REPORT ON WOOD BIOMASS

COMBINED HEAT AND POWER

FOR THE

IRISH WOOD PROCESSING INDUSTRY

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Wood fired Combined Heat and Power in the Irish Wood Processing Industry

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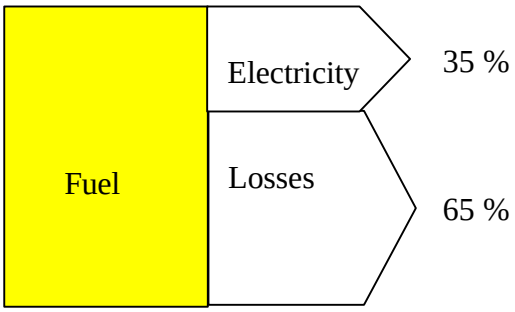
1) Introduction to Combined Heat and Power:

a) What is CHP ?

Combined heat and power is the generation of thermal and electrical energy in a single process, normally using fossil fuels such as natural gas. In this way, optimum use can be made of the energy available from the fuel. CHP installations can typically convert between 80% and 90% of the energy in the fuel into electrical power and useful heat. This compares with conventional power generation, which has a delivered energy efficiency of only around 30%.

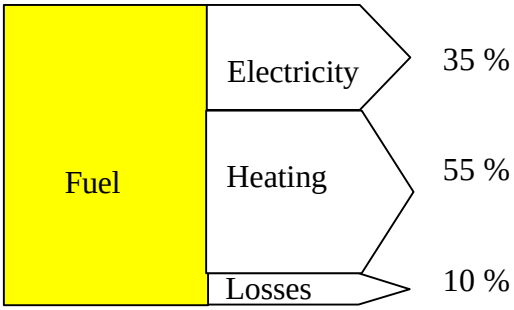
Condensing Power Station

Electricity production only.



Combined Heat and Power Plant

Production of both electricity and heat. Minimal Losses using CHP



b) Background

Combined Heat and Power (CHP) is a very common industrial energy efficient technology used increasingly in industry world-wide. In the UK alone, 10,000 MW of CHP is to be installed by 2010. As wood processing is an energy intensive industry, CHP can make a significant impact on profitability. Evidence shows that CHP can reduce total site energy costs by over 30%. In Europe, leading wood fired CHP equipment supply companies are based mainly in Scandinavian.

There are currently four large industrial wood processing plants in Ireland*. They have a combined heat capacity of over 110 MW and a combined electricity requirement of over 40 MW. All of these plants use wood waste to provide their process heat and then buy in their electricity separately. None of these plants currently uses CHP. Evidence shows that in the Paper and Board sector, CHP can reduce total site energy bills by as much as 30%.

All of these Irish plants could generate electricity from wood fired CHP. A recent report on the total renewable energy resource in Ireland has also highlighted the significant potential of wood biomass CHP. If the four companies were to employ this technology it would add some 30,000 toe (tonnes of oil equivalent) to Ireland's Renewable Energy Balance and would represent almost a quarter of Ireland's renewable electricity production in 2000. In addition, all of the wood fuel for these CHP plants would be grown in Ireland, providing a secure, long term, supply of electricity and heat from a major national resource.

As wood biomass is CO_2 neutral, the savings in terms of CO_2 emissions (the main greenhouse gas) could be in excess of 300,000 tonnes annually. This would represent a total CO_2 emissions saving, for Ireland, of about three quarters of a percent of total annual energy CO_2 emissions.

The overall cost benefit to any one of these four companies, in financial terms, could range from £ 500,000 to £ 1,500,000 per annum. Typical self-financed schemes normally have a payback of around 4 to 7 years and a plant life of 20 years or more.

* Irish Primary Wood Processors

- Willamette Europe, MDF manufacturers, Clonmel
- Finsa, chipboard manufacturers, Scariff, Co. Clare
- Louisiana-Pacific Europe, OSB manufacturers, Waterford
- Masonite Ireland, MDF manufacturer (doors), Leitrim
- Spanboard, MDF manufacturers, based in N. Ireland.

c) What is Biomass CHP ?

Biomass CHP uses renewable fuels which are derived from four main sources: forest residues, agricultural residues, waste & processing residues and from crop processing. Using wood waste as the fuel source in an industrial wood processing plant is an obvious choice as wood waste is a by-product of production.

From an environmental point of view a wood biomass CHP plant has many advantages over a fossil fuel plant:

- Wood is a renewable source of energy, which is carbon dioxide neutral. Generating 1 MW of electricity from wood would save the production of 7,500 tonnes of CO_2 (the main greenhouse gas) a year.
- The emission of gases which cause acid rain is considerably reduced.

d) Why invest in Wood Biomass CHP?

- CHP will reduce your energy costs.
- CHP is widely used by your competitors in Europe and elsewhere.
- CHP can offer security against energy price fluctuations.
- CHP provides a secure supply of energy to your site.
- CHP can help your business comply with environmental legislation.
- CHP can improve your profit margin and give your company a competitive edge.

The Benefits of Investing in Wood Biomass CHP

Benefits	Fossil Fuel CHP	Wood Biomass CHP
Energy Cost Savings	Yes	Yes
Secure Energy Supply	Medium term	Long term
Secure Energy Prices	Medium term	Long term
Better Control	Yes	Yes
Environmental Benefits	Yes	Yes
CO_2 Emissions	136 Tonnes/TJ	0 Tonnes/TJ *
Local Job Creation	Short term	Long term
Imported Fuel	Yes	No, a national resource
Local Self Sufficiency	No	Yes
Sustainable Development	No	Yes

* Wood Biomass is CO_2 neutral, 1 TJ = 278,000 kWh

2) What are the benefits ?

a) Cost savings:

CHP systems derive the largest amount of their revenue or cost savings from the generation of electrical power. In larger systems, that power is typically sold to the electric utility company; in smaller and mid-sized systems (10 MW to 20 MW or less), as would be installed at building and small industrial sites, the power is typically used on site, reducing retail electricity purchases.

b) Competitive Edge:

Board manufacturing is an energy intensive process with a large simultaneous demand for electricity and heat. This makes industrial board plants good candidates for CHP installation. The most important benefit that CHP offers is a substantial reduction in a site's energy costs. Evidence shows that in the Paper and Board sector, CHP can reduce total site energy bills by 35%. As energy cost represents over 20% of the production cost, this level of saving can make a significant impact on profitability.

c) Secure supplies of energy:

Secure supplies of electricity and heat are of critical importance for both commercial and safety reasons. The impact of any temporary loss of mains electricity can be minimised by configuring the CHP plant to supply essential site loads. In addition, combustion of biomass often takes place in multi-fuel boilers, which gives a choice of a much wider range of fuels. Typically, fuels such as sawdust, wood residues (bark, wood chips, wet and fresh wood residues), dry wood residues from the wood working industry (plywood, particle board, cuttings) and recycled fuel (paper, cardboard, demolition wood) can be used.

d) Better Control:

Modern wood biomass CHP equipment is likely to require less effort to operate and maintain than many older boiler systems, as CHP plant is equipped with automatic control and monitoring equipment.

e) Environmental benefits:

Wood Biomass CHP has a very high energy efficiency. This optimises the use of fuels and eliminates the production of CO_2. Furthermore, biomass CHP is one of the most environmentally friendly forms of heat and power generation. Wood biomass contains very little sulphur and is carbon neutral, which gives it significant environmental advantages over fossil fuels, particularly coal.

Biomass provides important global environmental protection gains. The sustainable use of biomass would displace fossil fuel CO_2 emissions and contribute to protection against global warming. Use of biomass rather than coal or oil, can result in lower levels of local and regional pollutants including NOx and SOx. However, the use of appropriate, modern technology is critical.

f) Plentiful Wood Fuel Resources:

Ireland's Wood Fuel Resources:

The potential wood biomass resource for electricity and heat production in Ireland is very large. Ireland has significant, under-utilised sources of wood based energy (Table 1). The first and most obvious source is the utilisation of existing surpluses and wastes from the forestry and wood processing industries.

Table 1 Energy from Wood Biomass – Practical Irish Capacity (MW)*

	Current Use	Practical 2000	Practical 2020
Forest Residues	0	43	145
Wood Industry	0	159	273
Total	0	202	418

*Electrical Capacity Only, Heat Not Included.

In addition, Ireland intends to increase its forest cover from the relatively low 8% of land area at present, to 17% by the year 2035.

Waste By–products from Industrial Wood Processing

These consist of chips, sawdust, bark, ply-wastes and wood wastes from the wood industry. The main portion of waste sawdust, bark and other wood waste is used to produce energy in the form of heat or sold to horticultural markets. The efficient use of these by-products is a basic necessity for an industrial wood-processing plant. However, a more energy and cost efficient way of utilising these by-products is as a fuel for *both* electricity and heat production in a wood fired CHP plant.

Logging residues

These are the parts of the tree that cannot be used by the timber or pulp industries, such as branches and tree tops, and small, whole trees from thinning. Normally this material is left on the forest floor to rot. If needed for fuel it is taken to a roadside or processing plant where it is chipped into 25 - 50 mm pieces. In response to the growing demand from biomass CHP plants in the Nordic Countries, new, more cost effective, technologies for fuel preparation are being developed. These include the integration of fuel chips with sawmill and pulp log production as well as the baling of logging residues for transportation to centralised chipping facilities. Wood from parks and gardens will also give a fuel with the same properties as logging residue.

Forestry residue is a high quality biomass fuel - it is clean and contains very little ash (only 1 to 3 % ash). It can have a high moisture content in the more northern countries but otherwise gives few problems with combustion equipment. Current deployment is concentrated in the Nordic countries, where there is a fully commercial market, but forestry residues will become increasingly important as a clean, secure and sustainable energy resource throughout the EU.

3) What are the risks?

a) Financial considerations:

Biomass CHP involves substantial investment. A decision to allocate millions of pounds to an energy plant rather than a production plant does not fit the investment strategies of many businesses. Over half of the companies installing CHP in the last 2 years in the U.K. have chosen to deal with this issue by using alternative sources to fund their scheme, such as those provided by energy service companies or by the CHP equipment supplier.

In a typical energy services contract, a third party provides the capital for the CHP plant and then installs, operates and maintains the equipment. Both parties agree on who should bear the different costs and risks, and how the savings should be shared. A contract will normally run for 10 to 15 years, with the host site buying the electricity and heat produced by the plant at preferential rates. As a comparison, self-financed schemes normally have a payback of around 4 to 7 years with a plant life of 20 years or more.

Capital costs of biomass fired power plants are higher than those of gas or oil fired plants due to the nature of solid fuel. However, cost levels have decreased considerably in the last few years. As the plant size increases, the economy of solid fuel plants becomes more attractive. Also, investment subsidies are available for renewable energy plants both from the European Commission and the Irish Government.

The financing options include:

- *Capital Purchase*, in this case the organisation bears all the capital cost and realises all the subsequent savings.

- *Equipment Supplier Finance*, where the capital is provided by the equipment supplier. This is typical for a site that does not have funds available and is looking for a straightforward “one-stop” approach to CHP.

- *Contract Energy Management*, where an organisation contracts out its energy services. Contracts can be based on a fixed fee, an agreed unit price for energy or a shared savings approach.

b) Technical considerations:

Biomass CHP is a well established and technically mature technology but it is vital that the right design decisions are made. In simple terms, the key to maximising cost savings is to have a good match between site heat requirement and the heat produced. Establishing this requires a detailed study.

Biomass to electricity plants need a wide range of standard equipment which is manufactured in many countries e.g. transformers, boilers, heat exchangers, generators, steam turbines, incinerators, fuel dryers etc.. The EU is the market leader in conventional steam cycle power plant since the inclusion of Finland and Sweden in the E.U.. The equipment used in the fuel supply chain such as forestry harvesting, transport machinery and residue baling systems are supplied largely from the EU but also from the USA.

c) Fluctuations in the energy market

The economics of biomass CHP depends on the cost of the fuel. A major advantage of a biomass CHP plant over fossil fuel plant is the ability to burn many various fuels. In the wood processing industry wood fuel is a by-product, which can be easily used in a CHP plant in the same way as it is now used in heat only boilers, but in a more efficient & cost effective manner. In addition, wood fired CHP will use a secure supply of local, low cost fuel from one of our own major national resources.

Wood chips from forest residues are usually used as an additional fuel and purchased by marginal price. This makes it difficult for wood chip fuel to be competitive with other fuels until markets are well developed. The price of wood fuel has decreased steadily in the Scandinavian countries due to the development of production technology, forest management and logistic systems. In addition, with multi-fuel boilers, inexpensive recycled fuels such as paper, cardboard, demolition wood and horticultural wastes, which are also renewable, can be used.

Energy and CHP suppliers recognise that businesses need price stability to enable decisions to be made. Hence these companies are developing the capacity to manage financial risk on behalf of clients through long-term energy supply contracts.

4) What Next?

a) Is Biomass CHP suitable for your company?

Before embarking on any feasibility studies, it is essential that your company is both in a position to take on the long-term commitment associated with a CHP plant and is prepared to make such a commitment.

CHP represents a major decision at board level. It will involve a major investment or a long-term, legally binding financial agreement with an energy services company.

b) Have other cost-effective efficiency measures been considered?

CHP should be considered as one element of an overall energy strategy. If overall energy demand can be reduced through other energy efficiency measures, then a smaller CHP plant may be appropriate. This would reduce the cost and may help the proposal to succeed. Conversely, economies of scale will be lost with smaller plant and the overall financial returns may be reduced. This last point is especially important for all solid fuel plants, including those using wood & waste biomass.

c) What is your company's long term strategy?

CHP plant has an operating life of up to 25 years and is typically evaluated over a 10-year horizon. The full financial benefit of the plant will be realised only when it is operated at close to optimum conditions over the whole of its life. Because the viability of the scheme may be adversely affected by major reductions to the heat or power loads, it is important to ask:

- What has been the historical pattern of heat & power loads?
- Are there any activities to be discontinued or are any new products or processes planned?
- If so, will they use existing plant and to what extent will they impact on the site's heat and power loads?

The flowchart on the next page may help you to evaluate the suitability of wood biomass CHP for your company:

d) Further information

Consider these questions:

- Is cutting costs the best way to boost profits?
- Is energy a major cost for any of your sites?
- Is wood, or waste, part of your business?
- Do any of your sites have a simultaneous demand for heat and electricity over 4,500 hours each year?

If you think the answer to the above is yes, then simply contact the Renewable Energy Information Office and ask for more information on biomass CHP.

Is Wood Biomass CHP a Potential Option for Your Company ?