Determination of Feed-In-Tariffs for Bioenergy

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Japan Renewable Energy Foundation - FIT-Workshop

Tokyo, 6 March 2012

DBFZ
Departments

Capacity Building / Technology Transfer

Theoretical Research / Advisory Activities / Monitoring

Bioenergy Systems

Biochemical Conversion

Biorefineries

Thermo-Chemical Conversion

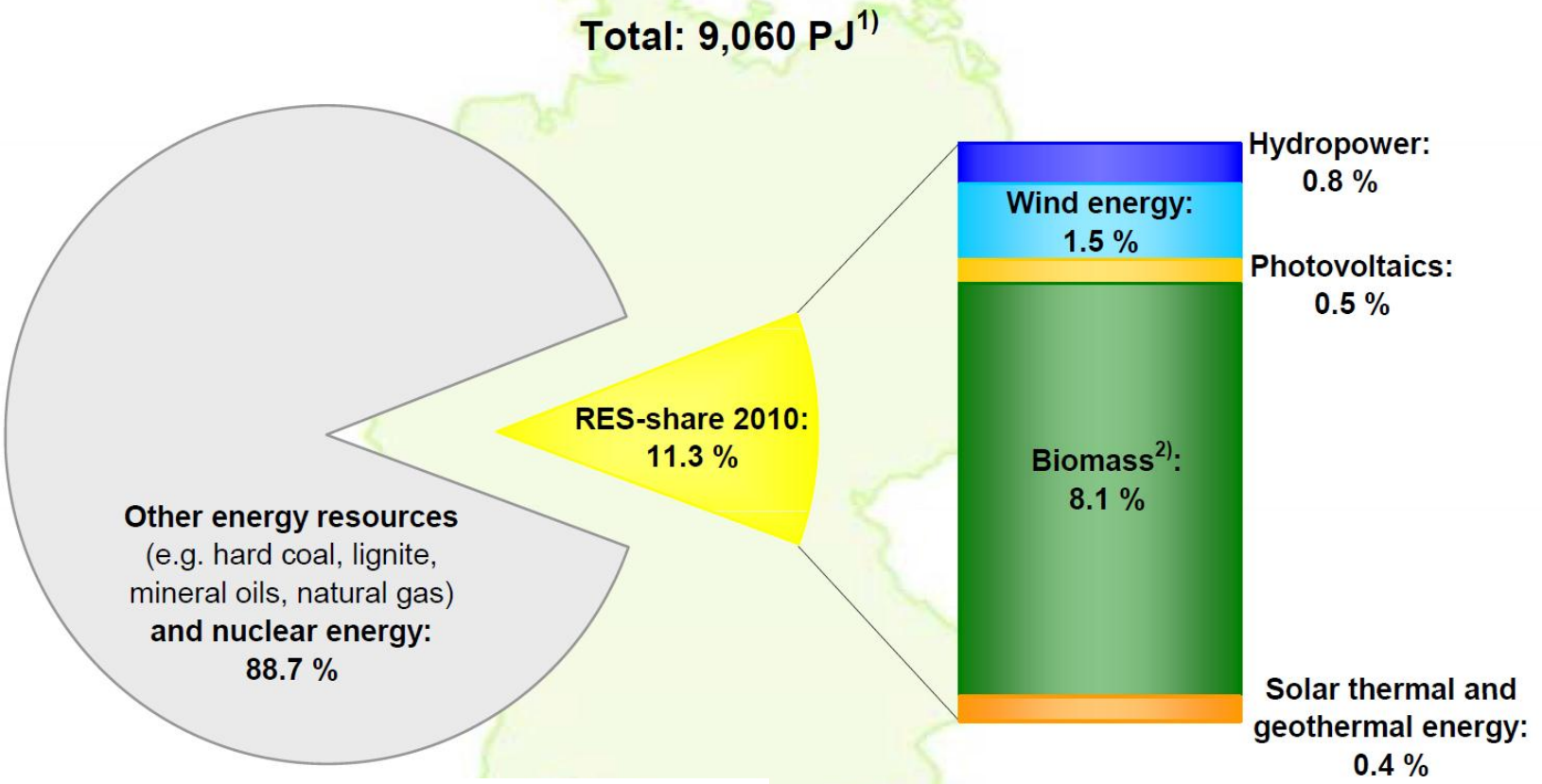
Experimental Research

Laboratory

Biofuels properties	Test & demo facilities	Furnace test facilities	Biogas laboratory	Engine test beds	Emissions

Contribution of Renewable Energies to
Final Energy Consumption in Germany 2010

final energy consumption GER 2010	total final energy consumption : ~2,518 TWh renewable energies: 284,5 TWh biomass: 205 TWh



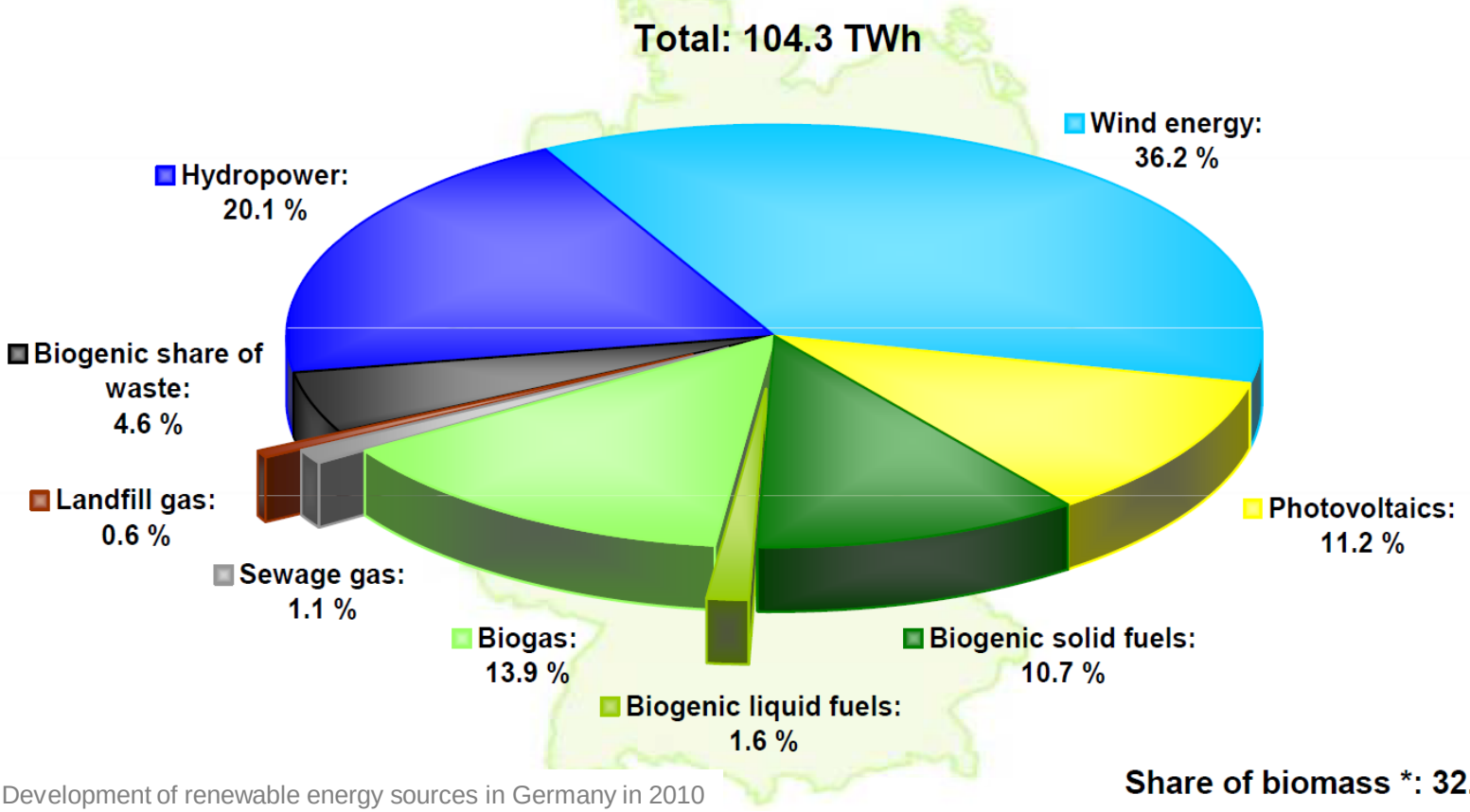
source: BMU, Development of renewable energy sources in Germany in 2010

Contribution of Renewable Energies to

Green Electricity (RES-E) – Status quo

- **Status quo:** RE share in total power consumption 17%, thereof 32.5% biomass (2010)
- **Goal:** RE share of 30% in power consumption by 2020

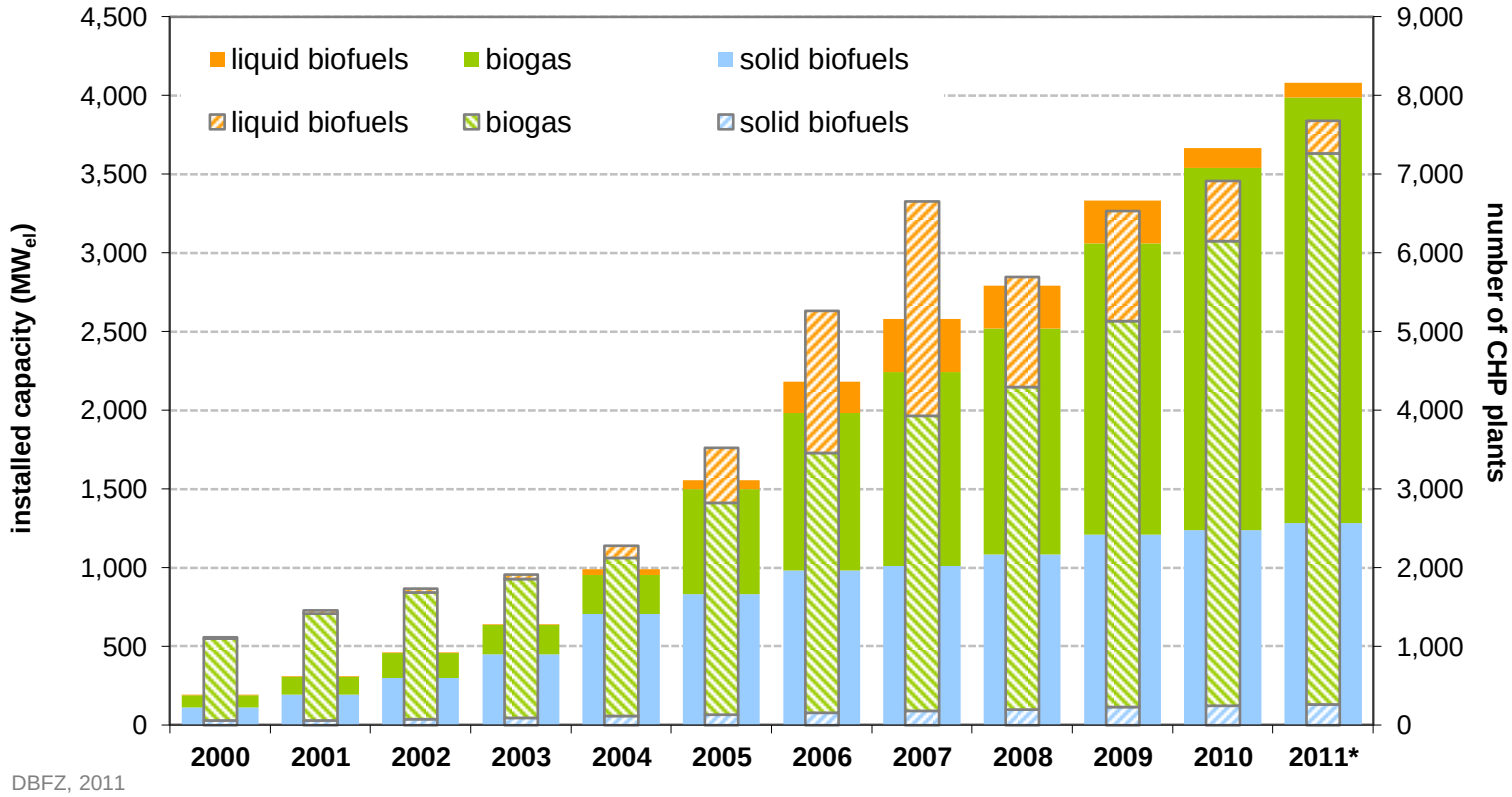
Structure of electricity supply from renewable energy sources in Germany 2010



source: BMU, Development of renewable energy sources in Germany in 2010

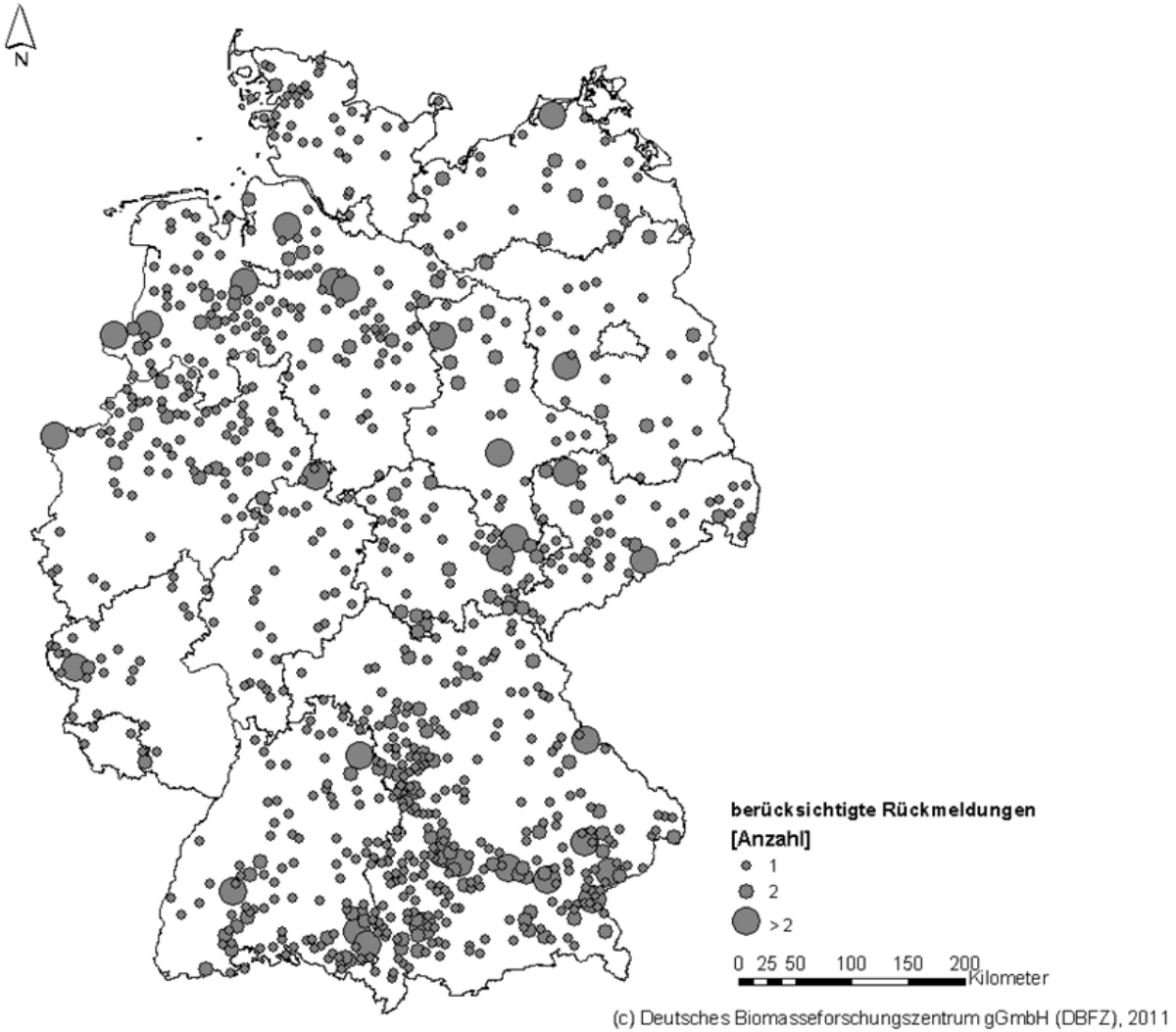
Development of electricity production from biomass under the German renewable energy source act (EEG)

- End of 2011
  - number of CHP plants: 7,677
  - installed capacity: 4,080 MW_{el}
  - realised power generation: 27 TWh_{el}/a



DBFZ, 2011

Distribution of biogas plants in germany



Decentralized production - reduce grid extension

EEG 2012 - Biomass tariffs

	Tariff for					
	Biogas (excl. bio-degradable waste) and solid biomass				Bio-degradable waste fermentation with post-rotting	Small manure installations
Rated average annual capacity	Basic tariff	Substance tariff class I	Substance tariff class II	Biogas processing bonus	-	-
[kW_{el}]	[€ct/kWh_{el}]					
≤ 75	14.3	6	8	size of biogas production plant ≤700 standard cubic metre (sm^3)/h: 3 ≤1,000 sm^3/h: 2 ≤1,400 sm^3/h: 1	16	25
≤ 150						
≤ 500	12.3					
≤ 750	11	5 (2.5)	8 o. 6		14	
≤ 5,000	11	4 (2.5)				
≤ 20,000	6	-	-	-		

- Structure: basic tariff + substance tariff class + processing bonus
- Substance tariff is paid according to the amount of the energy share
- Processing bonus is paid, if the natural gas grid is used
- Further requirements e.g. minimum heat use 60% (100% for gas from natural gas grid); bonus for market and grid integration

Rules of the EEG 2012

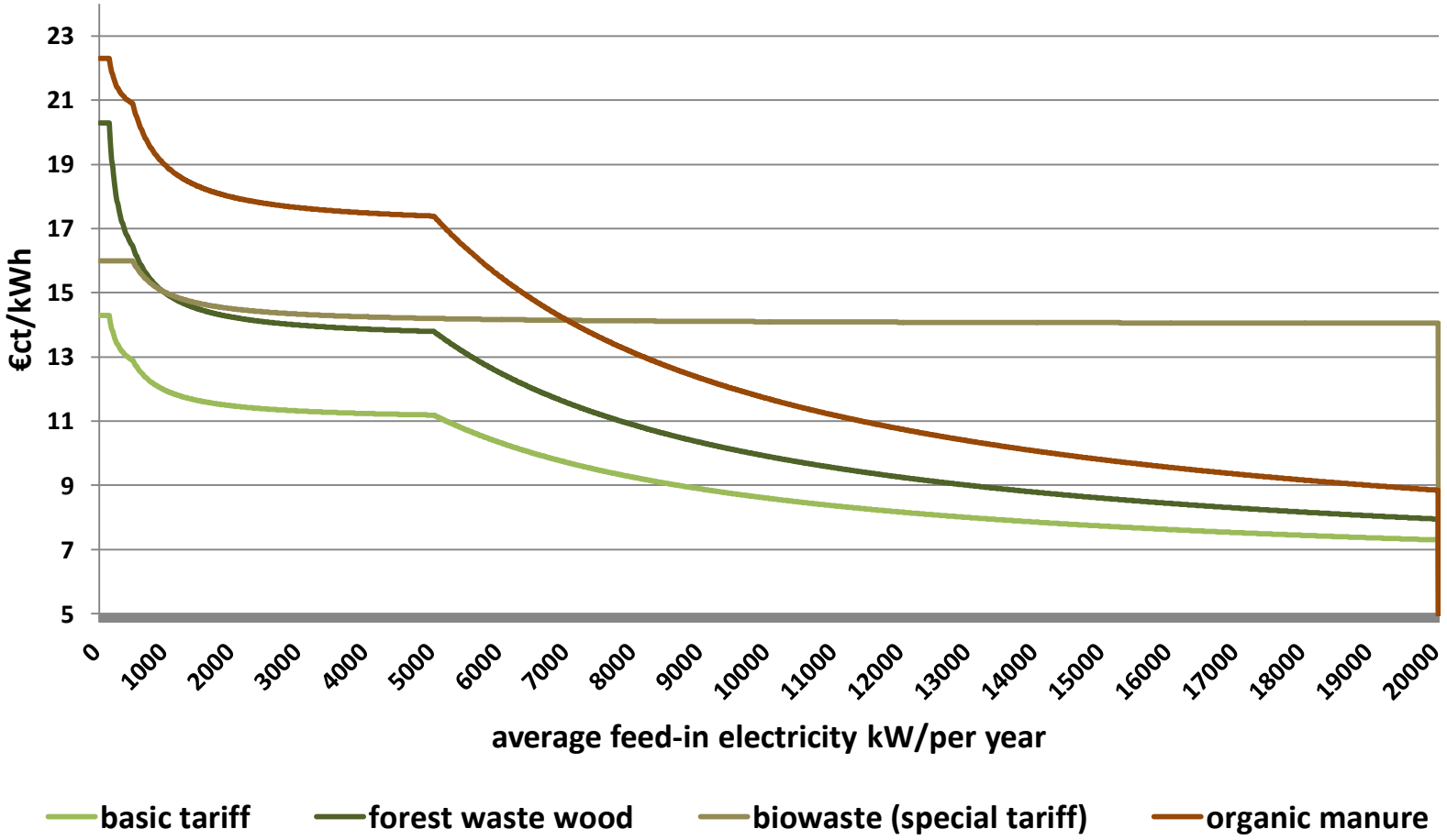
- Basic Tariff
  - Economies of scale ⇨ size degression
  - Reference – Full load hours per year
  - Funding only up to 20 MW
- Substance classes
  - Differentiation of the substances is necessary because of different provision costs and energy yield
- Extra tariff for bio-degradable waste and small manure installations
- Duration of payment – 20 years after year of comissioning
- Degression rate 2% per year (not for substance tariff classes)
- No co-incineration of fossil fuels is allowed
- No further funding for
  - Liquid biomass

  ⇨ high increase of vegetable oil prices because of food demand from Asia

  ⇨ basic principle of the funding – Food First!
  - Waste wood with the expection of industrial residual wood

  ⇨ All potentials in use ⇨ market balance is reached

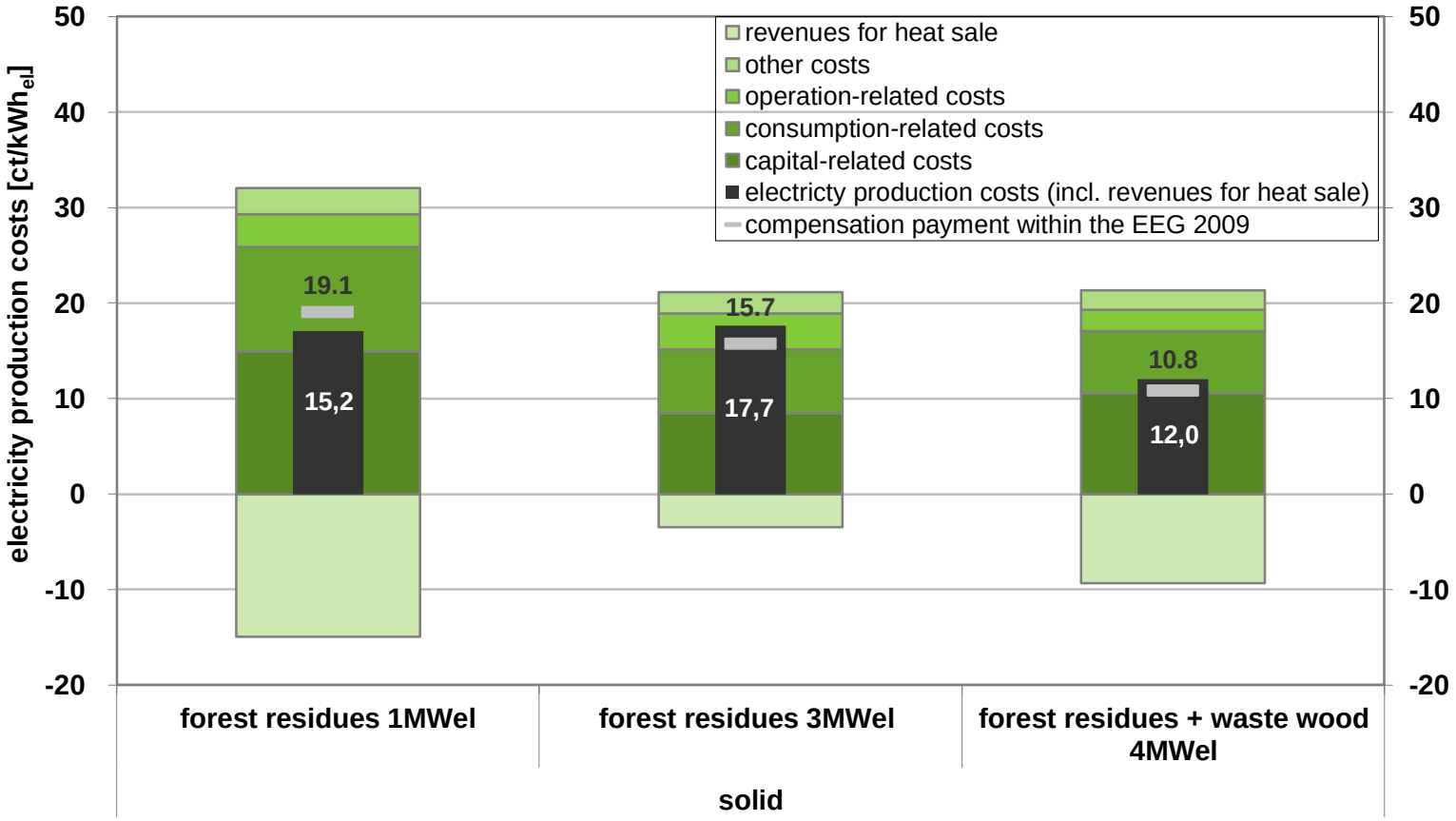
Overview of different tariffs dependent on the average feed-in



- High economies of scale (not for bio-degradable waste)
- Some potentials can be unlocked through small systems (liquid manure)
- Bigger systems use mainly wood residues, waste wood and industrial wood

Results of economic analysis

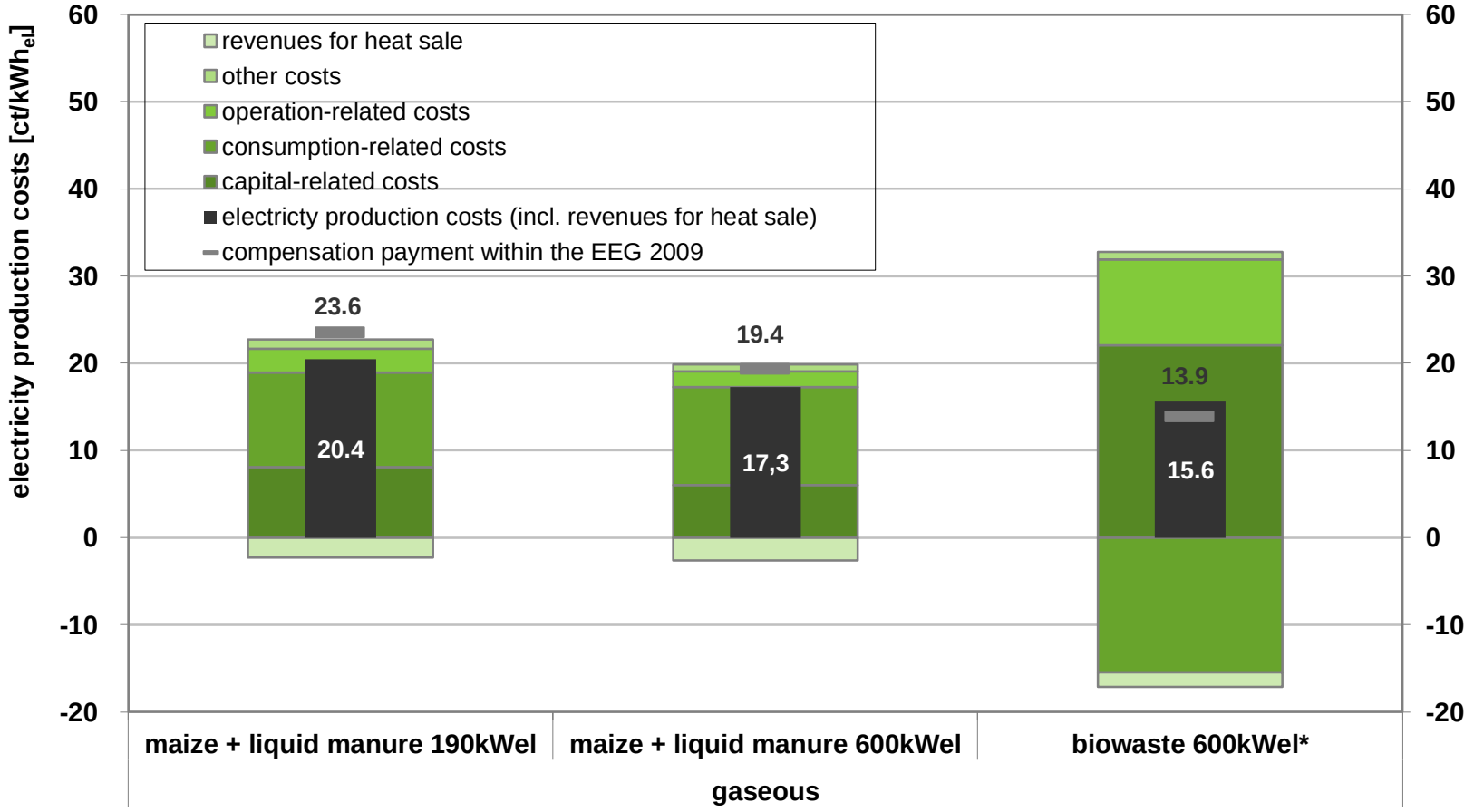
electricity production costs of solid biomass



- The investment of the bioenergy plant and the consumption of raw materials have the main impact on the total electricity production costs
- The revenues for heat sale is often the determining factor for economic efficiency

Results of economic analysis

electricity production costs of biogas



* negative operation related cost because of waste removal.

- The consumption of raw materials has the high impact on the total electricity production costs

Some basic questions for setting a FIT for biomass

- **Are there any non-used high potentials of biomass?**
- **Are there any competitions around the biomass potentials?**
- **What is the level of available biomass resources at a certain location?**
  - Background: Biomass resources have a very different energy density
  - Biogas substances have gernerally a big moisture content

  ⇨ only short transport distances are suitable

  ⇨ biogas substances have a local market
  - Solid biomass with a low moisture content has a high energy density

  ⇨ larger transport distances are possible

  ⇨ solid biomass substances are traded nationally and internationally
- **Which kind of stakeholder structure is given?**
  - Biogas production in Germany has a mainly agricultural small-scale structure

  ⇨high agricultural added value
  - Due to the technology solid biomass installations have generally larger capacities

  ⇨ larger stakeholders are necessary

Conclusion

- The bioenergy sector is very heterogen with many different sources, technologies and stakeholders
- An excessive or insufficient support of individual plants can occur
- Clear conditions for investors are necessary – especially for farmers
- The cost reductions will not be as high as for wind or PV because of the prices for biomass, but a value chain for the agricultural sector can be created
- The future of biomass use is a system integrated provison
  - Provision of system services – first pools of biogas plants in Germany provide positive and negative secondary balancing power
  - Compensation of volatile renewable energies
  - The introduction of co-incineration in Germany would destroy the established market for solid biomass and will hinder the move towards alternative energies (high emissions of coal)

Many thanks for your attention!

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Overview of the Methodology of the Economic Analysis

Profitability Analysis
Annuity method

- Investment for installation of components and periphery
- Maintenance and repair
- Interest rate
- Period under consideration
- etc.

- Fuel costs
- Auxiliary costs
- Plant capacity
- Full load hours
- Plant efficiency
- etc.

- Service and inspection
- Maintenance
- etc.

- Insurance
- Administration
- etc.

- Heat generation

- Electricity generation

Capital-related costs

Consumption-related costs

Operation-related costs

Other costs

Total annual costs [€/a]

Revenues by-product

Revenues main product

Total annual revenues [€/a]

Annual electricity production → **Electricity production costs [€/kWh]**

Annual electricity production → **Electricity production costs (incl. revenues by-product) [€/kWh]**

Annuity [€/a]
Average gain/loss per period