A GREEN PRICING MODEL IN SWITZERLAND
The 'Solarstrom Stock Exchange'
from the Electricity Utility of the City of Zurich

Daniel Ruoss
ENECOLO AG, Lindhofstr. 52, 8617 Mönchaltorf
Tel: 01 994 90 01 / Fax: 01 994 90 05
Email: info@enecolo.ch, http://www.solarstrom.ch

Sergio Taiana
Elektrizitätswerk der Stadt Zürich (ewz), Tramstrasse 35, Postfach, 8050 Zürich
Tel: 01 319 44 55 / Fax: 01 319 41 97
Email: sergio.taiana@ewz.stzh.ch, http://www.ewz.ch

Abstract - The original ewz- model of the 'Solarstrom Stock Exchange' for the promotion of solar electricity has evolved into a very successful project and the numerous positive feedback and inquiries ewz has received from home and abroad are most encouraging. At the beginning of 2000, 1570 kW nominal PV power had been installed. 42 PV plants are under contract, producing a total solar electricity value of 1,200,000 kWh a year. 5700 ewz customers ordered more than 850,000 kWh solar power at a current price of US$ 0.65kWh. Negotiations with further suppliers indicate prices for solar electricity below the US$ 0.50kWh mark. This includes the federal contribution of approximately a third of the installation costs. Cost reduction of around 20% for installed PV plants could be achieved due to the ewz 'Solarstrom Stock Exchange'- model, but, similarly, the quality and the aesthetics of the installation was noticeably increased.

1. INTRODUCTION

A representative opinion survey carried out in July 1995 showed that there is a definite demand for solar electricity from the electricity utility of the City of Zurich (ewz) customer base. In the survey, 3,500 EWZ customers were asked whether they would be prepared to accept solar electricity and to pay a higher price for it. The high response rate was surprising. From 270 of those contacted, some 7% responded positively to the idea of subscribing to solar electricity and indicated their readiness to purchase on average 70 kWh at 1 US dollar / kWh per year. At this point, it was not clear to what extent intentions would be borne out by actual practice, i.e. how many customers would finally subscribe to the solar electricity scheme.

The second motivating factor behind the 'Solarstrom Stock Exchange' is contained in the ewz company profile. ewz is actively promoting the introduction of renewable energy, and this also forms one of the energy policy objectives of the City of Zurich. In 1991, ewz began providing financial support from the so-called 'electricity saving fund' for various plants, including those exploiting renewable resources. However, in an urban environment dominated by rented flats, this proved an insufficient stimulus for encouraging more solar plants to be built. The 'subsidisation' encouraged only 51 kW to be installed. A new model was needed that would enable the majority of residents, i.e. the tenants, to support the building of solar plants, even though they were not property owners themselves. Moreover, a Swiss government promotion program called 'Energy 2000' is presently in force that calls for 50 megawatts of photovoltaic generating capacity to be installed in the whole of Switzerland by the

end of year 2000 (Swiss Federal Office of Energy, 1991). For the City of Zurich, this translates to a PV capacity of 2,400 kW_p as the aim for 2000.

2. HOW DOES THE EWZ 'SOLARSTROM STOCK EXCHANGE' WORK?

Explained in simple terms, ewz purchases solar electricity on the open market, offers it to customers at a flat rate corresponding to the average price of obtaining solar electricity and makes no additional charge. In this way, ewz plays the role of mediator between producers of solar electricity on the one hand and customers on the other.

2.1. How do we negotiate with suppliers of solar electricity?

ewz offers producers an undertaking to purchase solar electricity, guaranteeing the purchase price (indexed to inflation) for 20 years. First, ewz issues a public tender to planning consultants, property owners, insurance companies, etc., to supply solar electricity at an economic but, nevertheless, competitive price. Suppliers finance their projects via the capital market or from their own funds, and build and operate the equipment. The proviso is made that the plant should not exceed 100 kW_p and must be located within the City of Zurich. Tenders are accepted from those suppliers with the lowest, yet still economic, prices. To encourage high-quality design, ewz issues technical guidelines. An efficient and reliable plant is in the suppliers' own best interests, since frequent breakdowns would involve a financial loss for them.

'Solarstrom Stock Exchange' can only function properly with customers who are prepared to accept solar electricity at the present rate of five to six times the normal price. Thus, parallel to the tendering scheme, ewz is endeavouring to find customers who are willing to cover part of their electricity needs with solar electricity and pay the current rate of 0.65 US$ / kWh for it. Customers order solar electricity in the form of a subscription to EWZ. The aim is to convince customers that they do have a direct influence on whether or not solar plants are built in the City of Zurich. Subscribers undertake to purchase solar electricity for a period of one year, but this is automatically renewed for a further year if not cancelled in advance.

2.2. What happens if there is a difference between supply and demand?

Should the demand for solar electricity be greater than the supply, the yearly allowance is reduced until such a time as additional plants can cover the demand. An imbalance between supply and demand can occur in the long run if customer subscriptions for solar electricity – renewed on a yearly basis – should decline, ewz having committed itself to accepting solar electricity at an agreed price for 20 years. Assuming that the market volume over the next few years should expand to the 1 million kWh forecast, but that then demand should fall by (let us say) 10%, ewz would incur a loss, assuming a solar electricity price of 0.65 U$ per kWh, of around US$ 65,000. This situation is, however, improbable, as the price of solar electricity is more likely to fall with increased market volume owing to reduced costs of production. The cost reduction should also make it possible to attract more customers and to hold onto existing customers.

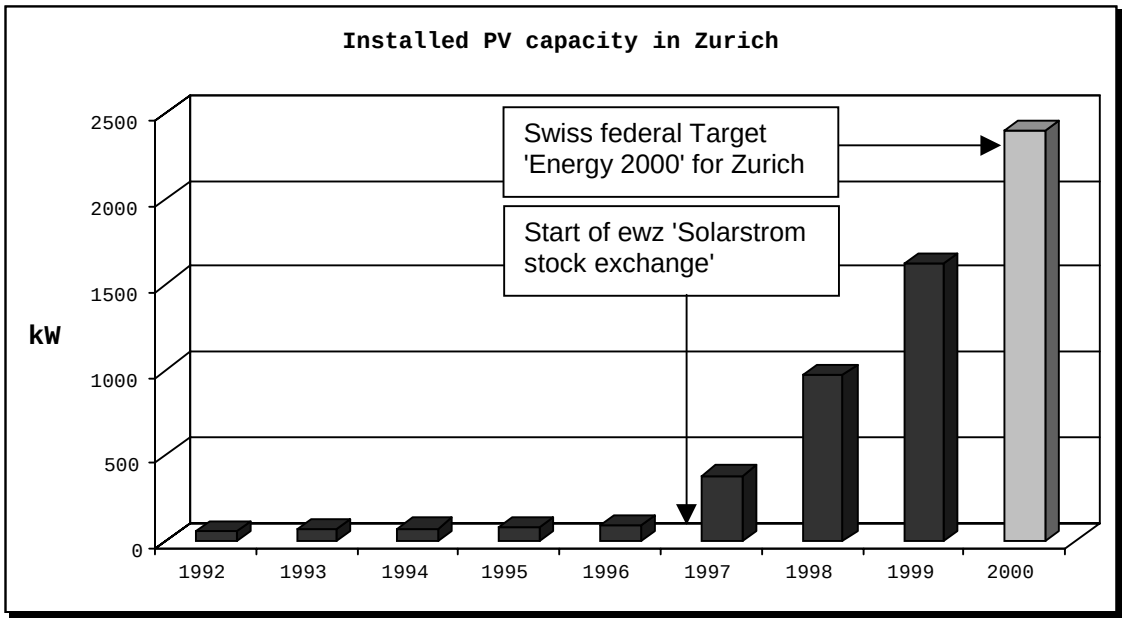
3. WHAT DOES EWZ ACTUALLY DO?

To publicise its solar program and increase public awareness in this area, ewz is conducting active and intensive marketing. Potential customers for solar electricity are directly or indirectly encouraged to take part, selecting from numerous options. ewz supplies customers with specific information designed to increase transparency and credibility. Furthermore, new photovoltaic plants materialising from customers' initiative are often inaugurated at an official ceremony. This is a good opportunity to invite customers to take part and to visit their plant. The rising number of customers (and plants) is making increasing demands on our book keeping and energy-consulting resources, as well as on our engineers. In coping with this, existing infrastructure and personnel are utilised, and, despite the increased workload involved, this does help to expand know-how for the future. The long-term success of models of this type is strongly dependent on the active and enthusiastic participation of employees, and on effective promotion at the highest level of management.

4. RESULTS ACHIEVED TO-DATE

ewz has met with a very positive response from the public. Also, co-operation with environmental organisations has been very constructive. To give an example, ewz has a joint program with the World Wildlife Fund (WWF), within the Living Planet Campaign, promoting 'climate' as the central theme. Since May 1997, it has been possible for Zurich citizens to order solar electricity from ewz. By the beginning of 2000, some 5700 customers had subscribed to a total of 850,000 kWh of solar electricity. This means that over 2.9% of ewz customers now cover part of their electricity needs with solar electricity, paying five times the normal price in return for an environmentally sound product - more orders are coming in every day. 42 plants are already under agreement and further negotiation with possible suppliers will take place this year. The present 42 plants together produce a total of 1,200,000 kWh per year from three rounds of tenders.

Fig. 1: The development of the installed PV power in Zurich due to the 'Solarstrom stock exchange'



The present offered price of solar electricity is below the 0.65 US$ / kWh mark. Additional price reductions will result from federal contributions, obtainable under the condition that 100% of the subsidy passes to the customers. A final price of less than 0.50 US$ / kWh is negotiated with most suppliers. Cost reduction of around 20% for installed PV plants could be achieved due to the ewz 'Solarstrom Stock Exchange'-model. Moreover, the quality and the aesthetics of the installations were noticeably increased.

Fig. 2: 53.04 kW PV installation ABZ for the 'Solarstrom stock exchange' with SOLRIF (in this figure only one house row, 26.52 kW is shown)

On two house rows a retrofit was done using a new integration system called SOLRIF (solar roof integration frame). Due to the very easy access to the PV installation and good insight, the client asked a perfect integration system. The system should be easy to mount, require limited construction work, integrate with the existing clay tiles and result in a good appearance. The goal was also to build a cost effective BIPV installation. The power utility of Zurich accepts an offer for solar energy of less than 0.70 U$/kWh for their Solarstock exchange. It also requires an acceptable appearance, in terms of the location and the usage of the buildings itself.

Since the SOLRIF system can be easily introduced in existing roofs in combination with any standard clay tile, a very aesthetic BIPV installation product has eventuated (Ruoss and Toggweiler, 1999). This way, the Zurich building authority approved the proposal to build the PV power plant. The final overall installed cost per Wp resulted around US$7.70, showing that BIPV can be cost competitive and aesthetically pleasing.

Several other new mounting structures were designed for the 'Solarstrom stock exchange' leading to cost reductions around 50% for mounting structures. Following another example, SOFREL® was applied to around 70% of flat roof installations (Toggweiler, *et. al.*, 1994). The mounting structure is a simple concrete element with a special feature for holding the module and uses the weight foundation on the roof. No screws or any other mechanical connection to the roof skin is applied.

Fig. 3: Most commonly applied mounting structure for flat roof installation within the 'Solarstrom stock exchange'.

SOFREL® is on the market for less than 0.35 US$ / Wp, including two elements and the necessary stainless steel brackets.

5. CONCLUSIONS AND OUTLOOK

The ewz- model of the 'Solarstrom Stock Exchange' for the promotion of solar electricity has evolved to become a very successful project and the numerous positive feedback and inquiries ewz has received from home and abroad are most encouraging. Very positive response was received from the public, press and environmental organisations, as well from related business partners, even in foreign countries.

At the beginning of 2000, around 1600 kW nominal PV power had been installed. 42 PV plants are under contract producing a total solar electricity value of 1,200,000 kWh per year. 5700 ewz customers ordered more than 850,000 kWh of solar power at a current price of 0.65 US$ / kWh This includes the federal contribution of approximately a third of the overall installation costs. Negotiations with further suppliers indicate prices for solar electricity, inclusive of the subsidy, will drop below the 0.50 US$ / kWh mark in the not too distant future.

Furthermore, thanks to the 'Solarstrom stock exchange' and its economic approach, competitive solar electricity prices have arisen and new mounting systems introduced. Cost reductions of around 50% were achieved for mounting structures and around 20% for the overall installed cost. For flat roof installation systems, costs less than 5.40 U$ / Wp were achieved. This cost reduction is being reflected in the produced electricity cost too, making it possible to attract more customers and still hold the existing customer base. Needless to say, ewz will increase their effort to promote and spread the 'Solarstrom stock exchange'. This augurs well for the Swiss federal 'energy 2000' program in meeting its target of 2.4 MWp. A further customer recruitment marketing communication campaign is planned. In fact, a situation of demand being greater than supply could not be more favourable. In this way, the basic idea of a Stock Exchange and the principle of a market economy underlying it, takes on full significance.

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