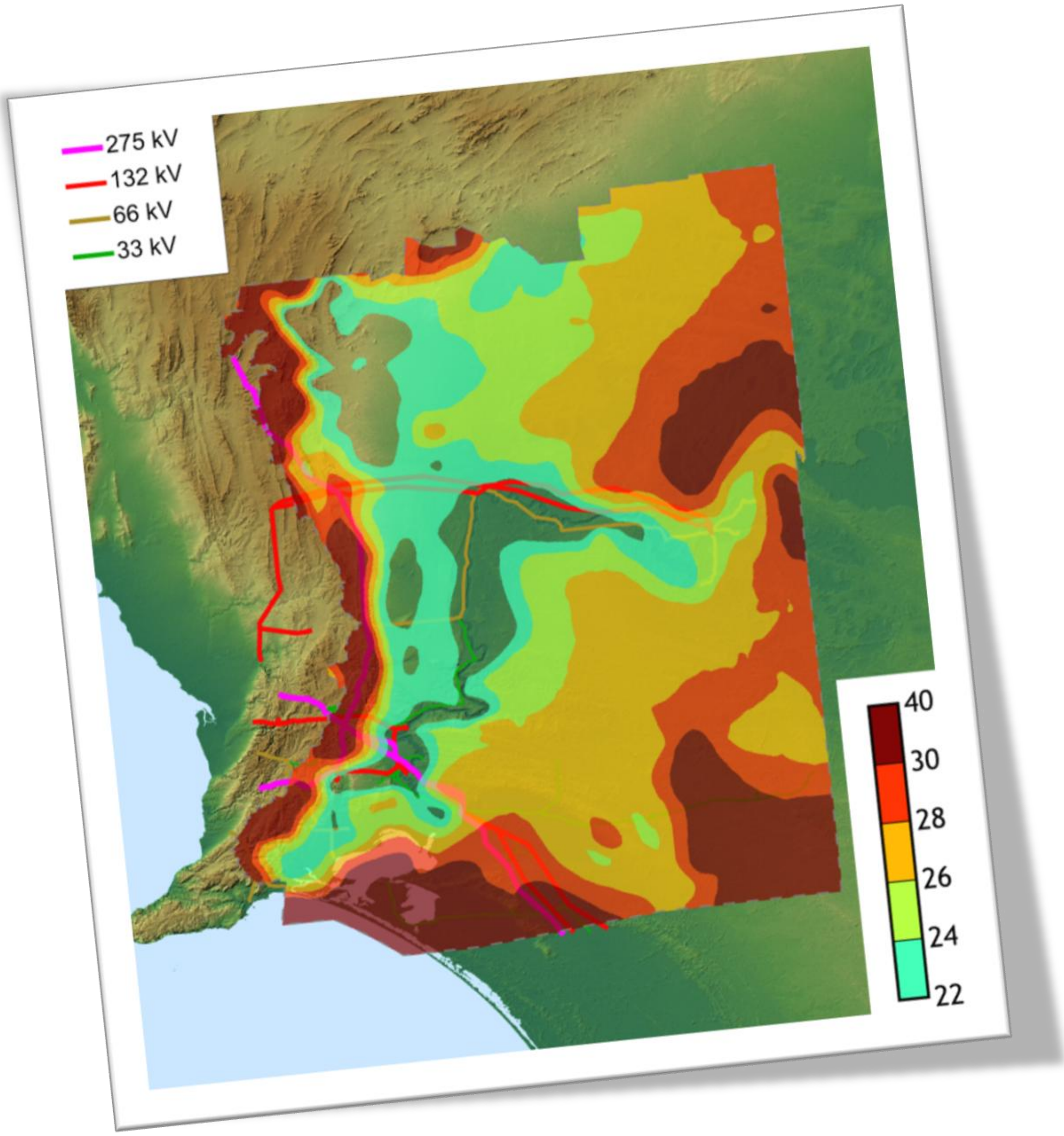
THE ENERGY PROJECT PTY LTD



LOCAL ENERGY SECURITY STUDY (LESS)

for

THE SOUTH AUSTRALIAN MURRAY-DARLING BASIN COMMUNITY (SA MDB)

December 2011

Document Control

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Acknowledgement: The City of Onkaparinga is acknowledged as the visionary sponsor of the work upon which this document is based.

About THE ENERGY PROJECT PTY LTD

The Energy Project Pty Ltd is an Australian energy consultancy specialising in localised energy security matters and advancing the consumer interest in energy markets. *The Energy Project* combines the experiences and expertise of renewable energy specialists Cyclopic Wind Pty Ltd and energy market specialists St Kitts Associates. For more information please contact Mr Andrew Nance at andrew.nance@yourenergyproject.com

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1. PURPOSE

The Australian Government released the first National Energy Security Assessment (NESA) in 2009. The second NESA was released in December 2011. The NESA forms a key input into Australia's Energy Policy. The purpose of this Local Energy Security Study (LESS) is to focus the consideration of energy security issues on a specific region – in this case the South Australian Murray Darling Basin.

The term local energy security is intended to convey a similar meaning to that of water security or food security. The spectrum of security in this context is considered to be from 'totally dependent' to 'totally self sufficient'.

Energy security is assessed in terms of the key objectives of access to adequate, affordable and reliable energy supplies. While there are environmental considerations that are relevant, especially in relation to renewable energy supply, the primary reason for considering energy security is an economic one.

This Local Energy Security Study forms part of the broader work program of the *Strengthening Basin Communities* program and has arisen out of consideration of adaptation for the region's economy. The study has aimed to estimate the SA MDB regional economy's reliance on energy as an input and, further, the extent to which this reliance results in a situation of expenditure wherein the region is without any local value-add.

A review of the various strategies and plans applicable to the region make repeated reference to energy – renewable energy and energy infrastructure in particular. Local Energy Security is put forward in this report as a way of organising these various strategic objectives and aspirations into a form that allows for priorities to be set and actions initiated.

This report has three main components: a Local Energy Security Assessment (LESA), a Local Energy Resource Assessment (LERA) and a subsequent Local Energy Security Strategy (LESS). The LESA represents a high-level assessment of the region's energy markets and infrastructure. The LERA provides an overview of the region's energy resource endowment. The LESS is the strategic planning framework that collates and prioritises the actions required to improve or even maintain a region's energy security.

This report has a deliberate end-user perspective. The preparation of a LESS is predicated on an assumption that an appetite exists within the community for the region to become less of a passive 'price taker' in the energy markets, and a much more active and engaged participant in meeting its own energy needs.

2. SCOPE

This study has been conducted over a deliberately short timeframe (3 weeks from November 21st to December 12th 2011) and has necessarily focused more on breadth than depth. With such a rapid development it is inevitable that some existing initiatives have been overlooked and the authors would appreciate any feedback that might contribute to an updated or expanded study into the future.

Given that this initial review of Energy Security for the region has, by necessity, synthesised information from differing years, from a variety of sometimes-inconsistent sources, and under ongoing inconsistencies in the definition of the region's boundaries, the authors consider that the figures quoted herein have a general uncertainty of +/- 15%.

In general, it is recommended that individual data be verified prior to initiating any significant expenditure based on the information presented herein.

Australian Bureau of Statistics data used have been those related to the Murray Lands Statistical Division (SD), which includes the Statistical Subdivisions (SSD) designated as Murray Mallee and Riverland.

The spatial scope of the study is that region within the NRM region boundaries as provided by the project sponsors. It is noted that there is some ambiguity over what should constitute the boundaries of the region (NRM, RDA, SA Government Planning Regions, Local Government Areas). This project apologises in advance for any areas that stakeholders feel may have unnecessarily fallen out of scope.

Figure 1 below shows the region used for the wind mapping, extending from Hallet in the North, to south of Coonalpyn, east to the Mount Lofty Ranges and west to the Victorian border.

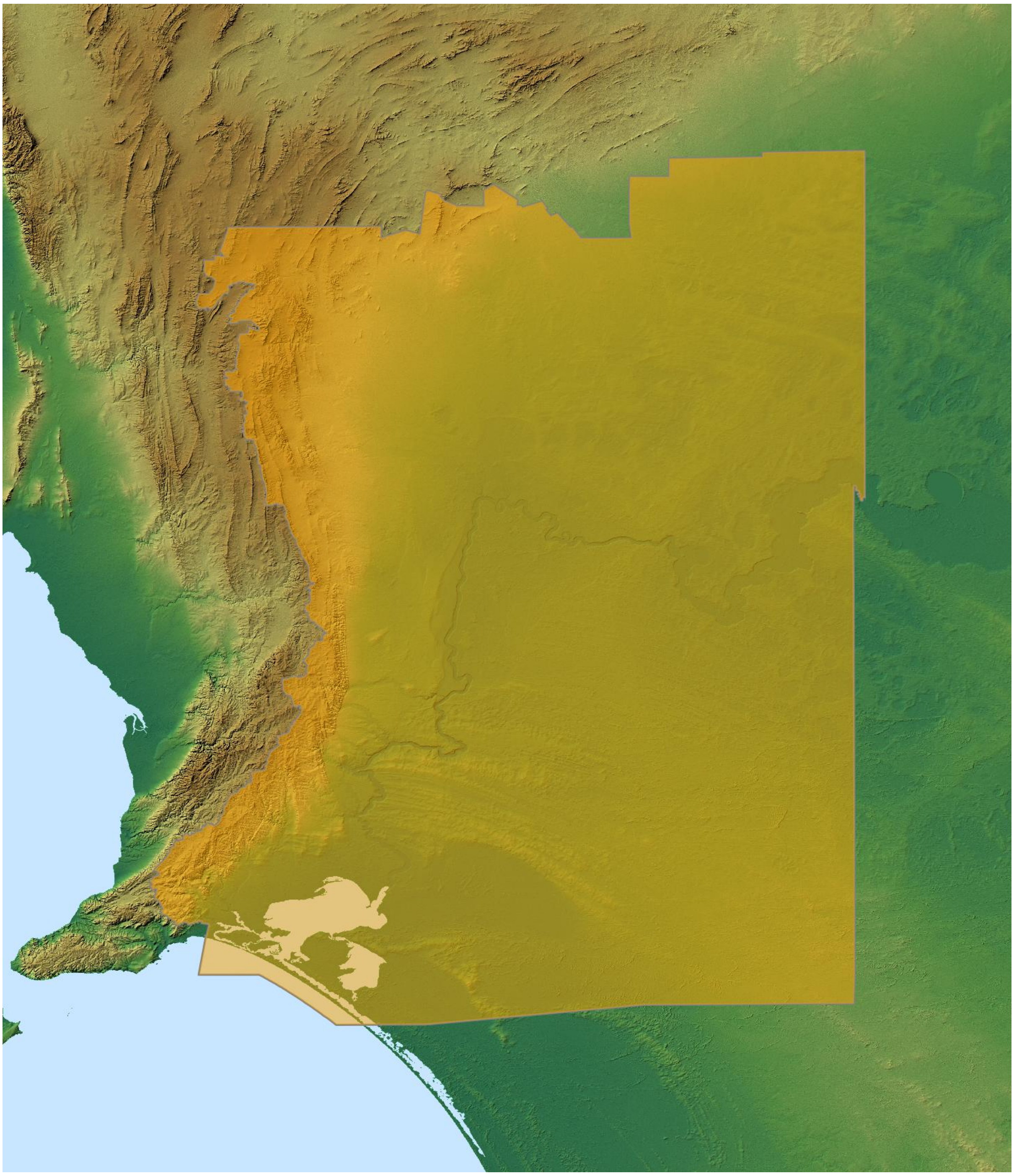

Figure 1 Map of the SA MDB region (in yellow)

3. EXECUTIVE SUMMARY

A region's energy economy can be seen as a vital input into the broader regional economy. *Energy Security* will be greater the more there is local economic benefit along the energy value chain. *Energy security* is lower when a region relies on simply importing energy in its final forms.

An assessment of security is also influenced by the relative size of a region's energy economy. Heavily energy dependant regional economies are inherently less secure than more service-based economies that count energy as a much smaller input cost.

FINDINGS

The SA MDB region energy security has been assessed as follows:

DIMENSION	RATING
Affordability:	Low-Moderate
Adequacy:	Moderate
Reliability:	Low-Moderate

GREATER THAN AVERAGE RELIANCE ON ENERGY AS AN INPUT

Findings: Energy consumers in the SA MDB region are estimated to spend over $300M p.a. on stationary and transport energy products and services in the creation of a Gross Regional Product of $2,500M. This 12% compares to a state-wide average of around 8% and is considered to be a strategic vulnerability for the region in a climate of rising energy costs and challenging economic conditions.

Beyond an economic assessment is consideration of the region's energy infrastructure – in summary, the study seeks to answer the question: Is infrastructure capacity a constraint or an opportunity for the local economy? This report provides a stocktake of energy supply, energy demand and energy infrastructure for the region. The reliability of electricity supplies has also been a key consideration.

INFRASTRUCTURE CAPACITY MORE CONSTRAINT THAN OPPORTUNITY

Findings: Existing infrastructure exhibits some available capacity in the key regional centres but is very limited beyond these locations. Electricity reliability is a limiting factor outside of the main centres. Access to reticulated natural gas is confined to a few major centres and results in limited energy supply diversity.

Consideration of potential measures to enhance energy security also requires an assessment of key energy resources in the region: solar, wind, biomass, and geothermal are the key renewable energy resources considered.

SIGNIFICANT RENEWABLE ENERGY RESOURCE POTENTIAL

Findings: The region exhibits a diversity of renewable energy resources, with commercial grade wind resources in a number of locations and strong solar resources that are highest around the north-east corner of the region. However, the defining attribute of the region is probably its bio-energy potential – a largely undeveloped resource that has the potential to be the basis of an energy '*import replacement program*', which can materially improve the region's energy self sufficiency and '*balance of trade*'.

Consideration is also given to the potential for community driven energy projects. Successful local energy initiatives invariably require strong governance arrangements and a discussion of local organising capacity is provided.

HARNESSING THE SIGNIFICANT HUMAN RESOURCE POTENTIAL

Findings: There is good anecdotal evidence of an appetite for community participation in local energy projects. It is recommended that key stakeholders meet to consider an appropriate organising 'vehicle' for advancing the region's energy interests. Some initiatives are appropriately advanced by the local Regional Development Australia (RDA) offices and others by the region's local governments. However, genuine 'ownership' of energy initiatives may require an entity more explicitly tied to the interests of the regions residential and business energy consumers.

SUMMARY OF RECOMMENDED ACTIONS

Based on the Local Energy Security Assessment (LESA, Chapter 6) and Local Energy Resource Assessment (LERA, Chapter 7), an initial Local Energy Security Strategy (LESS) has been developed along with recommendations for 10 initial actions. These actions are summarised in Table 1, below and detailed in Chapter 8.

Strategic Theme		Objective	Recommended Initial Actions	
1	Energy Infrastructure and Assets	Ensure infrastructure matches growth aspirations	1.1	Electricity Reliability Enhancement Project
			1.2	Review of Natural Gas availability in the SA MDB
2	Energy Supply	Promote local energy supply, particularly renewables, for the benefit of the local economy	2.1	Bioenergy Roadmap
			2.2	Mid Scale Wind and Solar Opportunities
3	Energy Demand	Improve economic efficiency through energy efficiency	3.1	Community Energy Efficiency Projects
			3.2	Food Value Chain Energy Efficiency Best Practice Project
			3.3	Detailed Energy Demand Study
4	Community Participation and Leadership	Deliver greater influence over the region's energy future	4.1	Regional Energy Cooperative Feasibility Study
			4.2	Public Institution Demand Aggregation
			4.3	Set a target for value-add to the region-wide energy economy

Table 1 Summary of Recommended Initial Actions

4. CONTEXT

NATIONAL

This study has been conducted at a time when the Parliament of Australia has approved the introduction of a carbon price into the Australian Economy. The price is scheduled to be introduced in July 2012.

The implications of a carbon price on individuals, businesses, sectors, regions, states and the national economy are being debated in various fora. This Energy Security Study aims to contribute to the debate over the implications for the region by estimating the 'exposure' of the SA MDB regional economy to eventualities in the energy markets.

STATE

Key Strategic Documents from the South Australian Government include the *Renewable Energy Plan for SA*, the *Murray and Mallee Region Plan - A volume of the South Australian Planning Strategy* and *Strategic Infrastructure Plan for South Australia, Regional Overview*, 2005/6–2014/15. All three documents highlight the region's potential and the strategic importance of energy and other infrastructure issues. However the conversion of strategic intent to physical implementation currently appears to be underdeveloped.

LOCAL

This study is largely related to the development, resilience and diversification of the regional economy. The local Regional Development Australia (RDA) office – RDA Murraylands & Riverland (MR) – has published the *Murraylands & Riverland Regional Roadmap 2011-13*,[1] which identifies a number of challenges, opportunities, and initiatives in the region. In relation to energy, it notes that "Communities in the region are engaged in recycling and reuse of waste products and there is on-going interest in investment in the expansion of local generation of energy through renewables and provision of strategic electricity infrastructure corridors for augmentation and the extension of the transmission network."

In the roadmap, the RDA MR Strategic Plan includes that:

> *"In collaboration with strategic partners, RDA M&R build demand aggregation studies that present compelling cases for all forms of infrastructure and alternative energy generation, including power, water, wastewater, saline water, gas and sustainable technologies."*

The RDA also focuses its Strategic Plan on R&D, skill development and investment in sustainable energy end resource management.

The region's local governments and Natural Resource Management (NRM) Board are also key local stakeholders in relation to energy, infrastructure, economic diversification and climate change resilience.

[1] http://www.rdamr.org.au/regional_roadmap.html

5. LOCAL ENERGY ECONOMY

According to the South Australian Government (southaustralia.biz Easydata portal), the Murray and Mallee region delivered a Gross Regional Product (GRP) for 2006-07 (the most recent data published) of nearly $2,500M.

An estimate of the size of the region's energy economy has yielded the following results:

Electricity

The maximum demand of the SA MDB Region for electricity is around 225MW.[2] The rated capacity of the main transmission infrastructure connection points is just over 300MW. Typical South Australian consumption patterns[3] would suggest a 'capacity factor' of around 40-50% is an appropriate estimation – conservatively using 40% and an average electricity price of $0.15 to $0.20 c/kWh implies overall electricity expenditure for the region is in the order of $120-160M p.a.

Gas:

Very limited gas data is published. However the gas pipelines[4] to Angaston and Murray Bridge have a nominal capacity[5] of around 12TJ per day (12,000GJ). Assuming 50% utilisation of capacity (noting some of the gas goes through to Mildura) and a conservative delivered cost of $5/GJ[6] the region's natural gas expenditure likely exceeds $10M p.a.

LPG (bottled gas) usage data has not been sourced for this project as it is expected to be a small fraction of total expenditure.

Transport Fuels:

On Farm: Diesel use is estimated at 40 megalitres (ML) (derived from ABARES 2009[7]). Indicating an expenditure of around $40M p.a. (assuming an excise-free cost of diesel of $1 per litre).

Road vehicle registrations in the region:[8] Approximately 40,000 passenger vehicles, 13,000 light commercial vehicles (LCVs) and around 50 heavier duty trucks. Based on a range of vehicle usages and fuel consumptions, the fuel consumption is estimated to be between 100 and 200ML.

For the purposes of this report, the regions transport fuel expenditure is estimated at around $200M annually.

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[2] Derived from Planning Reports published by Electranet and ETSA Utilities

[3] ESAA Electricity Gas Australia 2010, page 21, table 2.9

[4] www.pir.sa.gov.au/__data/assets/pdf_file/0007/27484/pl6_eir_dec03.pdf: Pipeline License PL6 covers the Angaston to Berri Transmission Pipeline and Murray Bridge Lateral Pipeline. The Angaston to Berri pipeline and lateral pipeline supplying natural gas to the Murray Bridge Township is referred to as the Riverland Pipeline and is governed by Pipeline Licence 6. The Riverland pipeline also supplies natural gas to the City of Mildura and surrounding townships in Victoria, via the Berri to Mildura transmission pipeline.

[5] www.epicenergy.com.au/media/docs/MAPS_Key_Commercial_Terms.pdf schedule 2, page 12

[6] More information on gas network charges is available from Envestra. Retail gas price information can be obtained from Origin Energy.

[7] ABARES Australian Energy Statistics - Energy update 2011 Publication date: 29 Jun 2011 Table F6 South Australian energy consumption by industry and fuel type. Available from www.abares.gov.au.

[8] ABS 9309.0 Motor Vehicle Census, 31 Jan 2011 (www.abs.gov.au/ausstats/abs@.nsf/mf/9309.0)

Total Energy Expenditure:

The region currently spends around $150M p.a. on stationary energy (Electricity $120-160M p.a., Gas $10M) and around $200M on mobile energy sources. This conservatively suggests that the region spends well in excess of $300M p.a. on energy supplies for a Gross Regional Product (GRP)[9] of $2,500M – over 12%.

This compares to a statewide estimate (using the same approach) of $2,500M on Electricity and Natural Gas and around $3,200M on transport fuels – totalling around $5.7B for a GSP of around $68B (2007) – around 8%.

This suggests that the MDB region's economy is around 50% more dependent on energy as an input than the South Australian average.

Key Concept: ENERGY VALUE CHAIN

The concept of value chains often applied to agriculture, food processing, wholesale and retail can also be used in the context of energy. The final forms of energy that households, businesses and industry consume are electricity, piped or bottled gas, petrol and diesel, firewood, kerosene and so on. In the case of electricity, for example, the energy value chain generally refers to everything from fuel extraction, transport, generation, transmission, distribution and retailing.

Generation, Transmission and Distribution (the assets and infrastructure) have strong capital (capex) and operational (opex) expenditure components. Attracting major capex into the region can provide an injection of investment during construction. However, sustained contributions to the local economy – from smaller capital expenditures occurring frequently, or assets and services with high opex – are the stronger potential long term contributors to the regional economy.

Due to the high capex to opex ratio and limited opportunity for local ownership, investment in network infrastructure is usually considered an economic enabler more than a direct contributor.

Generation provides economic opportunities for both capex and opex. Capex becomes a particular opportunity at appropriate regional scales. Opex opportunities include fuel supply. This is particularly true of biomass in primary production economies.

If energy security is an objective, then a region should be seeking to 'capture' increasing amounts of these value chains into their local economy. For the SA MDB, the value chain links do not extend much past the distribution and retailing of transport fuels and LPG (bottled gas) and some local firewood harvesting and sales.

[9] http://southaustralia.biz/easydata/

Growth Projections

Figure 2 reproduces Table A1 from the *Murray and Mallee Region Plan - A volume of the South Australian Planning* Strategy. It indicates that the resident population in the region is projected to increase by around one third – from around 70,000 to 90-95,000 – by 2036.

	Population trends		SASP T5.9 Target—Maintain regional SA's share (18%) of state population[a]			
Region	ERP in 2008[b]	Average annual growth rate 1996–2008 (%)	Share of 2008 regional population[c] (%)	Population target in 2036[d] (based on 2008 share)	Population increase 2008–36 (persons)	Population growth 2008–36 (persons per year)
Eyre and Western	58,072	0.19	19.54	77,385	19,313	715
Murray and Mallee	70,125	0.23	23.60	93,446	23,321	864
Far North	28,460	−0.46	9.58	37,925	9,465	351
Limestone Coast	65,402	0.35	22.01	87,152	21,750	806
Yorke and Mid North	**75,112**	**0.15**	**25.28**	**100,092**	**24,980**	**925**
Total	297,171	0.17	100.00	396,000	98,829	3660

Figure 2 the SA 30 year Plan population trends[10]

A particular mention of Murray Bridge was made in Page 51 of the Plan:

> *"Given Murray Bridge's proximity to Adelaide, it has been designated in The 30-Year Plan for Greater Adelaide as a focus of major urban growth, with some 13,400 additional people (representing a 40 per cent increase in population) anticipated in the centre and surrounds during the next 30 years."*

In summary, the region's population and economic base is expected to grow significantly over the coming decades. It appears that policies will aim to guide development toward the main centres (particularly around Murray Bridge) where the infrastructure is the strongest. How well the growth plans have been acknowledged in infrastructure planning is not clear at this time.

[10] "The regional population targets are aspirational, based on the all-of-state population target developed for The 30-Year Plan for Greater Adelaide. The timeframes cited are uncertain and the growth targets will be amended as the results of more recent demographic analyses become available."

6. LOCAL ENERGY SECURITY ASSESSMENT (LESA)

For regional Australia, *local energy security* has been defined[11] in terms of the adequacy, reliability and affordability of energy to support the functioning of the economy and social development, where:

• *affordability* refers to an assessment of the costs and benefits of energy for a regional economy and the extent a region value adds when meeting local energy demand.

• *adequacy* is a measure of the capacity of local infrastructure and local markets to support economic and social activity; and

• *reliability* is the provision of energy with minimal disruptions to supply – particularly for energy users away from the major regional centres;

These three dimensions of energy security each have a strong local context.

LOCAL ENERGY SECURITY ASSESSMENT SUMMARY REGIONAL RESULTS

The SA MDB region energy security has been assessed as follows:

DIMENSION	RATING
Affordability:	Low-Moderate
Adequacy:	Moderate
Reliability:	Low-Moderate

This assessment is discussed in quantitative terms below.

The level of energy security is expressed using classifications of high, moderate and low levels of energy security (adapted from NESA 2009).

[11] Adapted by the authors from the National Energy Security Assessment 2009 and 2011 published by the Australian Government Department of Resources, Energy and Tourism.

Low energy security is when the economic and social needs of a region are not, or might not be, met. A low rating means that the region's energy users, and its economy overall, are vulnerable to plausible price changes or supply disruptions.

Moderate energy security is when the economic and social needs of a region are being met, but where there could be a number of emerging issues that must to be addressed to maintain this level of security. Further, a moderate rating might suggest that current risks to energy security are being, or have been, mitigated – or that price movements are manageable within the broader economy, with minimal social and economic impacts. However, the mitigation strategies may take some time to resolve negative influences.

High energy security is when the economic and social needs of a region are being comfortably met.

Affordability

The SA MDB region's energy economy has been estimated at $300-$350M for a Gross Regional Product (GRP, the regional contribution to Gross State Product, GSP) around $2,500M p.a.

This implies that expenditure on energy (electricity, gas, petrol and diesel) represents 12-14% of the region's economic output. This compares to a statewide average of around 8% and, in our view, highlights an inherent vulnerability in the region's economy.

Further, this expenditure almost entirely exits the region without local value-add. This is why 'affordability' has been assessed as Low-Moderate.

Adequacy

The region's energy infrastructure has been assessed as Moderate – some electricity network capacity exists near major centres in the Riverland and Murraylands, however this decreases rapidly away from these locations. Natural gas reticulation is very limited. No limitations on liquid fuel distribution have been identified.

Reliability

The region has relatively poor electricity reliability away from the major centres and, overall, experiences outages commensurate with the rest of regional South Australia – significantly longer and more frequent than is achieved in the state's main metropolitan regions. Recent reports have highlighted that around 10% of the region's electricity consumers are supplied from 'low reliability' feeders.(see p.21).

The key strategic areas of Supply, Demand and Infrastructure are discussed in more detail below:

ENERGY SUPPLY

Electricity

The most significant local electricity supply project for the region is the gas-fired plant proposed for Tepko. According to the project proponents, Investec Bank:[12]:

> *"The Cherokee Power Station (Cherokee) will be built by the Tungkillo Power Company, a wholly owned subsidiary of Investec Bank, to help maintain continuity of South Australia's energy supply and should reach a maximum generating capacity of 1000 megawatts by 2021… Minister for Industry and Trade Tom Koutsantonis said the full development will cost around $750 million and create 400 local construction jobs."*

The Cherokee power station will be of more than sufficient capacity to meet all of the region's electricity needs. In a physical sense the electricity produced will be of some support to local demand but in an economic sense this is not likely to hold true. The post-construction economic value to the region is unclear but there is unlikely to be much local ownership along the value chains. Rule of thumb operational expenditure net of fuel costs and major overhauls might be 1% annually of the original investment amount – around $7.5m. Even if half of this is spent in the region – the local value add is likely to be in the order of several million dollars annually. This is a healthy start towards increasing the local value add proportion of the regions annual electricity expenditure of around $150m pa.

Gas

Consumers in the region are currently serviced by Envestra's Riverland Pipeline,[13] which includes a main line from Angaston through Sedan to Berri and on to Mildura in northwestern Victoria, as well as a lateral pipeline to Murray Bridge, as illustrated in the figures below**.** The RDA MR Roadmap notes that:

> *"Natural gas to the Riverland is supplied via the transmission pipeline in Berri (which also supplies Mildura) and investigations have been undertaken into extending the gas supply to Waikerie, Renmark and Loxton. The SEA Gas Transmission pipeline[14] has a take-off point at Tailem Bend to enable supply for future industry. Expansion of natural gas and electricity networks is considered a priority for food processing and other manufacturing."*

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[12] http://www.investec.com.au/#home/mediacentre/press_releases/en_au/energy_infrastructure.html

[13] www.pir.sa.gov.au/__data/assets/pdf_file/0007/27484/pl6_eir_dec03.pdf Pipeline License PL6 covers the Angaston to Berri Transmission Pipeline and Murray Bridge Lateral Pipeline. The Angaston to Berri pipeline and lateral pipeline supplying natural gas to the Murray Bridge Township is referred to as the Riverland Pipeline and is governed by Pipeline Licence 6. The Riverland pipeline also supplies natural gas to the City of Mildura and surrounding townships in Victoria, via the Berri to Mildura transmission pipeline. The pipeline has a Maximum Operating Pressure of 10MPa and a nominal outside diameter of 114.3mm (4 inches),

[14] The SEA Gas pipeline (South East Australia Gas pipeline): the Pt Campbell to Adelaide Pipeline is approximately 680km, stretching from Minerva in South West Victoria to Pelican Point in South Australia (http://www.seagas.com.au/our-pipeline-system.php).

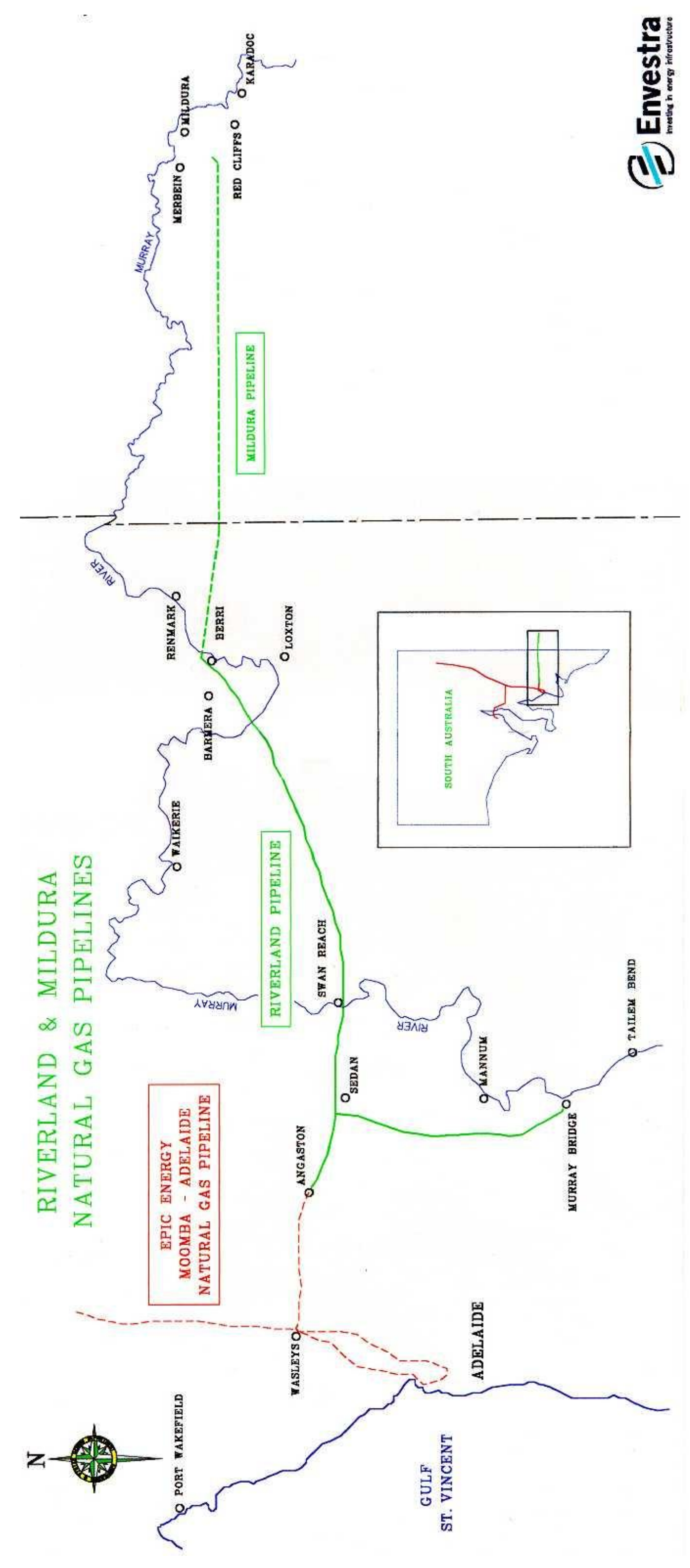

Figure 3 The local gas transmission infrastructure (source: AER/Envestra[15])

[15] www.aer.gov.au/content/index.phtml/itemId/679536

ENERGY DEMAND

Limited detailed information on energy demand for the region was found and a comprehensive energy demand study of the region should be considered as part of subsequent work. Summary results of aggregate demand are reported in the Local Energy Economy section (Chapter 5). However some noteworthy information was located in relation to irrigation.

CASE STUDY - Irrigation

The Central Irrigation Trust (CIT)[16] supplies water to 1,600 growers who cultivate 13,000 hectares of horticultural crop. The CIT's current annual energy usage is estimated[17] to be approximately 18,000 MWh, for a cost of approximately $2.5M. This is equivalent to the energy output of a 2.5 MW generation plant operating at an annual average capacity of 85%. Based on published water supply and electricity consumption figures, it is estimated that the pumping of each megalitre requires 200 kWh of electric energy. A quick comparison of electricity used per ML delivered by other irrigators to the National Water Commission highlights the relative energy intensity of pressurised water supply when compared to the gravity delivery systems popular in other regions – where energy consumption is in the order of a few 10's of kWh per ML (compared to over 200 kWh for the CIT).

Pressurised water delivery provides improvements in the efficiency of water use. The energy demands of this improved efficiency are becoming increasingly apparent. As reported on 8th June 2011 by the ABC:[18]

"The rising price of electricity has a major irrigation trust in South Australia's Riverland worried that it won't remain sustainable."

Based on information provided by the CIT to the National Water Commission,[19] the CIT electricity expenditure of $2.5M must be paid out of annual revenue in the order of $6-7M p.a. Electricity costs therefore consume around one-third of revenue – a very significant exposure to energy prices by any measure.

This very useful information about CIT is one of the few pieces of consumption detail available publicly. To estimate the region-wide implications, it is only possible to base this on an understanding that the CIT delivers around 25% of the combined volume of irrigation trusts in the region. This suggests an annual electricity cost exposure for the irrigation sector of around $10M p.a.

ENERGY INFRASTRUCTURE

Aggregate information provided in the ETSA Utilities 2011 Electricity System Development Plan[20] is provided in the Figures below. These illustrate the architecture of the electricity network and the available capacity of the main substations in the region. The figures also show the available capacity at the connection points between the Distribution and Transmission networks. To draw an analogy with road infrastructure, transmission networks represents the 'highways' and distribution networks the arterial and local roads.

[16] Central Irrigation Trust (www.cit.org.au)
[17] www.nwc.gov.au/__data/assets/pdf_file/0020/11765/0607-National-Performance-Report-Rural-SA-PUB.pdf
[18] www.abc.net.au/rural/news/content/201106/s3238635.htm
[19] www.nwc.gov.au/publications/bookshop/april-2011/national-performance-report-2009-10-rural-water-service-providers
[20] Available from www.etsautilities.com.au/centric/our_network/annual_network_plans.jsp

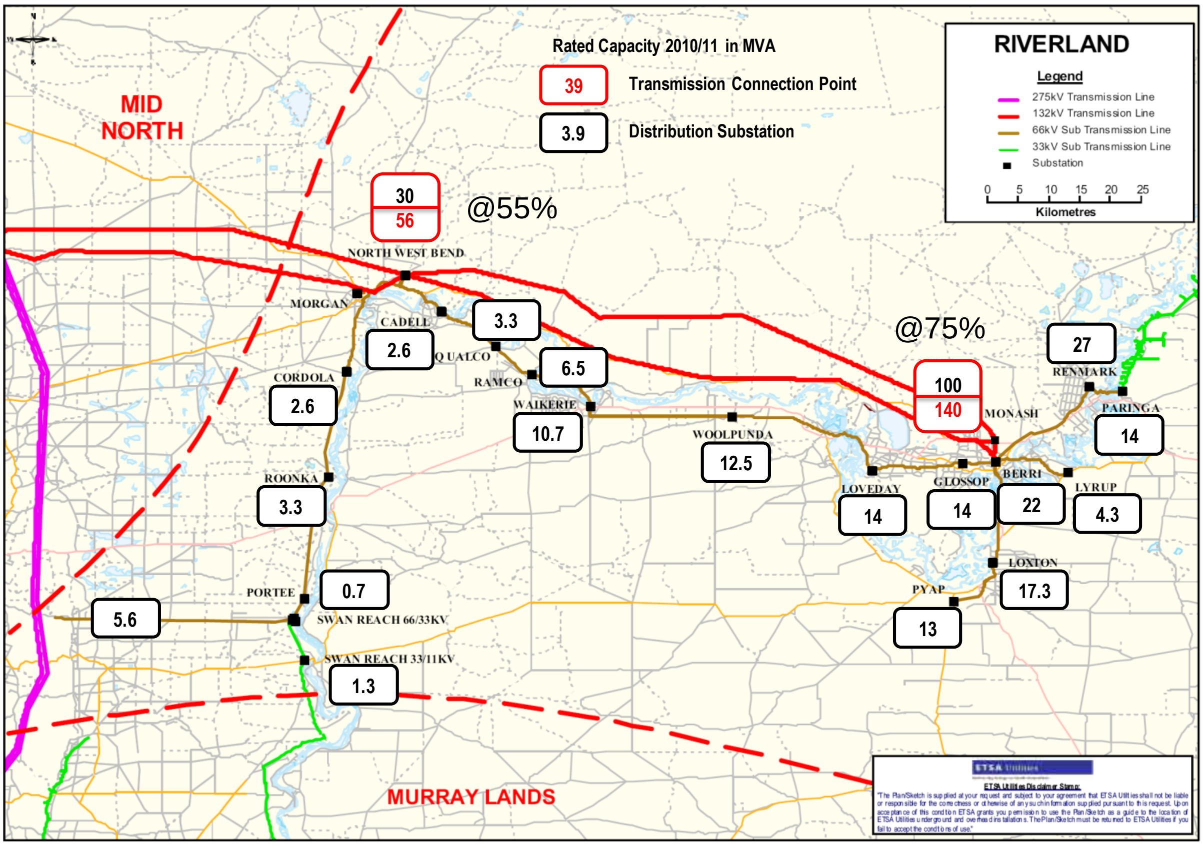

Figure 4 Electrical infrastructure in the Riverland (source: compiled from ETSA Utilities data)

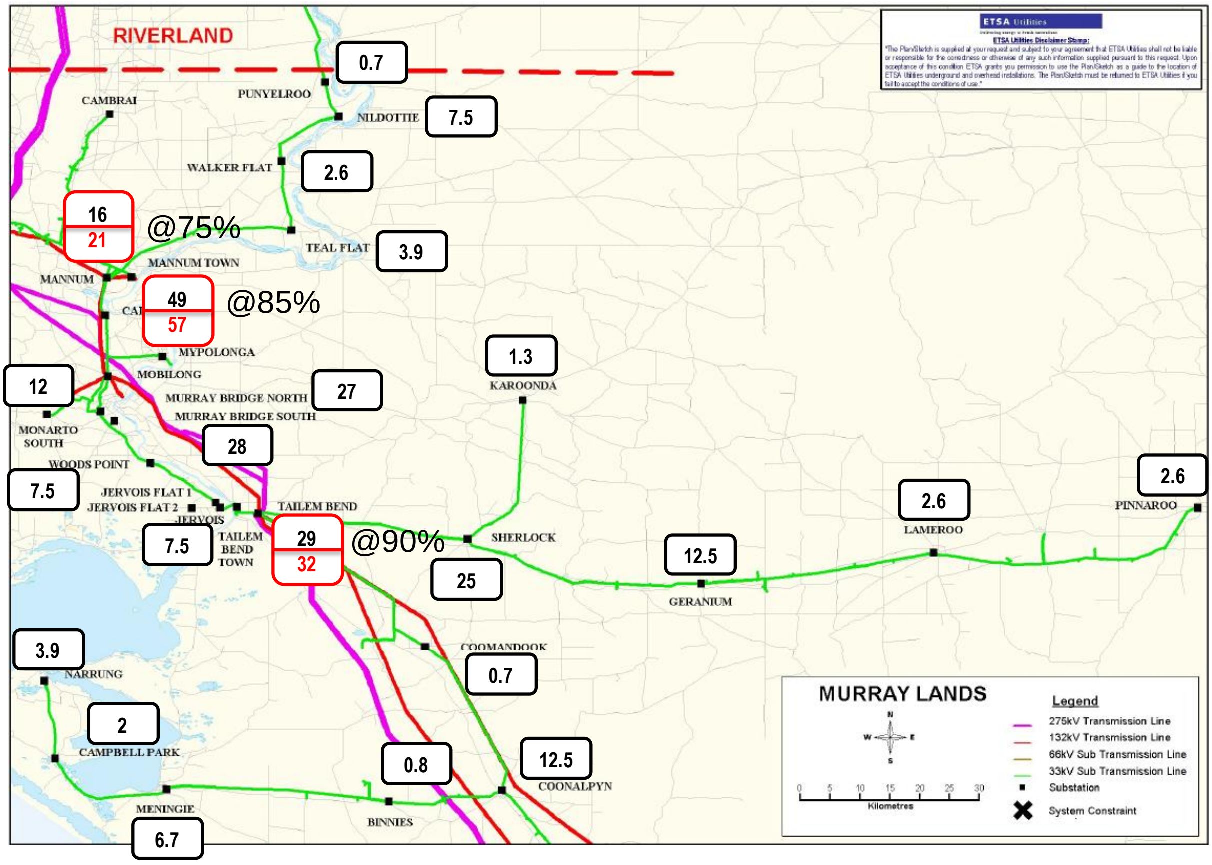

Figure 5 Electrical infrastructure in the Murraylands (source: compiled from ETSA Utilities data)

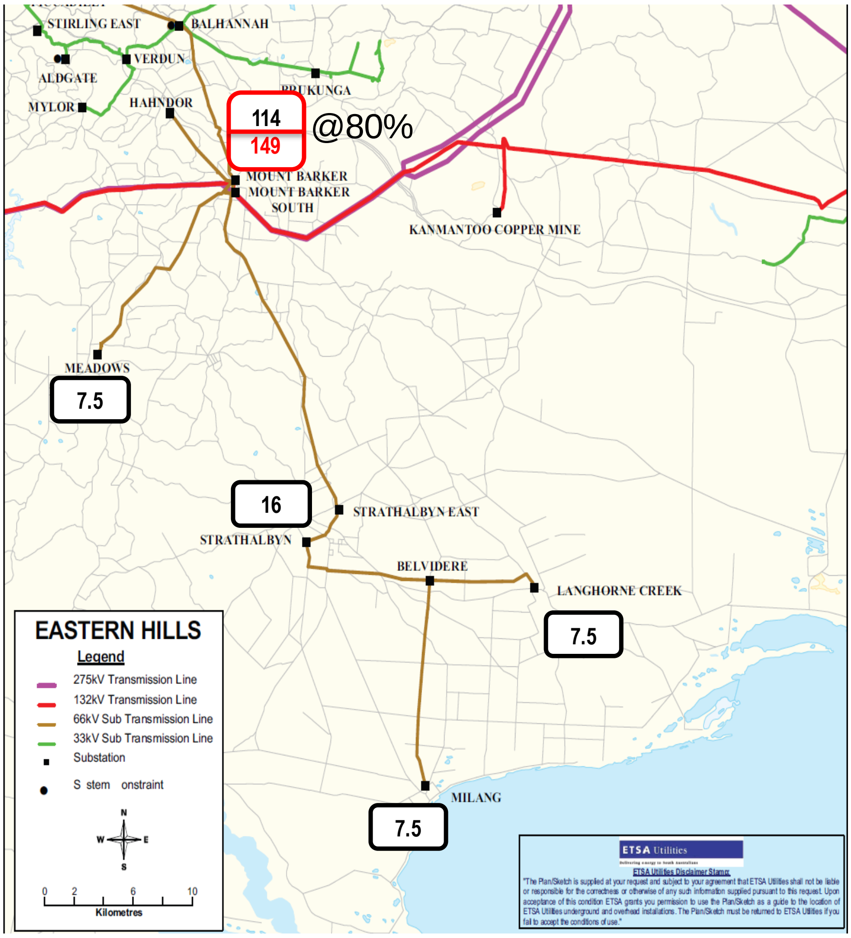

Figure 6 Electrical infrastructure in the Eastern Hills (source: compiled from ETSA Utilities data)

RELIABILITY

The reliability performance experienced by consumers in the region is dominated by the performance of the ETSA Utilities Distribution Network. The Essential Services Commission of SA (ESCoSA) publishes reliability performance data.

THE LANGUAGE OF RELIABILITY

There are a number of key terms and phrases that underpin the language used in the regulation of reliability. These are presented below and will then be followed by an explanation of the Service Standard Framework that applies in South Australia – and how it plays out for rural and regional customers.

There are four key 'measures' of reliability of supply. **Table 2** is taken from the Utility Regulator's Forum publication[21] '*National regulatory reporting for electricity distribution and retailing businesses: Discussion Paper March 2002*'.

[21] Available from the Utility Regulator's Forum www.accc.gov.au/content/index.phtml/itemId/3894

Table 2 The 'measures' of reliability of supply

Measure/description	Index	Definition
Total number of minutes, on average, that a customer on a distribution network is without electricity in a year.	**SAIDI** system average interruption duration index	The sum of the duration of each sustained customer interruption (in minutes) divided by the total number of distribution customers. SAIDI excludes momentary interruptions (one minute or less).
Average number of times a customer's supply is interrupted per year.	**SAIFI** system average interruption frequency index	The total number of sustained customer interruptions divided by the total number of distribution customers. SAIFI excludes momentary interruptions (one minute or less).
Average duration of each interruption.	**CAIDI** customer average interruption duration index	The sum of the duration of each sustained customer interruption (in minutes), divided by the total number of sustained customer interruptions (SAIDI divided by SAIFI). CAIDI excludes momentary interruptions (one minute or less).
Average number of momentary interruptions per customer per year.	**MAIFI** momentary average interruption frequency index	The total number of customer interruptions of one minute or less, divided by the total number of distribution customers.

In simple terms, the reliability performance is assessed in terms of the average customer experience in relation to the annual time without supply, the frequency of interruptions and the time it takes to restore supply.

While this sounds relatively simple, the actual practice of calculating values for these indicators is complex and not without some subjectivity. The accuracy of the reported values is subject to a number of variables including:

- The comprehensiveness of a business's monitoring and information systems;
- The need to supplement automated systems with manual records;
- Agreed methodologies for excluding some extreme events.

Results between regions within the state and in comparison with other jurisdictions can vary due to a number of causes somewhat unrelated to the distribution business's current performance including:

- Weather patterns and events;
- Age and condition of equipment;
- Access for maintenance and repair – issues such as terrain and access to private property.

For these and other reasons, it is probably important to acknowledge that reliability is as much an issue of relative performance over time as it is about any absolute measure of customer experience at any point in time.

Another term that appears in reliability discussions is the notion of "best endeavours." Best endeavours refers to the requirement for ETSA Utilities "*to act in good faith and use all reasonable efforts, skill and resources in order to achieve the various targets specified in the standards.*"[22] The regulatory process in this respect considers

[22] www.escosa.sa.gov.au/library/081222-ElectricityDistributionServiceStandards_2010-2015-FinalDecision.pdf page 29. Further detail is provided in the same document under section 3.3.

not only whether or not a target was met but whether or not "best endeavours" were applied to meet the target. Any penalties are only applied if the "best endeavours" test is failed.

RELIABILITY IN THE SA MDB

The SA MDB largely falls within the 'Central Region' which extends to the mid-north and Yorke Peninsula and contains the highest number of electricity 'feeders' of all of the non-metro regions. This means that only very limited data specifically for the SA MDB is publicly available.

The chart below illustrates the trends in SAIDI (average time off supply) over the last decade in SA. As can be seen, the Central region's performance appears to have deteriorated over the last two reporting years.

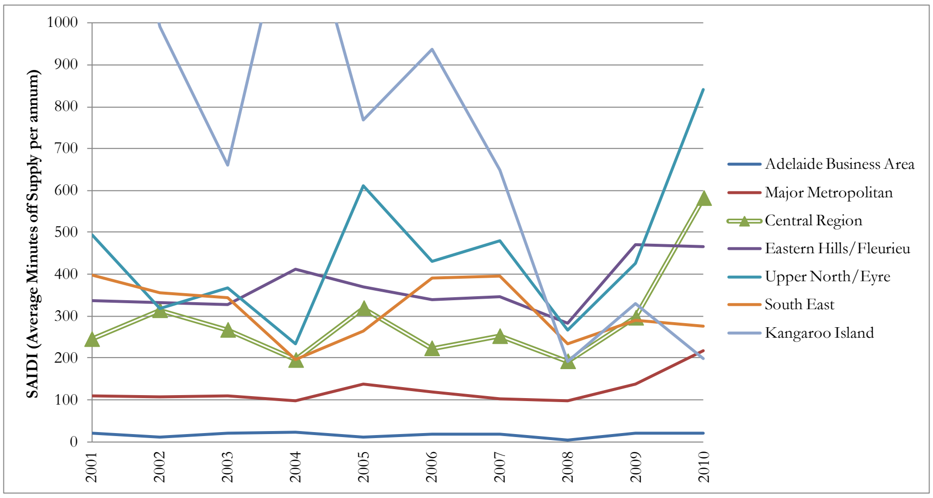

Figure 7 SAIDI over the last decade.

In order to provide more detailed information to consumers, ESCoSA recently published[23] a list of the feeders with the poorest reliability in each region and those related to the SA MDB have been able to be isolated. **Figure 8** illustrates what is meant by a 'feeder':

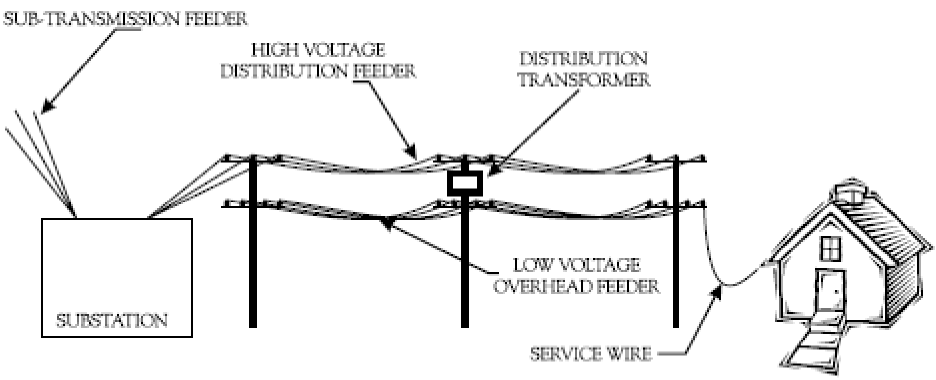

Figure 8 Illustration of a feeder

[23] Low Reliability Electricity Distribution Feeders 2010-11 available as an MSExcel spreadsheet from www.escosa.sa.gov.au

These low reliability feeders, and the number of customers connected to them, are shown graphically in **Figure 9** and represent those feeders where the average time off supply was more than twice the region-wide target of 240 minutes per annum for two years in a row – indicating an average of around 500 minutes or over 8 hours off supply. In summary, for the MDB region over 3,500 customers are supplied from these low reliability feeders. This represents around 10% of all electricity consumers in the SA MDB.

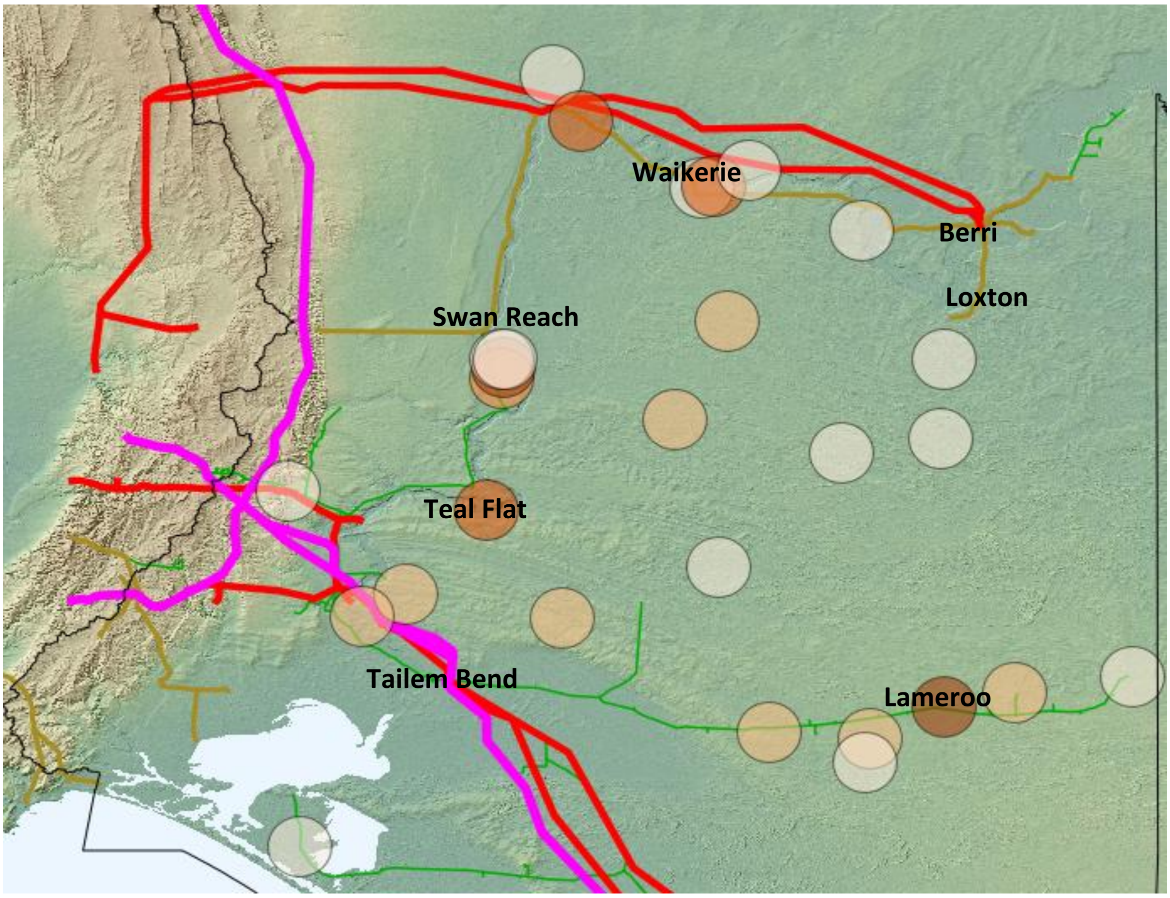

Figure 9 ESCoSA/ETSA Utilities November 2011
Worst performing feeders. Outages >8 hours per annum 2 years in a row.
Darker circles indicate more customers affected – illustrative only

7. LOCAL ENERGY RESOURCE ASSESSMENT (LERA)

An assessment of the region's endowment of local renewable energy resources (wind, solar, geothermal and biomass) has been carried out for this study.

The *Renewable Energy Plan for South Australia*[24] released in October 2011 presents a map of "*the State's potential zones for renewable energy development in relation to the State's electricity and gas transmission facilities*." An extract of this map is shown in **Figure 10** below, zoomed in on the MDB region.

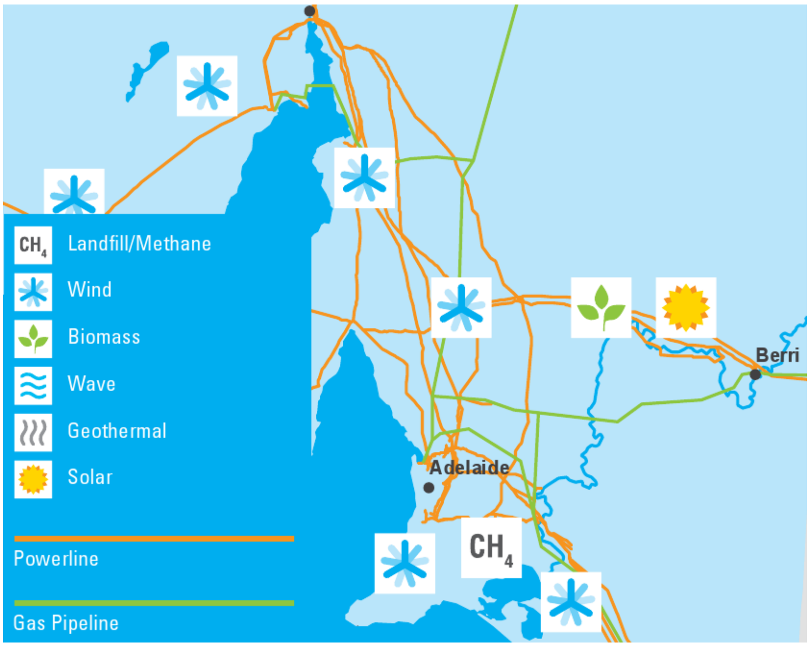

Figure 10 RenewablesSA map for renewable energy potential

In this report, Renewables SA identified the potential for:

- wind energy in the Wellington-Meningie area;
- biogas generation in the Murray Bridge – Strathalbyn area;
- biomass and solar energy north of Berri and Waikerie.

It is understood that these are indicative of potential rather than having been assessed as commercially viable. This Local Energy Resource Assessment (LERA) has verified that commercial wind energy potential does exist around the Coorong-Lower Lakes and that solar energy projects around Berri-Renmark are likely to become commercially viable in the near future as technology costs fall and electricity prices rise. It is understood that the 'CH4' (methane) potential refers to the Hartley Landfill near Callington. Enquiries with the landfill operator remain unanswered at the time of publishing this report.

[24] http://www.renewablessa.sa.gov.au/files/111019-renewable-energy-plan-for-south-australia.pdf

Key Concept: WHOLESALE VS. RETAIL ELECTRICITY PRICES

It is important to understand the very different business case that emerges when an electricity generation project seeks to get "behind the meter" and displace relatively expensive retail electricity, compared to that of generating electricity to sell 'into the grid' at wholesale prices. The strongest business case will be the one that generates at the lowest cost and displaces the most expensive alternative. Local energy generation projects will often be a scale well suited to 'on site' consumption – a scale that would often be too small to be competitive in the wholesale market.

Local energy generation projects can make it easier for local businesses to capture a significant proportion of the energy value chain.

The Energy Project was asked specifically to consider the wind resource over the region, and so particular effort was put into addressing this aspect, in the form of a desktop pre-feasibility study.

WIND ENERGY

TECHNOLOGY OVERVIEW

Wind turbines turn the kinetic energy of the wind into mechanical energy through the rotation of blades. The mechanical energy is then converted into electrical energy through a generator. Wind turbines can be classified as horizontal or vertical axis, depending on the direction of the axis of rotation. Vertical axis machines do not need to adjust their direction to face the wind. For a number of reasons, however, no commercially available vertical axis machines exist at the scale of project described in this report, and these will not be considered further.

The rotor swept area and generator rating are the main two factors that determine the power rating of a wind turbine. As the wind resource improves with increasing height above the ground, tower height also has a strong influence on the wind turbine's energy output.

Commercial wind farms

Wind energy projects exist at a number of scales. Commercial on-shore wind farm developments consist of dozens of machines rated between 1 and 3 MW, connected to the electrical transmission network. The tower height (hub height) of these wind turbines are generally 60 to 80 meters, with rotor diameters between 80 and 100m. A Power Purchase Agreement (PPA) – an agreement for an electricity retailer to purchase the output of the wind farm at a wholesale price – is usually required to secure project financing.

Community scale wind farms

Community scale wind is generally considered to be up to 5 MW of total capacity, and can be connected to the distribution network. These projects can utilise a few of the same megawatt scale wind turbines as commercial scale projects, however there can sometimes be difficulty in procuring these turbines from manufacturers, as it is more attractive to fulfill orders for commercial projects with high volumes of product, than for a much smaller-scale community project with one or two turbines. The Hepburn community wind farm (www.hepburnwind.com.au) and the Embark Project (www.embark.com.au) give further information on the first successful community scale wind project in Australia.

Distributed wind projects

At scales smaller that 1 MW, it is difficult to justify wind energy projects on pure financial terms unless the energy is entirely used on site, and the project competes against the retail price of energy – rather than the wholesale price as is the case with larger projects. These projects are still possible, but require a business case dependent on the local consumption as well as the wind resource. Because of the need to match supply and consumption, it is important to consider different scales of machine. This may be difficult because the range of turbines available at this scale is limited. We know of 50 kW and 100 kW machines offered commercially in Australia, but there is no known installation to date. Large machines in the 300 kW to 1 MW range are available both as new machines (e.g. the Enercon 330), or on the second-hand market. These machines are smaller – typically 25 to 50m hub height – with rotor diameters from 20m to 40m.

Existing and proposed wind farms

There are a number of existing and proposed wind farm developments within the region,[25] all in the mid-north. These include Hallet 1, Hallet 2 (Hallet Hill) and Hallet 5 (Bluff Range Wind Farm), which are operating wind farms of 95, 74 and 52 MW capacity, respectively. Proposed wind farms in or immediately adjacent the region include Willogoleche Hill (52 MW), Stony Gap (129 MW), Robertstown (96 MW), Australia Plains (150 MW), Worlds End (180 MW) and Keyneton (100 MW). There are several other wind farm projects in the State's south east.

[25] From http://www.ga.gov.au/renewable/, last update August 2010, and http://www.pacifichydro.com.au/english/projects/development-construction/keyneton-wind-farm/?language=en

WIND RESOURCE MAPS

Existing maps of the wind resource over the SAMDB such as the Renewable Energy Atlas of Australia,[26] shown in **Figure 11**, are at too coarse a resolution to make a reasonable estimate of the wind resource available to the SAMDB NRM Region, as well as being in a format unsuitable for further quantitative analysis.

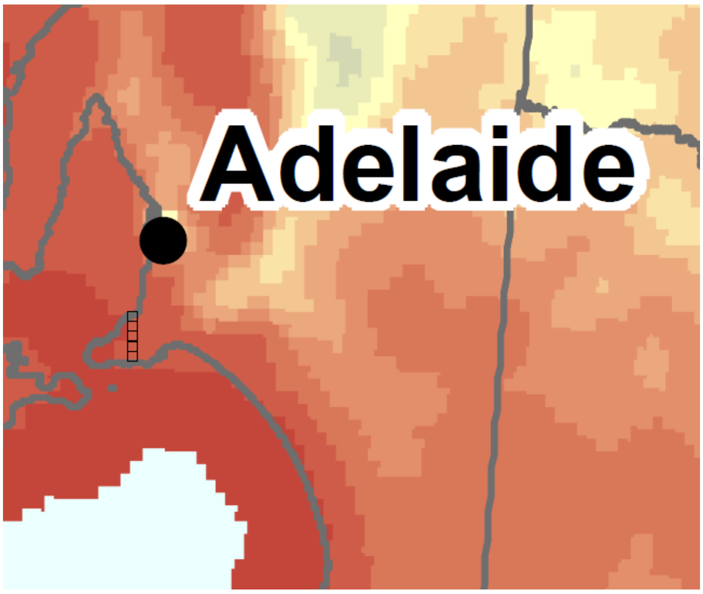

Figure 11 An extract from the Renewable Energy Atlas of Australia.

For the purpose of this study, 3 km resolution wind map data was purchased from a European data provider. This modelling work uses a "Numerical Weather Prediction" analysis tool, similar to that used by meteorological services to provide weather forecasts. Instead of simulating the future climate for short time periods, the historical climatology over the last 30 years has been used to produce 30 year mean wind speeds at three different heights.

When interpreting this data, it is crucial to consider and understand the resolution of the simulations. The wind speed data is generated at points 3 km apart – as a consequence any topographic or land use feature with a scale of less than 3 km is not seen by the model. The figures below show the topography interpolated to a 3 km spacing, and topography derived from a shuttle mission[27] at a spatial resolution of 90 m, illustrating how the coarser 3 km resolution used for the wind map significantly smoothes the terrain features.

[26] This data is no longer available from http://www.climatechange.gov.au/what-you-need-to-know/renewable-energy/atlas.aspx, however the map is still available on the internet http://www.energy.wa.gov.au/cproot/2469/2/mean-wind-speed.pdf.

[27] srtm.csi.cgiar.org

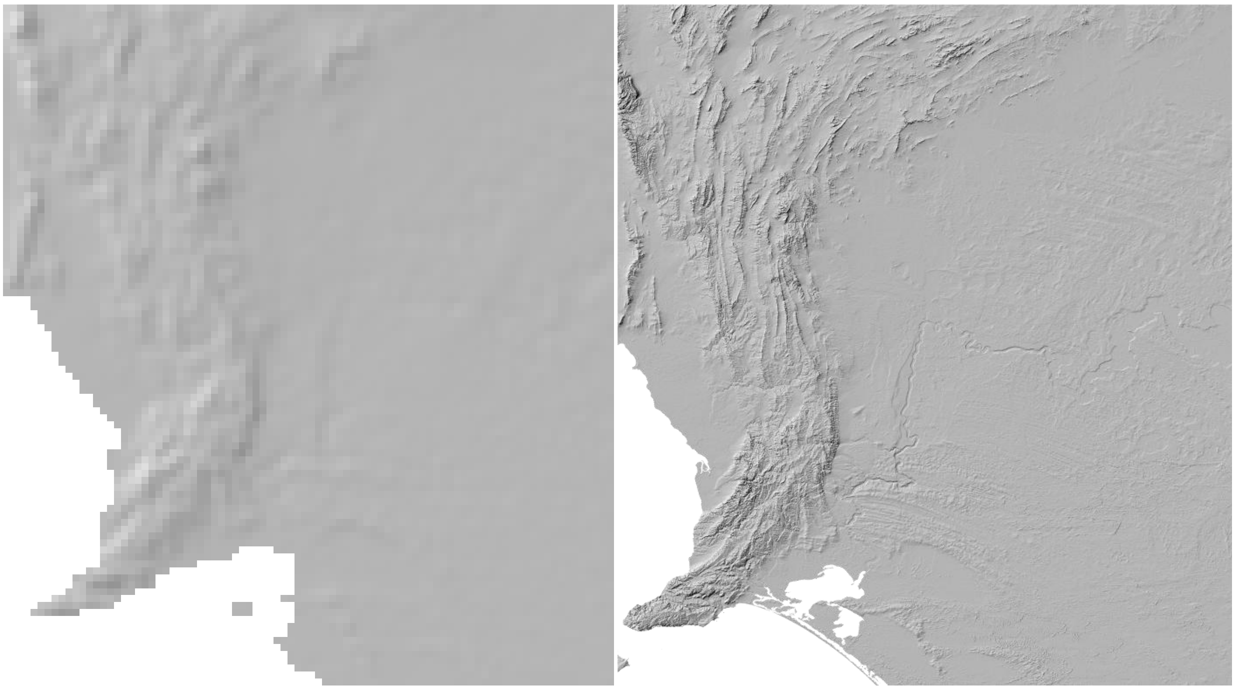

Figure 12 topographic map of the SAMDB region represented with two different spatial resolutions: 3 km (left) and 90 m (right).

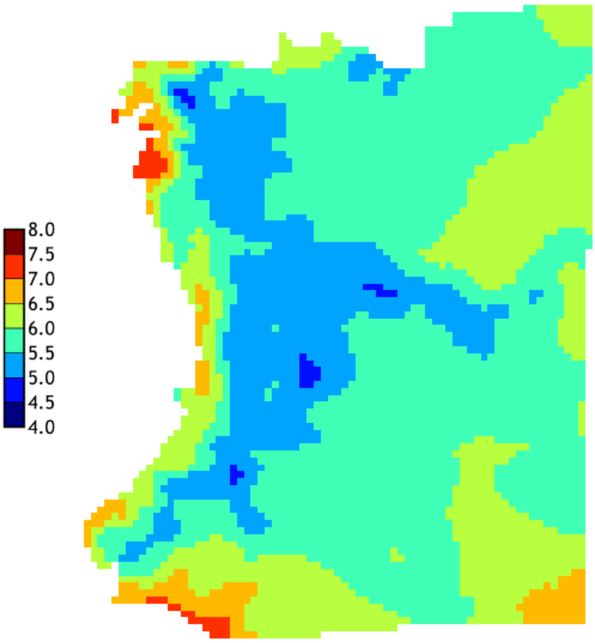

Figure 13 Map of the mean wind speed (in m/s) plotted with a spatial resolution of 3 km.

The long term mean wind speed is presented in **Figure 13** as raw data at 3 km resolution at 60 m above ground level, segmented into 0.5 m/s increments from 4 m/s to 8 m/s. This raw data will be later processed to identify opportunity over the region, but is included to emphasize the limitations of a 3 km resolution when assessing the wind resource at a particular location. This means that the wind map must be interpreted in conjunction with underlying terrain data. Regions that have a large variation in terrain topography within a 3 km cell will have a large variation in wind speed within the region – higher wind speeds on ridges and hills, slower wind speeds in valleys and possibly some highly turbulent regions in between. This implies that regions with lower average wind speed may still yield a good wind site, provided suitable topographic *speedup* exists. It also implies that even in regions of high predicted wind speed, careful turbine placement through micrositing and ground truth measurement must be undertaken to design a wind farm that maximises return while avoiding expensive fatigue and maintenance issues caused by excessive turbulence and wind shear.

It is of course possible to source wind maps of higher resolution than 3 km – both 1 km and 500 m maps are readily available,[28] however it is estimated that to cover the entire region with a 500 m map would cost in the order of $200,000. Such a wind map has recently been produced for the Green Grid[29] project over the Eyre Peninsula. By staging the procurement of wind maps and identifying broad regions for further investigation, we anticipate that capital outlay can be minimised.

Opportunity maps

By laying a hill-shaded relief map derived from 90 m topographic data underneath the 3 km resolution wind maps, and overlaying the known transmission and distribution network, an indication of the likely topographic effect as well as distance from the grid can be visually assessed.

Maps of mean wind speed over a region do give some indication of the potential for wind energy, however The Energy Project has further processed the data to give an indication of the actual energy yield as a fraction of rated capacity energy yield of a particular turbine. This is termed "Capacity Factor" – the ratio between the actual mean energy output and the energy that would be produced if the machine were operating at 100% of its capacity – expressed as a percentage. For thermal energy plants such as coal or gas turbines the capacity factor is primarily a measure of reliability and maintenance issues, as the fuel is always available. For renewable energy sources this aspect is less significant, and capacity factor is largely determined by the availability of the "fuel," which is either the solar irradiation or wind speed.

The capacity factor of a particular location's wind resource will vary depending on the choice of turbine – how effectively this particular turbine can convert wind energy into electrical energy over a range of wind speeds. For a given turbine, a map of capacity factor is a consistent way of examining the spatial variation of energy yield: in effect placing the same turbine at every point on the map, estimating how much energy it would generate.

[28] For micrositing applications, where the wind turbine placement on a particular wind farm is designed, local wind maps down to 2m resolution are used to accurately model wind shear and turbulence.
[29] http://www.renewablessa.sa.gov.au/files/final-green-grid-report---public-version.pdf

For this exercise, a Repower MM82 machine was chosen. This machine is rated at 2 MW, with an 82 m rotor diameter, and has a hub height varying from between 60 to 100 m depending on the choice of tower. This turbine is the same as that used to power the Hepburn wind project, which implies that Repower are prepared to supply commercial-scale wind turbines in small quantities. It should be noted that the manufacturer markets this turbine as specifically designed for operation under high wind speeds,[30] while other manufacturers[31] produce wind turbines designed for optimal operation in low to moderate wind speeds. The latter type generally features a larger rotor diameter for the same generator capacity.

The power curve of the Repower MM82 machine is plotted in **Figure 14** and shows how much power is generated by the turbine over a range of wind speeds. At wind speeds above 12.5 m/s, the machine is limited to its maximum rated capacity of approximately 2 MW. At wind speeds below 3 m/s, no energy is generated. The power generated is a non-linear function of the wind speed between these extremes.

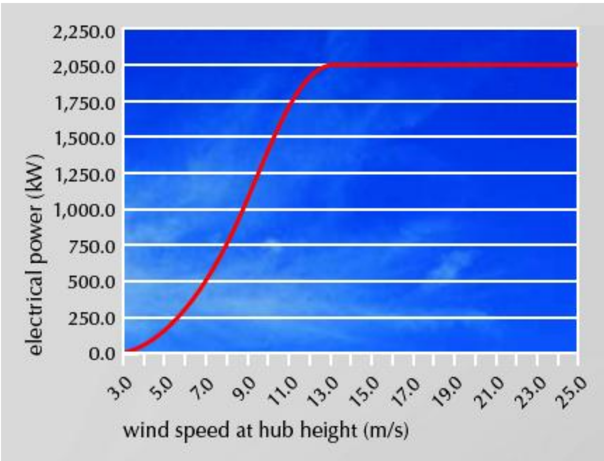

Figure 14 Power curve of the Repower MM82 (Source: Repower)

Because of this complex relationship between power generated and wind speed, it is not possible to directly relate the mean wind speed, as reported by the wind map, to the energy generated. We need to know not only the mean, but also the statistical distribution of actual wind speeds around the mean value. As the wind map data only reports the mean wind speed, we have assumed the simplest commonly accepted distribution of wind speeds, the Rayleigh distribution. This is a reasonable assumption for the exercise, but more precise methods should be used if wind energy is to be pursued at any of the sites.

When reporting capacity factor for the Repower MM82, contour maps have been produced from the 3km wind data. The highest range is for a capacity factor of between 30% and 40%, which is considered a commercially exploitable wind resource.[32] Other ranges are partitioned between 30% and 22% in increments of 2% – these indicate regions within which the wind resource is considered less viable, and project economics are likely to depend on other factors, such as utilising all of the produced energy *behind the meter,* or capturing a local topographic speedup such as over hills or ridges.

[30] www.repower.de/wind-power-solutions/wind-turbines/mm82/

[31] www.vestas.com/Admin/Public/Download.aspx?file=Files%2fFiler%2fEN%2fBrochures%2fVestas_V_100_brochure.pdf

[32] http://en.wikipedia.org/wiki/Hallett_Wind_Farm reports the Hallet 2 wind farm as having a capacity factor of 39%

Commercial scale wind map

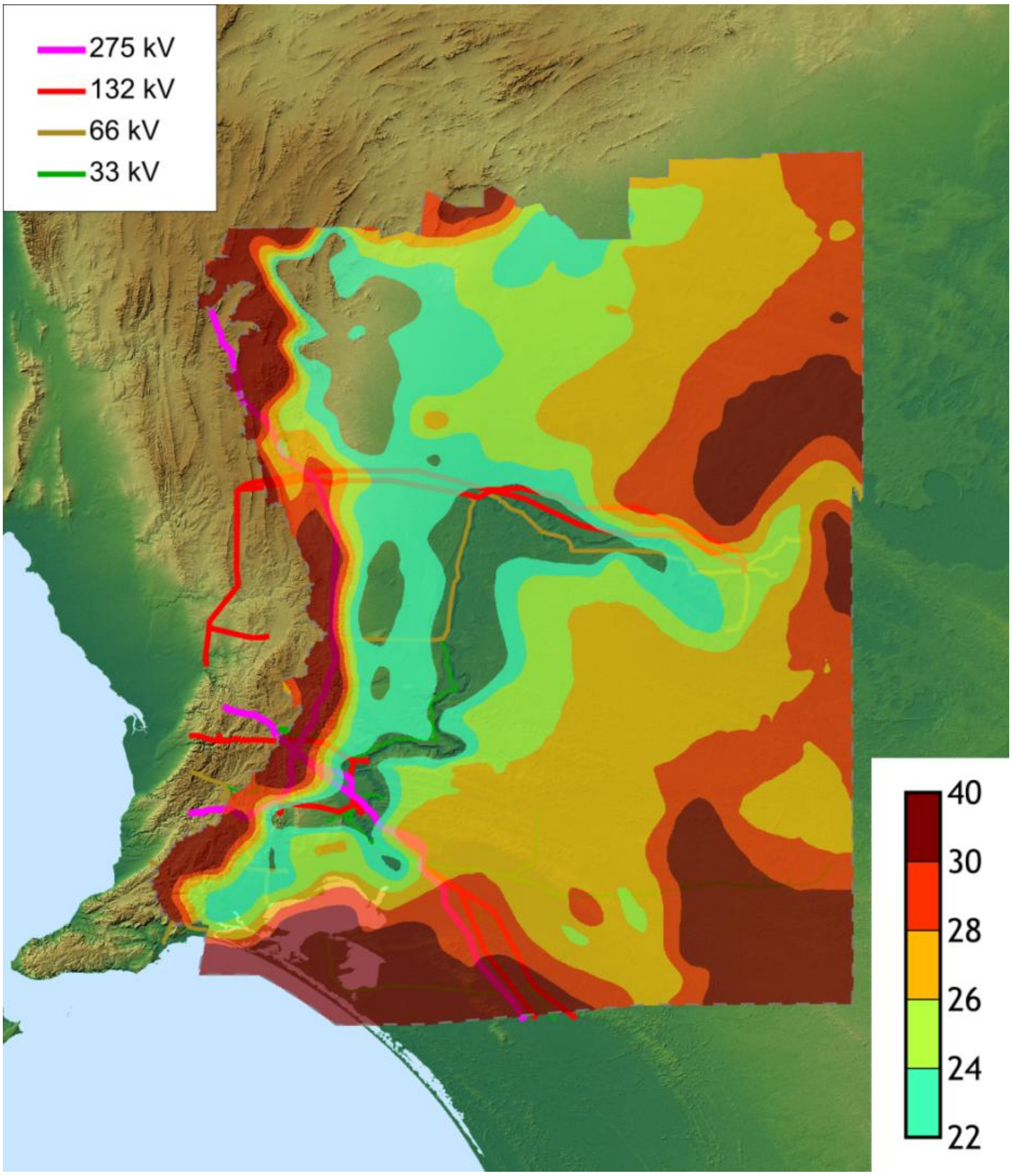

Figure 15 Map of the capacity factor (as a percentage) estimated at 80m height.

Figure 15 shows the capacity factor that was estimated at a height of 80 m. This indicates that a commercial wind resource is available in the Mid North (e.g. the Hallet wind farms, in the North Western corner of the SAMDB region) because of the high capacity factor and proximity to 275 kV transmission lines. The opportunity in this region is well known and is currently being exploited commercially by wind farm developers.

Other regions that have a high capacity factor include the Eastern edges of the Mount Lofty Ranges, the Coorong between Narrung and Coonalpyn, the Riverland north of Renmark, and south of Lameroo. Of these regions the two that are closest to 275 kV transmission lines, and thus more suitable for commercial wind farm development, are the Eastern Mount Lofty Ranges and the Coorong, which are discussed in some detail in Appendix A.

Community scale wind map

A 60 m capacity factor map has been produced over the region, and is shown in **Figure 16**. The map highlights similar wind resource opportunity to the commercial 80 m wind map, however because the wind resource is presented 20 m lower the wind speed is less, and the regions of commercial opportunity are reduced. Of course if a wind project is developed with an 80 m height, then the 80 opportunity map should be consulted.[33]

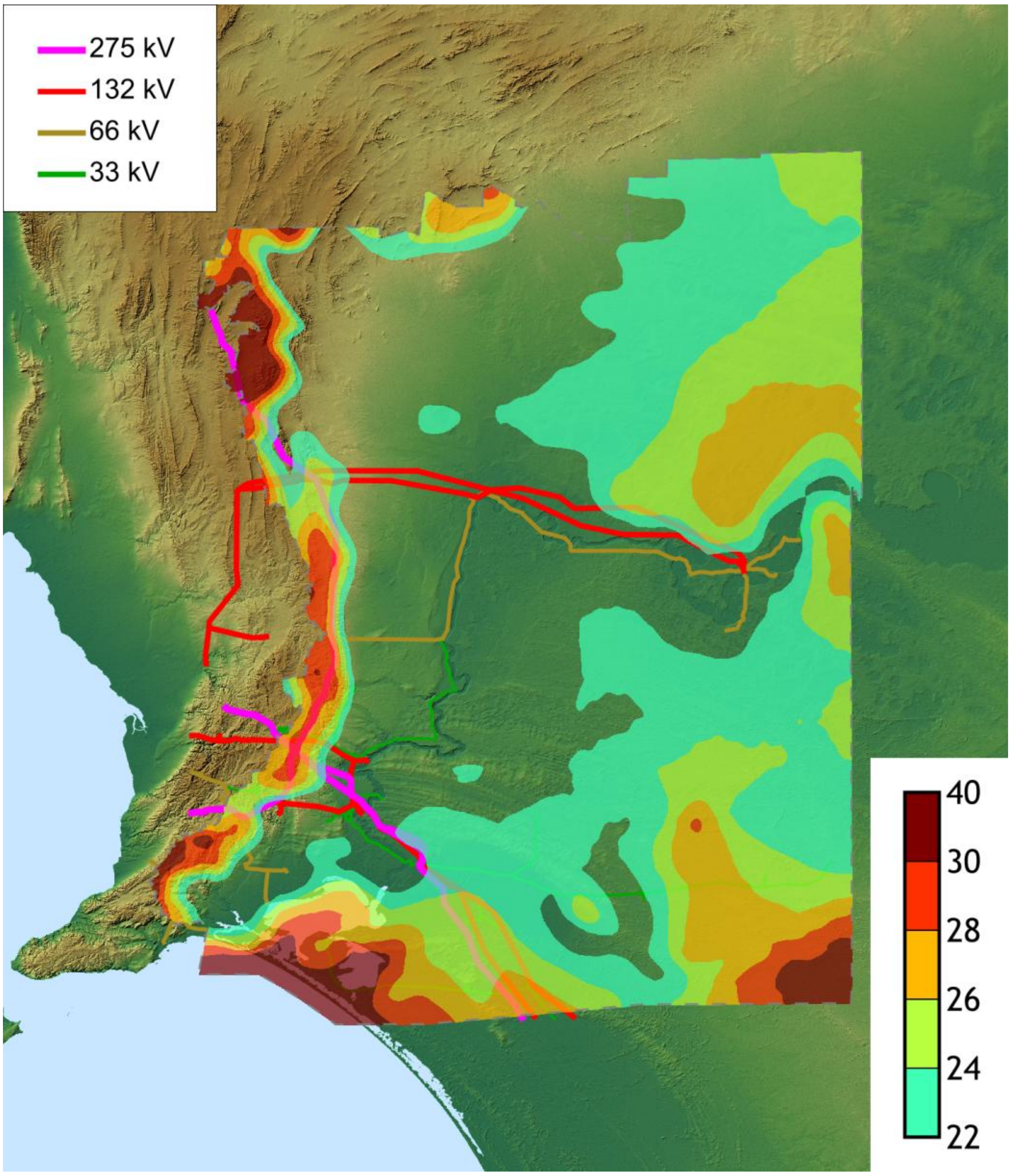

Figure 16 Map of the capacity factor estimated at 60m height.

Because of the smaller size of community projects, proximity to transmission lines is not necessarily a limitation and the distribution network may now be considered for connection, depending on its strength locally. The map shows the approximate location of 132 kV, 66 kV and 33 kV lines; the location of 11 kV

[33] The Hepburn Wind project was limited to 60m hub height to avoid installing anti collision lights, reducing the project yield, but increasing community acceptance.

lines is not generally publicly available, and connection of a community scale project may be possible, depending on scale and local network strength.

The map shows a commercial grade wind resource near a 66 kV distribution line near Meadows, which would be a good location to consider a community scale wind project. It is also worth noting the Woolworths Distribution Centre, which has an onsite wind turbine proposed,[34] is located in a marginal wind resource region at 60 m – however the economics of onsite energy usage are different to developing a project and selling energy on the wholesale market. Additional locations of interest include Mt Compass, Keyneton, Mannum-Birdwood, Cambrai, Brukunga, Narrung-Meningie, Lameroo-Pinnarroo, north of Berri, and east of Renmark. These locations are discussed further in Appendix B.

[34] http://www.energetics.com.au/testimonials/projects/woolworths-renewable-energy/case-study-energetics-helps-w.pdf

SOLAR ENERGY

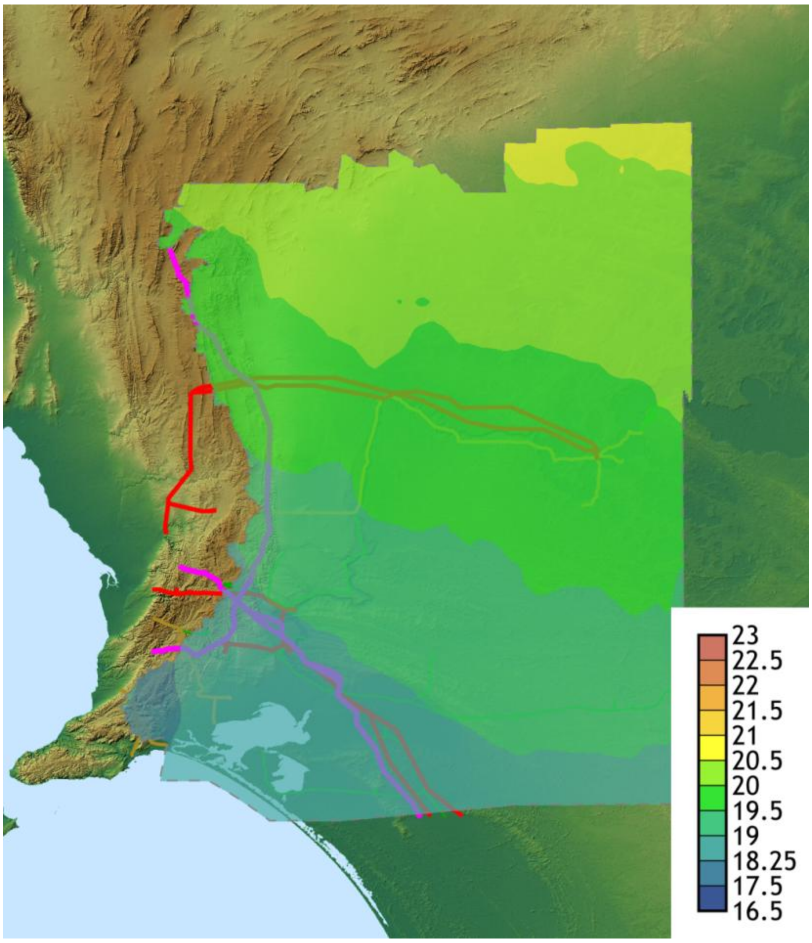

Figure 17 Map of the solar resource over the SA MDB

The map of the solar resource shows how the solar resource increases inland towards the north-northeast, and that the region with access to existing transmission infrastructure and the highest resource in the MDB region is located to the north of the Renmark-Berri area, with an average daily solar irradiance[35] of 19.5-20 MJ/m^2, to be compared with 18.25-19 MJ/m^2 at the southern edge of the basin.

This relatively consistent resource suggests that factors other than the solar resource, such as the proximity to consumers, load matching, ease of access for maintenance, will ultimately determine the viability of a solar installation.

It is understood that Berri Barmera Council is pursuing the feasibility of a 5MW scale solar facility in its region. Based on the resource information available (besides the Bureau of Meteorology data used to generate the figure, RenewablesSA have published detailed data for a site at North West Bend (near Morgan) and contemporary projections of electricity prices, it would be possible to determine the upper bounds of capital cost that can be tolerated for the region. As the price of solar energy technologies fall, the market conditions that would trigger investment can be determined.

St Kitts Associates (a partner in The Energy Project Pty Ltd) produced an assessment of the Riverland Solar Resource (entitled *Riverland Solar Futures*) for the Riverland Futures Taskforce in 2009. This report is available from the authors[36] and it is noteworthy that since the report was delivered in June 2009, the

[35] Global Horizontal Irradiance (GHI) – the vector sum of direct and diffuse (scattered) radiation on a horizontal surface.

[36] Of relevance, the report recommended that: "... Stakeholders consider a more detailed regional energy study that would include all renewable energy sources, network constraints and opportunities, energy demand profiles of residential areas and other major users, industrial skills audit for compatibility with renewable energy technologies. The study could also include an inventory of state and Commonwealth funding opportunities (for both energy and infrastructure)."

installed cost of solar technologies has fallen dramatically and the price of 'grid' electricity has also significantly increased – greatly improving the prospects of solar energy generation in the region.

A discussion of this convergence of falling technology prices and rising energy prices is provide in Appendix C. In certain configurations an economically viable project is likely to be possible in the Berri region within 2-3 years.

Key Concept: GRID PARITY

Grid Parity is a term that appears often in renewable energy literature and media coverage. The term refers to the point in time where falling technology costs and rising 'grid' energy prices intersect, and renewable energy becomes economically viable. In reality this 'point in time' is different in each energy markets, where it is a function of local energy costs, resource endowments, and the installed costs of technologies – reflecting local labour costs, red tape and so on.

It is important to acknowledge that technologies that are currently unviable for the region will become viable at some point in the future. For rooftop solar photovoltaics competing against retail grid electricity prices, this point of parity is expected to arrive in South Australia around 2015. This is discussed further in APPENDIX C.

BIOENERGY

TECHNOLOGY OVERVIEW

There are 6 main technologies for the production of energy or fuel from biomass:

- Combustion
- Anaerobic digestion
- Fermentation
- Gasification
- Pyrolysis

These are summarised in the figure below.

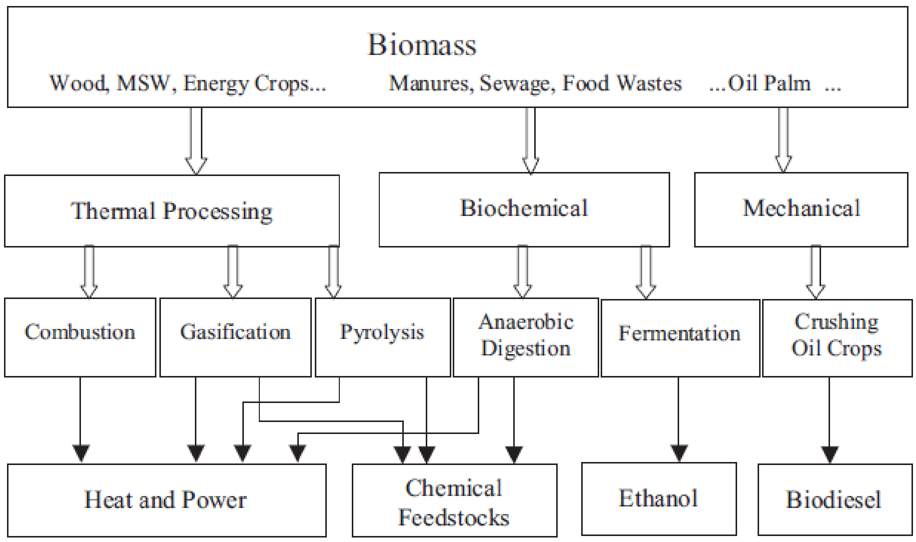

Figure 18 Chart of bioenergy processes (Schuck 2006)

Combustion, digestion, fermentation and oil extraction are commercially proven technologies. Future opportunities lie in pyrolysis and cellulose fermentation as its technology develops. Additionally, the products of pyrolysis (solid, liquid and gaseous fuels, lubricants etc.) are comparable to those derived from fossil sources, which presents a considerable opportunity in terms of energy security in a carbon constrained economy. A demonstration of this potential lies in the recent announcement[37] that Virgin Australia will participate in a consortium to develop the technology for the production of commercial biofuel for aviation. Syngas is currently completing a trial study into the logistics of transporting crop waste to centralised plants for processing and, ultimately, energy production. This work was supported by a $300,000 grant from Renewables SA. Syngas recently reported[38] a successful outcome, and are now looking into the feasibility of a straw pellet production or power generation plant.

[37] http://www.virginaustralia.com/cs/groups/internetcontent/documents/webcontent/~edisp/doc_bio-fuel-partnerships.pdf
[38] http://www.adelaidenow.com.au/business/sa-business-journal/syngas-happy-with-cropping-waste-trials/story-e6fredel-1226078724506

WASTE TO ENERGY

The RDA Roadmap notes that "The Murraylands requires an industrial precinct for processing primary products such as mineral sands, stock foods, meats and vegetables. This precinct would generate opportunities for transport-related industries." Such a concentration of activities is likely to offer significant opportunities for waste-to-energy conversion, with the potential for the energy to be consumed on site, thus minimising requirements for additional transmission infrastructure.

Agricultural waste

In Australia the most successful implementation of energy recovery from agricultural waste is with the sugarcane industry, where bagasse is burnt in power stations. Across Australia, a generation capacity of 420 MW relies on bagasse as feedstock.[39] Bagasse is a high value source of energy, but other agricultural waste products can also be considered for bioenergy production, such as wheat stubble. Table 3 shows the energy contents of various fuels and agricultural produce.

Table 3 Energy contents of various fuels (source: Dong 2008[40].)

Fuel	Bulk Density (kg/m^3)	Volumetric Energy Contents (GJ/m^3)
Ethanol	790	23.5
Methanol	790	17.6
Bio-diesel	900	35.6
Pyrolysis oil	1280	10.6
Gasoline	740	35.7
Diesel fuel	850	39.1
Agricultural residues	50-200	0.8-3.6
Hardwood	280-480	5.3-9.1
Softwood	200-340	4.0-6.8
Baled straw	160-300	2.6-4.9
Bagasse	160	2.8
Rice hulls	130	2.1
Nut shells	64	1.3
coal	600-900	11-33

[39] http://www.ga.gov.au/renewable/

[40] Dong 2008. GIS and Location Theory Based Bioenergy Systems Planning. PhD thesis, Waterloo, Ontario, Canada, 2008

Landfill, Industrial process and animal waste

A Clean Energy Council study[41] identified a strong trend towards the adoption of digestion plants near concentrated sources of waste such as piggeries in other developed countries, and the same trend is anticipated in Australia. Sewage methane plants in Australia have reached a total capacity of 58 MW, and 166 MW of landfill methane plants are currently operating in Australia. These figures clearly indicate that such technologies are now advanced enough to be commercially viable, and each landfill and sewerage plant in the SAMDB could be assessed for bioenergy generation by suitably qualified professionals.

In Victoria, three piggeries operated by Charles I.F.E. Pty Ltd have a total energy generation capacity of 390 kW based on biogas,[42] and Murray Goulburn operates a 770 kW generator running on the biogas produced from dairy waste.[43]

A 2005 study[44] into possible reuse of wastewater identified seven meat processing plants distributed between Strathalbyn (2), Murray Bridge (3), Loxton (1) and Berri (1). The vast majority of wineries are concentrated around the Loxton/Renmark Berri area, as are sewerage treatment plants. The nature and spatial distribution of these activities lends itself to the development of anaerobic digestion plants in these areas. This corresponds to the potential for biogas generation identified in the Renewables SA report in the Murray Bridge-Strathalbyn region, which could source its feedstock from five meat processing plants. Digestion plant feasibility and sizing should be the object of a subsequent feasibility study based on actual waste output figures.

There are a number of regulatory spheres relevant to a bio-energy /waste to energy project. Any project would require Development approvals, Environment approvals and Energy Market approvals.

On 1 September 2010 the Environment Protection (Waste to Resources) Policy 2010 (W2R EPP) became operational and replaced the Environment Protection (Waste Management) Policy 1994. The W2R EPP refers to the EPA Standard for the production and use of Refuse Derived Fuel (Feb 2010) www.epa.sa.gov.au/xstd_files/Waste/Guideline/standard_rdf.pdf

The guideline forms a key part of the approach to joint licensing of the feedstock production process and facility and the fuel combustion/energy production facility. The guideline is also clear that it is seeking to ensure that the feedstock does not contain waste that has a viable higher order use (from the standard waste hierarchy). For example if a waste stream could be recycled or reused then this is to be pursued before being combusted for the recovery of energy.

41 http://www.cleanenergycouncil.org.au/cec/resourcecentre/reports/bioenergyroadmap.html
42 http://www.srela.com.au/case_studies/Berrybank.pdf
43 http://www.sustainability.vic.gov.au/resources/documents/sv_annual_report.pdf
44 EarthTech. "River Murray Catchment Water Management Board. Investigation of opportunities for wastewater re-use within the Murray Darling Basin, SA Milestone Report 1. 29 July 2005

ENERGY CROPS

An active pursuit of bioenergy initiatives is perfectly aligned with RDA MR's roadmap, which refers to Econsearch highlighting the opportunities offered by carbon farming and "appropriately located forestry" for environmental improvement and the production of feedstock for biofuel applications. Adequate siting of energy crop farming and processing activities will be largely determined by the local transportantion and energy infrastructures.

According to Western Australia's Verve Energy,[45] a 5 MW integrated wood processing (IWP) plant developed in partnership with Enecon uses 100,000 tonnes of wood to produce 40,000 MWh p.a., which corresponds to an electric energy production of 0.4 MW/tonne. Additionally, the plant would produce over 3,000 tonnes annually of activated carbon (soil improvement, fuel, chemical processing agent) and 700 tonnes of eucalyptus oil, which offers diversified economic opportunities relative to a combustion power plant.

Based on productivity modelling carried out by Bryan et al (2010), between 4 and 13 tonnes per hectare of biomass can be harvested annually, with a mean value of approximately 6 t/ha/year. It is worth noting that this output is not predicted to decline dramatically under the climate warming/drying scenarios, contrary to other crops.

Based on this, an area of between 10,000 and 30,000 ha is required to yield 120,000 green tonnes on a sustainable basis. Work from the Future Farm Industries CRC indicates that production will need to occur within 100 km of the processing plant, and that several such plants will be required to develop a sustainable industry.

In summary, assuming a conservative 4 t/ha/year, a 5 MW plant installation is viable if 1% of the area within 100 km of it can be used for mallee farming. If this radius is reduced to 25 km to minimise transportation costs, 15% of the area within this radius needs to be assigned to mallee farming.

In terms of the region's current electricity consumption of around 800-1000 GWh (million kWh), each 5MW IWP facility would be able to meet around 5% of the region's energy consumption.

[45] http://thebegavalley.org.au/uploads/media/Verve_Energy_01.pdf

GEOTHERMAL

Geothermal energy is heat generated and stored within the earth. By extension, this term refers to the exploitation of the heat to generate power – generally a process of conversion to electricity by means of a steam turbine. The estimated geothermal resource is illustrated in the Geoscience Australia map shown in **Figure 19**.

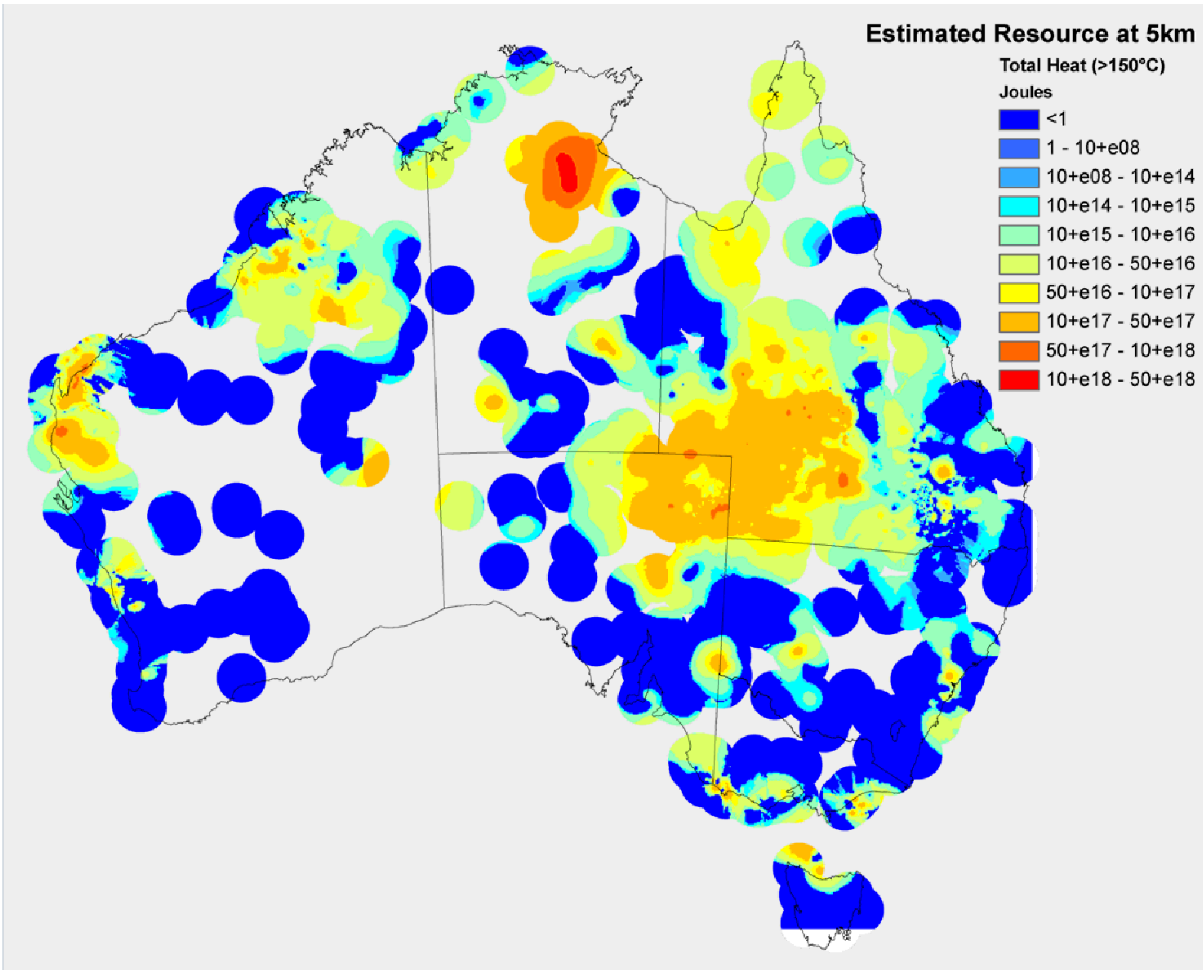

Figure 19 Geothermal resource map (Source: Geoscience Australia[46])

Most of the geothermal resource in South Australia is concentrated at the northeast corner of the state, with the notable exception of a hot spot just north of Renmark. This potential triggered the development of the Chowilla 1 well operated by Eden Energy 45 km north of Renmark. However, Eden Energy subsequently announced that the Chowilla 1 drilling did not indicate an exploitable resource.[47] According to PIRSA documents as at September 2011, all previously held Geothermal Exploration Licenses (GELs) in the region have been allowed to expire and there are currently no active licenses in the region. Based on this it is possible to assert that the region does not currently offer a viable geothermal resource. This may change as technology prices fall and energy prices rise but there does not appear to be an exploitable resource for the foreseeable future.

[46] Johnson J. Geothermal resources in Australia - Status and Research needs. Geothermal Energy Industry Roundtable March 2007 http://www.ga.gov.au/image_cache/GA10036.pdf

[47] http://www.edenenergy.com.au/pdfs/ASX_Announcement%2020080717%20%20Chowilla%20Well.pdf

8. LOCAL ENERGY SECURITY STRATEGY (LESS)

Once energy security in a region is assessed, consideration must then be given to tailoring a region specific strategy for preserving or enhancing this level of security in volatile energy markets.

The rapid development of a high level Local Energy Security Strategy (LESS) is a useful tool for prioritising issues and opportunities.

The goal of the strategy is to improve energy security in the region, with a focus on four strategic areas:

- **energy infrastructure and assets:** ensuring energy infrastructure (i.e. the electricity and gas networks) can support the planned growth in the region
- **energy supply:** promoting local energy supply options, including renewable energy projects and the associated economic development and employment benefits
- **energy demand:** improving the efficient use of energy and reducing peak demand
- **community innovation and leadership:** ensuring affordable access to energy for all communities and increasing community investment and participation in local energy initiatives.

This chapter provides recommendations under each of these 4 areas.

STRATEGY 1 – ENERGY INFRASTRUCTURE AND ASSETS

Objective:

To ensure the delivery of essential energy infrastructure and assets in a timely manner to support the region's growth.

Proposed Actions:

1.1. Electricity Reliability Enhancement Project

Recently released data by the Essential Services Commission of SA (ESCoSA) has identified a number of low reliability feeders in the region (as illustrated in **Figure 9**). It has been reported (pers. comm. Mr Rod Ralph, CEO, Southern Mallee District Council) that, in the past, improvements have been achieved through high-level advocacy. One objective of an Electricity Reliability Enhancement Project would be to ensure that the outage duration and frequency across the region becomes more consistent and, ultimately, moves more towards the statewide average figures.

Potential Funding Source:

Preliminary discussions have been held with the Australian Energy Market Commission's Consumer Advocacy Panel and the Local Government Association (LGA) of SA. An initial project valued at around $20-30k has potential for support.

1.2. Review of Natural Gas availability in the SA MDB

Repeated references to the inadequacy of reticulated gas in the region can be found in the literature reviewed for this project. The potential for an alternate supply from the SEAGas pipeline (from the Otway Basin gasfields) into the Murraylands to complement the supply from via Angaston is also apparent. It is not clear if a business case has been established for any potential augmentation of supplies. It is recommended that a consumer initiated study be commissioned to determine the conditions under which augmentation should be pursued.

Potential Funding Source:

Future funding rounds of the Regional Development Australia Fund may be a potential funding source.

STRATEGY 2 – ENERGY SUPPLY

Objectives:

To promote local energy supply and increase the uptake of renewable energy and low emission technologies and the associated economic development opportunities.

Import substitution to increase the local value-add to energy supplies to 25% by 2025 (circa $100M p.a. by 2025).

Proposed actions:

2.1. Bioenergy Roadmap

It is apparent from the results of this study and other referenced material that the region has the potential to source a significant proportion of its energy needs from locally grown biomass (as direct energy crops or in harvesting existing waste streams). A localised version of to the Australian Bioenergy Roadmap and Biomass Resource Appraisal[48] is recommended as the starting point. Given the work to date by the RDA in advancing interests in agro-forestry[49] it is recommended that the RDA lead the facilitation of this roadmap project. The Roadmap would develop a detailed assessment of the potential of various bioenergy technologies in the regions identified in this report, including a consultation with key stakeholders, detailed technical modelling, and energy market analysis. It was noted in this report that landfill sites, intensive farm sites, such as piggeries, and sewerage treatment plants are likely to present the immediate opportunities for energy generation.

According to the International Energy Agency (IEA):[50]

> *"A* **roadmap** *is a strategic plan that describes the steps an organisation needs to take to achieve stated outcomes and goals. It clearly outlines links among tasks and priorities for action in the near, medium and long term. An effective roadmap also includes metrics and milestones to allow regular tracking of progress towards the roadmap's*

[48] www.cleanenergycouncil.org.au/cec/resourcecentre/reports/bioenergyroadmap.html
[49] www.rdamr.org.au/agro-foresty.html

[50] Energy Technology Roadmaps, a guide to development and implementation (OECD/IEA Paris, 2010.) page 3. Available from www.iea.org/papers/roadmaps/guide.pdf

ultimate goals… **Roadmapping** *is the evolving process of creating and implementing a roadmap and monitoring and updating it as necessary. The process is often as important as the resulting document, because it engages and aligns diverse stakeholders in a common course of action, sometimes for the first time.”*

Potential Funding Source:

According to the Renewable Energy Plan for SA, such a project may be eligible for assistance from the state's Renewable Energy Fund.[51]

2.2. Mid Scale Wind and Solar Opportunities – Matching Supply and Demand

A number of commercial grade wind and solar opportunities are apparent in the region. Maximising the local economic benefits of these resources would see these resource exploited 'behind the meter' of the region's energy consumers. This necessarily results in smaller scale (usually less than 1MW but up to around 5MW) projects that are not necessarily the first choice of 'merchant' developers. It is recommended that more detailed work be performed to develop opportunities for more community scale and distributed generation opportunities. This would require matching strong local resources with local demands. Examples would include matching wind energy and dairy farming in the lower lakes region, matching solar and wind and irrigation pumping demand in the Waikerie to Renmark-Paringa corridor. Further information on wind opportunities is provided in Appendices A and B.

Priority projects would include continuing to assess the viability of a MW scale solar facility matched to irrigation demand around the Berri-Renmark area.

STRATEGY 3 – ENERGY DEMAND

Objective:

To improve the efficient use of energy and reduce peak demand.

Proposed Actions:

Three key subsectors of energy consumption are residential, government and public services and industry. It is recommended that distinct initiatives be instigated for each sector. The immediate opportunity arises out of the Clean Energy Futures package and the region should consider pursuing the funding opportunities created.

3.1. Community Energy Efficiency Projects

It is important to ensure that state and federal energy efficiency initiatives have a 'footprint' in the region. It is proposed that these initiatives be lead in partnership by the region's local governments (or via an

[51] Available from www.renewablessa.sa.gov.au/about-us/publications-and-reports Page 21: " … one source of market failure is the lack of quality information to support investment. This applies particularly to information about specific local factors where potential for market failure is high. In South Australia, the first of these conditions appears to apply particularly to the bio-energy sector. Bio-energy projects frequently require commitments from multiple feedstock producers acting in concert to create markets. However, often the emergence of these markets is conditional upon security of feedstock supply from suppliers acting collectively."

alternate 'vehicle' as discussed in Strategy 4). This should include ensuring that the state based Residential Energy Efficiency Scheme[52] (REES, a mandatory obligation on electricity and gas retailers in SA) achieves greater penetration in the region.

Potential Funding Source:

Local Governments to pursue opportunities in the Australian Government's Low Carbon Communities Programs:[53] Community Energy Efficiency Program (CEEP), Low Income Energy Efficiency Program (LIEEP). It is anticipated that program guidelines for both programs will be released in early 2012.

3.2. Food Value Chain Energy Efficiency Best Practice Project

It is recommended that the region consider applying to the Energy Efficiency Information Grants program, with a focus on the key energy consuming activities by businesses in the region. Given the dominant contributions of Agriculture, Food Processing and Winemaking in the regional economy, it is proposed that this would include water pumping, refrigeration and on-farm diesel use. It is suggested that the project would seek to identify and promote 'best practice' in these activities through research and benchmarking existing practices.

Potential Funding Source:

The Australian Government's Energy Efficiency Information Grants program and the $200M Clean Technology - Food and Foundries Investment Program.

Applications for the first round of grant funding under the Energy Efficiency Information Grants (EEIG) program[54] are expected to be sought in the first quarter of 2012. Grants are expected to range from $100,000 to $1 million.

According to the EEIG Discussion Paper (now removed from the website) Section 2.1 page 6:

The program would enable industry associations and non-profit organisations to deliver information and advice on how to implement energy efficiency measures. Examples could include:

- *Production and publication of fact sheets tailored for a specific type of SMEs* [small-medium enterprises] *or community sector organisations. These would provide information and recommendations on improving the energy efficiency of processes and equipment. These could include:*
- *Development and dissemination of case studies and success stories.*
- *Development and implementation of workshops and training courses on key energy efficiency issues for a specific type of SMEs or community organisations; and*
- *Provision of onsite energy efficiency advice, including energy management health checks establishing baseline energy consumption.*

Eligibility criteria include a proposal that excludes individuals and state/local government agencies from applying. The final criteria may or may not relax this requirement.

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[52] More information on the REES is available at http://www.escosa.sa.gov.au/electricity-overview/residential-energy-efficiency-scheme-rees-.aspx

[53] www.climatechange.gov.au/government/initiatives/low-carbon-communities.aspx

[54] www.climatechange.gov.au/energyefficiencyinformationgrants

3.3. Detailed Energy Demand Study Project

This project has only been able to conduct a high level review and analysis of publicly available data. All future energy initiatives would benefit from greater detail about energy consumption across the region and by the different economic sector represented in the region. Consolidation of existing regional energy consumption information will likely need to be supplemented by surveys and / or direct measurement. This project is closely related to recommendation 2.2 – pursuing mid-scale wind and solar projects through matching supply opportunities to on-site demand.

STRATEGY 4 – COMMUNITY PARTICIPATION AND LEADERSHIP

Objectives:

- To ensure affordable access to energy for all communities
- To increase community investment and involvement in local energy initiatives.
- To provide community leadership in the transition to a clean energy future.

Proposed Actions:

This strategy area necessarily involves matters of **Governance.** The term is used to encompass the definition of roles and responsibilities of a management arrangement. 'Good governance' similarly refers to the situation where roles and responsibilities are clearly defined and enacted. Actions could include the pursuit of Community Owned Renewable Energy (CORE).

4.1. Regional Energy Cooperative Feasibility Study

It is recommended that consideration be given to establishing an energy users' Energy Cooperative as a vehicle for advancing local energy interests. Such an organisation could showcase local energy projects (of which there appear to be many), aggregate demand to match local generation projects, advance the findings of a Local Bioenergy Roadmap (see Strategy 2), drive advocacy for reliability improvements and other tasks. An example of a similar initiative is the *Island Energy*[55] initiative of the RDA Adelaide Hills, Fleurieu and Kangaroo Island.

4.2. Public Institution Demand Aggregation

It is recommended that consideration be given to the potential buying power reflected in the energy expenditures of the local government bodies in the region. The 11 Councils, NRM Board, RDA, etc., can influence energy projects in a variety of ways. It is understood that some of the region's councils participate in the electricity buying group administered by Local Government Corporate Services (LGCS).

One example is the approach currently being advanced by the City of Onkaparinga. The approach, which is still being progressed via a confidential procurement process can be summarised as developing a local, renewable electricity generation facility for which the City is considering being the 'foundation customer' – that is, considering the merits of entering into a long-term power-purchasing-agreement (PPA) with the project developers and, in effect, underwriting the project. The approach has resulted in the City

[55] See www.kangarooislandenergy.com for more information.

considering a fixed-price (escalated by CPI only) PPA for a period in the range 10-20 years. The PPA price is higher than what they are currently paying but lower than what the City is projected to have to pay in the market over the same timeframe.

In effect, the project represents a physical and contractual hedge against the risk of rising electricity prices.

The RDA MR Roadmap notes that the Coorong Council supports a major agricultural development planned for Cooke Plains, and is keen to promote green energy and intensive farming activities such as piggeries. If realised, these initiatives would offer The Coorong Council significant opportunities to show leadership and actively participate in the development of bioenergy facilities. The Coorong is also one of the very few areas in the SA MDB that is likely to have access to a commercial-grade wind resource, which means that the Council is presented with a vast array of opportunities to implement local energy security projects. If feasible, combining several technologies in a precinct is likely to create an iconic and innovative facility, which would be of assistance when seeking grant funding.

4.3 Set a target for value-add to the region-wide energy economy

As discussed, the region currently expends in excess of $300m on energy products and services with very little local value add. It is recommended that a target of 25% by 2025 be considered as focal point for energy related economic development initiatives.

Key Concept: IMPORT SUBSTITUTION

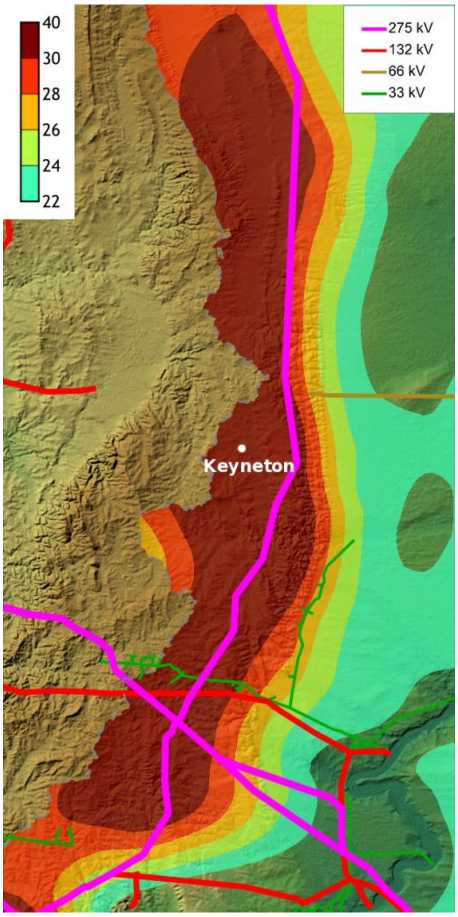
It is possible to consider the current SA MDB energy economy as around 95% imports. A strategy of "*import substitution*" with respect to the SA MDB energy economy could establish targets for energy value add – 25% by 2025 would be a plausible starting point.

APPENDIX A - PRELIMINARY WIND RESOURCE ASSESSMENT - COMMERCIAL SCALE

EASTERN MOUNT LOFTY RANGES

This region, shown in more detail below, shows a region of high mean wind speed from Brukunga in the South to Robertstown in the North. This region includes two proposed wind farms, one recently proposed 100 MW (42 turbine) wind farm at Keyneton, and the other (150 MW) at Australia Plains.

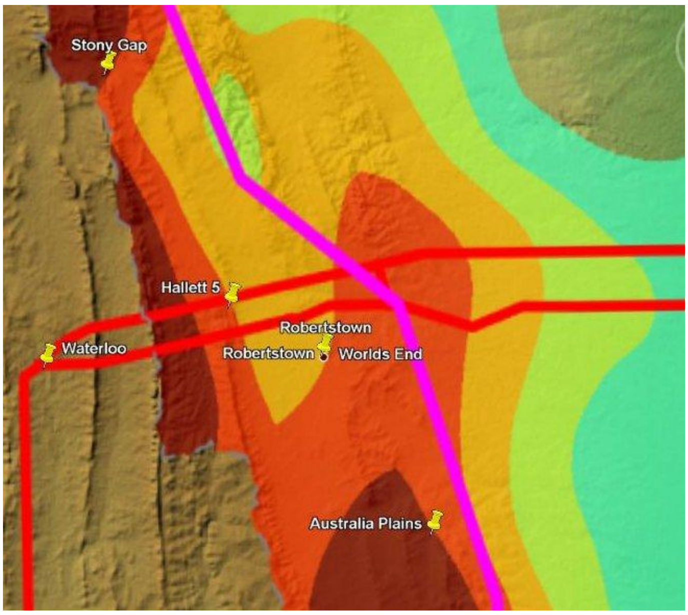
Future commercial development of this region is possible, depending on qualification of the wind resource at individual sites and further project development by wind developers.



AUSTRALIA PLAINS

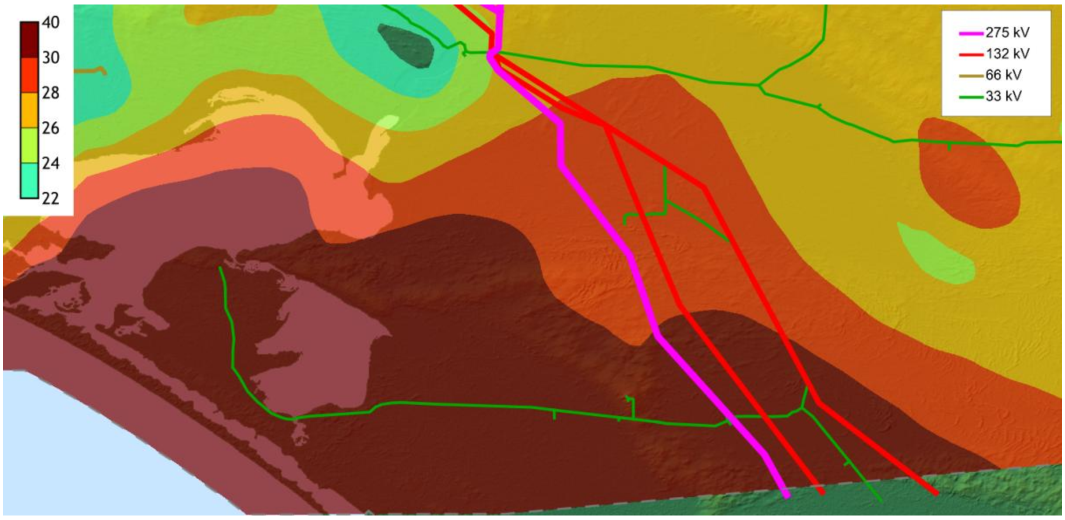
The figure below shows the capacity factor map overlaid with proposed wind farm developments around Australia Plains.

This figure shows that some of the proposed farms fall in regions predicted to be less viable according to the 3 km resolution preliminary wind map. This is to emphasize the limitations of the map, which does not take into account the local speed up effects of the topography, and can therefore largely under (or over-) estimate the potential of any given site. The map should be interpreted with these limitations in mind and taken as indicative only.



COORONG

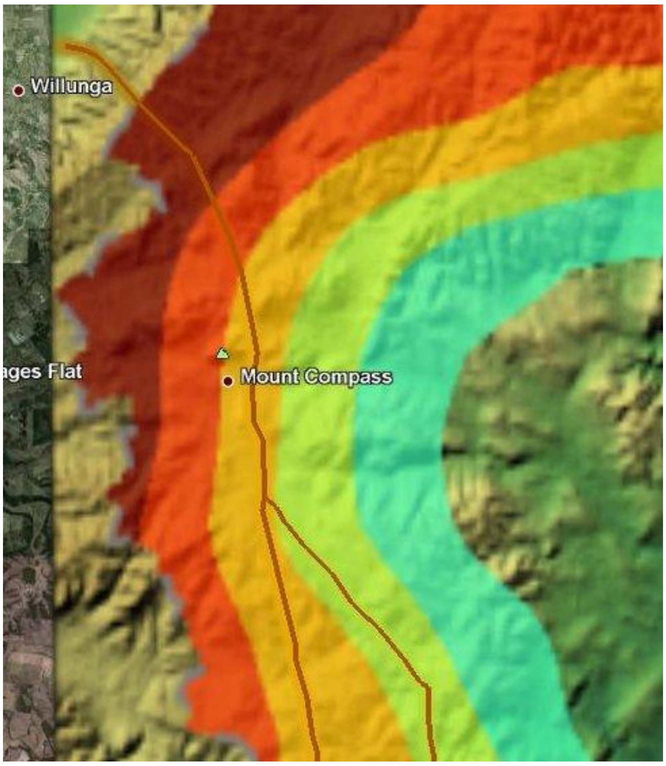
The Coorong has been identified in the Renewables SA publication[56] *A Renewable Energy Plan for South Australia* (Figure 1) as a potential zone for wind developments. The capacity factor map at 80 m of this region supports this, as it indicates a significant wind resource near 275 kV transmission lines near Coonalpyn. The hills to the west of the transmission line may show local speed ups that improve the potential for development of commercial wind farms in this region.



[56] http://www.renewablessa.sa.gov.au/files/111019-renewable-energy-plan-for-south-australia.pdf

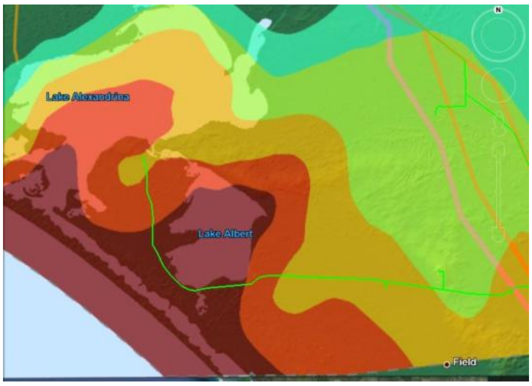
APPENDIX B - PRELIMINARY WIND RESOURCE ASSESSMENT - COMMUNITY SCALE

A community scale opportunity exists near Mt Compass – although the map shows less than commercially viable wind resource, the local topography is quite variable, and it may be possible to find topographical speed up close to the 66 kV Distribution network.

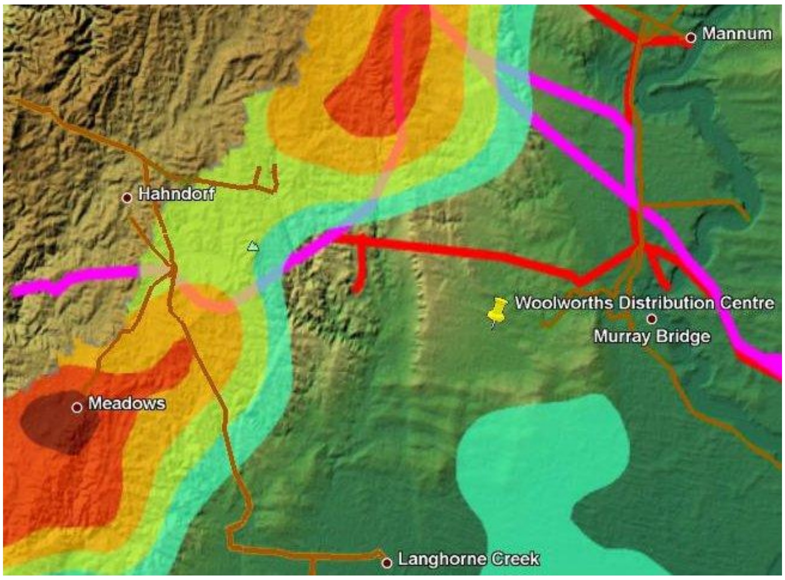


Furthermore, the area at the end of the 66 kV line near Keyneton may be an appropriate site for a community wind farm, as would the Manumn-Birdwood 33 kV, the Cambrai 33 kV along the back of the MLR, and Brukunga 33 kV.

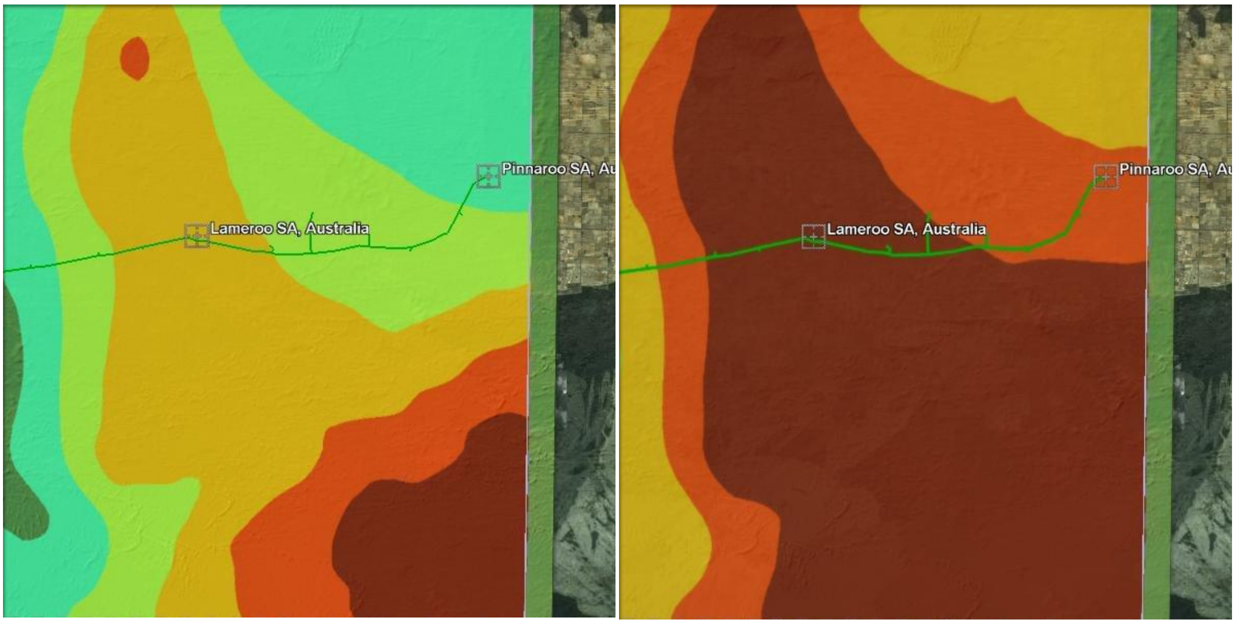
In the Coorong, the 33 kV line between Meningie and Narrung shows a significant wind resource at 60m, an opportunity further to the commercial one in the hills East of Coonalpyn. Severely limited network capacity means that only distributed, behind the meter, and non-exporting projects would be feasible without an upgrade.



The map below shows a commercial grade wind resource near a 66 kV distribution line near Meadows, which would be a good location to consider a community scale wind project. It is also worth noting the Woolworths Distribution Centre, which has an onsite wind turbine proposed,[57] is located in a marginal wind resource region at 60 m – however the economics of onsite energy usage are different to developing a project and selling energy on the wholesale market.



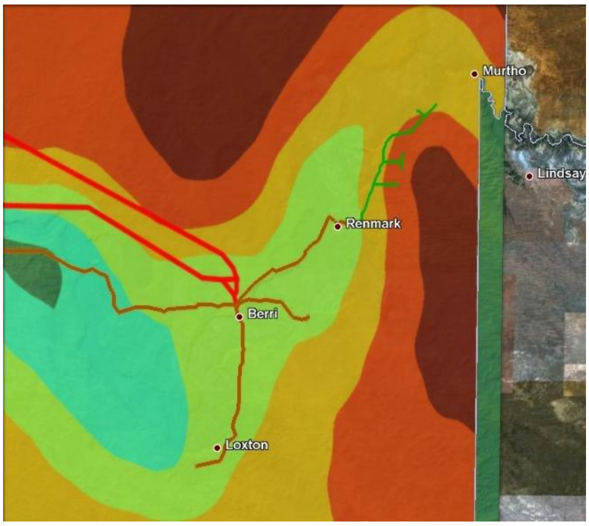
There is significant wind resource at 60 m height to the south of Pinnaroo, but it is a considerable distance away from the 33 kV line. At 80 m, the commercially exploitable resource extends over Lameroo. The network in this region is relatively limited. A wind turbine of up to 1 MW installed behind the meter on the site of a large energy consumer may be economically feasible and improve the local energy security of the region. Such a project would require much finer modelling in terms of the wind resource, interaction with the grid, local energy usage and the future price of energy.



Pinnaroo SA, Au
Lameroo SA, Australia

57 http://www.energetics.com.au/testimonials/projects/woolworths-renewable-energy/case-study-energetics-helps-w.pdf

In the Riverland, wind opportunities exist to the north of Berri near the 132 kV lines, and to the east of Renmark to the border, possibly at 60 m depending on the local topographic or land cover variations smaller than the resolution of the 3 km wind map. Lake Bonney is of the order of 3 km in size, and therefore unlikely to be accurately modelled by a 3 km wind map – as such the smooth surface of the water is likely to offer a wind speed up in this region, which may make a community scale wind project feasible on some of its shores, depending on the prevailing winds. Similarly, the economics of wind generation offsetting pumping electricity, rather than selling electricity into the wholesale market, may make such wind projects economically feasible in the region.



APPENDIX C - A DISCUSSION OF SOLAR

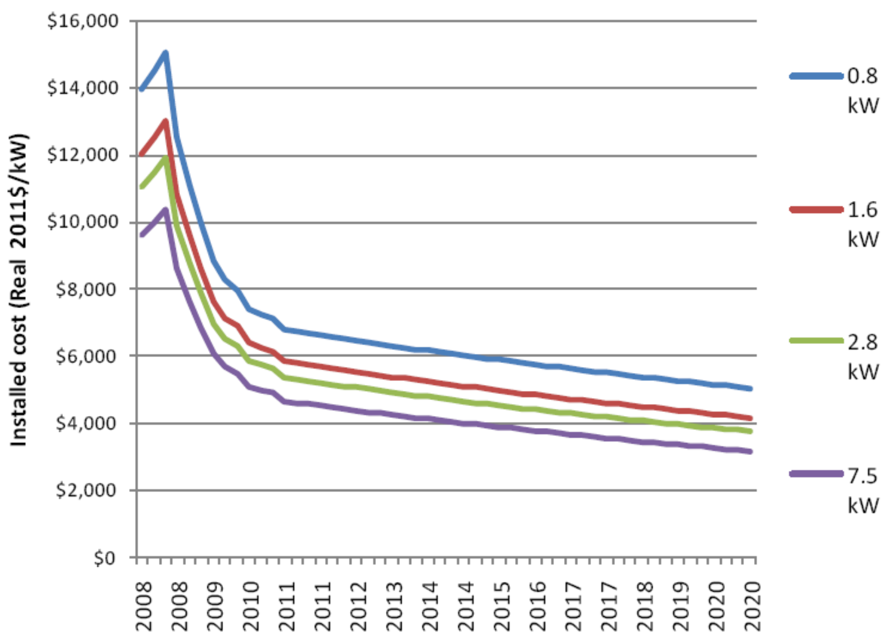
Solar Photovoltaics has a rather special place in the energy sector. Its modular nature and mass production has resulted in significant reductions in costs over recent years. The trend in cost reduction is expected to continue. At the same time, the cost of electricity (particularly for small consumers) is expected to increase significantly over coming years (for a number of reasons). The point where the unsubsidized cost of generating electricity from solar meets and then falls below the cost of buying from the grid is expected in Australia sometime after 2015.

The implications for local government and other consumers is that, regardless of current uncertainty and discontinuity regarding subsidies and incentives, the global momentum appears unstoppable. If this turns out to be the case, and there is strong reasons to believe it will, solar will represent a rather mainstream investment option for energy users.

The Essential Services Commission of SA (ESCoSA) recently engaged ACIL Tasman to assist in a review of amendments to the Electricity Act in relation to South Australia's feed-in scheme. The ACIL Tasman modelling had also been used by the Australian Energy Markets Commission (AEMC) and the Office of the Renewable Energy Regulator (ORER) in considering likely uptake in Australia.

Figure 21 is taken from ESCoSA's advice to the Treasurer:[58]

Figure 21 Real system costs by system size, 2008 to 2020

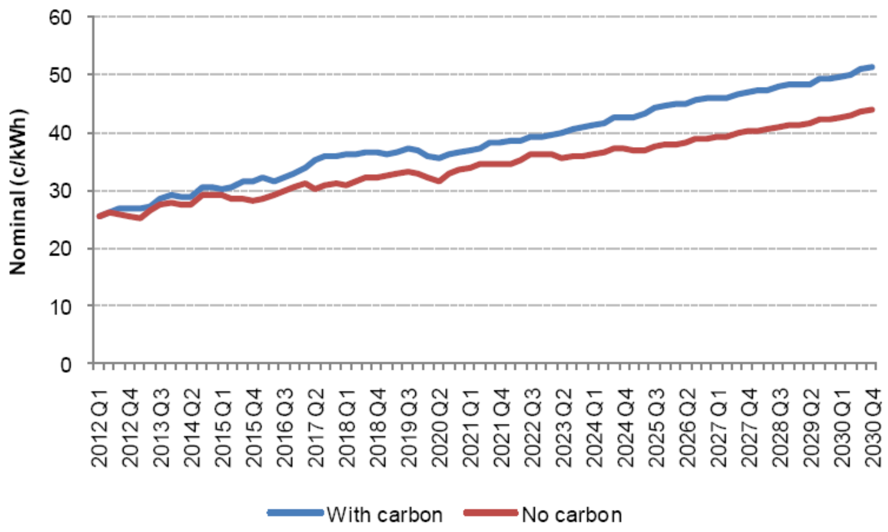


Source: ACIL Tasman analysis

As can be seen, the installed cost of systems continues to fall. Complementarily the price of electricity continues to rise. The ESCOSA report illustrates this in the below:

[58] www.escosa.sa.gov.au/library/110618-FeedInAdviceToTreasurer-ESCOSAReport.pdf, page 42

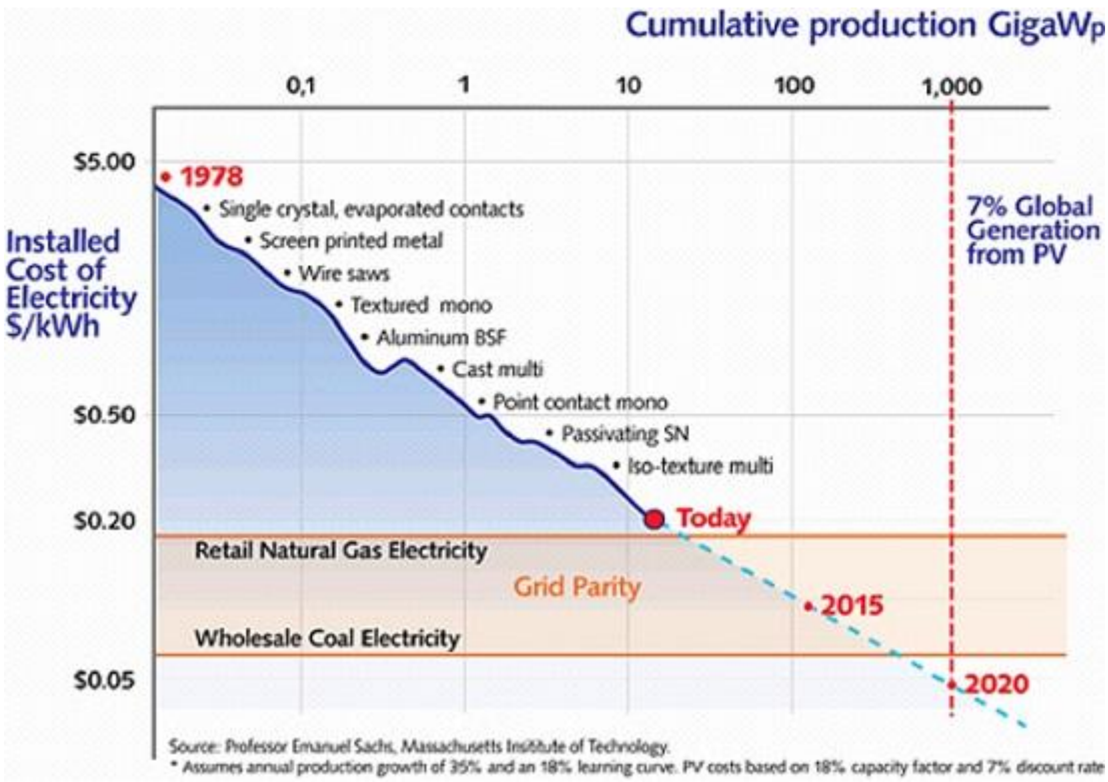
Figure 18 *Retail electricity prices with and without carbon*



Note: Variable components of retail price only. Excludes GST.
Data source: ACIL Tasman analysis

Logically, the trajectories must converge and intersect at a point where the business case for investing in solar is apparent, free of subsidies. The ACIL Tasman modelling suggests that this occurs around the middle of this decade.

The following diagram plots the development of solar photovoltaics and how the cost has fallen (vertical axis, logarithmic scale) as production has increased (horizontal axis, logarithmic scale). This global view appears to support the modelling of ACIL Tasman.



APPENDIX D – LITERATURE REVIEW

The following list consolidates the main documents reviewed as part of this study.

City of Onkaparinga: Energy Futures 2010-2014. Energy Futures is a new strategy that looks at energy demand and supply issues facing the city and what council's role is in addressing these issues. Available from www.onkaparingacity.com

SAMDB NRM Board Annual Report 2009-10

RDA Riverland and Murraylands- various publications via www.rdamr.org.au/; In particular:

- Murraylands & Riverland Regional Roadmap 2011-13 www.rdamr.org.au/regional_roadmap.html
- Jobs Growth and Investment Forecast 2012 – 2014
- Riverland Prospectus: www.rdamr.org.au/fileadmin/user_upload/Murraylands/Docs/Riverland_Prospectus_v6.pdf
- RIO- Regional Investment Opportunities http://www.murraylands.org.au/mlands_mining.html
- RDA: Economic Outlook reports prepared by Econsearch Ltd: www.rdamr.org.au/rio_reports_june2008.html

PIRSA Maps: http://www.pir.sa.gov.au/wid/regions/river_murray/site_selection_maps

Central Irrigation Trust (www.cit.org.au)

www.pir.sa.gov.au/wid/regions/river_murray/water_considerations/irrigation_trusts

National Energy Security Assessment (2009) NESA

http://www.ret.gov.au/energy/energy_security/national_energy_security_assessment/Pages/NationalEnergySecurityAssessment.aspx

Renewable Energy Plan for SA

http://www.renewablessa.sa.gov.au/files/111019-renewable-energy-plan-for-south-australia.pdf

Murray and Mallee Region Plan - A volume of the South Australian Planning Strategy via http://www.planning.sa.gov.au/index.cfm?objectid=9BF31A90-9496-11DF-AE47000F2030D46A

Strategic Infrastructure Plan for South Australia, Regional Overview, 2005-06–2014-15

http://www.infrastructure.sa.gov.au/strategic_infrastructure_plan/sa_strategic_infrastructure_plan

RIRDC Rural Industries Research and Development Corporation: Bioenergy, Bioproducts and Energy Program: RIRDC's Bioenergy, Bioproducts and Energy program aims to meet Australia's research and development needs for the development of sustainable and profitable bioenergy and bioproducts industries and to develop an energy cross-sectoral R&D plan. (www.rirdc.gov.au/RIRDC/programs/new-rural-industries/bioenergy-bioproducts-and-energy/bioenergy-bioproducts-and-energy_home.cfm)

Australian Bioenergy Roadmap and Biomass Resource Appraisal

www.cleanenergycouncil.org.au/cec/resourcecentre/reports/bioenergyroadmap.html

Australian Government Clean Energy Future Plan (www.cleanenergyfuture.gov.au).

US DoE Biomass Energy Data Book: http://cta.ornl.gov/bedb/appendix_b.shtml

Electranet:

http://www.electranet.com.au/network/current-planned-developments/riverland (There are no current or planned developments listed for the Riverland)

http://www.electranet.com.au/assets/Uploads/2011-Annual-Planning-Report.pdf

Earth Resources Information Sheet P1: Holders of Petroleum and Geothermal Tenements in SA (Current as at September 2011).

http://www.pir.sa.gov.au/__data/assets/pdf_file/0003/28551/p01.pdf