

## Submission to the inquiry into modernising Australia's electricity grid

From

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The problems faced by the Australian electricity grid stem from a lack of stable base load generation capacity in SE Australia. The increase in wind and solar PV and the decline in coal fired generation has created an increasingly unstable grid caused by weather related, seasonal and diurnal effects on wind and solar capacity. What is needed is a renewable energy technology that is base load and cost competitive. Ideally it should also create many full time permanent jobs in areas of high unemployment such as regional towns and rural communities and not be susceptible to severe weather events.

Such a technology already exists. It's called bioenergy and has been used in Europe for decades. It has a capacity factor of 80 to 90% (similar to or better than coal) and creates many more jobs than either wind or solar as shown in the table below.

<b>Technology</b>	<b>Manufacture, Construction, Installation - (Jobs per newly installed MW)</b>	<b>Operation &amp; Maintenance - (Jobs per MW)</b>	<b>Region</b>	<b>Year of Estimation</b>	<b>Source</b>
Wind, onshore	8.6	0.2	OECD countries (Average values)	Various (2006-2011)	IRENA - Renewable Energy & Jobs, 2013.
Solar PV	17.9	0.3	OECD countries (Average values)	Various (2007-2011)	IRENA - Renewable Energy & Jobs, 2013.
Biomass Electricity	13.3	1.2	United Kingdom	2010	UK Jobs in Bioenergy Sector by 2020 - 2012 Report
Biomass Thermal	4.8	0.6	United Kingdom	2010	UK Jobs in Bioenergy Sector by 2020 - 2012 Report
Anaerobic Digestion	1.4	2.9	United Kingdom	2010	UK Jobs in Bioenergy Sector by 2020 - 2012 Report

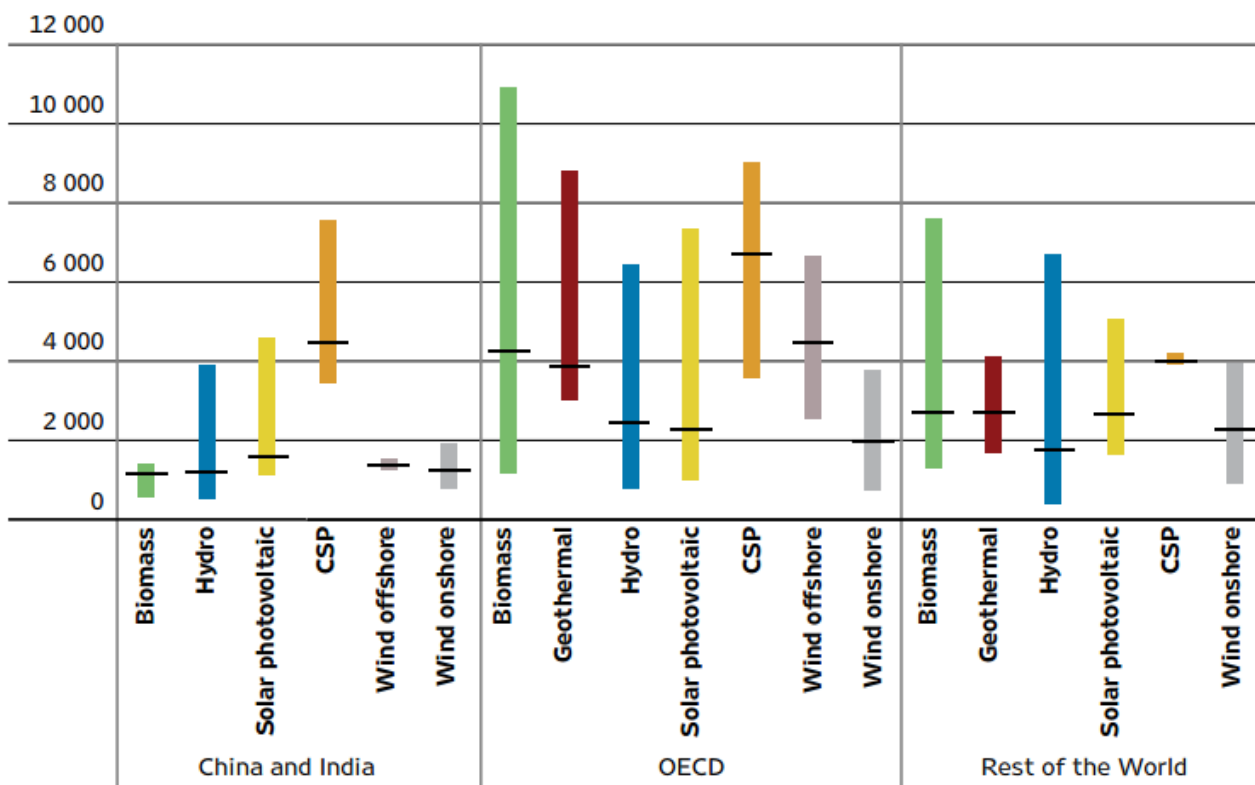
According to the 2016 South Australian Renewable Energy Report prepared by the Australian Energy Market Operator, the average capacity factor of South Australian wind farms was less than 40%. According to

Bioenergy Australia, modern bioenergy plants have a capacity factor of over 90% meaning you only need to install half the generating capacity compared to wind to achieve the same total output. Large scale solar has an average capacity factor in SE Australia of 23% meaning you'd need to install four times as much solar capacity to equal the average output of a bioenergy plant.

Below is a table from a IRENA report titled Renewable Power Generation Costs in 2014. As the OECD figures show, the average installed generation cost for onshore wind is \$1,900 US/kW. Solar PV was \$ 2,200 US/kW and bioenergy \$4,300 US/kW. However, once the effect of capacity factor is included then, by technology, the investment per kWh of annual output is: Wind –  $365 \times 24 \times 40\% = 3,504 / \$1,900 = \$0.54/\text{kWh}$ . Solar –  $365 \times 24 \times 23\% = 2,015 / \$2,200 = \$1.09$ . Bioenergy –  $365 \text{ days} \times 24 \text{ hours} \times 90\% = 7,884 / \$4,300 = \$0.55/\text{kWh}$ . This figure is not the whole story. Most bioenergy installations operate as a combine heat and power system producing between one and two times the kWhs of heat as electricity. If the capital cost is spread over the total energy output then it drops to \$0.27/kWh or even as low as \$0.16/kWh. By also producing heat bioenergy plants could help reduce demand for natural gas thereby reducing potential future demand for electricity.

**FIGURE E.S. 4: TYPICAL RANGES AND WEIGHTED AVERAGES FOR THE TOTAL INSTALLED COSTS OF UTILITY-SCALE RENEWABLE POWER GENERATION TECHNOLOGIES BY REGION, 2013/2014**

**2014 USD/kW**

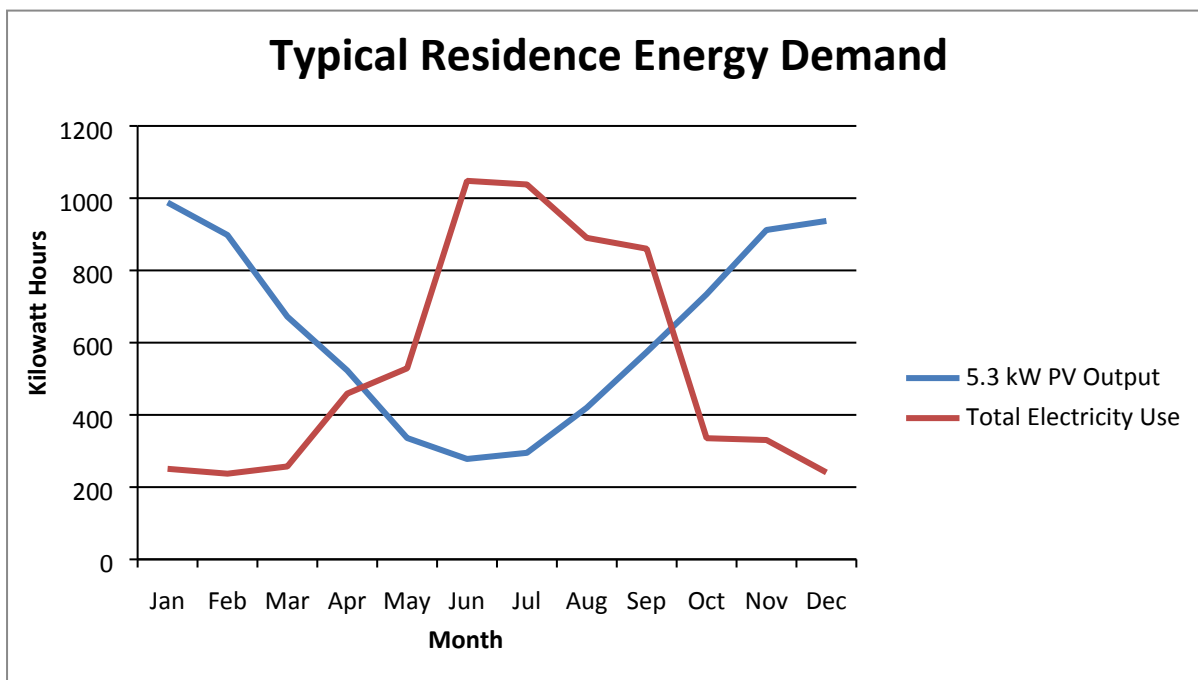


Source: IRENA Renewable Cost Database.

Note: Ranges and weighted averages are calculated for 2013 and 2014 to ensure representative ranges for biomass, CSP and offshore wind. Weighted averages for solar PV, CSP and onshore wind would be lower if only data for 2014 was used.

In modernising Australia's electricity grid you also need to consider the impact of emerging trends in energy use and technology shifts. For example, the increase cost and reduced availability of natural gas will cause consumers to shift away from gas heating and hot water to electric heat pumps. This will then lead to winter demand peaks on cold, frosty nights as now occurs on hot summer days. The problem that regulators will face is that on cold frosty nights there is no sun or wind.

The inevitable rise in fossil transport fuel costs will also cause a shift to more electric vehicles and as most of these will be charged over night this will further add to night time demands. The increasing use of home battery storage is another issue that will complicate energy management. The graph below shows the electricity use of a typical all electric home. There is plenty of excess electricity to store in batteries over summer but not in winter resulting in significant seasonal variation in residential energy consumption. Batteries to store sufficient electricity to meet this seasonal variation are not currently economic.



According to the ABS, in 2014 -15 Australia used around 194,000 GWh of electricity which was successfully delivered through the existing national grid. In the same period, Australia also used the equivalent of 397,500 GWh of natural gas, 13,262,500GWh of petrol and 21,659,166 GWh of diesel. As previously stated, increasing prices in fossil fuels will cause a shift away from them to electricity. As these figures show, that would result in a dramatic increase in demand. Natural gas prices have already started to rise as reserves fall and exports increase. Australia also now imports over 95% of its transport fuel needs and with Saudi Arabia expected to cease oil exports around 2030, global demand, particularly from China and India, will significantly increase prices. .

To meet this massive increase in electricity demand will require an enormous increase in generation and grid capacity. The most cost effective way to achieve this capacity is distributed energy production. This will allow production to occur as close as possible to demand, minimise transmission losses and maximise existing grid capacity. Below is an example of how this could be achieved with bioenergy in Victoria. The model would work in other states as well. The heat produced would replace natural gas heating and reduce the shift to electricity.

**Victorian Distributed Bioenergy Installations**

Town Name	Population - 2011	Output - MW	Capital Investment Required	Fuel Source	Annual Fuel Amount - tonnes	Employment	Electricity Produced - MWh	Heat Available - MWh
AIREYS INLET	989	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
ALEXANDRA	2245	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
ALLANSFORD	724	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ANGLESEA	2414	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
APOLLO BAY	1123	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
APSLEY	184	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ARARAT	6906	10	\$ 25,200,000	Agricultural Waste	64,000	15	82,000	150,000
AVOCA	945	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BALLAN	2008	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BALMORAL	196	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BANNOCKBURN	3429	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BARMAH	175	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BEAUFORT	983	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000
BEECHWORTH	2795	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000
BENALLA	9077	10	\$ 22,600,000	Agricultural Waste	64,000	15	82,000	150,000
BERRIWILLOCK	122	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BEULAH	177	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BIRCHIP	641	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BIRREGURRA	475	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BLACKWOOD	295	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
BOOLARRA	495	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BOORT	740	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000

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BRIAGOLONG	504	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
BRIDGEWATER	364	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BRIGHT	2294	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
BROADFORD	3342	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
BRUTHEN	528	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000
BUCHAN	115	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000
CAMPERDOWN	2856	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CANN RIVER	167	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
CARISBROOK	728	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CASTERTON	1349	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CASTLEMAINE	8965	10	\$ 22,600,000	Agricultural Waste	64,000	12	82,000	150,000
CHARLTON	943	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CHILTERN	1079	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CLUNES	1393	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
COBDEN	1536	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
COBRAM	5370	10	\$ 22,600,000	Agricultural Waste	64,000	12	82,000	150,000
COHUNA	1779	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
COLERAINE	870	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
CORRYONG	1044	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
CRESWICK	2582	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
DALES CREEK	396	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
DARTMOOR	269	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
DAYLESFORD	3294	5	\$ 12,600,000	Fire Management /Forest Harvesting	32,000	12	41,000	75,000

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				Residue				
DERRINALLUM	228	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
DIMBOOLA	1367	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
DONALD	1310	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
DOOKIE	233	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
DROUIN	9108	10	\$ 22,600,000	Agricultural Waste /Forest Harvesting Residue	64,000	15	82,000	150,000
DUNKELD	473	5	\$ 12,600,000	Agricultural Waste /Fire Management	32,000	12	41,000	75,000
DUNOLLY	644	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
EDENHOPE	690	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
EILDON	678	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ELMORE	656	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ENFIELD	384	5	\$ 12,600,000	Agricultural Waste /Fire Management	32,000	12	41,000	75,000
EUROA	2668	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
FOSTER	1063	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
GISBORNE	7906	10	\$ 22,600,000	Agricultural Waste /Forest Harvesting Residue	64,000	15	82,000	150,000
GLENGARRY	643	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GLENROWAN	289	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GLENTHOMPSON	123	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GORDON	378	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GOROKE	215	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GREAT WESTERN	177	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
GREENDALE	525	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
HAMILTON	9309	10	\$ 22,600,000	Agricultural Waste	64,000	15	41,000	75,000
HARCOURT	462	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
HEATHCOTE	1655	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
HEYFIELD	1440	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000
HEYWOOD	1245	5	\$ 12,600,000	Agricultural Waste /Forest Harvesting Residue	32,000	12	41,000	75,000

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HOPETOUN	528	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
INGLEWOOD	722	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
INVERLEIGH	673	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
JEPARIT	372	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KANIVA	714	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KERANG	3530	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KILMORE	6189	10	\$ 22,600,000	Agricultural Waste /Forest Harvesting Residue	64,000	15	82,000	150,000
KINGLAKE	1031	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
KOONDROOK	739	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KOROIT	1367	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KYABRAM	5477	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
KYNETON	4349	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LAKE BOLAC	147	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LAKES ENTRANCE	6137	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
LANCEFIELD	1216	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
LEARMONTH	287	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LEONGATHA	4697	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LETHBRIDGE	530	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LINTON	351	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LISMORE	281	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
LONGWARRY	990	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MACARTHUR	229	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MAFFRA	4089	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MALDON	1225	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MALLACOOTA	1000	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000

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MANSFIELD	3151	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MARLO	423	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MARONG	365	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MARYBOROUGH	7139	10	\$ 22,600,000	Agricultural Waste	64,000	15	82,000	150,000
MARYSVILLE	246	5	\$ 12,600,000	Fire/Forest	32,000	12	41,000	75,000
MEREDITH	369	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MERINO	171	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MILAWA	217	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MINYIP	419	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MIRBOO NORTH	1550	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MORTLAKE	1051	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MOUNT BEAUTY	1725	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MOUNT BULLER	2547	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MOUNT HOTHAM	2460	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
MURCHISON	737	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MURRAYVILLE	214	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MURTOA	783	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
MYRTLEFORD	2686	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
NAGAMBIE	1513	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
NATHALIA	1434	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
NATIMUK	392	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
NEERIM SOUTH	704	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
NEWSTEAD	483	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
NHILL	1849	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000



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NOWA NOWA	147	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
NUMURKAH	3745	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
OMEQ	282	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
ORBOST	2165	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
OUYEN	1130	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
PENSHURST	455	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
POREPUNKAH	557	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
PORT FAIRY	2893	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
PORTLAND	9705	50	\$ 102,000,000	Fire Management /Forest Harvesting Residue	160,000	40	205,000	375,000
PYALONG	439	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
PYRAMID HILL	418	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
QUAMBATOOK	197	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
RAINBOW	510	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
RAWSON	325	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
RED CLIFFS	2632	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ROBINVALE	2243	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ROCHESTER	2551	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ROSEDALE	1090	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
RUPANYUP	344	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
RUSHWORTH	950	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
RUTHERGLEN	2085	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
SAWMILL SETTLEMENT	365	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
SEA LAKE	616	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
SEYMOUR	5871	10	\$ 22,600,000	Agricultural Waste	64,000	15	82,000	150,000

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SKIPTON	439	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
SMYTHESDALE	479	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
ST ARNAUD	2146	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
STANHOPE	470	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
STAWELL	5655	10	\$ 25,200,000	Agricultural Waste	64,000	15	82,000	150,000
STRATFORD	1605	10	\$ 22,600,000	Agricultural Waste	64,000	15	82,000	150,000
STREATHAM	100	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
SWAN HILL	9897	50	\$ 102,000,000	Agricultural Waste	160,000	40	205,000	375,000
SWIFTS CREEK	143	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
TALBOT	243	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TALLANGATTA	917	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
TATURA	3574	10	\$ 22,600,000	Agricultural Waste	64,000	15	82,000	150,000
TEESDALE	1435	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TERANG	1908	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TIMBOON	690	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TONGALA	1216	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TOONGABBIE	428	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TOORA	442	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TRAFALGAR	2918	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
TRENTHAM	682	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
UNDERBOOL	196	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
VIOLET TOWN	661	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WARRACKNABEAL	2302	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WEDDERBURN	703	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WILLAURA	256	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WINCHELSEA	1534	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WOODEND	3389	5	\$ 12,600,000	Agricultural Waste /Fire Management	32,000	12	41,000	75,000
WOOLSTHORPE	231	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WOOMELANG	186	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
WYCHEPROOF	635	5	\$ 12,600,000	Agricultural	32,000	12		

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				Waste			41,000	75,000
YACKANDANDAH	928	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
YARRAM	1697	5	\$ 12,600,000	Fire Management /Forest Harvesting Residue	32,000	12	41,000	75,000
YEA	1087	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
YINNAR	552	5	\$ 12,600,000	Agricultural Waste	32,000	12	41,000	75,000
<b>TOTALS</b>		<b>1045</b>	<b>\$ 2,556,800,000</b>		<b>6,368,000</b>	<b>2225</b>	<b>8,118,000</b>	<b>14,850,000</b>

Notes: The generating capacity allocated to each town is indicative only. The actual size will depend on the amount of fuel available in that location, suitable grid connection and demand for heat. The actual capital investment required is likely to be much less than \$2.56 billion if multiple sites are developed simultaneously due to bulk purchasing. If a community investment model similar to the Bendigo Bank is used local communities will fund the investment required and the cost to the Victorian Government would be minimal. The total annual amount of fuel includes 5.8 million tonnes described in the Victorian Government report Fuelled for Growth and up to 600,000 tonnes of material that could be produced as part of annual fire prevention works across the state. Rather than just slashing strategic breaks and burning Zone 1 areas around townships and other assets the hazardous vegetation could be mechanically harvested and used as fuel for bioenergy plants. An addition 2.7 million tonnes of municipal waste suitable for energy production is also available annually for energy which would allow an additional 200 MW of generating capacity, produce an additional 1,890,000 MWh of electricity and employ around 300 more people. Direct employment would be around 2,225 in plant operation, maintenance and fuel supply or 2,500 if municipal waste to energy is included. The likely employment multiplier effect would be between 2 and 3 creating a total employment figure of 5,000 to 7,500 however the availability of low cost heat is likely to create additional employment in horticulture and intensive animal husbandry.

### Budget for 5 MW Bioenergy Plant

ITEM	CAPITAL COST	INCOME	EXPENDITURE
Infinite Energy 5.4MW gasifier system with dry gas cleaning	\$2,000,000.00		
Gas engines - 5 x 1MW	\$2,500,000.00		
Land purchase, site works and plant construction	\$4,000,000.00		
Electricity connection and sub station	\$1,000,000.00		
Heat delivery system - up to 10km	\$1,000,000.00		
Contingence amount - 20% of capital	\$2,100,000.00		
Loan repayment @ 5% over 20 years			\$1,020,000.00
Operating Hours - 8,200 p.a.			
Labour – 10 full time jobs operating the plant (up to 2 off site jobs would also be created in the fuel supply chain). Average EFT cost including overheads \$60,000/annum.			\$600,000.00
Fuel - 32,000 tonnes of biomass @ \$100/tonne			\$3,200,000.00
Plant & Equipment Maintenance (2% of capital)			\$252,000.00
RET payment - 41,000 MWh @ \$30/MWh		\$1,230,000.00	
Electricity Sales - 36,900MWh @ \$80MWh		\$2,952,000.00	
Electricity Sales -3,200MWh @ \$200MWh		\$640,000.00	
Heating value - 30,000MWh @ \$50/MWh		\$1,500,000.00	
Biochar sales - 1,000 tonne @ \$200/tonne		\$200,000.00	
<b>TOTALS</b>	<b>\$12,600,000.00</b>	<b>\$6,522,000.00</b>	<b>\$5,072,000.00</b>
<b>Potential annual profit if peak electricity and heat are sold - \$1,450,000.00 ROI - 11.5%</b>	<b>NB - Costings are indicative only and should not be used for investment purposes.</b>		