

CONCENTRATED SOLAR POWER TOWERS

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SITUATION

As technology increases in variety and complexity, power consumption and the demand for electricity are on the rise. Coupled with the hazardous environmental effects that fossil fuels create and their limited supply, engineers are challenged to search for a cheap, clean, and sustainable energy resource to replace them. Solar thermal conversion systems, in the form of a Concentrated Solar Power Tower (CSPT) can provide a viable and permanent solution to the ever-increasing energy consuming world of today.

How can concentrated solar power towers be implemented effectively?

How CSPT's Work?

By using a large array of flat mirrors, heliostats, that track the sun and redirect the rays onto a collector at the top of a tower, the heat is used to create steam, which runs a turbine coupled with a generator, producing electricity [1].

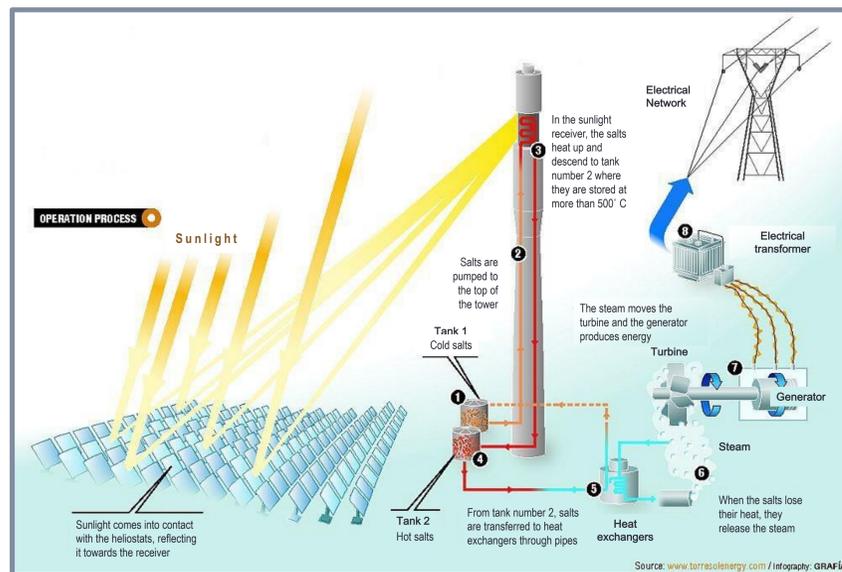


Figure 1: CSPT Design. [2]

PROBLEMS

- Geography & stability of the site
- Efficiency of the system
- Transmission of electricity
- Cost of infrastructure and maintenance

SOLUTIONS

- Earthquake resistant systems such as a seismic base isolator or a tuned mass damper can be used in earthquake prone areas.

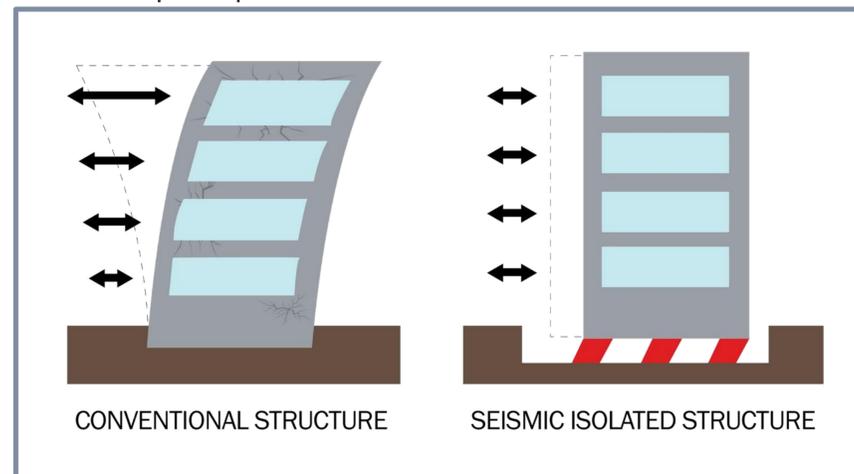


Figure 2: Earthquake Resistant Technology. [3]

- Piezoelectric filters can be used to shake off dust particles
- Multiple receivers may be used to increase the contact area upon which the sunlight is concentrated on by the heliostats [4].
- Energy and exergy efficiencies of the solar tower can be increased by integrating, Rankine cycles and supercritical Rankine cycles [5].
- The cost of using HVDC is comparably less than HVAC systems over distances above the break-even distance which is approximately 600km [6].

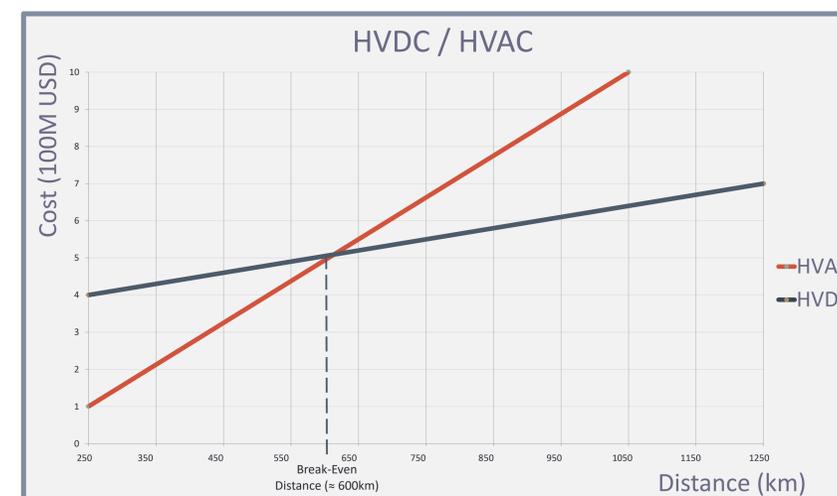


Figure 3: HVAC / HVDC Cost Vs. Distance. [7]

EVALUATION

- CSPT's are a clean form of renewable energy, which can be implemented in the Middle East
- Initial cost is high, yet maintenance cost is low
- Liquid receivers use molten salt, which encompass a wide range operating conditions [8].
- It is possible to implement earthquake resistant technology in the system for increased stability.
- It is more cost effective to transfer the power using HVDC rather than HVAC, due to minimalized losses.

Potential for CSP around the World

Source: Solar Millenium AG

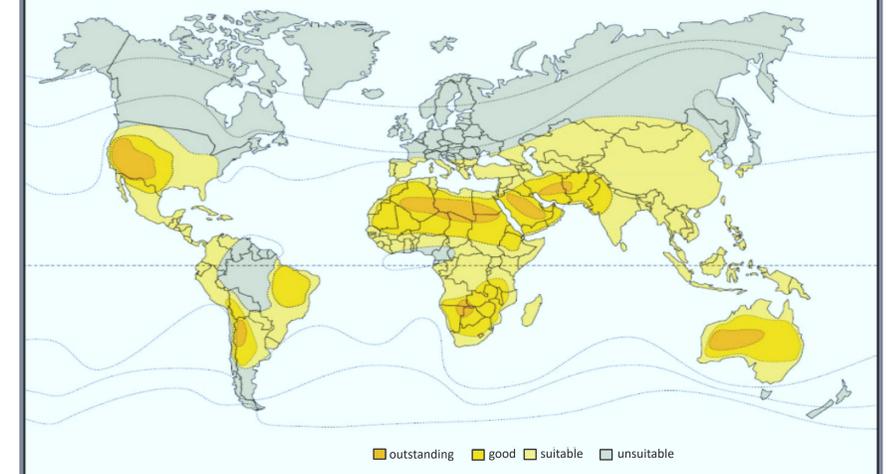


Figure 4: Regions where CSPT's can be implemented effectively. [9]

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