Industrial Experiences With Anaerobic Digestion Plants in Europe

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Structure of presentation

- Presentation of company
- Case studies AD projects in Europe with wet fermentation technology
- Biogas utilization

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Products and technologies for environmental protection

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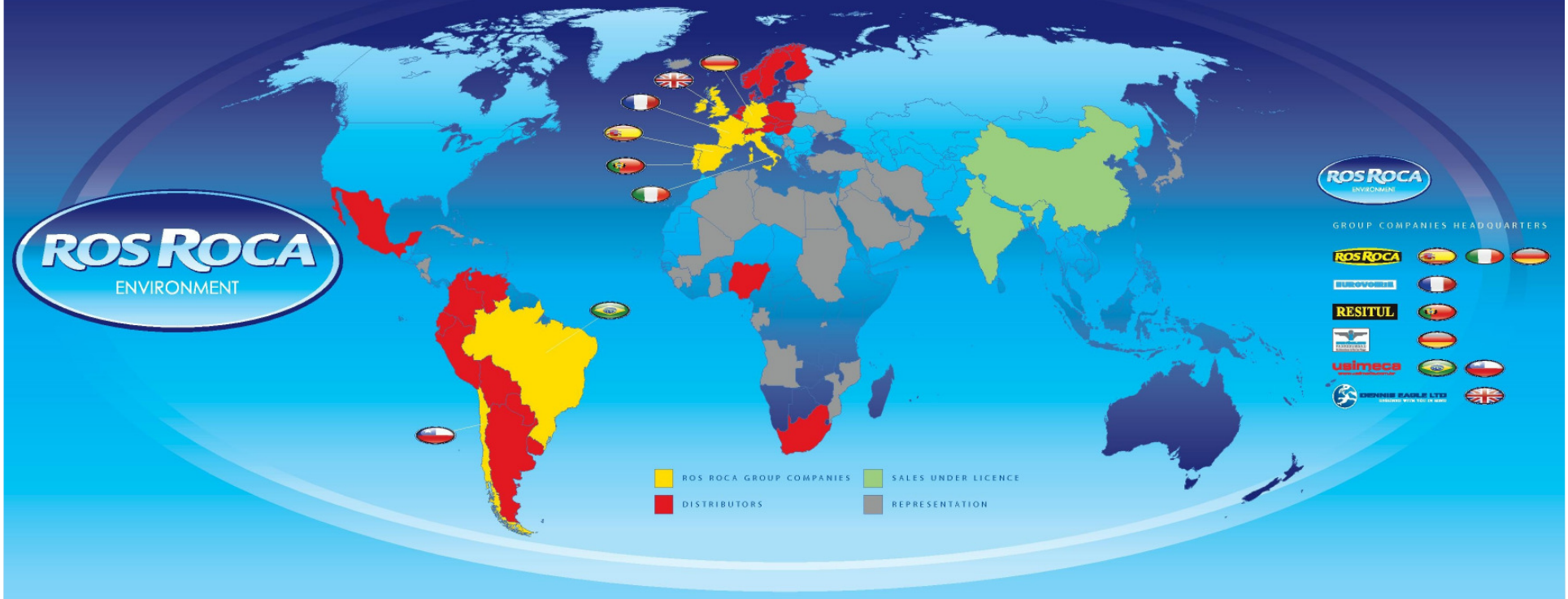

Collection and cleaning equipment

Pneumatic waste collection

Technologies waste, biomass utilization

Cryogenic products and technologies

Technologies

- Biogas plants (Wet and dry digestion technology)
- Biogas treatment (Drying, Desulphurization, Upgrading, CNG, LNG)
- Biogas utilization (CHP, Boiler, Grid injection, Filling stations)
- Composting (Tunnel, Drum, Turning machine)
- Mechanical-biologcal waste treatment with digestion and / or aerobic stabilization
- Mechanical sorting plants
- Manure treatment

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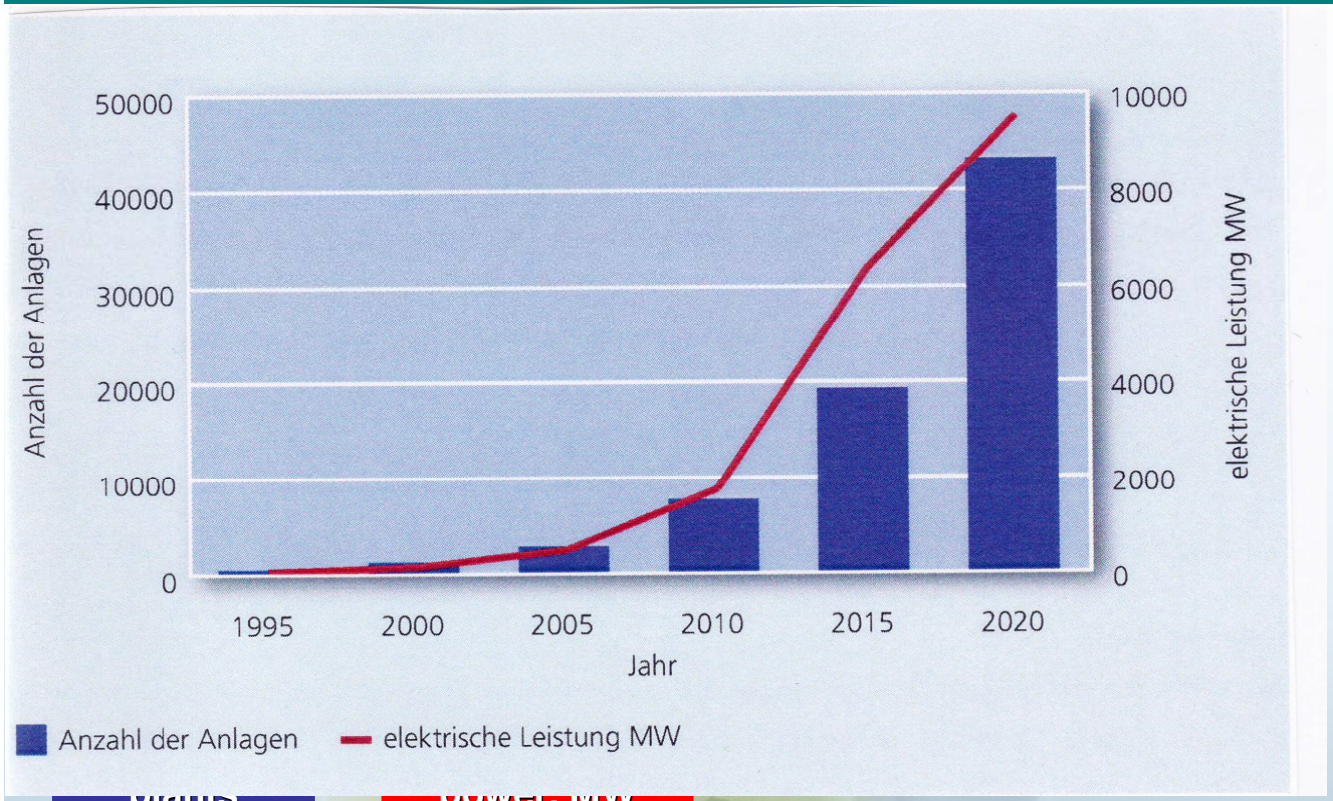
Experiences
Anaerobic Digestion

Development of AD plants in Europe



- EU requirements for increasing renewable enregy production to reduce emission of green house gases (CO_2, CH_4)
- EU requirements for waste treatment (reduction of organics to landfils)
- Regulatory conditions for renewable energy production are defined (Fixed infeed tarifs for electricity and heat, tax benefits for biofuels)

Input material for Ros Roca AD technology

Municipality

- Source separated organic waste (SSO)
- Organic fraction MSW
- Sewage sludge

Industry

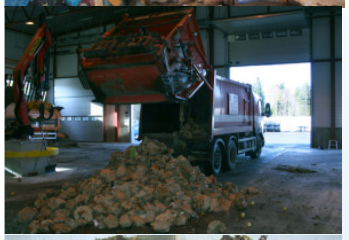
- Packaged food
- Residues from food and beverage production
- Food leftovers
- Grease
- Slaughterhouse waste
- Residues from ethanol fermentation
- .....

Agriculture

- Manure
- Dung
- Energy crops

Ros Roca AD process is flexible and treats organic waste independent of humidity

Process flexibility is important



- Waste quality is subject to strong variations
- Efficient utilization of fermenter for biogas production (no feeding of non bio-degradable organic material)
- Political frameworks change (e.g. renewable energy act Germany)
- Market conditions change

Ros Roca biogas plants in Europe

New contracts recently signed: Portugal 2 MBT plants with AD, Italy 1 AD plant for biowaste, Spain 1 agricultural AD plant, UK 1 AD plant for packaged food waste

Selected bidder in Mumbay, India for AD plant treating biowaste

1
Gran Canaria, Spanien
Hausmüll
Houshold Waste
60.000 to/a

2
Lanzarote, Spanien
Hausmüll, Klärschlamm
Houshold Waste,
Sewage Sludge
36.500 to/a

3
Jaén, Spanien
Hausmüll
Houshold Waste,
20.000 to/a

4
Avila, Spanien
Bioabfall, Hausmüll, Klärschlamm
Biowaste
Houshold Waste,
Sewage Sludge
36.500 to/a

5
Alicante, Spanien
Hausmüll
Houshold Waste
52.000 to/a

6
Tudela, Spanien
Hausmüll
Houshold Waste
28.000 to/a

7
Barcelona, Spanien
Hausmüll
Houshold Waste
90.000 to/a

8
Palma de Mallorca Spanien
Bioabfall, Hausmüll, Klärschlamm
Biowaste
Houshold Waste,
Sewage Sludge
32.500 to/a - 96.000 to/a

9
Lommel, Belgien
Abfälle aus der ind. Kartoffelverarbeitung
Waste from Potatoe processing
150.000 to/a

10
Kleien, Luxemburg
Rindermist, Rindergülle Bioabfall, NaWaRo
Cow Manure, Cow Dung
Biowaste, Energy Corps
48.400 to/a

11
Gescher, Deutschland
Bioabfall, Klärschlamm
Biowaste
Sewage Sludge
17.500 to/a

12
Voghera, Italien
Bioabfall, Klärschlamm
Biowaste
Sewage Sludge
27.000 to/a

13
Deißlingen Deutschland
Bioabfall
Biowaste
24.000 to/a

14
Volkenschwand Deutschland
Bioabfall, organische Gewerbeabfälle
Biowaste
Industrial Organic Waste
75.000 to/a

15
Wien, Österreich
Bioabfall, Speisereste, verpackte Lebensmittel
Biowaste
Food Waste
Packaged Food Waste
17.000 to/a - 34.000 to/a

16
Västeras, Schweden
Bioabfall, NaWaRo, organische Gewerbeabfälle
Biowaste, Energy Corps
Industrial Organic Waste
23.000 to/a

17
Krosno, Polen
Hausmüll
Houshold Waste
10.000 to/a

18
Saaremaa, Estland
Schweinegülle, Klärschlamm
Pig Manure
Sewage Sludge
40.000 to/a

19
Skellefteå, Schweden
Bioabfall
Biowaste
10.000 to/a

20
São Martinho do Porto, Portugal
Schweinegülle
Pig Manure
60.000 to/a

The AD technology of Ros Roca – Main process steps

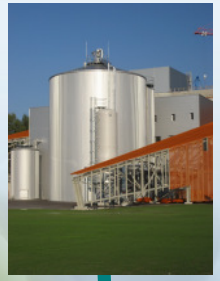
Wet Pretreatment
Adjust water content
Separation of impurities and non bio-degradable material

Minimizing wear in the plant
Avoid sedimentation and floating
Production of high quality fertilizer

Pasteurization (ABPR 1774/2002)
> 70 °C, > 1 h,
particle size < 12 mm

Kill pathogens
Production of pasteurized fertilizer for direct agricultural utilization

Anaerobic digestion
Mesophilic or thermophilic operation



Completely biogas mixed digester
No moving elements inside
High specific biogas production

Dewatering
Separation in high quality solid and liquid fertilizer

Reliable, effient dewatering with centrifuges
Low solid concentration in process water
Operation without polyelectrolytes possible

Biogas utilization
Energy production from biogas

Solutions with highest possible efficiency

Efficient biogas utilization: Ros Roca solutions

Raw biogas | CH_4 55 – 70 %

On-site CHP

Biogas upgrading

On-site heating boiler

Bio methane
CH_4 > 97 %

Natural gas grid

Bio fuel production

Central power plant

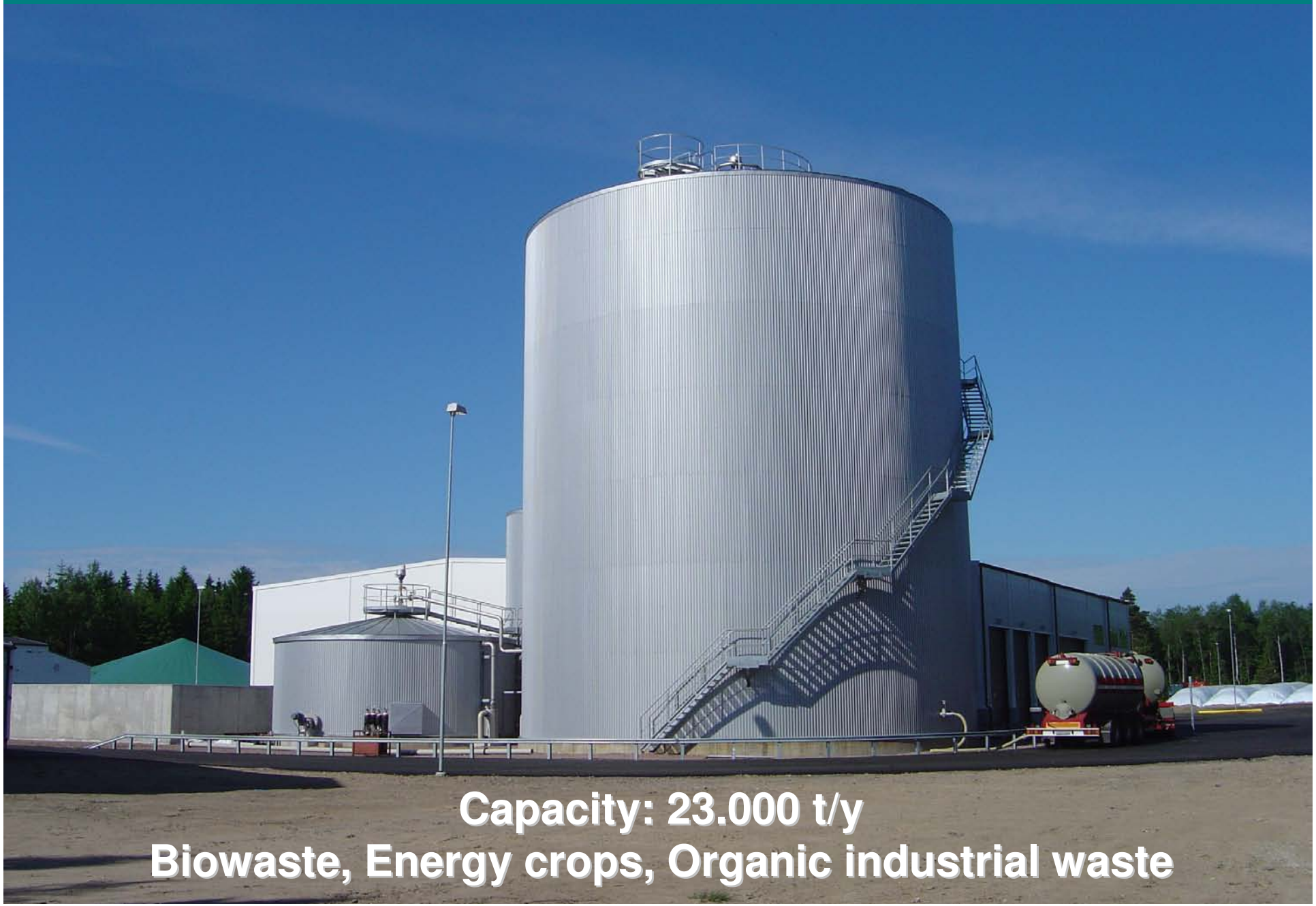
Consumer

Vehicles

Biowaste AD plant Vienna, Austria

Capacity: 17.000 t/y (34.000 t/y 2nd step)
Biowaste, Food leftovers, Packaged food

Co-digestion biogas plant Västerås, Sweden



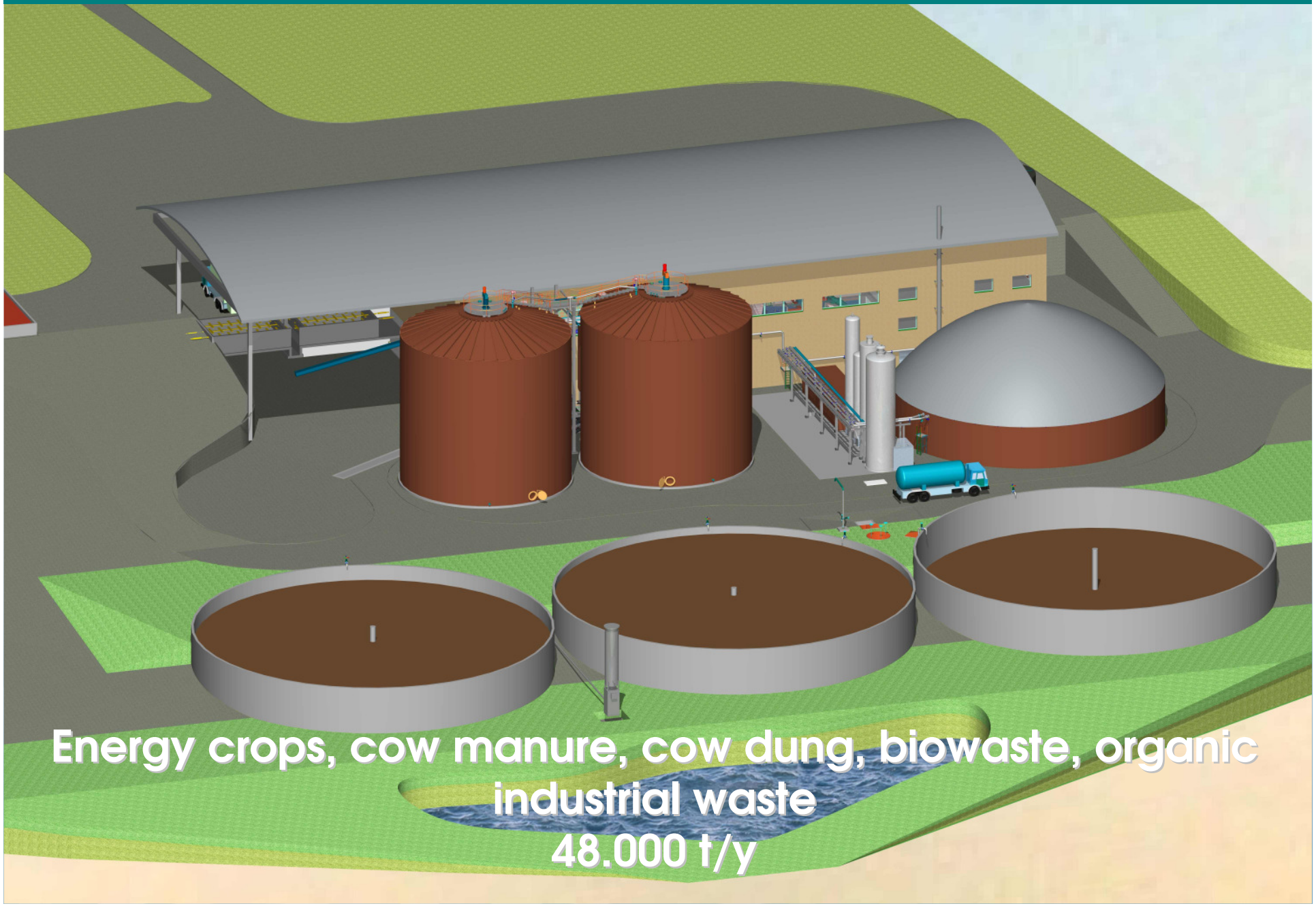
Capacity: 23.000 t/y

Biowaste, Energy crops, Organic industrial waste

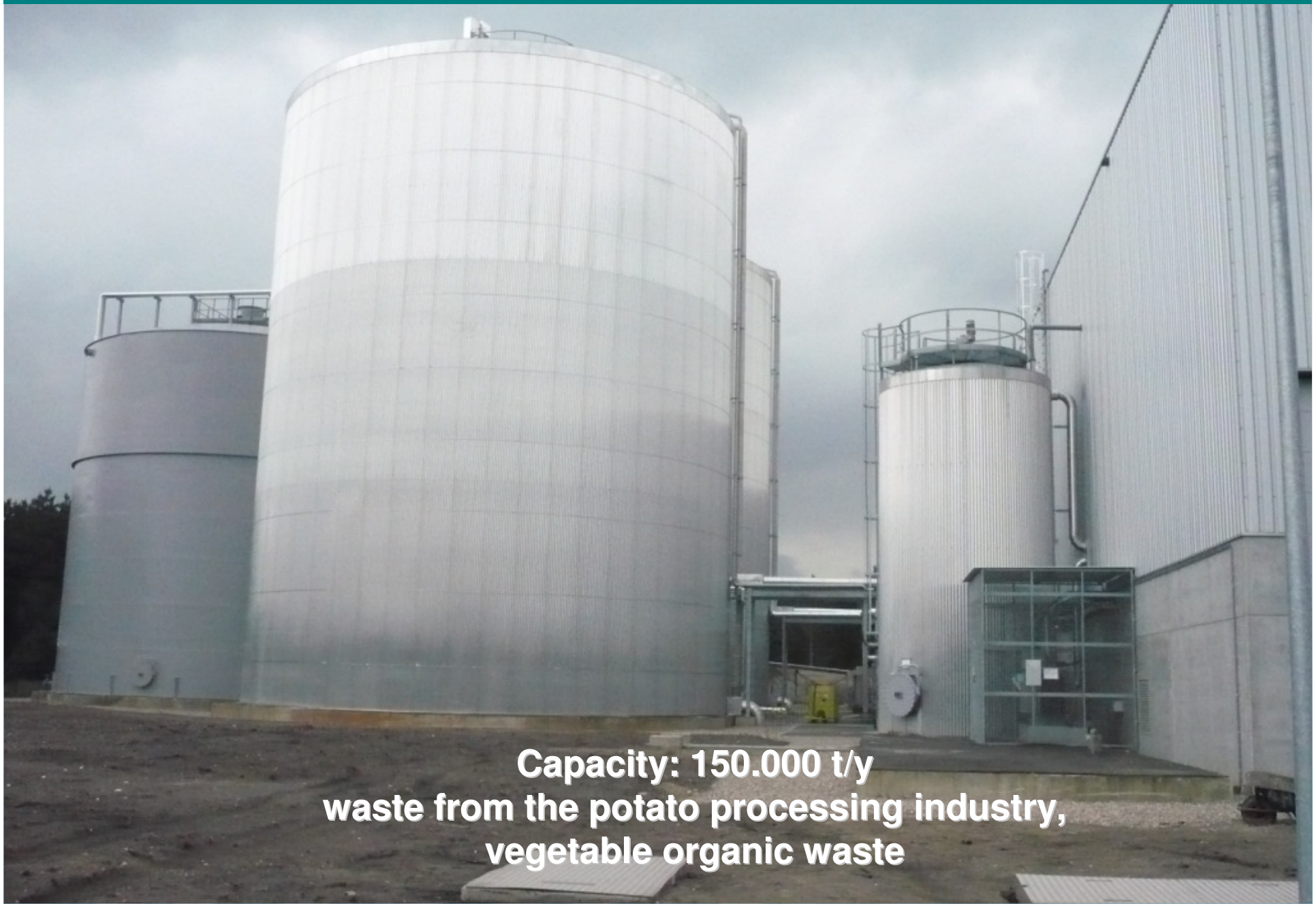
Co-digestion biogas plant Voghera, Italy

MBT with biogas plant, Alicante, Spain

Agricultural biogas plant Kielen, Luxemburg



Biogas plant for potato slurry Lommel, Belgium



Quality of fertilizer from biowaste

Parameter	Unit	Biogas plant Germany	Quality requirements for digestate Germany	Biogas plant Sweden	For the use in organic farming according to EEC 2092/91
Lead (Pb)	(mg/kg DM)	44,5	150	8,9	45
Cadmium (Cd)	(mg/kg DM)	0,6	1,5	0,3	0.7
Chrome (Cr)	(mg/kg DM)	36,0	100	28,0	70
Copper (Cu)	(mg/kg DM)	50,0	100	50,0	70
Mercury (Hg)	(mg/kg DM)	0,0	1,0	0,0	0.4
Nickel (Ni)	(mg/kg DM)	22,5	50	17,0	25
Zinc (Zn)	(mg/kg DM)	216,0	400	150,0	200
Dry matter	(% wet weight)	31,5	20	24,2	-
Organic dry matter	(% DM)	58,3	40	74,4	-

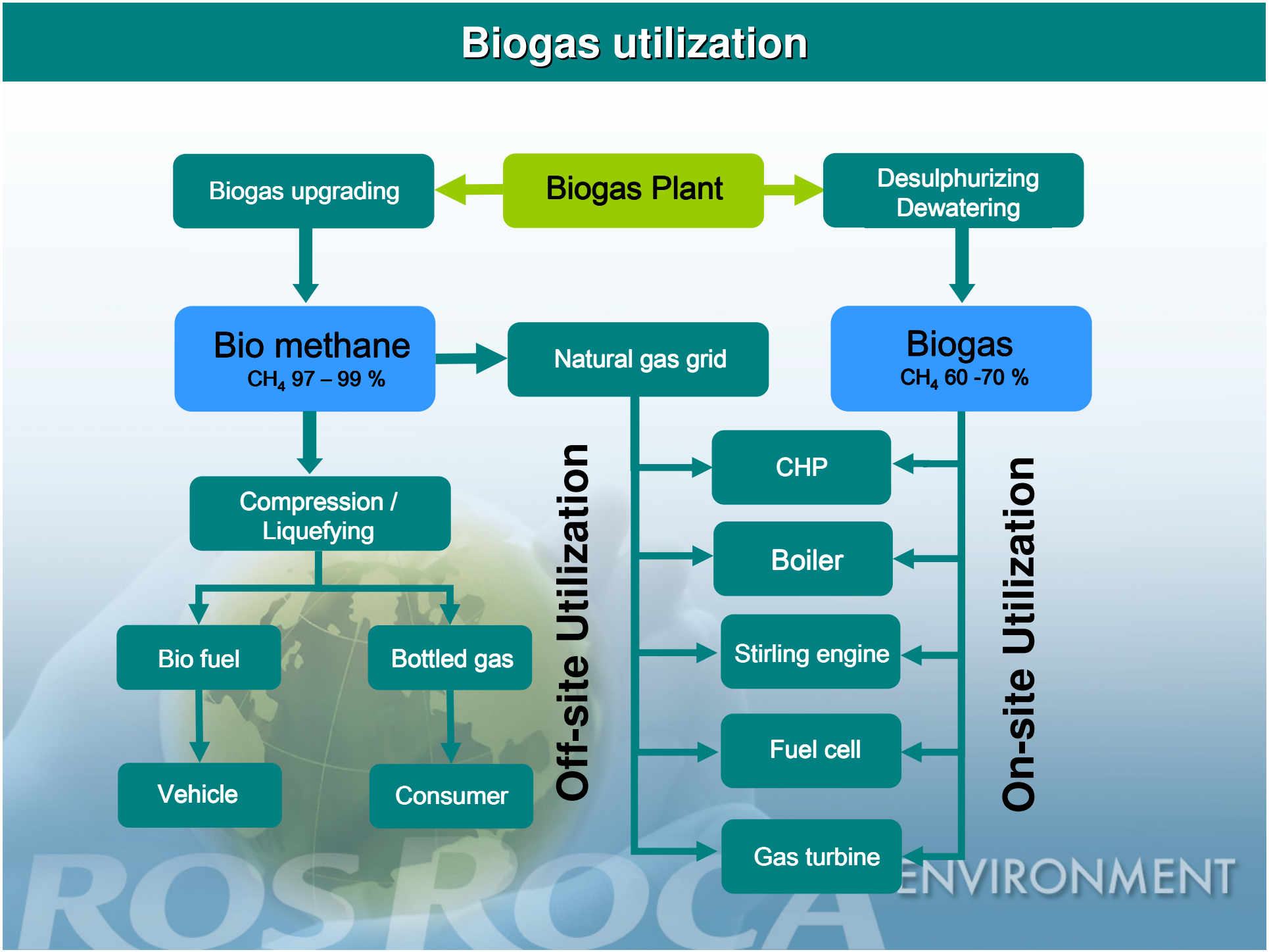
Main advantages wet digestion process of Ros Roca

- Process works independent from humidity of biomass
- Treatment of liquid and solid organic biomass from municipality, agriculture, industry
- Completely automized process
- Minimum manpower requirements
- Separation of impurities in front of digester
- Low maintenance requirements
- High quality digestate / compost
- Pasteurisation of waste according to ABPR (EU directive 1774/2002)
- High biogas quality
- Modularly extendable
- Technology approved in numerous big scale industrial plants

Biogas utilization

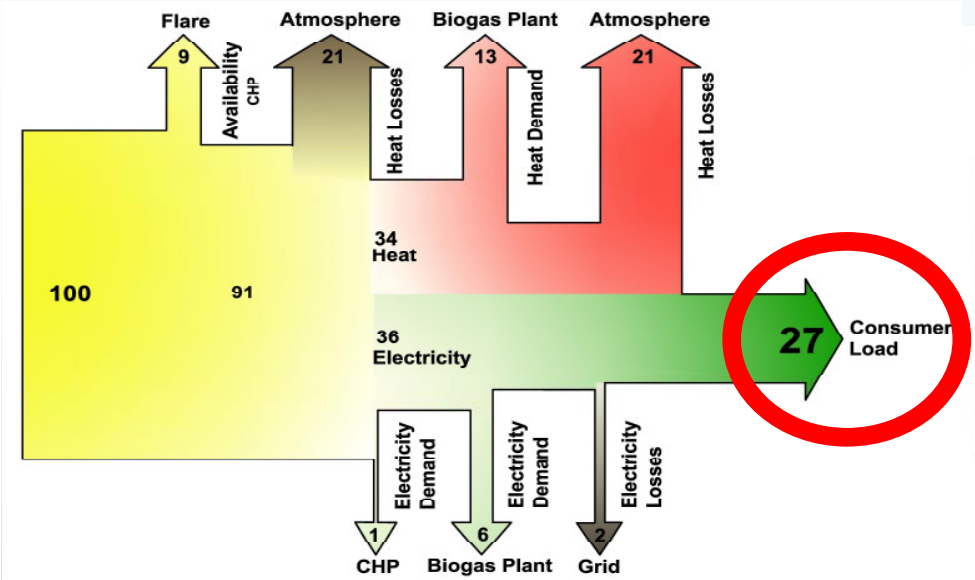



Biogas utilization

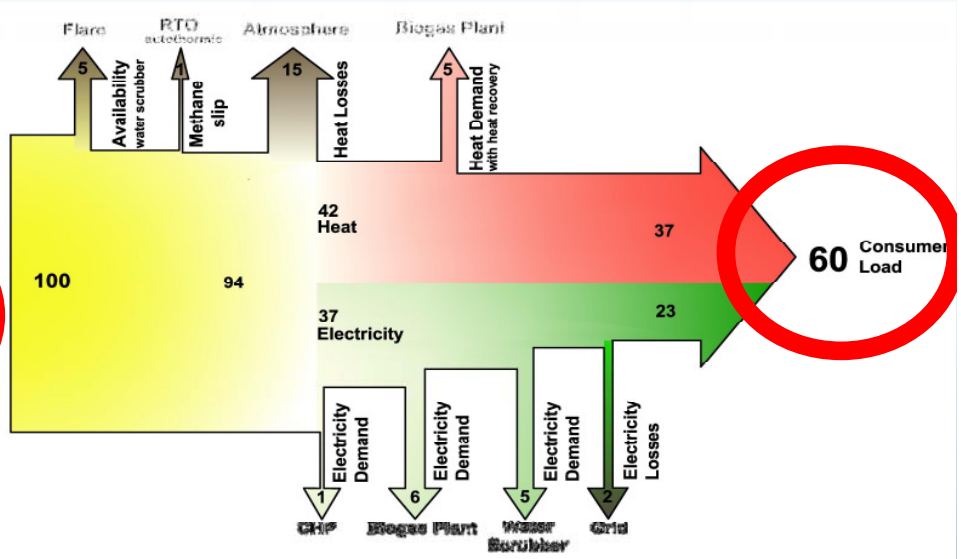


Why biogas upgrading ?

Energy balance of CHP on-site utilization

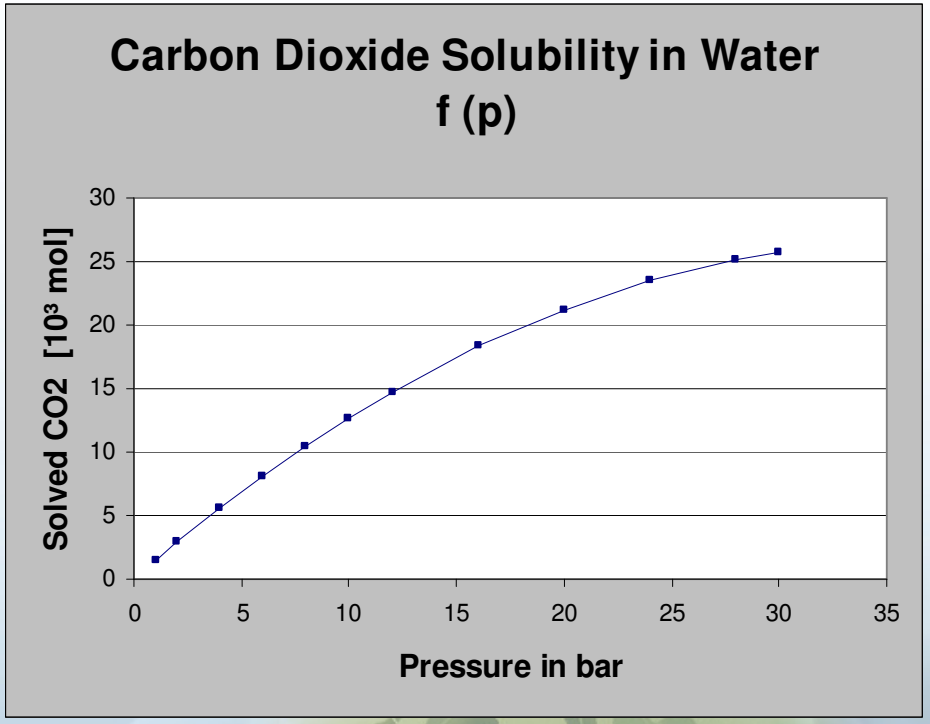


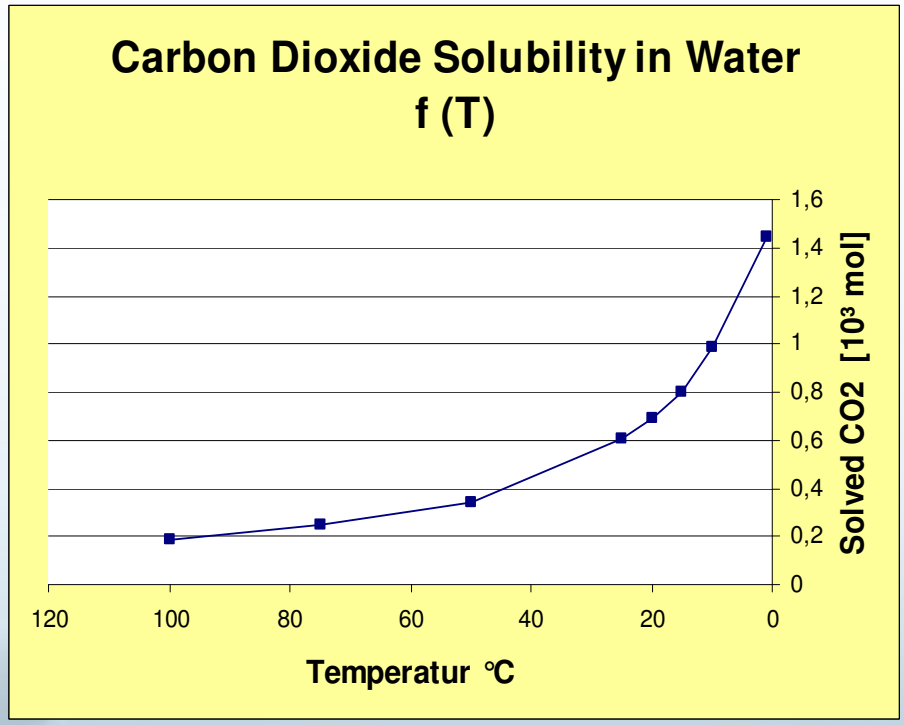
Energy balance of biogas upgrading & CHP off-site utilization



Energetic efficiency in biogas utilization is normally higher if biogas is upgraded to bio methane and utilized in off-site CHP-installations

Biogas upgrading: Pressurized water scrubber technology (PWS)





CO_2 – solubility rises under high pressure & low temperature

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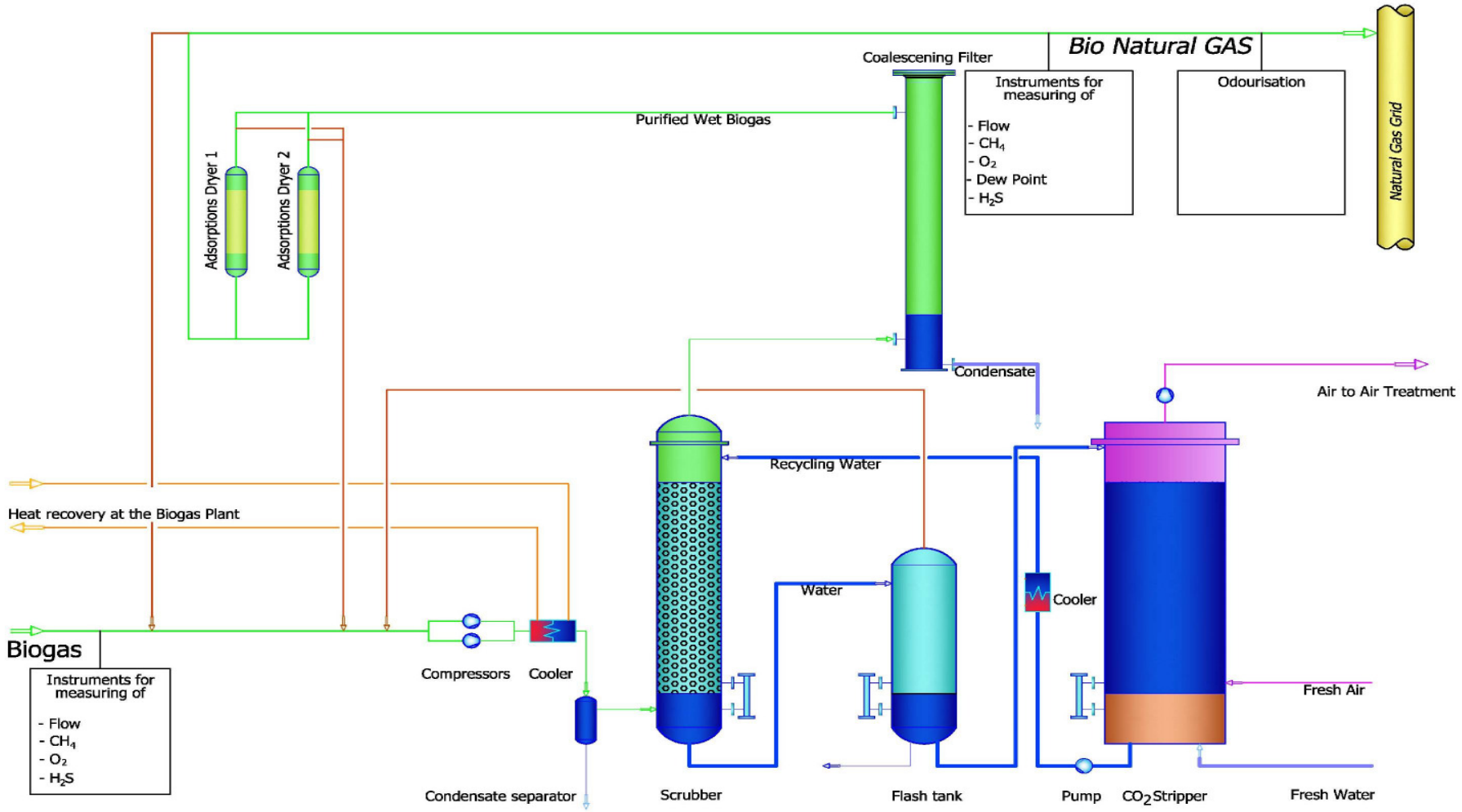
Biogas Upgrading (YIT water scrubber technology)



Experiences

Biogas upgrading




References biogas upgrading plants (YIT technology)

Location	Capacity, Nm^3/h	in operation since
Eskilstuna, Sweden	330	2003
Linköping, Sweden	1.400 (2 * 700)	2002
Västerås, Sweden	550	2004
Norrköpping, Sweden	400	2006
Boden, Sweden	250	2007
Altenstadt, Germany	1.250	Start-Up 2009
Kielen, Luxemburg	600	Start-Up 2009




Västeras, Sweden

Capacity: 550 Nm^3/h
Biomethane quality CH_4 97 +/- 2%
According SS 15 54 38
Utilization of biomethane as fuel

Air stripper

Flash tank

Scrubber

Process water pump

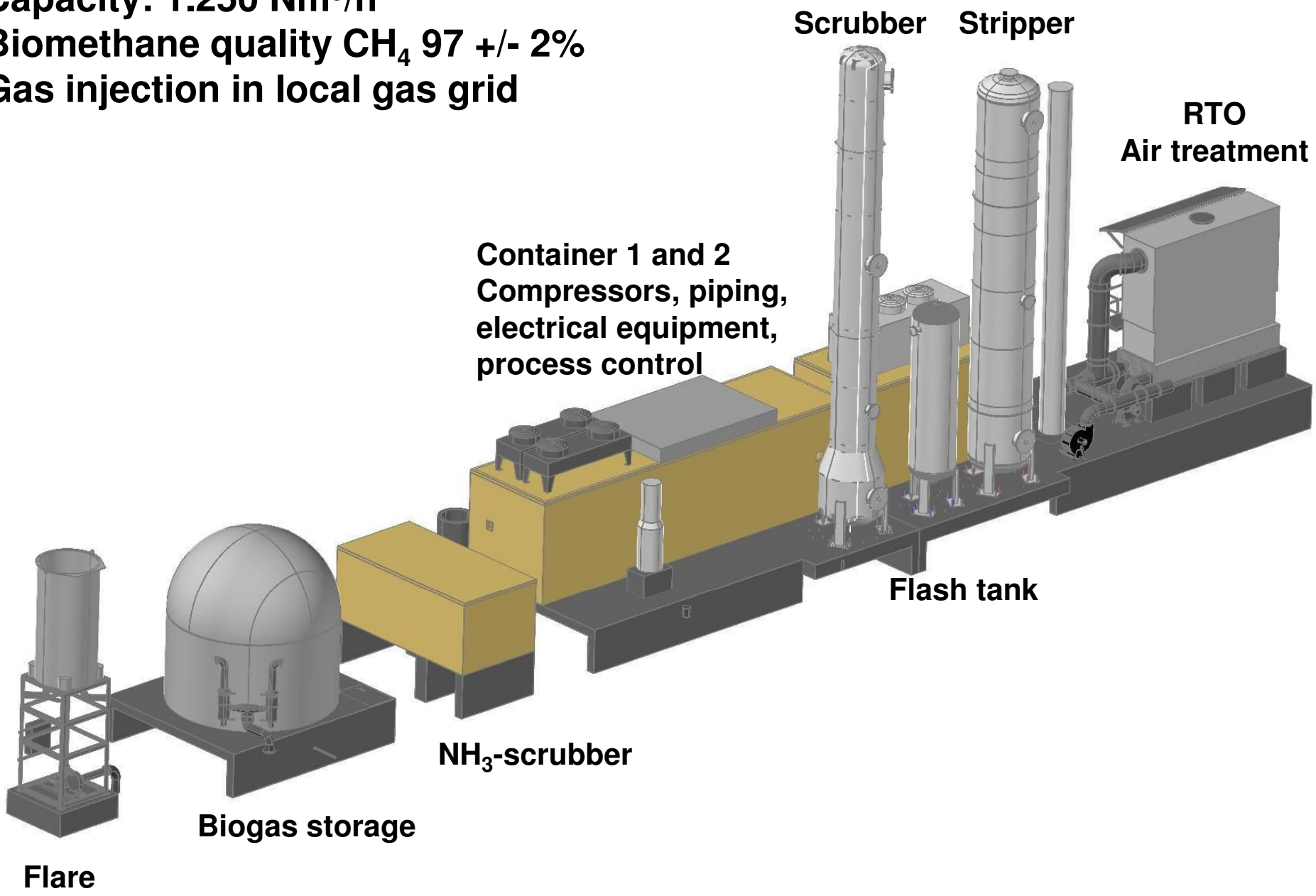
Biogas compressors

Methane concentration is increased from 60 Vol.- % to 98 Vol.- %

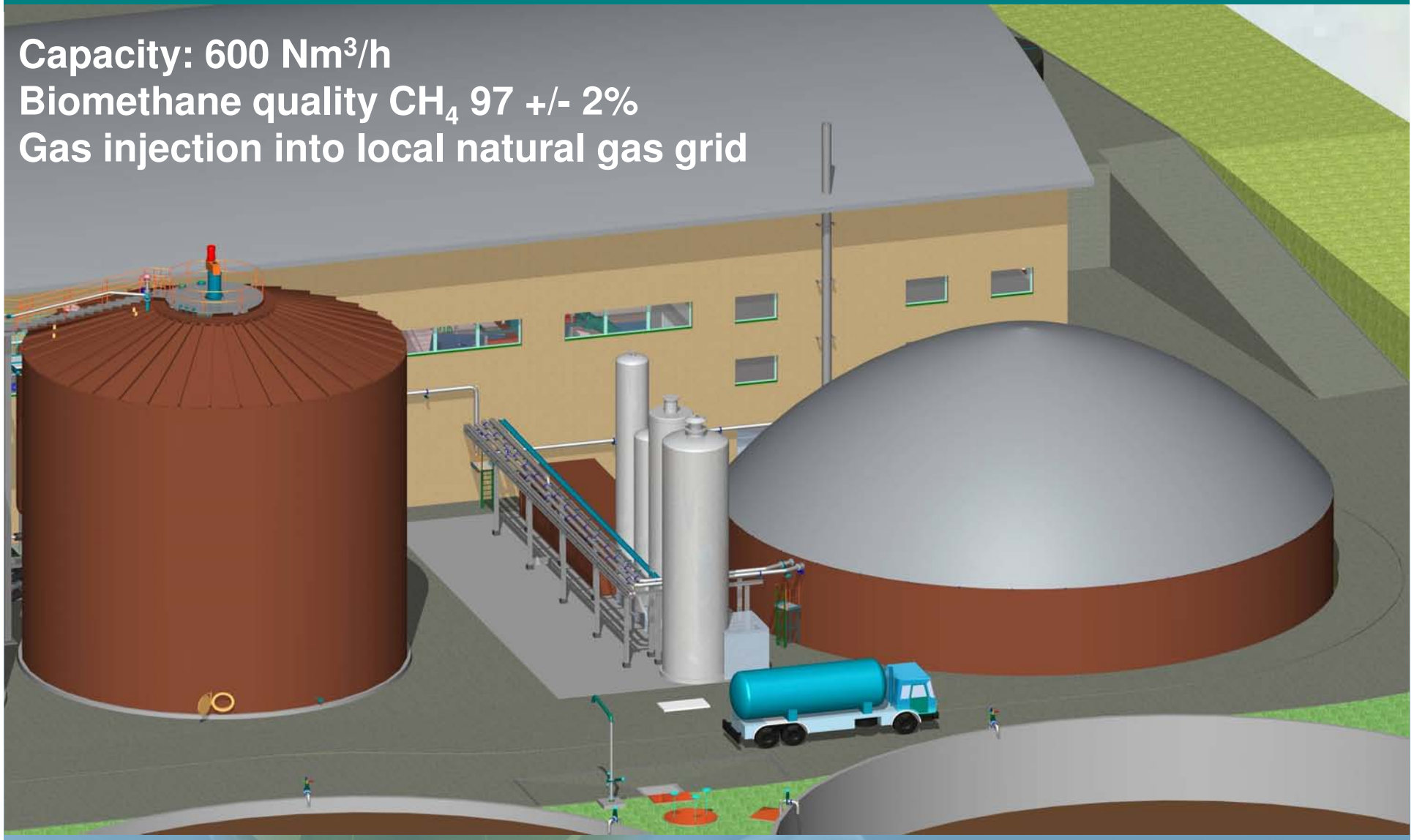
No biogas desulphurization is necessary

Biogas uprading project Altenstadt, Germany

Capacity: 1.250 Nm^3/h
Biomethane quality CH_4 97 +/- 2%
Gas injection in local gas grid



Kielen, Luxemburg



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LNG Trucks

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