



**Introduktion til Biometan Regions – indtryk fra  
Part 1 – Treforest, South Wales in Maj 2011  
Part 2 – København, Denmark in November 2011**

Følgende slides viser hovedtendenserne indenfor biogasudviklingen i Europa. se også

[www.bio-methaneregions.eu](http://www.bio-methaneregions.eu)

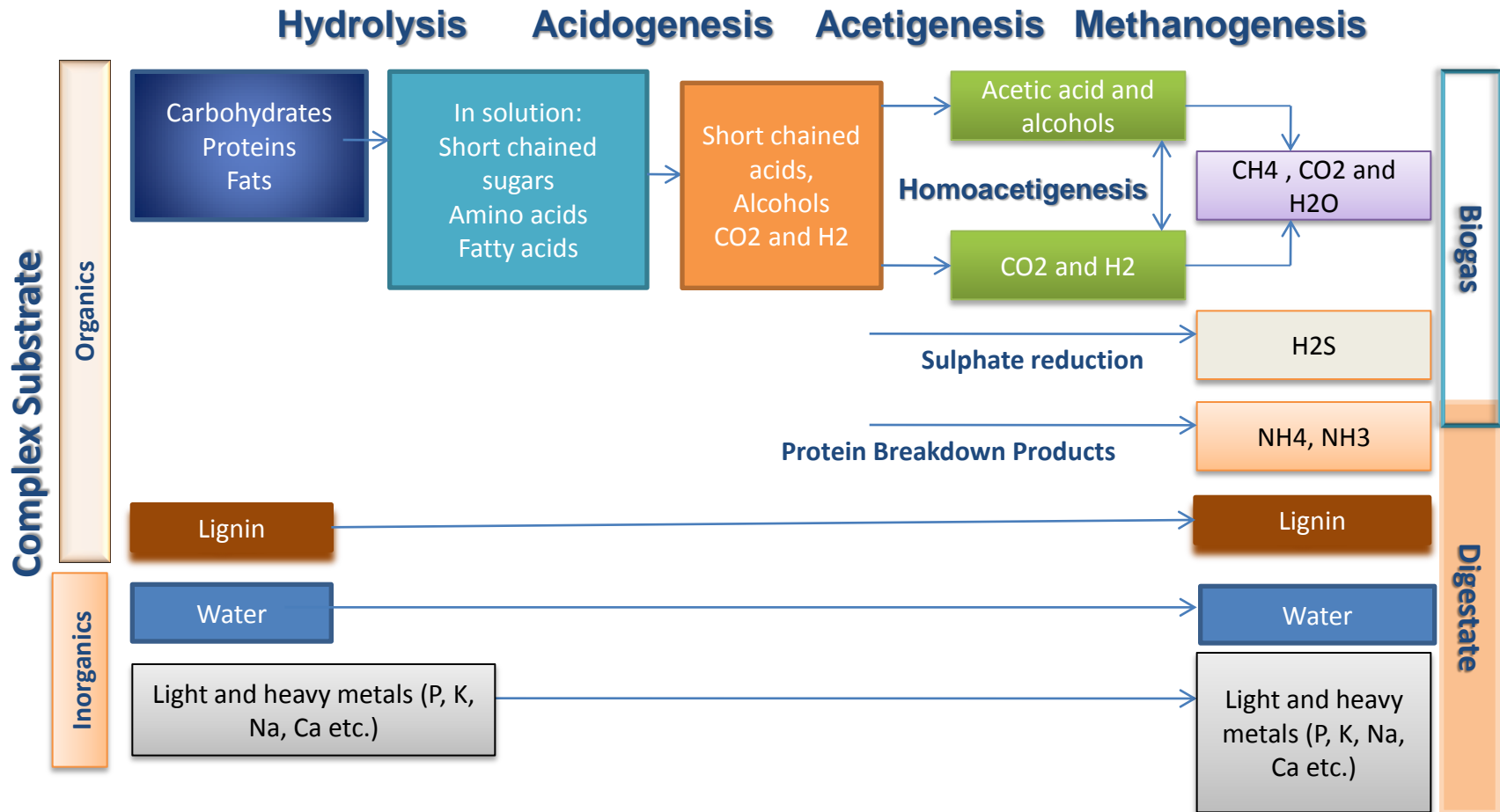
[www.biomethan.dk](http://www.biomethan.dk)



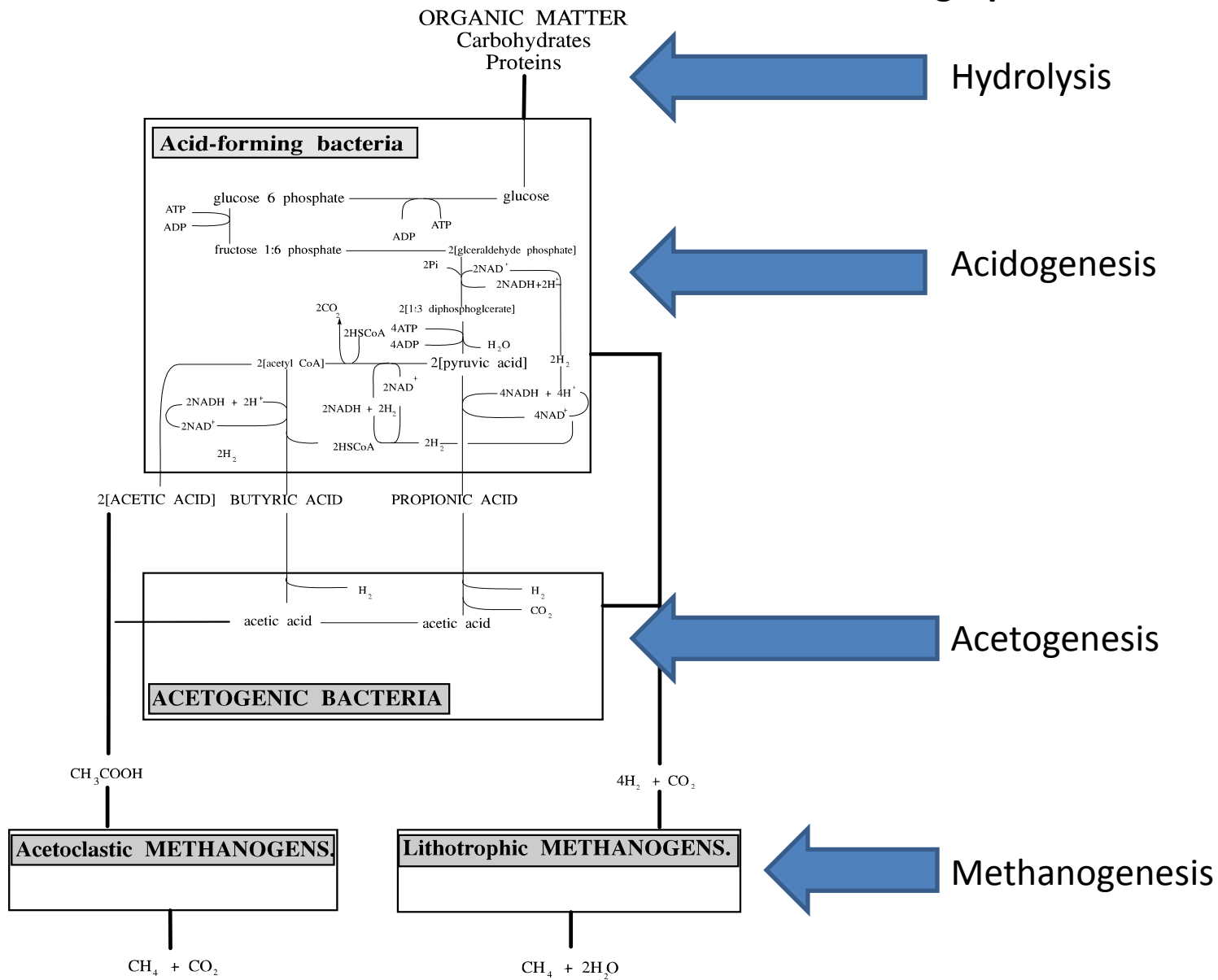
## **Indhold:**

- a) Den grundlæggende kemi i biogasprocessen**
- b) Optimeringsmuligheder**
- c) Opgradering af biogas**
- d) Europæiske tendenser indenfor biogas**
- e) En dansk styrkeposition**

# Anarob omsætning til biogas – en kompleks kemi



# Trin i biogasprocessen

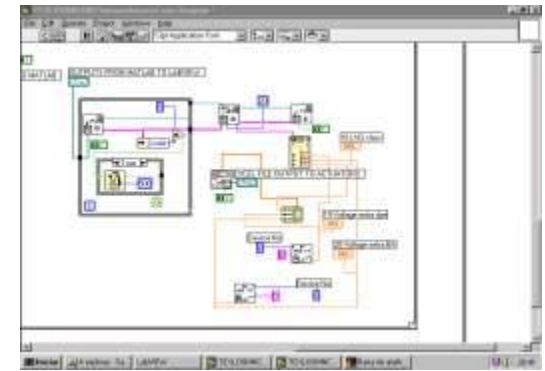


Taken from Guwy, (1996). Modified from Mosey, (1983)

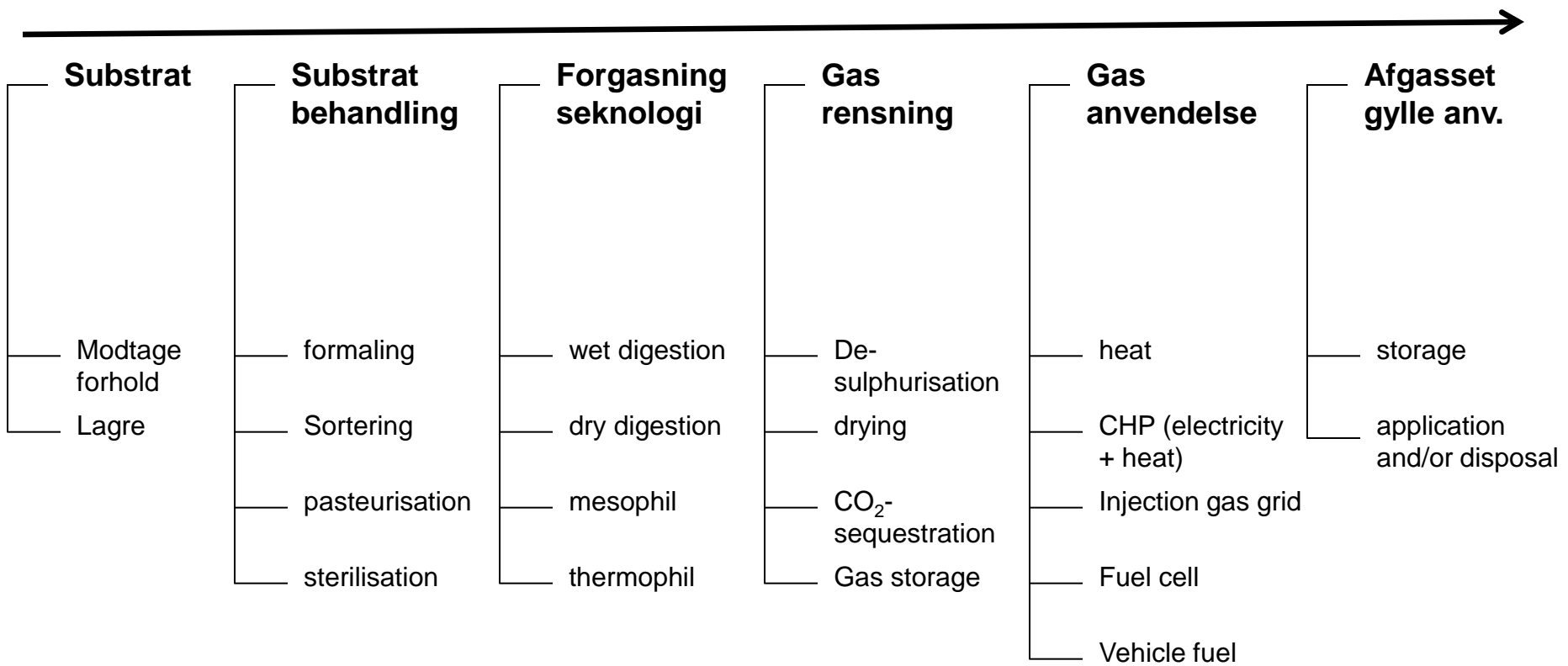


**Optimeringsmuligheder for biogasprocessen**

# Kontrol og optimering af biogasprocessen



- Kontrol baseret på biomassekontrol og regulering af reaktorprocessen
  - Fastholde ensartede temperaturer
  - Kontrollere indførsel og opholdstid i reaktoren
  - <Sammensætning af en optimal “foderplan” for reaktoren
  - Tilsæt/fjern vand og recirkuler den flydende biomasse
  - Justering af pH
  - Tilsæt mikro- og makro-næringsstoffer f.eks. Jern kobolt nikkel molybdæn, selen, calcium, magnesium and vitamin B
  - Udfør forbehandling af biomassen



**Forskelligt tørstofindhold: I Danmark anvendes højt biomasse/gylle vandindhold, mens tør forgasning ses i nogle europæiske lande.**



< 25% DM  
continious digersters (flow through)  
pumping  
automatic



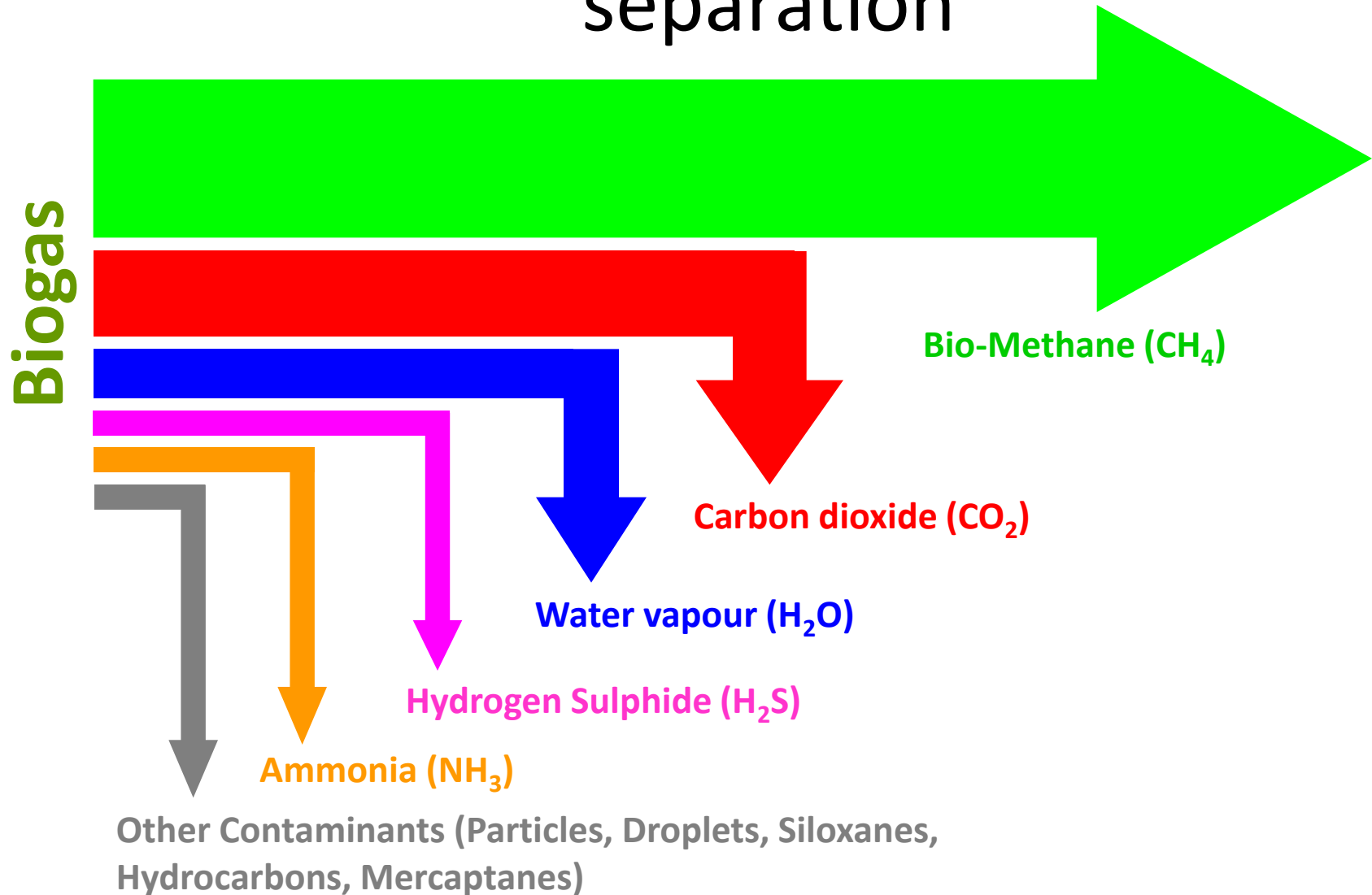
25% DM  
no pumping  
stackable  
batch-type (semi automatic)





**Biogasopgradering**

# Biogas opgradering – Et spørgsmål om separation



# Biogas opgradering i faser

1

- Preconditioning / pretreatment
- Removal of particles, droplets, siloxanes, other trace components

2

- Biogas desulphurisation

3

- Compression

4

- Biogas upgrading
- Separation of CO<sub>2</sub> and H<sub>2</sub>O

5

- Final conditioning
- Dewpoint control, adjustment of heating value, offgas treatment

# Biogas opgraderingsteknologier

- ✓ **Various technologies available**
  - ✓ Pressure swing adsorption
  - ✓ Water scrubbing
  - ✓ Selexol absorption
  - ✓ Amine absorption
  - ✓ Membrane separation
  - ✓ Cryo separation
  - ✓ Hybrid systems
- ✓ **Decide for suitable technology primarily NOT by investment costs – remember: cheap can be expensive!!**
- ✓ Select suitable technology according to:
  - ✓ upgrading capacity
  - ✓ turn-down ratio
  - ✓ shut-down / start-up performance and ease of operation
  - ✓ product quality needed
  - ✓ Chemicals and energy consumption





**Europæiske tendenser indenfor biogas**



Typisk gårdbiogasanlæg baseret på  
planteprodukter (Tyskland m.fl.)



**Biogasfællesanlæg**

# Den svenske udvikling – Biogas i transportsektoren

2010:

127 offentlige fyldestationer for gas

45 private fyldstationer

30.100 personbiler

1.200 busser

500 lastbiler – især til renovation

Nyudvikling omkring flydende biogas til transport







## Marketing methane as a vehicle fuel

- E.ON Gas Sverige AB sells compressed natural gas and biogas at 35 public filling stations in the south of Sweden  
18 busdepots  
The yearly volume is 400 GWh - replacing about 40 million liters of gasoline/diesel
- 40 % is biogas

### Target:

- Supply 2 000 GWh/year in 2020, of which biogas will account for 75-100 %



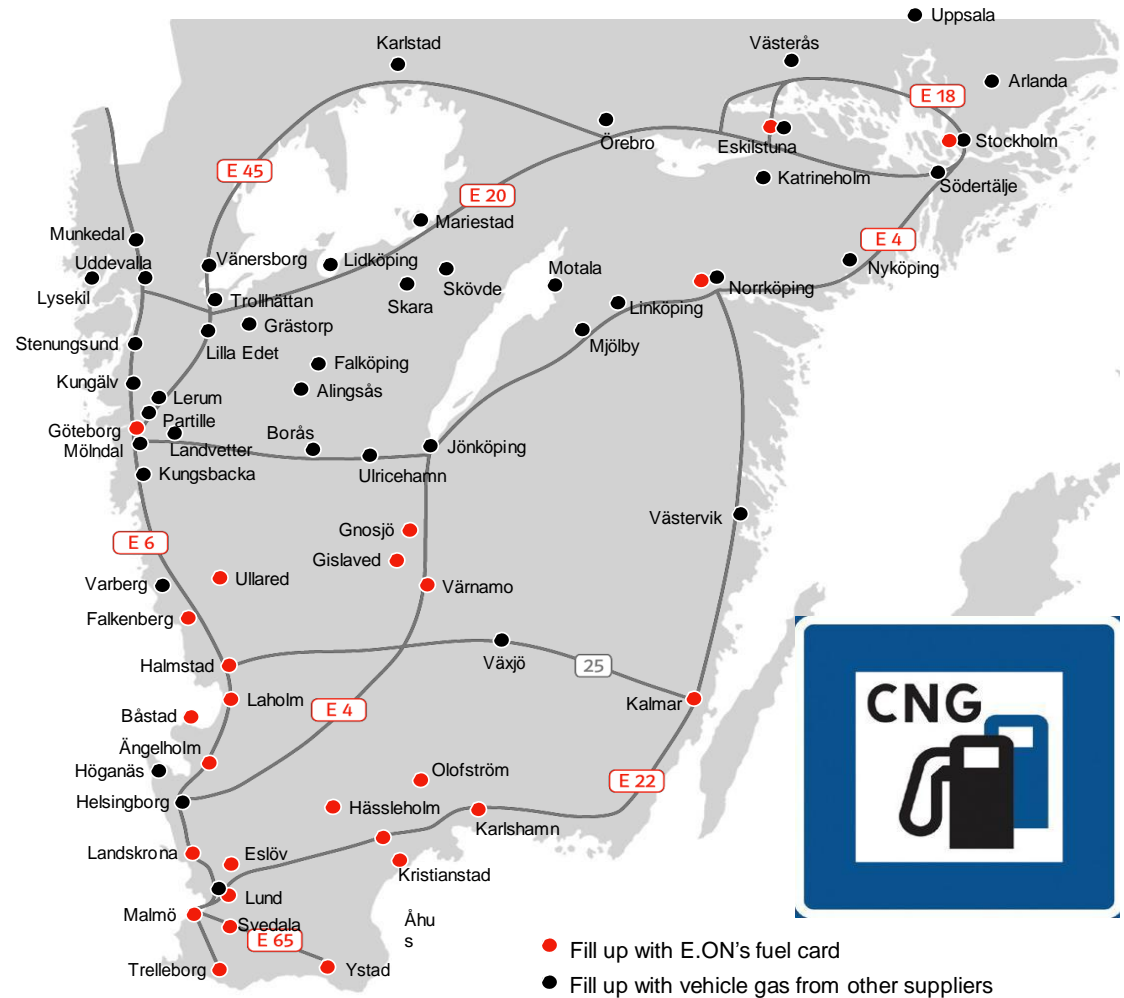


# Vehicle gas filling stations

## Filling stations in the north

- Östersund
- Boden
- Sundsvall
- Skellefteå

120 public filling stations  
50 depots for heavy traffic  
30,000 private cars  
950 buses  
350 trucks



Emerging demand and economy

EU directive for renewables

Developing the agriculture sector – new possibilities

High environmental benefit – global, local and regional

Technologies for producing and use are in place

Low or zero tax in many countries

Infrastructure in place

Huge potential – organic waste, manure, crops and in the future wood



**Danske styrkepositioner**

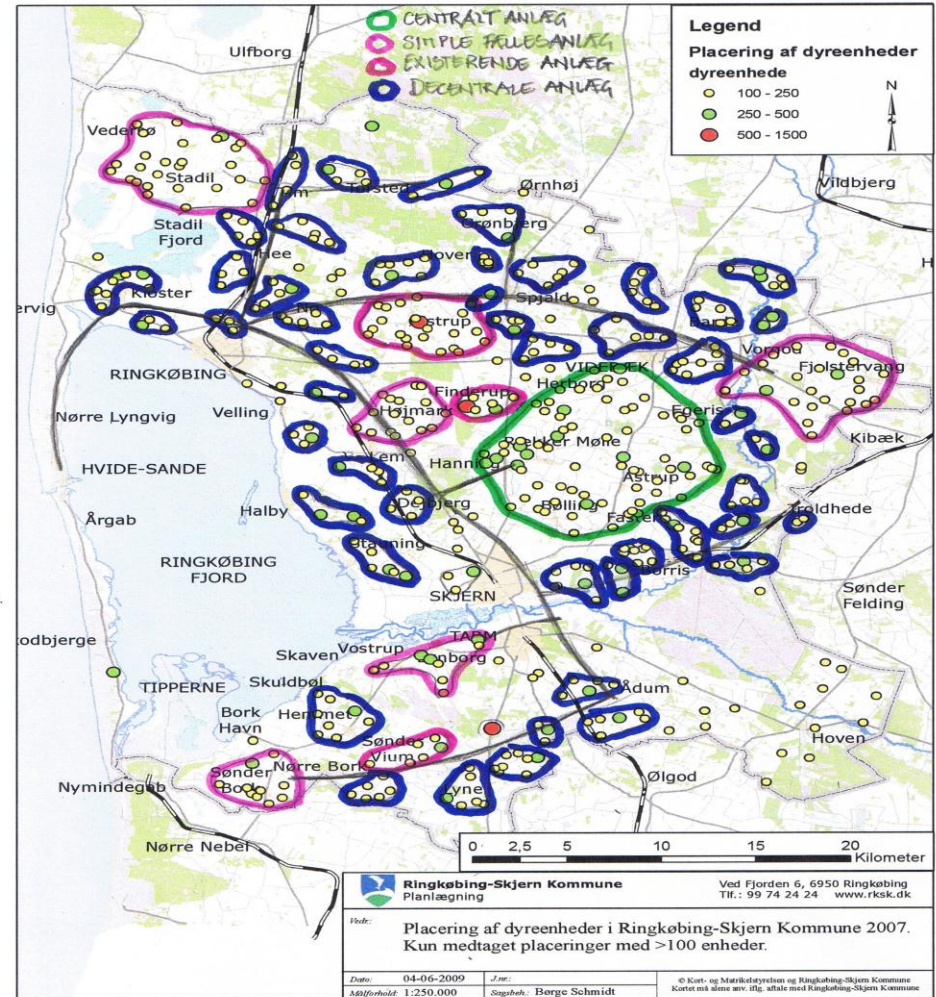
## Working towards a CO2 neutral energy system

- Fossil free energy system 2050
- 50% wind 2020
- Smart grids as an intelligent power system
- Potential for gas in the transport sector
- LNG as a low carbon option for ships
- Interlinking wind and gas systems
- Renewable gases as a supplement to natural gas



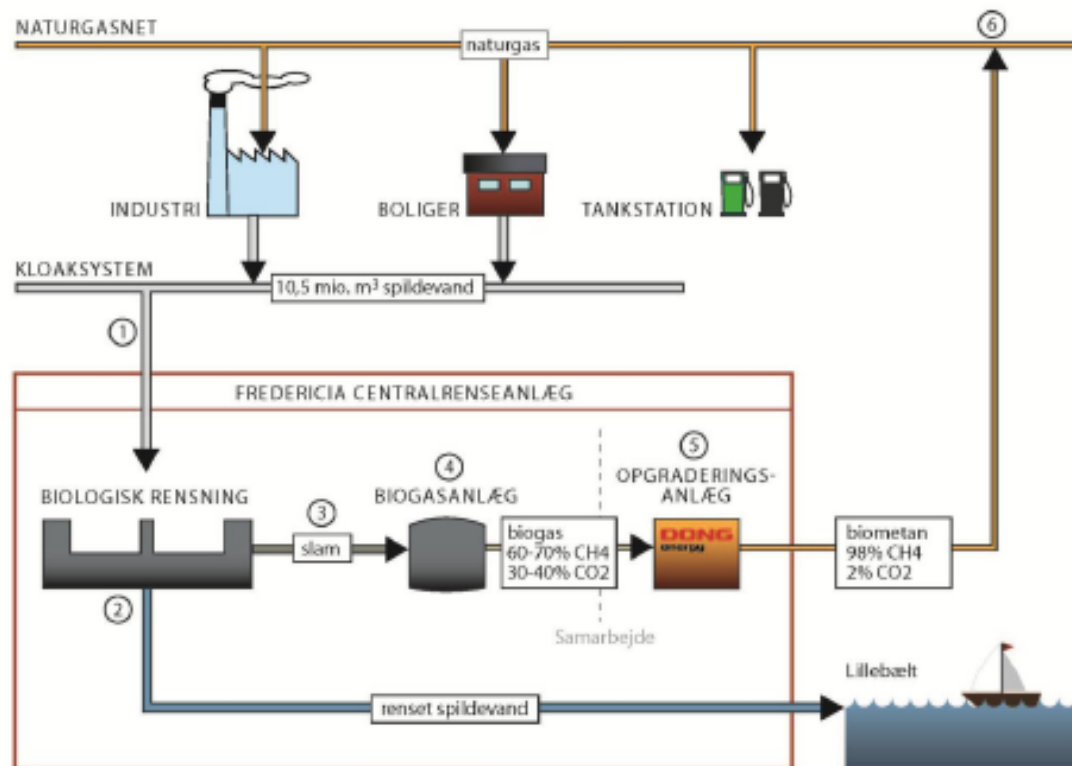
# RKSK-model

- 30 – 90 Decentrale biogas plants
- 1 - 2 Centrale biogas plants  
(service plants)
  - Fiber fraction
  - All kind of biomass



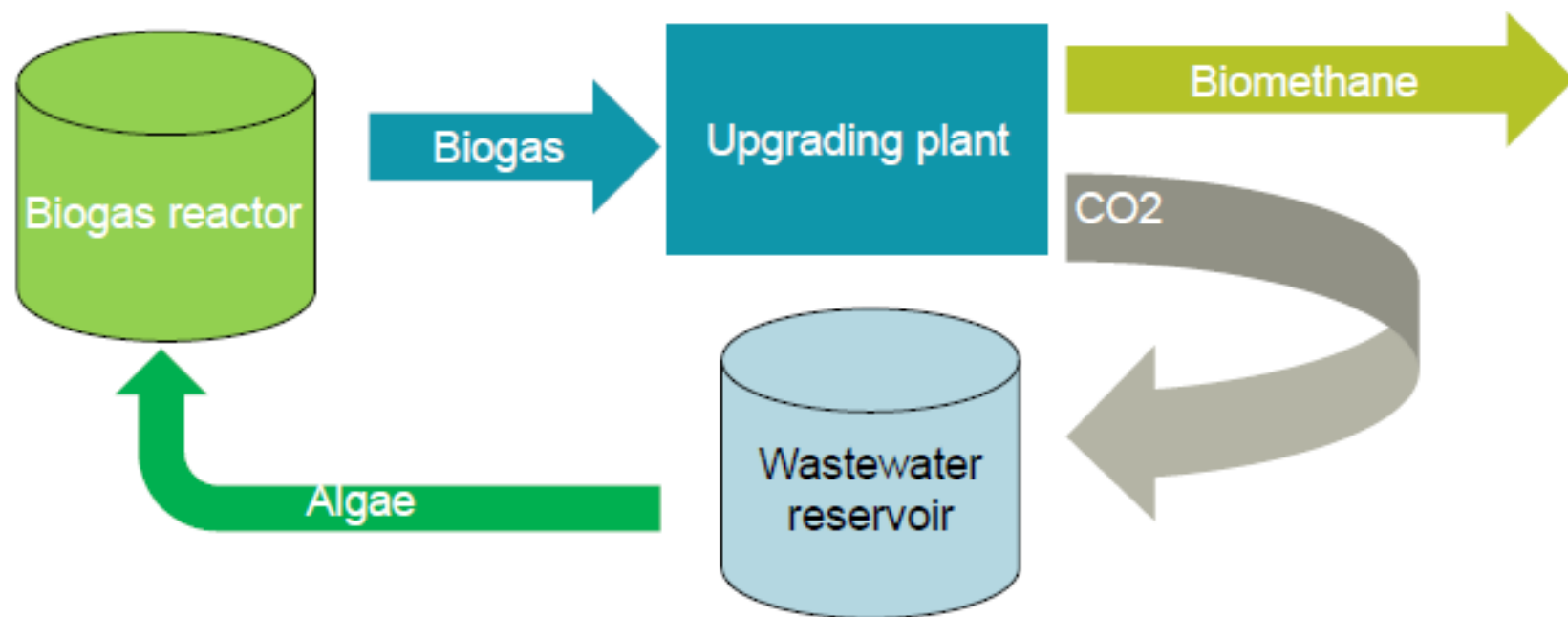
# DONG Energy now distributes biogas through the natural gas grid for the first time in Denmark

- In operation from 15th September 2011
- Expected production: 8-10 GWh/year
- Based on biogas from wastewater treatment plant



## Algae production and CO<sub>2</sub> reduction from upgrading plant in Fredericia

- Potential RTD project with Fredericia Spildevand as project manager
- CO<sub>2</sub> from the upgrading process will be used to stimulate algae production
- Improved CO<sub>2</sub> reduction effect of the biomethane







**Establishing an European Green Gas Market**  
**Knud Boesgaard**  
**energinet dk**

## Facts about Energinet.dk



- Independent Public Enterprise
  - Owned by the Danish State
- Non-profit self sustainable company
- Owns and operates the backbone of the energy infrastructure
  - 400 kilovolt High voltage electricity grid
  - 80 bar high pressure gas lines
  - Nord Pool Spot
  - Nord Pool Gas
- Conveys a number of energy related public functions
  - Subsidies for green energy production
  - Funds energy research
- Member of The European Network of Transmission System Operators for Gas/ Electricity (ENTSOG/ ENTSOE)





Foto:  Schmack



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