

# THE AVEDØRE PROJECT

**HOW TO FIND RENEWABLE BIOGAS SOURCES AND INTEGRATE THEM IN THE GAS GRID BY UPGRADING AND METHANIZATION WITH NEW TECHNOLOGIES.**

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## HMN Naturgas I/S at a Glance;

Owned by 57 municipalities in Mid-North Jutland and the Greater Copenhagen Region (unlimited partnership)

Owens the Supply Companies (limited)

-HMN Gassalg A/S (retail)

-HMN Gashandel A/S (wholesale)

## HMN Naturgas I/S (Distribution)

Customers: 253.008, Distributed volume: 1.611 mio. m<sup>3</sup>

Turnover: 617 mio. kr., Net debt: 1.204 mio. kr.

Employees: 301

## HMN Gassalg/Gashandel A/S (Sales)

Customers: 237.360, Sales volume: 1.133 mio. m<sup>3</sup>

Turnover: 4.673 mio. kr.

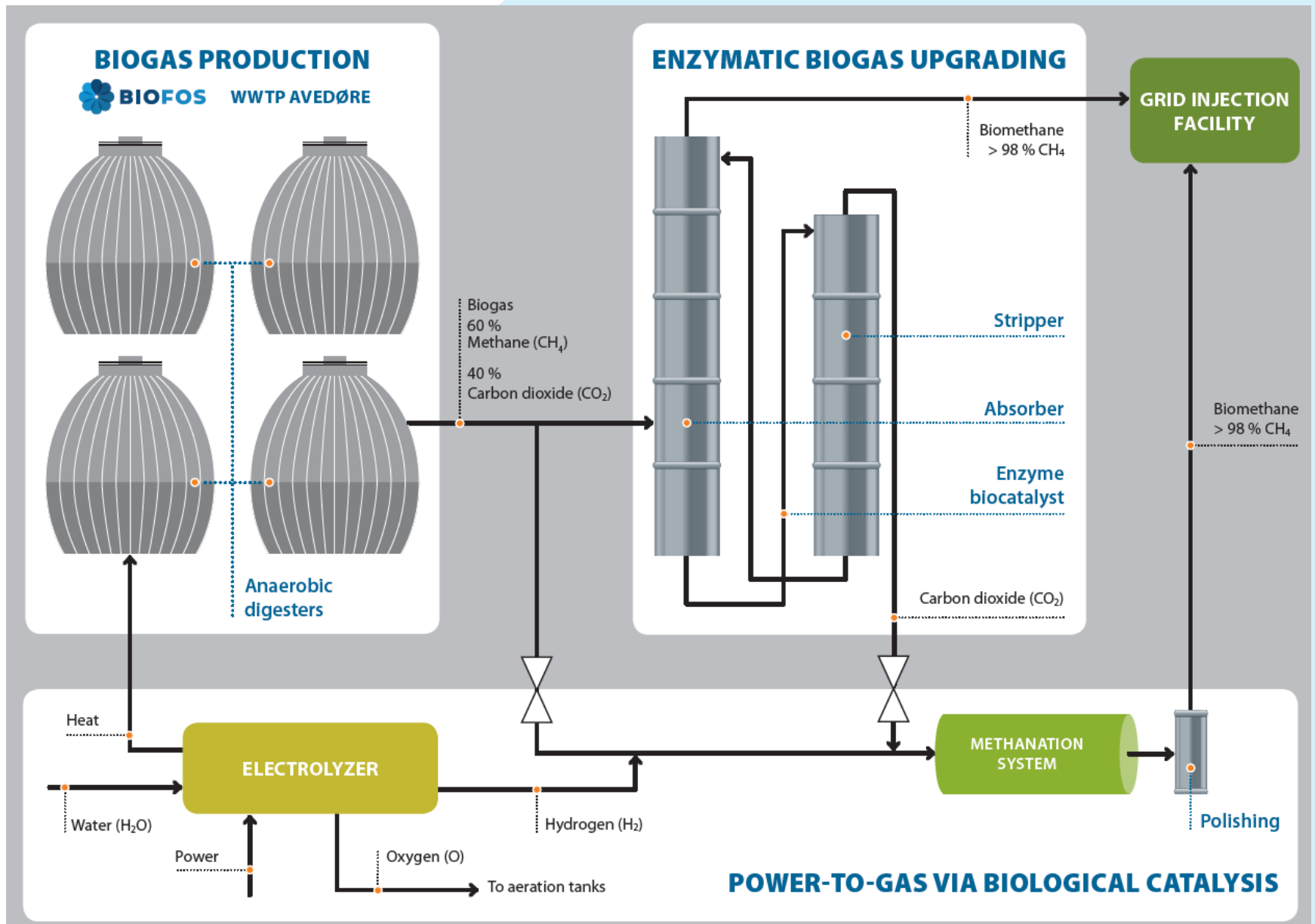
Employees: 61

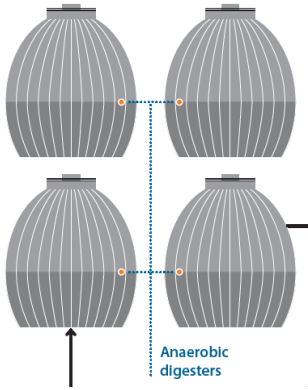
## The HMN Concern

Net debt: 580 mio. kr.

2013

# The Project





## BIOFOS

WWTP Avedøre, WWTP Damhusåen and WWTP Lynetten  
Owned by 15 municipalities.

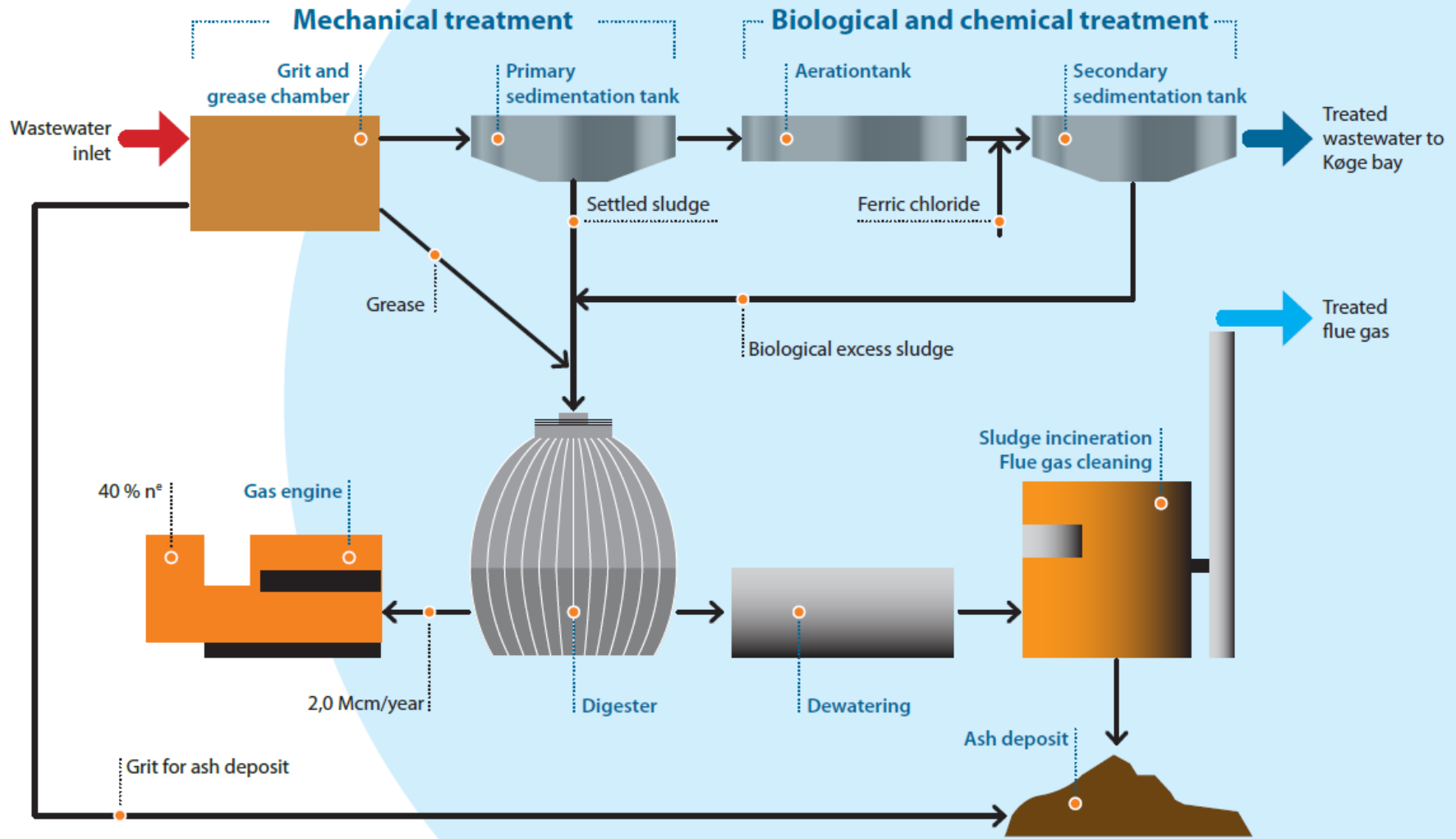
At the 3 plants they treat 130 million cubicmeter wastewater/yearly

”Suppliers” 1,4 million people in Greater Copenhagen



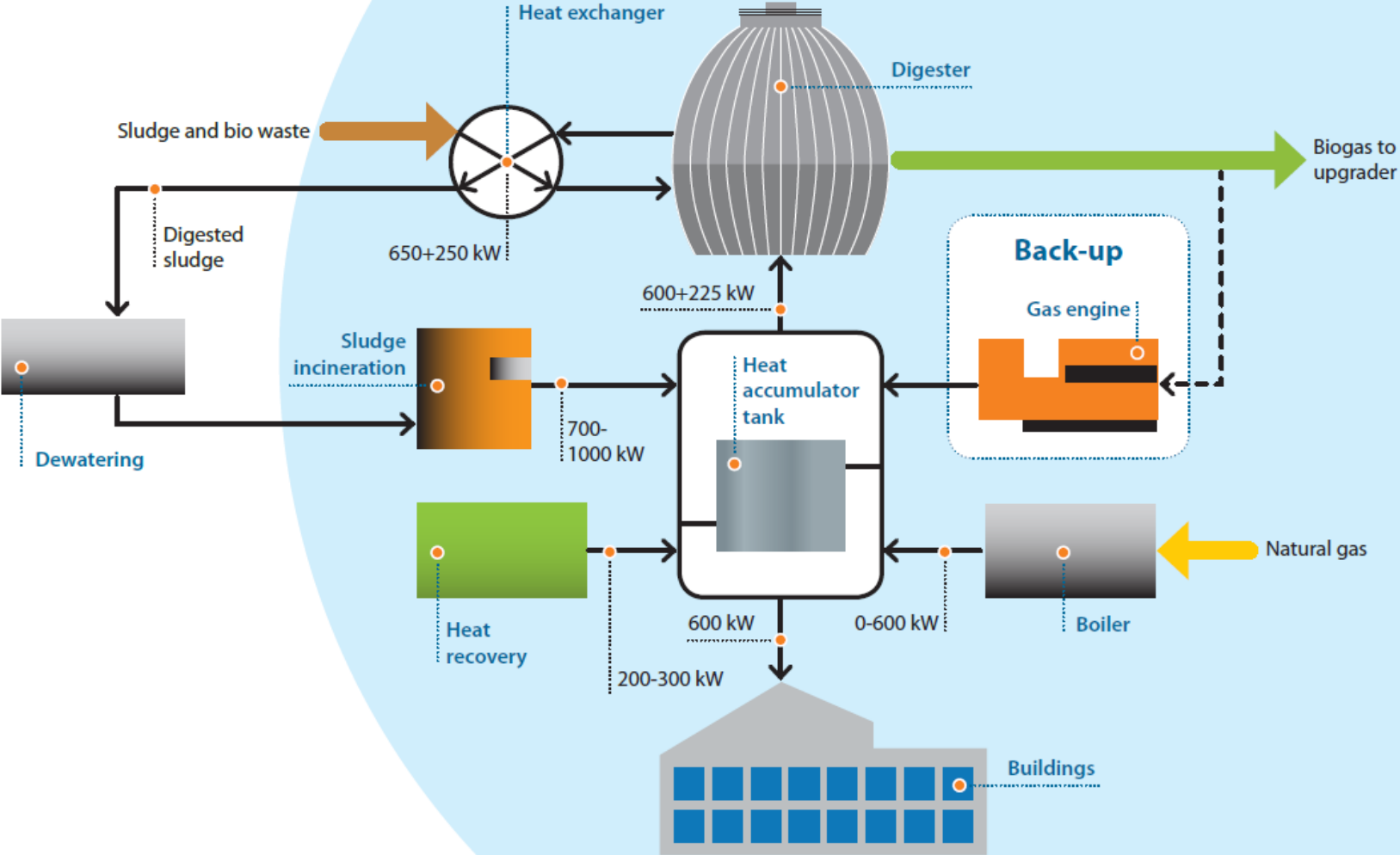
Tivoli Congress Center

# Wastewater Treatment Plant Avedøre

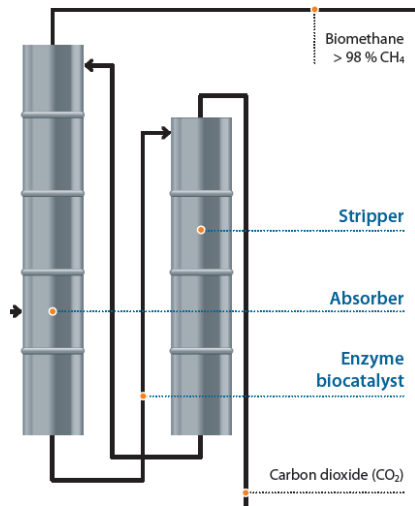




# Principle for the Heat Recovery and Balance



## ENZYMATIC BIOGAS UPGRADING



- 41 MDKK (5,5 million €) three-year demonstration project for enzymatic biogasupgrading.
- Supported by EUDP with 21 MDKK (2,8 million €) (Danish Energy Agency's Energy Technology Development and Demonstration Programme)
- **Target;** reduced upgrading cost
- **Benefits;** lower cost ↔ more green gases



Enzymes accelerate processes.

Carbonic Anhydrase accelerate CO<sub>2</sub> absorption up to 10<sup>6</sup>.

### Key figures;

Up to 2,6 million m<sup>3</sup> CH<sub>4</sub> (300 m<sup>3</sup>/h)  
 Quality: > 98 % target 99,9 % CH<sub>4</sub>  
 Rawgas ~ 60 % CH<sub>4</sub>

[www.enzup.com](http://www.enzup.com)



# Highlights from the Wind- and Powersystem im Denmark



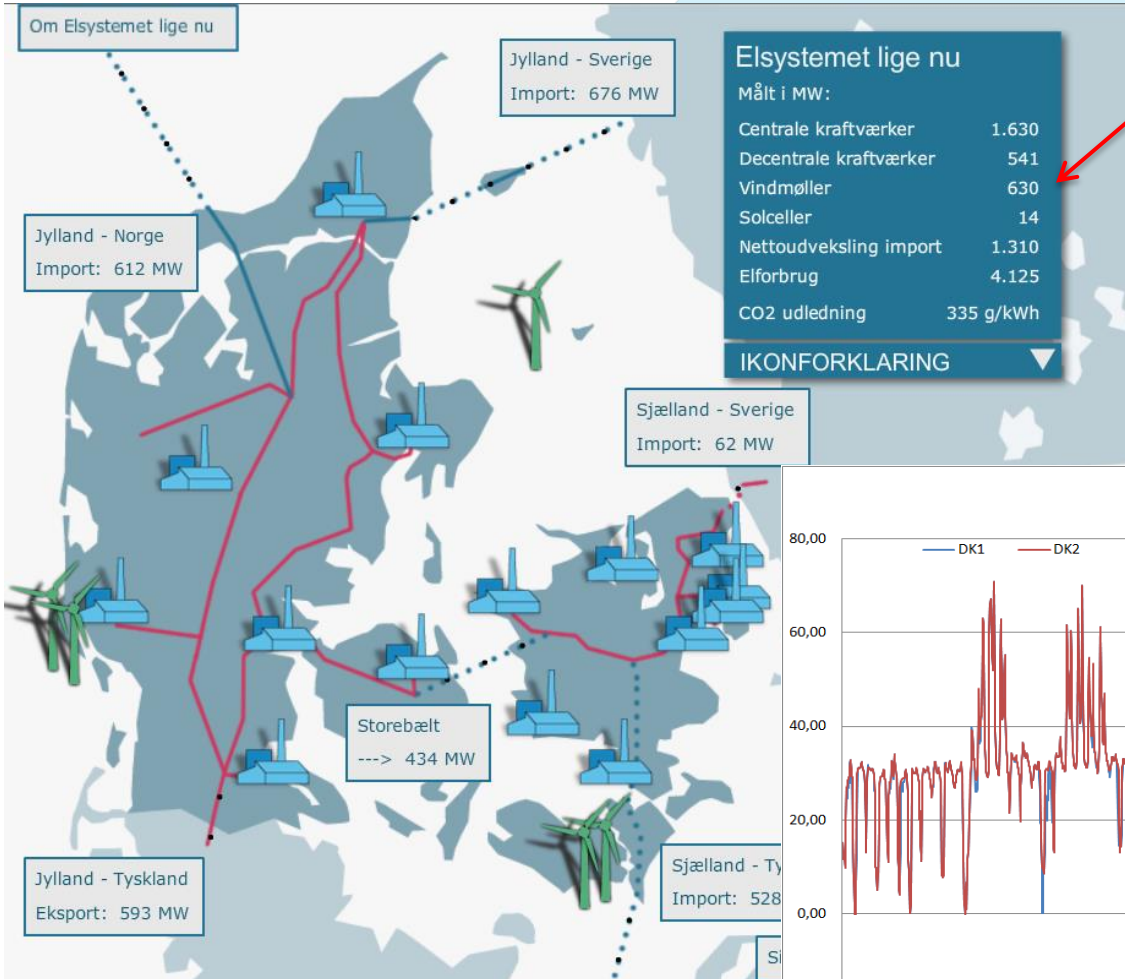
**HMN**  
GASHANDEL

15 %. 10<sup>th</sup>. Sept. 2014, 07.28

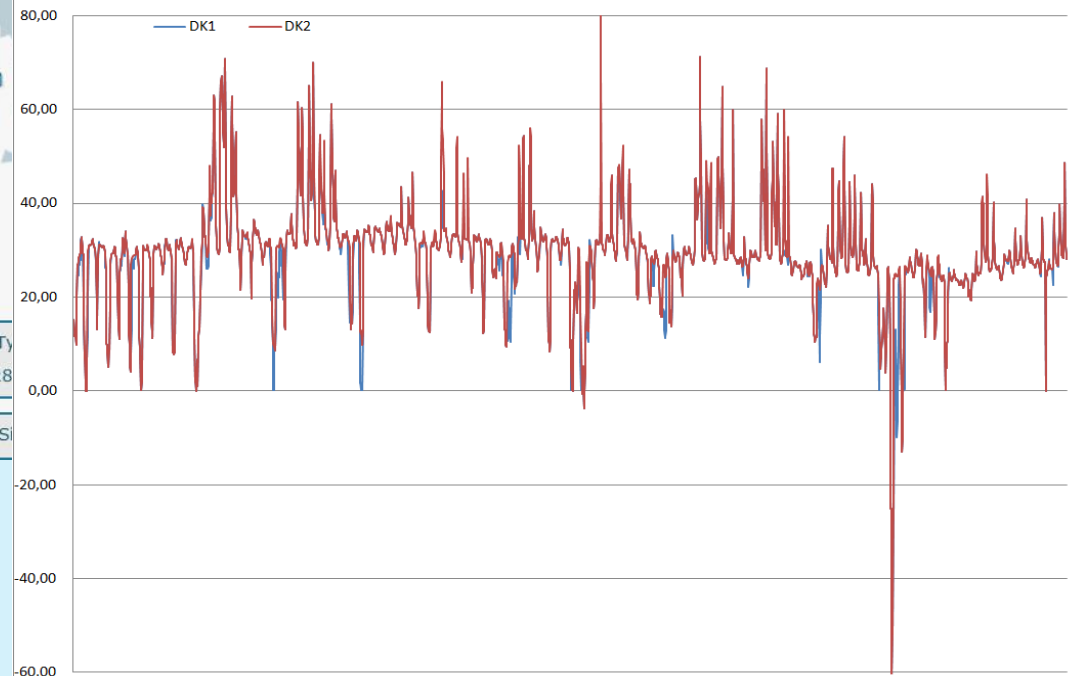
Windpowers share of total consumption i DK:

2013 = 33,2 %, december 2013 = 54,8 %  
Q1-Q2 2014= 41,2 %, January 2014 = 61,7 %

5.229 windmills 4,8 GW  
(energinet.dk)

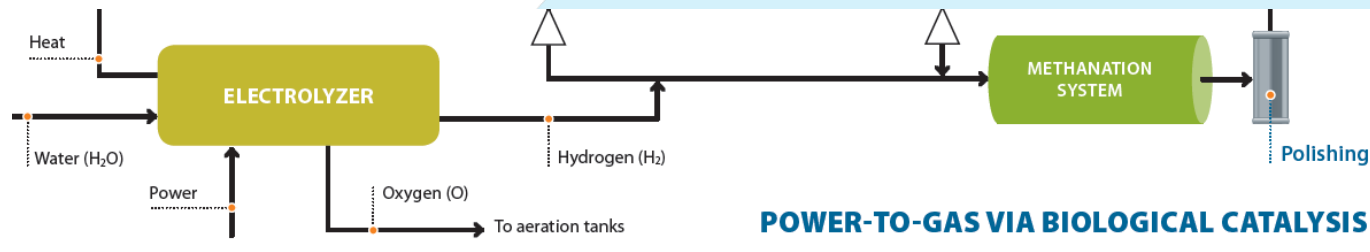


Power Spot Price Q1 2014 €/MWh



<http://www.energinet.dk/Flash/Forside/index.html>





## “System Integration”

### Microorganism

- Methanogenic archaea
- Selectively evolved, not genetically modified
- Thermophile (60-65° C)
- Properties:
  - Robust (tolerant to contamination)
  - Long-lived (self-replicating)
  - Efficient (long doubling time)
  - Dynamic (short ramp rate)
  - Selective (100% methane)

### Key figures;

1 MW electrical input  
Alkaline electrolysis and biological methanation

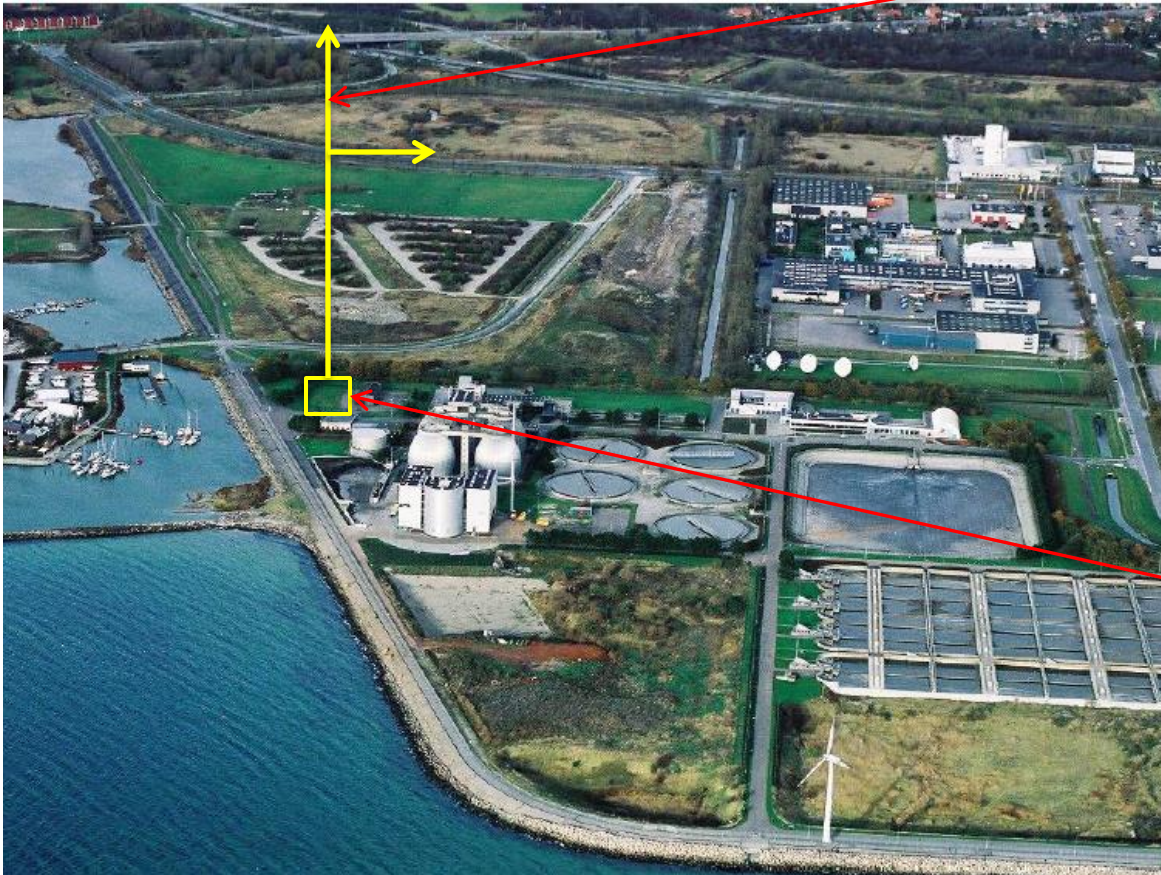
### Power-to-CH<sub>4</sub> Efficiency:

- 78% (incl. heat recovery)
- 58% (excl. heat recovery)

[www.biocat-project.com](http://www.biocat-project.com)



# GRID INJECTION FACILITY



## Grid Connection;

From Injection Station to existing Grid and new costumers

## Injection Station;

Double line Injection Station for two sepatat gasstreams, one line out.

Gaschromatographs  
Flowmeters  
Dewpoint

Odourisation

3-way valve to reject off spec gas.



*Connection-point to Danish Gas Grid*



# Thank you for your patience Questions?

See more at

[www.enzup.com](http://www.enzup.com)

[www.biocat-project.com](http://www.biocat-project.com)

and at session W4-4 and W3-4