Large-Scale Solar Power Production: Suiting the Technology to the Task

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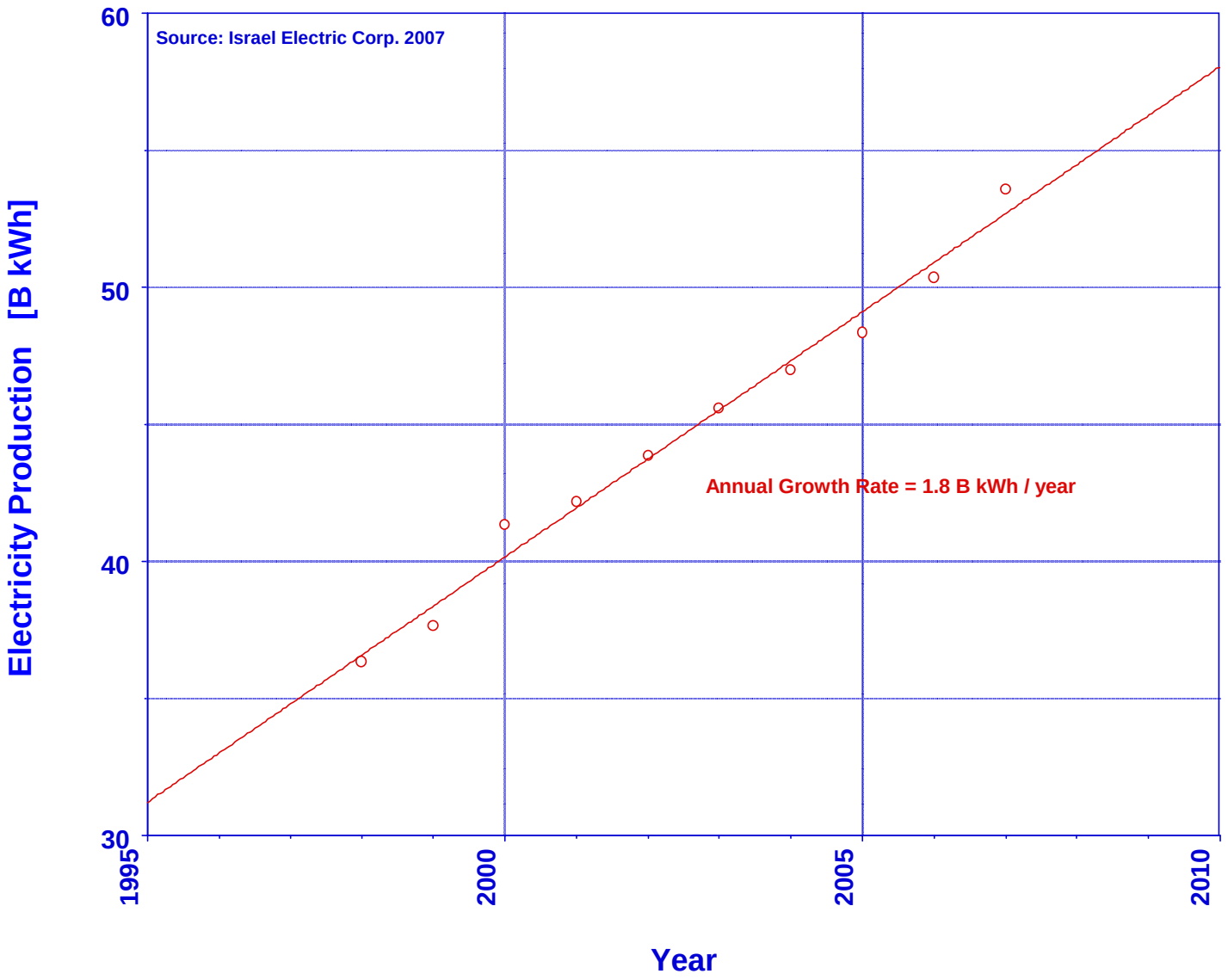
Outline

- What are Israel's electricity needs?
- What can today's technology give?
- What can we expect tomorrow?
- What should we do now?
- How can we finance it?

10 years of electricity production



Conclusion On Israel's Needs

Renewables must generate

~ 2 B kWh extra per year

every year

Just to freeze fossil fuel usage

at its present level

State-of-the-Art Desert PV

Springerville, Arizona, USA

Springerville Performance

(L.M. Moore & H.N. Post, *Prog. Photovolt: Res. Appl.* 2008; **16**:249-259)

Facts:

1707 kWh_{AC}/year/kWp (from central system)*

1398 kWh_{AC}/year/kWp (from rooftop systems)

3.51 MWp central system on 101.4 dunams

Implications:

Annual land requirement for 2 BkWh/y

= 33.8 km^2 each year! (33.2 km^2 @ Ashalim)

*Sede Boqer tests confirm efficiency of Springerville-type PV panels

1 Million Rooftop Systems ?

1 kWp = 10 m^2 each system
(assuming there is enough room!)

$\Rightarrow$1.4 B kWh/year

Not even enough to freeze 1 year of growth!

Solar-Thermal State-of-the-Art

Kramer Junction, California, USA

Kramer Junction Performance

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

Facts:

2,350 kWh_{AC}/year/kWp (Luz)

150 MW system occupies 2.53 km^2 land area*

Implications:

Annual land requirement for 2 B kWh/y

= 14.4 km^2 each year (19.0 km^2 @ Ashalim)*

*Sede Boqer tests indicate considerably higher efficiency for Solel receiver tubes

Conclusions for today's solar technology

Put it in the Negev/Arava - not on roofs

Land needs for parabolic trough solar thermal approximately 2x less than for PV

We need to install at least 850 MWp per year

What Can We Expect Tomorrow?

CPV (= Concentrator photovoltaics)

Brings us back to PV but

Reduces PV material requirements
by a typical factor of 1000*

Should reduce system cost < $1/Wp

*Amply confirmed by EU-funded research at Sede Boqer

Two Varieties of CPV

Zenith-Solar*:
industrial/domestic scale
- generates electricity
plus thermal energy

Both systems should be competitive with fossil fuel without need for subsidy!

*** In conjunction with BGU @ Sede Boqer**

MST: utility scale
- generates only electricity
  2 B kWh from < 12 km^2

What Should We Do Now?

1. Promote massive energy savings
2. Start building solar-thermal systems
3. Subsidize CPV demo systems
4. Massively fund R&D

How to Finance all this?

via a 2 US¢/kWh levee on electricity

Generates $1B per year =>
MMM$ cash prizes + BBB$ for RD&D

10% electricity saving = 5 B kWh/y