



**Regional
Development**
Australia

GOLDFIELDS ESPERANCE

Audit of Renewable Energy Projects

in the Goldfields–Esperance Region

June 2013



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Introduction

Located in the south-east quadrant of Western Australia, the Goldfields-Esperance region is home to 59,489 people (ABS). The region is the largest geographically in the state of Western Australia, and includes the following local government areas: Kalgoorlie-Boulder, Coolgardie, Dundas, Esperance, Ravensthorpe, Menzies, Leonora, Laverton and Ngaanyatjarraku.



Source: www.migration.wa.gov.au

As identified in the Regional Development Australia (RDA) Goldfields-Esperance submission to the Draft Energy White Paper (2011), the region's low population density, coupled with its large landmass, represents a significant challenge to delivering energy network infrastructure and associated services.

In order to provide a context for renewable energy projects, the report profiles the current energy supply structure of the Goldfields-Esperance region, the funding opportunities for renewable energy projects, as well as documenting some of the key challenges faced by renewable energy project developments.

A snapshot of renewable energy projects from across Australia has also been profiled to illustrate future options for the Goldfields-Esperance region. These projects have been specifically selected as being most viable to replicate in some way within the Goldfields-Esperance region.

Key Recommendations

RDA commissioned this report to contribute to the successful development of renewable energy projects within the Goldfields-Esperance region. The implementation of the recommendations outlined below will foster this aim.

Recommendation one: Coordination

It is recommended that RDA contribute to coordination of renewable energy policy and project development in the Goldfields-Esperance region. Support for renewable energy project development across all levels of government and peak organisations currently exists within the region. Coordination amongst these groups would reduce duplication and promote information sharing that would greatly assist in the development of a successful renewable energy project in the region.

Recommendation two: Solar PV Project Officer

From 2008 to 2012, the cost of solar PV panels fell by up to 70%. There may be a number of organisations and agencies across the region which have not yet taken advantage of the cost savings and environmental benefits which could be achieved as a result of solar PV installation.

It is recommended that an organisation within the Goldfields-Esperance region employ a solar PV project officer, who could manage the following activities:

- Promotion of funding for energy efficiency audits of buildings. There are a number of locally based individuals who can undertake the audits.
- Advocacy on behalf of organisations who may be encountering difficulties dealing with Western Power or Horizon Power due to the connection rules imposed on solar PV (as outlined in the report)
- Establishment of group buying power, which would deliver both cost savings and alleviate the issue of attaining quotes for solar PV systems.
- Facilitation of partnerships between organisations who may be seeking to reduce their carbon price liabilities (mining companies or local government) and community organisations who would like to take advantage of solar PV savings;
- Establish a Program within the region to encourage sustainable behaviours including reducing waste, increasing re-use and recycling, energy efficiency, and encouraging green star rated building design.

Recommendation three: Indicators of successful projects

- It is recommended that RDA focus their support for renewable energy projects, on those which meet the generic indicators of successful projects, which include:
- The use of proven technology. However this is not to say a calculated risk on innovation associated with proven technology should not be considered.
- Organisations which have experience in, and have delivered other successful renewable energy projects.
- Organisations which understand the region and how the current power supply arrangements operate within the region.
- The Power Purchase Agreement (PPA) is critical to the success of projects (customers who are prepared to purchase the power at the cost of production of the renewable energy technology).
- Many of the successful projects to date have been recipients of government funding for the up-front capital costs associated with the project.

Recommendation four: Federal funding opportunities

It is recommended that RDA investigate how remote Aboriginal communities and fringe of grid communities (e.g. Ravensthorpe) can take advantage of the recently announced federal funding programs managed by ARENA:

- Regional Australia's Renewable Community and Regional Renewable Energy Program.
- Regional Australia's Renewable Industry Program.

Due to current energy supply arrangements, remote Aboriginal communities in the Goldfields-Esperance region have not yet experienced a significant implementation of renewable energy supply options. Federal funding for renewable energy projects in remote communities and Ravensthorpe may ensure their viable development.

Context

Energy Supply in the Goldfields-Esperance Region

Understanding how the current energy supply needs are being met across the Goldfields-Esperance region is fundamental to understanding and measuring the potential viability of renewable energy projects in the region.

Supply Chain

The energy supply chain in Western Australia is regulated by the state government and structured into three (3) functional elements: generation, distribution and retail. Within the South West Interconnected System (SWIS), competitive markets have been established for the generation and retail elements, while responsibility for the distribution or network function is assigned to the state owned and regulated Western Power Networks Corporation. Companies wishing to participate in these markets must obtain a generation or retail licence and contract with Western Power for access to the network. Outside the SWIS, companies wishing to generate, distribute or retail electricity must obtain a licence for the location or town in which they wish to operate. Integrated regional licences covering all three (3) functions, are also available.

Synergy is state government owned and is the largest retailer in Western Australia. Synergy retails power to customers within the towns of Kalgoorlie-Boulder, Coolgardie, Kambalda and Ravensthorpe in the Goldfields-Esperance region. This power supply is provided via the SWIS with electricity being purchased by Synergy from a number of competing generation companies and generated at a variety of sites such as Muja and Collie power stations as well as some renewable sources such as the Collgar wind farm in Merredin. The main generator of electricity on the SWIS is the state government owned corporation Verve Energy. In April 2013, the state government announced plans to re-merge Synergy and Verve. They were established as separate entities following the disaggregation of Western Power in 2006.

The towns of Laverton, Leonora, Menzies, Norseman, Esperance, Salmon Gums, Grass Patch, Scaddan, Gibson and Hopetoun are provided with electricity by Horizon Power. Over the last ten years Horizon Power has outsourced the electricity generation in most of its service areas including those within the Goldfields-Esperance Region. In these towns, Horizon Power has entered into 10 to 20 year power purchase agreements (PPAs) with independent power producers (IPPs) to supply all its electricity requirements in each town. Horizon Power has retained management of the network and retail functions.

Horizon Power's generation arrangements within the Goldfields-Esperance Region are summarised in the following table and diagram.

TOWN	GENERATOR	GENERATION
Laverton	Energy Developments Ltd	Diesel
Leonora	Energy Developments Ltd	Natural Gas
Menzies	Energy Developments Ltd	Diesel
Norseman	Norseman Gold	Diesel
Esperance	Esperance Power Station (ANZIS)	Natural Gas and Wind
Hopetoun	Verve Energy	Hybrid Wind-Diesel



Source: www.horizonpower.com.au

Remote Aboriginal communities in the Nganyatjarra Lands and the communities of Tjuntjuntjarra and Coonana have diesel generators located at each community. The systems are serviced via a state government program; the Remote Areas Essential Services Program (RAESP) managed by Parsons Brinckerhoff on behalf of the Department of Housing. Nganyatjarra Essential Services is responsible for the repairs and maintenance and capital works for these generators and has recently commenced a new contract for the provision of these services.

The federal government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) provides a diesel fuel rebate to the community for the fuel consumption of the diesel generators. Approximately four (4) years ago Horizon Power implemented new metering technology and undertook a community education/energy efficiency audit within the Nganyatjarra Lands communities.

Within private or closed communities such as pastoral stations, roadhouses and tourist facilities, the owner or operator of the community is generally responsible for the electricity supply.

Mining Energy Supply

Energy for private industry, such as mining companies is supplied via a commercial arrangement with generators that can meet the exact needs of the client. Most mining companies are contestable customers due to the significant energy consumption requirements of mining activity.

If the mine site is located within the SWIS power grid network (within an 80km radius of Kalgoorlie-Boulder, Kambalda, or Coolgardie) it is likely that they will be connected to the SWIS and would purchase their energy supply from a gas power generator such as TransAlta or Alinta Energy.

Any mine outside of the SWIS has to produce its own energy and/or purchase from Horizon Power if located within a community they supply.

Most mining companies have Independent Power Producers contracted with Build-Own-Operate style contracts, where the mine has a take-or-pay agreement. These power stations are fuelled by diesel or gas. The map below illustrates the transmission line of the Goldfields Gas Pipeline.



Source: www.apa.com.au

Governance and Regulation

The West Australian energy market is regulated by the state government Economic Regulation Authority (ERA). A license must be obtained from the ERA to generate, distribute or retail electricity in Western Australia. The ERA also assesses and reports on terms and conditions of electricity and gas supply including pricing and has a surveillance role in the wholesale electricity market (which operates in the SWIS). The ERA can also report and inquire into matters referred to it by the state government, on issues such as efficiency of tariffs, underground power projects, and funding arrangements of Horizon Power.

The Independent Market Operator (IMO) is an industry-funded organisation that operates within the SWIS, managing and developing the wholesale electricity market. The IMO aim to facilitate competition between power generators and retailers, manage electricity capacity, encourage investment and support the development of sustainable technologies. The IMO is responsible for developing and maintaining rules, and has established the Market Advisory Committee (MAC) to advise the IMO on rule and procedure changes.

Another relevant energy agency is the Department of Finance Public Utilities Office, which was established in 2012, consolidating the role previously undertaken by the Office of Energy in providing a range of services to the Minister for Energy, the energy sector and the West Australian community.

Solar Photovoltaic (PV) Rules

In Western Australia there are different rules for solar PV connection and excess generation on the SWIS and within the Horizon Power network for non-residential customers. Exporting excess energy generated from a solar PV system on the Horizon Power network depends on the tariff, system size, and the location's hosting capacity.

Exporting excess energy generated from a solar PV system into the SWIS for commercial entities may be difficult to achieve for certain customers. Western Power has different rules for the size of connections. Solar PV systems smaller than 3 kW are those which apply mostly to residential customers. Western Power can approve connection within 24 hours and Synergy will purchase power back from those customers at 8.4094 cents per kWh. Solar PV systems with capacity between 3–30 kW require technical reviews and approvals. Solar PV systems over 30kW require network studies and technical reviews. Customers over 30 kW may have to meet stringent switching, control and protection systems design to stop energy generated by solar PV excess to requirements being exported into the grid.



Current Government Initiatives

The state and federal governments have introduced a number of initiatives aimed at increasing renewable power generation capacity. Some of these initiatives are and have been the catalyst for incentives to develop, and underpin the viability of some renewable energy projects within the Goldfields-Esperance region.

Programs which have existed in the past may have also been the incentive for some of the renewable energy projects profiled in this report. The relevant details of those programs are outlined below.

State Government

Renewable Energy Buyback Scheme

www.synergy.net.au

www.horizonpower.com.au

The Renewable Energy Buyback Scheme gives eligible customers the chance to make money from excess wind, solar or hydro power generated. If the system meets the scheme eligibility criteria and is duly connected to the grid with all necessary approvals, surplus energy can be exported into the network, and the retailer will pay for it in accordance with the Renewable Energy Buyback Scheme terms and conditions. Synergy currently purchases power back from customers at 8.4094 cents per kilowatt hour. Horizon Power currently purchases power back from customers at different rates depending on where the system is installed. This is due to the location and operational cost of generation in each town. The current renewable energy buyback pricelist for Horizon Power is attached.

Low Emissions Energy Development (LEED) Fund

www.dec.wa.gov.au

The Low Emissions Energy Development (LEED) Fund supported innovative technology projects at the commercial demonstration, commercialisation and local adaptation stages in Western Australia. The Fund was administered by the Department of Environment and Conservation (DEC). Decisions on funded projects were made jointly by the Ministers for Environment and Energy. The key objectives of the LEED fund were to support new low-emissions energy technologies in WA to help ensure clean, competitive and secure energy supplies in the future, reduce the impact of carbon pricing on energy prices in WA, form part of WA's contribution to Australia's Renewable Energy Target, address WA specific energy challenges and renewable opportunities, develop new low emissions industries in WA. The final round of funding recipients was announced in early 2013.

Federal Government

Renewable Energy Target

www.cleanenergyregulator.gov.au



The federal government's expanded Renewable Energy Target (RET) aims to produce 20% of Australia's energy needs in 2020 from renewable generation. The Renewable Energy Target (RET) is split into two (2) schemes - the Large-scale Renewable Energy Target and the Small-scale Renewable Energy Scheme. The schemes aim to encourage the additional generation of electricity from renewable sources, reduce emissions of greenhouse gases in the electricity sector and ensure that renewable energy sources are ecologically sustainable. This is achieved by the creation of online certificates by eligible renewable energy sources based on the amount of electricity in megawatt hours (MWh) generated by a renewable energy power station, or small-scale solar panel, wind or hydro system or displaced by a solar water heater or heat pump; and placing a legal obligation on liable entities (usually electricity retailers) to purchase and surrender a certain amount of these certificates each year. The trade in these certificates thereby provides financial incentive for investment in renewable energy power stations and for the installation of solar water heaters, heat pumps, and small-scale solar panel, wind, and hydro systems. The certificates are created and traded through the REC Registry, an Internet-based registry managed by the Clean Energy Regulator.

Carbon Farming Initiative

www.cleanenergyregulator.gov.au

The Clean Energy Regulator administers the Carbon Farming Initiative which is a legislated offset scheme allowing farmers and land managers to earn Australian carbon credit units by storing carbon or reducing greenhouse gas emissions on the land. These carbon credit units can be sold to people and businesses wishing to offset their emissions.

Carbon Pricing Mechanism

www.cleanenergyregulator.gov.au

Australia has introduced a price on carbon to support the transition to a low carbon economy. The Clean Energy Regulator administers Australia's carbon pricing mechanism. The carbon pricing mechanism started on 1 July 2012. It applies to Australia's biggest polluters who have to report on, and pay a price for, their carbon pollution. This creates incentives to reduce emissions. The price is fixed each year for the first three years, starting at \$23 a tonne in 2012-13. Then from 2015-16 the price will be set by the market.

Clean Energy Finance Corporation

www.cefcexpertreview.gov.au

The Australian government established the \$10billion commercially oriented Clean Energy Finance Corporation (CEFC). The objective of the CEFC is to overcome capital market barriers that hinder the financing, commercialisation and deployment of renewable energy, energy efficiency and low emissions technologies. The CEFC will invest in firms and projects utilising these technologies as well as manufacturing businesses that focus on producing the inputs required. It will not invest in carbon capture and storage technologies. The CEFC will not provide grants. It is intended to be commercially oriented and to make a positive return on its investments. The CEFC is not intended to compete directly with the private sector in the provision of financing to the clean energy sector. It is intended that the CEFC will act as a catalyst to private investment that is currently not available for clean energy technologies and thereby contribute to reducing carbon emissions and cleaner energy. Capital that is returned from investments will be retained for reinvestment by the CEFC, with the Board to determine the quantum of any dividends payable to the Australian Renewable Energy Agency.

Australian Renewable Energy Agency
www.arena.gov.au

The Australian Renewable Energy Agency (ARENA) is an independent Commonwealth authority, supporting innovations that improve the competitiveness of renewable energy technologies and increase the supply of renewable energy in Australia. Around \$2.2 billion of ARENA's funding is currently uncommitted and will be available for ARENA to expend in accordance with its functions and powers. These include providing financial assistance for: the research, development, demonstration, deployment and commercialisation of renewable energy and related technologies, and the storage and sharing of knowledge and information about renewable energy technologies. ARENA will also collect, analyse and share information and knowledge about renewable energy and related technologies.

Clean Technology Innovation Program
www.ausindustry.gov.au

The \$200 million Clean Technology Innovation Program (CTIP) is a competitive, merit-based grants program. The CTIP supports: applied research and development, proof of concept and early stage commercialisation activities that lead to the development of new clean technologies and low emission and energy efficient solutions that reduce greenhouse gas emissions. The program provides grants between \$50,000 and \$5 million on a co-investment basis of a dollar of government funding for each dollar of the applicant's investment.

Clean Technology Investment Program
www.ausindustry.gov.au

The Clean Technology Investment Program is an \$800 million competitive, merit-based grants program to support Australian manufacturers to maintain competitiveness in a carbon constrained economy. This program will provide grants for investments in energy efficient capital equipment and low emission technologies, processes and products.

Clean Technology Food and Foundries Investment Program
www.ausindustry.gov.au

The Clean Technology Food and Foundries Investment Program (the Program) is a \$200 million competitive, merit-based grants program to support Australian food and foundry manufacturers to maintain competitiveness in a carbon constrained economy. This program will provide grants for investments in energy efficient capital equipment and low emission technologies, processes and products.

Community Energy Efficiency Program
www.climatechange.gov.au/ceep

The Community Energy Efficiency Program (CEEP) is a competitive merit-based grant program that provides co-funding to local governing bodies and non-profit community organisations to implement projects that deliver a range of energy efficiency measures in council and community owned buildings, facilities and sites, particularly where this would benefit low socio-economic and other disadvantaged communities or support energy efficiency in regional and rural councils. The objectives of the CEEP are to support a range of local councils and community organisations to increase the energy efficiency of different types of non-residential council and community-use buildings, facilities and lighting; and demonstrate and encourage the adoption of improved energy management practices within councils, organisations and the broader community.

Remote Indigenous Energy Program
www.fahcsia.gov.au

As part of the Clean Energy Future package, the federal government has maintained its commitment to remote renewable energy through the \$40m four-year Remote Indigenous Energy Program (RIEP), which is administered by the Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA). RIEP will primarily provide reliable 24-hour power in up to 50 smaller remote Indigenous communities across Australia through the installation of fit-for-purpose renewable energy systems. RIEP will also provide energy efficiency education and training in basic system maintenance to community members and repairs and maintenance to existing systems.

Renewable Energy Projects in the Goldfields-Esperance Region

Kalgoorlie Solar Power Station

The proponent of this project is Investec Bank (Australia) Ltd, an international specialist investment bank which operates in three (3) main jurisdictions South Africa, London (United Kingdom) and Australia and offers services across a number of sectors. It invests the bank's own equity to develop clean energy projects from inception to 'construction ready'. In Western Australia, Investec was responsible for the successful development of the 206 MW Collgar Wind Farm, located 25km south east of Merredin.

Investec is currently proposing to develop a \$200 million, 50 MW photo-voltaic solar power station on 200ha of land within the Mungari Heavy Industrial Estate.

The facility would connect to the SWIS via direct connection to the existing 220 kV line adjacent to the site or via a new 132kV transmission line to the West Kalgoorlie substation. Investec has lodged a formal connection application with Western Power for the facility.

Investec is a company with a successful track record in developing viable renewable energy projects. The solar output for the region is predictable and consistent and the solar PV technology is well established and viable. It is currently negotiating land tenure and planning applications are likely to be made in the near future. Off-take agreements with customers are currently being discussed, and the full range of government initiatives, where relevant, will be explored to complement this development.

Solar Flagship Project

Mitsui & Co. (Australia) Ltd. is presently considering opportunities in the Kalgoorlie region for a large-scale solar development. Mitsui commenced initial investigations in the Kalgoorlie region during the Solar Flagships process in 2009. Although the Solar Flagships project did not eventuate Mitsui continues to explore the feasibility of a 10-50 MW solar facility in the region.

Mitsui & Co. (Australia) Ltd. is the wholly-owned Australian subsidiary of Mitsui & Co. Ltd. In Australia, Mitsui is involved in a number of industries including iron ore, coal, oil and gas, agriculture, power generation (including renewable), salt, steel products and woodchips.

The Solar Flagship program was a \$1.5 billion federal government funding program announced in December 2009. The Solar Flagships program was premised on the government contributing up to 33 per cent of upfront construction costs to ease financing issues. The Mitsui project was not one of the projects shortlisted for this funding.

Solar Systems Kalgoorlie

The City of Kalgoorlie-Boulder commenced negotiations in 2005 with Solar Systems Limited for the construction of a 2.5 MW solar power station, with 48 solar dishes, to be potentially located at a site on Anzac drive.

In 2008 the West Australian government committed \$4.5 million to the development of the project from the Low Emission Energy Development (LEED) Fund to assist in building a solar power station in Kalgoorlie using a 500-sun concentrator to focus an intense energy beam on efficient solar cells.

It was hoped that funding could be provided through the federal government Solar Flagship Program. The Solar Flagship program was a \$1.5 billion federal government funding program announced in December 2009. It was premised on the government contributing up to 33 per cent of upfront construction costs to ease financing issues.

The project was to be worth \$12.83 million, producing 1.77 MW of energy. In September 2009, Solar systems Ltd went into administration.

Esperance Wave Power

In the late 1980's Esperance was touted as the location for the world's-biggest wave-powered generator. The \$8 million project was underwritten by Wave Power International and based on a generating system known as Neptune which was developed in the US. The proposed project was to supply 20% of Esperance power requirements, with the plant capable of generating up to 3 MW. This proposed project is over 25 years old and there is no available information to verify why this project did not proceed.



Esperance Wind Farms

Esperance was home to Australia's first wind farm at Salmon Beach, developed by Western Power (now Verve Energy). The Salmon Beach wind farm commenced operations as a demonstration project in March 1987. It comprised six (6), 60 kW wind driven generators and supplied up to 360 kW into the Esperance electricity grid over 13 years.

In 1993 Western Power developed the Ten Mile Lagoon Wind Farm – Australia's first commercial wind farm. It is located 16 km west of Esperance and consists of nine (9), 225 kW wind turbines bringing the total wind generation capacity in Esperance to almost 2.4 MW. In 2002 the Salmon Beach wind farm was decommissioned due to encroaching urban development and



increasing maintenance costs. However, in 2003 Western Power commissioned the new Nine Mile Beach Wind Farm at a cost of about \$10.6 million. It consists of six (6) 600 kW turbines with a combined capacity of 3.6 MW bringing the total installed wind generating capacity at Esperance to 5.6 MW. The wind farms supply about 22% of Esperance's electricity needs each year.

Verve Energy now owns and operates both the Ten Mile Lagoon and Nine Mile Beach wind farms. All electricity produced is sold to ANZ Infrastructure Services (ANZIS), which is now the sole owner of the Esperance Power Station.

In 2010, not-for-profit research and education organisation, Beyond Zero Emissions Inc. released a report, the Zero Carbon Australia Stationary Energy Plan, which included Esperance as one (1) of twenty three (23) sites across Australia where additional wind

turbines could be installed. It is noted that this plan is part of their blueprint for the implementation of climate change solutions and aims to have 40% of Australia's energy needs met by wind power. There is however, no specific proponent/developer for additional wind turbines in Esperance.

Hopetoun Hybrid Wind-Diesel Power Station

Hopetoun is supplied with electricity by a hybrid wind-diesel generation system. The hybrid generation system was originally developed by Western Power but is now owned and operated by Verve Energy. Verve Energy has a power purchase agreement with Horizon Power to supply all its electricity requirements in Hopetoun.

The Hybrid power station was established in 2004 to replace the old diesel power station. The power station integrates seven (7) 320 kW Detroit diesel generators with two (2) 600 kW wind turbines. The first wind turbine was installed in 2004 and the second in 2007. Total generating capacity is 2.24 MW diesel and 1.2 MW wind and the system cost about \$8.1 million to develop. The wind/diesel project received 45% of the capital cost of the project from the federal government Renewable Remote Power Generator Program (which is now closed).

Solar Cities Kalgoorlie

Solar Cities was a 2004 federal government initiative, administered by the Department of Environment and Heritage. The program, worth \$75 million, aimed to trial new sustainable models for electricity supply and use through demonstrating the possibilities of solar power, smart meters, and energy efficiency for people living in grid-connected urban sites.

The City of Kalgoorlie-Boulder led a consortium of applicants in an unfortunately unsuccessful application. The project would have delivered a combination of photovoltaic systems, smart metering technology, cost reflective time-of-use pricing tariffs, in-house electricity use monitoring, and a broad range of energy efficient technologies, products and measures. These benefits would have accrued across private industry, public buildings, private households and public housing stock in Kalgoorlie-Boulder.

Mallee Biomass Esperance

In 2001, over 1 million mallee seedlings were planted in the Esperance region as part of a bioelectricity project proposed by Metasource Pty Ltd (a subsidiary of Woodside). The 5 MW biomass fuelled power station was to be constructed near Esperance, with the electricity to be supplied into the grid at Esperance or supplied directly to contestable customers.

To meet the additional energy demand in Esperance, the new 25 MW gas turbine Esperance power station was developed by Worley Parsons and ANZ Infrastructure Services (ANZIS), to supply all Western Power's electricity needs and those of the Esperance Port Authority under contract. The companies also extended the Goldfields Gas Transmission pipeline 360km from Kambalda to Esperance to supply gas to the power station and to a small gas distribution network established in the town. As there was no Power Purchase Agreement underpinning the Metasource Pty Ltd project, it was unviable.

Grain stubble/Mallee Biomass Ravensthorpe

Beacons Consulting International, a West Australian based company, is project manager for BioTek Fuels Pty Ltd, a West Australian company in the development of a \$171 million, 12 MW power station to be fuelled by grain stubble and oil mallee, with the expected creation of 40-50 permanent jobs.

The first stages involved 8 MW- 4 MW to be fed into the grid and 4 MW to 2 mine sites. The company was hoping to take advantage of the Renewable Energy Demonstration Program (a \$435 million federal government funding program introduced in 2009) however the launch of this project has been stalled due to the impact of the world economic uncertainties on investor confidence.

Ngaanyatjarra Lands Biomass Electricity

AgGrow Energy Resources Pty Ltd (AgGrow) in partnership with the Kanpa Aboriginal Community (Pira Kata Aboriginal Corporation) were initially seeking to establish a 250ha biomass crop (sorghum) to convert to a liquid fuel, with the fuel being supplied to the Ngaanyatjarra Lands Aboriginal communities and mine sites active in the area.

AgGrow is a privately owned company based in Perth, Western Australia. This project commenced in 2010. In Western Australia, AgGrow has also developed a biofuels project at Woodie Woodie mine site and a research and development facility in Carnarvon to showcase crop trials and growing techniques of sorghum.

The Kanpa project has not proceeded. Critical to this project would have been the support of the Ngaanyatjarra Lands communities for access to water for the crops, upgrading of current diesel powered generators, and negotiating a suitable fuel contract to replace the current diesel fuel requirements.

Geothermal Drilling Esperance

Greenpower Energy Limited listed on the ASX in March 2008. In 2010, Greenpower Energy was granted two (2) geothermal tenements covering a 10,732 square kilometre area in Esperance and north of the town. The company has started exploration in an area that includes Mt Ridley.

In June 2012, Greenpower Energy received \$120,000 funding from the Royalties for Regions, Exploration Incentive Scheme. The Exploration Incentive Scheme is a state government program managed by the Department of Mines and Petroleum which aims to encourage exploration in Western Australia. Proponents must provide co-funding on a dollar for dollar basis. The funds will be used for a 400 metre drill hole on each of the granted tenements. Drilling commenced on 19 April 2013. Drilling results are not publicly available at this time.

City of Kalgoorlie-Boulder Oasis Recreation Centre

The City of Kalgoorlie-Boulder has a large-scale alternative energy project, aimed at reducing the energy consumption of the Oasis recreation centre. \$1.1 million in funding was received from the state (Low Emissions Energy Development (LEED) Fund) and federal (Community Energy Efficiency Program (CEEP)) governments to implement these initiatives.

The first component of the project is the use of solar collectors on the roof, in conjunction with the current gas-fired boiler to heat swimming pool water. Water is circulated through the roof mounted black matting system. Solar radiation from the sun increases the water temperature and is re-entered into the pool reticulation circuit. The solar water heating system generates more than 1,000,000 kWh per year and is presently the largest rooftop matting system in the country.



The second component of the project involves the installation of 135kW of solar PV on the roof to reduce the overall power demand of the facility and is currently in the process of being installed. This project required a number of control systems to be installed to ensure any excess power being produced was not exported back into the Western Power electricity grid. The PV system will produce more than 200,000 kWh of electricity per year.

The third component of the project is a series of ground source heat pumps to complement the gas-fired boiler and solar collectors to meet the winter load requirement of the swimming pool. This project has commenced and drilling started in May 2013. The drilling process includes test bores adjacent to the

Oasis Recreation Centre, thermal response tests have been undertaken. The system will provide the Oasis Recreation Centre with 1,220,000 kWh of pool energy per year.

The City of Kalgoorlie-Boulder has utilised the expertise of Energy Made Clean, a West Australian based company, with a local Kalgoorlie office, on this project.

AngloGold Ashanti Australia Tropicana Solar Thermal

AngloGold Ashanti Australia conducted significant analyses of renewable energy options in the early development of the new mine-site, Tropicana (located approximately 330km north east of Kalgoorlie near the town of Laverton) The mine-site is not located near any current electrical grid or gas pipeline infrastructure. Solar thermal was considered a viable technology due to storage properties associated with the technology.

Funding via the Solar Flagship program (\$1.5 billion federal government funding program announced in December 2009) was explored however the potential project fell outside of the scope of the funding parameters. Funding via the Renewable Energy Demonstration Program (a \$435 million federal government funding program introduced in 2009) was also explored. However this was not one of the six projects which proceeded under this program.

Ultimately, the initial capital investment in solar thermal would not have been economically viable. A 44 MW diesel/gas power station, operated by a third party under a Power Purchase Arrangement will be installed.

Galaxy Resources Tracking Solar PV

Galaxy Resources Limited is a global lithium company listed on the Australian Stock Exchange. Galaxy Resources was the first mine site in Australia to install state-of-the-art real time solar tracking technology at their Mt Cattlin lithium mine, located near the town of Ravensthorpe.

Base load power for the mine-site was provided via a 5 MW diesel generator, supported by the 100 kW tracking solar PV and two (2) wind turbines. The solar panels are designed to follow the sun in order to maximise power generation compared to a single axis system. The system is made up of 429 solar panels on 14 giant solar trackers. It is estimated that the solar trackers generate 15% more power than a single axis conventional solar PV system.

The solar tracking technology, developed by Swan Energy Pty Ltd resulted in Galaxy Resources winning the energy Generation and Distribution Award from the Sustainability Energy Association of Australia. Swan Energy is a West Australian based private company established in 2008, providing large scale, commercial solar power stations and wind turbines.

In mid-March 2013 it was announced that the mine-site was closing indefinitely.



Photo source: www.galaxyresources.com.au

St Barbara Mine Camp Solar PV

In 2008, St Barbara Limited upgraded its 222-person Leonora village, based on the advice of a study undertaken by Sinclair Knight Merz (SKM). The upgrade aimed to make the village more water and energy efficient in line with St Barbara's environmental policies. The upgrade was the recipient of the 2009 certificate of merit from the West Australian, Golden Gecko awards for Environmental Excellence. One component of the upgrade was the installation of 22 SunPower Solar PV units, which generate 2.5-6% of energy consumption at the village. The company continues to monitor energy demand requirements and is very encouraging of other mining companies adopting similar renewable energy and energy efficient processes.

Eucla Border Checkpoint Department of Agriculture

In October 2002, Norman Disney and Young were commissioned by the Department of Agriculture to undertake a feasibility study of renewable power systems for the offices and checkpoint shelter on the WA/SA border to replace the current diesel generator power supply from the Border Motel.

The installation includes two (2) 10 kW rated wind turbines, seven (7) solar PV panels generating 112 kW with battery storage and backup generator. The facility also underwent an energy efficiency audit.

Photo source: www.ndy.com.au



Murrin Murrin Solar PV

Minara Resources Limited is an Australian based company privately owned by Glencore International. It operates a nickel and cobalt mine in the north-east goldfields region, located between the towns of Leonora and Laverton.

Minara, at its Murrin Murrin mine-site, has implemented two (2) successful renewable energy projects.

The company manages pastoral leases in the area, and installed solar PV systems at the pastoral stations Glenorn, Yundamindra and Minara to remove the requirement for diesel generator power. A 12 kW inverter was installed at both Minara and Yundamindra stations and a 20 kW unit was installed at Glenorn.

The second project is the expansion of the existing seepage recovery system around the tailings facility to include an additional 30 bores. These bores were equipped with solar-panel operated pumps to reduce diesel consumption.

Street Lighting Upgrade

The Goldfields Voluntary Regional Organisation of Councils (GVROC) has made two (2) applications to the federal government's second round of Community Energy Efficiency Program (CEEP) funding for LED street lighting upgrades in the non-SWIS towns of Esperance, Norseman, Leonora, Laverton and Menzies.

The project is based on the installation of LED's (Light-emitting diode) which are more energy efficient than incandescent and fluorescent lights. This will deliver energy use reductions for the locations in which they are installed. The current CEEP funding round has closed with this application currently being assessed. It is anticipated that the outcome of this funding application will be known mid-2013.

Tjuntjuntjarra Solar Thermal Desalination

In order to address a water supply issue, a pilot project has been established in the Tjuntjuntjarra community to produce freshwater from hard, hyper saline groundwater. The process will use solar thermal energy and potentially waste heat from the community's diesel-fired power station. The project is being managed by Parsons Brinckerhoff as part of the Remote Area Essential Services Program (RAESP). The pilot will run for 2 years from 2013 with the eventual aim of establishing a full scale plant.

KCGM Solar PV

Kalgoorlie Consolidated Gold Mines Pty Ltd operates the Fimiston Open Pit (Superpit) mine located on the edge of Kalgoorlie-Boulder.

The company has introduced a number of solar PV installations across the site, totalling approximately 1 kW to power bore fields, telemetry repeater stations, portable toilets, charging of battery backups and security and survey huts for staff.



Small Scale Solar PV in the Goldfields-Esperance Region

The Goldfields-Esperance region has 1,387 installed solar PV systems generating 3.9 MW of energy, as at 10 March 2013 (from 2001).

These installations range from residential systems to larger commercial or community buildings. Some of the examples of solar PV projects include the City of Kalgoorlie-Boulder Community Centre (17.5 kW) and Administration building (to be installed over the coming months) (30 kW), Boulder Pastries (13 kW), Tom and Fred's Supermarket (10 kW), Goldfields Ice Works (2 kW) and a number of the pastoral stations in the region.

The Department of Justice had 32 kW solar PV installed at the Mount Morgan's work camp. There was an array of 200 solar panels aimed to reduce the facility's dependence on a diesel generator.

The Water Corporation also utilises solar PV for controls and monitoring at Bulla Bulling and the West Kalgoorlie reservoir. Whilst the Kambalda water pipeline is gravity feed from Kalgoorlie, all of the controls and monitoring along the pipeline are powered by solar PV. Across the region, Telstra communication towers utilise small solar arrays for their power needs.

Challenges of Renewable Energy Supply

There are well documented reasons for aiming to increase renewable energy generation within the Goldfields-Esperance region, and as the audit of renewable energy projects demonstrates, a number of key projects have already been developed and more are likely to be developed in the near future.

Both successful renewable energy projects and those which have not progressed to full development within the region have served to highlight some of the key challenges faced by project proponents and regional stakeholders.

Grid and Islands

The Goldfields-Esperance region has segmented customer markets for power supply. Renewable energy generated near the SWIS infrastructure has the ability to sell (by entering into a Power Purchase Agreement) to a larger customer base than energy projects within island power environments. Within islanded grids there are limited customers within the infrastructure network.

Cost

The immediate impediment is often the initial high capital cost of investment required, particularly for newer technologies which do not yet have the economies of scale for mass production and therefore may not be economically viable at this stage. For the current major electricity generators, non-renewable sources of generation are still the most cost-effective for the region.

There may also be an issue with the perceived cost of renewables, despite technological advances and other market pressures reducing prices.

Projects can best be assessed using the Levelised Cost of Energy (LCOE). This allows energy generation methods to be equally compared. The LCOE is calculated by accounting for all of the energy systems lifetime costs: capital, financing, fees and taxes, maintenance, fuel, and incentives divided by the energy produced. The benefits of renewable energy generation are the low ongoing maintenance and either lower or nil fuel costs. There will be a point at which diesel price rises may lead to LCOE price parity for some renewable energy technologies.

Technical issues

Since the Goldfields-Esperance region's electricity is supplied through one interconnected system for some towns and via an island system for other towns, there are some very specific technical issues regarding balancing base-load power generated by non-renewables and integration with renewable sources. Project proponents need to have a thorough understanding of the current energy supply arrangements in the region as well as the environment in which the technology is to be installed.

Provability, Reliability and Dispatchability

Gas and diesel generation technologies are known and trusted. Adopting untested power supply arrangements is viewed as risky. There are few operational local large scale renewable energy examples to ease genuine concerns regarding reliability, which for some industries such as mining, would pose a risk to production certainty. Renewables are viewed as non-dispatchable and more difficult to modulate production. They are therefore not as able to respond to the needs of the customer. To secure reliability, storage solutions would need to be adopted as part of the renewable energy supply and these can pose technological and cost challenges.

Project life and contracts

Horizon Power investments in current generation capital, or their contracted arrangements with other generators, may not allow for the cost-effective introduction of renewable energy capital works. Most mining companies have an onsite power station and use a third party as a contract energy provider. These companies have contracts based on a take or pay consumption

making it difficult for mining companies to use alternate energy sources as they are still required to pay for their contracted production. This makes investment in renewables unviable.

Renewables also require a longer project life to recoup the initial capital investment. Mining companies are not always able to commit to longer payback periods due to short mine life and other uncertainties in the sector.

Ability to adopt renewables

Mining companies are not likely to make frequent changes to their energy supply arrangements. There may be a 3, 5 or 10 year window in which they may consider other energy options. This audit illustrates the low level take-up of renewable energy by mining companies to date. However as the cost of renewables becomes more competitive, government initiatives and incentives drive change, and technology becomes more reliable, we may see a greater take-up of renewable energy generation by mining companies in the region.

Within the Horizon Power networks, terms of contract are negotiated for long periods of time. Horizon Power, like many electricity utilities undertake demand forecast analysis studies approximately four (4) years ahead of capital or contractual arrangements. For the use of renewables, Horizon Power would have to foresee the load forecast increase or make a renewable component of the contract.

Change may be on the horizon

Mining companies are also understandably cautious in the release of what may be considered market sensitive information regarding both energy supply issues and commercial-in-confidence planning for renewable energy projects. It may be the case that the broader community only becomes aware of the projects once they have been successfully implemented by the mining company. Examples of potential renewable energy applications which could be adopted by mining companies is attached to this report to illustrate the number of ways mining companies could take advantage of renewable energy.

Future uncertainty

There is a very immediate issue, which will pass in time, related to the impending September 2013 federal election. Uncertainty regarding future federal government policy in this sphere is creating a level of caution for project proponents. Reportedly, even some bank finance is becoming more difficult to obtain for renewable energy projects. This uncertainty has certainly not halted all activity in developing renewable energy projects. Rather projects are proceeding more cautiously and we may not evidence the full extent of the impact until after September 2013.

Solar PV changes

The West Australian state government has previously provided very generous incentives for the installation of solar PV panels. This includes the residential net feed-in tariff which was available between 1 July 2010 and 1 August 2011, and provided a financial incentive over and above the renewable energy buyback scheme. The federal government have also started to phase out its solar credits mechanism, which provided a multiplier effect to the renewable energy target small-scale technology certificates.

Western Power has also indicated it would be supportive of a price structure change for residences with solar PV installations, to pay what it considers to be a fair share of the grid maintenance cost. Western Power believes households with solar PV installations are not incurring their share of costs for network infrastructure.

Notwithstanding, the installation of solar PV remains popular with households, which indicates the economic and environmental benefits continue to accrue. Further changes in this policy sphere may further impact upon the growth of solar PV residential installations.

Snapshot of Renewable Energy Projects in Other Locations

Morawa- solar thermal www.carbonreduction.com.au

The West Australian state government is providing \$3.775 million from the Low Emissions Energy Development (LEED) fund for the final feasibility studies for a 1.5 MW solar thermal power plant. Construction of the project is expected to commence in late 2013 or in early 2014. Titled 'North Midlands Solar Thermal Power Project', it is to be located 2-3km's south of Morawa and will be connected to the grid. The estimated cost of the project is \$15 million, consisting of 15 towers over 5.5ha of land. The project is a partnership between the Shire of Morawa, WA-based Carbon Reduction Ventures Pty Ltd and Solastor Pty Ltd.

Whyalla- solar thermal www.solaroasis.net.au

A proposed \$230 million, 40 MW solar thermal power plant is to be located 4km north of Whyalla, South Australia. A consortium has been established to deliver the project: SolarOasis, with partners Sustainable Power Partners, N.P. Power Pty Ltd and Wizard Power. The project will use 300 Big Dish solar thermal concentrators, each 500sqm in area. A \$60 million grant has been received from the federal government Renewable Energy Demonstration Program (a funding program which closed in 2010).

Carnarvon- solar PV ret.cleanenergyregulator.gov.au

Carnarvon has two (2) key solar PV initiatives which have positioned the community as a leader in solar developments. The high level of small scale solar PV adoption by the community has led to Carnarvon holding the record for the highest density of grid embedded solar PV in Australia. The 10 March 2013 Clean Energy Regulator, small generation unit data has 205 units, generating almost 2.7 MW in Carnarvon. This is within a community of approximately 6000 residents and 3000 homes (comparison with the Goldfields-Esperance Region of almost 60,000 residents 24,500 homes and 3.9 MW).



Source: www.energymadeclean.com.au

www.energymadeclean.com

Carnarvon is home to the first Power Purchase Agreement (PPA) solar power station in Western Australia. The project received \$1.7 million funding from the federal government Renewable Remote Power Generation Program (which closed in 2009). Constructed and owned by EMC Solar Ltd. subsidiary, Solar Farm Carnarvon Pty Ltd (a West Australian based company), the facility commenced energy generation in February 2012. The \$3.4 million, 300 kW facility on 45 ha of land is made up of 7 single-axis tracking arrays and 48 seasonally-adjusted fixed-frame arrays. Horizon Power purchases the energy generated under a 15 year PPA, extendable to 30 years.

**Centre for Appropriate
Technology and Bushlight**
www.icat.org.au/
www.bushlight.org.au

The Centre for Appropriate Technology was established in 1980 and is a national Indigenous science and technology not-for-profit organisation. They manage the Bushlight project, which delivers renewable energy services to remote Indigenous communities. The organisation is clearly a leader in its field and delivers the following comprehensive renewable energy services: reliable and sustainable energy supplies by designing, installing and maintaining renewable energy systems; training and education in household energy efficiency to reduce power bills; and support for local enterprise and activity development using renewable energy. In 2012, Bushlight won a Clean Energy Council Industry Award for the best design and installation, stand-alone power system greater than 10 kW. They have predominately implemented projects within Northern Australia (Queensland, Northern Territory, Western Australia) and with their combined experience, resources technical knowledge and highly developed community engagement processes, would be valuable partners for any proposed remote Goldfields projects.

Carnegie- wave energy
www.carnegiewave.com/

Carnegie Wave Energy Limited is a company listed on the Australian Stock Exchange currently developing a wave energy demonstration project using its CETO wave technology at Garden Island off Fremantle, Western Australia. The total project value is \$31.2 million, delivering 2 MW of power. The project will be connected to the grid, with the Department of Defence purchasing the energy. The project is a recipient of \$9.9 million from the federal government Emerging Renewables Program (managed by ARENA) and \$12.5 million from the state government. The project is due to be commissioned in early 2014.

Attachments

Renewable Energy Technology

- Wind** Wind energy is generated by the force of wind rotating propeller blades connected to a generator. The southern half of Western Australia has abundant wind resources and has multiple large wind farms in many locations. Energy yield is very sensitive to site conditions including prevailing winds and terrain. Electricity output stops immediately the wind drops so this technology needs to be supported by other forms of generation or energy storage. Wind generation is a mature technology and is currently one of the cheaper forms of renewable energy. The estimated capital cost of wind generation is between \$1500-\$2000 per kW subject to site conditions and network access.
- Solar Photovoltaic** A Photovoltaic (PV) cell converts light into electricity. Solar PV panels or modules consist of multiple solar cells mounted in a glass fronted frame, with a typical power rating of between 200 to 300 Watts. A solar farm consists of multiple PV modules mounted in an array collecting the light energy, connected to the power system via an inverter. Electricity output is only available during the day and drops quickly when the sun is obstructed by clouds (cloud events), so this technology needs to be supported by other forms of generation or energy storage. Solar PV systems can range in capacity from a few kilowatts to hundreds of megawatts. The energy yield from solar PV systems can be increased by up to 35% by using tracking devices to follow the sun daily and seasonally, however this also increases cost and performance risk. In Western Australia, solar PV has been adopted for residential and commercial uses, and several large solar farms are operational and planned. The typical development cost of solar PV systems is around \$3,500 per kW, however, this reduces to less than \$2,000 per kW for systems above 10 MW.
- Solar Thermal** Solar thermal systems use mirrors to reflect and focus the sun's rays to a central point and produce very high temperatures. At this point, the concentrated energy is used to heat fluids (water, oil or molten salt), which are then converted by the use of a heat exchanger to make steam to drive a traditional turbine to generate electricity. Like solar PV, solar thermal electricity output is only available during the day but is less sensitive to cloud events as some heat energy is stored in the system. Output can be further smoothed and extended beyond daylight hours by storing heat energy in molten salt or carbon blocks. In Western Australia, a solar thermal project proposing carbon block energy capture and storage is currently being developed at Morawa. This project is profiled in the snapshot of renewable energy projects in other locations section of this report. The current estimated capital cost of solar thermal is \$3,500 per kW without storage capacity and \$5,700 per kW with storage capacity.

Ocean Energy

The energy from ocean currents, tides, thermals and waves can be converted to electricity by several different methods. The energy of ocean currents is captured similar to wind energy, usually where currents are strongest, in narrow straights or channels. Tidal energy is harnessed in the same way as hydro power. An estuary or bay in an area with a large tidal range is dammed and the water flowing in and out during tidal movements is captured using hydroelectric turbines. Wave energy is more abundant and challenging. A number of technologies are under development including subsea buoys, surface systems and shore-based systems. The energy can be captured in various ways including hydraulic pistons, rotating cylinders and air compression. In Western Australia, a wave energy project is currently being developed off Garden Island, and is profiled in the snapshot of renewable energy projects in other locations section of this report. The current estimated capital cost of wave energy, which varies significantly according to the technology employed and location is typically \$15,600 per kW but can exceed \$30,000 per kW.

Biomass

Biomass is the process of turning organic matter into a fuel source (liquid or gas) which can produce electricity in a similar way to diesel generation. Costs associated with the processing of and transportation of the organic matter can be high, so co-location of the fuel source, processing plant, and energy generation is most cost effective. If a waste product can be utilised, further cost and environmental benefits are gained. The current estimated capital cost of biomass is \$4,000 to \$5,350 per kW.

Hydroelectricity

Hydroelectricity is electricity generated by the force of moving water, which drives a turbine. The amount of energy which can be extracted depends on the volume and flow of the water. Hydroelectricity can be adapted to meet changing energy demand needs quickly and is a relatively stable form of energy generation. It is the largest renewable energy source globally. In Western Australia, the Ord river is used to generate hydroelectricity. The cost of hydroelectricity is relatively low, compared to other renewable energy sources and the current estimated capital cost of hydroelectricity is \$2,000 per kW.

Solar Ponding

A body of hyper saline water which acts as a solar thermal energy collector. When the sun's rays hit the body of water, the temperature of the lower segment rises. The temperature can range from 60-100 degrees Celsius. This heat energy can be used similarly to geothermal energy- either solar thermal energy generation or energy efficiency technology, such as in heating for buildings and swimming pools. It does require a large body of water and the need for replenishment of the fresh water as the top layer on the pond. The current estimated capital cost of solar ponding is \$3,500/kW

Renewable Energy Projects by Type

PROJECT	LOCATION	OWNER/ PROONENT	TYPE OF RENEWABLE	YEAR OF PRODUCTION	CAPACITY	COST	STATUS (OPERATING, PROPOSED)
Ravensthorpe Biomass Energy Project	Ravensthorpe	BioTek Fuels Pty Ltd	Biomass	2009+	8-12 MW	\$171 million	Proposed
Mallee Biomass Esperance	Esperance	Metasource Pty Ltd	Biomass	2001	5 MW		Proposed
Ngaanyatjarra Lands Biomass Electricity	Kanpa Community, Ngaanyatjarra Lands	AgGrow Energy Resources Pty Ltd	Biomass	2010+	~5 MW	\$47 million	Proposed
Oasis Recreation Centre 3	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Geothermal	2013	1.2 million kWh/year	\$1.1 million +	In Progress
Geothermal Drilling Esperance	Esperance	Greenpower Energy LTD	Geothermal	2014+	400 MW		Proposed
Oasis Recreation Centre 1	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Solar heating	2013	1 million kWh/year	\$1.1 million +	Operating
Eucla Border Checkpoint	Eucla	Department of Agriculture	Solar Photovoltaic	2003	112 kW		Operating
Solar Flagship Project	Kalgoorlie-Boulder	Mitsui and Co (Australia) Ltd	Solar Photovoltaic	2009+	10-50 MW		Proposed
Solar Systems Kalgoorlie	Kalgoorlie-Boulder	Solar Systems Ltd/ City of Kalgoorlie-Boulder	Solar Photovoltaic	2005+	1.77 MW	\$12.83 million	Proposed
Kalgoorlie Solar Power Station	Kalgoorlie-Boulder/ Coolgardie	Investec Bank (Australia) Ltd	Solar Photovoltaic	2013/2014	50 MW	\$200 million	Proposed
Oasis Recreation Centre 2	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Solar Photovoltaic	2013	135 kW	\$1.1 million +	Operating

Murrin Murrin Solar PV	Laverton/Leonora	Minara Resources Ltd	Solar Photovoltaic	2008	44 kW	\$373,000	Operating
KCGM Solar PV	Kalgoorlie-Boulder	Kalgoorlie Consolidated Gold Mines Pty Ltd	Solar Photovoltaic		1 kW		Operating
St Barbara Mine Camp Solar PV	Leonora	St Barbara Ltd	Solar Photovoltaic	2008	~100 kW		Operating
Galaxy Resources Tracking Solar PV	Ravensthorpe	Galaxy Resources Ltd	Solar Photovoltaic	2010	100 kW		Operating
Solar Cities Kalgoorlie	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Solar Photovoltaic and energy efficiency	2006			Proposed
AngloGold Ashanti Australia Tropicana Solar Thermal	Laverton	AngloGold Ashanti Australia	Solar Thermal	2009	40 MW		Proposed
Esperance Wave Power	Esperance	Wave Power International	Wave powered generator	1989	3 MW	\$8 million	Proposed
Esperance Wind 1	Esperance	Western Power	Wind Turbine	1987	3.6 MW		Useful life expired
Esperance Wind 2	Esperance	Verve Energy	Wind Turbine	1993	2 MW		Operating
Esperance Wind 3	Esperance	Verve Energy	Wind Turbine	2004	3.6 MW	\$10.6 million	Operating
Hopetoun Wind 1	Hopetoun	Verve Energy	Wind Turbine	2004	0.6 MW	\$2.97 million	Operating
Hopetoun Wind 2	Hopetoun	Verve Energy	Wind Turbine	2007	0.6 MW	\$8.1 million	Operating
Eucia Border Checkpoint	Eucia	Department of Agriculture	Wind Turbine	2003	10 kW		Operating

Renewable Energy Projects by Town

PROJECT	LOCATION	OWNER/ PROONENT	TYPE OF RENEWABLE	YEAR OF PRODUCTION	CAPACITY	COST	STATUS (OPERATING, PROPOSED)
Geothermal Drilling Esperance	Esperance	Greenpower Energy LTD	Geothermal	2014+	400 MW		Proposed
Esperance Wave Power	Esperance	Wave Power International	Wave powered generator	1989	3 MW	\$8 million	Proposed
Esperance Wind 1	Esperance	Western Power	Wind Turbine	1987	3.6 MW		Useful life expired
Esperance Wind 2	Esperance	Verve Energy	Wind Turbine	1993	2 MW		Operating
Esperance Wind 3	Esperance	Verve Energy	Wind Turbine	2004	3.6 MW	\$10.6 million	Operating
Mallee Biomass Esperance	Esperance	Metasource Pty Ltd	Biomass	2001	5 MW		Proposed
Eucla Border Checkpoint	Eucla	Department of Agriculture	Solar Photovoltaic	2003	112 kW		Operating
Eucla Border Checkpoint	Eucla	Department of Agriculture	Wind Turbine	2003	10 kW		Operating
Hopetoun Wind 1	Hopetoun	Verve Energy	Wind Turbine	2004	0.6 MW	\$2.97 million	Operating
Hopetoun Wind 2	Hopetoun	Verve Energy	Wind Turbine	2007	0.6 MW	\$8.1 million	Operating
Solar Flagship Project	Kalgoorlie-Boulder	Mitsui and Co (Australia) Ltd	Solar Photovoltaic	2009+	10-50 MW		Proposed
Solar Cities Kalgoorlie	Kalgoorlie-Boulder	City of Kalgoorlie- Boulder	Solar Photovoltaic & energy efficiency	2006			Proposed

Oasis Recreation Centre 1	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Solar heating	2013	1 million kWh/year	\$1.1 million +	Operating
Oasis Recreation Centre 2	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	Solar Photovoltaic	2013	135 kW	\$1.1 million +	Operating
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Solar Systems Kalgoorlie	Kalgoorlie-Boulder	Solar Systems Ltd/ City of Kalgoorlie-Boulder	Solar Photovoltaic	2005+	1.77 MW	\$12.83 million	Proposed
KCGM Solar PV	Kalgoorlie-Boulder	Kalgoorlie Consolidated Gold Mines Pty Ltd	Solar Photovoltaic		1 kW		Operating
Kalgoorlie Solar Power Station	Kalgoorlie-Boulder/ Coolgardie	Investec Bank (Australia) Ltd	Solar Photovoltaic	2013/2014	50 MW	\$200 million	Proposed
Ngaanyatjarra Lands Biomass Electricity	Kanpa Community, Ngaanyatjarra Lands	AgGrow Energy Resources Pty Ltd	Biomass	2010+	~5 MW	\$47 million	Proposed
AngloGold Ashanti Australia Tropicana Solar Thermal	Laverton	AngloGold Ashanti Australia	Solar Thermal	2009	40 MW		Proposed
Murrin Murrin Solar PV	Laverton/Leonora	Minara Resources Ltd	Solar Photovoltaic	2008	44 kW	\$373,000	Operating
St Barbara Mine Camp Solar PV	Leonora	St Barbara Ltd	Solar Photovoltaic	2008	~100 kW		Operating
Ravensthorpe Biomass Energy Project	Ravensthorpe	BioTek Fuels Pty Ltd	Biomass	2009+	8-12 MW	\$171 million	Proposed
Galaxy Resources Tracking Solar PV	Ravensthorpe	Galaxy Resources Ltd	Solar Photovoltaic	2010	100 kW		Operating

Solar Photovoltaic Data

LOCATION	SMALL UNIT INSTALLATION POSTCODE	INSTALLATIONS QUANTITY	SMALL GENERATION UNIT RATED OUTPUT IN KW
Ravensthorpe/West River	6346	18	141.140
Hopetoun	6348	71	205.893
Coolgardie	6429	13	31.775
Kalgoorlie	6430	450	1,162.690
Boulder	6432	192	458.658
Kalgoorlie PO Boxes	6433	2	4.320
Cundeelee, Parkeston, Forrest, Rawlina, Zanthus	6434	9	58.920
Menzies	6436	6	13.935
Leinster	6437	185	296.730
Leonora	6438	28	77.395
Laverton	6440	8	30.775
Kambalda	6442	22	58.515
Norseman/Dundas	6443	15	94.019
Grass Patch	6446	2	8.140
Scaddan	6447	1	1.900
Gibson	6448	4	21.115
Esperance	6450	361	1,234.612
TOTAL		1,387	3,900.532

Source: Clean Energy Regulator, as at 10 March 2013 and Australia Post, postcode data spread sheet

Potential Renewable Energy Applications for Mining Companies

PROCESS	DESCRIPTION	NOTES
Lighting	Lighting towers	Battery powered LED flood lighting - charged by solar PV panels & wind turbines. In the past 4 years these units have gone from prototype to several manufacturers retailing these units. Hybrid units that have wind / diesel are also available
Pumping	Dewatering	Dewatering system range from 10 to 90 kW - a few mining companies have started using small solar PV installations all below 15 kW - some new technology using super capacitor based short term energy storage is in the prototype development stage- this is to assist with the high current required with the install pump start
Communications	Radio and telemetry systems	Installations have become common, radio and data is being sent to control and monitoring stations from remote installations in the field - this includes security cameras with next G data availability
Camps	Solar hot water Solar PV power	Most new mining camps are using large solar hot water for accommodation and laundries. Several camps have installed PV unit on the roofs of the camp to assist in reduction of power consumption but penetration has been unnecessarily constrained to sub-optimal levels
Power station	Solar PV power	Several companies are currently investigating the introduction of up to 20% of the mines load to be powered by solar. In most financial models the project needs to be in range of 7 years or more and with a fuel cost for generation in excess of \$0.225 per kW/h. The cost of carbon will also assist in the decision making process and there is some reluctance to commit to a project until the federal election in September 2013. The average installed cost per kW is \$3500
Back-up power	Battery charging	Solar PV is being used to charge back up battery or UPS systems with in power stations for black start purposes

Glossary

Base load	That part of electricity demand which is continuous, and does not vary over a 24-hour period. Approximately equivalent to the minimum daily load.
Contestable customer	Has the opportunity to negotiate with any electricity generator or wholesaler within a grid network. In Western Australia the threshold for contestability is more than 50 MWh of electricity per year (approximately \$12,600).
Dispatchable	Able to be easily turned on and off.
Electrical grid	An integrated system of electricity distribution, usually covering a large area.
Kilowatt (kW)	Measurement of electrical power. One thousand watts.
Kilowatt-hour (kWh)	Measurement of electrical power. Total number of kilowatts used per hour.
Load	Load is that the amount of electric power used by devices connected to electricity generating systems.
Megawatt (MW)	Measurement of electrical power. One million watts.
Non-contestable customer	A customer that does not meet the minimum load to negotiate an electricity contract. In Western Australia the threshold for contestability is 50 MWh per year (approximately \$12,600).
Off-take agreements	The amount of power a customer will purchase from a generator at an agreed price. This is most common within a grid or network.
Power Purchase Agreement (PPA)	Contract that is negotiated for an amount of power and a fixed term.
Take or pay consumption	Contract that is entered into with a minimum amount of kWh to be paid for whether it is consumed or not.
Watt	Measurement of electrical power. One watt is equal to 1 joule of energy per second.

Consultation List

- Amanda Rukuwai, St Barbaras
- Andrew Potter, Western Power
- Barton Loechel, CSIRO
- Brett Fowler, Mincor
- Brian Cameron, Goldfields St Ives
- Cameron Kelly, Dibbs Barker
- Cliff Herbert, Solargain
- Damien McLean, Warburton Community
- Daniel Thompson, Verve Energy
- Darius Hakayobe, First Quantum
- Edward Sheppard, Goldfields St Ives
- Eric Bellgard, Kalgoorlie Consolidated Gold Mines
- Eric Hill, NDEVR Environmental Consulting
- Gerard King, Green Power Energy
- Graeme Ely, Horizon Power
- Greg Benvenuti, Energy Made Clean
- Greg Sheppard, La Mancha
- Hugh Gallagher, Chamber of Commerce and Industry
- Ian Goldfinch, Shire of Ravensthorpe
- Ian Purcell, Sinclair Knight Merz
- Jim Thomson, Outback Energy Supply/Goldfields Renewable Energy Lobby
- Jon Price, Goldfields-Esperance Development Commission
- Josh Field, SolarReserve
- Keith Adams, TransAlta
- Linda Crook, Chamber of Minerals and Energy
- Lynne Lagan and Mark Headland, Investec Investment Bank
- Mike Loughton-Smith, Balance Utility Group
- Mike Telford and Pat McClusky, Department of Mines and Petroleum
- Natalie Giuffre, Minara Resources
- Pascoe Durtanovich, Shire of Ravensthorpe
- Rebecca Coonan, City of Kalgoorlie-Boulder
- Rob Humphryson, Silverlake Resources
- Rod Botica, Water Corporation/Goldfields Renewable Energy Lobby
- Sean Kenyon, Mitsui and Co.
- Shane Liddelow, Goldfields-Esperance Development Commission
- Steve Deckert, Shire of Laverton
- Terry Moylan, Norton Goldfields
- Wayne Stewart, La Mancha

Horizon Power Renewable Energy Buyback Pricelist

Renewable energy buyback Pricelist

Valid from 1 July 2012

You can reduce your electricity bill by generating some of your own electricity. If you don't use all the electricity you generate, Horizon Power can buyback excess electricity you are able to export into our electricity system.

Horizon Power offers one flat buyback rate per town, for all types of customers. The rate reflects Horizon Power's cost of electricity generation in your town.

The Renewable Energy Buyback rate will be reviewed annually and may increase or decrease depending on various factors, including changes in our electricity generation costs.

Some Commercial customers have a bespoke price agreed with Horizon Power. These customers have received confirmation of their buyback price.

Town	Renewable energy buyback offer - cents/kWh
Ardyaloon	50.00
Beagle Bay	50.00
Bidyadanga	48.41
Broome	10.00
Camballin / Looma	32.25
Carnarvon	18.32
Coral Bay	25.06
Cue	50.00
Denham	26.38
Derby	10.31
Djarindjin	50.00
Esperance	10.42
Exmouth	10.00
Fitzroy Crossing	11.55
Gascoyne Junction	50.00
Halls Creek	11.72
Hopetoun	41.63
Kalumburu	50.00
Karratha	10.00
Kununurra/Wyndham/Lake Argyle	16.09
Laverton	43.38
Leonora	13.45
Marble Bar	47.10
Meekatharra	50.00
Menzies	50.00
Mount Magnet	32.83
Norseman	24.35
Nullagine	50.00
Onslow	13.71
Port Hedland	10.00
Sandstone	50.00
Warmun	50.00
Wiluna	50.00
Yalgoo	50.00
Yungngora	50.00

Please refer to the eligibility web pages to see if the buyback offer is available in your town..



www.horizonpower.com.au

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