Scaling up bio methane on the pathway to a net zero future
WBA Webinar Series – Technology
13th October 2021 // 11.00 – 12.30 CEST

Fachverband BIOGAS
German Biogas Association
Association Allemande du Biogaz
Asociación Alemana de Biogás
www.biogas.org

Biomethane in Germany - Current Status and Ways ahead

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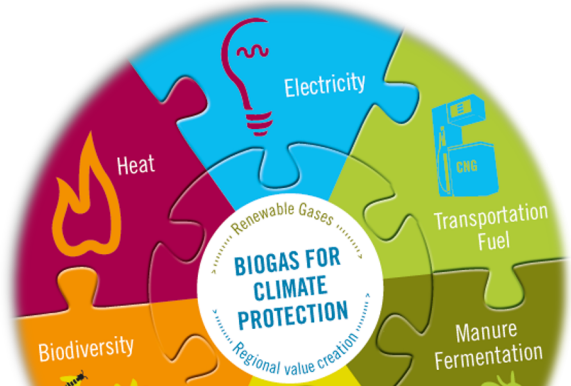

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Agenda

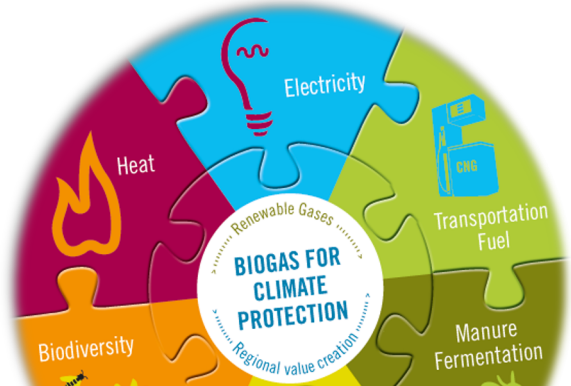
Who we are

Status quo of biomethane production and use

EU- and nationwide legal framework

Business examples

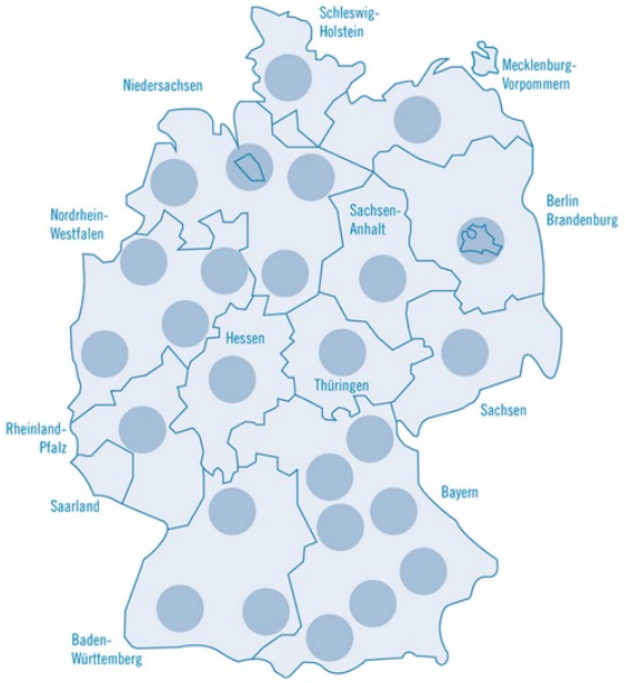
Summary and outlook



The German Biogas Association: Our profile

Fachverband BIOGAS

4,650+ members



- Plant operators
- Manufacturers
- Research institutes
- Public Authorities
- Consultants
- dedicated individuals
- … and you?

EBA European Biogas Association

40+ employees

Our Goals:

Establishing biogas as an important component for climate protection

- Definition of legal frameworks and guidelines
- Information exchange, knowledge transfer
- Advocating on EU-, national and regional levels

Good reasons for biomethane as a fuel

- Biomethane achieves the highest CO_2 savings of all biofuels
- Biomethane from residues and waste materials incl. manure is a cost-effective form of CO_2 avoidance in the transport sector
- Natural gas / biomethane vehicles have low NO_X / particulate matter emissions
- Only 25 percent of the manure produced in Germany is utilised in biogas plants
- Natural gas network infrastructure available
- Tax privileges and toll exemption for biomethane
- Energy carriers with high energy density that can be stored, distributed and combusted will continue to be necessary in many sectors (e.g., ships, airplanes, buses, trucks, …)

How much biomethane ends up in Germany's transport sector?

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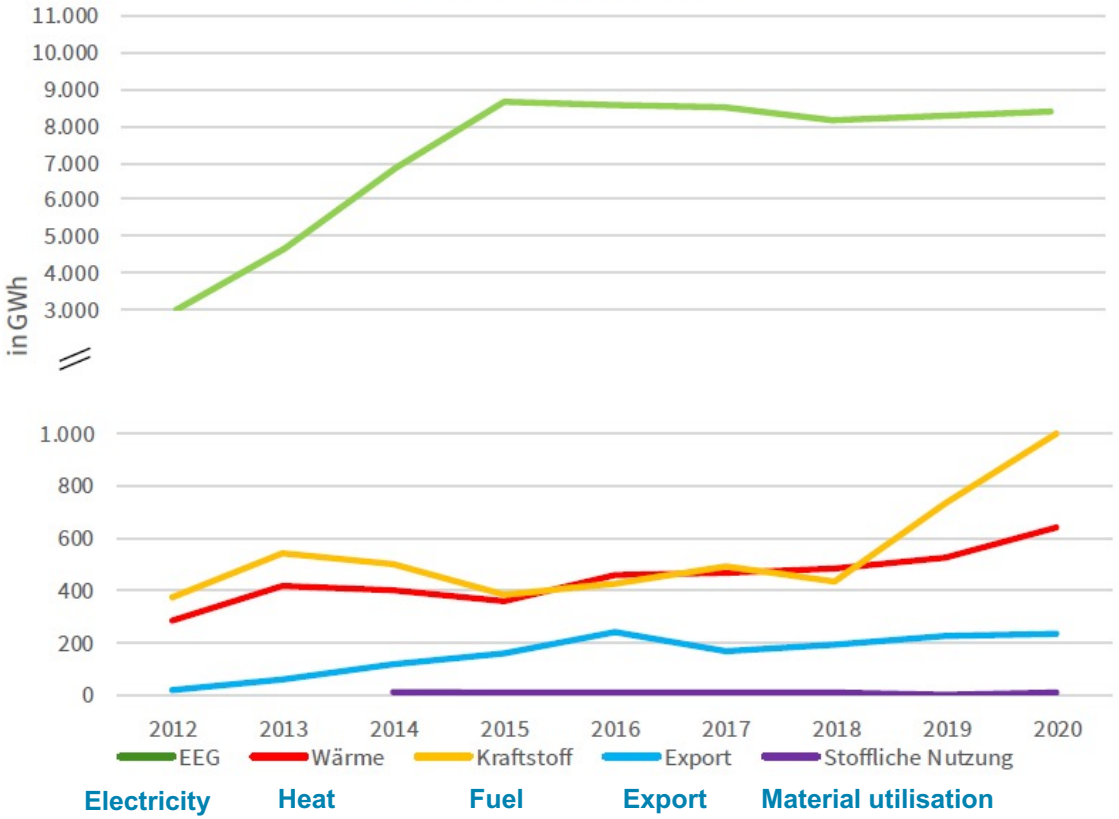
Biomethane Commercialisation



Year	Biomethane Feed-in [GWh]	Thereof fuel utilisation [GWh]
2020	9,847	1,000
2019	9,823	700
2018	10,108	389
2017	9,893	380
2016	9,318	379

+40%

+70%

Source: dena Branchenbarometer Biomethan 2021

More capacity for biomethane fuel is available:
40 % biomethane injection into the national grid could reach 40 % by 2030
made alone of waste and manure

How is biomethane used in transport?

- **Bio-CNG**
  - Compressed Biomethane
  - For passenger cars and light vans

Possibly no market anymore by 2035:
Ban of all internal combustion engines in planning

- **Bio-LNG**
  - Liquefied Biomethane
  - primarily for heavy goods traffic and maritime or inland waterway traffic

- **Decision making criteria**
  - Local offtakers (own consumption, vehicle fleets, public access)
  - CAPEX & OPEX
  - Incentives, tax exceptions
  - Long-term outlook (legal framework)

Good chances of being recognised as a climate-neutral fuel

Legal Framework

- **Overall framework: “Fit for 55 Packet”**
  - Target: GHG emissions reduction by 55% until 2030, climate neutral by 2050
  - Presentation on 14.07.2021, currently under revision
  - Reformed or new directives and regulations of the European Commission relating to EU climate policy

Clean Energy GHG Emissions

- RED II Revision (RED III)
- Energy Efficiency Directive (EED)

CO_2/GHG Taxation

- ETD (Energy Taxation Directive)
- LULUCF (Land Use, Land Use Change and Forestry)
- ETS
- Effort Sharing Regulation
- Carbon Border Adjustment Mechanism

Transport

- DAFI (Revised Alternative Fuels Infrastructure Directive), CVD
- FuelEU Maritime Initiative
- ReFuelEU Aviation Initiative

RED II: Emissions from biomethane as fuel

Default values in RED II for GHG Emissions (fossil comparator 94 g $CO_{2äq}$/MJ)

Substrate	g CO_{2eq}/MJ
Manure	-100
Biogenic waste	14
80 % manure + 20 % maize	-12

Disaggregated values along the process chain

Disaggregated default values for biogas for the production of electricity

Biomass fuel production system		Technology	TYPICAL VALUE [g CO_2eq/MJ]					DEFAULT VALUE [g CO_2eq/MJ]				
			Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits	Cultivation	Processing	Non-CO_2 emissions from the fuel in use	Transport	Manure credits
Wet manure (1)	case 1	Open digestate	0,0	69,6	8,9	0,8	– 107,3	0,0	97,4	12,5	0,8	– 107,3
		Close digestate	0,0	0,0	8,9	0,8	– 97,6	0,0	0,0	12,5	0,8	– 97,6
	case 2	Open digestate	0,0	74,1	8,9	0,8	– 107,3	0,0	103,7	12,5	0,8	– 107,3
		Close digestate	0,0	4,2	8,9	0,8	– 97,6	0,0	5,9	12,5	0,8	– 97,6
	case 3	Open digestate	0,0	83,2	8,9	0,9	– 120,7	0,0	116,4	12,5	0,9	– 120,7
		Close digestate	0,0	4,6	8,9	0,8	– 108,5	0,0	6,4	12,5	0,8	– 108,5

EUROPEAN UNION

THE EUROPEAN PARLIAMENT THE COUNCIL

Brussels, 21 November 2018
(OR. en)

VTypical and default values for biomethane 2016/0382 (COD) PE-CONS 48/18

Biomethane production system	Technological option	Greenhouse gas emissions – typical value (g CO_2eq/MJ)	Greenhouse gas emissions – default value (g CO_2eq/MJ)
Biomethane from wet manure	Open digestate, no off-gas combustion[1]	-20	22
	Open digestate, off-gas combustion[2]	-35	1
	Close digestate, no off-gas combustion	-88	-79
	Close digestate, off-gas combustion	-103	-100
Biomethane from maize whole plant	Open digestate, no off-gas combustion	58	73
	Open digestate, off-gas combustion	43	52
	Close digestate, no off-gas combustion	41	51
	Close digestate, off-gas combustion	26	30
Biomethane from biowaste	Open digestate, no off-gas combustion	51	71
	Open digestate, off-gas combustion	36	50
	Close digestate, no off-gas combustion	25	35
	Close digestate, off-gas combustion	10	14

Relevance of the RED and the GHG balance in Germany's transport sector

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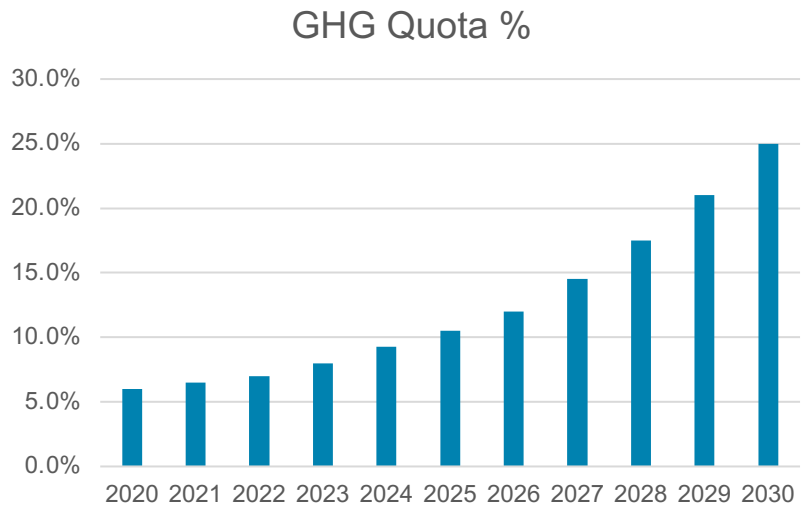
- GHG quota replaces energy quota since 2015
  - since 2015 : 3.5 % GHG reduction
  - since 2017 : 4.0 % GHG reduction
  - since 2020 : 6.0 % GHG reduction
- **Everyone who distributes fuel must prove quota fulfilment!**



Year	Minimum for energy purposes, double credit for amounts above the minimum	2022	2023	2024	2025	2026 2027	2028 2029	2030
Advanced biofuels quotas (RED II Annex IX Part A)		0.2 %	0.3 %	0.4 %	0.7 %	1.0 %	1.7 %	2.6 %

- The majority of quotas are fulfilled by blending
  - biodiesel (rapeseed / soy), UCO (used cooking oil) or HVO (palm oil phase-out by 2026)
  - Bioethanol
- Biomethane as fuel can be used to fulfill quotas
  - **Non-compliance is penalised: 0.47 €/kg CO_2 = 470 €/t CO_2 (raises to 600 €/t CO_2)**
  - Comparison stock exchange EEX: 55 €/t CO_2 interesting range!

Operator and business model concepts

- **Acceptance of raw biogas or biomethane by traders or distributors**
  - Low internal efforts
  - Market price dependence

- **Own yard gas station**
  - For internal and/or public use
  - Bio-LNG more expensive to produce
  - GHG Emissions trading possible for distributors to end-users

- **Feed-in to gas grid**
  - Moderate preparation effort
  - Purchase agreement with a dealer or gas station operator

    → In balance sheet terms, the operator extracts 100 % biomethane

- **Pooling of biogas/-methane plants**
  - Merger of several plant operators:
    - Central processing into bio-methane
    - Central processing to bio-C/LNG

Example Bio-CNG gas station grid

- **Biogas plant in Northern Germany**
  - Supplies 14 gas stations (partly self-owned)
  - Clients are logistics vehicle fleets, mobile care services, public transport, individuals – in a local context

- **Trade with THG quota**
  - Offtakers such as companies with a high CO_2 footprint
  - 2-3 times higher revenues as the earnings from the gas station itself

Bio-CNG gas station operator

PA
Price & Quantity

Additional earning
(GHG trade)

Quota subjected company
(e.g., mineral oil company)

H. Seide FvB

Example Bio-LNG gas station for transport fleet

- **Pilot project**
  - Shell
  - EDEKA Hannover-Minden (Lower Saxony)
  - IVECO

- **Goals**
  - Vehicle fleet conversion
  - 100 % Bio-LNG from 2023 onwards

Source: gas24.de (Shell, EDAKA Minden)

- **Key data tractor unit**
  - Two 540 l tanks

  → up to 1.600 km range

https://www.gas24.de/cms/603-0-edeka-stellt-mit-shell-und-iveco-auf-bio-lng-fuer-lkw-transporte-um.html?article_id=603&clang=0

Conclusion and outlook

- Implementation of RED II by 2021 offers opportunities for biogas/biomethane, especially for renewable gases from manure, biogenic waste, straw, etc.
- Revision of Fit for 55 package, RD II->III, CVD
- Further development also depends on the design of the political framework
  - Extension of toll exemption (CO_2 component expected)
  - Promotion of vehicles & fleet conversion
  - Energy tax and trade regulations, also EU-wide

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition

(45) LNG, including liquefied biomethane, might also offer a cost-efficient technology allowing heavy-duty vehicles to meet the stringent pollutant emission limits of Euro VI standards as referred to in Regulation (EC) No 595/2009 of the European Parliament and of the Council (3).

(48) An appropriate number of LNG and CNG refuelling points accessible to the public should be put in place by 31 December 2025, at least along the TEN-T Core Network existing at that date and, after that date, on the other parts of the TEN-T Core Network where these are made accessible to vehicles.

(58) In the application of this Directive, the Commission should consult relevant expert groups, including at least the European Expert Group on Future Transport Fuels, consisting of experts from industry and civil society, as well as the Joint Expert Group on Transport & Environment, which brings together experts from the Member States.

- Biomethane is in direct competition with other options
  – hence the options need to be technology neutral and utilised where applicable now

→ Well to wheel vs tailpipe approach

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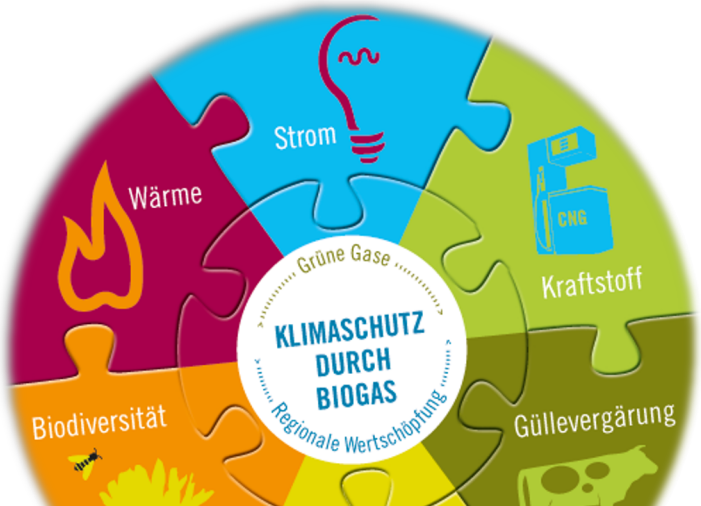
Thank you for your attention!
Any questions or comments?

BIOGAS Convention Digital
22. – 26. November 2021

BIOGAS Convention & Trade Fair
07.–09. Dezember 2021, Nürnberg

www.biogas-convention.com



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Business model

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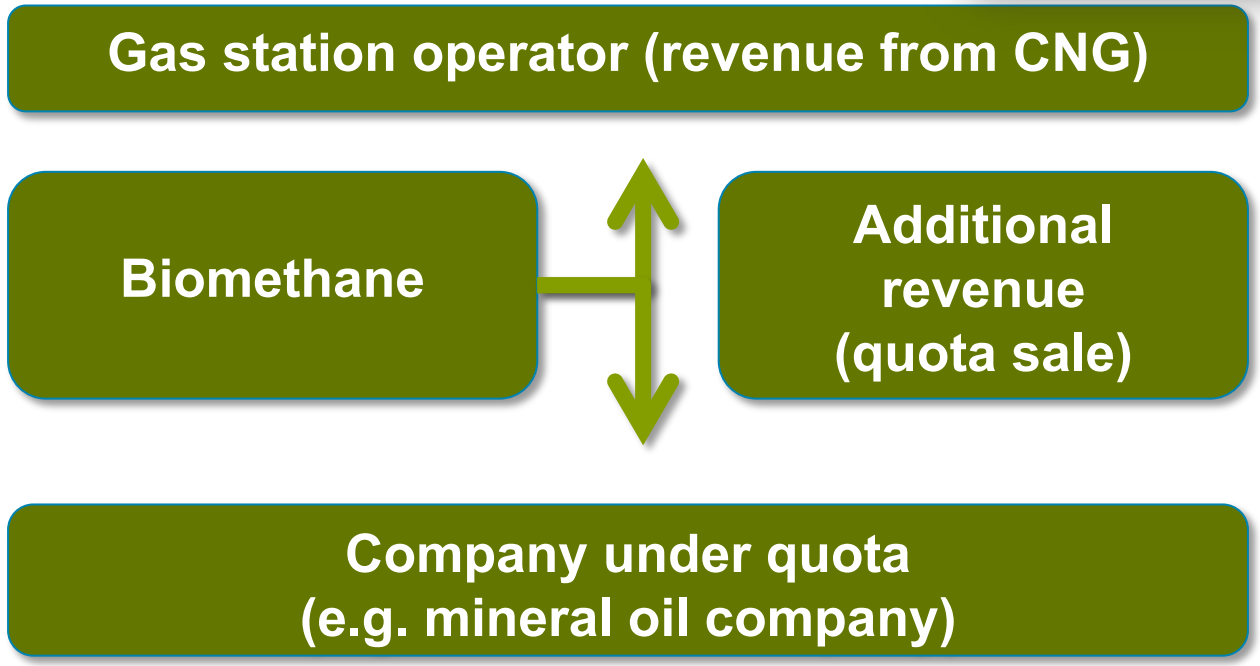


Long-term market situation for the sale of biomethane (from waste):
Revenue from sale of physical biomethane = 2 ct/kWh
Revenue from the sale of the GHG quota = 4 ct/kWh
Costs of biomethane production (5-7 ct/kWh) covered only thanks to quota

But: without incentives it does not work

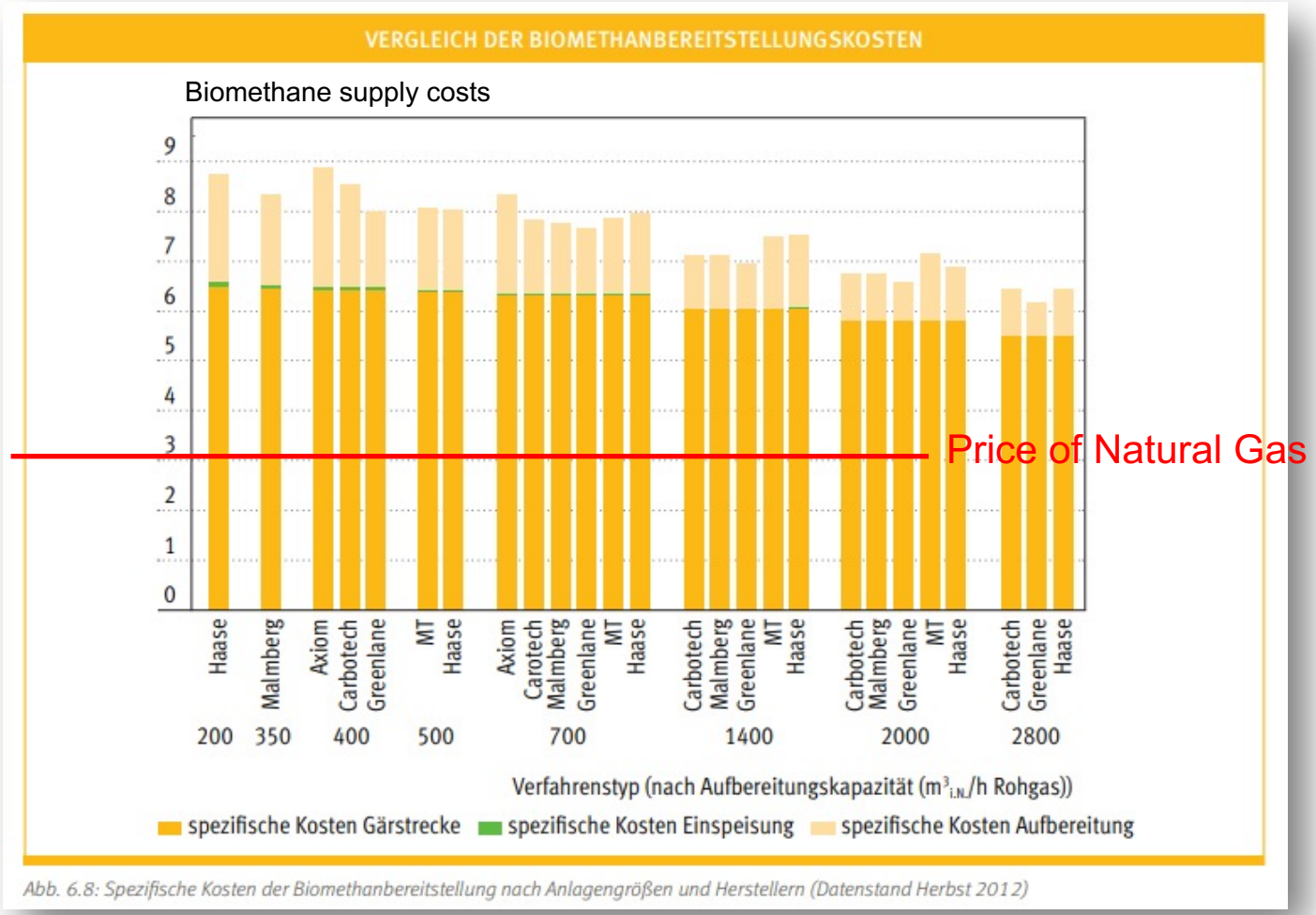


Abb. 6.8: Spezifische Kosten der Biomethanbereitstellung nach Anlagengrößen und Herstellern (Datenstand Herbst 2012)

Quelle: FNR (2014), Leitfaden Biogasaufbereitung & -einspeisung

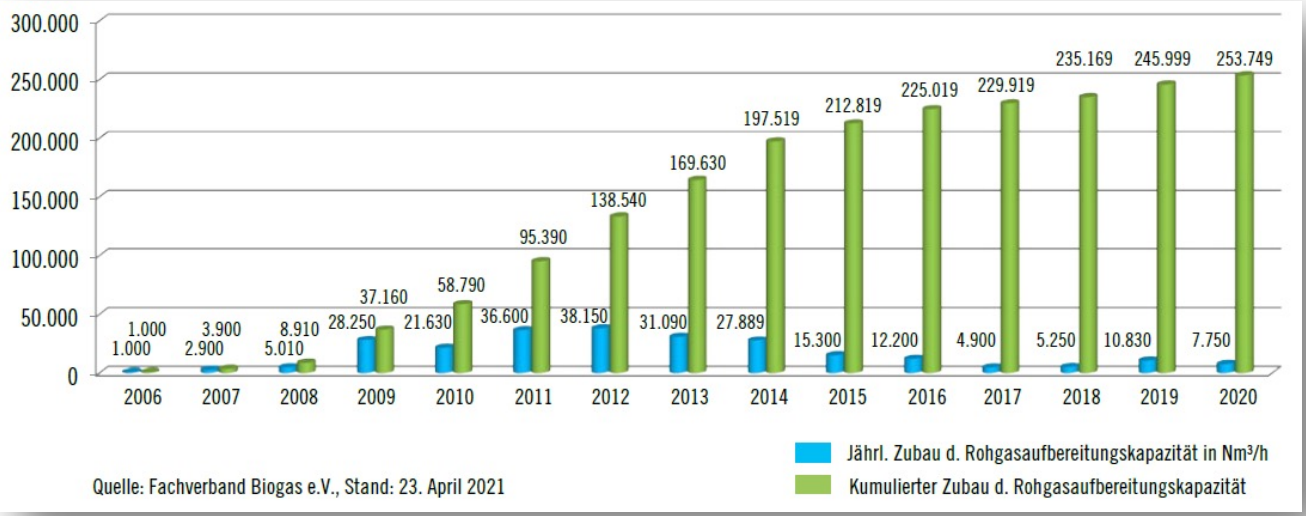
How much biomethane is produced?

Feed-in volume and average full-load hours of German biomethane plants

	2016	2017	2018	2019	2020
Feed-in volume, GWh	9.318	9.893	10.108	9.823	9.847
average full-load hours		7.526	7.624	7.672	7.234

Quelle: Dena 2021; Branchenbarometer Biomethan 2021

Development of raw gas processing capacity in m³ in Germany since 2006



Annual Plant construction:

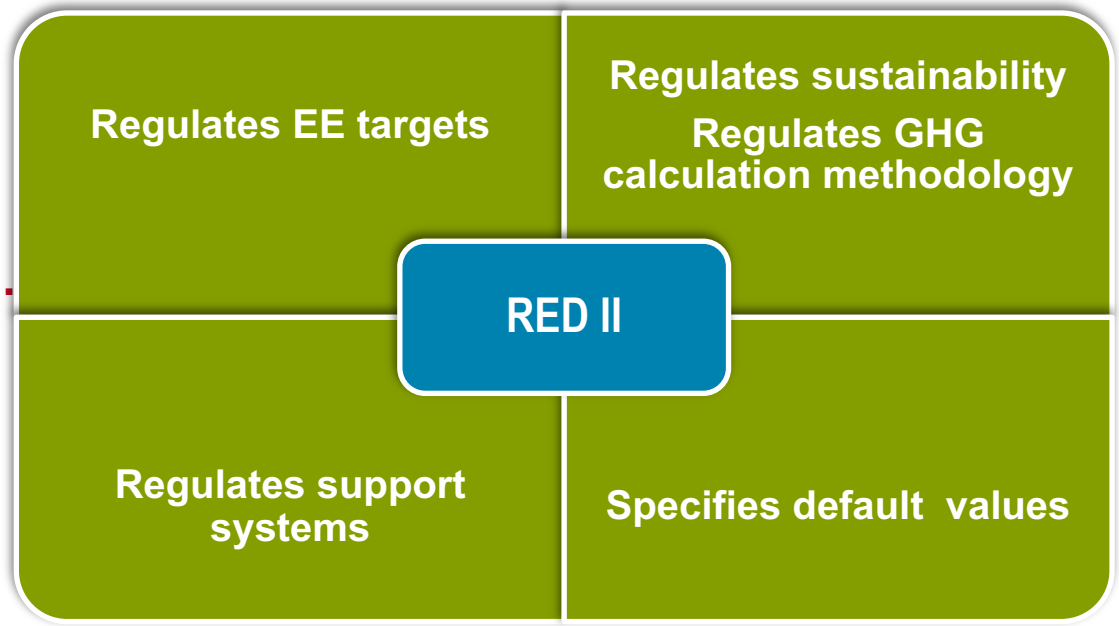
2020 → 6 St.

2019 → 7 St.

2018 → 7 St.

What is RED II and what does it regulate?

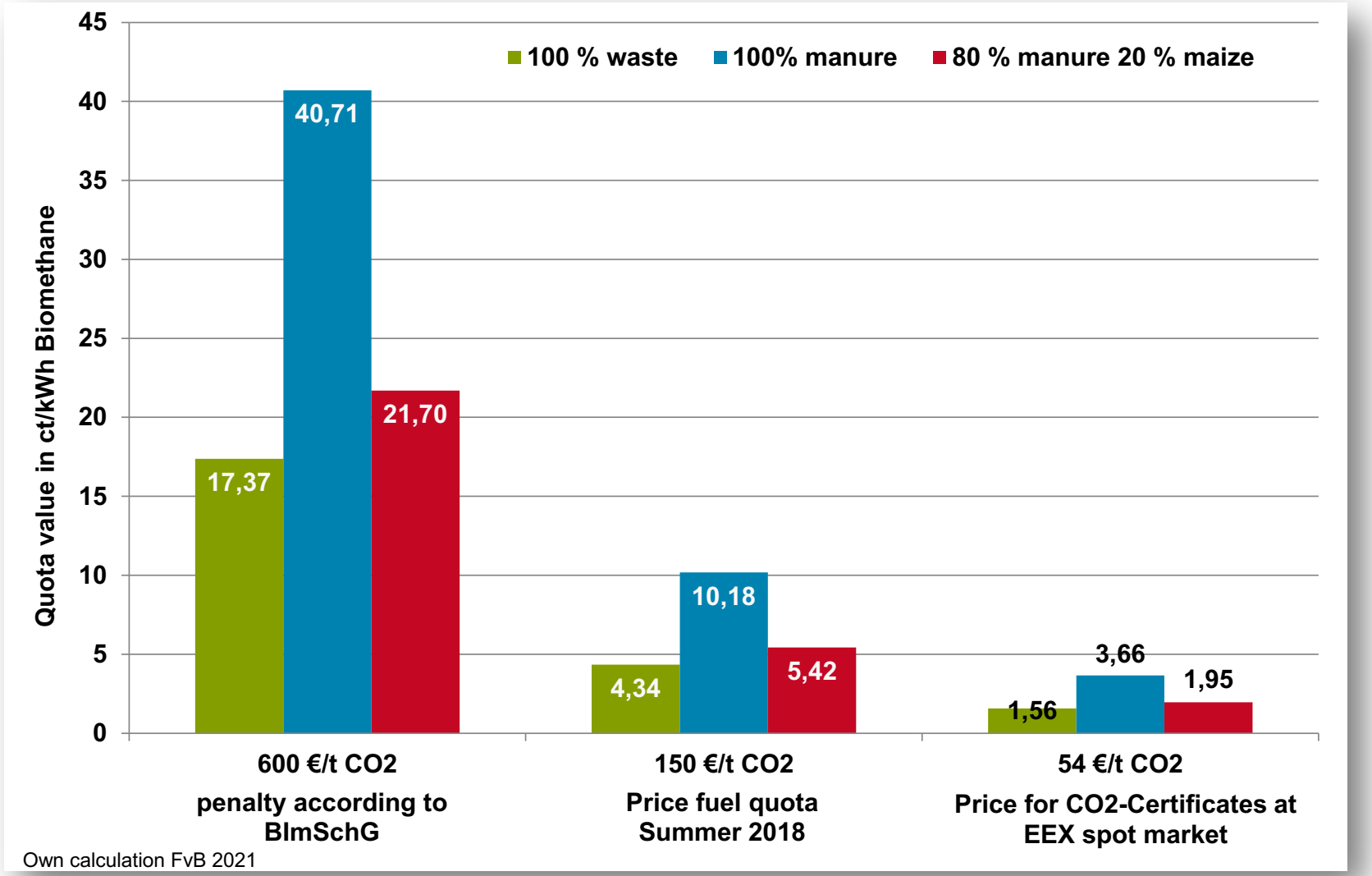
- The Renewable Energy Directive (2009/28/EC) (RED I) has been the basis of EU renewable energy policy since 2009
- RED I was comprehensively amended by Directive (EU) 2018/2001 ➔ RED II
- RED II is to be implemented in national law by June 30, 2021. RED I will expire on July 1, 2021
- Targets:
  - Gesamtziel der EU: 32%-Beitrag der EE bis 2030
  - **Only energy from bioenergy can be counted towards the 32% target if these sustainability criteria are met. With RED II, this now also applies to electricity, heating & cooling., heating & cooling.**
- **Exceptions: Plants below 2 MW for biogas** (or below 20 MW for solid biomass)
- Sustainability criteria for biofuels including biomethane introduced in RED I



Innovations of RED II in the transport sector

- Transport target 14%, each member state sets own pathway
- Sub-quota for biofuels and biogas from ANNEX IX, Part A 0.2% in 2022, 1% in 2025, and 3.5% in 2030; including:
  - Liquid manure/manure
  - Straw
  - Biowaste
- Default values for biogas can be found in the annexes of RED II: ANNEX VI will regulate the calculation of biomass fuels in the future & specifies default values
- New: substrates can be mixed
- New: credit for avoided methane emissions of manure storage
- But: default values only for waste, manure, corn and their mixtures → operators must calculate the GHG-balance individually

Impact of RED II on economic profitability



Own calculation FvB 2021

What is the status of national implementation?

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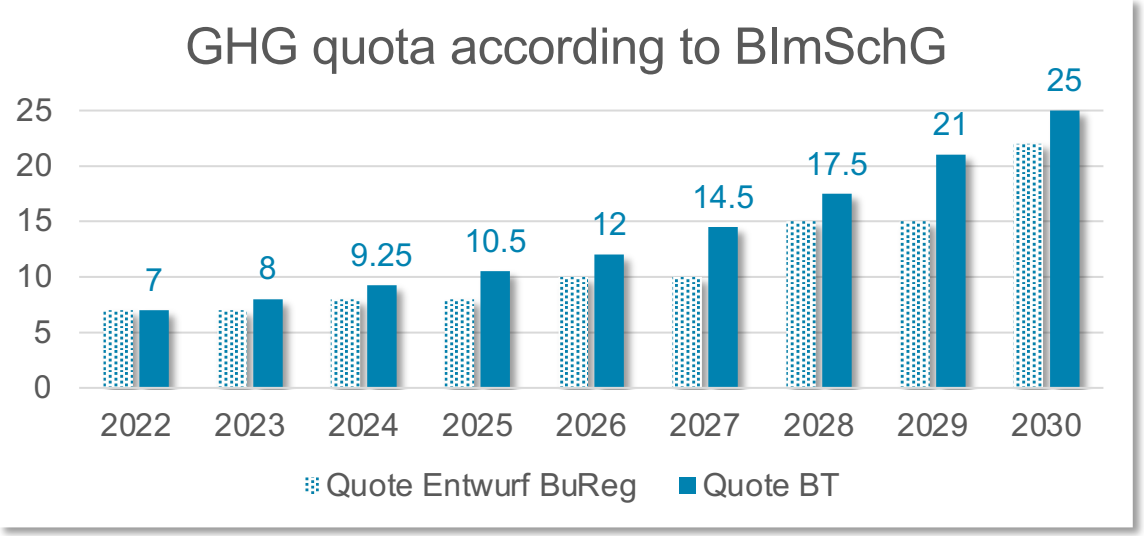
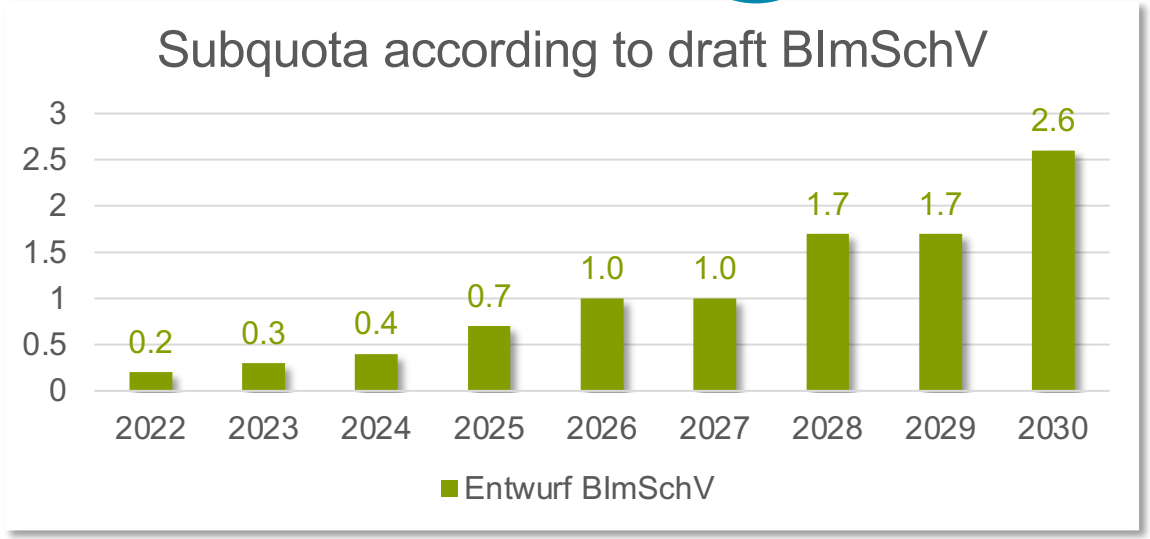
- National implementation is ongoing and is decisive whether a business model emerges in the fuel sector
- Law on the further development of the greenhouse gas reduction quota in the Federal Immission Control Act (BImSchG) passed in May
  - Higher greenhouse gas reduction quotas
  - Higher penalties (main quota: 450 → 600 €/t CO2; sub-quota 19 → 45 €/GJ ≈ 160 €/MWh)
  - Preparation of double counting of advanced fuels.
  - Accounting of biogenic hydrogen
- Draft version of 38th BImschV (not yet adopted)
  - Definition of sub-quota
  - Definition of double counting

„(4) Mengen an fortschrittlichen Biokraftstoffen, die den Mindestanteil nach Absatz 1 in Verbindung mit Absatz 2 übersteigen, werden ~~bis zu einem Anteil von 1,75 Prozent~~ mit dem Doppelten ihres Energiegehalts auf die Erfüllung der Verpflichtung zur Minderung der Treibhausgasemissionen angerechnet. Bei der Be-

Source: Entwurf 38. BImSchV aus BMU 2021

Evaluation of the quotas





- Evaluation of the sub-quota (36 PJ = 10 TWh):
- Actual production biogas ≈ 360 PJ = 100 TWh
- Actual production biomethane ≈ 36 PJ = 10 TWh
- Subquota 0.2 % from 2022 ≈ 3.5 PJ = 1 TWh complete actual fuel production
- Sub-quota 2.6% from 2030 ≈ 46 PJ =12.7 TWh more than complete current biomethane production

Source: nach DBFZ 2021