

SolarDynamics LLC

Concentrating on a new energy future™

SunBeam™ | Parabolic Trough Collector



Efficient | Robust | Reliable

Introducing the SunBeam: an advanced parabolic trough collector that combines proven utility-grade components with cost-saving steel space frame construction. This state-of-the-art design provides superior performance and versatility to support a range of thermal applications. Engineered for reliability and supported by a robust supply chain, the SunBeam is an ideal solution for large industrial and utility projects.

SunBeam™

Parabolic Trough Collector

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How does it work?

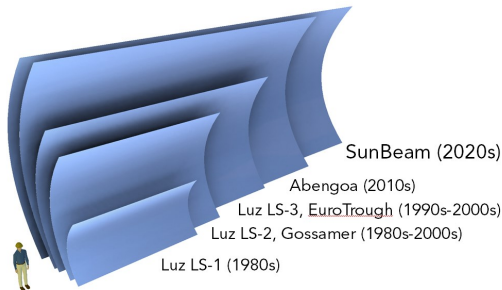
By tracking the sun to within 1 mrad (0.17°) to focus sunlight onto vacuum-insulated receiver piping, the sun's energy is collected in a heat transfer fluid. This energy can be directly utilized or saved for later use in an insulated storage vessel.



What is unique about the SunBeam?

The name "SunBeam" derives from our helical space frame truss. This construction provides a deep frame section with structural materials aligned precisely to the primary load paths – maximizing optical rigidity, load resistance, and material-efficiency. As a result we are able to deploy one of the industry's largest and highest-concentration collectors, providing economies of size and lowering thermal loss. Also, whereas most large trough collectors were designed for massive utility-scale projects, the SunBeam uses simple, easily-transportable parts that can be field-assembled to provide a better option for industrial scale projects that may require tens of collector rows rather than hundreds or thousands.

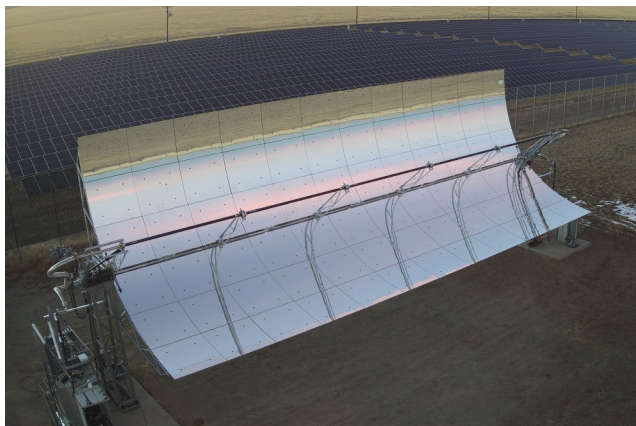
Building on a Legacy of Success



The SunBeam is the latest evolution of the world's most successful architecture. Our designs have roots in the glass-mirrored, steel-framed collectors of the California SEGS plants (1980s) and embody the improvements developed over decades of mass-deployment.

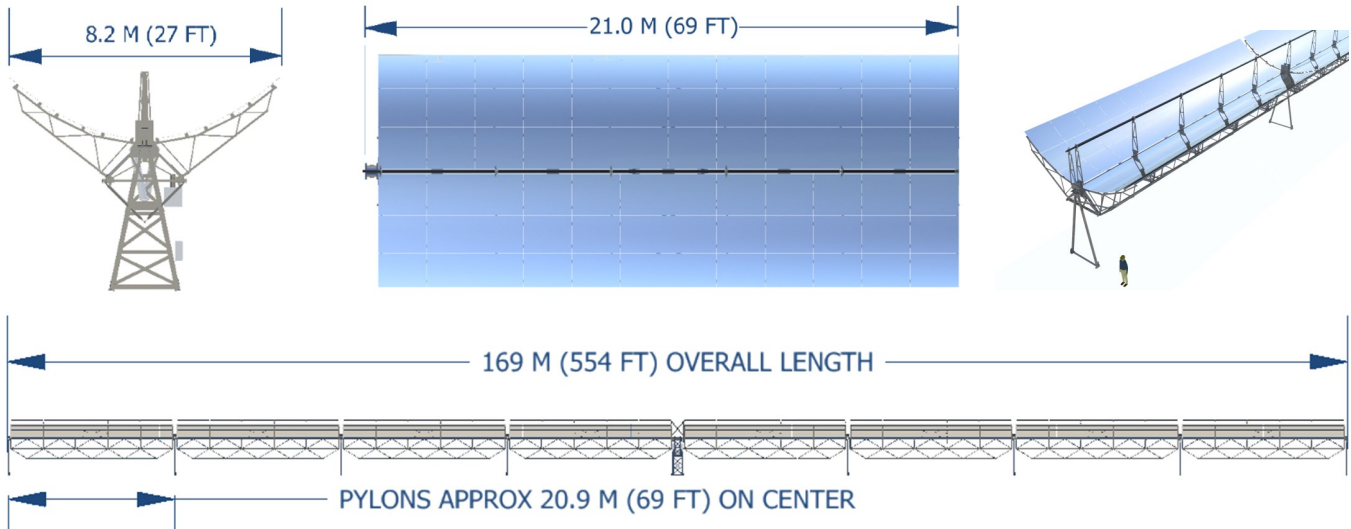
Key Advantages

- Accurate high-concentration optics maximize energy collection (>50% of annual direct radiation) and delivery temperature (up to 425°C at collector outlet)
- Large format collector generates economies of scale in construction and operation of large solar fields
- Factory mass-produced and field assembled
 - Bankable utility-grade optical components leverage existing mass-production lines for best quality and cost
 - Framing parts are transported in space efficient bundles and assemble quickly onsite with no welding required
 - Versatility in manufacturing and assembly systems allow optimization to project and geography
- Built from infinitely recyclable materials, compatible with existing industrial capacity (steel, glass, concrete)



SunBeam Collector Development

- Developed by veteran team with a focus on cost savings and enhanced reliability
- Designed and prototyped in collaboration with leading suppliers to previous utility-scale projects
- Accelerated by >\$5M USD U.S. Dept. of Energy awards and building on earlier DOE research
- Full-scale prototype modules built and tested at [SolarTAC test center](#) (Colorado, USA)
- [Commercial pilot facility](#) beginning construction in Q4 2023 (8 collectors / 10,560m² active collector area)

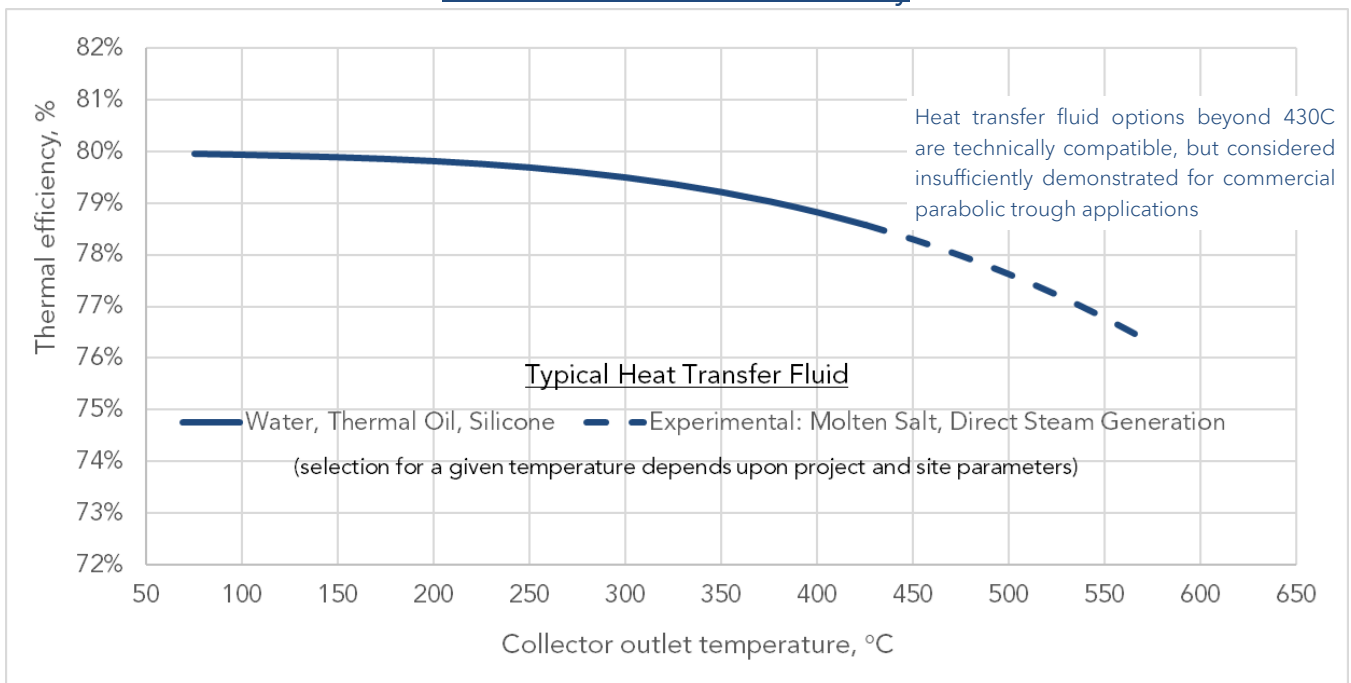


Geometric Specifications

Aperture width (C)	8.2 m	26.9 ft
Length; module / collector	21.0m / 169 m	69ft / 554 ft
Solar collector assembly (SCA) std. config.	8 modules; drive at midpoint	
Net aperture, SCA	1,320 m ²	14,200 ft ²
Absorber dia. ¹ (d); geometric concentration (C/d)	89mm (3.50 in); 92:1	
Ground coverage ratio, nominal	40%	

1) Note: other receiver sizes (70, 80, 102 mm) may be substituted to modify concentration based on project design conditions

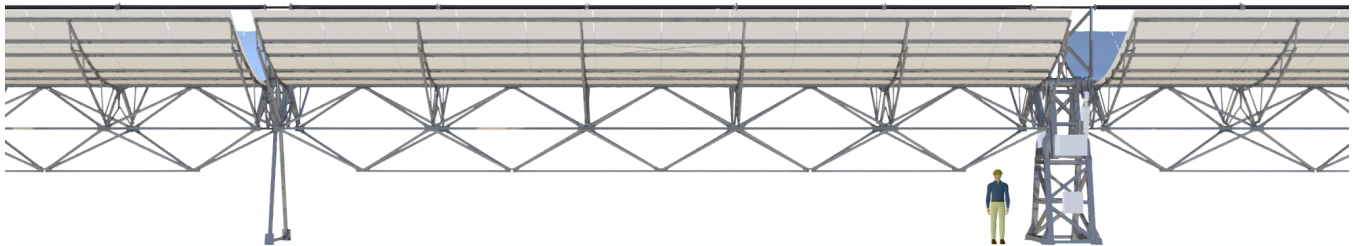
Characteristic Thermal Efficiency



Technical Specifications

Base configuration	8 modules per collector; drive at center		
Operating temperature	80°C-565°C		
Onsite construction method	<i>Large Industrial Scale Projects</i> 8-128 Collectors	<i>Utility Scale Projects</i> 128-5,000+ Collectors	
	Stick-framing (precision drilled steel parts)	Assembly line with control fixtures (allows lower-cost, lower-tolerance parts)	
Design optical efficiency ¹	75.6%	78.5%	
Indicative thermal output ²	1.00 MW _{th} (3.41x10 ⁶ BTU/hr)	1.04 MW _{th} (3.54x10 ⁶ BTU/hr)	
Indicative annual output ³	2,198 MWh _{th} (7.50x10 ⁹ BTU)	2,286 MWh _{th} (7.80x10 ⁹ BTU)	
General arrangement	2 to 8 collectors are plumbed in series in “loops” to provide up to 250° C gain from inlet to outlet. Multiple parallel loops provide the required field capacity		
Ambient temperature	-40C to 55C		
Design wind resistance	Survival:	42.5 m/s gust	(95 mph)
	Operation:	15.6 m/s sustained	(35 mph)
Design seismic resistance	Up to 0.5g equivalent lateral force		
Installation slope (typical)	Up to 4% gradient		

1. Based on mirror and receiver cleanliness 97% and 98%, respectively; normal incidence and 1000W/m² direct normal insolation
2. Single collector at near-ambient operating temperature; nominal conditions; 1000 W/m² direct normal insolation
3. Based on 55.5% (lg industrial) /57.2% (utility) annual efficiency and annual direct normal insolation 3000 kWh/m²



Component Specifications
(± indicates typical specification)

Mirror	Rioglass Solar 1.5m x 1.7m facets, 4mm thickness Tempered low-iron glass Silver reflector, average specular reflectance ≥94% Facet slope accuracy ≤1.5mrad std. deviation
Receiver	Rioglass UVAC or Huiyin ±90mm evacuated receiver ±2.5mm wall steel absorber with selective coating; absorbtance >96%, emittance ≤10% ±135mm OD borosilicate glass envelope w/ antireflective coating; transmittance >96%
Drive Actuator	Dual-cylinder hydraulic linkage (standard utility CSP type) Prepackaged hydraulic power unit (HPU) with accumulator; ±2kW (1.5hp) 3φ 480V motor Sun tracking accuracy ≤1 milliradian (std. deviation) 200° range of motion
Rotation bearings	Maintenance-free permanently-lubricated
Steel components	Light-gauge steel profiles; processing extensively mechanized
Corrosion protection	Specified to at least category C2 per ISO 12944
Fasteners	Structural rivets and bolts. No welding onsite (exc. receiver piping)

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About Solar Dynamics LLC

We are a team of experienced Concentrating Solar Power (CSP) professionals with the common goal of delivering products, services, and projects that enable the U.S. and the world to move to a sustainable and reliable carbon free energy supply to help address climate change in an economic manner.

The market for solar energy is changing. As the world moves to greater penetrations of wind and photovoltaics and industries move to decarbonize, new more flexible renewable energy resources will be needed. CSP can provide power when the sun isn't shining, a key advantage. The same technologies can also provide a steady supply of renewable heat for thermal process applications. In both roles, the high efficiency and low storage costs of concentrating solar systems are emerging as critical enablers of a cost-effective transition.

Our proprietary technology focus is in parabolic trough and heliostat collector systems and developing advanced designs to maximize cost-competitiveness and reliability.



SunBeam™ Parabolic Trough Concentrator
Full scale test module at Solar Dynamics test center



SunRing™ 27m² Wireless Heliostat
Full scale test unit at Solar Dynamics test center

Solar Dynamics LLC
Colorado | USA

www.solardynllc.com

For further information, please contact: info@solardynllc.com

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U.S. DEPARTMENT OF
ENERGY | Office of **ENERGY EFFICIENCY
& RENEWABLE ENERGY**
SOLAR ENERGY TECHNOLOGIES OFFICE

About the Solar Energy Technologies Office

The U.S. Department of Energy Solar Energy Technologies Office supports early-stage research and development to improve the affordability, reliability, and performance of solar technologies on the grid.

Learn more at energy.gov/solar-office.