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Biomethane – political guidelines and conclusions for advancement of incentives from the perspective of the German Government

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On secondment to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Division KI III 2 – Solar Energy, Biomass, Geothermal Energy, Market Introduction Programmes for Renewable Energies

Ecologic Institute

- Think Tank for applied environmental research, policy analysis and consultancy
- offices in Berlin, Brussels, Vienna and Washington DC
- private, independent and non-profit Institute
- founded in 1995
- Partner in the network of Institutes for European Environmental Policy

- Our project: legal and scientific assistance for Federal Ministry for the Environment (BMU)
  - evaluation and advancement of Renewable Energies Sources Act (EEG) and associated ordinances
  - advancement of legal framework conditions and guidelines for biogas production, -upgrading and -grid injection,
  - knowledge development and implementation of sustainability standards for energetic utilization of biomass
  - evaluation and advancement of Renewable Energies Heat Act (EEWärmeG)

outline

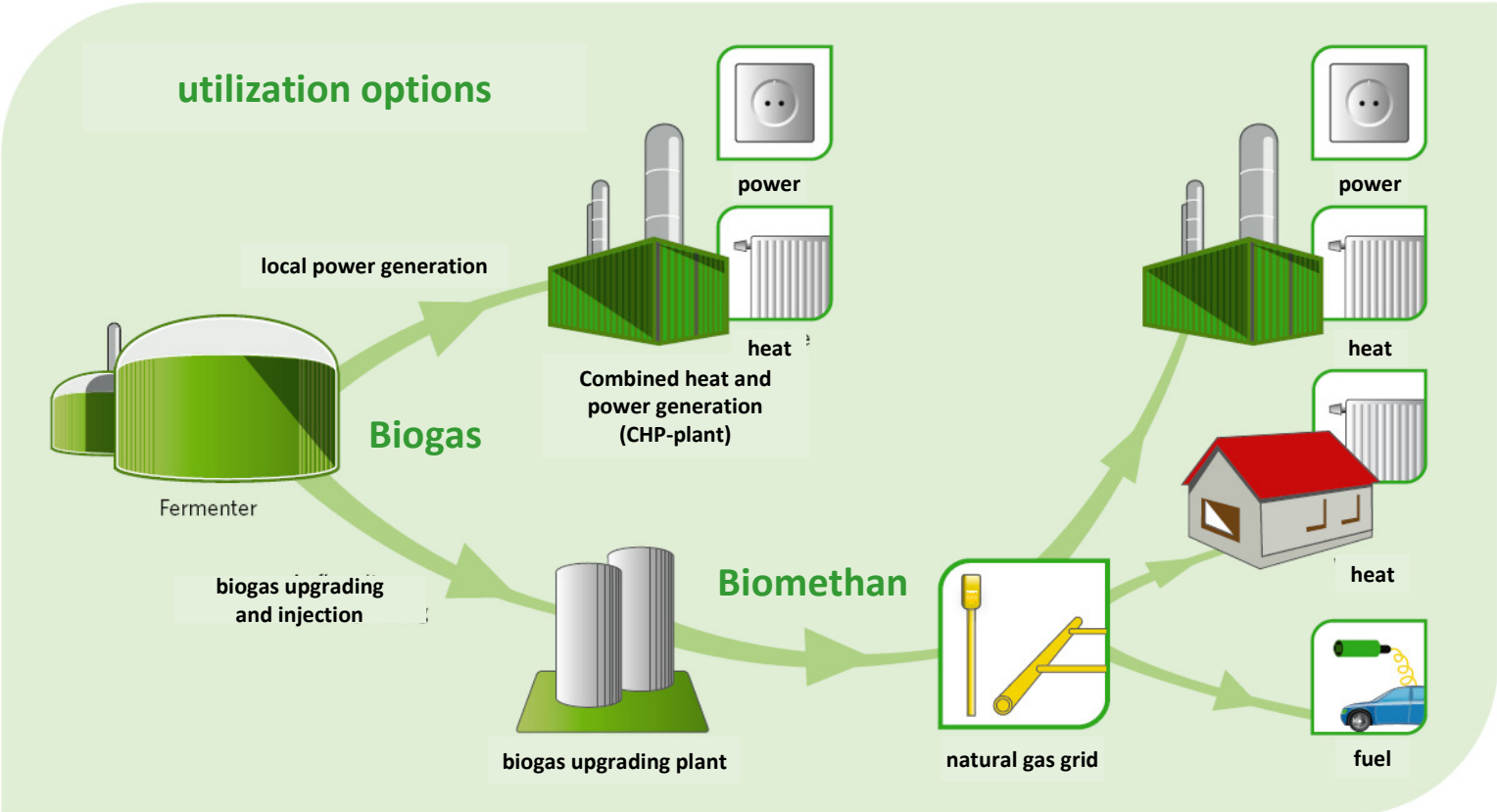
- biomethane – classification of utilization options
- political targets – Gov´s Energy strategy 2050
- biomethane – Contribution to national targets
  - biogas potential
  - contribution to climate protection
  - energy efficiency
  - assessment of Biogas utilization options in the whole context
- conclusions

Biomethane – classification of utilization options

biomass

energy plants
grass
sugar beets

residue / waste materials
liquid manure



source: AEE, www.unendlich-viel-energie.de; www.erdgas.info: Broschüre Bio-Erdgas – Umweltschonende Energie mit Zukunft

Political targets – Energy strategy 2050 Government

- **Goal:** Germany, the most energy efficient and climate friendly economy of the world with competitive energy prices and high prosperity level at the same time
- longterm strategy until 2050 for transformation of energy supply towards a sustainable energy economy
  - renewable energy as a key towards sustainability
  - energy efficiency, halving primary energy consumption
  - reorganization of grid infrastructure (power, gas)
  - energetic building refurbishment
  - sustainable mobility
  - binding policy targets, agreement on financing concept …

National targets for 2020 (a selection):

- CO_2-emission reduction of 40% (compared to 1990)
- share of renewable energies in different energy sectors:
  - 30% in electricity sector („at least“)
  - 14% in heat sector
  - 10% biofuels
- CHP share within electricity sector at least 25%

National targets for 2050:

- CO_2-emission reduction up to 80 – 95%
- consequences: power generation almost entirely by RES necessary

Gov´s Energy strategy 2010: establishment of obligatory targets

	Climate	RES		Efficiency		
	GHG reduction (base 1990)	share power sector	share total	primary energy	energy produc-tivity	Building refurbish-ment
2020	- 40 %	35%	18%	- 20%	yearly improve-ment 2%	rate double 1% → 2%
2030	- 55 %	50%	30%			
2040	- 70 %	65%	45%			
2050	- 80-95 %	80%	60%	- 50%		

Quelle: BMU 2010

How can biomethane contribute to achieve the targets?

- biogas potential based on energy crops, residues and waste materials
- contribution of biogas to climate protection (GHG reduction)
  - Environmental impacts – sustainable biomass supply
  - minimization of GHG-emissions along the value chain of biogas production
  - biogas utilization pathways
  - energy efficiency
  - assessment of biogas utilization pathways within in the whole bioenergy sector
- conclusions for amendment of incentives, laws and ordinances
  - fields of action within power or heat supply sector

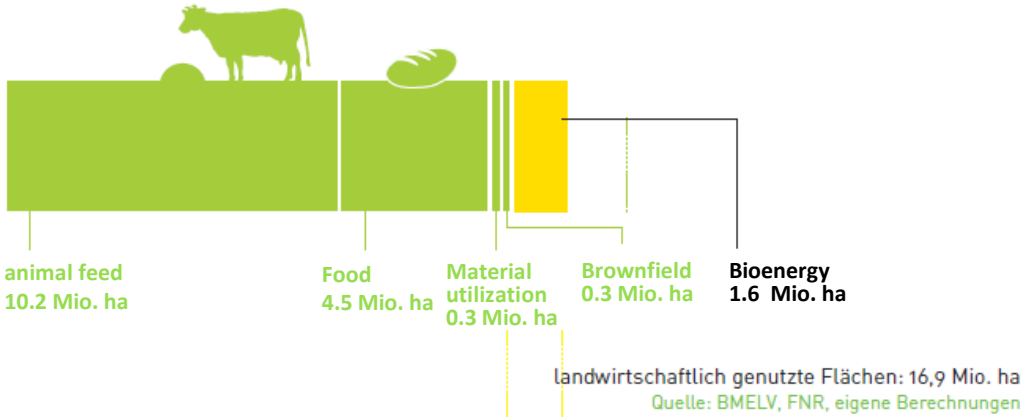
Biogas potential from residue and waste materials

Residue and waste material categories technical potential for 2020 (Germany)	Billion kWh/a
grass clipping	6.4
landscape conservation materials	4,.
solid dung, liquid manure, slurry of animal orig.	26.7
waste materials from commercial and industry	3.3
other harvest residues	3.6
organic fraction of municipal waste	5.6
total	50

- **max. economic accessable potential ca. 23 Billion kWh/a**
- **complies with acreage substitution for energy crops of 490.000 ha**

source: BMU-Leitstudie 2009; NREAP 2010; BGW-DVGW 2005; BMU 2004 – DLR, IFEU, WI; own calculations 2011

Biomass potential –availability of agricultural land



Bioenergy today and in the future needs a small percentage of agricultural area

source: AEE – Bioenergieatlas, www.unendlich-viel-energie.de

Biomass potential –availability of agricultural land

energy yield from 1 hectare:

1 hectare
= ca. 45 t maize
= ca. 9.000 m³ biogas

= 18.000 kWh_{el} = power for 5 households
+ 20.000 kWh_{th} = heat for 1 households

source: AEE – Bioenergieatlas, www.unendlich-viel-energie.de

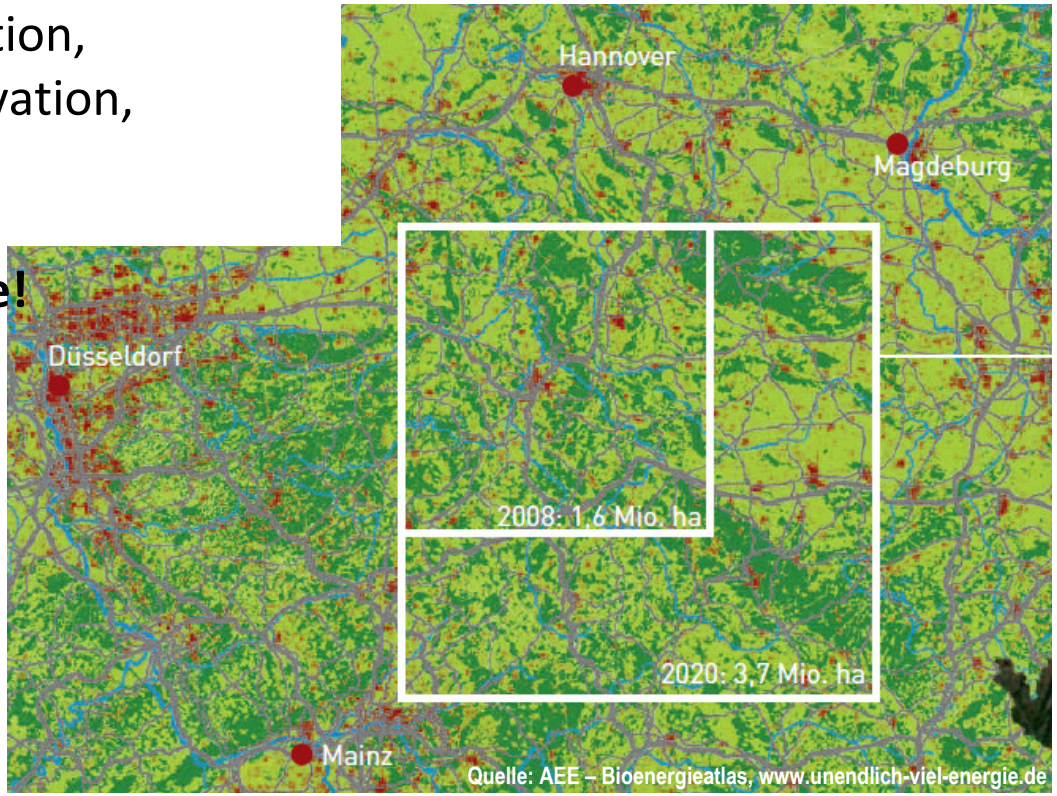
	acreage	possible biogas yield	
	hectare	in bill. Nm^3/a	in bill. kWh/a
2008	500,000	4.5	23.4
2010	650,000	5.85	30.4
2020	1,200,000 1,300,000	10.8 11.7	56.2 60.8
2030	2,140,000	19.2	100

Energy crops supply

- availability of acreage for energy crops in Germany limited
- therefore increase of acreage for energy crops needs critical review to avoid conflicts in spatial development
  (food and animal feed production,
  nature- and landscape conservation,
  recreation)

  Question of public acceptance!
- Hectare yields cannot be increased arbitrarily high!
- limiting factor: water

- 2010: 2,15 Mio. hectare



Environmental impacts, climate protection I

- biomass supply not per se climate friendly: sustainable biomass acreage and land management as well as efficient biogas utilization is a prerequisite
  - no rededication of areas with high nature conservation value, biodiversity or carbon stocks (primary forests, grassland, bogs)
  - minimize GHG-emissions from growing, fertilization, harvest, conversion
  - compliance with crop rotation, alternative crops, mixed and catch crops and flower stripes instead of maize
  - close substance loops via location adapted cultivation systems
  - minimize soil erosion, control water pollution
- avoid damage of landscape
- mobilisation of residues and waste, as far as reasonably practical from economic point of view

Environmental impacts, climate protection II

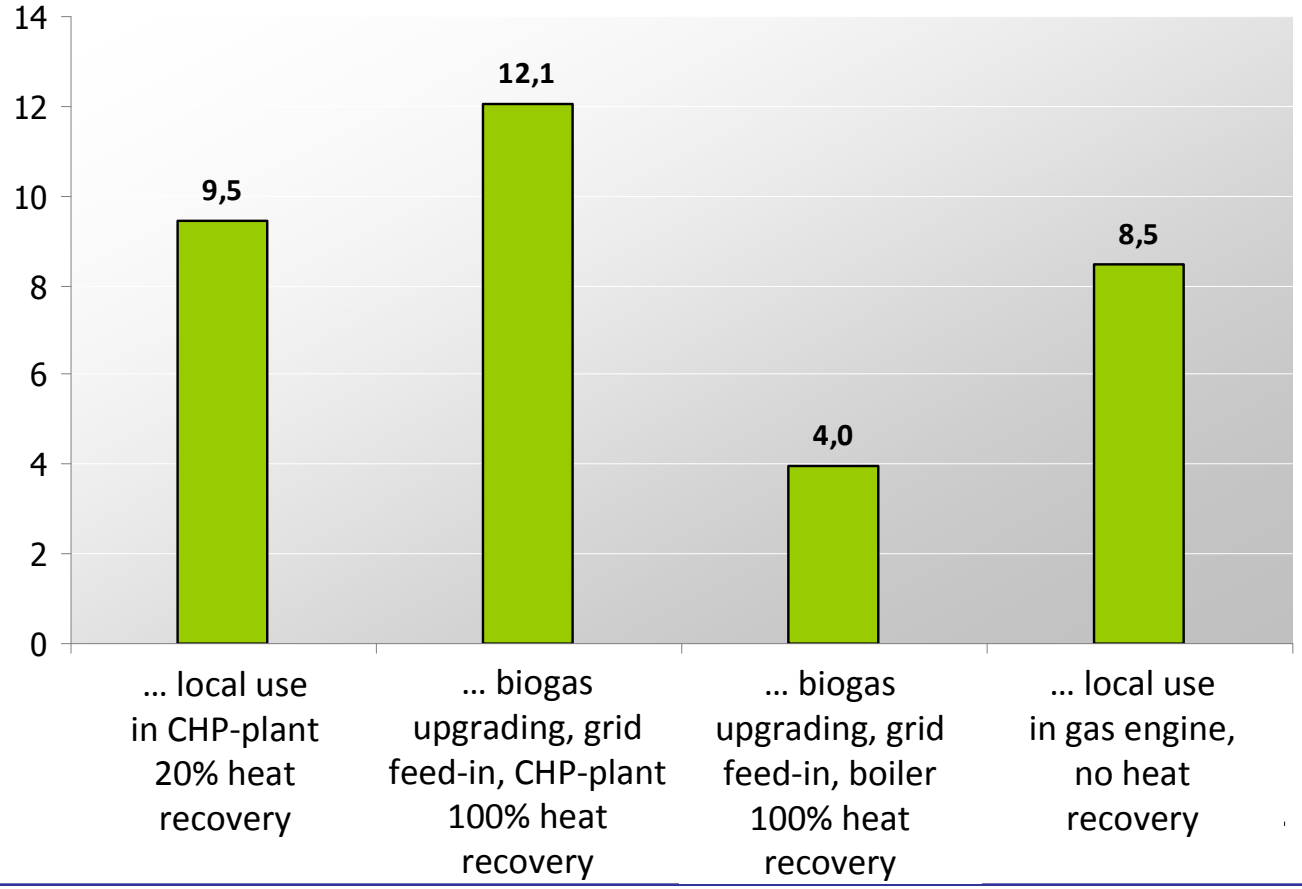
- GHG-emissions at the point of provision of biogas
  - depend on substrate, cultivation system, efficiency of conversion technologies, prevention of diff. CH_4-emissions, digestate storage etc.
  - liquid manure-biogas: between -40 und 0 g CO_2-equiv./kWh gas
  - energy crop-based biogas: between 145 – 120 – 100 – 80 g CO_2-equiv./kWh gas
- GHG-saving depends on biogas utilization path
  - What will be replaced due to biogas utilization? comparator
  - amount of heat used!

Minimize GHG-emissions in biogas production

- substrate supply: location adapted cultivation systems, return of digester output, minimization fertilizer, cultivation methods and harvest machinery, optimization transport logistics (deadheads)
- conservation of feed material (silo): coverage, compression, chopping level…
- efficiency conversion technology: gas yield increase, avoid diffuse CH_4-emissions, lower energy consumption
- choice of location: substrate availability, plant size, pressure level and distance of gas grid

Climate protection dependent from utilization path

Avoided GHG-emissions (in tons CO_2-equiv.), if biogas is used in …



Assumptions:
biogas from maize,
biogas yield of 1 hectare and year

Netto-GHG-reduction
after deduction of GHG emissions for biogas production

Source: UBA, IFEU 01/2011

conclusions I

- Biogas is a limited ressource
  - Land use competition: energy crops vs. food vs. animal feed vs. other energetic or material utilization of biomass, sustainability!
  - residues and waste materials: potential vs. activation costs
  - biomass import: sustainability! avoidance of new dependancies, costs

  obligation to climate- and energy efficient utilization!
- GHG reduction impact dependent on utilization path
  - expansion of CHP sector necessary
  - utilization of biomethane must mandatorily be more energy efficient and climate friendly than state of the art (wood firing, local power generation)
  - lowest GHG reduction in boilers

  biogas upgrading and feed-in is not an end in itself!

conclusions II

- cost- and energy efficiency
  - high costs for upgrading and injection is justified or can be incentivised if used in pathways with high energy efficiency and high GHG savings
- sustainable supply of biomass
  - minimize GHG-Emissions throughout biogas production chain (fertilization, biomass conservation, reduction CH_4-emissions)
  - minimize harmful environmental impacts (soil erosion, water protection, landscape protection, Emission reduction…)
  - strengthen utilization of residues and waste material potential and limitat energy crops cultivation, minimize land use competition and biomass imports
- joker system integration: storage capacity of biogas, flexibility of CHP-plants
- energy efficiency and energy savings

Instruments and Incentives to achieve the targets

- Gas network access ordinance (GasNZV) in 2008 and 2010
  - prior grid access for Biogas feed-in
  - distribution of CAPEX between grid operator and grid access client 75% : 25%, at maximum 250,000 € grid operator fully responsible for OPEX
  - grid access contract with time schedule for realization of grid access between grid operator and client
  - permanent availability of the grid connection of at least 96 %
  - reduced fees for energy balancing (1€/MWh) and credit for avoided mains operation (7€/MWh)

Instruments and Incentives to achieve the targets

- sustainability standards
  - sustainability standards for Biomethane as a fuel (2009/28/EC)
  - expansion of sustainability standards for solid and gaseous biomass is under review
  - Advancement of legal framework to ensure a sustainable biomass supply (e.g. Fertilizer ordinance, Federal Immission Control Act …)

- Integration of Biomass power plants into power market and supply infrastructure
  - market integration: incentives for direct trading and marketing at energy exchange (EEX), 2014: obligatory for Biogas driven plants > 500 kW
  - Demand based power generation via flexible Biogas-CHP-engines
  - Participation at balancing and system energy market (ancillary system services)

Thank you for your attention!

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