International Energy Agency

CO-OPERATIVE PROGRAMME ON PHOTOVOLTAIC POWER SYSTEMS

Task 1
Exchange and dissemination of information on PV power systems

National Survey Report of PV Power Applications in Israel
2003

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1 Executive summary

1. Installed PV power: Total installation of PV in Israel has remained essentially unchanged for the past 3 years, at approximately 30 kW. Typical applications also remain the same: irrigation systems, consumer and remote houses, security and communications.
2. Costs & prices: Typical module prices range according to the size of system being installed, ranging from 22.5 - 28.35 NIS/ W.
3. PV production: Not Applicable.
4. Budgets for PV: R&D budget from Israeli government sources during 2003 was NIS 1,035,000.

2 The implementation of PV systems

2.1 Applications for photovoltaics

Virtually the entire PV market in Israel is for off-grid projects, as in the past. Through 2003, there was still no standard procedure for connecting PV to the national grid, so such projects were extremely limited. PV is used in: agriculture (computerized irrigation systems), remote homes, defense and communications. There is some additional use of PV among the non-urbanized Bedouin population, with hybrid systems (usually PV-wind) increasing in popularity. In some cases, outside funding has made this possible.

In 2004, proposals for clean-energy premiums and grid-connection standards for clean energy production were issued, and the market (both distribution and potential purchasers) is looking forward to seeing an increase in PV grid-connected projects. It is still too early to predict a precise effect on the PV market, e.g. will it become primarily small consumer driven, or will there be someone willing to become a private commercial energy producer, using PV?

Israel's primary emphasis on solar energy electricity production remains solar-thermal. The plans to build a 500 mW parabolic trough plant (in increments of 100 mW at a time) are proceeding through the system, and a site has been approved by the national planning board at Ashalim, in the Negev.

Following are examples of some typical applications:

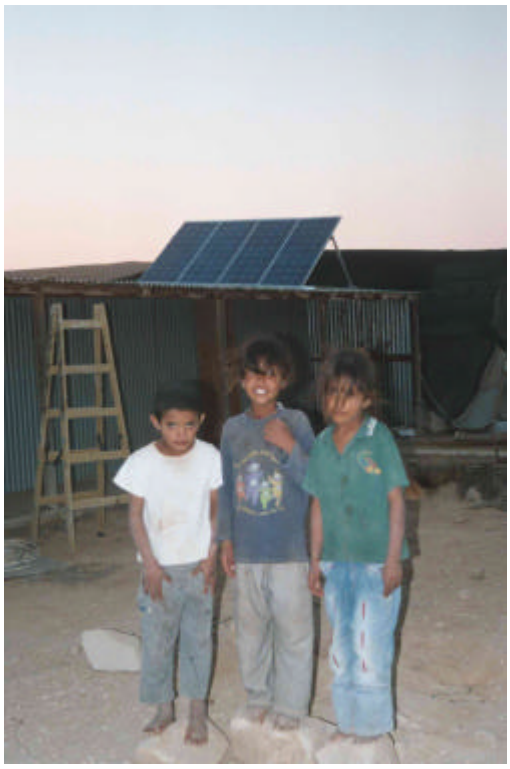

Figure 1: Bedouin village, south of Israel, not connected to the electricity grid. The family of Suliman now has a hybrid PV-wind system totaling 400W, enough to provide lighting, refrigeration and TV. Note that this use of hybrid-systems is attractive to this sector. [Provided by Solarpower Co.]

Figure 2: City of Carmiel, in the Galilee. The owners of a supermarket chose PV as the choice for adding lighting to their parking lot, primarily as the least expensive method. The system consists of three double and two single poles, which automatically turn on at sunset and turn off at midnight. . [Provided by Solarpower Co.]

Figure 3: Village of Klil, a solar village established about 20 years ago, was never connected to the grid. The families need to continue adding power for larger families and new needs, with PV still filling a major niche. This new home shows an installation of Wp, 400AH/12V batteries and a 1500W Inverter [Provided by Interdan Co.]

Figure 4: *Environmental-Education Park*, near Modi'in Israel. A hybrid PV-wind system is the sole method of powering inter-active exhibits, in line with their ideology. The systems consists of eight 100 W panels and a small wind turbine (not pictured). [Provided by Solarpower].

2.2 Total photovoltaic power installed

Table 1 The cumulative installed PV power in 4 sub-markets.

Sub-market/ application	31 Dec. 1998 kW	31 Dec. 1999 kW	31 Dec. 2000 kW	31 Dec. 2001 kW	31 Dec. 2002 kW	31 Dec 2003 kW
off-grid domestic ##	88	181	221	253	283	313
off-grid non-domestic ##	200	200	200	200	200	200
grid-connected distributed	6	6	6	6	6	6
grid-connected centralized	14	14	14	14	14	14
TOTAL	308	401	441	473	503	533

Notes

1. ## A single figure is provided for total new applications because grid-connected systems are still not legal, therefore not reported as such by the distributors/installers.

2.3 Major projects, demonstration and field test programmes

We have learned of no new major projects or initiatives which actually began implementation in 2003. The projects reported last year for implementation by the Israel Electric Corporation's R&D department encountered some difficulties in start-up, but they finally issued a call for public tender in 2004.

2.4 Highlights of R&D

All of Israel's universities and some hi-tech start ups continue research on various PV-related projects. Basic research includes studies of materials, including fullerene, silicon, cadmium telluride, copper indium-di-selenide; dye sensitized solar cells, design synthesis, characterization and application of a full solar cell; Modelling of solar devices and systems; and energy conversion and storage devices; and the

fabrication technology of Si solar cells (single and multi-crystal, and bifacial) at the Center for Photovoltaic Solar Energy at the Jerusalem College of Technology. Teams at Ben-Gurion University are investigating various technologies for Concentrator Photovoltaics (CPV). MLM-Israel Aircraft Industry had developed and proven in concept a CPV product.

2.5 Public budgets for market stimulation, demonstration / field test programmes and R&D

Table 2 Public budgets (in National Currency) for R&D, demonstration/field test programmes and market incentives.

	R & D	Demo/ Field test	Market
National/federal	NIS 1,035,000	-	-
State/regional			
Total	NIS 1,035,000		

3 Industry and growth

3.1 Production of feedstocks and wafers

There is no production of feedstocks and wafers.

Table 4a: Typical module prices (NC) for a number of years

Year	1992	1993	2003
Module price(s):			22.5 - 28.35 NIS/ W

3.3 Manufacturers and suppliers of other components

N/A

3.4 System prices

Table 5: Turnkey Prices of Typical Applications

Category/Size	Typical applications and brief details	Current prices per W in NC
OFF-GRID Up to 1 kW	Domestic, including installation Non-Domestic (normally without installation, 3rd party purchase)	NIS36 - 50 NIS31.5-45
OFF-GRID >1 kW		
GRID-CONNECTED Specific case		
GRID-CONNECTED Up to 10 kW		

3.5 Labour places

An estimate of **labour places** in the following (where these are mainly involved with PV):

a) Research and development (not including companies); Academic= 70
b) Manufacturing of PV system components, including company R&D; Not Applicable
c) All other, including within electricity companies, installation companies etc. 20

The source of this information: direct reports from distributors and academic heads of projects.

3.6 Business value

Insufficient information.

4 Framework for deployment (Non-technical factors)

4.1 New initiatives

The Israeli government has proceeded with implementation of its decision of November 2002 to increase the production of clean energy, though these did not affect the 2003 market, and it will probably not directly affect the market during 2004.

As previously reported, the primary vehicle for implementing this policy is approval of a 500 MW solar-thermal power plant. This large project, utilizing Israeli technology, has continued to progress through the approval process, and in February 2004, the land allocation was approved.

The Israeli government and the Israel Electric Corporation (IEC, Israel's monopoly power company) issued a number of complementary draft provisions in the spring of 2004, which could have significant impact on the clean energy market in general, and PV in particular. They are:

4.1.1. Ministry of National Infrastructures: Revision of Electricity Regulations

The Minister of National Infrastructures issued a draft of the "Revision of Electricity Regulations (Transactions with Licensee of Supplier of Essential Service) -2004". The stated purposes of the new policy are: a) Enlarge Israel's electricity production capacity and provide sufficient reserves[1], through encouraging private producers, including special financing opportunities; b) create conditions for fair competition and encourage private producers to sell directly to their consumers/customers; c) **encourage the production of electricity by efficient technologies or those with high environmental value.** Though

[1] Note: Israel is an "island" in terms of electricity production, and must supply all its own needs.

not dedicated solely to renewable energies, the law does specifically mention them, through encouraging private electricity producers to enter the market. The significance of this new legislation lies in the fact that the IEC will no longer have a monopoly over production of electricity - and which methods to encourage - though it will continue to be the sole deliverer.

Of particular interest to the PV market are: a) the encouragement of commercial size renewable energy production; and b) the recognition and permission to link households, via a net-metering scheme.

4.1.2. Public Utility Authority Electricity - Renewable Energy Premiums

In an effort to internalize the negative externalities associated with fossil fuel based electricity production, the Public Utility Authority - Electricity (PUA) has decided to issue premiums for the production of renewable electricity. These "Environmental Premiums" will be restricted to specific renewable sources of energy, where the primary source of energy is renewable. Although premium payments will be available to both large and small (residential) power producers, the current regulations apply solely to the non-residential power producers. Regulations applying to residential users will be available at a future date, when a number of other factors are considered, such as balancing the ease of using a net-metering system vs. higher premiums for even the small producers.

Hybrid-systems may also qualify for such premiums, e.g. PV and wind.

Payment of the premiums will be based on calculations of the displaced pollution by type and quantity. Establishment of the premium is only the first step in the process of "environmental quality tariff". Further steps are expected to include: a) Net Metering for household producers, expected to be primarily PV; b) Decentralization of renewable power production capacity, with tariff's which will reflect the location of stations, and their contribution to savings in electricity conduction and distribution; c) Definition of mechanisms for trading in pollutants.

4.1.3. Israel Electric Corporation - Procedures for connecting Solar Homes to the Grid

The draft procedures define the technical, operational, commercial and legal conditions for connecting "solar homes" in synchronization with low-tension grids of the IEC. Their definition of a "solar home" is an "installation including photovoltaic panels, inverter and other electrical apparatus". The procedure suggests existing Israeli laws concerning the supply of electricity, the European standard for electricity quality EN-50160 from 1999. The standards for specific PV equipment will be those already published and recommended by: ASTM PV, IEEE PV, IEC, UL, and the NEC.

The IEC is recommending Net Metering, with the applicable tariff to be chosen by the home producer, either standard household tariff or voluntary adoption of time-of-use readings.

4.a Utility perception of PV

The Israeli utility IEC has not, in recent years, implemented PV as a legitimate source of electricity, for inclusion in its portfolio, due to its high cost. However, according to the new

regulations mentioned above, the IEC will be required to connect any approved private electricity producer, even PV.

4.b Public perceptions of PV - the environmentally aware public has always viewed PV positively, and personal purchases were usually limited because of the inability to connect to the grid. Once all regulations are formalized, and the private market will be allowed for the first time to connect home-PV systems to the grid, it will be interesting to see how many people will actually do so.

4.2 Indirect policy issues

See various new regulations in **4.1.**

4.3 Standards and codes

PV standards to be applied by the IEC are, as mentioned above, the standards for specific PV equipment will be those already published and recommended by: ASTM PV, IEEE PV, IEC, UL, and the NEC.

5 Highlights and prospects

During 2003, there were no particular new PV deployments, nor long term targets set for installed PV power capacity. All new regulations were published during 2004, but here, too, no particular targets were set.

Annex A Method and accuracy of data

Data on sales is collected through personal conversations with all known photovoltaic dealers. New dealers are identified through a network of people interested in projects being established around the country. An active attempt is made to locate new dealers through internet and other searches. As the National Solar Energy Center, we are also often the first source of information people contact when they require information on solar energy.

On national and policy issues, conversations and interviews are held with decision makers in government offices, environmental protection groups, and economists interested in the field of energy.

The margin of error in reported sales is impossible to measure. On one hand, some dealers give exact sales quantities in W, though could not provide system costs due to vagaries and uncertainties in the system. On the other hand, some dealers still had such a low level of sales that they are “embarrassed” to report it. Our estimation of sales - based on last year’s level and showing no growth over the past year, was confirmed in conversations with dealers.