Renewable Energy Asia 2008

June, 4th 2008 / BITEC, Bangkok

Johann Heinrich von Thünen-Institut

International Development in Biogas Utilization

A. Schattauer

Johann Heinrich von Thünen Institut (vTI)

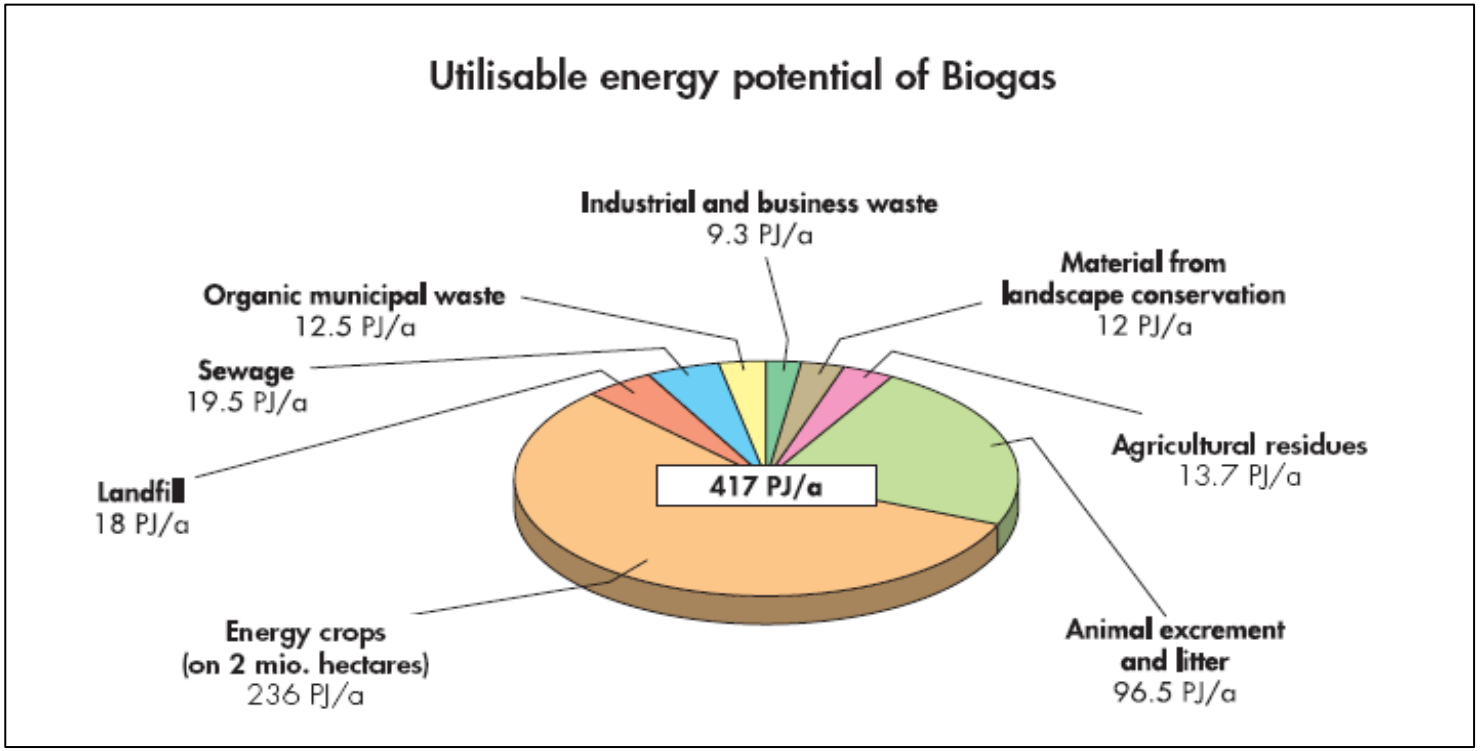
Federal Research Institute for Rural Areas, Forestry and Fisheries

Braunschweig / Germany

Outline

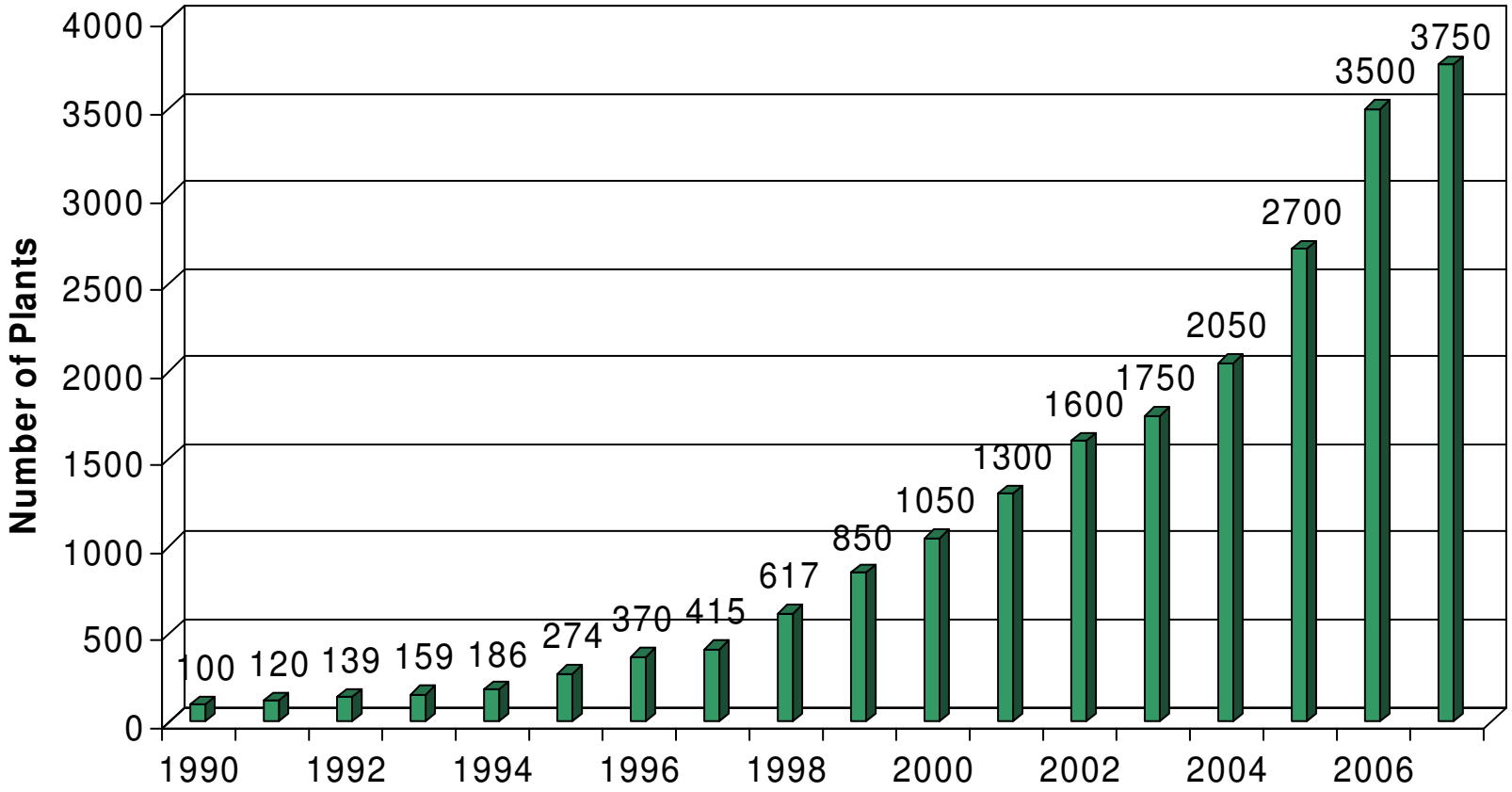
- Introduction
- Biogas plants & renewables in Germany
- Activities at vTI-Institute
- Process Design and Operating Conditions

Energy Potential

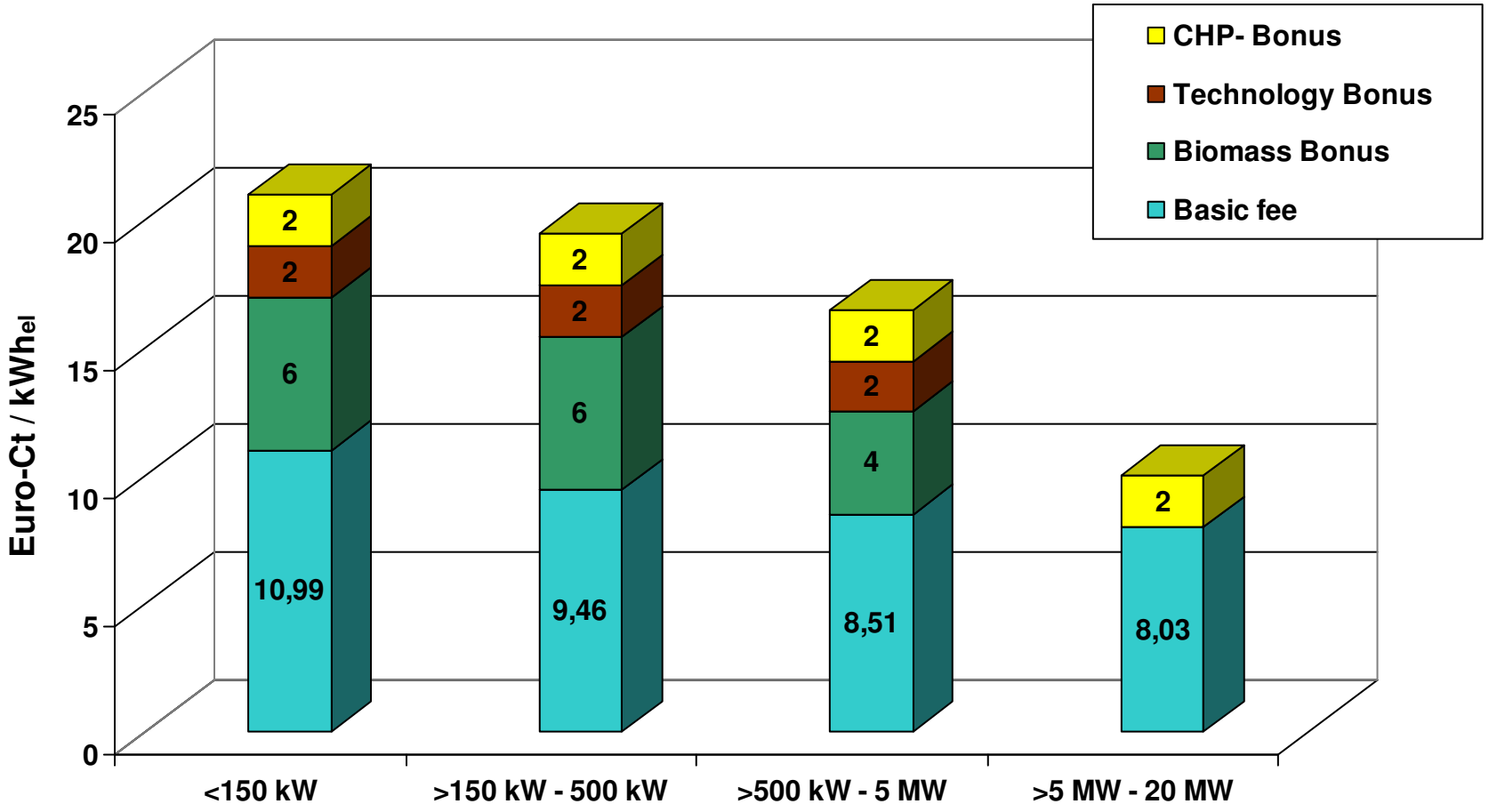


Source: FNR

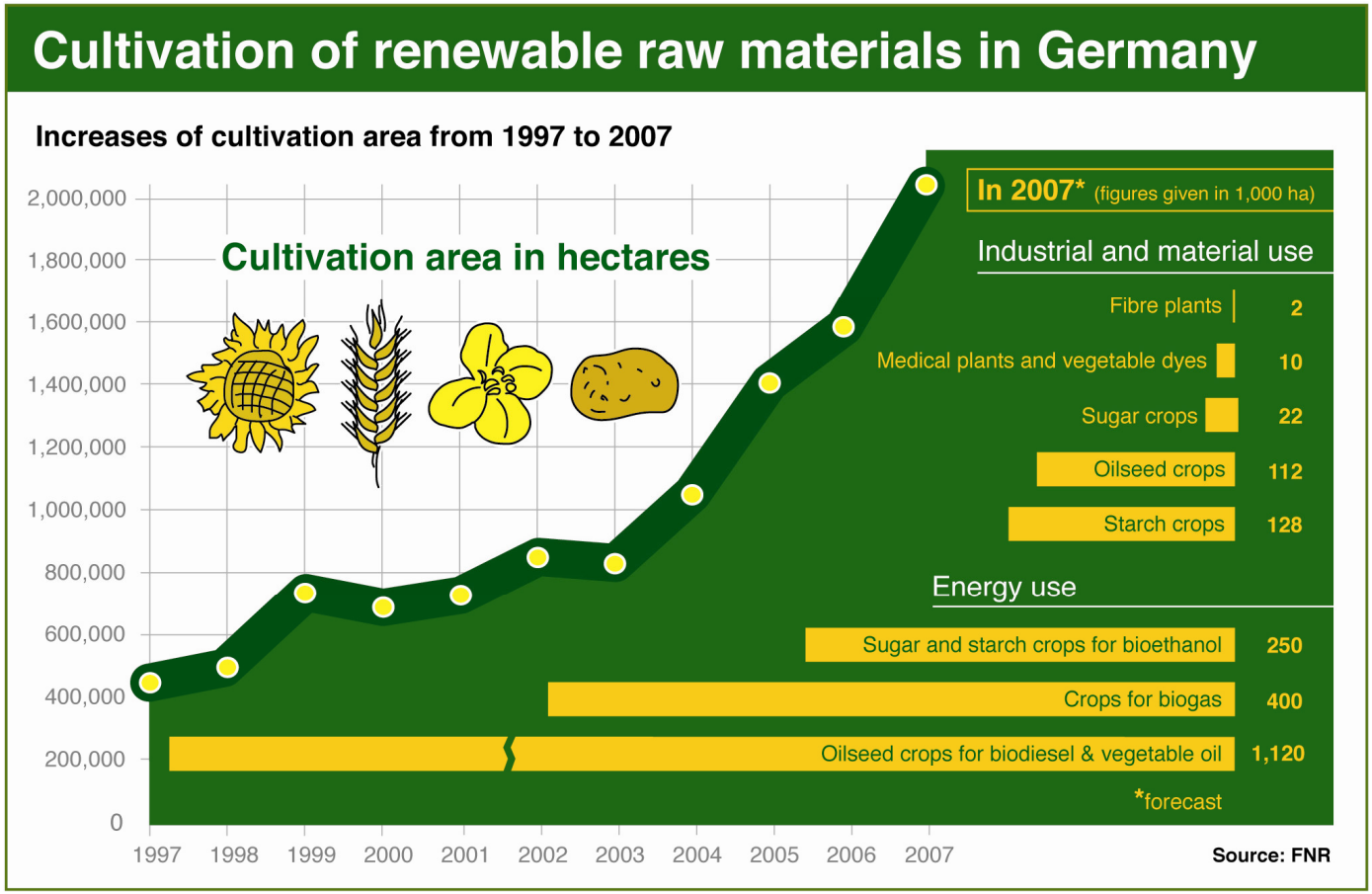
Biogas plants in Germany



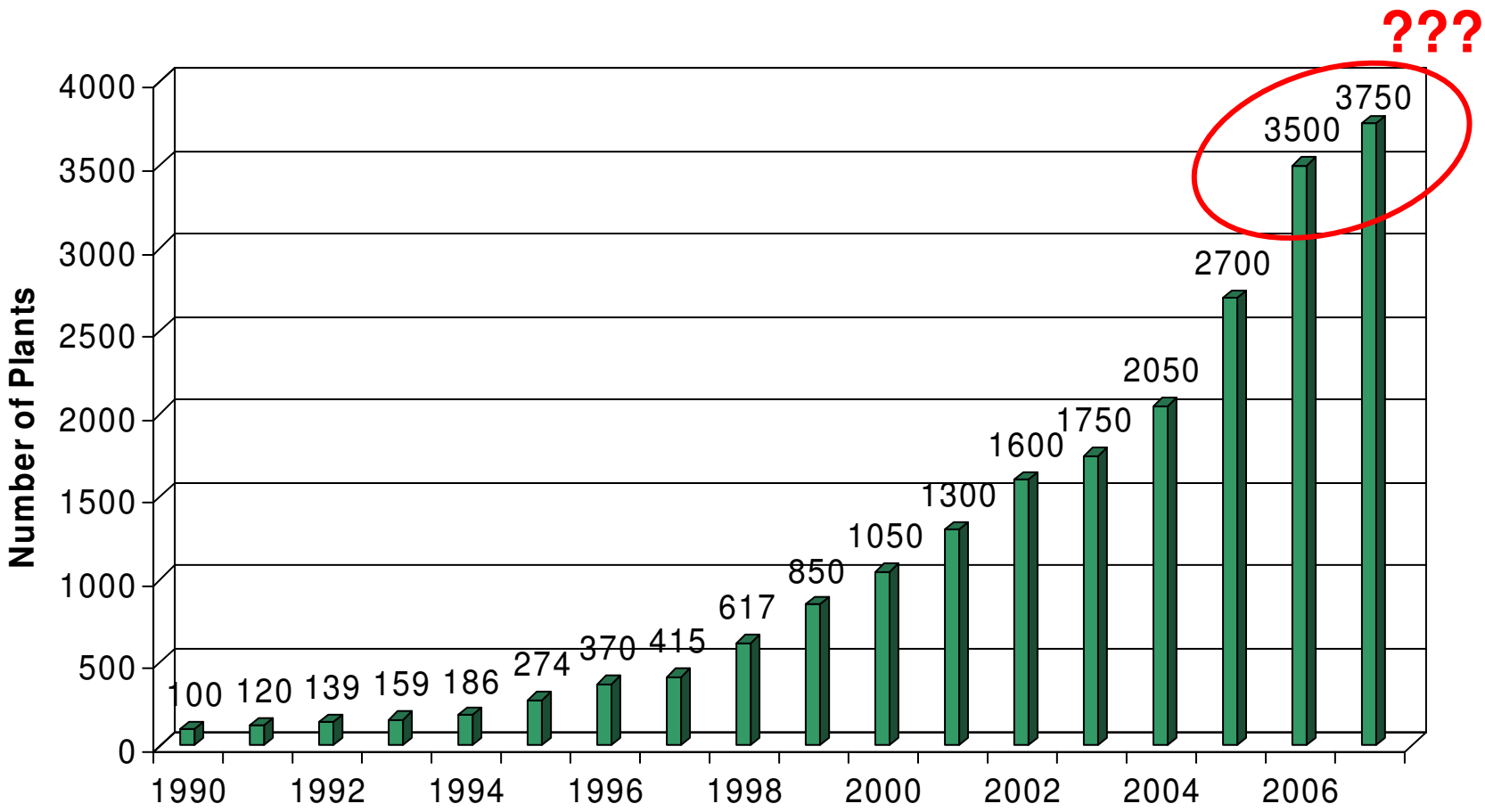
Feed-in tariffs for biogas-based electricity



Renewables in Germany



Biogas plants in Germany



Amendment of EEG (2008)

- **The actual draft for the amendment of the EEG has planned to open the input of biogas plants for specific by-products and residues from industry without loosing the biomass bonus.**

➢ **<u>Application of biorefinery concepts possible</u>**

Johann Heinrich
von Thünen-Institut

Activities at vTI

Projects & Programs

EU-Agro-Biogas Project (2007 – 2009)

European Biogas Initiative to improve the yield of agricultural biogas plants

Objectives:

- To improve the degree of efficiency in the fermenter of about 35%
- To increase the biogas yield of about 40%
- To optimise and guarantee quality and safety of digested material
- To improve, optimise and demonstrate selected conversion technologies (CHP, heat utilisation)
- To reduce the investment and operational costs of medium and large agricultural biogas plants of about 20 to 30%

vTI

EU-Agro-Biogas Project

- **14 Partners from 8 countries**

- **European online substrate atlas / database and standardised methane energy valuation model**
- **Innovative feeding technology**
- **Monitoring, management and early-warning system for agricultural biogas plants**

National Biogas Evaluation Program (2005 – 2008)

Aims:

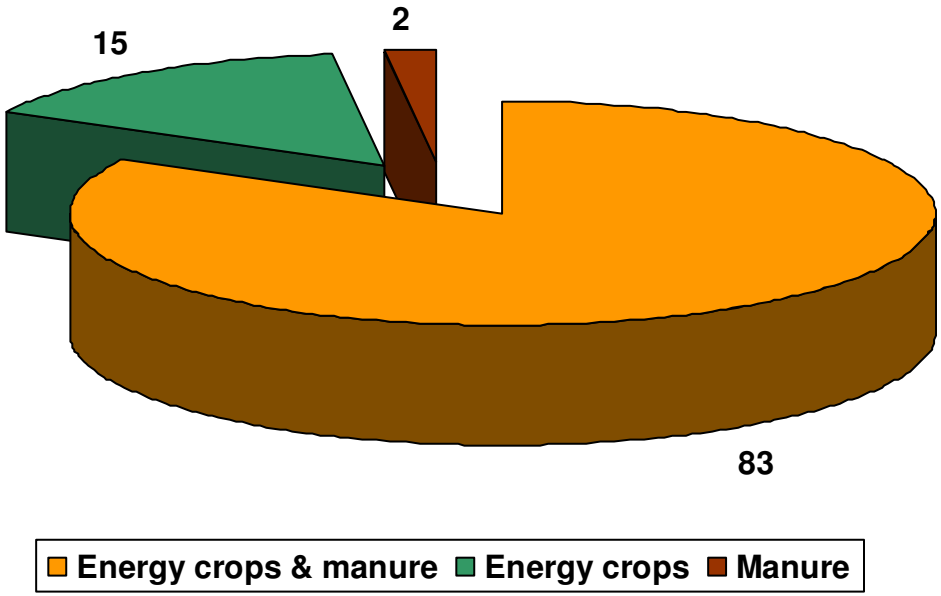
Evaluation of new biogas plants build after 2004

- State of the art
- Type of substrates
- Operating conditions

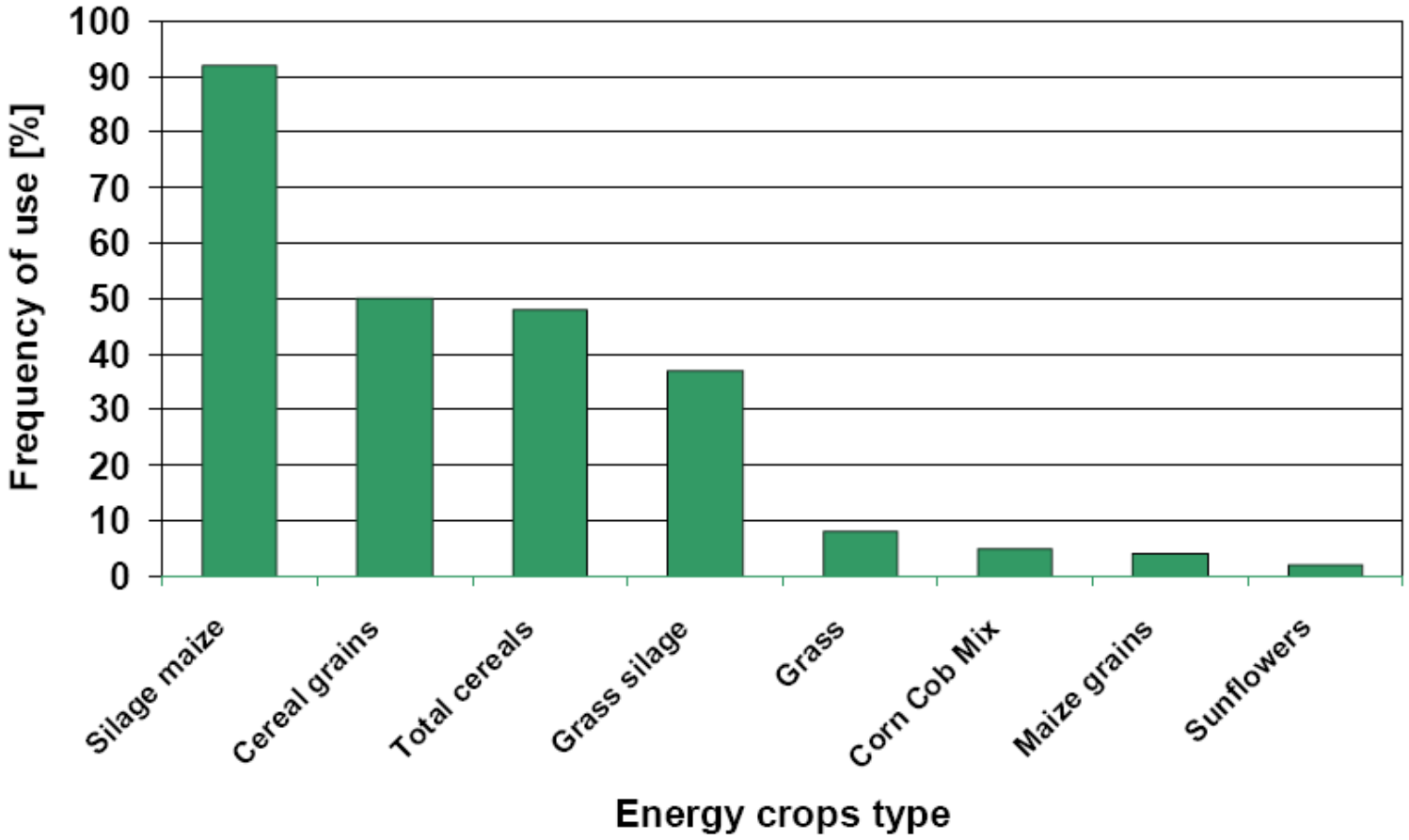
Procedure:

- Pre-evaluation of 346 biogas plants
- Detailed techno-scientific investigation of 60 representative biogas plants

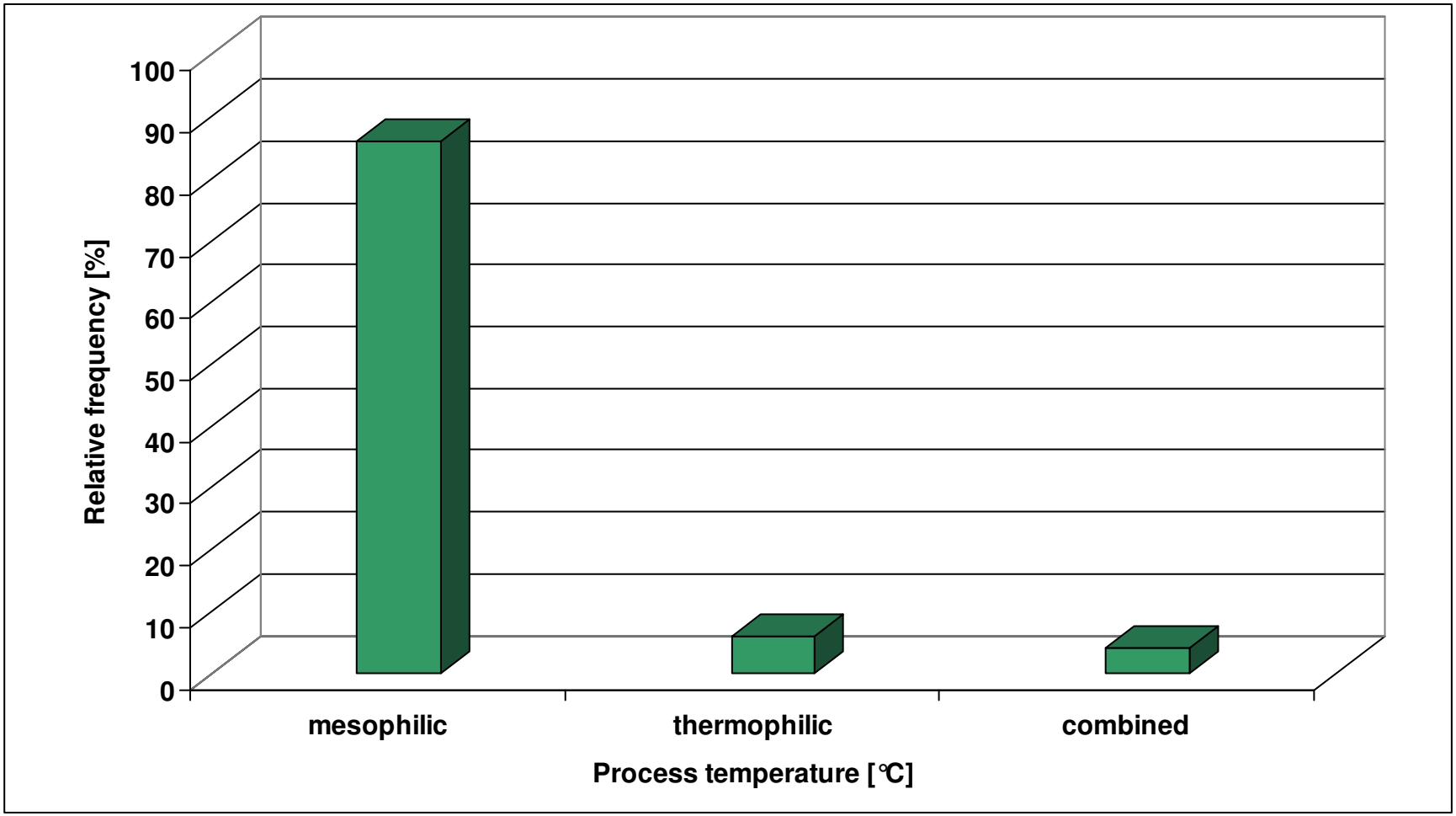
Substrate application in agricultural biogas plants (2005-2007)



Use of raw materials (2005-2007)



Applied process temperature

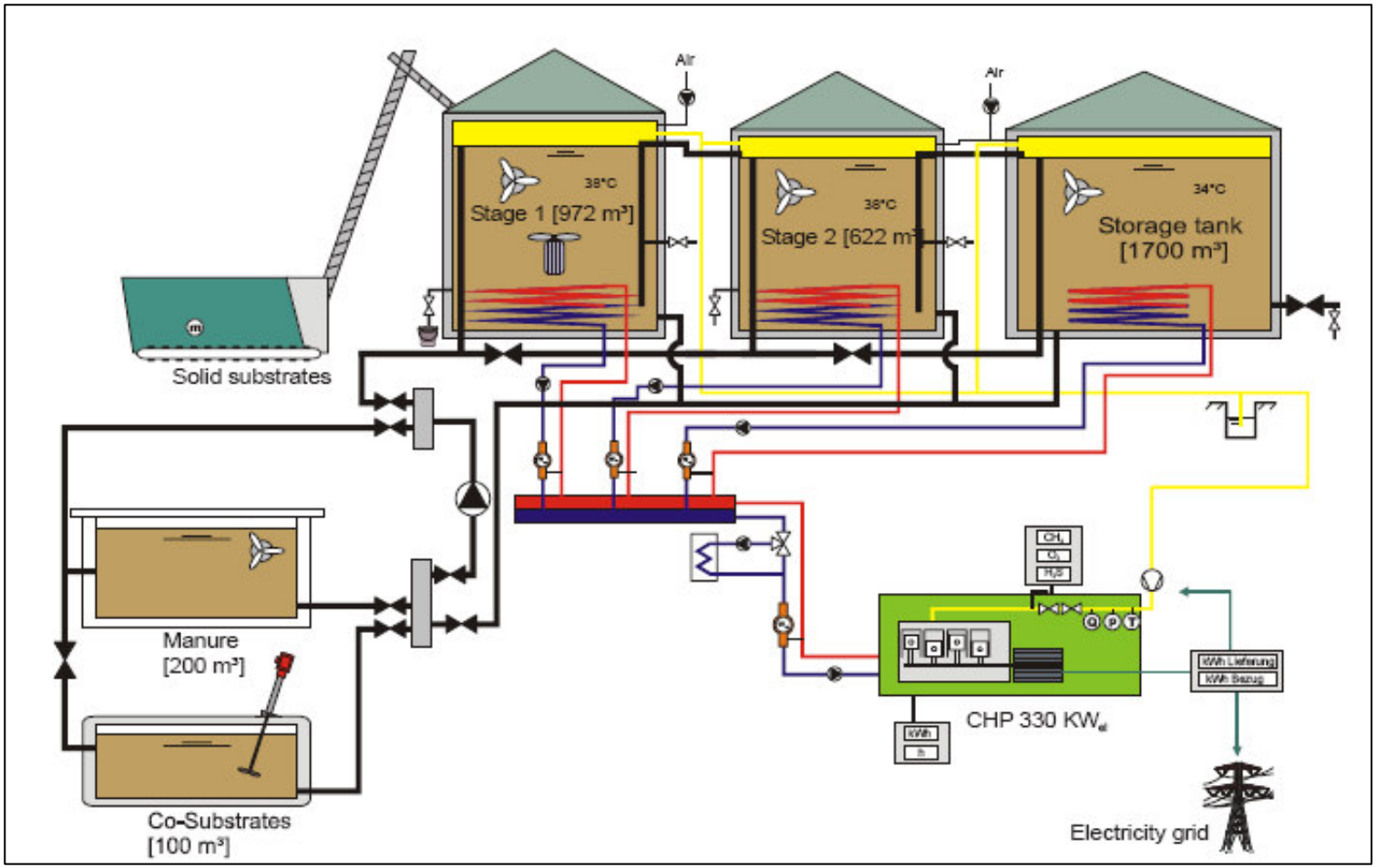


Johann Heinrich
von Thünen-Institut

Biogas plants in Germany

Techniques & Design

Two-stage agricultural biogas plant

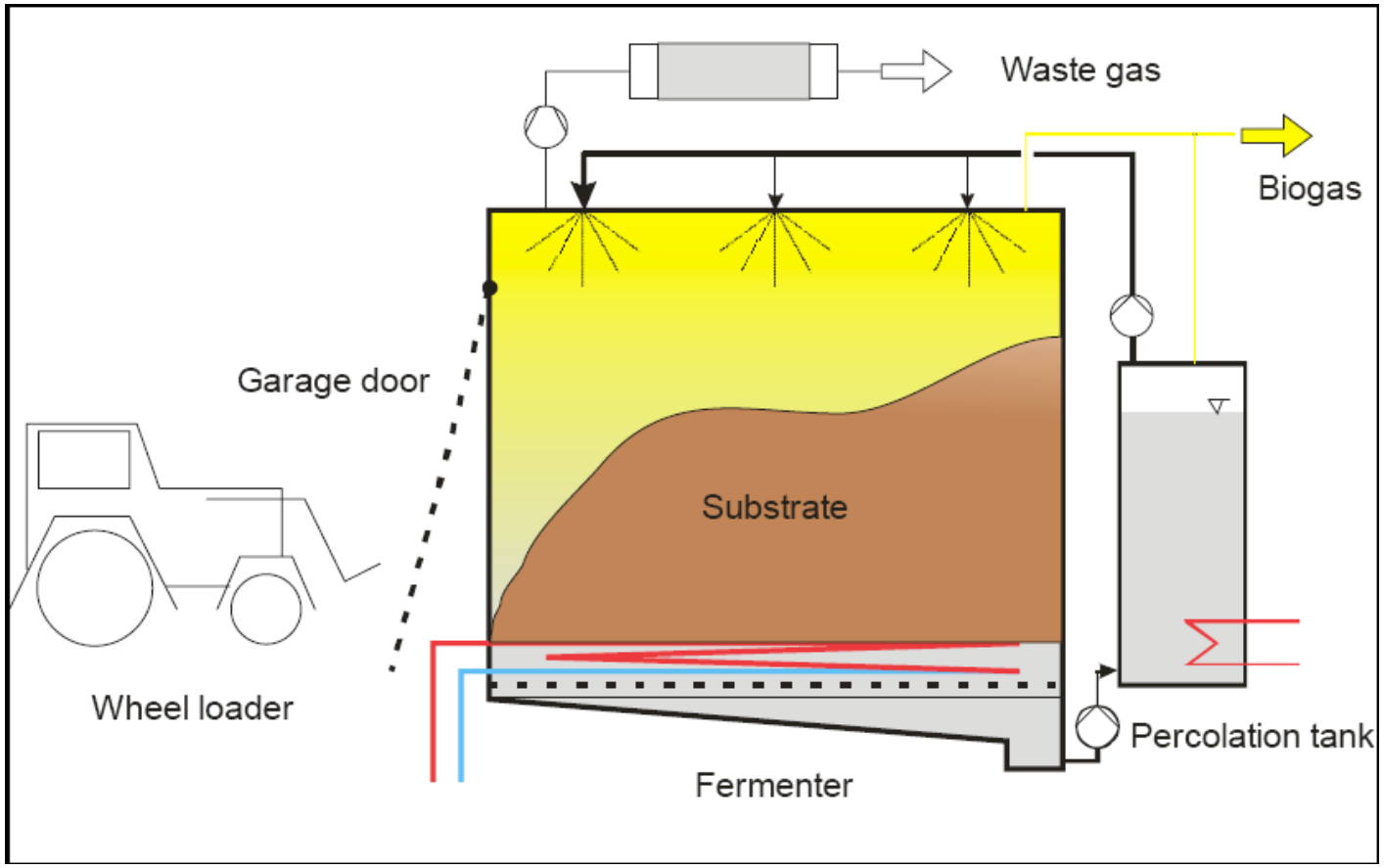


Dry-fermentation plants with garage fermenters

System BIOFerm®

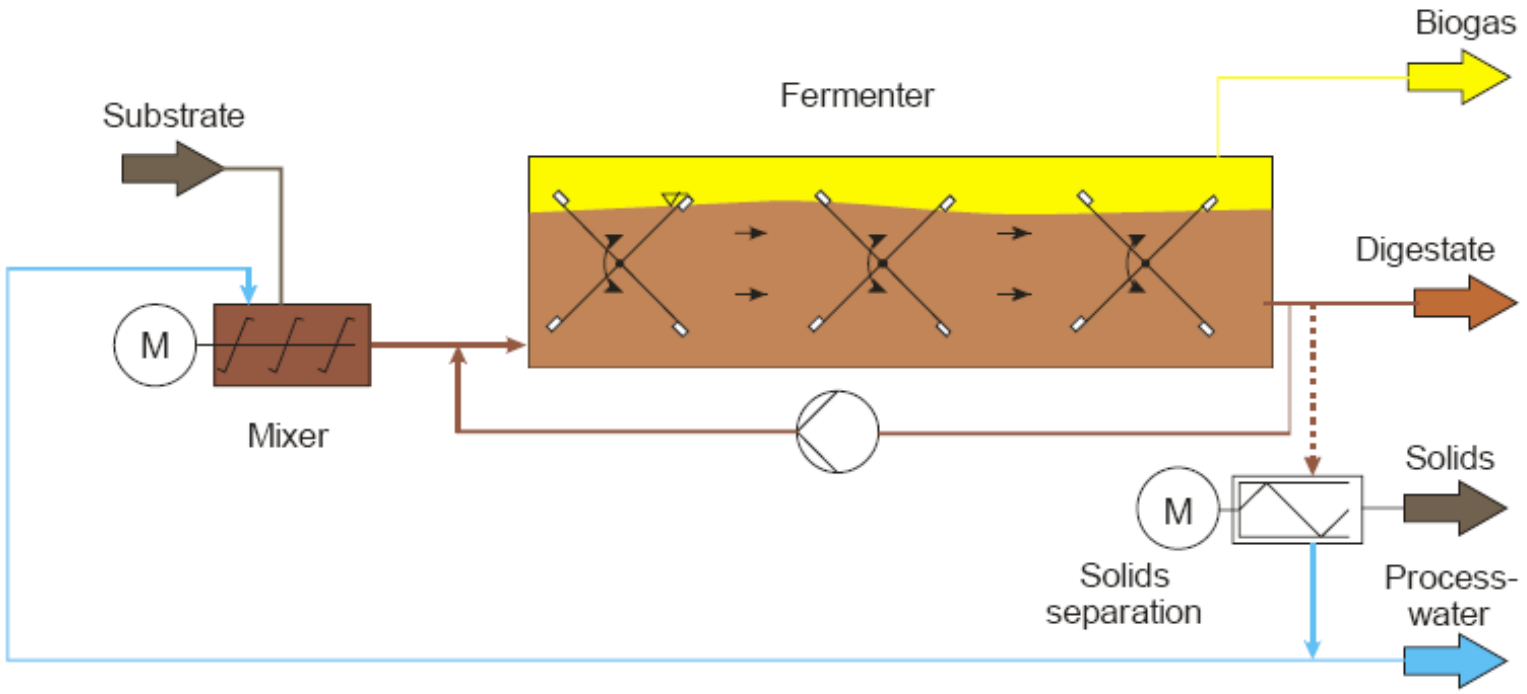
System Bekon®

Discontinously operated dry-fermentation with perkolation



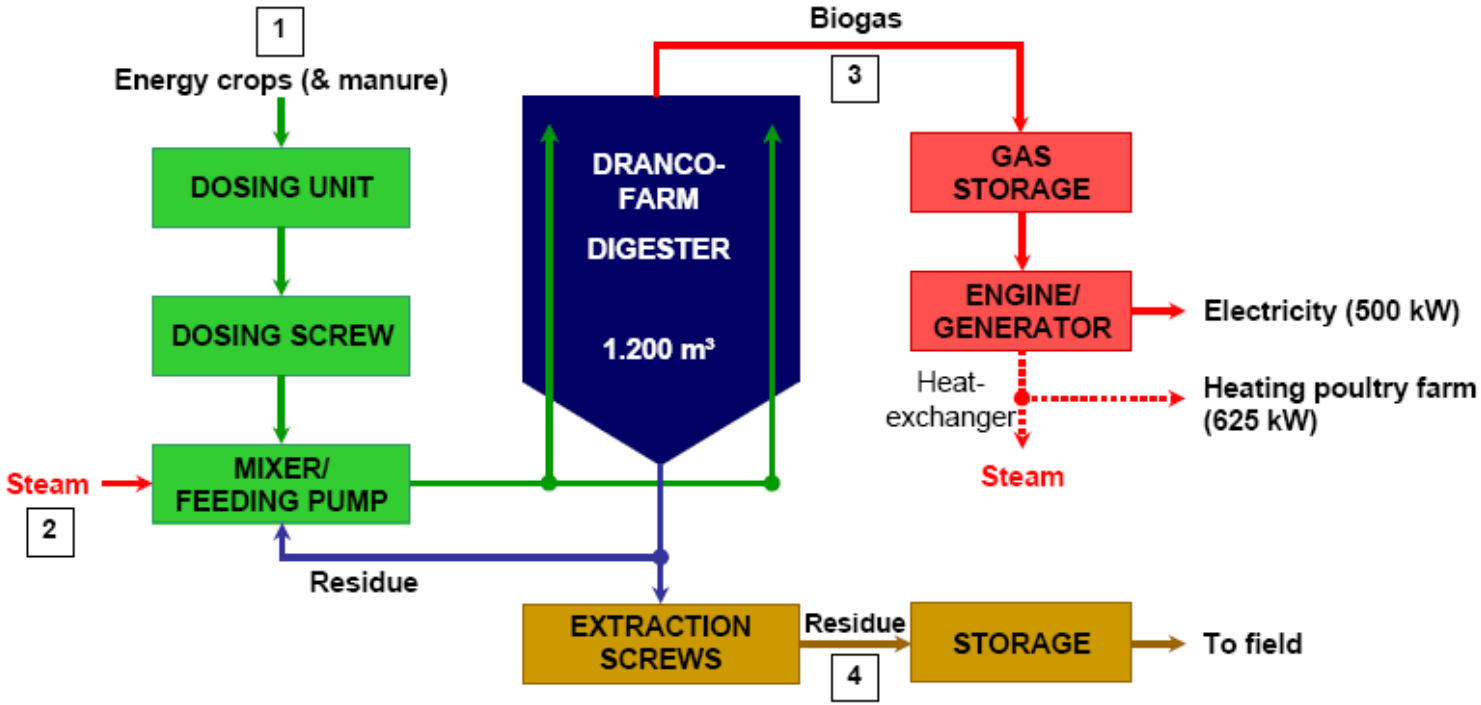
Linde, KCA plant in Hoheneggelsen, Germany

Continuosly operated dry-fermentation plant



DRANCO-FARM plant in Bassum, Germany

Continously operated dry-fermentation plant with silo fermenter (DRANCO-FARM, OWS)



Biogas plant Nüstedt-Bassum (Germany)

Thank you very much...

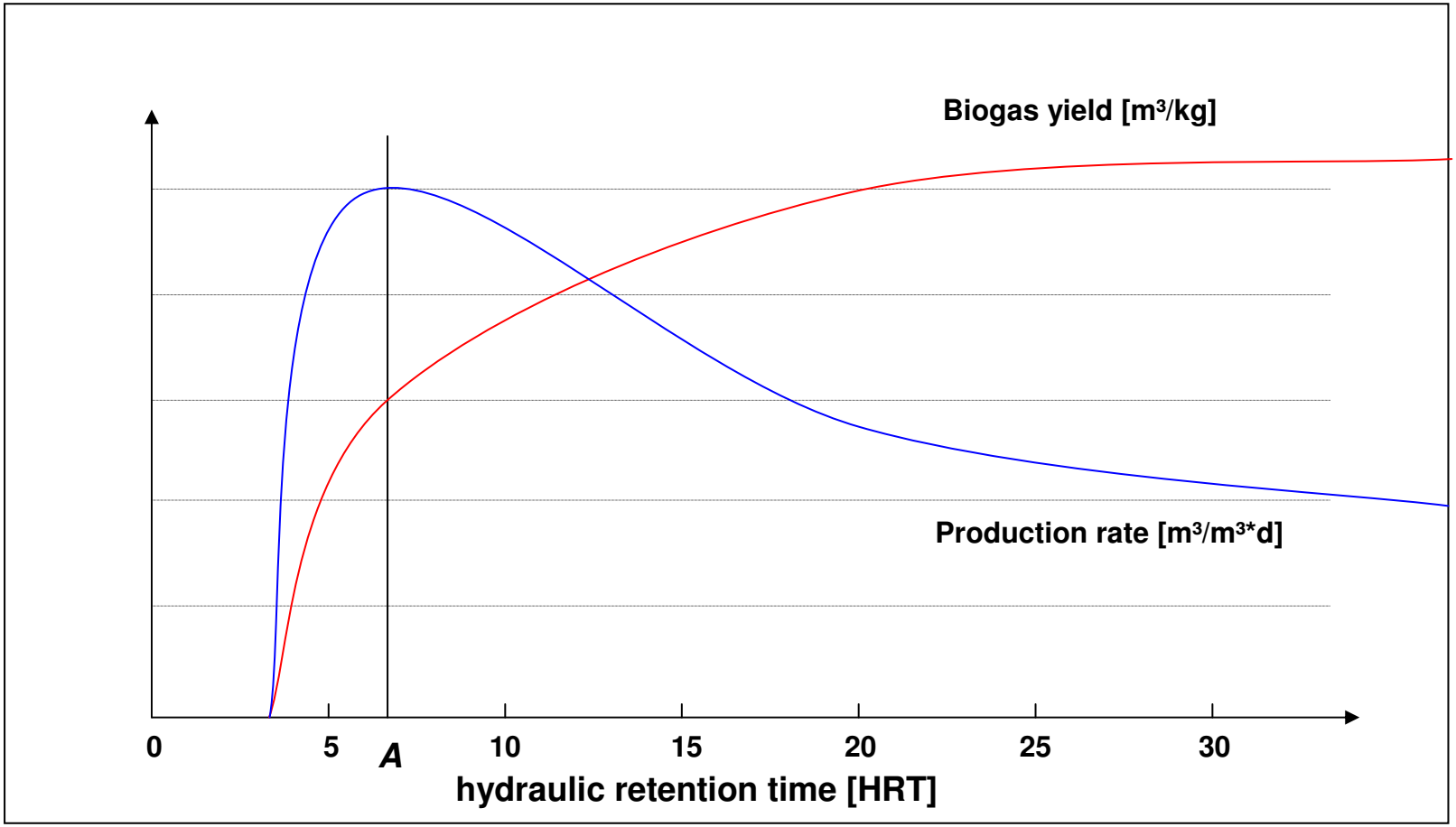
…for your attention !

Use of fermentation residues

- Approx. 80 – 90 % of Input
  - Depends on substrates

- Utilization as organic fertilizer
  - Decrease of dry matter content
    - Improved field application
    - fewer losses of ammonia
  - Increase of the ammonia content
    - Organic nitrogen is converted into ammonia
    - Improved availability for plants

Biogas yield & Production rate



Quelle: Linke, ATB

Simple & Fast: VFA/TAC - Analysis

Empiric Method from waste water treatment

$$VFA/TAC = \frac{VolatileFattyAcids}{TotalAnorganicCarbon}$$

- **Advantages:**
  - **Easy to use (Titration)**
  - **Reliable results for specific plant**

- **Disadvantages**
  - **VFA = cummulative value**
  - **Redundant dimensioning of VFA**
  - **Sample conditioning affects result**

Conditioning of biogas

Biogas as vehicle fuel

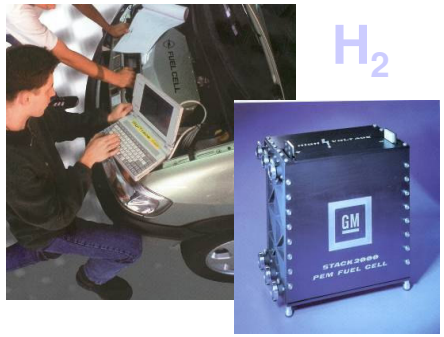
Biogas

Water | Particles | H_2S | H_2S, NH_3, Cl-Verb. | CO_2

Drying → Filtration → Desulfuration → Precision Cleaning → Methane-enrichment → Compression / Reforming

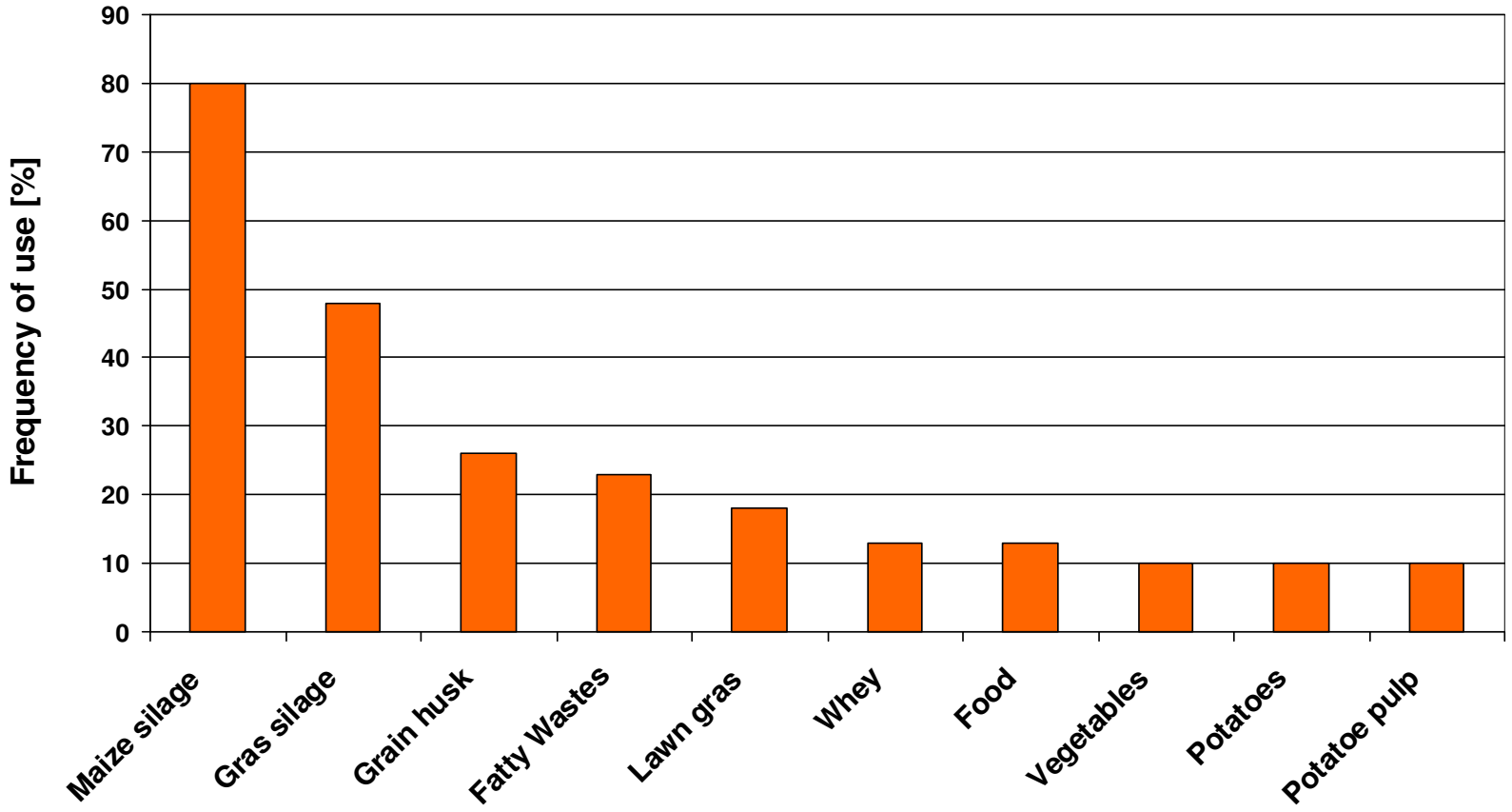
Raw biogas

Hydrogen as fuel (fuel cell)



H_2

Frequency of use of different substrates



Biogas yield of different substrates