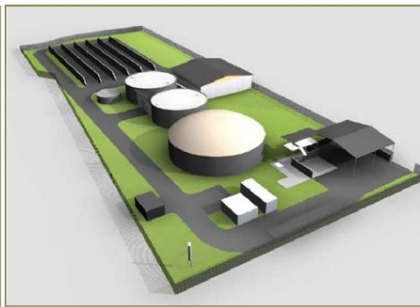


# easy, robust, high efficient

## – the perfect biogas technology for Waste to Energy in Kambodscha –

Mr. Hans Westphal  
11.10.2022



## BioEnergy Group – since 15 Years



- ✓ robotic
- ✓ factory automation
- ✓ control systems

- ✓ biogas plants
- ✓ financing
- ✓ BOOT-projects

## BioEnergy Group and partners



supplier of total biogas systems, equipment and services  
located in SEA (Thailand) since 4 Years  
office, workshop and laboratory in Thailand  
experiences in biogas >15 years



technology partners  
office, workshop or representation in SEA  
expert companies  
several years of experiences in SEA



...open for further partners...

## overview - biogas systems



### Current lagoons and „modified“ lagoons

- 🚫 not suitable for agricultural products, industrial waste and MSW
- 🟡 more or less suitable for wastewater
- 🚫 floating layer and sinking layer
- 🚫 not possible to control
- 🚫 high risk of leaking (gas and liquid)
- 🚫 dangerous / low safety



### Lagoon 4.0

- ✅ perfect for wastewater like POME or POME/POM-DC-mix
- ✅ (all weak points of lagoons removed)
- ✅ perfect mixing / no floating layer and sinking layer
- ✅ possible to control
- ✅ no risk of leaking (gas and liquid) / high safety
- ✅ big volume, high quality, high efficiency but low costs
- 🚫 not usable for EFB



### CSTR

- ✅ suitable for input/feedstock with 1-100% dry matter
- ✅ suitable for agricultural products, industrial waste and MSW-OF (perfect for EFB, POME, POM-DC or a mix of it)
- ✅ high efficient (95%+)
- ✅ easy to control and operate
- ✅ mesophilic/thermophilic operation
- 🚫 not suitable for low energy loaded wastewater

## CSTR - general



### German biogas technology

- ✓ 16,000 CSTR Biogas plants all around the world
- ✓ > 10,000 plants in Germany
- ✓ > 5,000 MW installed power

### Know-How

- ✓ continuously developed during the last 24 years
- ✓ high qualitative and robust equipment
- ✓ in-depth knowledge about the biology
- ✓ robust process with minimum disruption
- ✓ high efficiency



## CSTR - general

### Mesophilic (39 °C) or thermophilic (52 °C) process?

Modern biogas plants operate at **thermophilic process** temperatures.

#### Benefits:

- ✓ effective destruction of pathogens
- ✓ higher organic load (smaller tanks, **lower invest**)
- ✓ faster process and lower required retention time (smaller tanks, **lower invest**)
- ✓ higher microbial efficiency, gas yield and methane content (more methane by same input, **higher revenue**)
- ✓ higher process stability and easier process controlling in hot countries like Thailand (**higher revenue**)

#### Disadvantages:

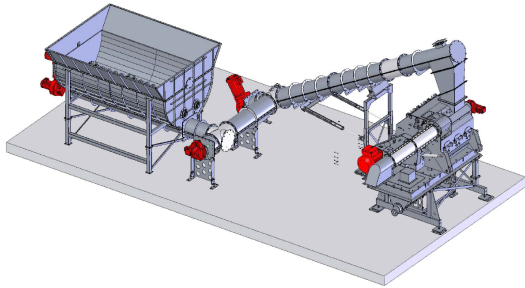
- ✗ risk of imbalance by temperature fluctuation  
(in SEA mesophilic is at higher risk than thermophilic)
- ✗ larger thermal energy demand due to high temperature  
(true for Europe, but no problem in SEA, heat for free from CHP, approx. 25% of Engine waste heat)
- ✗ higher risk of ammonia inhibition  
(this is a problem for ammonia rich feedstocks like chicken manure, no problem for POM-by-products)



## CSTR - overview feedstock



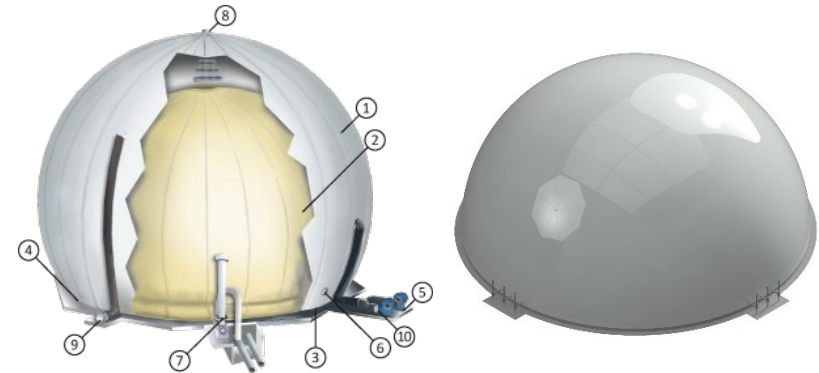
## Special services and products - general products



feeding/dosing systems



liquid/solid separation



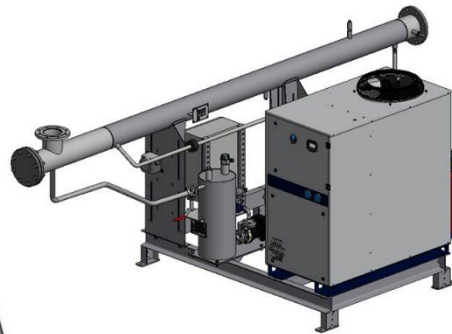
external double membrane gas holder



flares



activated carbon filter



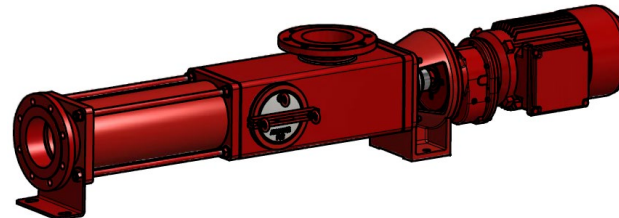
chiller



blower



online gas analyzer  
(up to 50.000 ppm H<sub>2</sub>S)



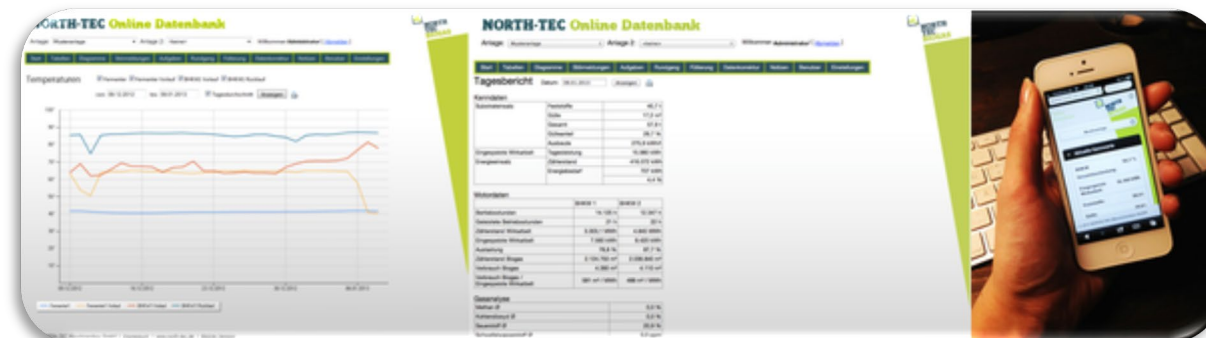
pumps

and much more ...



## Plant control system with powerPro Software

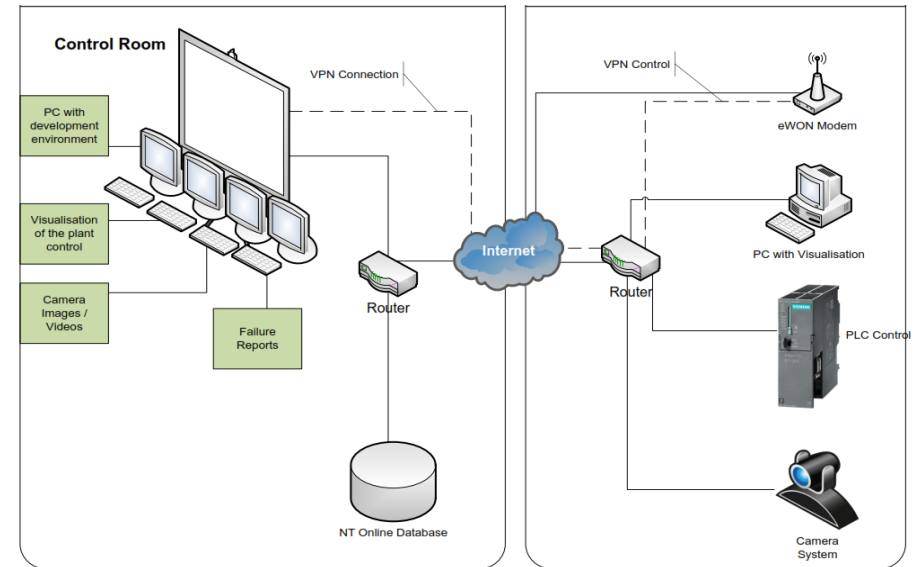
- ✓ user-friendly and intuitive design
- ✓ automatic plant operation is possible
- ✓ have a look in each component
- ✓ helpful diagrams visualize plant parameters
- ✓ reduced energy consumption through the Energy Management
- ✓ all data is stored in the data base
- ✓ detailed failure reports and alarms to your mobile phone
- ✓ monitoring by mobile phone and tablet app
- ✓ integrated CCTV to see what's happen at your plant



## 24/7 monitoring and controlling

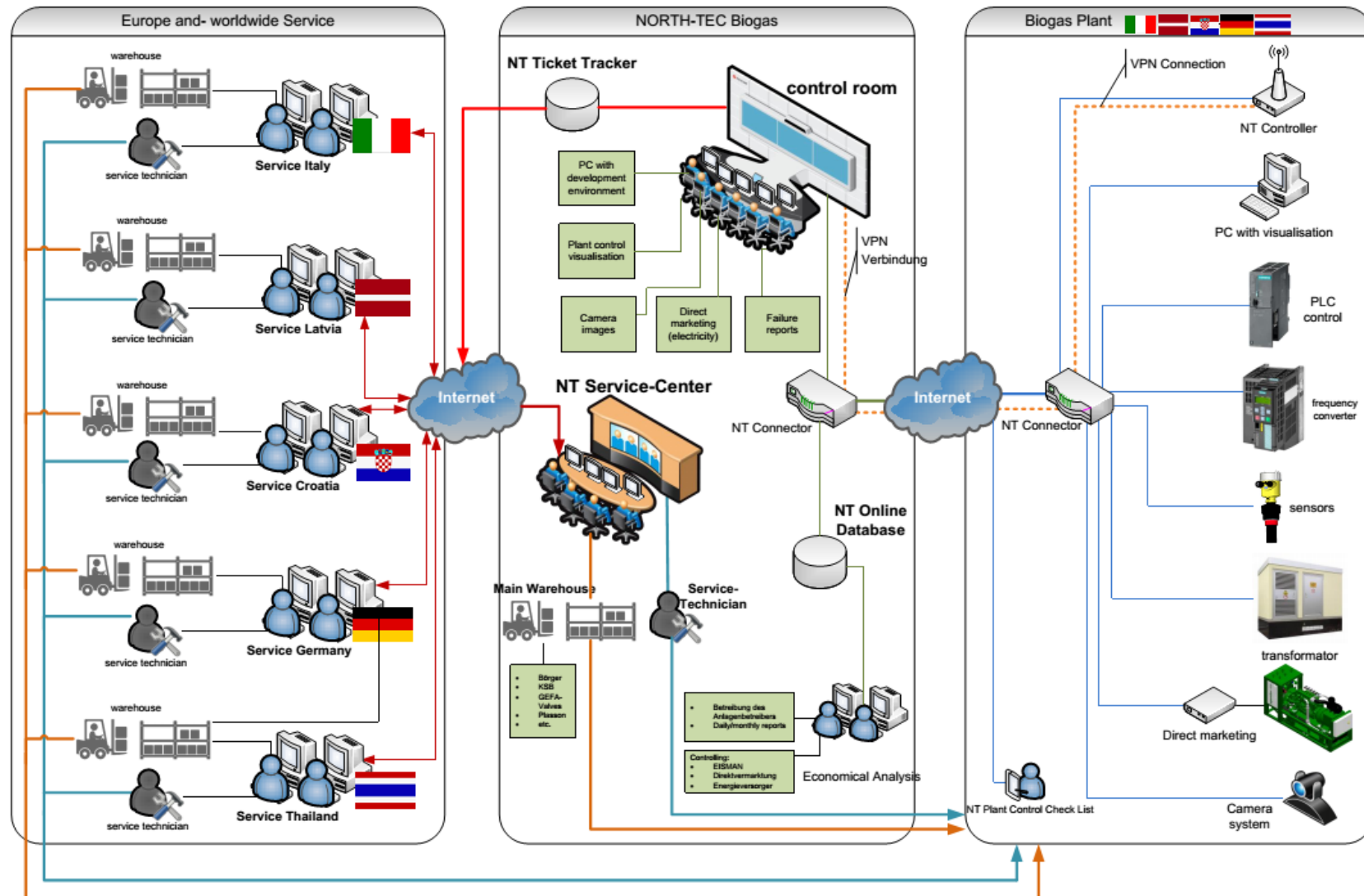
Our control and monitoring room guarantees optimal servicing of the biogas plant at anytime. At our control room we have the ability to log into biogas plant's system: Simply put we see what the operator see and can actively assist the operator getting rid of his problems. This saves valuable time and money.

- ✓ a team of technicians offer 24/7 plant control surveillance
- ✓ our team analyze plant system failure reports, solve problems or give advice on how to solve them
- ✓ our service team is available 24/7 to move out to the biogas plant



## Service & maintenance

### S&M Team in Thailand (Korat)



## Service & maintenance and biological maintenance

### Our high specialized standard analysis:

- ✓ pH-value, electrical conductivity
- ✓ VFA/TAC (volatile fatty acids and total anorganic carbon)
- ✓ DM and oDM (dry matter and organic dry matter)
- ✓  $N_{\text{total}}$  and  $NH_4\text{-N}$
- ✓ acetic acid equivalent and fatty acid spectrum
- ✓ gas yield test and inhibition test
- ✓ micro-, trace and macro nutrient requirements
- ✓ on-site gas quality analysis

### Benefits of laboratory support:

- ✓ safe and fast start up and plant operation
- ✓ continuously high gas and methane yield
- ✓ extended life of plant equipment

➔ high and reliable revenue  
thru high efficient plant operation



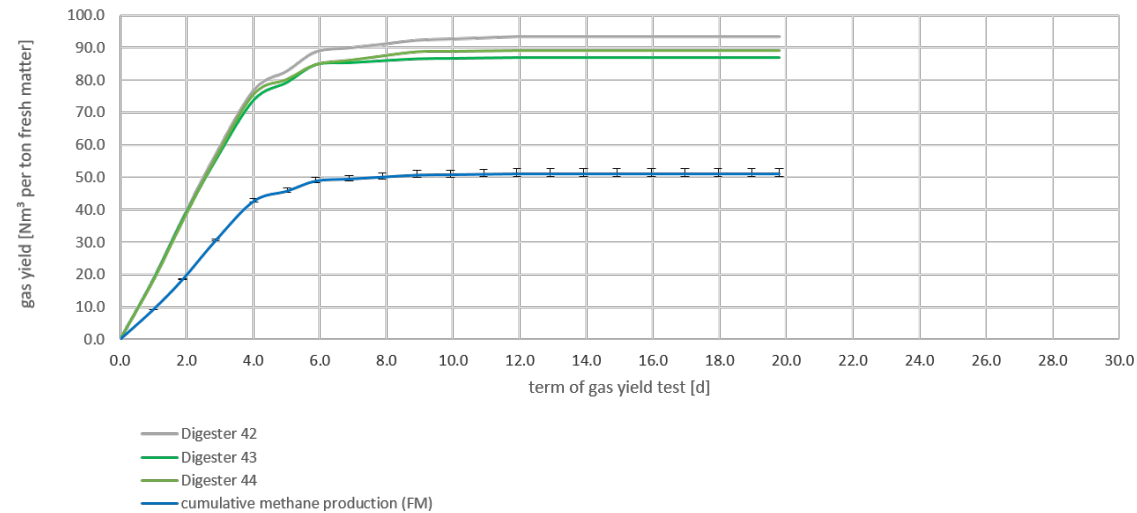


## Gas yield Test – VDI4630

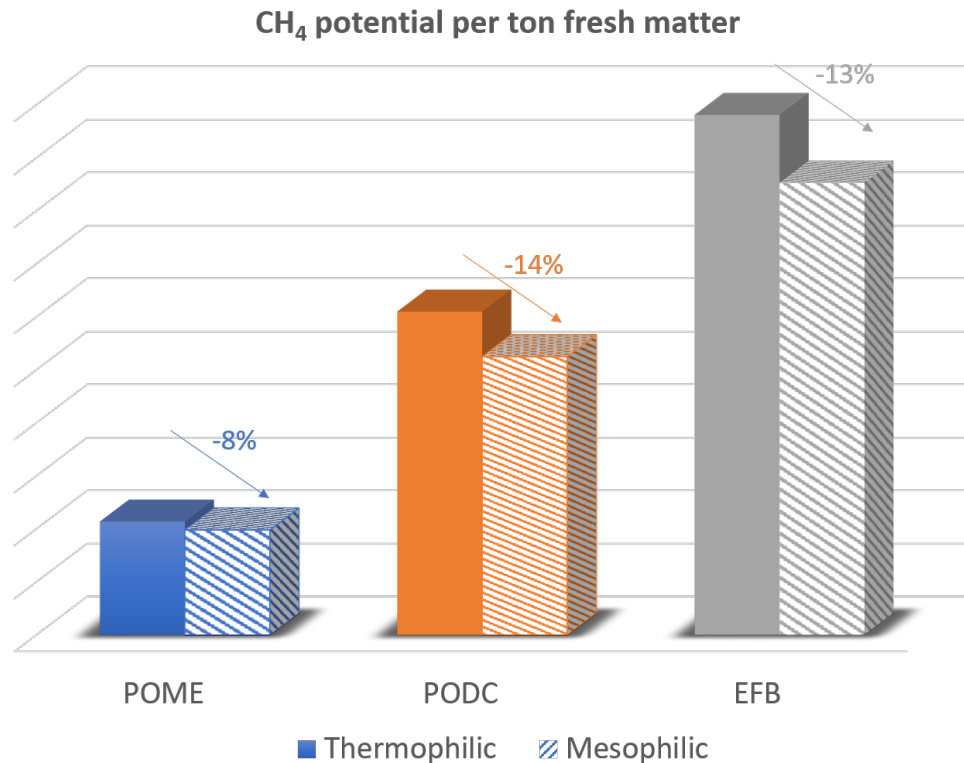
### results of gas yield test in accordance with VDI 4630

	average
biogas yield per ton fresh matter [Nm <sup>3</sup> /ton <sub>FM</sub> ]	<b>89.8 ± 2.7</b>
biogas yield per ton organic dry matter [Nm <sup>3</sup> /ton <sub>odm</sub> ]	536.3 ± 16
methane yield per ton fresh matter [Nm <sup>3</sup> /ton <sub>FM</sub> ]	<b>51 ± 1.6</b>
methane yield per ton organic dry matter [Nm <sup>3</sup> /ton <sub>odm</sub> ]	304.9 ± 9.5
methane yield per COD [Nm <sup>3</sup> /kg <sub>COD</sub> ]	0.32
methane content in biogas [%]	56.8 ± 0.3
H <sub>2</sub> S content in biogas [ppm]	251 ± 15
COD decomposition [%]	<b>91-97</b>
results after term of gas yield test [d]	20

detected specific gas yield (cumulative) per ton fresh matter



## Gas yield of the BioEnergy Germany CSTR – System for Palm Oil Mill by-products

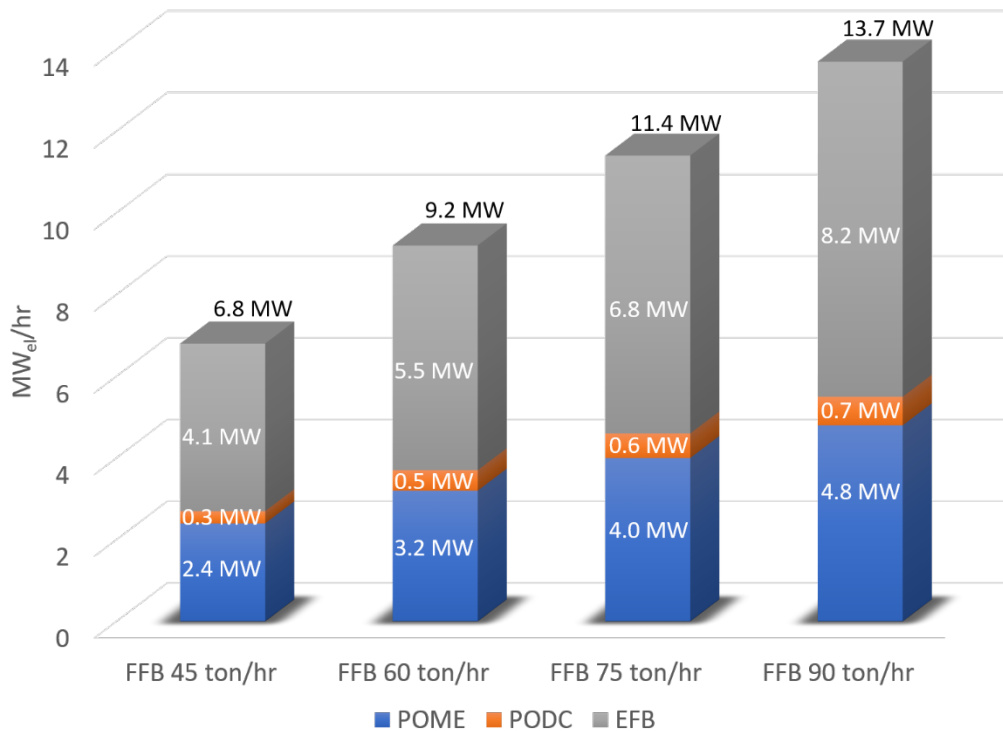


- ✓ thermophilic well controlled process
- ✓ well mixed process
- ✓ 95% plant efficiency
- ✓ use of POME, PODC and EFB in one
- ✓ turnkey, BOO or BOOT models
- ✓ optimization of existing plants

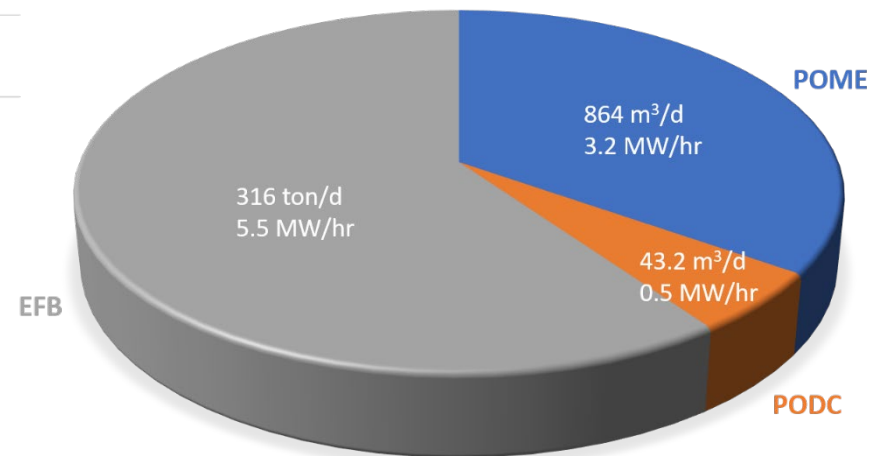
- ➔ EFB: shredded to 2-5 inch, no further pre-treatment required
- ➔ POM and POM-DC: no pre-treatment required

## Your POM gas potential based on the BioEnergy Germany CSTR – System

Biogas potential of palm oil mill feedstock



Biogas potential of palm oil mill feedstock with 60 ton/hr FFB



## General Keys for a successful biogas plant operation

- ✓ chose of plant technology
- ✓ correct plant design
- ✓ fast construction and smooth start up
- ✓ professional plant operation and automatisisation
- ✓ service & maintenance and biological maintenance
- ✓ plant monitoring and database



## We offer you

- ✓ 15 years experiences in Biogas and Biogas in Thailand
- ✓ CSTR / Lagoon as required for your project (technology neutral)
- ✓ new construction and/or optimization
- ✓ German technology adapted to local conditions
- ✓ we are located in Thailand (short ways)
- ✓ service & maintenance and biological maintenance



Thank you for your attention



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