Bioenergy

Threat or opportunity?

As investment in renewable energy grows, bioenergy will become increasingly prominent in Europe's renewable energy mix, along with wind and solar power. And investment in renewable energy in Europe is growing fast, financial crises notwithstanding: between 2005 and 2009, installed capacity grew by 21 percent a year, and from 2009 to 2010, when many other markets contracted , it grew another 20 percent. European utilities' current investment plans show most of them still favoring on-shore wind projects, with some looking at off-shore wind and solar. But the National Renewable Energy Action Plans that all EU member states have had to produce give bioenergy a critical role in meeting the European Commission's 20-20-20 energy targets[1]. Together, the plans anticipate more than 50 percent of the growth in Europe's renewable energy output[2] by 2020 coming from bioenergy, including bio-based transport fuels.

Anna Granskog
Pia Kåll

The pulp and paper industry eyes this rapid expansion in bioenergy with understandable concern. Will new demand from bioenergy plants affect its long term supply of fiber? Will competition for biomass force up fiber prices in the short to medium term? Yet forest products companies should remember that their sector has years of experience in harvesting woody biomass and, in many cases, converting it to energy. This is knowledge that could give them an edge in new bioenergy markets.

This article describes the growing popularity of bioenergy in Europe today and why it has become attractive. It then lays out some initial ideas on how forest products companies could turn this trend from a threat to an opportunity.

Bioenergy's growing popularity

Until now, the largest power plants fuelled by biomass have been situated beside pulp and/or paper mills, while smaller municipal utilities have been producing biopower and heat for local needs in the Northern and Eastern parts of Europe. These smaller facilities mostly burn locally available forestry residues or household waste.

[1] A 20 percent cut in emissions of greenhouse gases by 2020, compared with 1990 levels; a 20 percent share of renewables in the energy mix; and a 20 percent cut in energy consumption.

[2] Measured in terawatt hours.

However, in the past few years greater interest in reducing carbon emissions through using renewable energy has in turn increased interest in bioenergy among larger power utilities. Finding it an attractive renewable power source compared to solar and wind, they are making some larger scale investments. In April 2011 a French utility announced plans to invest 100 million euro in energy from biomass in Bulgaria and in May unveiled a scheme to build a 205 MW plant in Poland by the end of 2012. In August 2011, an utility in the UK announced its intention to build two new 290 MW biomass power plants. (Exhibit 1)

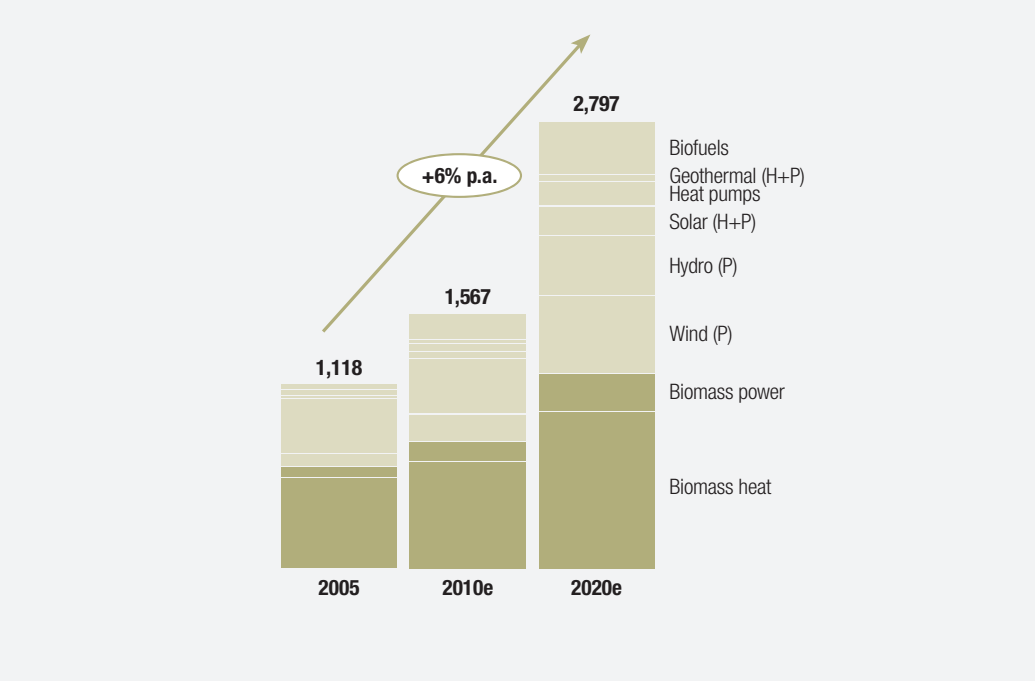
In the Nordic countries too, with their long history of using biomass to produce energy, there has been a steady stream of investments in biomass plant conversions and greenfield projects. To mention just a few, in March 2010, a utility inaugurated their forestry residue fuelled combined heat and power (CHP) plant in Finland, which replaces a natural gas-fired plant. The new plant has a capacity of 21 MW electricity and 58 MW heat divided between district heating and process steam for a nearby brewery. In April 2010, a major utility converted a coal fired CHP unit in Denmark from coal to straw. In June 2010 a Finnish utility replaced old oil-fuelled heat capacity with a new 18 MW plant fuelled by wastewood and forest residues.

Bioenergy's technological advantages

The European 20-20-20 targets cover total energy use, comprising energy used for electricity, heat (and cooling), and transportation.

Exhibit 1

According to the NREAPs, biomass is expected to play a sizeable role in renewable energy growth in Europe



Source: EU member state governments, Factiva, McKinsey analysis

Biomass is the only renewable source that can provide steam on a large and regular scale

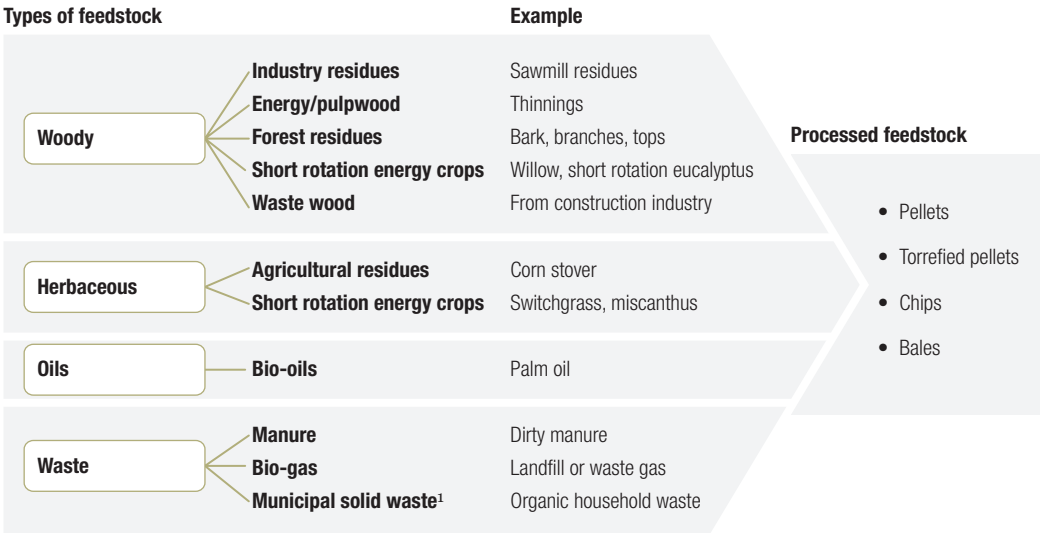
This plays directly to bioenergy's flexibility based on its technological advantages.

First, biomass is the only renewable energy source that can provide steam for heating on a large scale, regardless of location, at an even temperature and pressure. By the same token, it is the only renewable source that can produce regular quantities of steam for industrial applications: wind and solar power just can't compete. Secondly, there exists already a range of bioenergy boiler technologies that can extract energy from a broad variety of feedstocks, increasingly the flexibility of biomass as a bioenergy source. (Exhibit 2) Lastly, as energy systems produce an increasing portion of their load from intermittent wind and solar sources, biomass can be relied on to produce stable supplies of dispatchable power throughout daily and annual cycles: indeed, the best bioenergy plants run at more than 90 percent yearly availability.

From a construction viewpoint, bioenergy plants require less new space – if any – compared to wind parks and solar installations. These require vast new areas of land meeting very specific requirements, such as favorable wind conditions or solar radiation levels. In contrast, the easiest way to generate biopower is by co-firing biomass with coal in an existing coal-fired power plant, or by converting an existing coal plant to biomass. In both cases, the existing infrastructure is (re)-used in a resource efficient and economically effective way.

Exhibit 2

A broad variety of feedstocks are being used for bioenergy



[1] Not 100% biomass

Source: McKinsey analysis

Attractive bioenergy economics

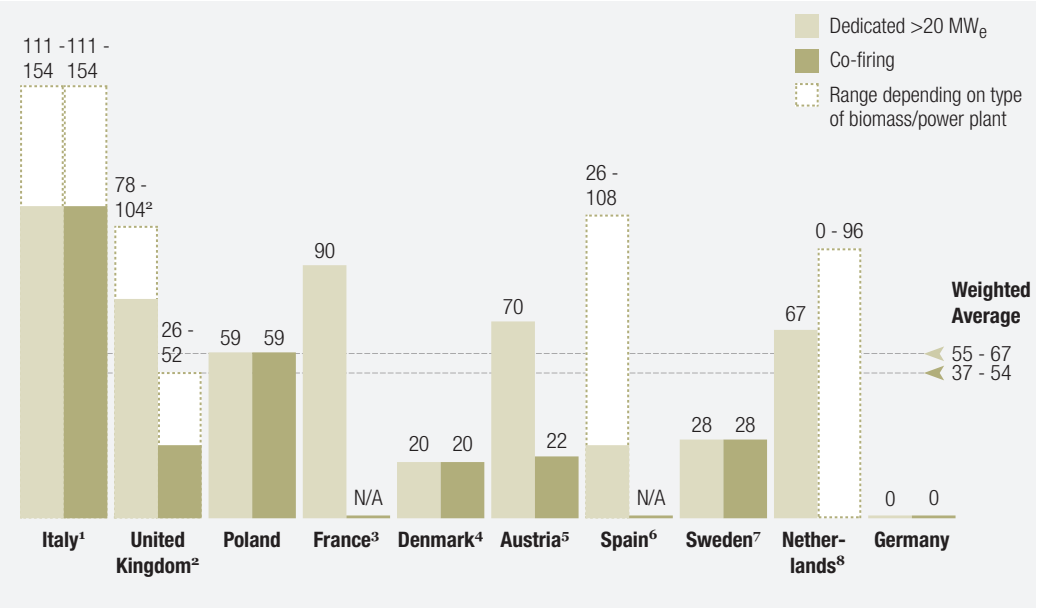
For years, bioenergy has been economically viable without any regulatory support in CHPs that provide district heating or process steam for industrial use, where the additional revenues from the heat or steam complement electricity revenues. In addition, many existing bioenergy plants utilize local waste or by-product streams as low-cost or free feedstock. Many players also find co-firing biomass with coal economically viable with only modest regulatory support, including a moderate price set on CO_2 emissions.

However, the standalone economics of moving to electricity-only installations, and more expensive fuels, like imported pellets and wood-chips, are not so attractive. Although greenfield biomass plants using imported pellets may be more cost competitive than off-shore wind plants, everywhere in Europe they still need substantial regulatory support to be economically viable at current power prices. Every European government offers some support in the form of, for example, feed-in tariffs, renewable energy certificates and investment incentives, but its level varies significantly by country and is not always high enough for bioenergy to play the the role envisaged for it in countries' National Renewable Energy Action Plans. (Exhibit 3)

That said, the full cost of bio-based electricity would have a realistic chance of coming close to the full cost of coal-based electricity, were the

Exhibit 3

Support for both dedicated biomass electricity production and co-firing biomass with coal varies greatly across Europe



[1] Excluding waste gas and non-local biogas; 2010 Jan-Apr weighted average GC price
[2] Jan 2010 ROC auction price
[3] Average FIT tariff for tender 3 – average wholesale power price Q1 2010
[4] Biomass premium for newer plants
[5] Solid biomass FIT – average wholesale price Q1 2010
[6] ≤50 MW plant burning forest residue – average wholesale price Q1 2010
[7] Jan 2010 GC price
[8] Dedicated 10-50 MW condensing plants; combustion support for already co-firing plants
[9] Wholesale power price ~30-50 EUR/MWhe

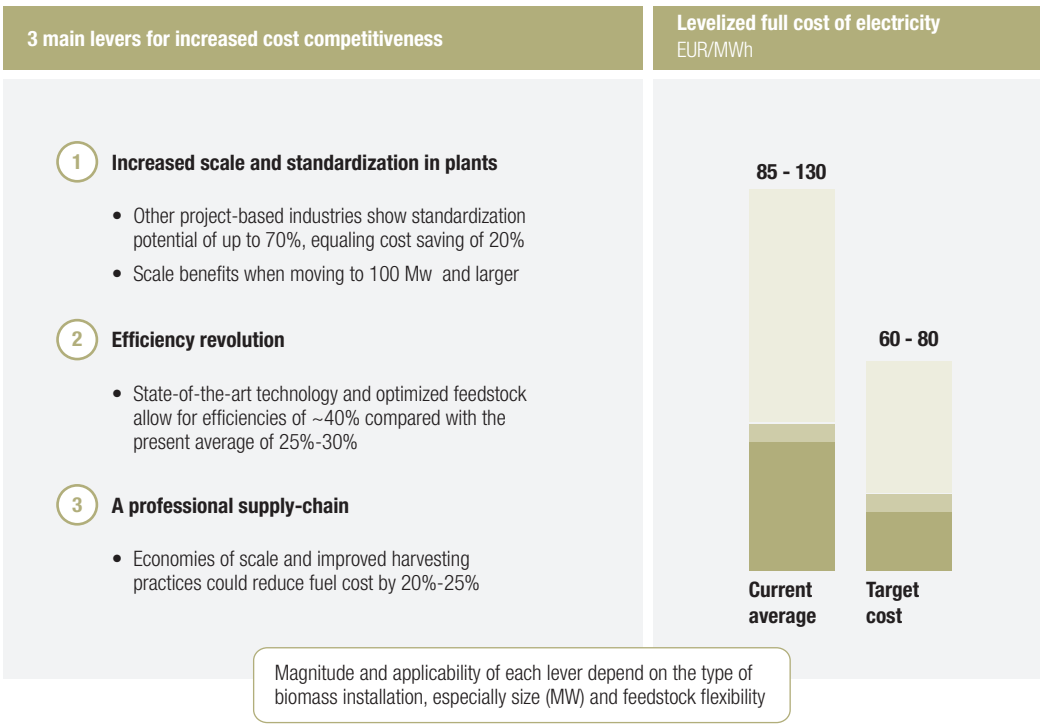
Source: National regulators, power exchanges, McKinsey analysis

regulated price of CO_2 to be set fairly high, at EUR 20/ton. This would diminish the need for direct subsidies (Exhibit 4).

Experience from other industries suggests there are a number of other factors that could reduce the costs of producing bio-energy in future. These include:

- Standard plant designs with modular components. Standardizing other types of energy production equipment has led to cost benefits in the order of 10-20 percent, and there is nothing to suggest this could not be also be true in the bioenergy sector, if equipment providers and energy players jointly decide what standards to adopt.
- Bigger boilers. Comparing the construction cost of existing bioenergy plants of different sizes shows that moving from 25 MW plants (the size of most plants today) to plants of 100 MW or above delivers scale benefits corresponding to roughly 30 percent of their capital expenditure.
- Improving large boilers so they convert steam to electricity more efficiently. Conversion efficiency is a critical influence on bioenergy cost that has been understandably overlooked when feedstock has been abundant and/or largely made up of low cost by-products from other processes. Modestly increasing a large boiler's efficiency in converting steam to electricity from 30 percent to 35

Exhibit 4
Significant cost reduction potential in biomass electricity



Source: McKinsey analysis

The unique economic advantage of bioenergy is its flexibility

percent will reduce the feedstock component of a bioenergy plant's overall electricity production cost by some 15 percent, as well as using resources more efficiently by lowering feedstock consumption per unit of energy produced .

- Optimizing the feedstock supply chain. Optimizing all the links in plants' feedstock supply chains, including those of plants running on waste-based biomass, can lower costs by an estimated 20-25 percent. Effective measures range from improving crop yields and harvesting practices, to increasing efficiency in processing, for instance by increasing the scale of pellet plants, ground transportation and sea freight.

Applying these cost-reducing levers may not require technological breakthroughs or other innovations, but the fragmented nature of the industry makes them nevertheless difficult to capture. Realizing the improvements they promise would depend on developing stronger and longer term co-operation among parties along the bioenergy value chain, especially between energy players and equipment providers, to agree standard plant specifications, and between energy players and fuel suppliers, to optimize feedstock supply chains.

Finally, as noted above, the unique economic advantage of bioenergy is its flexibility. If, for some reason, the cost of biomass surges without a corresponding rise in regulatory support or electricity prices, power producers can convert their bioplants back to using more coal with relatively small plant modifications and so avoid losing the whole of their biopower investment. In Finland there is one large scale plant with this flexibility "built in", which normally uses coal as a back-up fuel but can easily convert to coal-only if need be. This is an advantage that wind and solar installations cannot achieve .

Impact of increasing demand for biomass

Forest products companies are not the only ones to worry about where supplies of sustainable feedstock for all these new bioplants will come from and how much they will cost. All bioenergy players, old and new, share these anxieties, though for different reasons. New demand is likely to bring in new sources of supply that will regulate average prices over the very long term. But in the near future, regional supply-demand imbalances may emerge. In addition, the variety of products and trading practices in these relatively new markets make it hard to predict the actual dynamics of feedstock prices in the near future. And with the majority of the new biopower installations dependent on subsidies underpinning a fixed EUR/MWh value, the cost of feedstock cost will be the determining factor in the profitability of each plant.

One objective happily shared by energy and forest products players is ensuring that all biomass inputs are sourced sustainably. But as this is a new and rapidly evolving market, there are as yet no sustainability and quality certificates of the type developed by and recognized across the forest products community, such as the FSC. Creating such certificates would require pressure from both private players and governments. So far, none has taken the lead in driving this endeavour on an industry wide scale.

Perhaps surprisingly, the many uncertainties currently surrounding biomass supply place forest products companies' experience and expertise in this area at a premium. There are several ways they can create value from this knowledge, as long as they act soon.

How energy players are addressing the need for more biomass supply

When asked what is the main challenge of developing bionergy, most energy players cite

Forest products companies could be more successful than traditional energy players in biopower markets

mastering new and, as yet, not-fully-developed supply chains for biomass to secure sufficient sustainable and stable volumes for their operations.

But energy players are not sitting back and waiting for the supply market to evolve. They are seriously hunting for new biomass supplies, either to diversify their supply portfolio as a protection against price and volume fluctuations, or to develop and lock in totally new sources of supply. In the first category come energy players with a long history of using locally available bio-feedstock, as in the Nordic countries. These are already seeking sourcing opportunities on every continent and use imported feedstock as a natural part of their fuel mix. As well as a means to lower supply costs , they see importing biomass as a way to diversify their portfolio geographically, reducing their exposure to local price variations and increasing their security of supply when local supply-demand is tight or volumes uncertain.

Fortunately, the range of possible feedstocks is remarkably wide, extending well beyond the pellets from the south eastern United States and wood chips from southern Brazil that have led the market so far. Energy companies are experimenting with all kinds of biomass, from recycled construction wood to olive kernels and residues from rubber tree plantations. Those territories already active in biomass markets obviously have better-developed infrastructure for exporting biomass than new suppliers.

But many of the bioenergy players taking a global view of feedstock supply today are prepared to originate their own supply, including making upstream (co-)investments in infrastructure or processing technology to secure biomass at competitive costs. At the same time, involvement across the value chain increases the possibility for energy players to ensure sustainable practices are used.

How forest products players could benefit from increasing biomass demand

At first sight the development of bioenergy markets seems a legitimate concern for the forest products industry. Its long-term impact on the availability of fiber and the short-to-medium term impact on feedstock prices are as yet unkown but could significantly affect the economics of the forest industry. But this cloud may have a silver lining: we believe that increased interest in biobased energy presents fast adopters in the forest products industry with some interesting opportunities.

Forest products companies have several capabilities that could make them equally or more successful than traditional energy players in biopower markets:

- Optimizing multi-fuel plant operations. We often hear energy companies complain that they don't have enough experience or in-house capabilities to operate their multi-fuel boilers optimally, adjusting for varying fuel qualities and non-homogeneous fuels. But many forest products companies have years of such experience through operating CHPs at their pulp mills powered, for instance, by black-liquor and hog, and their saw mills fuelled by wood and wood processing residues. Similarly, the biggest single challenge, and sometimes surprise, that energy utilities face when making bioenergy conversions is the relatively larger space they require for fuel logistics, storage and handling. For forest industry players, in contrast, the bulkiness of different types of biomass is a familiar problem: achieving efficient fiber logistics has been central to success in the industry for decades. Energy companies starting out in this field could well be open to a partner or supplier with such multi-fuel plant expertise. This expertise may not always be fully appreciated within forest products companies

themselves but, if packaged right, could be turned to significant advantage in the broader bioenergy sector.

- Securing large and stable volumes of fiber. As described earlier, another area of concern for energy players is how to secure stable supplies of fiber cost-efficiently in large volumes: some 400,000-500,000 tons a year are needed to fuel a 100 MW bioenergy plant. Forest products companies have long histories of managing the complex fiber supply chain to deliver regular, large volumes for their mills. Indeed, no other players in the market today can match their track record for achieving long-term, continuous and cost efficient supply agreements for larger volumes. There are already some examples of partnerships between energy and forest product players based on this experience. For instance, in 2007 a forest products company and an utility joined forces to develop BtL (biomass to liquids) in Finland, leveraging the forest products company's knowledge of wood sourcing, handling and integrated processing.

- Managing forests and plantations for sustainability and productivity. Energy and forestry players have a common interest in ensuring sustainable biomass supply. However, for energy players, forest and plantation management is a new skill. Some forest products players are already leveraging their extensive forest management experience to help companies entering bioenergy integrate upstream and set-up feedstock operations that are both productive and sustainable. But there is much more they could do to increase efficiency in forests that are already harvested. Forest products companies could also play a larger role in introducing new sources of supply.

Capabilities in the three areas mentioned above have a direct impact on the profitability of bioenergy. Fuel costs often comprise up to 50-60 percent of the total cost of bio-electricity, that is, including capital and operational expenditures. Simply by exercising their expertise in fuel sourcing, forest products companies could be as successful in the bio-energy market as established energy players. They could enter selected parts of the bioenergy value chain alone or with a partner, or compete as fully integrated players against integrated energy companies.

Even if forest product companies are not keen to enter the bioenergy market with a 'stand-alone' business, there may be other ways they can benefit from the renewable trend using existing assets both to increase and broaden revenues. Several "green" business alternatives exist that are economically at least as attractive – and, in some cases, more so – than making paper, which is no longer necessarily the highest value product that can be produced from fiber. Certainly, producing pellets for energy instead of pulp will destroy value at today's prices. However, thanks to the renewable subsidy schemes in Europe, running a CHP on those same pellets will give the same or higher absolute EBITDA margin per cubic meter of wood used as producing fine paper. As well as becoming net producers of bioelectricity in this way, forest products companies might consider broadening their portfolio to adjacent biobased products such as transport fuels, chemicals, textiles or other bio-materials.

Forest products companies with privileged access to fiber will benefit directly from increasing demand for biomass for energy. Obviously, having access to captive wood gives a company a cost advantage, but it may also choose to sell fiber to the highest bidder rather than using it for its own production, when such a deal would yield a higher gain.

Timing

This window of opportunity to enter the bioenergy game won't stay open forever. For now, forestry and forest products companies may have a competitive edge in multifuel operational excellence, supply chain management and managing forests and plantations based on their experience. But as energy players fail to find offerings in the market that meet their biomass supply needs, they are increasingly taking matters into their own hands and developing new supply chains. This could mean a lot of inefficiencies and "re-inventing of the wheel" for them, and a big lost opportunity for the forest products industry, unless it moves as swiftly.

* * *

The forest industry has been watching the growth of bioenergy over recent years with understandable concern. But we contend that the industry can turn this apparent threat into an opportunity. Even though some large forest products companies that have entered the bioenergy market have yet to play the shaping role they could, there is still time for them and others to raise their level of ambition for bioenergy in their overall future business mix. However, this will require a shift in mindset, in particular towards a readiness to reassess and challenge some of the industry's core beliefs about the value of energy as a forest product.