Wood Waste to Profit
a Different Approach

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Biomass CHP (Combined Heat and Power)

Where waste wood biomass is being inefficiently burned for heat production only, and where market economics factor in all costs, including carbon costs for fossil fuels, then CHP is the most efficient and economic form of energy production available.

Refer Cogen Europe’s Position Statement – EU Biomass Action Plan –
The need to prioritize cogeneration – 25 February 2005’

- Bioenergy is among the most promising areas within the biomass sector, and combined heat and power using biomass has the greatest potential in volume among all renewable energies”.
- As for all other fuels, the cogeneration of heat and electricity from biomass is the most efficient way of converting this precious and sometimes expensive fuel into useful energy.
Why Feed-in Tariffs?

Countries in Europe and Asia are following Germany’s lead in implementing feed-in tariffs because wherever they have been enacted, feed-in tariffs stimulate uptake of energy efficiency and CHP in timber mills and other heat-intensive process industries, thereby increasing their competitiveness and reducing their carbon footprints.

Feed-in tariffs reduce production costs and provide additional revenue.

Feed-in tariffs substantially increase the value of wood residues.

Feed-in Tariffs Are Not Subsidies

Feed-in tariffs are not state aid / subsidies as ruled by the European High Court.

(contrary to what economists purport)

Refer: Judgment of the Court of 13 March 2001.
www.normoff.gov.sk/docs/files/61998j0379.htm
**Power of German EEG Feed-in Tariff Law**

On 27 June 2001, the German Federal Government’s Biomass Regulation entered into force, laying the foundations for generating electricity, not harmful to the climate, from sustainable raw materials and biogenic residues and waste.

At the end of 2002, biomass in Germany contributed about 3.4% to heat generation and about 0.8% to gross electricity production.

The long-term potential corresponds to an approximate 10% share in power supply and about 20% in heat supply.

At the end of 2002, there were about 100 operational biomass heating plants in Germany with an electricity output of about 400 MW.

In Germany a large amount of wood (energy crops and forestry waste) is used for the production of heat and electricity. Primary energy production from wood came to 5.0 Mtoe in 2000.

Source:


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**What BP Says About Feed-in Tariffs**

On 2nd October 2006, Mark Twidell, Regional Director BP Solar Australasia congratulated the South Australia State Government for enacting feed-in tariffs.

Mark stated:

“This policy is one that has been adopted in over 30 countries worldwide and has proven to be instrumental in transforming markets, creating jobs, and delivering greenhouse savings.

refer: www.bp.com/genericarticle.do?categoryId=9008681&contentId=7023566

NOTE: At this stage their feed-in tariff applies only to solar systems.
How do Feed-in Tariffs relate to ‘Residues to Revenues’?

It is quite simple.

Feed-in tariffs increase the value of your residues providing opportunity for development of additional revenue streams and in so doing underpin and support the competitiveness of your business.

Recommended Action

Inform yourselves about feed-in tariffs.

Evidence as to the considerable benefits of feed-in tariffs is compelling.

If you are persuaded by the evidence then we recommend that you:

- Hound you industry organizations to lobby Government to enact feed-in tariffs – make it an election issue
- Write to your local MPs and the Government Ministers insisting that they enact feed-in tariffs
A Different Approach

In this conference other presenters will show how different technologies can be applied to cut costs and create additional revenue from process and forest residues:

- hog fuel / wood chips
- pellets
- woody biomass boilers
- cogen and gasifier
- BTL and Ethanol

All this comes down to this simple equation:

Wood residues = Energy = $

Wood Residues to $

To achieve best results for our clients Key Energy Ltd has joined with technology leaders in their field:

- Pelletiser Technology
- Drying Technology
- Heat Exchanger Technology
- High Pressure Steam Boilers
- ORC power plants
High Value Product – Wood Pellets

Wet sawdust is lousy fuel but an excellent raw material for pelletising

Other raw materials:
- fines
- shavings

Pellet Fuel is a standardized fuel for specially designed boiler systems

Pelletising Technology

Pelletising technology can utilize different input material:
- different wood species
- different wood qualities
- different wood sizing

To produce pellets according to standard the input and output has to be conditioned.
Pelletising Technology

Matrix design has to be specific for:

- Input material
- Moisture content
- Conditioning
- Output desired
- Pellet standard required

Pelletising Technology

Design for a 10ton/hr continuous running plant

Required space about B12 x W12 x H10m

- Input elevator
- Reaction hopper with 3 feeder screws
- 3 Pelletizers with conditioner and forced feeders
- Transport conveyors
- Cyclone for exhaust air
- Pellet cooler to get pellet to ambient air temperature
- Serve for pellets before storage
Pelletising Plants

Plant design has to be specific for the client.

Several plants in Europe operating with 100,000 tons/yr built by our partners.

Pellet Markets

International export markets for Pellets are Asia, USA and Europe

Each of these Pellet export markets is different in standards, packing etc. Depending on the application delivery will be in bags or bulk.
Pellet Market Europe / Germany

E.g. retail prices € / ton (5 tons delivered within 50km) in Germany

Each Pellet export market is different in its stage of development.

pellet Market USA

USA / Canada Pellet markets are in strong growth phase and developing fast.
Mass and Energy Balance
Achieving ‘Economy of Scale’

For those mills using wood residues for heat production, as currently operating, there may be no residues spare for undertaking any of the above projects.

To achieve “Economy of Scale”, a careful analysis of their mass and energy balances would need to be undertaken in order to determine potential for plant optimization capable of freeing-up enough residues that could be put to projects such as cogen or pellet production. (Additional factors will pertain to mills using other fuels).

Therefore Key Energy adopts the approach to look from the ‘Mass / Energy Balance and Optimization’ point of view as to which technologies are suitable for the different wood processing plants and which further value-add projects might be feasible.

Each plant needs to be assessed on a ‘case by case’ basis.

Optimizing Heat Demand - Reducing Losses

Fixing steam leakage
reducing LP steam demand

Insulation
reducing LP steam demand
Optimizing Boiler Efficiency

Boiler air and return flow pre heating
- reducing fuel demand
- increase efficiency

Due to high moisture content the dew point is high and most economizers will run into corrosion problems.

Flash steam heat recovery

Corrosion resistant condensing G-flon heat recovery, utilizing flue gas and latent heat down to 60°C

Heat plants in Wood Processing Industry

Boiler efficiency 70% - 80% of what? Usually based on LHV, not HHV!
<> depending on fuel moisture content boiler efficiency is only approx 60%

Burning water with carbon content i.e. wet sawdust 55% moisture
<> incomplete combustion
<> bad emissions
<> “there is not enough fuel”

Heat recovery possibilities
<> not utilised

Optimisation before generation
External Fuel Drying / External Fuel

Fuel drying = more fuel

Sludge drying using flue gas of a 22t/hr high-sulphur coal-fired steam boiler

Low Temperature Drying

There are different designs for fuel drying.

Depending on the material to dry and the temperatures available, the optimal design has to be selected.

For large volumes and low drying temperatures (e.g. 80°C) belt dryers have proven to be superior.
External Fuel Resources

Leaving forest residues and cuttings on the forest floor creates fire risks and is not good for the following generation of plantings.

Sensible policy framework would make it economic to gather forest cuttings and residues thereby reducing fire risks and eliminating wholesale burn-off of valuable wood residues as is happening right now with the burning of mountains of waste wood in the forests next to State Highway 5 between Rotorua and Taupo →

Other external fuel sources:
- dried sludge
- forest residues and thinnings
- cut off's of dairy conversion land

On-site Power Generation with ORC

Thermal Oil Circuit | ORC - Process

- Furnace
- Thermal Oil Heater
- Economizer I
- Economizer II
- ORC Evaporator
- Primary Pump
- Add. ORC Pre-Heater
- Air Pre-Heater
- Turbine
- Generator
- Regenerator
- Condenser
- Feed Pump
- Water Circ. Pump
- Consumer

A Comb. Air
B Flue Gas

Advanced internal heat recovery

Hot Water Circuit
Boilers that have been designed to handle maximum kiln heat demand results in an excess of installed but unutilized heat capacity.

Boiler output has to follow the kiln demand (load) and to ramp up and down. In case of fast changes or loading the kiln surplus heat has to be dumped.

Instead of ramping the thermal oil system up and down the boiler runs on constant load and the heat surplus is converted into power.
ORC Integration into Existing Plant

There are a lot of possibilities for utilizing heat output of the ORC plant (80°C – 110°C)

1) Air pre-heater for drying and boiler
2) Pre-heat feed water for steam generators
3) Hot water for processing & cleaning
4) Heat for absorption chillers
5) Heat for cooking
6) Heat for desalination

Utilising excess boiler capacity using ORC power plant.

Due to the wide operational range 20% to 100% - ORC is perfect to run under variable load conditions.

Using Condenser Heat

Reducing power demand, cooling with heat:
- Absorption
- Adsorption
- DEC

Output approx. 0.7MWo/MWth

Creating an other product, potable water by desalination.

Desalination designs using heat:
- Vacuum Evaporation
- Multi Stage Evaporation

Output approx. 6 m³/MWth

Chiller

Container desalination plant
On-site Power Production with HP Steam

HP steam boiler advantage:
high efficiency in heat and power generation

Operational Issues to be Watched
- Water quality
- Steam quality
- Control quality
- Maintenance quality
- Staff quality
- Fuel quality
- Runtime
- Investment costs

Capable to burn CCA timber with very clean emissions

Power Plant Optimization Potentials

Optimization potentials:
- Economizer
- Heat recovery for:
  - fuel drying
  - air pre-heating

condensate & feed water pre-heating
Power Demand in Wood Processing Industry

e.g. saw mills

Optimization before generation

- load management
- power factor
- fan efficiency
- pump efficiency

Reducing Power Demand

e.g. Boiler house fans

ID fan now = 85 kW
ID high efficient fan = 45 kW
ID fan part load 80% = 25 kW

applying VSD inverter control

Note: same savings are possible for pumps

Optimization before generation
Wood Residues for more $

Key Energy Ltd is offering technology and expertise to assist timber processing plants determine feasibility for using their wood residues for power or pellet production.

Thank you for your attention