



**Coping with challenges of biogas utilization
– learning from international experience**



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TÜV NORD GROUP

Agenda

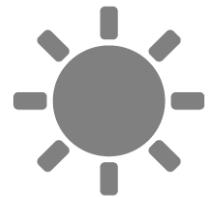
- ee energy engineers GmbH
- Biogas in Germany – a success story supported by the Renewable Energy Sources Act (EEG)
- Structures of biogas production and usage in Germany
Advantages, disadvantages and side effects
- Conclusion – Biogas, More than energy!

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We are an innovative consultancy

- **Founded:** 1996, member of TÜV NORD Group since 2007
- **Turnover 2013:** 6.8 million €
- **Headquarters:** Gelsenkirchen, Germany
- **Further locations:** Düsseldorf, Bochum, Bad Sassendorf
- **Key topics:** Renewable energies and energy efficiency
- **Main contractors:** NRW State Government, Federal Government, European Commission, GIZ, industry, ...





We offer consulting services in three business areas



Strategy consulting:

We mainly support public sector clients to plan, organize and implement necessary structures to deal with current and upcoming energy issues.



Technology consulting:

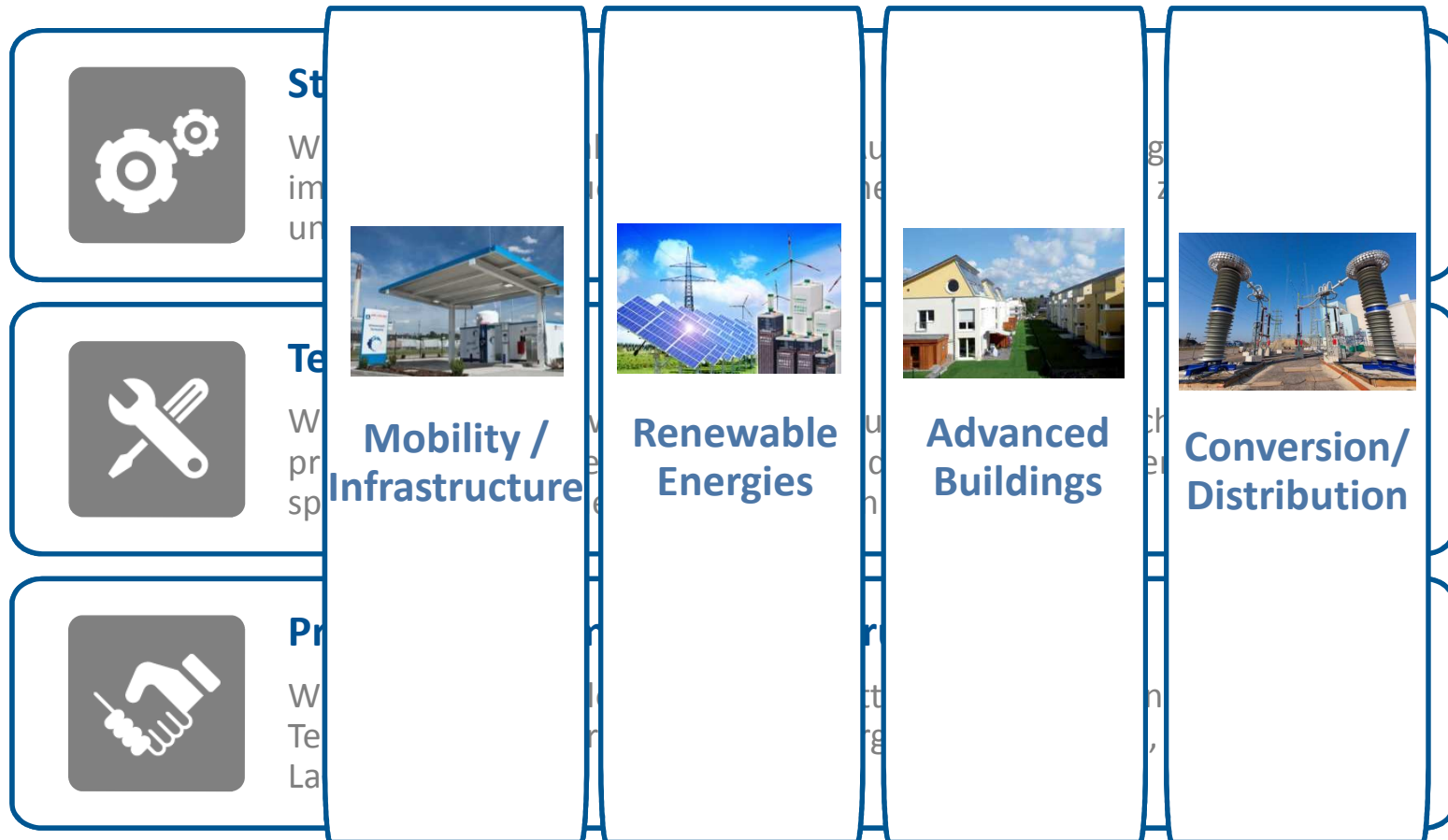
We support public sector clients as well as private institutions to analyze and address specific technical issues.



Project management:

We mainly support small and medium sized enterprises to participate in European, national and regional funded projects in the energy sector.

We offer consulting services with technical focus on



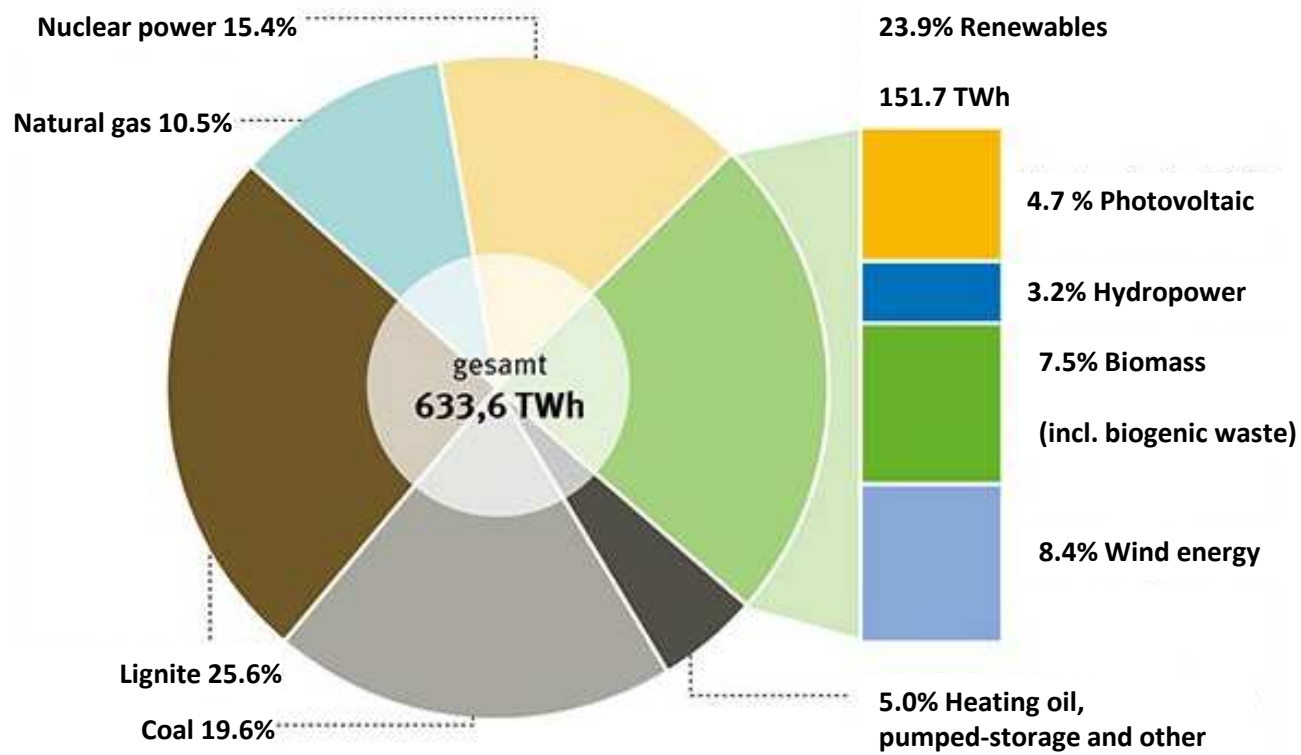
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The German Renewable Energy Law (EEG)

- EEG 2000
 - Amendments in 2004, 2009 and 2014
- Supports the sustainable energy production by **giving priority to power from renewable sources**
- Allowance for each fed in kWh_{el}
- Investment protection through **guaranteed feed-in tariffs and connection requirement for 20 Years**
- No charge to Germany's public purse
- **Innovation by decreasing feed-in-tariffs**

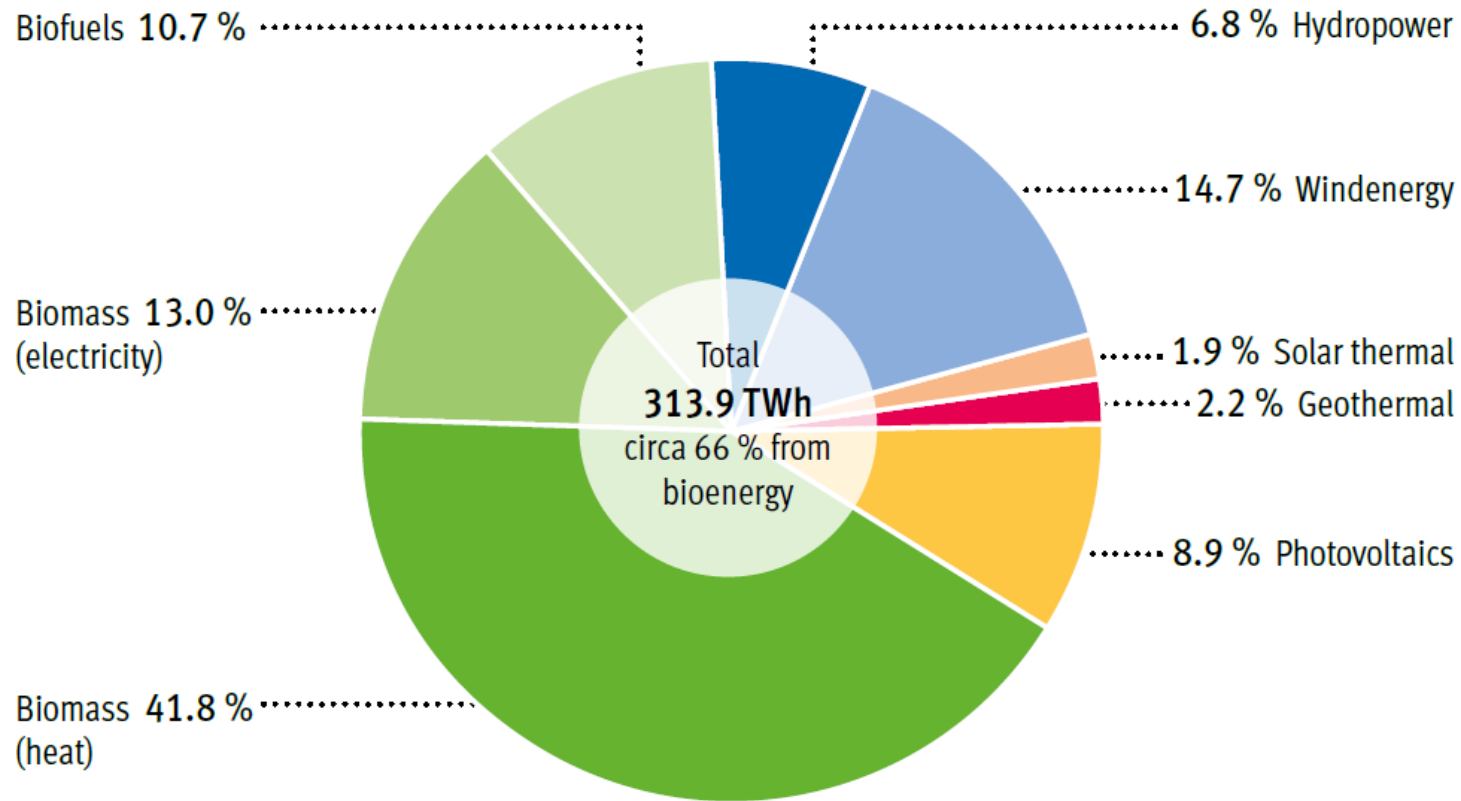
Germany's electricity mix in 2013



Quelle: FNR nach AGEb (Februar 2014)

© FNR 2014

Energy supply from renewable resources 2012

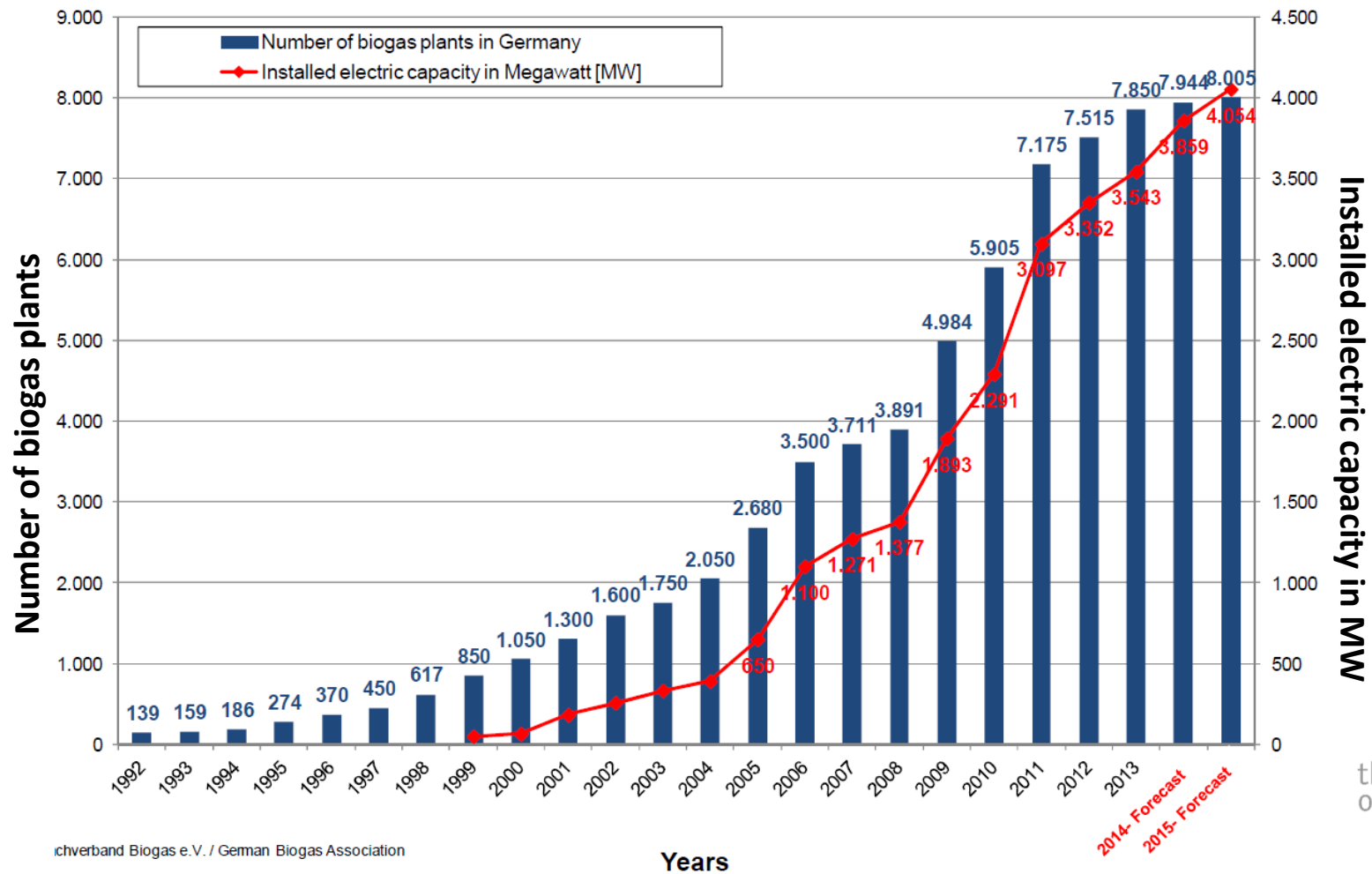


Electricity and heat from biomass, including sewage gas, landfill gas and biogenic fraction of waste

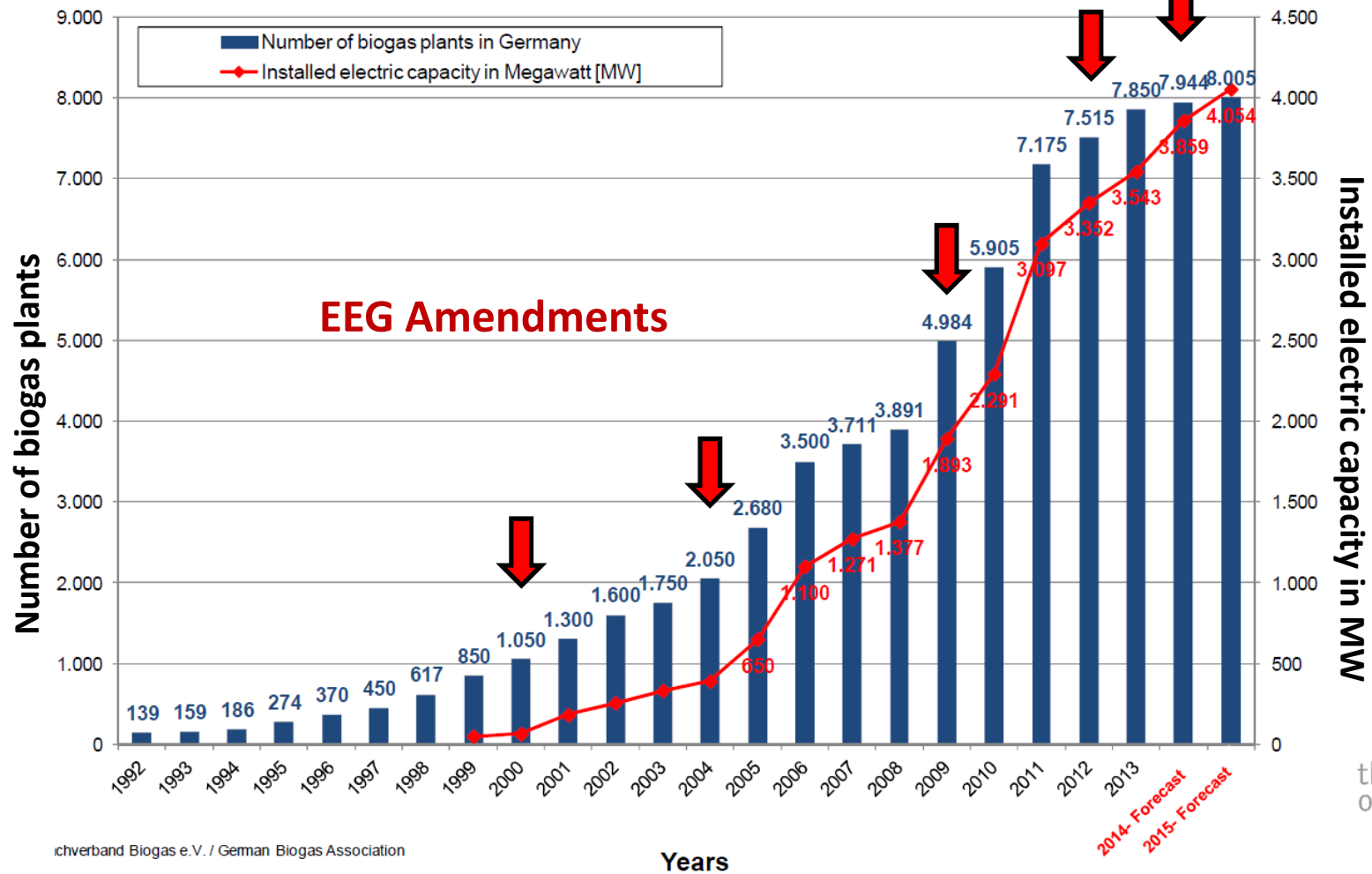
Source: BMU, AGEE-Stat (March 2013)

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Development of biogas plants in Germany



Development of biogas plants in Germany



Biogas Sector Statistics in Germany at a Glance

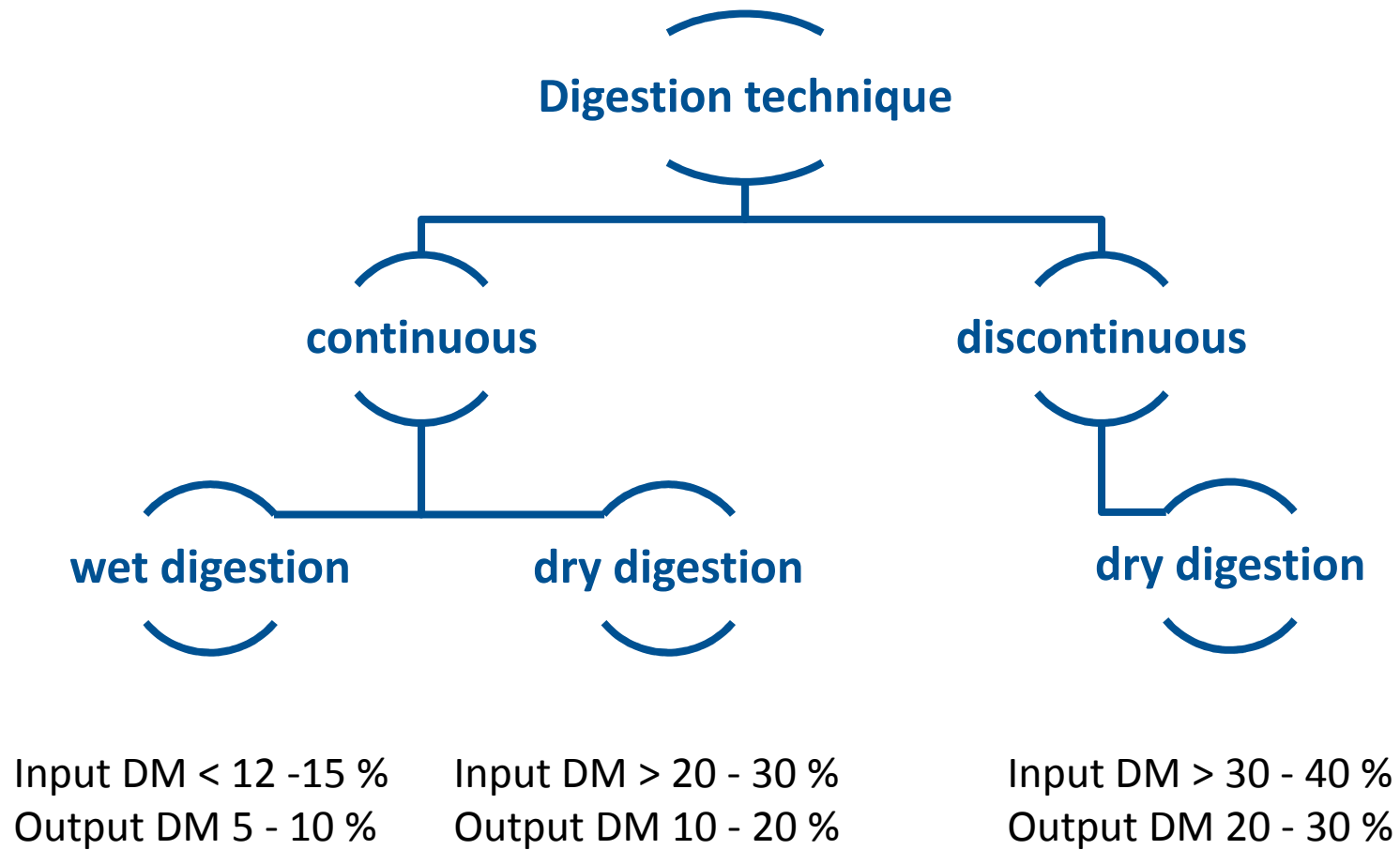
	2013*	Forecast 2014**	Forecast 2015**
Number of biogas plants (biogas plants with biomethane injection)	7.850 (144)	7.944 (153)	8.005 (156)
Installed electric capacity in MW	3.543	3.859	4.054
Gross electricity production in TWh per year	26,42	27,55	27,88
Housholds supplied with biogas-based electricity in millions	7,5	7,9	8,0
CO ₂ reduction by biogas in million tons	16,8	17,6	17,8
Turnover in Germany in Euro	7,3 Billion	7,4 Billion	7,2 Billion
Jobs in the biogas sector	41.000	41.000	39.000



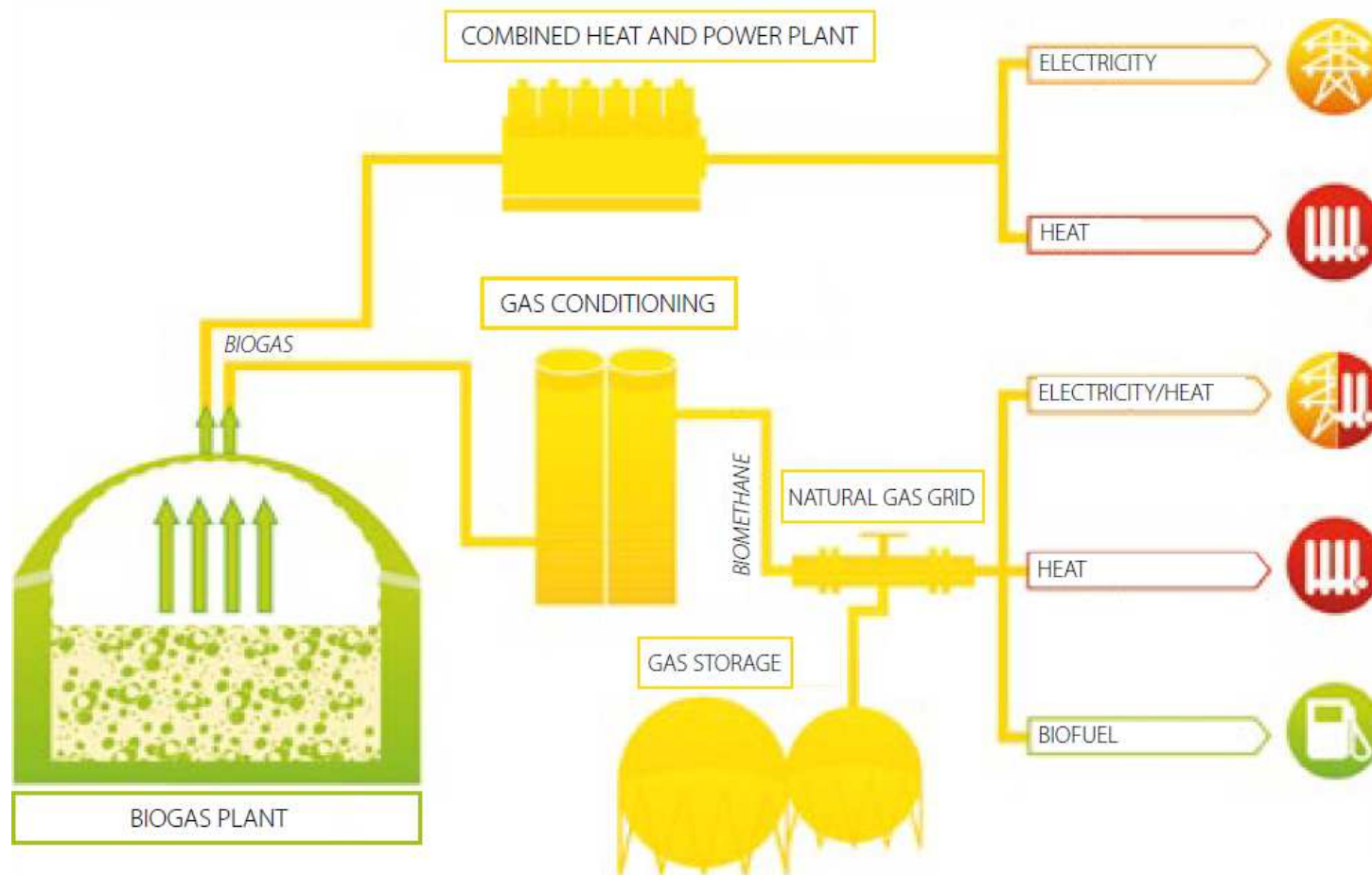
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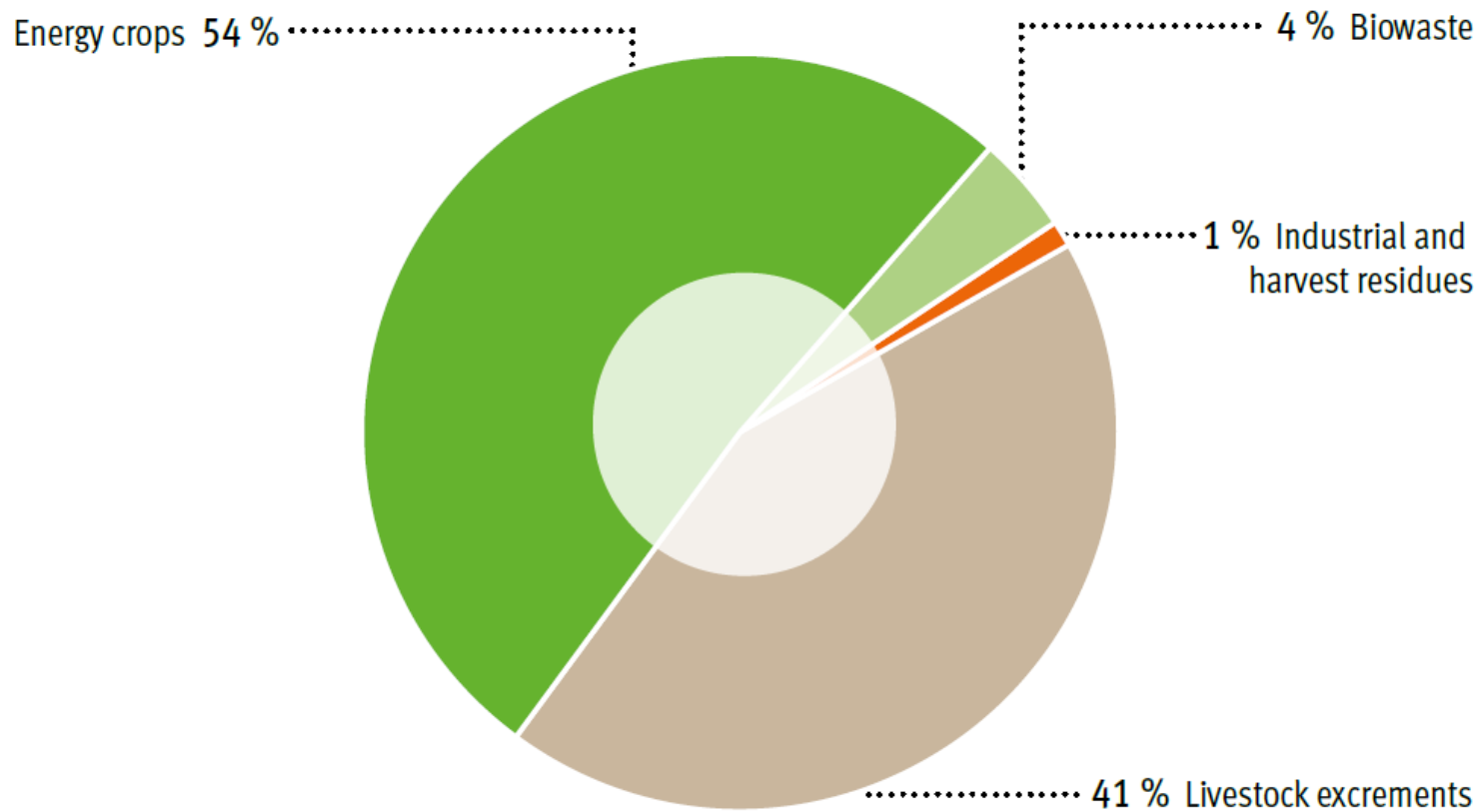
Systematic of digestion



Various utilization of biogas



Mass-related use of substrate input in Biogas plants 2012



Source: DBFZ (2013)

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Agricultural Biogas production

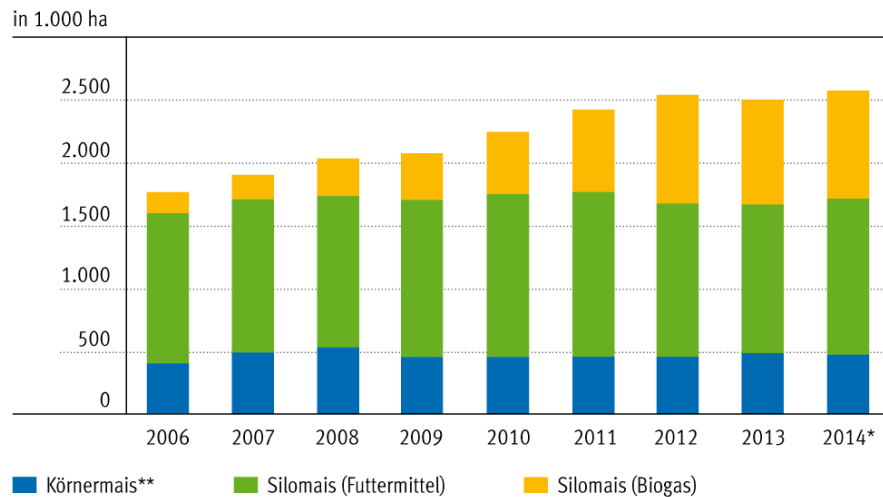


- Producing energy (electricity, heat (cold), fuels)
- Producing organic fertilizer
- Extra income for farmers

- Using overcapacities, agricultural waste and by-products
- Climate friendly manure treatment

Agricultural Biogas production

- side effects



* Prognose; ** ca. 85 % Futtermittel, 6 % Industrie (Stärke), 5 % Energie (Ethanol), 3 % Verluste, 1 % Saatgut

Quelle: Stat. Bundesamt, DMK, ZMP, AFC, FNR

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- Increasing cultivation of energy crops
 - Food vs. energy
 - Low biodiversity
- Local over fertilization
- Increasing prices for rentals
- New jobs in rural area

Waste to energy

- an other bin for the back yard



- The brown (or green) bin for bio waste
 - Kitchen waste (bevor cooking)
 - Green and wooden garden waste

Collecting, pre-treatment and fractionizing →

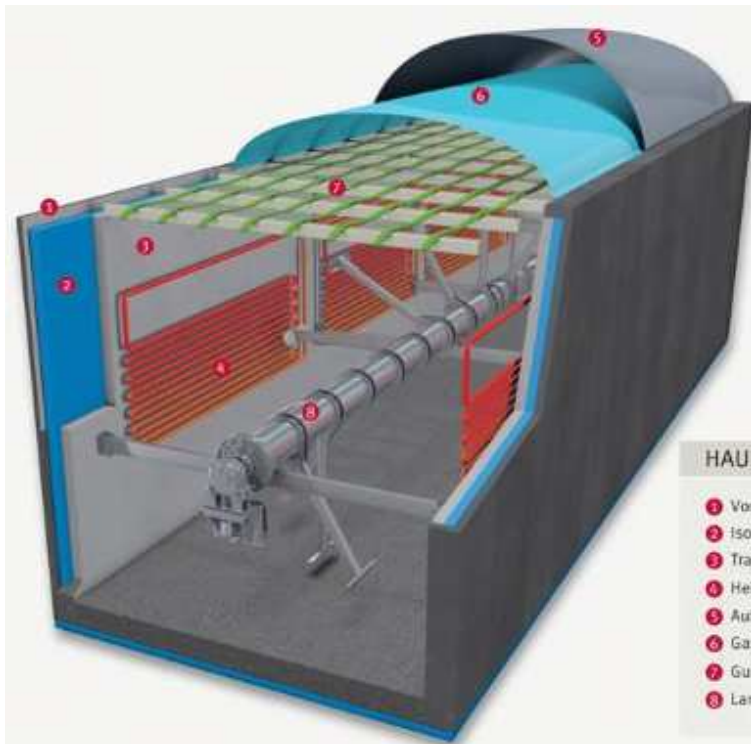
Energetic use

- Digesting
- Incineration

Fertilizer production

- Composting

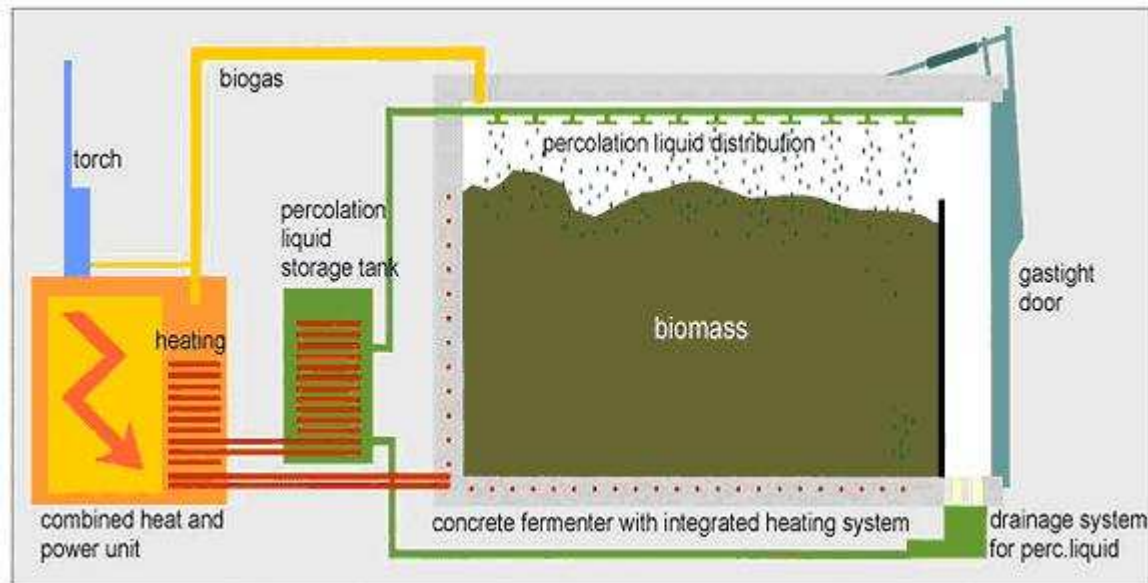
Bio waste to Biogas (continuous) - plug flow digester



- Dry digestion for high dry matter contents
- robust technique
- Disinfection
- High efficiency

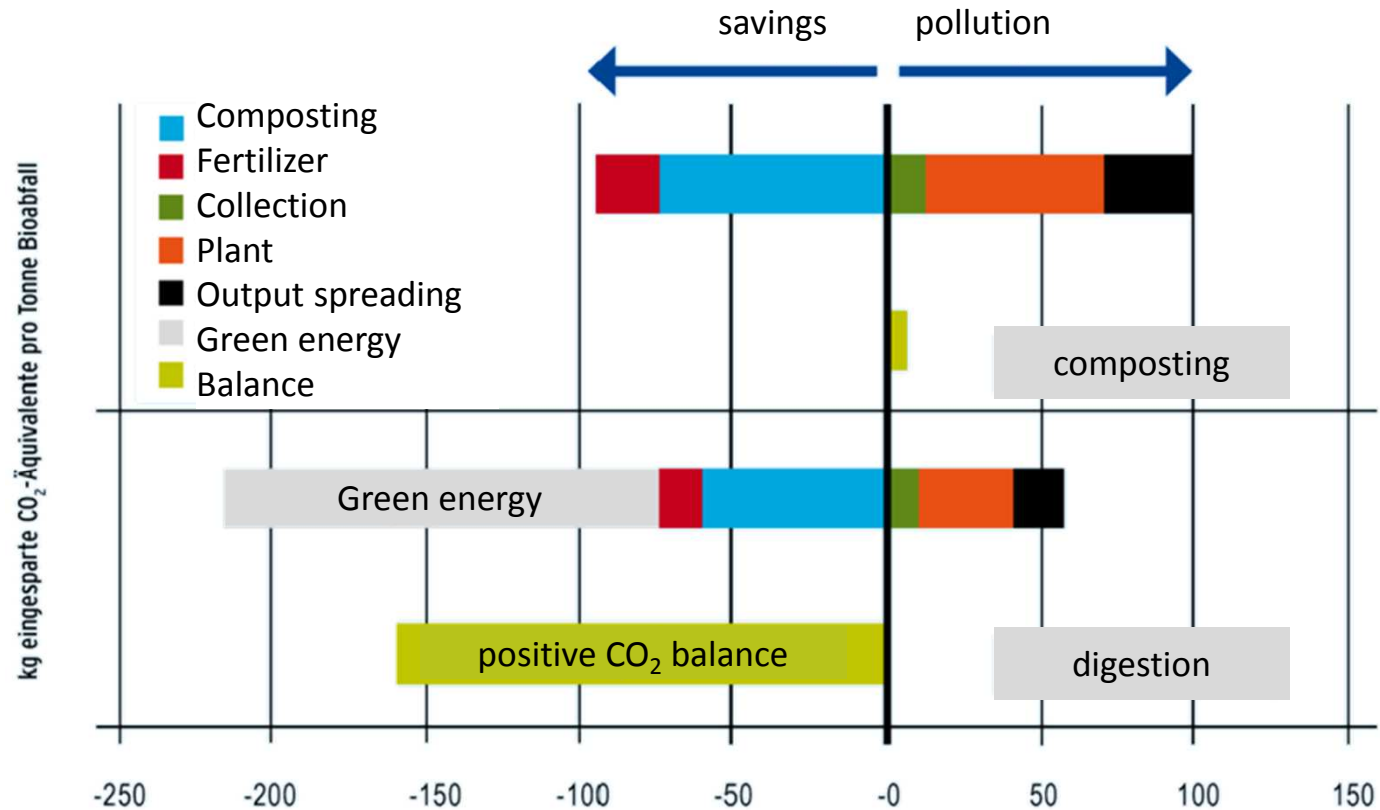
- As pretreatment bevor the composting unit

Bio waste to Biogas (discontinuous) - garage digester



- For (very) high dry matter contents
- Unsusceptible for foreign materials
- Disinfection
- High work load
- Ineffective digestion
- As pretreatment bevor the composting unit without dewatering

Climate protection: composting vs. digestion



Quelle: ifeu und Partner 2008:
Optimierung für einen nachhaltigen Ausbau der Biogaserzeugung und -nutzung in Deutschland

Anaerobic sewage sludge treatment (egg digester)



Anaerobic sewage sludge treatment



- breaking down of organic pollutants
- disinfection
- producing organic fertilizer

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Biogas, More than energy!

- Renewable energy
 - Decentral, capable for the base load, controllable and storable
- Conserving resources
 - Waste and waste water to energy
- Value added
 - Organic fertilizer for agricultural use
 - Jobs in rural areas
- Environmental protection
 - Waste water treatment
- Climate protection
 - Green energy instead of greenhouse gases

Thank you!

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