The Solar Power&Water System

The Problem:

Fresh water shortages, agricultural drainage cleanup, and the need for low cost renewable energy.

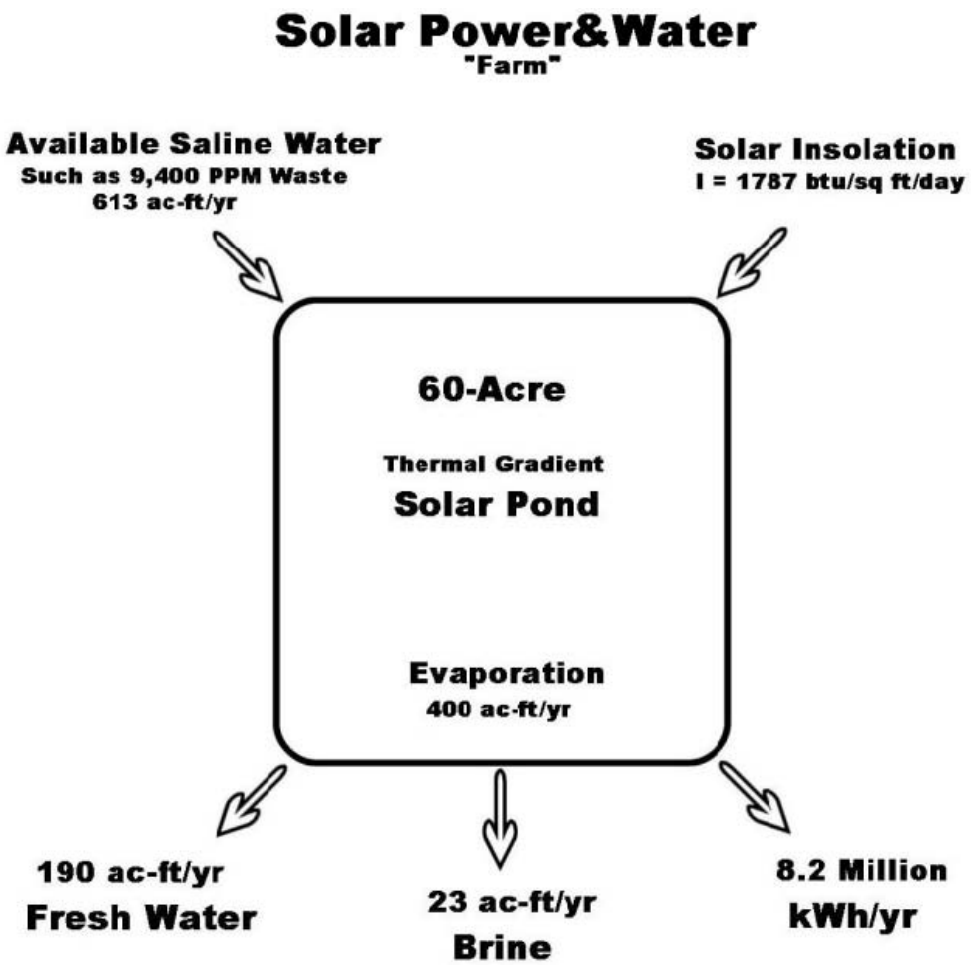
Our Technology:

The Solar Power&Water system uses a salt gradient solar pond and a new prime mover (engine) designed to extract power directly from the pond's hot brine. Salt gradient solar ponds were not invented; they were discovered in nature and first observed in Transylvania, Romania, in the early 1900s. Solar ponds work in winter, even when covered with a sheet of ice and surrounded by drifts of snow. The new prime mover design is a derivative of a prior machine, which operated for thousands of hours on geothermal brines. The pond and engine are existing technology, which, combined as in the Solar Power&Water System, offers advanced technology.

Our technology produces both power and fresh water using agricultural wastewater, brackish/saline water, or ocean water, and sunshine.

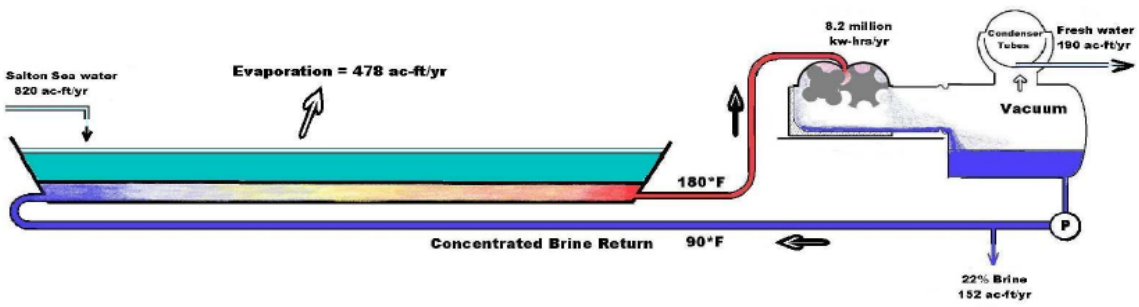
Our technology can also be used with the waste brine stream produced by reverse osmosis (RO) desalination. It is important to point out that the fresh water output of RO membranes is temperature dependant. Raising the feed temperature from 70 F to 110 F doubles the output. This can be done using a little of the heat in the pond. Increased membrane output, plus cheap in-house power driving the RO process, significantly reduces costs. The net result is a combined plant that produces low cost power and fresh water. A solar-based power plant also being a desalination plant with or without RO is a new concept offering tremendous benefits.

Shown is an input/output balance for a representative 60-Acre pond supplied with RO wastewater. Different input salinities do not change the power and fresh water outputs.



System Cycle

The Solar Power&Water system uses a proprietary low-temperature prime mover. The system has no boiler. Instead hot brine from the pond is flashed within the prime mover. Fundamental is that the hot brine follows isentropic expansion from the saturated liquid line. This is clearly shown in the "Thermodynamic Properties of Water" by Keenan and Keyes. The prime mover inlet receives only hot brine and the outlet yields depleted brine and water vapor. The water vapor is condensed to produce fresh water and the depleted brine is returned to the pond to be reheated, thus completing the cycle. We call it the Sprankle cycle.



Hot bottom layer brine from the pond flows into the expander which drives a generator to produce electricity. Pond and expander and rates are sized so as to drive a 1-MW synchronous generator for electricity production. Steam exiting the expander is condensed, yielding distilled water, and the residual brine is more concentrated than was drawn from the pond.

For a 1 MW, 1200 RPM size generator, the prime mover-generator drive train weight is estimated at 40,000 lbs. Estimated cost for the first unit is $3 million. Annual income depends on the sales of the 8,200 MWh/yr energy and the190 af/yr water produced.

The following is a comparison of solar power systems.

SOLAR POWER SYSTEM COMPARISONS

A. Desert Water Agency PV (photovoltaics), http://www.caprep.com/b0405024.htm

B. Semitropic Water Storage District PV,
http://www.energyvortex.com/pages/headlinedetails.cfm?id=1937&archive=1

C. APS STAR Center trough,
http://www.aps.com/images/pdf/SolmatesFall05.pdf (p3)

D. LVVWD Distributed Solar PV,
http://www.lvvwd.com/html/about_facilities_solar.html

E. PowerLight PV,
http://www.powerlight.com/company/pressreleases/2006/04.27.06_Serpa_Portugal_Worlds_Largest_Solar_Power_Plant.shtml

F. Solar Power&Water pond http://www.solarpowerandwater.com

Reported data

A. 662,000 kWh/yr, 355 kW, $2.5 million (= $3.77/kWh)
B. 1.7 million kWh/yr, 980 kW, $6 million (= $3.59/kWh)
C. 2,000 MWh, $6 million (= $3.00/kWh)
D. 5.3 million kWh/yr, 3.1 MW, $22.6 (= $4.26/kWh)
E. 11 MW, $75 million (= $ 6.82 million/MW)
F. 8,200 MWh, 1 MW, $2.5 million, 190 af/yr water, 24 hr/day (= $0.30/kWh, $2.5 million/MW)

SYSTEM	A	B	C	D	E	F
COLLECTOR TYPE	PV	PV	TROUGH	PV	PV	POND
$/kWh	3.77	3.59	3.00	4.26	?	0.30
$million/MW	6.76	6.13	?	7.29	6.82	2.5
24 hr/day	no	no	no	no	no	yes
yields water	no	no	no	no	no	yes

The Solar Power System Comparisons table compares five solar power systems and the Solar Power&Water system (SPP) on the bases of installed cost per kWh and cost per installed MW calculated from reported data. The advantages of the SPP are startling. Moreover, only the SPP produces power 24 hr/day and only the SPP produces water.

The Solar Pond/Plant team is composed of the key members behind a proposal for construction and testing of a novel geothermal engine, which was awarded 11.4% of the total U.S. Government's geothermal budget for 1975 during the energy crisis. The new engine is an improved direct descendant of the earlier machine. This earlier machine met the proposal objectives. Subsequent testing was requested by CFE - Mexico, ENEL - Italy, and Ministry of Works - New Zealand. The subsequent testing was carried out sequentially on their sites with additional funds. During the tests in Italy, 53 hours were logged while connected to the Italian electrical grid. Note: Seismic concerns must be considered in risk assessment. The earlier machine was operating in Cierro Prieto, Mexico, during an earthquake of magnitude 6.7, epicenter 1/4 mile away. The machine shifted 3/4" on its base but was unharmed. The extent to which a salt gradient pond might be upset by a seismic event is unknown, but recovery would be a minor problem.

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