

Biogas Association Roundtable Talk, 19th of October 2016, Bangkok



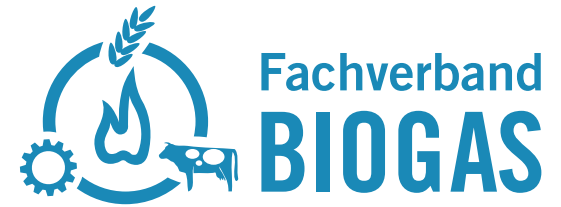
# Biogas Market in Germany and its Main Drivers

**Frank Hofmann**

Consultant International Affairs, German Biogas Association

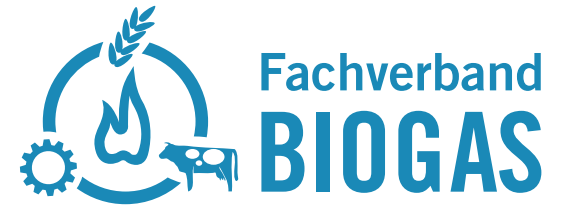
**Biogas  
can do it!**

# Content



- The German Energy transition
- Biogas in Germany and Europe
- Political success factors
- Future role for biogas
- Biogas market players in Germany
- Technical success factors
- Conclusion

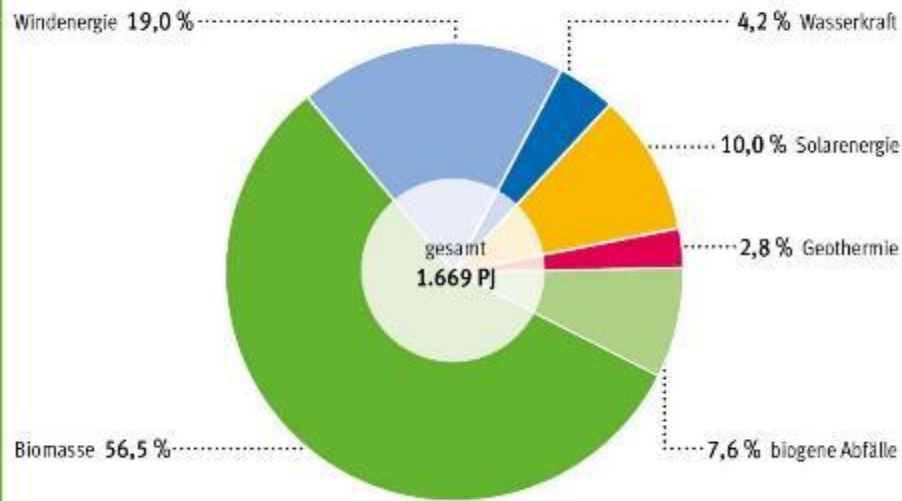
# Reasons for the energy transition in Germany



- Climate and environmental protection
- Sustainable development of energy production
- Reduction of costs for German national economy by incorporating long-term external effects
- Conservation of fossil resources
- Independency from imports of fossil fuels
- In the long term costs for fossil fuels will rise; “fuel costs“ for RE are for free or will probably decrease
- Technology development
- Creation of employment, especially in rural areas
- Development of new markets and sales

# Primary energy generation in Germany

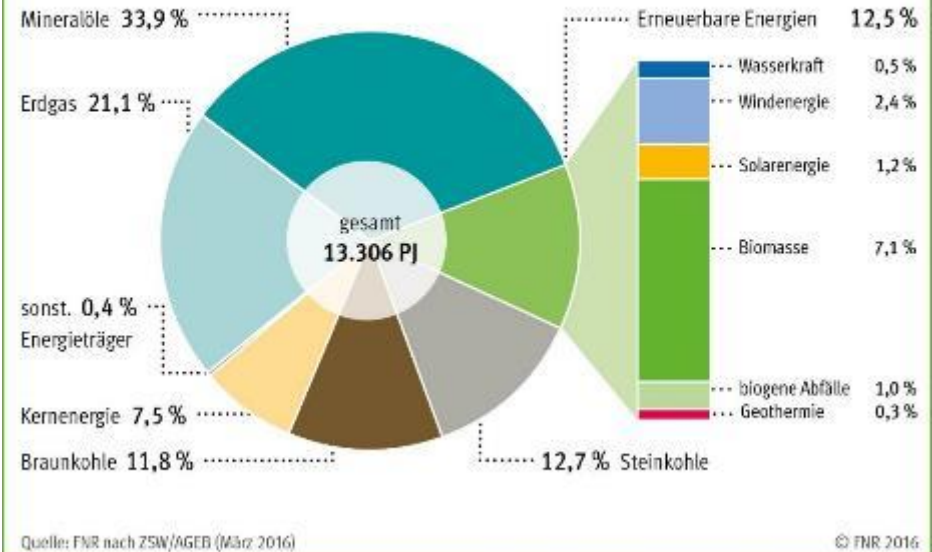
PRIMÄRENERGIEVERBRAUCH ERNEUERBARER ENERGIETRÄGER 2015



Quelle: FNR nach ZSW/AGEB (März 2016)

© FNR 2016

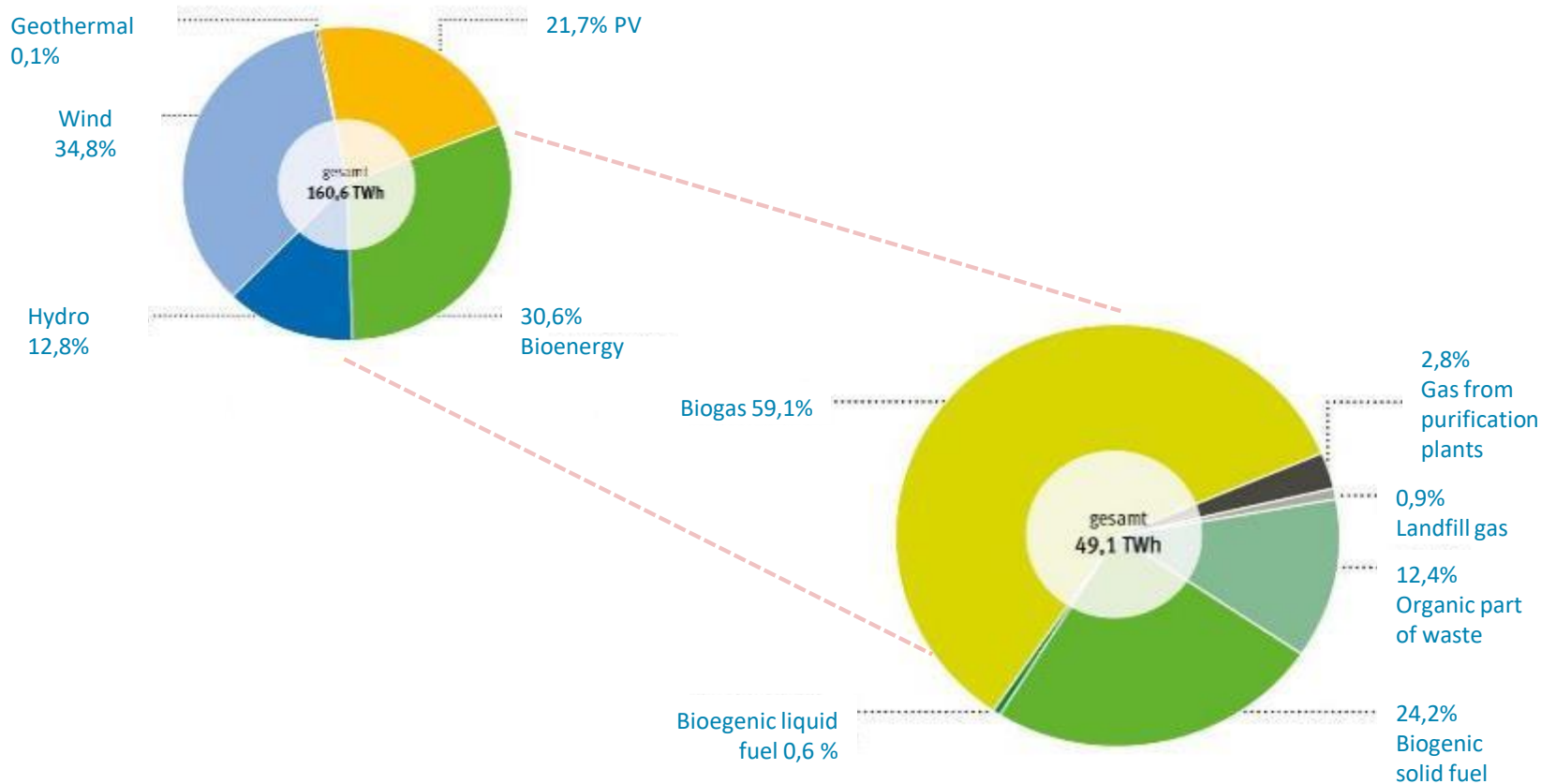
PRIMÄRENERGIEVERBRAUCH 2015



Quelle: FNR nach ZSW/AGEB (März 2016)

© FNR 2016

# Gross electricity production from RE in 2014

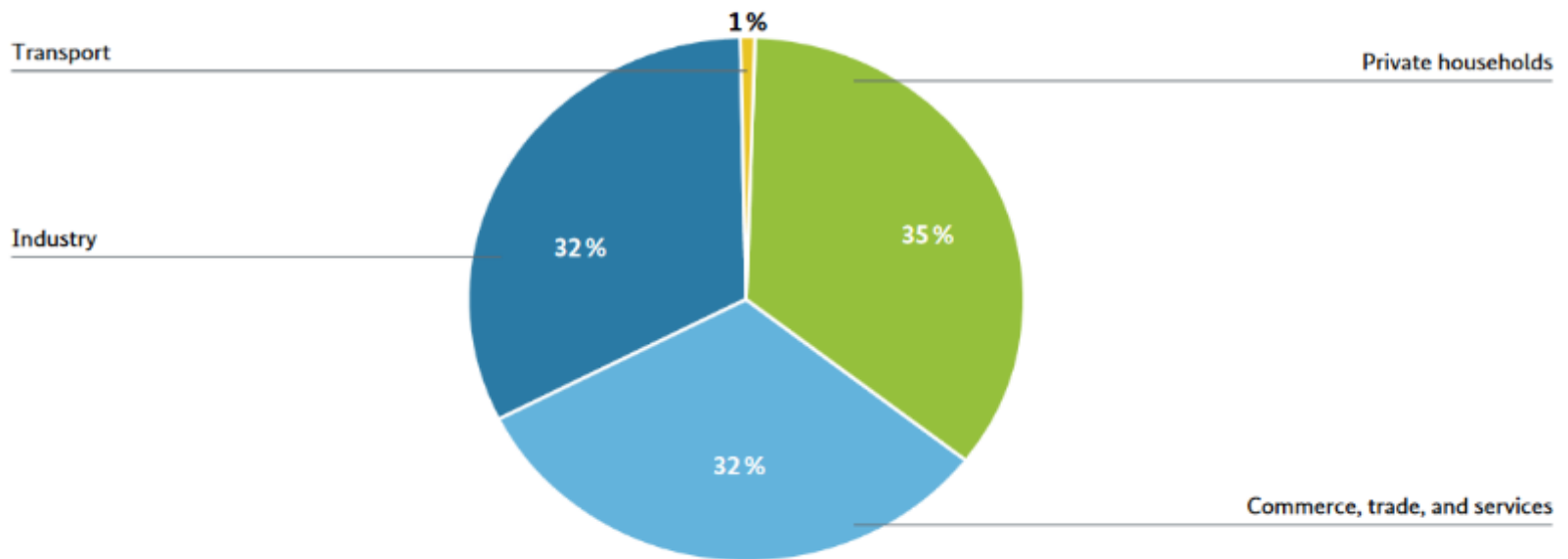


Source: BMWi, AGEE (February 2015)

© FNR 2015

# Market players in the German energy transition

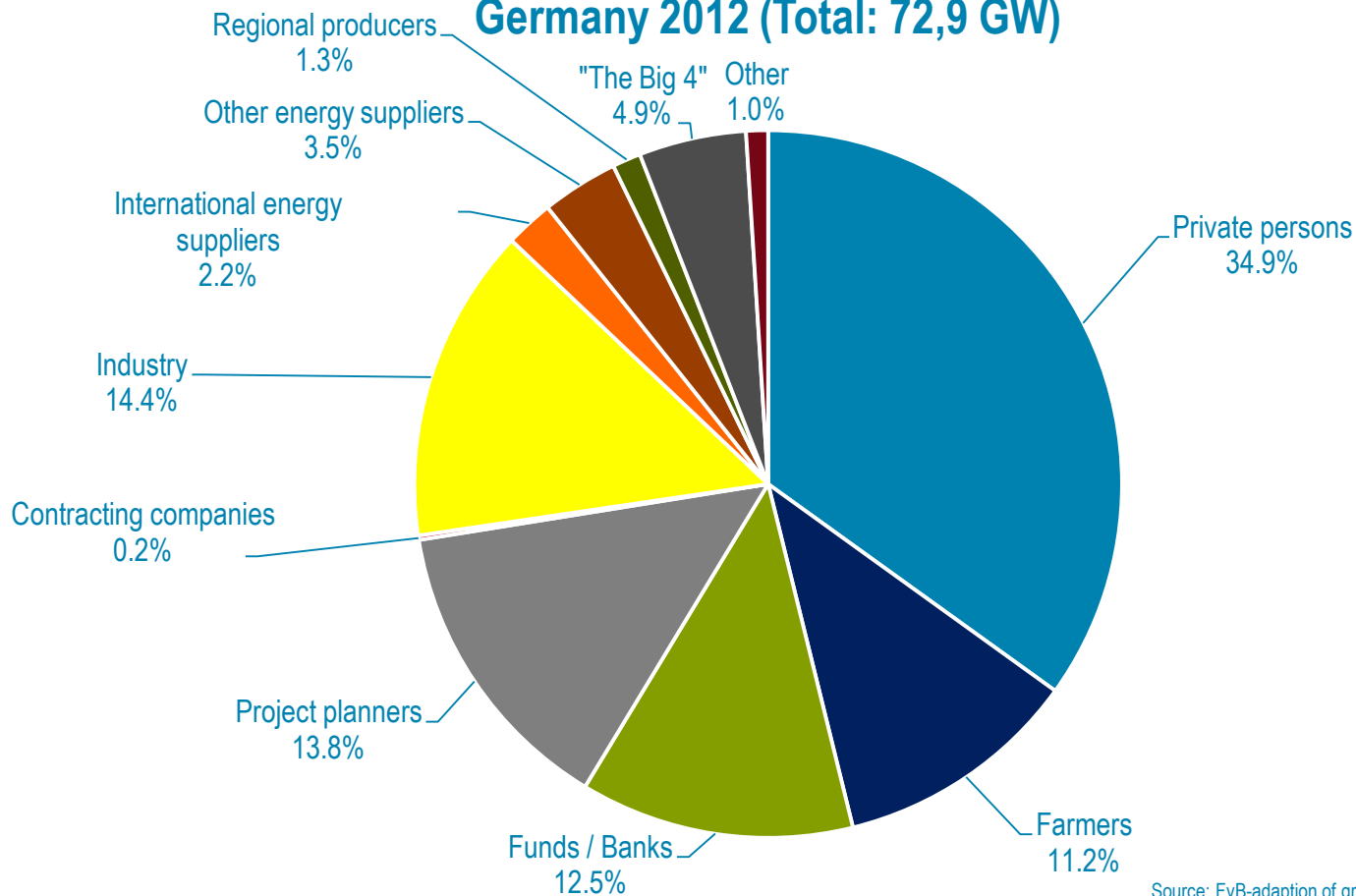
## Financial contribution according to end consumer group



Source: Transmission system operators ([www.netztransparenz.de](http://www.netztransparenz.de))

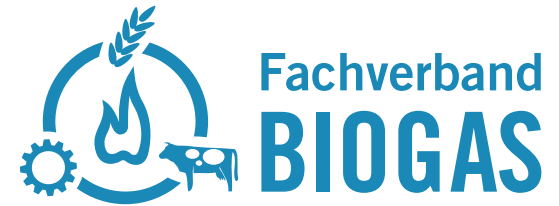
# Market players in the German energy transition

## Structured Renewable Energy according to Group of Owners in Germany 2012 (Total: 72,9 GW)



Source: FvB-adaption of graphic from trend:research 2013

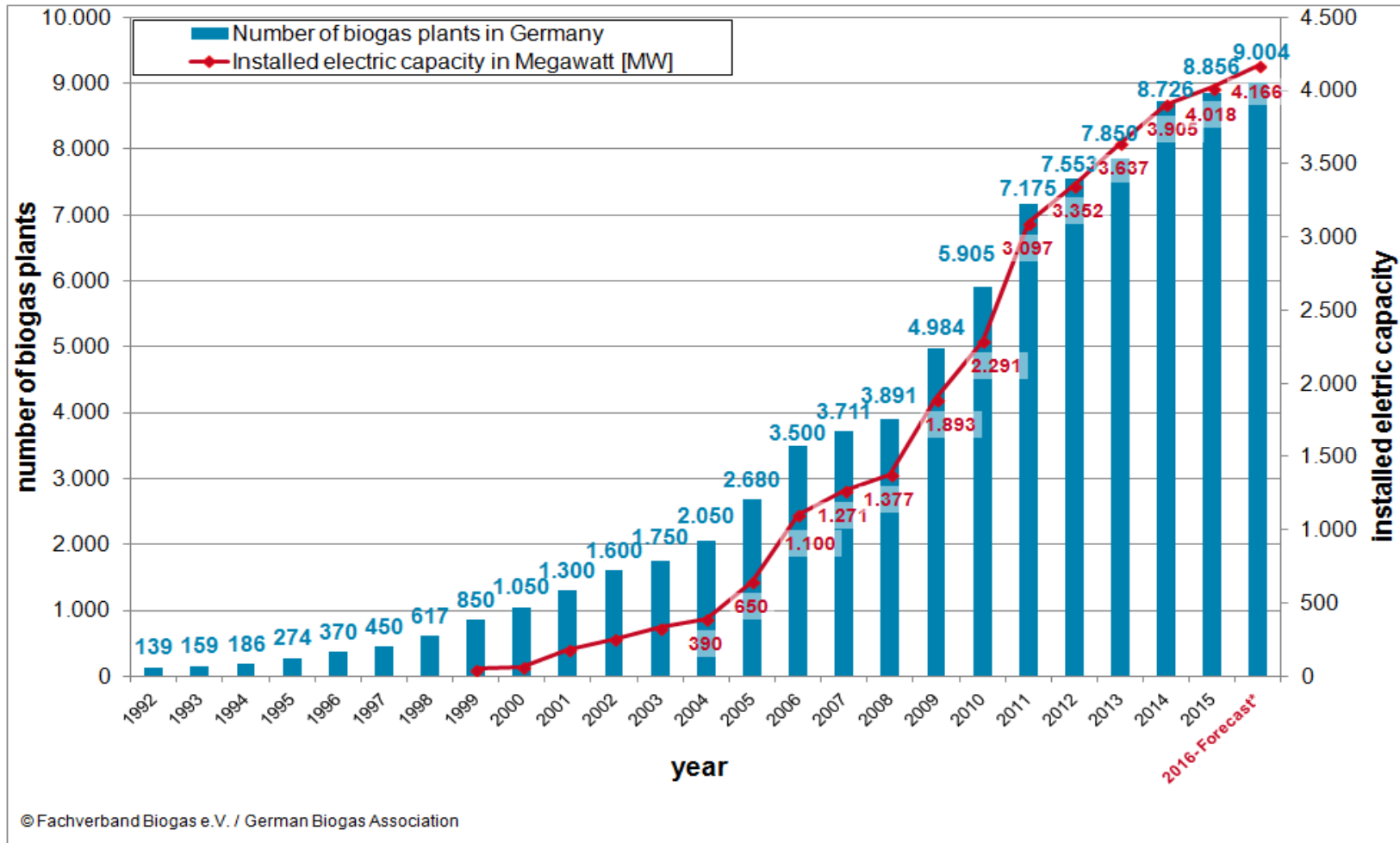
# Reasons to support biogas in Germany



- Biogas reduces greenhouse gas emissions
  - Avoidance of uncontrolled methane emissions by manure storage
  - Substitution of fossil fuels
  - Substitution of mineral fertilizer
- Biodiversity can be enhanced
- Local employment (40.000 jobs in Germany)
- Business creation (9 billion EUR turnover in Germany)
- Technology development, Germany is biogas market leader
- Biogas produces a fertilizer of high value
- During the biogas process the material is sanitized
  - Seeds deactivated
  - Potential pathogen microorganisms reduced
- Due to the biogas process odor (smell) is reduced



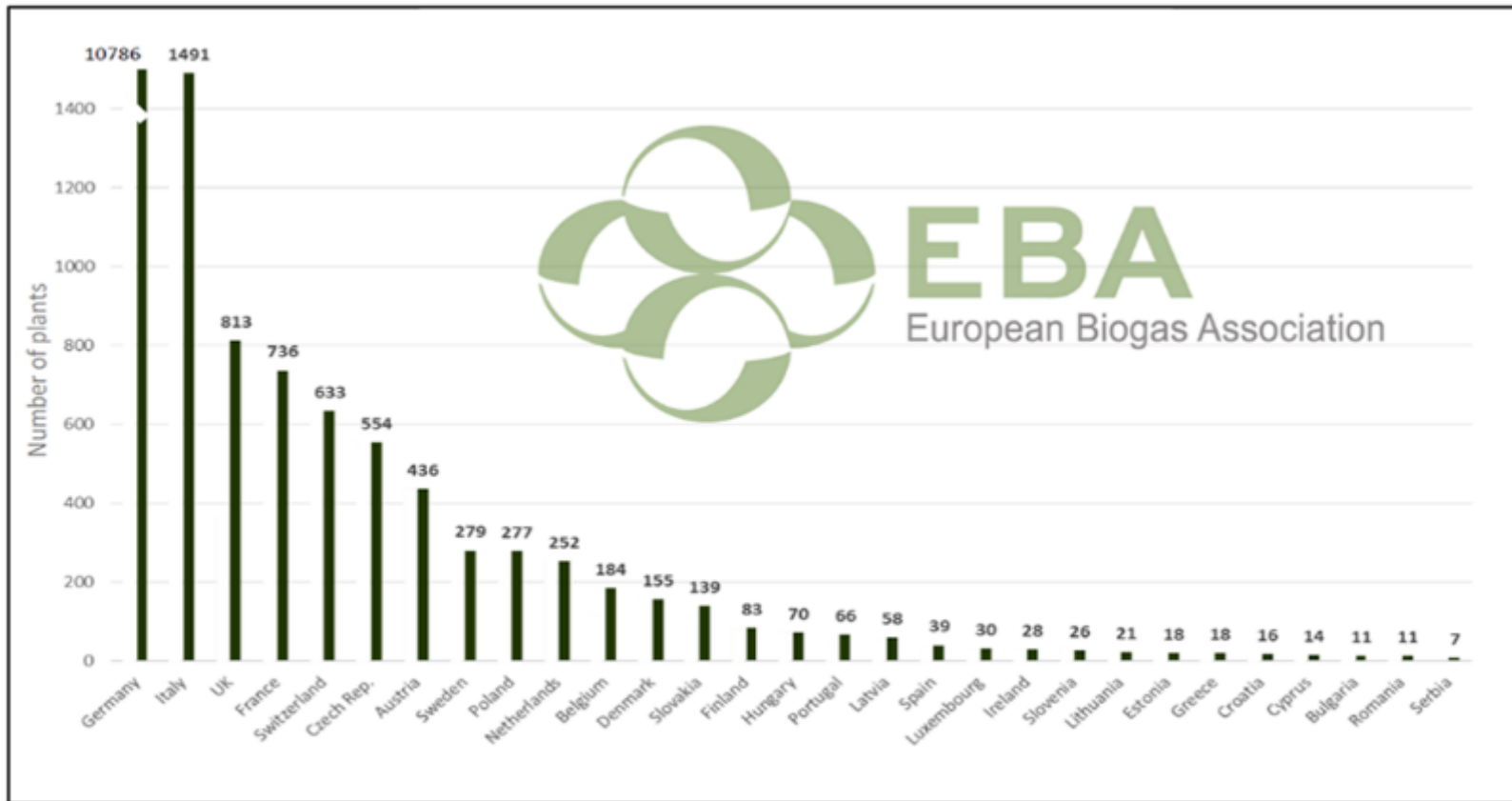
# Biogas in Germany - number of plants and installed capacity



# Biogas sector at a glance

	2014*	2015*	Forecast 2016**
Number of biogas plants + (biogas plants with biomethane injection)	8.726 + (167)	8.856 + (183)	9.004 + (193)
Installed electric capacity in MW	3.905	4.018	4.166
Gross electricity production in TWh per year	28,88	29,38	29,41
Households supplied with biogas- based electricity in millions	8,3	8,4	8,4
CO <sub>2</sub> reduction by biogas in million tons	18,7	19,0	19,1
Turnover in Germany in Euro	8,4 billion	8,2 billion	8,3 billion
Jobs in the biogas sector	45.000	42.000	43.000

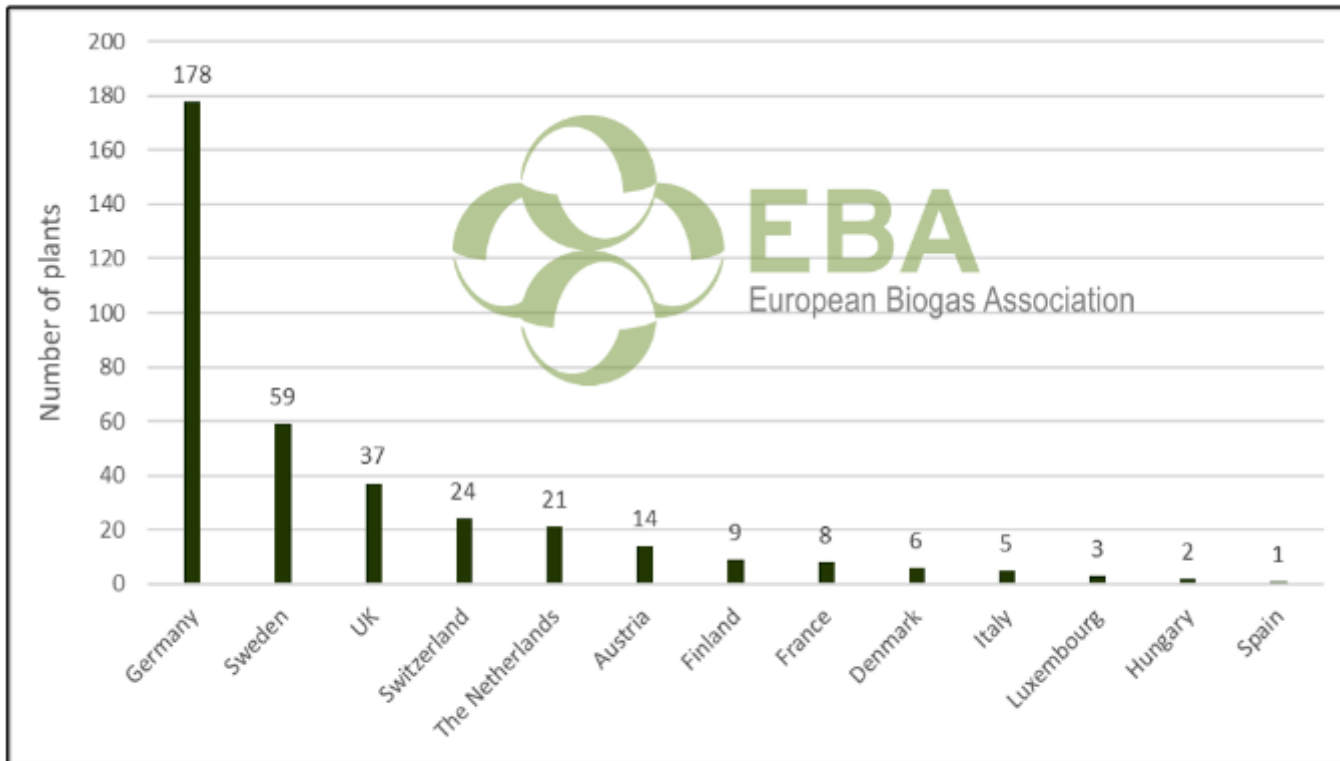
# Biogas plants in Europe



**17 240 biogas plants in Europe (31/12/2014)**

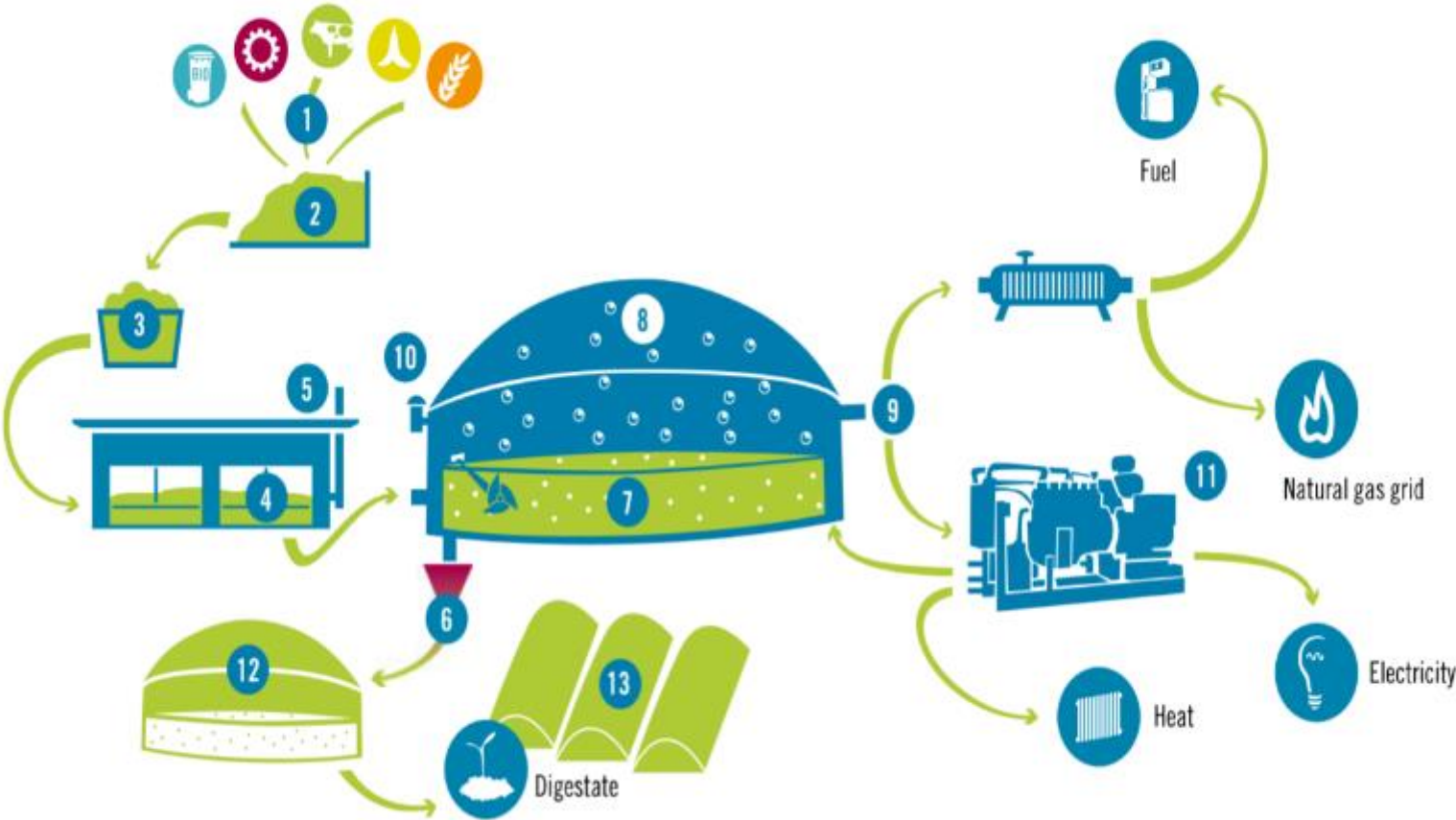
**Total installed capacity of 8 293 MW<sub>eI</sub>**

# Biomethane plants in Europe



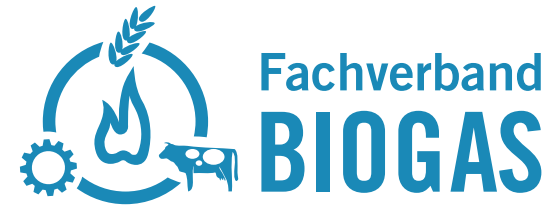
**367 biomethane AD plants in Europe (31/12/2014)**  
**Total upgrading capacity 310 thousands m<sup>3</sup>/h of raw biogas**

# Biogas production



Source: Biowaste to Bioenergy, FvB, 2016

# Political Success factors: German Renewable Energy Act (EEG)

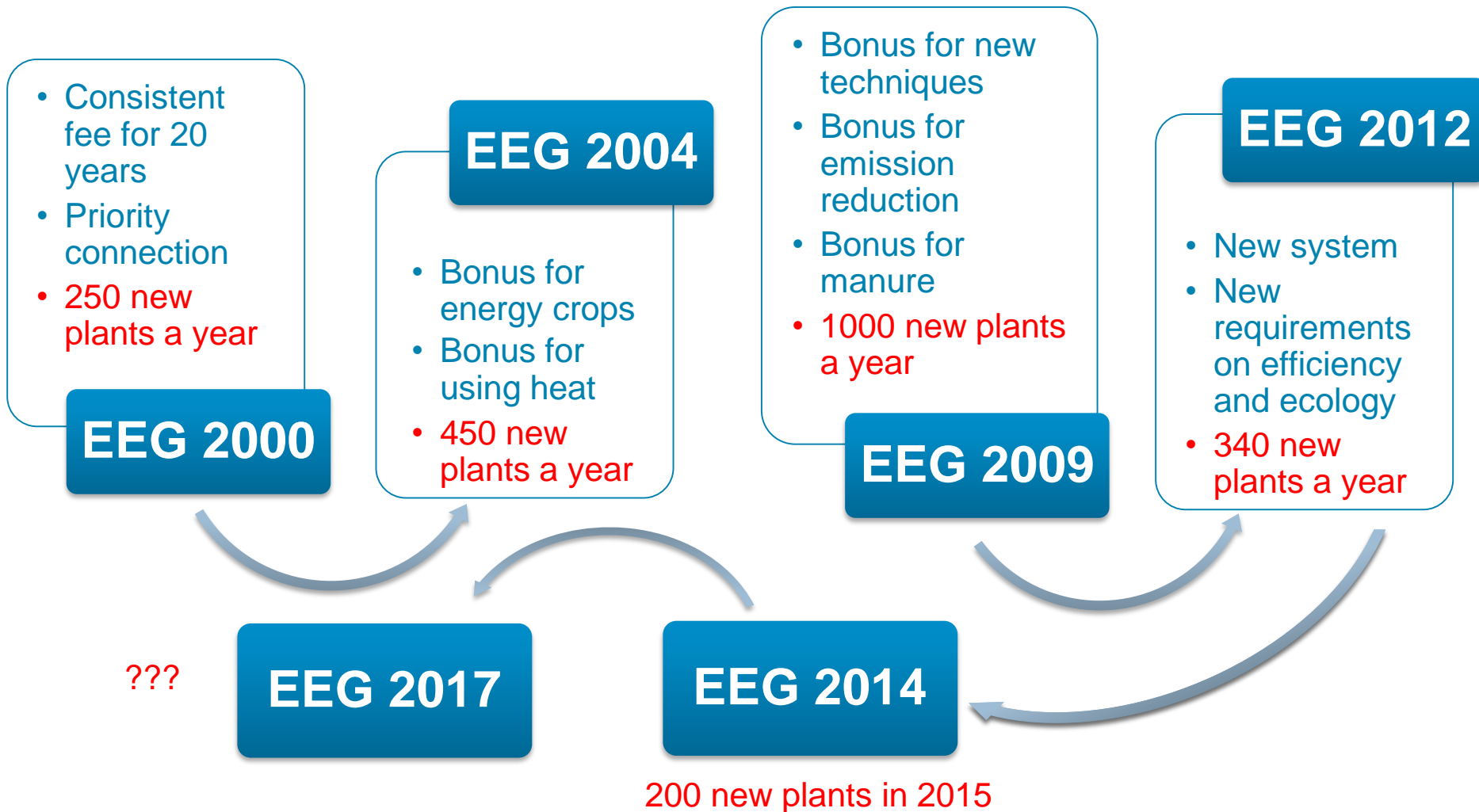


- Priority connection, purchase and transmission for electricity from renewable energy sources
- A consistent fee for this electricity paid by the grid operators for a 20-year period

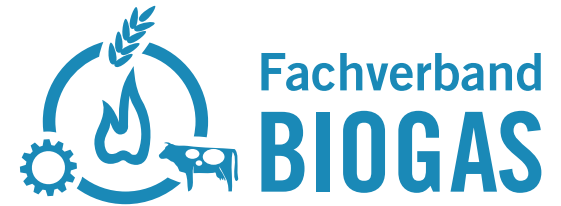
## The core elements of the EEG guarantee :

- Mid and long term planning and investment security
- Calculable costs for consumers
- Specific fees for different technologies
- Low bureaucratic effort
- Participation for local and regional players

# Development of the Renewable Energy Act EEG (2000-2014)



# Sufficient tariffs for market stimulation? EEG 2009 tariffs!



		<=150 kW	<=500 kW	<= 5 MW
1.	<b>Basic feed-in tariff</b>	11,67 Cent	9,18 Cent	8,25 Cent
2.	<b>Bonus for emission reduction</b>	1,0 Cent	1,0 Cent	
3.	<b>Bonus for energy crops</b>	7 Cent	7 Cent	4 Cent
4.	<b>Bonus for residues from landscape management</b>	2 Cent	2 Cent	
5.	<b>Bonus for manure</b>	4 Cent	1,0 Cent	
6.	<b>Bonus for new techniques</b>	2 Cent	2 Cent	2 Cent
7.	<b>Bonus for new techniques</b>	2 Cent		
8.	<b>Bonus for using heat</b>	3 Cent	3 Cent	32 Cent



# New “EEG 2017“

## System change

- Tender process
- Connection FiT after 20 years of FiT

## Exceptions Fixed tariffs

1. Existing plants
2. Bio waste plants
3. Small manure treatment plants

# Fixed tariffs

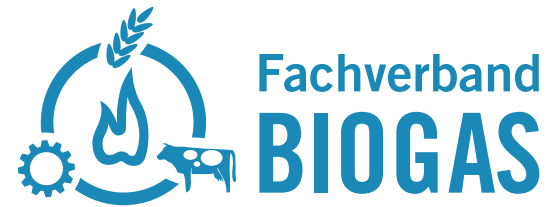
## Fixed tariffs Biomass § 42

- Up to BM      **150 kW**      **13,32 Cent/kWh**
- Up to BM      **500 kW**      **11,49 Cent/kWh**
- Up to BM      **5 MW**      **10,29 Cent/kWh**
- **Degression 1% per year**

## Fixed tariffs Biowaste § 43

- Up to BM      **500 kW**      **14,88 Cent/kWh**
- Up to BM      **20 MW**      **13,05 Cent/kWh**
- **Degression 1% per year**

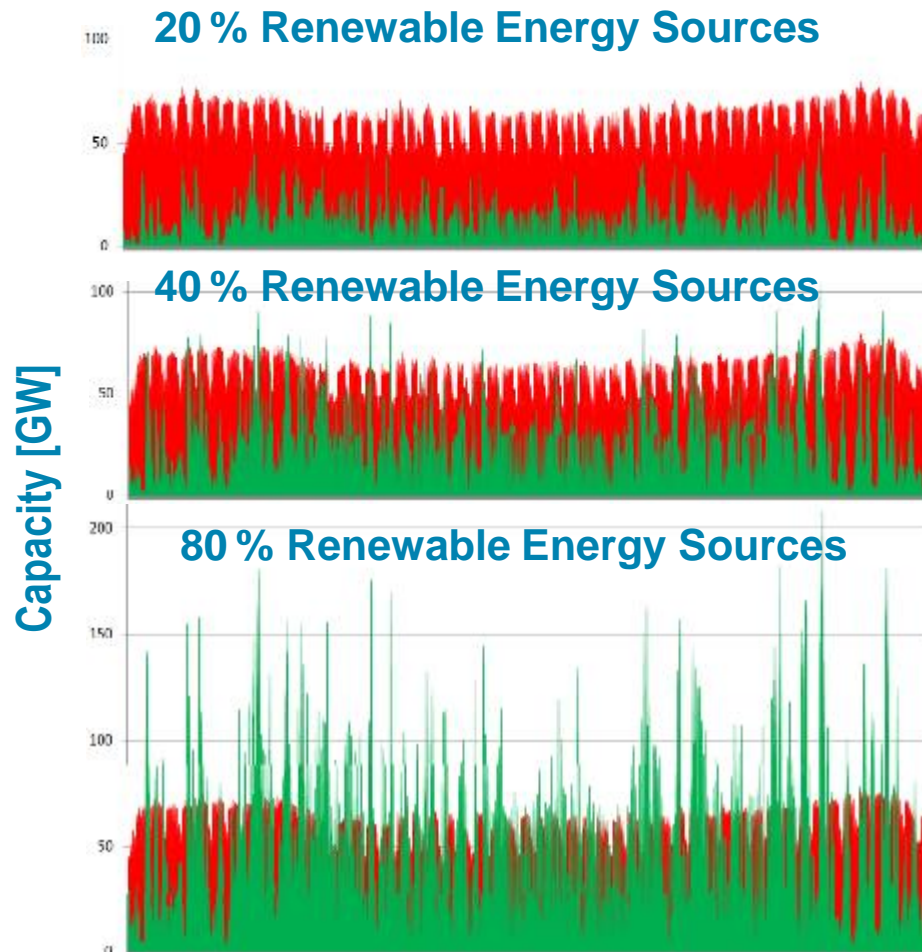
# Fixed tariffs for small manure treatment biogas plants



## Manure treatment biogas plants § 44

- Up to 75 kW<sub>el</sub>                      **23,14 Cent/kWh in der DV**  
   **22,94 Cent/kWh in der FV**
- **Degression 1% per year**
- About 150 new installations estimated for 2016

# The future role of biogas in electricity production: Flexibility instead of base load



With increasing share of RES, baseload loses importance

Flexible systems fill the valleys of wind and sun

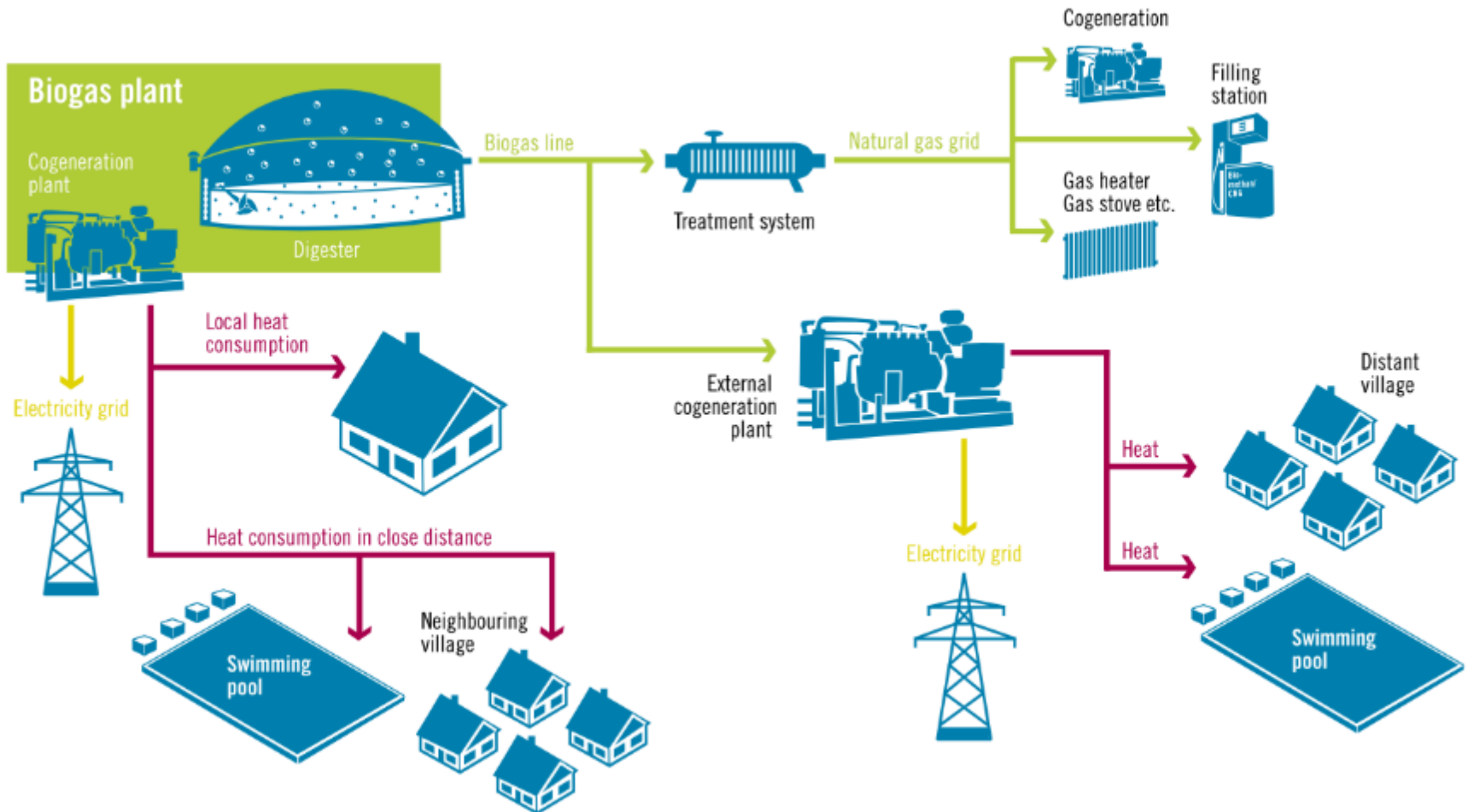
→ CHP with bioenergy & natural gas

→ New role of biogas

red Demand (2010)

green Production Wind & Solar

# Biogas: Energy utilisation

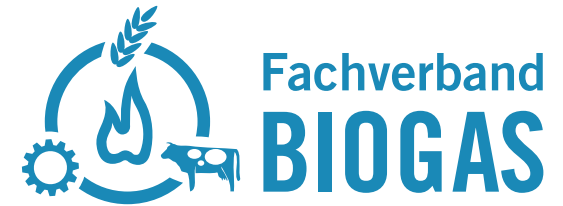


Source: Biowaste to Bioenergy, FvB, 2016

# Technical success factors

- A biogas project is only successful if the biogas plant is working
  - Reliably
    - biogas production 8,760 h/a
    - CHP about 8,200 h/a
    - biogas upgrading to biomethane 8,600 h/a
  - Efficiently
    - High gas yields
    - Optimized energy utilization, low parasitic load (el. own consumption below 8%)
    - Optimized reactor load
  - At least for the calculated lifetime of the project
    - Lifetime could be above 20 years
    - 12 years typical
- ▶ Investment in robust and reliable technology
- ▶ Optimised maintenance are key

# Biogas suppliers/manufacturers



- About 600 companies are organized in the GBA
  - Turn key manufacturers
  - Components
    - CHP
    - Agitator
    - Input feeder
    - Gas system
    - Measurement and control system

More information can be found at [www.biowaste-to-biogas.org](http://www.biowaste-to-biogas.org)

## Matrix overview of the company directory

Company										Page
Turnkey system provider										
AAT Abwasser- und Abfalltechnik	X	X	X	X	X	X	X			42
BEKON Energy Technologies	X	X	X	X		X			X	43
BDI - BioEnergy International	X	X	X	X			X			44
BioConstruct	X	X	X	X	X	X	X			45
BTA International			X	X	X		X			46
Greenline	X	X	X	X	X		X	X		46
bwe Energiesysteme	X	X	X	X		X	X			47
EISENMANN Anlagenbau	X	X	X	X		X	X	X		48
GICOM Großmann Ingenieur Consult	X	X	X	X	X	X	X	X	X	49
Hitachi Zosen Inova		X	X	X	X	X		X		50
NQ-Anlagentechnik	X	X	X	X	X	X	X			51
PlanET Biogas Group	X	X	X	X	X	X	X			51
Rehau Energy Solutions	X	X	X	X	X		X			52
Schmack Biogas	X	X	X	X	X	X	X		X	53
Thöni Industriebetriebe	X	X	X	X	X	X	X	X		54

# Biogas experts

- Planners
- Scientific researcher
  - Research institutions, like DBFZ, German Biomass Research Center, Fraunhofer Institutes
  - Universities
  - Laboratories
- Other experts for
  - Planning
  - Due diligences
  - Feasibility studies
  - Environmental impact assessment
  - Life cycle assessment



# Aspects about maintenance

- For optimal biogas projects several components must act together optimally
- Each failure might lead to a lower performance
- The main reasons for failures in maintenance work are
  - CHP
  - Stirrers
  - Input feeder
- Biology
  - Should never be the reason for failures, if the operation and dimensioning is well done

# Components maintenance work

- CHP maintenance
  - Most relevant component for maintenance and repair
    - amount of lost operation time
    - costs for maintenance
  - Costs regular maintenance
    - about 1 ct/kWh for machines above 300 kWe,
    - higher for smaller machines, e.g 2 ct/kWh for 100 kWe, 3 ct/kWh for 50 kWe
  - After about 2,500 - 4,000 operation time, small maintenance routine
  - After about 40,000 h, small revision
  - After about 60,000 h (about 8 years), big revision
    - costs: 100 – 200 €/kW,
    - higher specific costs for machines below 200 kWel, e.g 300 €/kW for 50 kWe
- Replacement of whole CHP would be expensive but might not be relevant

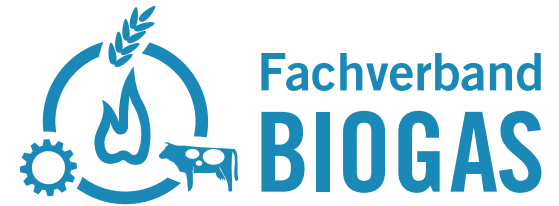
# Componentes maintenance work

- Stirrer
  - High mechanical stress
  - Robust technology needed
  - High energy demand
  - Replacement expensive, about 20 – 28% of investment costs
  - Choose experienced manufacturer and robust technology
- Input feeder
  - High mechanical stress
  - Depending on feedstock
  - The whole process is depending on the input feeder
  - Choose experienced manufacturer

# Replacement of components

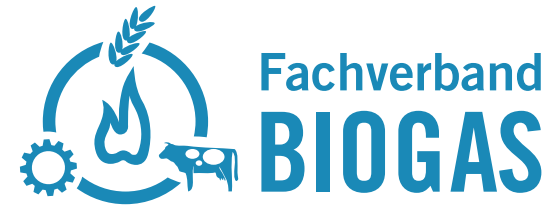
- Parts of a biogas plant which must be replaced regularly
  - Pumps, about every 3 – 6 years
  - Stirrers, about every 3 – 8 years
  - CHP, after 12 years?

# Conclusions: Biogas in Germany



- Biogas is an important part of the German Energy Transition
- Biogas is a storable energy carrier which can be used as
  - Electricity
  - Heat
  - Vehicle fuel
  - Substitute for natural gas
- Actual about 9,000 biogas plant with an installed capacity above 4,000 MWel are in operation
- Experience since decades
- The success of a biogas project mainly depends on reliable biogas operation
- Investment in robust, reliable technology

# Trends in developing and emerging countries



- Carbon trade – focus on the **reduction of methane** rather than electricity production
- Decentralized energy solutions driven by industry – **avoid energy black outs and high costs of importing fossil fuels**
- **Environmental regulations** (waste water, municipal waste, agricultural waste, landfills, etc.)
- **Feed in Tariffs / Quotas**
- **Biogas upgrading to biomethane**
- **MSW, Agricultural residues, landfill gas, sewage gas, energy crops?**
- **Establishment of national biogas associations!**

Thank you for your attention!

