SkyTrough® DSP

Parabolic Trough Concentrator

ATTRIBUTES

- Lowest Cost Parabolic Trough
- Molten Salt Capable
- 7 Meter Aperture Width
- High Optical Efficiency
- ReflecTech® Mirrors

The Future of Parabolic Trough Technology

SkyTroughDSP is a true revolution in parabolic trough technology, offering the lowest cost option on the market with zero compromise to quality.

DSP stands for Dispatchable Solar Power, as the technology is fully capable of using Molten Salt as its heat transfer fluid, thus reducing the cost of long-term thermal storage.

SkyTroughDSP features many industry-leading innovations that result in a durable, high-performance platform that is quick and easy to install, accelerating parabolic trough technology into the future.

SkyFuel

SKYTROUGH®DSP ORIGINS – INNOVATIONS IN COST REDUCTION

SkyTroughDSP was developed at SkyFuel's USA headquarters with initial funding from the U.S. Department of Energy's (DOE) SunShot Initiative. In 2011 SkyFuel was awarded a grant as part of the SunShot program to advance parabolic trough technology with the goal of achieving 9 US cents per KWh on a cost of energy (LCOE) basis; the result was SkyTroughDSP. SkyFuel Engineering has continued to develop SkyTroughDSP by working in collaboration with Chinese Manufacturing experts to optimize every aspect of the design in order to reduce the cost of materials, installation and operation while maintaining exceptional optical performance. SkyTroughDSP is ultimately the lowest cost parabolic trough in the world, providing important cost reduction and profitability improvements for global CSP projects of all types.

ADVANTAGES

SkyTroughDSP has been designed to operate with thermal oil, molten salt or other high temperature novel HTFs. It has a maximum temperature capability of 400°C when using oil and 560°C when using molten salt. However, the technology is also ideal for medium temperature applications that demand the highest performance and lowest cost technology possible.

SkyTroughDSP is a state-of-the-art, 7.0 meter aperture parabolic trough solar collector that features even greater value than the original SkyTrough. The design of SkyTroughDSP builds on the innovative features pioneered and proven at SkyFuel, most notably the use of ReflecTech® Mirror Film panels in place of heavy and fragile glass mirrors. ReflecTech makes monolithic mirror panels possible, resulting in a simple slide-in mirror process that expedites assembly and installation.

SkyTroughDSP module under performance testing at SkyFuel HQ - USA

REFLECTECH® MIRROR PANELS

By utilizing ReflecTech-based monolithic mirrors that slide into SkyFuel's patented parabolic track system, SkyTroughDSP revolutionizes the optical surface of parabolic troughs. This new type of mirror module offers long term durability, lower mirror material costs, higher optical efficiency, and quick & easy installation.

ReflecTech has been tested above and beyond any other mirror material used in the CSP industry. It is a proven technology that will never crack or break and is guaranteed to maintain its reflectance, even in the harshest environments found within CSP projects.

EASE OF INSTALLATION

Installation of SkyTroughDSP is fast, simple and low cost. The process starts with the assembly of the steel space frame and the parabolic track system within an assembly station located directly in the solar field. There is no need for a dedicated building or expensive jigs or fixtures to align the frame and mirrors, significantly reducing the capital cost of installation.

Once assembled, the modules are attached to their pylons and tilted in a position to receive the mirror panels. The mirrors panels easily slide into place and automatically form an accurate parabolic shape. No additional mirror alignment is required. The process is then repeated for each module until the field is complete.

SkyTroughDSP
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APPLICATIONS

With Molten Salt as the HTF, SkyTroughDSP can produce thermal energy for a variety of applications.

Hybrid Power Generation

A hybrid power plant is the combination of thermal energy from the sun with heat produced by a coal, gas, biomass, oil, or geothermal facility to increase its efficiency, reduce its usage of fuel, and mitigate pollution caused by the extraction, transportation and combustion of fossil fuels. With steam production as high as 535 °C, SkyTroughDSP can easily be used in hybrid projects.

Stand-Alone Power Generation

The largest segment of the CSP industry is thermal power plants that use only heat from the sun. These facilities can be improved by using parabolic troughs that operate with molten salt directly. This approach increases the working fluid temperature, thus increasing the energy density of the storage system and improving the cycle efficiency of the power block.

Industrial Applications

Many industrial applications use heat as an input to their processes. Mining, desalination, waste & agricultural processing are just a few examples. SkyTroughDSP can easily produce the thermal energy needed for these industrial applications through the concentration of sunlight. The solar generated heat eliminates exposure to volatile fossil fuel prices, especially in remote areas.

ReflecTech mirrors being inserted into a SkyTrough module

CONCLUSION

SkyTroughDSP has achieved a breakthrough in parabolic trough technology by combining innovative new designs and materials into a complete system that achieves the highest standards of cost, performance and reliability. The combination of US engineering and Chinese manufacturing expertise has resulted in a technology with the best economics in the world, allowing parabolic trough technology to remain at the forefront of the CSP industry.

SkyFuel

SkyTrough®DSP Specifications

GEOMETRY

Total Solar Collector Assembly(1) Length	148 m	*486 ft*
Net Aperture Area	975 m^2	*10,495 ft^2*
Number of Modules(2)	8 per Solar Collector Assembly(1)	
Module Aperture Length	17.74 m	*58.2 ft*
Module Aperture Width	7 m	*23 ft*
Receiver Type	Evacuated	
Receiver Length	4.512 m	*14.8 ft*
Absorber Tube Diameter	80 mm	*3.15 in*

(1) The Solar Collector Assembly (SCA) length comprises the modules, pylons, control and drive, and pipe connections.
(2) A module is the parabolic reflector and receiver unit supported by a pair of pylons.

PERFORMANCE

Optical Efficiency	75 %		
Thermal Efficiency(3)	71 %		
Design Point Thermal Output(3)	692 kW-th(*)		
Maximum Temperature	560 °C (4)	*1,050 °F*	
Typical Working Fluids	Molten Salts Silicone Oils Synthetic Oils Mineral Oils Water		
Maximum Installed Slope	3 %, gradient		
Maximum Wind Speed (Stow)	40 m/s	*90 mph*	3 second gust
Maximum Wind Speed (Operation)	18 m/s	*40 mph*	3 second gust
	12 m/s	*26 mph*	sustained

(3) Defined as (Gross Thermal Power) / (Solar Power) at 1,000 W/m2 of direct normal incident solar radiation and 350°C heat transfer fluid temperature.
(4) With Molten Salt Working Fluid
(*) kW-th = Kilowatt Thermal

MIRRORS

Reflective Surface	ReflecTech® Mirror Film
Specular Reflectance(5)	94 %
Mirror Service Life	30+ Years

(5) Measured with a Device & Services Specular Reflectometer at 660nm and 25mrad acceptance angle

ONSUN™ DRIVE AND CONTROL

Controller Communication	Network	RS485 Wired
Control System Architecture	SCADA + PLC + Embedded Board @ Drive	

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