

11. Concentrated Solar Power (CSP)

11.1 Overview

Concentrated Solar Power plants generate electricity by collecting incoming solar radiation and concentrating it into a small area to generate very high temperatures. The heat is then used to drive conventional (usually steam) generators in much the same way as current power plants do. A CSP plant can be divided into two basic sections 1) the Collector, which collects the incoming solar radiation and converts it to heat and 2) the Generator, which converts the collected heat into electricity. Most CSP technologies use very similar generators but there are currently three main collector technologies available.

1. Solar Trough:

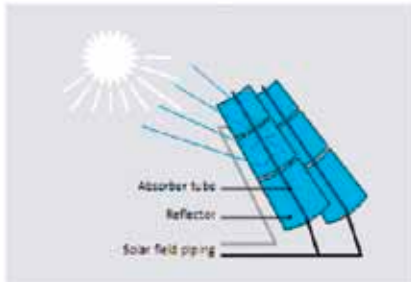
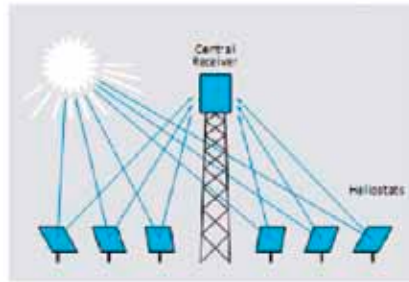
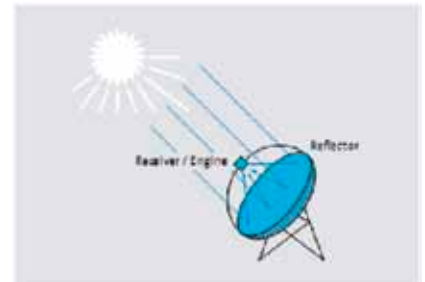
A solar trough consists of a linear parabolic collector, which tracks the sun on a single axis to focus the light onto an absorber tube, which runs along the focal length of the troughs. The collector holds a carrier fluid, which transfers the heat to the storage medium or generator. Currently, examples of solar trough systems can be found in California, Nevada and Spain

2. Power Tower:

The power tower uses an array of mirrors, which track the sun on multiple axes to focus sunlight onto a central receiver, which is placed on the apex of a tower. Like the solar trough, the collector holds a carrier fluid, which transfers the heat to a storage medium or directly to the generator. Examples of this technology can be found in California and Spain. Eskom has indicated plans to build a 100MW power tower CSP plant in the Northern Cape, although no further progress in this area is evident.

3. Parabolic dish:

This system consist of stand-alone parabolic dishes, which focus sunlight onto a focal point, which can either hold a collector, which holds a carrier fluid, or a Stirling engine, which would generate electricity directly. Parabolic dish systems are known for their very high efficiencies in converting solar power to electricity. An example of this technology can be found in Canberra, Australia.

*Solar Trough**Power Tower**Parabolic Dish*

One of the main benefits of CSP is the relative ease of energy storage. As the concentrated solar energy is used to generate heat, this heat can be stored (often as molten salts) in insulated containers and then used to generate electricity on demand, even when there is no sunshine. This means that CSP can be used for both base-load power generation as well as peak load power generation. Energy storage is not as easy from most other renewable sources.

11.2 The Case

Currently there is very little development of CSP in South Africa. Internationally, where there is a stimulating financial market with strong feed-in tariffs and political support, CSP is growing. This is mainly happening in Spain and in the USA. The recently released renewable energy feed in tariff (REFIT) in South Africa includes CSP and offers attractive energy purchase rates to project developers. With this in place, it is expected that a strong case can be made for CSP growth in South Africa.

Financial viability:

CSP technologies are relatively new and therefore immature and the financial viability is still not clear. The quote below gives an idea of the costs of CSP.

“In the recent Integrated Resource Plan developed by Eskom and the NER, a levelised power cost in the range R0.33 to R0.96/kWh is indicated, depending on the assumptions used for discount rate, load factor and other costs. In our opinion, these cost figures are over-stated and do not adequately take account of the potential for cost reductions as the technology develops.” (The potential contribution of renewable energy in South Africa, Banks and Schafler, 2005.)

Spain expects to have 500+MW of CSP in operation within the next two years. With typical capital costs of €4-6 M per MW and capacity factors of 25-35%. The tariff for CSP in Spain markets exceeds 3.0 Rand per kWh.

The renewable energy feed in tariff (REFIT) for CSP offered by NERSA currently stands at R2.10 per kWh.

REFIT Tariffs - 2009 (R/kWh)		
Technology	Unit	REFIT
Wind	R/kWh	R 1.25
Small hydro	R/kWh	R 0.94
Landfill gas	R/kWh	R 0.90
Concentrated solar	R/kWh	R 2.10

While this tariff seems reasonable, given that installation and operating costs in Spain will most likely be higher than those in a developing country, it is unclear whether this tariff is sufficient to stimulate developers at this stage.

Installation Capacity

Currently there is no capacity in the country to build CSP plants and due to the fact that there have been very few 'repeat' projects internationally, it is difficult to know what is needed. The technology is however not very complex and South Africa would have the skills and resources to build a CSP plant if combined with some expert international experience.