

Value Creation of Biogas from Agricultural Residues in China -Comparative Analysis between China and Germany

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2nd Economy

**the Largest
carbon emitter**

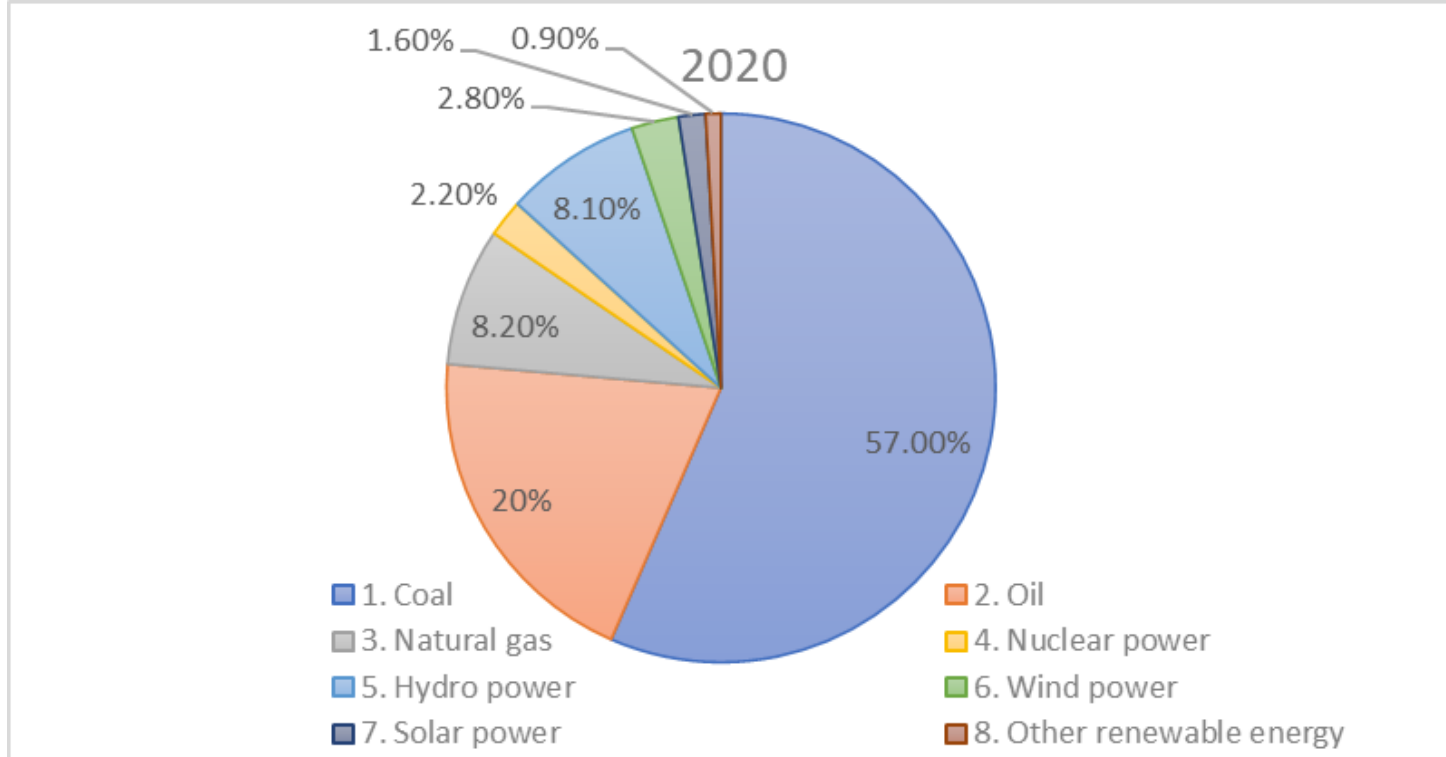
**900-million-ton
straw and 4-billion-
ton livestock
manure yearly**

**largest meat
producer,
consumer, and
importer**

**75,000 large-scale
biogas projects
More than 50 bio-
natural gas projects**

**2030, Carbon peak
2060, Carbon Neutrality**
Agricultural carbon neutrality

Energy Structure in China



Biogas Development in China



Stage 1: Small household biogas projects in rural area

Stage 2: Large and medium-sized biogas projects

Stage 3: Large-scale biogas and bio methane projects for comprehensive utilization of renewable energy production

Problems and Opportunities



Difficulties in

- material collection
- storage
- transportation
- utilization

Cost pressure

≠ an effective whole
industry chain

Subsidy
Framework conditions

the long-term
sustainable operation
ability is low

Shortcomings in
business model

Value Creation of Biogas



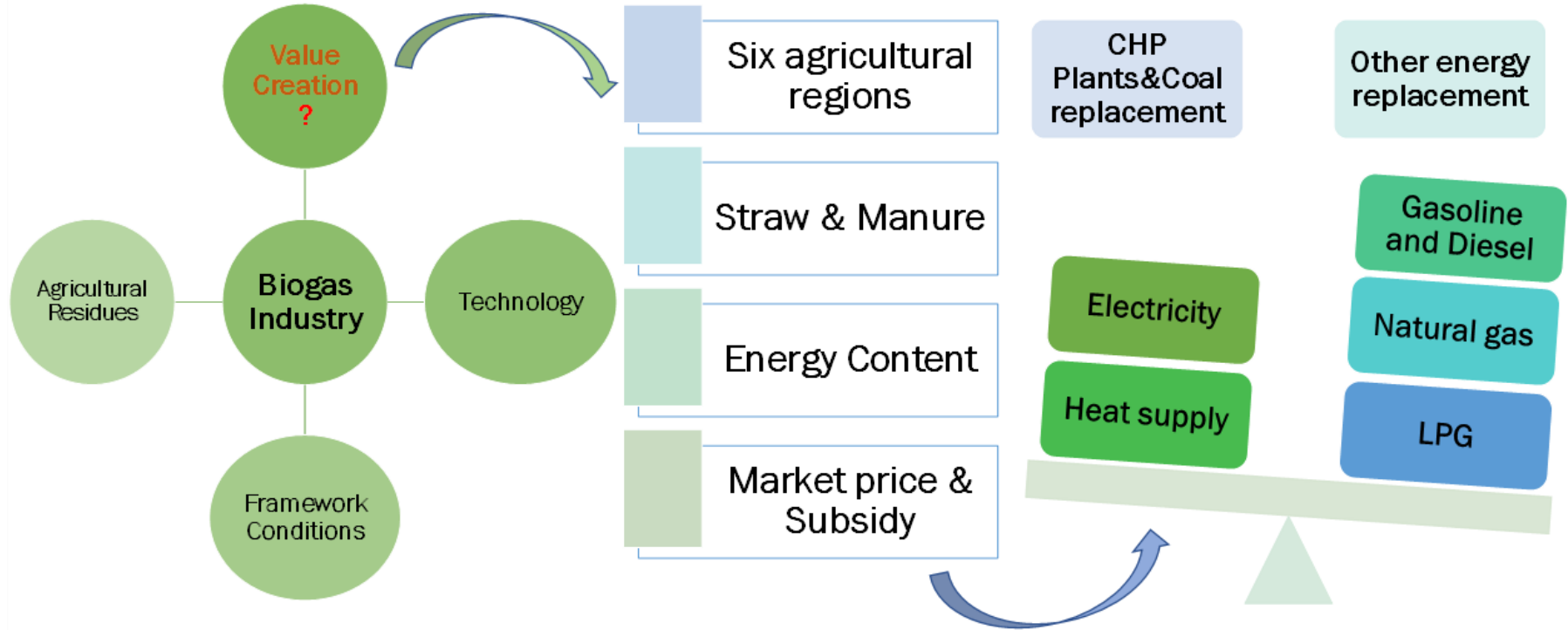
What is value creation?

- a common concept in business
- the core purpose of economic actions
- the value something created

What is value creation of biogas?



- How much value biogas can create when it is used for different purposes
 - Fossil fuel replacement
 - Value in energy market
 - Rural Revitalization

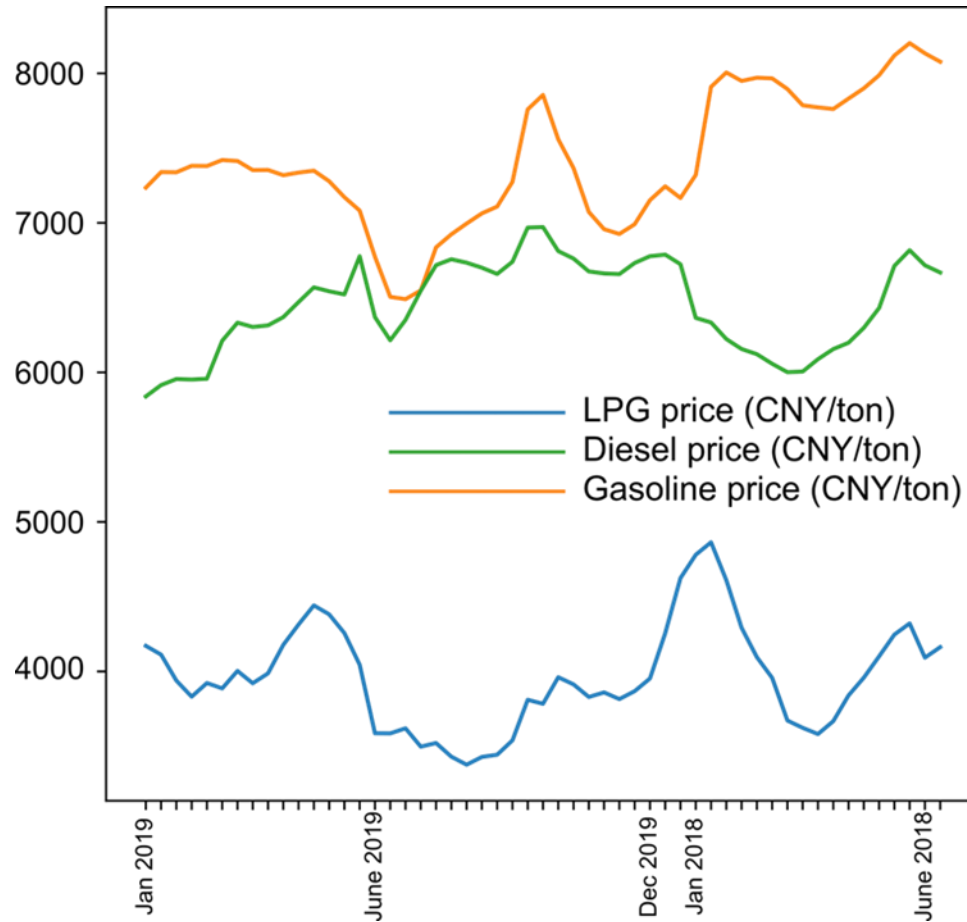
Methodology



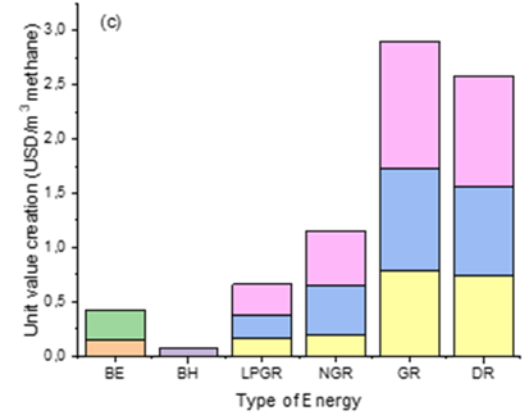
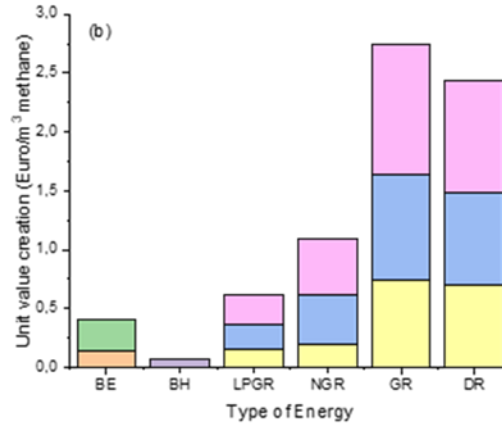
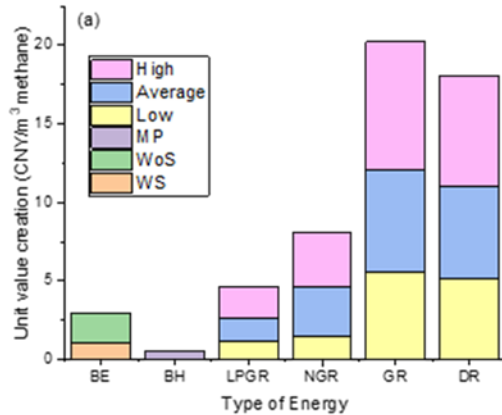
Biogas electricity price and subsidy by province



Biogas electricity price	Provincial desulfurization elec price	Subsidy	Special local bonus/price
Northeast power grid	√	√	
North China power grid	√	√	
*Hebei			
East China power grid	√	√	
*Zhejiang	√	√	
Central China regional grid	√	√	
Northwest regional grid	√	√	
Southern regional grid	√	√	



Unit Value Creation



WS: with subsidy
WoS: without subsidy
MP: market price
Low, average, high (energy price)

BE: biogas electricity
BH: biogas heat
LPGR: LPG replacement
NGR: Natural gas replacement
GR: Gasoline replacement
DR: Diesel replacement

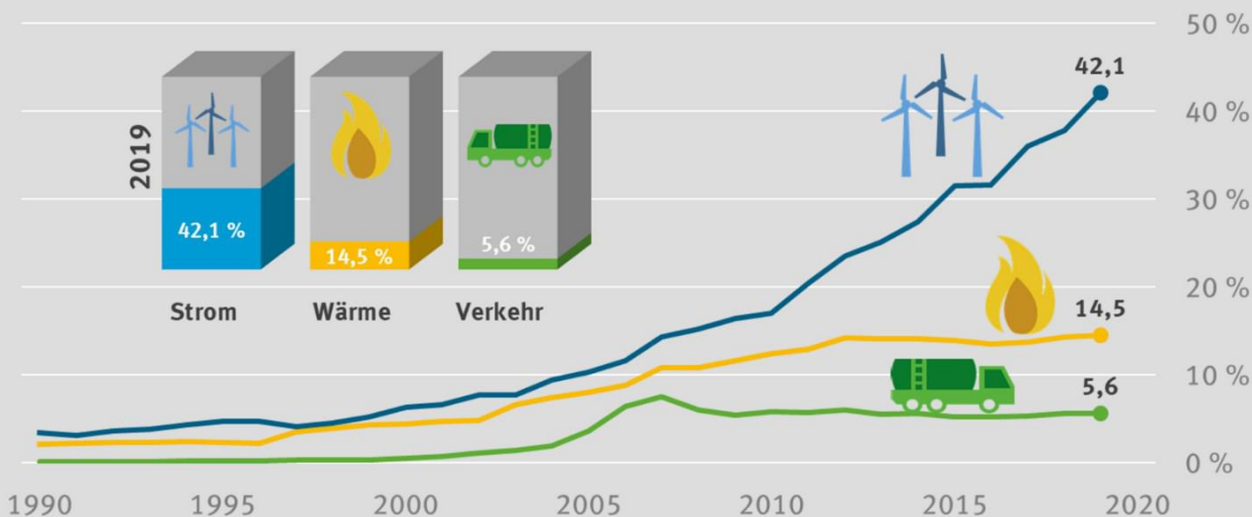
Discussion



- ✓ Vehicular use is the highest (gasoline>diesel), and followed by natural gas, and LPG
- ✓ Electricity of CHP plant is low, and heat supply is the lowest
- ✓ Higher provincial bonus promotes higher value creation
- ✓ Work opportunity for both well-educated and less-educated people; rural vitalization

RES in Germany (Electricity, Heat, Transport)

Erneuerbare Energien: Anteile in den Sektoren Strom, Wärme und Verkehr

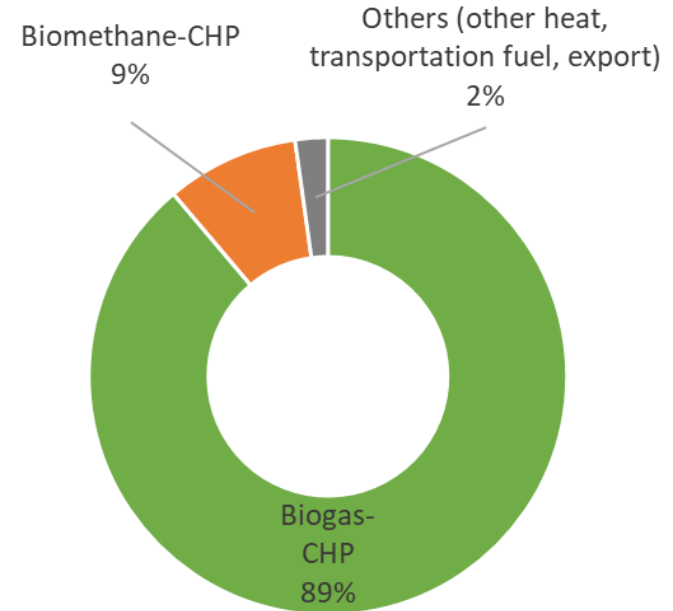


Heat and transport sectors predominantly provided by biomass

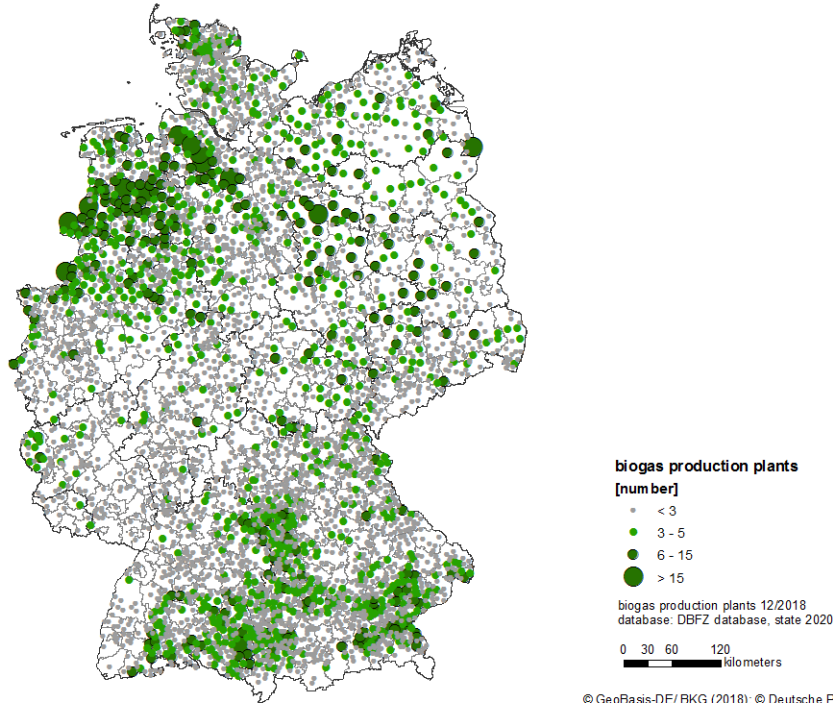
Electricity sector - Bioenergy (2020): 18% share on RES; (8% of total energy demand)

Biogas and Biomethane production in Germany

- ~ 10 billion m³ biogas production incl. biomethane (> 100 TWhHs)
- Feed-in of biomethane around 10 TWhHs
- Biogas and biomethane primarily used in the CHP sector
- Biomethane as a transportation fuel is primarily generated from waste and residues; **Biomethane as a fuel plays a minor role, but is increasing**; in total in 2020: ~884 GWh (compared to 389 GWh in 2018) (BMWi 2021)



Biogas plants in Germany



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Biogas plants (2020) ~ 9,000 plants
(including shutdowns)

- ~ 8,800 on-site electricity conversion of biogas
- ~ 230 upgrading to biomethane

Installed electrical capacity

→ 6,9 GWe

Gross electricity production

→ 31,3 TWh_e

Heat supply

→ 16,7 TWh_{th}

Bioenergy in the energy transition -general trends



- Electricity: focus on flexibilisation & system services (wind & solar as the backbone of electricity production); increasing quality criteria of demand-driven electricity provision (daily / seasonal)
- Heat: use & market more heat with higher value (increase overall efficiency)
- Transport: bio-based fuels provide GHG reductions (e.g. internal vehicles)
- Focus on agricultural residues and waste, reduce share of energy crops (maize cover); sustainable cultivation of biomass (limited)
- GHG reduction: better utilization in the agricultural sector (e.g. liquid manure) & efficiency increase



Thank you for your attention

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