Experiences and future perspectives of biomethane in Germany from a regulatory perspective

Dr. Wolfgang Urban
Ecologic Institute

On secondment to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Division E I 5 – Solar Energy, Biomass, Geothermal Energy

Outline

- biomethane – political targets, utilization priorities
- legal framework and incentive scheme
- biomethane – challenges, future perspectives and conclusions from amendment of legal framework

Gov´s Energy strategy: some „Energiewende“ 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%**		

source: 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 the different energy sectors?

Biomethane – contribution to climate protection

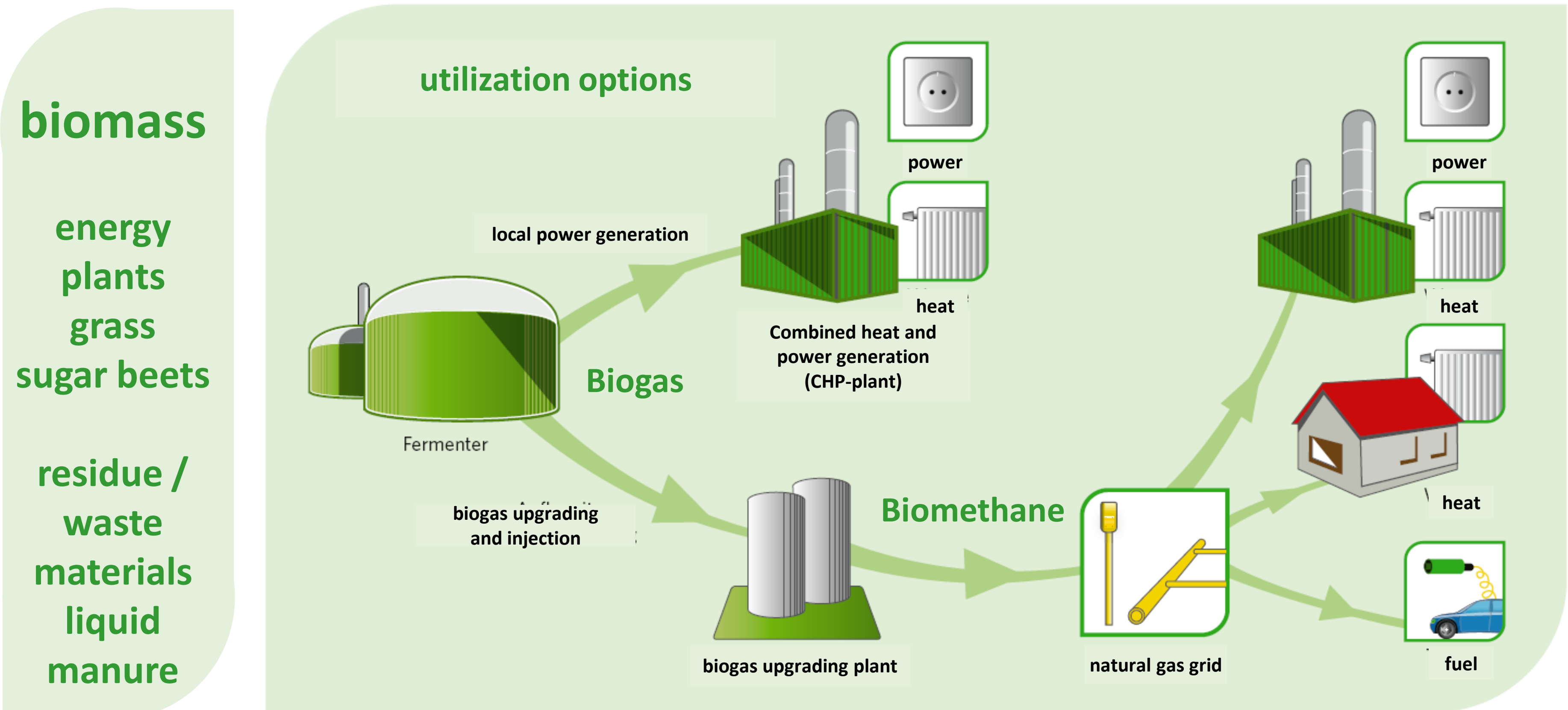
- most flexible RES
- easy to store and to transport

What option is prior-ranking from

- economic
- ecologic
- social

point of view?

Biomethane – classification of utilization options



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

contribution of biogas to meet the targets

- as a prerequisite to understand the german biogas strategy:
  - limitation of biomass resources, restrictions of biomass imports
  - high CFP of german power plant mix ruled by coal and nuclear power
  - heat supply in Germany governed by gas, oil, wood, distr. heating & CHP systems
  - optimal utilization of different biomass resources (e.g. wood chips for heat sector)
- top priority for biogas utilization: flexible power generation! Preferably CHP! followed by biomethane utilization within transport sector
- local power generation with heat utilization prior to biogas upgrading and feed-in into the gas grid from economic and ecologic considerations

Biogas feed-in in Germany – legal framework and incentives

Incentive scheme for biomethane I

- Renewable Energy Sources Act (EEG): feed-in tariff system for power generation from RES

- Gas network access ordinance (GasNZV) and Gas network fee ordinance (GasNEV)

EEG: main driver for biomethane production in Germany

Incentive scheme for biomethane II

- **biomethane in transport sector**
  - biofuel quota act: biomethane can be charged to quota
  - reduced energy tax for natural gas and biomethane use in vehicles
- **biomethane in heat sector**
  - Renewable Energy Sources Heat Act: obligation use of RES or high energy efficiency measurements in new buildings, e.g. biogas fired (micro-) CHP devices, wood firing, solar heating, thermal insulation of buildings, waste heat recovery etc.
  - role model of public sector at building renovation: obligation use of RES and high energy efficiency measurements
  - Biogas use: CHP-obligation

Renewable Energy Sources Act (EEG) I

- prior grid access for RES-power, technology specific feed-in tariff for each RES-technology guaranteed by law for 20 years, degression 2% p.y.
- indirect subsidy for biomethane feed-in via EEG
- EEG: feed-in tariff system for power generation of biogas / biomethane
- height of feed-in tariff in ct/kWh el dependant of
  - CHP-plant size or biogas plant size resp. between 6 - 14.3 ct/kWh
  - used biomasse resource (waste, energy crops, ecologic important materials)
  - bonus for biogas feed-in (3-2-1-0 ct/kWh in regard to upgrading plant capacity)

Renewable Energy Sources Act (EEG 2012) II

installed power plant capacity	EEG feed-in tariff in €ct/kWh el					
	biogas plants and solid biomasses (e.g. wood)				biowaste AD plants recycling of solid fermentation residues [5]	mini AD plants for liquid manure
	base tariff	feedstock remuneration: energy crops tariff [1]	feedstock remuneration: eco tariff [2]	biogas upgrading bonus		
[kW_{el}]	[$€ct/kWh_{el}$]					
≤ 75 [4]						25 [4]
≤ 150	14,3			≤ 700 Nm^3/h: 3		
≤ 500	12,3	6	8	≤ 1.000 Nm^3/h: 2	16	
≤ 750	11	5		≤ 1.400 Nm^3/h: 1		
≤ 5.000	11	4	8 / 6 [3]			
≤ 20.000	6	-	-	-	14	-

max. feed-in tariff for power from biomethane from energy crops 23-25 ct/kWh el or in gas equivalent appr. 9 ct/kWh for biomethane

Gas network access ordinance (GasNZV)

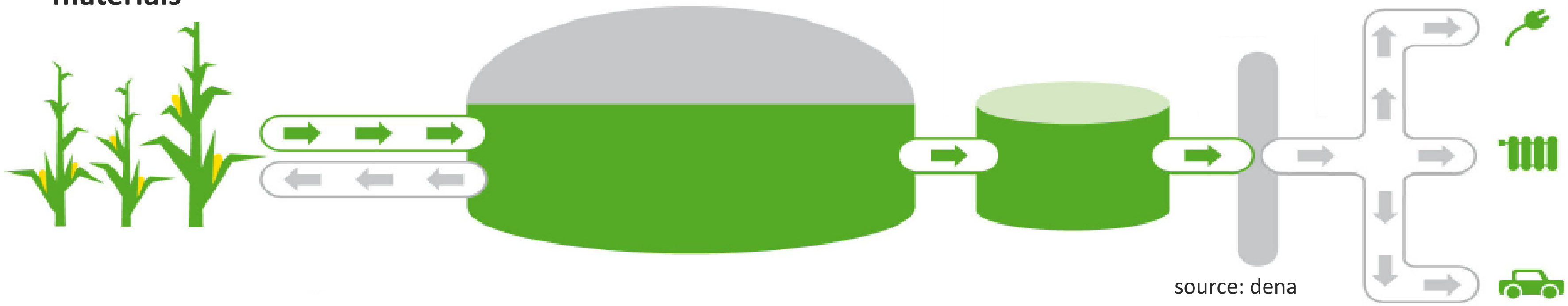
- Gas network access ordinance (GasNZV), renewed in 2008 and 2010
- prior grid access for biogas feed-in, point of access chosen by client
  refusal only in cases of technical impossibility or economic unreasonableness
- distribution of CAPEX between grid operator and grid access client 75% : 25%, capture at 250,000 €, grid operator fully responsible for OPEX
- Grid operators are allowed to allocate all biogas related costs to all gas customers (grid fees)
- 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)

CAPEX – capital expenditures, OPEX – operational expenditures

Biogas feed-in in Germany – challenges and future perspectives

Challenges along the value chain

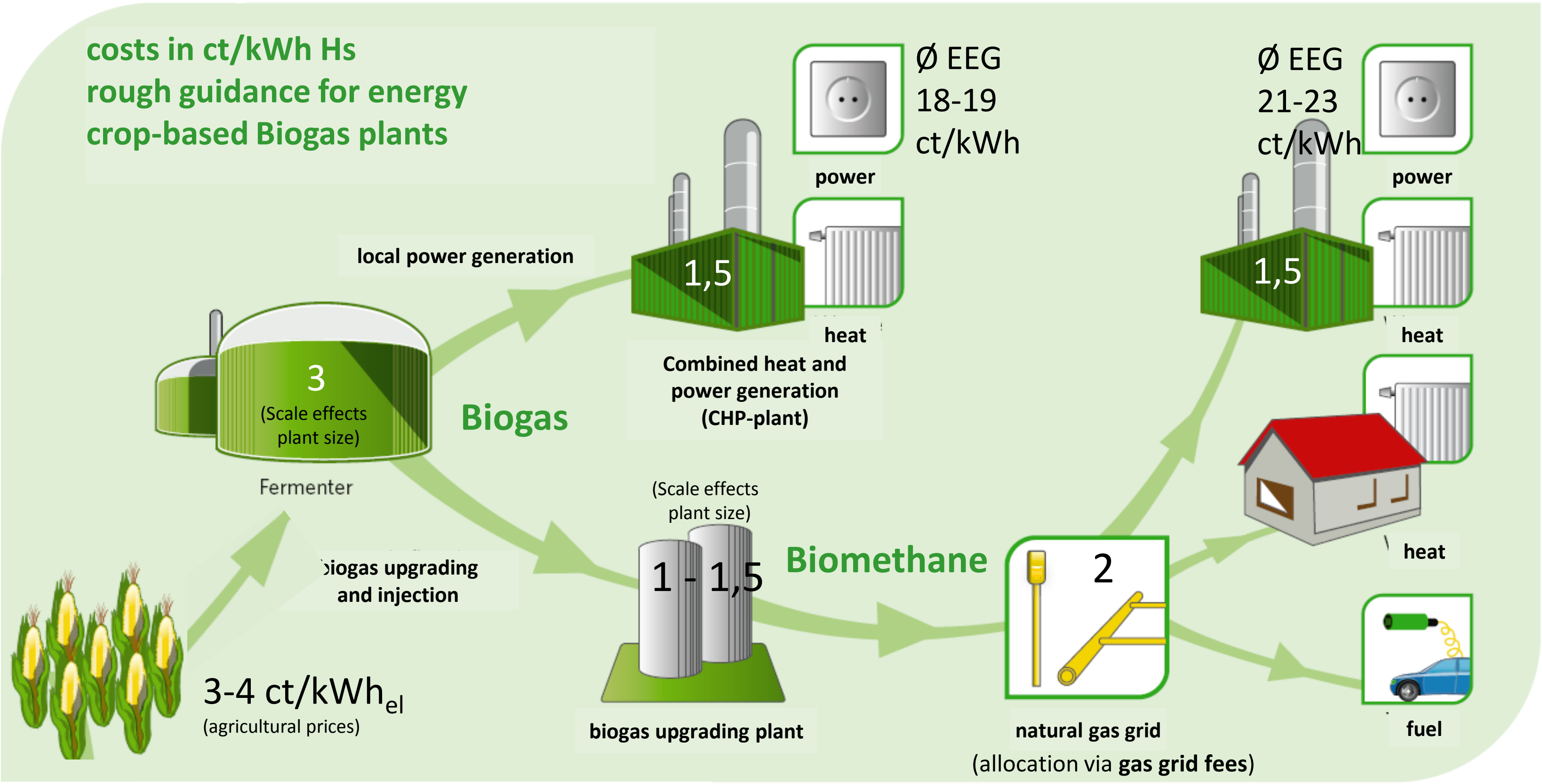
Acreage energy crops waste materials	substrate logistics and ensiling	biogas production	biogas upgrading	grid access	biogas utilization



source: dena

- resource limitations
- social acceptance
- cost efficiency
- GHG reduction
- land use competition
- CFP biomethane production
- technologies
- time efforts

Biomethane provision – cost efficiency along value chain

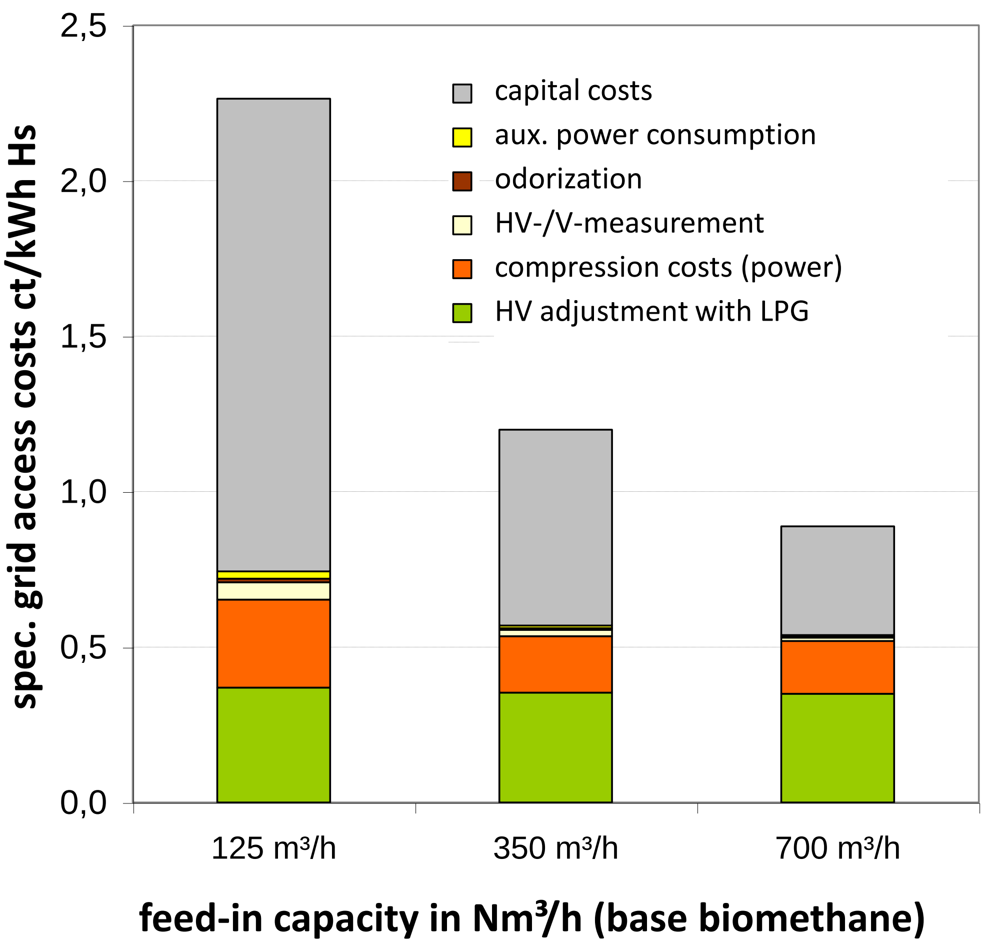


Grid access – potential for cost reduction?

- scale effects very dominant due to high fixed CAPEX independent from feed-in capacity
- election grid access point crucial (in regard of gas quality, grid level, pressure…) for costs
- HV compliance accord. to DVGW G 685 alternative processes of HV adjustment necessary

calculation example

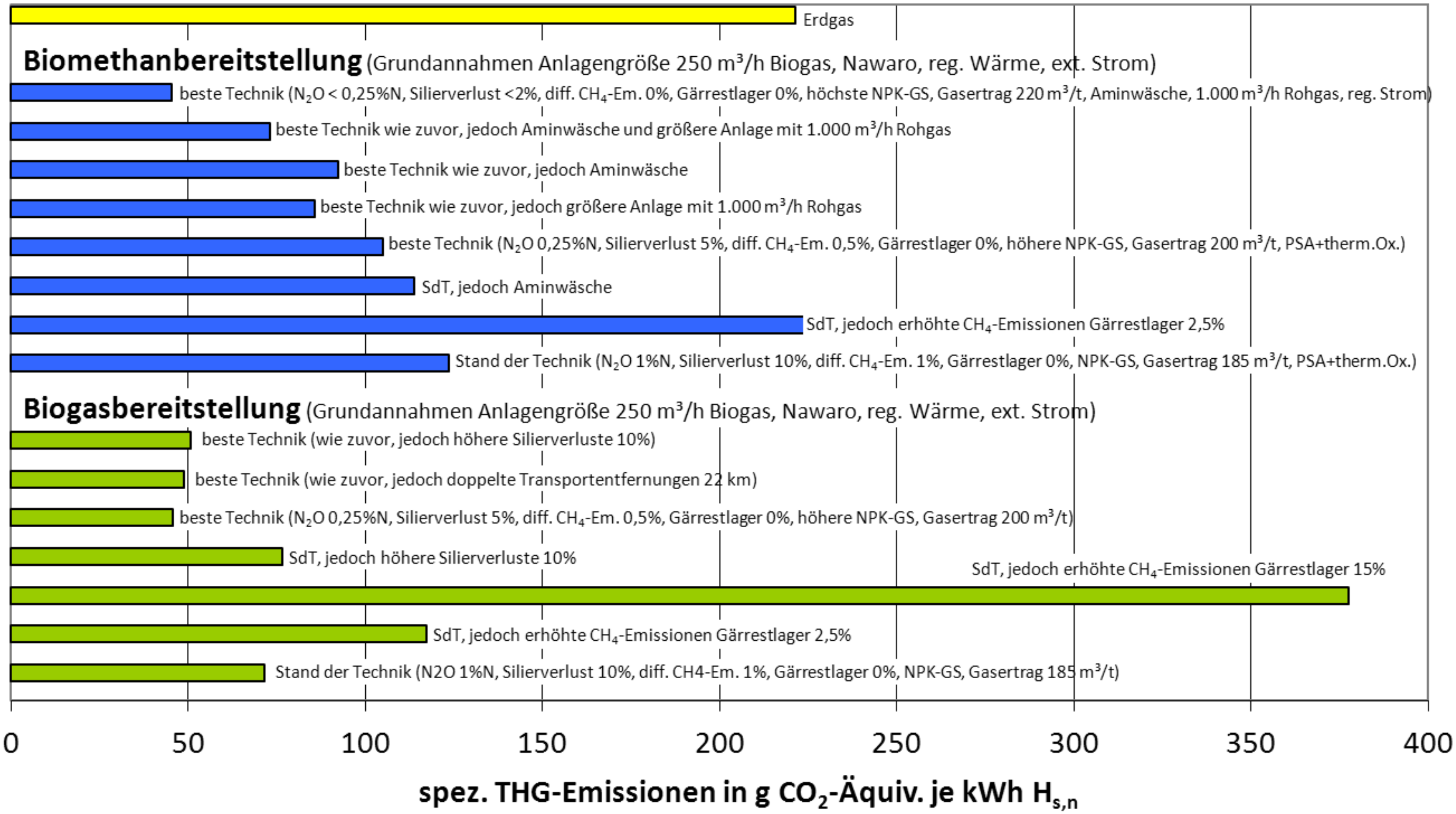
total specific costs of grid access (CAPEX incl. OPEX), feed-in in HP-grid 16 bar, H-Gas
with HV 11,3 kWh/Nm³ Hs, HV adjustment with LPG, pipe to grid 1,5 km, compressor
100% redundancy



Challenges - grid access

- **time schedule of grid access realisation**
  - considerable delays, duration in some cases above 30 month, restrictive action agieren of grid operators, reason: loss of CAPEX- from biogas client
- **costs of grid access (CAPEX) and biogas feed-in (OPEX)**
  - CAPEX: level of redundancy, quality of technical equipment don´t comply with demand of biogas feed-in,
  - individual planning: standardization as a key of cost reduction
  - OPEX: evaluation of different measurements of HV adjustment
- **technical challenges**
  - alternatives for HV adjustment without LPG (CA-HV-reco???,)
  - deodorization, feeding back
  - necessity of simpler standards and measuring technologies

Challenges in regard to sustainability



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, cost efficiency

  obligation to climate- and energy efficient utilization!

- GHG reduction impact dependent on utilization path
  - expansion of CHP sector in Germany
  - utilization of biomethane must mandatorily be more energy efficient and climate friendly than state of the art (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 needs to be justified
    Incentives for use in pathways with high energy efficiency and 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 for system integration of RES**: storage capacity of biogas, flexibility of CHP-plants

Thank you for your attention!

Dr.-Ing. Wolfgang Urban

Ecologic Institute, Pfalzburger Str. 43-44, 10717 Berlin
www.ecologic.eu

On secondment to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Division E I 5 – Solar Energy, Biomass, Geothermal Energy
Tel.: + 49 30 18305 3627
e-mail: wolfgang.urban@bmu.bund.de