



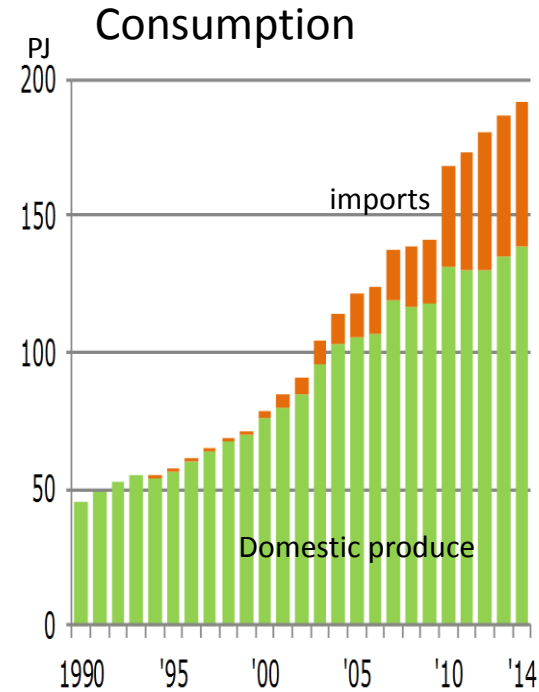
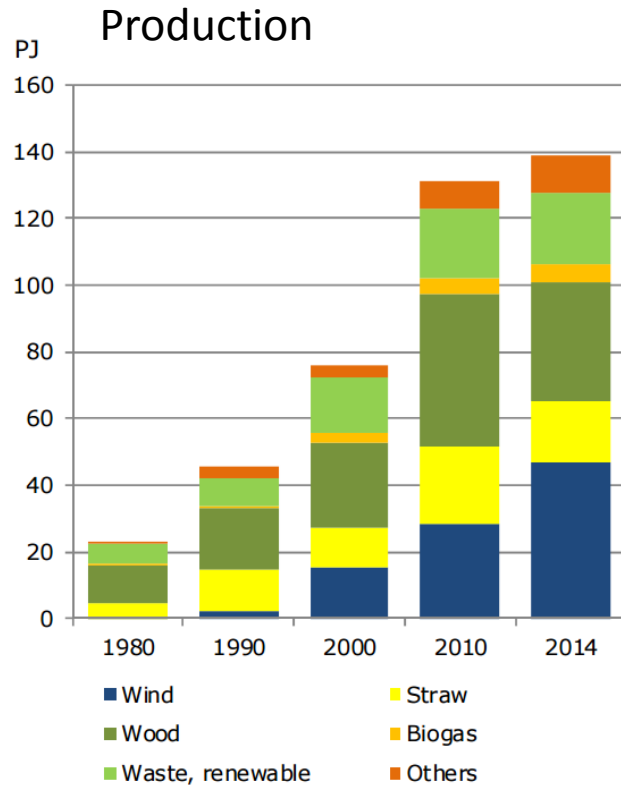
Ukraine-Denmark Energy Center

Developing biomass market for power and heat generation in Denmark

1 November 2016

*Government cooperation on strategic energy planning between
Ukraine and Denmark*

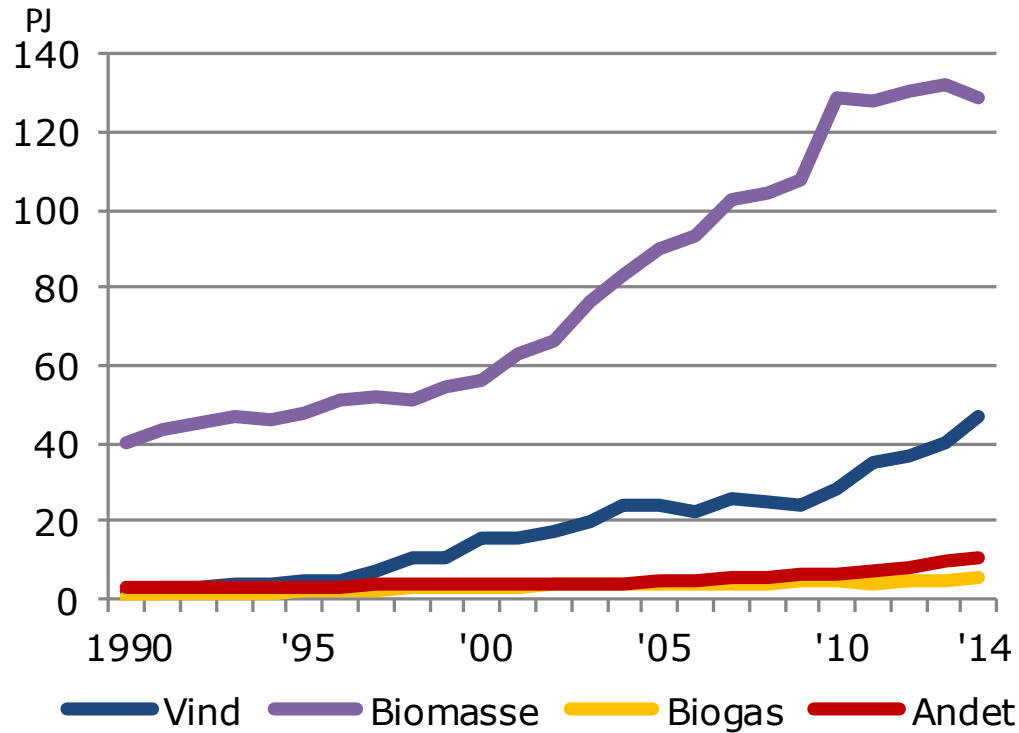
Renewables in Denmark



Production 140 PJ + Imports 55 PJ

Renewables cover today **27 % of total gross demand** – of which biomass 18 %

Not only wind!



Denmark is world famous for large share of wind, but use of biomass is nearly 3 times higher

Different markets – different reasons

3 markets



1. Large scale combined heat and power

- Power generation is not attractive today – power price is low. Main income is now from district heating. Higher total profit if fuel is biomass

2. Small scale CHP units near the end of designed lifetime

- No feasibility in replacement of natural gas CHP due to low electricity prices. Gas boilers already exist but investment in new biomass boiler are more feasible

3. Individual boilers for heating (mainly in countryside)

- Biomass is cheaper than natural gas or oil

Danish biomass market 2014

Approximate demand 6.7 mio ton/year – and increasing
 Import of 2.7 mio ton - mainly wood pellets for large CHP plants

SUPPLY					
<i>000 ton</i>	straw	chips	fire wood	pellets	ind. wood waste
'000 production	1.270	986	1.203	111	470
'000 ton imports		508	214	2.024	
TOTAL	1.270	1.493	1.416	2.136	470
import share		34%	15%	95%	
CONSUMPTION					
large scale	403	438		1.216	37
DH boilers	534	1.032		132	243
individual boilers	333		1.416	788	190

- Straw used in all three markets
- Chips mainly for DH boilers – but large scale use is coming
- Fire wood only in private households on country side
- Pellets for large scale and private households
- Industrial wood waste for DH boilers and private households

Economic rationale behind biomass

- These years biomass to replace natural gas and coal is very popular in Denmark
- The main reason is that coal and gas for heat production is taxed – a policy incentive
 - Fossil fuel is cheaper than biomass, BUT
 - Fossil fuel used for heating is heavily taxed, biomass is not
 - Fossil fuel + tax is more expensive than biomass

Indicative cost of fuels and fuel tax in Denmark 2016

DKK/GJ	cost of fuel	Tax	Total
Coal	27	55	82
Natural Gas	40	55	95
Straw	40	0	40
Chips	48	0	48
Pellets	66	0	66

Before tax:
Coal & natural gas cheapest

EUR/GJ	cost of fuel	Tax	Total
Coal	3,6	7,4	11,0
Natural Gas	5,4	7,4	12,8
Straw	5,4	0	5,4
Chips	6,4	0	6,4
Pellets	8,9	0	8,9

After tax:
Biomass cheapest

Difficult start in the 1990'ies

- First policy incentive to promote biomass is from 1993
 - Imposed utilities to use of 1.4 m tonnes biomass for power and heat generation
- But coincided with with support to new natural gas system;
 - Natural gas also exempt of taxes and therefore cheaper
 - Tax on natural gas introduced during 10 years. Full tax only in 2006
- Only after full tax on natural gas biomass became interesting for investors



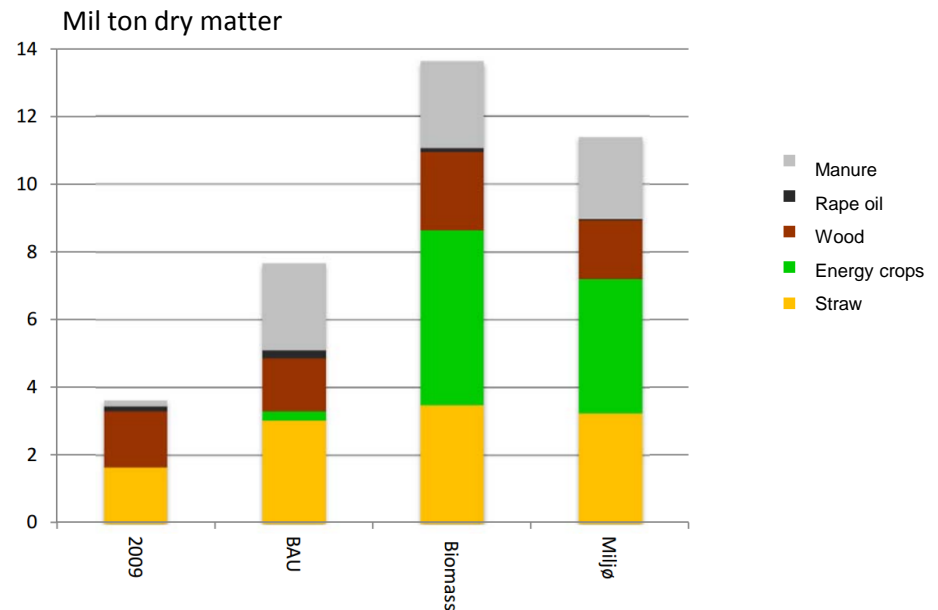
Domestic potential not yet exploited

- 30 years ago only enthusiasts believed in biomass to energy
- Today high utilization of domestic biomass for energy
- But 'unknown potential' is revealed with increase in demand



+ 10 MIO. TONS PLANEN

muligheder for en øget dansk produktion af bæredygtig biomasse til bioraffinaderier



Copenhagen University report 2010 – about increase of biomass to energy from 3.8 m to 13.8 m tonnes

Conclusion

- Experience from Denmark shows that
 - A 'market' requires both a seller and a purchaser - basic economic theory of supply and demand
 - The competitive biomass market develops in parallel with increasing demand
 - Demand of biomass increases if policy makes biomass economically competitive with fossil fuels – not before
 - Support of natural gas in the 1990'ies prevented increased use of biomass
- Development of a biomass market in Ukraine?
 - If Ukraine wants biomass for energy it should be feasible for consumers compared to natural gas
 - Tariff reform – unified gas tariff and the 90% tariff for biomass heat is a huge step
 - Domestic potential for biomass is big
 - But supply side of the biomass market and true competition only develops in parallel with increasing demand – not before

Conversion of 400 MWe CHP plant from NG to biomass

