Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

German biogas plants standards, monitoring, and technology experience sharing




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Bio-natural Gas Summit on 3-5 November in Beijing

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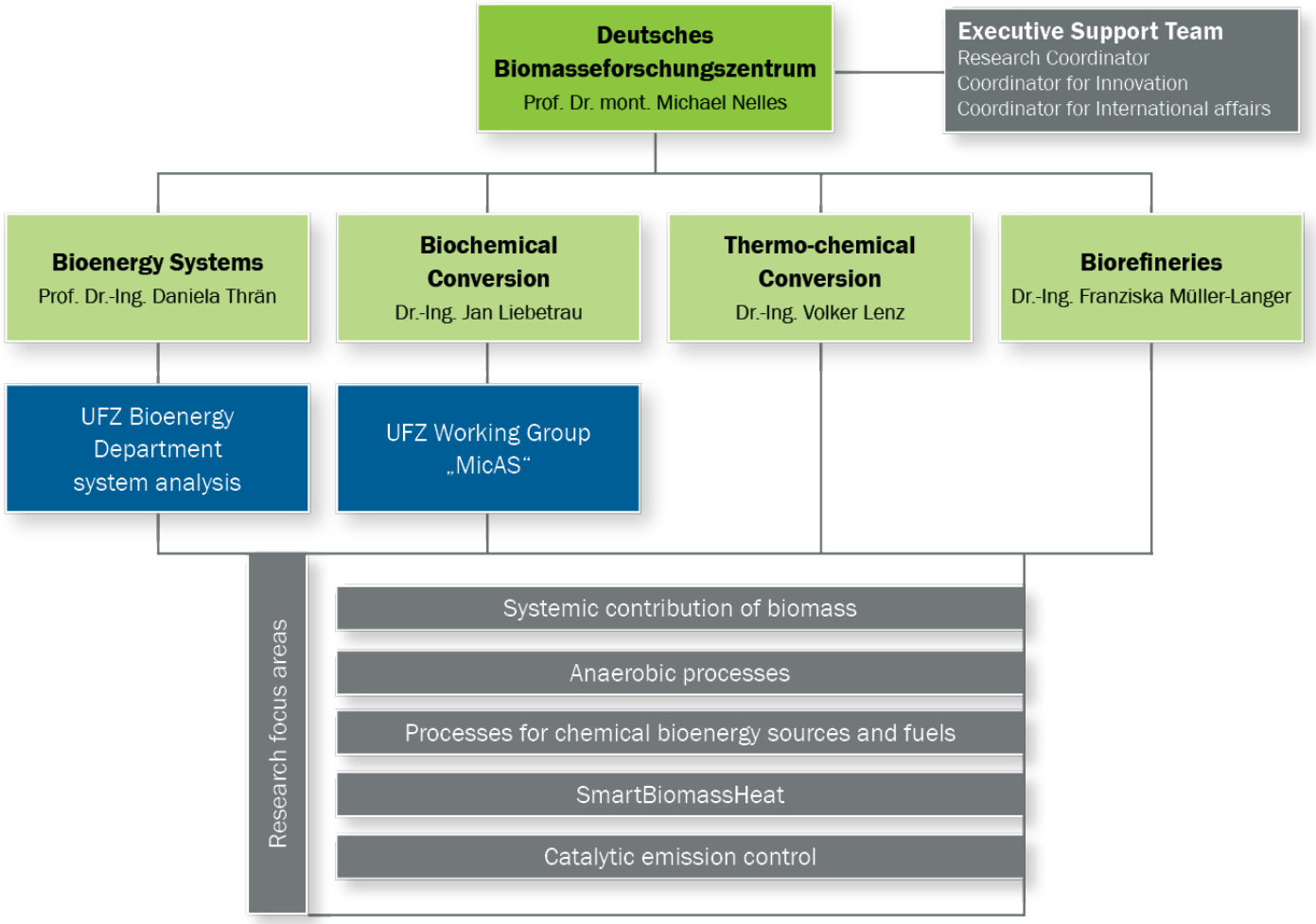
- Development of policy recommendations and subsidy system
- Data collection

(4) Results of the biogas plant operators' survey

Research Departments & Focus Areas



- Founded in 2008
- Owner: Federal Ministry of Food and Agriculture
- Staff: 190
- 130 ongoing projects
- Third-party funding: 6 Mio. €/ year
- Turnover: 12 Mio. €/ year

Applied research at the DBFZ

Biogas Pilot Plant

Biogas lab

Fuel conditioning lab

Fuel technical centre

Engine test bed

Analytical lab

Pictures: DBFZ / Jan Gutzeit

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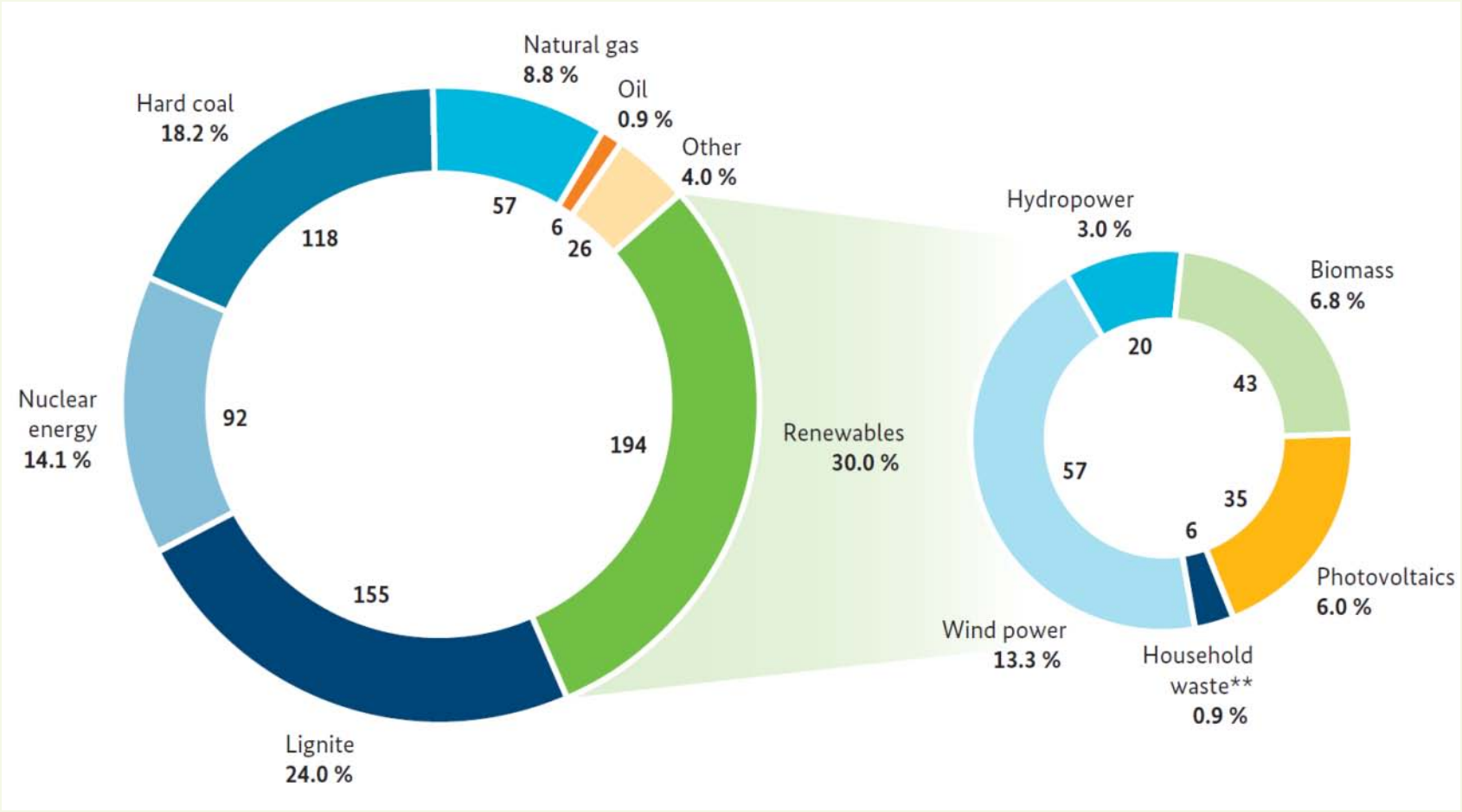
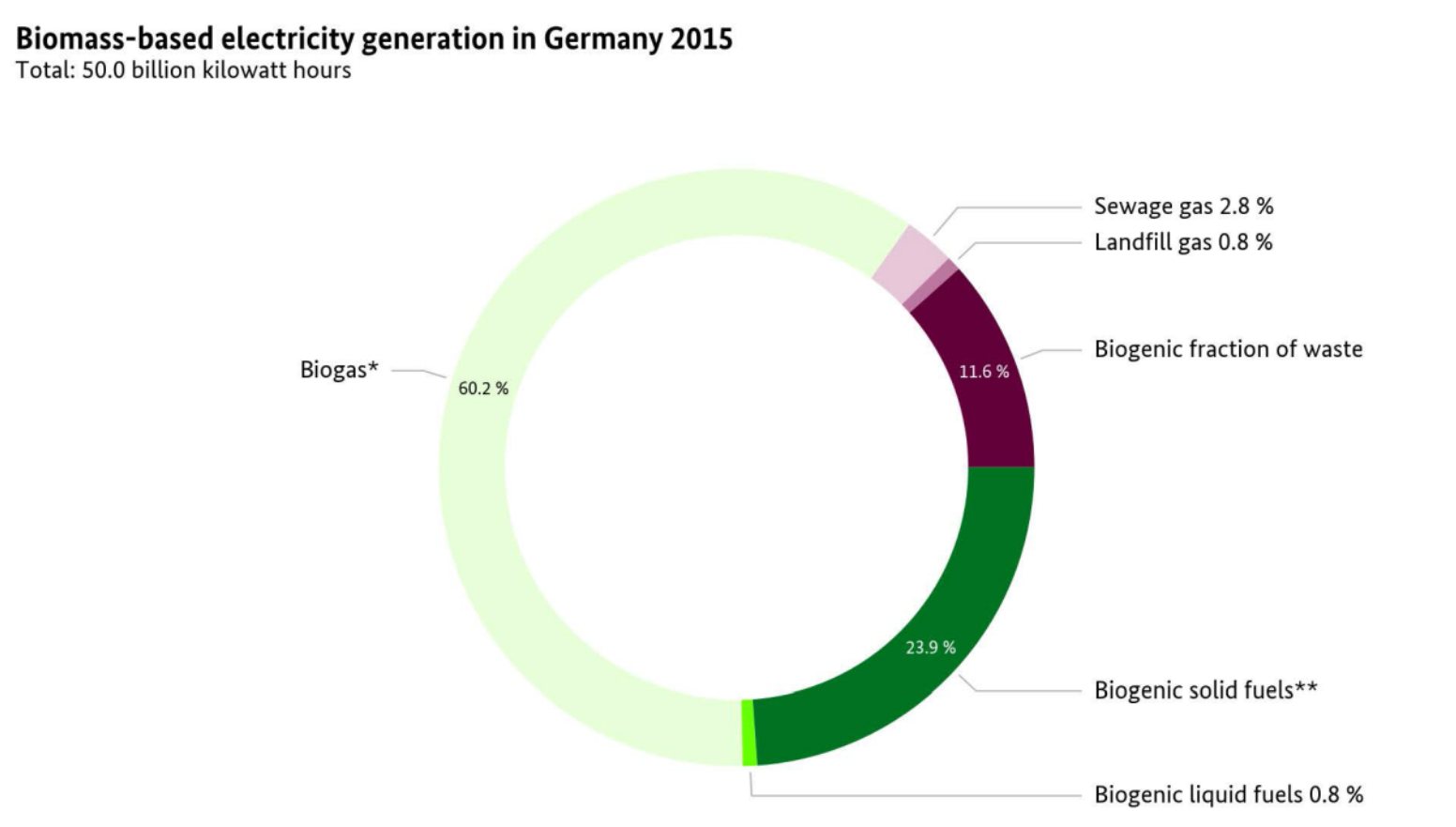
Renewable Energy Sources Act (EEG)
Composition Gross Electricity Generation 2015



In 2015, renewable energy covered 30 %of gross electricity generation. The 2014 figure had been 25,8 %

Source: http://www.bmwi.de/EN/Topics/Energy/Renewable-Energy/renewable-energy-at-a-glance.html

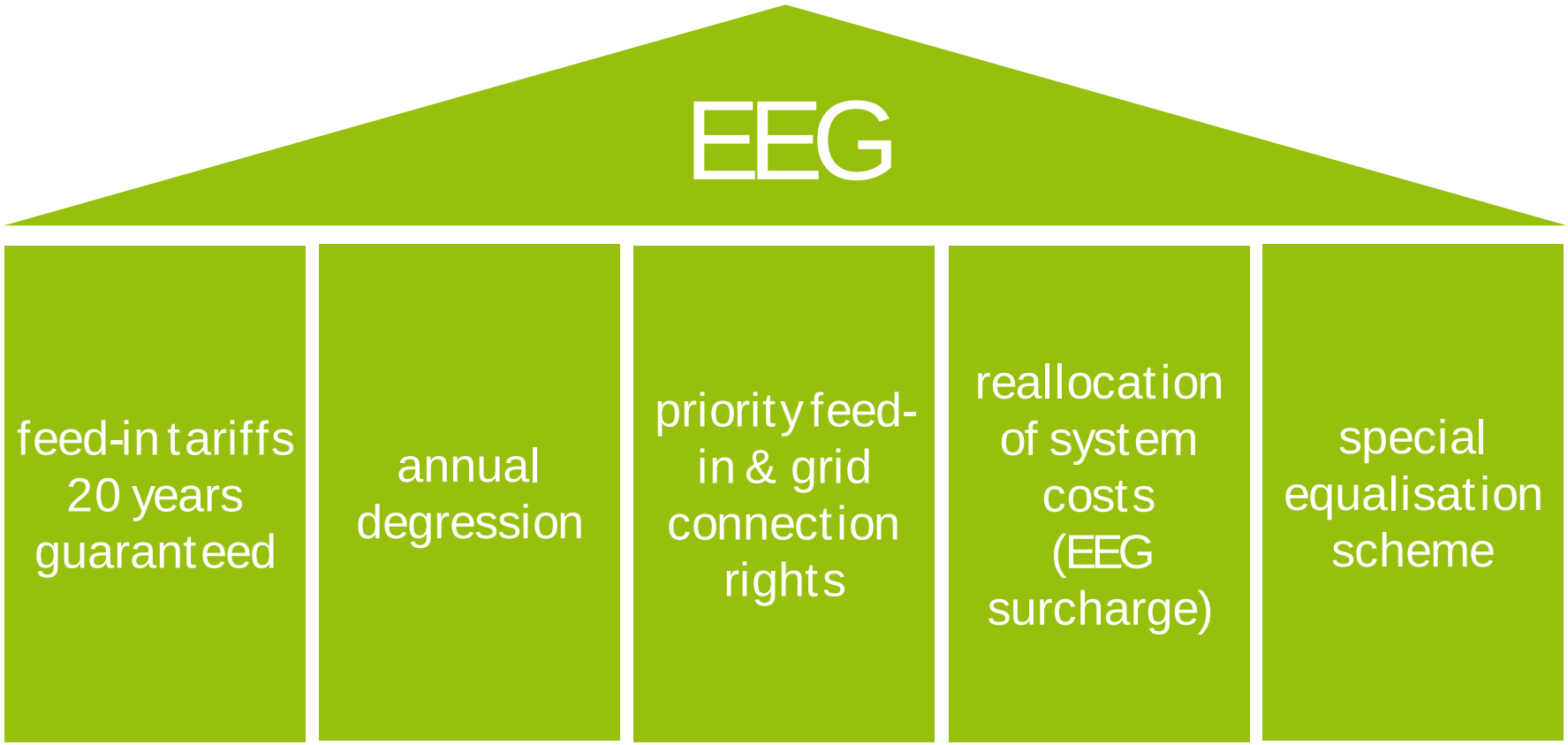
Renewable Energy Sources Act (EEG)
Biomass Electricity Generation 2015



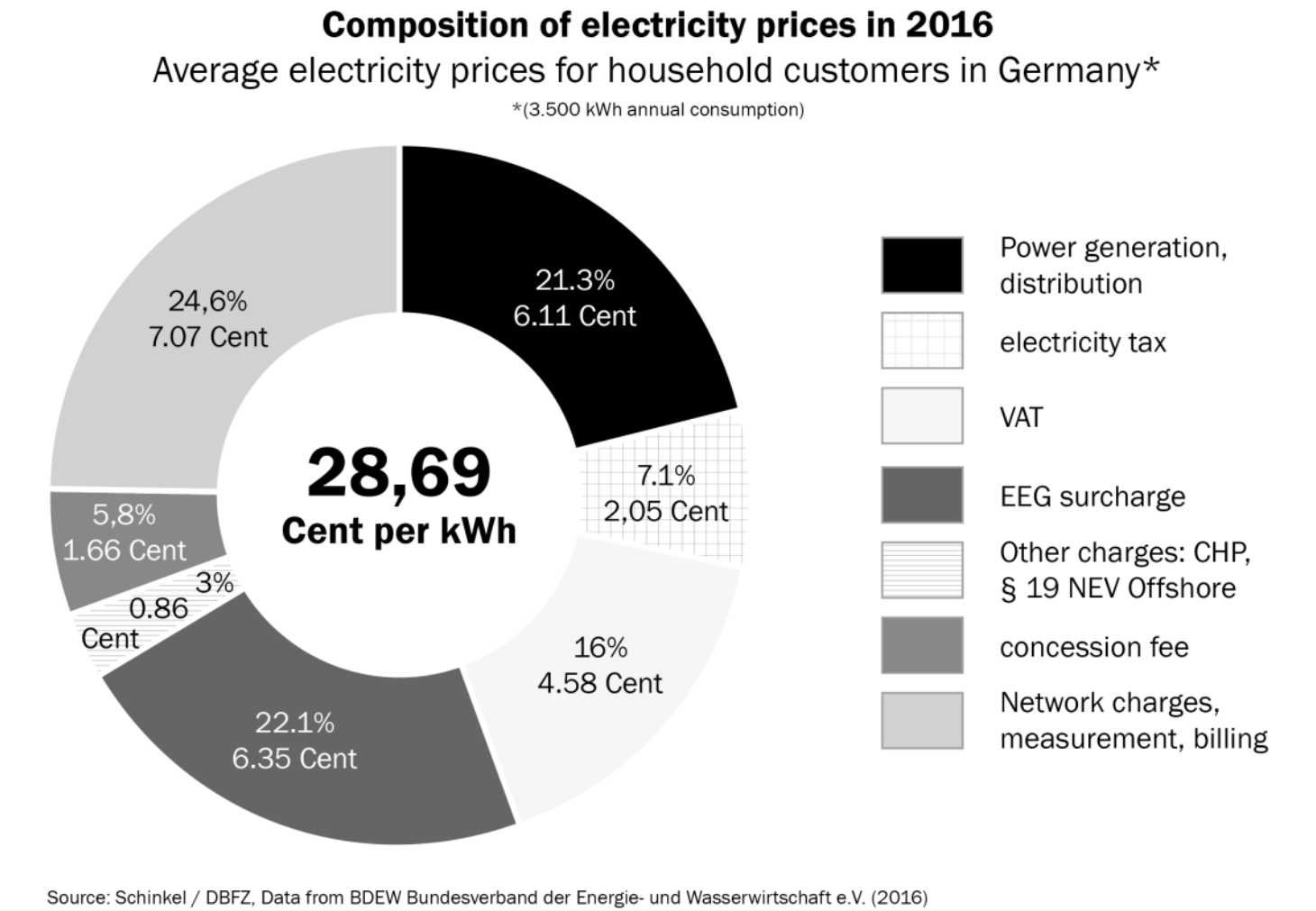
In 2015, 50 billion kilowatt hours of electricity production were based on biomass, with biogas being the main contributor with around 60%

Source: Federal Ministry for Economic Affairs and Energy Germany, AGEE-Stat, Development of Renewable Energy Sources in Germany 2015, data from the Working Group on Renewable Energy-Statistics (AGEE-Stat), as at February 2016

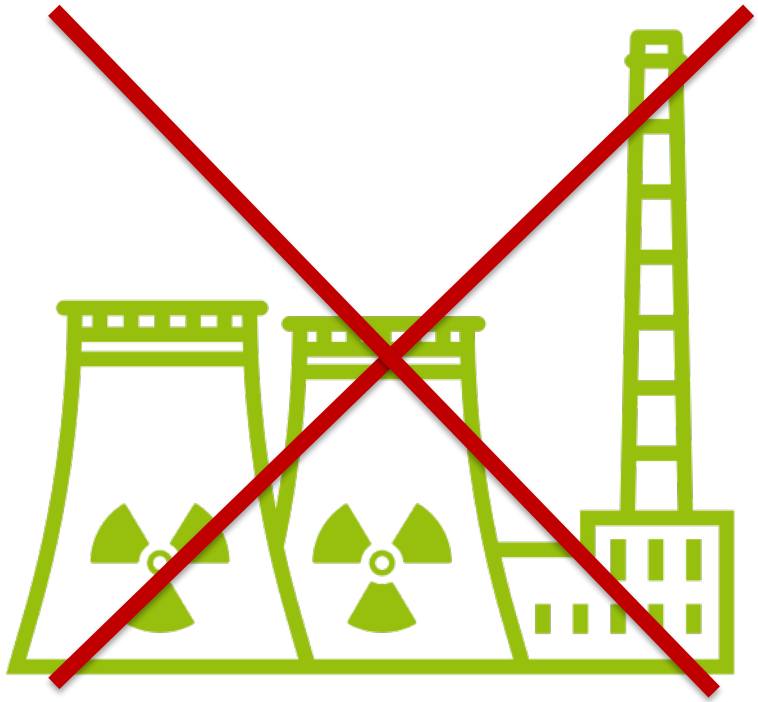
Renewable Energy Sources Act (EEG)
Basics

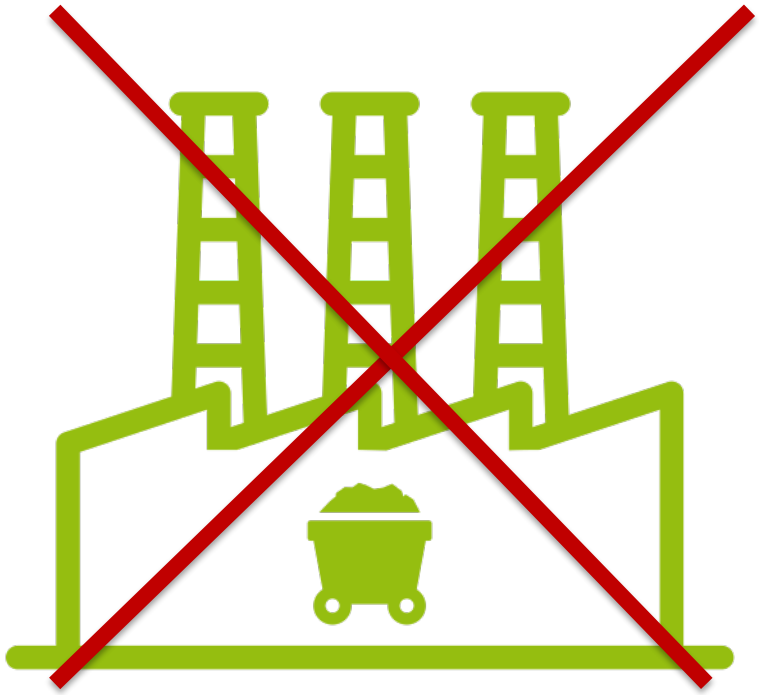


Renewable Energy Sources Act (EEG)
Composition of Electricity Prices



Renewable Energy Sources Act (EEG)
Continuous Public Support



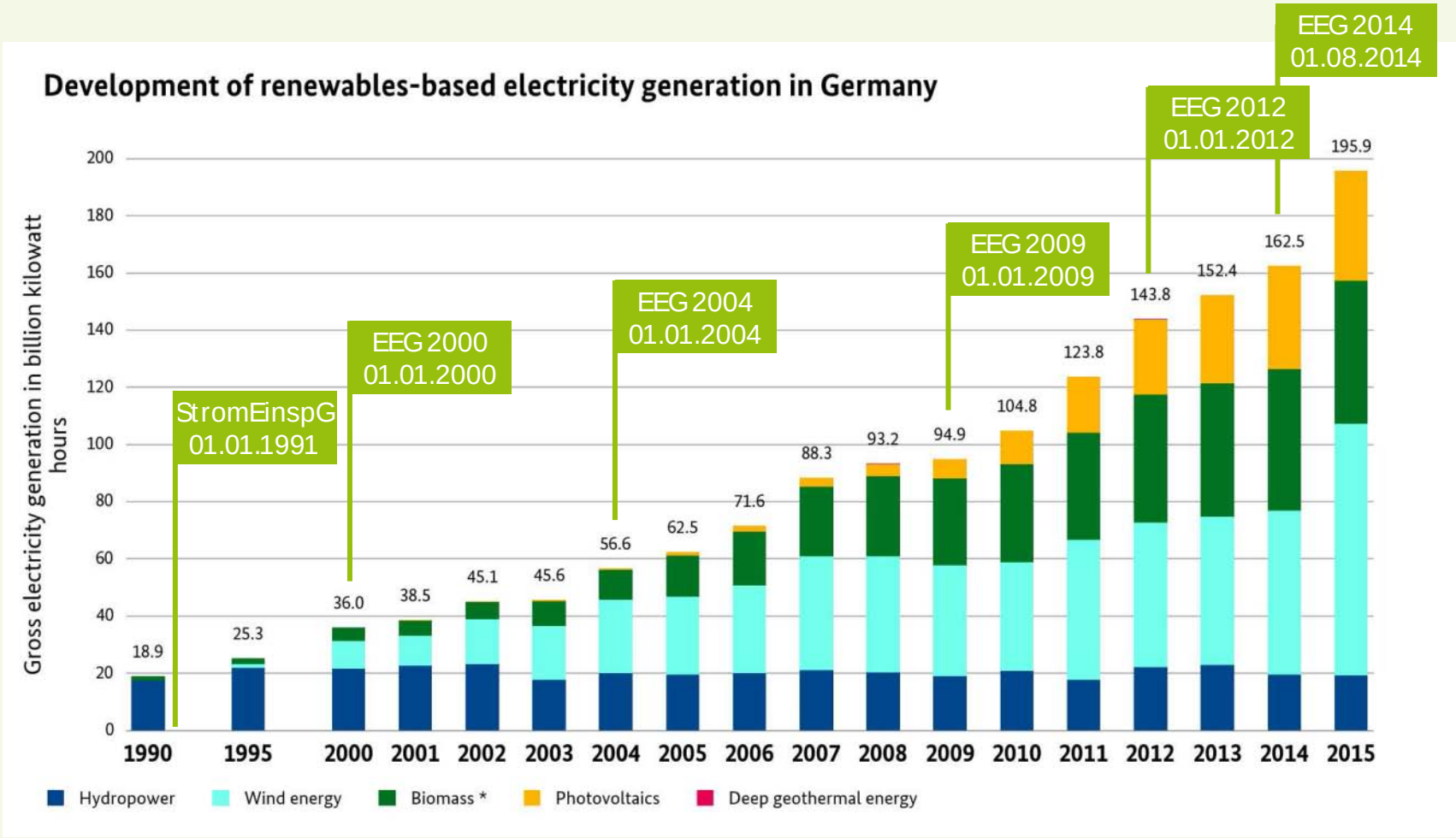


Icons by flaticon.com

Renewable Energy Sources Act (EEG)
Focus Biogas

Source: Adapted from Biogas Association Germany, Dr. Stefan Rauh, 2014

Renewable Energy Sources Act (EEG)
Development Renewable Electricity Generation



Source: Federal Ministry for Economic Affairs and Energy Germany, AGEE-Stat, Development of Renewable Energy Sources in Germany 2015, data from the Working Group on Renewable Energy-Statistics (AGEE-Stat), as at February 2016

Renewable Energy Sources Act (EEG)
System Change EEG 2016

- Guaranteed feed-in tariffs

EEG 2000 - 2014

EEG 2016

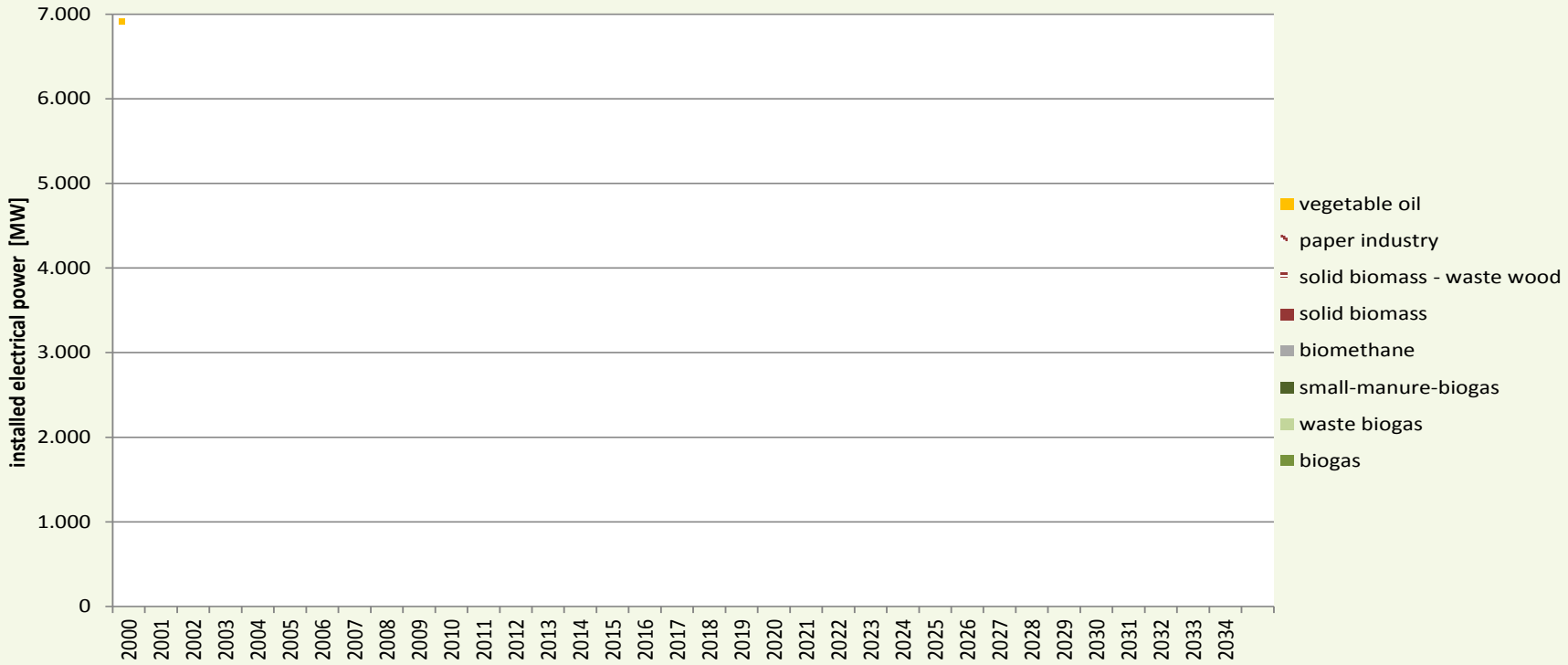
- Tendering Model
- Subsequent funding for existing plants possible (10 years)
- Fixed expansion corridor for bioenergy (2017-2019 around 150 MW annually 2020-2022 around 200 MW annually)
- Further Regulations for flexibilisation/ direct marketing

EEG – past and current situation

10 years ago	Today
Target of politics: increase of share of renewable energies, climate protection All renewable energy technologies have been promoted, as the development was unclear	Wind and photovoltaic shows decreasing costs, biogas not and there is limited potential for reduction of the costs
Bioenergy as a flexible resource for heat, power, transportation	Highly flexible energy production from wind and photovoltaic, steady production might not be needed, cost development differs
2 Mill ha of unused land, Perspective for farmers and an option of an additional income	Limited land available, as 2 Mill ha of agricultural land are used for bioenergy production, increasing demand on land worldwide, public debate grows difficult and acceptance decreases (Food vs. Fuel)

Renewable Energy Sources Act (EEG)
Future of Bioenergy Infrastructure

- Renewable Energy Act (EEG) guarantees fixed tariffs for electricity production for a period of 20 years
- Operation of biogas plants without additional revenue streams not economic viable



Source: M. Scheftelowitz, D.Thrän (2016): Biomasse im EEG 2016 Hintergrundpapier zur Situation der Bestandsanlagen in den verschiedenen Bundesländern. Deutsches Biomasseforschungszentrum DBFZ gGmbH.

Post-EEG
New Value Chains

- Wood composites from biogas digestate
- Insulation materials from biogas digestate

- Bio-based waxes from fruit residues
- Bio-based carboxylic acids from biogas fermentation

- Phytoremediation/ Phytomining &rare earths
- Fodder production & bio-based oils

Icons by flaticon.com

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Methodology of biogas policy revision

- Feed-in-tariffs, investment benefits and tax exemption can be used to give incentives
- Monitoring of the implications of legal framework on development of plants
- Data collection by scientific institutions
- Survey of relevant actors (plant operators/ farmers, plant manufacturers, engineering offices, energy providers)
- Best option: central plant register with relevant data of plants in operation (biomass, wind, solar) coming into force by beginning of 2017
- Continuous comparison of current situation vs. political aims

Monitoring Renewable Resources Act (EEG)

Since the implementation of the Renewable Energy Act (EEG) in 2000 the DBFZ pursues on behalf of the Federal Ministry of Economics and Technology (BMWi) a comprehensive monitoring to assess the impact of the development of biomass power generation in Germany.

Data collection – biogas survey (DBFZ)

Monitoring of the implications of the amended „Renewable Energies Law“ (EEG) on the development of power generation from biomass by annual survey by DBFZ

Monitoring of most important parameters:

- Location of plant
- Contact person
- Status (in operation, planning)
- Installed capacity
- Year of operation
- Amount of produced electricity / biogas
- Substrates (kind and amount)
- Origin of substrates, transport/ Logistic
- Price of substrates
- Area under crops
- Tariffs
- Technology / innovative technologies
- utilization pathways for biogas
- Separation of digestate / utilization of digestate
- Heat utilization (kind and amount)
- Changes in operation, problems

	☐ in Betrieb ☐ in Planung ☐ in Bau ☐ z.Zt. außer Betrieb ☐ stillgelegt
nbetriebnahme	
gung	☐ Baurecht ☐ BImSchG ☐ UVP-Gesetz ☐ Abfallrecht
re Anlage nach EEG t?	☐ Grundvergütung NawaRo-Bonus: ☐ 2004 ☐ 2009 ☐ Gülle-Bonus KWK-Bonus: ☐ 2004 ☐ 2009 ☐ Emissions-Bonus Innovationsbonus: ☐ 2004 ☐ 2009 ☐ Landschaftspflege-Bonus
de Vergütungsum- eabsichtigt?	Flexibilitätsprämie ☐ ja ☐ nein Direktvermarktung ☐ ganz ☐ anteilig ☐ nein

e elektrische Gesamtleistung	kW_{el}	Anzahl BHKW	
ste Strommenge	kWh_{el}/Jahr	Betriebsstunden	h/Jahr
inzeln benennen) f ergänzen!	kW_{el} Inbetriebnahme ☐ Zündstrahl ☐ Gasmotor kW_{el} Inbetriebnahme ☐ Zündstrahl ☐ Gasmotor kW_{el} Inbetriebnahme ☐ Zündstrahl ☐ Gasmotor		
gt die Gasnutzung? nennung möglich)	☐ Satelliten-BHKW ☐ Fahrzeug-Kraftstoff ☐ Wärme/Brennkessel ☐ Mikrogasturbine ☐ Biogasaufbereitung/-einspeisung ☐ sonstige		
grad (Gasnutzung)	elektrisch: %	thermisch: %	
rhanden?	☐ nein ☐ ja wenn, ja: ☐ stationär ☐ mobil ☐ Gaskessel		

mverbrauch der Anlage	kWh_{el}/Jahr bzw. % (bezogen auf die prod. Strommenge)
meverbrauch	kWh_{th}/Jahr bzw. % (bezogen auf die prod. Wärmemenge)
ler produzierten Wärme n genutzt?	kWh_{th}/Jahr bzw. % (KWK-Anteil) Wärme genutzt für:
rkaufspreis (nicht KWK-Bonus)	ct/ kWh_{th}

	☐ Nassvergärung ☐ Garagenverfahren ☐ sonstige:
er Fermenter	Fermentervolumen (ohne Gärrestlager): m^3
der Fermenter werden mit Frischsubstrat beschickt?	

ger (nicht beheizt)	☐ abgedeckt ☐ gasdicht abgedeckt ☐ offen Volumen Gärrestlager: m^3
ie eine Gärrestaufbereitung?	☐ nein ☐ ja wenn ja, welche:
ng der Gärreste	☐ im eigenen Betrieb: ha; bzw. m^3 ☐ extern: ha; bzw. m^3

handlung	☐ nein ☐ Oxidationskatalysator ☐ therm. Nachverbrennung				
efelung/ Gasreinigung	☐ Lufteinblasung ☐ Biol. Wäscher ☐ Aktivkohle ☐ Eisenzudosierung ☐ andere				
m Umfang traten im hr Ausfallzeiten und minderung auf? Was Ursachen?	Eintragstechnik	Tage/Jahr	Schaum	Tage/Jahr
	Rührtechnik	Tage/Jahr	Schwimmschicht	Tage/Jahr
	Übersäuerung	Tage/Jahr	BHKW	Tage/Jahr
	sonstige _____	Tage/Jahr		

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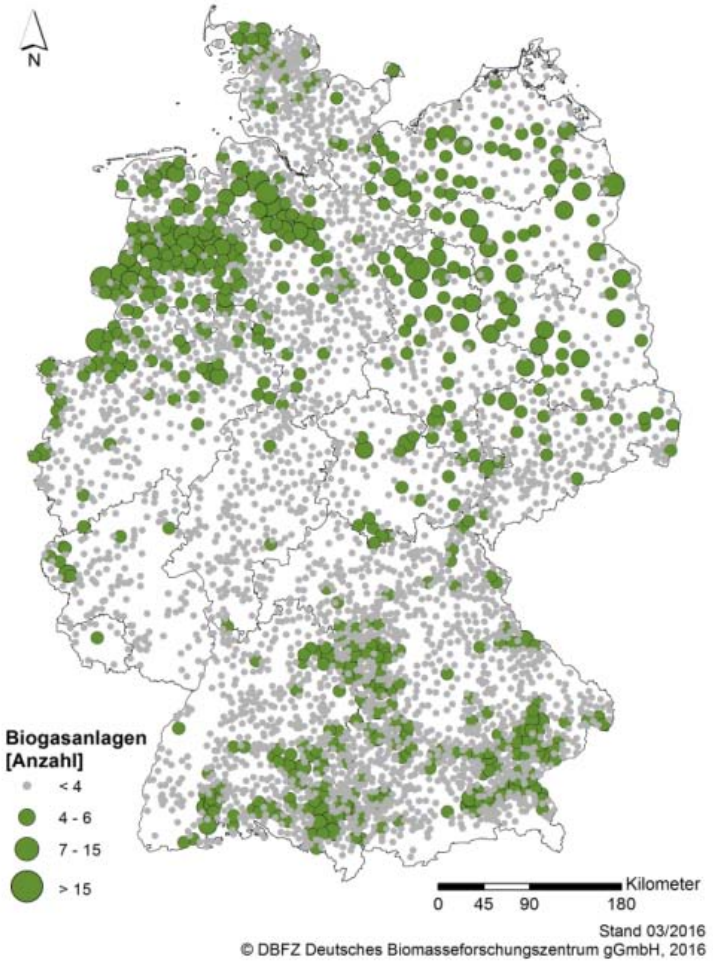
Portfolio - Biogas Plants in Germany

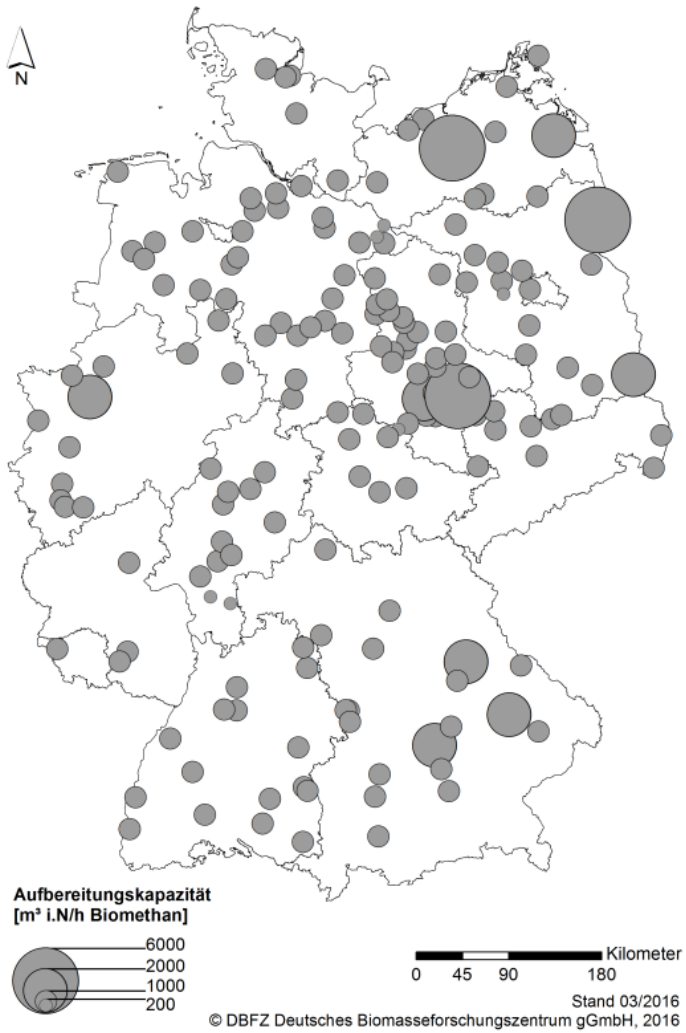


End of 2015: ~ 8,500 biogas plants with an installed capacity of app. 4.5 GWel (including expansions without extra yield of electricity); (capacity based on BNETZA-data-basis and own estimation); 70% of the installed capacity in direct marketing;

8/ 2015: flexible operation of ~3,000 CHP (biogas and biomethane (!) with an overall capacity of 1.7 GWel

Source: (1) DBFZ, 2016; (2) Scheftelowitz et al., Stromerzeugung aus Biomasse. 2015

Biogas Upgrading to Biomethane



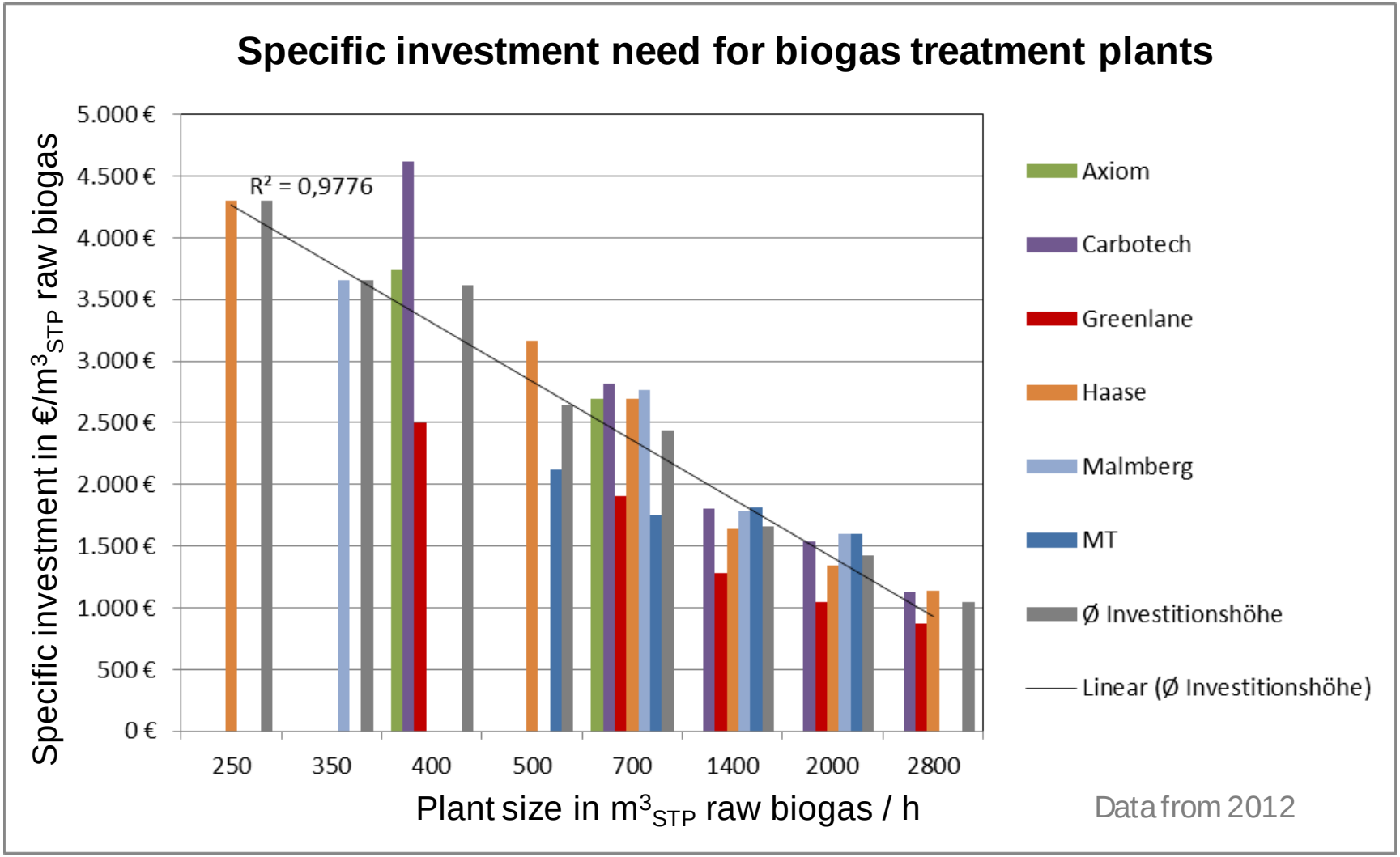
- 2014: 178 biomethane plants in operation with an actual feed-in capacity of 688 Mio.m^3_{STP} biomethane (7.49 TWh_{Hs})
- End of 2015 (estimation): around 187 biomethane plants in operation
- Annual number of newly built upgrading facilities is declining (2014: 27 new plants, whereas 2015: only 9 new plants)

Sources:

(1) DBFZ: Stromerzeugung aus Biomasse. Zwischenbericht Mai 2015. Leipzig

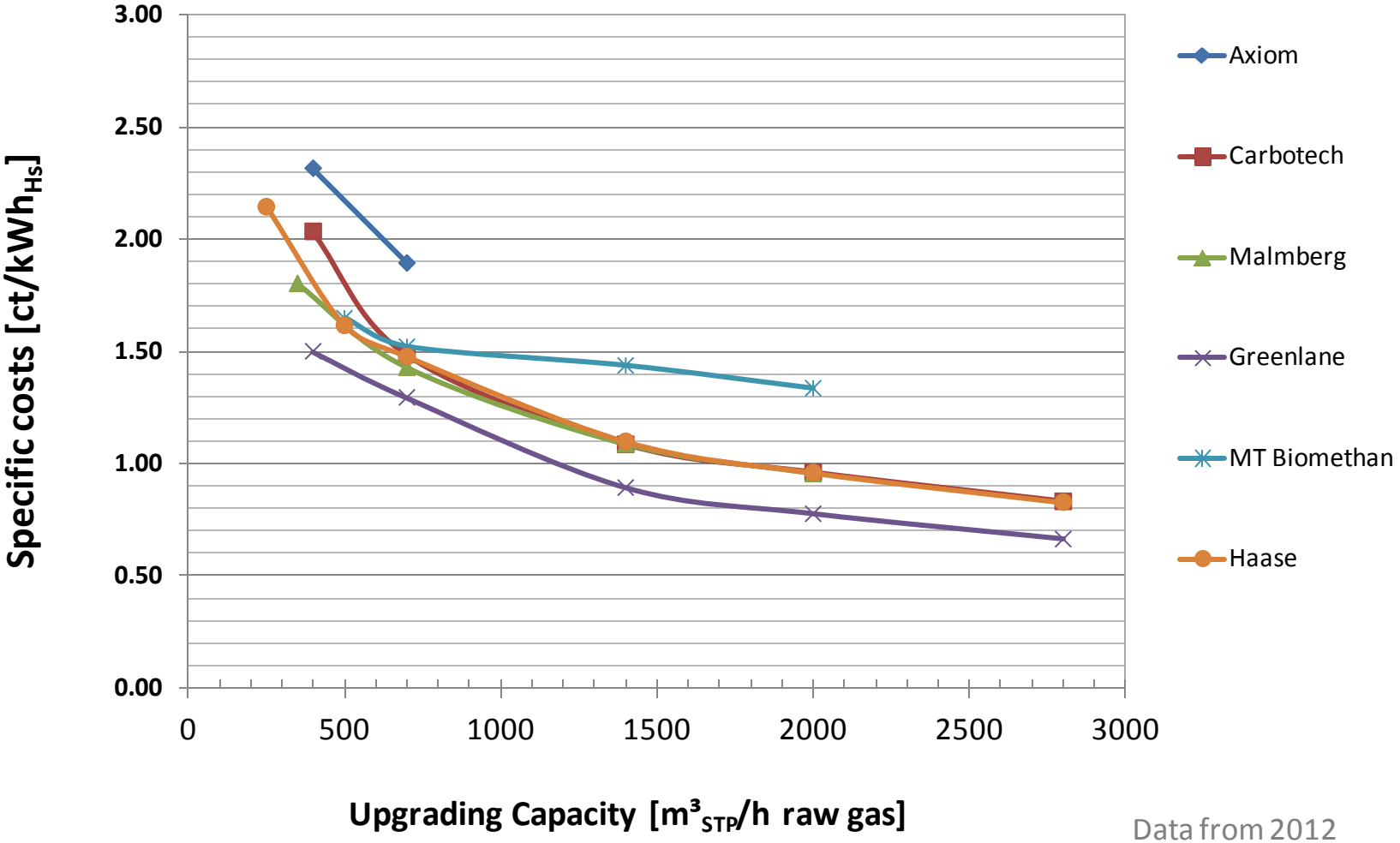
(2) Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (BNetzA), Bundeskartellamt: Monitoringbericht gemäß § 63 Abs. 3 i. V. m. § 35 EnWG und § 48 Abs. 3 i. V. m. § 53 Abs. 3 GWB, November 2015, Bonn

Cost of biomethane conditioning



Source: FNR, Leitfaden Biogasaufbereitung und –einspeisung, 2014

Specific costs of biogas conditioning



Data from 2012

Source: FNR, Leitfaden Biogasaufbereitung und –einspeisung, 2014

Outlook German biomethane sector

- Biomethane has the potential to become an important and essential component of the future energy supply system as a fuel and for power production on demand.
- Biomethane affords a flexible and efficient use of biomethane (advantage: gas grid as a storage)
- It is necessary to make biomethane available as cost-efficient as possible to ensure a social acceptance of this energy source

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DBFZ

Smart Bioenergy – innovations for a sustainable future
Come and join us!

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Complex Feed-in-Tariffs (EEG 2009)

Installed capacity	Basic tariff	Boni					
		Cultivated biomass[1]	Manure[2]	Landscape conservation material[3]	Emission reduction[4]	Technology[5]	CHP[6]
≤ 150 kW_{el}	11.67	+ 7.00	+ 4.00	+ 2.00	+ 1.00	+ 2.00	+ 3.00
≤ 500 kW_{el}	9.18	+ 7.00	+ 1.00	+ 2.00	+ 1.00	+ 2.00	+ 3.00
≤ 5 MW_{el}	8.25	+ 4.00	-	-	-	+ 2.00	+ 3.00
≤ 20 MW_{el}	7.79	-	-	-	-	-	+ 3.00

[1] Cultivated biomass, manure and vegetal by-products as substrates allowed. Raw material log with data about type, amount and origin of biomass substrates necessary for documentation of used substrates. If biogas plant needs immission control licencing -> gas-proof cover of digestate storage and gas consumer installation for breakdown necessary. Used by 88% of all biogas plants in 2010

[2] Coupled to cultivated biomass bonus. Only granted to plants < 500 kWel in order to avoid „manure tourism". Share of manure must exceed 30 % (mass), Used by 70% of all biogas plants in 2010.

[3] Material from landscape conservations (streets, parks, etc.), > 50 % of material from landscape conservations (mass FM).

[4] Introduced in 2009, only for biogas plants. < 60 mg/m³ (40 mg/m³) formaldehyde emissions. Only for plants licenced via federal immission control act (BImSchG)

[5] Innovative technologies: Fuel cell, Gas turbines, ORC, stirling motors (dry fermentation technology not anymore).
Biogas upgrading if max. 0.5% CH_4 emissions and max. 0.5 kWh/Nm³ raw biogas energy demand. Max. 700 Nm³/h capacity for biogas upgrading: < 350 Nm³/h: 2.00 €-ct/kWh, < 700 Nm³/h: 1.00 €-ct/kWh

[6] Positive list with several utilization forms for exhaust heat (heating buildings, feed into heating grid, process heat, heating of poultry, livestock buildings, process heat for digestate treatment used as fertilizer). Used by 73% of all biogas plants in 2010.

Simplyfied New Feed-in-Tariffs (EEG-2012)

	Feed-in-tariffs					
	Biogas plants (excl. biowaste)				Biowaste biogas plants[1]	Small manure plants
Installed capacity	Basic tariff	Substrate tariff I	Substrate tariff II[2]	Biogas upgrading/ Biomethane bonus		
[kW_{el}]	[€ct/kW_{el}]					
≤ 75	14.3	6	8	≤ 700 Nm^3/h: 3 ≤ 1,000 Nm^3/h: 2 ≤ 1,400 Nm^3/h: 1	16	25[3]
≤ 150						
≤ 500	12.3					
≤ 750	11	5	8 / 6[4]		14	
≤ 5,000	11	4				
≤ 20,000	6	-		-		

[1] Only for biogas plants using specific biowaste and post rotting process for solid fermentation residues. The stabilized fermentation residues have to be used materially (fertilizer). The tariff is only to be combined with the bonus for biomethane production.

[2] Only for selected, environmental friendly substrates according to definition

[3] Special category for manure plants until 75 kW installed capacity, not to be combined with other tariffs.

[4] Electricity from manure > 500 kW 6 ct/kWh

Feed-in tariffs EEG 2014

Related electrical capacity [kW_{el}]	Bonuses [1] [ct / kWh_{el}]		
	§ 44 Biogas plants	§ 45 Biowaste plants [2]	§ 46 Manure-based small capacity [3]
≤ 75	13.66	15.26	23.73
≤ 150			-
≤ 500	11.78		
≤ 5,000	10.55	13.38	
≤ 20,000	5.85		

1) From those 0,2 ct/ kWh_{el} should be subtracted in accordance to § 37 subparagraph 3 EEG 2014.

2) Only biowastes regarding § 45 subparagraph 1 EEG 2014. For digestate composting treatment and material use afterwards are required.

3) The amount of manure of min. 80 % is required by the installed el. capacity ≤ 75 kW_{el}.

Source: KTBL, 2014