



Foto: Jens B. Kjeldsen

## Perennial energy crops

Energy supply on a global scale is still totally dominated by fossil fuels (oil, coal and natural gas). But biomass is by far the largest source of renewable energy, covering 11 percent of the World's energy demand. Average scenarios estimate a 5-10 fold increase in biomass based energy production from 2002 to 2050

16 percent of the Danish energy consumption comes from renewable energy sources and of these 75 percent derives from biomass; primarily wood chips and straw.

It is a challenge that production of biomass for energy purposes will increasingly compete with food production on the arable land. So as part of the solution biomass production have to change to marginalized land. Here the short rotation forestry plantation of fast growing trees like willow for energy purposes is likely to become increasingly important if we are to meet our target defined in the EU directive on promotion of the use of energy from renewable sources.

A study from December 2008 from the Danish Ministry of Food, Agriculture and Fisheries has shown that Denmark has a huge potential for growing energy crops - namely cultivation of short rotation willow on marginal soils. This can be achieved without affecting the current food pro-

duction. At the same time the environment will benefit from reduced leaching of nitrogen and phosphorus together with reduced use of pesticides and reduction of greenhouse gas emissions.

### Benefitting the environment

Trials and research have shown that willow as perennial energy crop will reduce the leaching of nitrogen and phosphorus with 30-45 kilos nitrogen and 8-12 kilos phosphorus per hectare compared to annual crops such as cereals. This will lead to a drop by up to 70 percent in leaching of nitrogen.

Perennial energy crops also lead to less greenhouse gas emissions. Compared to annual crops such as cereals there will be a drop in  $N_2O$ - emissions equal to 0,27 - 0,73 tonnes  $CO_2$ -equivalents per hectare. More importantly the perennial energy crops will secure carbon storage (sinks) of 1,565 tonnes  $CO_2$ - equivalent per hectare. On top of this, the use of pesticides is very limited and concentrated primarily to the first two years.

### The Green Growth Agreement

With this positive perspective, the Danish Government has included the promotion of growing perennial energy crops in its Green Growth Agreement from June 2009. The Green Growth

Agreement combines a high level of environmental, nature and climate protection to go hand in hand with modern and competitive agriculture and food industries. DKK 32 million a year in the period 2010–2012 to subsidize perennial energy crops – equal funding of 10,000 hectares per year. There will be preference to plantation of perennial energy crops in areas vulnerable to nitrogen leaching. In this way the programme will contribute to fulfilling the EU Water Framework Directive.

The current level of perennial energy crops in Denmark is 4,000 hectares, mainly willow.

The Green Growth agreement also includes initiatives to equalize tax rules for perennial energy crops and annual crops. Finally, the agreement allows growing perennial energy crops on marginalized areas like buffer-strips alongside streams, ponds and lakes without using fertilizers or pesticides.

To promote the use of biomass from perennial energy crops, The Danish Government will work for a Parliament decision on the use of these in small combined power and heating stations.

## Future challenges for growth in perennial energy crops

There is a need of drought resistant strains of willow which may easily grow in sandy soil. There is also a need of willow with high content of dry matter.

To lower the plantation costs it is necessary to further develop other means of planting than the cutting method, e.g. the lay-flat method.

Growing perennial energy crops have raised concerns about biodiversity and landscape features.

On the landscape issues, there is concern about “forestification” of the open agricultural landscape, where 4-6 meter high “green walls” of willow block the view. This problem will be limited by use of a new strain of willow, that can be harvested every year and thereby ensuring a variation in the open landscape.

On biodiversity, the concern is that perennial energy crops will benefit some animals connected to more closed landscapes e.g. field hare, roe, fallow, and red deer to the disadvantage of birds of the open land such as waders, ducks and geese.

## The competitiveness of perennial energy crops to other agricultural productions

Types of production:	Average income per hectares DKK	
	Sandy soil	Clay soil
Plant/pigs	756	2984
Plant/pigs with high value crops	910	3315
Dairy	1152	2073
Meadows (beef cattle)	50	428
Crops:		
Winter wheat (1. year)	1631	4627
Industrial potatoes	4024	-
Sugar beets	-	7956
Spring barley (feed)	579	2447
Perennial energy crops	1900	

Source: Modified by the Danish Ministry from Jakobsen et al juni 2008

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