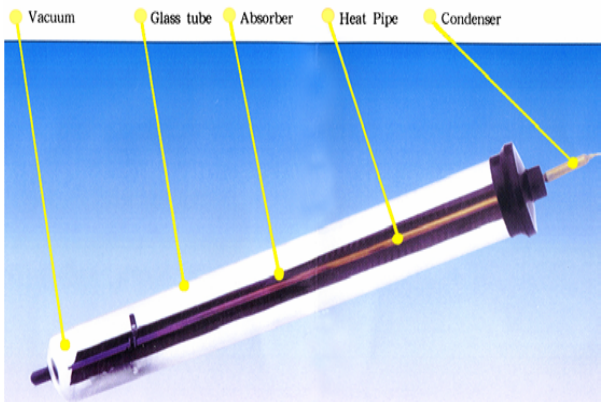
What is Heat Pipe Technology ?

R & D work for the SEIDO line of evacuated tubes using heat pipe technology was carried out by the Daimler-Benz Aerospace Group based on experience gained in the temperature control of satellite electronics.

The main component of a SEIDO collector is the aluminum absorber mounted in an evacuated glass tube. The absorber, coated with a special aluminum nitride layer, converts incoming solar radiation to heat. The special coating absorbs more than 92% of the arriving radiation, but radiates less than 8% back to the environment.

Heat transfer from the absorber to the fluid circuit is performed by the **"heat pipe".** A heat pipe is a closed system, carefully evacuated and charged with a small amount of water before it is sealed. The absorber imparts heat to this water, causing it to evaporate. The steam rises to the upper end of the heat pipe where it transfers heat to the fluid circuit via a metallic conduction bridge. Being a "dry" connection, fluid in the heating circuit does not flow through the collector.

The absorber and heat pipe are mounted in a sealed evacuated glass tube, cutting heat losses via conduction and convection. The stable vacuum assures that the collector performs at low outside temperatures and protects the absorber against the environment.



Our Objective

To ensure a high level of customer satisfaction with our products, technology and service.

Whether residential, commercial, or institutional applications, SUNDA draws on a world of experience to provide you with qualified technical support in planning custom solar thermal systems at a competitive price.

High-tech solar meets old world charm

For more information on SUNDA evacuated tube solar collectors, please contact:

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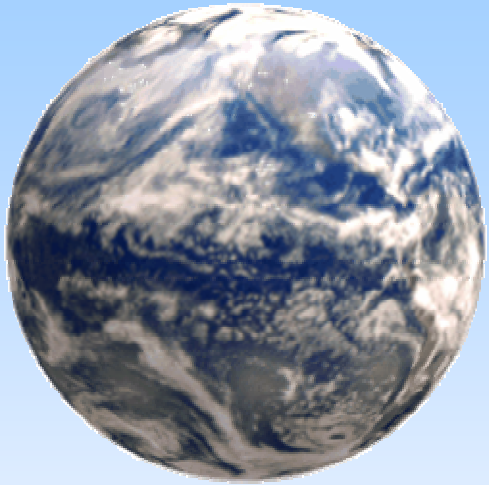
SUNDA SOLARTECHNIK

aerospace technology for a world of water heating needs



The *SEIDO* Line of Evacuated Tube Solar Collectors for...

- **Sanitary Water**
- **Home Heating**
- **Pool Heating**
- **Air-Conditioning**
- **Desalination**
- **Industrial Process Heat**

Americans are saying they want solar

According to a survey conducted for the U.S. Department of Energy's National Renewable Energy Laboratory…

- *43% of respondents agreed that solar water heating should be standard on all new homes.*
- *40% indicated a willingness to pay more on their mortgage to have solar installed.*
- *76% perceive a clear advantage of solar water heating is saving money.*
- *78% indicated that if their home builder had recommended solar, they would have either seriously considered it or wanted to learn more.*
- *82% strongly favored using clean energy and helping the environment.*
- *Over half agreed that solar made economic sense.*

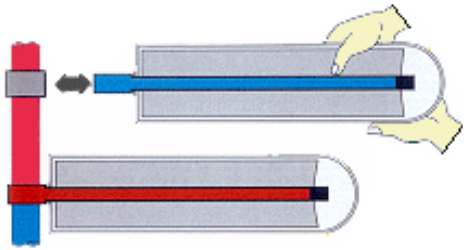
Source: "Report on Solar Water Heating Quantitative Survey" (1997-98) by Focus Marketing Services, for National Renewable Energy Laboratory (NREL), Golden Colorado and Solar Energy Industries Association (SEIA), Washington, D.C.

Advantages of Evacuated Tube Technology over Flat Plate Collectors

Easier Installation - One person can quickly and easily install a SUNDA collector without a hoist or special tools because the vacuum tubes, manifold, and frame are installed separately. This unique feature results in substantial savings in installation time and expense. This is not possible with most flat plate products because of their one-piece construction.

Superior Insulation - As any good thermos bottle proves, there is no better insulator to heat transfer than a vacuum. SUNDA's glass tubes are evacuated to 10^{-5} mbar, which provides excellent resistance to heat losses via conduction and convection, even under extreme environmental conditions like cold winter temperatures and wind. Flat plate collectors lose a considerable part of the heat energy collected back to the environment.

Easier Servicing - Since the evacuated tubes are installed in the manifold via dry connections, any tube can be replaced without shutting the system down. Flat plate systems must be shut down and drained.



Longer Life - High vacuum protects the absorber surface from moisture, condensation, corrosion, and degradation of the selective coating over the entire life of the collector, which easily exceeds 15 years. Flat plate collectors are not immune to these effects since air contacts the absorber and all interior surfaces.

Better Efficiency - Vacuum technology insures a high year round efficiency. Flat plate collectors are less efficient during cold seasons.

Dual Use Potential - Domestic water and space heating are possible.

Better Conversion Threshold - More energy is collected earlier in the day and during partly cloudy days because of the special absorber coating and superior insulation.

An optimally sized SUNDA system can provide from 65% to 70% of a typical household's hot water needs, and up to 100% during the summer.

A business can save 40 to 80% on electric or fuel bills by replacing its conventional water heater with a solar heating system. ***(source: Solar Energy Industries Association, www.seia.org)***