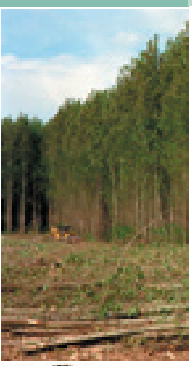
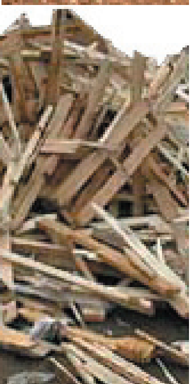
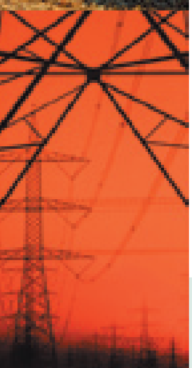
Efficient economies of scale for renewable energy generation facilities

National Association of Forest Industries

Wood Waste Bioenergy Information Sheet No. 12

The price paid for wood waste and the size of a renewable energy plant have a significant impact on the costs of each unit of electricity that is generated. Quite importantly, the size of each plant determines the thermal efficiency of converting wood waste into renewable energy, with thermal efficiency being the amount of heat, and therefore the electricity generated, from each tonne of wood waste.

As the size of a plant increases, the average capital costs decrease on a per MW basis. For example with direct combustion technologies, as the size of a renewable energy plant doubles, the average cost of installed capital per MW of power generating capacity could fall by as much as 15%.

The relationships between the scale of a renewable energy plant, the efficiency of converting wood waste into renewable energy and the energy production costs, are essential elements for assessing and designing renewable energy projects[3]. Other relevant factors are described in Information Sheets 9 and 10.

Capital costs for wood waste electricity plants

The average capital cost to install a large wood-waste electricity plant is around $2m per MW of capacity, with a relatively large plant size required to achieve economies of scale. When the size of the plant falls below 25MW, the capital costs per MW of output rise sharply.

The efficiency of conversion (from wood waste to energy) for a renewable energy plant is a critical issue. This is especially important for a low value product such as electricity, where the wood waste accounts for at least 50% of the total operating cost of the plant[4]. New investment proponents must therefore assess the 'trade-offs' between the up-front capital costs, the efficiencies from the economies of scale and the operating costs for the facility in the longer term.

Key Points:

- *The most efficient scale for operating renewable energy facilities using wood waste and employing direction combustion technologies, require a 30MW plant and over 300,000 green tonnes of fuel per annum[1].*
- *Key trade-offs exist when attempting to determine the most efficient scale of operation:*
    - *There is lower efficiency in converting wood waste into energy with smaller plants.*
    - *Larger plants require a significant increase in the demand for wood waste, resulting in longer transport distances for the wood waste and greater storage requirements at the energy plant.*
- *Six areas have been identified with the potential for supporting 30MW renewable energy plants based on the use of wood waste[2].*

Economies of scale – conclusion

Economies of scale are critical for efficient conversion of raw material into electricity, regardless of the type of raw material that is used. The typical size of coal-fired power stations is substantial (in the order of 2,000MW capacity), ensuring that the capital costs per unit of electricity produced remain very low.

Unless targeted at specific markets, for example replacing remote diesel generation with biomass, wood waste facility proponents must attempt to maximise the economies of scale. In general, for the conventional combustion technologies, if the plant size decreases below 25MW, the thermal efficiency declines quite markedly. Within the constraints imposed by the long-term resource availability for any given region, wood waste plants should strive for capacity of at least 30MW[2].

1. Rizza (2005) Babcock and Brown's bioenergy projects, Bioenergy Australia Conference (Melbourne).
2. Report 3 – Potential wood flows, technical and scale issues and identification of sustainable management criteria (p.43).
3. Report 2 – Potential for wood in a sustainable and competitive Australian renewable energy industry (Appendix 4); Report 4 – Converting wood waste into renewable energy – a summary of biomass conversion technologies; Stucley, Schuck, Sims, Larsen, Turvey and Marino (2004) Biomass energy production in Australia: Status, costs and opportunities for major technologies (RIRDC Publication No. 04/031).
4. Gerardi (2005) Prospects for bioenergy in Australia, Bioenergy Australia Conference (Melbourne).
5. The Review of the Renewable Energy (Electricity) Act 2000 (National Association of Forest Industries and Australian Forest Growers, 2003) submission into the review of the Renewable Energy (Electricity) Act 2000.
6. Report 3 – Potential wood flows, technical and scale issues and identification of sustainable management criteria (p.35).

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