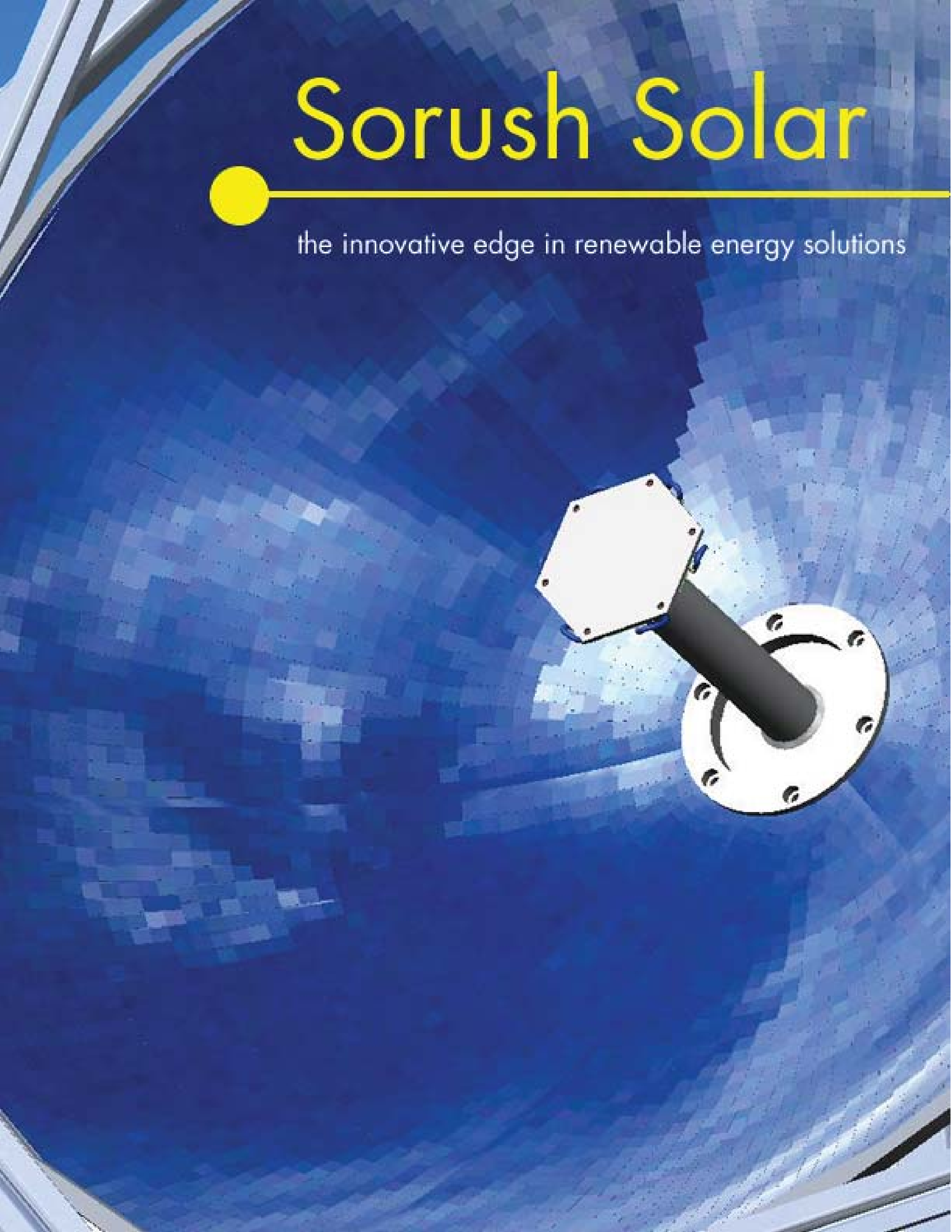
Sorush Solar

the innovative edge in renewable energy solutions

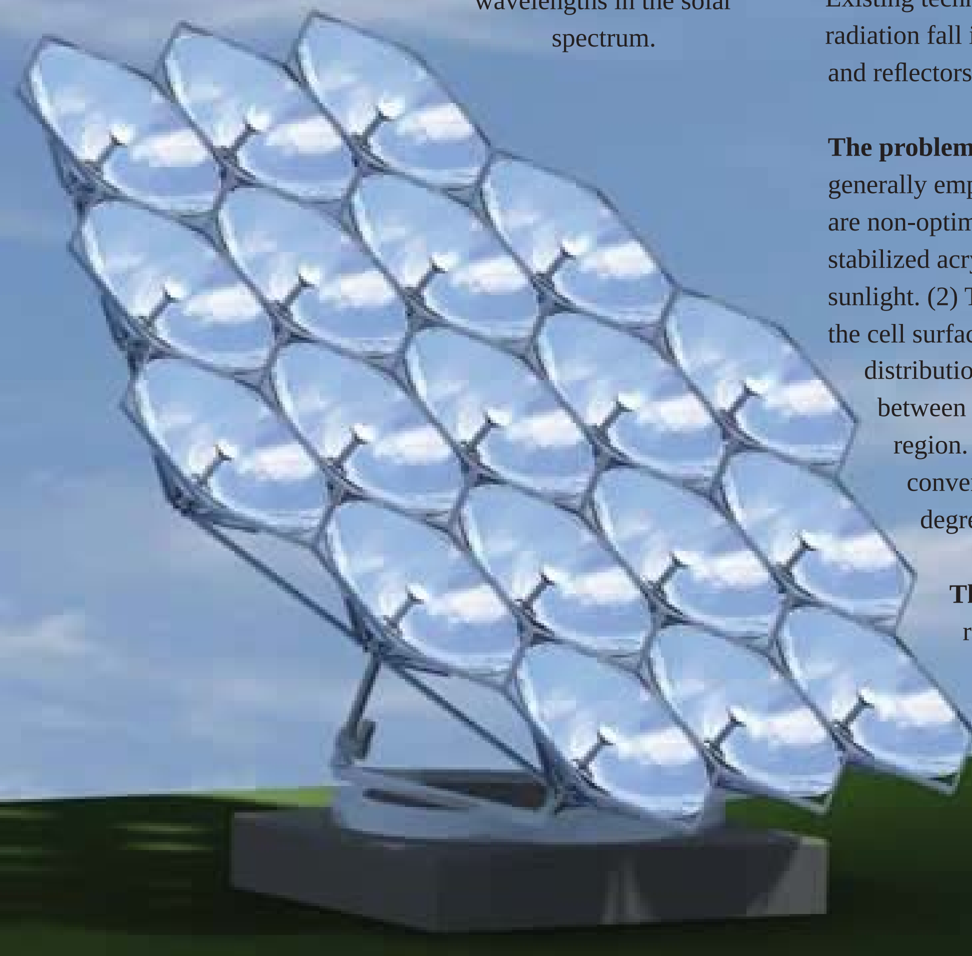


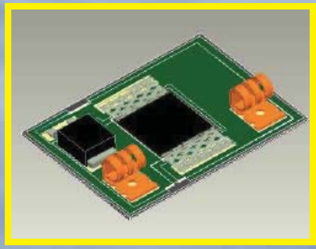
Unlocking the power of concentrated solar electric power generation...

Sorush Solar's innovative concentrator technology will siginificantly increase the efficiency of photovoltaic systems used in both residential and commercial installations. Our mission is to create well-engineered, weather-resistant solar electric generating equipment at prices competitive not merely with traditional solar arrays but with traditional fossil fuels as well. Our ultimate goal is to help America and the world break our dangerous addiction to fossil fuels.

New technology means new opportunities

Triple-junction photovoltaic cells offer the highest efficiencies yet in converting solar radiation into electric power. Efficiencies of 37% are available in commercial cells. Efficiencies of 40% are achieved under laboratory conditions, and efficiencies of over 60% are theoretically possible—and promised in the near future. Triple-junction cells achieve their high conversion efficiencies by recovering energy in three layers of the cell. Each layer is designed to extract energy from a different range of wavelengths in the solar spectrum.





Triple-junction cells are, however, one hundred times more expensive to make than silicon cells. As a consequence they cannot compete economically with silicon until the solar irradiance on the cell surface is increased by a factor of 100. Fortunately, with the right collector design, solar radiation can be concentrated by a factor of 1,000 or more, radically increasing the electrical output from a triple-junction solar cell. And it is at these concentration levels that this technology offers an opportunity to generate economically viable solar electric power.

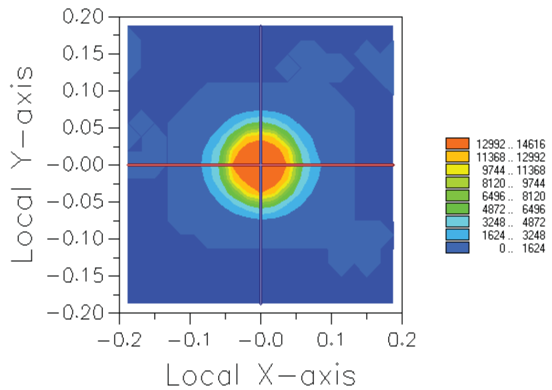
Sorush Solar has developed a breakthrough patent-pending technology that will finally make the promise of high-efficiency triple-junction solar cells a reality.

The technological challenges

Existing technical solutions for concentrating solar radiation fall into two broad categories. These are refractors and reflectors.

The problem with refractors. Refracting systems generally employ acrylic Fresnel lenses. Fresnel lenses are non-optimal for three reasons: (1) Acrylic—even UV-stabilized acrylic—has a short lifespan under exposure to sunlight. (2) They introduce chromatic non-uniformity on the cell surface. (3) They create a round aspect irradiance distribution with a high degree of intensity difference between the central peak value and the nearby annular region. The semiconductor material is not able to convert sunlight efficiently when there is a high degree of non-uniform illumination.

The problem with reflectors. Conventional reflecting concentrators do not introduce chromatic non-uniformity, but they do produce intensity non-uniformity. As a result, cell performance is compromised. Secondary and tertiary components must be added to the optical path to compensate for these problems. The penalty for adding these additional components is added cost, complexity, alignment difficulty, efficiency losses, and rapid decay due to high solar flux. The best design accomplishes the 1,000-power concentration effect while preserving spectral and intensity uniformity with a single reflecting interaction.

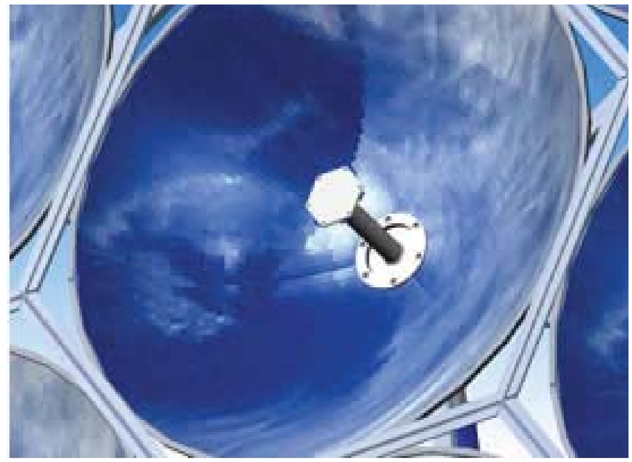


This image shows intensity non-uniformity, which is a consequence of conventional Fresnel refractors and reflector concentrators.

The problem of heat. Another challenge is that high concentration solar designs also produce a lot of heat. (Remember: If 40% of solar energy is converted to electricity, then that leaves 60% as heat.) Finding ways to dissipate this heat safely is a major challenge for the technology.

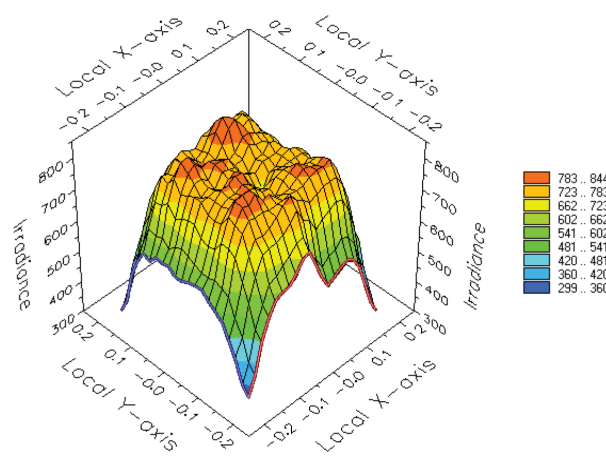
The tracking problem. The final challenge for this technology is that concentrated solar electric power generation devices must track the sun. This is a consequence of high concentration optics and the inevitable laws of physics. The tracker design must be light, rigid, and optically robust under non-ideal ambient conditions. It also requires a stable support structure and optical design that is not degraded by alignment error. High-quality reflectors also need protection from adverse weather conditions; wind, dust, rain, and humidity all conspire to permanently degrade reflector performance.

The Sorush Solution



The Sorush faceted reflector design

The Sorush Solar Concentrator achieves the 1000-times concentration using reflecting facets. Each facet is positioned and shaped so that it is an exact projection of the receiving cell on to the reflecting surface. Advanced, computer-optimized optical design is used to specify the shape and orientation of each of the 1,100 facets that reflect light on to the triple-junction cell. This is the only way to achieve the required rigorously uniform irradiance distribution required for optimal power generation. Additionally, since the concentrator is a reflector, no chromatic aberration is present. To the best of our knowledge, no other solar concentrators have followed this approach.



Uniform irradiance distribution across the surface of a triple junction cell, provided by the Sorush reflector.

The mission of Sorush Solar is to create well-engineered, weather-resistant solar electric generating equipment at prices competitive not merely with traditional solar arrays but with traditional fossil fuels.

Our reflecting dish is composed of six sectors. Each sector is provided with the above-described 1,100 facets. The six receiver assemblies are thermally bonded to the central support structure, which as been provided with water channels for the removal of excess heat. This turns what could be a disadvantage—the heat production inherent in concentrator technologies—into a valuable resource, providing hot water for residential or industrial applications.

Our design allows us to place the receiving structure below the lip of the reflector and close to the vertex. Optically, this means the optics are "fast," and fast optics, in this situation, result in a design that is forgiving of alignment error. Because the receiver is below the lip of the dish, we can cover the module with a flat glass. This provides protection from adverse ambient conditions and protects the module from dust and water.

Our Tracker

The production design Sorush system consists of a molded glass, faceted reflector mounted in a carbon fiber 3D truss. This provides maximum rigidity and minimum weight. The tracker uses a carousel for the vertical axis with a tripod support structure. The third leg of the tripod uses an electrically powered linear actuator to control the elevation of the array. The computer-controlled tracker uses a hybrid strategy of power maximization and ephemeris calculation to insure optimum alignment throughout the day.

Stable tri-pod tracker provides light and rigid space frame with high accuracy and resistance to wind loading forces.

Utility-Scale Power Generation

Nineteen modules in this array generate 4.5 kWp electric power.

There is a growing consensus that the economics of concentrated solar photovoltaic power generation favor large-scale production. This means it's particularly suited for use by public utility companies. The Sorush system, shown here, is composed of nineteen modules mounted to a single tracking space frame. Overall dimensions for the collection optics are 5m x 5m. The design power production for this array is 4.5kWp. A production facility consisting of 250 arrays in a geographical location characterized by high insolation would produce 1MWp.

A Bright Future

Weaning the world from its dependence on fossil fuels is the central technological challenge of our time. At Sorush Solar we are proud to be laying the foundation for a new, clean and secure energy future for America and the world.

Our Team

Inspired by his observations of advanced solar technology research in Israel, entrepreneur **Gideon Sorokin** decided to found a solar energy company in the United States with the goal of making solar energy affordable and available on a mass scale. He recruited mechanical engineer and inventor **Christopher Rush** to help develop the next generation of low-cost, efficient, solar energy equipment, based on concentrated solar photovoltaics.

CONTACT: *www.sorushsolar.com.* Gideon Sorokin, sorokin1@pacbell.net, 415.789.5303 or Christopher Rush, crush@sorushsolar.com, 707.887.1668