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MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Biogas – Technology for Solid ("Dry") Digestion – Sustainability, Trends and Examples

- Kirchberg, 26. May 2020
- Michael Köttner
- International Biogas and Bioenergy Centre of competence, IBBK

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Facilitator:
eclareon

International Biogas and Bioenergy Centre of Competence IBBK

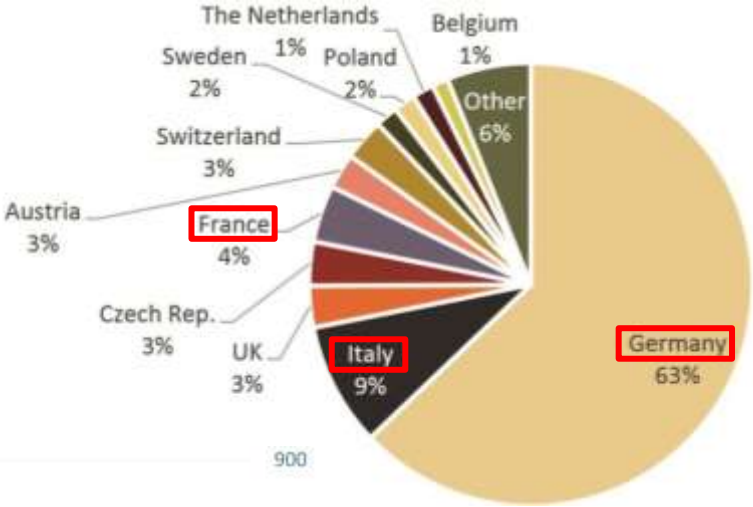
- Know-How transfer (international workshops, conferences, study tours, training)
- Technical support especially with dry digestion, lagoon technology, small scale installations
- Contacts to experts in planning, design and construction
- Contacts to specialized companies
- Networking with members in different regions nationally and internationally
- Origin in Organic Biogas

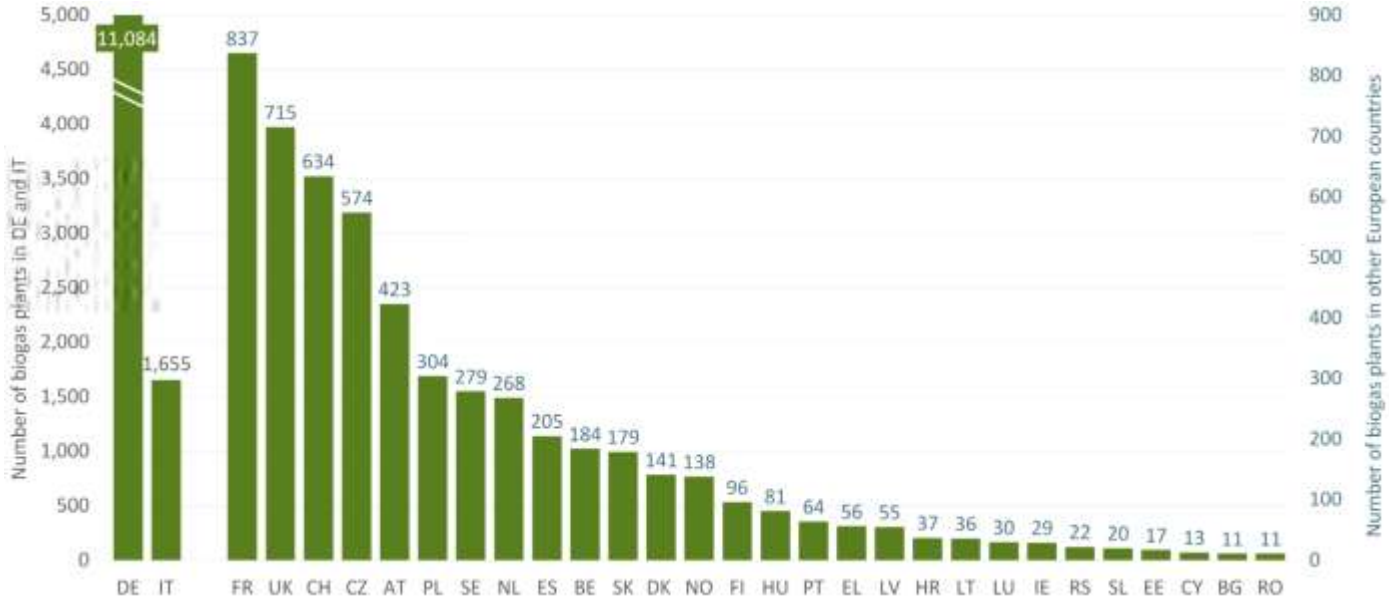
Content

1. Overview of Biogas and Biomethane Production in Europe
2. Feasible technology options for dry and wet residues
3. Economic success factors
4. Case studies of wet and dry digestion in India and Germany

Number of biogas plants in Europe

- 18,202 biogas plants in Europe
- 11,082 MWel total installed electric capacity





EBA Statistical Report
European Overview 2019

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Number of biomethane plants per country

31 countries in Europe have biogas plants, but only 17 have upgrading units to produce biomethane.

18,202 biogas plants in Europe
610 biomethane plants

Germany is the market leader for both biogas and biomethane plants

EBA Statistical Report
European Overview 2019

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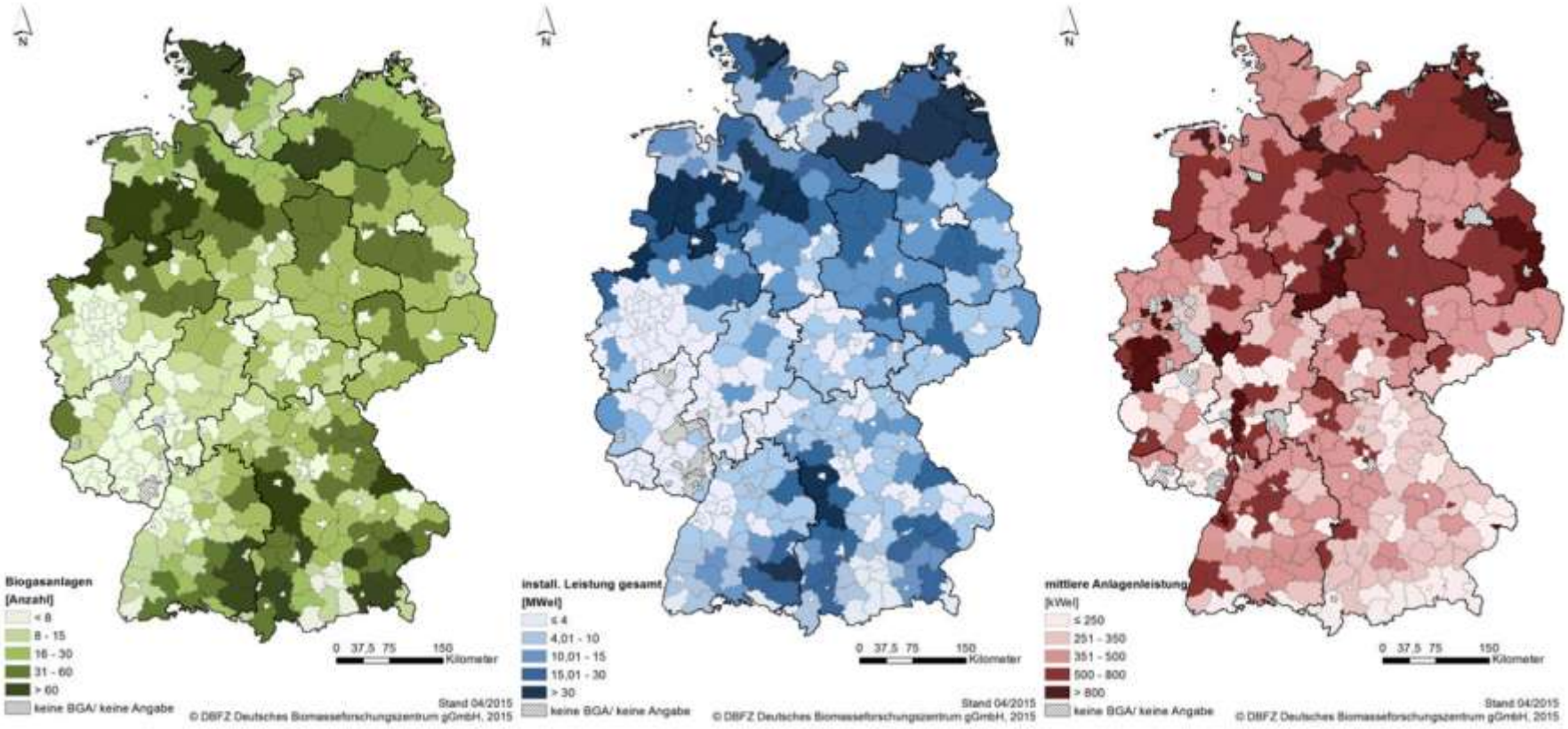
Biogas plants in Germany



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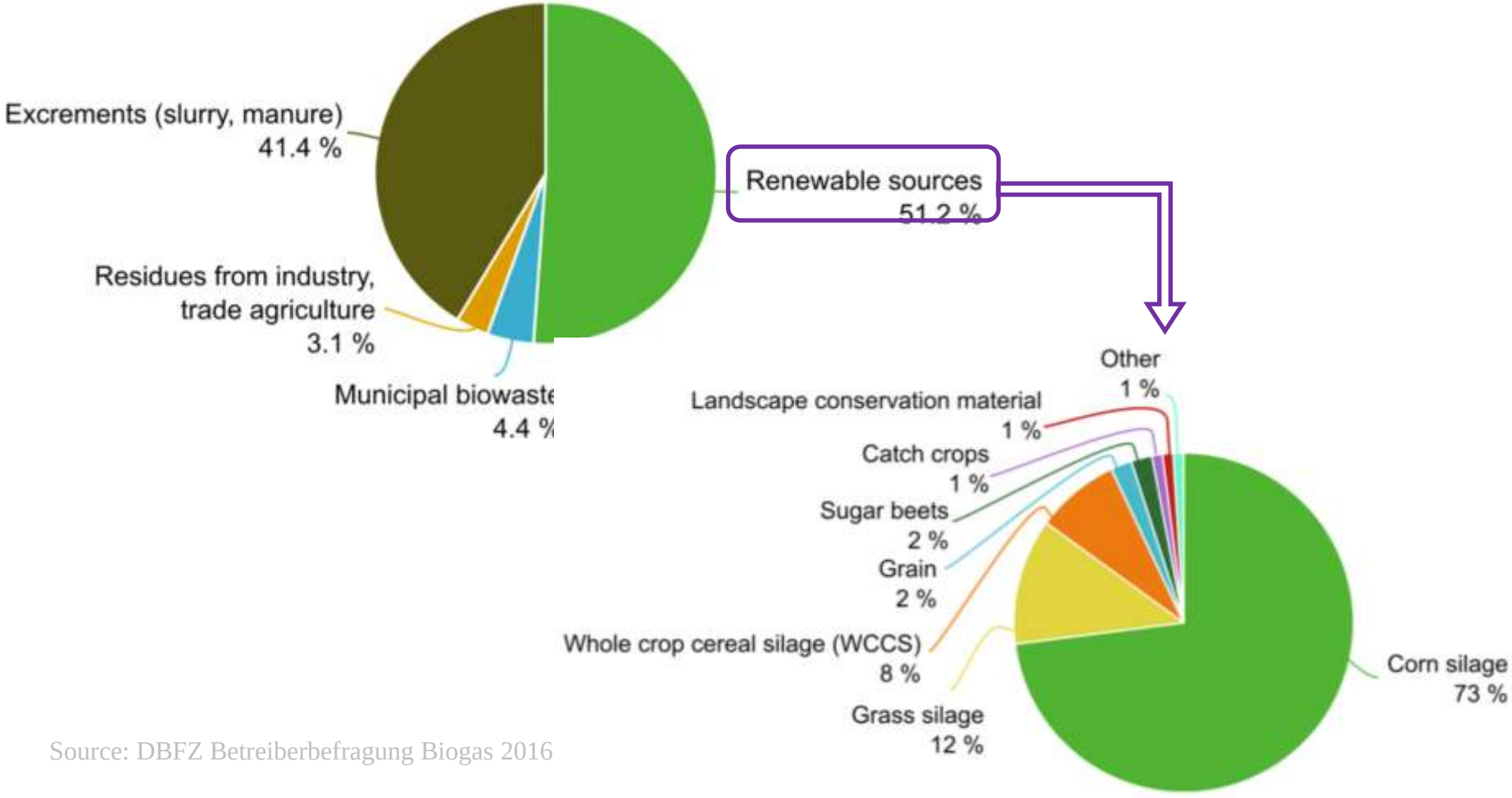
Feedstock for biogas production in Germany

9 009 biogas plants with a total installed electric capacity of 4 166 MWel



Source: DBFZ Betreiberbefragung Biogas 2016

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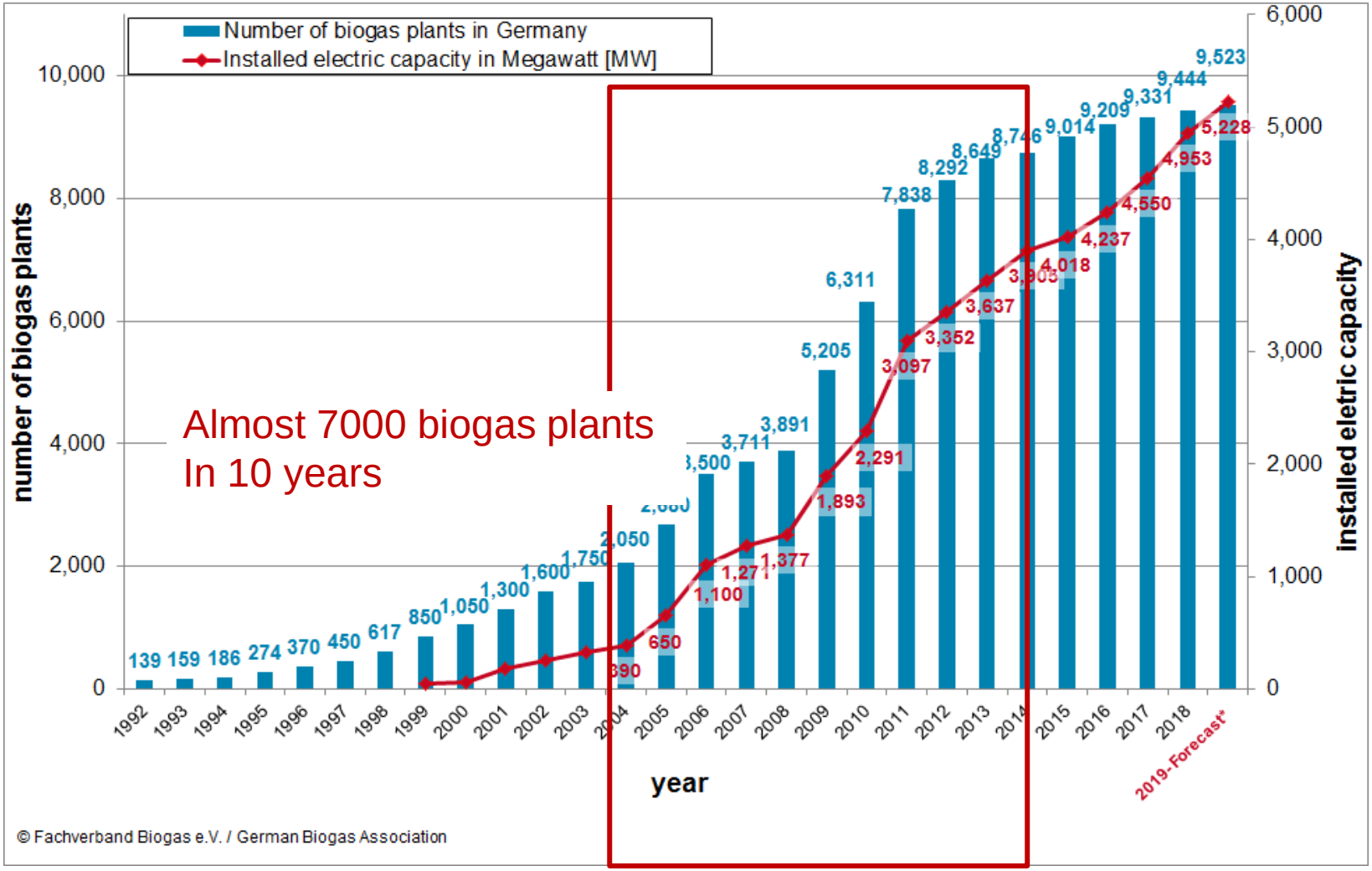
German development: Number of biogas plants and electrical output in MWe



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Biogas sector statistics in Germany

	2018*	Forecast 2019**
Number of biogas plants (biogas plants with biomethane injection)	9,444 (200)	9,523 (204)
Installed electric capcity in MW	4,995	5,228
Gross electricity production in TWh per year	33.15	33.4
Households supplied with biogas-based electricity in millions	9.47	9.54
CO_2 reduction by biogas in million tonnes	20.0	20.1
Turnover in Germany in Euro	9.7 billion	9.3 billion
Jobs in the biogas sector	49,000	48,000

© Fachverband Biogas e.V. / German Biogas Association

* Own extrapolation based on country data / plant register BNetzA

** Based on a expert survey / plant register BNetzA

Development of the number of biogas plants, installed electric capacity and the work-relevant electric capacity per year in Germany (as of 07/2019)

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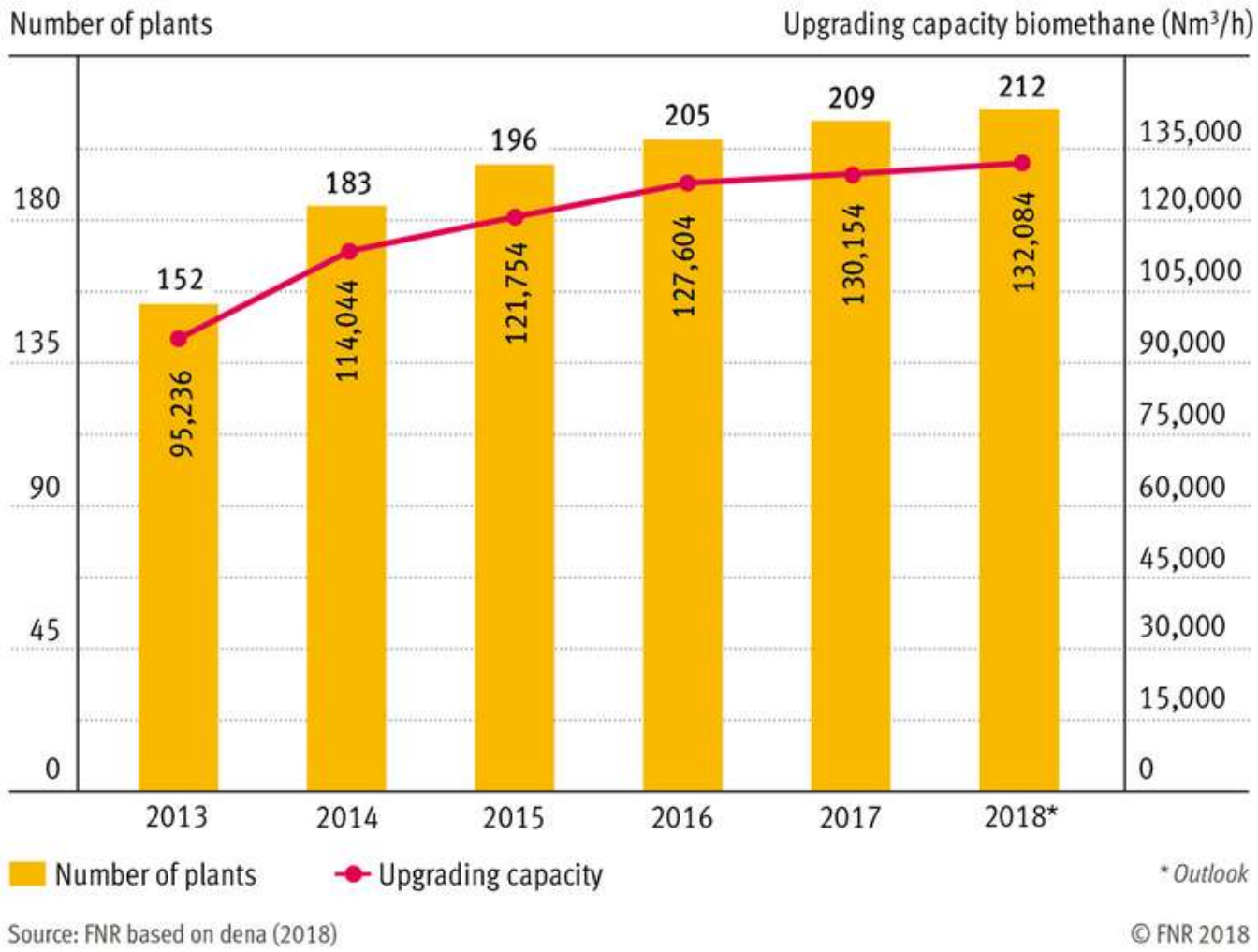
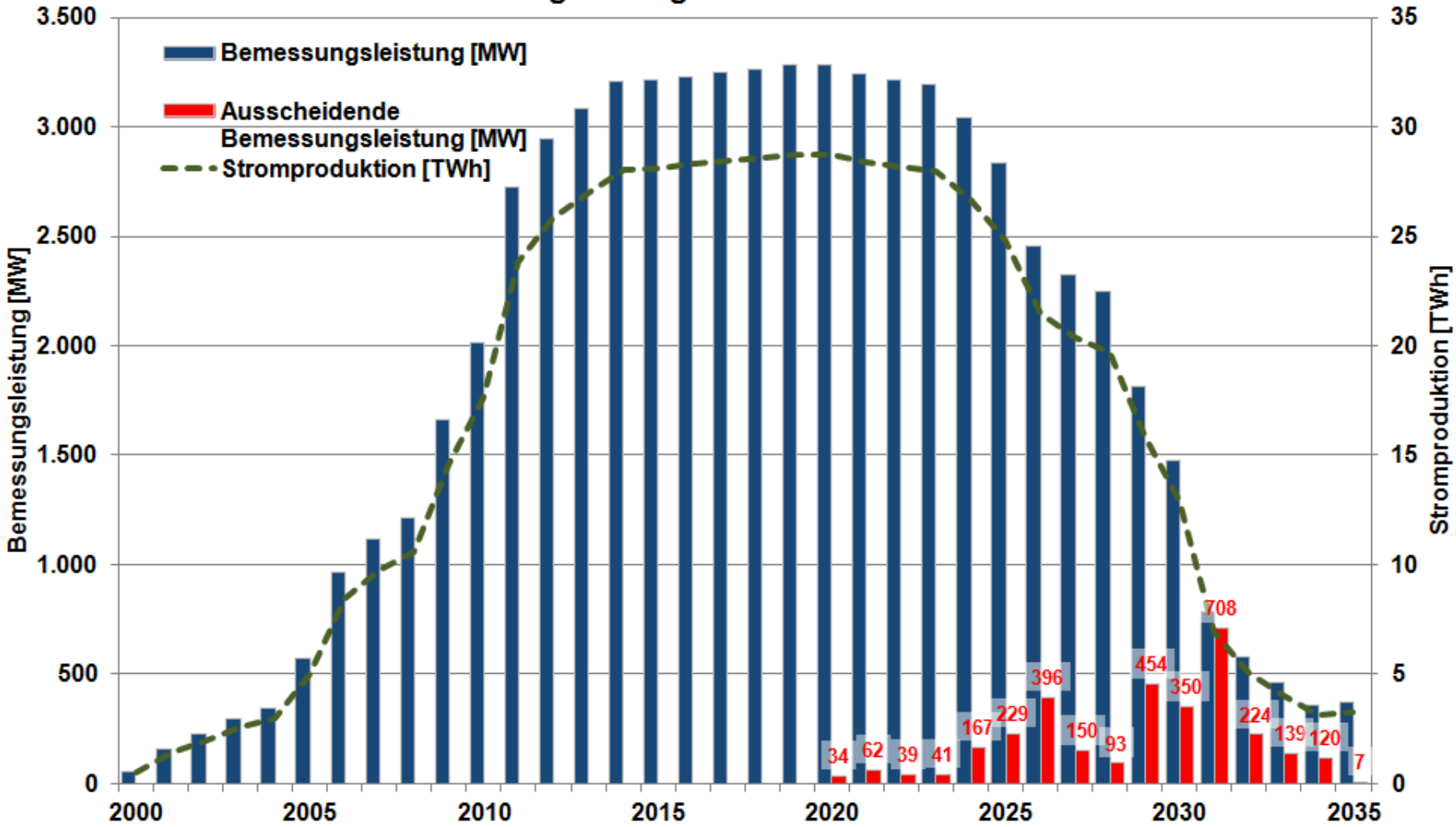
Cumulative number of biomethane plants in Germany



Entwicklung der Bemessungsleistung sowie der Stromproduktion der Biogasanlagen in Deutschland



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2. Feasible Technology Options for Biomethane Production from feedstock over 20% DM

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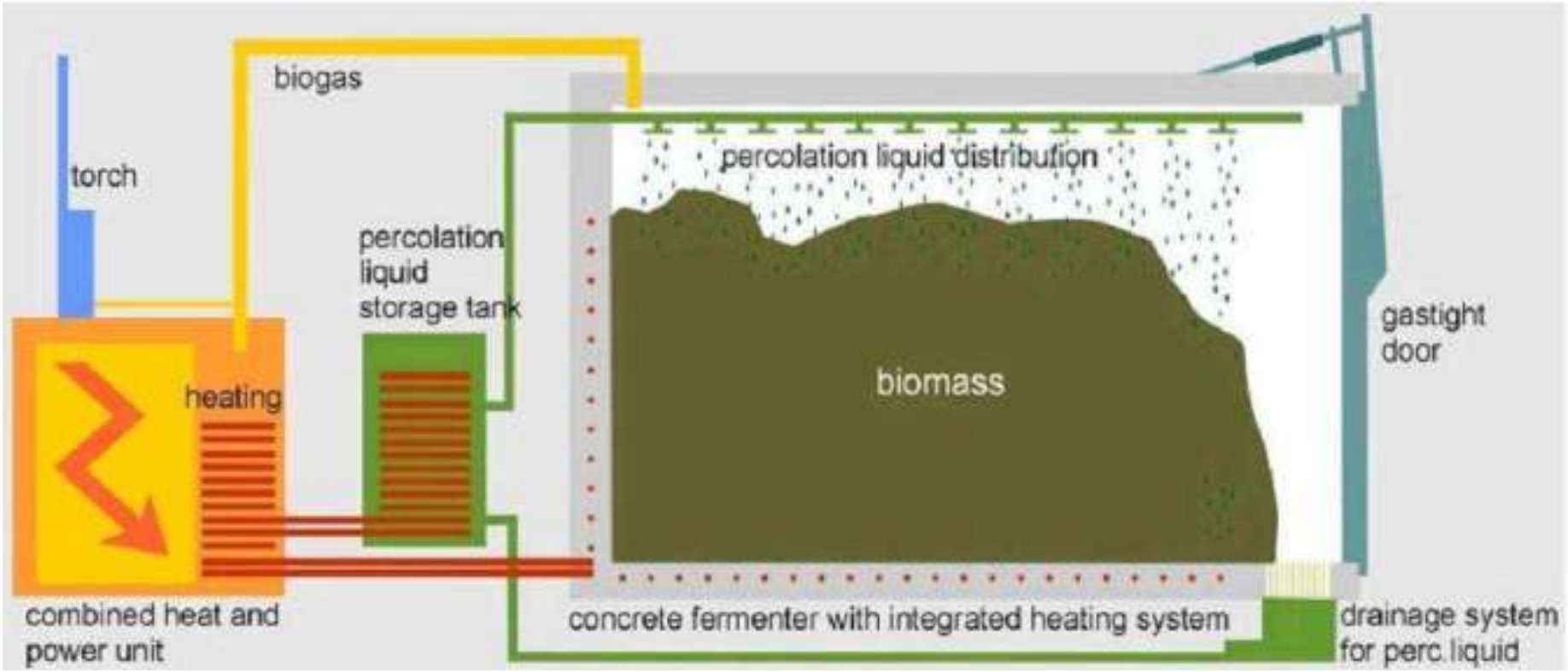
Dry fermentation in a batch garage type digester



CSTR System Steel Tank with Hydrolysis

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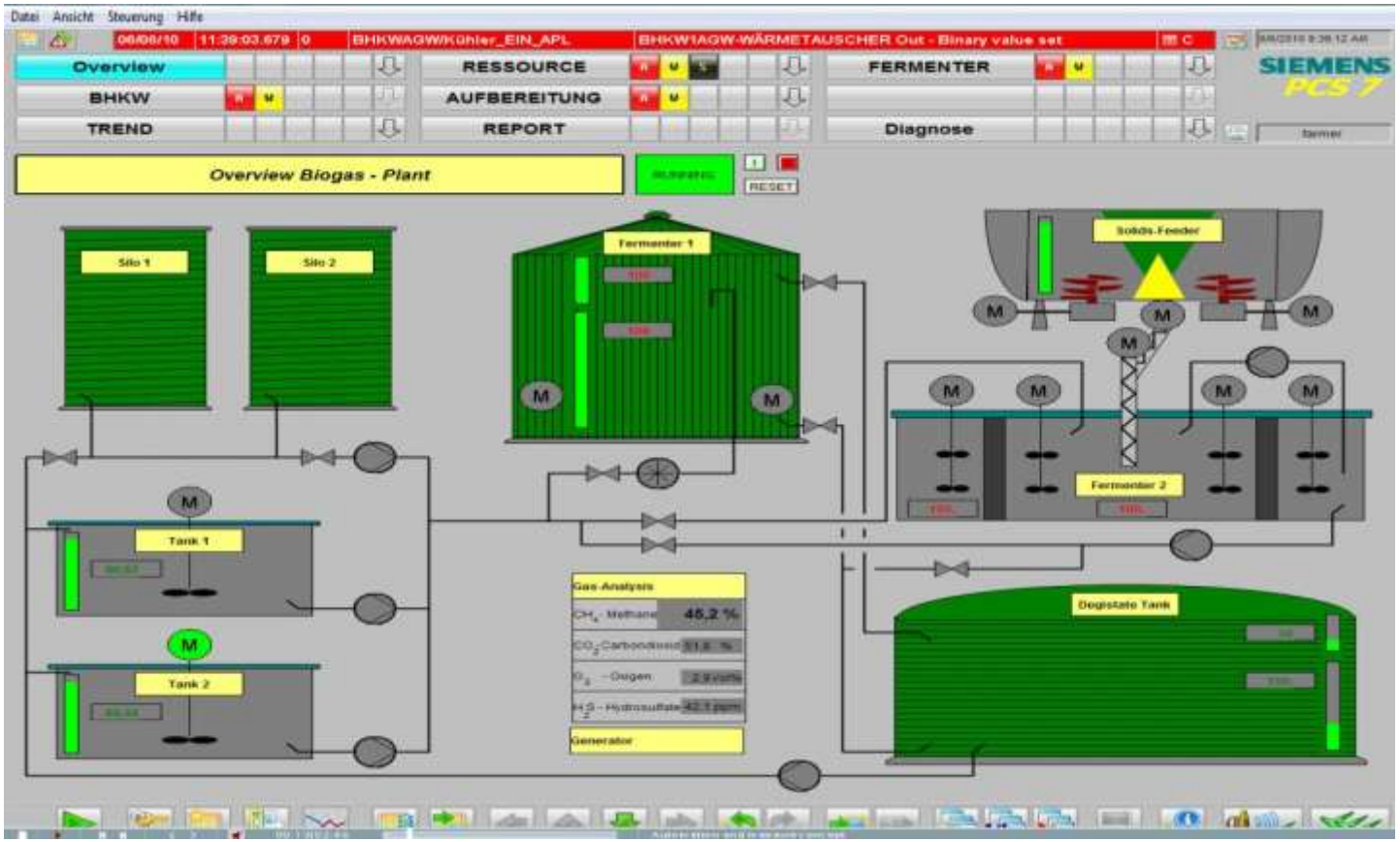
CSTR Control system with Hydrolysis



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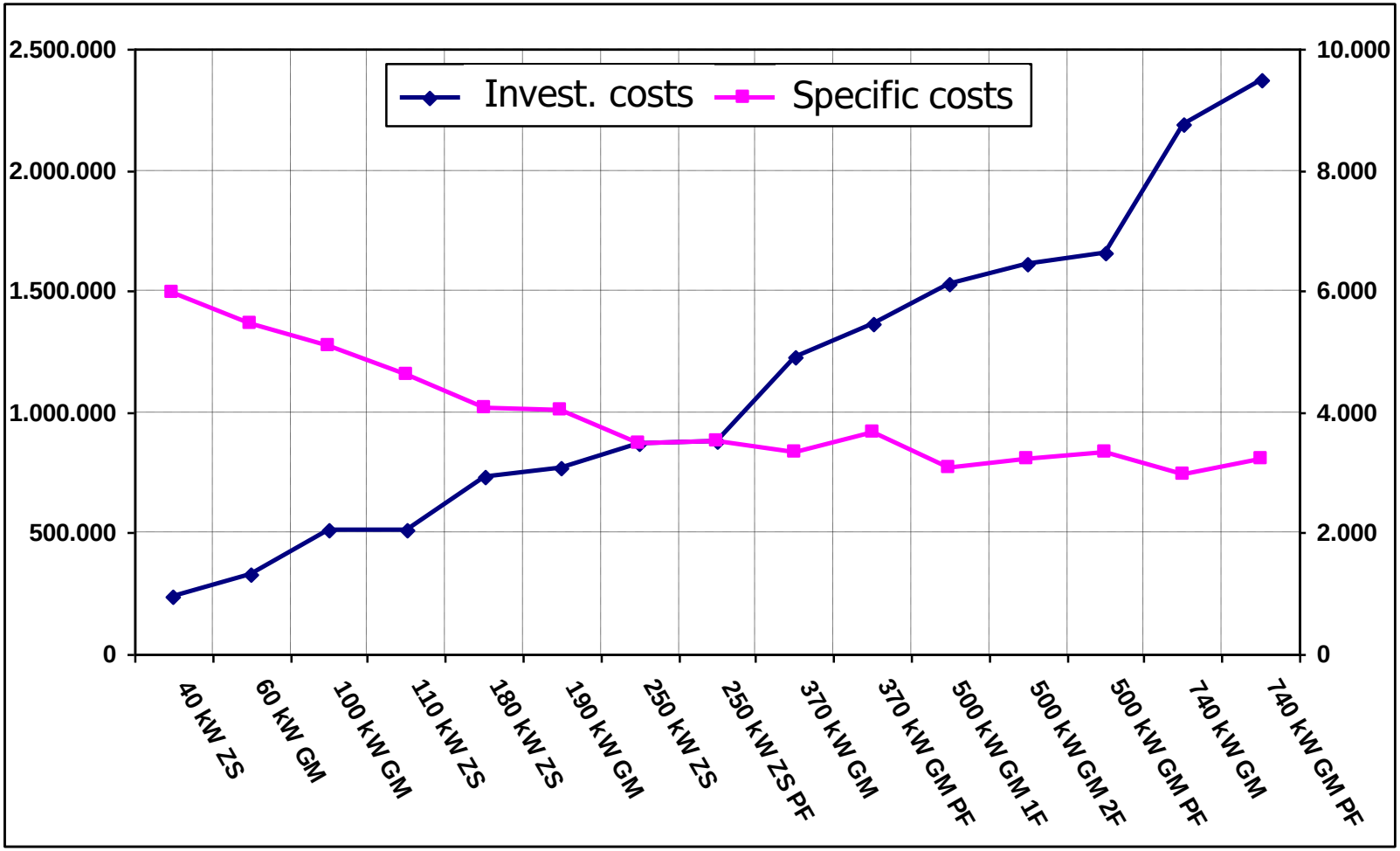
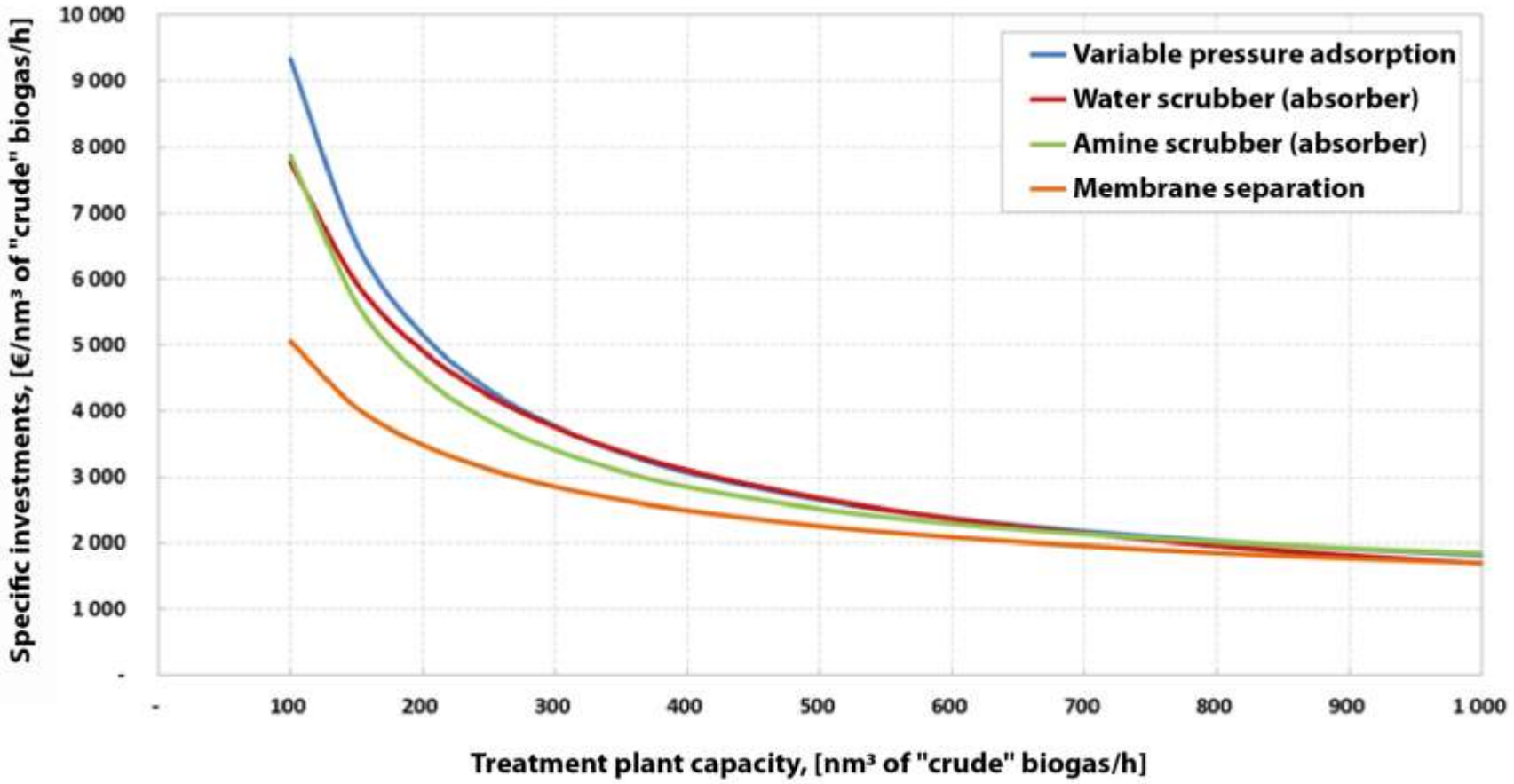
Investment costs for Biogas Plants without gas upgrading



Investment costs for Biomethane Upgrading Plants



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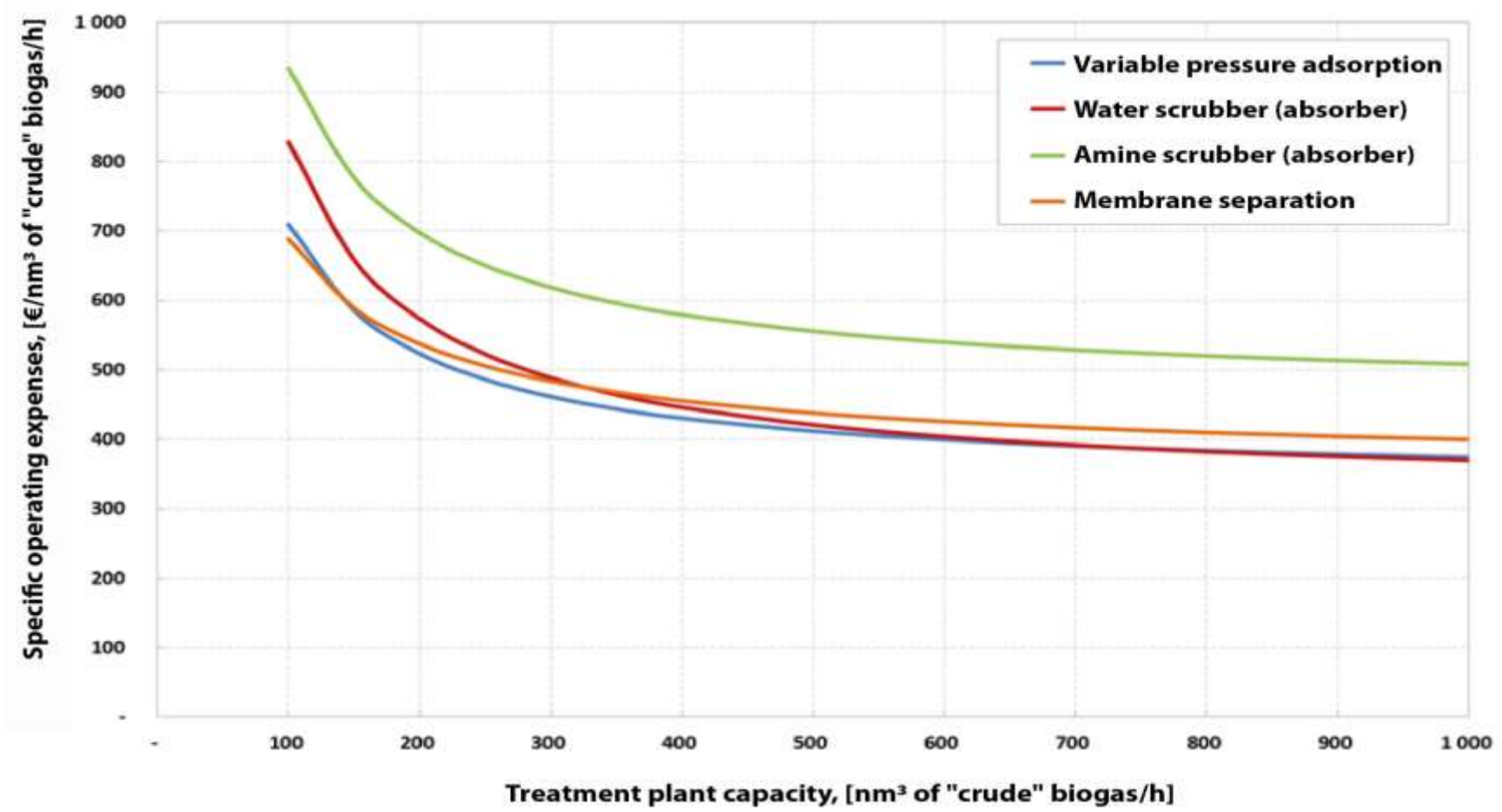
Operating Costs for Biomethane Plants



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Operating Costs

- Depreciation costs
- Interest charge (related to 1/2 of investment costs)
- Maintenance & repair of biogas plant
- Maintenance Biomethane Upgrading lant
- Insurance
- Labour costs
- Costs for input substrates
- Costs for land spreading digestate

1. Biogas Project, Goa, India

- 1500 m3 Dry Digester volume for 350 m3/h biogas production

- Thermophillic operation at 55°C

- Slow turning paddle mixer at 2 rpm

- Digester is easily accessible to be able for maintenance

- Continious sand drain for safe operation

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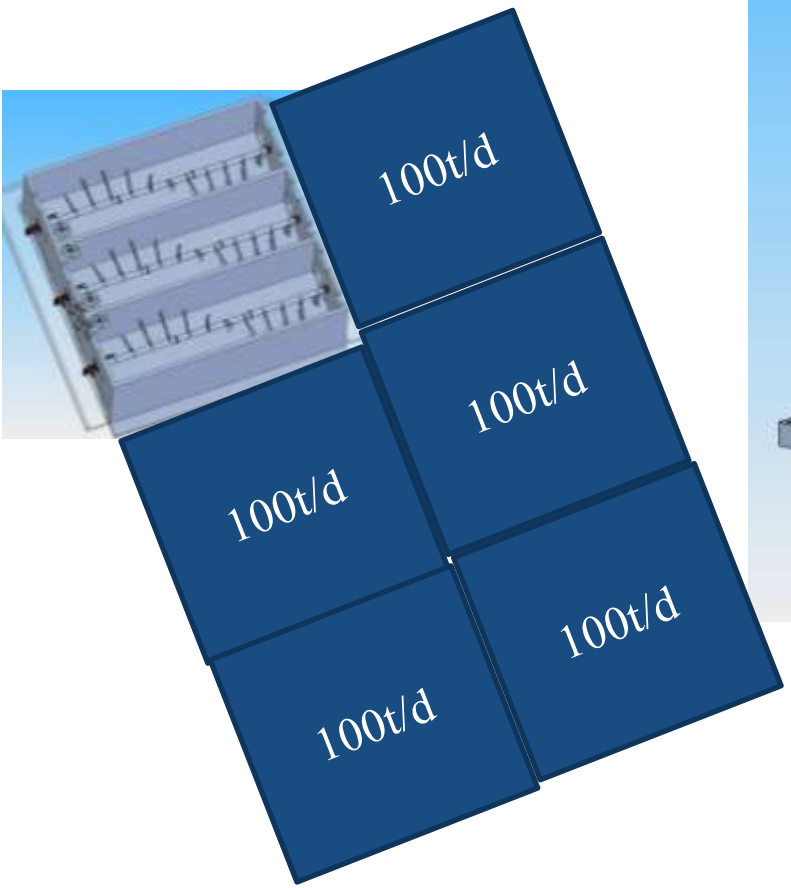
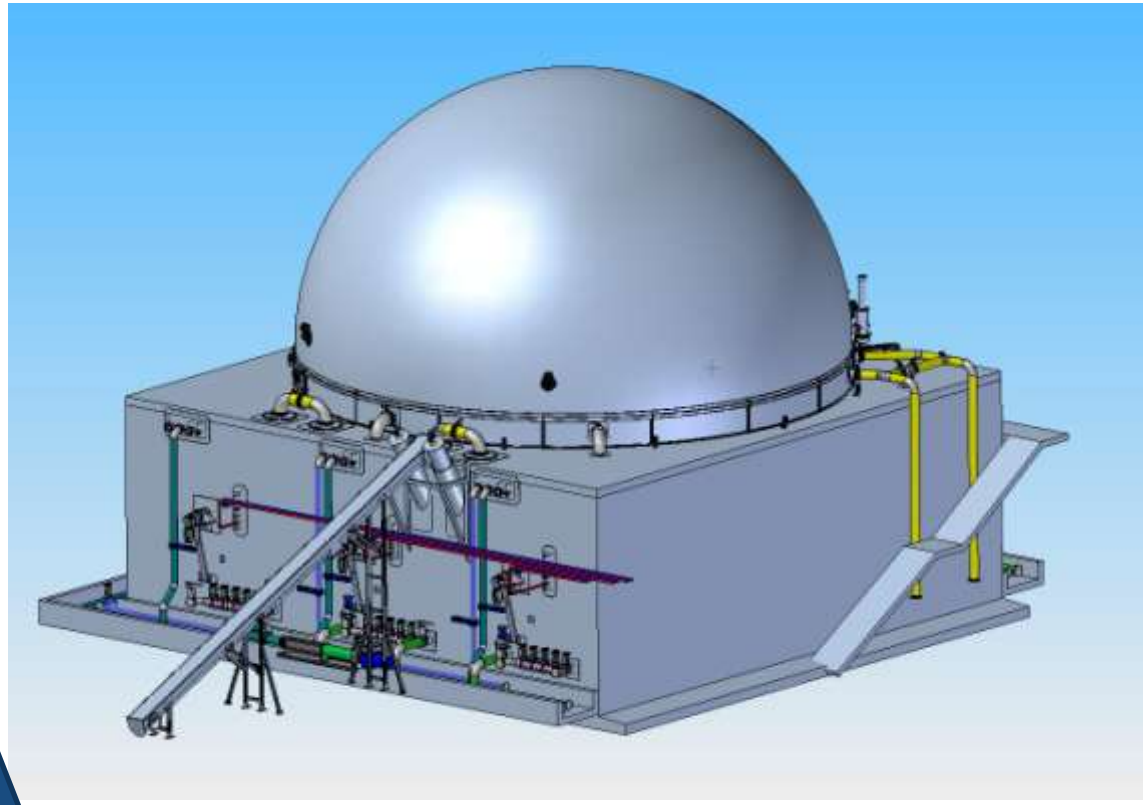
Dry digester in modular construction





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Dry Digester Inside

- Digester within waste treatment facility

- Composting and waste water treatment plant

- Prettreatment and reception hall

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2. Biogas Project, Jalgaon, India

Fruit Processing Plant at JISL, Jalgaon

Onion Dehydration Plant at JISL, Jalgaon

- Fruit plant processes over 1,000 MT of fruit /day.
- Onion plant processes over 350 MT of Onions /day

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Solid waste problems

Mango waste

Onion waste

- Over 30 – 40 % from processed quantity comes out as organic waste
- Solid waste posed problems of eco-friendly disposal and space constraints

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Salient Points

- Although there are tons of waste but availability is seasonal.

  Biogas process runs 24x7 without break.
- Looking for an alternative feedstock to run the plant 24x7x365.
- Identified Press Mud Cake (PMC) from Sugar Industry as a viable alternate feed stock.
- Disposal of PMC is a problem for Sugar Industry.

Biogas Digester

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Biogas Cleaning

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Biogas storage balloons & Blower

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Automation & control panel

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Biogas Engine

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Waste Heat Recovery (VAM)

"Jain Bio-Samrudhi" – soil conditioner – a byproduct of Biogas power project

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Salient Points

•Biogas power plant operates at more thane 80 % PLF (Plant Load Factor) and obtains average 33 MWh/day at 1.7 MW installed synchronized with the grid

•Efficient utilization of Biogas for generation of electricity, recovery of heat and 400 MT of refrigeration.

•Officially recognized as “First of its kind” Biogas power plant in India by MNRE, Government of India. Because of its unique nature of-

- •Two stage bio-methantion process
- •Acceptance to broad area of feedstock.
- •Utilization of biogas to generation of Combined Heat and Power (CHP)
- •Zero discharge system
- •Standard protocol for waste treatment established

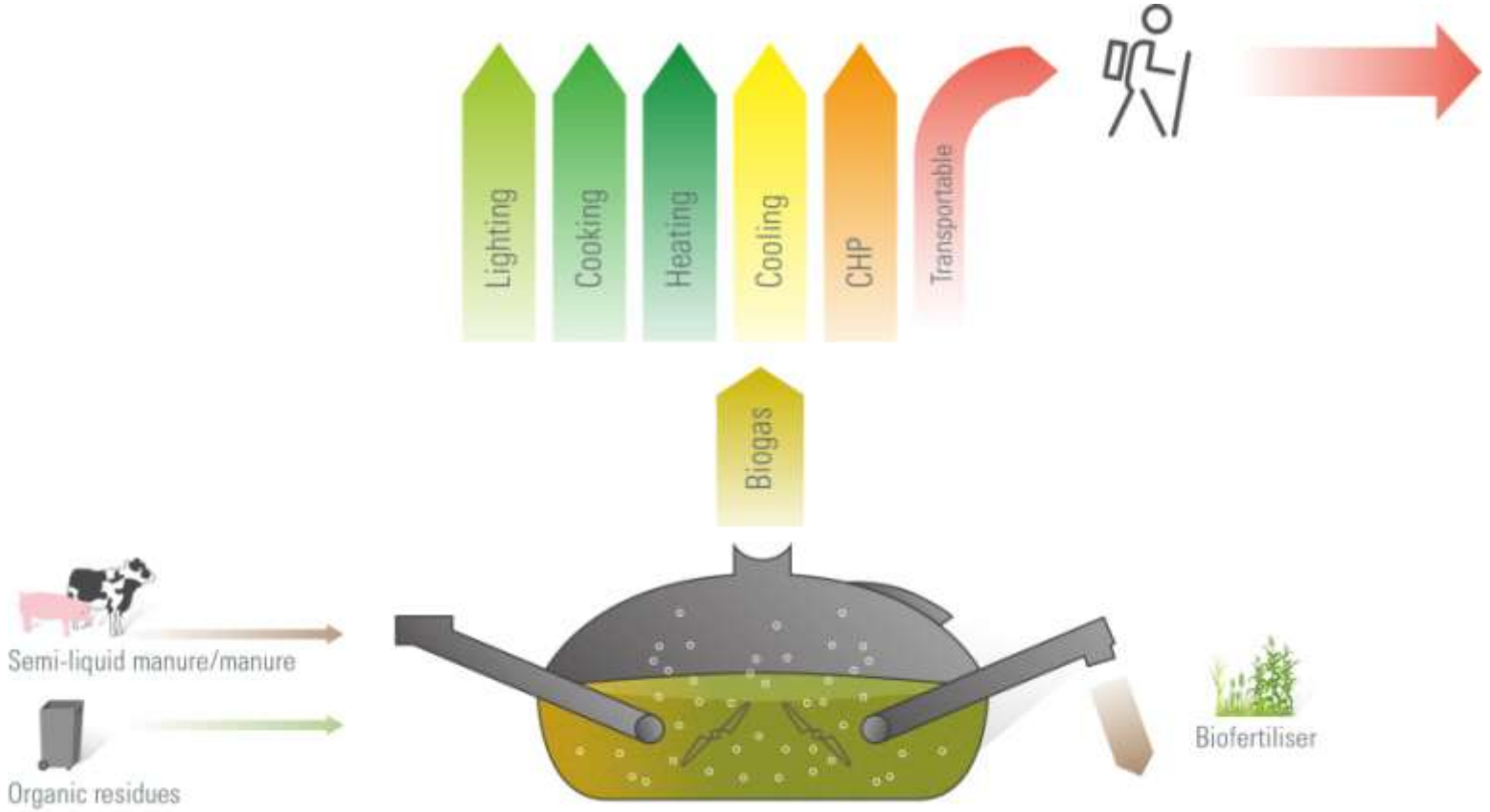
•Fully automated power plant with Industrial and Environmental safety standards.

•Power Plant run by competent and highly trained technical team

3. Small Scale Manure and straw for cooking, Columbia

HoMethan Technology

5m³ biogas per day



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HoMethan Technology

5m^3 biogas per day

4. Manure and straw to CNG, Germany

- **Future option BioCNG instead of (only) green electricity**
- **Readiness for new technology**

Winfried Vees Energiehof Weitenau

eclareon

Biomethane tractor

Full day of farm-work autonomy

Source: https://www.bwagrar.de/Am-liebsten-mit-eigenem-Kraftstoff,QUlEPTU1MzIzNzEmTUlEPTE2MjkyNQ.html

Manure and straw to CNG

Biogas Plant Hof Weitenau; VEES

Problems encountered:

- Little offered technology for
  On farm plants
- Lack of political support (generally only political "electrical vehicle euphoria")
- Offers are mostly for larger plants
- Service problem (Chicken - egg)

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Outlook

- IBBK can help with Technology adaptation and knowledge Transfer.
- The technology adaption is combining low investment cost with high rate degradation performance
- Long experience with solids („dry“) digestion in batch and continious mode

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Thank you for your attention!

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