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CASE STUDIES OF STATE SUPPORT FOR RENEWABLE ENERGY

Support for PV in Japan and Germany

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CASE SUMMARY

Case Description

Japan and Germany rank first and third in the world, respectively, in terms of installed photovoltaics (PV) capacity. Most of Japan's capacity has been installed through a residential buy-down program (supplemented, to some degree, with low-interest loans). Germany has used a number of approaches to stimulate PV development, including rebates, low-interest loans, and premium feed-in tariffs that combine a high incentive level and a mandatory purchase requirement by utilities. This case study briefly describes PV support programs in Japan and Germany.

Innovative Features

- The fact that these two countries are currently among the world's largest PV markets is reason enough to take a closer look at their programmatic approaches.
- Both countries have a long track record (i.e., since the early 1990s) of offering a combination of PV support measures that are currently being implemented in the U.S., including capital cost buy-downs and low-interest loans.
- This history provides relevant insights into how such programs

perform over periods longer than the few years of experience with such programs in the U.S.

Results

Both Japan and Germany demonstrate that various combinations of low-interest loans and buy-down programs can work over extended periods.

- As of the end of 2000, nearly 320 MW of PV was installed in Japan, while Germany hosted more than 110 MW.
- While the specific mechanics of one of the major drivers of success in Germany – the Renewable Energy Sources Act (feed-in law) – may not be particularly applicable to clean energy funds in the U.S., the overwhelming success of the Act demonstrates that production-based support for PV can work if the per-kWh payment is high enough.
- In addition, Germany's 100,000 Solar Roofs Program demonstrates that loan programs for PV can be successful if the value proposition is otherwise sufficiently attractive (loans for nearly 130 MW of PV have been approved since January 1999).

CASE STUDY DETAILS

The case studies that we have selected include a large number of cases on different forms of support for photovoltaics (PV) within the United States. It is also potentially useful to look outside of the U.S., however, to examine the approaches of other countries that have had success in promoting this technology. Japan and Germany, with more than 320 MW and 110 MW of installed PV capacity respectively, rank first and third in the world by this metric (with the United States in second place). Both countries have a long track record (i.e., since the early 1990s) of offering a combination of PV support measures that are currently being implemented or considered in the U.S., including capital cost buy-downs, performance incentives, and low-interest loans. This history provides relevant insights into how such programs perform over periods longer than the few years of experience with such programs in the U.S. This case study, therefore, examines the programmatic approaches undertaken to support PV in both Japan and Germany.

Japan

Japan leads the world in installed PV capacity, with over 300 MW in place at the end of 2000. More than 2/3 of that capacity has been installed through a residential capital cost buy-down program that began in 1994 and is

administered by the New Energy Foundation (NEF), part of the Ministry of Economy, Trade, and Industry (METI). The program is open to private households, owners or developers of housing complexes, and local governments. Local governments are allowed to pass on the subsidies to their citizens for use *in addition to* any subsidies the citizens receive directly from the NEF. Some governments do this by simply supplementing the NEF's capital cost subsidy, while others have instead used the funds to set up low-cost PV financing programs. Systems are grid-connected and net metered – an attractive proposition given the high price of electricity (average residential rate of \$0.22/kWh) in Japan.

The following table summarizes the program's history. As shown, the maximum subsidy per system has declined from 900,000 ¥/kW (up to 50% of installed costs) in 1994 to 120,000 ¥/kW (up to 33% of installed costs) in 2001 (120,000 ¥/kW equates to roughly \$1/Watt). Through fiscal year 2001, approximately 300 MW of PV had been installed under the program. This impressive result should be considered within the context of the program's sizable budget – roughly \$200 million in fiscal year 2001 alone.

Fiscal Year	Number of Approvals	Installed Capacity	Max Subsidy/ System (%)	Max Subsidy/ System (¥/kW)	Max System Size (kW)	Budget (Billion ¥)
1994	539	1.9	50%	900,000	5	2.0
1995	1,065	3.9	50%	850,000	5	3.27
1996	1,986	7.5	50%	500,000	4	4.06
1997	5,654	19.5	33%	340,000	4	11.11
1998	6,352	24.1	33%	329,000	10	14.7
1999	15,879	57.7	33%	329,000	10	16.07
2000	20,877	74.4	33%	270,000	10	14.5
2001	29,389	114.7	33%	120,000	10	23.5

Source: Haas 2002

Notwithstanding the large budget, the program appears to have been successful at installing progressively larger amounts of capacity even in the face of declining incentive levels, thereby demonstrating that buy-down programs can work over long time periods, and can lead to system cost reductions. The installed price of a residential grid-connected PV system has reportedly declined from nearly \$11/W in 1995 to less than \$7/W in 2001 (Maycock 2002).

METI announced in September 2000 that it will abandon government subsidies for rooftop PV systems at the end of fiscal year 2002 (March 31, 2003) in an attempt to boost industry competition. What, if anything, will replace the METI buy-down program is unclear. The fact that the federal government increased METI's FY01 budget request for both new renewable energy companies and local government programs suggests that increased industry competition and local government programs may play a large role in the future (http://www.photon-magazine.com/news/news_01-03_ap_japan.htm).

Germany

Support for PV at the national level has progressed through 3 phases: the 1,000 solar roofs program (rebates) from 1990-1995, the 100,000 solar roofs program (soft loans) initiated in 1999, and the Renewable Energy Sources Act (premium tariffs) implemented in April 1, 2000. Each of these phases is discussed below.

- **1,000 Solar Roofs Program:** Germany became the first country worldwide to launch a major solar installation initiative when it announced the 1,000 solar roofs program in 1989. This program provided rebates for up to 60% of system costs, and had installed roughly 2,250 systems totaling 5.25 MW by the time of the program's sunset in 1995 (Weiss and Sprau 2002). Lessons learned from this program were applied in Japan (Haas 2000).

- **100,000 Solar Roofs Program:** This program was implemented in January 1999, with an initial goal of installing 300 MW by 2004. Funded with EUR 560 million (~\$500 million), the program provides 10-year low interest loans (1.91% in 2001) with no money down and no interest payments for 2 years (Weiss and Sprau 2002). This financing package corresponds to a subsidy of roughly 20% (Reinmüller et. al 2002). Since inception, loans for nearly 130 MW have been approved. The early success of this program, in part due to the introduction of the new Renewable Energy Sources Act in April 2000 (described below), has prompted the German government to advance the 300 MW target date by one year to 2003 (Ecotec 2001).
- **Renewable Energy Sources Act:** This new and improved version of Germany's original feed-in law (which had been in place since January 1991) took effect in April 2000. Under the old feed-in law, PV and wind shared the same tariff, around DEM 0.17/kWh (~\$.08/kWh). While this tariff was sufficient to spur massive wind development throughout Germany, it was insufficient to support a similar rate of PV development, given its higher cost. The Renewable Energy Sources Act increased the PV tariff nearly 6-fold to DEM 0.99/kWh (~\$0.50/kWh). Starting in 2002, the tariff will decline by 5% each year to encourage cost reductions. The program will remain in place until one year after Germany's installed PV capacity reaches 350 MW, a number that accounts for the 50 MW of existing capacity in place at the time the Act was written, as well as the 300 MW goal of the 100,000 Solar Roofs program (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2000). When that goal is reached, a new support program (as of yet unspecified) will be enacted.

Though at first glance a feed-in law that combines a high incentive level and a mandatory purchase requirement on utilities may not seem particularly relevant to clean energy funds in the U.S., moving beyond labels and thinking about the mechanics suggests otherwise. As is the case with a system-benefits charge, end-use customers in Germany end up paying the cost of the feed-in tariff through higher rates. Furthermore, the new Act contains a provision to equalize the proportional cost of the feed-in tariff among all German customers, thereby increasing the resemblance to a system-benefits charge. While differences between the two approaches remain, the overwhelming success of Germany's feed-in tariff suggests that production-based support for PV – no matter how it is funded – may work if the per-kWh payment is high enough.

In addition to these national programs, municipalities throughout Germany have offered attractive production incentives (reportedly as high as DEM 1-2/kWh, or ~\$1/kWh) funded by surcharges on utility bills (Starrs and Schwent 1998). While these state-sponsored programs were primarily intended to fill the gap in national funding from 1995-1999 (Weiss and Sprau 2002), state subsidies have also, at times, been used in combination with the national programs.

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Web sites:

<http://www.nef.or.jp>

<http://www.solarbuzz.com/FastFactsJapan.htm>

<http://www.solarbuzz.com/FastFactsGermany.htm>

ABOUT THIS CASE STUDY SERIES

A number of U.S. states have recently established clean energy funds to support renewable and clean forms of electricity production. This represents a new trend towards aggressive state support for clean energy, but few efforts have been made to report and share the early experiences of these funds.

This paper is part of a series of clean energy fund case studies prepared by Lawrence Berkeley National Laboratory and the Clean Energy Group, under the auspices of the Clean Energy Funds Network. The primary purpose of this case study series is to report on the innovative programs and administrative practices of state (and some international) clean energy funds, to highlight additional sources of information, and to identify contacts. Our hope is that these brief case studies will be useful for clean energy funds and other stakeholders that are interested in learning about the pioneering renewable energy efforts of newly established clean energy funds.

Twenty-one total case studies have now been completed. Additional case studies will be distributed in the future. For copies of all of the case studies, see:

<http://eetd.lbl.gov/ea/ems/cases/> or <http://www.cleanenergyfunds.org/>

ABOUT THE CLEAN ENERGY FUNDS NETWORK

The Clean Energy Funds Network (CEFN) is a foundation-funded, non-profit initiative to support the state clean energy funds. CEFN collects and disseminates information and analysis, conducts original research, and helps to coordinate activities of the state funds. The main purpose of CEFN is to help states increase the quality and quantity of clean energy investments and to expand the clean energy market. The Clean Energy Group manages CEFN, while Berkeley Lab provides CEFN analytic support.

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