

Bioenergy in the Nordic countries – policy models

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On the coast of Sweden directly across from the Danish capital of Copenhagen the Barsebäck nuclear plant sits decommissioned and cooling off. Outside the locked gates a fading billboard lists the environmental and economic benefits of the going plant. In 1990 this plant was producing about 60% of the electricity for Skåne, the heavily populated, intensively-farmed southern province of Sweden. It employed about 400 people on site and 2000 overall. It had replaced regional coal-fired plants burning six tonne of coal a minute and producing vast amounts of CO₂ and other more noxious emissions. The billboard showed a photo of smoke belching from the smokestacks of the coal-fired Amager plant in Copenhagen harbour and in the background the smoke-free Barsebäck plant.

The irony is that now the nuclear plant is closed awaiting its immensely expensive demolition, and the storage for thousands of years of radioactive material including the whole inner containment structure, while across the strait the three furnaces of the Amager plant are now fuelled by carbon-neutral straw and wood pellets. The energy needs produced by the nuclear plant now come from a number of smaller more efficient plants fuelled by municipal waste and timber industry waste. A nearby example at Malmö, Sweden's third largest city, makes heat and electricity from 500,000 tonnes of municipal solid waste a year. Over the next 20 years more of Sweden's nuclear plants are likely to be replaced in this way.

Bioenergy is the main form of renewable energy in most EU countries. It is sustainable, carbon-neutral and baseload, and creates permanent regional jobs. In these countries it is one of the most cost-effective sources of renewable energy. Even in Denmark, renowned for its early adoption of wind energy and with only about 10% forest cover, of the approximately 17% of primary energy provided by renewable energy in 2007, 40% was produced by woody biomass and straw, flammable and putrescible municipal waste provided over 30%, and wind turbines produced only about 20%. But it is in Sweden and Finland that energy from forestry waste and timber industry waste is now demonstrating the real potential of this resource to provide a substantial share of primary energy. They have shown how biomass from many small sites can be aggregated to fuel efficient, regional, combined heat and power (CHP) plants year round.

But why biomass is cost-competitive in Denmark, Sweden and Finland as a source of energy is because there has been a long development of policy that underpins and helped fund this renewable energy sector. Each country began to invest in renewable energy in the late 1970s after the two oil shocks. During the first oil shock of 1973/74 the price of oil increasing up to tenfold stimulated each country to rapidly develop renewable energy strategies. Sweden and Finland began working intensively in the late 1970s to develop woody biomass as a fuel to replace coal and oil, and now to replace nuclear energy. Before 2005 Denmark and Sweden had both made it a requirement to use putrescible and sorted solid municipal waste as an energy source. Landfill for such waste was no longer an option. Separation to a high standard of waste for recycling or energy happens at the home or business.

Both Sweden and Denmark instituted a carbon tax in 1991. Tax revenue raised on fossil fuels funded R&D in renewable energy, subsidised conversion of small and large power plants to use of biomass and municipal waste, and improved efficiency of transport and household energy supply and use. These processes are ongoing. Each country concentrated on making better use of previously under-utilised energy sources. Denmark developing the use of straw for energy and now has numerous district heating (DH) and CHP plants fuelled partly or entirely by straw and straw pellets. It developed anaerobic fermentation of sewage and animal manure for production of biogas and biomethane. It instituted tax inducements for small and large scale investment in wind energy and now in offshore wind farms.

Sweden similarly has developed production of industrial volumes of biomethane from sewage, food processing waste, green plant waste and slaughterhouse waste. It has subsidised development and purchase of cars that can be run on biomethane, 85% ethanol or biodiesel. Sweden's municipal truck, bus and car fleet is increasingly fuelled by biomethane, and excess is sold into Europe's natural gas reticulation system. About 27% of Sweden's energy in 2008 comes from biomass (mainly woody biomass), and the target is to increase this to 39% by 2020. Sweden's heating is now effectively carbon-neutral due to use of biomass-fueled district heating. It aims to cease imports of fossil fuels by 2025.

Finland now produces about 20% of its electricity from biomass - almost entirely waste from forestry or from the timber processing industries. About 23% of its energy overall comes from this source now (28% including peat). It has the target of producing 39% of its national energy needs from renewable sources by 2020, with most of this increase as biomass from more efficient first thinning in the mainly family-owned mixed native forest holdings that are the foundation of Finland's post-war industrial development and present prosperity.

For all these countries the amount of energy from forest residue and thinnings is less than half the total of woody biomass utilised. The majority is from timber industry processing including the pulp and paper sector. For example Finland is currently putting about 3 million m³ solid wood directly into bioenergy but over 50 million m³ of industrial roundwood goes into processing, and about half of this also becomes available as a fuel source for bioenergy production. The timber industry processing sector uses about a third of Finland's energy but in practice most plants will generate some or even all of their own requirement. Kraft process pulp plants particularly are often net exporters of electricity.

The forest management associations in Finland and Denmark, and the cooperatives in Sweden, play an important role in aggregation and sale of biomass from forest sites. They act for the family and individual members in negotiating sale price and arranging contractors. In the case of Södra Skog the largest of Sweden's cooperatives, it has a separate section, Södra Energi, specifically for dealing in biomass and energy. In 2007 this small section of 18 employees had a turnover of about 367 million Swedish Kroner (about A\$61 million) from sales of about 3.2 million m³ - loose of biomass: sawdust, chip, bark, peat and forest residues. Much of this biomass would be coming from Södra-owned sawmills. This material is sold to small and large bioenergy plants and to pelleting plants over the southern third of Sweden. As well as this excess biomass sold to the market Södra, with its 50,000 members and their 2.3

million ha of forest holdings, uses biomass 'in-house' to generate all the energy needed by its sawmills and pulp and paper plants, and as well supply to the national grid about 300 GWh of green electricity, enough for about 40,000 households.

While Sweden, Denmark and Finland all have policies that drive and support bioenergy, or renewable energy generally, these are often not visible. They have been developed systematically over the last 25 years as a complex array of interrelated policies that combine support for education and research, taxes on fossil fuels, incentives for industrial innovation and development. Often they are part of long-term strategies that may be part of a national planning philosophy or direction with a 30 to 100 year timeframe.

To develop Australia's great potential and opportunity for bioenergy will require a similar development of coherent policies and long-term strategies that to date have been lacking. We have the available land, climate and infrastructure. We have expertise and initial plantings through the farming community. We have the national need for carbon sequestration, and farmers who are well placed to quickly develop a massive total of plantings for emissions offsets. And we have vast amounts of municipal waste and forestry waste. The process of producing a significant fraction of our national baseload energy needs from biomass, conceivably 20% or more, can be funded and fast tracked in the same way as for 'Clean Coal'.

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