Solar-Thermal Power Generation Project

The need for more renewable energy sources has become paramount in order to reduce Australia's carbon emissions. Australia is among the highest emitter of carbon emissions per capita than any other country in the world. It is therefore incumbent upon Australia to do more than most other countries in reducing carbon emissions.

Already there are numerous wind farms around the country with more in the planning stage. Wind generators have a high potential to produce electricity 24 hours a day at a lower cost than solar, but there are several big advantages with solar-thermal generation.

1. In NSW, the peak electricity demand is between the hours of 11am to 3pm, just when solar power generators can perform at their peak. A computer display at the Snowy-Hydro tourist facility in Cooma indicated that NSW buys power from other states at a high cost during this period. A number of solar generators dotted around the state have the potential of coping with the increased electricity demand during the middle of the day.
2. The maximum power output of a solar-thermal generator is on a hot summer's day, exactly the time when air conditioners are in peak demand. Again, these generators will help cope with electricity demands caused by the use of air conditioners.
3. It is also possible to create a base load solar-thermal power station by utilising a gas dissociation process, whereby gases such as ammonia or methane are broken down into their elemental components using high temperatures, and then later re-combined in an exothermic reaction to recover the heat for power generation. Alternatively, heat storage can be utilised using either molten salt or graphite.
4. It is also possible to supplement the solar thermal power generation with gas on days when there is little or no sun instead of or as well as heat storage.

The electricity grid has the burden of supplying power over many hundreds of kilometres, with the associated losses involved due to line resistance, transformer losses, and other factors. These losses become greater as the demand increases. Electricity providers are becoming concerned about the increased demand on the grid, and are talking about massive investments to increase the capacity of the electricity grid.

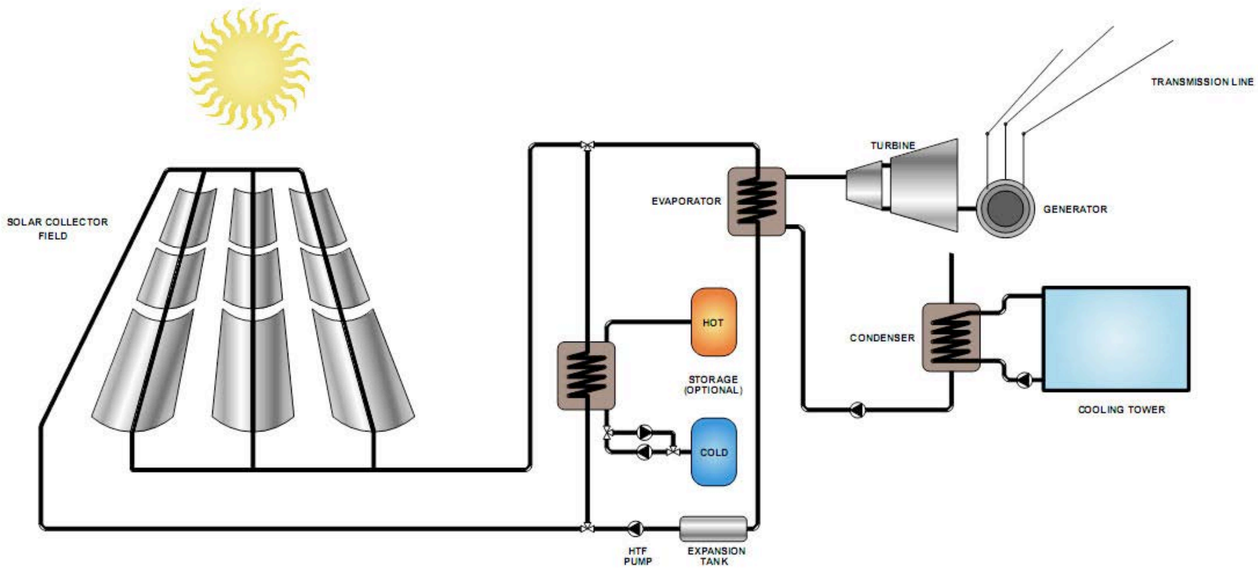
Solar power generation plants located at strategic places around the state will reduce the demands on the electricity grid. Electricity can be generated locally, which reduces grid loading, and in turn reduce the losses incurred with long distance electricity supply. They will also eliminate the massive expense of upgrading the electricity grid.

Larger solar power generation facilities coming on the market now use steam turbines rather than photovoltaic panels. This are called solar-thermal technology. However, these solar-thermal generators need to be bigger than 10megawatts in size to warrant the cost of the steam turbine. Electricity production costs from the equipment suppliers are quoted at around 7 – 15 cents per kilowatt hour depending on the size of the station, which is a viable wholesale electricity cost.


Examples of these facilities are the Solar Heat and Power site at Liddell power station, and the parabolic dish at Moree made by Wizard Power in association with the Australian National University. Both systems concentrate the sun's energy onto a heat collector, which converts water to steam.

A solar-thermal power station doesn't use photovoltaic solar panels like we're used to seeing. A solar-thermal power station is based on heat. It uses parabolic dishes, or parabolic troughs to concentrate the heat from the sun onto a point or a pipe, which is heated to between 500 and 800°C. Parabolic trough technology has been around for about 20 years in America. There are pictures on our display board that show what these collectors look like. This heat is used to create steam, which drives a turbine to create the electricity.


A solar-thermal power station also is not limited to only producing power during daylight hours. Technology exists that uses a gas, such as ammonia or methane, to store the heat, and to recover the heat during the night to generate electricity. This technology uses what is called a gas dissociation process. It works by using the 800°C heat to break down the gas into its elemental components, in the case of ammonia into hydrogen and nitrogen, and then later on re-combine the elements in an exothermic reaction to form the original gas. An exothermic reaction is one that gives off heat. This process is a very efficient way of storing heat. The heat from the exothermic reaction is used to create steam to drive a turbine. If this method is used, 24 hour power would be available, and the power station becomes a base load power station.



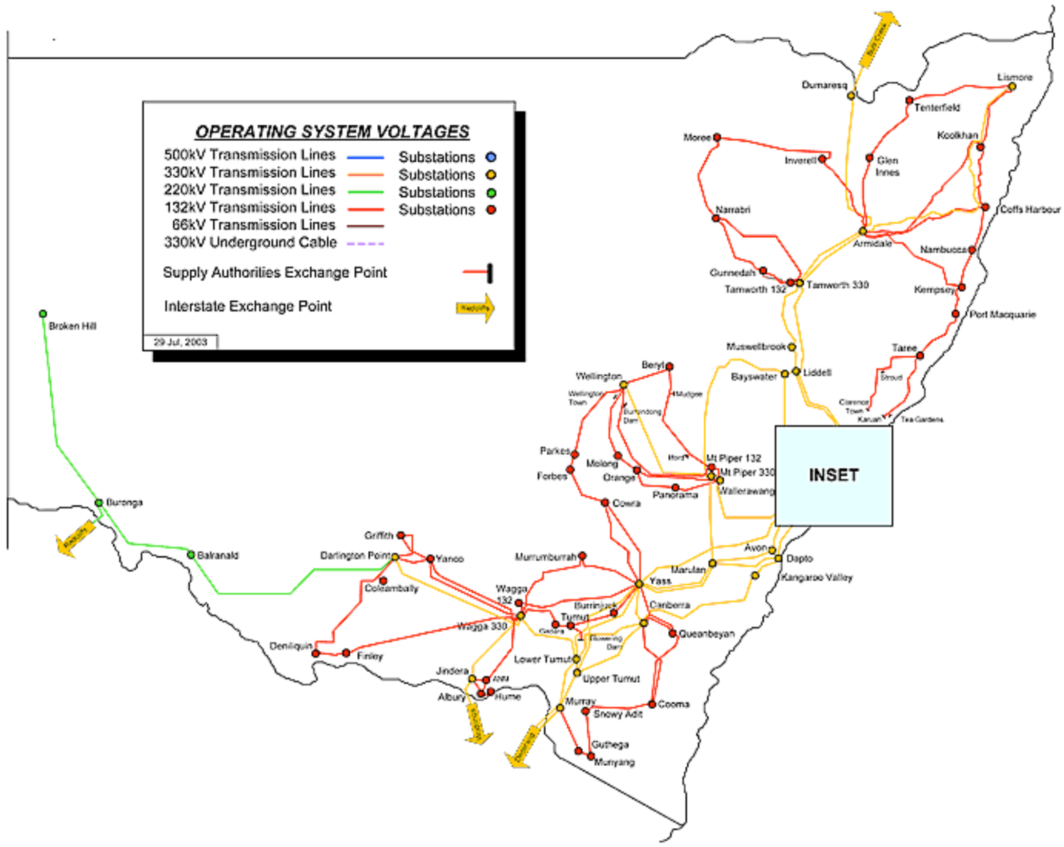
The federal government was going to introduce an emissions trading scheme, which would have affected coal-fired power stations. This scheme would increase the cost of electricity generated by these power stations. Solar-thermal power stations will be unaffected by the scheme, and so will become more competitive as the carbon cost increases.

In fact, it is only the construction cost that is more expensive for a solar thermal power station. The entire lifetime cost of a solar thermal power station is lower than a coal fired power station, because once it is built there is very little input cost.

Solar power generators are relatively easy to expand. As future electricity demands increase, more solar collectors can be added to the system. Future electricity expansion costs will thus be considerably reduced. If solar generators are placed strategically in local areas around the country, only the generators in areas that have increased demand need be expanded. This reduces the major cost of an additional large centralised power station and the associated extra transmission costs.

Beryl Solar-Thermal Generator

The proposed solar-thermal generator site in the Gulgong region will address the issues pointed out above. There is a major electricity substation located at Beryl, in central NSW. This substation is on a main 132kV line between Mt Piper power station and Wellington. The grid map below shows the location of the substation. A number of lower voltage lines are supplied from this substation, which supply Gulgong and areas to the north.



NSW Electricity Grid (from Transgrid website)

200 hectares would be enough area to generate around 50megawatts of electricity. Having the power station somewhere reasonably near a substation reduces the costs of injected the generated power into the grid. The pictures below give an impression of the area around the Beryl substation.

There is enough transmission line capacity at Beryl for 50MW to be injected there, which will reduce the cost of connecting such a power station to the grid. The Cudgegong River is within 2km of the site, and the solar radiation is 2038kW per square meter per year. There is also a reasonably large area of relatively flat land within proximity of the Beryl substation

Water is always an issue when it comes to steam generation. However, water can be piped from the Cudgegong River to the solar power station site. Around 600ML of water per year would be required for a 50MW power station. Windamere Dam is located on the Cudgeong some 60km up river from this site, and so can act as a water storage facility if required.

There are a number possible ways that the 50 megawatts generated could enter the grid.

1. The generated power could be put straight into the grid. This method would compensate for peak demand during the middle of the day, but would not provide power during the evening or night. There would be some time delay every morning during which the generator would have to synchronise with the electricity grid. It is also the cheapest form of installation.
2. A percentage of the power generated could be diverted to storage by the use of ammonia dissociation technology. The stored energy could be put into the grid during the evening demand.
3. The installation could provide 24 hour base load power of around 6-8megawatts using ammonia dissociation technology or methane dissociation technology.
4. A combination of the above could be utilised. During times of low demand most of the generated energy could be put into storage, but all generated power could be put into the grid during high peak demands, such as hot summer days.

A solar-thermal power station could be commissioned in stages if required, unlike major coal or gas fired power stations. The only essential equipment needed at the start of the project is the steam turbine and generator. Solar collectors could be added in stages as funds allow, and could continue to be added at low cost until the capacity of the generator is reached. Energy storage facilities such as the ammonia dissociation technology or molten salt storage banks could also be added at a later stage.

In summary, the requirements and advantages for a solar-thermal power station are:

1. Open land area
2. A sunny northerly aspect
3. Close to water
4. On a main electricity line
5. Preferably adjacent to a substation, which reduces grid connection costs
6. More than 100km from an existing power station
7. Reduced transmission losses as the power would be used locally
8. Potential for further expansion

Epuron, a global renewable energy company, has assessed the area and estimate that a 50megawatt solar thermal power station could be built at Beryl. Epuron have various types of renewable energy power stations in Germany, Spain, Bulgaria and Australia.

Epuron have several solar power projects both in production and under development in Europe. Most of them use photovoltaic solar panels with large government subsides. They are also in the construction phase of a solar-thermal power station in Spain, which is of similar size to the one proposed at Beryl.

The Beryl site has a better yearly solar radiation level than the site in Spain, which means that this idea by Mudgee District Environment Group has a high probability of proceeding if funding is available. Mudgee District Environment Group are looking at ways of funding a feasibility study on this proposal.

This is an ideal location for an investor wishing to invest in renewable energy.