Recent Developments in Israeli Solar Technology

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The Vision

David Ben-Gurion, (*Southward*, 1956)
1st Prime Minister of Israel

The largest and most impressive source of energy in our world, the source of life for every plant and animal, yet a source so little used by mankind today is the sun. …This energy can be converted into a driving, dynamic and electric force, and even after the exhaustion of all the uranium and thorium deposits from the face of the earth, solar energy will continue to flow toward us almost indefinitely.

The Early Years 1953-1973

Solar Water Heaters

Solar Water Heating Economics

System cost = $1,000 (No subsidies!)

Annual electricity saving = 2,000 kWh

Annual monetary saving = $200

Simple payback period = 5 years

Manufacturer's guarantee = 8 years

Typical system lifetime = 12 years

Israel Has No PV Systems

Why Not?

a. Space

b. Cost

The Space Problem

1 million roofs @ 1 kWp per roof

$\Rightarrow$1.5 B kWh

= 3% of Israel's present electrical usage

Israel's present electrical usage is rising

@ 4% per annum!

Conclude: Serious solar production

can come *only* from the desert

The Cost Problem

1 million roofs @ 1 kWp per roof
would cost $10 B

Israel's present generating capacity
= 10 GW

$10 B could buy another 10 GW !!!

Solar-Thermal State of the Art

Kramer Junction, California, USA (Israeli Technology)

Kramer Junction Performance

SEGS III-VII (1998)

(Scott Frier, Parabolic Trough Workshop, Ontario, Canada, Aug 16, 1999)

- Design output power = 150 MW
- Total field area = 2.53 km^2
- Total Aperture area = 1,012,000 m^2
- Gross solar output = 352.5 GWh
- For DNI/(1-ax) = 2600 kWh m^{-2} y^{-1}
- <Solar $\Rightarrow$ electrical efficiency> = 13.4%

$\Rightarrow$ 7.2 km^2 TWh^{-1} y^{-1} (cf 17 km^2 for PV)

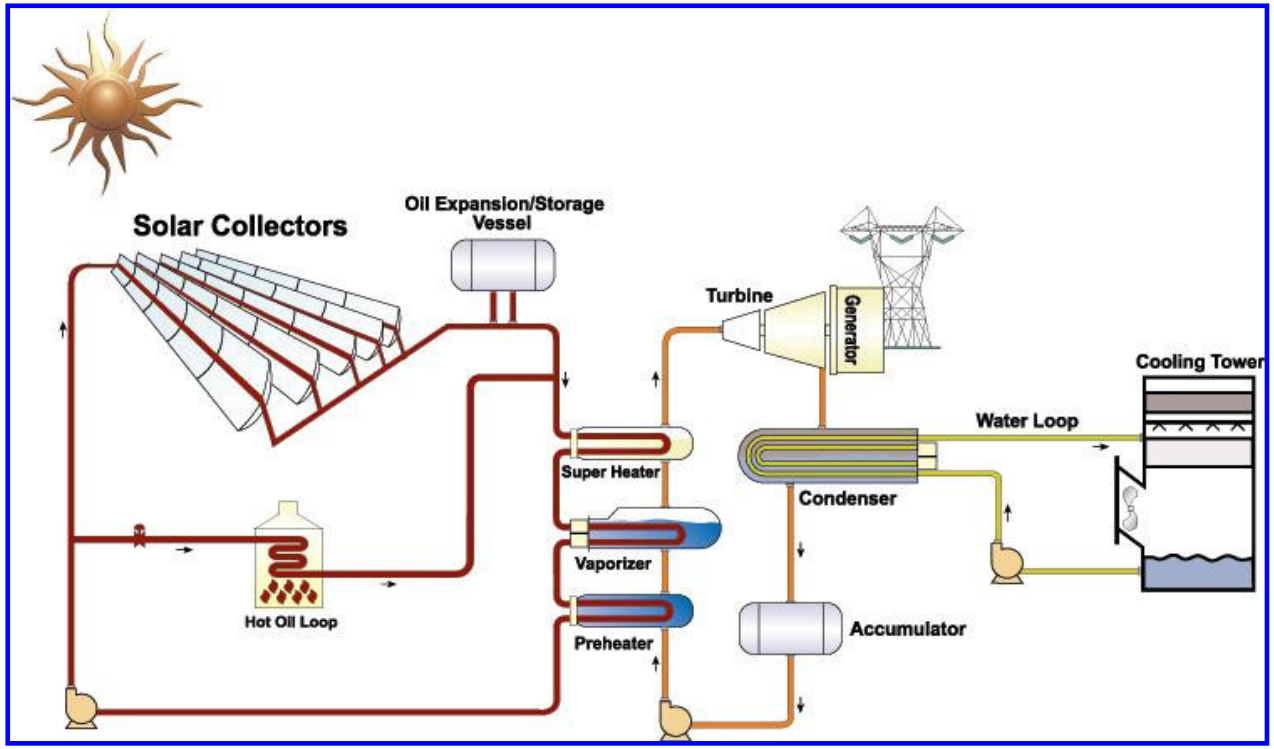
What's cooking in Israel?

Tender for 500 MWp at Ashalim site

Principal local contenders:

Solel (parabolic troughs)
Luz-II (distributed solar towers)

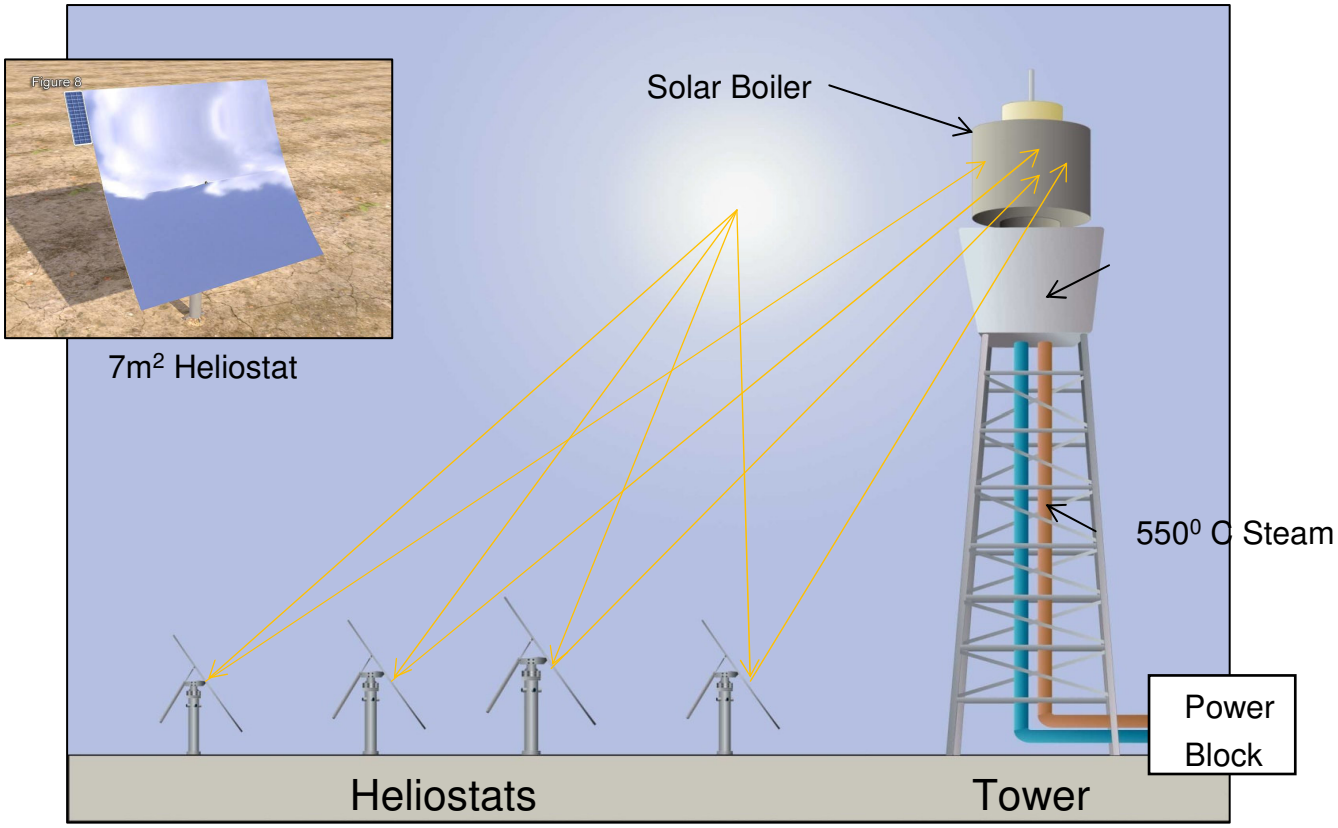
The Solel Concept



The Solel Flagship

Solel-6 collector at Sede Boqer test facility, Israel

The Luz-II Concept



The Luz-II Flagship

Luz-II DPT-550 at Rotem test facility, Israel

What else is cooking?

The revival of PV

via its concentrated light variety - "CPV"

The problem with PV is that it uses the same expensive material both to **collect** light and to **convert** it to electricity

The New PV Paradigm

Separate

Conversion from Collection

Small PV converter

Large ***low-cost*** collector

One form of CPV Technology

Passively cooled - for utility use

MST expectations

(Kurokawa et al Energy from the Desert II, 2007)

Cell efficiency = 32% ($\Rightarrow$ 40%)

Collector efficiency = 25% ($\Rightarrow$ 31%)

Collector rating = 50 kWp ($\Rightarrow$ 62 kWp)

Collector size = 200 m^2

$\Rightarrow$ 6 km^2 TWh^{-1} y^{-1} ($\Rightarrow$ 4.8 km^2)

(at projected cost of $1,150/kWp including storage)

Also in the pipeline

Solar-thermal "dish" systems
- for domestic/commercial/industrial

The 400 m^2 "***PETAL***" solar test dish at Sede Boqer, Israel

The Zenith Solar System

Combined Heat and Electrical Power (10 m^2 units)

Conclusions

Israel burns 0.25% of world's fossil fuel

$\therefore$ 0-emission would reduce CO_2 negligibly

But Israeli solar technology could make a significant contribution in the world arena

Solar-Thermal Today

Concentrator Photovoltaics Tomorrow

Thank You

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