



Solar and Energy Empowerment in Conservative Judaism
“Stewards of the Land” - Shomrei Haaretz
Federation of Jewish Men’s Clubs
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Brief #: SH350

Title: Solar Ner Tamid Typical Components

Discussion:

The Solar Ner Tamid is a very simple concept that requires a professional approach to implementation because it is part of the structure of our sanctuary. Happily there are many solar energy companies and electric contractors who can guide your specific implementation once they understand the specific requirements.

At the simplest, the need is to collect energy from the sun, store it as electricity and use it efficiently to create a small spot of light 24 hours a day 365 days a year. From Jewish tradition we posit a goal that enough energy is stored to permit the light to remain bright for a full 8 days of cloudy weather.

The following paragraphs give more information than you may want to know but are important for communication with the professionals who will be implementing the system – to help them understand the real needs.

A hobbyist would create his solar Ner Tamid from marine, recreational vehicle and home alarm system components. It is ideally run at 12 volts DC to maximize efficiency and to minimize electrical safety and code issues. The key components are a solar panel, a lead acid battery with charging controller and a high efficiency LED (light emitting diode) bulb. The typical design envelope provides for enough battery storage for 8 days of operation with cloudy days. An appropriate LED bulb uses 2 Watts of energy, as bright as a 25 Watt incandescent bulb, consuming about 50 Watt-hours of electricity in a 24 hour day.

Solar panels are normally rated based on receiving full sun for 4 hours a day. This takes into account the inefficiencies from different angles of sun over the day and some degree of cloudiness. Location and orientation of your solar panel is not to be taken lightly. Shadows from trees, placement at the right angle from the horizontal for your location (about 35% in the northern USA) and facing due south are critical. Panel efficiency can drop by 90% with shadows and orientation compromises. Panel efficiency drops with extremes of temperature as well. A 30 Watt solar panel, typically 1.5 x 3 ft in area, is expected to generate 120 Watt-hours of energy each 24 hour period.

Energy storage is achieved with an AGM dual purpose sealed lead acid battery. Note that an automotive battery is not appropriate as their life is shortened by significant cycling of the energy stored. A U-1 size weighs about 25 pounds. It is typically is rated at 32 amp hour capacity at 12 volts DC or 380 Watt hours available storage capacity. Each day the fully charged battery would use less than 120 Watt hours of this 380 Watt hour capacity – the lamp uses 50 Watt-hours a day. This type of battery is typically rated for 300 plus full discharges and has a 5 year warranty.

For a string of cloudy days with, say, only 25% of the normal 120 Watt-hours generated by the solar panel, 30 Watt-hours, the charge in the battery would drop from 380 to 330 the first night and rise to 360 the first cloudy day, drop from 360 to 310 the second night and rise to 340, dropping 20 Watt-hours each day – until it goes dead after 19 days. This is well above our 8 day Judaic based requirement. When bright sun returns the battery would be brought back to its fully charged level.

Applications requiring a brighter bulb or with less sunlight available would need to be adjusted from the above model. It may be preferable to use more solar panel area in a partially shaded location to achieve the required charging capacity.

Other components include boxes for the battery, waterproof connectors and outdoor rated 18 gage wire, a fuse, a controller to keep the battery from being overcharged and from being over-discharged, a meter to observe the condition of the battery and the amount of energy created by the solar panel, and the base and bulb for the lamp. For distances up to 200 ft, the voltage drop in the wire is an acceptable 5% or less.

Wiring requires careful negotiation with your electrician. Typically the Ner Tamid is on a separate circuit from other lighting so that it remains on when the room is otherwise darkened. The electrician can remove the wire to the Ner Tamid from the electrical panel and connect it to the battery system through a new panel that only contains 12 volt wiring. The panel may also contain the battery and battery charging controller. The LED bulb can be expected to have an 8 year minimum life and the battery at least 5 years life. Adapters may be necessary to match the base of the available bulb with the socket of an existing Ner Tamid.

A hobbyist system can be created with components from West Marine using their 15 watts panel, available mounting bracket, battery charging controller, U-1 sized AGM battery, battery box, fuse and holder and wire. Twelve volt low energy LED bulbs are available there and at www.superbrightleds.com . A useful watt-hour meter is available at www.rc-electronics-usa.com . The cost for this assembly is about \$400.

A turnkey 30 Watt solar system that your electrician would wire to your existing lamp, changing the bulb with one obtained from the vendor above and using various base adapters, can be obtained by working with www.ctsolar.com for about \$900.

Note that the solar ner tamid will never be a significant energy saver; however, like a work of art it can become a source of pride and focus in a community that holistically becomes a “Steward of the Land”.