

IEA Bioenergy Task 31

SWEDEN COUNTRY REPORT 2008

Overview – status, hot issues, new developments

As a fairly large forested country with a small population, a well developed forest industry, and with barely any fossil fuels much focus is on biomass from Sweden's forests as a renewable energy source. A lot of steps towards more biomass for energy have been taken already, primarily by the forest industry, and lately by the energy industry. This has caused an increasing demand for biomass in the country and some frustration for the pulp and paper industry, as they are dependent on both cheap raw material as well as cheap energy. Some pulp wood is already used for energy purposes without passing the forest industry at the same time as Russia is introducing custom taxes on round wood export making that source less available. Therefore there is a need to use more of the biomass that we have in our forests i.e. logging residues, stumps and small sized trees.

Policy and legislation – recent changes

According to the government's web page *Swedish energy policy strives to create a sustainable energy system with a long term vision for Sweden to obtain all energy supply from renewable energy sources*.

The two main bodies responsible for implementing energy policy measures are the Swedish Energy Agency and Affärsverket svenska kraftnät. However, the National Board of Housing, Building and Planning, the Swedish Consumer Agency, the Swedish National Electrical Safety Board, the Swedish Agency for Innovation Systems, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, the Swedish Research Council and the county administrative boards are also involved.

The need for more biomass for energy has become even more obvious after the new targets for renewable energy in Europe was passed by the European Commission in late 2007 namely:

- 20 % renewable energy sources within the union by the year 2020
- 20 % lower CO₂ emissions as compared to 1990 by the year 2020
- 10 % of the fuels based on renewable energy by the year 2020

The burden for different countries within the union, based on economic and structural conditions, was presented in January 23, 2008. The piece-work for Sweden will be to increase the use of renewable energy from today's 40 % to 49 %, and to decrease CO₂ emissions with 17 %, as compared to the level in 2005, by the year 2020.

This has the potential to make a hot market even hotter and the demand for more biomass from our forests greater. Some of the logging residues (8 TWh) are already on the market, but so far barely any stumps or small stems are delivered. The increased interest for stumps as a biomass resource forced the Swedish Forest Agency to demand an environmental impact assessment study before stump harvest can be accepted as a common forestry practice in

Sweden. Therefore, no stumps are harvested in Sweden at the moment (2008). Major concerns are:

- the loss of coarse woody debris and its impact on biodiversity
- soil disturbance and its impact on
 - erosion and thereby siltation of surface waters
 - physical soil properties
 - nutrient losses and potential acidification of surface waters
 - carbon balance
 - cultural heritage hidden in the forest soil
 - mobility of toxic substances ó organic mercury in particular

The work with an environmental assessment study on stump harvest has begun in spring 2008 whereas one dealing with harvest of logging residues and ash recycling has already been accomplished in 1998, resulting in new recommendations included in the Swedish Forestry Act. These recommendations are currently (2008) under revision.

In the government's proposition (2007/2008:108) ó ðA forest policy for this timeö ó much emphasis is put on increased harvest and growth in our forests to match the increased needs from the forest and energy industry.

Energy supply and use in Sweden

The Swedish Energy Agency publishes annual statistics over energy supply and use in Sweden. Figure 1 and 2 show that Sweden's energy supply and use have increased steadily since 1970 up until today. At the same time the use of fossil fuels has decreased both in absolute and relative terms. This was made possible by the introduction of nuclear power in the 1970s and later on by increased use of biomass for energy, primarily in the forest industry.

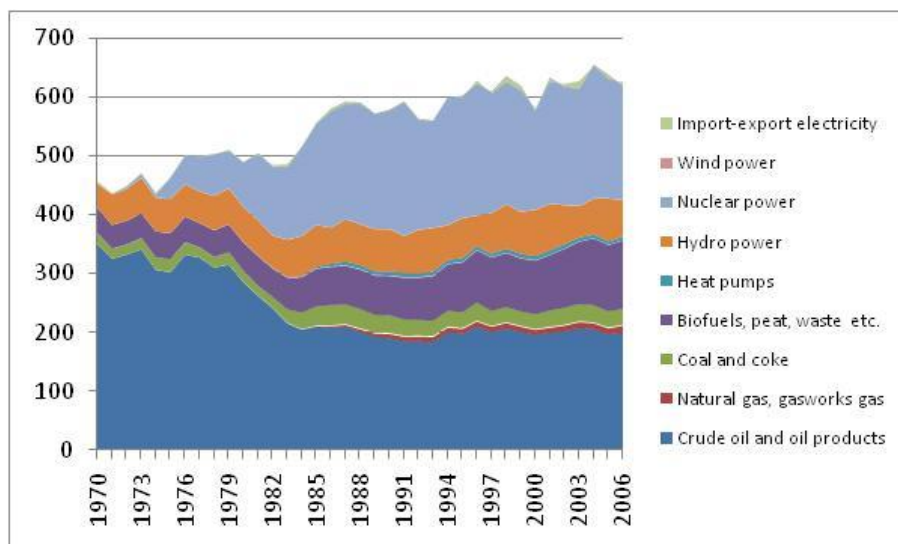


Figure 1. Total energy supply in Sweden 1970-2006 (TWh) Source: Statistics Sweden and the Swedish Energy Agency

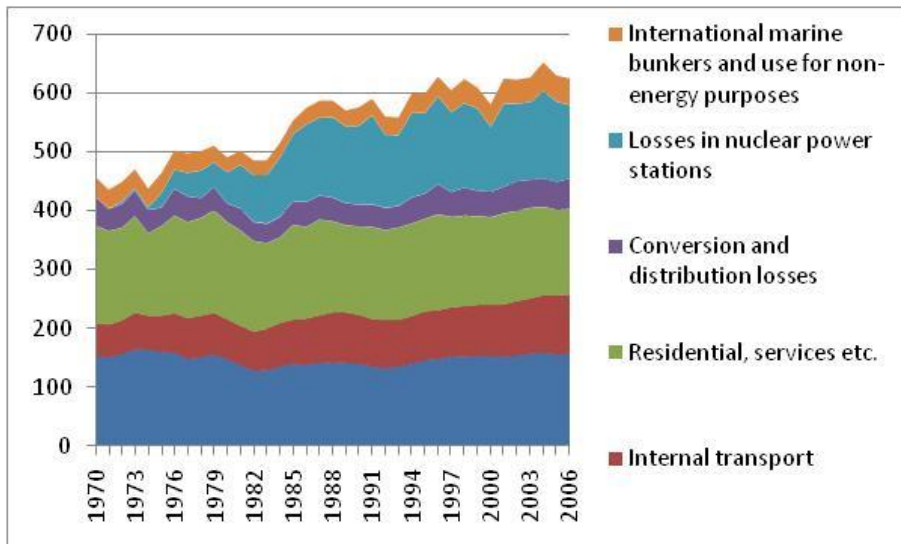


Figure 2. Total energy use in Sweden 1970-2006 (TWh) Source: Statistics Sweden and the Swedish Energy Agency

Based on energy supply (figure 1) the proportion renewable energy in Sweden was 26 % in 2006, with bioenergy (including garbage and peat) contributing with 19 %. The same figures based on energy use (excluding losses in nuclear power stations and conversion and distribution losses) were 40 % and 26 % respectively. The bioenergy proportion equals 116 TWh, with 56 TWh used directly by primarily the forest industry and 42 TWh in power plants with a big proportion in district heating (Figure 2, 3). The other 18 TWh was mainly fuel wood, pellets and briquettes in individual houses and a small proportion biofuels (most of it imported).

The figures clearly show the dominance of biomass from the forest with garbage as the second largest source (8 TWh). The out-taxed peat contributed with 2 TWh only, despite its large potential in Sweden, and bioenergy from agricultural land contribute with slightly more than 1 TWh (Salix, stalks, and wheat (mainly for ethanol production)).

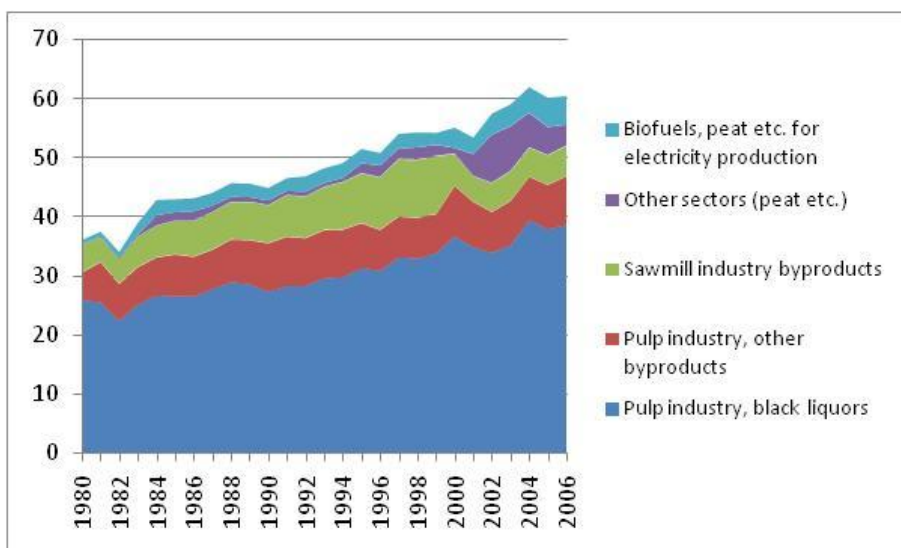


Figure 3. Use of biofuels, peat etc. in industry (including electricity generation), 1980-2006 (TWh). Source: Statistics Sweden and the Swedish Energy Agency.

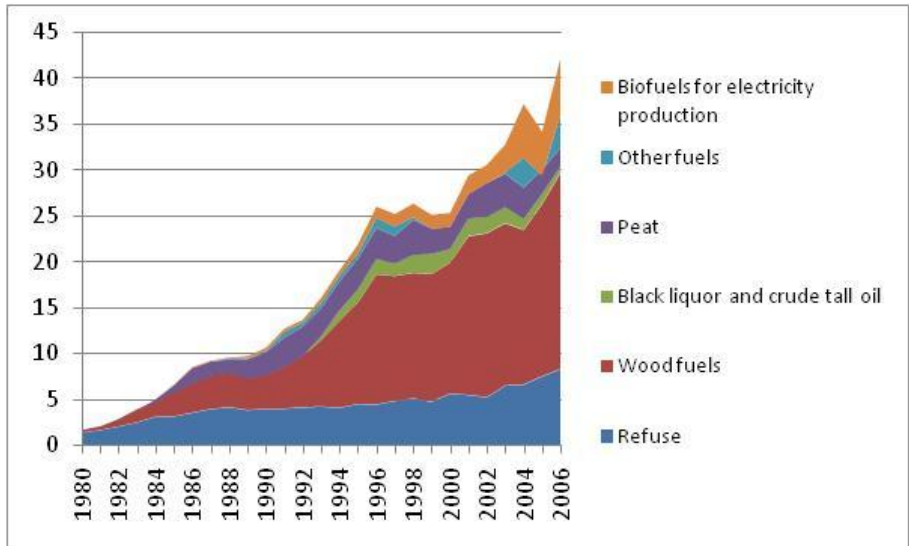


Figure 4. Use of biofuels, peat etc. in district heating 1980-2006 (TWh). Source: Statistics Sweden and the Swedish Energy Agency.

Over a long period the annual increase in the use of bioenergy in Sweden has been around 2 TWh (figure 5), with a trend towards higher increase after year 2000. Initially the increase was mainly due to changes within the forest industry with increased production capacity at the same time as more of the biomass residues were used in the process at the expense of primarily oil. From the 1980s and onwards the use of bioenergy in district heating and power generation has been a major contributor (figures 3 & 4).

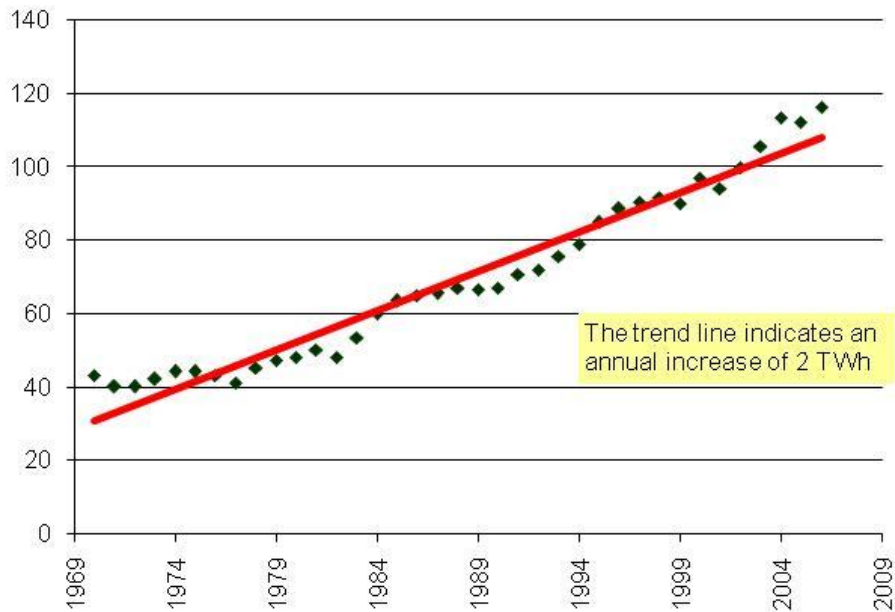


Figure 5. Total supply of bioenergy in Sweden from 1970 to 2006 (TWh). Source: Statistics Sweden and the Swedish Energy Agency.

Technical information

The Swedish Energy Agency is the financing body that totally focus on energy related research. As the Government's central administrative authority responsible for energy supply and use, its main task is to implement the energy-policy programmes adopted by the Swedish Parliament. The Agency's current research programme (2005-2011) is intended to develop the energy system and to generate economical growth in the country. The annual budget for the programme is approximately SEK 800 million. Besides both basic and applied research it includes development, demonstration and commercialisation. The programme falls into six subject categories:

1. Fuel-based energy systems
2. Energy use in buildings
3. The transport sector
4. Energy-intensive industry
5. Power generation and distribution
6. Energy systems

When it comes to bioenergy from conventional forestry R&D is now focused on the procurement efficiency of biomass from our present forests (logging residues, small sized trees and stumps). Environmental aspects mainly focus on further outcome from long term experiments with harvest of logging residues and ash recycling. The recent interest in stump harvest has put focus on environmental aspects of this and the number of knowledge gaps experienced. Therefore, a fairly large number of new projects, launched by the Swedish Energy Agency, focus on environmental aspects on stump harvest. However, most of the R&D budget from the energy agency is swallowed by the development of the next generation of biofuels based on cellulosic feed stock.

The insight that Sweden may need more biomass from our forests in the future has put some focus on research focusing on increased growth in our forests. The Foundation for Strategic Environmental Research (MISTRA) is now launching a major research programme called "Future Forests" with one specified condition of 50 % higher production in our forests.

Industry – key stakeholders

- Swedish Energy Agency ó URL: <http://www.swedishenergyagency.se/>
- Swedish Forest Agency ó URL: <http://www.skogsstyrelsen.se/>
- Swedish Environmental Protection Agency ó URL: <http://www.naturvardsverket.se/>
- Swedish Forest Industries Federation ó URL: <http://www.forestindustries.se/>
- SVEBIO ó Swedish Bioenergy Association ó URL: <http://www.svebio.se/>
- LRF ó The Federation of Swedish Farmers ó URL: <http://www.lrf.se/>
- Swedish District Heating Association ó URL: <http://www.svenskfjarrvarme.se/>

Events – workshops, conferences, past and future

World Bioenergy 2008, 27-29 May, Jönköping, Sweden. URL: <http://www.svebio.se/?p=979>

Reports and publications

Caruso A. 2008. Lichen Diversity on Stems, Slash and Stumps in Managed Boreal Forests - Impact of Whole-tree Harvest. Acta Universitatis agriculturae Sueciae, Doctoral Thesis 2008:141, Faculty of Natural Resources and Agricultural Sciences. Swedish University of Agricultural Sciences.

URL: <http://diss-epsilon.slu.se/archive/00001675/>

Rudolphi J. 2007. Bryophytes, Lichens and Dead Wood in Young Managed Boreal Forests. Acta Universitatis agriculturae Sueciae, Doctoral Thesis 2007:88, Faculty of Natural Resources and Agricultural Sciences. Swedish University of Agricultural Sciences.

URL: <http://diss-epsilon.slu.se/archive/00001546/>

Rosling A. 2003. Responses of ectomycorrhizal fungi to mineral substrates. Doctoral Thesis, Acta Universitatis agriculturae Sueciae. Silvestria 296. Swedish University of Agricultural Sciences.

URL: <http://diss-epsilon.slu.se/archive/00000404/>

Blomqvist, L. 2007. Attractive landscape and biofuel production - a possible combination?. Lic. thesis. Dept. of Bioenergy, SLU. Report / Department of Bioenergy, SLU vol. 15.

URL: <http://diss-epsilon.slu.se/archive/00001336/>

Eriksson, E. 2006. The potential for forestry to reduce net CO₂ emissions. Doctoral Thesis. Dept. of Bioenergy, SLU. Acta Universitatis agriculturae Sueciae vol. 2006:103.

URL: <http://diss-epsilon.slu.se/archive/00001240/>

Hagström, P. 2006. Biomass potential for heat, electricity and vehicle fuel in Sweden. Doctoral diss. Dept. of Bioenergy, SLU. Acta Universitatis agriculturae Sueciae vol. 2006:11.

URL: <http://diss-epsilon.slu.se/archive/00001038/>

Jonsson, A. 2006. Planning for increased bioenergy use. Lic. thesis. Dept. of Bioenergy, SLU. Rapport / Institutionen för bioenergi, SLU vol. 13.

URL: <http://diss-epsilon.slu.se/archive/00001180/>

Allmér, J. 2005. Fungal communities in branch litter of Norway spruce. Doctoral diss. Dept. of Forest Mycology and Pathology, SLU. Acta Universitatis agriculturae Sueciae vol. 2005:125.

URL: <http://diss-epsilon.slu.se/archive/00000993/>

Bioenergy - for what and how much? Edited by Birgitta Johansson, Formas Fokuserar. ISBN 978-91-540-6006-1

URL: http://www.formas.se/formas_shop/ItemView.aspx?id=3903&epslanguage=EN

Egnell, G., Hyvönen, R., Högbom, L., Johansson, T., Lundmark, T., Olsson, B., Ring, E., von Sydow, F. 2007. Environmental aspects on stump-harvest ó compilation of knowledge and knowledge gaps. Energimyndigheten Rapport 40 2007. In Swedish with English summary.

URL:

[http://www.swedishenergyagency.se/web/biblshop.nsf/FilAtkomst/ER%202007_40W.pdf/\\$FILE/ER%202007_40W.pdf?OpenElement](http://www.swedishenergyagency.se/web/biblshop.nsf/FilAtkomst/ER%202007_40W.pdf/$FILE/ER%202007_40W.pdf?OpenElement)

Egnell G., Westling O., Dahlberg A., Bergh J. and Rytter L. 2006. Miljöeffekter av skogsbränsleuttag och askåterföring i Sverige ó En syntes av Energimyndighetens forskningsprogram 1997 till 2004. Energimyndigheten Rapport 44. In Swedish with English summary.

URL:

[http://www.swedishenergyagency.se/web/biblshop.nsf/FilAtkomst/ER2006%2044W.pdf/\\$FILE/ER2006%2044W.pdf?OpenElement](http://www.swedishenergyagency.se/web/biblshop.nsf/FilAtkomst/ER2006%2044W.pdf/$FILE/ER2006%2044W.pdf?OpenElement)

Contacts for further information – people and websites

- RecAsh ó Regular recycling of wood ash to prevent waste production
 - URL: <http://www.recash.info/default.asp?lang=en>
- Wood-En-Man ó Wood for energy ó a contribution to the development of sustainable forest management
 - URL: <http://www.flec.kvl.dk/wood-en-man/>
- CHRISGAS ó fuels from biomass
 - URL: <http://www.chrisgas.com/>
- Värmeforsk's programme - Environmentally friendly use of non-coal ashes
 - URL: <http://www.askprogrammet.com/english.shtm>
- Bioenergiportalen
 - URL: <http://www.bioenergiportalen.se/>
- ETC ó Energitekniskt centrum
 - URL: <http://www.etcpitea.se/eng/index.html>
- The Nordic Bioenergy Project
 - URL: <http://www.nordicenergy.net/bioenergy/index.cfm?path=101>
- BioFuel Region
 - URL: <http://www.biofuelregion.se/english.cfm?open=eng>