GOODVALLEY

Since 1994

Biogas – one of Best Available Techniques in pork production

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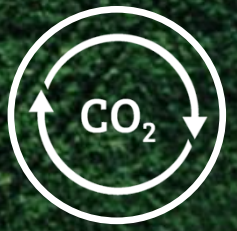
GOODVALLEY GROUP



Environment and climate challenges

2.1. 10:10-11:40 Biogas

Q1: To which extent can biogas add value to the pigmeat sector?

Q2: To which extent can biogas address environment and climate challenges?

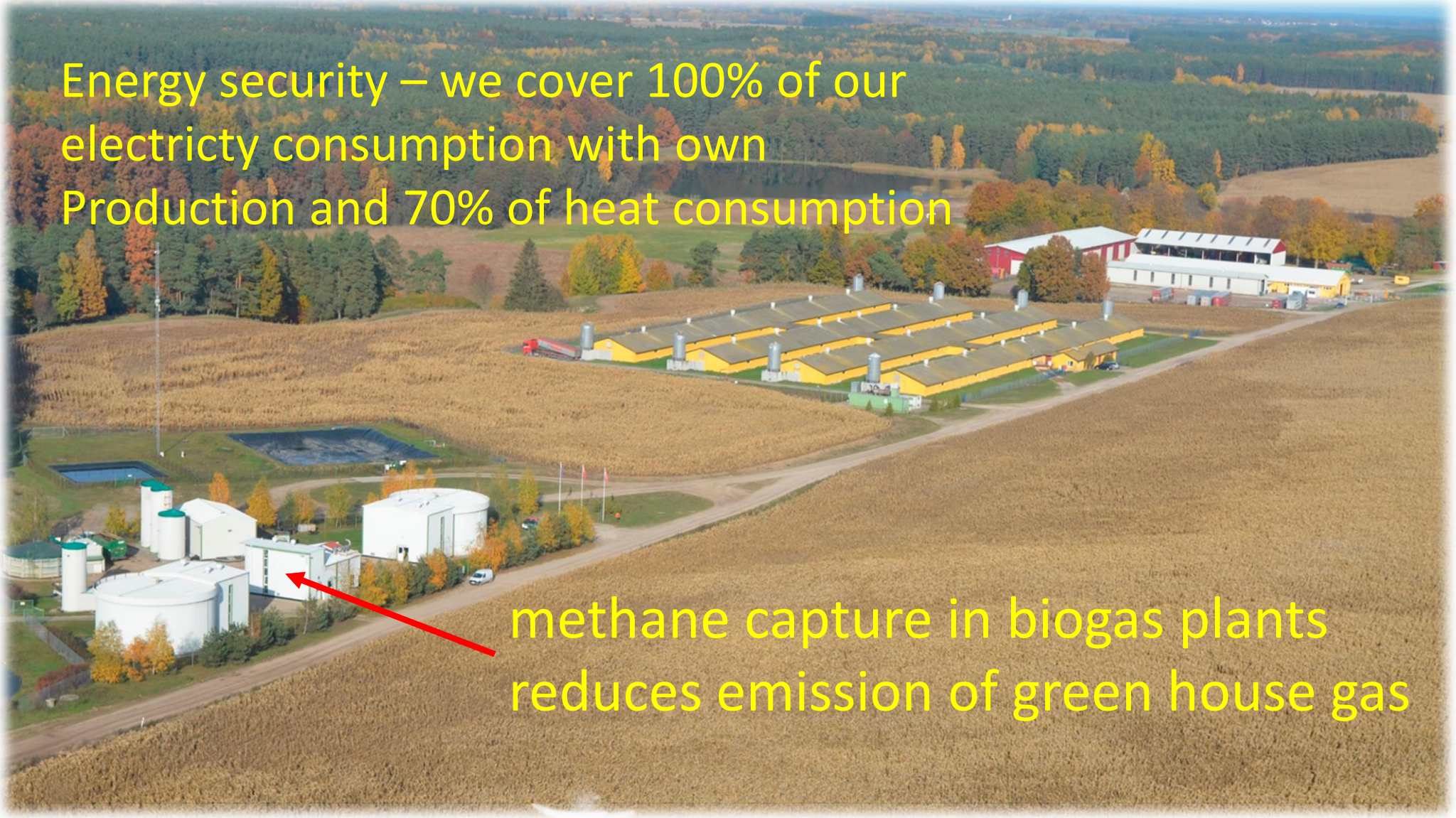
Q3: Are there pitfalls with biogas that should be avoided?

Goodvalley Poland – company profile

- Danish shareholders
- Yearly turnover: app. 100M Euro
- Employment: 1350 people
- 13,000 ha arable land grown (mostly cereals)
- Over 40 production units and farms
- 24,500 sows
- 8 biogas plants:
  - 50 000 MWh (renewable energy for ca. 16.000 households)
- Slaughterhouse – 10,000 pigs/week

Loose sows at Bara

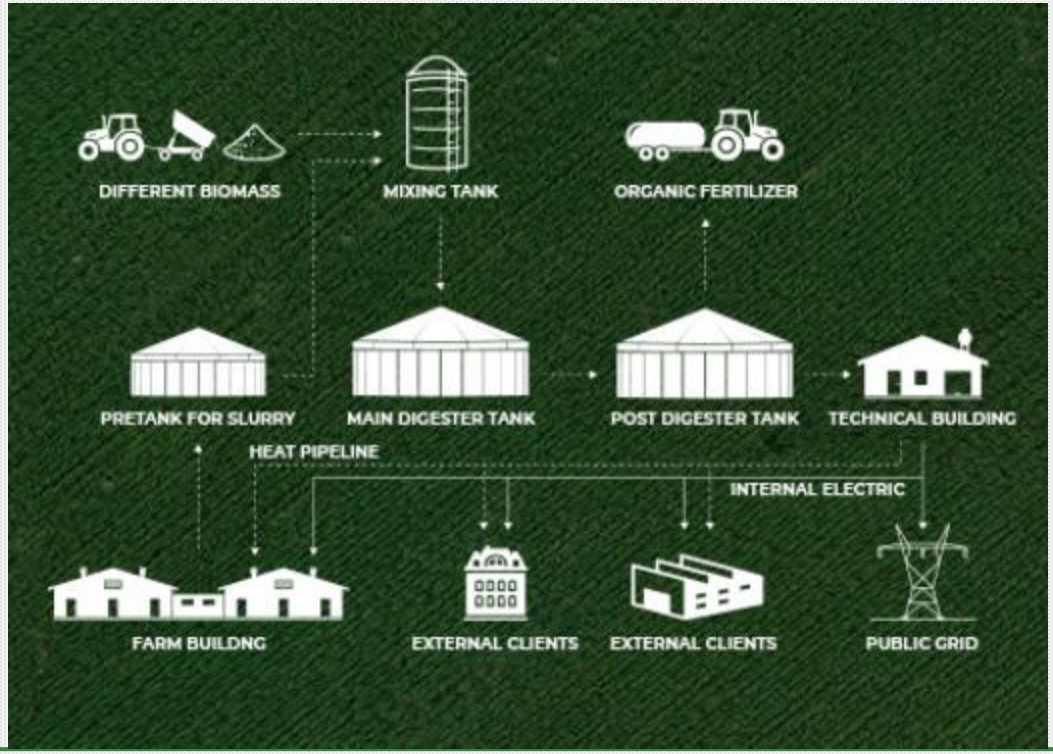
Pig farm for 9000 finishers, Arable Centre for 5000 ha, biogas plant 964 kWe in Pawłówko, Pomerania



Application of fermented pig manure using direct injection into the soil

Biogas plant – production proces (from biomass to Energy)

In Goodvalley **pig manure** represents around 45-50 % of the total feedstock input to the 8 agricultural biogas plants.
Energy crops such as **gastric content** from slaughter-house and **corn silage and grass** are used to increase the organic matter and thus the total production of biogas.
However, when using plant energy crops in biogas production, the benefits for climate and environment are reduced.



To which extent can biogas add value to the pigmeat sector?

According to the report "Pork new perspective" for 2021, a number of negative consequences for health and the environment are very often attributed to pig farming.

Biogas - advantages:

- Improvement of the image of the industry through GHG emission reduction – striving for carbon neutrality and using the Best Available Technique (BAT)
- reduction of production costs by lowering energy costs (electricity and heat)

Example from Goodvalley:

		2021	8 months of 2022
Consumption of own electrecity through own grid	[MWh]	10 324	6 784
Consumption of own electricty through external grid	[MWh]	10 159	6 582
Consumption of own heat from biogas through external grid	[MWh]	8 682	5 782
Saving of electricity costs	[kPLN]	6 752	8 971
Saving of heat costs	[kPLN]	2 038	1 374
Saving of distribution costs of electricity	[kPLN]	1 829	1 221

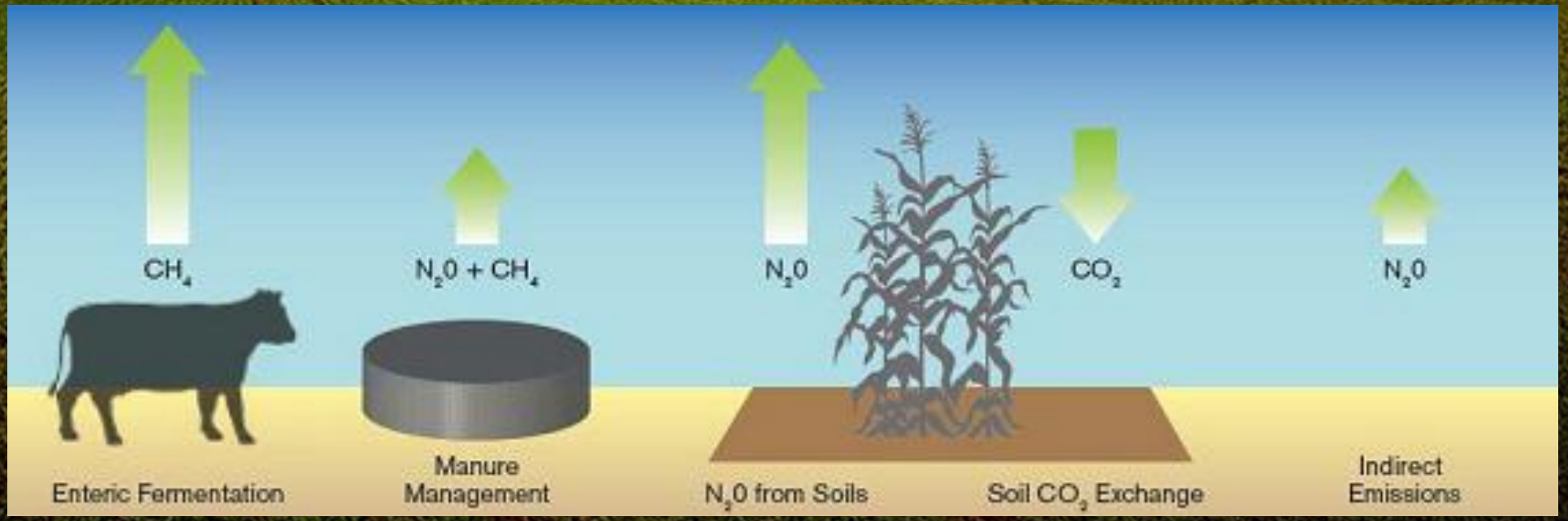
To which extent can biogas add value to the pigmeat sector?

Biogas - advantages:

- energy self-sufficiency is possible
- important element in Circular Economy and Full Value Chain
- facilitates the investment process in the case of new livestock buildings (permissions)
- digestate from biogas plants is used in the fields as high-quality organic fertilizer, which has a positive effect on the environment - very important in the „from field to table" model
- significantly lower odor nuisance – avoiding local complaints and conflicts
- unloading the General Power System – on-site self-consumption via own grid (additionally - stable source of Energy – complementary for other less stable RES)

Agriculture is responsible for around 15-20% of green house gasses,

Pork – significantly less than beef and other ruminants



To which extent can biogas address environment and climate challenges?

1. Emission reduction concerning the slurry management (methane capture):

- **1 ton of slurry[1] ➔ 1 ton of $CO_{2\text{-}e}$ (??? – various calculations are applied)**

2. Emission reduction concerning the production of green electricity and replacement of black (conventional) energy

- **/MWh[2] ➔ 698 kg $CO_{2\text{-}e}$** (conversion factor)

3. Emission reduction due to production of green heat and replacement of conventional heat sources (oil, coal, gas)

- **0,190 kg $CO_{2\text{-}e}$/ liter of LPG;**
- **0,263 kg $CO_{2\text{-}e}$/ m^3 of NG**
- **0,603 kg $CO_{2\text{-}e}$/ liter of oil[3]** (conversion factor)

[1] Corporate Carbon Footprint Report – Goodvalley 3.05.2021

[2] „Emission Indicators CO2, SO2, NOx, CO and total dust for electricity, The National Centre for Emissions Management (KOBiZE), May 2021.

[3] 2012 Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting.

To which extent can biogas address environment and climate challenges?

4. Emission reduction - biomethane / bio-LNG alternative to conventional gas (though still high cost of cleaning technologies)

- **1 m^3 of biomethane ➔ 297 t $CO_{2\text{-}e}$** ("Pork new perspective" for 2021)

5. Emission reduction due to the replacement of artificial fertilizers with digestate from biogas plants (lower dependency on imported mineral fertilizers)

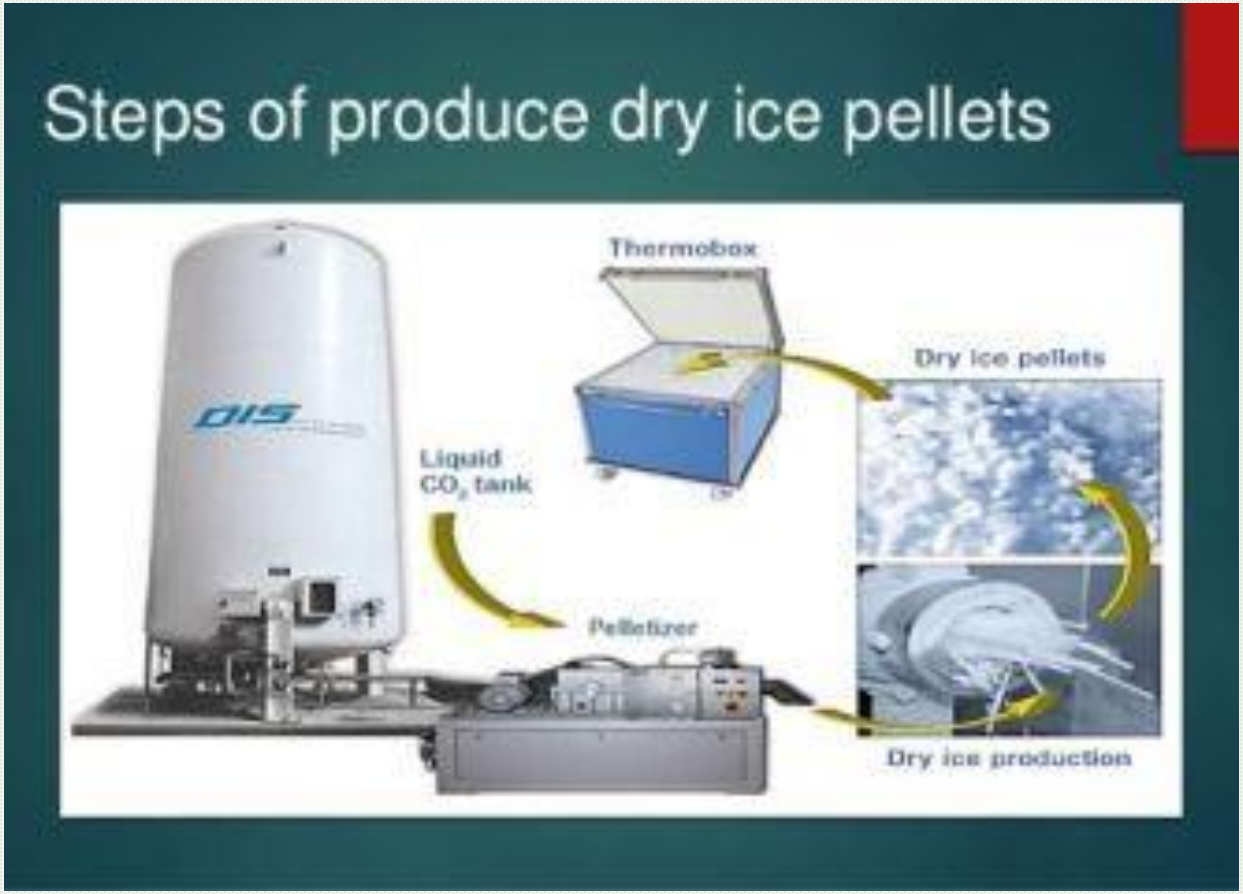
- **1,25 t $CO_{2\text{-}e}$ /1 ha** ("Pork new perspective" for 2021)

6. Waste from agri-food industry, gastric content from slaughtered animals, etc. may be good input to a biogas plant

- waste utilised in biogas plant: overall conversion factor of **21.32 kg CO_2/1 ton** is applied

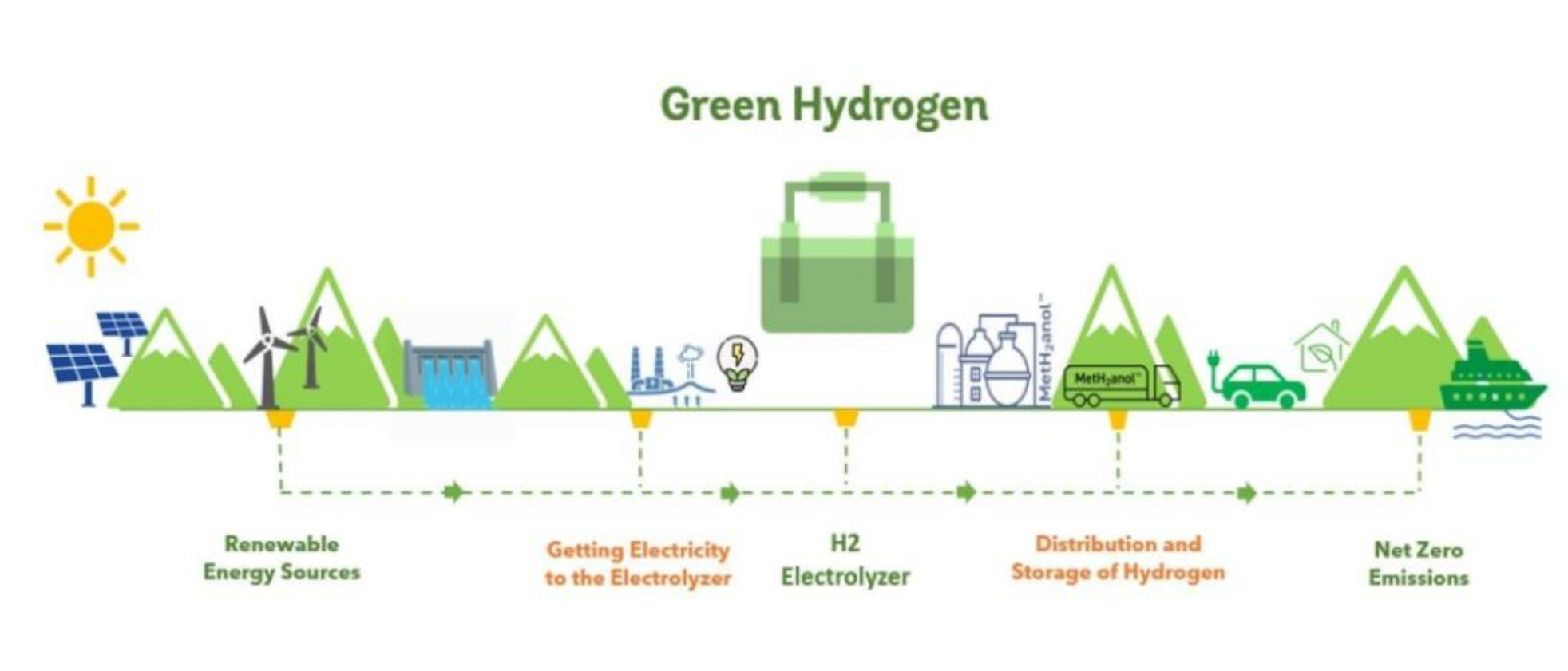
To which extent can biogas address environment and climate challenges?

- Possible direct capture of CO_2 for e.g. production of dry ice for meat processing industry



To which extent can biogas address environment and climate challenges?

- Possible production of **green hydrogen** for fuel purposes



https://blogs.worldbank.org/ppps/green-hydrogen-key-investment-energy-transition

Climate-friendly actions undertaken by producers vs. consumers' perception

- Consumers' awareness of how pork production and agriculture influences the cimate is rather low (too technical terms)
- Consumers' readiness to pay a premium for climate-friendly products? – rather low and expected to be weakened by the the forthcoming recession
- Goodvalley's experience: the consumers pay attention to:

Referring to processed products ➔

TOP IMPORTANT CRITERIA

93%	Good taste
90%	100% meat
87%	Without additives
85%	Good nutritional value
81%	Without conservatives
79%	Natural product

Referring to processed producer ➔

TOP DRIVERS - PRODUCER

41%	Pigs are from Poland
38%	Coop. with Polish farmers
32%	High animal welfare

- **Animal welafre and climate-friendly come lower in the rank**
- Goodvalley's new approach: replace calculation of Carbon Footprint with **Life Cycle Assesment** (from 2022)

Are there pitfalls with biogas that should be avoided?

- Power of the plant not adapted to the raw material input
- Unsecured input of raw materials (stable contracts needed)
- Technology not adapted to the raw material input (e.g. too small tanks)
- Insufficient amount of land for responsible management of the digestate
- Challenges with obtaining official registration of digestate-based fertilizers
- No possibility of consuming or selling heat (important for the total economy)
- Mistakes due to formal status: biogas vs. agricultural biogas (using wrong
- raw material)
- Using of animal by-products without proper registering of the plant
- Location far away from consumers of energy and raw material supply
- Failure to systematic maintanance and service
- Making investments and operations dependent on the national support schemes

Are there pitfalls with biogas that should be avoided? How to address?

- Use of first generation raw materials (applicable in food or feed production) will be probably limited or forbidden in the near future
- It is necessary to develop technologies which can allow a viable replacement with second generation materials, e.g. straw

Goodvalley's straw briquette project in Uniechówek biogas plant:

- The straw briquette production line in Goodvalley started operating in
- Uniechówek on the 15th of September of 2020 to replace maize silage as substrate
- for biogas production with 2nd generation raw materials.
- The automated briquette production line opens straw sheaves, shreds the raw material into the expected fragments and is finally briquetted by the press.
- The most difficult challenge is the hard-to-breakdown cellulosic lignin fibers.
- During production, the briquette is exposed to high temperatures of about 160-200°C. Due to the high temperature, briquette is a safer material in terms of biosecurity for animals. Therefor Goodvalley uses it as **bedding and toys** for the pigs.
- Goodvalley produces briquettes from own straw.

Production of straw briquettes for replacement of maize silage (Goodvalley – Uniechówek)

Production capacity about 1.5 t / h.

1 ton of briquette replaces 1.5 ton of maize silage

Economy:

Investment cost – 0.6 m Euro

Production cost of 1 ton of briquette – 127 Euro/t

Are there pitfalls with biogas that should be avoided?

- Scale of biogas plant vs. size of the pig farm

Biogas plant	Power [MW_e]	Number of pigs	Kind of pigs
Pawłówko	0,946	9.200	finishers
Płaszczyca	0,625	3.200	sows (+piglets)
Koczała	2,126	8.100	sows (+piglets)
Nacław	0,625	12.000	finishers
Świelino	0,625	12.000	finishers
Uniechówek	1,063	16.000	finishers
Giżyno	1,063	1.900	sows (+piglets)
Bara	0,330	5.000 sows and 23.000 weaners	sows and weaners

- Size of biogas plant must be adopted to the available volumes of raw materials
- Size of biogas plant must be adopted to the heat needs of the technological process

Are there pitfalls with biogas that should be avoided?

- Quality of slurry from different pig groups

Kind of pigs	m^3 of biogas / ton of slurry
Sows	12-15
Weaners	20
Finishers	30-35

Parameters	Value	Unit*
Raw materials name	Pig manure	m^3
PH	5.5 – 8.0	[-]
Dry matter content	Optimum 6-8% ca. 4%	[%]
Organic matter content	>= 70%	[%]
Expected biogas output	>=14	[nm^3/t]
Expected methane content	>=57%	[%]
Nitrogen (N)	Max 6	[g/kg]
Phosphorus (P_2O_5)	Max 5	[g/kg]
Sulphur (S)	Max 1	[g/kg]
Potassium (K)	Max 6	[g/kg]
Calcium (Ca)	max 3,5	[g/kg]
Copper (Cu)	Max 8	[mg/kg fresh matter]
Zink (Zn)	Max 38,2	[mg/kg fresh matter]

Models for sale of Energy to the grid (in Poland)

- Tarrifs:

There are two kind of tariffs in Poland: **feed-in-tariff** (FIT) and **feed-in-premium** (FIP)

- **FIT** concerns plants below 0,5 MW and is calculated as 95% of reference price which is published in ordinance of the Council of Ministers
- In **FIT system** the energy has to be sold to operator (so called „obliged entity")
- FIP concerns plants over 0,5 MW and below 1 MW and is equal to 90% of reference price which is published in the ordinance of the Council of Ministers
- **In FIP system** energy is sold to a trading company and then the producer applies for negative balance coverage (the difference between the reference price and the average price on the TGE – Energy Stock Exchange)
- The reference price **760 PLN/MWh** for agricultural biogas plants producing in high-efficiency cogeneration and **650 PLN/MWh** for other agricultural biogas plants
- Currently projected reference prices accordingly: **885 PLN/MWh** and **760 PLN/MWh**
- FIT and FIP apply only to the electricity put to the grid

Models for sale of Energy to the grid (in Poland)

- **Public auctions**:
  - Public auctions concerns biogas plants over 1 MWe
  - the maximum price that can be obtained in the auction is equal to the reference price and the bidding during the auction is down
  - Public auction applies only to the electricity put to the grid
- **Direct sale to the market and „blue certificates”**:
  - In the old support system electricity produced from agricultural biogas plant is supported by **blue certificates** for each 1 MWh of electricity produced (app. 300 PLN/MWh)
  - energy is sold on the energy market to the regional operator, to a trading company or to final customers if there is possibility
  - energy is sold to the operator at a price established on the competitive market (market average for the previous quarter published by the Energy Regulatory Office)
  - energy is sold to the trading company at market price in a few models: on balancing market, contract market and SPOT market

Investment case – agricultural biogas plants 0,999 MW – in Feed-in-Premium support scheme

	1st generation raw materials	2nd generation raw materials
Investment expensess ['000 PLN]	**30,000**	**33,000**
Sale of electricity - FIP ['000 PLN]	5,400	4,800
Sale of heat ['000 PLN]	1,600	1,600
Total revenue ['000 PLN]	**7,000**	**6,400**
Variable costs ['000 PLN]	4,200	4,600
Overhead costs ['000 PLN]	2,500	2,700
Total costs ['000 PLN]	**6,700**	**7,300**
EBITDA ['000 PLN]	**300**	**-900**

GOODVALLEY

Since 1994

Home of Quality

Thank you for your attention,

Grzegorz Brodziak

Vice President – Sustainable Development

Goodvalley Group

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