Expérience allemande: politique et appresentissage technologique

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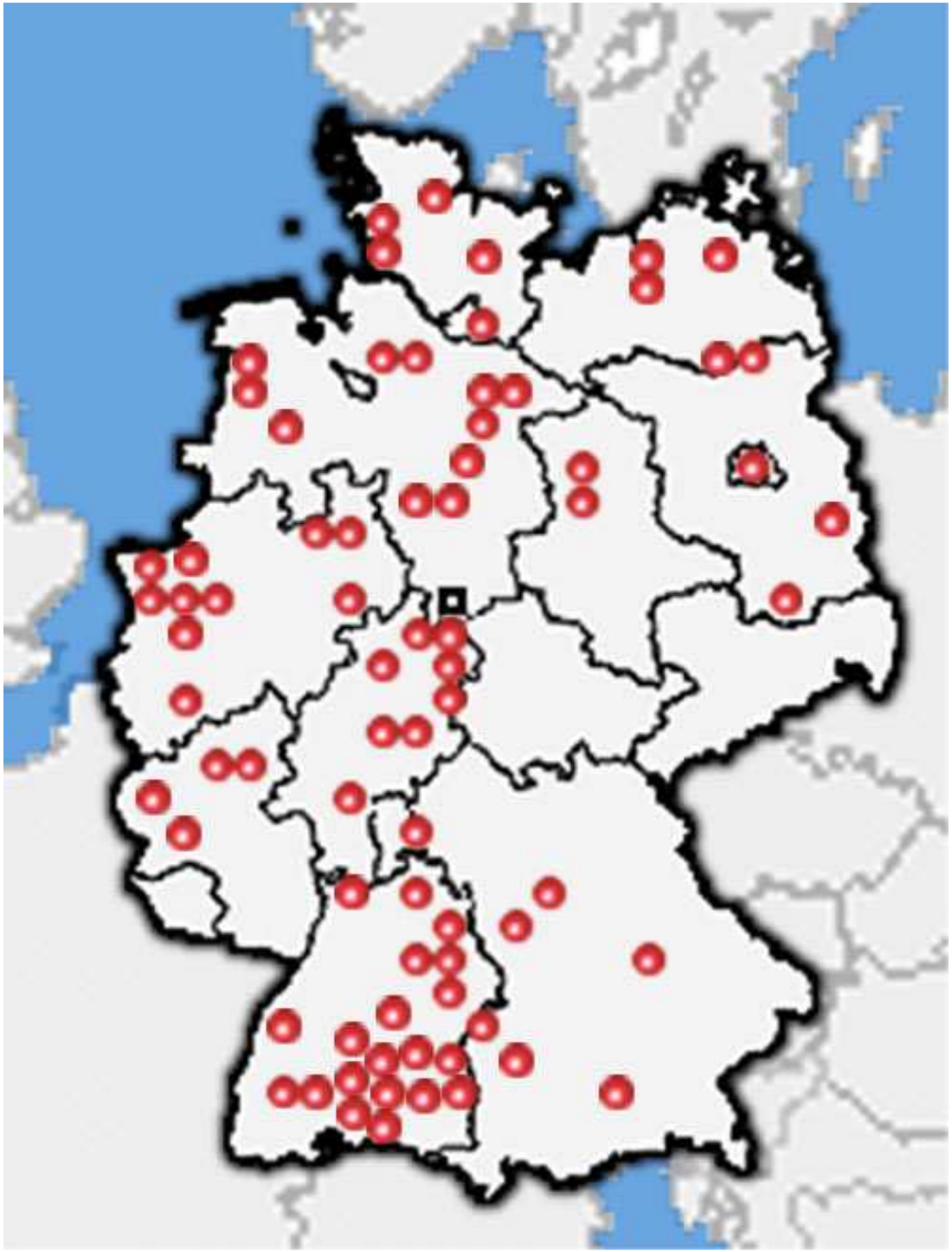
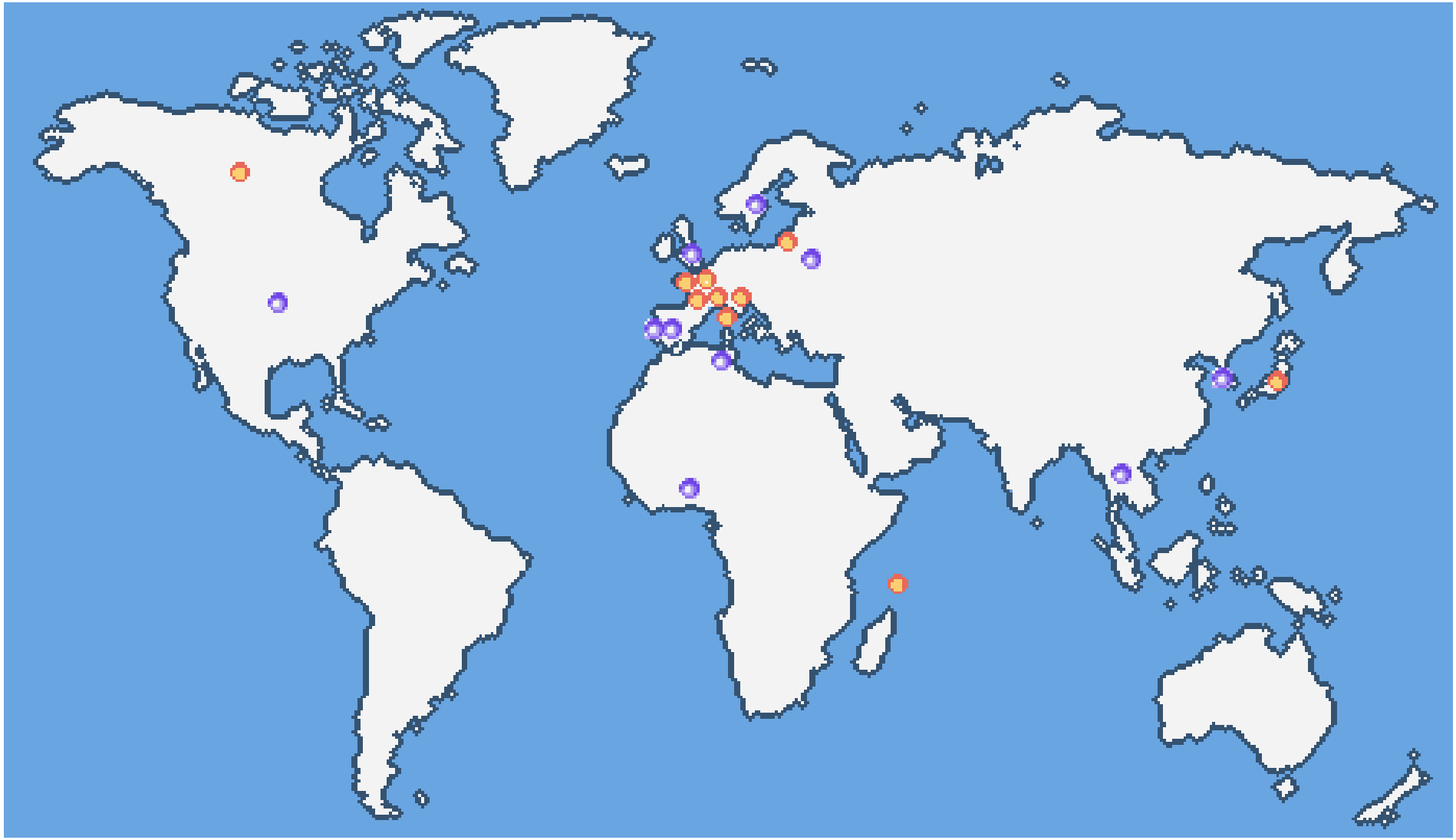
Krieg & Fischer Ingenieure GmbH

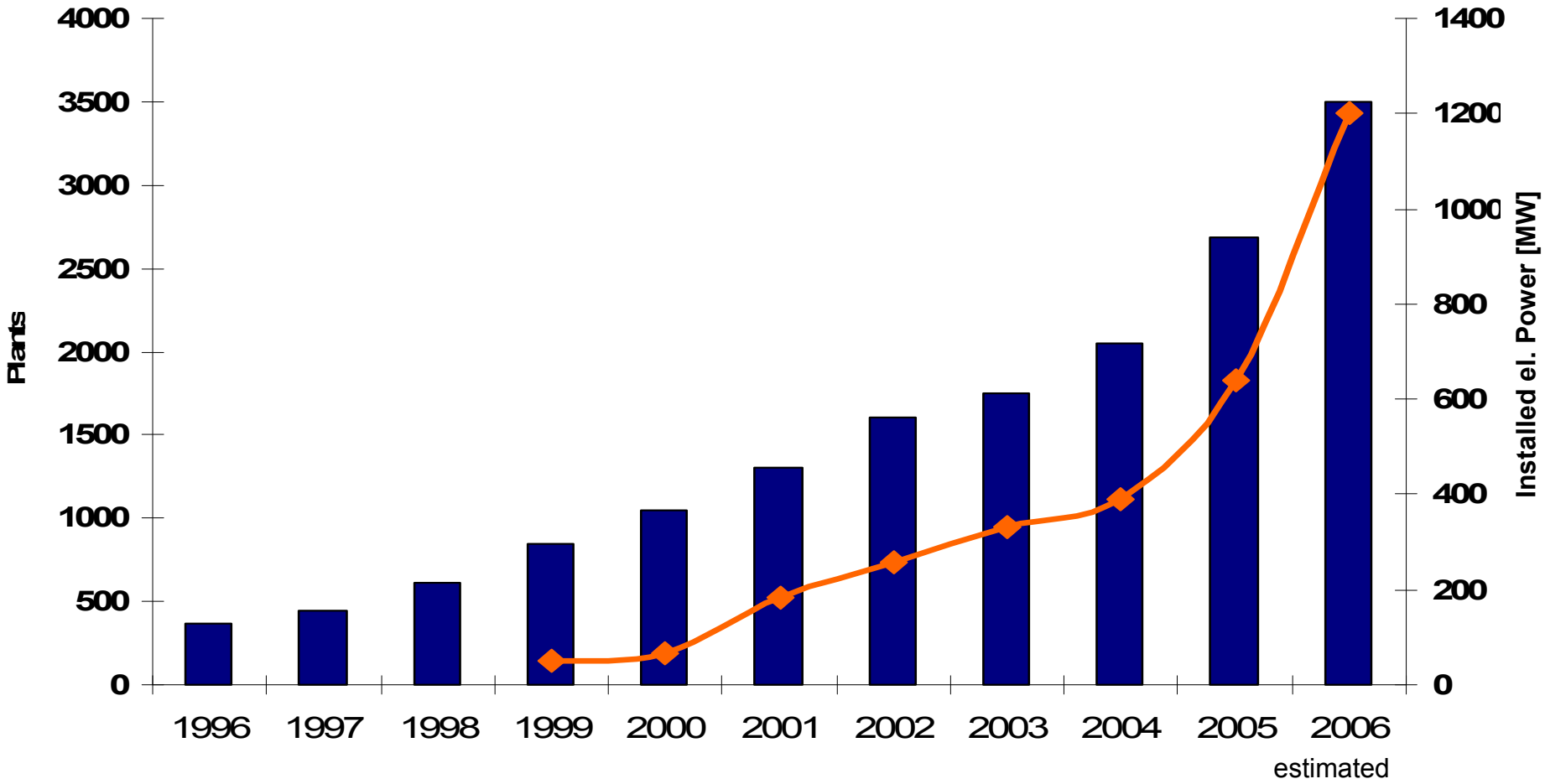
Engineering Office, Planning and Construction

Founded:	**1999**
Experience:	**20 Years**
References:	**about 120 total**
	about 90 farm-scale
	Germany, Japan, Netherlands, Austria, Switzerland, Lithuania, Italy, Slovacia, Canada, USA, Spain, France
Team:	**14**
Partners:	**Japan, USA, Austria, Bulgaria, France, Hungary, Turkey, Poland, Ireland**





Biogas Plants in Germany



Reasons for Biogas Plant Development in Germany

- Local activities against nuclear power plants
- National interests in renewable energy production
- Shortage of national coal, oil, etc. resources
- Official responsibilities regarding Kyoto Protocol
- Economical interest of farmers, utilities, fonds, etc.
- Guaranteed Income by law
- Few other possibilities to make business with farm work

Development for Renewable Energies in Germany

- 1992 first Renewable Energy Law

  Payment: about 6,5 €ct/kWh$_{el}$, unclear funding for investment

- 2000 second Renewable Energy Law

  Payment: about 10 €ct/kWh$_{el}$,30% funding for investment

- 2004 third Renewable Energy Law

  Payment: about 10 (9-11,5) €ct/kWh$_{el}$, + 6 (4) €ct/kWh$_{el}$ for energy crop digestion, + 2 €ct/kWh$_{th}$ for heat usage

Economical Background in Germany

- Income until 2000: about 50% by tipping fee for waste, about 50% by selling electricity to public grid
- Income until 2004: about 25% by tipping fee for waste, about 75% by selling electricity to public grid
- Income now: 100% by selling electricity to public grid (energy crops and manure); about 25% by tipping fee for waste, about 75% by selling electricity to public grid (waste digestion)

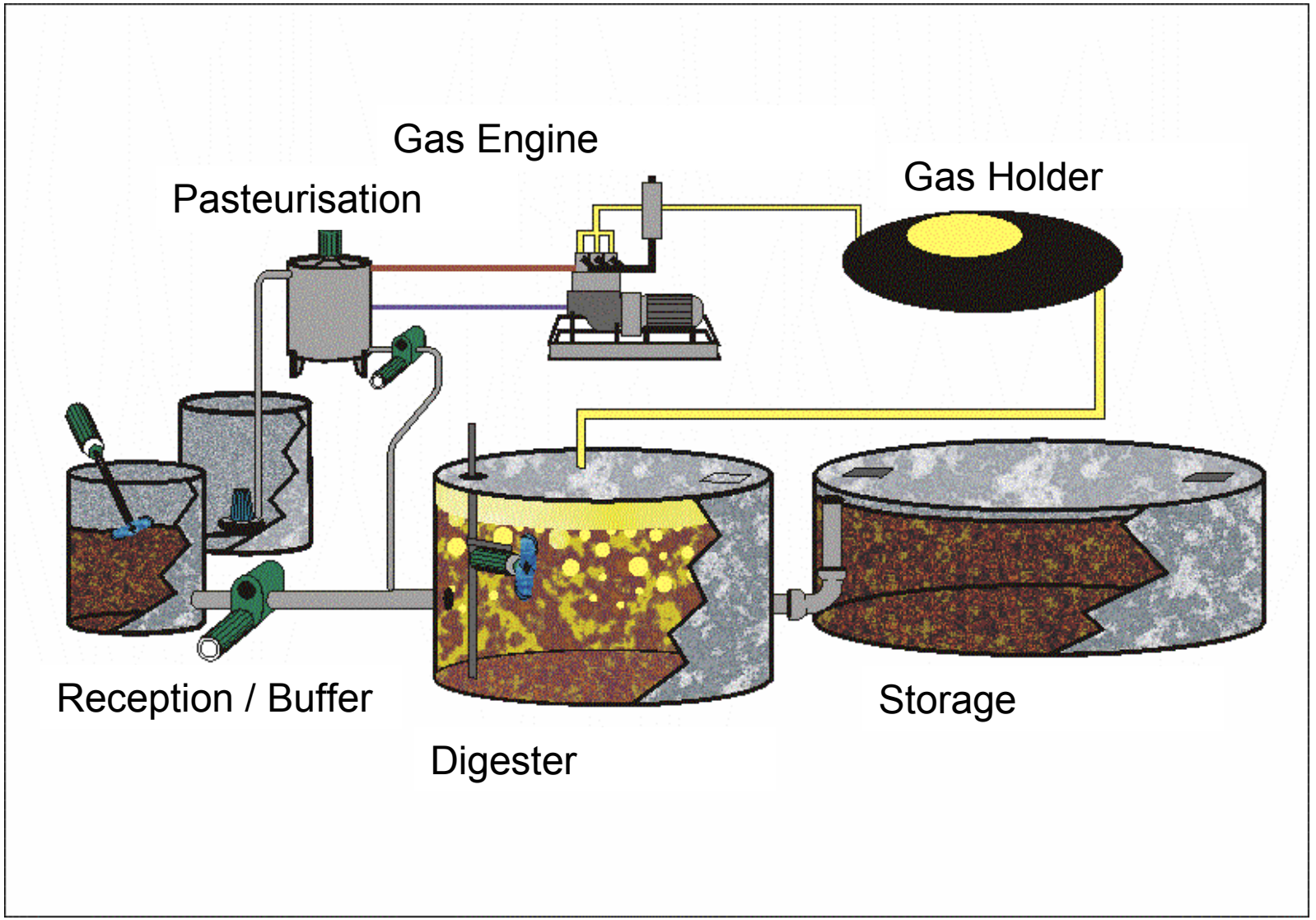
→ all the time: low interest rates for investment in renewable energies

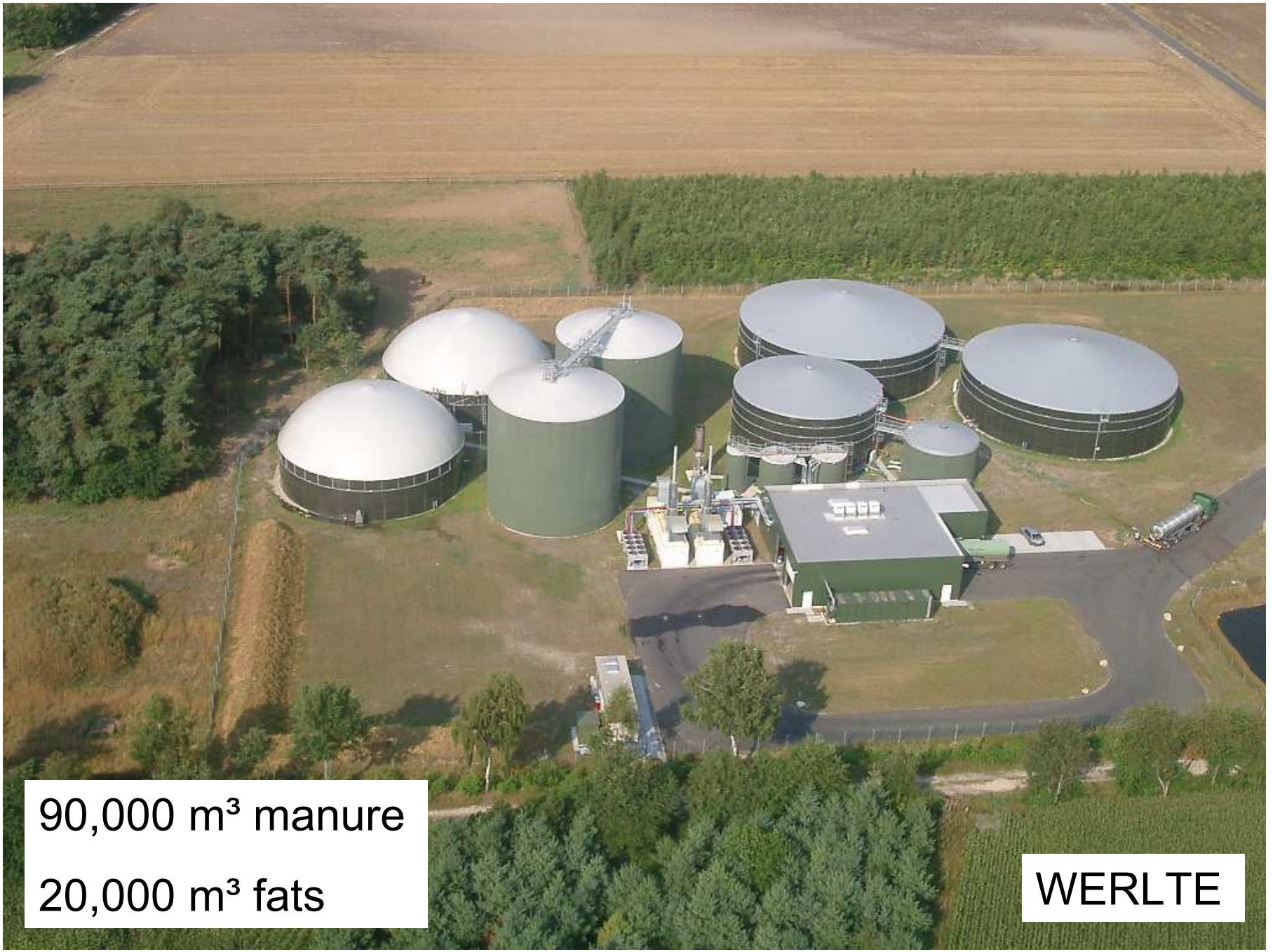
Trends in AD

- until 2000 all biogas plants were designed for organic waste digestion or organic waste + manure digestion
- from 2000 to 2004 very few farmers tried energy crop digestion
- first pure energy crop digestion biogas plant: startup in 2003
- 2005 + 2006 98% of all biogas plants are energy crop digestion plants with and without manure

- new: „Energy Crop Biogas Plants“ vs. „Waste Biogas Plants“


2003: 100% silage
110 kW$_{el}$, 680 m³ digester volume

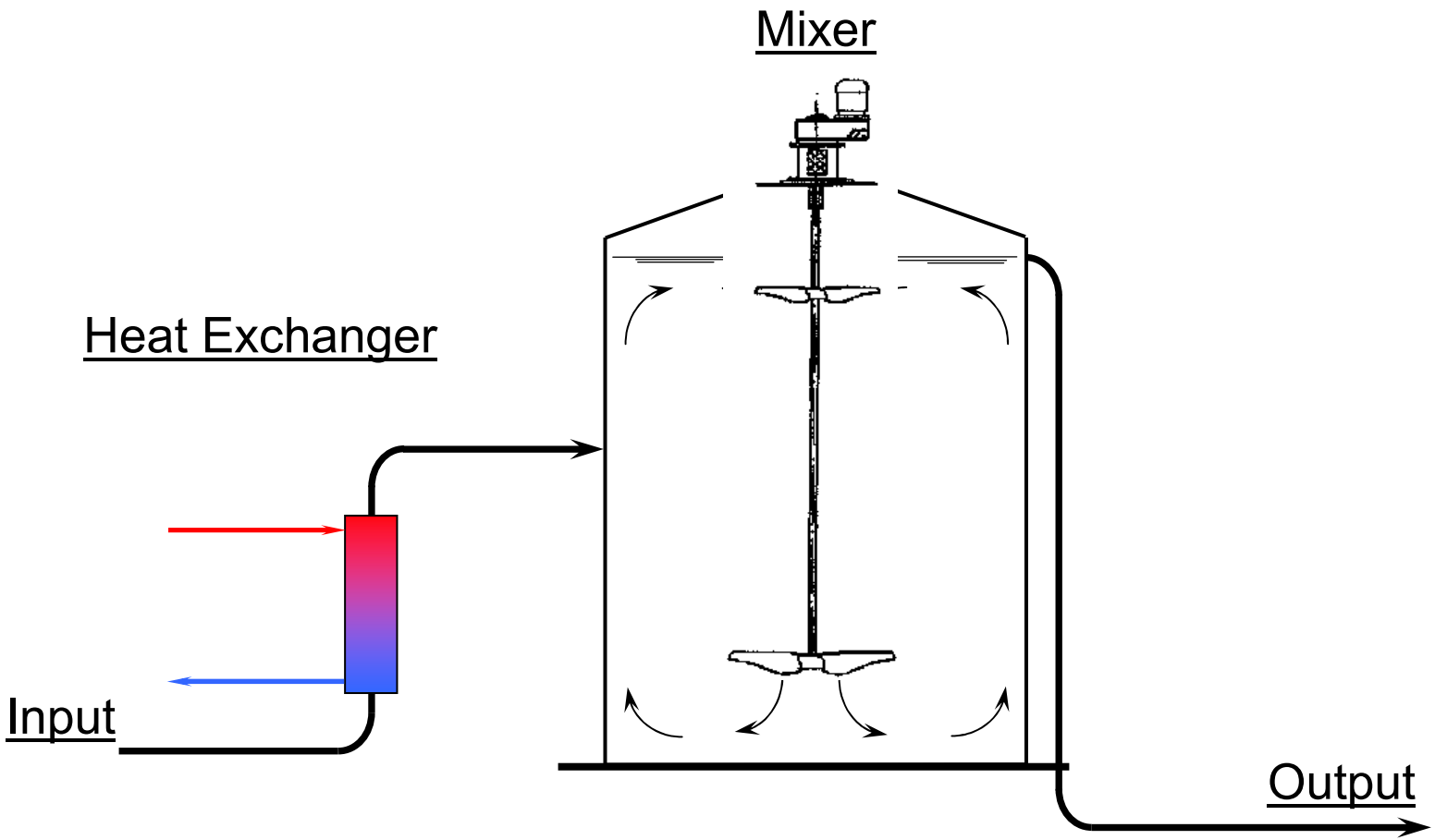

Gas Engine
Pasteurisation
Gas Holder
Reception / Buffer
Digester
Storage


90,000 m³ manure
20,000 m³ fats
WERLTE


WIETZENDORF
100% potato residues
(after starch production)

Upright Large Digester

(up to 5.000 m³ Volume)



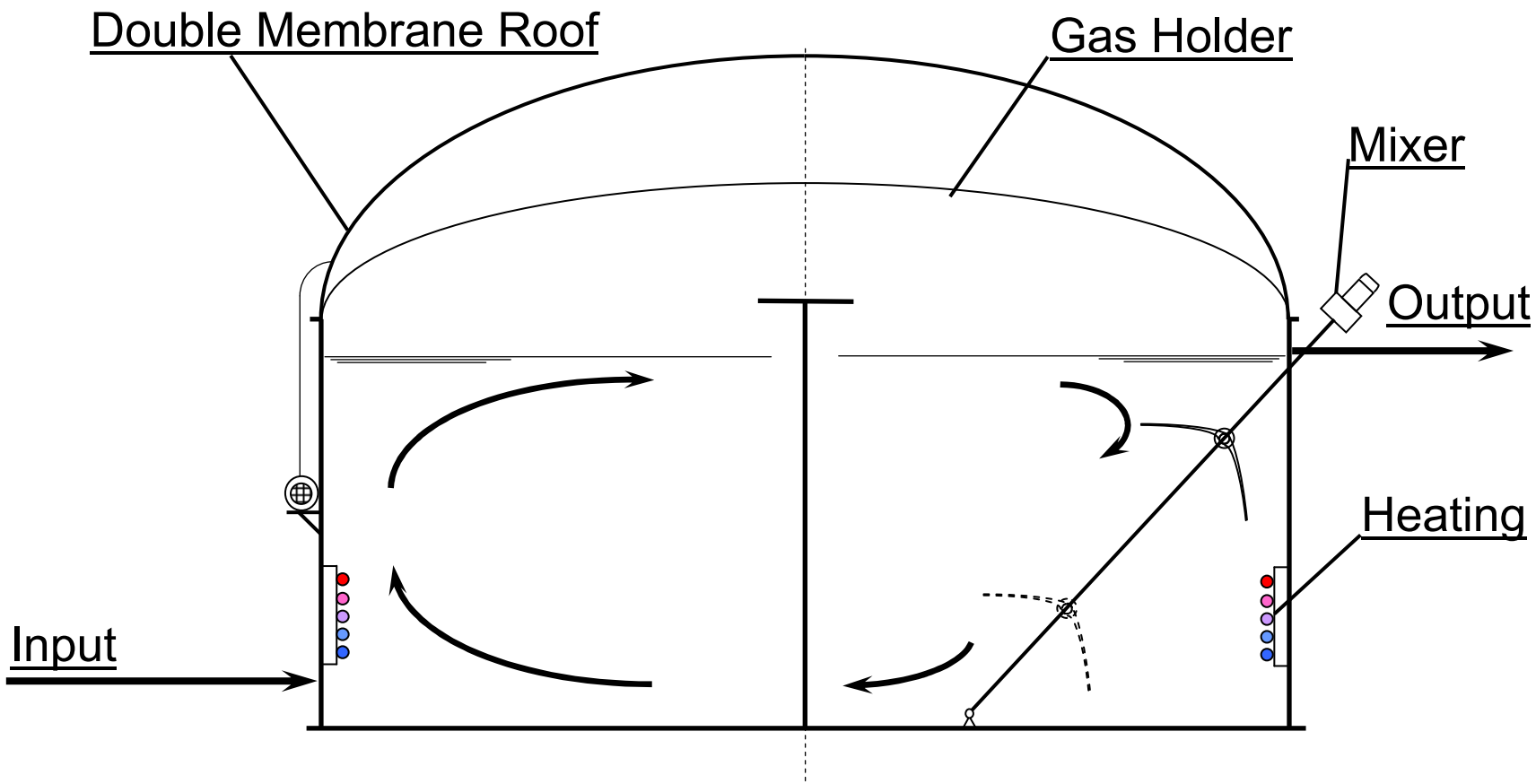

Saskatoon, SK


VAN GENNIP
70,000 m³ pig manure


FABEL
pig manure, corn,
sugar beet residues,
potatos, …

Standard Digester in Agriculture

(up to 1.250 m³ Volume)




Im Brahm
pig manure,
kitchen waste


Prad
manure, apple
juice residues

Requirement for this presentation:

Layout of a small farm scale biogas plant

- What is a small farm scale biogas plant?
- What waste? What economy? What manure? What acreage? What pasteurisation?

Result: there is NO „the“ typical farm scale biogas plant. Every biogas plant – and especially for waste digestion is designed independently. (In Canada only waste digestion biogas plants are economically feasible.)

Biogas Production

Corn Silage	1 Mg	30% TS	94% VS	700 l/kg$_{VS}$	197 m³ Biogas
Wheat Silage	1 Mg	30% TS	90% VS	600 l/kg$_{VS}$	162 m³ Biogas
Grass Silage	1 Mg	30% TS	89% VS	550 l/kg$_{VS}$	145 m³ Biogas
Cattle Manure	1 Mg	8% TS	80% VS	200/500 l/kg$_{VS}$	13/32 m³ Biogas
Pig Manure	1 Mg	6% TS	75% VS	350/500 l/kg$_{VS}$	16/23 m³ Biogas
Poultry Manure	1 Mg	24% TS	85% VS	300/550 l/kg$_{VS}$	61/112 m³ Biogas
Kitchen Waste	1 Mg	20% TS	90% VS	700 l/kg$_{VS}$	126 m³ Biogas
Fats	1 Mg	25% TS	95% VS	1.000 l/kg$_{VS}$	238 m³ Biogas

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Statement

No biogas plant is economically feasible with manure as input substrate only. In Canada we need organic waste for two reasons:

a) Tipping Fee (Gate Fee)
b) Extra Biogas Production

Example for a waste biogas plant, farm scale

(in Germany) (1)

Basic Design:
- 8,000 m³/a pig manure, 6% TS, 75% VS, 400 m^3/t_{VS}
- 4,500 t/a kitchen waste, 20% TS, 90% VS, 700 m^3/t_{VS}

- Result 1: 16 m³/h biogas production from pig manure
- Result 2: 65 m³/h biogas production from kitchen waste

- Result 3: 190 kW_{el} power gas engine
- Result 4: 1.000 m³ digester volume (net volume)

- Result 5: Investment € 600.000 - 800.000,- (plus VAT)

Example for a waste biogas plant, farm scale

(in Germany) (2)

Open Questions:

- How much storage capacity for the digestate is available on site the farm? Has there to be constructed additional storage capacity?
- How high will be the costs for the transformer (connection to the electricity grid)
- Do we need a pasteurisation? If yes, pasteurisation with what temperature, for how long, what particle size?

Prices for a biogas plant in Germany, example food waste + pig manure	
	Euro
Civil Works	**60.000,00**
Reception Tank	**on site**
Pasteurisation	**60.000,00**
Digester	**125.000,00**
Secondary Digester/Storage Tank	**100.000,00**
Storage Tank	**60.000,00**
Gas System	**10.000,00**
Buildings	**25.000,00**
Equipment	**50.000,00**
Gas Engine, 191 kWel	**170.000,00**
Electrical Equipment	**70.000,00**
Transformer, incl. Connection to grid	**on site**
Engineering, Permission, etc.	**70.000,00**
Sum, without VAT	**800.000,00**

Example for a waste biogas plant, farm scale

(in Germany) (3)

Economical Basics:

- How much tipping fee will the operator get? - € 20,-/ton kitchen waste? € 40,-? € 60,-? For what period is this calculable?
- How high will be the costs for spreading the digestate onto the fields? Has the farmer got enough own fields or does he need to hire fields from other farmers? What will this cost over 20 years?
- How long is the life expectancy of the 191 kW_{el} gas engine? 10 years or more? What about reinvestment and costs for maintenance and repair services?
- What interest rates will the operator get for financing?

Example for a waste biogas plant, farm scale (in Germany) (4)

Typical Results for farm scale waste biogas plants in Germany:

- Investment: € 1.000.000,- (+ VAT) +/- € 500.000,- (+ VAT)
- Depreciation Time: 8-14 years
- Working Time per day: 1-3 hours
- Reinvesting every few years according to the requirements of the market
- Spending more and more money for better process control (measurement device, laboratory tests)
- People who have invested once will build another biogas plant or will enlarge the old one again and again

Mistakes in Biogas Plant Design and Construction

- each biogas plant is designed independently according to the input substrate.
- every operator should have a look to several biogas installations in order to find the most suitable for himself – in respect to his input substrates
- a lot of materials for the equipment have to be suitable for use in biogas plants. To make a proper assessment somebody with experience is necessary. Too cheap is never good.
- the money is earnt with the gas engine. The price for the investment of the gas engine is of minor importance compared to maintenance costs and service costs.

using proper materials


using proper biogas
cleaning systems

using proper insert gaskets …


…. or cleaning up


using proper
measurement devices


What is this?


… a submerged mixer from a kitchen waste digester !


BE A CLEAN
OPERATOR ! ……..


…….. AND BIOGAS
WILL BE WONDERFUL !

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