

Use and importance of bioenergy

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Bioenergien: Landwirte als Akteure der Energiewende

2. April 2020

Motivation for bioenergy

Climate protection

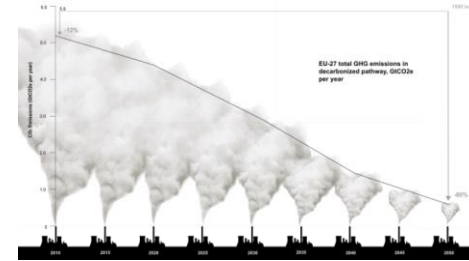
- Ambitious reduction targets

Energy security

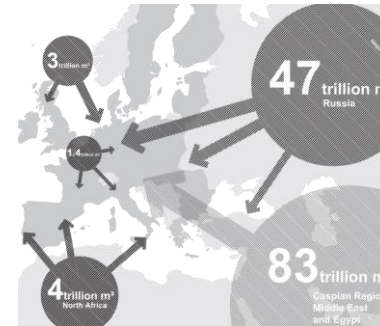
- Reduction of energy imports
- Reduction of dependencies from fossil energy carriers

Creation of income/jobs

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

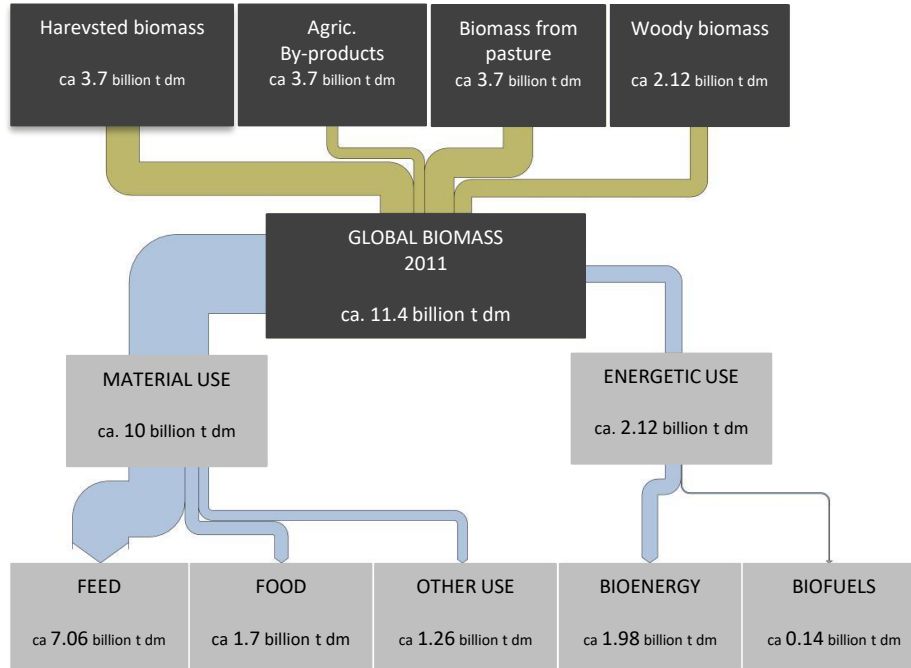


Source: Roadmap 2050, Vol. 3



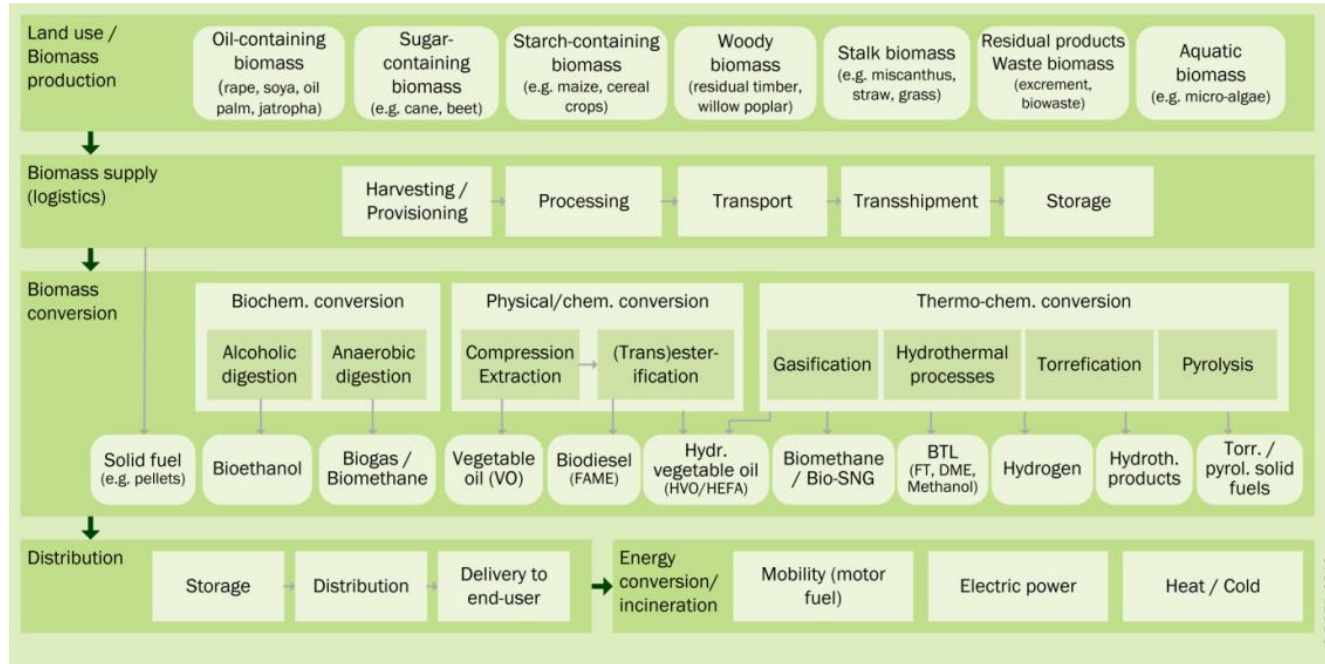
Source: Roadmap 2050, Vol. 3

Global biomass and use



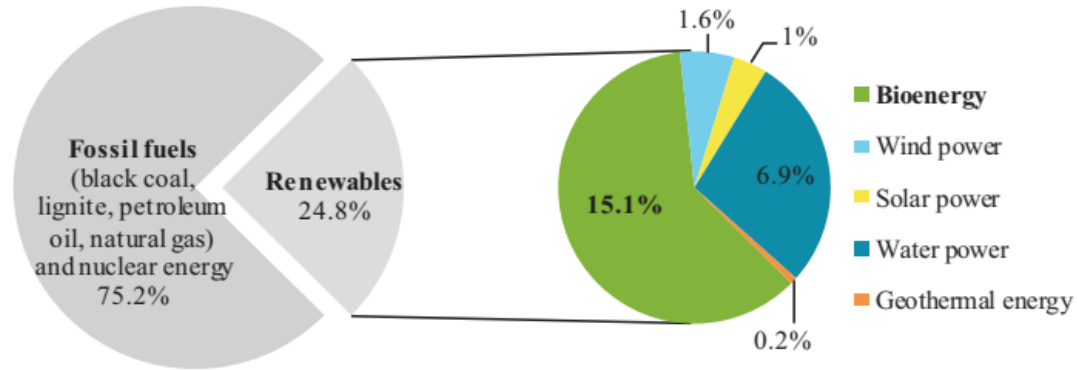
Source: DBFZ, 2015

Paths from biomass into the energy system



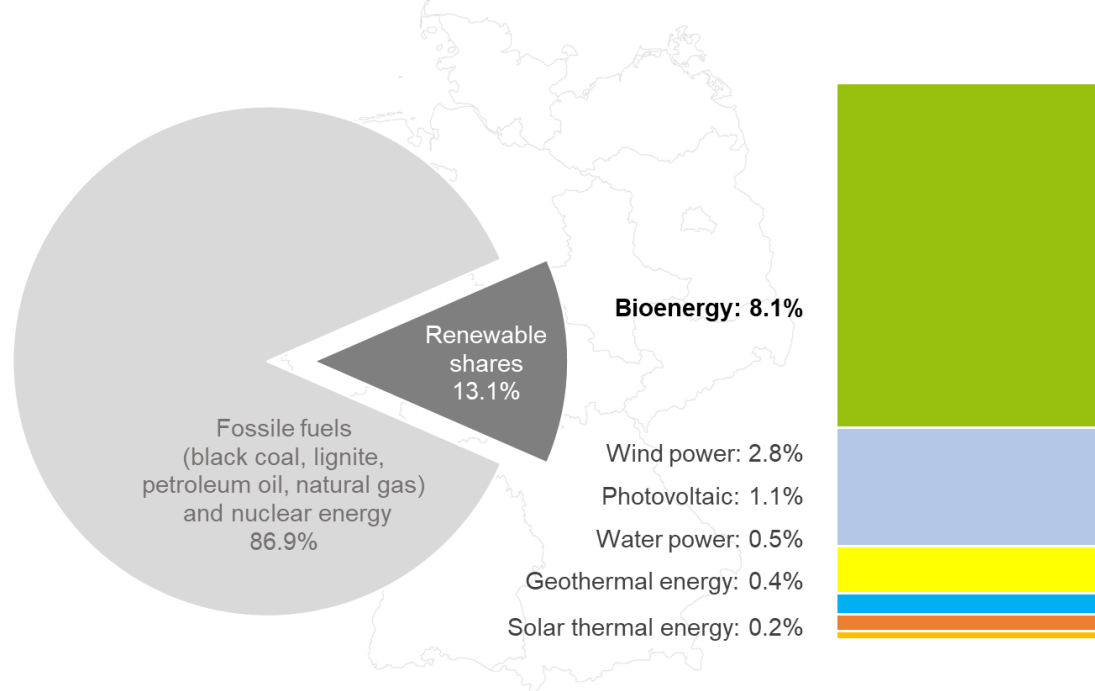
Status quo - Biomass in the global energy system

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



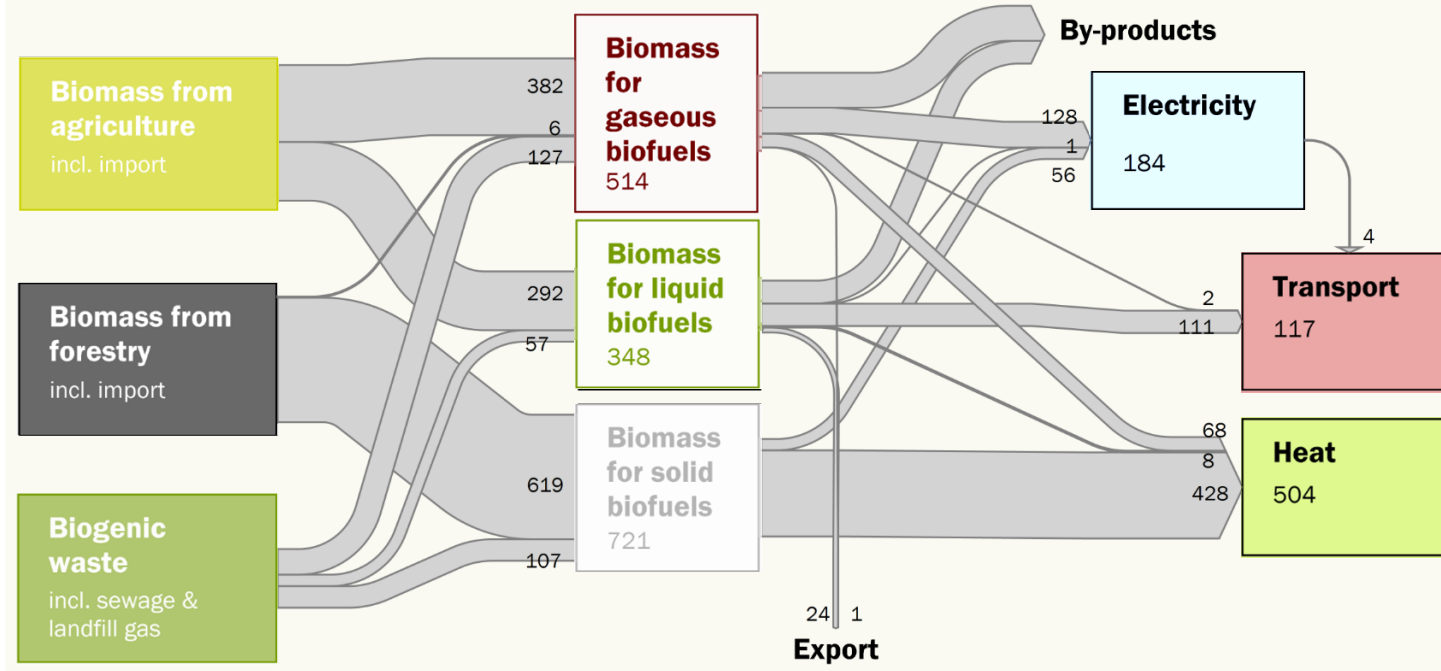
Status Quo - Biomass in the German energy system

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



Status quo - Bioenergy in Germany

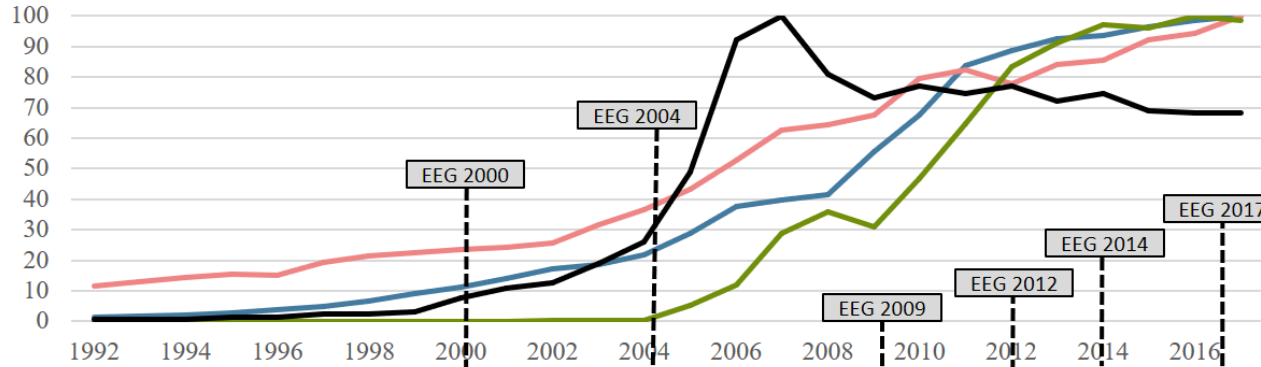
Energetic Biomass Use in Germany in PJ (2017)



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

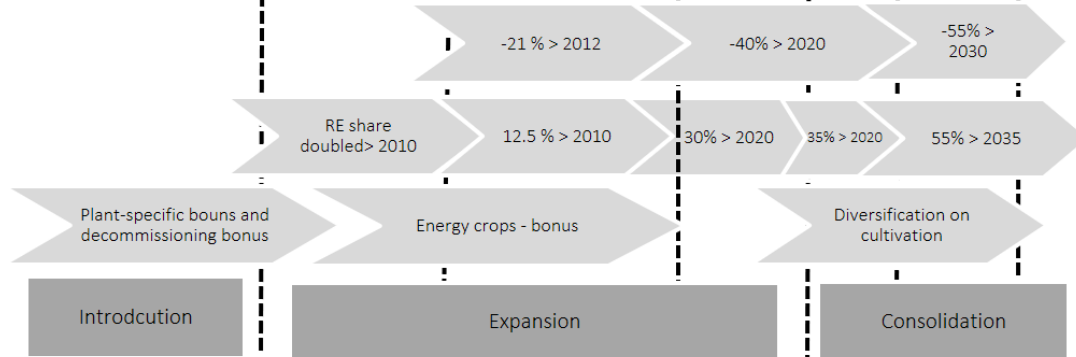
Development in Germany

— Biogasplants [%] 100 = 9346 plants — RE expansion[%] 100 = 1780 PJ
— Land for energy crops [%] 100 = 1.4 millions ha — Final energy consumption biofuels[%] 100 = 157 PJ



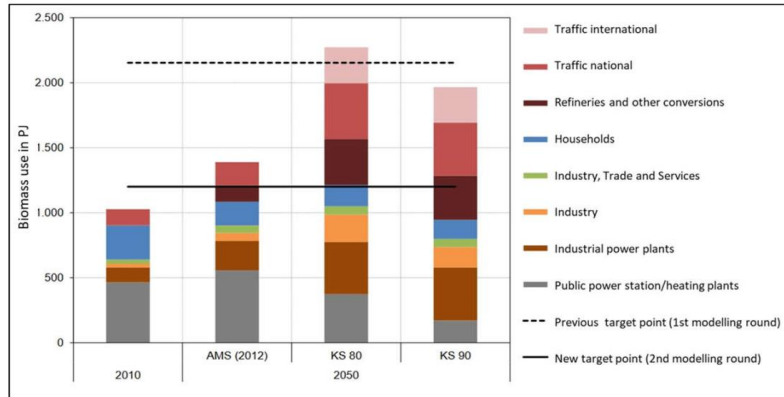
What's next with bioenergy in Germany?

- Target: GHG savings
- Target RE share
- Focus Agriculture
- Phases of market development



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.

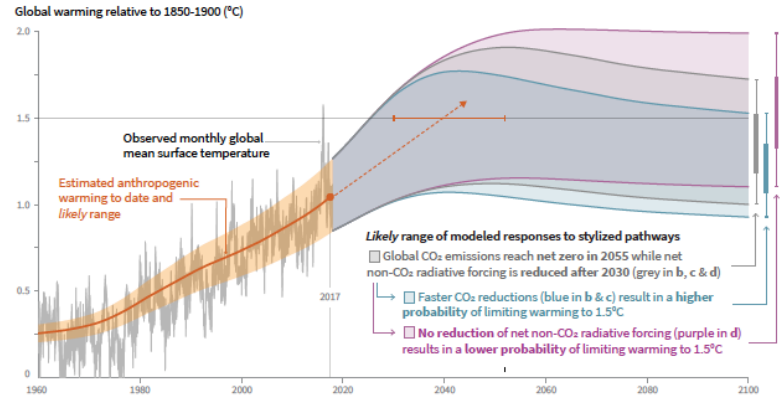
Source: REPENNING, J., et al. Klimaschutzszenario 2050. 1. Modellierungsrunde. Studie im Auftrag des BMU. Berlin: Öko-Institut, 2014.

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

New demands from WB2 sceanraion

Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°C

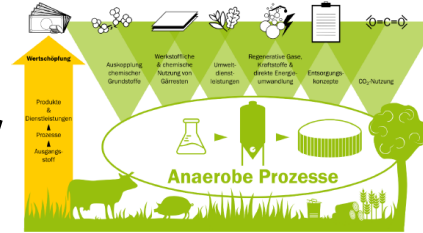
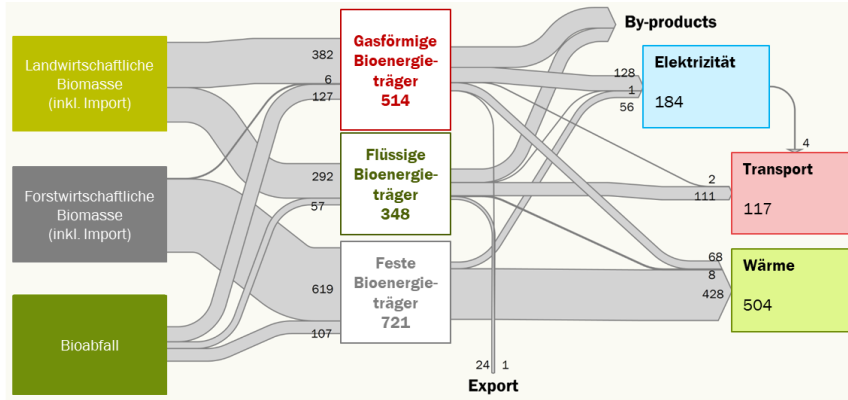
a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways



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

- BECCS

Bioenergy in 2050 – Options for transformation



- CHP
- Transport



- CHP
- Transport

Bioenergy in 2050 – Assessment approach



- 29 criteria has been defined for the assessment of bioenergy options, considering technical, environmental, social, systemic, economic and BECCS aspects
- Various hot spots has been identified for the different technologies
- See more: <https://energiesysteme-zukunft.de/themen/bioenergie/>

Technologie		2018		2050			
		Biogas KWK 2018	Holz-Wärme 2018	Biogas KWK 2050	Bio-methan 2050	Holz KWK 2050	Holz Raffinerie 2050
Ökonomische Kriterien							
Betriebliche Kosten	Energiegestehungskosten	Red	Red	Green	Green	Green	Green
	Brenn-/Rohstoffkosten	Red	Green	Red	Red	Red	Red
Volkswirtschaftliche Aspekte	Inländischer Anteil Beschäftigung	Green	Green	Green	Green	Green	Green
	Inländischer Anteil Wertschöpfung	Green	Green	Green	Green	Green	Green
Regional-ökonomische Effekte	Potenzial für Wertschöpfungs- und Beschäftigungseffekte auf regionaler Ebene	Green	Green	Green	Green	Green	Green
Soziale Kriterien							
Verteilungsgerechtigkeit	Profit einer Vielzahl von Akteuren	Green	Green	Green	Yellow	Green	Orange
Autonomie	Regionale Eigenversorgung Individuelle Selbstversorgung	Green	Green	Green	Yellow	Green	Orange
Risikobewertung		Green	Green	Green	Green	Green	Green
Nationaler Dialogprozess & Regionale Planungsprozesse		Green	Green	Green	Green	Green	Green
Rohstoff (ethische Aspekte)		Orange	Green	Green	Green	Green	Orange
Akzeptanz		Green	Green	Green	Green	Green	Green
Gesundheitliche Beeinträchtigungen		Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Potenzial zur CO₂-Abscheidung							
Technischer Aufwand zur Integration von CO ₂ -Abscheidung	CO ₂ -Anteil im Gas	Green	Red	Green	Green	Yellow	Green
Entnahmekapazität der Einzeltechnologie	kl CO ₂ pro Jahr	Green	Red	Green	Green	Red	Green
Reifegrad für den kommerziellen Einsatz von CO ₂ -Abscheidung	Manufacturing Readiness Level (kurz MRL)	Green	Orange	Green	Green	Green	Green
Zusätzlicher Energieaufwand für CO ₂ -Abscheidung	Prozent der Produktenergie	Green	Orange	Green	Green	Green	Green
Kosten für CO ₂ -Abscheidung	Prozent der Investitionssumme	Green	Orange	Green	Green	Green	Green
Potenzial einer vollständigen CO ₂ -Abscheidung	CO ₂ -Abscheiderate	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

Bioenergy in 2050 – Results of the assessment

May 2019
Summary of the Position Paper

Biomass: striking a balance between
energy and climate policies
Strategies for sustainable bioenergy use

- 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)

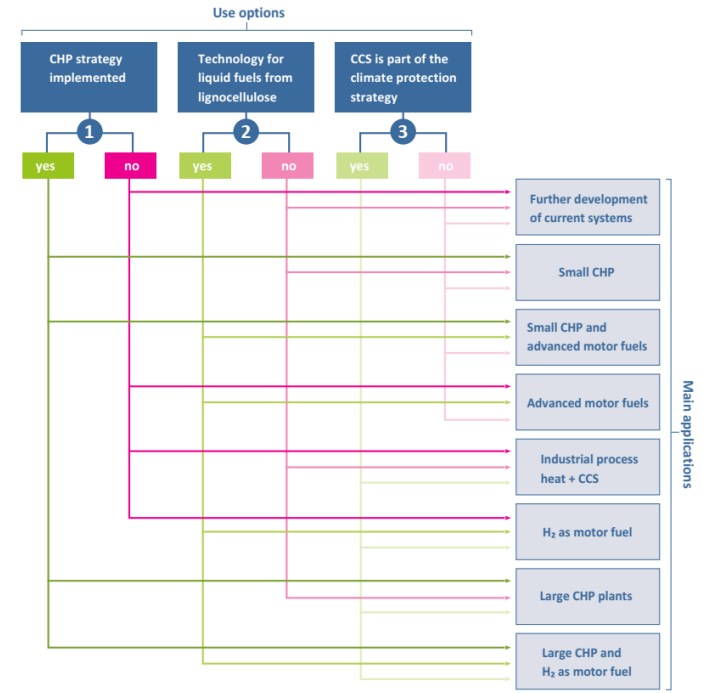
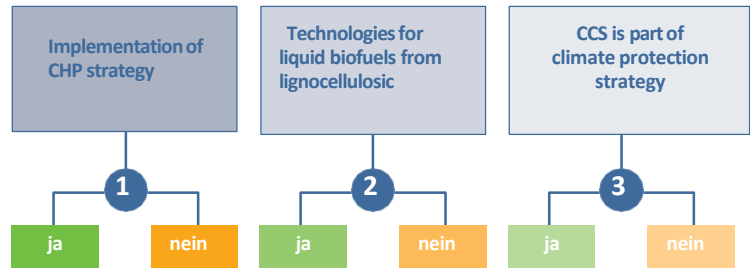
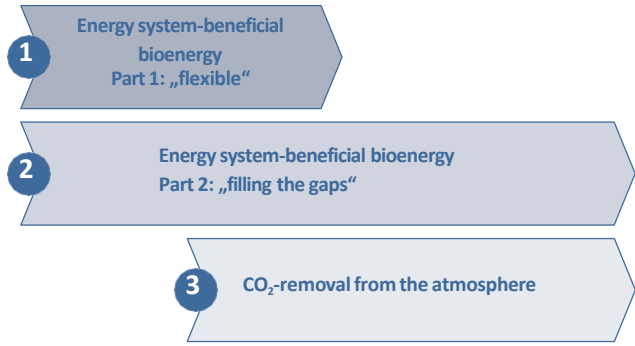


Bioenergy in 2050 – Road map and prioritization

May 2019
Summary of the Position Paper

Biomass: striking a balance between energy and climate policies
Strategies for sustainable bioenergy use

2000 → 2050



Bioenergy in 2050 – Example for prioritization

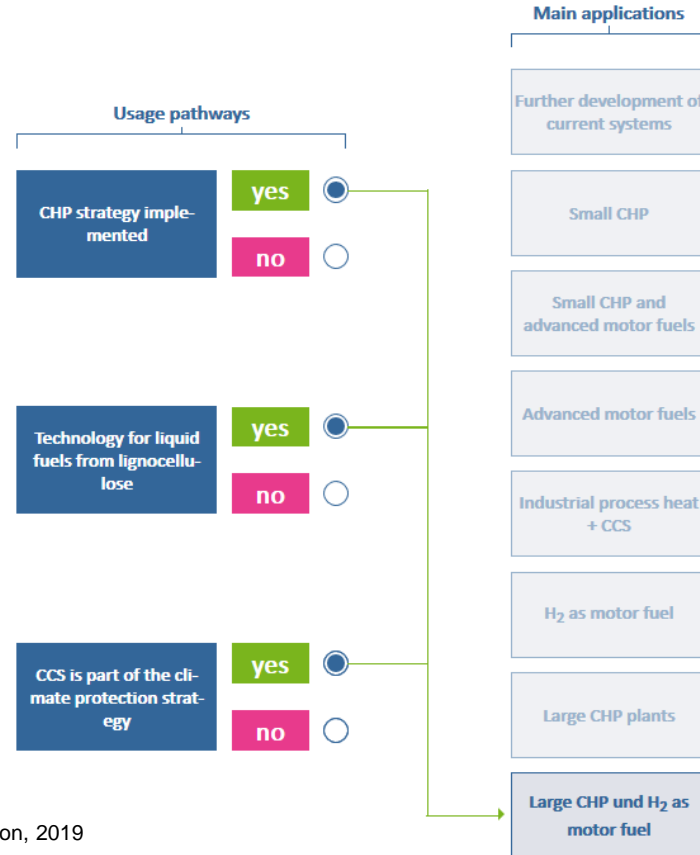
May 2019
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Biomass: striking a balance between
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Strategies for sustainable bioenergy use

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 H₂ 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

May 2012
Summary of the Position Paper

Biomass: striking a balance between
energy and climate policies
Strategies for sustainable bioenergy use

- 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

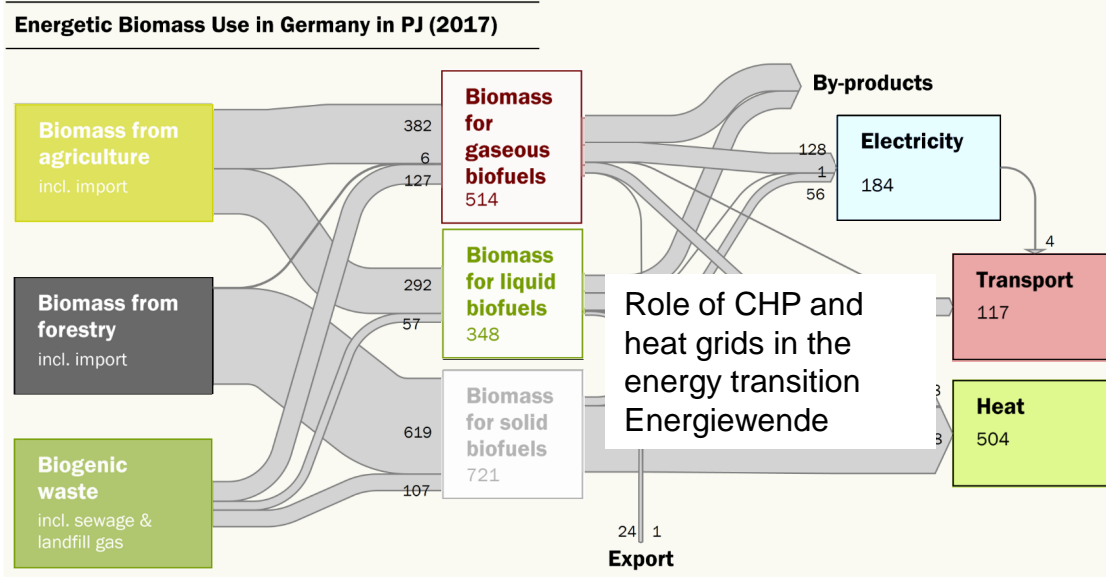
- The three switches are applicable for other countries working on long term bioenergy strategies >> a variety of national bioenergy strategies can be expected.

What does that mean for bioenergy in Germany?



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

EXPECTATIONS AND FIELDS OF ACTION



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

CO₂ 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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