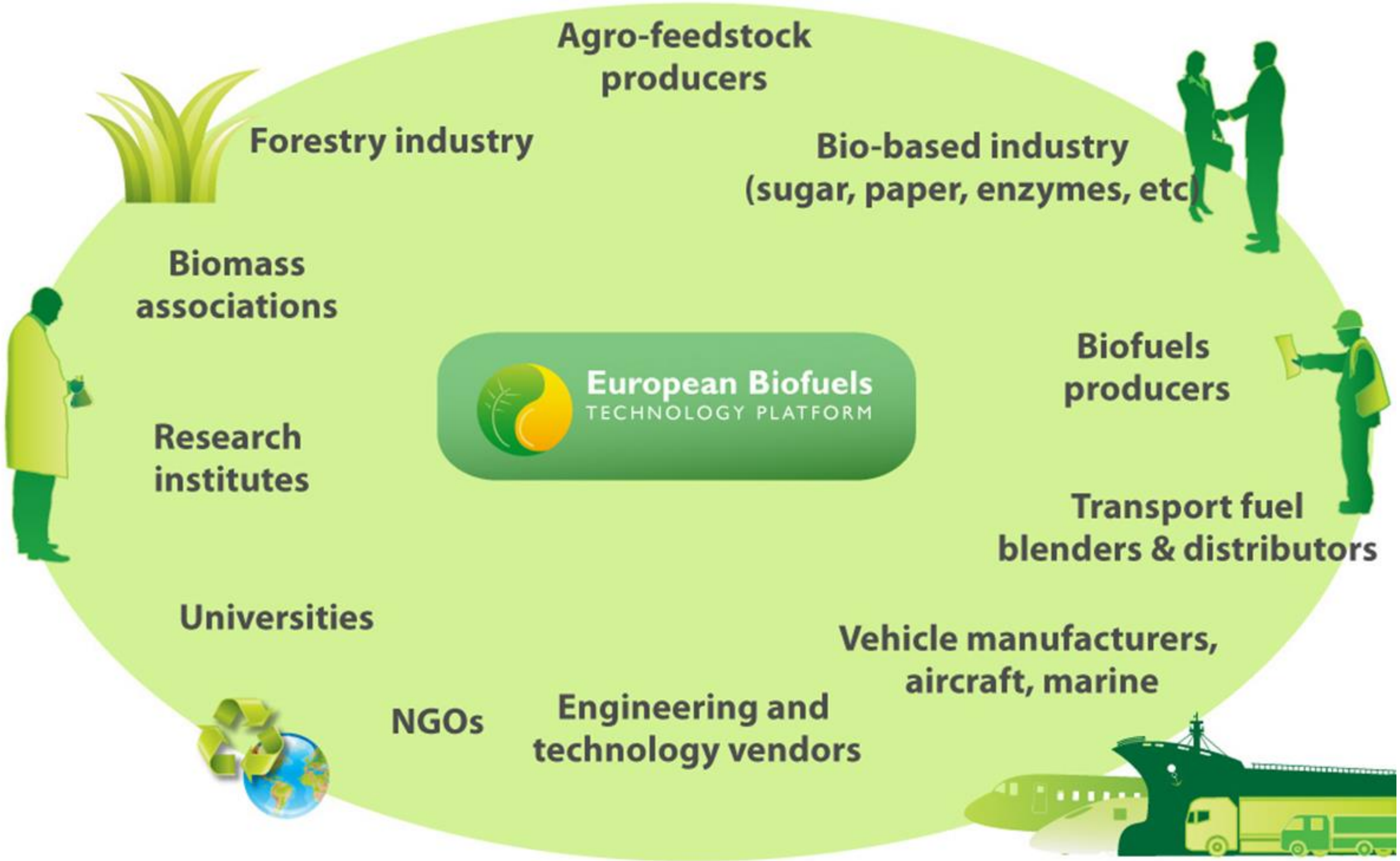
- to the development of cost-competitive world-class bioenergy and biofuel value chains,
- to the creation of a healthy bioenergy industry, and
- to accelerate the sustainable deployment of biofuels and bioenergy in the EU
- through a process of guidance, prioritisation and promotion of research, technology development and demonstration.

Organisational Chart ETIP Bioenergy (June 2016)



Picture: Ingvar Landälv

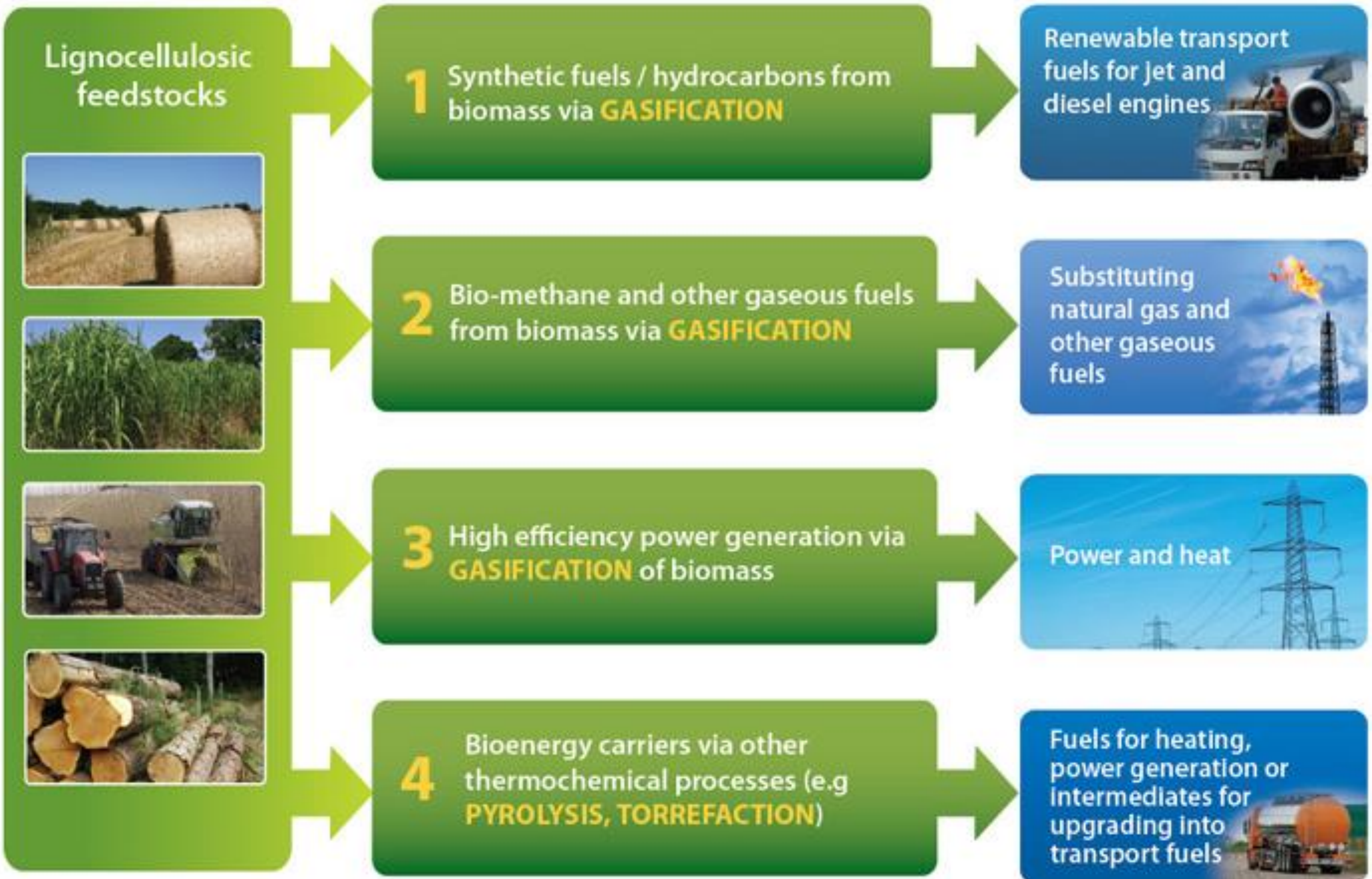
Stakeholders of the ETIP Bioenergy



ETIP Bioenergy Steering Committee Members

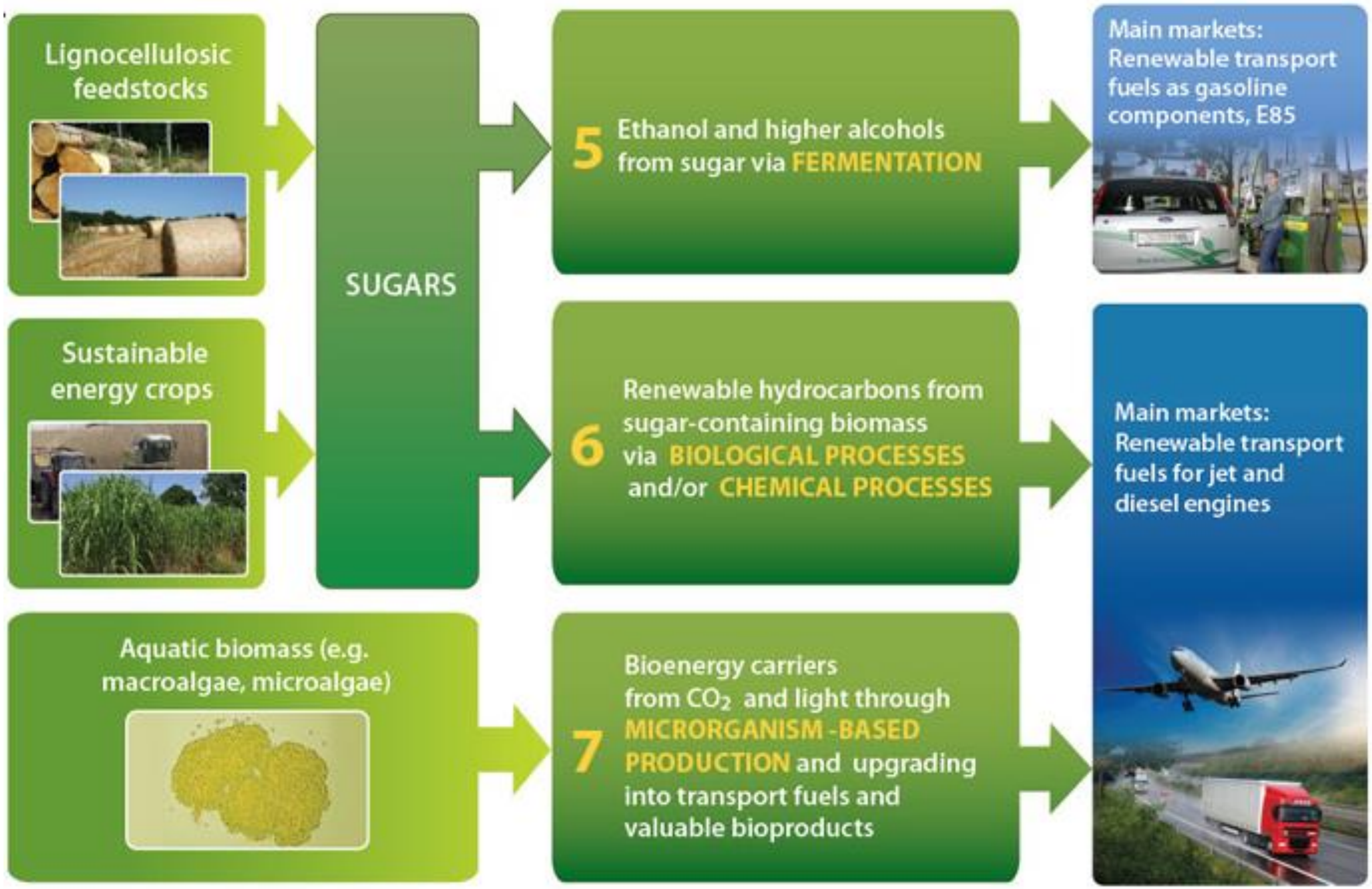
- Institute of Industrial Organic Chemistry, Warsaw
- Gruppo M&G
- EuropaBio/ SusChem
- ABENGOA Bioenergy
- European Biodiesel Board
- Bellona
- DONG Energy
- SAFRAN Group
- Finnish Forestry Industries Federation
- Lulea University
- Neste
- Fossil Free Fuel Centre
- IFPEn
- Volvo Technology Corporation
- REPSOL S.A.
- SINTEF
- Pannonia Ethanol
- FZ Jülich/RWTH Aachen
- Wageningen University and Research
- ETIP RHC-Biomass
- *EERA*

Thermochemical Pathways



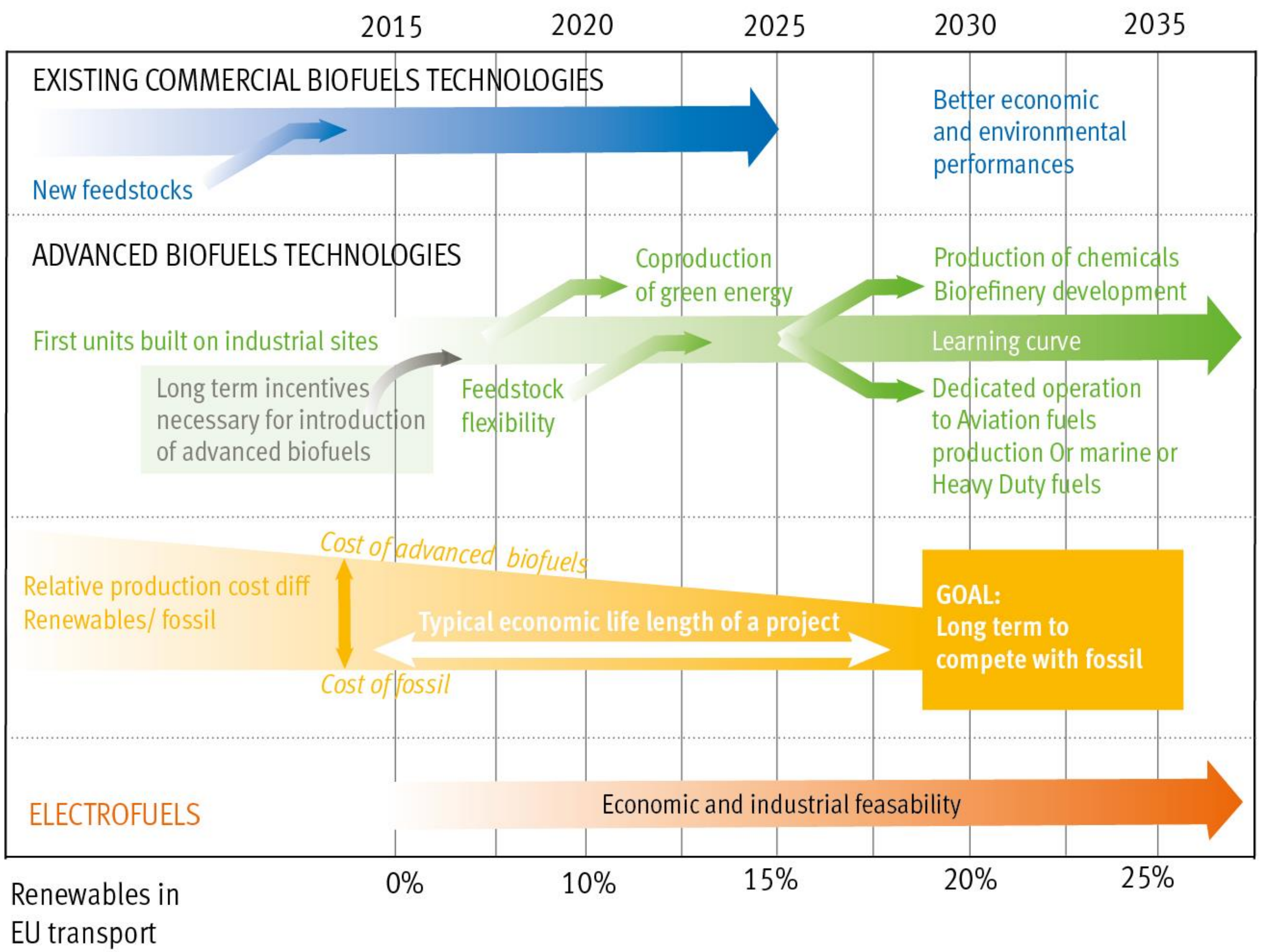
Source : EBTP/EIBI

Biochemical Pathways



Source : EBTP/EIBI

Biofuels deployment



ETIP Bioenergy activities

- Support of the SET Plan Implementation
- Mapping of research projects, reports, pilot and demonstration plants
- Stakeholder Plenary Meetings
- Update of the Strategic Research and Innovation Agendas (2008/2010/2016)
- Specific working group activities
- Production of fact sheets (technologies, fuels, demonstration plants, countries)
- Preparation of position papers (iLUC, RED, SET Plan Key Action 8, etc.)
- Cooperation with other ETIPs (RHC, CCS, ERTRAC)

Stakeholder Plenary Meetings

7th Stakeholder Plenary Meeting Agenda, 21st June 2016

Welcome: 10 years of EBTP 2006 - 2016

Towards an Integrated SET-Plan – The role of bioenergy/biofuels in accelerating the European energy system transformation

Session 1 Decarbonising transport

- Current Changes and Outlook in Global Oil Market
- The EBTP Transport Vision Group
- The role of advanced biofuels in future transport options

Session 2 Biofuels and the latest research developments

- Results from the EBTP Strategic Research Innovation Agenda Update
- Sustainable and resource efficient biomass
- Integration of advanced biofuels in bioeconomy

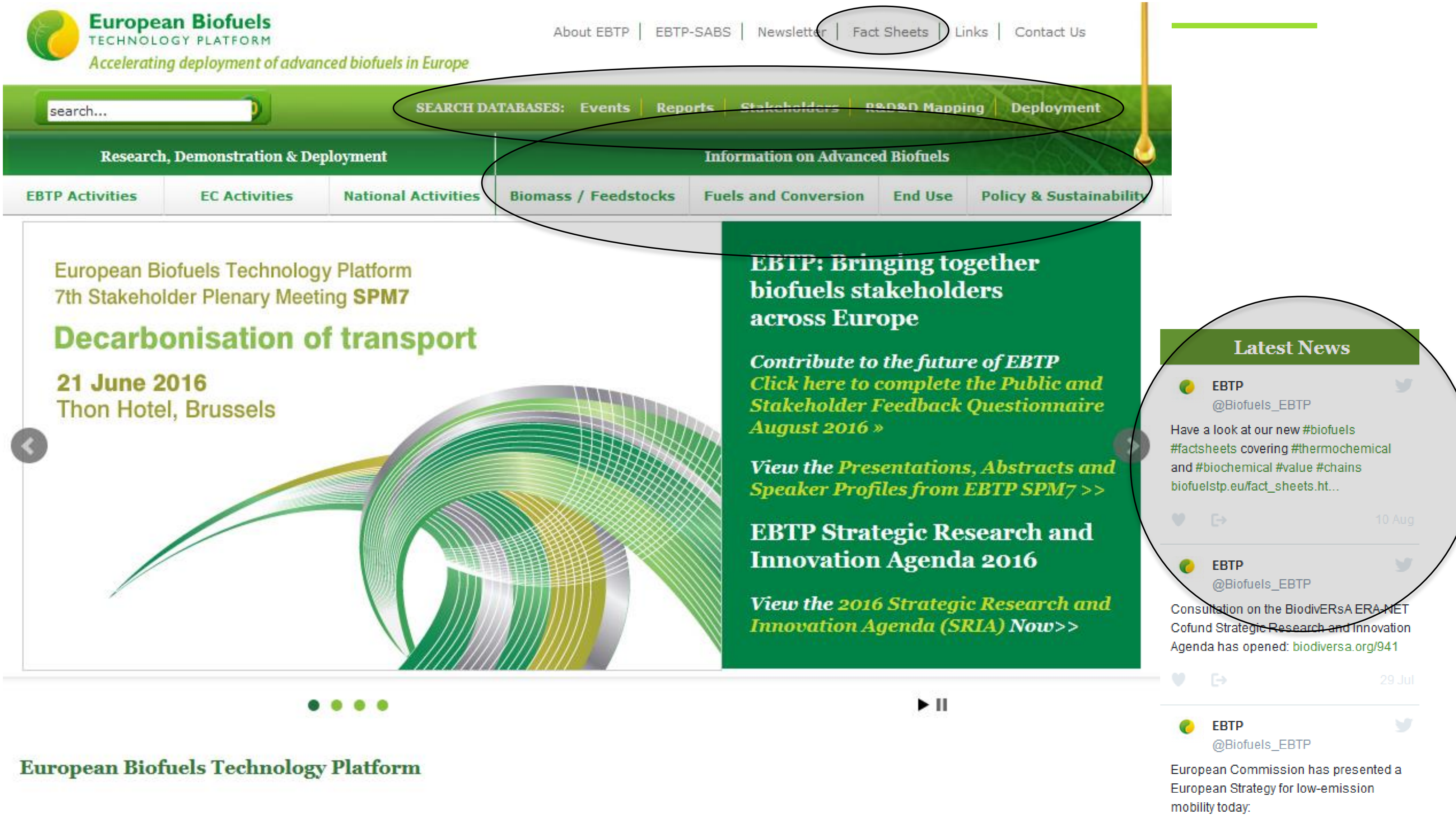
Session 3 Biofuel technologies-The road so far -lessons learnt from different biofuel plants

- Status and Outlook for bioliq-Project – Syngas Platform for High Performance Fuels
- The Etanolix® unit in Gothenburg
- GoBiGas: Technical successes and economic challenges
- Experiences made in Canada with the processing of municipal solid waste
- Efficient integration of fuel generation with pulp mills

SET-Plan Key Action 8: Renewable Fuels and Bioenergy

- Stakeholder consultation on Issues Paper (May/Oct 2016)
- ETIP Bioenergy calls for:
  - balanced presentation of all bioenergy, biofuel and renewable fuel pathways
  - specific actions to decarbonise the transport sector
  - focus on 2030 and beyond
  - all steps in the value chain can be further improved – provide clear targets for specific steps and overall
  - urgent action to scale up to commercial advanced biofuels
  - reliable policies and strong policy instruments, immediately
  - build on existing industries, e.g. existing conventional and advanced biofuel plants.
- Declaration of Intent (DoI) to be published (Nov 2016)
- Member States and stakeholders will develop Implementation Plan

Website


European Biofuels
TECHNOLOGY PLATFORM
Accelerating deployment of advanced biofuels in Europe
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SEARCH DATABASES: Events | Reports | Stakeholders | R&D&D Mapping | Deployment
Research, Demonstration & Deployment
Information on Advanced Biofuels
EBTP Activities
EC Activities
National Activities
Biomass / Feedstocks
Fuels and Conversion
End Use
Policy & Sustainability
European Biofuels Technology Platform
7th Stakeholder Plenary Meeting SPM7
Decarbonisation of transport
21 June 2016
Thon Hotel, Brussels
EBTP: Bringing together biofuels stakeholders across Europe
Contribute to the future of EBTP
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EBTP Strategic Research and Innovation Agenda 2016
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Have a look at our new #biofuels #factsheets covering #thermochemical and #biochemical #value #chains biofuelstp.eu/fact_sheets.ht...
10 Aug
EBTP
@Biofuels_EBTP
Consultation on the BiodivERsA ERA-NET Cofund Strategic Research and Innovation Agenda has opened: biodiversa.org/941
29 Jul
EBTP
@Biofuels_EBTP
European Commission has presented a European Strategy for low-emission mobility today:

Fact Sheets

European Biofuels
TECHNOLOGY PLATFORM

Biofuel Fact Sheet

Bioenergy value chain 1: biomass to liquid

Feedstock

For gasification, any lignocellulosic material is suitable as feedstock. The term lignocellulosic covers a range of plant molecules/biomass containing cellulose, with varying amounts of lignin, chain length, and degrees of polymerization. This includes wood from forestry, short rotation coppice (SRC), and lignocellulosic energy crops, such as energy grasses and reeds. Biomass from dedicated felling of forestry wood is also lignocellulosic but is not considered sustainable.

Gasification

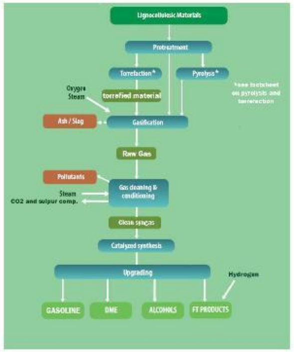
Gasification is a thermochemical process at 800-1300°C run at under-stoichiometric conditions (typically λ = 0.2-0.5). Under these conditions the biomass is fragmented into raw gas consisting of rather simple molecules such as: hydrogen, carbon monoxide, carbon dioxide, water, methane, etc. Solid by-products are: char, ashes and impurities. The gaseous molecules are then chemically re-synthesized to biofuels.

After size reduction of the raw material, it is moved into the gasifier. Typical gasification agents are: oxygen and water/steam. The choice of the gasification agent depends on the desired raw gas composition. The combustible part of the raw gas consists of hydrogen (H_2), carbon monoxide (CO), methane (CH_4) and short chain hydrocarbons; the non-combustible components are inert gases. A higher process temperature or using steam as gasification agent leads to increased H_2 content. High pressure, on the other hand, decreases the H_2 and CO.

Entrained-flow gasifiers operate at high temperatures (1000-1300 °C) and are therefore suitable when a low methane content is preferred. Bubbling and circulating bed gasifiers in contrast are operated at lower temperatures (800-1000 °C).

The process heat can either come from an autothermal partial combustion of the processed material in the gasification stage or allothermally via heat exchangers or heat transferring medium. In the latter case the heat may be generated by the combustion of the processed material (i.e., combustion and gasification are physically separated) or from external sources.

Figure 1: biomass-to-liquid value chain



End products

Biomethanol

Can be blended to gasoline; purely used in race cars

BioDME

Stored in the liquid state under relatively low pressure of 0.5 MPa

Biogasoline

Renewable diesel

Biokerosene (jet fuel)

In contrast to bioethanol or biodiesel (FAME), biogasoline, renewable diesel and biokerosene have the same combustion properties as their fossil based equivalents, gasoline, diesel or kerosene. They can thus be used without adaption or blend-limits in conventional engines.

By-products

Naphta, e.g. from FT synthesis

Impurities of the raw gas depend on the gasification condition and used biomass and can cause corrosion, erosion, deposits and poisoning of catalysts. It is therefore necessary to clean the raw gas. Depending on technology impurities such as dust, ashes, bed material, tars and alkali compounds are removed through various cleaning steps. Components having mainly poisonous effects are sulphur compounds, nitrogen and chloride. The sulphur compounds can be withdrawn by commercially available processes; to get rid of nitrogen and chloride wet washing is required.

The cleaned raw gas will then be upgraded to clean synthesis gas (syngas).

An optimal H_2/CO ratio of about 1 – 2 is obtained by the Water-gas-shift reaction:

$CO + H_2O \leftrightarrow CO_2 + H_2$.

The gas reforming reaction converts short-chain organic molecules to CO and H2 (for example

$CH_4 + H_2O \leftrightarrow CO + 3H_2$).

CO_2 removal can be performed by physical or chemical methods. Other absorption methods are based on pressure or temperature variations.

Product formation

Fischer-Tropsch-Liquids

In the Fischer-Tropsch (FT) process, the clean syngas is transformed into alkanes using mostly iron and cobalt as catalysts. The Low Temperature Fischer-Tropsch (LTFT) technology (200 – 220°C and less 20 bar) provides outputs for diesel production. The raw product, though, cannot be directly used as fuel, it needs to be upgraded via distillation to split it into fractions; via hydration and isomerization of the C5 – C6 fraction and reforming of the C7 – C10 fraction in order to increase the octane number for gasoline use; and via cracking by application of hydrogen under high pressure in order to convert long-chain fractions into gasoline and diesel fraction.

Methanol and dimethyl ether (DME)

The syngas is converted into DME via a two-step synthesis, first to methanol in the presence of catalyst (usually copper-based), and then by

Example projects on biomass-to-liquid production

Pilot

BioDME	producing DME; formerly operated by Chemrec and LTU (Sweden); now idle
Bioliq	producing biogasoline; run by Karlsruhe Institute of Technology (Germany); operational since 2014
Güssing FT	producing renewable diesel on gasifier side stream; run by Vienna University of Technology and BIOENERGY 2020+ (Austria); operational since 2005
BioTfueL	will produce biokerosene; run by a French industrial consortium; planned operation 2020

Demo

None in Europe

Edmonton Waste-to-Biofuels project	producing ethanol and methanol; run by Enerkem (Canada); operational since 2014

The following reactions occur:

$2H_2 + CO \leftrightarrow CH_3OH$

$2\ CH_3OH \leftrightarrow CH_3OCH_3 + H_2O$

$CO + H_2O \leftrightarrow CO_2 + H_2$

Alternatively, DME can be produced through direct synthesis using a dual-catalyst system which permits both methanol synthesis and dehydration in the same process unit, with no intermediate methanol separation.

Further information

Read up-to-date information about the thermo-chemical conversion technology at www.biofuelstp.eu.

Supporting project: ETIP Bioenergy-SABS

- Funding programme: Horizon 2020 EU Framework for Research and Innovation (Grant agreement No 727509)
- Funding volume: 599,195 €
- Duration: 24 months (09/2016 – 08/2018)
- Participation:
  - Agency for Renewable Resources (FNR, Germany)
  - Bioenergy 2020+ (Austria)
  - INCE - Iniziativa Centro Europea / CEI – Central European Initiative (Italy)
  - ETA Florence Renewable Energies (Italy)

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THANK YOU FOR YOUR ATTENTION

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