

## **PRODUCE ELECTRICITY AND FRESH WATER USING CONCENTRATED SOLAR POWER(CSP) IN THE NORTHERN PROVINCE OF SRI LANKA**

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### **A brief Outline of Report to Northern Development Foundation, Jaffna, Sri- Lanka**

#### **Goal:**

The government of Sri Lanka has committed to providing potable water and electricity to all of its citizens in an efficient, affordable and sustainable manner.

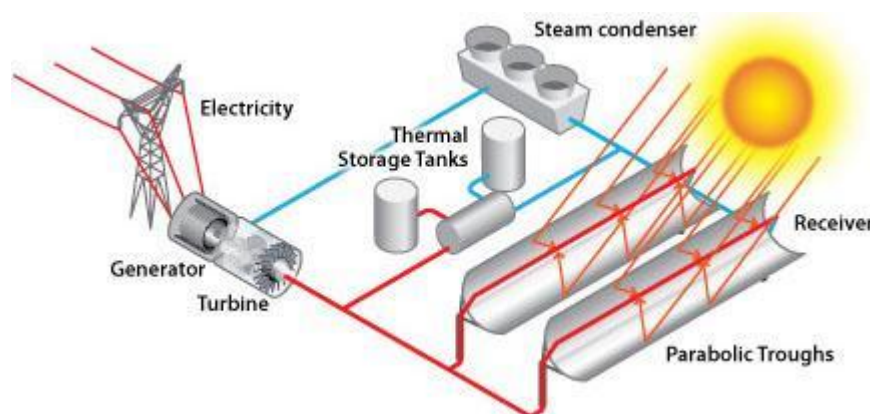
#### **Proposed Solution:**

Using solar power to generate electricity and produce fresh water via desalination.

#### **Reasoning:**

Solar energy is abundant, clean and sustainable.

#### **Technical Insight:**



Source: The Cooler Energy Project

There are four CSP plant variants, namely: Parabolic Trough (“PT”), Fresnel Reflector, Solar Tower and Solar Dish. The PT system, demonstrated in the diagram, is the most commercially mature technology.

The diagram above demonstrates how a Concentrating Solar Power (“CSP”) plant uses mirrors to concentrate sunlight onto a receiver, which collects and transfers the solar energy to a heat transfer fluid that can be used to generate electricity through steam turbines. Large CSP plants can be equipped with storage systems to allow for heat supply or electricity generation at night or on days with less sunlight (e.g. high degree of cloud cover). In fact, the ability to integrate a low cost storage system is one of the most significant advantages CSP has over its most common alternate, Solar Photovoltaic (“PV”) technology. This key feature increases the capacity and ‘dispatchability’ (i.e. ability to provide power on demand) of CSP plant and therefore improves its grid integration and economic competitiveness. There is however, a trade-off between the capacity of storage required and capital cost of the plant. Another advantage conferred by CSP technology is the ability to easily integrate such plants into existing fossil fuel-based power plants that use conventional steam turbines to produce electricity. Essentially part of the steam produced by the combustion of fossil fuels can be substituted by heat from the CSP plant. Similar to conventional power plants, most CSP installations need water to cool and condense the steam cycle.

### **Is it suitable for Sri Lanka?**

To operate efficiently CSP plants should be built in an area of high direct solar irradiance (i.e. power). The areas considered most suitable are typically between the 40<sup>th</sup> parallel north and 40<sup>th</sup> parallel south on the earth's surface. Sri Lanka lies in this region and initial indications suggest that parts of the country will be extremely well suited for CSP plants. In fact, the technical potential of CSP-based electricity generation is expected to be many multiples greater than times higher than their electricity demand which will mean a CSP solution will remain viable even as the country's electricity demand increases (a likely consequence of economic development). **Note: As of Feb 2014 India has FIVE 50MW CSP plants in operation and FIVE more under construction.**

### **Fresh water from sea water**

CSP plants are primarily designed for electricity generation, but the heat produced can be used for industrial heating, production of synthetic fuels (e.g syngas), enhanced oil recovery, refineries and **water desalination**. CSP can provide electricity for reverse-osmosis water desalination or heat for thermal distillation.

### **Typical Costing for a CSP PT system**

Ernst & Young and Fraunhofer (2011) estimate that a 50 MW CSP PT plant similar to the Andasol plant in Spain, with a storage capacity of 7.5 hours has an estimated cost of USD 364 million

The table shows the cost comparison for Spain and Sri Lanka for a 50MW and 25MW systems

	Cost in Spain in Million US \$ 50MW	Estimated Cost in SL 50MW	Estimated Cost in SL 25MW
Solar Field	\$140.00	\$70.00	\$35.00
Thermal storage	\$36.40	\$36.40	\$18.00
Grid connection	\$51.00	\$25.00	\$12.00
Labour	\$62.00	\$30.00	\$15.00
Finance cost	\$71.00	\$71.00	\$35.00
Total in Millions	\$360.40	\$232.40	\$115.00

We estimate that a single 50MW CSP PT system could power about 100,000 homes in Jaffna (without air conditioning)

**Operation and Maintenance Costs:** – The O&M costs of CSP plants are low compared to those of fossil fuel-fired power plants. A typical 50 MW PT plant requires about 30-40 employees.

**Lifespan:** Estimated 25 years

**Conclusion :** Sri Lanka's prevailing conditions give the country a chance to 'start from scratch' with the right infrastructure for the 21<sup>st</sup> century. We firmly believe that CSP PT technology is the right solution at the right time for the country.

**Useful website, company based in California:**

**<http://waterfx.co/>**