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Briagolong Solar Power Station

Business Plan – Report

Prepared By
Energy Strategies
in association with Punchline Energy Pty Ltd

January 2003

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This report has been prepared for the Wellington Shire Council.

ABBREVIATIONS

AGO	Australian Greenhouse Office
BSPS	Briagolong Solar Power Station
IPCC	Intergovernmental Panel on Climate Change
NGGI	National Greenhouse Gas Inventory
REC	Renewable Energy Certificates
GPR	Green Power Rights
CH_4	Methane
CO_2	Carbon Dioxide
N_2O	Nitrous Oxide

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Executive Summary

The viability of a renewable energy power station sited near the town of Briagolong, East Gippsland, Victoria, has been analysed to further a feasibility study undertaken by others. The scale of the proposal is targeted at an average of 2,000 kWh/day alternating current output with wind, solar thermal and solar photovoltaics and the three main contenders.

The most likely system is the use of photovoltaic technology in one of four possible formats: fixed array, fixed array with seasonal tilt modification, single axis sun tracking and double axis sun tracking. Each of the alternatives has merit and the cost-preferred system is sensitive to projections of the maintenance of the tracking mechanisms which have given trouble in smaller installations in the past. Should that be the financially preferred technology, the risk involved in the tracker maintenance may be off-set by the use of a supply and maintain contract for their provision.

The technology is expensive and requires substantial government subsidy to make the project reasonably competitive with conventional grid reticulated electricity. The financial structure is enhanced by partnership with an electricity retailer such that the power can be effectively sold to the participants at retail prices of 16.75 cents per kWh plus another 4.0 cents per kWh for associated Renewable Energy Certificates and another 0.5 cents per kWh for associated Green Power Rights – a total of 21.25 cents per kWh. By comparison, TXU's Green Earth Plus is sold at a 5.63 premium over the standard domestic rate of 16.75 cents per kWh for a total of 22.38 cents per kWh (marginal) and an average of 25.21 cents per kWh for the average residential consumer. Creating such a partnership, however, seems problematic.

A community based co-operative structure seems the one most likely to garner the full support of the townsfolk and access the large sums of government financial backing to make the project a reality.

There are many risks confronting the proponents although none of them appears to be prohibitive: Sovereign Risk, Technology Risk, Climatic Risk, Enterprise Risk, Financial Risk and Social Risk. For this project both the Climate Risk and the Sovereign Risk are somewhat larger than for most on-shore projects but these are still manageable.

Firming up of potential government support is recommended as the next step for the proponents as, without it, the project will be extremely financially challenging – although still possible with sufficiently strong community support.

1. Introduction

Energy Strategies has been asked to produce a coherent but adaptable Business Plan for the new and innovative entity to implement the Briagolong Solar Power Station in collaboration with the Wellington Shire Council. The requirements of this Business Plan, including the target audience of current and potential stakeholders, and the available information and data, have been considered in the drafting of this document. The Power Station is to meet the community's aspiration for local development and the provision of a local supply of Green Power.

Energy Strategies has extracted information, where reliable and adequately detailed, from the feasibility study prepared by Pivotal[1], which contains much generalised information for remote area applications which is of limited use in the intrinsically grid-connected proposal for a solar farm. This information forms the basis of the (1) Enterprise Profile and is supplemented by a thorough (2) Market Analysis which builds largely on Energy Strategies' expert knowledge of the sustainable energy market and the extensive database of sustainable energy technologies and services developed in-house. The market analysis necessarily includes the technical refinement of the feasibility study's quite crude projections of Station output by application of detailed solar irradiation data[2] and the most relevant of the solar system simulation tools available today for the Australian context[3]. Together, these two sections establish the environment in which the Briagolong Solar Power Station will operate.

Drawing on all the information developed in the first two areas of work and pooling the expert technical, market, financial and business knowledge of the Energy Strategies team, we will develop a (3) Business Strategy reflecting the innovative and potentially evolving nature of the Briagolong Solar Power Station. We propose that the plan will provide a viable generic roadmap for the Station for the next seven years. Its design will allow flexibility for updating as work advances and new commercialisation opportunities arise from replication of the Briagolong Solar Power Station in similar environments throughout Victoria and further afield.

Following on from this we will develop a (4) Financial Plan and undertake a (5) Risk Analysis, thus highlighting core details of the Briagolong Solar Power Station operations. A capstone component of the Business Plan will be the (6) Investment Matters, which will be investigated and presented in a manner that allows to us exploit various partnership and joint venture opportunities for the advancement of the Briagolong Solar Power Station and its subsequent replications.

A collection of relevant support information is presented in Appendices.

2. Enterprise Profile

2.1. Feasibility Study Summary

The "Feasibility study of alternative power solutions for the Briagolong community – Final Report" prepared by Pivotal Management Consultants in conjunction with Strategic Alignment Consultants" was used as one of the directional documents for the development of the Business Plan. The report summarises stakeholders, methodology, objectives, local conditions and preferred technology and capacity leading to potential financial models.

In essence we agree with the content of the report and the recommendations in Section 8 of the study. There are, however, some flaws in the modeling that have been addressed in the Business Plan. The three most significant matters that make the Business Plan vary from the Feasibility Study are

1) Underestimation of the capital cost. The fixed array option will cost A$1.4M more than indicated in the Feasibility Study.

2) Overestimation of the daily generation from the 360kW array. The system will generate 57% of that shown in the Feasibility Study.

3) Omission of depreciation costs in the financial analysis with these being potentially the largest single recurring cost component.

In spite of the errors, we agree that the retail pass through option is the most viable of all provided it can be negotiated with a retailer with a presence in the area.

2.2. Solar Output Prediction Software

2.2.1. System Performance Calculations

The system simulation utilises the proprietary software "Nsol" developed by Orion Energy Corporation.

The program has worldwide popularity as a simple tool for analysing a variety of system types, with flexibility on entering appropriate data and varying parameters such as array tilt and azimuth (orientation). The software version is that supplied by BP Solar to its distribution network. A copy of this software has been supplied to Punchline Energy by BP Solar.

The program utilises monthly global horizontal solar insolation, temperature data, solar module data, simple inverter data, ground reflectance and proprietary algorithms.

The prediction of hourly performance for a "typical clear day" is calculated from daily data, time of day and sun angles. It does not allow for cloudiness for calculating these hourly values.

2.2.2. System Parameters

Solar module type: BP2150 150W monocrystalline silicon cells.

Inverter: Generic inverter with 92% DC to AC conversion efficiency.

Ground reflectance: Varying from 0.2 in winter to 0.3 in summer (this coincides with flat land which is pasture or where the soil is "dirt" with scattered rocks through it). Higher values were tested for evaluation of enhancement potential.

System Losses: 10 percent allowed for solar module mismatch and dust accretion. Whilst this is a relatively conservative approach, other factors such as DC cable losses, AC transmission line losses and solar module degradation are also included in the 10%.

2.3. Climate Data Applied

2.3.1. Solar Irradiation

Global solar exposure data for Briagolong was extracted from the Bureau of Meteorology's Australian Solar Radiation Data CD (product reference NCCSOL version. 2.209). It is satellite derived data from the processing of Japanese Geostationary Meteorological Satellite (GMS) imagery. The resolution of this data is between 6 km x 6 km and 24 km x 24 km per pixel and the data is derived for the location for the enclosing pixel with no interpolation. The co-ordinates used to derive data for Briagolong were 37°47'S 147°6'E. Available data was collected between 1990 and 1994 as well as between 1997 and 2001.

While this data is more geographically accurate for the site, it does not offer any interpretation in terms of irradiation of engineered surfaces such as we are intending. Accordingly, Figure 1 shows the irradiation climate of the nearest available site in the "Australian Solar Radiation Data Handbook" (Lee et al, 1995).

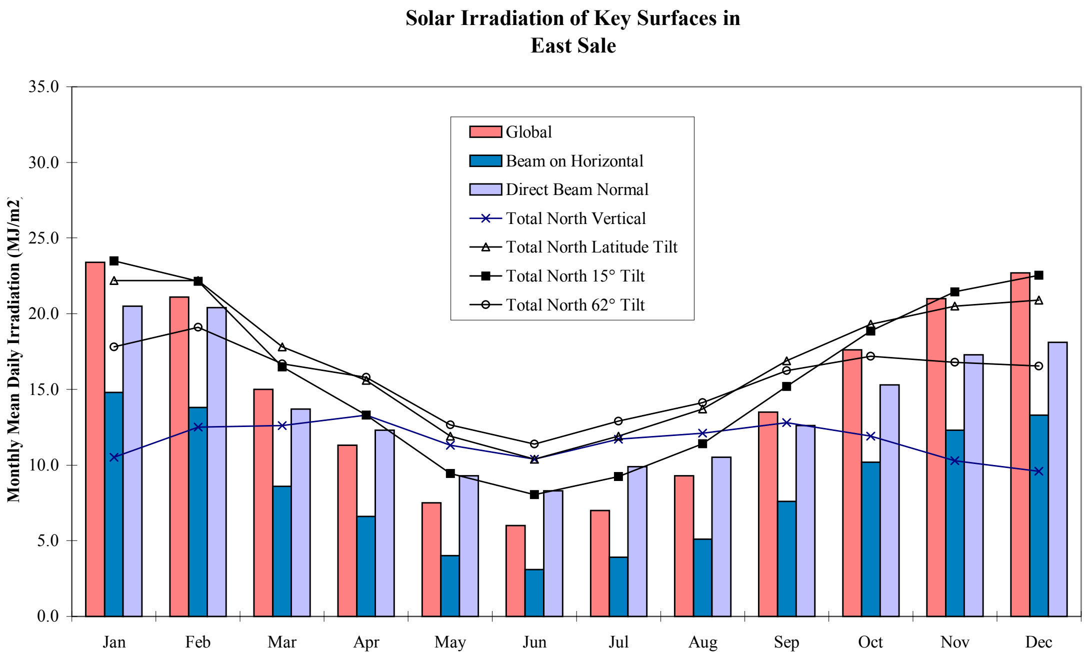


Figure 1 Solar Irradiation on Key Surfaces for East Sale after Lee et al, 1995

Local knowledge suggests that insolation at Briagolong substantially exceeds that at East Sale due to several anecdotally reported micro-climatic factors outlined by Renewable Research Australia Pty Ltd (RRA)[4]. This observation has been tested by comparing the satellite data for the two locations which has shown that while such an effect is evident from April to October that the reverse is true for the other months and that there is virtually no difference for the year overall as is shown in Figure 1.

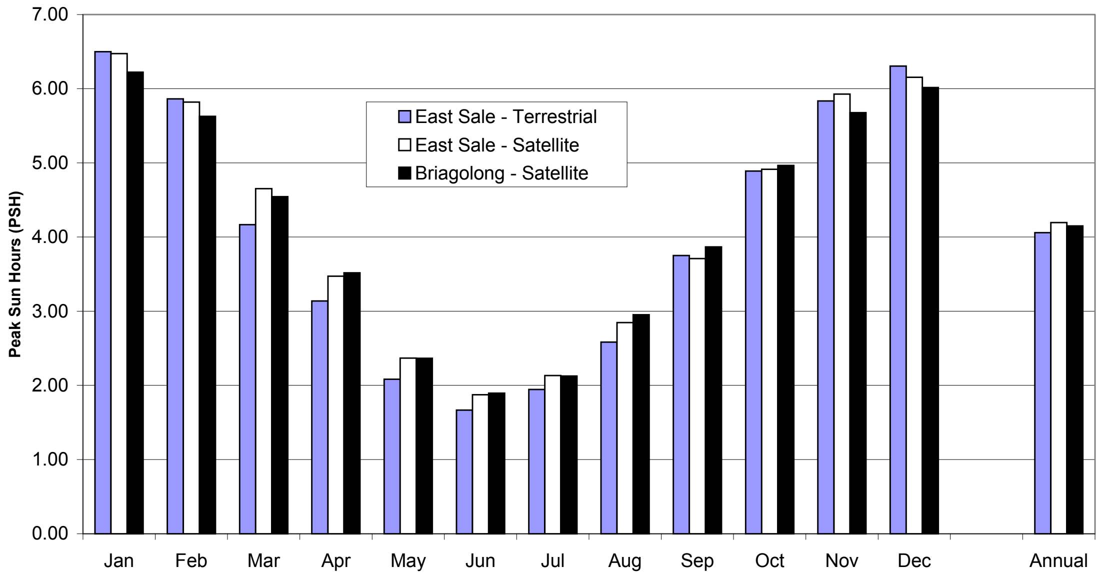


Figure 2 Daily Global Solar Irradiation Data for East Sale and Briagolong

The above chart shows the difference in calculated daily peak sun hours (PSH) between satellite derived data for both East Sale and Briagolong, as well as terrestrial data (ie, data measured on the ground by the Bureau of Meteorology) for East Sale. The PSH derived from the satellite data was obtained by converting all available satellite derived daily global exposure data into kWh/m^2 and then assuming that peak solar radiation is 1 kW/m^2. The available satellite derived data included the years 1991 to 1994 and 1997 to 2001, although there was a substantial amount of missing data. PSHs were calculated for each day for which global exposure data was available and the average PSHs per day for each month were calculated.

As a significant amount of data was missing from the satellite derived global exposure data, the calculated PSHs were compared to PSHs derived from East Sale terrestrial solar radiation data which is the most accurate available in the vicinity of Briagolong. Terrestrial data was obtained from AUSOLRAD, which is a simplified electronic version of the Australian Solar Radiation Data Handbook (ASRDH). When all three sets of data are compared in the above chart, there appears to be little difference in the calculated average PSHs per day for each month. Although intrinsically less accurate than terrestrial measurement, this confirms the reliability of the satellite data and hence the data for Briagolong itself was used in the system performance prediction software.

2.3.2. Temperature

Monthly mean data for Orbost (the nearest centre) from Szokolay, (1988) were used in determining the seasonal efficiency of the solar cells which are moderately temperature dependent (more efficient when cold).

2.3.3. Wind

Wind data was also obtained from the Bureau of Meteorology. As no data is available for Briagolong, data from Maffra and East Sale was obtained. Both sets of data included daily and monthly data. Daily data consisted of wind speed and measurements of wind speed at 9am and 3pm daily, while monthly data consisted of mean monthly wind speed and mean monthly wind speed at 9am and 3pm. Both sets included data between 1965 and 1975 however there was a substantial amount of missing data for Maffra.

2.4. Solar Output Prediction

Solar output of a fixed array is approximately sinusoidal for a fixed array, peaking at solar noon on the average day as shown in Figure 3. Tracking arrays plotted on the same graph provide a much more consistent output over the day and deliver more at times of peak consumption and therefore at marginally higher average prices. This price effect has not been quantified in the current cash flow projections. Actual output will be much more variable due to the transients of clouds and, to a much lesser extent, temperature and wind (which together affect the array temperature and thus its instantaneous efficiency.

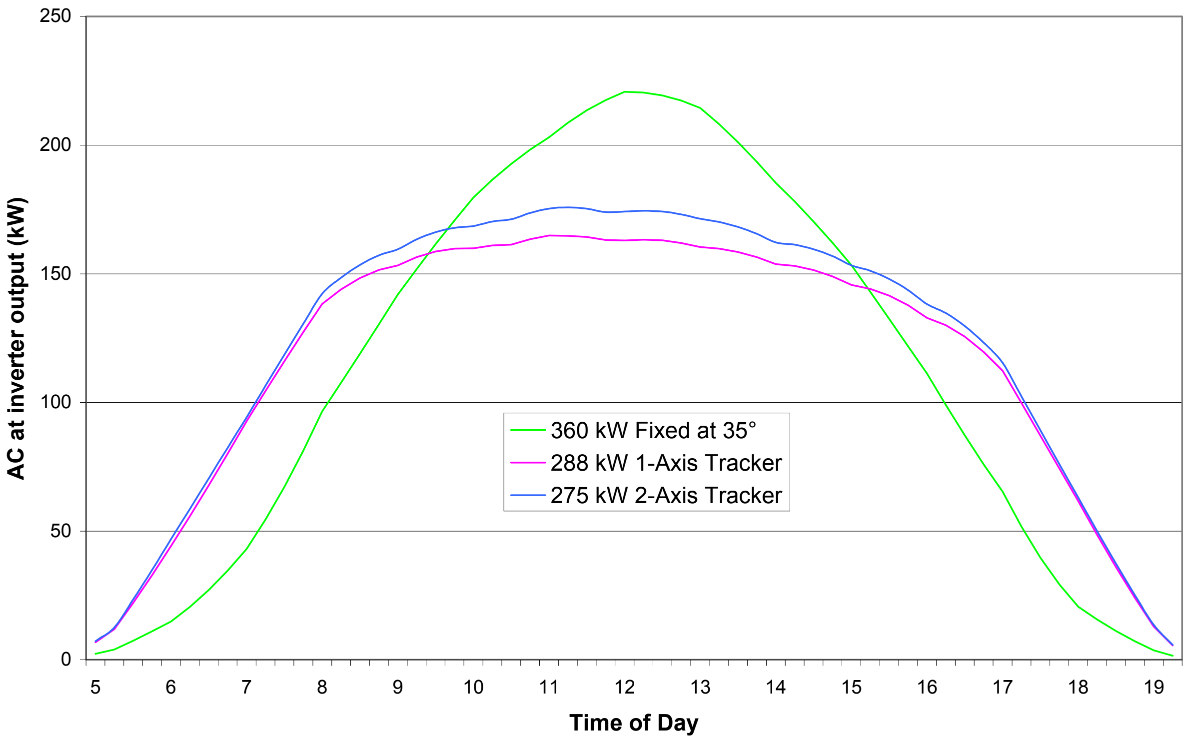


Figure 3 Hourly output for each array option for an Average day in January

It appears that adjusting the tilt each month results in a 5% gain over the optimum fixed tilt of 35 degrees.

Also shown is the data for one and two axis tracking. Here the gains are 26% and 30 % respectively over the fixed 35 degree tilt.

The baseline we have used for the project is a module DC output of 360kW (peak). The Met Bureau data for the Briagolong region indicates an average around 4.6 PSH/day plus ground reflectance effects. Cell temperature, module mismatch, dust and cable losses, inverter efficiency etc. all reduce the output of the system.[5]

2.5. Wind Output Prediction

Wind data for the site is poor for energy output prediction purposes, being only the standard meteorological readings for speed and direction at 9:00 am and 3:00 pm and the long term arithmetic average speed derived from those twice daily values. Wind power varies with the cube of the speed so an arithmetic mean is misleading even if the twice daily readings are indicative of the 24 hour wind speed pattern. Most of the energy will be delivered by the short periods of higher speed. Also, wind speed increases with height above the ground and a commercial scale wind turbine is mounted far higher than the standard WMO anemometer (10 metres) or common homestead scale wind generators.

Despite this data limitation, a technique has been developed for estimating energy outcomes from that data based on a wind speed height correction formula and a speed frequency distribution pattern called a Weibull curve whose "shape parameters" can be estimated from knowledge of the local topography (Berrill, 2002).

From the available data, however, (and the anecdotal report of a poorly performing homestead scale wind generator in the area) it can be said that the site rates as "poor to fair" as wind farm sites go (annual mean wind speeds of 6 m/sec are considered "good"). Even so, some firming up of the wind energy capability of the site is recommended due to the very large cost advantage that wind generators on "good" sites have over photovoltaics at the present time.

2.6. Solar Power Station Costs

2.6.1. Capital Costs

Current estimates of cost are set out in this report at Appendix 2 Solar Power Station Costs.

The costs are based on budgetary quotes for large systems from the various companies contacted. Punchline Energy's experience includes quoting on large grid connected systems and confirms that the pricing is based upon a large project, not retail nor wholesale pricing. There are many other costs built into an installed system price, such as all the civil works, project management, installation, manuals, acceptance tests etc. in addition to the costs of the components.

The estimates were prepared on the basis of providing complete systems up to and including the inverters and a shelter for them. It is assumed that the local authority will provide transmission line connection to the grid. Other key assumptions and inclusions are:

- Module efficiency is about 12.7% therefore 0.127kW/m² is the theoretical peak module output

- "Other" includes contingency for currency fluctuations
  provision for warranty expense on imported items
  general contingency for unforeseen site etc problems

The systems costed are based on matching the output to that of 360 kW of fixed photovoltaic modules but is evaluated on the basis of the system's predicted maximum output allowing for unavoidable losses described in 2.2.2 System Parameters. Thus the options are:

- 360 kW fixed array at 35 degrees

- 337 kW with tilt adjustment from 10 to 55 degrees

- 288 kW single axis tracking

- 275 kW two axis tracking

Tracking systems have a disadvantage in their space requirements if inter-array shading is to be completely avoided both early and late in the day. To achieve this goal, initial estimates show the following land requirements.

- 360 kW fixed 9,750 m²

- 337 kW with tilt adjustment 11,400 m²

- 288 kW single axis tracking 11,700 m²

- 275 kW two axis tracking 25,000 m²

All are expected to fit comfortably within the proposed 2.8 Ha (28,000 m²) site, but not all will do so allowing a good "stone's throw" clearance within the security fence. As land is apparently available at a low cost relative to the other resources included in the project, it would appear prudent to seek out a larger area (for, say, an extra $7,500) if the 2-axis trackers are to be adopted.

For comparison purposes, a costing is also set out for a system delivering an annual average of 2 MWh/day for distribution to participants and to the grid for sale. Between these two sizes there is not much economy of scale to be reaped so the cost of the larger system is nearly proportional to the increase in size.

2.6.2. Operational Costs

The operational costs have been provided by BP Solar, based upon their international experience. The costs indicate, as expected, that tracking systems will be more expensive to maintain, due to moving parts etc. It is possible that some maintenance, such as array cleaning (and tilt adjustment if that is adopted) and land maintenance, can be carried out by the community. However there are some functions that require skilled, experienced practitioners, such as inverter inspection and maintenance.

3. Market Analysis

3.1. Energy in Australia

Australia has very large reserves of coal and relatively large reserves of natural gas, but only modest reserves of crude oil, which are not sufficient to supply all Australian needs for crude oil. Coal, mainly used for electricity generation, provides 42% of total primary energy consumed, petroleum 34% and natural gas 18%. Renewable energy sources, including fuel wood, bagasse and hydro-electricity, provide almost all the remainder. The contributions of direct solar energy and wind are currently very small. Just under 80% of electricity used in Australia is generated from coal, while just over 10% is generated from natural gas and 8% from hydro. Petroleum products and other renewables account for the remainder (about 3%).

Australia's current total annual primary energy consumption is around 5,000 PJ and consumption grew at about 3% per annum for most of the 1990s. Trends in primary energy consumption by fuel over the past 10 years are shown in Figure 2.

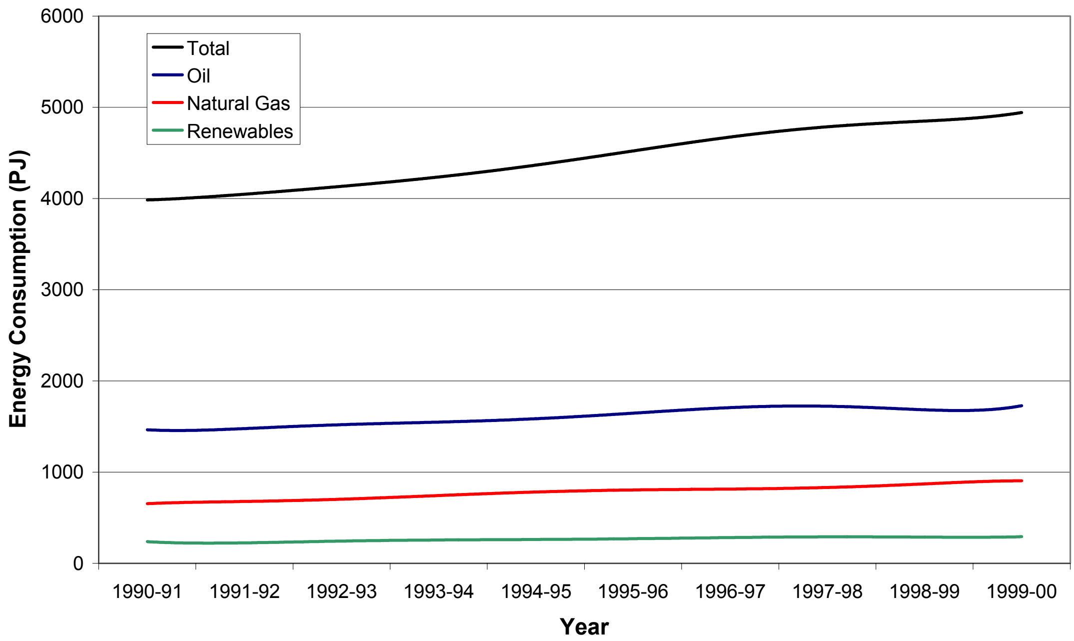


Figure 4 Trends in Australia's primary energy consumption by fuel[6]

3.2. Renewable Energy in Australia

In Australia, renewable energies currently account for under 7% of Australia's primary energy demand and supply just over 10% of Australia's electricity supply. The technologies contributing to this include hydro (21%), solar (1%), wood (39%), and bagasse (39%)[7].

Biomass and wind energy are both currently experiencing large growth as a direct result of Australia's renewable energy legislation (see section 2.2.3). Cumulatively, over 1 GW_e of generation capacity is being considered, detail-planned or constructed[8]. Likewise solar energy is expected to experience a steady growth, particularly solar hot water and PV technologies due to government grant schemes. This is further discussed in section 2.2.3.

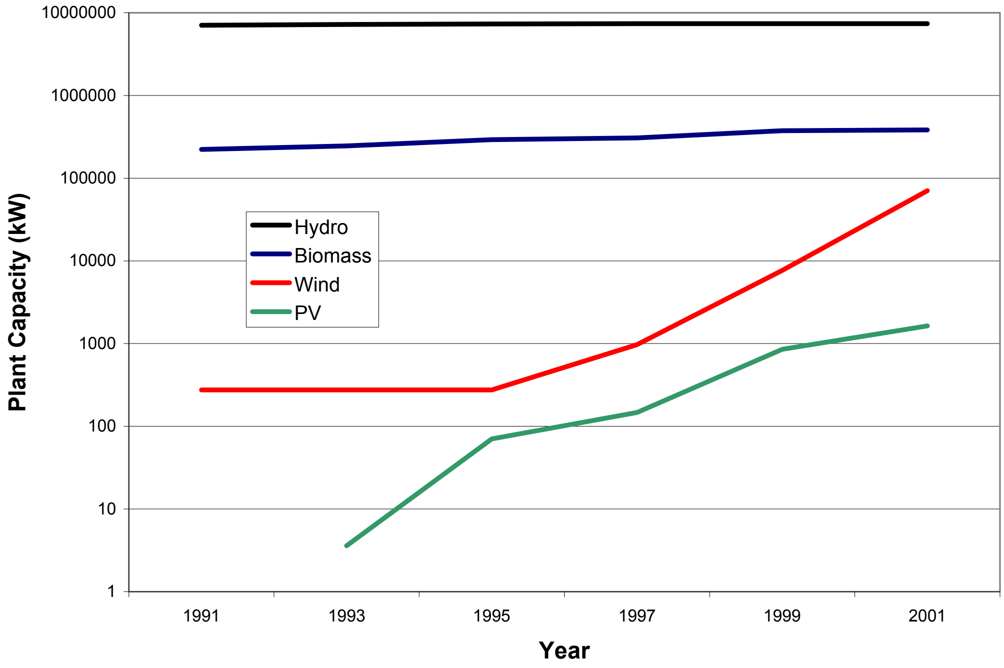


Figure 5 Australia's renewable energy capacity growth

3.3. Government Support Programs

Australia's renewable energy market growth is strongly driven by energy and environment policies. Three programs are of key importance. These programs are:

- Renewable Energy Action Agenda[9];
- Mandatory Renewable Energy Target[10]; and
- Various renewable energy technology commercialisation / promotion / subsidy programs[11].

Less relevantly for this project but still of some pertinence in considering the scope for replication of the Briagolong initiative, there are support and cooperation programs in place for export opportunities in renewable energy technologies. The most notable ones are:

- Renewable Energy Exporters Network;
- Export Markets Development Grants[12];
- US-Australian Climate Action Partnership; and

- Asia-Pacific Economic Cooperation Program[13].

Similarly, many other regions throughout the world also have government support programs which will help to increase the growth of renewable energies. For example, the European Union has a mandatory renewable energy target, details of which can be found at http://europa.eu.int/scadplus/leg/en/lvb/l27035.htm), and many Asian countries have policies and programs in place (see www.aseanenergy.org). Descriptions of many other programs and policies can be obtained from the EIA's (Energy Information Administration) International Energy Outlook 2002.

3.4. Solar Photovoltaic Markets

3.4.1. World

Between 1985 and 2001, the annual solar PV module shipment has increased steadily from 17 MW_p to just over 400 MW_p, as shown in Figure 6 which gives this data from 1993 to 2001[14]. The annual growth rates in said period have been steadily increasing from 13% to 42%. Some 60% of all PV modules manufactured to date (close to ? GW_p) are used in small off-grid applications. The average capacity of grid-connect PV systems is between 2-3 kW_p. Japan and the USA have the largest capacity of PV systems installed as shown in Figure 6, while Switzerland, Japan, and Australia have the highest per-capita installation of PV systems, as shown in Figure 8. Strategies Unlimited[15] forecasts the annual world PV shipments to reach 2 GW_p in the year 2010, which equates to an annual market growth of about 23%.

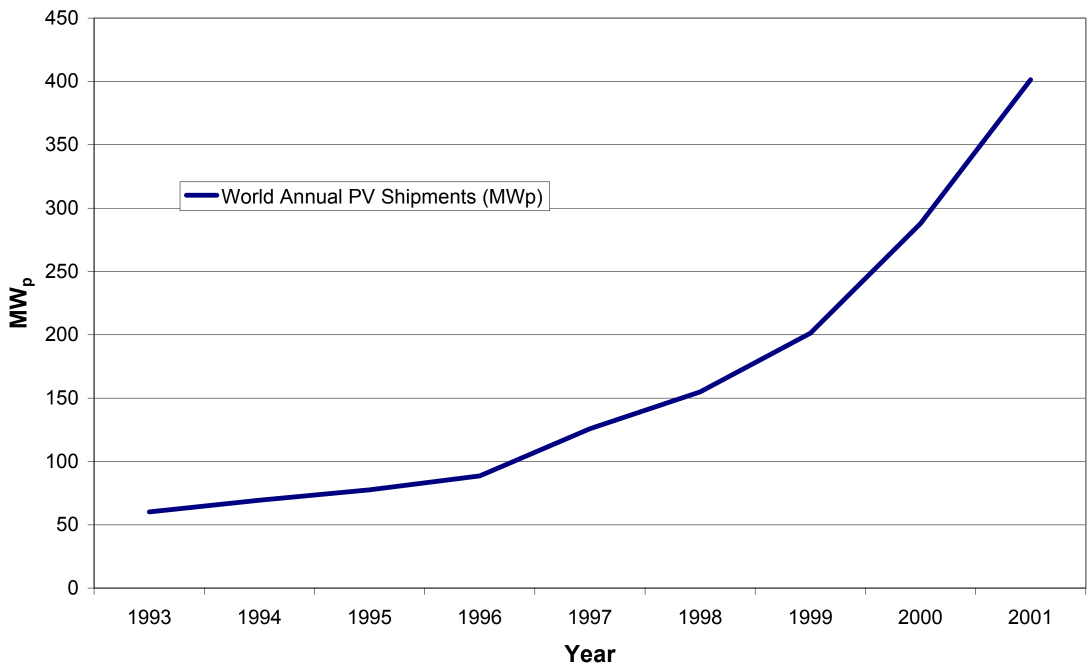


Figure 6 World annual PV module shipments

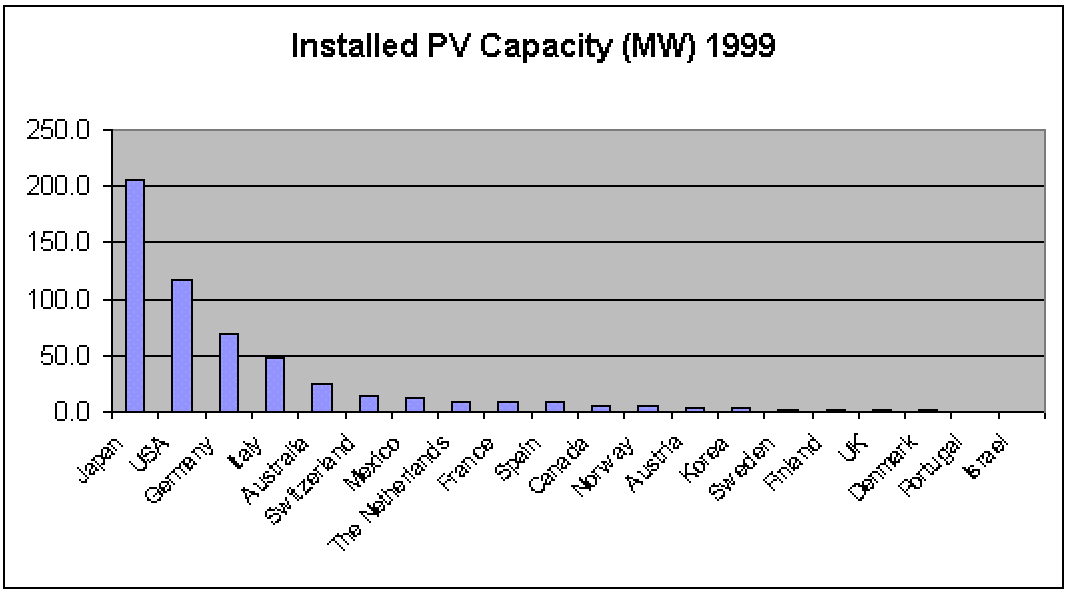


Figure 7 Installed total PV capacity (1999)[16]

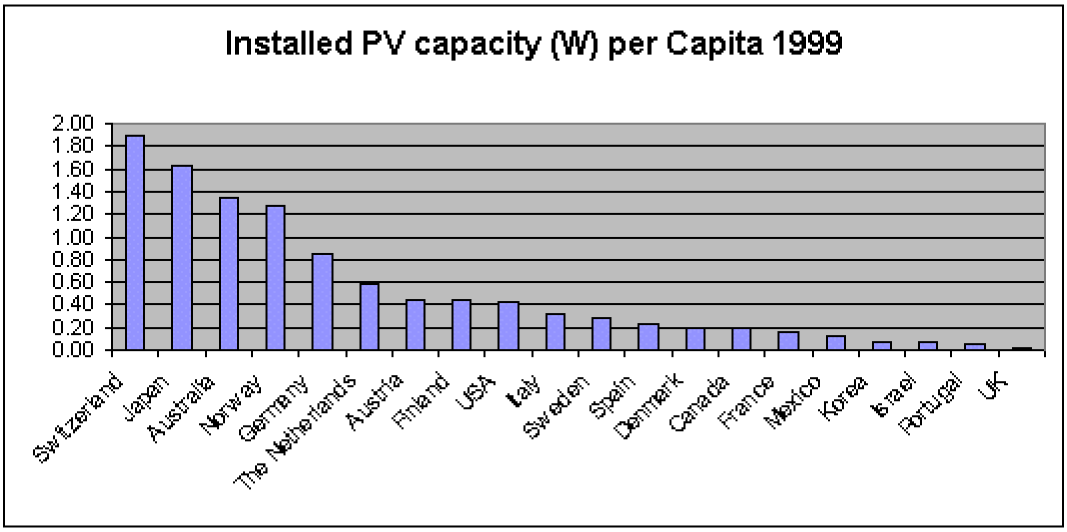


Figure 8 Installed per-capita PV capacity (1999)[17]

3.4.2. Australia

As of 2000, Australia had a cumulative installed PV capacity of about 22 MW_p. Two thirds of this was installed in remote locations, 25% in off-grid locations, and 10% was used for water pumping[18]. The Australian market absorbs annually between 2-3 MW_p of the local manufacturing capability (currently BP Solar only).

As a result of legislation, rebate programs, increased community awareness and improved marketing, PV system installations are experiencing strong growth.

Over the past 15 years, the cost of solar electricity using conventional flat-plate PV technology has reduced by an average of 4% per annum[19], primarily as a result of technology advancements and production volume increases. There is at present only one PV cell manufacturer in Australia (BP Solar). A fully-installed, grid-connected PV system in the range of 1-20 kW_p costs approximately \$ 8.5-14 per W_p which also is influenced by location and site conditions. Without any financial incentives, such systems would generate an RoI of approximately 1.5-2% (city) and 6-12% (remote area) respectively.

Concentrator PV technology is emerging worldwide, with Solar Systems Pty. Ltd.[20] (Melbourne) and Amonix[21] Pty. Ltd. (Torrens, CA) being the most serious competitors to the ANU's Combined Heat and Power System (CHAPS) technology. Ordered in the range of 200 kW_p or bigger, their prototype systems are currently being offered for approximately \$ 8.5-12 per W_p. Given that such systems operate with improved system efficiency when compared with flat-plate PV technology, a potential cost advantage over flat-plate PV technology is indicated.

Two silicon-based thin-film technologies are being developed for market penetration by 2003/04 (Pacific Solar and Origin Energy). No significant price reductions are expected over the next 3-5 years from these two emerging PV technology manufacturers.

The potential for the generation and sale of low grade heat from the Station from the application of a CHAPS technology may be identified as cost effective. Local dairy farms are substantial users of hot water and may be customers for such added output if suitably sited. Similarly, some other industry with such needs could be attracted by a low cost source of energy in that form, such as the autoclaving of concrete blocks and castings or timber seasoning for the output from a nearby sawmill.

3.5. Replication Potential for the Briagolong Project

Except perhaps for the replication of the social/legal structure for physically very different projects, we do not see the BSPS entity earning money from consulting to others or managing other BSPS equivalents etc within the mid term. At present, the BSPS appears too dependent on government subsidy to be feasible to replicate as a whole before a substantial reduction in PV costs (and prices) occurs - which is probably a decade into the future. Accordingly, we have not include consideration of such potential income in this business plan.

4. Business Strategy

4.1. Preferred Strategy

Even with substantial government subsidy, the BSPS faces a substantial logistic and promotional task in obtaining around 400[22] households to engage financially in the project which means that at least 200 of them must lie outside Briagolong. Our financial analysis assumes that this is all done with volunteer effort tapping personal networks. A provision of, say, $50,000 would be appropriate if this is to be professionally done to a wider public.

Even so, the "shareholders" will be putting up $1,000 per unit each for 25 years and paying $25 per year to get the quintessence in renewable energy supplies (let's call it "Green Earth Pure Gold" with due apologies to TXU) while paying less than their normal electricity bills to whoever is their retailer[23]. The selling of this concept to both the end consumers and a local electricity retailer is not an impossible task but it must not be underestimated.

The preferred strategy is:

1. Firm up Commonwealth PVRP support for the BSPS as currently conceived.

2. Firm up Victorian Government support for the BSPS as currently conceived (anticipating that this may need to be negotiated in tandem as there may be an unwillingness for the two tiers of government to allow what they might see as "double dipping".

3. Firm up the local and wider customer base for the investment, fees and service projected in the light of 1 and 2 above.

If all three of these factors develop positively, or if the third is positive with the much higher customer expenses without the government backing), proceed to establish the preferred entity and commence the capital raising required to build the BSPS.

4.2. Resource requirements

The following resources were identified by the Feasibility Study as being required to fund and construct a power farm project:

Resource	Comment
Power generating equipment	Turn-key solutions are available from major suppliers and these form a good basis for evaluation. However better prices may be achieved by managing the project directly.
Land	Land for the project must be available. The land should be close to appropriate network equipment for a grid-connected system.
Buildings	These may be included in the turn-key quote or separately included
Inverters	These may be included in the turn-key quote or separately quoted.
Grid connection costs	These will depend on the location of the land and the

	network infrastructure.
Fencing	It is recommended that the land be fenced off for safety reasons.
Project management costs	These may include planning costs, engineering costs and construction costs.
Capital raising costs	These will vary depending on the funding sources.

There will also be operating resources required to ensure that the power farm continues operating. These are:

Resource	**Comment**
Administration costs	These costs will depend greatly depending on the operational model. The costs will be minimised if retail and network responsibilities are handled by other organisations.
Maintenance costs	These costs will depend on the technical solution adopted.
Grid connection fees	There will be an annual fee associated with connecting to the grid.
Retailer charge	There may be a charge from a retailer if preferential terms are negotiated for community members.

5. Financial Plan

5.1. Preferred Vehicle

It may be a condition for some avenues of government support to form a co-operative to operate the BSPS and this could tip the scales in favour of that option. If not, the greater flexibility in capital raising and structure presented by the public[24] limited liability company would be the preferred vehicle.

If, say, 400 subscribers are required and there are only 220 residences in Briagolong, then over 200 "remote" subscribers are required. This could bring up a billing issue for the credit of the 1 kWh per day (per subscriber unit), possibly even for the Briagolong subscribers. It would require an unusually "interested" retailer to tackle this requirement (eg, Graeme Charles reports unenthusiastic interest among retailers in his pool of over 5,000 domestic customers). The theoretical ideal of the entity selling power to its "customers" at retail prices but through the wires of the local retailer appears to not have the support of any retailer we have approached.

This could be overcome with sufficient motivation from the "customers" if they will simply buy their power from the retailer at standard prices but "know" that they are actually consuming 1 kWh per day of "Green Earth Pure Gold" which their investment is putting into the National Electricity Grid on their behalf. This is the basis of the costings set out in 9.1 and 9.2. Whether that concept can find favour in a sceptical market is yet to be established and will certainly take effort and marketing widely in the Wellington Shire and perhaps beyond. The alternative concept of an "interested" retailer and selling half of the output to the grid is the basis of the costings set out in 9.3 and 9.4.

5.2. Cash Flow Projection

The capital costs of the PV options for the BSPS are itemized in 2.6 Solar Power Station Costs. As projected expenditure is highly sensitive to depreciation and interest costs, each of which depend on net capital cost, that aspect is crucial to the success of the BSPS. Projections are provided for both the government subsidized and the unsubsidized cases. No allowance has been made for the rolling replacement of panels that are operating satisfactorily during the life of the project as these cannot be sold at any financial benefit to the BSPS[25]. Rolling replacement of panels that are not operating satisfactorily or fail completely is included in the O&M provisions in the cost analyses.

5.2.1. Projected Revenue

Projected revenue is tabled in the three costings set out in Appendix 2 Solar Power Station Costs and Revenues. It comprises a household member fee per annum (for one or more 1 kWh per day units), Electricity Sales to the grid or the local retailer, RECs Sales to any retailer or "liable party" and GPRs Sales to any retailer offering a GreenPower option to its customers. Ideally, there will be a maximization of this revenue by partnering with a retailer active in the area (especially if it allowed the co-op to sell to its members at retail prices) but this is yet to be negotiated and current indications are that it will not find favour.

5.2.2. Projected Expenditure

Projected expenditure is tabled in the three costings set out in Appendix 2 Solar Power Station Costs and Revenues. It comprises Administration, Operation / Maintenance of the Panels, Operation / Maintenance of the BOS, Operation / Maintenance of the Trackers (where applicable), Rates and Fees, Insurances, and Interest. Other minor costs like landscaping and grass cutting have been ignored and may well be undertaken on a voluntary basis anyway.

The major cost which is not an outgoing over the years is Depreciation of 4.0% pa to allow for the need to replace the system after 25 years. This figure implies an assumption that the reductions in manufacturing costs of PV over that period will be of the same order as inflation such that the replacements can be bought for the same $ sum. The outcome may be better or worse than this.

5.3. Finance Options

To a conventional lender, the BSPS will be a major and innovative enterprise undertaken by a new and unproven entity in a relatively remote location involving high value materials in a relatively unprotected environment. The security will mainly comprise the power station itself which is a depreciating asset exposed to fire, storm, theft and vandalism as its main physical risks. Its income stream will also be uncertain in that the value of RECs and GPRs which make up half of its earnings will fluctuate in value. It is likely then that the conventional lenders will require complementary security by way of guarantees from the major shareholders/directors.

Because of this, it may be better to approach a range of lenders which include local banks familiar with the town and the BSPS promoters and include lenders specializing in “green” projects which understand the technology and structures to be adopted. The key ones are listed below:

5.3.1. Australian Ethical Investment Trusts

The BSPS should fit the Australian Ethical Charter which requires the trust to seek out investments which provide for and support:

c) the development of locally based ventures;
d) the development of appropriate technological systems;
e) the amelioration of wasteful or polluting practices;
f) the development of sustainable land use and food production;

Contact: Robert Sharf, Loans Manager, Australian Ethical Investment Ltd,
Suite 66, Canberra Business Centre, Bradfield Street, DOWNER ACT 2602
Ph: 02 6242 1910, Fax: 02 6242 1987, E-mail: rsharf@austethical.com.au

5.3.2. Australian Secured Investments Limited

AuSec is about to launch its "SRI Fixed Interest Debentures" which will, alas, focus on low energy (and reducing energy) buildings initially and hence not be available to support the BSPS in the near future.

Contact: Martin Venier, General Manager, (02) 9215 4111, MartinV@RESI.COM.AU

5.3.3. Green Energy Australia Fund

Being established by Warrakilla Securities Pty Ltd, this fund is targeting projects like this and its promoters are interested to provide financial guidance to prospective borrowers but a date for its inauguration has not been set despite its having been announced in late 2001.

Contact: Matthew Williams, Managing Director, (03) 9436 2165, warrakilla@onthe.net.au

5.3.4. Local Bonds – Bendigo Stock Exchange

This new source is being established for rural infrastructure projects under $20M and ought to be a competitive source of finance.

Contact: Dr Greg Walsh, iona4@bigpond.com

5.3.5. Oxfam/Bendigo Bank – Ethical Investment Trust

Contact: Nicholas Rawlins Senior Business Banking Manager Camberwell
Mobile phone: 0418 146 487 Phone: 9811 3906 Fax: 9811 3910
Email: nick.rawlins@bendigobank.com.au

To assist with an indication to you, could you please help by providing me with an outline of what you propose, how it is to be secured and what is the cash flow associated with the project for serviceability. This will assist me in understanding your project and the inherent risks associated with it. With this to hand I will have a better idea of our interest level and what rates and conditions would apply.

5.4. Risk Analysis

Innovative projects like the BSPS need to deal with risks creatively to deliver an enterprise that is attractive to customers, investors and regulators. Those risks are set out below with comment on each as to how best to manage or ameliorate those risks.

5.5. Sovereign Risk

The financial viability of this project is heavily dependent on the provision of grant funding and indirect support from both the Commonwealth and State governments and as such is highly open to enhancement or damage by actions of the Australian and Victorian parliaments and the bureaucracies that action their decisions. One example of such risk is the imminent review of the MRET legislation after two years of operation. This legislation currently provides half of the unit sales value of the BSPS through the RECs that it will generate so its repeal would be disastrous for the project. Below is a pertinent extract from a monthly newsletter from SEDA which illustrates how the review could be advantageous or highly damaging. There is no way to manage such risk other than defer committing to proceed until it is completed and any parliamentary response is known.

5.5.1. Different Opinions for MRET direction

The Commonwealth Mandatory Renewable Energy Target (MRET) currently requires that an additional 9,500 GWh of renewable energy be generated annually by 2010. This target was calculated on the basis that it would lead to a 2% increase in renewable energy's market share relative to 1997 levels.

MRET is now due to be reviewed. Terms of reference for the review will be posted on the Australian Greenhouse Office website in the coming weeks. Several organisations have made statements about the scheme in the past two months (see Issue 69 of Renewable Energy News, which reports a number of organisations' positions). In summary:

the Business Council for Sustainable Energy now estimates that the current 9,500 GWh required under the scheme needs to be increased to 14,000 GWh for it to truly represent a 2% increase in renewable energy's market share by 2010. See www.bcse.org.au for more detail. The Council recommends increasing the current target to 33,800 GWh - representing an increase in market share of 10% (rather than 2%) compared with 1997 levels.

The Chair of the Council of Australian Governments has released the final report of the Independent Review of Energy Market Directions (known as the 'Parer Review'), which makes recommendations for further reform to 'achieve a truly national and efficient energy market'. Over 100 submissions were made on the draft report in November 2002. One of several recommendations is that "the array of greenhouse gas emission abatement measures under Commonwealth and State legislation [including MRET and the NSW Benchmarks] be abolished and replaced with a single, national emissions trading regime". The press release accompanying the report indicates that investments that have been made based on existing schemes should receive an equivalent subsidy under any new regime. The final report is available at www.energymarketreview.org, the media release at www.energymarketreview.org/finalreportmediarelease.pdf and the submissions are reproduced in full at www.energymarketreview.org/issues.htm

The federal Shadow Environment Minister, Kelvin Thompson confirmed the Federal ALP's commitment to boost the MRET to an additional 5% of the market share (compared to 1997 levels) by 2010. The full media release is posted at www.alp.org.au/media/1202/20003295.html

The Victorian Government's Energy for Victoria – A Statement by the Minister for Energy and Resources released in October 2002, proposes an increase in the target from 9,500 GWh to 15,100GWh, to "accord with the Government's original intent for the measure". The document is available at www.nre.vic.gov.au/energy

Source: WATTS News, January 2003

5.6. Technology Risk

The BSPS is confronted with two technology risks, only the first of which is manageable.

5.6.1. Selection of the best technology currently available

This risk is best ameliorated by thorough research as forms the basis of this business plan report. Even so, some judgment is inevitably required in several substantial cases: the selection of solar over wind, the selection of PV over solar thermal electric and the selection of tracking PV over fixed array PV are the three largest in this context. The climate and commercial availability combine to make the last of these decisions the most sensitive one. This is essentially a trade-off decision between first cost and operational cost and a wrong decision appears likely to generate an unnecessary cost in the order of 10-20%. Life cycle cost analysis, as in AS 3595 (Standards Australia, 1990) appears the best way to ameliorate this risk other than by buying a tracking system from a financially substantial firm which guarantees its product or co-finances the project.

5.6.2. Technological obsolescence (accelerated depreciation)

Once selected and installed, the costs are fixed for about 25 years but the technological advances in solar energy continue. This can have two negative impacts on the success of the project. Firstly, the price of RECs and GPRs could decline over time as competing solar power stations come on line using the newer and cheaper technologies. Secondly, the value of the BSPS is primarily made up of the PV panels themselves and that value will depreciate over time due to their aging (with both reduced output and reduced remaining years of service). This depreciation will be greater as the cost of replacement PV panels is reduced through technological advancements like the Sliver Cells discussed in the Appendices (9.11 Sliver Cell Technology). This latter effect may create difficulties in providing adequate security should the need arise to refinance during the life of the project.

5.7. Climatic Risk

Climatic risk takes three main forms:

5.7.1. Climate Knowledge

There is a risk that our knowledge of the solar and wind climates of the site are significantly inaccurate due to both the inferences over distance and the limited time and reliability of the actual measurements being relied upon. For engineering design, knowledge of such information is presumed to be within ±5% whereas we are really only confident to the ±10% level.

5.7.2. "Bad Luck" in Timing the Project

The solar and wind energy availability will ordinarily vary by ±10% from year to year with extremes varying by more than ±30%. The project needs to be able to survive an unfortunate weather pattern of, say, the first three years being –30%, -20% and –10% relative to the climatic mean (upon which the design is based) unless its start is to be deliberately timed to avoid such a dire outcome by, say, building the BSPS at a time when an El Niño event approaches. In that case a series of years providing +30%, +20% and +10% is possible with its concomitant significant advantage to the project's cash flow.

It is possible to insure against "inclement" weather but the cost of the premiums may be prohibitive on a project like this.

5.7.3. Climate Change

It is also possible in the later years of the life of the BSPS that long term climate change will become evident at the site. It is not known whether that offers advantage or disadvantage to the project but its distance in time ensures that it will be restricted to a ±5% effect on the discounted cash flow.

5.8. Enterprise Risk

Once established, the operating entity for the BSPS will be as exposed to the normal range of risks that beset any new business: staff fidelity and competence (and succession), site security (vandalism and theft), weather damage (wind and lightning), customer preferences, key person death or disability and fire to cite the most common. All except staff competence and customer preferences are insurable and the costs of same should be built into the financial plan. If site security became an ongoing problem, that would also become uninsurable.

Customer preferences risk is best managed by detailed knowledge. Below is a possible source of such knowledge but a Victorian equivalent is not available at this time.

5.8.1. New Solar Market Research

Copies of SEDA's latest market research, Who Buys Solar Power? are now available for $55 including GST. The report includes a CD-ROM with the full data set from over 800 purchasers of small solar power systems. Order forms are available on SEDA's website at www.seda.nsw.gov.au/pdf/SolarPowerSurveyOrderForm.pdf

Source: WATTS News, January 2003

SEDA is the Sustainable Energy Development Authority (NSW).

5.9. Financial Risk

The financial risks associated with the project reside in the future of interest rates in two separate ways:

5.9.1. Costs of Finance

The BSPS is a capital intensive project. Its cost structure is therefore heavily dependent on interest rates which are currently at an historical low which is to the project's advantage. However, borrowing for 25 years at a fixed interest rate (the low risk strategy) will come at a substantial interest rate premium (if it is possible on this scale) relative to a variable rate contract. Accordingly, some analysis of finance options, including a variable rate finance contract hedged by a balancing interest rate futures contract should be considered to manage that risk

Similarly, borrowing for less than the expected life of the project exposes it to a refinance risk in that interest rates may have risen substantially by the time the refinance needs to be negotiated with a lender. It is possible, but unlikely, that they will have fallen further by then.

5.9.2. Price of RECs and GPRs

Most RECs and GPRs will be generated by capital intensive installations and hence the costs of new capacity should be highly responsive to changes in interest rates in the medium term and this effect should flow through to market prices for both RECs and GPRs. The market prices of these sales is monitored and published by several institutions like the "Energy Reform Bulletin" (BCSE, periodical). Discussion of the nature of RECs and their likely costs/values over time is included at 9.5 Analysis of the Value of RECs.

While interest rates being at historical lows largely protects the BSPS from this risk (and it may be to its advantage) the proponents need to be aware of this indirect effect of interest rate changes on the financial viability of the project.

5.10. Social Risk

If the BSPS is viable, it is likely to be so as a result of the social support and cohesion in the Briagolong community and its desire to be the home of this initiative. Such community support is known to be fragile elsewhere so it is important that the risk of social disaffection be managed. The proven planks of such management are primarily transparency and democracy (with fairness usually flowing from the application of those two principles).

Another way to enhance social cohesion is to ensure that benefits flow to other than the project proponents and customers. Employment opportunities are important in this context and conflict with an overall "low maintenance" aim for the project. This may impact on the decision between fixed and tracking PV systems where the trackers are amenable to local fabrication (eg, see 9.9 B W semi-Double Axis Tracker) and require ongoing maintenance for their optimal performance.

High/Low maintenance aside, a possible model for this social interaction is the OurEnergy co-operative in the Wangaratta area as described in Appendix 9 OurEnergy - a possible model structure. It is likely that consulting with its promoters, Co-operative Energy Ltd, will be of advantage to the BSPS in its formative stages.

In the event that a wind energy system is preferred, there is the risk that the large scale of commercial sized aerogenerators will find less acceptance from the town's residents than the low height and low visibility that the BSPS is likely to achieve. Certainly there has been a history of local resistance to wind farm planning applications elsewhere in Australia, including Victoria. Even if such resistance is primarily tactical to try to extract concessions from the wind farm proponents, it represents as risk of delay and of the costs that inevitably go with such delay.

5.10.1. Green Power Market Support

On the macro-scale, there is a social risk that consumer support for GreenPower will wane and the GPRs decline in price, thus reducing the revenue to the BSPS. This is thought to be only a small risk as the following recent report on the growth of the scheme attests. It also reveals however, just how small a fraction of the total GreenPower sold is of solar electric origin (0.1%).

http://www.greenpower.com.au/images/dl/Sept02QuarterlyReportUpdate.pdf accessed 11 Jan 03

Green Power this Quarter ...

- *Total Green Power sales of renewable energy reached 106 GWh for the Quarter, equivalent to offsetting over 100,000 tonnes of greenhouse gas emissions and taking around 25,000 cars off the road for an entire year.*
- *Sales in NSW alone have increased by over 7000 MWh since last quarter and Victorian sales now represent almost 30% of total sales.*
- *Over 500 new domestic customers have signed onto the program, bringing total customer numbers to 66,866. Energex continues to show high participation rates with over 20,000 domestic and 250 Green Power customers - almost a third of all Green Power customers.*
- *Commercial interest in Green Power continues to grow - Insurance Australia Group (IAG) has recently joined the program with purchases in excess of minimum logo requirements.*
- *Purchases of 'new' Green Power exceeded 115 GWh.* Figure 9 *shows the breakdown of Green Power generation types purchased during the Quarter.*

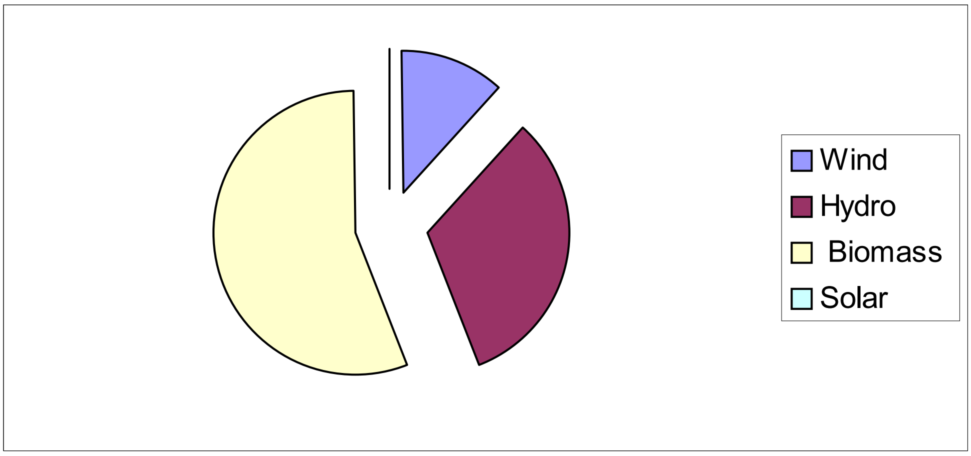


Figure 9: Green Power Purchases by Generation Type for the Sept 02 Quarter

The Green Power Annual Audit is currently being collated and is expected for release in early January 03.

5.10.2. Co-operative Energy Ltd

Graeme Charles is the Chairman of Co-operative Energy Ltd. which was formed in 1994 to advocate for co-operative involvement in the newly privatised electricity industry in Victoria. COE are affiliated with the National Rural Electric Co-operative Association of America, which is the peak body representing the USA's approximately 1,000 electricity co-operatives. These co-op's located in rural America generally own and maintain the distribution systems as well as retailing electricity to their members. They range in size quite markedly. Currently Graeme is project managing Our Energy Inc. which is an aggregation of individual users across NE Victoria (www.ourenergy.com.au). The intention is to use the buying power created via the aggregation to negotiate with retailers. COE have thus far aggregated something like the equivalent of 5,000 individual households (about 10% of that market). COE believes there is a proven methodology that should be followed in order to successfully aggregate individual users.

Contact: Tel. 03 57 261173; graemech@netc.net.au

6. Investment Matters

6.1. Sources of Support or Additional Revenue

On a basis of capital cost versus projected revenue, the BSPS is not financially viable. Some possible ways of attracting subsidy or added revenue are briefly considered below.

Government up front support is currently unclear and needs to be explored early along with possible local synergies if the project is to proceed. To assist in this, an extract from Dr Robert Passey's summary prepared for the "Solar Harvest" in Newcastle in November 2002 is included at Appendix 6 Sources of Possible Government Support.

6.1.1. PV Rebate Program

The Commonwealth's PVRP is operated by the AGO and appears to offer the largest potential for support of the BSPS. It is intended to foster the installation of individual house systems and is *prima facie* not available for a "centralised" system. Advice from the AGO is that the community basis of the BSPS provides arguable grounds that it will in fact be achieving the PVRP objectives at higher efficiency by optimal siting and maintenance but the decision would have to be made at ministerial level due to the novel structure. It is far less likely that it would be available for the projected 50% of shareholders who will necessarily reside outside of Briagolong as the scheme is currently conceived. A draft letter for such an approach is included at Appendix 6 PVRP Support – Draft Letter and should be refined with the AGO before despatch.

6.1.2. Victorian Government Programs

Within the Victorian Government's Greenhouse Strategy (VGS) there are several potential sources of support. (See attached file: VGStrategy.pdf)

Glenne Drover, Sector Manager - Resource Based Industries, Department of Innovation, Industry and Regional Development, has been most helpful. He advised:

"It is big but if you concentrate on the landscape format tables, this is where the $s are concentrated. For example Item 2.1 on page 46, also 2.1, 2.5, 5.1, 5.5, 5.6, 9.3.

I am not sure if the RIDF would apply. The RIDF fund link is at
http://www.business.vic.gov.au/ridf
and a contact for the fund is Jim Demetrious on Ph 9651 8075. Have a look at the guidelines and see if your project idea may fit them and then perhaps talk to Jim and he and I can then discuss it further. Alternatively define your project scope for me and I will talk to Jim directly."

The Regional Infrastructure Development Fund (RIDF) is providing $180 million, for capital works in regional communities to:

1. support new industry development
2. link transport infrastructure

3. improve tourism facilities

4. better link regional Victoria to new opportunities in education and information technology.

It seems most likely that the BSPS may qualify under rationale 1. but a component under rationale 3. is also possible if that side of the project is developed. His references to the VGS are discussed briefly below:

2.1 Renewable Energy Support Fund (SEAV)
This is the most likely source of support but the person in charge of its roll-out (Megan Wheatley, 03 9655 3275) advises that it is still being recast in response to policy shifts occurring during the election campaign but has committed to advise the BSPS proponents as soon as its workings become publicly known. She was unable to comment on its potential support at this stage but the VGS states that a grant of up to 20% of capital cost is possible for "small-scale renewable energy generation projects".

2.5 Facilitating the Use of Cogeneration
A possible support if using the ANU's CHAPS technology, but not otherwise.

5.1 Energy Management in Local Government (SEAV)
A possible support if Local Government (WSC) were a participant or customer.

5.5 Regional Partnerships (Natural Resources and Environment)
A possible support if the project is seen as cost effective but this is unlikely given the large GHG emissions reductions from much more basic projects like flaring or harnessing land fill gas (mostly the intense GHG methane) from council-operated tips.

5.6 Community Action Fund (Natural Resources and Environment)
A possible support if suitable partners are found (eg, the Business Council for Sustainable Energy). It offers up to 50% co-funding but has a total of only $2.29 million over 3 years so other support will be needed.

9.3 Sustainable Energy in Agribusiness (SEAV)
A possible support if agriculture was involved such as in providing solar heat for dairy processing if using the ANU's CHAPS technology.

Mr Drover can be contacted at:
17th Floor 80 Collins St (Nauru House), Melbourne Vic 3000
PO Box 4509RR, Melbourne, Vic, 3001
Ph 9655 8799, Fax 9655 9777, Mob 0401 991 401

6.1.3. Other Possible Sources

Several other possible sources were considered but found to not offer substantial prospects of support at this time.

- Car parks generating parking income – site is remote from pay parking.

- Industrial roofs displacing roof costs, land costs and better building performance – no obvious examples available.

- NOx SOx emissions trading - international trading is not currently possible on this scale.

- Capital deferment on transmission line upgrade construction costs – no upgrades are planned by the current electrical retailer or distributor.

- Avoided costs of transmission line losses - not yet transparent in the costings of the electricity supply and distribution industry.

- Attracting green industry and hence added local income – still possible, but this would need to be evaluated by the WSC and the BSPS proponents.

- Any new major commercial developments that could include Building Integrated PhotoVoltaics (BIPV) to defray some of the construction cost – none are known.

6.2. Capital Raising

6.2.1. Equity Capital

Equity capital is partial ownership and in the context of the BSPS will entitle the co-op members to the predetermined amount of green electricity set at 1 kWh/day for the life of the project (notionally 25 years). This capital will likely take the form of the co-op membership units priced at $1,000 each - of which it is estimated that 1,300 will be taken up by a total of around 400 households raising about $1,300,000 before deduction of the costs of the capital raising. With a high level of community support around half of this raising will come from the Briagolong and hinterlands community and the other half from supporters elsewhere but presumably within the retail area of the electricity retailer serving the BSPS.

The novelty and environmental merits of the co-op are likely to result in free dissemination of the information about the BSPS through publications like “Earth Garden” and “Solar Progress” magazines provided the volunteer effort is available among the proponents to draft articles for them.

6.2.2. Debt Finance (Borrowings)

Borrowings for this project are highly dependent on the level of government support that the proponents are able to garner prior to construction. In the absence of substantial guarantees from the proponents and/or the co-op members, there is likely to be a loan to valuation ratio of 50% limit – that is the lender will not lend more than half of the value of the assets owned by the borrowing entity. The main reasons for this prudential limit are that the project site is rural and that the security itself is not real property but effectively a chattel mortgage over the installed value of the PV system which is exposed to risks of theft, vandalism and storm and tempest as well as a risk of accelerated depreciation unrelated to the physical like of the hardware.

This limit is likely to preclude the project if substantial government support is not forthcoming.

6.2.3. Promotion of Capital Raisings

This is an activity subject to restrictive legislation and regulations. Detailed professional advice should be sought in formulating any marketing plan for investment in the project. One possible source of inexpensive promotion is the annual Victoria Power Conference next year. Contact details are cited below.

6th Annual Victoria Power 2003 Conference, 18-20 February 2003, Grand Hyatt Melbourne. Conference topics up for discussion include: defining the policy agenda, infrastructure investment, the outlook for gas-on-gas competition for 2003-2004, emissions control and more. For more information visit:
http://www.utilicon.com.au/2003/vicpower_AU/

7. Conclusions and Recommendations

7.1. Output and Viability

The BSPS has been sized on two bases: 360 kWp fixed array (or a tracking alternative of similar annual output of 479,280 kWh) and a 548 kWp fixed array (or a tracking alternative of similar annual output of 730,000 kWh or around 2,000 kWh/day).

The project is technically and socially viable and is also financially viable with substantial government support but probably prohibitively costly without it.

7.2. Structure

Ordinarily, the public limited liability company would be the preferred legal structure for an enterprise like this, but as the BSPS needs to demonstrate its community roots in order to tap into several sources of Government financial support, the Co-operative structure is preferred and recommended.

7.3. Next Steps

The key role of Government financial support needs to be evaluated next as without it the project is unlikely to be financially viable without a substantial private benefactor. Should such support be confirmed, the following further steps are recommended.

7.3.1. Further Detailed Analysis of Commercial Solar Options

Once the decision has been made to proceed with the project, it is recommended that an experienced consultant be engaged to work with the steering committee. The role of the consultant would be to:

- Prepare an Expression of Interest document (brief) and answer clarification questions from intending respondents.
- Assist in selecting tenderers.
- Prepare the tender documents and answer clarification questions from respondents.
- Analyse responses to the tender, negotiate as required to obtain the best possible offer and recommend acceptance.

7.3.2. Weibull Analysis of Wind Resource

Unless there is substantial local resistance to a wind farm (which is not unknown in Victoria), it is recommended that some firming up of the wind energy capability of the site is undertaken due to the very large cost advantage that wind generators on “good” sites have over photovoltaics at the present time. Such analysis is required to confirm that the predicted solar output is not exceeded by a wind farm of similar cost (net of applicable subsidies) on the same or a nearby site.

8. References

BCSE, *"Energy Reform Bulletin"*, Business Council for Sustainable Energy, Melbourne, periodical

Berrill T et al, *"Wind Energy Conversion Systems – Resource Book"*, Brisbane Institute of TAFE, Brisbane, 2002

Lee TR, et al, *"Australian Solar Radiation Data Handbook"*, ANZSES/ERDC, Canberra, 1995.

Standards Australia, AS 3595, *"Energy management programs – Guidelines for the financial evaluation of a project"*, Sydney, 1990

Szokolay S V, *"Climatic Data and its Use in Design"*, RAIA, Canberra, 1988

9. Endnotes to the Body of the Report

[1] "Remote Area Power Solutions Network" prepared by Pivotal Management Consultants Pty Ltd and Strategic Alignment Consultants Pty Ltd, March 2002

[2] "Australian Solar Radiation Data Handbook", Lee TR et al, ANZSES/ERDC Canberra 1995 (this extensive work is currently undergoing a major update and data refinement in our offices under a contract with ANZSES (Australian and New Zealand Solar Energy Society) funded by the Australian Greenhouse Office.

[3] We could have used one of three well known design and evaluation tools: BIPVsim (University of NSW), RAPSIM (Murdoch University) or PV-SPS (Business Council for Sustainable Energy) depending on the technology that is confirmed as the best for the Station.

[4] Whilst East Sale may be the nearest available site for irradiation data, the fact that we are about 30km north of this site makes a significant difference. The East Sale weather station, located within the East Sale RAAF base, sits on the edge of Dutson Downs and the Lake Wellington wetlands. Although the immediate area has been used for farming, it is primarily low lying swamp lands. East Sale receives more rain than Briagolong and is prone to morning fogs and mists. Even on relatively clear days, the light would tend to be more defused than in the dryer areas to the north. Briagolong is situated in the dry land areas on the southern edge of the Great Dividing Range and is not subject to the same weather conditions as Sale. The dryer climate makes for consistently clearer skies without the fogs and mists experienced in the low lands south of the Avon and Macalister Rivers. (advice from RRA)

[5] In the Renewable Research Australia comments on the Interim Report, there is a calculation that leads to higher performance than reality will deliver, irrespective of the capacity or PSH used. The simple multiplication of 400 kW peak x 5 PSH = 2 MWh is not correct.

[6] Australian Energy – Market Developments and Projections to 2014-15, ISBN 0 642 26636 0, ABARE

[7] Australian Energy: Market Developments and Projections 2014-15, ABARE

[8] International Energy Outlook 2001

[9] http://www.industry.gov.au

[10] http://www.greenhouse.gov.au

[11] http://www.greenhouse.gov.au

[12] http://www2.austrade.gov.au/exportassistance

[13] http://www.apec.org

[14] http://www.photon-magazine.com

[15] http://www.strategies-u.com

[16] http://www.solarbuzz.com/StatsCountries.htm, originally sourced from IEA PVPS

[17] Ibid

[18] http://www.solarbuzz.com

[19] http://www.solarbuzz.com/StatsMarketShare.htm

[20] http://www.solarsystems.com.au

[21] http://www.amonix.com

[22] Assuming 1,300 such $1,000 / 1kWh/day units are sold with an average of a little over 3 per household.

[23] If this is not so, then the revenue from the sale of part of the BSPS output on the wholesale market will not be realised and the financial position will look dire indeed.

[24] The simpler option of the proprietary limited liability company is restricted to 50 shareholders and is inappropriate to the proposed scale of the BSPS.

[25] If PV prices drop so much as to make buying new PV attractive, then the original (used) PV would have less value due to its second hand nature and the fact that potential buyers could also source new "cheaper" PV from manufacturers. While the BSPS may be able to buy at wholesale prices and sell used panels at retail prices, unless the labour involved in such operations is voluntary it is unlikely to form a financially attractive enterprise.

Appendix 1 Extracts from the Feasibility Study

"The chosen generating technology" is reproduced below for reference. The typographical error (in 3.2 below) in writing megawatt.hours as "mWh" (literally milliwatt.hours) rather than MWh is noted. More substantially, the misinterpretation of "sunshine hours" (which is the number of hours in which the sun is not obscured by cloud) as being the same as "peak sun hours" (which is the convenient energy intensity unit for solar design where a PSH is the energy intensity delivered by the sun in an hour around solar noon) has resulted in a serious overestimation of the output of the planned system.

3.2 The chosen generating technology

Initial indications are that the chosen solution will be a solar solution as wind conditions are believed to be unsuitable. We have been informed that a 1,000 watt generator in Briagolong generated 1 mW of electricity over a 18 month period. This 18 month period included two Spring seasons when wind conditions are optimal for wind generation. This is well below what is considered viable for a wind generator.

We have concentrated on two main solar solutions. These are:

- Solar panels from BP solar; and
- Solar dishes from Solar Systems.

We have received the following indicative costs and performance from the two suppliers:

BP solar

Solar panels for a 360 kW power farm would cost approximately $2.7m. This cost covers modules and structures but does not include cost of interconnection to the local grid, civil works, specific electronic requirements for inversion, protection and control equipment, and shipping.

The power farm would comprise about 2,250 160 W units and was quoted as being capable of generating approximately 1,260 to 1,620 kW per day based on an annual average of 3.5 – 4.5 psh per day. The mean daily sunshine at East Sale RAAF base is 6.4 hours according to the Bureau of Meteorology records compiled using data from 1943 to 2001. On this basis we have adjusted the projected power output as follows:

Average hours of sunlight	Predicted daily power generated
3.5 (as quoted by BP Solar)	1,260 kWh
4.5 (as quoted by BP Solar)	1,620 kWh
6.4 (Long term average at East Sale, as per the Bureau of Meteorology)	2,300 kWh

Solar Systems

Solar Systems quotes approximately $3.2 million for a power farm capable of generating 630 mWh per annum. This quote includes sensors and transformers.

A full comparison between the two possible solutions will be necessary during the business case phase. The following factors will be taken into account at this time:

- Concentrators only work with direct sunlight and stop operating in cloudy conditions;
- Flat panels continue to operate with diffuse light but are inefficient in these conditions only producing about 20% of peak output;
- As they are directional, concentrators start earlier and finish later;
- The cost of upgrading concentrators as technology improves is relatively low as the solar panels only represent a proportion of the overall solution. Flat panels would probably require total replacement if improvements in technology were made. It is our understanding that significant improvements in technology are anticipated.

The estimates that we have received can be summarised as follows:

Supplier	Cost for 360kW nominal	Adjusted daily generation average	Annual generation
BP Solar	$2.7 m plus invertors Total approx $3m	2,300 kWh	840 mWh
Solar systems	$3.2 m	1,725 kWh	630 mWh
Solar Sales	$2.2 m plus invertors plus mounts – Total approx $2.9 m	2,365 kWh	863 mWh
Kyocera	$2.37 m plus invertors plus mounts – Total approx $3.1m	1,783 kWh	651 mWh

We have used the daily generation figure of 2,300 kWh in the financial projections based on our adjustment of the predicted output to take into account average hours of sunlight.

We have also used a figure of $2.6m for the equipment based on expected prices for foreign solar equipment post negotiations. It is hoped that local manufacturers will match this figure.

Appendix 2 Solar Power Station Costs and Revenues[26]

9.1. Projected Costs with Government Funding 360 kWp Array and Equivalents

		Fixed at 35°	Seasonal Adjustment	Traxle 1 Axis Tracker	BP Solar 2 Axis Tracker	SunTracer 2 Axis Tracker
Array Size (kWp)		**360**	**337**	**288**	**275**	**275**
Annual Generation (kWh)		479,280	471,360	479,616	472,817	472,817
Area of Solar Module @ kWp/m²	0.13	2,835	2,656	2,268	2,165	2,165
Solar Modules		$2,173,608	$2,036,720	$1,738,886	$1,659,187	$1,659,187
Array Structure		$175,112	$176,990	$390,176	$1,289,350	$385,704
Electricals		$459,091	$551,858	$648,466	$648,466	$648,466
Monitoring and Display		$69,902	$72,626	$72,626	$72,626	$72,626
Inverters		$404,199	$404,199	$325,983	$325,983	$325,983
Design, Engineering and PM		$78,755	$81,823	$72,626	$72,626	$72,626
Installation - Civils, Shed, Fencing		$325,322	$363,575	$325,660	$325,452	$325,452
Packing and Freight		$76,348	$71,037	$81,823	$81,823	$81,823
Land		$12,500	$12,500	$12,500	$12,500	$12,500
Other		$76,348	$71,037	$74,139	$90,859	$90,859
Total Capital Expenditure (CapEx)		$3,851,185	$3,842,365	$3,742,885	$4,578,872	$3,675,226
CapEx per annual kWh		$8.04	$8.15	$7.80	$9.68	$7.77
Subscriptions supplied 1 kWh/day from PV array		1,300	1,300	1,300	1,300	1,300
Subscription investment	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Total subscriber investment		$1,300,000	$1,300,000	$1,300,000	$1,300,000	$1,300,000
Commonwealth Grant / Household	$1,523	$1,980,000	$1,980,000	$1,980,000	$1,980,000	$1,980,000
Victorian Grant / Household	$592	$770,237	$770,237	$770,237	$770,237	$770,237
Capital Shortfall to be Financed		-$199,052	-$207,872	-$307,352	$528,635	-$375,011
Annual Costs (First Year)						
Administration		$15,000	$15,000	$15,000	$15,000	$15,000
Operation / Maintenance Panels @	0.4%	$8,694	$8,147	$6,956	$6,637	$6,637
Operation / Maintenance BOS @	0.1%	$1,678	$1,806	$1,614	$1,630	$1,630
Operation / Maintenance Trackers @	4.0%	$0	$0	$15,607	$15,607	$15,607
Rates and Fees		$6,000	$6,000	$6,000	$6,000	$6,000
Insurances		$13,131	$12,914	$13,140	$12,954	$12,954
Interest @	7.0%	-$13,934	-$14,551	-$21,515	$37,004	-$26,251
Total Annual Expenditure		$30,569	$29,315	$36,802	$94,832	$31,577
Depreciation over 25 Years @	4.0%	$154,047	$153,695	$149,715	$183,155	$147,009
Total Annual Cost		$184,617	$183,010	$186,517	$277,987	$178,586
Potential Annual Revenue (First Year excluding GST)						
Fee per annum for 1 kWh per day	$25	$10,000	$10,000	$10,000	$10,000	$10,000
Electricity Sales @ MWh Price	$50	$23,964	$23,568	$23,981	$23,641	$23,641
RECs Sales @ MWh Price	$40	$19,171	$18,854	$19,185	$18,913	$18,913
GPRs Sales @ MWh Price	$5	$2,396	$2,357	$2,398	$2,364	$2,364
Total Annual Revenue		$55,532	$54,779	$55,564	$54,918	$54,918
Net Annual Cash Flow		$24,962	$25,464	$18,762	-$39,915	$23,340
Net Annual Surplus		-$129,085	-$128,231	-$130,954	-$223,070	-$123,669

9.2. Projected Costs without Government Funding - 360 kWp Array and Equivalents

		Fixed at 35°	Seasonal Adjustment	Traxle 1 Axis Tracker	BP Solar 2 Axis Tracker	SunTracer 2 Axis Tracker
Array Size (kWp)		**360**	**337**	**288**	**275**	**275**
Annual Generation (kWh)		479,280	471,360	479,616	472,817	472,817
Area of Solar Module @ kWp/m²	0.13	2,835	2,656	2,268	2,165	2,165
Solar Modules		$2,173,608	$2,036,720	$1,738,886	$1,659,187	$1,659,187
Array Structure		$175,112	$176,990	$390,176	$1,289,350	$385,704
Electricals		$459,091	$551,858	$648,466	$648,466	$648,466
Monitoring and Display		$69,902	$72,626	$72,626	$72,626	$72,626
Inverters		$404,199	$404,199	$325,983	$325,983	$325,983
Design, Engineering and PM		$78,755	$81,823	$72,626	$72,626	$72,626
Installation - Civils, Shed, Fencing		$325,322	$363,575	$325,660	$325,452	$325,452
Packing and Freight		$76,348	$71,037	$81,823	$81,823	$81,823
Land		$12,500	$12,500	$12,500	$20,000	$20,000
Other		$76,348	$71,037	$74,139	$90,859	$90,859
Total Capital Expenditure (CapEx)		$3,851,185	$3,842,365	$3,742,885	$4,586,372	$3,682,726
CapEx per annual kWh		$8.04	$8.15	$7.80	$9.70	$7.79
Subscriptions supplied 1 kWh/day from PV array		1,300	1,300	1,300	1,300	1,300
Subscription investment	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Total subscriber investment		$3,250,000	$3,250,000	$3,250,000	$3,250,000	$3,250,000
Commonwealth Grant / Household	$0	$0	$0	$0	$0	$0
Victorian Grant / Household	$0	$0	$0	$0	$0	$0
Capital Shortfall to be Financed		$601,185	$592,365	$492,885	$1,336,372	$432,726
Annual Costs (First Year)						
Administration		$15,000	$15,000	$15,000	$15,000	$15,000
Operation / Maintenance Panels @	0.4%	$8,694	$8,147	$6,956	$6,637	$6,637
Operation / Maintenance BOS @	0.1%	$1,678	$1,806	$1,614	$1,638	$1,638
Operation / Maintenance Trackers @	4.0%	$0	$0	$15,607	$15,607	$15,607
Rates and Fees		$6,000	$6,000	$6,000	$6,000	$6,000
Insurances		$13,131	$12,914	$13,140	$12,954	$12,954
Interest @	7.0%	$42,083	$41,466	$34,502	$93,546	$30,291
Total Annual Expenditure		$86,586	$85,332	$92,819	$150,849	$87,594
Depreciation over 25 Years @	4.0%	$154,047	$153,695	$149,715	$183,455	$147,309
Total Annual Cost		$240,633	$239,027	$242,534	$334,004	$234,603
Potential Annual Revenue (First Year excluding GST)						
Fee per annum per subscriber	$100	$40,000	$40,000	$40,000	$40,000	$40,000
Electricity Sales @ MWh Price	$50	$23,964	$23,568	$26,379	$23,641	$23,641
RECs Sales @ MWh Price	$40	$19,171	$18,854	$19,185	$18,913	$18,913
GPRs Sales @ MWh Price	$5	$2,396	$2,357	$2,398	$2,364	$2,364
Total Annual Revenue		$85,532	$84,779	$87,962	$84,918	$84,918
Net Annual Cash Flow		-$1,054	-$553	-$4,857	-$65,931	-$2,676
Net Annual Surplus		-$155,102	-$154,247	-$154,572	-$249,086	-$149,685

9.3. Projected Costs without Government Funding – 2.0 MWh/day Array Alternatives

		Fixed at 35°	Seasonal Adjustment	Traxle 1 Axis Tracker	BP Solar 2 Axis Tracker	SunTracer 2 Axis Tracker
Array Size (kWp)		**548**	**522**	**438**	**425**	**425**
Annual Generation (kWh)		730,000	730,000	730,000	730,000	730,000
Area of Solar Module @ kWp/m²	0.13	4,317	4,114	3,452	3,343	3,343
Solar Modules		$3,310,661	$3,154,290	$2,646,673	$2,561,683	$2,561,683
Array Structure		$266,716	$274,106	$593,868	$1,990,678	$595,503
Electricals		$699,250	$854,668	$986,998	$1,001,192	$1,001,192
Monitoring and Display		$106,469	$112,477	$110,540	$112,130	$112,130
Inverters		$615,643	$625,987	$496,163	$503,298	$503,298
Design, Engineeering and PM		$119,953	$126,720	$110,540	$112,130	$112,130
Installation - Civils, Shed, Fencing		$495,504	$563,072	$495,671	$502,478	$502,478
Packing and Freight		$116,287	$110,016	$124,539	$126,330	$126,330
Land		$20,000	$20,000	$20,000	$20,000	$20,000
Other		$116,287	$110,016	$112,843	$140,281	$140,281
Total Capital Expenditure (CapEx)		$5,866,770	$5,951,350	$5,697,836	$7,070,199	$5,675,024
CapEx per annual kWh		$8.04	$8.15	$7.81	$9.69	$7.77
Subscriptions supplied 1 kWh/day from PV array		1,000	1,000	1,000	1,000	1,000
Subscription investment	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Total subscriber investment		$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Commonwealth Grant / Household	$0	$0	$0	$0	$0	$0
Victorian Grant / Household	$0	$0	$0	$0	$0	$0
Capital Shortfall to be Financed		$3,366,770	$3,451,350	$3,197,836	$4,570,199	$3,175,024
Annual Costs (First Year)						
Administration		$15,000	$15,000	$15,000	$15,000	$15,000
Operation / Maintenance Panels @	0.4%	$13,243	$12,617	$10,587	$10,247	$10,247
Operation / Maintenance BOS @	0.1%	$2,289	$2,523	$2,457	$2,518	$2,518
Operation / Maintenance Trackers @	4.0%	$0	$0	$23,755	$23,755	$23,755
Rates and Fees		$6,000	$6,000	$6,000	$6,000	$6,000
Insurances		$20,000	$20,000	$20,000	$20,000	$20,000
Interest @	7.0%	$235,674	$241,595	$223,849	$319,914	$222,252
Total Annual Expenditure		$292,206	$297,735	$301,647	$397,433	$299,771
Depreciation over 25 Years @	4.0%	$234,671	$238,054	$227,913	$282,808	$227,001
Total Annual Cost		$526,877	$535,789	$529,561	$680,241	$526,772
Potential Annual Revenue (First Year excluding GST)						
Fee per annum per subscriber	$100	$100,000	$100,000	$100,000	$100,000	$100,000
50% Electricity Sales @ MWh Price	$50	$18,250	$18,250	$18,250	$18,250	$18,250
RECs Sales @ MWh Price	$40	$29,200	$29,200	$29,200	$29,200	$29,200
GPCs Sales @ MWh Price	$5	$3,650	$3,650	$3,650	$3,650	$3,650
Total Annual Revenue		$151,100	$151,100	$151,100	$151,100	$151,100
Net Annual Cash Flow		-$141,106	-$146,635	-$150,547	-$246,333	-$148,671
Net Annual Surplus		-$375,777	-$384,689	-$378,461	-$529,141	-$375,672

9.4. Projected Costs with $-for-$ Government Funding – 2.0 MWh/day Array Alternatives

		Fixed at 35°	Seasonal Adjustment	Traxle 1 Axis Tracker	BP Solar 2 Axis Tracker	SunTracer 2 Axis Tracker
Array Size (kWp)		**548**	**522**	**438**	**425**	**425**
Annual Generation (kWh)		730,000	730,000	730,000	730,000	730,000
Area of Solar Module @ kWp/m²	0.13	4,317	4,114	3,452	3,343	3,343
Solar Modules		$3,310,661	$3,154,290	$2,646,673	$2,561,683	$2,561,683
Array Structure		$266,716	$274,106	$593,868	$1,990,678	$595,503
Electricals		$699,250	$854,668	$986,998	$1,001,192	$1,001,192
Monitoring and Display		$106,469	$112,477	$110,540	$112,130	$112,130
Inverters		$615,643	$625,987	$496,163	$503,298	$503,298
Design, Engineeering and PM		$119,953	$126,720	$110,540	$112,130	$112,130
Installation - Civils, Shed, Fencing		$495,504	$563,072	$495,671	$502,478	$502,478
Packing and Freight		$116,287	$110,016	$124,539	$126,330	$126,330
Land		$20,000	$20,000	$20,000	$20,000	$20,000
Other		$116,287	$110,016	$112,843	$140,281	$140,281
Total Capital Expenditure (CapEx)		$5,866,770	$5,951,350	$5,697,836	$7,070,199	$5,675,024
CapEx per annual kWh		$8.04	$8.15	$7.81	$9.69	$7.77
Subscriptions supplied 1 kWh/day from PV array		1,000	1,000	1,000	1,000	1,000
Subscription investment	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Total subscriber investment		$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Commonwealth Grant / Household	$2,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Victorian Grant / Household	$500	$500,000	$500,000	$500,000	$500,000	$500,000
Capital Shortfall to be Financed		$866,770	$951,350	$697,836	$2,070,199	$675,024
Annual Costs (First Year)						
Administration		$15,000	$15,000	$15,000	$15,000	$15,000
Operation / Maintenance Panels @	0.4%	$13,243	$12,617	$10,587	$10,247	$10,247
Operation / Maintenance BOS @	0.1%	$2,289	$2,523	$2,457	$2,518	$2,518
Operation / Maintenance Trackers @	4.0%	$0	$0	$23,755	$23,755	$23,755
Rates and Fees		$6,000	$6,000	$6,000	$6,000	$6,000
Insurances		$20,000	$20,000	$20,000	$20,000	$20,000
Interest @	7.0%	$60,674	$66,595	$48,849	$144,914	$47,252
Total Annual Expenditure		$117,206	$122,735	$126,647	$222,433	$124,771
Depreciation over 25 Years @	4.0%	$234,671	$238,054	$227,913	$282,808	$227,001
Total Annual Cost		$351,877	$360,789	$354,561	$505,241	$351,772
Potential Annual Revenue (First Year excluding GST)						
Fee per annum per subscriber	$25	$10,000	$10,000	$10,000	$10,000	$10,000
50% Electricity Sales @ MWh Price	$50	$18,250	$18,250	$18,250	$18,250	$18,250
RECs Sales @ MWh Price	$40	$29,200	$29,200	$29,200	$29,200	$29,200
GPCs Sales @ MWh Price	$5	$3,650	$3,650	$3,650	$3,650	$3,650
Total Annual Revenue		$61,100	$61,100	$61,100	$61,100	$61,100
Net Annual Cash Flow		-$56,106	-$61,635	-$65,547	-$161,333	-$63,671
Net Annual Surplus		-$290,777	-$299,689	-$293,461	-$444,141	-$290,672

9.5. Analysis of the Value of RECs

The Government's Mandatory Renewable Energy Target (MRET), which commenced on the 1st of April 2001, requires the generation of an additional 2% (subsequently defined as 9500GWh) of renewable electricity per year by 2010. To ensure compliance with this target, Renewable Energy Certificates (RECs) have been created to act as a form of currency and an interim target is required to be met each year to ensure that the necessary industry development takes place over the decade of implementation. The concept of the RECs was invented to relieve the liable parties from any necessity to generate renewable energy themselves. In that way the liable parties (many of which are geographically constrained) may generate the renewable electricity in house or, instead, pay others to generate their quota in the most economic sites. For example, a Melbourne based electricity retailer can meet its MRET by buying RECs for solar electricity generated in sunny Broken Hill. The MRET applies to all electricity retailers and wholesale purchasers of electricity across Australia (called liable parties) with grids greater than 100MW of installed capacity.

9.5.1. Administration of RECs

Before a renewable energy power station can generate RECs, they must first be accredited by ORER (Office of Renewable Energy Regulator http://www.orer.gov.au/). RECs are not simply allocated to eligible renewable energy generators, instead, they are created by the power station owner in the REC registry (http://www.rec-registry.com/). The REC registry is an internet based process, developed by the Marketplace Company Pty Ltd, to facilitate the generation, transfer and surrender of RECs.

Once RECs have been created, the power station owner is required to pay a registration fee of eight cents for each REC that they have created and these are not registered until the fee is paid. Before the RECs are registered in the registry, the registry performs automatic checks to ensure that they can be created validly and the registry operator also makes manual checks on a sample of REC registration requests.

The REC registry exists to ensure that the Renewable Energy Regulator can determine who the current owner of a REC is at any time. When RECs are transferred, or sold, the seller acknowledges the transfer of ownership through the REC registry and when the buyer confirms the transfer, the REC is registered with its new owner.

Between the 1st of January and the 14th of April each year, those liable under the MRET are required to surrender a number of RECs equal to their liability for the previous year. A party's liability is determined by multiplying the amount of liable electricity purchased by the renewable power percentage (RPP). Each REC is equal to 1MWh and in 2001 the RPP was 0.24%. As the enforceable interim targets increase each year, so does the RPP. The table below shows the interim targets for each year along with the number of RECs each equates to.

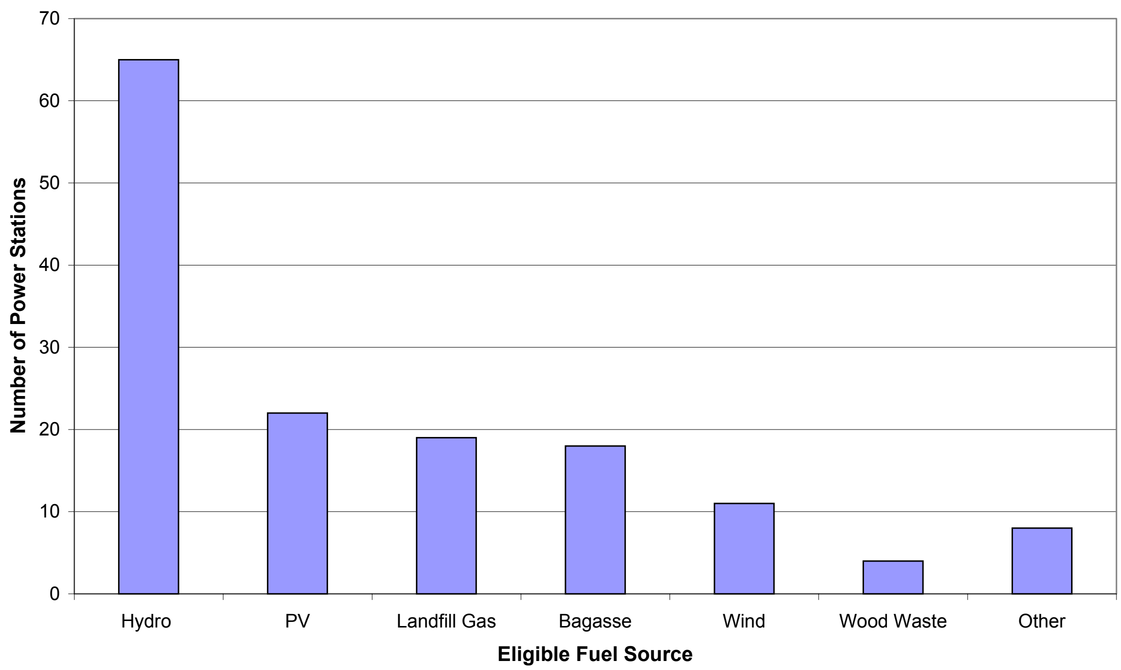
Year	Required Additional GWh	Renewable Energy Certificates (RECs)

2001	300	300 000
2002	1100	1 100 000
2003	1800	1 800 000
2004	2600	2 600 000
2005	3400	3 400 000
2006	4500	4 500 000
2007	5600	5 600 000
2008	6800	6 800 000
2009	8100	8 100 000
2010	9500	9 500 000

9.5.2. Generated RECs, Prices and Power Stations

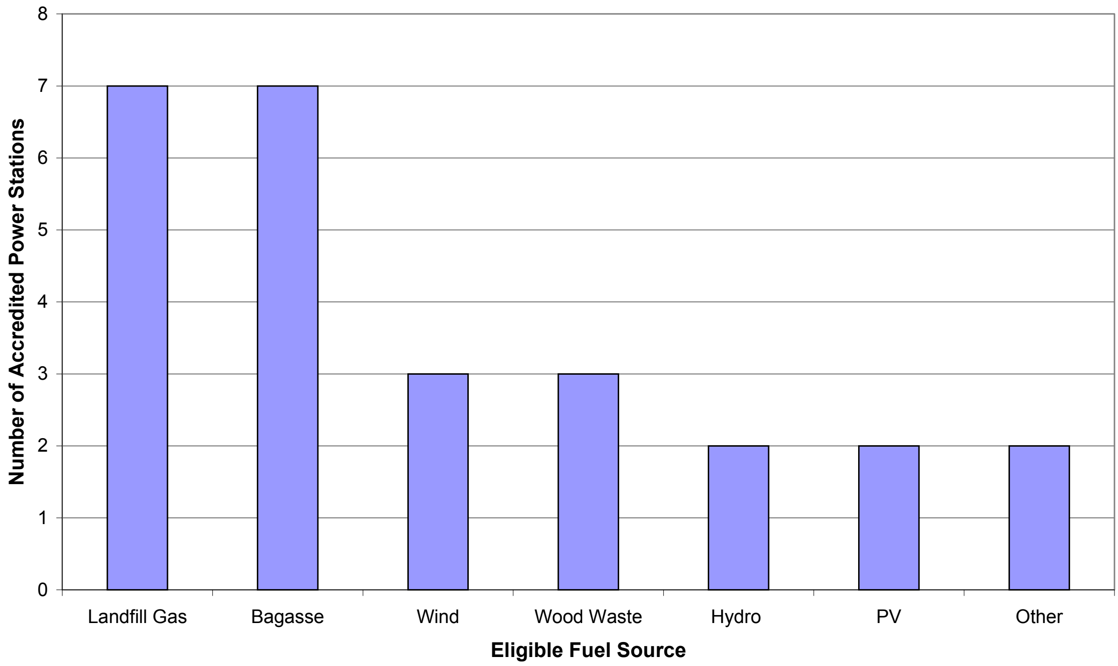
Before a power station can gain accreditation, first it must be accredited by ORER. As of 12 of December 2002, only three power stations had been denied accreditation, these all being landfill gas power stations. One hydro application had however been withdrawn.

In 2001, 147 power stations were accredited. This is displayed in the chart below which shows the accredited power stations by fuel source.



While the above shows the accreditation of many hydro power stations, this does not mean that new dams have been developed. Rather, hydro power stations are entitled to create RECs for any generation above their 1997 baseline. This means that they have to increase their generation through increasing their efficiency from improved generator and turbine technology, or, add generators to pre-existing dams. During the development of the MRET, many believed that the 1997 baseline for hydro generation was inappropriate as they believed that this was a drought year and thus, hydro plants were generating much less than they normally would[27].

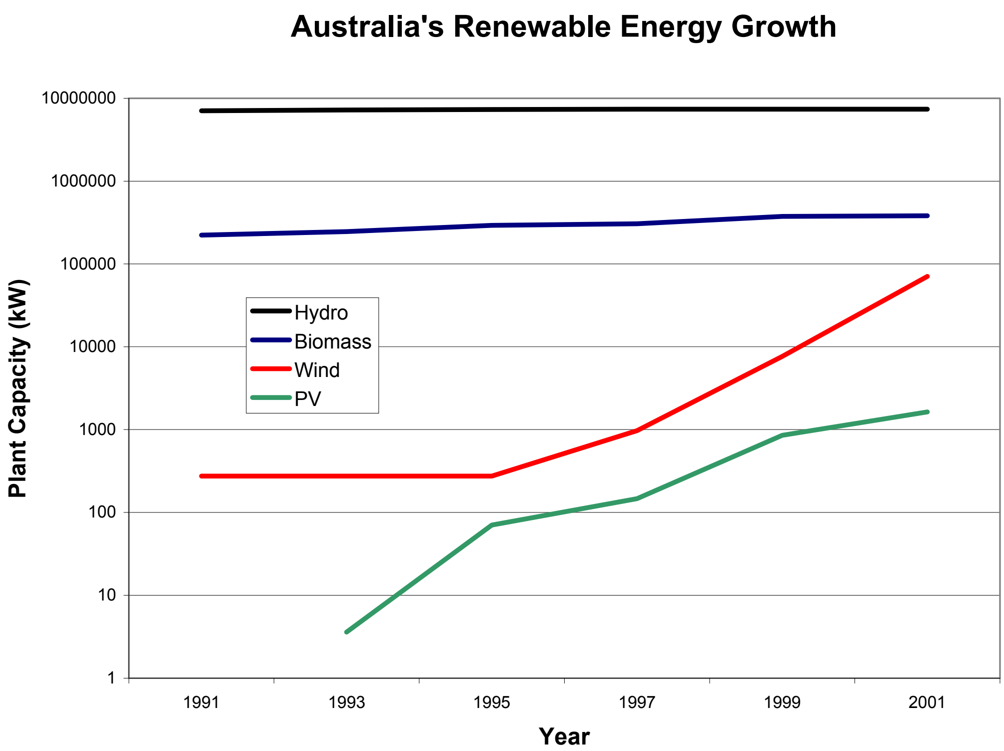
Similarly, the inclusion of some biomass technologies was also of concern for many as it was believed that the fuels for many biomass technologies would come from unsustainable sources. In particular the potential damage to native forests from the economic use of sawmill "waste" was of concern due to its potential to underwrite otherwise economically marginal harvesting.



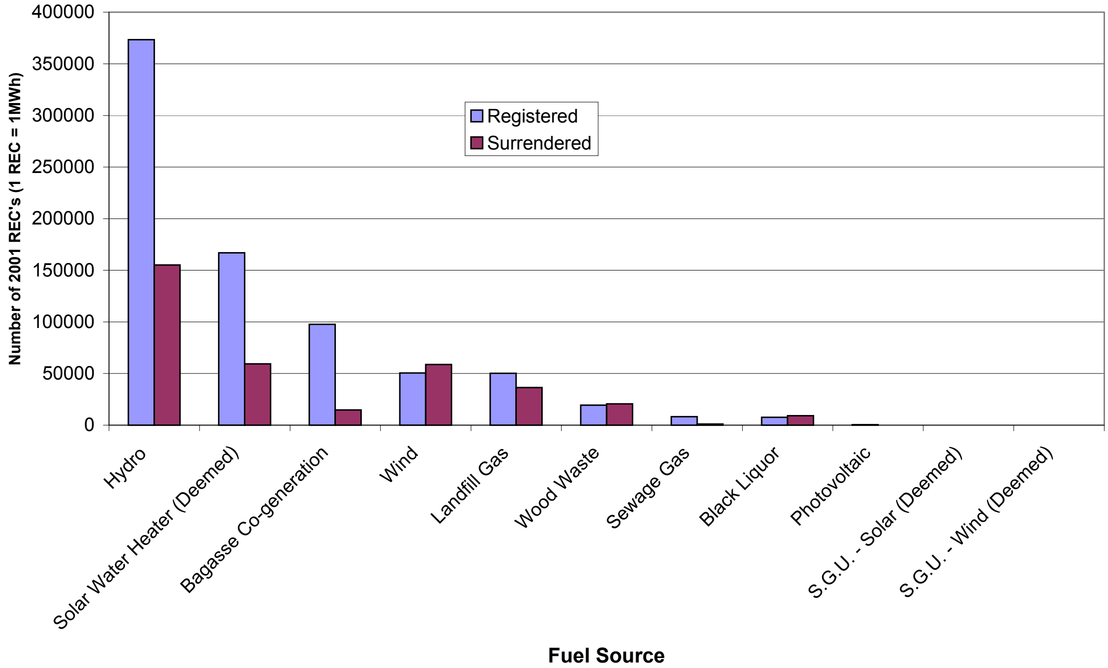
The above chart shows the power stations accredited during the year 2002 as of 16/12/02. On this particular date there were also four power stations awaiting accreditation including one wind, a bagasse, a landfill gas and a hydro power station. There have been 26 accreditations in 2002, a large percentage of which were landfill gas and bagasse power stations. This is considerably less than the 147 accredited in 2001.

While the lower number of accredited power stations in 2002 may suggest that the growth of renewable energy in Australia is slowing, data on the growth of renewable energy, as shown in the figure below, shows the contrary. Information on the Australian Wind Energy Association homepage (http://www.auswea.com.au/) corroborates this. While there are approximately 100MW of operational wind farms in Australia at present, there are another 1743 MW in the planning phase. Assuming a wind capacity factor of 0.4, this equates to 350,000 MWh of annual generation, while if all of the planned wind farms are implemented, then an annual generation of 6,450,000 MWh.

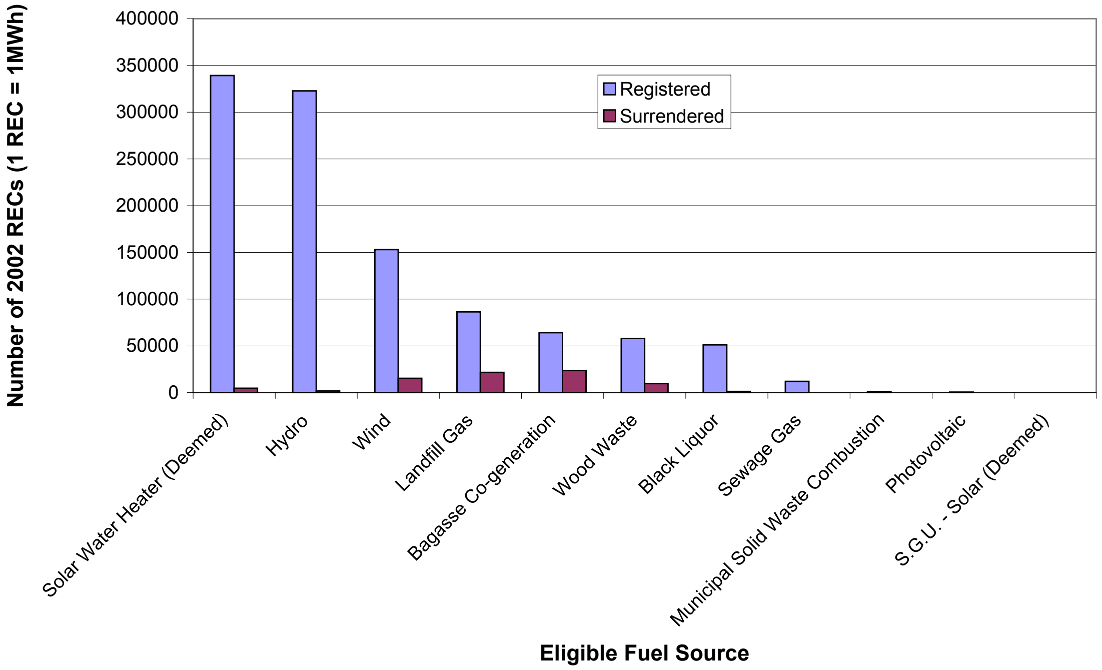
Similarly, the successful completion of Basslink[28] will mean that Tasmania will be likely to make a significant contribution to Australia's MRET. Basslink, which is a project that will allow the transfer of electricity from Tasmania to the mainland, will allow Tasmania to enter the National Electricity Market (NEM) during the summer of 2003/2004 (the target completion date for the project). It will mean that Tasmania will be able to fully utilise its wind resources. For example, the proposed 130 MW Woolnorth wind farm would be able to be installed whereas, only 54 MW could be purposefully installed while the Tasmanian grid remains isolated. Thus, not only will Basslink protect the southern states against a shortage during peak load periods (similarly to the Snowy scheme), but it will also increase the Australian mainland's access to renewable energy sources. If the cost of the generated electricity, in combination with the cost of transferring the electricity to the mainland, remains competitive with renewable electricity generated on the mainland, Basslink is also likely to exert downward pressure on RECs and electricity prices, especially at peak times.



Until the 16th of December, 1,084,568 valid RECs had been created from electricity generated in 2001 and of these 309,950 had been surrendered to reach the first interim target. . This is depicted, with a breakdown by fuel source in the table below. The RECs surrendered in the chart not only include those surrendered towards the interim target, but also those found to be invalid through the auditing process[29].



The number of RECs created in 2001 was 594,407 while the interim MRET for 2001 was 300 GWh, which equates to 300 000 RECs. Therefore there was an excess of 294,407 RECs created and surrendered to 2002. In 2002 the interim MRET is 1100GWh, which equates to 1 100 000 RECs, thus an additional 805,593 RECs needed to be created in 2002 to reach the target[30]. Up until the 16th of December 2002, 490,161RECs had been created in 2002 for electricity generation in 2001 and a further 1,088,314 for electricity generated in 2002, thus there will be an excess of over 772,882 RECs after the second surrender period . The figure shown below displays the number of RECs created and surrendered in 2002 for electricity generated in 2002. At the time of this research the surrender period for 2002 has not occurred and therefore all surrendered RECs were deemed to be invalid by the auditing process.



Findings of a survey of electricity retailers and generators released by PriceWaterhouseCoopers in late 2001 showed that 60% of respondents believed that there would be a shortage of RECs from 2005. The majority (74%) believed that the price of a REC in the early stages was below the $40/MWh penalty for non-compliance (this is likely to set the upper limit for the price of a REC although, as a penalty, it is not tax deductible and hence a profitable company should be willing to spend up to $57/REC to avoid the penalty even if the market perceives no PR cost in failing to make their quota) and was likely to do so until 2002, whereas others (22%) believed that the price would go as high as $50 by 2002. The current price of RECs is uncertain since they have been, and still are, mainly traded through bilateral agreements (eg, it is understood that Origin Energy has contracted to buy all of Energy Development's wind farm RECs). Tullet and Tokyo Liberty Pty Ltd[31] are currently running a mini-futures market in RECs with spot prices for RECs estimated at about $36.50 as of the 16th of December 2002 and one year forward trades estimated at $37.85. In may of 2002, Tullet and Tokyo were bidding for RECs at $34.25 and offering at $34.75, and bidding and offering forward trades for the 15th of January next year at $35.50 and $35.75 respectively. Bidding and offering prices for forward trades for the 15th of January in 2004 are $35.50 and $36.00. No information was available on the depth of that market.

The table below[32] shows the average and peak prices for electricity during March in 2002. Therefore, for each MWh of electricity generated by new renewable energy generators, they can expect to receive the value listed below as well as the value of a REC.

State	Average RRP ($/MWh)	Peak RRP ($/MWh)
NSW	37.87	56.78
VIC	24.29	33.37
QLD	36.09	54.11
SA	26.32	31.92
Snowy	34.34	49.45

9.5.3. Conclusion

Nearly 40% of accredited power stations so far are hydro, while landfill gas, bagasse and photovoltaic power plants are also significant. In 2001, the majority of RECs created were from hydro generators and solar hot water installations with bagasse, wind and landfill gas also making significant contributions. Thus far in 2002, the majority of renewable energy certificates created appears to be from domestic solar hot water installations (where the RECs are mostly bought from the householders for $26 each), hydro with again a significant contribution from wind.

While the interim MRET of 2001 was easily reached, there has not been a large number of power stations accredited in 2002, or awaiting accreditation. While this may seem like the Australian renewable energy industry is slowing, recent Australian renewable energy growth, along with the large number of wind farms in the planning phase, seems to oppose this theory. Despite the low number of power station accreditations in 2002, the interim MRET will easily be reached in 2003.

The impact of the MRET legislation is due to be reviewed at the end of its first two years. If it appears as though the target is likely to be easily met, then an increase in the level of the overall or interim targets may result. Alternatively, if there is a shortage of RECs and their price increases above the penalty for non-compliance, the penalty for non-compliance may be increased or the interim targets reduced. Similarly, a “portfolio approach”, the capping of RECs from certain technologies, may be introduced as a result of the relative greenhouse emissions of the various technologies to ensure that the MRET is as beneficial to the environment as possible. Consideration of these issues will occur shortly after April 2003, each of which are likely to further promote the growth of renewable energy in Australia.

It is also worth noting that renewable energy generation is capital intensive and hence the cost of generating RECs (though not necessarily their price) will be sensitive to interest rates in the case of not-yet-financed new installations. Given the trends in this factor, it should have the effect of shoring up the price of RECs for the next few years.

Appendix 3 Wind Data for Maffra

Maffra Monthly Mean Wind Speed (km/h)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968								14	15	19	24	18
1969	19	12	7	10	7	6	7	12	14	10	16	17
1970	14	16	11	10	8	6	12	10	16	16	16	18
1971	19	17	12	14	16	11	6	16	18	22	17	16
1972	13	14	13	13	6	5	13	11	13	11	10	15
1973	13											
1974	12									7		17
Average	12.9	8.4	6.1	6.7	5.3	4.0	5.4	7.0	8.7	9.4	8.4	11.9

Maffra Monthly Mean Wind Speed (m/sec)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968								3.9	4.2	5.3	6.7	5.0
1969	5.3	3.3	1.9	2.8	1.9	1.7	1.9	3.3	3.9	2.8	4.4	4.7
1970	3.9	4.4	3.1	2.8	2.2	1.7	3.3	2.8	4.4	4.4	4.4	5.0
1971	5.3	4.7	3.3	3.9	4.4	3.1	1.7	4.4	5.0	6.1	4.7	4.4
1972	3.6	3.9	3.6	3.6	1.7	1.4	3.6	3.1	3.6	3.1	2.8	4.2
1973	3.6											
1974	3.3									1.9		4.7
Average	3.6	2.3	1.7	1.9	1.5	1.1	1.5	1.9	2.4	2.6	2.3	3.3

Maffra Monthly Mean Wind Speed at 9:00 and 15:00 (m/sec)

Year	Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	9:00								2.8	3.3	4.7	5.6	3.1
1968	15:00									5.0	5.8	7.8	6.9
1969	9:00	3.3	1.7	1.4	2.2	0.8	0.8	1.1	2.2	3.3	1.7	3.1	3.6
1969	15:00	6.9	4.7	2.8	3.6	2.8	2.5	2.8	4.2	4.2	4.2	5.8	5.8
1970	9:00	2.2	2.5	1.7	1.7	1.7	0.8	1.9	1.9	3.3	3.3	3.6	4.4
1970	15:00	5.6	6.7	4.2	3.9	2.8	2.5	5.0	3.9	5.6	5.6	5.0	5.6
1971	9:00	4.4	3.6	2.2	3.1	3.6	1.9	1.1	3.3	4.2	5.0	3.6	2.8
1971	15:00	6.1	5.8	4.4	4.4	5.3	3.9	2.5	5.6	5.8	7.2	5.8	6.1
1972	9:00	1.9	2.5	2.5	2.5	1.1	0.6	3.1	2.5	2.8	2.5	1.9	2.5
1972	15:00	5.3	5.6			1.9	1.9	4.4	3.9	4.4	3.6	3.9	5.8
1973	9:00	2.5							1.1				2.5
1973	15:00	4.7											
1974	9:00	1.9	1.9	1.1							1.4		3.6
1974	15:00	4.4											

Appendix 4 Sun-tracking Systems

9.6. "Traxle" Single Axis Tracker

The predicted output enhancement of single axis tracking has been included in 2.4 Solar Output Prediction and its cost included in 2.6. The following advice was received from the manufacturer:

There is one small Traxle unit running in Australia at Solarsales, Perth. Enquiries should be directed to Mr. John Hall.

Traxle is a solar tracker manufacturer from the Czech Republic. Our units are durable, reasonably priced and Australia patented. We have several hundred units running in Europe. Below is a picture of our 1.4 kW unit installed in California.

Martin Pekarek, sales@traxle.cz, www.traxle.cz

9.7. Generic Double Axis Tracker

The predicted output enhancement of double axis tracking has been included in 2.4 Solar Output Prediction and its cost included in 2.6 Solar Power Station Costs. The following advice was received from three relevant manufacturers/suppliers.

9.8. “Sun Tracer” semi-Double Axis Tracker

Solar Energy Systems Ltd, Perth, manufactures a single axis tracker with manual seasonal adjustment.

Managing Director, Anthony Maslin, provided the following information.
Please find attached a basic comparison model for tracked vs fixed arrays. Our wholesale price for a F4 Sun Tracer is $2,846 as a starting point. This will hold 16 sqm of panels.

I have put in the panel pricing that you gave me (which by the way, is very competitive - well done if you have organised that supply), and assumed 35% improvement from tracking. This is Western Power's official reading from test work at Kalbarri, although on a clear day it is more like 40%. The fixed frame price is in there also. I would imagine this would come down with an array of this size, but have started here.

Please take this as a "back of the envelope" only, obviously we can talk in more detail when you are further down the road.

The Kalbarri site probably has far more clear weather than Victoria and hence is far more suited to trackers as trackers “capture” more of the beam radiation, rather than diffuse radiation.

In response to our query on reliability and maintenance costs, SES replied that hey are much improved and that they would be willing to bid and contract on a basis of including the maintenance for, say, the first 5 years. Their response is cited below.

No problems bidding on the service, especially considering the volume on (the) site. Gauging whether service contracts stack up for the end user really depends on the cost of getting to the site and number of systems at that site.

It would be worth highlighting that maintenance can be high if periodic and preventative maintenance is ignored, as is the case with most mechanical equipment. Also it is worth mentioning that as our production volumes of trackers have increased, we are actually seeing a reduction in the number of associated mechanical problems. This is due to refinements in the pivot bearing configuration and linear actuator weather protection. The way the new electronic is progressing it would be safe to say that our new electronic controls have a degree of built in diagnostic fuctionality for maintenance purposes.

9.9. B W semi-Double Axis Tracker

B W Solar, Perth, Proprietor, Bruno Wittwer, has undertaken to provide details and pricing in the near future. His design is similar to that of SES. It is single axis tracking with manual seasonal adjustment. Tracking is done in six hourly rests of 15° each commencing at 9:00 am (solar time). This offers a minor loss of solar efficiency but, he says, it significantly reduces cost and increases reliability. An earlier version of the BW trackers was used at the Kalbarri site.

B W Solar is interested to license the manufacture of the trackers to a local firm to further reduce costs and enhance the local economic stimulus from the project. Indicative costs, as supplied, are set out in aggregate below, with a breakup by component.

360 kW of PV's on a fixed array @ $6.95 per Watt	$2,502,000
270 kW of PV's on 5 Star Trakers as above	$1,876,500
Savings on solar modules alone	$625,500

Tracking Project
Calculations are on 140W 24V mono crystalline solar modules.
270kW / 140W = 1,928 solar modules

Use 1920 solar modules / 16 modules = 120 5 Star Trakers
16 solar modules are ~ 20 sqm. per tracker. (Same pattern as in Kalbarri)
16 modules are most probably ideal for the voltage needed to supply the inverter.
120 5 Star Trakers running them in pairs using 60 electronic controllers only.

	(excluding GST)
120 x 5 Star Trakers with 60 tracking electronics @ $2,000. -	$240,000
120 x Linear Actuator HD2436	$24,000
Conduit and wiring for solar panels (no switches or varistors)	$20,000
Wiring work on panels and Installation of tracking arrays	$48,000
Accommodation and travel expenses etc.	$8,000
	Total $340,000

Transport is not included, as it would be more convenient to manufacture the tracker frames near the solar power plant.

1,920 solar modules x 140W each @ 6.95 per Watt	$1,868,160

System details and final prices should be sought at the time of calling tenders should the project proceed and a tracking option be desirable.

9.10. Single Axis Horizontal Tracker

The ANU's CHAPS system is of this type. While not yet into mass manufacturing, its indicative cost is $65,000 per trough of 38 m² intercept area (24.0 x 1.6 m) which has an indicative peak output of 4.5 $kW_{electrical}$ and 20 $kW_{thermal}$ although there would be added cost to make use of the thermal component as the price above includes for heat dissipation fins only (ie, it is passively air cooled). For the Briagolong project, added cost of design, installation, plumbing and pumps, heat dump (wet cooling tower?) and electrical Balance of System (BOS) needs to be estimated.

The above information was obtained from Joe Coventry, development Engineer, at ANU's Centre for Sustainable Energy Systems, (02) 6125 3976.

In evaluating CHAPS, it was compared to a baseline 360 kW peak fixed PV system which will generate some 480 $MWh_{electrical}$ per annum.

To achieve the same electrical output, some 92 collectors are required at a capital cost of $6.0 million for the collectors alone. Adding inverters, installation etc. will add some $1.8M resulting in a capital cost almost double that of the baseline system.

CHAPS also produces thermal energy at a level 3.7 times the electrical output.

Accordingly, the CHAPS can only be considered if a large user of thermal energy could be located near the system (or the power station re-sited to suit such a use, like a dairy), which would involve some additional cost in plumbing and thermal storage. From the reference documents this appears to be unlikely.

Appendix 5 Novel Photovoltaic Technologies

9.11. Sliver Cell Technology

The Sliver Cell innovation was announced by Professor Blakers at the Solar Harvest Conference in November 2002 and the associated media release is reproduced below. While the technology is claimed to provide a major reduction in solar cell manufacturing cost, Prof Blakers rightly pointed out at the conference that in a market growing at 40% pa as the photovoltaic market currently is worldwide, even major cost advantages will not flow into substantially lower prices for several years. It is possible though that some value can be extracted for this project by offering field testing in a Power Station context.

Media Release

New Sliver Cell TM offers revolution in solar power

28 Nov 2002

A joint venture between the Australian National University and Origin Energy has developed a new type of solar cell with the potential to revolutionise the global solar power industry. Director of the ANU Centre for Sustainable Energy Systems, Professor Andrew Blakers today unveiled the Sliver Cell, which uses just one tenth of the costly silicon used in conventional solar panels while matching power, performance and efficiency.

Professor Blakers said, "A solar panel using Sliver Cell TM technology needs the equivalent of two silicon wafers to convert sunlight to 140 watts of power. By comparison, a conventional solar panel needs about 60 silicon wafers to achieve this performance. "By dramatically reducing the amount of expensive pure silicon, the largest cost in solar panels today, this new technology represents a major advance in solar power technology." Origin Energy's Executive General Manager, Generation, Andrew Stock said, "Origin Energy has worked with ANU's Centre for Sustainable Energy Systems for several years, investing more than $6 million in research to discover a way to harness the sun's power at much lower cost. "Due to the economy and flexibility of Sliver CellsTM, we believe this technology will play an important role in the future wide-spread adoption of solar power. Sliver Cell TM technology is an excellent example of the way Australian researchers can work with Australian industry to innovate a product that leads the world".

ANU Vice-Chancellor, Professor Ian Chubb welcomed the research breakthrough. "Origin Energy is to be congratulated for its foresight and persistence in supporting the ANU team in this project. The company has made a substantial contribution since establishing the research partnership with ANU," Professor Chubb said. The most expensive part of traditional solar power panels is the silicon from which the individual cells are made. The Sliver Cell TM is a radically different concept in photovoltaics. Sliver Cells TM are produced using special micro-machining techniques, then assembled into solar panels using similar methods to those used to make conventional solar panels.

The new technology reduces costs in two main ways – by using much less expensive silicon for similar efficiency and power output, and needing less capital to build a solar panel plant of similar capacity.

The unique attributes of Sliver Cell ™ technology could open many new Sliver Cell ™ applications, in addition to conventional rooftop and off-grid uses, including:

- Transparent Sliver Cell ™ panes to replace building windows and cladding
- Flexible, roll-up solar panels
- High-voltage solar panels, and
- Solar powered aircraft, satellite and surveillance systems

Prof Andrew Blakers
Centre for Sustainable Energy Systems
Australian National University
Phone +61 2 6125 5905, Mobile 0404 056 079
www.anu.edu.au/mac/media

Andrew Stock
Executive General Manager, Generation Origin Energy
Phone +61 8 8217 5817, Mobile 0417 876 470
www.originenergy.com.au

About Origin Energy:
With a history dating back 140 years, Origin Energy is a leading Australian energy provider. It participates in most segments of the energy chain including natural gas exploration and production; power generation; energy retailing and trading; and asset services. Origin Energy supplies energy to more than two million homes and businesses. The company focuses on providing cleaner energy choices for customers. It is now the largest retailer of grid-connected solar systems in the Victorian and South Australian markets, the largest markets for grid-connected solar power in Australia. It is the only energy retailer to win preferred partner status with three leading property development companies, Australand Homes, Henley and Metricon to bring competitively priced packaged solar power products to the new-home market. Origin Energy also is partnering with BP Solar to install Australia's largest city-based solar system on the roof of the Queen Victoria Market, Melbourne, is managing a 20kW solar power system on the SA Museum, opened yesterday, and has installed a 10kW grid connected solar system on Australia's greenest commercial building, '60L' in Carlton, Melbourne.
Website: www.originenergy.com.au

About the ANU Centre for Sustainable Energy Systems:
ANU is the premier research University in Australia. The ANU Centre for Sustainable Energy Systems (CSES) involves a group of 45 staff & PhD students working on renewable energy technologies. About 80% of its turnover comes from external sources; primarily from companies and from government funds provided on a matching basis with industry. CSES has substantial activities in the areas of photovoltaics, solar thermal power and solar energy systems. Further information and pictures of systems can be obtained at http://solar.anu.edu.au

Media Release Source:
http://www.originenergy.com.au/news/news_detail.php?pageid=82& newsid=233

9.12. Titania Solar Cells

While offering the potential for cost reductions in the medium term, this Swiss/Australian technology will not be available in time for the BSPS project. Sustainable Technologies International, the Australian developer/manufacturer, advises as follows:

Our current product (glass wall panels) is not designed for solar farm type applications. It is priced to complete with silicon glass laminate panels, and is therefore significantly more expensive than standard panels. We have a design which we hope (funding being available) to develop and put in production for RAPS or standard applications, but it will be around three years before we have it on sale.

Contact: Dr Sylvia Tulloch, stulloch@sta.com.au

9.13. Bifacial Solar Modules

Bifacial solar module performance increases due to the rear surface being a PV generator. The contribution from the rear surface obviously depends upon how much light hits the cells. To maximise the benefit, reflective surfaces are required behind each sub-array, which would add to both capital and maintenance costs. This technology is not seen as offering any advantage in a green-fields context like Briagolong.

The manufacturer claims:

Bifacial PV modules collect the sun light from both the front face and also from the back face! As a result you get more energy for the same price.

www.pvcomponents.com

back face *front face*

Appendix 6 Sources of Possible Government Support

This summary was kindly provided by Dr Robert Passey, Phone: 02 9665 0594, Mobile: 0421 783 122, robertp@bigpond.net.au.

9.14. Federal Programs

Type of Support	Start/Finish	Amount Allocated	Amount Spent [33]
Renewable Remote Power Generation Program (RRPGP) Supports reduction of diesel-based electricity generation by providing up to 50% of the capital costs of renewable energy installations. The amount allocated to water pumping is limited to 5% of total funds provided to each State. Program funds are allocated to participating States and Territories on the basis of the relevant diesel fuel excise paid in each State or Territory by public generators in financial years 2000/01 to 2003/4. Seven RRPGP Programs are currently operating in five States, with an eighth, the Indigenous Community Support Program (Bushlight), managed Federally across several States.			
Market Support	1st July 2000 / 30th June 2004	Up to $264 million, a proportion of which is for other renewables such as wind	To the end of June 2002, grants of $6.96 million had been paid for 467 installed systems, which included 589.6 kWp of PV, and an additional $7.37 million had been approved
Comments: Each State/Territory has established a slightly different program to meet the specific needs of local off-grid communities. Details of the State and Territory schemes are described in Table … The target groups are indigenous and other small communities, commercial operations, including pastoral properties, tourist facilities and mining operations, water pumping and isolated households. One State has been overwhelmed by grant applications, while other States may have problems finding sufficient matching funds to utilise their allocations - although this may be assisted by allocations to several major projects. Start-up delays have caused major problems in the industry, with some customers delaying purchases for up to two years. Some States are attempting to achieve standardisation and quality control over systems installed, to reduce on-site problems later on. Some funding is also being made available to assist the industry in training and accreditation.			

<table>
<tr><td colspan="4">Indigenous Renewable Energy Services Project (Bushlight)
Mostly funded through the RRPGP. The Indigenous Renewable Energy Services Program is a support program providing independent advice, access to education and training, design and maintenance support to small indigenous communities installing renewable generation. It is being implemented by Bushlight, a joint-venture between the Centre for Appropriate Technology (CAT) and the Australian Cooperative Research Centre for Renewable Energy (ACRE). Bushlight is funded by $8m in funds from the Australian Greenhouse Office and $0.4m from the Aboriginal and Torres Strait Islander Commission (ATSIC). Bushlight is managed by ATSIC. The Bushlight program is expected to provide support services to facilitate the installation of renewable energy systems for around 200 small indigenous communities. Funding for the renewable energy systems will be sourced 50% from ATSIC Regional Council's infrastructure funds and 50% from the RRPGP sub-programs in each State. Individual communities will be expected to meet the maintenance and battery replacement costs for each system.</td></tr>
<tr><td>Market Support</td><td>1 July 2002 to
1 July 2006</td><td>$8.4 million over 4 years</td><td>As of 30 June 2002, the AGO has paid $2m to ATSIC for the delivery of Bushlight. System delivery scheduled to start in April 2003.</td></tr>
<tr><td colspan="4">Comment: At this stage no funding has been allocated or spent. Most staff positions in Bushlight have been filled, consultations with relevant communities and Regional Councils and design work on standardised systems have commenced.</td></tr>
<tr><td colspan="4">Photovoltaic Rebate Program (PVRP)
Administered by various state government agencies. Cash rebates are available to householders and owners of community use buildings who install grid-connected or stand-alone photovoltaic systems. Residential buildings are eligible for a rebate of $5.00/Wp for new systems, capped at $7,500 (or 1.5kW) for each installation. Upgrades to existing PV systems can receive rebates of $2.50/Wp capped at $2,500 (1.0kW). Community buildings are eligible for a rebate of $5.00/Wp, capped at $10,000 (2kW).</td></tr>
<tr><td>Market Support</td><td>1 Jan 2000 / 30 June 2003</td><td>Up to $31 million</td><td>Up to the 30 September 2002 the PVRP program had committed $23,168,661.50 for pre-approved systems.</td></tr>
<tr><td colspan="4">Comments: Introduction of the GST had a significant negative impact on this program because PV modules were exempt from wholesale sales tax (that the GST replaced). After an initial rush prior to the imposition of GST, PVRP rebates have remained steady averaging slightly over $1.5m per month. Because of problems with too high a rate of uptake, conditions were restricted – originally a rebate of $5.50/Wp was applicable to both new systems and upgrades, and the cap was $8250.

Most rebates have been awarded to NSW, Vic and QLD that together make up over 83%. Grid connected systems account for only 25% of rebates, the rest being stand-alone.

This program is currently expected to conclude in mid 2003. Given the significant support this program provides, in the absence of replacement programs, its conclusion is expected to result in a slump in the PV market.</td></tr>
<tr><td colspan="4">Renewable Energy Industry Development Program (REID)
Is a competitive grants program to Australian companies and organisations who can demonstrate that their projects will assist the development of a sustainable internationally competitive Australian renewable energy industry. It provides full funding although projects with other sources of support either in cash or in kind are favoured. It was a component of the Renewable Energy Commercialisation Program.</td></tr>
<tr><td>Industry Development

Demonstration and Commercialisation</td><td>2000 - 2004</td><td>$6 million</td><td>$1.14m has been provided to date for PV-related projects (and this is expected to exceed $1.3m when round 7 is announced)</td></tr>
</table>

Comment:			
Renewable Energy Equity Fund (REEF) Provides venture capital and managerial advice for small innovative renewable energy companies along with private sector funding on a 2:1 basis. This includes companies which are commercialising direct or enabling renewable energy technologies and services, such as manufacturers of photovoltaic cells or inverters, providing there is an innovative development being commercialised. In return for the provision of capital, the fund manager acquires a part-ownership of the company and usually a seat on the Board of Directors. The fund manager's ultimate goal is to make a profit from the long term, patient investment, through capital gain.			
Venture Capital	2000 - 2009	$17.7 million	$3 million on PV-related projects, approximately $3.5 million to non PV-related projects.
Comment: At this stage only one REEF grant has gone to a PV-related company. This went to Battery Energy who with the CSIRO and BP Solar has developed a long life, deep cycle, lead acid battery for RAPS. Note that it supplies venture capital that requires a return on investment and so is different to other government programs that simply provide financial support with no requirement for return.			
Renewable Energy Industry Program (REIP)			
Demonstration Development	1998 - 2003	$2.235 million	$360,000 on PV projects, $1,675,000 to non PV-related projects.
Comment: At this stage REIP funding has been allocated to two PV-related projects. One to CitiPower for the installation of at least 50 grid-connected rooftop systems at reduced prices in Victoria using Australian technologies. The other went to ANUTECH, Solahart Industries and Western Power Corporation, to build a 20kW grid-connected solar PV trough concentrator using parabolic mirrors and high efficiency PV cells.			
Renewable Energy Commercialisation Program (RECP) This finished in 2001 and involved 6 rounds of Commercialisation funding and 2 rounds of Industry Development funding. The Commercialisation component funded projects that demonstrated strong commercialisation potential, contribution to the wider development and diversification of Australia's renewable energy industry, and reduction of greenhouse gas emissions. The Industry Development now operates as the REID program.			
Industry Development Demonstration and Commercialisation	1998 - 2001	Up to $55.6 million, $49.6 million for Commercialisation, $6 million for Industry Development	$11,112,000 on PV projects, $4,793,500 on PV-related projects, $23,408,200 spent on non PV-related projects.
Comment: A wide variety of projects were funded which ranged from those that directly benefited PV (including R&D, manufacturing, commercialisation and demonstration projects) to those that have only indirect benefit by supporting BOS components, development of standards, evaluation tools, education/demonstration systems, and computer modelling tools. The Renewable Energy Technology Roadmap was also supported through this program.			

9.15. State and Territory Programs

VICTORIA			
Renewable Energy Support Fund (RESF) Support will be provided for up to 20% of the total capital cost of small-scale renewable energy generation projects. The focus will be on projects and technologies that have demonstrated local market development potential.			
Demonstration and Commercialisation	late 2002 / 2004	$8.45m	None as yet
Comment: This fund has yet to define its parameters, some may be available for PV.			

Appendix 7 PVRP Support – Draft Letter

<date>

Attention: Mr E Vickery

Australian Greenhouse Office
GPO Box 621
Canberra ACT 2601

Application for PVRP Support

On behalf of <xx> households in the town of Briagolong, Victoria, <entity name> hereby applies for <xx> PVRP Grants to the sum of <maximum amount permissible for xx households> as set out in the PVRP Application Guidelines. That sum is to be applied to the construction of a community-owned Solar Power Station located adjacent to the town using the same technology as for household roof-top systems but with optimal siting and maintenance and with sun-tracking performance enhancement <if applicable>.

This co-operative application is put forward on the basis that the proposed Solar Power Station will provide greater solar electricity output than the <xx> roof-top systems at no extra cost to the Government while providing regional development and local skilled employment, safer installation and maintenance and environmental improvement to East Gippsland.

Details of the organisational and physical characteristics of the project are set out in the attached application form and its associated business plan. Individual applications for each of the households could be provided if that would be required to suit your protocols for processing this co-operative application.

We are proud of the innovative and cost-effective nature of our proposal from the Government's point of view and look forward to discussing its advantages to the AGO in detail at your earliest convenience if that would assist you in your assessment.

Faithfully,

<name>
<position>
<entity name>

Copy: Hon. Peter McGauran[34]

Appendix 8 Recent Relevant Policy Changes in Victoria

During the elections held in late 2002, the ALP (which was returned as the Government) made several commitments that will have a positive effect on the viability of the BSPS. At this stage the details of the potential advantage are not known.

9.16. Renewable Energy Initiatives

http://www.vic.alp.org.au/policy/sustainable_state.html

1. Set a target, to increase the share of Victoria's electricity expected from renewable energy sources from the current 4% to 10% by the year 2010.

2. Increase the Government's own purchase of Green Power from 5% to 10% of its overall electricity consumption at a cost of $3.5 million.

3. Facilitate up to 1,000 megawatts of wind energy generation in environmentally acceptable locations, building on Victoria's leadership in this new industry.

4. Commence a $3 million solar energy retrofit scheme for schools, kindergartens, childcare centres and community health centres.

5. Commit an additional $3.5 million to an extension of the successful solar hot water rebate.

6. Boost the renewable energy industry in Victoria by implementing the $8.45 million Renewable Energy Support Fund established in the 2002/3 Budget.

9.17. Victoria's renewable energy target

http://www.vic.alp.org.au/policy/sustainable_state.html#2.%20Renewable%20energy

Victoria has been making rapid progress with the introduction of major renewable energy generation facilities in recent years. The economics of wind power in particular are now quite favourable and a significant number of projects are being proposed and constructed throughout Victoria.

Renewable energy is attracting strong public support with many consumers making the switch to "Green Power" for their electricity needs.

The establishment of the Sustainable Energy Authority of Victoria (SEAV) has given new drive to these developments. The sustainable energy sector is creating new jobs and driving new innovations, while at the same time improving the environment and ensuring a future for all Victorians.

To drive these developments further, the Bracks Government will set a target to increase the share of electricity generating capacity using renewable energy sources to 10% of Victoria's electricity capacity by 2010. Currently only 4% of our electricity generation capacity uses renewable energy sources.

This is a major step forward from the Howard Government's 2% Mandatory Renewable Energy Target (MRET) for the increase from new renewable energy over the next five years. The Bracks Government has called on the Commonwealth to immediately increase this target by 60% by 2010.

Achievement of the 10% renewable energy target will maintain Victoria's position as a leader in sustainable energy development. It will also ensure that industries related to renewable energy will continue to be a key growth sector in the Victorian economy.

Labor will set a target to increase the share of Victoria's electricity generating capacity using renewable energy sources from the current 4% to 10% by the year 2010.

There is also a Victorian proposal for compulsory electricity bill "labeling" as to the source and environmental impact of the electricity provided which would be expected to enhance the market for Green Power. This does not as yet have the status of a Government proposal.

Appendix 9 OurEnergy - a possible model structure

The following information was obtained from the co-op's website (www.ourenergy.com.au) to describe this model's structure for consideration.

Community Buying Power - Why Our Energy?

The introduction of deregulation into the electricity industry has exposed all consumers, especially small and rural consumers to higher electricity prices. As of January 13, 2002 when Full Retail Contestability was introduced, prices for residential customers of some electricity retailers have risen up to18%.

Apart from the higher prices, this competitive environment will not be a reality for many small consumers. Individually, smaller consumers do not use enough electricity to enjoy negotiating clout. The one self-help mechanism available to small consumers is aggregation. Aggregation is essentially the bringing together of individual consumers into a larger group, thereby creating market power for the purpose of bargaining and negotiating better prices and services on their behalf.

What is Our Energy?

OUR ENERGY is an association sponsored by WAW Credit Union and the Shires of Alpine, Indigo, Towong and Hume, together with the Cities of Albury, Wangaratta and Wodonga. The Gippsland Herd Improvement Co-operative Ltd has also joined the association.

What are the Benefits?

OUR ENERGY's aim is to "turn customer choice into customer control". Joining together to purchase electricity gives us:

- Real customer choice and protection
- Reclaiming some control over a basic service we all depend on
- Lower energy prices and increased services
- Additional savings through energy efficient programs
- Access to green power at competitive prices

How do I join?

It's easy ... print and fill out the authorisation form and send or deliver it to any of the locations listed below. Our Energy is available to any individual or organisation that purchases electricity - residents, farmers, businesses large or small.

How does it work?

Our Energy will negotiate with electricity retailers on your behalf and advise you of the outcome. The aim will be to make cheaper prices available to you. You will be offered a contract by the successful retailer, the decision to accept it will be yours. Remember that Our Energy will ensure that your contract is consistent with the negotiated agreement.

More About OUR ENERGY?

OUR ENERGY an incorporated association, is a WAW Credit Union Community Link Project. The board of management will have representatives drawn from those using OUR ENERGY to ensure that the people using the service have a say in its operations. The board of management will always seek to direct any funds earned by OUR ENERGY, back to the community.

What Happens If I Don't Join OUR ENERGY?

You have two choices:
Stay with your existing retailer on their standard price and terms.
Attempt to negotiate a contract with a retailer by yourself for a better deal than the standard price and terms.

The purchasing power OUR ENERGY will create when thousands of individual electricity users join together will enable us to exercise the same bargaining power that is generally enjoyed only by big consumers.

Send your application to - Our Energy
PO Box 568, Wodonga, Vic, 3690

For Gippsland residents - Gippsland Herd Improvement Co-operative Ltd
2 Foster Street, Maffra, Vic, 3860

Download: Our Energy Authorisation Form (requires Adobe Acrobat)

Email:- ourenergy@wawcu.com.au

WAW Credit Union
Member Service Centres: Walwa, Wangaratta, Wodonga, Yackandandah

Your Local Shire Offices:
Albury City of Albury
Beechworth Alpine Shire
Chiltern Hume Shire Council
Corryong Indigo Shire Council
Lavington Towong Shire Council
Myrtleford Rural City of Wangaratta
Tallangatta City of Wodonga

Appendix 10 TXU as the Local Electricity Retailer

9.18. TXU Current Electricity Prices

Based on an average consumption of 20 kWh per day

			7,300	kWh per year
TXU quoted pricing	**Prices c/kWh**	**Annual Cost**	**Total Cost**	**Average Cost c/kWh**
Service charge pa		$ 154.44		
Consumption (c/kWh)	16.75	$1,222.75		
Conventional electricity			**$1,377.19**	18.87
Green Options				
Fixed charge per week		$ 52.00		
Additional Charge				
Green Earth	0.00	$ -	**$1,429.19**	19.58
Green Earth Extra[35]	3.09	$ 225.57	**$1,654.76**	22.67
Green Earth Plus[36]	5.63	$ 410.99	**$1,840.18**	25.21

9.19. TXU buys Portland wind power

Media Release

TXU has announced a new wind power contract that will increase its portfolio of renewable energy in Australia to 490 gigawatt hours each year.
21 November 2002

Under the contract, TXU will buy 150GWh of wind power each year from the Pacific Hydro Portland wind farm site, starting in 2004. TXU says that's enough energy to power more than 87,000 homes and reduce greenhouse gas emissions by 510,000 tonnes each year.

Steve Philley, Chief Executive of TXU's Australian operations said the decision to further its position as a major player in the Australian renewable energy market was strategic.

"Building a solid base in greenhouse friendly energy allows us to explore the growing renewables market and respond to the environmental concerns of the community."

"TXU is one of the largest purchasers of wind energy in the US, with enough renewable energy purchases and contracts to power more than 132,000 homes each year. We want to make the same kind of contribution to Australian communities."

TXU's current renewable energy portfolio includes landfill biogas and mini-hydro electricity.

10. Endnotes to the Appendices

[26] 9.1 and 9.2 are costed on the basis of the subscribers still paying standard tariffs for their electricity and gaining notional green power through their subscription. 9.3 and 9.4 are costed on the basis of 50% of output being sold to subscribers through an unusually "interested" electricity retailer with the other 50% being sold on the wholesale market.

[27] Still need to check if this has been resolved.

[28] Information on Basslink was current as of May 2001

[29] At the time of this research the REC Registry was unable to differentiate between the two.

[30] It is assumed that most of the power stations accredited to generate RECs in 2001 will attain a similar output in 2002.

[31] Energy – Tullett & Tokyo Liberty Australia: www.tullib.com.au/prod/energy.asp

[32] National Electricity Market Management Company (NEMMCO) website: www.nemmco.com.au

[33] While all care has been taken to ensure the accuracy of data, it is only as reliable as the sources that provided it.

[34] Mr McGauran is known to be supportive of the BSPS and may lobby the deciding minister if urged to do so by some of his constituents in a timely manner.

[35] 20% wind and 80% hydro electricity.

[36] 40% wind and 60% hydro electricity