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NOVOSOL CSP POWER SYSTEMS

INTRODUCTION

NOVOsol together with RPConnect incorporates in its power projects developments for low cost solar energy collection and thermal energy storage that enables the production of solar only, base-load 24 hour a day power at costs equivalent to USA grid parity without subsidies.

NOVOsol Power Company has participated in the Canadian and International government investments in SHEC Energy Inc. that has generated substantial IP including 10 issued patents and over 30 patents pending.

TECHNOLOGY ADVANCEMENTS

NOVOsol Ultra Lite solar concentrator technology represents a major material and production cost reduction that enables the sale of concentrators for less than $75 per square meter. NOVOsol solar trough arrays replace glass and heavy metal structures, which make up the bulk of solar collection fields. The result, a ten fold decrease in weight and cost of deployment. NOVOsol Thermal Store heat storage replaces traditional molten salt-based thermal energy storage that uses a 2-tank storage system with expensive double wall tanks to maintain the corrosive mixtures. NOVOsol thermal storage with a single wall in-ground storage tank. The NOVOsol thermal energy storage technology advancements lower storage system capital costs by 50% over volatile and corrosive molten salt and reduce the storage system size by 50% with very similar storage efficiency.

The combination of low cost solar collection and low cost thermal storage dramatically lowers the cost of CSP power not only because of their lower capital costs, but also because they enable using the turbine for 24 hours a day instead of just the daytime. NOVOsol provides stable solar operation as a standalone power plant, not requiring conventional power plants as a backup like PV and wind.

The technology can be retrofitted to existing fossil fuel (natural gas, coal, diesel and nuclear) steam power plants at very low cost, preserving current investment made in those power plant infrastructures.

NOVOSOL SOLAR FIELD

The glass mirrors and steel frames in a traditional solar CSP field make up a

large percentage of the cost of a base load power plant. The NOVOsol using SHEC Ultra-lite technology reduces the costs of solar concentrators by about 75%. In addition to this high cost reduction is a correspondingly large weight reduction that increases the rate of assembly and simplifies deployment therefore lowering the overall cost of installation.

NOVOsol solar collector technology has reduced the weight of the reflective surface by replacing the heavy glass mirrors with a reflective thin film material mounted by enveloping a lightweight superstructure. NOVOsol reflective film trough arrays are formed on the curve shape by creating a partial vacuum behind the trough back surface. The trough array superstructure is strengthened by pressurizing the tubular interior frame (This technology works for both trough and point focus solar concentrators). The entire structural weight (less heat collector actuators) is about 100 kg for 30 square meters of cross sectional reflective surface of the solar concentrator. The solar troughs are designed to operate in sustained 40 MPH / 60 KPH winds and will survive safe mode to 80 MPH / 140 KPH storms. Depending on operational wind loading requirements, the structure can be designed with heavier or lighter backing components. Repair is as simple as vacuum forming another film on the existing in-field trough back.

The solar reflective and capture surface is a patented thin film material such (PVC with metal) that has been mirrored on the inside surface protecting it from the elements. The film uses an industry standard low cost abrasion resistant coating. Due to the thinness of the material, as little as 0.001 inch, a very high transmittance of about 96% is achieved on average from a spectrum wavelength of 350 nm to 2,600 nm. The resulting high efficiency solar heat receiver can operate at temperatures of 850 C (or more) with only a 2% emissivity loss, versus 40-50% loss for competitors' systems. It does this by focusing collected light into the end of a copper tube receiver. The energy reflects inside the tube and eventually 98% of all the energy is captured. As the tube heats up, the patented heat transfer fluid flows over the exterior of the tube and pulls the heat off for either sending to storage or directly to boilers for turbines. Trade secrets cover how to build a system that

handles the heat (does not burn out despite extraordinary energy in the tightly focused beams sent into the tube), and has survived long-term testing in Arizona USA.

The solar trough system is the most cost effective solution for generating temperatures up to 560 C. This is good for high temperature turbines for daylight only or storing heat for running lower temperature turbines. Using packaged GEE Energy steam turbine generators, for full base load and increase stored power the NOVOsol system stores the fluid heat from the trough's 550 C solar heat to deliver 280 C steam to the turbine. The high heat transfer fluid temperature and controlled thermal storage will allow a substantial temperature drop from storage to steam and still be able to drive the GEE turbines

The trough concentrator has been described, the technology is also applicable to point focus systems and adaptive focusing heliostats for solar towers. The technology incorporated by NOVOsol allows us to deploy hybrid plants with a mix of point focus and trough concentrator arrays to maximize plant efficiencies and economics.

The heat transport fluid is a patented organic based, non-toxic fluid that brings the high heat from the solar collector/receiver system to the thermal storage tank. The fluid circulates through a series of pipes inside the insulated thermal storage tank. A parallel set of steam boiler pipes would go through the storage tank to collect heat for the turbines.

NOVOSOL THERMAL STORAGE

There are 2 types of CSP power plant thermal storage strategies:

- Daylight produced energy (8AM to 4PM) to peak day usage (8AM to 8PM).
- Daylight produced energy to provide 24/7 base load power.

Traditionally, molten salt as a storage medium is generally used for the daylight only strategy where it is relatively cost effective, but has not really been used for the second because of the disproportional capital costs and maintenance for long-term storage. NOVOsol thermal storage system uses half the volume of storage material and only 1 in-ground tank, thus saving half the capital cost of the storage system. In addition the

molten salt system is about 24% of the total cost (per the NREL model), then the NOVOsol silica-sand system would save about 12% of the total material cost.

Sand is a relatively free commodity in most of the world. It has a very high melting point and a zero coefficient of expansion. This makes it an ideal medium to store heat energy. NOVOsol supporting SHEC development has tested sand to its extremes through 900 C temperature changes repeatedly. Despite the highly efficient heat transfer of a molten corrosive salt storage system, which uses 2 expensive above ground tanks (hot and cold), and related structural and insulating costs, the NOVOsol Thermal Store system achieves approximately equal efficiency with 1 low cost in-ground tank.

The NOVOsol long-term solar thermal storage is optimized by using insulating tiles that create "heat compartments" within the in-ground tank. Heat is added to individual compartments by switching pipelines, and can simultaneously pull heat from fully heated compartments for the steam supply going to the turbine. The Energy storage systems could operate as high as 800 to 900 C (although the GEE steam turbines require only 280 degree C temperatures) with a higher delta-T (storage temperature minus turbine temperature) in the storage system meaning a smaller in-ground solar thermal tank volume required. The NOVOsol system is design to optimize heat capture and release and therefore to minimize CapEx costs. SHEC patents cover the use of the tube collection process.

NOVOSOL and RPConnect MAJOR BENEFITS SUMMARY

- More usable power per mirror: With the "Low Emissivity" highly efficient receiver, a given mirror system will produce substantially more power output than competitor's CSP systems (potentially up to double the output per equal mirror system).

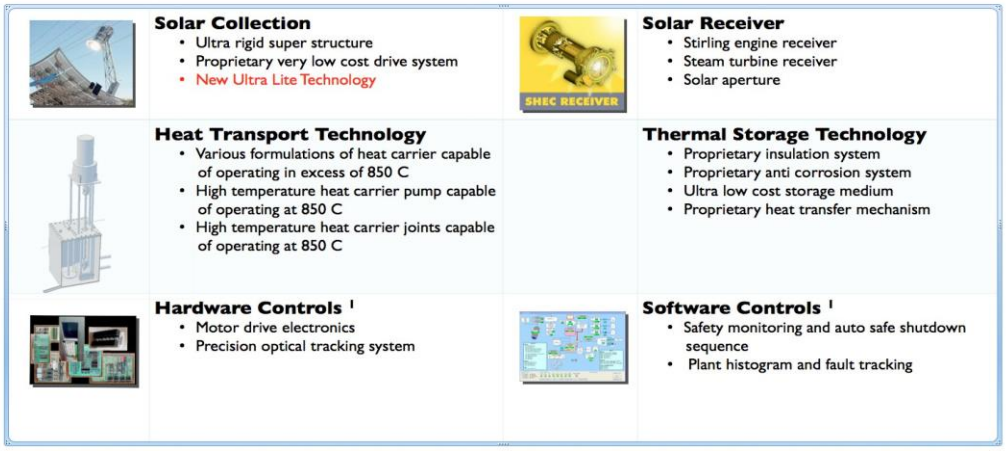
- Drive higher efficiency turbines: The ability to cost effectively capture the high heat, drives higher temperature need by efficient steam turbines in a "stored energy system". In a conventional solar system temperature drops in the recovering of heat from storage will allow

the system to drive lower 280 C GEE turbines. If the thermal store system was charged up to 850 C, then allowing for temperature drops for heat recovery from storage, would allow the system to drive even higher output 550 C turbines.

- Improve storage system productivity: In addition to the benefit of having only half the storage tanks vs. molten salt, the NOVOsol Thermal Store can store higher temperatures in the same sized storage system using that heat to run standard GEE low turbines cost effectively as base load for 24/7 multiple days without recharge.

- Hybrid power plants: The solar trough concentration system is the most cost effective solution for generating temperatures up to 560 C. This is good for running GEE prime or base power turbines. NOVOsol thermal store reduces CapEx whenever storage is needed. To expand hours of power generation to full base load by raising the fluid temperatures from the trough's 550 C to the 850 C is enabled by NOVOsol's use of the patented SHEC receiver. The portion of the fluid temperature increased by doing this will allow a temperature drop from storage and still be able to drive turbines.

Summary of our Current Technology Matrix



The technology has been reviewed by the Canada Research Council, Canadian IRAP, the USA NREL Laboratories, the Massachusetts Institute of Technology (MIT) High Energy Laboratories, the US Department of Energy, GE Energy and Siemens CSP engineering for CSP applications.