Kangaroo Island Regional Plantation Committee and Kangaroo Island Development Board

Kangaroo Island Biomass Study

Study Report by Enecon Pty Ltd

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Enecon Pty Ltd ACN 006 087 494
Level 2, 35 Whitehorse Rd (PO Box 555)
Deepdene, Victoria 3103
Tel: (03) 9817 6255
Fax: (03) 9817 6455
Email: cstucley@enecon.com.au

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Attachment 1: Study Brief
Attachment 2: Itinerary for visit to Kangaroo Island by Colin Stucley

HISTORY OF DOCUMENT REVISIONS

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Disclaimer

This report has been prepared to assist with the appraisal of technologies and costs for a biomass to energy. While care has been taken in its preparation, the study work and report are preliminary only and no responsibility will be taken by the authors for omissions or inaccuracies, or for the use of this information in commercial decisions by any other party.

1. EXECUTIVE SUMMARY

Enecon has been engaged by the Kangaroo Island Development Board (KIDB) and the Kangaroo Island Regional Plantation Committee (KIRPC) to investigate and report on the opportunities for generating renewable electricity on the island using biomass as a feed. KIDB and KIRPC personnel have made a preliminary investigation of the availability of biomass, now and in the future. These sources of biomass were also discussed when Colin Stucley of Enecon visited the island in February, 2002. During this trip public seminars and industry meetings were held, and likely project sites were visited.

Two sorts of project have been considered based on availability of feed:-

Immediate project - Developments proposed for the Timber Creek Saw mill should provide feed for a small bioenergy plant by the end of 2002. Kiln drying proposed for the same site could also allow the generation of electricity as part of a small co-generation facility. Approximately 500 kWe to 1 MWe could be generated with expected mill residues, and up to 2 MW may be possible if additional wood residues are brought in from the plantations.

The likely cost of electricity generated from such a site is 11 to 15 c/kWh. Unknowns include:
- the average cost of wood feed, which will depend on the mix of saw mill waste and plantation residues ultimately used (assumed $20 per green tonne)
- the ability to generate and sell renewable energy certificates (which have not been included in the above estimate)
- cost improvements via co-generation to support kiln drying (not included above)
- labour costs on a common site (labour savings assumed)
- markets for electricity sold (full utilisation assumed)
- ability of existing grid to take the electricity that is generated (connection cost included, but no allowance for grid upgrade).

All such power could be utilised on the island. With sustainable feed supply and proven plant technology, the supply of renewable electricity to the island grid could be expected to be quite consistent and reliable. Such on island generation would diminish reliance on the existing sub-sea cable for supply, however it would not necessarily be relevant for increasing reliability of the grid on the island itself.

Future project - It is expected that other sources of biomass will become available over the next five years, including:
- Residues from a proposed wood chip export facility at Ballast Head
- Spent leaf from increased eucalyptus oil activities at Emu Ridge
- Other biomass from activities such as farm forestry and management of fire breaks and road-side vegetation.

The probability of supply, quantities and costs are still largely unknown for these sources. In the absence of firm data, two hypothetical cases were considered:
- A plant similar to that considered for Timber Creek could also be used for these residues. Costs would be similar to Timber Creek, plus any additional costs for feed purchase and handling associated with a new site.
- A larger biomass plant (say 5MWe) would achieve an economy of scale over the Timber Creek example, but would probably require more expensive feed and would be more

dependent on selling electricity off the island, as on island use may not stay above 5 MW in the foreseeable future.

2. INTRODUCTION

2.1 Background

The background to this study has been described in the study brief prepared by the Kangaroo Island Development Board. An extract is provided below and the complete brief is provided in Attachment 1.

"Kangaroo Island currently has access to around 10MW of power from the mainland grid, fed via the Yankalilla substation through a submarine cable laid direct on the seabed between Fishery Beach on the mainland and Cuttlefish Bay on Dudley Peninsula. At present Kangaroo Island uses approx. 5.1 MW at peak times. The substation does not have the capacity to supply any further power to areas south of this locality, including Kangaroo Island. A back-up capability in times of service failure is available from a 2.4MW diesel generator installed near Kingscote.

The Island suffers frequent (and often lengthy) power outages, causing significant loss of income to business and inconvenience to residents and tourists. The inability of the available power to be effectively distributed around the Island is hampering expansion of existing businesses (eg. the Timber Creek sawmill, expansion of fish processing facilities at Vivonne Bay), and acting as a barrier to new investment. There is currently a heavy reliance on privately owned diesel powered generators, and increasing private utilisation of renewable energy generation for domestic use in remote areas of the Island. Most of the western end of the Island is serviced only by a fully utilised SWER line system, and there are a number of areas where the existing infrastructure is substandard. The cost of connection to the grid on the Island, particularly for users requiring 3 phase supplies, is often prohibitive.

Provision of adequate power distribution infrastructure and electricity supply is critical to the development of Kangaroo Island as a region within South Australia.

Extensive discussions between local agencies, businesses, government agencies and ETSA Utilities over the past two years have identified the following key issues:

- The demand for additional power on the Island remains to be accurately quantified;
- The existing grid network on the Island is subject to frequent failure; and
- The existing grid network fails to distribute adequate and reliable power supply to areas of the Island where it is required for economic development and community service purposes.

Renewable energy options have the potential to provide the Island with the opportunity to develop a degree of self-sufficiency in power generation, and are in keeping with the Island's "clean, green" image as a tourism destination. The Island has the opportunity to assess the commerciality of renewable energy options with the capacity to augment local supply, as an alternative to obtaining additional power from the mainland grid. However, the inadequacy of the on-Island grid network remains a critical issue. An assessment of the relative costs and benefits of upgrading the mainland grid supply, versus expenditure of funds on improvement of the on-Island network, in part to facilitate distribution of locally generated renewable power, is needed.

The purpose of this project is to provide the information required to enable Island and State government agencies to make informed decisions concerning the future possibilities for addressing Kangaroo Island's power demand needs."

2.2 Visit to Kangaroo Island

As part of this study, Colin Stucley of Enecon visited Kangaroo Island from 18 – 20 February. During this visit the study team conducted public meetings and seminars and also visited a number of potential sites for biomass supply or power plants around the island. Colin Stucley then held a meeting in Adelaide with personnel from ETSA and the Department of Industry and Trade. Further details and the meeting agenda are provided as Attachment 2.

2.3 Kangaroo Island's Electricity System

The present situation regarding electricity on the island is summarised in Section 2.1 above. It would appear that there are several issues that will ideally be addressed by any new bioenergy project on Kangaroo Island.

a) Decreased reliance on the sub-sea link, which has failed in the past and could fail again, cutting the island off from all mainland power for an indeterminate time.

b) Improvement of electricity reliability on the island (as opposed to supply to the island).

c) Development of new industry on the island.

d) Profitable disposal of industrial and municipal waste biomass.

e) Promotion of the island's image as an environmentally conscious community.

In each case these benefits must be achieved as part of an economically viable solution to the problem identified. Renewable energy has environmental benefits over electricity from fossil fuels, however it must still be commercially competitive within the frameworks established by state and federal renewable energy markets.

These issues share considerable common ground, but also have individual requirements or benefits. For example, improving the reliability of power supply to Kingscote may reduce dependence on the sub-sea cable by that area of the island, however it will do little to improve the reliability of power supply out to other parts of the island.

It is not the function of this study to examine:
- Reliability of existing grids - sub-sea or local
- Location and nature of existing power requirements on the island
- Likely requirements for additional power on the island

3. BIOMASS FEEDS

The biomass feeds to be considered for electricity generation are a mixture of:

- material that will be available independently of a bioenergy project, such as municipal wastes and saw mill residues
- material that would be made available if a bioenergy project could partly or fully justify its collection, such as fire break prunings, where the possible value as a bioenergy feed will subsidise the cost of cutting and maintaining the fire breaks.

Some material is available immediately, while some material is currently “hypothetical” and will arise from activities that are proposed on the island over the next few years.

The feeds identified may be summarised as follows:

Feed	Quantity per year and timing	Composition	Location	Cost
Municipal wastes	Available now, at least 1,000 tonnes per year	Variable	Kingscote	Nil, to avoid disposal costs
Sawmill residues	Approx. 10,000 tonnes available from late 2002	Saw dust and chips, green and dried	Timber Creek	Nil
Forest residues	Not known yet. Probably flexible to suit demand up to 20,000 tonnes	Chipped green wood and bark	Timber Creek	Not known
Wood chip fines	In approx. 5 years:10,000 green tonnes, possibly increasing to 20,000 tonnes	Green chip fines	Ballast Head	Not known
Euc. Oil residues	Nil now, possibly up to 20,000 green tonnes of leaf waste in several years	Leaf residue after distillation	Emu Ridge	Not known, but no other perceived use or value
Farm forestry	No firm plans in place for any significant amounts.		Varied	
Land Management	If fire management work proceeds	General tree prunings	Varied	Negotiable, may include significant transport cost

The energy content of wood is approximately 20 MJ/kg (dry basis) and does not usually vary by more than 10% between wood species. When green wood is harvested it contains significant amounts of water, which lowers the specific energy content to a figure of approximately 10-14 MJ/kg (wet basis). Green wood can be used as feed in many energy systems, but the water in the green wood must be evaporated as part of the energy recovery process and this lowers the efficiency of energy recovery.

Any bioenergy project on the island is expected to cost several million dollars. With such levels of money to be invested, it is very unlikely that any project would go ahead without adequate security for the supply of biomass feed. Such security includes:

- Quantities of feed
- Quality or condition of feed
- Cost of feed.

The characteristics of each feed will influence its use, particularly in its suitability to be substituted for another feed in a bioenergy plant. For example, a plant that is designed to operate using planer shavings (at low moisture content) may not work efficiently with a feed of wet saw dust. A plant built to use large chunks of wood may not work efficiently with small chips, and so on. The impact of changing feed supply can be lower efficiency, problems with emissions or even an inability to operate for reasons of poor combustion or an inability to physically handle different sized material. It is possible to design plants that utilise multiple feeds, however this design is most effective if carried out at the start of a project, and the use of multiple feeds in any plant can be expected to require additional equipment costs.

The location of the feed material relative to the power plant can also be expected to have a significant impact on cost. The cost of transporting logs on good roads is often given as approximately 10 cents per tonne per kilometre, so a journey of 50 km may be expected to add $5 per tonne if the feed is whole logs. However the transport cost of other wood waste can be considerably greater than this. Prunings, plantation residues, and saw mill wastes may all have bulk densities that are only a fraction of whole logs, sometimes as low as 200 kg per cubic metre. In such cases the cost of transport can rise to 20 or even 30 cents per tonne per kilometre, because a truck cannot fit as much weight within a given volume. Such feeds may be baled, briquetted or otherwise compacted to reduce transport costs. However this densification activity carries costs of its own and so a compromise needs to be found for each project as to location of plant relative to feed and the handling and transport of that feed.

4. BIOMASS POWER SYSTEMS

4.1 Summary

This section is provided as a general introduction to biomass energy and steam and power generation for those who may be unfamiliar with these topics.

Different methods for this energy recovery may be classified into four general groups. The first three relate to different methods of extracting energy from biomass as follows:

Combustion
- This may be defined as burning wood in the presence of sufficient air to allow complete combustion. Energy is released as heat for use directly or indirectly in heating applications, or for conversion into steam and/or electrical power.

Gasification
- In gasification systems typically 20 - 50% of the air needed for complete combustion is injected into the reaction vessel and a low energy fuel gas is produced. This gas may be burnt for heating, or steam or power generation.

Pyrolysis
- In pyrolysis systems typically 0 - 20% of the air theoretically needed for complete combustion is used in a reaction with the wood that produces varying quantities of char, oil and gas, largely by thermal decomposition. Each of these may then be used as a fuel for heating, or steam or power generation.

Each of the above methods is normally carried out as a stand-alone processing activity on the wood. The fourth group to be considered covers processes where energy recovery is carried out in conjunction with other processing steps that recover fractions of the wood feed for production of value-added chemicals. In these situations the actual energy recovery process may be similar to one of the above three methods, however detailed processing, and plant economics, will be influenced by the other activities involved in chemical production.

Technologies for direct combustion and for gasification of wood are well developed, and both of these approaches to energy recovery may be used for a wide variety of wood feeds in small and large systems. Experienced suppliers for both technologies are available in Australia. Wood combustion systems in Australia and overseas are regularly used for steam and power generation. Wood gasification systems in Australia are primarily used for thermal energy for product drying rather than steam generation, but overseas use of gasification includes steam and power generation.

Pyrolysis is not as developed as combustion or gasification and does not currently appear to be used in any commercial installations for energy recovery.

Alternative	**Possible applications**
Direct heating	• Hot air or fuel gas for use in kiln drying
Steam production	• Produce low or medium pressure steam for process use • Produce high pressure steam to run a condensing steam turbine and

	generate electricity for local use or sale to grid • Select the discharge pressure from the turbine according to possible uses for low pressure exhaust steam
Gas engines	• For sufficiently clean producer gas, or for water gas, operate a gas engine to generate electrical power • Recover heat from the system (via hot water, oil or steam) if suitable uses exist

4.2 Direct Combustion

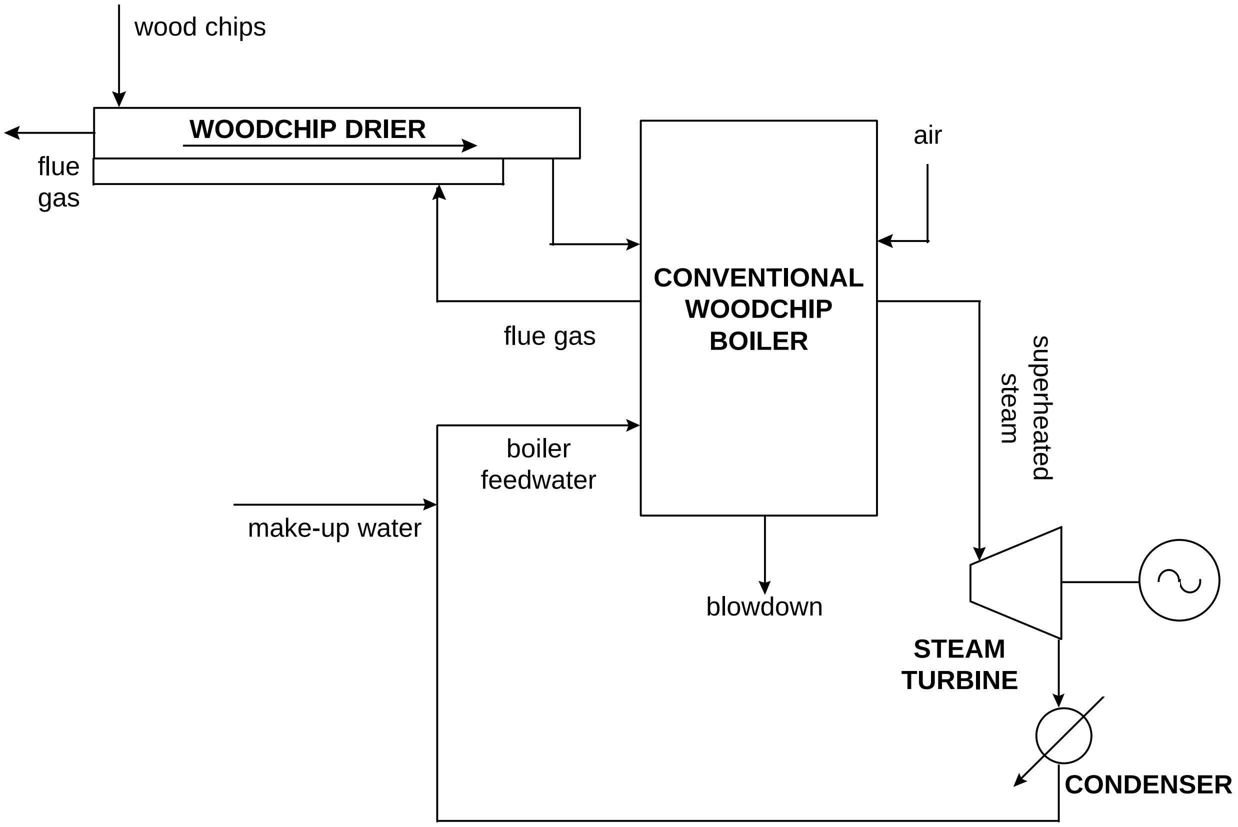
Direct combustion involves burning the wood in a suitable container to allow efficient, cost effective release of the energy in the wood as radiant heat and hot combustion gases. The energy may then be used directly or converted into transfer media such as hot oil, hot water or steam. Steam may in turn be used for power generation, as described in the next section.

The actual burning process may be divided into three phases: evaporation of water, release and burning of volatile matter and combustion of fixed carbon. As water is evaporated from the wood feed, heat may be absorbed by the wood, raising its temperature and driving off the volatiles, which then burn. When most of the volatiles are burnt the remaining fixed carbon burns. In practice, wood is fed continuously into the combustion zone and all three of these steps are occurring simultaneously during plant operation. Combustion systems are designed to balance evaporation and burning while taking into account the characteristics of the feed (particle size, variation in moisture content etc) and also the limitations of construction materials used for vessels operating at high temperatures.

Based on the above parameters, the alternative systems for direct combustion are generally classified by the way in which they burn wood feed:
- Pile Burning
- Suspension Burning
- Semi-suspension Burning
- Fluidised Beds.

A process flow diagram of a conventional direct combustion system is shown in Figure 4-1 following.

Figure 4-1 Process Flow Diagram of Direct Combustion Plant



4.3 Gasification

Gasification involves the conversion of biomass to a fuel gas by controlled combustion of the feed in a low oxygen environment. As with direct combustion, gasification technology is applicable to a wide range of biomass feeds including coals, wood and municipal refuse. Similarly it may be used to provide heating, power or a combination of the two.

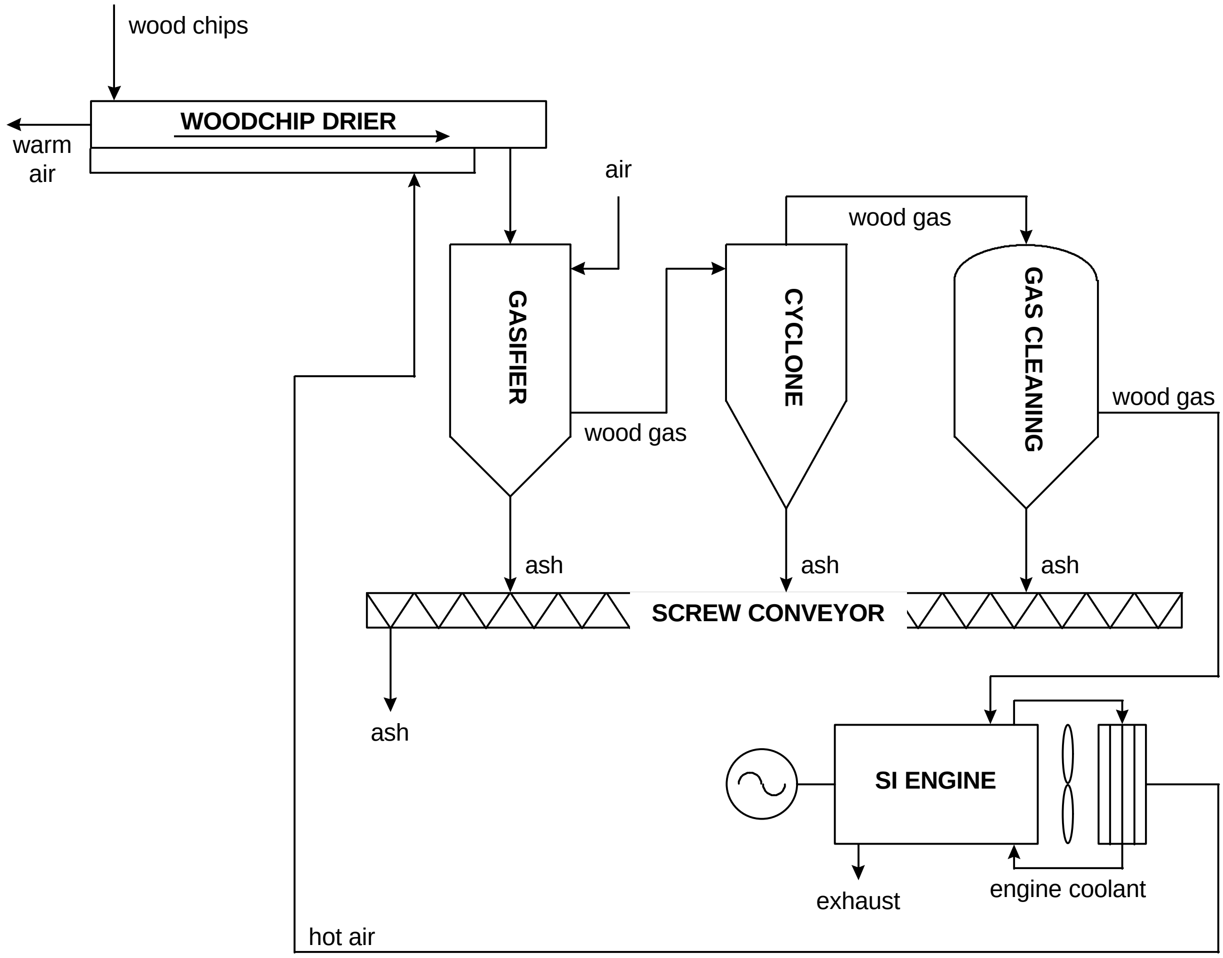
Wood gasification allows power generation by several alternative routes:

a) Fuel gas may be burnt to raise steam in a conventional boiler, and the steam used to drive a turbine and a generator. Some such plants exist in other parts of the world but no gasification plants in Australia are linked to steam and power generation to the best of our knowledge.

b) Fuel gas may be suitably prepared and then used to fire a gas turbine or modified spark-ignition engine, which can in turn drive a generator. There are commercial examples and several trial plants examining this technology overseas. In Australia the CSIRO is examining such as system via a trial unit to be built in Melbourne

A gasification plant involving direct firing of fuel gas in a spark-ignited engine is shown in Figure 4-2 following.

Figure 4-2 Process Flow Diagram of Gasification Plant



4.4 Pyrolysis

Pyrolysis is the transformation of biomass into a mixture of charcoal, gas and liquids by heating with little or no oxygen present. This is essentially a process of thermal decomposition. Compared to direct combustion and even to gasification, pyrolysis is at a relatively early stage of development. To our knowledge there are several plants using pyrolysis to make food additives in the USA (flavour enhancers for barbecued meat), and one or two power plants based on pyrolysis are being developed in the UK under the government assisted renewable energy scheme there.

4.5 Carbon Products

Combustion and gasification both totally utilise the wood for energy production, with no other products. As an alternative, energy may be recovered as part of the processing of wood to produce other products such as charcoal or activated carbon. This is not considered to be relevant for Kangaroo Island due to a combination of lack of feed material and markets for the carbon products.

4.6 Efficiencies

The efficiency with which biomass power systems convert wood energy to electrical energy will depend on a number of factors, including:

- Moisture content of feed
- Realistic steam conditions for a combustion/boiler system
- Efficiency of the turbine or engine used to drive a generator
- Ability to use heat in other areas (for example kiln drying) which may reasonably take energy way from power generation.

These factors vary from system to system and overall efficiencies can range from around 20% or less in small (under 1 MWe) systems up to as much as 30% in large, well built biomass systems. Greater efficiencies may be built into systems at any given size of plant, but usually at the price of more expensive equipment that must be paid for via increased electricity sales.

How much biomass feed is needed for a typical system? If a system is 20% efficient, this means that every GJ of energy recovered as electricity will require some 5 GJ of energy in the wood feed. For example, consider a system that is:

- Running continuously for 8,000 hours per year (which allows reasonable time for planned maintenance etc)
- Designed for 1 MWe output[1]
- Running at 20% efficiency
- Using green feed with an energy density of 12 GJ/tonne.

This system will require will require annual feed of 12,000 green tonnes.

Thus, in the context of the biomass identified above:

- Use of all the mill wastes expected at the Timber Creek saw mill later in 2002 should allow the generation of approximately 1 MWe.

- Suitable municipal wastes from Kingscote or other locations could contribute to the feed for this plant, remembering that taking feed with different physical characteristics may add to the cost of feed handling and combustion. Ideally the municipal waste would have similar physical dimensions (eg. wood chips) so that it could be handled by the same equipment. Perhaps the wood chipper at the saw mill could be used to prepare such wastes. Wet wastes, or wastes with odours or other handling problems would need to be considered carefully before they were allowed on site. Just as with the wood feed, the reliability of supply of municipal wastes would need to be understood so that a plant was not designed or modified to suit a feed stream that could change seasonally. These issues can not be fully understood or costed without more work, and should be investigated in more detail during the development of a any bioenergy project on the Island.

- Recovery of a similar amount of forest waste could allow a second MWe to be generated at the Timber Creek Mill.

[1] One MWe for 8,000 hours equates to 8,000 MWh. As a MW represents a MJ of energy for one second, a MWh is 3,600 MJ or 3.6 GJ. Thus 8,000 MWh is the same as 28,800 GJ.

- If all of the proposed forestry and eucalyptus oil activities occur then a further 1 to 3 MWe of generating capacity could be developed, say five years later. Plant location would depend on the nature and distribution of feed and access to suitable power lines for electricity distribution.

Actual efficiency figures are used in the project costing below, particularly for the selection of steam turbines, where there is a link between the capital cost of the turbine and the efficiency with which it can convert steam energy into shaft energy to drive a generator. The more expensive the unit, the greater the efficiency.

5. BIOENERGY SYSTEM COSTS

The commercial viability of a biomass project is usually assessed by looking at a typical project life (say 15 years) and determining whether the revenue from electricity sales will offset the plant's capital and operating costs and provide a suitable return on investment to those that have provided funding.

The various cost elements are described below:

5.1 Capital Cost

The capital cost of a new biomass to energy plant reflects all of the costs to design, fabricate and install that plant, and typically includes:

- Major equipment for wood combustion or gasification
- Turbine or engine and generator
- Management and distribution of electricity from the site
- All services and utilities
- Feed handling and storage, plus any size reduction needed
- Civil and infrastructure costs (buildings, roads, storage areas, drainage, fire water, fences, noise barriers, etc)
- Design and project management, approvals, environmental studies, etc

Costs for these items are usually summarised into a single capital cost which may then be described in terms of the plant output, i.e. $ cost per MW of electricity that may be produced.

- For a large plant at 20 MW or more the capital cost may be around $1.5 million per MWe (or $30 million total for a 20 MWe plant). This reflects economy of scale in a large plant, but is still more expensive per unit output than a larger gas-fired or coal-fired power plant.

- As the biomass plant output is reduced the opportunities for economy of scale diminish and the unit cost rises. Thus for a 1 MWe output plant the total capital cost may be up to $5 million.

The fact that a larger plant usually offers economy of scale raises the issue of finding the best balance between feed utilisation and plant cost. Quite often the provision of additional feed to a plant will involve extra costs for transport or recovery. Against this, the increased feed may allow a larger plant, with an associated an economy of scale. If a range of feed is available at a range of prices it is usually necessary to examine several plant options to properly consider this.

5.2 Feed Cost

Feed costs can include and reflect one or more of the costs below:

- collection, which may involve collection of residues in the plantations or centralising wastes at the mill.
- storage, particularly if feed supply is intermittent, or seasonal variations in quantities occur.
- size reduction – each type of combustion or gasification plant will have a preferred range of feed size, such as sawdust, chips, or even lumps of wood. Each can be used as feed, but if a range of these sizes are to be used the plant will need to be designed to accommodate

(at additional cost) or some from of size "standardisation" will be needed. If whole logs are received, running a small chipper at the power plant site can add significantly to the cost of feed.

5.3 Other Operating Costs

Operating costs for both gasification and combustion systems may be broken into several categories.

Feed supply - The supply and cost of wood feed is common to all systems and is treated elsewhere in this report.

Labour - Personnel are required for each of the following activities:

- feed purchase, receival, handling, resizing etc
- operation of gasification or combustion plant
- operation of steam and power generation.

In small, automated power plants many of these activities can be undertaken by employees working on a part-time basis. Depending on the location of the plant adjacent to other facilities, it may be possible to share personnel to manage infrequent feed receivals, check the plant several times each day, respond to control system alarms and so on. With small plants in particular, this sort of approach can have a significant effect on operating costs and electricity sales prices. Quoted labour requirements for plant operation vary between suppliers, even when broadly similar plants are under review. Thus it is very difficult to determine an accurate cost for operating personnel before a particular site and set of equipment is chosen.

Plant labour is an operating cost that can contribute to economies of scale, as operating labour requirements do not increase proportionally with plant size. Additional capital expenditure and more sophisticated control systems will allow reduction of labour. As with any equipment, a compromise is ultimately required between capital cost and operating expenses.

Plant management - plant operation will require either a dedicated manager or part-time involvement of other management personnel.

Maintenance - Maintenance (including labour and materials) is usually quoted as a percentage of capital cost. Once again, quoted figures vary, ranging from 1% to 4% of the plant capital cost. We suggest a common figure of 3% be used for initial calculations. As with labour costs, increasing the capital cost may bring equipment quality that reduces maintenance costs, however it is beyond the aims and scope of this study to analyse in such detail. Also the availability of personnel from other parts of the site may have an effect on the cost of routine maintenance.

Consumables - This category includes items such as chemicals that may be required for boiler water treatment, and utilities such as power, start-up fuel, ash handling, cooling water chemicals, instrument air and so on. An allowance can be made as a percentage of plant capital cost. In practice the cost of consumables will be greater for a plant generating steam, however for this preliminary study we suggest a general allowance of 1% of the capital cost of the plant.

5.4 Financial Analysis

The following assumptions were used in the financial analysis. The results of the financial analysis are shown in Section 6.

Table 5-1 Assumptions for Financial Analysis

Item	Value used
Project life	15 years from first investment
Residual value of plant	Nil
Inflation	Costs inflated by: 3% per annum Revenue inflated by: 3% per annum
Depreciation	Straight line over 15 years
Company tax rate	30% [2]
Interest on borrowings	10%, all loans repaid by end of 10th year.
Financing	40% debt financing
Plant availability	90%
Required project IRR	15%

Renewable Energy Credits (RECs) will probably be generated (subject to compliance with the Federal Government regulations and project acceptance by the Office of the Renewable Energy Regulator, but no value has been included here for their sale.

5.5 Utilisation of Plant

It is assumed that the power plants will operate for the maximum time possible after allowance has been made for maintenance and other down time. This is typically 90% of the year (or 7,884 of a possible 8,760 hours).

It is important to realise the implications of operating for less time than this. The revenue from electricity sales is dependent on those sales taking place, and so the costs of capital recovery and all the other fixed costs for the plant must be spread over this revenue. With small bioenergy plants, which are capital intensive, lower operating time very quickly brings about significant increases in cost per unit of electricity sold.

It is thus very important to be confident of the utilisation of the plant based on electricity purchase, to the point of having it fully described in a power purchase agreement.

5.6 Electricity Sales

The electricity use at any time on Kangaroo Island is not known by the KIDB or KIRPC with any accuracy. The peak demand has been given as approximately 5 MWe, however it is quite likely that the lowest demand (for example at night in Winter) may be approximately half of this amount. The current selling prices of electricity on the island may well reflect this, with higher charges for peak times when the whole state wants electricity and lower charges for those periods when demand is low. When electricity sales from a bioenergy plant are being priced this may need to be taken into account. If electricity is to be sold to island consumers it would

[2] Recommendation of “Ralph report”. If the current figure of 36% is used, accelerated depreciation (straight line over 8 years) could be used, providing an even better return.

be expected that the average sales price would not be greater than the average sales price for electricity from the SA grid.

Note that the cost of electricity to a consumer typically includes cost for the electricity itself and also a cost for the maintenance of the infrastructure required to bring the electricity to the consumer. It can also include a maximum demand factor, which recognises the maximum amount of electricity that a consumer may need at peak periods and supports the infrastructure needed to be able to meet this demand.

5.7 Renewable Energy Certificates

The Federal Government has established the Renewable Energy (Electricity) Act 2000 to help develop increased use of renewable electricity. The Act provides for the generation and trading of Renewable Energy Certificates (RECs), which are then used by the electricity industry to meet obligations for increased use of renewable electricity each year up to 2010. These obligations are described in the Mandatory Renewable Energy Targets (MRET).

The Act is supported by the Renewable Energy (Electricity) Regulations. These regulations describe criteria by which renewable energy projects can be accredited as being acceptable for the generation of RECs. Electricity projects which are not accredited can not be used to create RECs and thus will not help electricity companies meet their renewable electricity obligations. Those projects which are accredited can *potentially* add value to their financial returns through the sale of the RECs. The selling price for RECs to external customers is market driven, and at present there is an oversupply. The penalty for not having sufficient RECs is 4 cents per kWh, which indicates a potential upper value for RECs if trading does occur in future years.

It is Enecon's opinion that the biomass components of the Regulations have been formulated partly to satisfy concerns in sections of the Green movement that bioenergy will cause expanded logging in native forests and a "lowest value" mentality similar to some perceptions of the wood chip industry. As a consequence of considerable pressure from this section of the Green movement, the Regulations have been written in a way that many in the energy industry consider cumbersome and obstructive. As a part of the legislation, the Regulations will be subject to review in the next couple of years. The Office of the Renewable Energy Regulator (ORER) is available to assist project developers in the interpretation of the Regulations and the achievement of accreditation.

Note that Renewable Energy Credits (RECs) can be sold independently of the electricity sales. If a market for RECs is found, it may be possible to sell electricity directly to local consumers and RECs to others within SA or even interstate.

5.8 Distribution of Electricity

The capital costs outlined above include an allowance for the interconnection of a new bioenergy plant with an existing grid so that the electricity may be exported to customers remote from the generating plant. For example, a plant at Timber Creek Saw Mill may send power to Kingscote and other towns. A plant at Ballast Head in the future may seek to export power off the island and back into the mainland grid via the sub-sea cable.

No allowance has been made in the costs presented in this study for any upgrade or duplication of the existing electrical distribution network. As part of the study tour by Colin Stucley of Enecon, a meeting was held in Adelaide with personnel from ETSA, the operators of the electricity transmission and distribution infrastructure to the island and on the island. ETSA could give no assurances that the existing distribution infrastructure at any point on the island could accommodate electricity generated from a new bioenergy plant. They also indicated that sending electricity from the island to the mainland via the sub-sea cable was not a straightforward issue. They further inferred that the benefit of sending stable electricity from Kangaroo Island to the south of the Fleurieu Peninsula was minimal, given the plans for a large wind farm to be built in that area (Starfish Hill, 35 MW, Tarong Energy) and upgrades to the grid in that region.

Thus in any development of bioenergy projects on the island, the ability of the existing grid to be used for power distribution must be assessed on a case by case basis. If necessary, additional distribution infrastructure will need to be built. ETSA advised verbally that the cost of rebuilding an 11kV line at 33kV could be $50,000 per kilometre, so costs for new grid work could potentially be a major component of any project. The responsibility for upgrades and the associated cost sharing will need to be understood so that the impact on electricity prices can be assessed.

5.9 Reliability of Supply

ETSA Utilities owns 2.4 MW of diesel-powered backup generation that is located at the Kingscote substation. It has been suggested by ETSA that the reliability of electricity supply on the island could be improved by providing and a further 3 MW of diesel generation capacity at Kingscote as additional back up. This would mean that back up generation on the island could match the 5.1 MW peak use on the island even if the mainland link was broken. The provision of an additional 3 MW of remotely controlled generation and modification of the network to facilitate the remote control is estimated by ETSA to cost $4.5 million. The equipment would operate only as backup in the event of power failures, with expected operation for a total of 20 hours annually (8 as back up and 12 for routine monthly operation).

If there is a grid failure between Kingscote and the mainland, the diesel backup generation will be able to maintain supply to the Kingscote area and also to other users still connected to the Kingscote supply. A new bioenergy facility at Timber Creek could also be expected to act in such a role. If the mainland supply is interrupted the bioenergy plant should still be able to generate power and transmit this to Kingscote and linked users. (This assumes that the grid link between Timber Creek and Kingscote does not fail.) Thus the bioenergy plant could be considered as an alternative to provision of an equivalent supply of diesel generation.

6. PROJECT OPTIONS

A number of possible projects have been investigated for this study, based on several scenarios for feed supply now and in the future. These comprise plants of 1 or 2 MWe output at the Timber Creek saw mill, and a larger plant of 5 MWe at an unspecified location. We have not identified sufficient feed to run a 5MWe plant, however this option and its associated costs help show the trade off between larger (and more economical) plants and increased costs for feed supply.

The pricing for plants at Timber Creek is indicative of the price for similar plants elsewhere on the island, provided a similar amount of infrastructure is available.

6.1 Timber Creek Saw Mill

6.1.1 Plant Options

Three options have been considered for the Timber Creek Saw Mill site. These are:

- **Gasification Option A**

Biomass is converted to fuel gas, and then used to fire a gas engine to produce 1 MW of electrical power.

- **Direct Combustion Option A**

Biomass is burned in a conventional boiler, and the heat generated is used to raise steam. The steam is then used to power a steam turbine to produce 1 MW of electrical power.

- **Direct Combustion Option B**

Identical to the option above, excepting a larger plant is assumed which produces 2 MW of electrical power.

The main technical parameters of each option are shown in Table 6-1 below.

Table 6-1 Technical Parameters - Timber Creek Saw Mill

Option	Gasification Option A	Direction Combustion Option A	Direction Combustion Option B
Technology employed	• Gasifiers • Gas engines	• conventional boiler • steam turbine	• conventional boiler • steam turbine
Feed drying assumed	Yes	yes	yes
Construction & Commissioning Period	6 months	12 months	12 months
Plant Output	1 MW	1 MW	2 MW
Annual feed requirement (wet basis)[3]	15,000 tonnes	22,000 tonnes	44,000 tonnes

[3] Note that the two 1 MWe options use different amounts of feed. This is based on typical efficiencies provided by equipment suppliers for each option. For equipment selected, gasification achieves a higher efficiency and thus lower feed use.

6.1.2 Capital Costs

Capital costs are shown in Table 6-2 following for each of the plant options considered.

Table 6-2 Capital Cost Breakdown - Timber Creek Saw Mill

Option	Gasification Option A	Direction Combustion Option A	Direction Combustion Option B
Equipment Costs	$3,090,000	$2,780,000	$3,670,000
Freight, Import Duties & Installation	$ 370,000	$ 290,000	$ 390,000
Civils & Infrastructure	$ 350,000	$ 340,000	$ 470,000
Engineering & Commissioning	$ 580,000	$ 520,000	$ 690,000
Contingency	$ 380,000	$ 340,000	$ 450,000
Total	**$4,770,000**	**$4,270,000**	**$5,670,000**

For each option, no capital allowance has been made for preliminary civil works, office facilities, fire fighting equipment and infrastructure, fencing, or feed storage and handling infrastructure and equipment, as these are assumed to be available on site at no cost. Other costs are based on prices obtained by Enecon from experienced equipment suppliers, together with factored estimates for other areas such as remaining civil works, grid connections and so on. A small contingency is included. Accuracy of all these estimates is not expected to be better than –10%, +25%.

6.1.3 Operation Costs

Annual operational costs for each option are shown in Table 6-3 following.

Table 6-3 Operational Cost Breakdown - Timber Creek Saw Mill

Option	Gasification Option A	Direction Combustion Option A	Direction Combustion Option B
Operational labour	-	$ 70,000	$ 70,000
Maintenance	$140,000	$130,000	$170,000
Consumables	$ 50,000	$ 40,000	$ 60,000
Total	**$190,000**	**$240,000**	**$300,000**

For each option it has been assumed that considerable labour savings are possible by utilising management and operating personnel existing at the Timber Creek Saw Mill site. For the gasification option, this can result in a best case whereby no additional labour resources are required. For the direct combustion options, this could result in the requirement for a boiler operator (as we understand that there are no other steam generating sites on the island), and therefore these skills may need to be employed for the project in addition to the management and plant operation skills existing at the site.

Further discussions will be needed with the saw mill operators to better understand the opportunity for sharing personnel and thus determine actual labour requirements. Note that if additional labour is required for bioenergy plant operation, this could add up to several cents per kWh to the cost of electricity produced.

6.1.4 Financial Analysis Results

Financial analysis was performed on each option to determine their relative economic attractiveness. Wood feed to the plant was assumed to be free of cost for the first 12,000 green tonnes per annum, and costed at $20 per green tonne[4] thereafter. The economic assumptions of the analysis are detailed in Section 5.4.

The electricity sales price required in order to achieve a project IRR of 15% is shown for each option in Table 6-4 below.

Table 6-4 Base Case Financial Analysis - Timber Creek Saw Mill

Option	Gasification Option A	Direction Combustion Option A	Direction Combustion Option B
Electricity Sales Price	12.0 ¢/kWh	14.5 ¢/kWh	11.5 ¢/kWh

6.1.5 Co-generation

At the Timber Creek Saw Mill there is potential for a bioenergy plant to be combined with the generation of steam or hot air for use in kiln drying.

No actual figures are available yet for the energy requirements of kilns at the site. As a guide for steam use in softwood kilns, some 2.5 GJ of steam are used for every cubic metre of wood to be dried. Thus to dry 10,000 m^3 per year will require some 2,500 GJ of steam. Taking boiler efficiencies in to account, approximately 4,000 tonnes of green wood per year would be required to raise steam for kiln drying.

It can be seen from the data above that generating 1 MW or more of electricity uses significantly more wood than would be required for running kilns. If a steam system was put in place to generate electricity, it would be possible to “bleed” steam for kiln drying from a suitably configured steam turbine. Note that this would reduce the amount of electricity that could be generated, so the relative economics of electricity only, or electricity plus kilns would need to be evaluated.

Alternatively, if kilns can be operated on waste heat, either the gasification or combustion option can be reconfigured to send exhaust gases to the kilns. These gases may be blended with air to achieve temperatures suitable for effective and safe kiln drying. Once again, there may be a trade off between energy to kilns and energy to electricity, however it is quite likely that the overall economics for such a project will be more favourable than for either electricity or kilns alone.

6.2 Ballast Head

6.2.1 Plant Options

A separate plant has been considered for the Ballast Head site:

[4] This figure is an estimate only and actual costing would be required to determine the real costs associated with plantation management and residue recovery, transport and use.

- **Gasification Option B**

Biomass is converted to fuel gas, which is then combusted to produce a high temperature exhaust gas stream. The exhaust gas is used to raise steam in a waste heat boiler, which in turn is used to power a steam turbine to produce 5 MW of electrical power. A gasifier is chosen for this duty on the understanding that it may be capable of using a wider variety of feed types than a combustion unit.

The main technical parameters of this option are shown in Table 6-5 following.

Table 6-5 Technical Parameters – Ballast Head

Option	Gasification Option B
Technology employed	• integrated gasifier & combustion unit • waste heat boiler • steam turbine
Feed drying assumed	Yes, using waste heat
Construction & Commissioning Period	12 months
Plant Output	5 MW
Annual feed requirement (wet basis)	100,000 tonnes

6.2.2 Capital Costs

The capital cost breakdown is shown in Table 6-6 following.

Table 6-6 Capital Cost Breakdown – Ballast Head

Option	Gasification Option B
Equipment Costs	$ 7,790,000
Freight, Import Duties & Installation	$ 910,000
Civils & Infrastructure	$ 750,000
Engineering & Commissioning	$ 1,430,000
Contingency	$ 940,000
Total	**$11,820,000**

As was the case for the Timber Creek Saw Mill options, no capital allowance has been made for preliminary civil works, office facilities, fire fighting equipment and infrastructure, fencing, or feed storage and handling infrastructure and equipment, as these are assumed to be available on site.

6.2.3 Operation Costs

The breakdown of annual operational costs is shown in Table 6-7 following.

Table 6-7 Operational Cost Breakdown – Ballast Head

Option	Gasification Option B
Operational Labour	$300,000
Maintenance	$360,000
Consumables	$120,000
Total	**$780,000**

No labour savings due to site sharing have been assumed for the 5 MW plant option, and therefore the operational labour cost shown is for full labour levels. These levels are assumed to be the same as full labour levels for the 1 MW and 2 MW direct combustion plants, as there is not expected to be any additional labour requirement for a plant size increase of this magnitude.

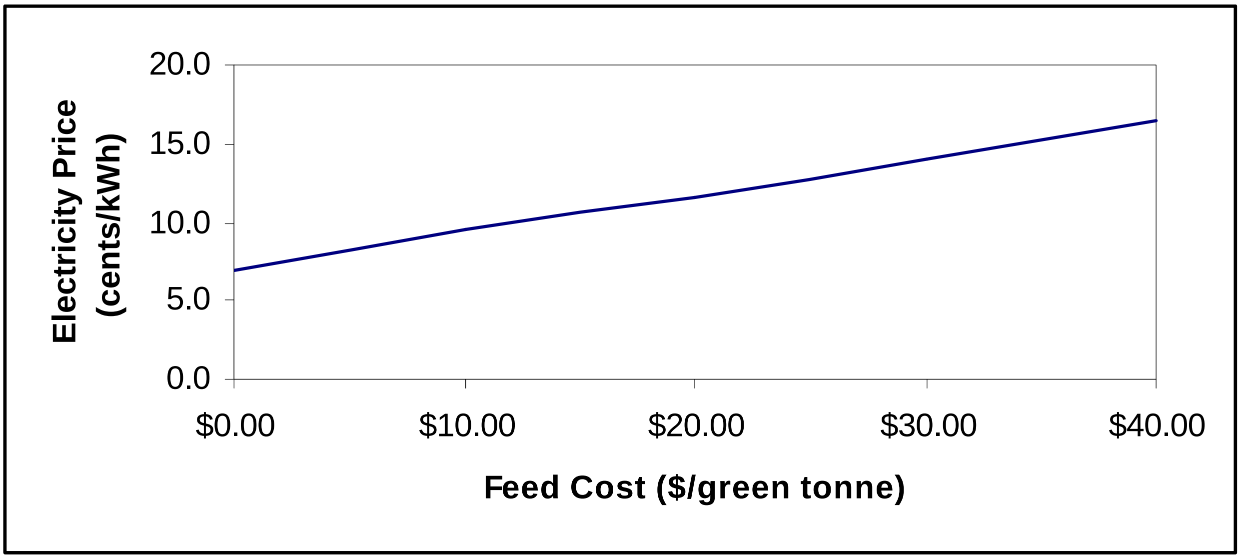
6.2.4 Financial Analysis Results

For the financial analysis of this option, wood feed to the plant was costed at $20 per green tonne for all of the 100,000 tonnes required on an annual basis. The other economic assumptions of the analysis are detailed in Section 5.4.

The electricity sales price required in order to achieve a project IRR of 15% is 11.5 ¢/kWh.

A sensitivity analysis was performed to determine the effect of feed cost on the required electricity sales price. The results of this analysis is shown in Figure 6-1 following.

Figure 6-1 Effect of Feed Cost on Electricity Sales Price



It can be seen that the electricity price is highly sensitive to the cost of feed, ranging from 7 ¢/kWh for a zero feed cost, to 16.5¢/kWh for a feed cost of $40/green tonne.

The economics above are based on full utilisation of the plant, however the current electricity demand on the island does not always reach 5 MW. Unless the demand on the island is increased, the plant would need to export electricity back to the mainland via the sub-sea cable to maintain full utilisation. Lower utilisation than the 800 hours assumed would force up the cost of electricity produced.

6.3 Micro-scale Bioenergy

One of the aspects of the Kangaroo Island grid that contributes to current problems is the diffuse nature of power requirements – individual customers at remote parts of the island are serviced by a distribution system that appears costly to maintain and has limited reliability because most areas are only served by a single line.

It would appear that this has driven many individuals to meet their electricity requirements with combinations of small diesels, wind generators, batteries and solar panels.

Biomass can contribute at this scale, via small steam engines that can drive generators to provide power directly or via batteries. Such steam engines are built in South Australia by the company Strath Steam (http://users.olis.net.au/strathsteam/) and typically supply several kW of energy. The Emu Ridge eucalyptus oil plant already has one such unit installed.

Assessing the viability of such units is somewhat different to the assessment for large plant. In the case of individual steam engines the purchaser may be able to put in time for feed supply (chopping wood) and routine maintenance at no cost. Sustainable wood feed may be available simply by managing a small tree lot on the purchaser's land.

Attachment 1 – Project Brief

The Project Brief presented below was prepared by the Kangaroo Island Development Board to describe the background to this study and the work required. The version provided here was provided to Enecon by KIDB on 17th January 2002

KANGAROO ISLAND DEVELOPMENT BOARD

KANGAROO ISLAND ENERGY AUDIT
PROJECT BRIEF

Background

Kangaroo Island currently has access to around 10MW of power from the mainland grid, fed via the Yankalilla substation through a submarine cable laid direct on the seabed between Fishery Beach on the mainland and Cuttlefish Bay on Dudley Peninsula. At present Kangaroo Island uses approx. 5.1 MW at peak times. The substation does not have the capacity to supply any further power to areas south of this locality, including Kangaroo Island. A back-up capability in times of service failure is available from a 2.4MW diesel generator installed near Kingscote.

The Island suffers frequent (and often lengthy) power outages, causing significant loss of income to business and inconvenience to residents and tourists. The inability of the available power to be effectively distributed around the Island is hampering expansion of existing businesses (eg. the Timber Creek sawmill, expansion of fish processing facilities at Vivonne Bay), and acting as a barrier to new investment. There is currently a heavy reliance on privately owned diesel powered generators, and increasing private utilisation of renewable energy generation for domestic use in remote areas of the Island. Most of the western end of the Island is serviced only by a fully utilised SWER line system, and there are a number of areas where the existing infrastructure is substandard. The cost of connection to the grid on the Island, particularly for users requiring 3 phase supplies, is often prohibitive.

Provision of adequate power distribution infrastructure and electricity supply is critical to the development of Kangaroo Island as a region within South Australia.

Extensive discussions between local agencies, businesses, government agencies and ETSA Utilities over the past two years have identified the following key issues:

- The demand for additional power on the Island remains to be accurately quantified;
- The existing grid network on the Island is subject to frequent failure; and
- The existing grid network fails to distribute adequate and reliable power supply to areas of the Island where it is required for economic development and community service purposes.

Renewable energy options have the potential to provide the Island with the opportunity to develop a degree of self-sufficiency in power generation, and are in keeping with the Island's "clean, green" image as a tourism destination. The Island has the opportunity to assess the commerciality of renewable energy options with the capacity to augment local supply, as an alternative to obtaining additional power from the mainland grid. However, the inadequacy of the on-Island grid network remains a critical issue. An assessment of the relative costs and benefits of upgrading the mainland grid supply, versus expenditure of funds on improvement of the on-Island network, in part to facilitate distribution of locally generated renewable power, is needed.

The purpose of this project is to provide the information required to enable Island and State government agencies to make informed decisions concerning the future possibilities for addressing Kangaroo Island's power demand needs.

Project Objectives

The following objectives have been identified for the project:

- To determine existing power capacity within the Island's electricity network throughout the Island;
- To determine the capacity in the existing on-Island network to inject locally generated power back into the grid;
- To determine the spatial distribution, frequency and timing of current power demand;
- To project future power demand on the Island to 2020 at 5 year intervals;
- To determine an appropriate mix of renewable energy options to meet the Island's power needs, including possible power generation sites and transmission corridors;

To identify what options for local renewable energy generation (including biomass energy generation) on the Island could be commercially viable.
It is intended that the study will provide sufficient information to enable strategic choices to be made as to the size, type and location of electricity generation and distribution infrastructure.

Project Methodology

It is proposed to undertake the study in two stages.

Stage One: Energy Audit

A general audit of power demand on the Island was undertaken by the Infrastructure SA in 2000. This identified an overall requirement of approx. 14MW of additional power for the Island up to 2020 if all of the projects were constructed and utilised power at projected rates. This audit requires verification and augmentation.

- Determine the spatial distribution, frequency and timing [daily, weekly and annually] of existing power demand and available capacity within the Island's electricity network, including provision of maps of existing infrastructure
- Determine the capacity in the existing on-Island network to inject locally generated power into the Kangaroo Island grid
- Determine real power demand projections from all known proposed projects over a 20 year time frame within the framework of a strong policy of favouring energy efficient technology
- Project power demand for known projects at five year intervals to 2020 (ie. 2005, 2010, 2015, 2020), and comment on the capacity of currently available distribution mechanisms to meet the future demands at each five year interval

Stage Two: Renewable Energy Options for Kangaroo Island

Based upon the assessed power demands for the Island, including their geographic location, determine:

- The renewable energy options that will work on Kangaroo Island. This will require preparing broad costings of the key elements of the proposed options (ie. upgrade of transmission corridors, capital expenditure on equipment, maintenance costs etc., as applicable);
- An appropriate mix of the commercially viable renewable energy options to meet the Island's power needs, including power generation sites and transmission corridors

Key issues for any renewable option(s) for the Island will be:

(a) their on-Island location, in terms of proximity to the grid, and
(b) the need for upgrades to the existing on-Island electricity network to enable locally generated power to be distributed around the Island according to demand.

At least the following renewable energy options should be considered for the Island in the course of this study.

Biomass

Various forms of bioenergy development have considerable potential for the Island, largely as a consequence of the existence of the growing plantation forestry industry. Other sources of green waste may include municipal wastes, and wastes produced from roadside vegetation maintenance. Use of these wastes would assist in developing an integrated waste management strategy for the Island, which is in keeping with Kangaroo Island Council policy. However, it is not expected that the volumes of these wastes will be high given the size of the Island and its population.

A preliminary biomass study for the Island has recently been commissioned by the KI Development Board and KI Regional Plantation Committee. This will provide an indication of the total available residues, and identify commercially viable options for biomass energy development on the Island.

Wind Power

It has been suggested that the identified power demand for the Island (14MW) is insufficient to justify the development of a commercial wind farm on the Island. it has been suggested that a minimum of 30MW would be required for this purpose. Both the identified power demand and assessment of the minimum commercial size for an Island wind farm require verification.

A New South Wales based company, Neo Energy, has been undertaking wind readings on a number of properties around the Island over the past 12 months. These have so far identified that the wind speed in the areas measured are reasonable, but not consistent. However, it is likely that there are only highly localised areas on the Island where power can be provided by wind alone [with back up storage technologies]. Its most effective use would be within a hybrid system, and/or servicing properties where it is uneconomic to connect to the mains grid. The highest wind energy sites are likely to be on the western end of the Island, which is largely covered by protected areas, and is remote from the grid.

Solar Power

Solar power is used successfully on residential properties on the Island, and by the Seal Bay Conservation Park visitor centre. The Island experiences lengthy periods with heavy cloud cover (on occasion up to 10 consecutive days). Total reliance upon solar power would be problematic. However, once again, solar has considerable potential within a hybrid system, and/or to service properties where it is uneconomic to connect to the mains grid.

Wave Power

This option for power generation on the Island is largely unexplored at this point but it thought to have significant potential, particularly for the western end and southern side of the Island. Preliminary inquiries made by the KIDB indicate that the preferred location for a wave power generator would be on the south or south west coast of the Island. The location would require a minimum of 4m water depth, preferably at the edge of a cliff, and the tidal range should not exceed 6m. Road access to the generator would be required, and it would need to be located reasonably close to the grid. These requirements indicate there are a number of hurdles to be cleared, including:

- identification of an area with appropriate tidal range (allowing for storm surges);
- community and tourism operator concerns about impacts on scenic coastal amenity of the development;
- much of the south-west and all of the west coast of the Island is covered by protected areas, which would present significant problems for development;
- the absence of road access in many of these areas;
- the distance from the grid in these areas.

The option of wave generated power should nevertheless be investigated.

STAKEHOLDER CONSULTATION AND SITE INSPECTIONS

The consultant will be expected to consult with relevant stakeholders during the course of the project, including representatives of:

- Local agencies (Kangaroo Island Development Board, Kangaroo Island Council, Kangaroo Island Regional Plantation Committee, Agriculture KI);
- Representatives of the forestry and agricultural industries;
- Kangaroo Island businesses;
- State government agencies (Infrastructure SA, Energy SA, PIRSA, Forestry SA, Planning SA), and ETSA Utilities in the course of conducting the study.

It is expected that the successful consultant will visit the Island at least once while undertaking the study, and incorporate inspections of prospective renewable energy generation sites within these visits.

PROJECT SPONSORS

The project is being funded by the Kangaroo Island Development Board and SENRAC (State Energy Research Advisory Committee).

Kangaroo Island Development Board

The KIDB is a community-controlled body, funded and supported by the South Australian government through the Department of Industry and Trade. The Board has a charter of facilitating economic development on the Island, and has identified infrastructure development as a strategic priority.

ACCOUNTABILITY

The consultant will be accountable to the Kangaroo Island Development Board for completion of the study
On a day to day basis, contact person for the study will be David Furniss (Chief Executive Officer, Kangaroo Island Development Board).

TIMEFRAMES & PRESENTATION

The consultant will be expected to produce a final draft report to the KI Development Board for Stage One no later than (date TBA) 2002, and for Stage Two no later than (date TBA) 2002. Both reports will need to be presented in both hard copy and electronic (Microsoft Word 97 or above) formats.

It is expected that the consultant(s) will visit the Island to present the outcomes of the study to Island agencies and interested members of the community upon completion of the project.

CONTACT DETAILS

David Furniss, Chief Executive Officer, Kangaroo Island Development Board – 08 8553 3211

TENDER SUBMISSION DETAILS

Tenders should be submitted by post to ‘KI Energy Audit Tenders’, PO Box 471, KINGSCOTE, S.A. 5223 and received no later than **5pm, (date TBA), 2002**. Late tenders will not be accepted.

Attachment 2 - ITINERARY FOR COL STUCLEY, ENECON PTY LTD
KI BIOMASS STUDY

18-20 February 2002

Monday 18 February

5.45pm	Depart Adelaide AN8687 (Kendell Airlines)
6.20pm	Arrive Kingscote Airport Collected from airport (David Furniss)
6.40pm	Arrive Ozone Seafront Hotel
7.00pm	Meet with David Furniss & Anthea Howard re confirmation of project objectives etc.
7.30pm	Dinner with KI RPC members
O/night	Ozone Seafront Hotel

Tuesday 19 February

9.00am	Targeted Workshop *(see detailed program below)* Ozone Seafront Hotel Function Room
10.30am	Break for Tea/Coffee
10.45am	Targeted Workshop continues
12.15pm	Break for Lunch
2.00pm	Timber Creek and Eucalyptus Distillery Tour *(see detailed program below)*
5.15pm	Return to Kingscote
5.30pm	Interview with Rob Ellson, Managing Editor, *The Islander*
7.30pm	Public Bioenergy Seminar Ozone Seafront Hotel Function Room *(see detailed program below)*
9.30pm	Conclude Seminar
O/night	Ozone Seafront Hotel

Wednesday 20 February

8.30am	Meeting with Greg Sharp (WRF Securities Ltd) – Ozone Hotel
10.00am	Depart Kingscote for airport (with David Furniss)
10.45am	Depart Kingscote Airport AN8684 (Kendell Airlines)
11.15am	Arrive Adelaide Airport
11.45am	Arrive Adelaide
Lunch	
1.00pm	Meet with ETSA Utilities and Department of Industry and Trade Reps – DIT Offices, Terrace Towers, 178 North Terrace, Adelaide
3.00pm	Meeting concludes

TUESDAY 19 FEBRUARY

TARGETED WORKSHOP PROGRAM

Invitees:
David Furniss - KIDB
Jeanette Gellard – KIDB
Anthea Howard – KI RPC
Malcolm Boxall – KI RPC
Leith Davis – ForestrySA
Roger Pfitzner – ForestrySA
Martyn England – PIRSA Rural Solutions (Farm Forestry)
Phill Hyder-Griffiths – Australian Growth Ltd
Jim Witham – Treecorp
Mike Thomas - Treecorp
Greg Sharp – WRF Securities Ltd
Brendan Jenkin – WRF Forestry Ltd
Grant Jackson - Riverleas
Quinton Mitchell – KI Council
Other KI Council rep (Jeff Grinnell or Bob Rattray)
Agriculture KI rep (Kim Blenkiron)
KISCB rep (Helen Richards)
KINRB rep (Helen Richards)
Lyn Dohle – PIRSA Rural Solutions (Land Management - KI)

9.00am **Current Options**

The intention of this session is to explore the "options and hurdles (technical and commercial) to a successful biomass energy project" on KI in the 'here and now'.

- current demand and supply
- future demand and supply
- biomass supply (available green wastes and access to these)
- bioenergy technologies
  - equipment costs
  - feed processing and the influences of differing feed materials
  - plant size versus technology
  - electricity costs versus plant size and running time
  - synergies with cogeneration and co-production
- optimisation issues
- opportunities and costs associated with phased development

10.30am **Break for tea & coffee**

10.45am **Continue 'Current Options'**

11.15am **Future Opportunities**

The intention of this session is to explore possible future commercial opportunities that could be associated with biomass energy generation, particularly opportunities that also have beneficial outcomes for natural resource management.

- Possible tree planting options for salinity mitigation and energy production – synergies with NRM planning and commercial forestry development

- Co-products (eg. oil, carbon)
- Opportunities and costs associated with phased development

12.15pm Conclude Workshop

6.3.1.1 AFTERNOON TOUR

2.00pm Depart Kingscote
Drive to Timber Creek

2.30pm Arrive Timber Creek for inspection and discussion

3.15pm Depart Timber Creek
Drive to Emu Ridge Eucalyptus Distillery

3.55pm Arrive Eucalyptus Distillery for tour and inspection

4.45pm Depart Emu Ridge
Drive to Kingscote

5.15pm Arrive Kingscote

EVENING PUBLIC SEMINAR

7.30pm Electricity demand and supply issues for KI – David Furniss
KI Biomass Study – Anthea Howard
What is bioenergy? – Col Stucley
Options for KI – Col Stucley

9.30pm Conclude
(can go a bit longer if there are lots of questions or good discussion etc).