



# Implementation of technologies to deliver energy positive thermophilic digestion

**Nicholas GuriEFF**

*Product Manager. BioSol, Krüger AS, Denmark*

**KRÜGER**

 **VEOLIA**  
WATER  
Solutions & Technologies

# Why thermophilic digestion?

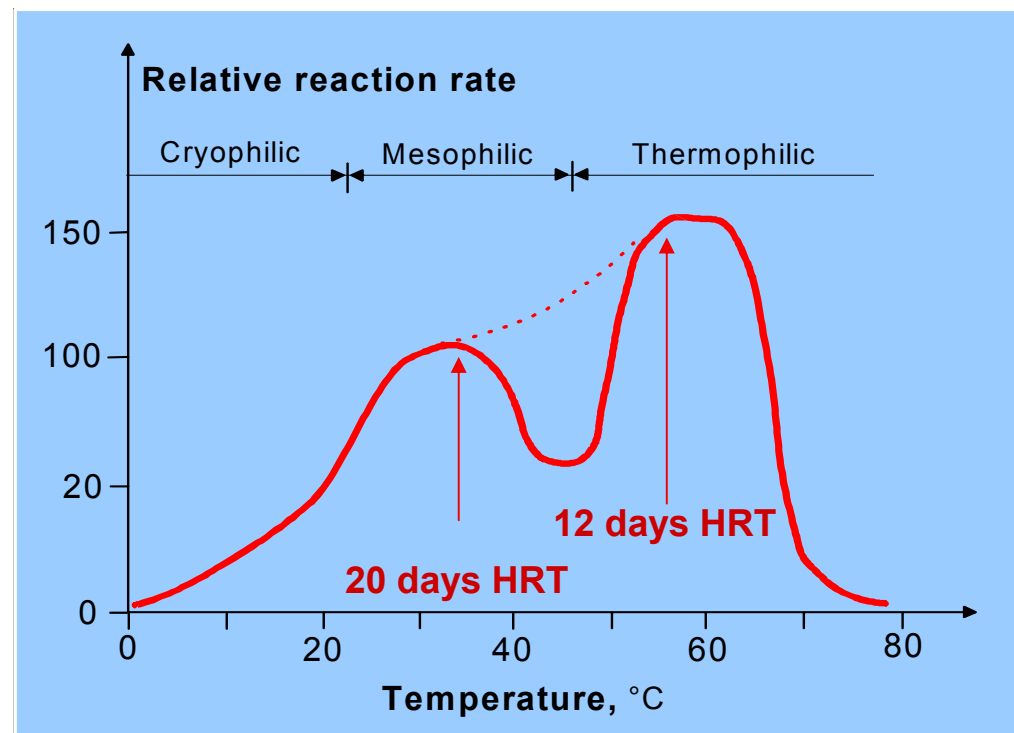
- ▶ Increased activity
  - 20 day @ 35°C = 12 day @55°C
- ▶ Easy conversion to digest all sludge on site
- ▶ Increased reduction of biological sludge
- ▶ Decreased sludge disposal costs
- ▶ Pathogen reduction



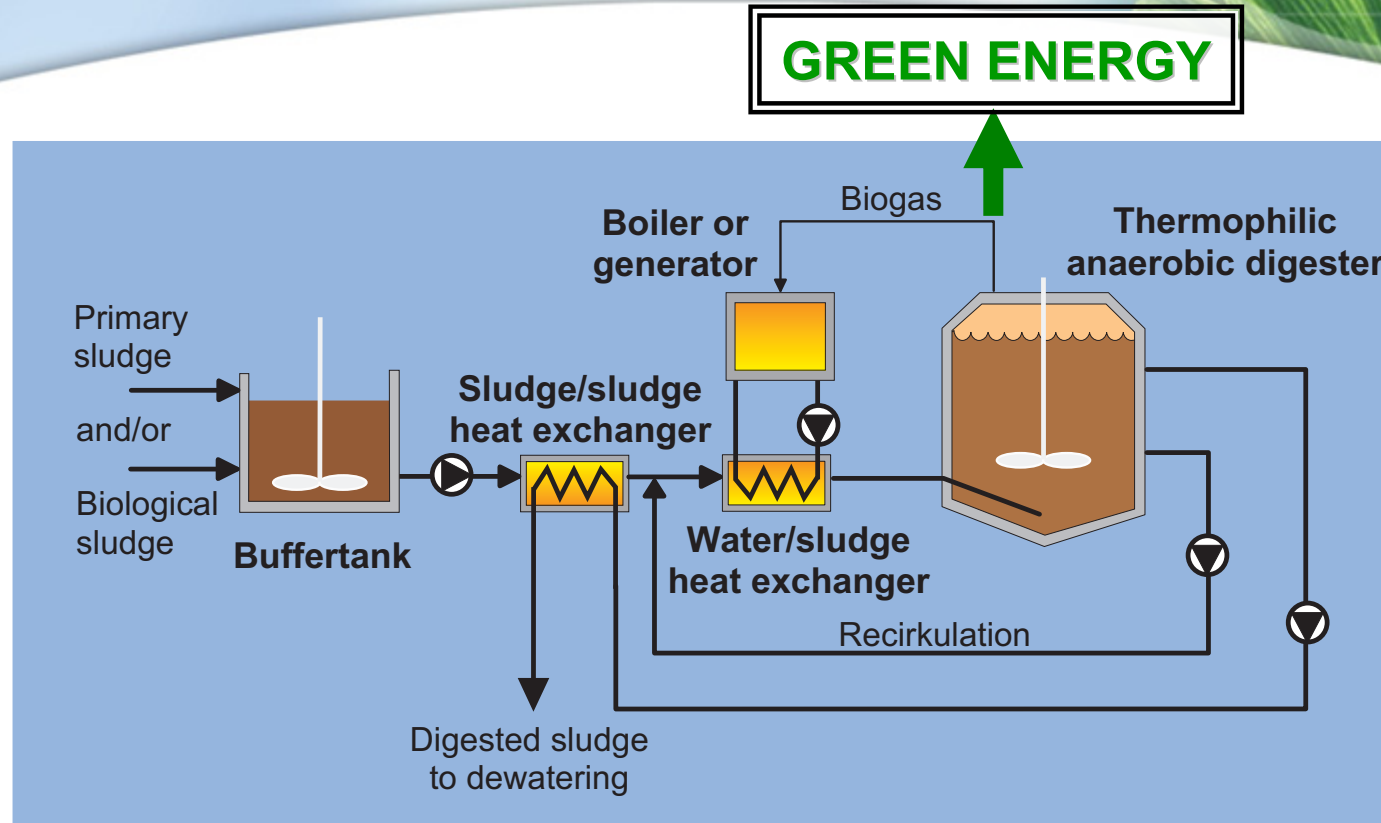
# But bad press is hard to overcome

## ► Range of misconceptions include:

- Operational issues
  - Odour
  - Increased energy demand
- Perception of lack of reliability
  - Impact of temperature
  - Ammonia inhibition
- Difficult start-up period
- Mesophilic widely accepted – no need to try something new

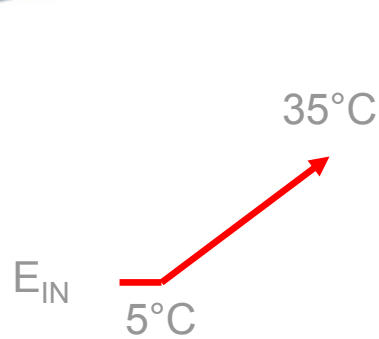


# Energy Recovery – the key to positive energy



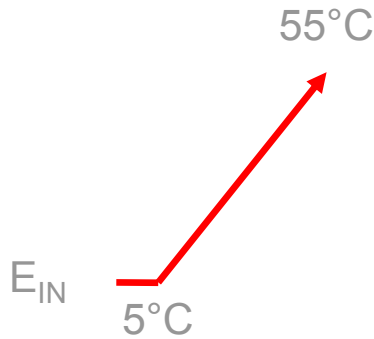
- ▶ Concentric tube heat exchangers
  - Very efficient with a compact footprint
  - Clean in place
  - SWS system – maximum performance at all times

# Advantage of Thermophilic + heat recovery



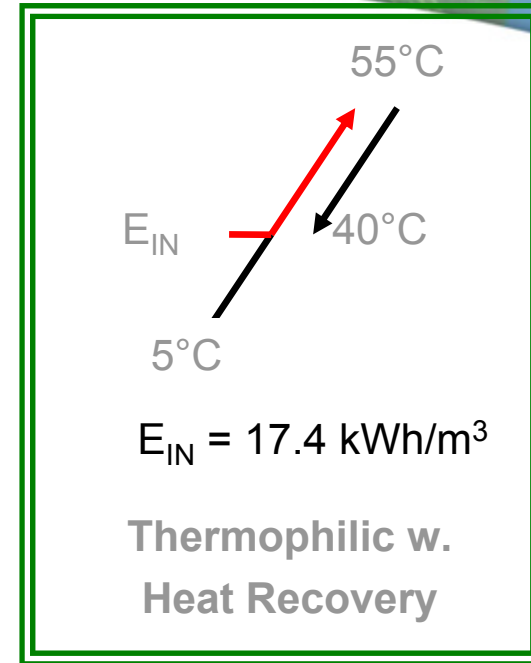
$$E_{IN} = 34.8 \text{ kWh/m}^3$$

Traditional  
Mesophilic



$$E_{IN} = 57.8 \text{ kWh/m}^3$$

Traditional  
Thermophilic



$$E_{IN} = 17.4 \text{ kWh/m}^3$$

Thermophilic w.  
Heat Recovery

- ▶ Thermophilic digestion with heat recovery is key to energy self-sufficiency
- ▶ Increased opportunity for electricity and heat production – CHP, fuel cells

**Reduced CAPEX + Reduced OPEX + Reduced Carbon Costs**

# Stability proven from experience

## ▶ Temperature variations

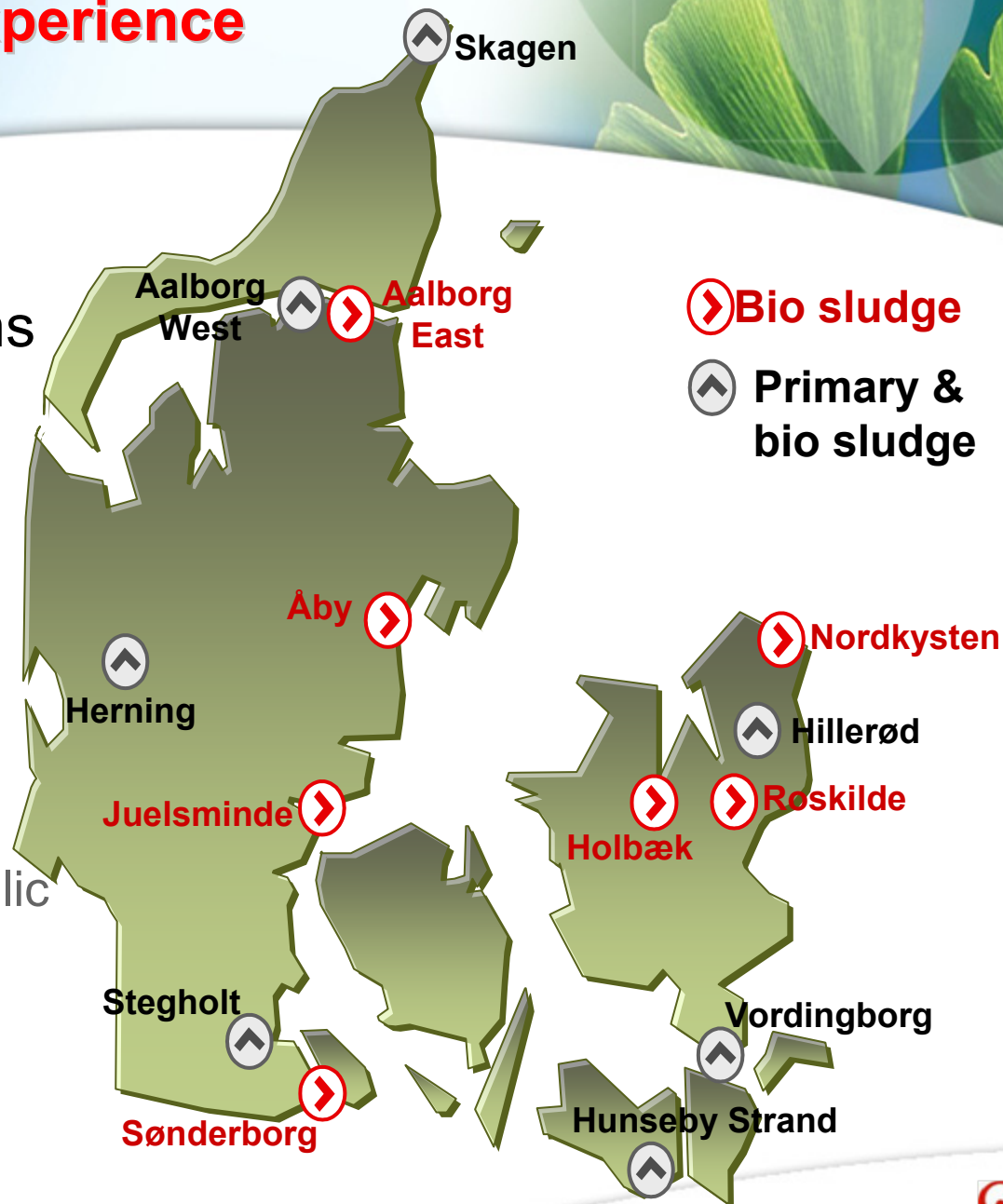
- No issue

## ▶ Ammonia inhibition

- Limited

## ▶ Odour

- No more than mesophilic



# Case study – Nordkysten WWTP, Denmark

- ▶ 20,000 PE with digestion of primary and biological sludge
- ▶ Pre-fabricated digester system
  - Tanks (2 x 90 m<sup>3</sup>)
  - Heat exchanger
  - Gas cooling
- ▶ Results:
  - 37% sludge reduction
  - Dewaterability to >30% w/w
  - Excess energy production of >5000 kWh/month
  - High pathogen destruction
- ▶ Long-term operation at 45-53°C showed no impact on results



# Synergistic processes → Energy self sufficient WWTP

## ▶ Pasteurisation

- Heat exchangers
- Pathogen destruction
- Nutrient recovery

## ▶ Sludge drying

- Energy recovery to heat digester
- Disposal options expanded

## ▶ Thermal hydrolysis

- Increased biogas production >20%
- Reduction sludge for disposal



# Conclusions

- ▶ Thermophilic digestion has matured
  - Reliable – process stability proven
  - Efficient – effective heat recovery system
- ▶ Key component to achieve an energy self-sufficient wwt system
  - Green energy
- ▶ Economically and environmentally beneficial



Reduced CAPEX + Reduced OPEX + Reduced Carbon Cost