Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

Current developments and challenges in the field of biofuels

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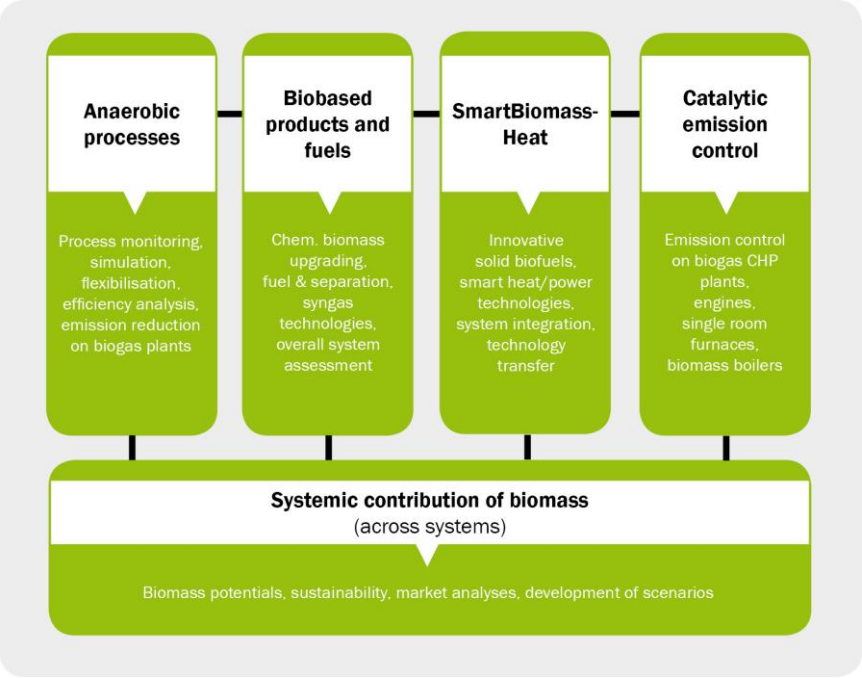


„Green Fuels“ IEA EGRD | Session „Advanced biogas and biofuels“ | Paris | 22.10.2019

Agenda

1. DBFZ in a nutshell
2. Status and characteristics of biofuel technologies
3. Exemplary scenarios for biofuels in Germany
4. Ongoing initiatives
5. R&D&D&I requirements
6. Conclusion

DBFZ in a nutshell



- Founded in 2008 a non profit research company
- More than 200 personal working in the field of smart bioenergy
- Total revenue in 2018 about 28.4 MEUR, thereof: 7.3 MEUR third-party funding revenue; 20.6 MEUR capital investments and new building, 7.8 MEUR personnel and equipment costs
- Besides R&D contract research and science-based services
- ISO 9001 certified

DBFZ in a nutshell

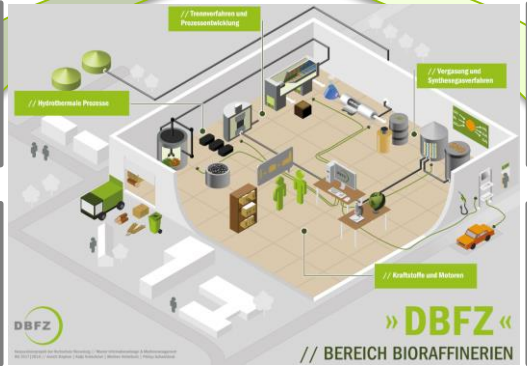




Biobased fuels and products

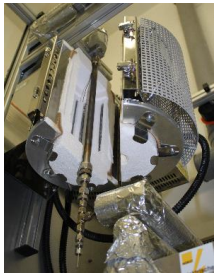
Separation technologies and process design

Hydrothermal processes



Gasification and synthesis gas processes

Motor fuels and engines





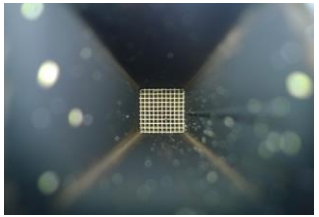














DBFZ in a nutshell

DBFZ scienists in the IEA Bioenergy

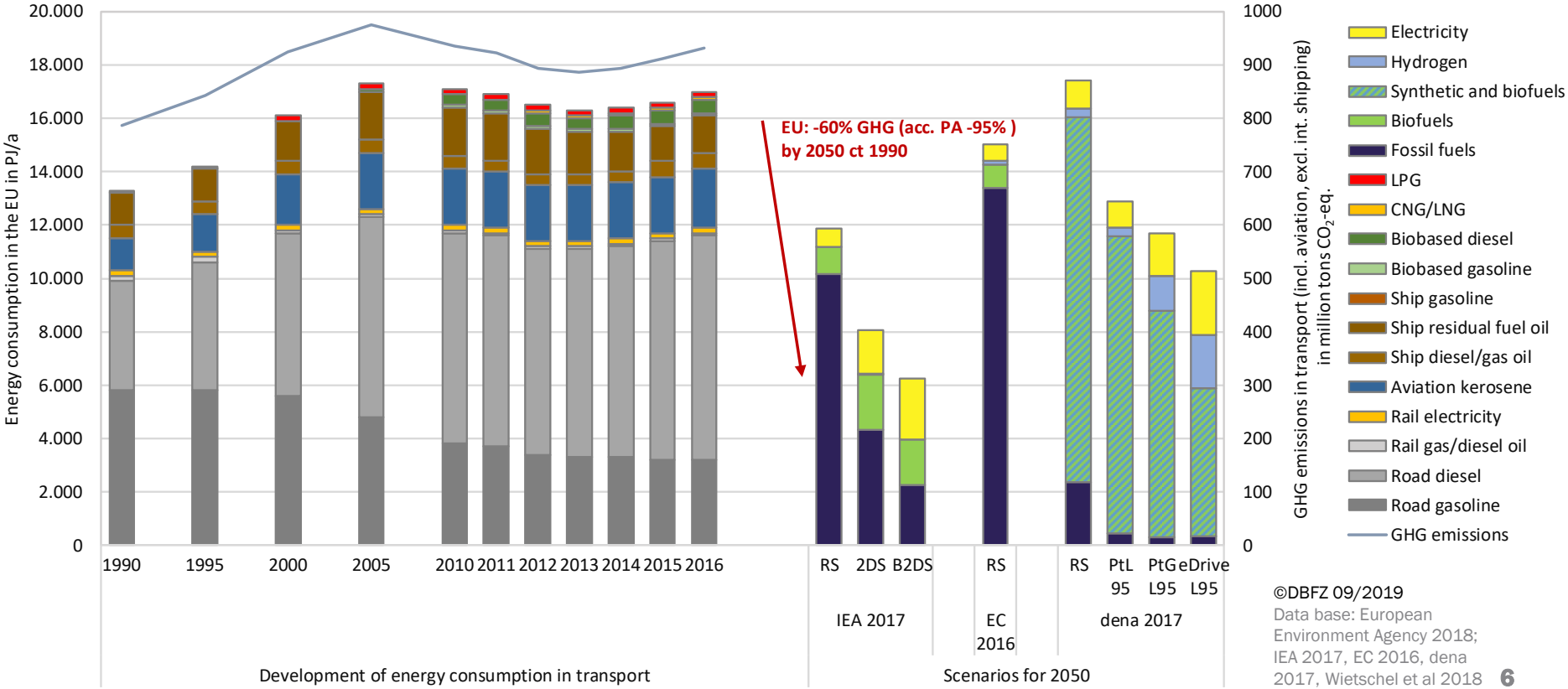
- Task 37 - Energy from Biogas
- Task 39 - Commercializing Conventional & Advanced Liquid Biofuels from Biomass
- Task 40 - Sustainable International Bioenergy Trade / Task 40: Deployment of biobased value chains
- Task 41 - different projects
- Task 44 - Flexible bioenergy and system integration
- Task 45 - Climate and sustainability effects of bioenergy within the broader bioeconomy

DBFZ scientists in national and international advisory boards and scientific committees

DBFZ scientists in national and international committees for regulation and standardization

Status and characteristics of biofuel technologies

EU | Energy & GHG in transport



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Data base: European Environment Agency 2018; IEA 2017, EC 2016, dena 2017, Wietschel et al 2018

Untersuchungen zur Ausgestaltung der Biokraftstoffgesetzgebung
FKZ: 22401416
2016 - 2019

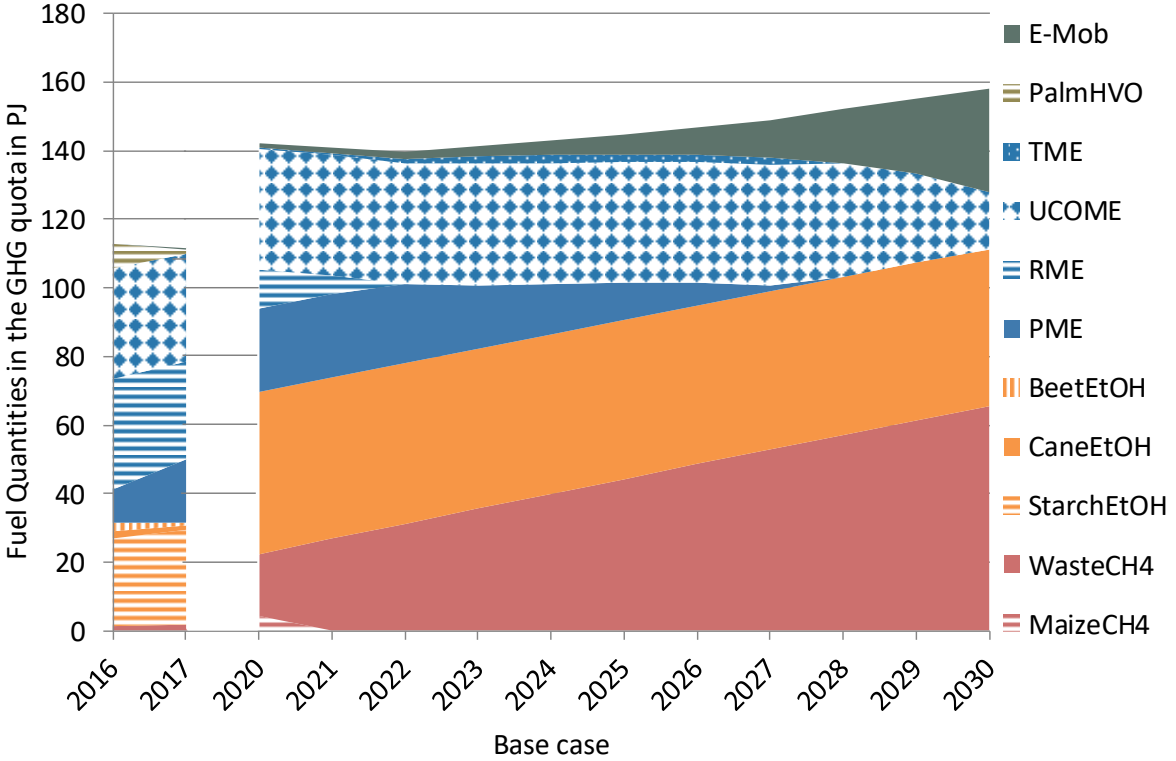
Gefördert durch:
Bundesministerium für Ernährung und Landwirtschaft
aufgrund eines Beschlusses des Deutschen Bundestages
FNR Fachagentur Nachwachsende Rohstoffe e.V.

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Exemplary scenarios for biofuels in Germany

RED II target | Most relevant fuel options



Red II frame scenario modelling:

- mainly based on GHG mitigation costs
- considering feedstock potentials, fuel blend walls, gas market 3%
- E-mob about 6 million vehicles

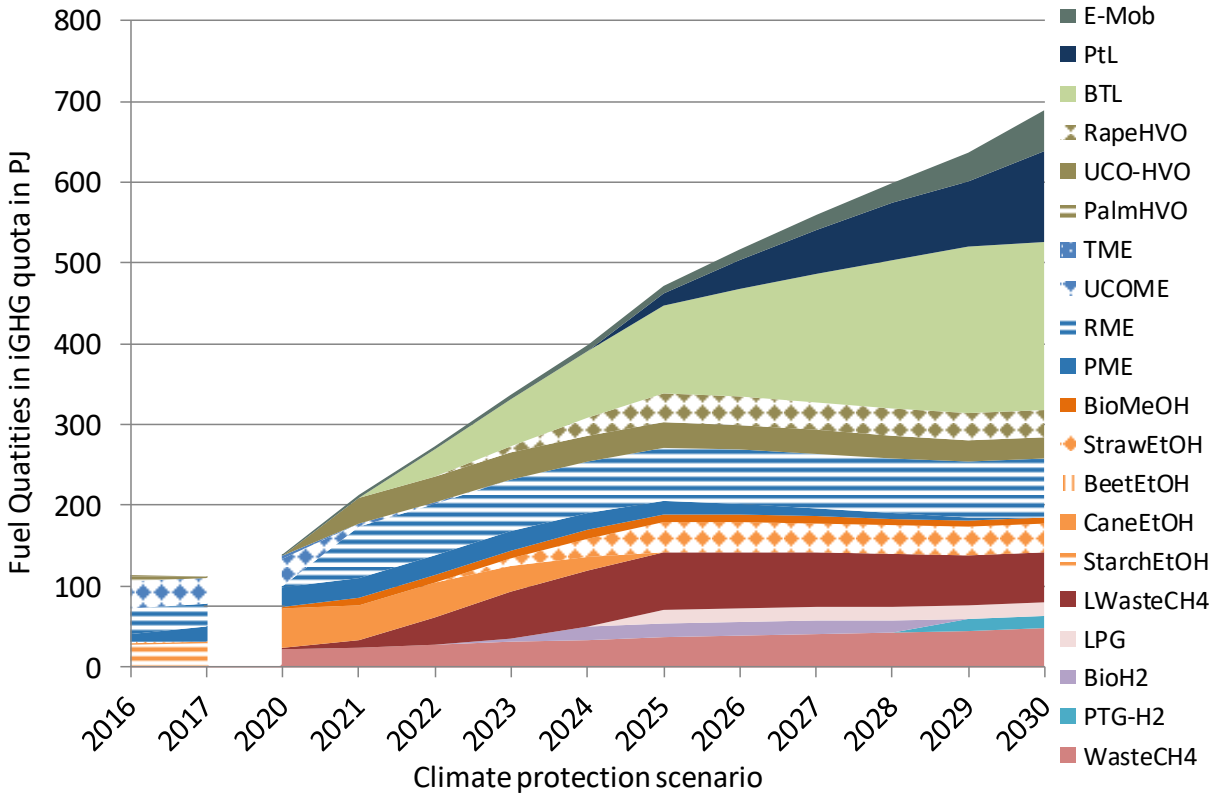
Key results:

- advanced fuels share only covered by biomethane from biowaste >> requires strong increase of gas as fuel
- domestic ethanol if no import increase of sugar cane ethanol
- decreasing shares on UCOME and phase out of PME

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Exemplary scenarios for biofuels in Germany

Climate target | Most relevant fuel options



Frame scenario modelling:

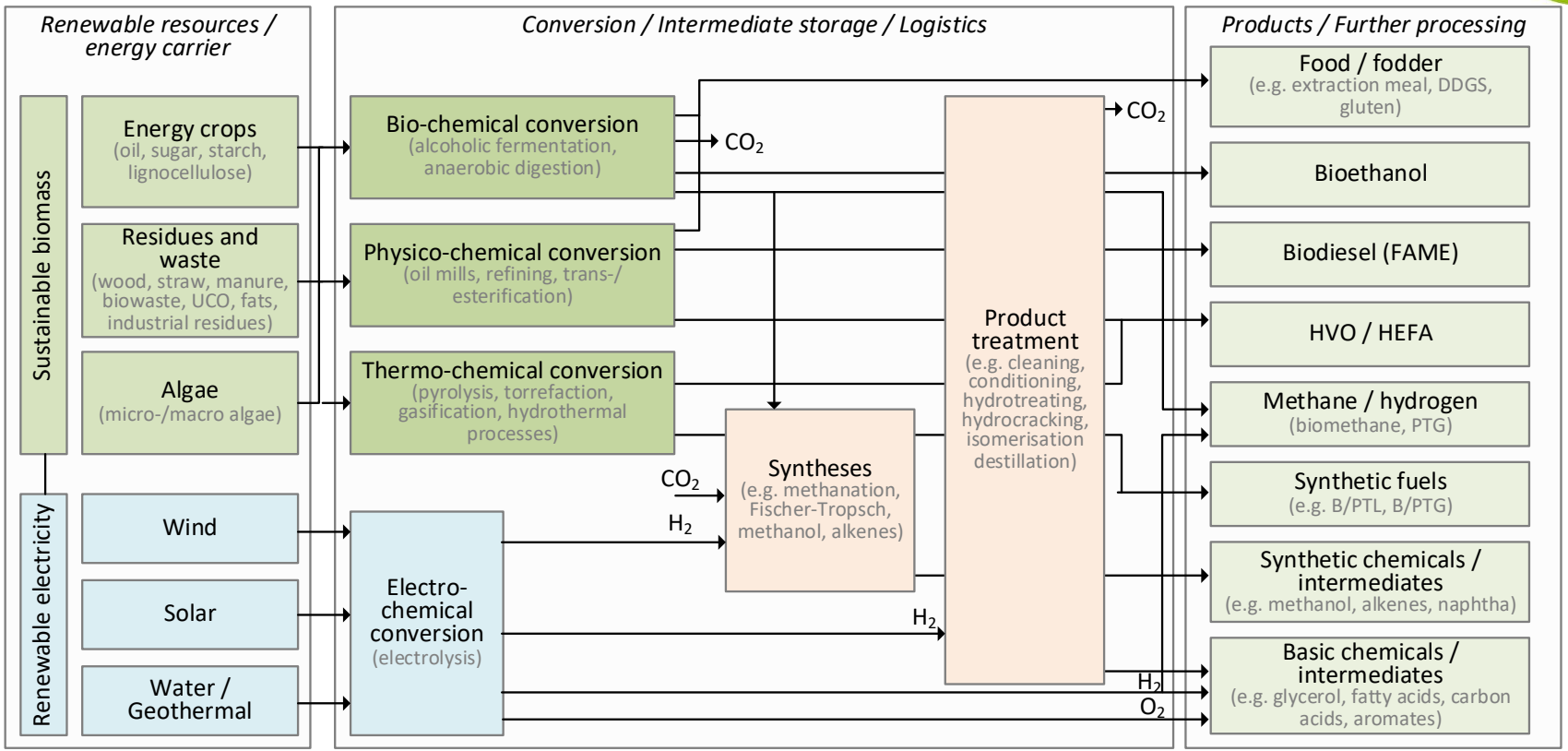
- RED II frame but climate target
- mainly based on GHG mitigation costs
- considering blend walls
- E-mob about 10 million vehicles

Key results

- All fuel options, a significant decrease in energy consumption and a high GHG quota are required
- Capacities of advanced biofuels and PTx have to built up asap
- Share on RE 41% in 2030

Status and characteristics of biofuel technologies

Technical routes and synergies



SynBioPTx © DBFZ 01/2019 (w/o entitlement of completeness)

B/PTG – Biomass-/Power-to-Gas, B/PTL – Biomass-/Power-to-Liquids, DDGS - Dried Distillers Grains with Solubles, FAME – Fatty acid methyl ester, HVO / HEFA - hydrotreated vegetable oils / esters and fatty acids, UCO – used cooling oil

Status and characteristics of biofuel technologies

Technology availability

Option	Feedstock according RED II Annex IX and others[a]	TRL/FRL[b]	Capacity (production) EU in PJ/a[c]	Development perspectives within RED II
Conventional biofuels	**Consumption DE 2018[c]: 113 PJ (of which 30% based on residues)**			
Bioethanol	Sugar cane/beet, corn, grain	9	166 (115)	Stillage for biogas and/or bio-CO_2
Biodiesel (FAME)	Vegetable oils, UCO, animal fats	9	786 (356)	Use of UCO
HVO/HEFA	Same like FAME	9	172 (97)	Use of UCO and feedstocks for advanced fuels
Advanced fuels and PTx	**Consumption DE 2017/2018[c]: 1,6 PJ**			
Bioethanol	Lignocellulosic, e.g. straw	7 - 9	6	s.a., competivness to conventional ethanol
HVO/HEFA (or hydrotreated fuels)	Biocrude oil, like tall oil, algae oil, HTL	8 for tall oil 3-4 for others	7	PT-H_2 for hydroprocessing
Biomethane / Biogas	Manure, maize, biowaste, stillage	9	44	bio-CO_2 for SynBioPTx/advanced fuels
BTG (SNG)	Lignocellulosic (wood, straw)	6 - 7	0.01	PT-H_2 integration, synthesis
BTL (FT, Methanol, D/OME)	Like BTG, also waste streams	3 - 5	0.003	PT-H_2 integration, synthesis
PTG (H_2, SNG)	electricity, CO_2	8 - 9	0.33	Use of bio-CO_2, synthesis
PTL (same like BTL)	electricity, CO_2	TRL 8-9 components, FRL 2 (methanol 8-9)	0.8 (methanol), ~0	Use of bio-CO_2, synthesis

Abbrv. see slide before, DE – Germany, D/OME – Dimethyl-/Oxymethylethers, FT – Fischer-Tropsch, s.a. – see above, HTL – hydrothermal processed fuels, SNG – synthetic natural gas

[a] PTx not specifically defined in REDII, but addressed in DE 37.BImSchV, [b] according to technology readiness level (TRL) of the European Commission, fuel readiness level (FRL) according CAAFI,

[c] DBFZ Report 11, 2019 & https://demoplants.bioenergy2020.eu/

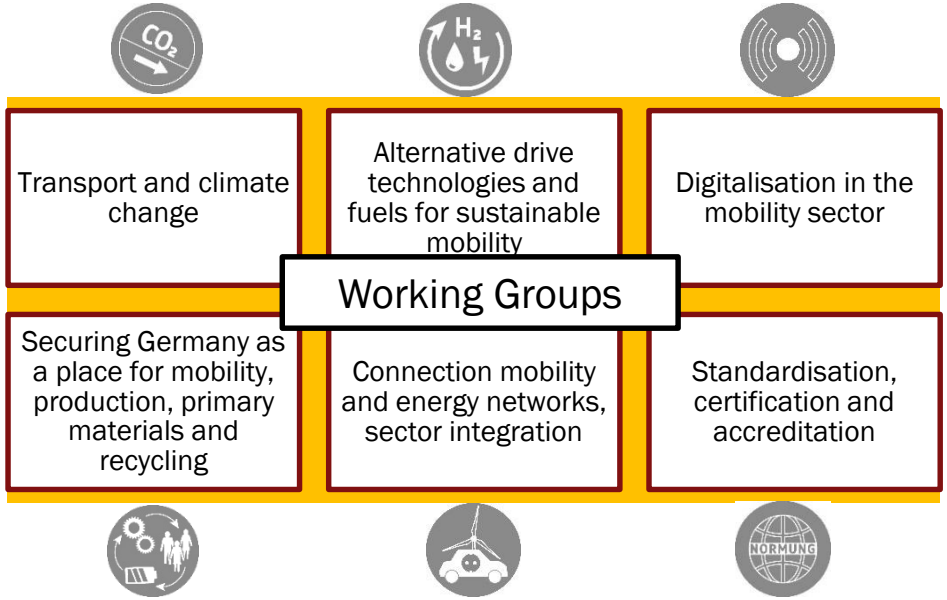
Ongoing initiatives

National platform future of mobility

Targets:

- Development of intermodal and interconnected solutions for a largely greenhouse gas-neutral and environmentally friendly transport system
- Ensuring a competitive automotive industry and promoting the employment location of Germany
- Enable efficient, high quality, flexible, secure and affordable mobility
- Clarification of facts on complex topics with relevant stakeholders

>> based on the results recommendations for action in politics, business and society



Further information: https://www.plattform-zukunft-mobilitaet.de/

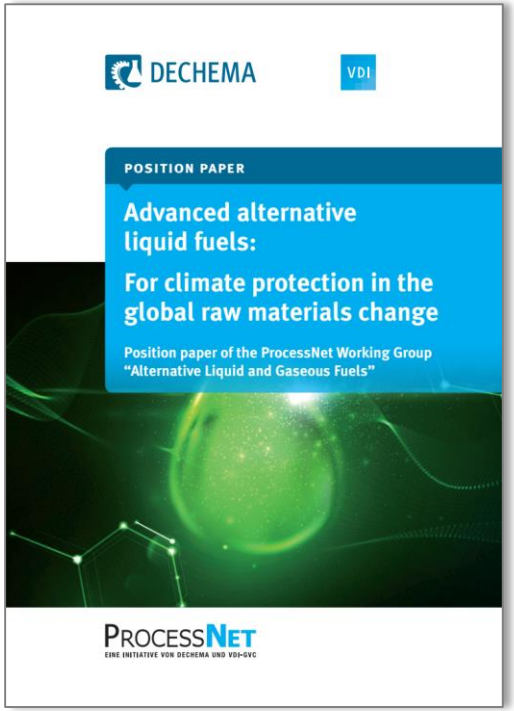
Ongoing initiatives

ProcessNet working group and position paper

Advanced alternative liquid fuels

Targets

- Extended resource basis: biomass, organic residues and waste, carbon dioxide
- Co-processing
- Synergies (e.g. renewable hydrogen supply)
- Integration into biorefineries
- Enhance technological development

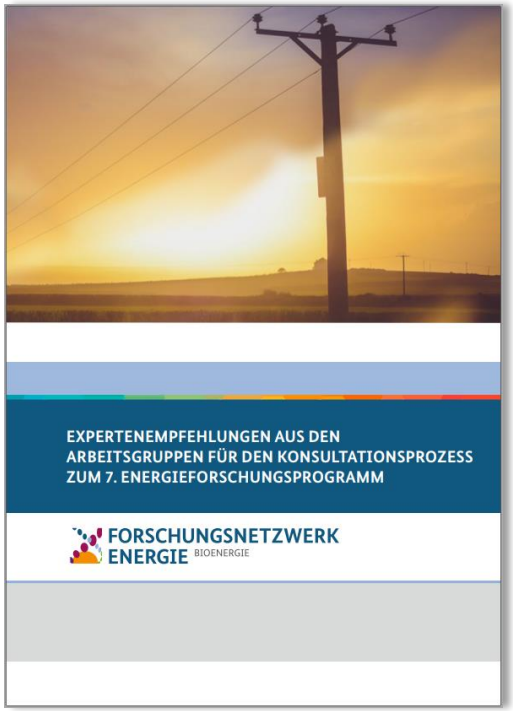


Further information: https://processnet.org/en/Publications/Topics+of+Strategic+Relevance/_/PP_Alt.Brennstoffe%202018_engl_ezl.pdf

R&D&D&I requirements

DE | Bioenergy network expert recommendations

- Efficient provision of biomass-based fuels through
  - development of additional biomass potentials
  - development of new biofuels
  - new plant concepts and upscaling
- Use of synergies during the biofuel production
- Research to biofuels in selected applications



Source: „Expertenempfehlungen aus den Arbeitsgruppen für den Konsultationsprozess zum 7. Energieforschungsprogramm“ from 11/2017 (in particular AG 3 – bioenergie and integration in the traffic sector: https://www.energetische-biomassenutzung.de/fileadmin/media/4_AGs_Methoden/2017_Expertenempfehlungen_Forschungsnetzwerk_Bioenergie.pdf)

R&D&D&I requirements

Additional biomass potentials and new biofuels

- Identification, quantification and characterization of additional biomass potentials (e.g. production residues)
- Expansion of the range of the raw materials by new technologies
- Development of biofuels with advanced combustion properties
- Energy efficient product separation and purification



Source: „Expertenempfehlungen aus den Arbeitsgruppen für den Konsultationsprozess zum 7. Energieforschungsprogramm“ from 11/2017 (in particular AG 3 – bioenergie and integration in the traffic sector: https://www.energetische-biomassenutzung.de/fileadmin/media/4_AGs_Methoden/2017_Expertenempfehlungen_Forschungsnetzwerk_Bioenergie.pdf)

R&D&D&I requirements

New plant concepts and upscaling

- Enhancement of efficiency of plant concepts, including separation and commercialization of valuable products and by-products
- Application oriented operation in pilot or demonstration scale, including process simulation
- Production of new biofuels in sufficient amounts for certification and application tests
- Concept evaluation and system analysis concerning sustainability criteria for market implementation



Source: „Expertenempfehlungen aus den Arbeitsgruppen für den Konsultationsprozess zum 7. Energieforschungsprogramm“ from 11/2017 (in particular AG 3 – bioenergie and integration in the traffic sector: https://www.energetische-biomassenutzung.de/fileadmin/media/4_AGs_Methoden/2017_Expertenempfehlungen_Forschungsnetzwerk_Bioenergie.pdf)

R&D&D&I requirements

Use of synergies during the biofuel production

- Improvement of synergies between material use and production of foodstuff, animal feed and fuels
- Development of concepts for sector coupling and integration, e.g.
  - electrochemical processes for biomass conversion
  - production of fuels from biomass and biogenic CO_2 with electric power
- Integrated conversion of carbon dioxide from other biomethane and bioethanol production



Source: „Expertenempfehlungen aus den Arbeitsgruppen für den Konsultationsprozess zum 7. Energieforschungsprogramm“ from 11/2017 (in particular AG 3 – bioenergie and integration in the traffic sector: https://www.energetische-biomassenutzung.de/fileadmin/media/4_AGs_Methoden/2017_Expertenempfehlungen_Forschungsnetzwerk_Bioenergie.pdf)

R&D&D&I requirements

Research to biofuels in selected applications

- Development and analysis of biofuel applications to non road mobile machinery

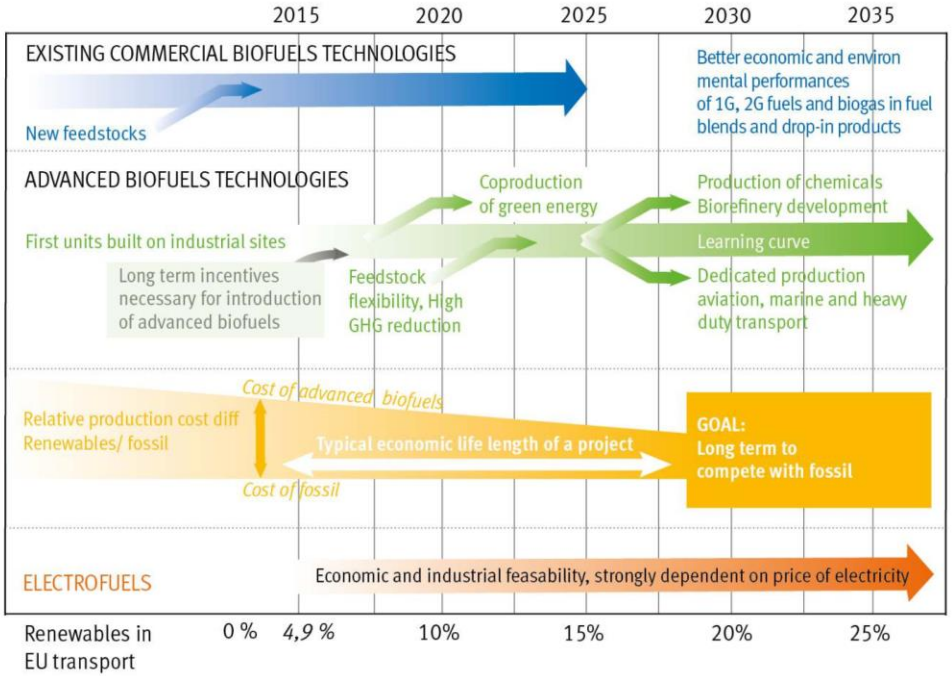
- Investigation of implementation options of pure biofuels, fuels with higher amounts of added biofuels and multiblends, e.g.
  - Storage properties
  - Motor and material compatibility
  - Emissions
  - Preparation of the national and international acceptance as suitable fuel



Source: „Expertenempfehlungen aus den Arbeitsgruppen für den Konsultationsprozess zum 7. Energieforschungsprogramm“ from 11/2017 (in particular AG 3 – bioenergie and integration in the traffic sector: https://www.energetische-biomassenutzung.de/fileadmin/media/4_AGs_Methoden/2017_Expertenempfehlungen_Forschungsnetzwerk_Bioenergie.pdf)

R&D&D&I requirements

ETIP | Strategic Research and Innovation Agenda 2018



- Technical challenges for all value chains: feedstock flexibility, energy and carbon efficiency, reliability & maintenance, capex efficiency
- Thermochemical pathways: feeders, gas cleaning, catalysts, biofeedstock compatible materials and technologies, able to process a wide range of biomass qualities, handling/stability of bio-oil, materials, specifications of intermediates
- Biochemical Pathways: preparation of feedstocks, enzymes, microorganisms, catalyst performance, bioprocessing, selection of strains, process design, water treatment, scale up
- Integration of other RES

Source: „STRATEGIC RESEARCH AND INNOVATION AGENDA 2018“ von 2018 unter http://www.etipbioenergy.eu/images/ETIP_SRIA_2018.pdf

R&D&D&I requirements

Bioeconomy | Building block of a post-fossil economy

Five targets >> main action areas:

- strengthen and scale-up the bio-based sectors, unlock investments and markets
- deploy local bioeconomies rapidly across Europe
- understand the ecological boundaries of the bioeconomy



Source: https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf

Conclusion

- Big gaps and thus challenges resulting from recent developments and binding targets
  >> for reaching future targets many different sustainable renewable fuels possible and potentially competitive

- Climate target frame requires all options and start-up of advanced biofuels and renewable PTX fuels asap
  >> not only R&D >> R&D&D&I important

- Challenges:
  >> advanced fuel availability
  >> establishing market competition of educts/products

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Smart Bioenergy – Innovations for a sustainable future

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