

## **THE FINANCIAL VIABILITY FOR PRODUCERS OF ISRAEL'S SOLAR FEED-IN TARIFF REGULATION OF 2008**

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### **ABSTRACT**

In July of 2008 the first solar subsidies came into effect in Israel in the form of Feed-In tariffs under which the Israel Electric Company (IEC) would purchase electricity produced by individual households (installations up to 15 kWp) and businesses (up to 50 kWp) at a tariff of 2.01 NIS a kWh. We analyzed the financial feasibility of producing electricity under this arrangement for a 4kWp private system, and of two commercial systems of 50kWp—with and without two axis tracking. We describe payback period, Net Present Value, and Internal Rate of Return based on actual costs and typical operating parameters, as well as on their values under various scenarios as sensitivity tests.

Our analysis shows that the smaller systems have a payback period of 16 years and a NPV of only 17,220 NIS, and, thus, marginal viability, which would be undermined by small deviations from optimal operating conditions. The larger system without tracking had a payback period of 16 years, a NPV of 138,819 NIS, and it too will have negative returns with moderate deviations from optimum (for example if system costs rise above 29,000 NIS/kWp or production falls below 1400 kWh.) The system with 2 axis tracking is costlier, but its greater output gives a NPV of 307,533 and a payback period of 13 years. Its feasibility is more robust, becoming negative, for example, only if output drops below 1400 kWh at the same time as the gain from tracking drops to 25% as opposed to the 35% gains anticipated.

It should be noted that these financial gains are made possible by a significant subsidy (solar electricity is purchased by the IEC at more than four times the rate at which it sells it), amounting to a cumulative transfer of over 2.2 million NIS for the non-tracking system described above and 3.4 million NIS for the tracking system. The financial horizon of these systems is, essentially, the 20 years until their subsidized tariff expires (in addition to the assumed progressive loss of efficiency of about 1% a year), and it is unlikely that will financially merit the cost of the first repair needed after this.

### **1. INTRODUCTION**

One of the dominant policy vehicles for overcoming the barriers to broader use of renewable energies that are not currently cost-competitive with fossil fuels is the feed-in tariff (FIT), whereby producers of renewable energy are paid for their electricity at above-market rate. This rate is set at a level designed to ensure profitable operation and assured for a period long enough to cover much of

the working life of installations—typically 20 years (Mendonca, 2007). Grid operators are obliged by law to purchase this electricity, with the costs of the subsidy to renewable energy passed on to consumers by an addition to the price they pay for electricity. The rate of the tariff is typically technology-specific, matched to the costs of generation for each technology, with solar being considerably higher than hydro, wind, or biomass (Fouquet, Klein et al). Over 40 countries, states, or provinces have adopted FIT laws, including 19 EU member states (Mendonca, 2007; Fouquet, 2007). There remains some debate over the virtues of the FIT approach and best practices in implementing it, and comparisons with other mechanisms for promoting renewables (Meyer, 2003; Klein et al), especially the Renewable Portfolio Standards (RPS) approach to renewable energy support, which is more common in the USA (Rickerson, 2008). But it is clear that FIT is a—perhaps the—leading policy mechanism for renewable energy.

Israel began its solar subsidies somewhat later than many developed countries, with the July 1, 2008 rollout by the Public Utilities Authority (PUA) of FIT regulations supporting small PV systems, which followed a November 2002 government decision committing to the generation of a certain portion of its energy needs through renewable sources. These FIT regulations were broadly similar to those in many countries: the commitment to purchase electricity would expire at the end of 2014 or with the achievement of an overall capacity of 50 MW; it had categories for private producers (up to 15 kWp) and commercial producers (up to 50 kWp), with 15 MW of the overall 50 MW reserved for the former; the tariff was set at an initial 2.01 NIS, which would be locked in at this rate for 20 years (linked to a combination of price and currency indexes), with the tariff offered to new systems decreasing 4% each year (from 2011 till the expiration of offering in 2015); and private producers below 4 kWp would be exempt from taxes from their sale of electricity. The FIT was crafted based on an assumption of an annual production of 1600 kWh for each installed kWp. The solar FIT was followed by the announcement of a similar FIT for small wind turbines in 2009, with a total quota of 30 MW by 2016, and the solar FIT regulations are expected to be extended to larger facilities up the range of 5 mWp, and, eventually, beyond this.

One of the claimed virtues of FITs is the stability they offer investors through legal assurance of a fairly stable level of payment over a long time horizon. Since the goal of the FIT is to encourage the participation in solar energy production by private individuals and companies, it is important to understand the financial incentives such providers will "see" under the FIT regulations. In this paper we describe an analysis of the standard financial indicators of typical private and commercial projects operating under the new FIT. Such an analysis can help elucidate the extent of uptake of different systems in the coming years. It can also offer potential investors in such systems with a point of reference for assessing claims made by the dozens of companies that now offer to sell and install such systems, some of whom have suggested payback periods of between 7 and 10 years—statements that were repeated in the media. (UPI, 2008; Waldocs, 2008).

## **2. METHODS**

In order to become oriented with the parameters of operation and typical costs of systems, interviews were conducted with companies that were offering to sell solar systems, with people who had already installed systems, with accountants familiar with the taxation aspects of production under the FIT (income tax, depreciation, VAT), with the authors of the PUA regulations and with experts from academia. Based on the estimates gained from these interviews, three typical systems were evaluated: a private system of the maximum non-taxable capacity (4 kWp), and tracking and

non-tracking systems of the maximum capacity for commercial systems (50 kWp). Our evaluation was in the form of an Excel spreadsheet that provided Net Present Value (NPV), Internal rate of Return (IRR), and payback period for each system. NPV assigns a present value to the stream of net benefits into the future, taking into account the time value of money. In other words, it converts cash flows to their value at the start of the project. A zero NPV means the project only repays the investment with a required rate of return (typically the interest rate). IRR is the average annual return earned through the life of an investment, and it should be higher than the desired rate of return (again, typically an interest rate). Payback period is the number of years it will take for the project to recover the initial investments.

Sensitivity tests were conducted, in which the evaluation was performed with alternations in various assumptions (for example, reduced or enhanced output, different interest rates, more or less frequent replacement of invertors, etc.) In addition, a Monte Carlo simulation was performed for the system with tracking in which three key parameters (output, percentage system gain due to tracking, and annual maintenance costs) were repeatedly (several thousand runs) assigned values normally distributed around average values in order to yield a distribution curve for Net Present Value, rather than a point value.

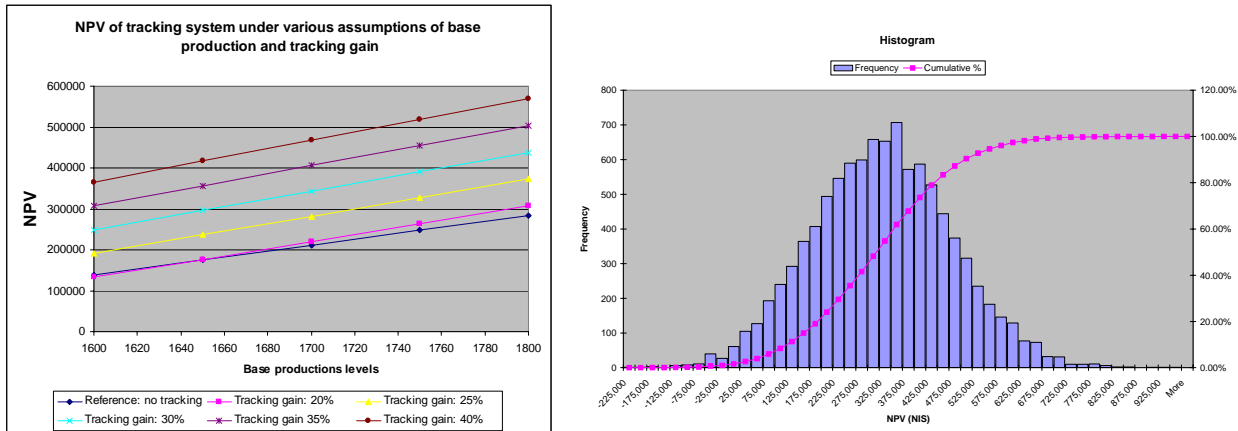
### 3. RESULTS AND CONCLUSIONS

A household system of 4kWp was assumed to cost 120,000 NIS (inc. VAT), and produce 1600 kWh annually, with a loss of 1% a year. With an interest rate of 6% and tariff of 2.01 NIS/kWh linked to tariff index, the system's NPV was 17,220 NIS, with a payback period of 16 years. The NPV is sensitive to production levels, falling to zero if the production is 1400 kWh in the first year, and rising to 34,300 NIS if production is 1800 kWh. A system cost of over 30,000 NIS/kWp is not viable (negative NPV under normal assumptions). Replacement of an inverter more than once in the 20 year life of the system (if not covered by manufacturer warranty) also seriously degrades profitability. At the end of 20 years of the FIT contract, when electricity is no longer purchased at subsidized levels, the system is not worth repairing if this entails a cost of more than a few thousand shekels. The cumulative extent of subsidy over the installation's lifetime is 173,000 NIS.

A commercial system of 50 kWp without tracking under the same assumptions and an initial cost of 1.3 million NIS has a NPV of 138, 819 NIS. It's IRR is 7.6% with a payback period of 16 years. It, too, is vulnerable to production levels, with a negative NPV if these fall below 1400 kWh. The subsidy accruing to such a system over its lifetime is 2,155,000 NIS and the owners will pay 490,000 NIS in taxes on income to the government.

A commercial system of 50 kWp with two axis tracking will costs 1,555,000 NIS and, assuming a 35% gain due to the tracking, will have a NPV of 307,533 NIS and a payback period of 13 years, benefiting from a cumulative subsidy of 3.4 million NIS. As illustrated in figure 1a, various combinations of assumptions were evaluated: for example, the system would become non-viable if production dropped below 1400 kWh and the gain due to tracking fell below 25%. Figure 1b illustrates a Monte Carlo simulation of the distribution of NPV, showing that in a few percent of exceptionally unlucky or lucky combinations of parameters, a system might have a negative NPV or one exceeding 750,000 NIS.

Overall, we can see that a private household system will break even if managed well in a high insolation environment, and is likely to be adopted by those committed to environmental values, rather than those intending to "profit from the sun." Commercial systems do offer real profits, due, in large part, to the tax advantages available to companies. In particular, while a tracking system is more costly in terms of initial outlay and maintenance, it boosts financial viability considerably. The profits made by producers under the FIT regulation are, in effect, redistribution to them of money from electricity consumers in general, and a broader evaluation of this and other aspects of FIT is underway by the first author of this paper.



**Fig. 1a and b.** To the left (a), the viability of a 50 kWp system with 2 axis tracking under different assumptions of base production and percentage gain due to tracking. To the right (b), distribution of NPV from Monte Carlo simulation of production, gain, and maintenance cost values normally distributed around averages.

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