Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

Use and importance of bioenergy

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Bioenergien: Landwirte als Akteure der Energiewende

2. April 2020

Motivation for bioenergy

Climate protection

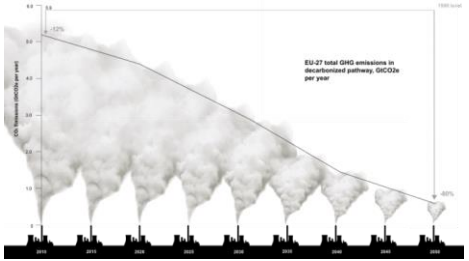
- Ambitious reduction targets

Energy security

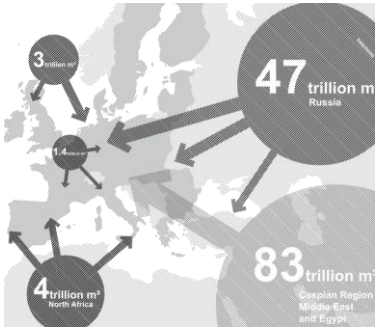
- Reduction of energy imports
- Reduction of dependencies from fossil energy carriers

Creation of income/jobs

- Direct: creation of income in rural areas
- Indirect: development of a biomass-/bioenergy based economy

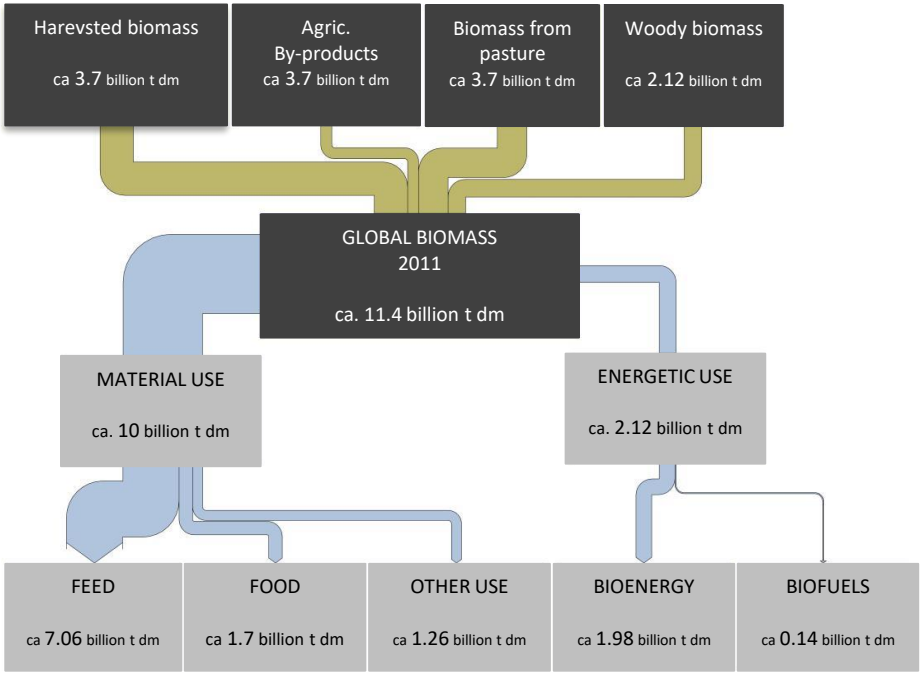


Source: Roadmap 2050, Vol. 3



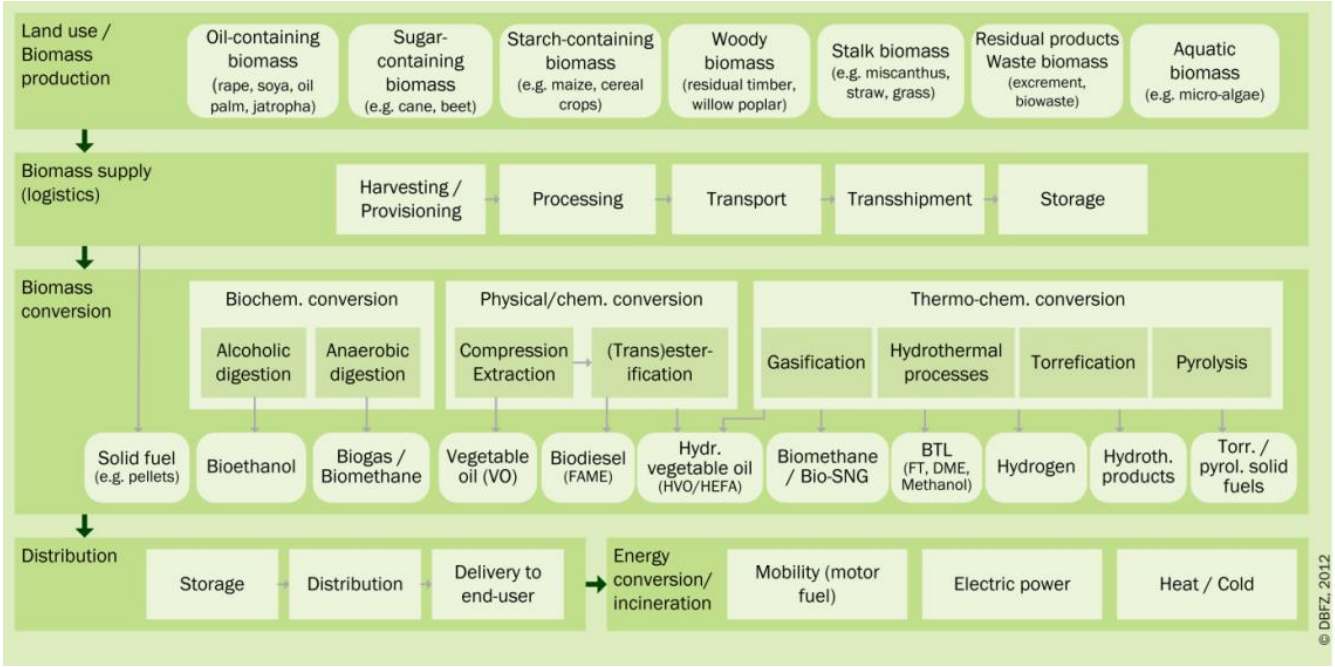
Source: Roadmap 2050, Vol. 3

Global biomass and use



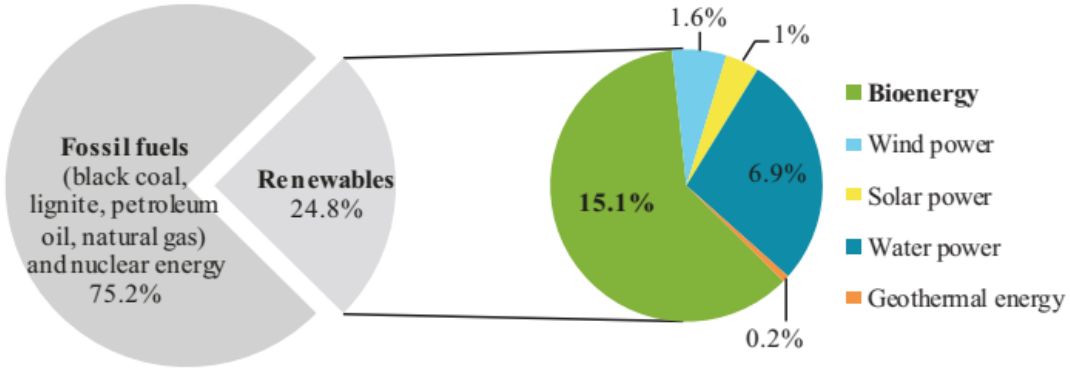
Source: DBFZ, 2015

Paths from biomass into the energy system



Status quo - Biomass in the global energy system

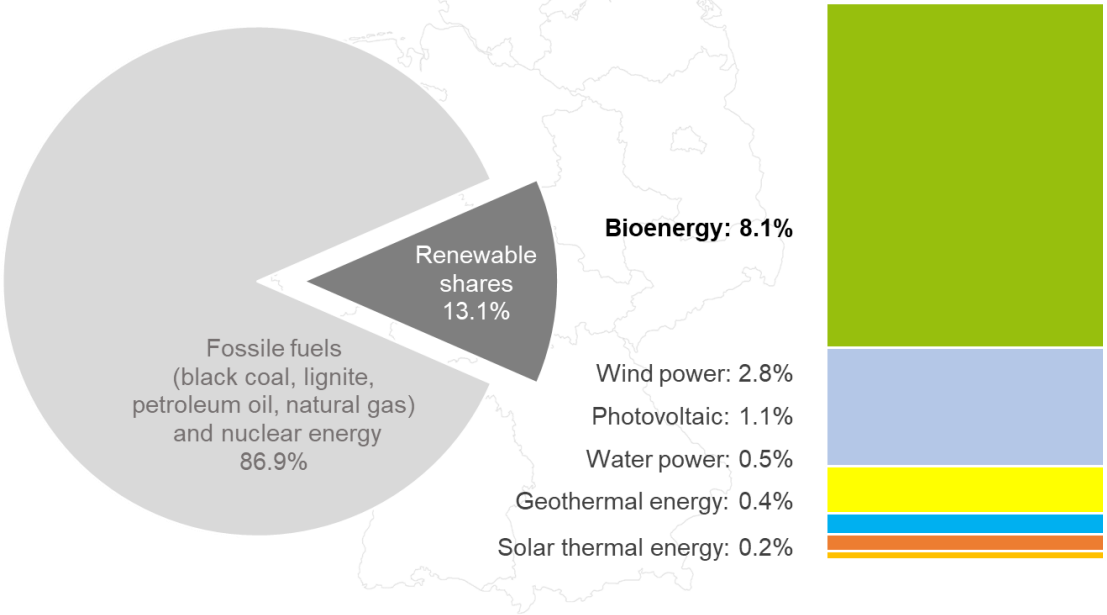
Use of renewable energies to cover global primary energy consumption in 2016 (total: 556 EJ)



Source: Stinner et al (2018): Perennial and Intercrop Legumes as Energy Crops for Biogas Production,; based onWitt et al (2017);

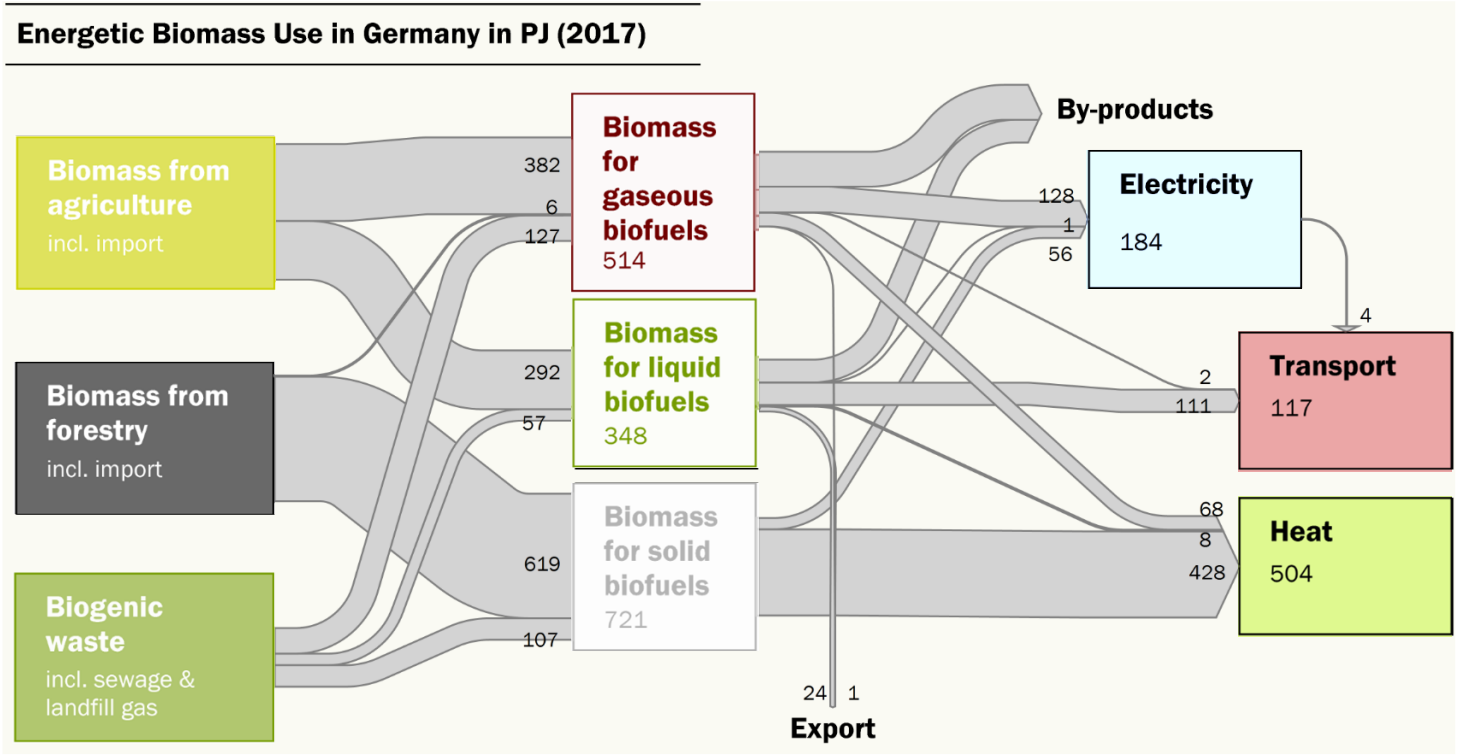
Status Quo - Biomass in the German energy system

Share of renewable energies in national primary energy consumption 2017 (total: 13.6EJ)



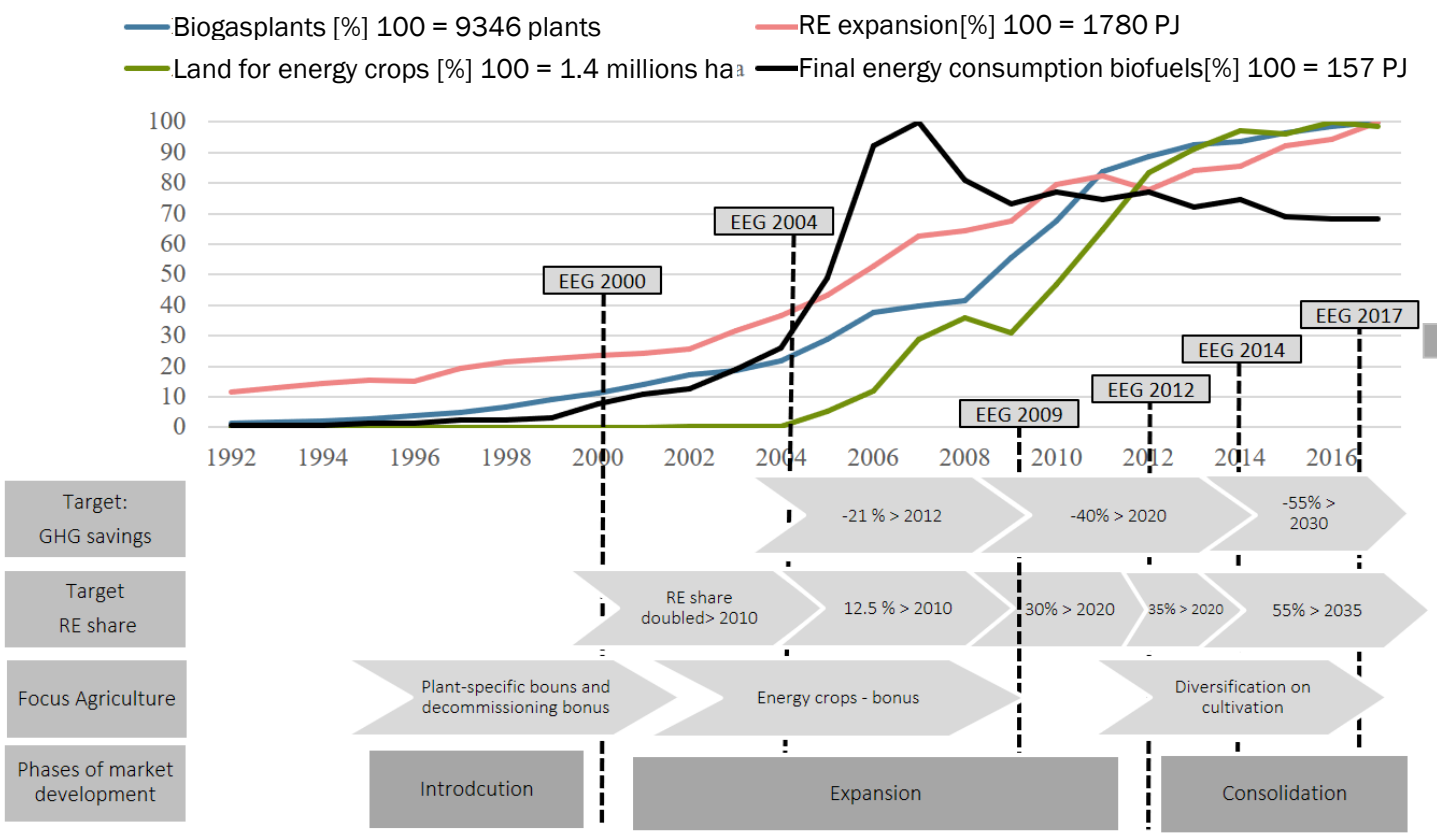
Source: Modified from Arbeitsgemeinschaft Energiebilanzen(AGEB), Arbeitsgruppe Erneuerbare Energien-Statistik (2018)

Status quo - Bioenergy in Germany



Source: Based onThrän et al. (2017): Bioenergy carriers – from smoothly treated biomass towards solid and gaseous biofuels, CIT)

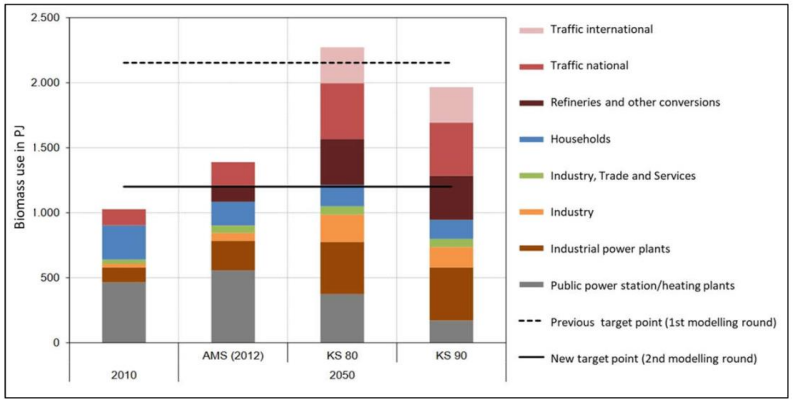
Development in Germany



What's next with bioenergy in Germany?

Bioenergy in 2050 - Challenges

New demands from 100% scenarios



Source: REPENNING, J., et al. Klimaschutzszenario 2050. 1. Modellierungsrunde. Studie im Auftrag des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit. Berlin: Öko-Institut, 2014. Graphic translated by DBFZ 2019.

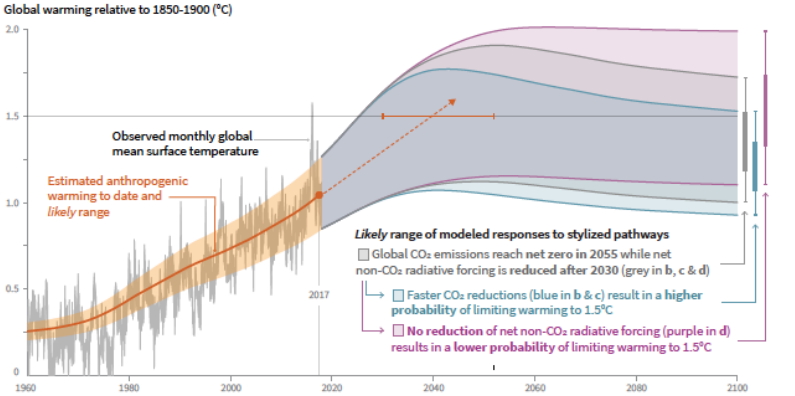
Source: REPENNING, J., et al. Klimaschutzszenario 2050. 1. Modellierungsrunde. Studie im Auftrag des BMU. Berlin: Öko-Institut, 2014.

- Flexible power provision
- Industrial heat
- Dedicated transport fuels (aviation)

New demands from WB2 sceanraion

Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C

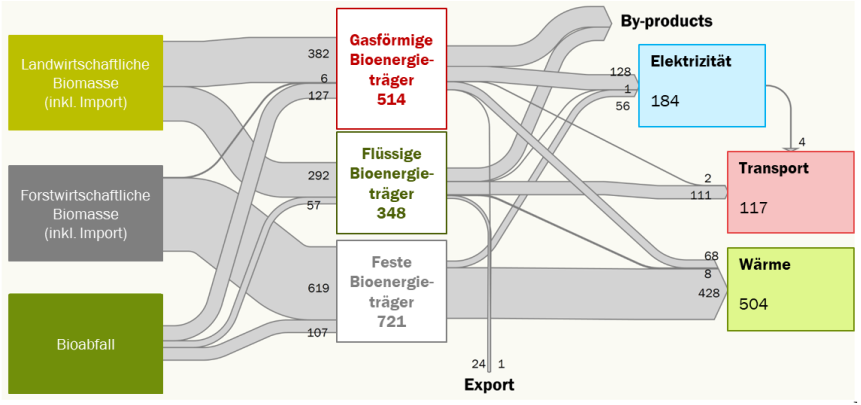
a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

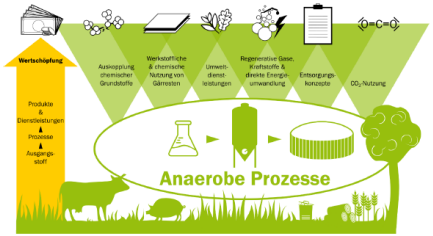


Source: IPCC Special Report on 1.5°C (2018)

- BECCS

Bioenergy in 2050 – Options for transformation





→CHP

→Transport

Biogas

→CHP

→Transport

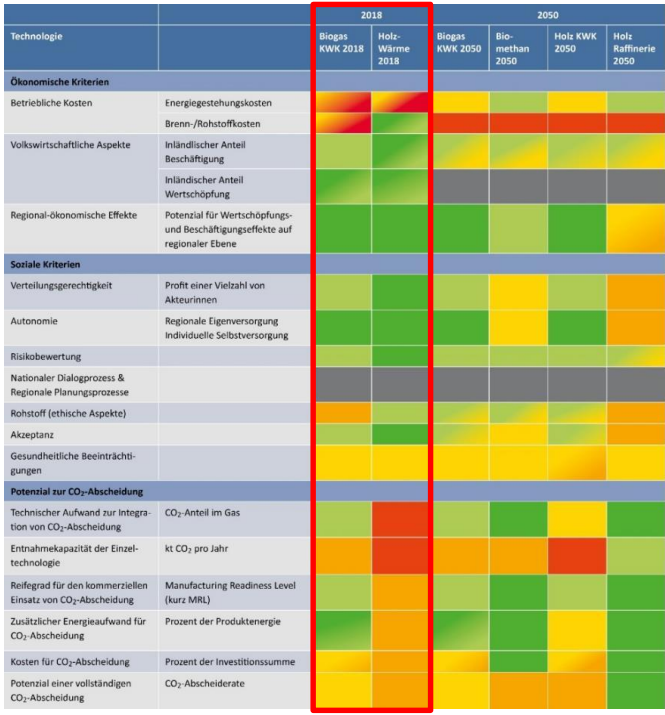
Lignocellulosic

Bioenergy in 2050 – Assessment approach

- 29 criteria has been defined for the assessment of bioenergy options, considering technical, environmental, social, systemic, economic abd BECCS aspects

- Various hot spots has been identified for the differnt technologies

- See more: https://energiesysteme-zukunft.de/themen/bioenergie/



Bioenergy in 2050 – Results of the assessment

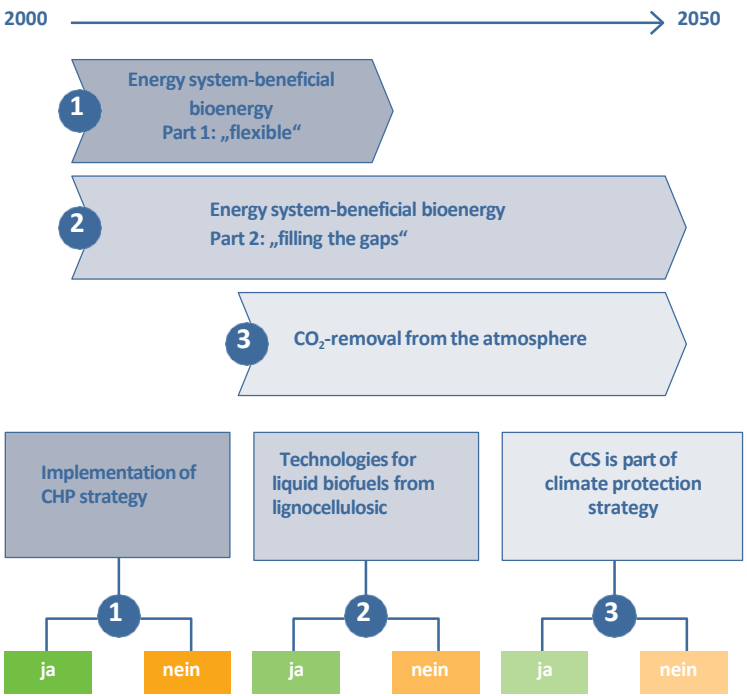
- Environmental and economic criteria are challenging for all bioenergy systems
- CHP application needs heat infrastructure (beyond bioenergy)
- Transport fuels from Lignocellulosic are not in the market yet
- BECCS-Integration is preferable in large conversion plants
- Smaller installations are better ranked in social indicators
- CCS is very critical discussed in Germany (beyond bioenergy)

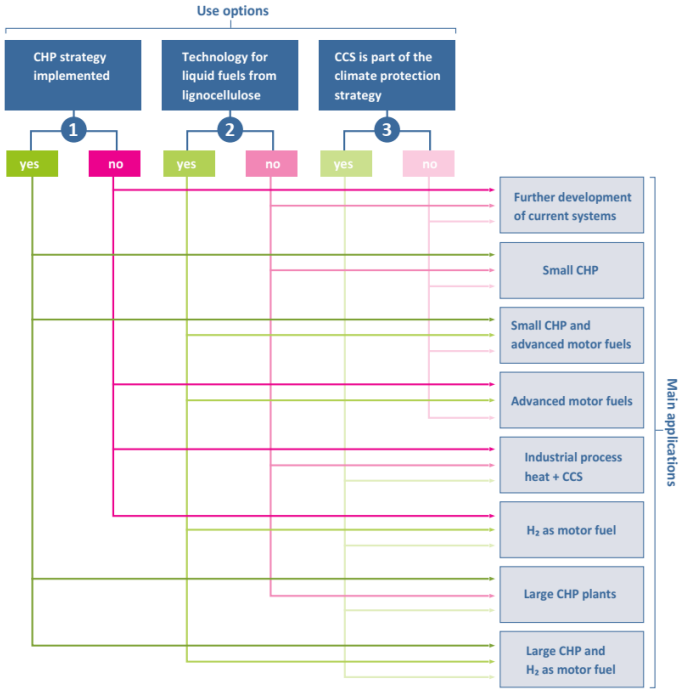
Bioenergy in 2050 – Road map and prioritization

May 2019
Summary of the Position Paper

Biomass: striking a balance between energy and climate policies

Strategies for sustainable bioenergy use





Bioenergy in 2050 – Example for prioritization

May 2019
Summary of the Position Paper

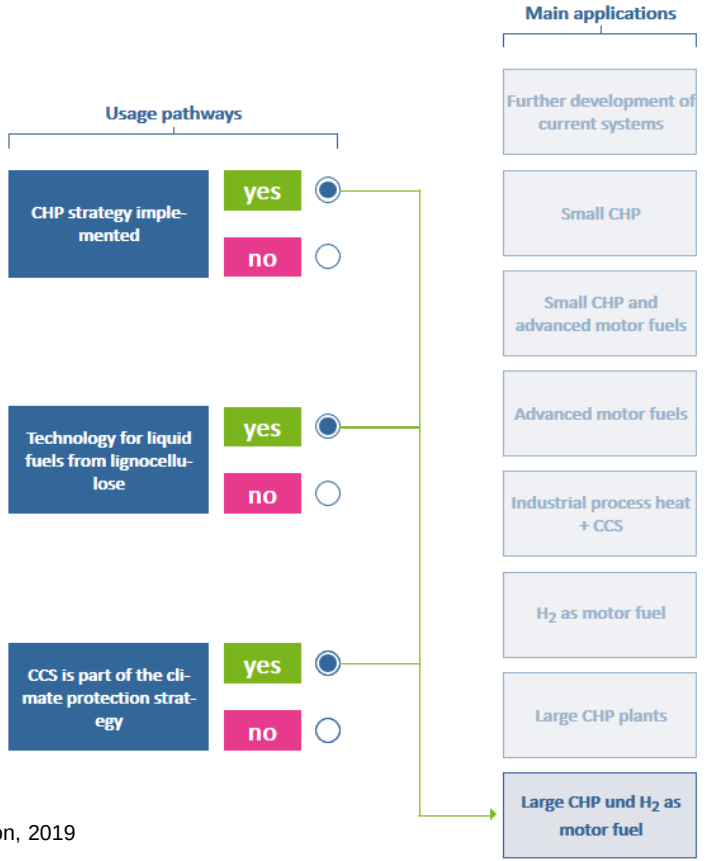
Biomass: striking a balance between energy and climate policies

Strategies for sustainable bioenergy use

Usage pathways:

CCS is part of the climate protection strategy

Climate protection scenarios show that carbon dioxide will have to be removed from the atmosphere within a few decades. One possible way of achieving this is bioenergy with carbon (dioxide) capture and storage (BECCS). This works by plants capturing carbon dioxide from the air and using it to form energy-rich compounds. If the plants are then used for energy production, the resultant carbon dioxide is captured and put into underground storage. Carbon dioxide storage is a highly controversial issue in German society.



Main applications:

Large CHP and H_2 as motor fuel

If society does opt for CCS (Carbon Capture and Storage) as part of the climate protection strategy, priority could be given to using bioenergy technologies which allow CO2 capture to be as complete as possible. These technologies would be firstly the production of hydrogen in biorefineries and secondly the generation of electricity and heat in large CHP plants. Widespread use of both technologies entails both expanding heating networks and building infrastructure for transporting and using the hydrogen (e.g. in fuel cell vehicles).

If the framework for both technology pathways is favourable, they will be in competition for limited biomass potential.

Bioenergy in 2050 – conclusions of the study

- Bioenergy strategies are not only influenced by biomass potentials but also by
  - Market implementation of advanced liquid biofuels
  - Overall energy infrastructure (district heating systems and gas pipelines)
  - Social acceptance of carbon capture and storage.

- Decisions on those three switches will lead to clear preferences, where to use the limited biomass in the future

➢ The three switches are applicable for other countries working on long term bioenergy strategies >> a variety of national bioenergy strategies can be expected.

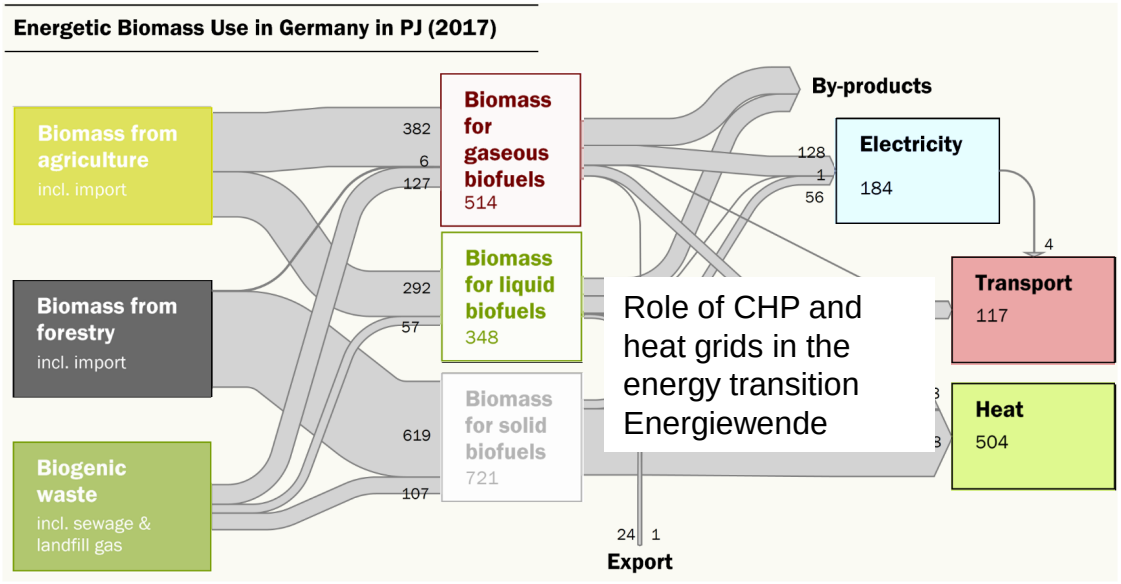
What does that mean for bioenergy in Germany?

EXPECTATIONS AND FIELDS OF ACTION

Added value, cascades, closed cycle (nutrients, carbon)

ca. 1.000 PJ of residues permanently available in Germany

Sustainability criteria for all agricultural and forest biomass; reducing bioenergy risks



synergy RE in Transport

Efficient?
* Integrated / hybrid
* Lignocellulosic fuels
* Low emissions (particles)

Political-social discourse on CCS

CO_2 pricing & far. Instruments to ensure sustainable generation and climate protection contribution

Develop future images and at different levels and establish monitoring systems

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Smart Bioenergy – Innovations for a sustainable future

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