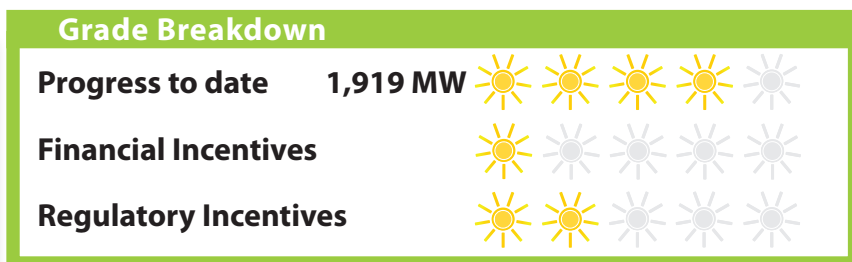
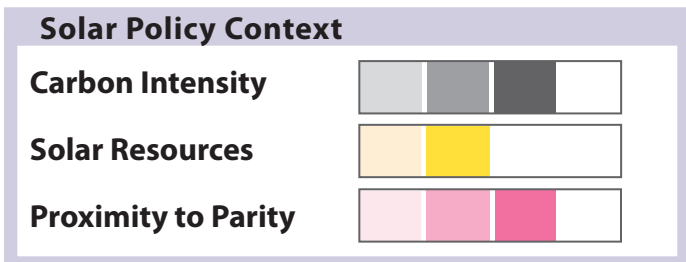




Solar Insolation: ~1051 kWh/kWp/yr Yearly Average Solar yield
 ~2.0-4.0 kWh/m²/day Average Solar Radiation on collector surface



Installed PV capacity

Cumulative installed end 2006: 1,709 MW¹ (95% grid-connected)
 Cumulative installed end 2007: 1,919 MW²

Cumulative installations growth rate	2005-2006: +20.2%	2006-2007: +12.3%
Annual installations growth rate:	2005-2006: -1%	2006-2007: -26.7%

Population: 127 M PV/capita: 15.1 W/capita

Drivers for Future Developments

Financial Incentives

Residential PV Support Programs

In 1994, Japan became the first country to introduce federal subsidies for the implementation of residential PV systems. With this program, Japan emerged as world leader in PV installation and production; a position it held for over a decade. These subsidies were intended to create a self-sustaining PV market and ended in March 2006.

The policy operated for 11 years (FY1994 to FY2005) with a total budget of ¥ 134,131 million (USD 1.16 billion). A total capacity of 932 MW from 253 754 PV systems were installed.³

	Residential PV Support Program							
	1994	1996	1997	2001	2002	2003	2004	2005
Budget (billion ¥)	2	4	11.1	23.5 \$193.6 M	23.2	10.5 \$ 90.3 M	5.25 \$ 48.6 M	2.60 \$ 23.6 M
Subsidy level ¥/W \$/W	50%		340 ¥/W \$2.80/W	120 ¥/W \$1/W	100 ¥/W \$0.8/W	90 ¥/W \$0.78/W	45 ¥/W \$0.42/W	20 ¥/W \$0.2/W
Module Costs ¥/W \$/W	927	646	656 ¥/W	484 ¥/W \$3.98/W	463 ¥/W \$3.7	446 ¥/W \$3.85	441 ¥/W	428
Systems Costs (3-5 kW)	1920	1090	1060¥/W	770 ¥/W	710 ¥/W	680 ¥/W	670 ¥/W	665

Sources: Osamu Ikki and Izumi Kaizuka, "Overview of Urban Scale PV Projects in Japan", IEA PVPS Task 10 workshop, June 1st, 2005 and Paul Parker, "Successful market stimulation in Japan's photovoltaic industry: Industrial development, national solar energy policies and global exports", Energy Studies Working Paper 2005-02, University of Waterloo, Canada, February 2005.

Financial Incentives (continued)

The subsidy undoubtedly contributed to the growth of the residential PV market in Japan in the early years. Today, residential PV still accounts for about 89% of total demand for PV.

However, the aim of the program was to establish a self-sustaining market, and while annual installations have not dramatically dropped, growth is now negative. Annual PV installations totaled 290 MW in 2005, 287 MW in 2006 and 240 MW in 2007 (140 MW by some accounts), which amounts to growth rates of -1% and -16.4% for 2006 and 2007 respectively.

Some have argued the silicon shortage and increase in system prices, and not the end of the program, are to blame for the drop in annual installations. Photon also noted that a significant part of the market is “tied to developments in the prefab housing industry, which has slumped in recent years.”⁴ In any case, 240 MW/yr is far from the 1 GW of PV Japan needs to install annually to reach 4.82 GW by 2010.

In June 2008, Japan’s then Prime Minister Fukuda announced the so-called “Fukuda Vision”, which laid out targets for a tenfold increase in solar PV capacity by 2020 (14 GW) and 40-fold by 2030 (50 GW). Through a new incentive program, Japan would also seek to boost its solar panel makers’ competitive edge in the world market.⁵ Since the subsidy ended in 2005, Sharp has lost its place as the world’s largest PV supplier. The initiative, which would start in April 2009 unless met with political opposition, would aim to “halve the price of residential solar panels in three to five years” and would include a target to equip more than 70 percent of newly built houses with solar panels by 2020. Four ministries drew a joint action plan to implement the “Fukuda Vision”.

Photon had published in August that a 4-year, ¥50 billion (US\$475 million) program was in the works, with a first year budget up to ¥30 billion and a subsidy level of ¥100,000/kW (\$950).⁶

As of October, METI had requested ¥23.75 billion (\$218.4 million) from the Ministry of Finance for the first step of a residential PV program that would support 340 MW in 2009 through a ¥70,000/kW (\$644) rebate. If approved the program would still have to be passed by the parliament.⁷

Municipal Programs

314 local governments continue to provide financial support for dissemination of residential PV system. Tokyo and Iida are notable examples. Iida has subsidized loans in the past for PV installation and is now granting a maximum ¥100,000 (\$870) subsidy per system, in hope to have 30% of households equipped with PV systems by 2010.⁸

Tokyo’s Metropolitan Government has put in place a Renewable Energy Strategy (2006) and a Climate Change Strategy (2007). The first calls for the city to generate 20% of its total energy use from renewables by 2020. The second aims to install, among other targets, one million kW residential solar systems using a feed-in tariff and green energy certificate scheme, and is scheduled to begin in April 2009.⁹

Project for Promoting the Local Introduction of New Energy¹⁰

For local government and non-profit organizations that develop plans for the installation of renewable energy systems, as well as for projects that increase public awareness of RE dissemination.

- Currently, PV systems with a capacity over 10 kW are eligible for the subsidies
- 50% of the system installation cost or 340 000 JPY/kW for non-profits
- 33% of installation cost or 220 000 JPY/kW for local governments
- The subsidy level for education and awareness projects depends on the project size.

Between FY1997 and FY2006, 254 PV systems were installed, with a total capacity of 23 012 kW. In FY2007, 49 PV systems qualified with a total capacity of 945 kW. Numerous schools and public buildings have been involved in this program.

Project for Supporting New Energy Operators¹¹

For private institutions for the installation of RE systems.

- Not PV specific
- For systems at least 50 kW, subsidy capped at 1/3 of installation costs
- 90 % of the debt is guaranteed

Between FY1998 and FY2006, 14 PV systems were installed, with a combined capacity of 986 kW. In FY2006, an additional 2 PV systems were installed under this program, with a capacity of 160 kW.

METI has also provided financial support to local governments and non-profit organizations to implement projects that develop their own visions for the introduction of new and renewable energy.

Financial Incentives (continued)

Solar Promotion Program (MoE Initiative)

Introduced in FY2005, this program was developed in conjunction with Japan's "Law Concerning the Promotion of Measures to Cope with Global Warming". The program is multi-layered and includes -among others- initiatives such as town-wide goals of a 20% reduction of GHG emissions by 2020, demonstration projects illustrating the potential of PV for large-scale generation (three areas were selected for three-year projects from FY2006, with a combined capacity of 3 MW), and projects financially supporting the growth of PV in regional areas.

Tax Credits

The IEA PVPS 2007 National Survey Report on Japan noted, "Corporate bodies or individuals with PV systems of 100 kW or more are eligible for a 3-year property tax credit", and that some individuals and incorporated bodies were eligible for a special deduction (7%) or special depreciation (max. 30%).

Eco-school Promotion Pilot Model Project

Since FY1997, Japan has been promoting the introduction of PV systems into elementary schools, junior high schools and kindergartens. By the end of FY2006, 388 schools across Japan had each installed PV systems with capacities of at least 10 kW. In FY2007, it was expected that PV systems would be installed in 51 further schools.

Regulatory Incentives

Renewable Portfolio Standard

Efforts were made in Japan to establish a feed-in tariff but the country opted for an RPS instead.

The Japanese RPS law or "Law on Special Measures Concerning New Energy Use by Electric Utilities" went into effect in 2003. This excludes large hydro.¹² Its goal is to increase the total usage of renewable energy to 12.2 TWh by 2010 or 1.35% of electricity generated and 16 TWh (or 1.63%) by 2014.

The Agency for Natural Resources and Energy sets aggregate targets for renewable energy usage nationwide (12.2 TWh by 2010) and then requires electric power companies to set their own annual sales target for six types of renewable energies, including solar. The companies can choose whether they will generate that electricity from their own sources, purchase it from other generators or buy another company's RE surplus (through a government certified Renewable Energy Credit).

Critics have argued that the RPS target being so low (1.35% by 2010) is actually hampering the development of renewable energy rather than fostering it.

Net Metering

Utilities in Japan have had voluntary net metering programs in place since 1992. Although not a government policy since it is voluntary, it should be noted for having contributed to the success of the residential support programs and by extension the deployment of solar in Japan, since grid-tied residential installations have accounted for about 90% of total demand for PV. Japanese utilities have bought surplus PV electricity at the standard electricity selling rates. However, the 2003 RPS, which sets a price cap of 11 JPY/kWh for its obligation, is interfering with the utilities' voluntary net metering scheme with a buy back rate of 20 JPY/kWh.

In order to ensure Net Metering, the government would have to mandate an RPS obligation price cap twice as high.

Other

Utilities' Green Fund

Japan's utilities also created the Green Fund, to promote the development of renewable energy. Utilities match their customers' 500 ¥ (~\$4.35) voluntary contributions to fund construction of RE facilities. From its creation in October 2000 through the end of 2005, about 2.2 billion yen (\$19.4 million) were invested in the building of about 12 MW of systems mostly on public facilities.

Green power certificate

A voluntary green power certificate program was developed as a joint initiative of Tokyo Electric Power, Sony and the Institute for Sustainable Energy Policies in 2000. Historically, this program had been a private-sector voluntary program without governmental support -regulatory or other. In 2008 however, the government decided to use this program as an energy and climate policy tool. As of Septem-

Other (continued)

ber 2008, 200 GWh of green certificates had been traded in 6 months time; a market size almost 4 times larger than in previous years. Green certificates are part of some solar PV projects such as the distributed solar PV program in Iida city, Nagano prefecture under the program by Ministry of Environment.

Local governments are promoting “green power purchasing” and integrating green certificates in their policies. Notably, the Tokyo Metropolitan Government is using these green certificates for their new solar one-million program as a new feed-in scheme.

Local and National Awareness Campaigns

Television and newspaper ad campaigns geared toward changing the perception of PV have also played a role in the success of the development of the Japanese market.

Green Building

Under the “Guideline for Planning Environmentally-Friendly Government Buildings” as well as the Kyoto Protocol Target Achievement Plan, the construction of green government buildings, equipped with PV Systems, has been promoted. In addition, MLIT has started to utilize PV systems under several other specific measures: promotion of environment-friendly houses and buildings for global environment conservation, introduction of navigation aids using clean energy and a program to reduce CO2 emissions in road projects.

Industry Status

In 2007 Japan’s PV industry continued to grow strongly. Japan has been the largest PV production country in the world since 1999, though the share of Japan in the worldwide PV production has been decreasing in recent years. Currently, approximately 40% of the world’s cell production occurs in Japan. Most of this is now being exported to European markets. In 2006, more than 900 MW of cell capacity was produced, and the total exported shipment was 630 MW.

Renewable Energy Targets

Japan has pledged a renewable energy introduction target of about 3% of total primary energy supply by 2010 (this excludes hydro, geothermal and ocean power).¹³

The Japanese RPS law -or “Special Measures Law Concerning the Use of New Energy by Electric Utilities”- requires 12.2 TWh (1.35%) of electricity to come from renewables by 2010 and 16 TWh (1.63%) by 2014. This excludes large hydro.¹⁴

As of April 2007, renewable energy generation capacity for accredited facilities was 12.63 GW.¹⁵

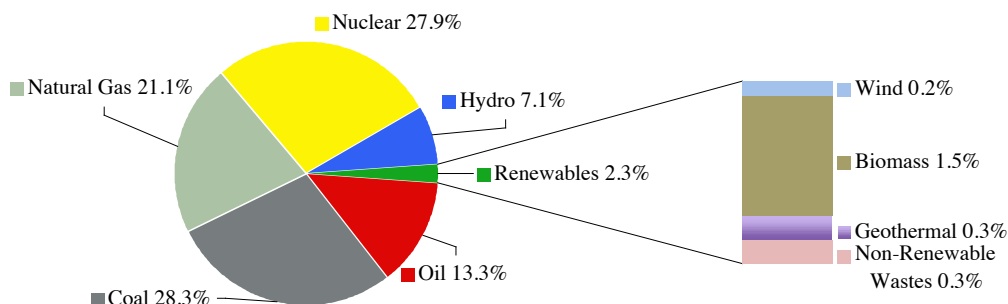
Overall, Japan seems to be on track with its RPS but the RPS targets are very low (less than 2% of electricity generated by 2014).

Solar Target

In the early 1990s, Japan set a solar target of installing 4.82 GW of PV by 2010. At the end of 2006, Japan had installed 1.7 GW of PV. Therefore, to reach the 2010 target, Japan would need to install 1 GW of PV every year until 2010. In 2007, 230 MW were installed.¹⁶

The July 2008 “Action plan to create a low carbon society” establishes a target of 14 GW of PV by 2020 and 50 GW by 2030.

Electricity Generation by Fuel (2005)¹⁷



Total electricity generated and purchased: 964.93 TWh in FY2005 and 971.33 TWh in FY2006¹⁸

Energy Subsidies

The Earth Policy Institute reported that Japan has phased out all subsidies for coal.¹⁹ However, the International Energy Agency’s data suggests that in 2006, US\$107 million were allocated for coal R&D.²⁰

2006 R&D budgets (in million USD)	
Coal	107.00
Oil and Gas	228.93
Total Fossil Fuels	359.92
Nuclear	2,253.08
Solar PV	152.97
Renewables	238.59
Total Energy R&D	3,620.41

Source: IEA.

Public Budgets for PV

As cited in the European Commission’s *PV Status Report 2007*²¹, The Ministry of Economy, Trade and Industry’s (METI) budget for PV for photovoltaics increased by 31% from ¥ 18.758 billion (US\$ 161 million)* in 2006 to ¥ 24.60 billion (US\$ 209 million) in 2007. The Ministry of the Environment (MoE) has added another ¥ 8.1 billion (US\$ 69 million). Other ministries such as the Ministry of Land, Infrastructure and Transport (MLIT), and the Ministry of Education, Culture, Sports, Science and Technology (MEXT), have budgets allocated for PV but have not published them. In 2006, 319 local governments and municipalities implemented subsidy programs, budgets unknown.

* 1 JPY=0.0091 USD (2005), 0.0086 USD (2006), 0.0085 USD (2007).

Solar R&D

NEDO (New Energy and Industrial Technology Development Organization) is the public agency that, with a budget from METI, is responsible for “R&D project planning and formation, project management and post-project technology evaluation functions”.

NEDO promotes, among other things, the development of PV cost-effectiveness, performance and deployment through several programs.

PV Roadmap Toward 2030

This NEDO initiative was announced in 2004, and is dedicated to the realization of the mass introduction of PV systems across Japan. The Roadmap is a long-term strategy for PV R&D, with the overarching goal of PV technology generating 100 GW of power in Japan by 2030. PV would then supply 50 percent of Japan’s residential electricity consumption (approximately 10% of total electricity consumption).

The PV Roadmap Toward 2030 has established financial milestones for PV, to achieve cost levels as that for residential use ~23 Yen/kWh by 2010, for business use ~14 Yen/kWh by 2020, and industrial use ~7 Yen/kWh by 2030.

- 4-Year Plan for Photovoltaic Power Generation Technology Research and Development (FY2006 - FY2009). FY2007 Project Budget: ¥ 2.38 billion (US\$ 21 million). As a result of this NEDO initiative, two large PV R&D projects developed in 2007, R&D for Next Generation PV systems, and Development of PV Systems Technology for Mass Deployment, Phase II.
- Field Test Project on New Photovoltaic Power Generation Technology (FY2007 - FY2014) (Installation work to be completed in FY2010); FY2007: Project Budget: ¥ 7.86 billion (US\$ 70 million). This program is intended to further promote the installation of PV systems and will provide 50% project costs subsidies to public facilities and industrial partners for medium and large-scale systems.

“Solar panels to go in 30% of houses by 2030”

In January 2008, the Government announced that the number of solar-powered households in Japan would increase to 14 million by 2030 (from 400,000 as at January 2008), with a capacity expanding 30-fold from the current 1.3 GW.²² According to Government officials, this will be achieved through R&D into innovative PV technologies, which will drastically reduce the cost of panels, rather than through subsidies or other financial incentive policies. The government is seeking ¥2 billion (US\$ 19 million) in FY2008 to set up a new research institution.

Energy Efficiency Measures

The energy efficiency requirements of non residential buildings in Japan is determined by the ‘Criteria for Clients on the Rationalization of Energy Use for Buildings’, and the energy efficiency of residential buildings is determined by the Design and Construction Guidelines on the Rationalization of Energy Use for Homes.²³

There have been recent energy efficient policy developments in Japan. In 2006, targets for residential energy efficiency were mandated.²⁴ 40% of houses in Japan must implement energy saving measures by 2015, (such as double-paned windows-18% as of 2003), and the average lifespan of a residential house must increase to 40 years (about 30 years as of 2003).²⁵ In 2007, the Japanese Government announced an action plan to reduce GHG emissions from Government buildings. This involves the introduction of energy efficient appliances, as well as ensuring overall energy conservation actions in existing Government buildings.²⁶

Summary of PV support measures in Japan

PV Support Measures	
Feed-in tariffs	No
Direct capital subsidies	For local governments and non-profit organizations: 50% of installed costs or 340 000 JPY/kW (~3,230 USD/kW) for PV systems over 10 kW For private institutions: 1/3 of installed costs for 50 kW systems and above.
Renewable portfolio standards (RPS)	12.2 TWh (1.35%) by 2010 16 TWh (1.63%) by 2014
PV requirement in RPS	No
Solar Renewable Energy Certificates	Yes
Tax credits	<i>“Corporate bodies or individuals with PV systems of 100 kW or more are eligible for a 3-year property tax credit (7/8)” Some individuals and incorporated bodies are eligible for a special deduction (7%) or special depreciation (max. 30%)</i>
Net metering	Not mandated - voluntarily offered by utilities
Net billing	Not mandated - offered voluntarily by utilities
Subsidized Loans	Not government funded but low interest loans for PV available from financial institutions.
Sustainable building requirements	Yes; not mandatory
Interconnection	Standards

Sources: IEA PVPS National Survey Report of PV Power Applications in Japan 2006, May 2007. Japan Energy Conservation Handbook 2007, The Energy Conservation Center, Japan. Photon International

Conclusion

Japan is dependent on imports for almost 96% of its total energy supply (including imported uranium), 50% of which is crude oil. Energy security ought to be a key driver for PV in Japan.

The Japanese government has a multitude of programs for the dissemination of PV, which have unfortunately not done much for the Japanese market in terms of installed capacity. Indeed, there seems to be no federal support to help individuals or private institutions meet the up-front costs of installing smaller systems.

There have been mixed messages this year coming out of the government regarding how it plans on reaching its 4.82 GW of PV by 2010 and whether it will be through direct financial incentives or by aiming at cost reductions through R&D investments. Reports had pointed to a new law in the works to support solar development. However, with the recent resignation of Prime Minister Yasuo Fukuda, the Japanese solar market lost a staunch and powerful supporter and it is unclear what the future now holds for solar in Japan.

Japan, once the leader in PV installations, now has negative growth in terms of installations. It is time the government:

- **Reinstate some PV financial support program for market growth,**

preferably not restricted to the residential market. If the government approves a new Residential PV rebate, it should be expressed as a performance-based incentive (per kWh) as opposed to a capacity-based one (per kW), so as to ensure the most efficient technology will be installed and operated optimally. In keeping with the previous program, incentive levels should decrease over time. And finally the program should provide support over the long term (discussions so far have mentioned a 5-year program).

- **Increase the low RPS and include a Solar Provision**

The Japanese RPS calls for utilities to provide only 1.35% of their sales from renewable sources by 2010 (excluding large hydro) and 1.63% by 2014. To put these numbers in perspective, California and France both are aiming at 20% by 2010. Critics of the Japanese RPS have noted the scheme may actually be hindering the development of renewable energy rather than promoting it. Japan should therefore increase it and include solar provisions (a set percentage to come from solar). The price cap for the RPS obligation should be doubled (from 11 JPY/kWh) to secure Net Metering.

In fact, METI (the Ministry of Economy, Trade and Industry) may be exploring the possibility of a \$60 million program mandating utilities to install solar plants between 10 and 30 MW.²⁷

Endnotes

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- ¹⁹ “Shifting Subsidies”, excerpt from Lester R. Brown, *Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble*, (NY: W.W. Norton & Co., 2006), http://www.earth-policy.org/Books/PB2/PB2ch12_ss3.htm.
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- ²³ International Energy Agency, Energy Efficient Building Codes 2008, http://www.iea.org/g8/2008/Building_Codes.pdf
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