

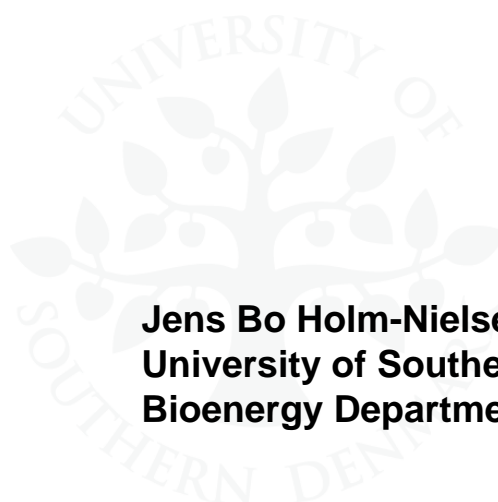


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BIOGAS in DENMARK

Country up-date 2007

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Energy production from biogas in Denmark

Unit: PJ per year	Potential	Production 2001	Production 2002	Production 2003	Production 2004
Animal manure	26.0	0.61	0.70	0.85	0.91
Sewage sludge	4.0	0.86	0.87	0.87	0.83
Industrial waste	2.5	0.59	0.67	0.80	0.86
Industrial waste, imported	-	0.40	0.45	0.55	0.65
Meat and bone meal	2.0	0.00	0.00	0.00	0.00
Household waste	2.5	0.03	0.05	0.07	0.03
Green waste/garden waste	1.0	0.00	0.00	0.00	0.00
Landfill gas	1.0	0.56	0.62	0.44	0.46
Total	39	3.05	3.58	3.58	3.74

Source:

Tafdrup, S. (2006). "Insufficient knowledge of gas from manure" in *Bioenergy Research*, Vol. 3, issue 14, June 2006, pp. 2-3, <http://www.biopress.dk/FiB-UK.htm>



Denmark needs more biogas plants

Manure based biogas plants:

20 centralised plants

- now new plants since 1997

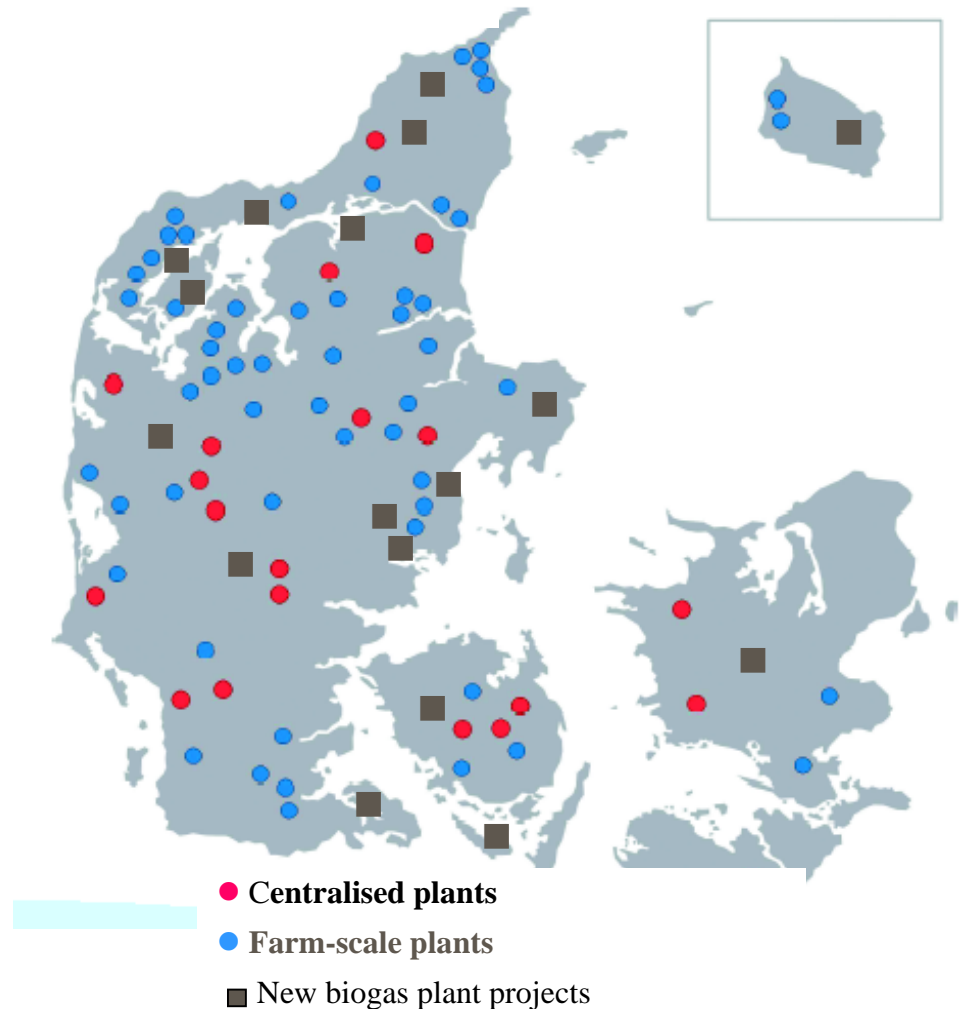
60 farm scale plants

- triple their number during last years

1.3 mill tonnes manure / year (5 % of total)

0,3 mill tonnes organic waste / year

A number of new projects





**Ribe Biogas; 15 years of production, 18.000 m³ biogas/day.
Source J. B. Holm-Nielsen, Bioenergy Dept., SDU, Denmark.**

Biogas cleaning and upgrading

Draining, cooling, drying

Biogas contains H_2S

- Can be removed chemically or biologically in - Post storing units or gas cleaning units.

Upgrading





Denmark needs more biogas plants

- Manure based biogas is economically and socio – economically feasible when:
 - Organic waste is included
 - Environmental and economic externalities are taken into account
- Cost-efficient tool for Green House Gas reduction
- Beneficial for involved farmers
- Creates jobs and local activity

Political goals:

- **5 PJ from biogas and 10-20 new biogas plants established by 2012**
(doubling of 2007 production)

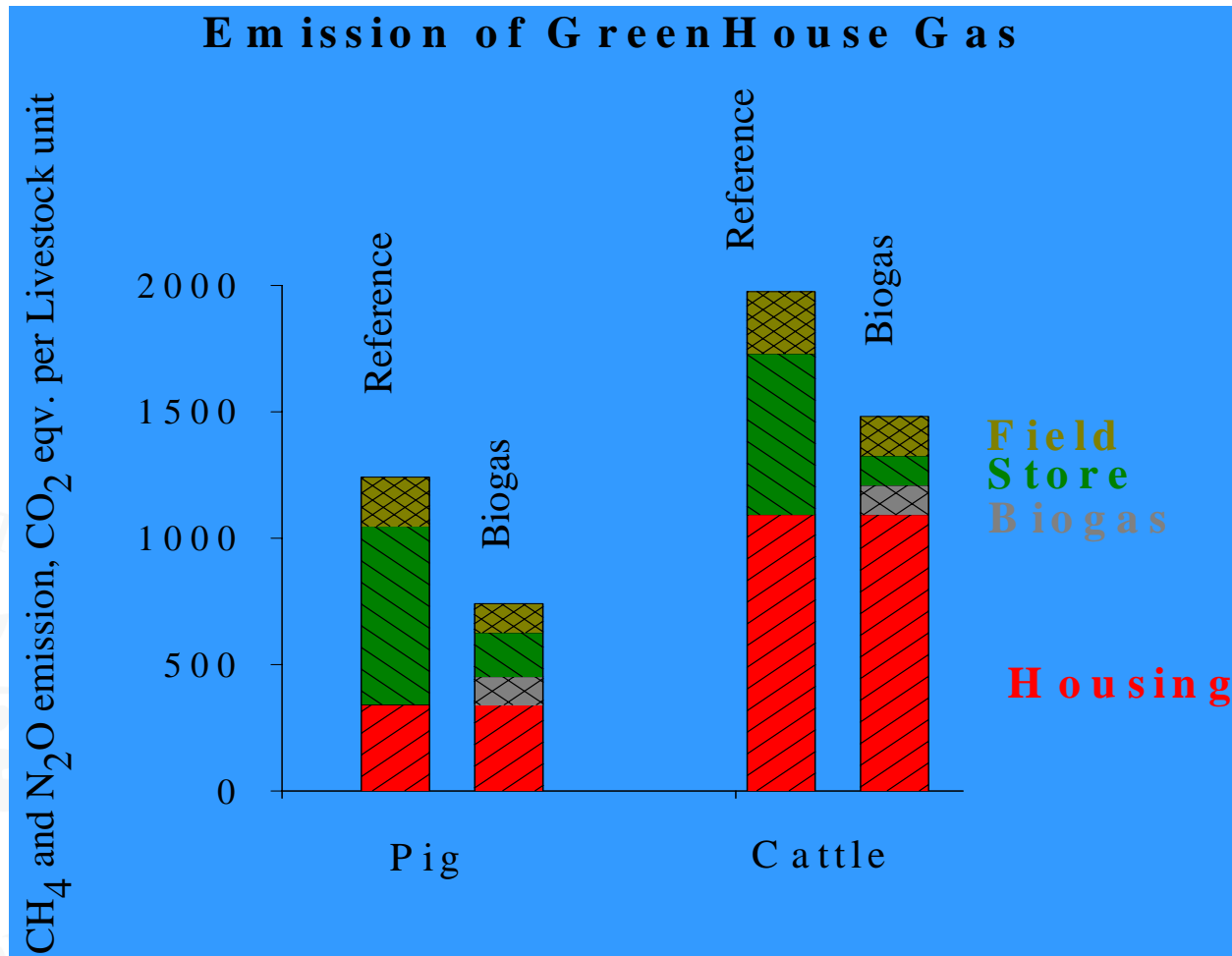


Denmark needs more biogas plants

Actual incentives for establishment of new plants:

- **Socio-economic advantages of biogas production**
- **Fulfilment of environmental tasks**
 - cheap tool for reduction of CO₂ emissions (40 DKK/tons CO₂)
 - 90 kg CO₂ EQ. / t biomass treated
- **Agricultural benefits**
 - cheap slurry storage
 - less transport
 - less odours and flies at application and around the storage tanks
 - less CH₄ emissions from treated manure - biofertilizer
 - cheap redistribution of slurry (centralised co-digestion)
 - sanitation and pathogens control
 - NPK declaration
 - high N-utilisation and less N- leaching
 - possibility of separation

Green House Gas emission, with and without biogas production





Biogas and slurry separation

Digestate



Fibre fraction



Decanter



Liquid fraction



70 % of total P
25 % of total N, organic compounds
15 % of initial volume

75 % of total N, mainly as ammonia

**Sill no market fibre fraction. Costs of drying (50 eur/T) exceed nutrient value of fibres.
Heavy metals content could be a problem; removal expensive
Incineration seen like the only alternative; Documentation and approvals needed**



Denmark needs more biogas plants

Existing framework:

- Price of produced/ sold m³ CH₄: 3DKK
- Heat production: exempted from energy and CO₂ taxation
- Power-production: price guaranty of 0,60 DKK/kwh the next 10 years and of 0,40DKK/ kwh further 10 years (only for plants established before 2007)
- Co-digestion of organic waste a “must” for balanced economy
- Decreasing => 0 grants

Limitations/barriers:

- Future power prices
- Insufficient organic waste
- Frequently negative public image due to odours around the plants
- Complicated approval procedures for establishment



Denmark needs more biogas plants

Necessary framework to achieve the political tasks: (Danish Biogas Association)

- Fair electricity prices / price guaranty
- Access to other co-digestion substrates than slurries
- Simpler rules for plant approvals and operation
- Environmental and veterinary framework
- Improved public perception of biogas: awareness campaign on-going (Danish Biogas Association)
- Founding for RD&D work (externalities, new substrates, pre/post treatment etc.)