Strategies for the implementation of nREAPs in the field of biogas

History and future biogas market development in Germany

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Content

- Biogas (& biomethane) market development in Germany
- Status quo: Energy production from biogas in the German heat, electricity and transport sector
- Biogas in the German nREAP
  - Targets until 2020
  - Support mechanisms

Biogas market development in Germany 1940 - 1992

- Biogas production through agricultural biogas plants has started during the early 1940s in Germany
- First biogas plants digested mainly manure and agriculture residuals
- Improving the fertilizer quality of manure through AD was already known among farmers
- No significant biogas market development due to a not matured biogas technology and low energy prices for fossil fuels
- The number of biogas plants was constantly about 140 until 1990

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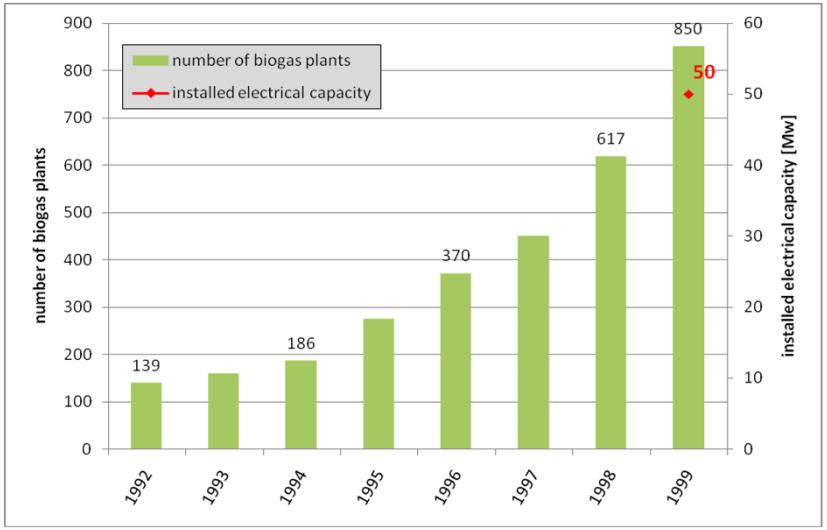
Biogas market development in Germany 1992 - 1999

- Implementation of the “Electricity Supply Law” (StrEG) in 1991 amended in 1994 provides increased prices for sold electricity generated from biogas
- Implementation of investment grants for renewable energies

  ➡ increased biogas market development from 140 to 850 biogas plants in 1999
- Average biogas plant capacity: 50 - 60 kW_{el}
- Feedstock:

  mainly manure and argriculture residuals



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Biogas market development in Germany 2000

The Renewable Energy Source Act (EEG)

- Goal is to speed up the market launch of technologies for RE production
- Core element is the duty of grid operators to give priority to electricity from RE source and to pay for it according to fixed tariffs

Main driver stimulating the development of a sound biogas market, since it has ensured revenues for 20 years

	Basic tariff (2000)
	[ct/kWh]
< 500 kW_{el}	10.23
< 5 MW_{el}	9.21
5 - 20 MW_{el}	8.7

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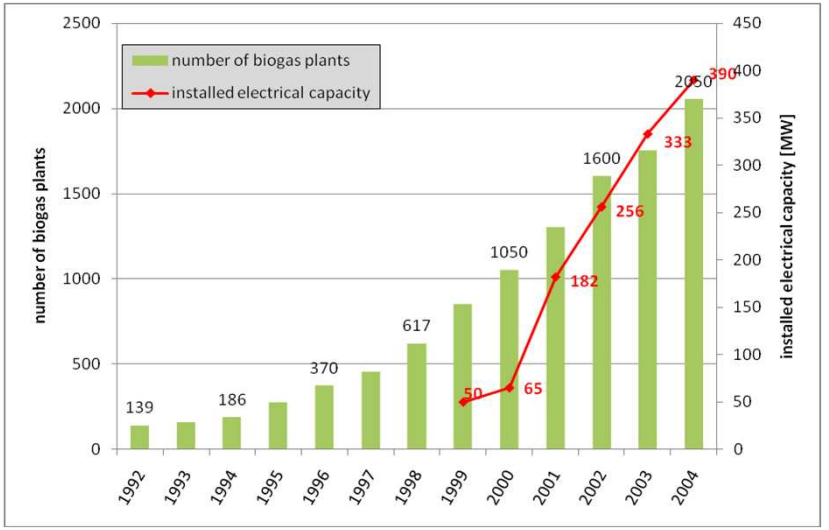
Biogas market development in Germany 2000 - 2004

- Number of biogas plants has increased to more than 2 000 in the year 2004
- Beside the EEG this development has resulted also through
  - The implementation of a Market Incentive Programme (MAP) which provides investment grants up to 30% of the total investment for biogas plants!
  - Implementation of investment attraction programmes by several federal states



Low energy efficiency at existing biogas plants!

No utilization of the produced waste heat!

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Biogas market development in Germany 2004

EEG amendment

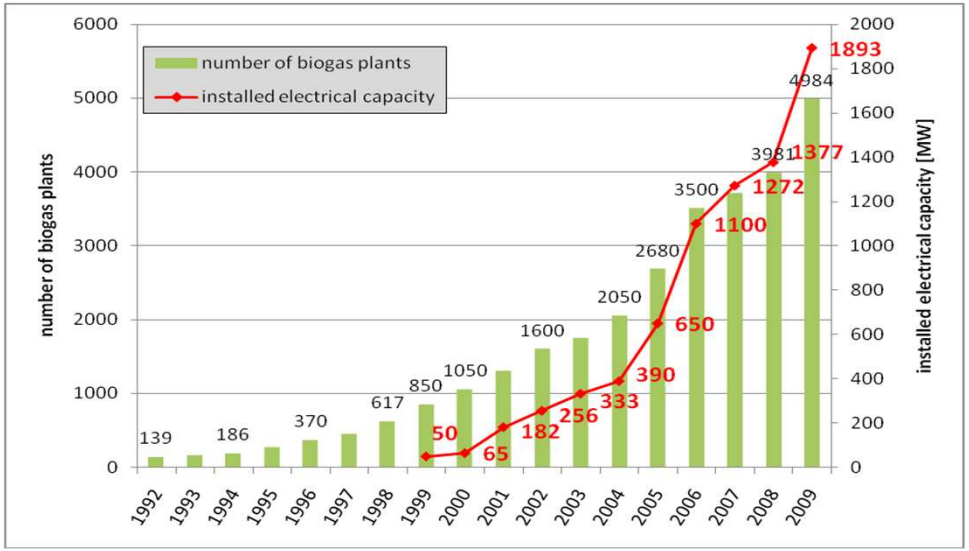
Incentives for:

- waste heat utilization
- small biogas plants (< 150 kW_{el})
- energy crop digestion
- innovative technologies

	Basic tariff (2004)	Bonus for energy crops	Bonus for CHP	Technology bonus
	[ct/kWh]	[ct/kWh]	[ct/kWh]	[ct/kWh]
< 150 kW_{el}	11.5	6	2	2
< 500 kW_{el}	9.9	6	2	2
< 5 MW_{el}	8.9	4	2	2
< 20 MW_{el}	8.4	0	2	0

Biogas market development in Germany
2004 – 2006: Booming biogas market

- Major driver for this development was the **new bonus for energy crop digestion**
- Most biogas plants used **corn silage** and occupied the bonus for their generated electricity
- CHP generation was done at many biogas plants (for questionable utilization paths)



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Biogas market development in Germany

Consequences through the energy crop bonus:

- Reduced digestion of organic residuals (esp. manure) in agricultural biogas plants
- Regional reduced ecological diversity (maize monocultures)!
- Reduced acceptance from the population and environmental organizations!

Biogas crises in 2007/2008 due to high prices for agricultural products!

- Economic problems for biogas plant operators

Biogas market development in Germany 2009

Amendment of the EEG with new incentives from the legislator!

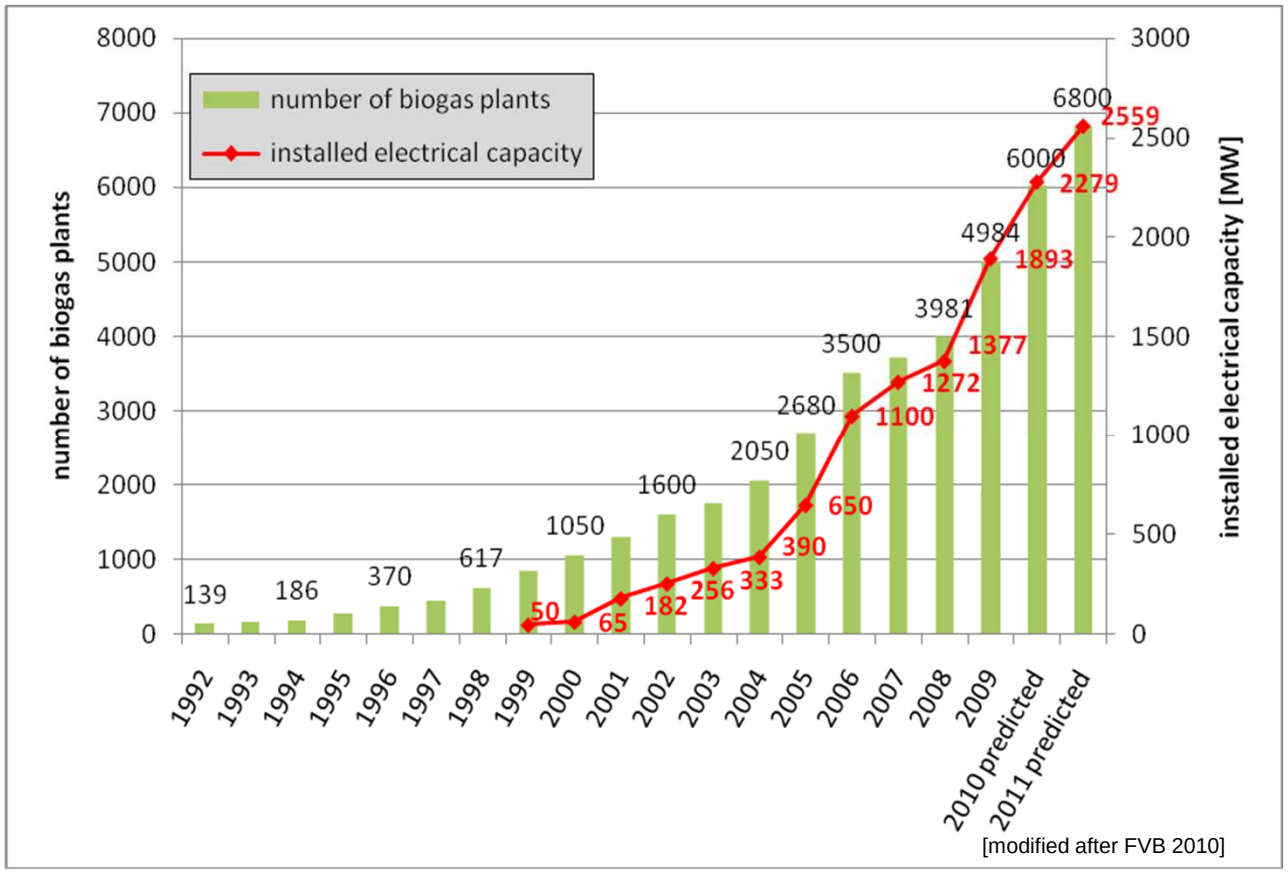
- New bonus for the digestion of **manure** and **landscape conservation materials**
- New bonus for air quality

Increased incentives for:

- Small agriculture biogas plants (up to 150 kW_{el})
- CHP generation (stringent criteria)
- Innovative technology (e.g. for technologies digesting organic residues)

	Basic tariff (2009)	Bonus for energy crops	Bonus for CHP	Technology bonus	Bonus for manure	Formaldehyd bonus	Bonus for landscape conservation material
	[ct/kWh]	[ct/kWh]	[ct/kWh]	[ct/kWh]	[ct/kWh]	[ct/kWh]	[ct/kWh]
< 150 kW_{el}	11.67	7	3	up to 2	4	1	2
< 500 kW_{el}	9.18	7	3	up to 2	1	1	2
< 5 MW_{el}	8.25	4	3	up to 2	0	0	0
< 20 MW_{el}	7.79	0	3	0	0	0	0

Biogas market development in Germany until today



[modified after FVB 2010]

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Biogas market development in Germany

Expected amendments in the Renewable Energy Source Act (EEG) in 2012:

- Further development of the integration of RE in the power supply system (esp. electricity from biogas plants)
- Support of demand oriented electricity feed-in and load management of electricity from RE
- Reduction of the guaranteed tariff of several bonuses

  (manure and energy crop digestion bonus)

[modified after FVB 2010]

Biomethane market development in Germany
Biomethane grid injection: framework

In 2008 improved legislation for opportunities to inject biomethane into the natural gas grid:

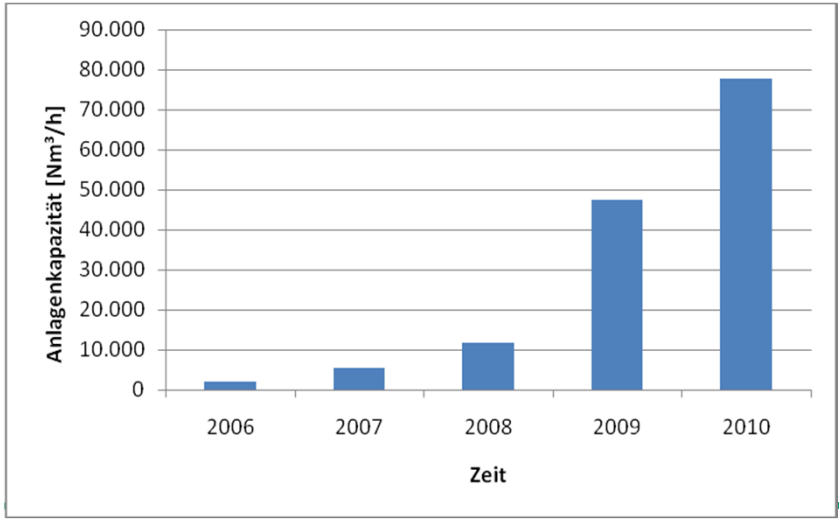
- Gas Grid Access Odiance (GasNZV) (amended in 2010)
- Gas Grid Fees Ordiance (GasNEV)
- Incentive Regulation Ordiance (ARegV)

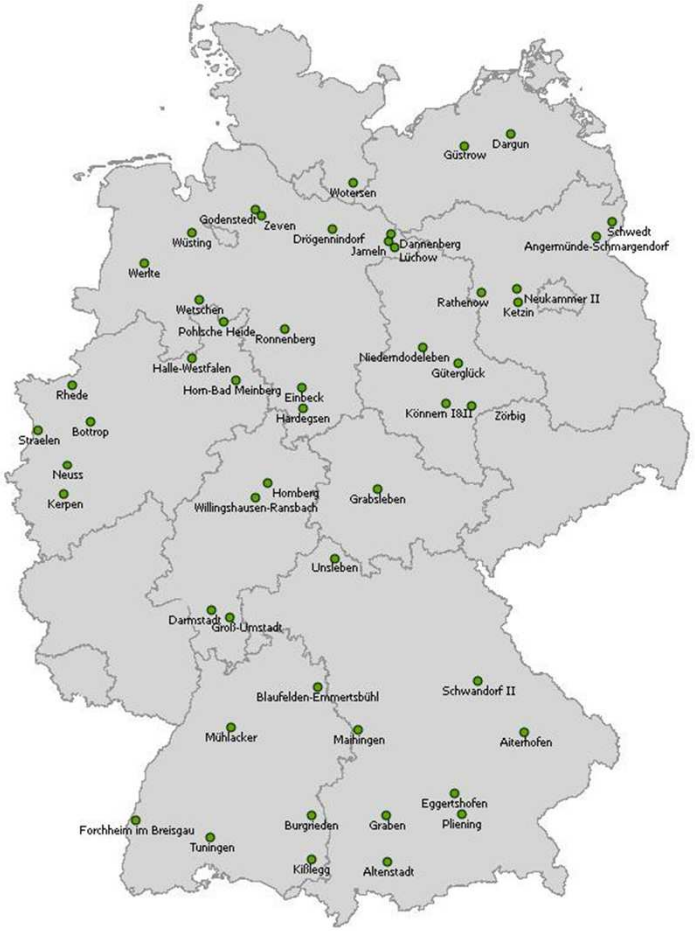
- Priority grid access for biomethane gas
- Split gas grid connection costs between gas suppliers and grid operators
- Grid flat rate (0.7 €ct/kWh) paid to gas producer (decentral gas grid injection)
- Gas grid operators may allocate the costs from the biomethane support to the network tariffs

Biomethane market development in Germany

Biomethane feed-in projects in 2010

- 52 upgrading plants in operation
- Capacity: 78 000 Nm³/h (raw gas)
- Further upgrading facilities are under construction





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Biomethane market development in Germany

Biomethane grid injection target until 2020:

- 6 bn. m³ biomethane grid injection in 2020
- Equates to 6 % of German natural gas consumption
- > 5 % were reached in 2010
- More than 100 new upgrading plants per year will be necessary to reach the 2020 target!

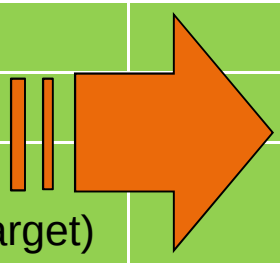
- Biomethane shall be utilized in CHP generation and in the transport sector

→ Achievement of the biomethane targets can also be reached through gasification of solid biomass

Biogas in the German nREAP

- German nREAP, based on the EU Renewable Energy Directive 2009/28/EC (RED), was submitted in August 2010
- It has been estimated that the mandatory target of 18 % RE as share of the final energy production (RED 2009/28/EC) will be exceeded by 1.6 %
- The nREAP has specified measurements and instruments of the federal government to achieve the targets

Sectors	Previous target of the federal government	Estimations according to nREAP
Share of RE at the gross final energy consumption	18 % (according to EU-RED)	19.6 %
Heating and cooling	14 %	15.5 %
Electricity	30 %	38.6 %
Traffic	10 % (according to EU-target)	13.2



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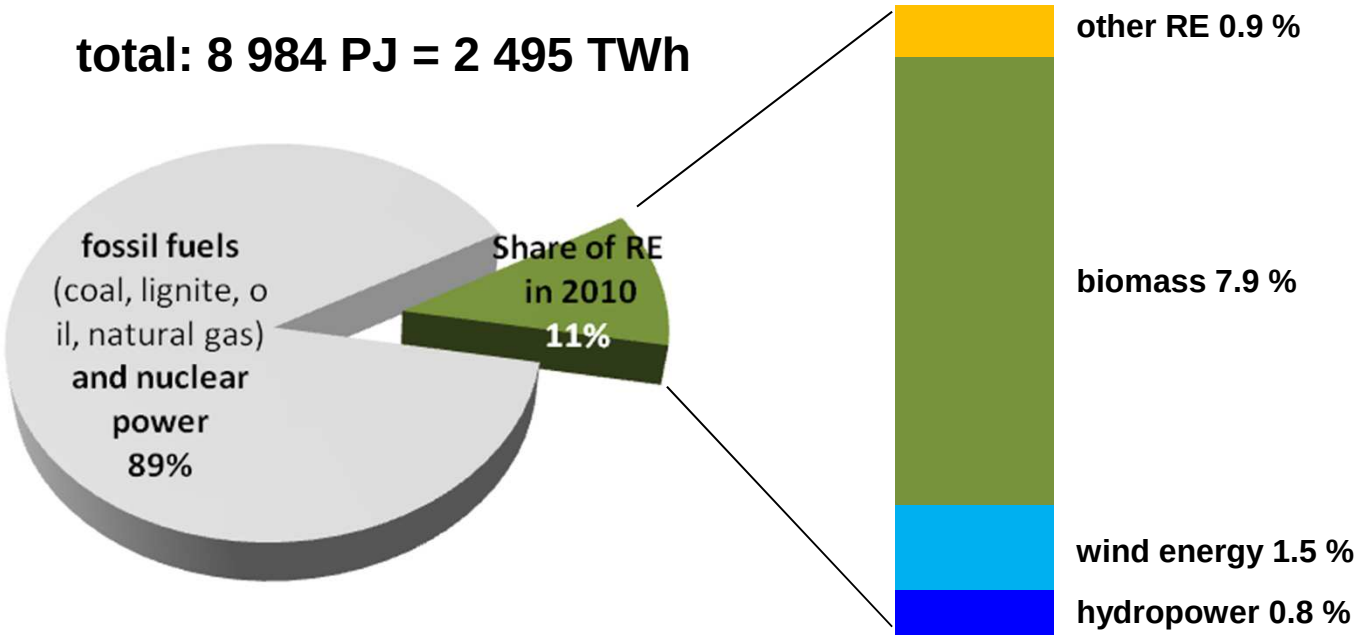
Share of RE on the final energy consumption in Germany 2010



[modified after BMU/AGEE Stat. 2010]

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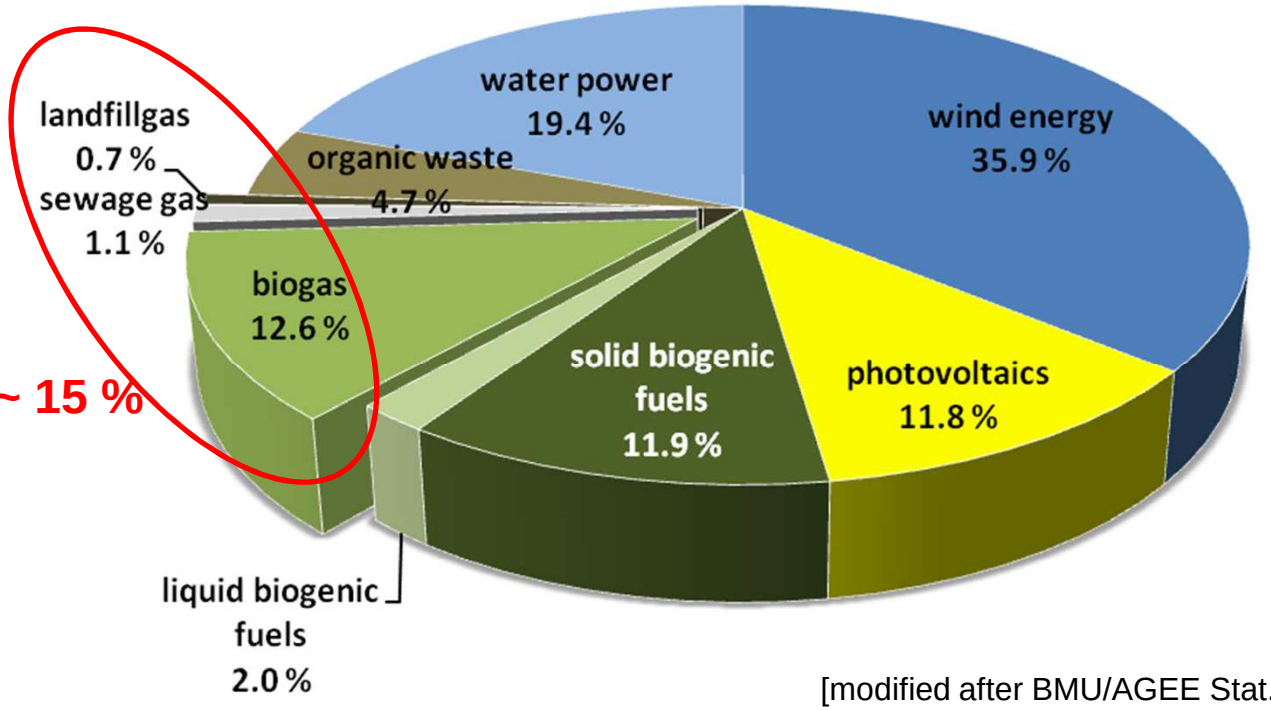
Structure of the electricity production of RE in Germany in 2010

Total: 101.7 TWh



share of biogas: ~ 15 %

[modified after BMU/AGEE Stat. 2010]

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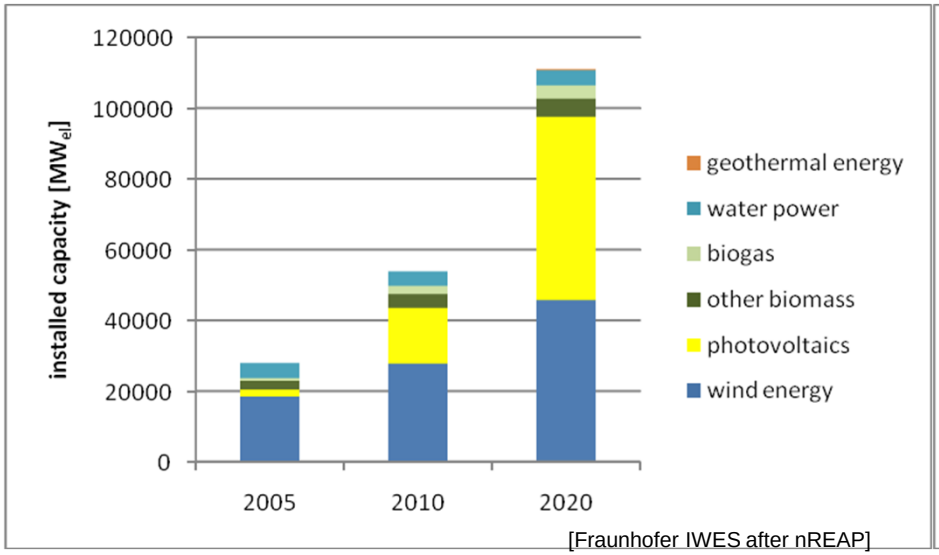
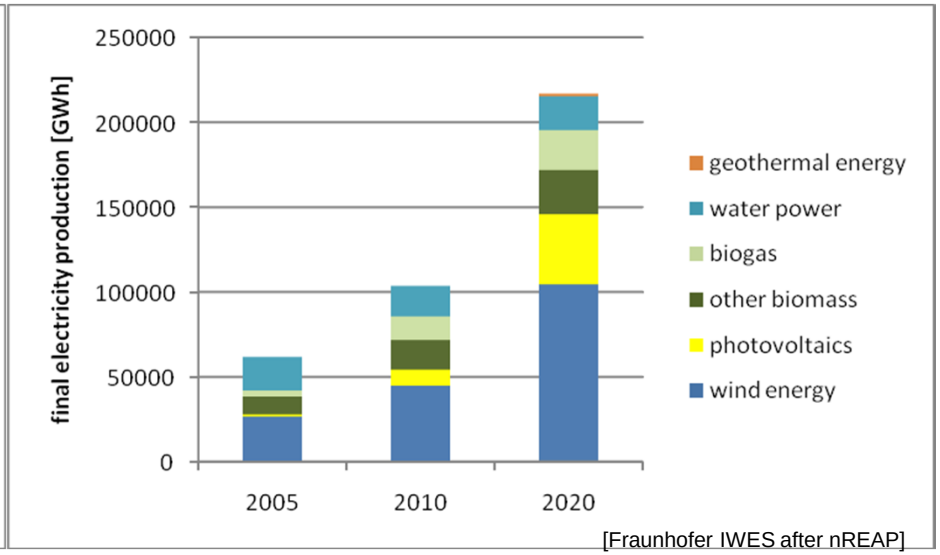
Biogas in the German nREAP
Sector target: Electricity

Estimated installed capacity of RES



[Fraunhofer IWES after nREAP]

Estimated gross power generation



[Fraunhofer IWES after nREAP]

- Almost doubled share of installed capacity of RES from 2010 to 2020
- Wind is and stays the most important RES for electricity generation
- High availability of electricity from biomass and biogas plants
- Estimated increase of power generation from biogas is 70 % compared to 2010

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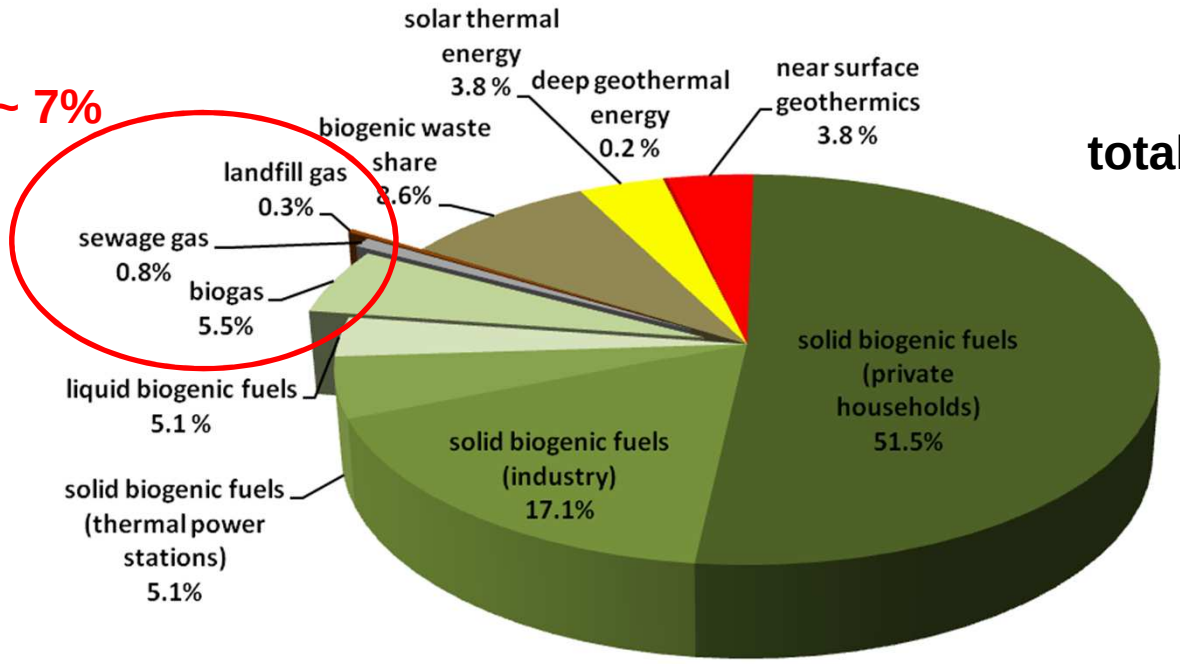
RE production in the heat sector in 2010

share of biogas: ~ 7%



total: 137.8 TWh

[modified after BMU/AGEE-Stat. 2011]

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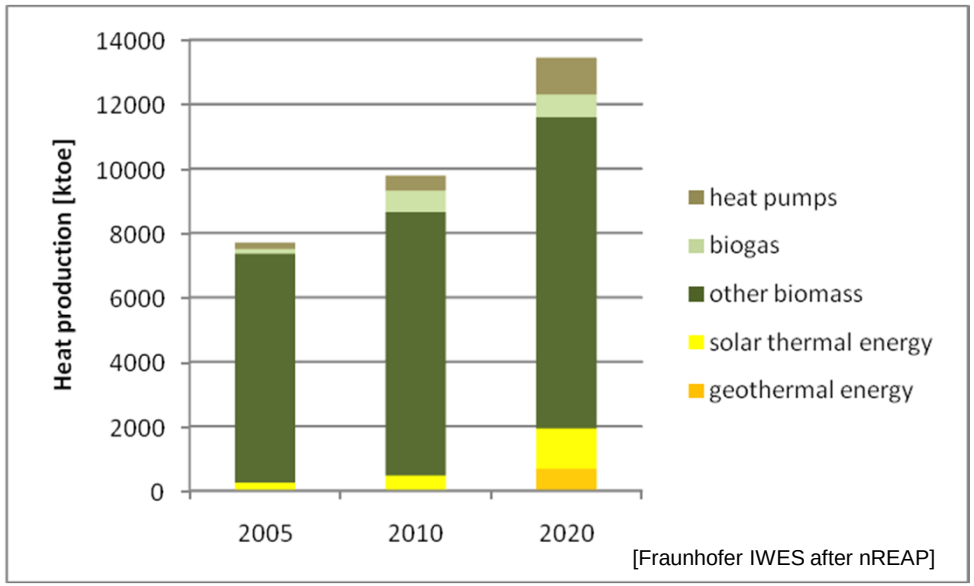
Estimated generation of heating and cooling from renewable sources



- Biomass will remain most important RES for heating and cooling
- Estimated increase of heat from biogas is 70 % compared to 2010
- Heat from biogas is generated mainly through CHP generation

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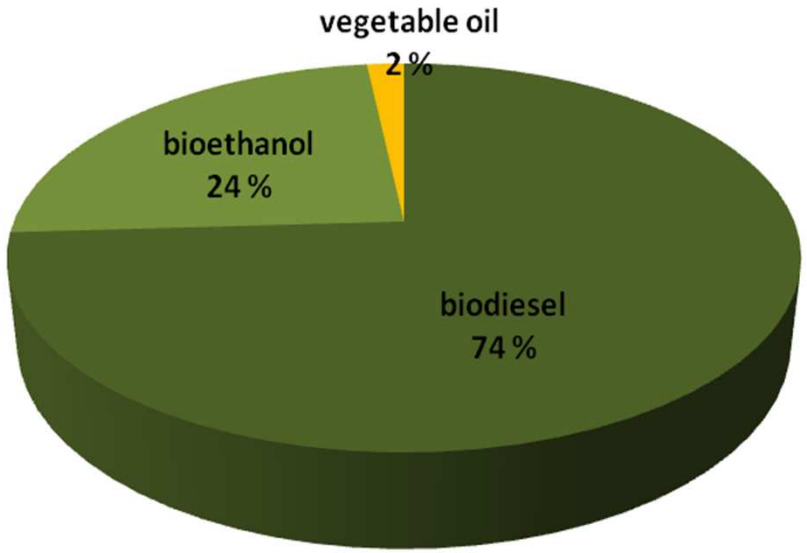
Status quo: Energy from biogas in the heat, electricity and transport sector

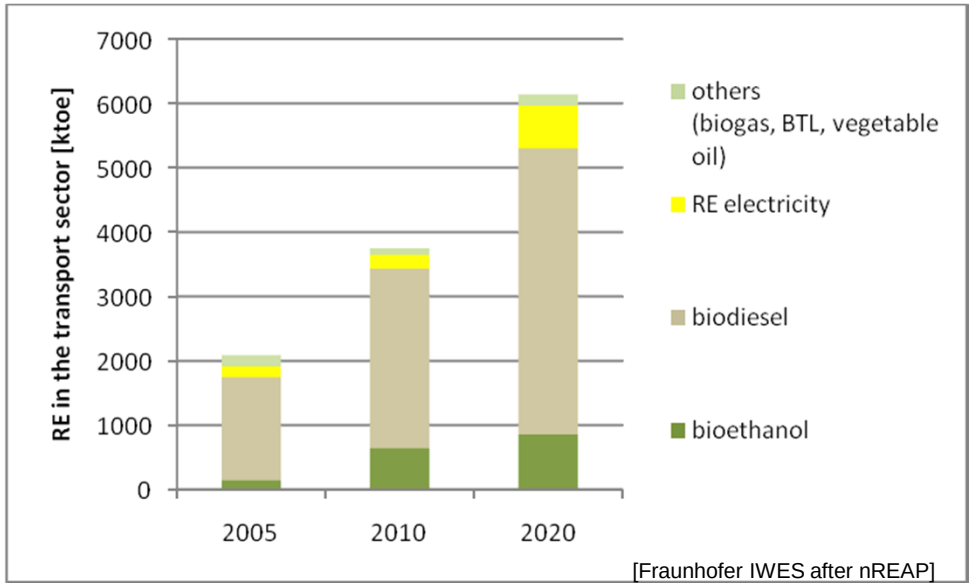
RE share in the transport sector



[modified after BMU/AGEE-Stat. 2011]

Biogas in the German nREAP Sector Target: Transport

Estimated amounts of renewable energies in transport



[Fraunhofer IWES after nREAP]

- Share of biogas is not fixed!

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Biogas in the German nREAP-
Support instruments in the field of biogas

Electricity sector:

EEG

- Fixed price (“tariff”) for each kilowatt hour produced from RE for 20 years
- Efficiency requirements (Waste heat utilization, utilization of organic residues,...)

Biogas in the German nREAP-
Support instruments in the field of biogas

Heating/Cooling sector

Renewable Energy Heat Act

- Obligation to use renewable energy sources in new buildings
- Alternative measures: energy saving, CHP, waste heat utilization (district heating grid)

Support instruments for a efficient utilization of biogas waste heat:

- **Market Incentive Programme (MAP)**
- **Cogeneration Act (KWKG)**
  - Grants and low interest loans for e.g. heat conductions

Biogas in the German nREAP-
Support instruments in the field of biogas

Transport sector

Biofuel obligation

- Obligation to sell a legally specified minimum share (quota) of biofuel as petrol
- Energy quotas:
  - 6.25 % in 2010 until 2014
  - From 2015 energy quotas will be transformed into minimum net GHG reduction targets: 2015-2016: 3 %; 2017: 4.5 %; 2020: 7 %

Energy tax act

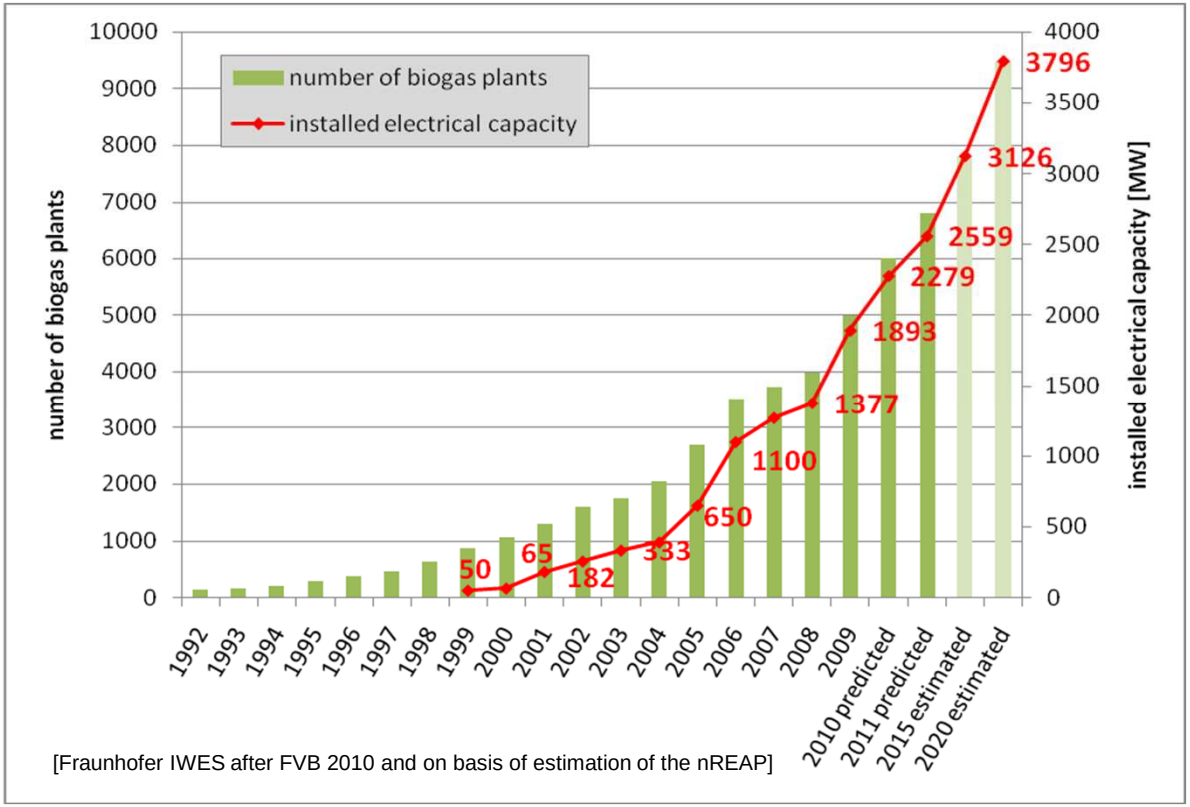
- Tax incentives for biomethane as vehicle fuel until 2015

Promotion of electric vehicles

- Target: 1 mio. vehicles in 2020

Biogas in the German nREAP

Estimated development of biogas plant installations according to the nREAP



[Fraunhofer IWES after FVB 2010 and on basis of estimation of the nREAP]

2010: 6 000 biogas plants
2.3 GW inst. capacity

2020: 9 500 biogas plants
3.8 GW inst. capacity

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Thank you very much!

M.Sc. Henning Hahn

Fraunhofer - Institute for Wind Energy and Energy System Technology

Division Bioenergy System Technology

Phone: +49/(0)561/7294-261

Henning.Hahn@iwes.fraunhofer.de

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Backup

Biogas in the German nREAP-
Support instruments in the field of biogas

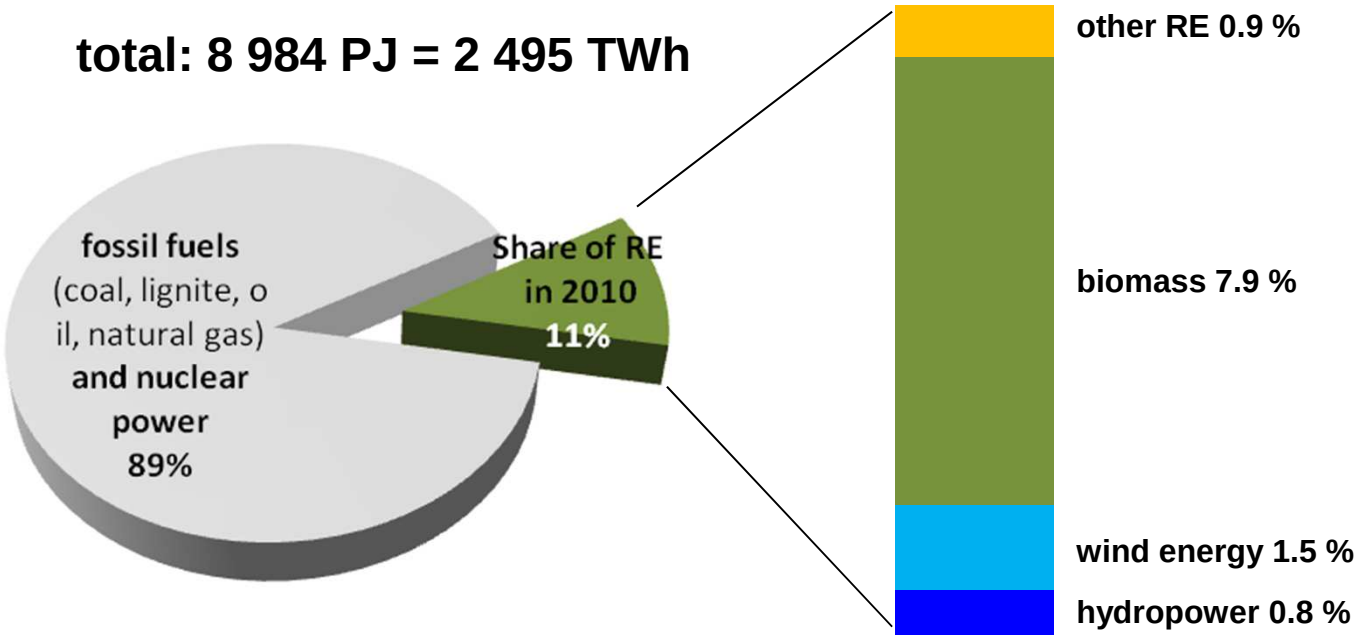
Biofuels Sustainability Ordinance:

> *sustainability criteria is necessary to be considered in quota or for tax reductions*

- Protection of areas with high biodiversity value, carbon stock and peatlands
- Environmental Cross Compliance rules (sustainable agriculture)
- Minimum GHG savings of 35%, after 2017 of 50%, after 2018 of 60%

Biomethane as vehicle fuel can only be produced by waste or corn silage digestion!

Share of RE on the final energy consumption in Germany 2010



[modified after BMU/AGEE Stat. 2010]

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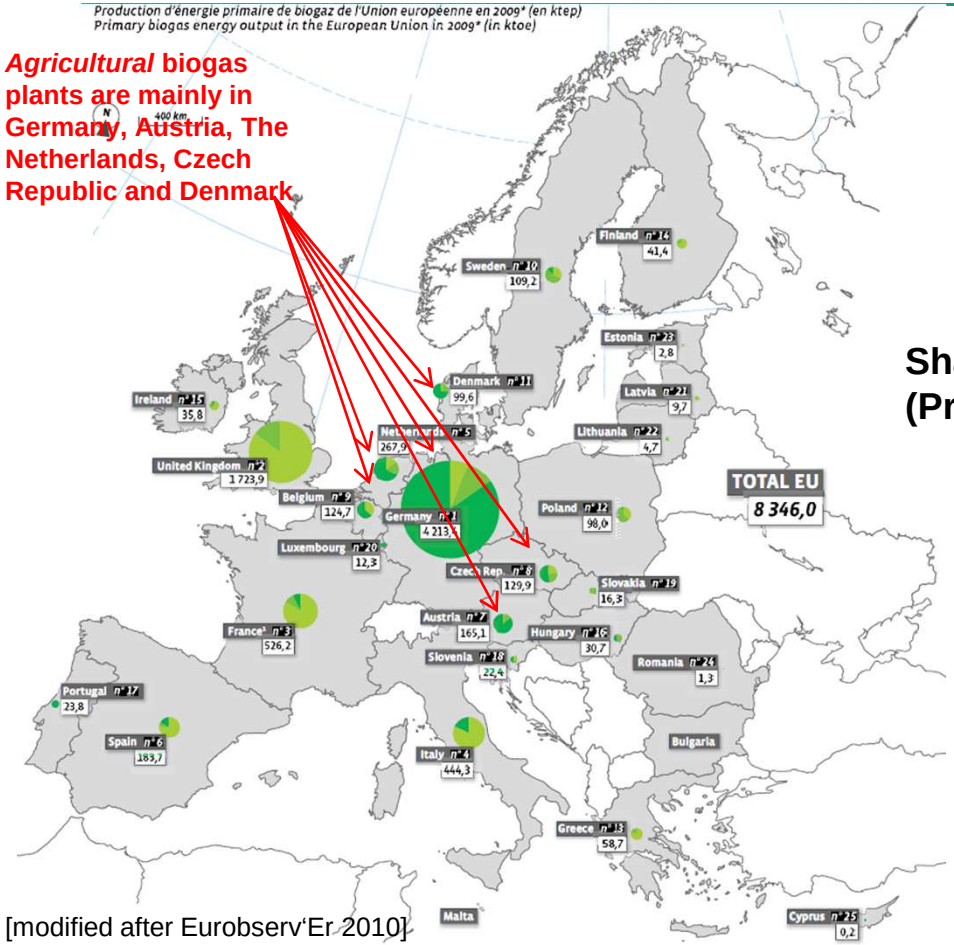
Overview-
biogas production in the European Union

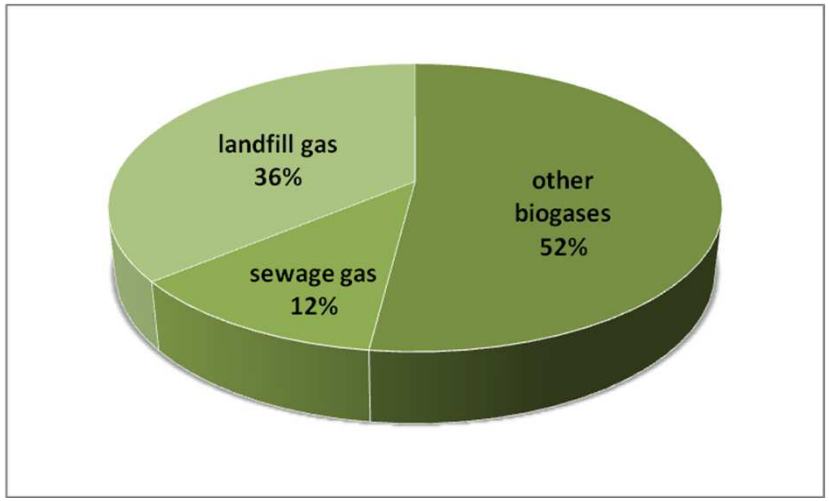


***Agricultural* biogas plants are mainly in Germany, Austria, The Netherlands, Czech Republic and Denmark**

[modified after Eurobserv'Er 2010]

- Other biogases
- Landfill gas
- Sewage gas

Shares of biogases on the gross EU biogas production (Primary energy output of 8.3 Mtoe in 2009):



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Biogas in the German nREAP

Estimated development of biogas production in the heat, electricity and transport sector

- Electricity sector: + 70 %
- Transport sector: share of biogas is not fixed!
- Heat and climatisation sector: + 70 %
- Total : ca. 60 % increase of the installed capacity

Biogas in the German nREAP-
Support instruments in the field of biogas

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Biomethane as vehicle fuel can only be produced by waste or maize digestion!

Biogas in the German nREAP-
Support instruments in the field of biogas

- Renewable Energy Source Act (EEG)

  > Proirity access and feed-in tariff system

- Renewable Heat Act

  > Obligation and incentives

- Market Incentive Programme

  > Grants and loans

- Biofuels

  > Blending obligation

EU Renewable Energy Directive 2009/28/EC

Targets until 2020

- Share of RE of the Europen final energy consumption = 20 %
  - Mandatory national targets from Member States vary between 10 % from Malta to 49 % for Sweden
  - Target for Germany: 18 %
- Share of biofuel at vehicle fuel consumption = 10 %
  - The Member States mandatory minimum target should be reached cost efficient and suistainable
  - Therefore, the 10 % target should be defined at share of the final energy consumption in the transport sector which shall be covered through RE and not only by biofuels
  - Achievement of the target through e.g.:
    - Synthetic biofuels and biofuels (can be counted double when using waste material for the fuel production)
    - Electricity from RE in electric vehicles (can be counted 2.5 times)
    - Hydrogen from RE