Power to Change:
Australia's solar future

Key Findings

1. **Based on installing 2,500MW by 2020, Australia's solar thermal industry is projected to create 12,225 full-time equivalent jobs in manufacturing, construction, and plant operation.**
2. **Solar thermal technology is ideal to power energy intensive industries in regional Australia, resulting in substantial regional job creation in existing and new industries.**
3. **Developing an Australian supply chain for solar thermal equipment would result in new manufacturing and export opportunities particularly in the steel and glass industries.**
4. **Baseload emissions-free energy resources like solar thermal energy need targeted support today so that their development is fast and seamless tomorrow.**

About the Participants

Ausra is an Australian/American company which designs, manufactures, and installs solar thermal energy systems around the world. Its zero-pollution emitting solar thermal energy systems produce steam directly from the sun.

WWF-Australia is part of the WWF-International Network; the world's largest and most experienced independent conservation organisation. It has close to five million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity;
- ensuring that the use of renewable natural resources is sustainable; and
- promoting the reduction of pollution and wasteful consumption.

"We know that climate change is the biggest threat facing the planet today. We must begin an energy revolution if we are serious about creating a low-carbon future. In Australia we're blessed with a wealth of renewable energy resources, which includes the knowledge, expertise and abundant sunshine to make solar thermal power an effective and sustainable energy source."

Greg Bourne,
WWF-Australia CEO

"Solar thermal is the large-scale, zero emissions solution for powering Australia, and Ausra's game-changing technology is ready to deploy now to help build a clean energy economy."

Bob Matthews,
Ausra Australia CEO

Australia is one of the world's best solar energy locations. Early development of a solar thermal industry would put Australia in a strong position to export the knowledge and technology as demand for solar thermal grows worldwide. It would create significant jobs growth, including construction, maintenance and manufacturing (steel, glass and cement) particularly in regional Australia.

Solar Thermal – Plentiful and Flexible

By 2050, solar thermal could contribute up to 10.3% of Australia's forecast emissions reductions.

The present energy consumption of the entire world could be met by a solar plant covering an area of 700km by 700km[1], however, at present solar energy use only makes a small contribution to overall electricity and heat requirements. This is about to change.

The Australian continent has the highest average amount of solar radiation per square metre per year of any continent on the planet, making it one of the world's best locations for concentrating solar power.

Solar thermal power plants harness the sun's energy to produce steam for use in industrial applications or electricity production. Solar thermal steam can be deployed on a small scale, such as 20MW for industrial applications, and up to 500MW for electricity-generation plants. Solar thermal can be tailored for a wide range of energy markets:

- **Large-scale power generation (peak and baseload)**: Because solar thermal is closely aligned with peak demand, investment now will reduce the need for investment in baseload fossil fuel power generation in the future. When storage becomes commercially viable, solar thermal will be both a baseload and peak power generation source, opening the door to competitive large-scale zero-emissions power generation.
- **Steam augmentation for existing gas and coal-fired plants:** Located at the 2,000MW Liddell coal-fired power station in NSW, Ausra has developed the world's first solar thermal power collector system for coal-fired power.
- **Solar steam generators for industrial processes:** Solar steam generators can be used for diverse industrial operations (enhanced oil recovery and petrochemical refining, food processing and desalination). These space-efficient, reliable, direct solar steam generators can integrate simply with conventional steam systems in retrofit and new plant designs.
- **Off-grid and decentralised power:** Solar thermal generators can supply power to remote or off-grid communities or industrial operations.

Modelling[2] undertaken for WWF indicates that solar thermal power stations can contribute 0.8% of Australia's energy supply by 2020, with its contribution rising dramatically to 12.2% of Australia's final energy supply by 2050. By 2050, solar thermal would also contribute up to 10.3% of forecast emission reductions.

To ensure Australia has the skills and manufacturing support base to reach its solar thermal potential by 2050, we must aim to install 2,500MW of industrial scale solar thermal power stations by 2020.

Ausra's Compact Linear Fresnel Reflector (CLFR) Technology

A variety of solar thermal technologies exist, including parabolic trough, paraboloidal dish and central receiver power towers. Ausra's technology, Compact Linear Fresnel Reflector (CLFR) technology, is ideally suited to both industrial steam process systems and electricity generation and claims to be the most land use-efficient technology on the market.

Flat reflectors follow the path of the sun and reflect heat onto elevated receivers, which consist of a system of tubes through which water flows. The sun boils water in the tubes, producing high pressure steam. The steam spins a turbine, generating electricity that can be delivered to customers. Back at the solar thermal power station, the steam cools and returns the water, which is recirculated to continue the process. This closed loop system produces zero-emissions energy from a free and abundant fuel source—the sun.

Source: Ausra Australia

A World Leader in Installation and Production

Creating new and conventional jobs

The installation of solar thermal is more capital and labour intensive than other energy sources such as gas and coal-fired power stations or wind energy, which means it creates more employment.

Jobs would be created in the construction, maintenance and operation of solar thermal plants. Supply chain jobs would also be created beyond the local site area and would include many jobs in the manufacture of steel, glass and concrete.

Market research[3] indicates that a global boom in solar thermal power deployment is likely over the next five years. The development of an Australian supply chain for solar thermal equipment to meet this boom would result in significant export opportunities and job creation through the expansion of Australia's manufacturing industry, including steel and glass in particular.

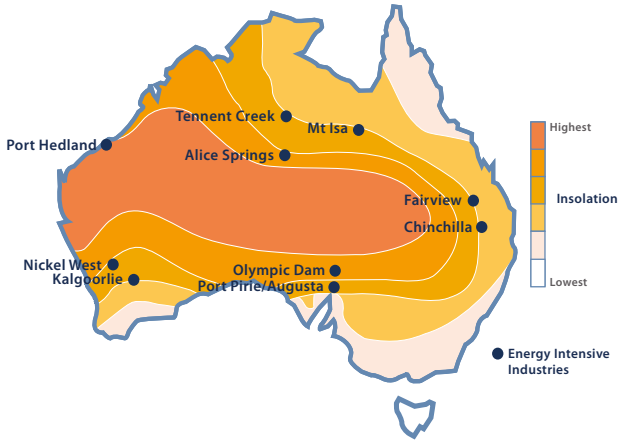
According to estimates by Access Economics[4], 4.89 full-time equivalent jobs are created for every megawatt of solar thermal capacity. That means the installation of multiple solar thermal power stations totalling 2,500MW would create 12,225 jobs by 2020.

Keeping and growing jobs in regional Australia

Some of the best solar locations are in regional Australia, where there are many energy-intensive industries. These include remote mining areas and communities such as the Mt Isa area, the Pilbara System, and Alice Springs-Tennant Creek area.

Installing solar thermal in regional Australia would provide a zero-emissions energy source to major carbon-polluting industries while creating regional employment and securing existing industries.

Solar insolation map of Australia



Source: Drawn for ANZSES using data from the Australian Solar Radiation Data Handbook

Other areas, such as Port Augusta in South Australia, Mildura in north-west Victoria, Bourke and Moree in north-west New South Wales and Chinchilla in Queensland, have the potential to supply the local community and industrial needs, as well as feeding excess electricity into the national electricity grid.

Case Study : Brett Squires
Solar Electrical Operator

Brett credits two teachers at Singleton High School for sparking his passion for all things solar. Mr Oleary, who offered a Solar Science elective, and Mr Gough and his design and technology electronics course which put him on track to join Australia's leading solar thermal company just ten years later.

It wasn't however a direct path to renewables for the solar electronics specialist. Commercial and industrial projects, work with coal producers and a few months with CSIRO, led to Ausra where he has been for the past four years.

As a local wanting to stay in the Singleton area Brett speaks highly of the opportunities renewables technologies like Ausra's offer in regional areas.

"The learning curve is incredible. Not only do we have an amazing team of engineers and technicians here, we also work closely with Ausra's engineering team in the USA," said Brett.

Brett, who works on a shift basis to ensure the solar arrays achieve optimum thermal generation, says it feels right working in the solar thermal industry.

"It makes it easy getting out of bed each day knowing we are working for future generations - doing something positive for our children and the environment."

Brett says the Ausra technology roll-out at Liddell positions Australia as a solar thermal leader and believes there is massive potential growth for jobs and investment with the technology.

"Australia has an ideal solar environment and I want to see this rolled out around the country."

Case study and image of Brett Squires and the Prime Minister provided by Ausra Australia.

Government Policy Framework

The challenge – we're running out of time

If Australia is going to meet the challenge of achieving deep emissions reductions by 2050 it must develop emissions-free peak loading and baseload energy technologies now. Australia does not have the luxury of building each new technology from the ground up when it is financially attractive to do so.

Governments must provide targeted support to both high and low-cost renewable technologies today. Fostering these technologies now, even at a comparatively small scale, will develop the skills and supporting industries needed for faster, cheaper, larger-scale deployment tomorrow.

Current incentives not enough for large-scale solar thermal deployment

The Government's Renewable Energy Target of 20% by 2020 is a welcome measure to grow renewable energy industries and the Australian Parliament should strengthen and pass that legislation as soon as possible. However, the overwhelming beneficiaries will be mature technologies such as wind and biomass, as they are currently the lowest cost form of renewable energy.

In the longer term, a carbon price will make carbon-intensive fossil fuels more expensive and clean renewable energy more attractive. However, in the short term a low carbon price will do little to encourage immediate investment in transformative but more costly technologies like solar thermal energy.

With the announcement of the $1.6 billion Solar Flagships Program in the May 2009 Budget – a commitment to build two large-scale solar thermal power stations and two large scale solar photovoltaic power stations delivering 1,000MW – and the introduction of a 20% Renewable Energy Target, solar thermal will begin to make an important contribution to Australia's renewable energy mix. Unfortunately, it is still not enough to deliver 2,500MW of solar thermal power by 2020 or to develop the supply base needed for large-scale deployment and a competitive export market.

1 Assume: current energy consume per yr = $1.4x10^{14}$ kWh, sunpower that reaches earth = 1.6 x 10 kWh per yr, 8hr light per day, 1kW/m^2 (solar constant: 1.4 kW/m^2), efficiency 10%.

2 Climate Risk (2008) Industrial Constraints and Dislocations to Significant Emissions Reductions by 2050 http://wwf.org.au/publications/carbon-constraints-2050-report/

3 Emerging Energy Research (2009) Global Concentrated Solar Power Markets & Strategies, 2009 – 2020. http://www.emergingenergy.com/user/GlobalConcentratedSolarPowerMarketsandStrategies200920201561467216_pub/SolarCSP2009Promo.pdf

4 Access Economics (2009) The net employment impacts of climate change policies, pg 15. http://www.cleanenergycouncil.org.au/documents/R090603%20CEC_Employment%20Impacts_Final.pdf

Policies to foster solar thermal industry in Australia

In addition to the Solar Flagships Program the Government should:

1. Strengthen the Renewable Energy Target (RET) or introduce a Feed-in-Tariff to support emerging renewable technologies, such as solar thermal. The RET could be amended to:

(a) include a multiplier of two Renewable Energy Credits (RECs) for every megawatt hour of deemed renewable energy for emerging technologies, such as solar thermal. This approach draws on the United Kingdom's proposed scheme which will award the equivalent of a quarter of a REC per megawatt-hour of electricity for established technologies such as landfill gas, one for wind and two for emerging technologies, such as solar thermal; or,

(b) create a 'band' or 'sub-target' within the RET scheme dedicated to emerging baseload technologies, such as solar thermal. A 'banded' RET ensures emerging technologies are given the opportunity to develop now by providing a guaranteed market (by setting aside a percentage of the renewable energy target) for early and sustained investment in these technologies.

2. Establish an Australian solar thermal supply chain to take advantage of the global boom, and position Australia as a major global supplier of solar thermal technology and components. This would be a natural extension of the current Solar Flagship Program and would provide an avenue to foster technology transfer to developing countries under a post-Kyoto agreement. Australia's strong research and development in solar thermal power and strengths in production of solar thermal power station core components (glass, steel and cement) offer the potential for Australia to be a natural technology and supply chain leader.

Liddell Solar Farm – Liddell Power Station NSW

Source: Ausra Australia