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Fact Sheet

CONCENTRATING SOLAR POWER (CSP)

An example of a power plant using central receiver technology. This is a 10 MW demonstration plant that was built in the United States (image courtesy NREL).

In order to explore new generation options, find solutions that can contribute to meeting the growing electricity demand and in an effort to utilise renewable energy resources, Eskom is assessing the feasibility of constructing a Concentrating Solar Power (CSP) plant rated at approximately 100 MW in the Northern Cape Province. This facility will utilise the energy from the sun as its fuel source. The assessment focuses on environmental eligibility, technical feasibility and commercial competitiveness.

Why is the project required?
Eskom is responsible for the provision of reliable and affordable power to South Africa and generates approximately 95% of the country's electricity. Electricity cannot be stored in large quantities and generally must be used as it is generated. Therefore, electricity is generated in accordance with supply-demand requirements.

The demand for electricity in South Africa grows annually. This growing demand, fueled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmental impact, climate change and the need for sustainable development. The use of renewable energy technologies, as one of a mix of technologies required to meet future energy needs is being investigated as part of Eskom's long-term strategic planning and research process.

Eskom's renewable energy strategy supports the South African Government's White Paper on Renewable Energy. Eskom is committed to investigating and evaluating the options for the diversification of its energy mix, including renewable resources.

The Concentrating Solar Power (CSP) technologies have been identified as being potentially viable and capable of being employed on a large scale. The Northern Cape has an excellent solar resource when compared to other areas of the world considered suitable for concentrating solar power generation.

Refer to the table on page 2.

International Solar Potential relative to South Africa

Location	Site Latitude	Annual radiation (kWh/m^2)
South Africa		
Upington, Northern Cape	28°S	2,995
United States		
Barstow, California	35°N	2,725
Las Vegas, Nevada	36°N	2,573
Albuquerque, New Mexico	35°N	2,443
International		
Northern Mexico	26-30°N	2,835
Wadi Rum, Jordan	30°N	2,500
Quarzazate, Morocco	31°N	2,364
Crete	35°N	2,293
Jodhpur, India	26°N	2,200
Spain	34°N	2,100

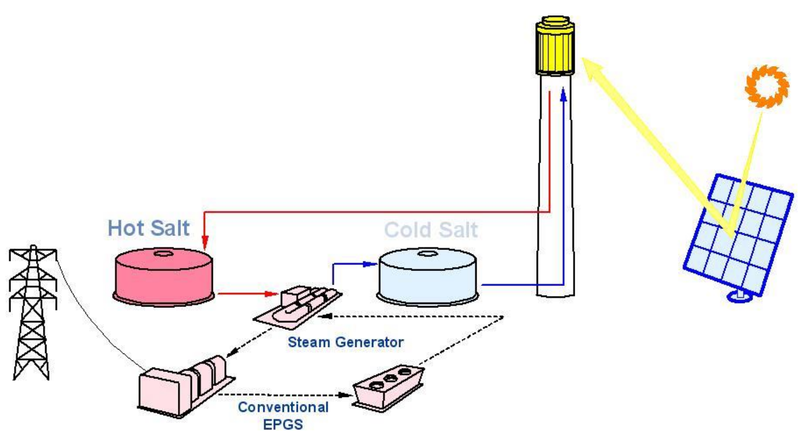
How does a CSP Plant work?

The CSP Plant being considered is a molten-salt type, central receiver technology. This technology is based on the concept of thousands of large, two axes tracking mirrors (known as heliostats) which track the sun and reflect the beam radiation onto a common focal point. This focal point (the receiver) is located on a tower well above the heliostat field in order to prevent interference between the reflected radiation and the other heliostats.

A heliostat is a mirror mounted on an axis and by which the sun is steadily reflected onto one spot. Heliostats are arranged in an elliptical formation around the focal point with the majority of the reflective area weight to the more effective side of the heliostat field (southern side in South Africa). It is estimated that approximately 6 000 heliostats at 120 m^2 each will be required within the heliostat field in order to obtain a power output of approximately 100 MW, while also enabling approximately 8 hours of energy storage.

The central receiver is situated on the top of the central tower. The central tower will be roughly 150 m to 200 m high for a 100 MW facility, with the central receiver taking up the top part of the structure. This receiver is in essence a heat exchanger consisting of thin walled tubing which absorbs the concentrated beam radiation. The heat is transferred to the working fluid (the molten salt circulated through it) which in turn is used to generate steam. Electrical power is then generated through a Rankine cycle (steam turbine process).

The working fluid is a salt mix of 60:40 ratio of Sodium Nitrate ($NaNO^3$) and Potassium Nitrate (KNO^3) - a very safe and environmentally friendly substance, which is a solid at room temperature. The cold salt is pumped up the central tower at approximately 300°C and flows through the central receiver where it is heated to approximately 600°C, after which it can be stored for use in the conventional steam power generation process. 1 MWh requires approximately 5 m^3 (roughly 10 tonnes) of stored hot salt.



The molten salt circuit

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