2008 GLOBAL SOLAR REPORT CARDS

The time has come to harness the sun

GREEN CROSS
International

The 2008 Global Solar Report Cards were commissioned by Green Cross International's Energy Program and compiled by Global Green USA.

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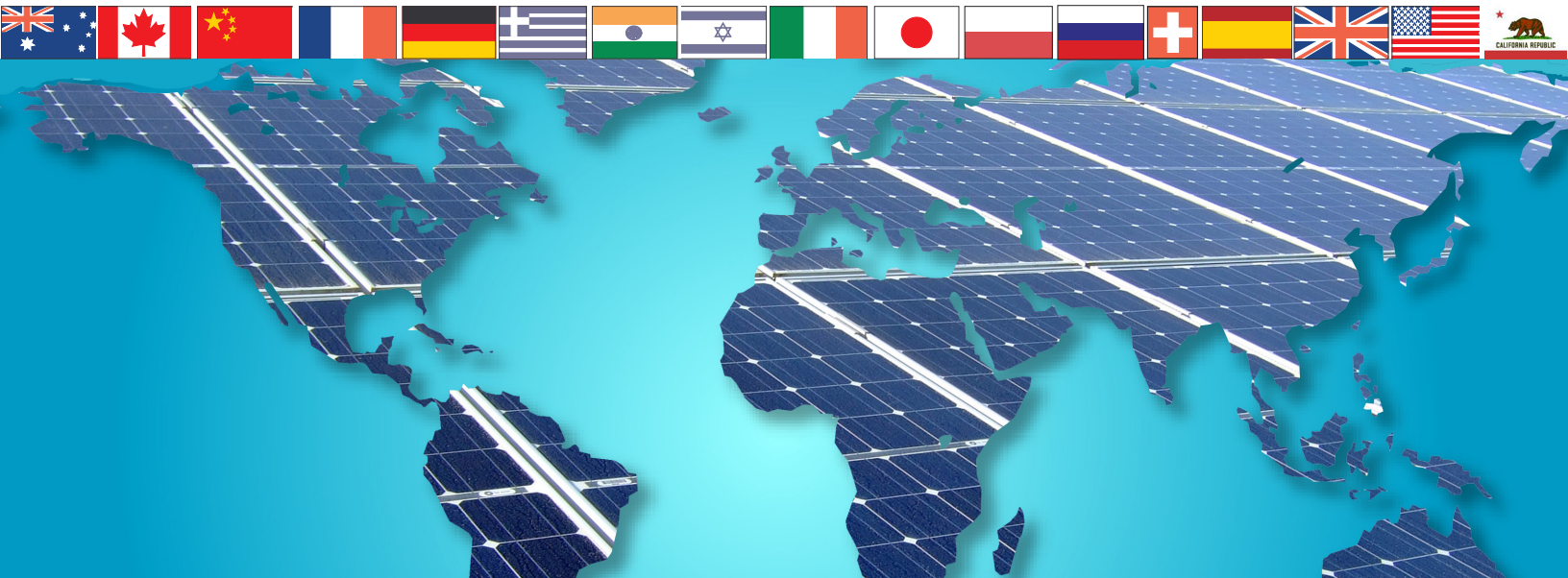


Executive Summary

The time has come to harness the sun. Today, humanity faces a multitude of sweeping crises. Amongst them, an energy crisis, which requires us to meet an ever increasing demand; an environmental crisis, which requires all of that additional energy supply come from clean sources, and an economic crisis, which suggests a need for new models for growth.

Fortunately, solar energy stands at the crossroads of these challenges and offers an opportunity to address them simultaneously. Indeed, with today's solar technology we can access about 4 times the world's annual demand for power and we can do so cleanly. The solar industry, growing at rates of 40-50%, offers tremendous economic and employment opportunities. Furthermore, solar is a source of power which is not only clean but versatile; it can serve power providers' grids as well as 2 billion people, most of whom live in rural areas not connected to the grid and rely on expensive, dirty sources of energy.

The International Energy Agency has estimated that meeting our increasing global energy demand by 2030 will require investments of $16 trillion (or about $600 billion/year); notwithstanding the tremendous health and environmental costs associated with a continued reliance on polluting sources of energy. It is imperative that most of that investment be earmarked for clean, renewable sources such as solar. A committed investment in solar technology today will ensure a competitive, secure, clean and 'non-depleting' energy source tomorrow.

The study draws benchmark snapshots exploring several countries' solar commitments to date as well as their efforts in fostering future growth of their solar markets. Additionally, the state of California is considered here for its importance in the global solar and economic context. While 30% of the evaluation reflects each country's progress to date, the emphasis is on drivers for future growth (70%), namely policy frameworks in place such as financial and regulatory incentives. The study's focus is on photovoltaics and policies in place at the national level. For countries such as Australia, Canada and the United States, where electricity policy is the purview of states or provinces, attention is also paid to the main state policies in place. However, scoring reflects federal level policies --and to a lesser extent state-level ones -- as federal governments have an important role to play in coordinating action at the national level.

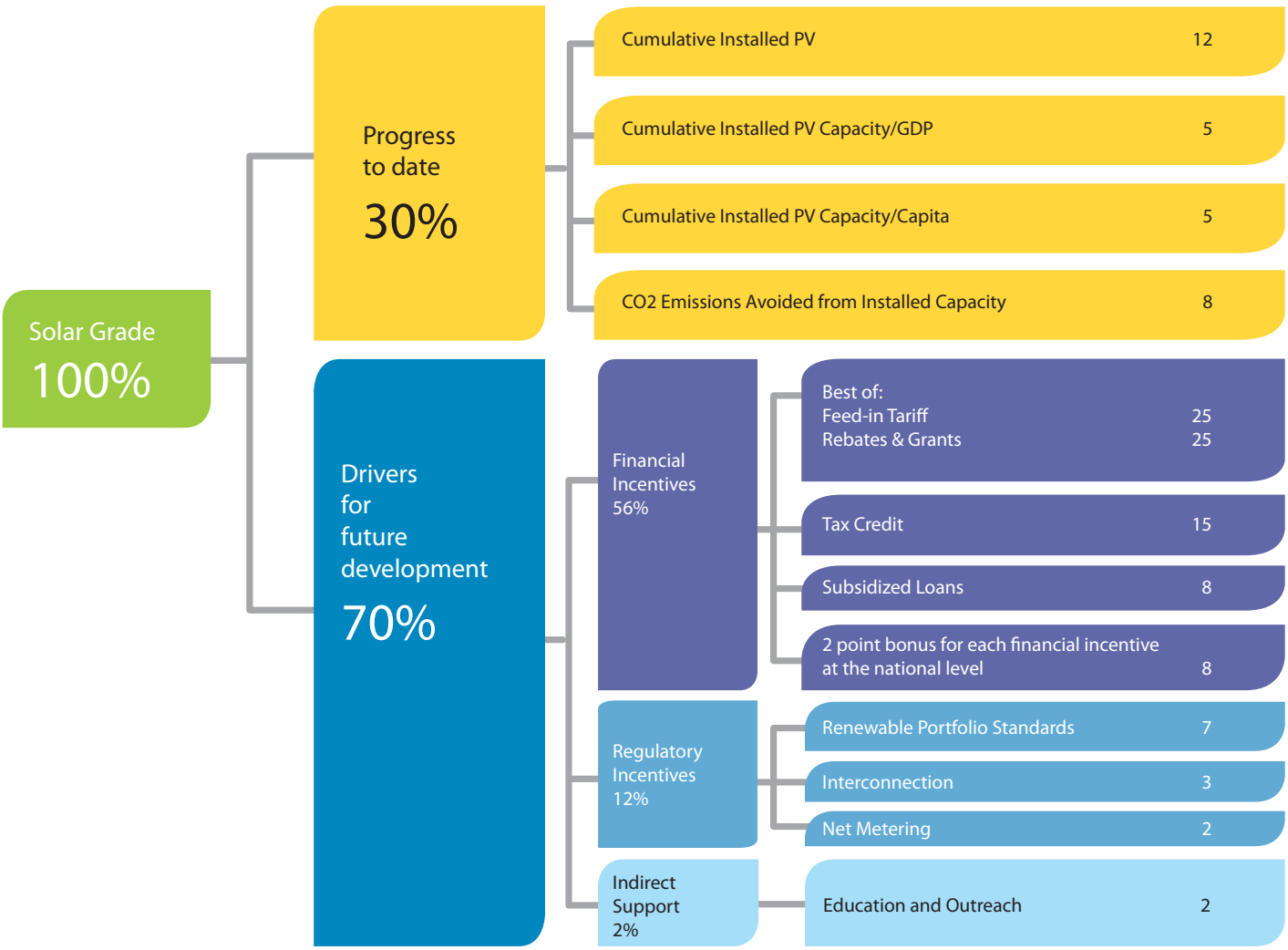
While country grades are a function of solar-specific indicators only, the full report also examines the general context surrounding solar support measures, such as energy efficiency measures, fuel sources used for electricity generation and renewable energy targets.

Final grades reveal that all countries are still in the early phases of solar deployment.

- Even Germany, which scored highest being the country with most PV installed and having put in place promising 'drivers for future growth', still finishes with only 70 out of a 100 possible points. The state of California, also scored well in 2nd place, having implemented a 10-year $3 billion rebate program for solar.
- Spain, which saw tremendous growth up until this year, overtook the US in 2008 as the 3rd country with the most installed PV. A period of uncertainty as to its commitment to solar followed by a decision to cap the market for 2009 negatively affected Spain's grade. However, based on Spain's expected installed capacity for 2008 (this report uses end 2007 installations data -2008 numbers not yet available), Spain would score a B instead of C+.
- A recent move by the United States to extend its only federal-level financial support for solar, assured a much needed long term commitment for the industry. However, much more could be done in a country with such solar, financial and technological resources.
- A few countries such as Italy, France and Greece fare moderately because of still young markets, but all earn points for having put in place substantial drivers for growth. Solar industries are expected to grow in these countries moving forward.
- Australia's federal level support is currently inadequate to meet the demand for solar growth. The government is considering an aggressive support mechanism, which, if adopted, could spur significant growth in the country. Similarly to the US, Australia is a country with tremendous solar, technological and financial resources that could do much more to reach its solar potential.
- Japan, once the leading country in terms of both production and installed capacity scores low, its main incentive program having ended in 2005. However, the Japanese government is considering restarting its residential PV program.
- China, which seems committed to developing a clean energy infrastructure, has set ambitious targets and put in place a comprehensive renewable energy policy framework. However, the country scores poorly here because the specifics for solar PV remain unclear. China stands to gain a lot from supporting the deployment of PV, given its tremendous energy needs, its high insolation and position as one of the three largest PV producers in the world.
- Finally, countries that rate poorly in the study are Russia and Poland, with no solar markets and no mechanisms to capitalize on their solar potential, and to a lesser extent, the United Kingdom with a very small market and no significant support for solar growth.

The 2009 version of the Solar Report Card will explore the same countries and more along solar-specific lines only. Additionally, it will include a few developing countries and examine barriers to solar investments there.

Grading Scheme: 100 Point Distribution



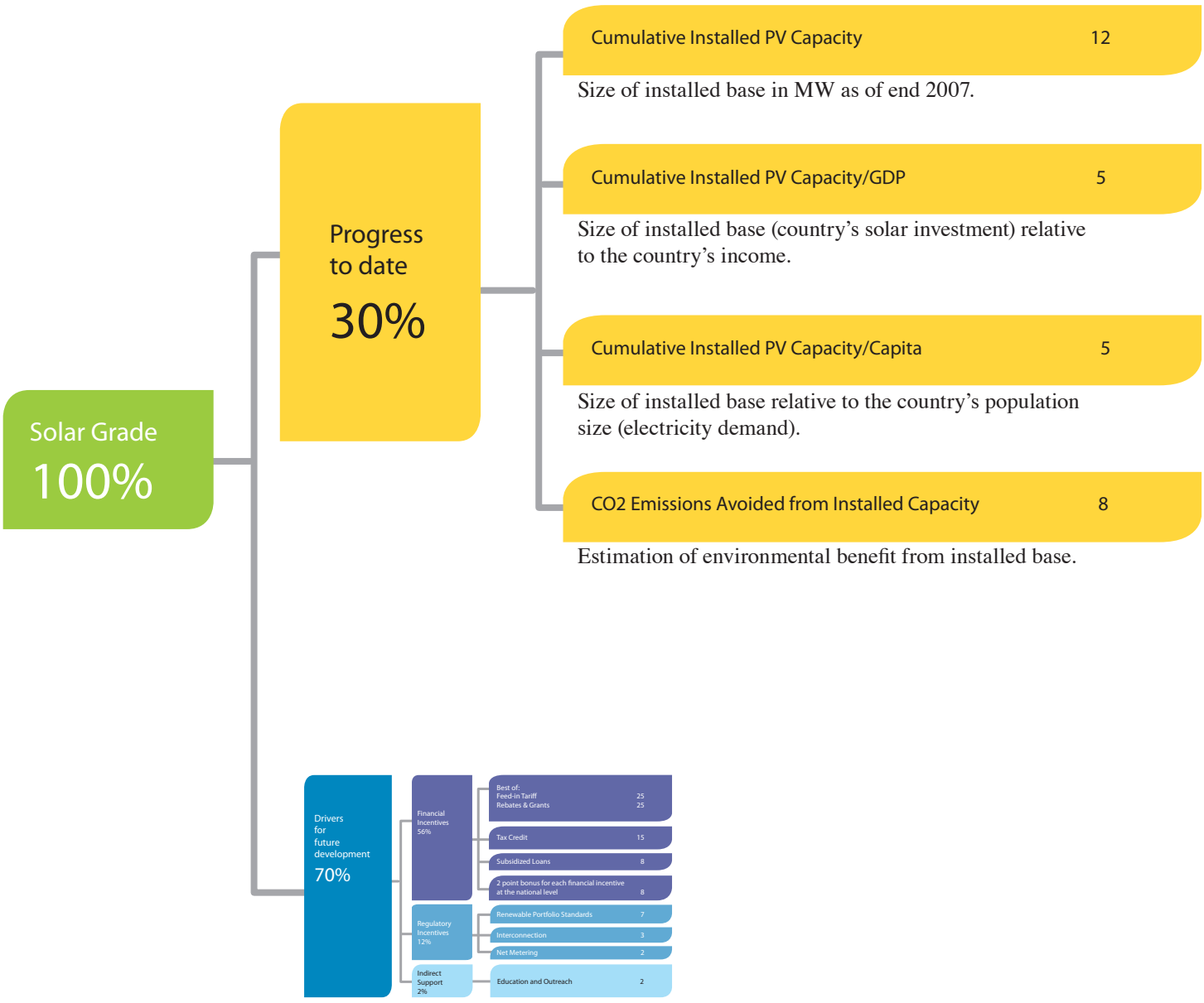
Grade Breakdown

Progress to date
30 out of 30 Possible Points =

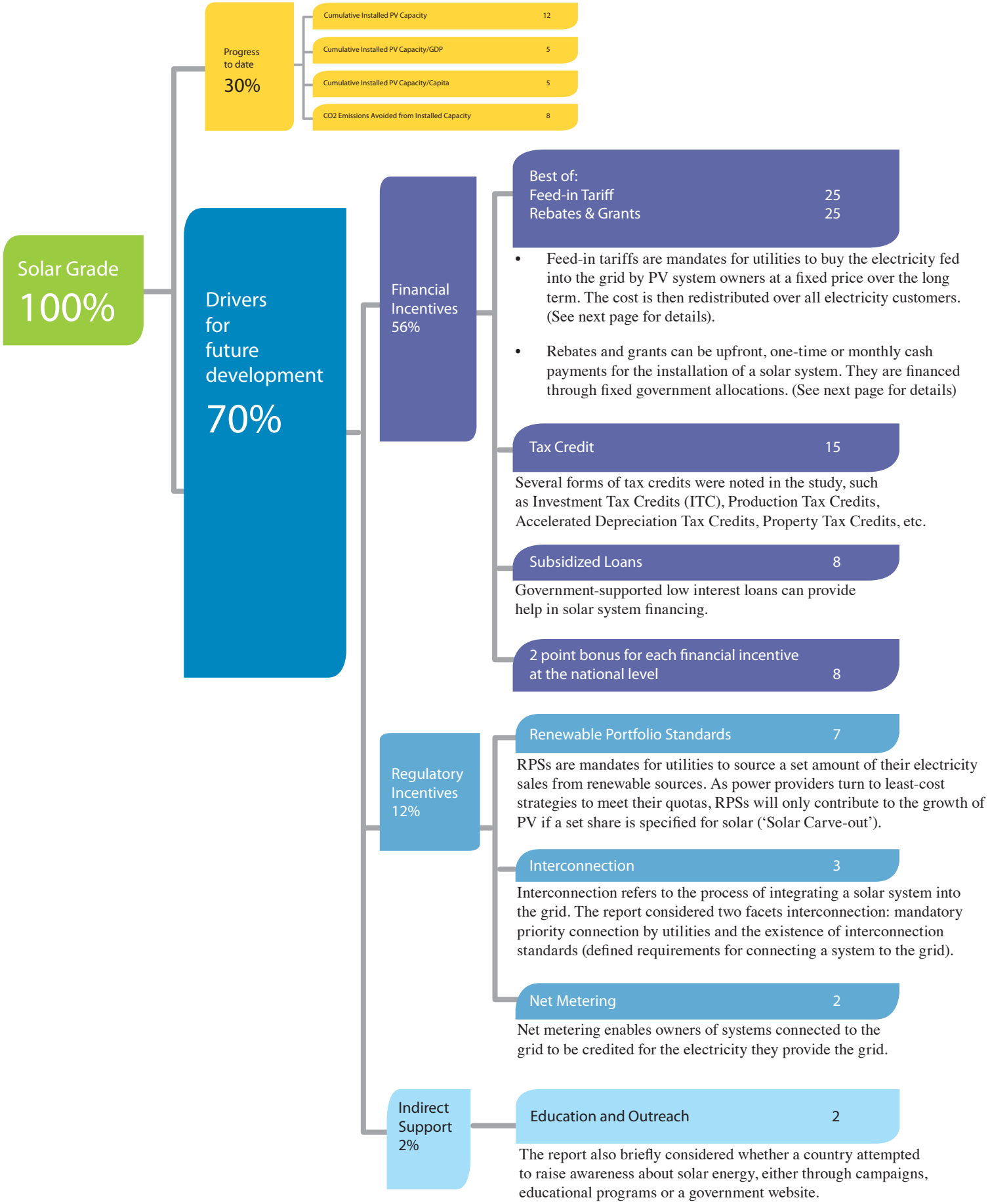
Financial Incentives
56 out of 56 Possible Points =

Regulatory Incentives
12 out of 12 Possible Points =

Grading Scheme: "Progress to date" Indicators Defined



Grading Scheme: "Drivers for Future Development" Indicators Defined



Grading Approach: SOLAR INDICATORS

Progress to Date (30 possible points)

- **Cumulative Installed PV** (12 Pts): Size of installed base in MW as of end 2007.
- **Cumulative Installed PV capacity per GDP** (5 Pts): Size of installed base (country's solar investment) relative to the country's income.
- **Cumulative Installed PV per capita** (5 Pts): Size of installed base relative to the country's population size (electricity demand).
- **CO2 Emissions Avoided from Installed Capacity** (8 Pts): Estimation of environmental benefit from solar effort to date; based on electricity portfolio and average emission factors for each fuel source, installed capacity and insolation rates.

Included in the full report but not in the grading scheme are **annual installations growth rates** for 2005-2006 and 2006-2007, which show recent market take-up rates, thus putting young markets in perspective.

Drivers for Future Development (70 possible points)

The study compiles information on several types of incentives (financial incentives and aspects of the regulatory infrastructure) available for PV –mostly at the national level, though state-level incentives in federal systems were also taken into account to the extent that they contributed to the national market.

Desirable characteristics considered for all incentives are:

- that they provide long-term assurance for the market,
- that they be either PV-specific or provide enough of an incentive to address PV's specific cost structure,
- ideally, the incentive does not restrict PV market growth to one or several particular segments (Residential, Commercial, Non-profit, Utilities, etc.), buts instead promotes a diversified use of PV technology.

Financial Incentives (56 possible points)

Financial incentives come in many shapes and sizes, which makes a cross-comparison challenging. Policies ought to not only aggressively promote market growth, but also do it sustainably and at least cost for rate-/taxpayers. [1]Ideally, the incentive is dispensed for each unit of solar electricity generated (kWh) as opposed to system capacity (kW). This ensures that subsidized systems are not only installed but also operating optimally.

In the present analysis, the grading assumes that historically, feed-in tariffs and rebate programs have provided more effective support than tax credits, and that tax credits in turn have been more efficacious than subsidized loan programs. However, the particular grades reflect the specific policy's design according to the following characteristics:

- **Feed-in tariffs/Renewable Energy Payments** (w/Rebates, best of 25 Pts)

Feed-in tariffs guarantee owners of grid-connected PV systems that the electricity they provide to the grid will be bought at a fixed price over a long period (usually about 20 years). These laws, which differ in specific design across countries, have been successful in accelerating the deployment of solar and the growth of the industry. These policies have been widely adopted in Europe and are gaining popularity elsewhere. The main advantages of Feed-in Tariffs (FiTs) are that they provide a long-term commitment to the market, and one that is not subjected to government's budgetary fluctuations (as explained below). However, there have been concerns about FiTs being too blunt an instrument and a costly policy and it is thus important they be carefully designed. Countries that incorporated the design features outlined below scored higher (this list is by no means an exhaustive list of important considerations, but aims at summarizing the main points).

- The level of the fixed rates should allow for reasonable profits. The incentive level should be carefully set so as to not be overly generous and overheat the market. It should be country-specific in its considerations of factors from investment climate to solar insolation.
- Tariffs should be degressive and the rate of degression should reflect market take-up. FiTs have been criticized for not putting any downward pressure on system prices by guaranteeing a fixed rate over the years. But the policy can incorporate a periodic decrease in rates --i.e. systems that apply in year 2 of the program get a long-term fixed rate that is lower than the rate year-1 systems received- so that rates reflect or promote the industry's progress in achieving economies of scale. The rate of the

[1] It should be noted here that a useful metric to assess the cost-benefit across mechanisms would be a "cost per ton of CO2 displaced through PV installations" indicator, one that was not achievable due to a lack of transparency regarding program costs. Much is to be gained from countries conducting and making available program cost analyses and data.

Financial Incentives (continued)

degression (i.e., how much less year-2 systems will get than year-1 systems) should reflect the country's PV market stage and rate of development and can be used as an instrument to keep its growth at a sustainable pace.

- Feed-ins should not include restrictive caps. Legislators should refrain from capping their program in order to control the growth of their market. Experiences with FiT caps have shown caps to be very problematic for a smooth development. They tend to cause boom/bust cycles. For the purpose of the study, countries with a high cap (Italy 3,000 MW) were less penalized than countries with low and thus quickly restrictive ones (France with 160 MW). Incentive levels should be used to control market growth but growth itself should not be capped.
- Funding for the feed-in program should not come from the government's budget. Instead, utilities should be allowed to redistribute the cost to ratepayers in proportion to their consumption. Funding feed-in tariffs through government earmarks makes the programs vulnerable to political vagaries and economic fluctuations.

- **Direct Capital Subsidies: Rebates and Grants** (w/Feed-ins, best of 25 Pts)

These policy mechanisms also vary greatly across countries and even within programs. For example, California's Solar Initiative can come both in the form of a monthly performance-based payment ($/kWh) and a one-time rebate based on expected-performance ($/W).

Grant programs that provide a one-time cash payment address the major hurdle to the adoption of solar that is the upfront system cost. They usually are allocated on an installed capacity (per kW) basis. Performance-based incentives (per kWh) ensure the most efficient technology will be employed and that systems are more likely to be used at and maintained for optimal performance. Expected-performance incentives are a hybrid trade-off that seek to capture the benefits of an upfront rebate and a performance-based one.

As any support policy, rebates should provide assurance to the market over the long-term, and similarly to feed-in tariffs, performanc based incentives should be degressive and decrease according to market development.

Other characteristics considered for the purposes of grading are level of incentive, program and budget size, whether the program is restrictive in its support of a particular segment or within a segment (means-tested for example).

- **Tax Credits** (15 Pts)

Several forms of tax credits were noted in the study, such as Investment Tax Credits (ITC), Production Tax Credits, Accelerated Depreciation Tax Credits, Property Tax Credits, etc.

Tax credits should include provisions for non-taxable entities such as non-profits, governmental bodies and schools for example, to benefit from the incentive through third-party agreements.

Better grades were given to tax credits that allow for the largest numbers of actors to claim the largest deduction and for credits that can be claimed in conjunction with other incentives.

- **Subsidized Loans** (8 Pts)

Low interest loans are an important element when considering accelerating adoption of solar.

The study focuses on low interest loans subsidized by the national government although low-interest loans or 'green loan' programs may also be available to investors for PV system purchase from local financial institutions or regional bodies. Loan programs that cover the largest part of a system's costs (ideally 100%), with the lowest fixed interest rates and longest terms were graded more favorably.

- **2 Pt Bonus for each available incentive at national level** (8 Pts)

Regulatory Incentives (12 Possible Points)

- **Renewable Portfolio Standards (RPS)** (7 Pts)

Renewable Portfolio Standards or Obligations are mandates for utilities to source a set amount of their electricity sales from renewable sources, either by producing it themselves or by purchasing from another generator. This policy instrument has been advocated as an efficient, market-based tool to promote the development of renewables, as it leaves it to power providers to find the least-cost strategy to meet their quotas. However, since utilities will opt for the least-cost options, this also means that unless they have a specific mandate to incorporate a set share of solar in their renewable portfolio ('Solar Carve-out'), they will usually not invest in solar energy projects. None of the countries studied that have adopted RPS-type policies seem to have a solar carve-out provision as well. Therefore, for the purposes of this study and as far as the grading is concerned, a RPS is not a heavily weighted approach.

Additionally, some of these Standards or Obligations allow power providers to "buy their way out" by paying a penalty for each unit of electricity they fail to source from renewables.

Drivers for Future Development (continued)

Regulatory Incentives (continued)

- **Interconnection** (3 Pts)

The report cards also consider whether the country facilitates the deployment of photovoltaics by either mandating priority connection to the grid for PV systems (as is usually the case in countries that are guaranteeing feed-in tariffs), or whether the country has at least interconnection standards.

Interconnection standards define the requirements for connecting a system to the grid and are a crucial part of the regulatory infrastructure necessary for facilitating the uptake of renewables. Too often still, these requirements vary from utility to utility and this lack of uniformity renders the process of connection to the grid tedious, time-consuming and thus costly.

- **Net Metering** (2 Pts)

Countries were also evaluated on whether they allow net metering, which enables owners of distributed systems connected to the grid to be credited for the electricity they provide to the grid. This measure decreases the pay back time for the system and encourages conservation.

Indirect Support (2 Possible Points)

- **Education and Outreach** (2 Pts)

Finally, each country was evaluated according to whether it attempted to raise awareness about solar energy, either through campaigns, educational programs or at the very least a government website.

Solar Energy Policy Context

The following section addresses issues that provide a context for a country's solar market. However, because those indicators are either not directly related to solar or are a function of how much sun a country gets (which is beyond its control), they are included here but not evaluated as part of the country grade.

Carbon Intensity

Data for CO2 emissions from Electricity Output as well as C02 emissions growth rates were used to highlight which countries stand to gain most from deploying solar technology in terms of reducing pollution.

Grid-Parity Proximity / Solar Competitiveness

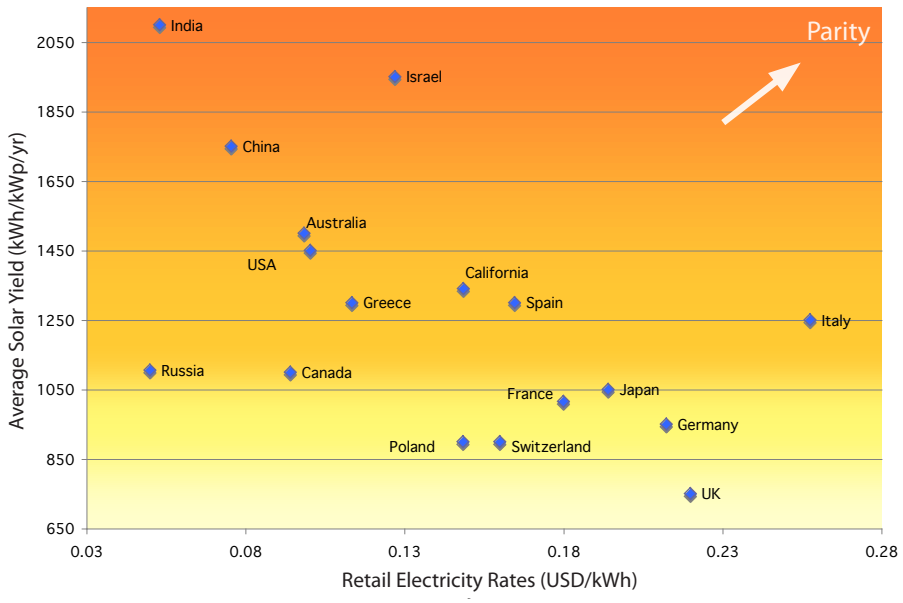
Grid-parity is the point at which the cost of electricity generated from solar equals that of electricity generated from prevailing sources. That point varies for each country, depending, notably but not exclusively, on average electricity rates and how much sun the country gets.

Holding constant the price of solar, the study looked at retail electricity prices and insolation rates as indicators of how close solar stands to being competitive with other sources of electricity in any given country. Because solar incentives are intended to bridge the gap between the price of solar and prevailing electricity rates, the higher the electricity rates, the lower the incentives need to be in order to make solar power competitive.

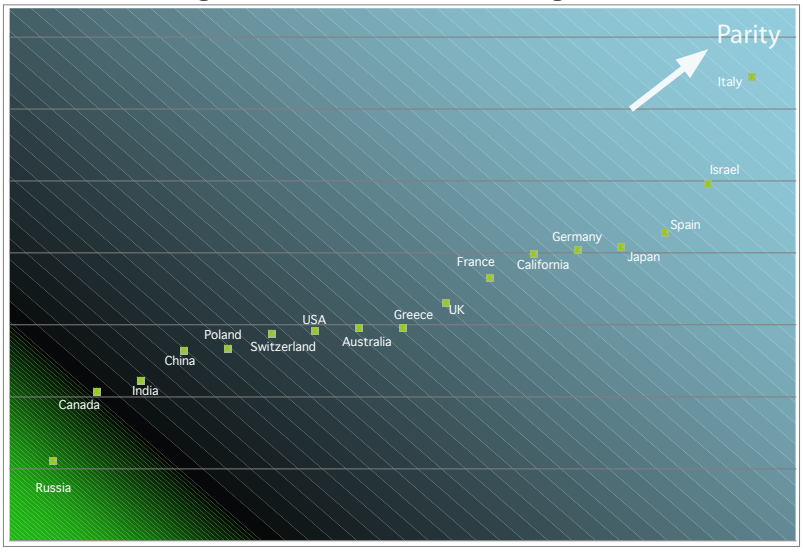
Therefore, in the tables opposite, countries with the highest electricity rates and highest insolation rates (closest to the upper right hand corner) stand to gain the most from incentivizing solar.

It should come as no surprise to find that countries closest to the left edge of the graphs (with the cheapest electricity rates) such as India, Russia, China, Australia and the US are also notorious for heavily subsidizing fossil fuels. Countries that subsidize their electricity not only encourage higher electricity consumption, but also artificially keep solar energy from reaching grid parity.

Proximity to Parity



Countries closest to the upper right hand corner stand to gain the most from incentivizing solar.



Solar Resources, Carbon Intensity and Proximity to Grid Parity.

The table below shows the relative position of countries in terms of their solar resources, CO2 intensity and proximity to grid parity.

The darker the grey, the more CO2 emissions the country contributes.
The darker the yellow, the more sun the country gets.
The darker the pink, the closer to grid parity, point at which the cost of solar equals the cost of other sources of electricity.

The table is a tool to highlight:

- countries that stand to gain the most from installing solar in terms of emissions reduction given their solar resources
- countries for whom financial support of solar can be least costly given their solar resources and cost of electricity.

Solar Energy Policy Context (continued)

Renewable Energy and Solar Targets

The report compiles countries' official renewable energy targets as an indication of their commitment to incorporating clean energy sources in their portfolios. It is important to note that ambitions expressed both as medium and long-term targets are more credible than long-term targets only. Countries may be tempted to set a seemingly ambitious goal 'on the horizon' without any medium term accountability. Conversely, a medium-term target without a long-term one can denote a lack of continuity in the commitment.

Particular attention was paid to whether the country had set a specific target for solar.

Electricity Generation by Fuel

Countries' electricity portfolios were considered as a representation of their commitment to clean and renewable use of electricity to date.

Energy Subsidies and Public Budgets for PV

According the latest estimates by the International Energy Agency, energy subsidies worldwide range from $250 to 300 billion a year. Fossil fuels, the most polluting sources of energy are also the most subsidized at the tune of $180 to 200 billion a year. Renewable sources account for about a $10 billion share of subsidies.

Subsidies are not inherently bad. In fact, the development of photovoltaics depends on important subsidies. But the allocation of electricity subsidies around the world is grossly biased towards fossil fuels and nuclear. The result is that fossil fuel prices are kept artificially low, which encourages an over-consumption of greenhouse gas emitting fuels and hinders the development of renewable sources by making them appear costlier. It is therefore important to place the discussion of the financial viability of renewables -and particularly photovoltaics- in this context. At the tune of $210 billion a year, renewables too would be economically viable.

Unfortunately, there has been a notorious lack of transparency and dearth of recent studies on the topic of energy subsidies. This report attempts to compile the scattered data. When available, data on electricity subsidies -more particularly- was collected. More specifically still, R&D data per technology seems more accessible. However, while an essential parameter for emerging technologies such as photovoltaics, R&D amounts are only a particular type of subsidy.

R&D funding unfortunately follows the same pattern as electricity subsidies in general: a UNEP study estimated government R&D spending on renewable energy and energy efficiency at $7.1 billion in 2007 (which represents 12% of government R&D funding on energy, compared to 40% for nuclear technologies). It also noted, "Energy R&D accounted for just 4% of total government R&D in 2005."[2]

In fairness, it should be noted that a portion of fossil fuel R&D support is sometimes allocated to reduce emissions associated with fossil fuel use, which may also be an important part of the short-term solution.

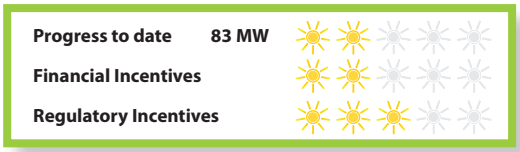
[2] United Nations Environment Programme, "Global Trends in Sustainable Energy Investment", 2008.

Summary of Findings

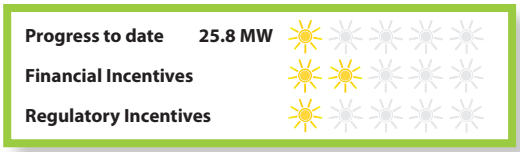
	Possible Pts	Australia	Canada	China	France	Germany	Greece	India	Israel	Italy	Japan	Poland	Russia	Spain	Switzerland	UK	USA	California
PROGRESS TO DATE																		
Cumulative Installed PV	12	6	3	8	6	12	3	8	0	8	12	0	0	10	3	3	10	8
Cumulative Installed/GDP	5	2	0	0	0	5	0	1	0	1	4	0	0	4	1	0	1	2
Installed PV/Capita	5	2	0	0	2	5	0	0	0	2	4	0	0	4	2	0	2	3
Avoided Emissions from Installed Capacity	8	1	0	1	0	8	0	2	0	0	6	0	0	3	0	0	4	1
30	**30**	**11**	**3**	**9**	**8**	**30**	**3**	**11**	**0**	**11**	**26**	**0**	**0**	**21**	**6**	**3**	**17**	**14**
FINANCIAL INCENTIVES																		
Feed-in Tariffs	25	7	5	3	16	25	19	9	18	22	0	0	0	19	4	0	1	6
Direct Capital Subsidies (Rebates/Grants)	25	16	6	0	0	0	17	9	0	4	6	3	0	0	0	12	10	22
Tax Credits	15	0	10	1	11	0	3	12	0	0	3	0	0	3	0	2	15	8
Subsidized Loans	8	5	2	1	5	8	4	2	0	5	0	3	0	0	0	0	0	0
2 pt bonus for each available incentive at the national level	8	4	4	6	6	4	8	6	2	4	4	4	0	4	2	4	2	4
56	**56**	**25**	**22**	**11**	**38**	**37**	**34**	**29**	**20**	**31**	**13**	**10**	**0**	**26**	**6**	**18**	**27**	**34**
REGULATORY INCENTIVES																		
Renewable Portfolio Standard	7	2.5	0	1.5	0	0	0	1	0	2.5	1.4	0	0	0	0	3	3.5	6
Interconnection	3	3	2	3	3	3	3	1.5	3	3	2	0	0	3	3	2	1.5	2.5
Net metering	2	1	1	0	0	0	0	0	0	2	2	1	0	0	0	0	1	2
12	**12**	**7**	**3**	**5**	**3**	**3**	**3**	**3**	**3**	**8**	**5**	**1**	**0**	**3**	**3**	**5**	**6**	**11**
INDIRECT MEASURES																		
Education and Outreach	2	2	2	0	2	0	2	2	2	0	2	1	0	0	2	2	2	2
2	**2**	**2**	**2**	**0**	**2**	**0**	**2**	**2**	**2**	**0**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**2**
TOTAL PROGRESS TO DATE	30	11	3	9	8	30	3	11	0	11	26	0	0	21	6	3	17	14
TOTAL DRIVERS FOR GROWTH	70	34	27	16	43	40	39	34	25	39	20	0	0	29	11	25	35	47
100 Point Total	**100**	**45**	**30**	**25**	**51**	**70**	**42**	**45**	**25**	**50**	**46**	**0**	**0**	**50**	**17**	**28**	**52**	**61**
FINAL GRADE	**A**	**C**	**D**	**D-**	**C+**	**A-**	**C-**	**C**	**D-**	**C+**	**C**	**F**	**F**	**C+**	**F**	**D-**	**C+**	**B**

Summary of Findings (continued)

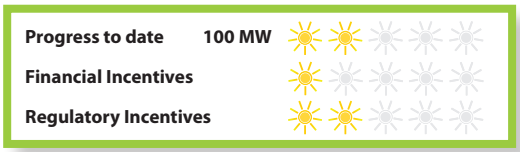
AUSTRALIA C



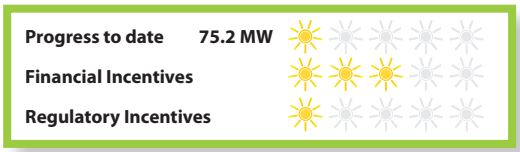
CANADA D



CHINA D-



FRANCE C+



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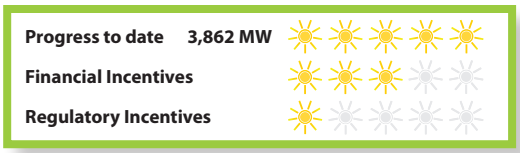
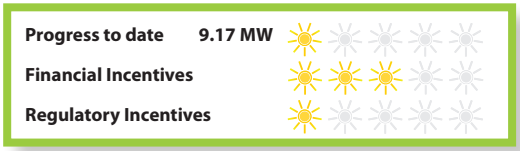


GREECE C-



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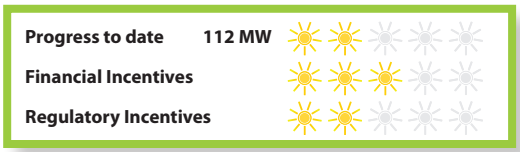
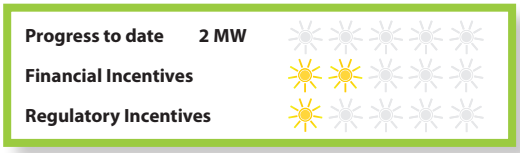
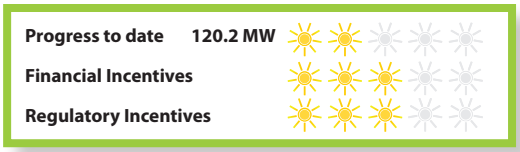


ISRAEL D-



ITALY C+



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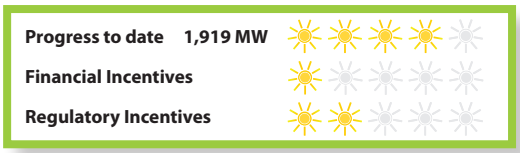

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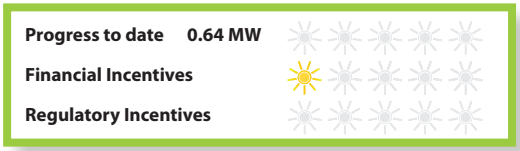

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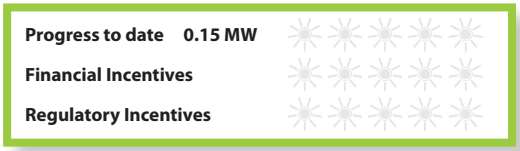

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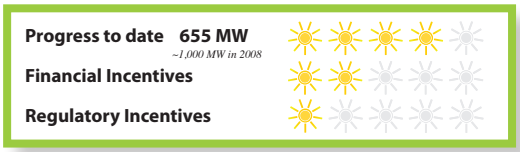

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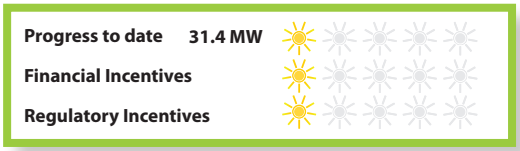
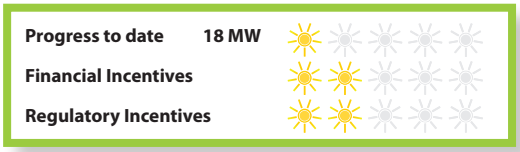
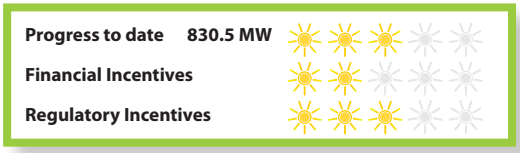


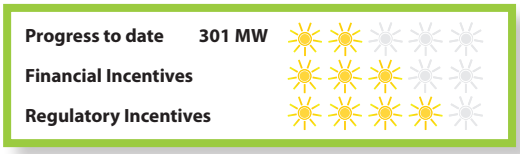
UNITED KINGDOM D-



UNITED STATES C+



CALIFORNIA B



AUSTRALIA

Source: *Global Energy Network Institute*

- Greater than 6.67 kWh/m2/day
- Between 6.38 and 6.67 kWh/m2/day
- Between 6.11 and 6.38 kWh/m2/day
- Between 5.56 and 6.11 kWh/m2/day
- Between 5 and 5.56 kWh/m2/day
- Between 4.4 and 5 kWh/m2/day

Solar Insolation: 1000-2000 kWh/kWp/yr Yearly Average Solar yield
3.75-6.75 kWh/m2/day Average Solar Radiation on collector surface

Grade C

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **83 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2007: 82.5 MW[2]
Cumulative installed end 2006: 70 MW[3] (85% off-grid)
15 MW of PV installations expected in 2008.[4]
Annual installations growth rate 2005-2006: +17.4% 2006-2007: +40%
Population: 21 M PV/capita: 3.9 W/capita

Drivers for Future Development[5]

Financial Incentives

National Level

PV Rebate Programme: 'Solar Homes and Communities' (2000-2010)

Provides cash rebates to Australian households or community use buildings for the installation of PV systems.

Goals:[6]
- Reduce greenhouse emissions
- Assist in the development of the Australian PV industry
- Increase public awareness of renewable energy

Rebate for households: AU$ 8/W (US$ 7.65) capped at AU$ 8,000 per system.**
Program capped at 6000 households per year.
Rebate for extensions to existing systems: AU$ 5/W capped at 1 kW per system.
Community buildings are eligible for a 50% rebate of the system cost, capped at 2 kWp.

In May 2008, eligibility for this rebate became means tested: the rebate is now only available to households with a pre-tax income of less AU $100,000 for systems up to 1 kW.[7]

Overall amount of funding dedicated to the rebate program (which terminates at the end of the 2009-10 financial year): AU$ 201.8 million.

- From 2000 to April 2008, almost 13,000 systems were installed under the PVRP, amounting to 17.8 MWp of PV. [8]
- 1.85 MWp in 2006[9]
- 4.6 MWp in 2007 (93 % grid connected)
- In April 2008 alone 856 kW were installed.

The numbers show the increase in PV installations since the doubling of the rebate.

In October 2008, the Sydney Morning Herald reported the program had been so successful, "the federal government had handed out $150 million - the equivalent of three years' funding - in 16 months", and that only 4 months into the 08/09 fiscal year, all the funds for the PVRP had already been allocated.

The program is still slated to end when the budget is fully allocated or at the end of FY 2009/10, whichever comes first.

** The amount of the rebate doubled in 2007 from AU$ 4/W capped at AU$ 4,000 in 2006.

Financial Incentives (continued)

National Solar Schools Program (2008/09 to 2014/15)[10]

This new program aims at providing grants for schools to install solar power systems, rainwater tanks and energy efficiency measures. Grants up to AU$ 30,000 are available for schools with systems below 2 kW and AU$ 50,000 for systems over 2 kW.
Programme allocation: $AU 480 million starting 2008-09 (up from $AU 150 million in 2008).

Solar Cities Program (2007-2013)

Comprises of various public displays demonstrating how high penetration solar power, smart meters, energy efficiency and improving the market for distributed generation and demand side energy solutions can combine to provide a sustainable energy future in high density locations.[11]

There are currently 7 Solar cities: Adelaide, Coburg, Townsville, Blacktown, Alice Springs, Perth and Central Victoria.

The Solar City displays also distribute renewable energy information, including technology advantages, disadvantages, initial and ongoing costs, performance expectations, lifetimes of components, and usage restrictions.

AU$75 million over 5 years is the program budget.

The Solar Cities program is a partnership involving all levels of Government, the private sector, and the local community. As such, this program has rekindled utility interest in PV.

Renewable Remote Power Generation Programme (RRPGP) (2000-2007-2011)

Provides financial incentives to increase the use of renewable energy for power generation in remote areas of Australia, with an aim to reduce diesel use, to assist the Australian renewable energy industry and the infrastructure needs of indigenous communities, and to reduce long-term greenhouse gas emissions.[12]

Although not PV specific, over 95% of systems installed under the RRPGP have been PV systems replacing diesel powered off-grid generators.
Grants are for up to 50% of capital value of RE components in the replacement systems, plus additional funding by the states. Energy efficiency measures also qualify for grants.

In 2006 1.64 MWp of PV was installed, bringing the total installed capacity to 7 MWp.

An additional AU$ 100 million was allocated in July 2007, extending the project until June 2011.
Approximately AU$ 256 million will be available over the life of the RRPGP.[13]

The RRPGP also provides funding for industry support activities, such as test facilities, standards development, training, feasibility studies and demonstration projects, as well as support for the Bushlight programme to assist with deployment of renewable energy systems in small indigenous communities (more than 100 PV powered household systems have been installed via Bushlight[14]).

Regulatory Incentives

Mandatory Renewable Energy Target (MRET)

The MRET Scheme requires electricity retailers and wholesale electricity buyers to increase their sourcing from renewables so that by 2010, they may collectively generate an additional 9,500 GWh of electricity annually from renewable sources (compared with a 1997 baseline) and so that by 2020, 20% of the country's electricity supply comes from renewables. 9,000 GWh represents about 3.8% of current generation. The government is working on a law that would increase this target to 45,000 GWh by 2020, which should be put in place in 2009. There is no solar carve out in the MRET

Utilities are required to multiply their total amount of purchases of electricity by the yearly Renewable Power Percentage (RPP) to determine to number of RECs that must be surrendered to ensure compliance. In 2006 the RPP was 2.17% (1.64% in 2005 and 1.25% in 2004)[15]. If liable parties fail to surrender the required RECs, a financial penalty of AU$ 40 per REC applies.

MRET will be phased out between 2020-2030, with the implementation of an Australian Emissions Trading Scheme.

Interconnection

It is mandatory for utilities to connect distributed energy generation systems that meet requirements and comply with safety standards.

Net Metering

No net metering law in place at the federal level. Net-metering is available at the state level in some instances (e.g. Victoria, Queensland), and at the utility level in other instances (e.g. Western Australia).

Drivers for Future Development (continued)

Other

Education and Outreach
Both the National Solar Schools Program and the Solar Cities Program have educational components.
The Australian government also has clear information on its Internet pages regarding available financial incentives as well as educational programs.[16]

Green Power Programs
Customers voluntarily pay a premium on their electricity rates for Green Power.
Launched in 2000, the program has had only a small impact on the PV industry, however it effects overall RE awareness and allows individuals to go beyond government mandated programs.

Low Emissions Technology and Abatement (LETA)
This program has an allocation of AU$ 27 million to assist the uptake of low emission technologies by supporting development of PV-related standards, training of PV designers and installers, and of solar resource mapping.[17]

State Government Support Programs

WESTERN AUSTRALIA
Feed-in Tariff
In August 2008, two Western Australian utilities introduced a gross feed-in tariff of AUD 0.60/kWh for domestic PV systems of up to 10 kW (though apparently only available to homes committing to 100% Green Power supply). The utilities then on-sell this Green Power to other electricity consumers. In September 2008, prior to an election, Western Australia's government committed to a policy allocating AUD 13.5 million to a residential feed-in tariff, and an investigation of the feasibility of extending the scheme to small business and commercial premises; as yet however, no government FiT has been legislated.

Solar Schools
The Western Australian State Government supports the installation of PV systems in Government schools. Previously it has committed AUD 5.1 million to ensuring over 350 metropolitan and regional schools harness the power of the sun by 2010. Under this program, schools were required to contribute a minimum of 1,000 AUD towards the cost of the system, and the Sustainable Energy Development Office was contributing up to 12,500 AUD to schools in metropolitan areas and 13,000 AUD to schools in regional areas.
According to the WA Sustainable Energy Development Office, this program is currently under review to enable it to operate within the National Solar Schools Program.

SOUTH AUSTRALIA
Solar Feed-In Tariff[18]
From July 2008, 'small electricity customers' (i.e. with annual consumption below 160 MWh) with PV systems will receive AUD 0.44/kWh (US$ 0.42) for solar electricity in excess of their consumption fed into the grid.
The tariff is guaranteed for 20 years. Some utilities in South Australia may provide net-metering in addition to the State tariff so that some generators may receive up to 64 cents. Program cap: a review is scheduled after the first 2.5 years or if PV capacity reaches 10 MW.

QUEENSLAND
Solar Feed-In Tariff
From July 2008, households (and other small energy users) with small-scale PV installations will be paid a guaranteed tariff of AUD 0.44/kWh for solar electricity in excess of their consumption fed into the grid. The tariff is guaranteed for 20 years. The program will be reviewed after 10 years, or 8 MW of installed capacity, whichever comes first.

NEW SOUTH WALES
In November 2008, the NSW government committed to implementing a feed-in tariff for small scale PV systems by mid 2009. A task force is being established to determine the scheme structure, such as whether it shall be a net or gross tariff.
Additionally, electricity retailer Energy Australia offers an AUD 0.27/kWh buyback tariff (twice the typical Sydney tariff) for net export between 2 and 8 pm. This initiative may encourage west facing PV arrays.

The AUSTRALIAN CAPITAL TERRITORY introduced a feed-in tariff in July 2008. The per kWh rates are set at 3.88 times the highest retail price (approximately AUD 0.60) for 100% of production for systems up to 10 kW, 80% from 10 to 30 kW and 75% above 30 kW. Rate paid for 20 years.[19]

State Government Support Programs (continued)

VICTORIA

Solar Feed-In Tariff

Consumers are currently paid a 1:1 ratio for excess generation (i.e. the same rate they buy electricity from the grid).
A Premium Solar Feed-In Tariff is expected to begin in 2009, for owners of systems up to 2 kW. The tariff will be AUD 0.60/kWh (US$ 0.57) and will be paid on net generation. The tariff will be paid for 15 years and reviewed every 5 years.

Solar Energy Policy Context

Renewable Energy Targets

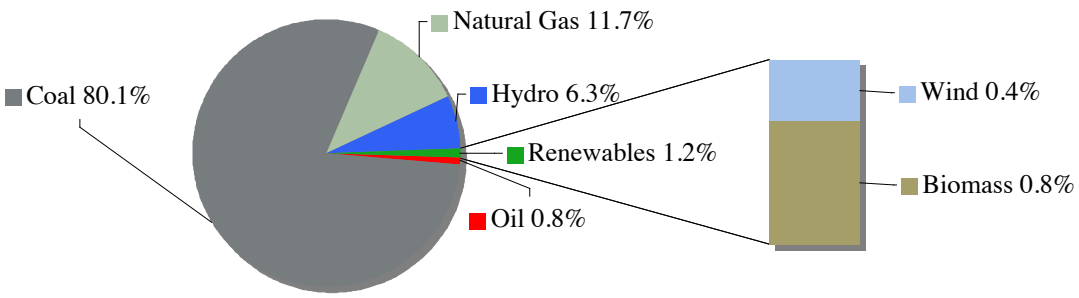
Australia's current RPS, the Mandatory Renewable Energy Target (MRET), stipulates that an additional 9,500 GWh/year is to be generated from renewable sources by 2010. This target is to remain constant until 2020, at which time the scheme is to end. Section 40 of the MRET specifies annual interim targets (6,800 GWh for 2008).

However, the MRET is expected to be superseded by the Renewable Energy Target (RET) in 2009. The RET mandates that by 2020, 20% of electricity generated per year will come from renewable sources. Taking into account current renewable energy generation, this equates to an additional 45,000 GWh/year by 2020.[20]

Solar Target

None.

Electricity Generation by Fuel (2005)[21]



Energy Subsidies [22]

Fossil Fuel subsidies: AU$9.7 billion (US$ 7.3 billion*) for 2005-06 or 97% of total energy subsidies.

Renewables subsidies: AU$330 (US$ 245 million) or 3% of total energy subsidies.

Electricity Subsidies (2005-2006):

2005-06 Support for:	Million Australian dollars	Million US dollars
Coal	1,091 - 1,866	821 - 1404
Oil	3	2.26
Gas	120	90.3
Total fossil Fuels	1,214 - 1,989	913 - 1,497
Renewable Energy and Energy Efficiency	110 - 119	83 - 90

Source: C. Reidy, "Energy and Transport Subsidies in Australia", Institute for Sustainable Futures, 2007.

Public Budgets for PV

Public budgets for PV R&D, demonstration and market development AU$ 23.5 million (US$ 17.7 million) in 2006, increased from AU$ 20 million (US$ 15 million) in 2005.
PV research and development is undertaken across a range of university, government and industry facilities in Australia. University research groups primarily focus on system components, whilst industry based and collaborative research groups focus on manufacturing processes.[23]
In 2006, AU$ 7 million was spent on research at universities and institutes and AU$ 0,6 million was spent on demonstration.

Australia had launched a 5-year AUD 150 million Energy Innovation Fund (EIF) to offer grants to research centers and companies conducting clean energy technologies R&D. AUD 100 million of this has been allocated to the establishment of an Australian Solar Institute (AIS); a

*2006 average: 1 AUD= 0.7525 USD

Solar Energy Policy Context (continued)

key objective of which is to "restore and maintain Australia's world leadership in solar energy R&D". The AIS is anticipated to be a collaboration of top universities and scientific research organizations, researching both solar thermal and PV technology.[25] It was reported in October however, that the AUD 100 million promised for July 2008 had still not been allocated. The government announced in September it would allocate that same amount annually to "clean" coal technology through the Global Carbon Capture and Storage Institute.[26]

Energy Efficiency Measures

Since 2006, Minimum Energy Performance Standards (MEPS) have been applied to all buildings. To complement the MEPS, a nationally consistent House Energy Rating Scheme (NatHERS) was implemented to enable householders to assess the energy efficiency of houses and make informed choices about housing purchases and renovation. All new residential buildings in Australia since May 2006 have been 5 star-rated.

Since 2006 The Voluntary Building Industry Initiatives Programme of the Australian Greenhouse Office (AGO), has assisted the building industry in ensuring the energy-efficient practice of building and construction professionals.

In 2005, Australian governments and the Australian lighting industry committed to a target of reducing the energy consumption of lighting by 20% by 2015.

Summary of PV Support Measures in Australia

PV Support Measures	**National (unless noted)**
Feed-in tariffs	<u>States</u> South Australia — Net FiT AUD 0.44/kWh for 20 years Queensland — Net Fit 0.44/kWh for 20 years Victoria — Expected implementation in 2009 Net Fit 0.60/kWh for 15 years
Direct capital subsidies	<u>Solar Homes and Communities Plan</u> AU$ 8/W capped at 1 kW per residential system Means-tested since May 2008: only available to households with a pre-tax income of less than AU$ 100k for systems up to 1 kW. Capped at 6,000 households per year. AU$ 5/W capped at 1 kW for extending existing system. Community buildings: 50% of capital cost for 2 kW worth of installations. <u>National Solar Schools Program</u> Grants of AU$ 30,000 for systems up to 2 kW and AU$ 50,000 for systems over 2 kW. <u>RRPG</u> 50% capital costs of the PV system components. Also provides funding for energy efficiency measures, and industry support activities.
Renewable portfolio standard	MRET: 9,500 GWh/yr by 2010 to reach 20% of electricity supply by 2020.
Solar Renewable Energy Certificates	PV systems up to 100 kW are eligible for RECs on installation for up to 15 years of operation but there are no SRECs since the MRET has no solar requirement.
PV requirement in RPS	No
Tax credits	No
Subsidized Loans	Starting 2009: "Green Loans" will provide $300 million over five years for low interest loans of up to $10,000
Net metering	Utility
Net billing	Utility
Interconnection	Mandatory + Standards

Conclusion

Due to Australia's abundance of coal, the provision of electricity has always been managed overwhelmingly on a supply-side basis. In accordance with this, electricity consumption per capita has continued to increase over the past decade. Whilst Australia ratified the Kyoto Protocol in 2007, and is on track to meet its 2010 Kyoto target, additional aggressive measures will be required for future GHG emissions reduction.

PV has huge potential in Australia. Not only is the country one of the best insolated in the world, it also has a robust body of PV research groups (which have been emigrating overseas) and an industry already developed through a significant off-grid market.

As of November 2008, there was again uncertainty regarding the government's continued commitment to its solar market. The popularity of its rebate program caused funds to be depleted a lot sooner than anticipated, in spite of the means-tested restriction put in place in May 2008. Indeed, the PV rebate program has been fully subscribed until the end of fiscal year 2009 and it is unclear whether there will be any significant support mechanism for the Australian solar market in a few months when the program is fully allocated. This type of stop and go policy trend is deleterious for the development of a domestic market.

As the Australian Government develops an emissions trading scheme (ETS) -scheduled to commence in 2010- there is significant risk that the Government will absolve itself of the responsibility of embracing clean energy options and averting dangerous climate change; instead leaving it to the market to decide a course of action. Large GHG emitters should not be financially compensated for the implementation of the scheme, as they would be under the current plan.

Alongside an Emissions Trading Scheme, Australia's government should develop a long term, bipartisan policy framework to nurture Solar Photovoltaics deployment, so that the sun-burnt country may embrace its most powerful energy resource, redevelop its industry and take part in the emerging global PV market.

This policy framework should strive to establish a long-term, sustainable support for a domestic solar market, breaking with the instability in policy direction that continues to date, which creates boom/bust cycles and uncertainty in the market.

- **Support the adoption of a gross national Feed-in Tariff.**

In recent months, several Australian states experienced with (net) Feed-in Tariffs, financial incentives that mandate utilities buy back each kWh generated by solar systems (in excess of consumption) at a fixed rate for over the long term. The cost to utilities is then redistributed over ratepayers. In September 2008, the Senate's Environmental Committee conducted an inquiry into the possibility of a gross National Feed-in Tariff.

We support a scheme that will provide sustainable, long-term support. To this end, special considerations should be given to the policy's design:

- The program should not impose a cap that may hamper market growth in the medium term or that may cause a boom and bust pattern. Market control should take place at the incentive level, not by restricting growth overall.
- Incentive levels should be:
  - Set for each sector (Commercial, Residential, etc.) so as to provide reasonable 'cost plus' profits. Incentive levels set too high will make for a costly and unsustainable program.
  - Degressive and self-adjusting; incentives should decline over time so as to reflect decreases in systems costs. Their degression rate should also account for the rate of market growth (the faster the market take-up, the faster the decrease in incentive level; conversely, if the market is slow to develop, incentive levels should decrease slowly).
  - The cost of the program should not be funded through the government's budget. Instead, utilities should be allowed to redistribute the cost to ratepayers proportionally to their consumption.

In case the government opted for a continued Rebate Program as opposed to a feed-in tariff, the incentive should be "performance-based ($/kWh)" and not "capacity-based ($/W)" so as to promote the deployment of the most efficient technology and ensure installed systems are operated optimally.

- **Consider introducing a targeted Tax Credit**

The adoption of a tax credit would be particularly important if the national feed-in tariff being considered only applied to the residential segment. In this case an investment tax credit available to commercial/industrial and utilities segments would balance market growth.

- **Support efforts to increase the current Renewable Energy Target scheme, express it as percentage of electricity and include a Solar provision**

The current Mandatory Renewable Energy Target (MRET) scheme requires electricity retailers and wholesale electricity buyers to increase their sourcing from renewables so that by 2010 they may collectively generate an additional 9,500 GWh/yr of renewable electricity (compared with a 1997 baseline), and to stabilize at 20,000 GWh in 2020. The interim target for 2008 is 6,800 GWh (less than 3% of 2006 production).

Conclusion (continued)

The government is working on a law that would increase this target to 45,000 GWh by 2020 to meet the 20% MRET target. The national Renewable Energy Target legislation is expected to be put in place in 2009.

The MRET needs to be increased and expressed as a share of electricity production. Since Australia's annual electricity production is around 255 TWh (2006), 9,500 GWh of electricity from renewables represent less than 4% of current electricity consumption. When taking into account the expected increase in electricity consumption by 2010, the 9,500 GWh target becomes abysmally small (0.3% by some accounts). By contrast France, Greece and California aim at 20% of their electricity to come from renewables by 2010.

Finally, given the country's solar resources, the MRET should include a specific share of electricity to come from solar. Indeed, such regulatory mechanisms as the MRET do not support the development of technologies with a higher up-front cost, even if, as is the case for solar in Australia, they may be a sound long-term investment. As utilities are given the choice among qualifying technologies, they tend to choose least-cost options regardless of other factors that may make solar more advantageous in the long run.

- **Support redirecting fossil fuel subsidies**

In 2005-2006, between AUD 1,214 and 1,989 million of support were allocated to fossil fuels compared to between AUD 110 and 119 million in support of Renewable energy and energy efficiency, according to research by the Institute for Sustainable Futures. It is important to understand the fact that solar technology is not competitive with fossil fuel sources of electricity in this context. As Australia considers building a clean electricity infrastructure, it should also consider redirecting its investments from polluting sources to clean renewable ones.

- **Invest in R&D**

Strengthen the relationships between the government, universities and other research institutions to ensure Australia regains its status as a world leader in PV R&D; technological developments can be utilized by Australia to capitalize on international PV market potential. The creation of a five-year AUD 150 million Energy Innovation Fund (EIF) was a good step in that direction. However, the Australian government seems to have shifted this pledge almost entirely to "clean" coal technology through the Global Carbon Capture and Storage Institute, while research funds are also needed for PV and other renewable technologies. Indeed, many of the world's most substantial research solar breakthroughs have come from Australian research, which should be supported. Also the Australian government should invest in more aggressive commercialization of breakthrough research to ensure that commercial value is not captured predominantly by international venture capital funds.

Endnotes

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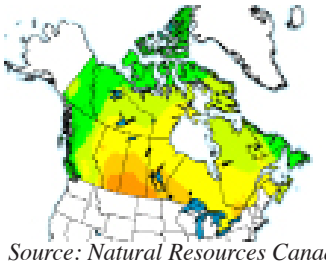
CANADA

Grade **D**



Source: Natural Resources Canada[1]

Solar Insolation: ~800-1400 kWh/kWp/yr Yearly Average Solar yield
2.50-5.0 kWh/m2/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **25.8 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2007: 25.8 MW[2]

Cumulative installed end 2006: 20.5 MW (93% off-grid)

Annual installations growth rate 2005-2006: +30.6% 2006-2007: +41.5%

Population: 33 M PV/capita: 0.62 W/capita

Drivers for Future Development[3] (prices in CAD, CAD=0.925 USD)

Historically, electricity policy has been the purview of provinces because the constitution places natural resources under the provinces' jurisdiction. Today, most electricity production comes from provincially owned monopoly power generators. The federal government however has a role to play in designing a national renewable energy strategy, providing incentives and coordinating policy across provinces.

Federal Solar PV Incentives

Financial Incentives

ecoENERGY for Renewable Power Program

Federal initiative aimed at increasing Canada's supply of electricity from clean sources (including solar PV) by investing US$1.5 billion through an incentive of one cent per kilowatt-hour for up to 10 years to eligible low-impact, renewable electricity projects constructed between 2007 and 2011.

The program is designed to support 4,000 MW. The federal government was petitioned in vain to add another $2.2 billion and extend the target to 12000 MW by 2010, since the success of the program has lead officials to believe it would be fully subscribed by 2009.[4]

Tax Credit

50% Accelerated Capital Cost Allowance (CAD 25 million budget)

Businesses or individual taxpayers can deduct the cost of PV systems 3 kW and above, up to 50% per year.

Drivers for Future Development (continued)

Federal Solar PV Incentives (continued)

Regulatory Incentives

Interconnection

Canada put in place the first interconnection standard for PV systems in 2006.[5]

Net Metering

There is no federal net metering mandate in Canada but some provinces have adopted net metering and net billing policies.

Education and Outreach

The Canadian government has extensive information on photovoltaics on its websites (CANMET Energy Technology Center and the Canadian Renewable Energy Network), including information for children.

Main Provincial Solar Support Programs

Ontario

- The Province of Ontario's Renewable Standard Offer Program (RESOP) started in 11/06 and aimed at 1000 MW of PV by 2017. As of August 31, 2008 there were already over 520 MW of PV under contract and more under review. RESOP is essentially a feed-in tariff that pays solar energy producers 42 cents/kWh for grid-tied solar power for 20 years and for projects under 10 MW.

  Obviously, given the 2017 target, this rapid take up was unexpected. The 520 MW of contracts have been awarded amongst a small pool of developers, while the development of rooftop residential has lagged behind due to prohibitive administrative barriers associated with connecting to the grid and the RESOP contract process. The program is being redesigned to improve its support of residential PV.
- At province level: Some residents of Ontario eligible for 0% loan up to $50k (PowerHouse program)
- Sales Tax Rebate on purchase of PV systems components.

British Columbia's utility is considering a Standard Offer Program as well for clean electricity projects up to 10 MW; solar rates are expected to be lower than Ontario's.

Northwest Territories

The Alternative Energy Technologies Program provides funds for alternative energy demonstration projects as well as up to 1/3 of costs for residential/commercial PV projects -with a cap of $5,000/yr ($15,000 cap for off-grid). 50% of project funds for communities capped at $50,000.

Prince Edward Island

- Offers a provincial sales tax exemption on RE equipment.
- There is also a regulation in place for utilities to buy electricity from large-scale renewable generators at a rate of ¢7.75/kWh.

Solar Energy Policy Context

Renewable Energy Targets

No Federal renewable energy target (9 provinces have targets based on renewables portfolio standards or other policy goals).[6]

The federal program 'ecoENERGY for Renewable Power' aims to support 4000 MW by 2011 (Ontario's Renewable Energy target is 2.700 MW 2010).

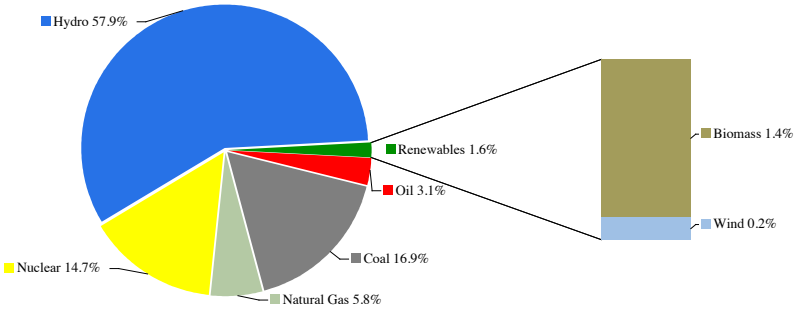
Renewables accounted for 2% of electricity generated in 2006[7], up from 1.6% in 2005.

Solar Target

No federal target. Solar provided 0% of generating capacity by renewable sources and 0% of electricity production in 2005.

The Ontario Solar Initiative seeks to install 1,000 MW Solar PV by 2017. As of end 2007, 316 MW of PV were contracted.[8]

Electricity Generation by Fuel (2005)[9]



Energy Subsidies

Of the 2008 federal budget, the Canadian Broadcasting Corporation noted, "There is $800 million for the auto, nuclear and coal-fired power industries listed under environmental initiatives in the budget, but very little to boost alternative energy."[10] The federal budget earmarked $300 million to the Atomic Energy of Canada Limited. The budget makes no changes concerning alternative energies (except $10 million over two years for research and analysis on biofuels emissions). No amount was set aside for solar.

However, the ecoEnergy program continues to allocate the $1.5 billion available as a ¢1/kWh incentive for renewable electricity projects built during the period 2007-2011. (More below on this program under "Policies")

Oil and gas sector subsidies are estimated at $1.4 billion/year.[11]

Tom Adams of Energy Probe reported federal government subsidies to Atomic Energy of Canada Limited were worth $2477.8 million in 2006 (up from $163 million in 2005).[12]

2006 Renewables R&D budget: US$ 53.21 million or 11.3% of total energy R&D budget:

Canada's 2005 and 2006 R&D budgets (in 2006 million US $)[13]

	2005	2006
Fossil Fuels	98.164	103.964
Nuclear	195.720	211.278
Renewable Energy	42.748	53.207
Solar	11.546	10.630
Photovoltaics	7.406	7.880
Total Energy R&D	448.058	469.416

Solar Energy Policy Context (continued)

Solar PV R&D

Federal and Provincial public budgets for PV R&D, demonstration / field trials and market stimulation in 2006 amounted to CAD 8.15 million up from CAD 7.7 million in 2005 (or about US$ 7.2 and 6.36 respectively). CAD 6.35 million was the Federal portion in 2006 (~US$ 5.6 M).[14]

The report prepared by Canadian representatives for the IEA, explains, "Total public budgets for solar in Canada showed a slight increase of CAD 450,000 (6%) (~US$ 396,000) in 2006, over the previous year. This is due to a large multi-year federal funding to the Solar Research Buildings Network as well as to a private sector project to develop and demonstrate high purity solar grade silicon."

In November 2007, the Ministry of Natural Resources awarded CAN$ 900,000 for building integrated solar demonstration projects led by the Solar Building Research Network.[15]

Energy Efficiency Measures

Energy efficiency measures in Canada are based on national codes, such as the National Building Code for Canada 2005, and the Model National Energy Code for Building and Houses. These codes are implemented by Canadian provinces.

Some of the programs that have been developed under national codes include ecoEnergy for buildings and houses, ecoEnergy Retrofit-Homes, and ecoEnergy Assistance for Implementation Projects. These programs promote energy efficient and environmentally responsible buildings and houses, provide information and training to building industry professionals and officials, develop and support the energy rating and labeling system for houses, and develop and support the voluntary energy labeling system for buildings.[16]

ecoENERGY Retrofit Program

Provides grants to homeowners (CAD 5,000 maximum) and financial incentives to small and medium-sized businesses, industry and public institutions to help them invest in energy and pollution-saving upgrades. Not for solar systems apparently.

Summary of PV Support Measures in Canada

PV Support Measures	National
Feed-in tariffs	No Federal Program
	Ontario: $0.42/kWh; 20 years; <10 MW. (US$0.41/kWh) 1000 MW of PV by 2017
Direct capital subsidies	Federal program: ecoENERGY will invest $1.5 billion to increase Canada's supply of clean electricity from renewable sources. It will encourage the production of 14.3 TWh of new electricity from renewable energy sources. It will provide an incentive of $0.01/kWh for up to 10 years to eligible low-impact, renewable electricity projects constructed during 04/2007-03/2011.
Renewable portfolio standards (RPS)	No Federal RPS. As of 2007, 6 provinces had a RPS in place; 2 others had a non-binding target or an RPS under discussion.
Solar Renewable Energy Certificates	No
PV requirement in RPS	No
Tax credits	Federal: 50% Accelerated Capital Cost Allowance (2005-2012)
Subsidized Loans	None found at Federal level. Some residents of Ontario.
Net metering	No. (Province-specific)
Interconnection Standard	Yes

Source: IEA PVPS National Survey Report of PV Power Applications in Canada 2006, May 2007; "Canadian Renewable Energy Policies", Matthew H. Brown, InterEnergy Solutions, 2007.

Conclusion

Although electricity measures are mainly the purview of provinces, the Canadian federal government has a role to play in coordinating policies. The federal government currently has no policy that can support solar PV development. It could:

- **Set solar and renewable energy targets for the country**

Unlike many developed nations that have recognized the necessity of deploying clean energy infrastructure, Canada still has not set official targets for either renewable energy nor solar specifically. Excluding hydro (which does provide almost 60% of the country's electricity), only 1.6% of electricity comes from renewables.

- **Back solar target with financial incentive mechanism**

While Canada may not seem to have substantial solar resources, these are comparable to a country like France and better than Germany's (the leader in solar deployment), and solar has a legitimate place in Canada's electricity portfolio. The development of a solar infrastructure is therefore warranted and should be supported through financial and regulatory incentives. The financial incentive could come in the form of a performance-based rebate program and investment tax-credit, or a national feed-in tariff. One possible way to fund a rebate program for example would be to redirect part of the $800 million earmarked in the 2008 budget for the auto, nuclear and coal power industries (see V. Energy Subsidies).

- **Put in place a regulatory infrastructure that is conducive to the development of solar**

A Federal Renewable Portfolio Standard, which would mandate utilities provide a set share of their sales from renewable energy sources, could be implemented to second official renewable and solar targets. The RPS would need to include a solar provision for a set share of electricity to come from solar (1% by 2015 for example).

Furthermore, work is still needed to improve the process of connecting systems to the grid so that this step does not constitute a barrier to PV development. Although Canada did adopt interconnection standards in 2006 (which define the requirements for connecting systems to the grid and are intended to simplify the procedure), the IEA PVPS Canadian survey noted, "Interconnection of PV systems continues to contain many barriers to mass marketing, particularly in lengthy, complex, multiple steps required to obtain approvals. Often due to a general lack of awareness and experience with the technology, significant barriers to grid-connected PV systems [...] are raised by various stakeholders including utility companies, inspectors, and unions that perceive a life-threatening risk by it and don't want to accept the risk." Efforts should be made to educate stakeholders about the benefits of solar electricity.

- **Redirect fossil fuel and nuclear subsidies**

As mentioned above, polluting sources of electricity are being subsidized at the tune of billions of dollars annually (see section on Energy Subsidies above). This keeps electricity rates artificially low and keeps emerging technologies like solar artificially uncompetitive. Redirecting part of these subsidies to the development of solar would be a smart investment for a clean and renewable (free) energy future.

Endnotes

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[2] Natural Resources Canada, "Photovoltaic Technology Status and Prospects - Canadian Annual Report 2007", http://cetc-ctec.nrcan-rncan.gc.ca/eng/clean_power/pv_buildings/publications/2008027.html (last updated 2008-08-15).

[3] Canadian Solar Industries Association website, "Government Incentives", last updated January 28, 2008. http://www.cansia.ca/government.asp

[4] The Pembina Institute in a letter to the Minister of Finance, February 12, 2008. pubs.pembina.org/reports/Letter-financeminister-fedbudget2008.pdf

[5] Natural Resources Canada, "Photovoltaic Systems in Buildings-Success Stories; First Canadian Interconnection Standard". http://ctec-cetc.rncan-nrcan.gc.ca/eng/clean_power/pv_buildings/success_stories/interconnection_standard.html

[6] REN21, "Renewables 2007 Global Status Report", REN21 Secretariat and Worldwatch Institute, 2008. http://www.ren21.net/pdf/RE2007_Global_Status_Report.pdf

[7] Canadian Electricity Association, "Power Generation in Canada; A Guide", 2006, p5.

[8] Paul Gipe, "Ontario Standard Offer Contracts Awarded"; available from http://www.windworks.org/FeedLaws/Canada/OntarioStandardOfferContractsAwarded.html,

[9] International Energy Agency, Energy Statistics 2007, "Canada Electricity Generation by Fuel 2005", http://www.iea.org/textbase/pm/JRECPIC/Electricity%20Generation%20by%20Fuel%202005%20-%20Canada.gif

[10] The Canadian Broadcasting Corporation, "Federal Budget 2008: Environmental funds target nuclear power, carbon storage, greener cars", February 26, 2008. http://www.cbc.ca/news/background/budget2008/issues-environment.html

[11] Pembina Institute et al., Matthew Bramley, Letter to Prime Minister Harper "Re: The Environment as a Priority - A Real Opportunity to Put Canada on Track", Oct 4, 2006.

[12] Tom Adams, "Federal Government Subsidies to Atomic Energy of Canada Limited", Energy Probe, January 11, 2006.

[13] IEA, Data Services Reports, "Energy Technology RD&D Budgets 2007". http://wds.iea.org/wds/ReportFolders/ReportFolders.aspx?CS_referer=&CS_ChosenLang=en

[14] International Energy Agency, Co-operative Programme on Photovoltaic Power Systems (IEA PVPS), "National Survey Report of PV Power Applications in Canada 2006", May 2007. http://iea-pvps.org/countries/download/nsr06/06cannsr.pdf

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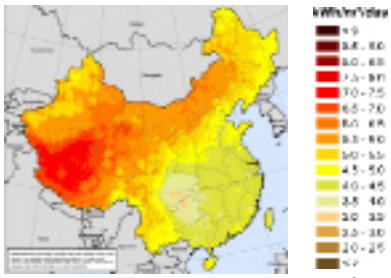
CHINA



Source: NREL, UNEP and SWERA[1]

Zone	kWh/m2	(%)
I	1,750 (	17.4
II	1,400-1,750	42.7
III	1,050-1,400	36.3
IV	(1,050	3.6

Solar Insolation: ~1050-2450 kWh/kWp/yr Yearly Average Solar yield
~3.0-7.5 kWh/m²/day Average Solar Radiation on collector surface

Grade **D-**

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date 100 MW

Financial Incentives

Regulatory Incentives

The World Energy Council reports, "An estimated 2/3rds of the country receives solar radiation in excess of 4.6 kWh/m²/day. China's annual solar power potential has been estimated to be 19,536,000 TWh. Capturing 1% of this resource, and utilizing it with 15% efficiency, could supply as much electricity as the whole world currently consumes in 18 months."[2]

Installed PV Capacity

Cumulative installed end 2007: 100 MW (95% off-grid)[3]

Cumulative installed end 2006: 80 MW (95% off-grid)[4]

Cumulative installations growth rate 2005-2006: +14.3% 2006-2007: +25%

Annual installations growth rate 2005-2006: +100% 2006-2007: +100%

Population: 1,300 M PV/capita: 0.08 W/capita

According to the energy revolution scenario, China has the potential as well as the capacity to develop 25 GW (25,000 MW) of solar PV power by 2020.[5]

Drivers for Future Development

In 2006, The Chinese Renewable Energy Law provided China with a comprehensive renewable energy policy framework. The law institutionalized a number of policies and instruments for China's renewable energy development and utilization, covering renewable energy targets, renewable energy planning, entry of renewable energy products to the market, grid connection of renewable power generation project, feed-in-tariffs for renewable power generation, fiscal and taxation measures, renewable energy technology R&D and diffusion, and renewable energy education and training. Unfortunately China's domestic PV industry is small and fragmented in comparison to other RE technologies and so not all of these policy initiatives are applicable.

Financial Incentives

The Renewable Energy Law (2005, in force since 2006)

Feed-In Tariff

- Not PV specific
- The rate for solar is to be fixed by "the responsible pricing department of the State Council according to the principle of reasonable production costs plus reasonable profit."[6]
- The standard renewable energy feed-in rate (applicable to biomass) is RMB 0.25/kWh (2008 USD 0.035/kWh). Guaranteed for the first 15 years of operation; 2% degression starting 2010.
- For wind the rate is not specified either; the government to provide bidding price guidelines.
- The cost of the feed-in and interconnections are to be redistributed over whole grid electricity price.

Financial Incentives (continued)

The law also stipulates the tariff should be offered to off-grid systems generators (and the cost borne by grid users). However, according to the China Renewable Energy Development Project (CREDP)'s Report on the Development of the Photovoltaic Industry in China (2006-2007), to date, no funding has been disbursed for such off grid systems.

Tax Incentives, Subsidized Loans and R&D Support

The details below address the Renewable Energy Law's prescriptions for tax incentives, loans and R&D support for renewable energy in general. However, these articles do not have any solar-specific provision and while details on tax incentives for biomass and wind were found for example, none were found for solar.

Article 24 of the Renewable Energy Law requires that a Renewable Energy Development Fund be established through the government budget to support R&D efforts, demonstration projects, etc.

Article 25 states, "Financial institutions may offer preferential loan with financial interest subsidy to renewable energy development and utilization projects that are listed in the national renewable energy industrial development guidance catalogue and conform to the conditions for granting loans", though the article fails to specify the terms of the subsidy. (The development guidance catalogue was not found).

Article 26 deals with tax benefits for renewable energy projects but again refers to the catalogue for details.

China's 11th 5 year plan (2006-2010)

Outlined the first phase of the Village Programme: 250 MW of PV, bringing power to 2 million households. It also plans for 50 MW of rooftop and BIPV systems, as well as a 20 MW demo plant in the Gobi desert. [7]

Subsidies for PV in rural areas

These subsidies take the form of project subsidies, user subsidies and construction assistance. The funding for this initiative comes from the central government budget, local government budget and international aid. Over the past ten years, there have been numerous such subsidies granted, including:

- From 1996 to 2000, more than ten solar PV power systems were built in Tibet to provide electricity for villages without access to the grid. The power produced by PV covered lighting and other basic residential electricity uses.
- In 1997, the government introduced the "Bright Project", which started with pilot projects in Qinghai, Xinjiang, Inner Mongolia and other provinces. This initiative supported the use of solar PV to provide domestic electricity for peasants and herdsmen. Funding came from international aid and the local government budget. The project distributed solar PV devices to schools, hospitals and local people.
- With the help of the Global Environment Fund, the Chinese government implemented the Renewable Energy Development Programme through the World Bank. The Programme was designed mainly to promote household solar PV systems in the nine provinces of Western China, including Inner Mongolia, Tibet, Qinghai, Gansu, Xinjiang, Shaanxi, Yunnan, Ningxia and the west part of Sichuan.
- From 2002 to 2004, the Chinese government initiated the Township Electrification Programme, which mainly used solar PV. The Programme received 2 billion RMB (~240 million USD) from central government and 1 billion from local government. Electricity supply was introduced to over 700 villages, representing more than 200,000 households and about 1 million people. There have also been many other initiatives by provincial governments to subsidise the use of solar PV for peasants and herdsmen. In Xinjiang and Qinghai, for example, every installation of solar PV could receive between 100 and 200 RMB in subsidy.

Pilot Programs and Public Procurement

More than 1 million household PV systems, more than 1,000 village PV power stations, over 100 grid-connected roof PV systems and one large 100 kWp grid-connected desert power station have been installed as a result of these policy initiatives.

- Shanghai's "100,000 Solar PV Roof Plan": Shanghai plans to build 100,000 Solar PV on roofs in the five years from 2006 to 2010, with an estimated total installed capacity of 400 MWp.
- Beijing's "Solar Road Lighting Project": Beijing plans to supply road lighting with solar PV power in rural streets and some main roads using government funding. Solar PV was also installed on some of the Olympic venues.
- Jiangsu's "Solar PV Promoting Plan": The Jiangsu provincial government plans to install solar PV at some airports and in landmark buildings in various cities.
- Desert PV Station: The Ministry of Science and Technology has arranged specific funding to build four pilot projects of desert PV stations in Gansu, Tibet, Sichuan and one other location.
- Dezhou in Shandong Province and Baoding in Hebei Province are trying to build a Solar City.

Drivers for Future Development (continued)

Regulatory Incentives

Mandatory Market Shares (Renewable Portfolio Standard)[8]

- 1% of total power generation to come from non-hydro renewable sources by 2010 and over 3% by 2020.
- Power generators with self-owned capacity of over 5 GW will be required to account for 3% of that capacity from non-hydro renewable energy sources in 2010 and over 8% by 2020.

Interconnection

- As per the "Renewable Energy Law", priority interconnection for renewable energy systems is mandated. The costs of interconnection are to be redistributed over all ratepayers through the price of grid electricity.
- In case the utilities fail to comply with this mandate, they are liable for compensation, though the price of the fine is not stipulated (article 29). [9]

Industry Status

In 2007, China increased solar cell production by 138%, overtaking both Europe and Japan to become the world's largest solar cell manufacturer. Its annual production reached 1,088 MW. [10] Suntech remained the industry leader, with a production output of 327 MWp, representing 30.1% of total Chinese production. The Chinese PV industry has increased at an average annual rate of 191.3% since 2002, indicating the success of its combined approach of industry development and capital market development.

Solar Energy Policy Context

Renewable Energy Targets

Renewable energy target (including large-scale hydropower): 10% primary energy supply by 2010[11], 15% (or 360 GW) by 2020.[12]

While there is no official government target for share of electricity generation, the government has set capacity targets by technology (i.e. 2.2 TWh of solar PV by 2020). Based on these, renewable energy targets for share of electricity generation (including large-scale hydropower) have been estimated at 10% by 2010 and 21% by 2020.[13]

Renewables accounted for 17% of electricity generated in 2006[14], up from 16% (or 0.1% excluding hydro) in 2005.[15]

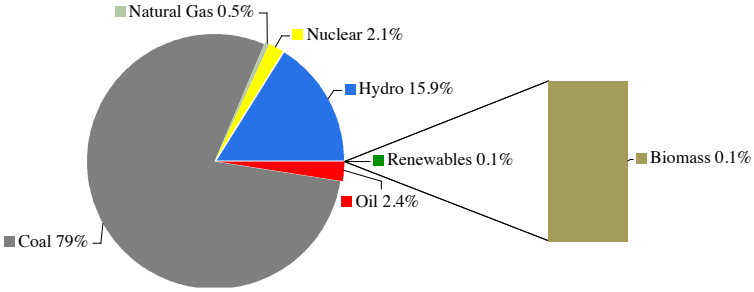
The 2007 "Medium and Long-Term Development Plan for Renewable Energy in China" mandates a renewable portfolio standard for major national power companies to generate or purchase 1% by 2010 and 3% by 2020. Additionally, for power producers with capacities greater than 5 GW, actual ownership of non-hydro renewable energy facilities will need to amount to 3% of their total generating capacity by 2010 and 8 percent by 2020."[16]

Solar Target

Solar PV targets: 300 MW (50 MW grid-tied) by 2010 and 1,800 MW (1,000 MW grid-tied) by 2020.[17]

Solar provided ~0% of electricity production in 2006. (0.08 GW out of a total electricity generating capacity of 620 GW for 2006.)

Electricity Generation by Fuel (2005)[18]



Energy Subsidies

China's total energy subsidies have been estimated at over $10 billion a year.[19]

The International Energy Agency reported a 58% drop in energy subsidies in 2006 from 2005 levels. Oil products received $3 billion in 2006, coal more than $4 billion and natural gas about $2.5 billion. Around $1.2 billion were allocated to electricity.[20]

It should be noted that consumption subsidies related to transport fuels have now been largely eliminated.

Another study[21], which referred to the above IEA numbers as being consistent with its results, noted, "Subsidies to electricity in 2006 reached an all time high of $385.44 million and from January through mid-year 2007 were about $215.88 million." It also reported that, "Subsidies to natural gas in 2005 reached an all time high of $91.78 million and from January through 2007 mid-year, because of the supply problems, the loss of subsidies amounted to approximately $27.51 million."

Finally, the IEA's 2006 World Energy Outlook reported that Chinese consumption subsidies expressed as percentages of 2005 reference prices, amounted to 45% for Natural Gas and 17% for coal.[22]

Figures cited in a Worldwatch Special Report on China relate that, "Renewable Energy R&D spending in the 10th Five-Year Plan (2001-05) reached 1 billion RMB over the five years, equivalent to $25 million per year."[23]

Solar PV R&D

The government has provided various support schemes for the research and development of solar PV. These include:

- Basic R&D Support Scheme, that supports future solar PV technologies, including backing for the technical and theoretical development of thin-film and dye sensitized solar cells.
- High-tech R&D Support Scheme, that supports solar PV technologies which are about to become commercialized, including basic equipment and materials for solar power, cadmium telluride, copper indium germanium selenium and thin film silicon solar cells.

Solar Energy Policy Context (continued)

- Pillar R&D Support Scheme in 2006, which has helped lay down the foundations for commercialisation of solar PV in China.
- Commercialisation Support Scheme, which provides funding for the development of solar industries.

Energy Efficiency Measures

Within its 11th Five-Year Period, China plans to reduce the energy consumption of residential and public buildings by 50%.[24] Current energy efficiency policies vary for different regions of China, however a national energy efficiency building code is expected to be issued this year. This national code is being developed by the Central Ministry of Construction. The implementation and enforcement of the program will be the responsibility of regional governments.[25]

China has a green Building Rating System but is also establishing a labeling system for buildings to help ensure the efficiency of new buildings and the visibility of energy efficiency in the market place.[26]

Energy efficiency in new buildings in China is crucial; according to the Ministry of Construction, more than 2 billion m_ are constructed in China every year, which accounts for more than 40% of all new constructions in the world.[27]

Summary of PV Support Measures in China

PV Support Measures	
Feed-in tariffs	Yes but Not PV specific. No set rate for PV.
Direct capital subsidies	Not mandated, project-specific.
Renewable portfolio standard	1% of total power generation to come from non-hydro sources by 2010 and 3% by 2020. Power generators with self-owned capacity of over 5 GW required to account for 3% of that capacity from non-hydro renewable energy sources in 2010 and over 8% by 2020.
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	No
Subsidized Loans	No
Net metering	No
Interconnection	Mandatory

Conclusion

Although China's Renewable Energy Law denotes an aggressive stance on RE and seems to have all the necessary ingredients, it remains non-committal on PV. It establishes rules for feed-in tariffs, tax credits, subsidized loans but stops short of defining specific terms for PV.

Given the country's great solar resources and the tremendous social, economic and environmental benefits to be gained, the government would be well served by supporting solar more aggressively.

For example, the China Renewable Energy Development Project (CREDP) Report on the Development of the PV Industry in China (2006-2007) notes the dramatic increase in employment in the PV industry from 13,800 jobs in 2005 to 82,800 in 2007. And this growth reflects China addressing the international market. China's domestic market remains untapped (only 20 MW of the 1088 MW produced were installed in China, 90 to 98% of Chinese production being exported to European markets).

The CERDP authors also report a major hurdle to the success of the feed-in tariff for PV: "For safety and other concerns, PV generated electricity is not allowed transfer to main high voltage (10 kv) electricity power grid through power transformer". They conclude, "to realize true "Feed-in tariff" according to "cost and profit" direction and fully accept PV generated electricity, there are still great efforts that need to be done by government and electricity companies."

Indeed without firm government support behind PV, utilities are unlikely to embrace the technology. Efforts should be made to mandate interconnection and promote education about solar and the benefits of its integration.

China could redirect the billions spent on fossil fuel subsidies to fund incentives for PV. It would also be helpful for the long term development of a domestic solar market that China continue to reduce electricity subsidies, so that solar electricity may become competitive.

Endnotes

[1] NREL, UNEP and SWERA map: "China- Flat Plate Tilted at Latitude, Annual Solar Radiation", http://swera.unep.net/typo3conf/ext/metadata_tool/archive/browse/257.pdf Second map: Li Junfeng et al., "China Solar PV Report 2007", China Environmental Science Press, 2007, http://www.greenpeace.org/raw/content/china/en/press/reports/china-pv-report.pdf

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FRANCE

Source: PVGIS © European Communities, 2001-2007[1]

Grade **C+**

Solar Insolation on the Mainland: ~770-1260 kWh/kWp/yr Yearly Average Solar yield
~2.7-5.2 kWh/m^2/day Average Solar Radiation

Solar Insolation in overseas departments: 4.11-4.93 kWh/m^2/day

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **75.2 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2007: 75.2 MW[2] (generate 38 GWh/yr)

Cumulative installed end 2006: 43.9 MW[3] (51% grid-connected)

Cumulative installations growth rate: 2005-2006: +33% 2006-2007: +71%

Annual installations growth rate: 2005-2006: +55% 2006-2007: +187%

Population: 62M PV/capita: 1.2 W/capita

Drivers for Future Development

2006 turned out to be a favorable year for photovoltaics in France with a doubling of the feed-in tariff, an increase in tax credits and the creation of two agencies working together to promote and oversee PV R&D. Installations have been growing rapidly in spite of a lengthy application process (up to 12 months) that should improve with time.

Financial Incentives

2006 Feed-in Tariff and Inflation-adjusted 2008 tariffs

The French feed-in is characterized by its emphasis on Building Integrated PV (BIPV).

	2006 Feed-in Tariff		2008 (Inflation-adjusted)	
	Mainland	Corsica and Overseas Departments	Mainland	Corsica and Overseas Departments
Basic tariff	0.30	0.40	0.31193	0.41591
BIPV premium	0.25	0.15	0.25994	0.15596
⇨Tariff for BIPV	0.55	0.55	0.57187	0.57187

- Rates guaranteed 20 years.
- Rates are non-degressive and are revised upwards for inflation annually.
- Buy-back capped at 1500/1800 hours per unit of peak capacity.
- 160 MW program cap.

- The cap for total capacity installed under the feed-in tariff is 160 MW. Discussions are underway to increase this to 7 GW by 2020.[5]
- The above rates are guaranteed for the peak capacity of the installation times 1500 hours on the Mainland and 1800 in overseas depart-

Financial Incentives (continues)

ments. Beyond that, each kWh will be purchased at □ 0.05.[4]

- The cost of the feed-in is redistributed over all electricity customers through a tax proportional to the customer's consumption.

The 2006 basic tariff for PV-generated electricity of □0,31/kWh ($0.44/kWh) is an increase from □0,14/kWh in 2005. The 2006 scheme also strongly encourages building integrated PV (BIPV) with a four-fold increased tariff of □0,57/kWh ($0.81/kWh). In France's overseas departments, where solar insolation is higher, the basic tariff is □0,42/kWh ($0.59/kWh).

Proposed additions as of 11/17/08

The environment minister announced in November "50 measures for the development of renewable energies". The plan, which lays out specific approaches for each energy source, envisions a "major scaling up for the photovoltaic sector". In addition to a simplification of permitting requirements, the plan suggests:

- a new tariff for large commercial BIPV,
- a clarification of the BIPV requirements in general,
- public buildings will benefit from feed-in buy-back rates,
- a call for tender for 300 MW of large scale solar, with specific regional targets.

	Proposed Additions
	Tariffs guaranteed until 2012
Basic tariff	0.30
Small BIPV (Surfaces <30m²)	0.55
Large commercial BIPV	0.45
• Rates guaranteed until 2012 • Simplified permitting and interconnection procedures for residential systems.	

"Off-grid feed-in"

Isolated dwellings that are unable to connect to the grid can benefit from a contract in which most of the PV system investment cost, its maintenance and repair costs are supported by the utility, the owner paying a small part of the total cost (about 5%) and an annual rent (for example, the annual rent is □193 for a 1.8 kW system).[6]

Other Rebates and Grants

Some areas in France also offer additional subsidies through regional funds.

Tax Credits

- Tax credits amount to 50% of PV modules and other equipment costs capped to □8,000 ($11,800) on residential systems below 3 kW per income-tax paying person (€16,000 per couple + €400 per dependent) over the 2005-2010 fiscal period. In 2010, the tax credit will have to be renewed.
  - The caps on this tax credit are not PV-specific, which means they also apply to energy efficiency improvements as well for example.
- Upcoming: Value-added Tax and Business Tax exemptions for purchases of systems under 3 kW.

Subsidized Loans

The government does subsidize "green loans" through financial institutions. The exact terms of the green loans vary per institution but interest rates fall between 3 and 5% over 5-10 years (20 in some cases).

Regulatory Incentives

Interconnection

Interconnection of renewable energy systems is now mandatory in France. Additionally, the French Agency for the Environment and Energy Management (ADEME) reports that after a long adjustment period, interconnection costs and time requirements have been harmonized and reduced to around □300 (US$ 450) and 3 months for residential systems[7], though according to Hervé Le Berre of AlterPro Energie, a French solar integrator, costs fall more between □500 and 1000, and time requirements 5 to 6 months.

Net Metering

Since 2005, France no longer has net metering.

Solar Energy Policy Context

Renewable Energy Targets

21% of electricity output by 2010[8], and 20 percent of total energy consumption by 2020[9]
On target? Probably not.
Renewables accounted for 12.4% of electricity generated in 2006, up from 10.2% in 2005 (hydro making up almost 90% both years).

Solar Target (according to the July 2005 Energy Law)

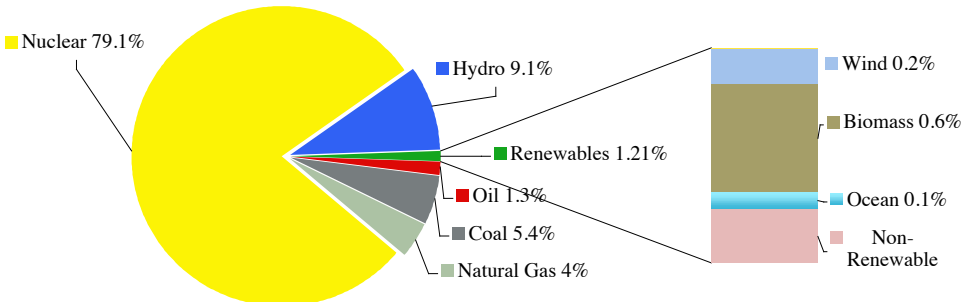
Installations of 50 000 solar photovoltaic roofs (1 kW equivalents) per year by 2010 and over 80 000 in 2015, for a cumulative 160 MW by 2010 and 500 MW by 2015.[10]

In a draft law to be studied by the government in October 2008, new targets for solar are set at 1100 MW by end 2012 and 5400 MW by 2020.[11]

Solar provided 0.1% of generating capacity by renewable sources in 2005[12] and 0.006 % of electricity production.[13]

38 GWh were generated from solar in 2007 (Mainland and overseas)

Electricity Generation by Fuel (2005)[14]



Energy Subsidies

France has phased out coal subsidies.

In 2005, total energy R&D amounted to □795.8 M ($995 M). Nuclear energy R&D accounted for 62% of the total, while 18% and 5% (or $53.25 M) were allocated to fossil fuels and renewables respectively.[15]

Public Budget for PV

The total budget for photovoltaics' R&D, demonstration and market development amounted to

$26.7 M in 2005[16] and $32.9 M (□26.2 M) in 2006[17].

Energy Efficiency Measures

As a EU member state, France is bound by the EU Energy Performance of Buildings Directive. This directive was implemented in France in 2006 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. It is up to member states to decide the level of energy efficiency requirements, however these levels must be revised at least every 5 years and updated based on technological developments.[18] Aspects of residential buildings that are taken into account include the building shell including air-tightness, heating and cooling installations, ventilation, the orientation and position of the building, passive solar systems and solar protection.[19]

In addition to EU requirements, France has implemented national energy efficiency initiatives. One such scheme commenced in 2007 and funds domestic energy conservation projects with low-interest loans.[20] This financial measure complements the 2005 tax credit scheme. Another national scheme is the White Certificates Trading program. This program requires suppliers of energy (electricity, gas, heating oil, LPG, heat, refrigeration) to meet government-mandated targets for energy savings. Suppliers can meet their objectives by informing customers how to reduce energy consumption, running promotional programs, and providing incentives to customers to save energy. Energy certificates can be traded between suppliers who exceed and undercut their objectives.

France has also created two energy efficient building labels, and has invested in a consumer EE education campaign.

Summary of PV Support Measures in France

PV Support Measures	**National**
Feed-in tariffs	Basic tariff □0,31 and 0.42/kWh (+0.26/0.15 BIPV premium=0.57/kWh)
Direct capital subsidies	No. Regional council subsidies for private rooftop investors and industry/communities projects.
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	PV systems up to 3 kW are eligible for a 50 % tax credit on material costs capped to □8,000 ($11,800) per income-tax paying person (16,000 for per couple) and benefit from a value-added tax (VAT) of 5.5% reduced from the normal 19.6%.
Subsidized Loans	Yes. Green loans subsidized through financial institutions, between 3 and 5% over 5-20 years.
Net metering	No longer since 2005
Interconnection	Mandatory

Conclusion

France has taken the first steps in promoting domestic PV development. It is important the country made a stronger commitment at this point, starting with the adoption of the new targets as prescribed by the "Grenelle Environnement", namely for 1100 MW of solar by end 2012 and 5400 MW by 2020.

Through its feed-in tariff design, France is the country that most incentivizes building-integrated PV (BIPV). However, it seems to do so at the expense of other market segments. According to an ADEME study[21] which considered internal rates of return as a result of incentives, the structure of France's feed-in only supports the viability of two markets: building integrated PV on the mainland and PV in the overseas departments (due to the higher insolation there).

While this emphasis can be understood as a brave attempt by France to support the development of the BIPV market segment and the assimilation of PV as a construction material, it could also be said to have limited the development of PV to a niche market in the global context. Which is perhaps what has led some critics to claim that the FiT's design reflects a disingenuous attempt by the government to have a PV policy without really having one, citing a traditional aversion for supporting alternative energy sources which is still perceived as an incursion into nuclear territory.

While BIPV has its advantages and should be promoted, it needn't be done at the expense of non-BIPV. Support for PV in France should be unequivocal and this could be achieved by increasing the rate for non-integrated PV. The BIPV premium is not the only way the Feed-in program is restricting the market, however. The program is capped at 160 MW, which, for a 75 MW market at end 2007 (and which is anticipated to reach 150 MW at end 2008), is quite low. Additionally, buy-back is capped at 1500/1800 hours per unit of peak capacity. On the other hand, tariffs should be degressive and adjustable to market take-up so that incentive levels decrease with technological improvements (or at least provide downward pressure on PV prices) and correspond to the success of the PV market. (A degression starting 2012 is being considered[22]).

Indeed, the French PV policy is not perceived as an unambiguous, solid commitment. Integrators are compelled to diversify into other technologies or even foreign markets to shield themselves from a sudden change in policy, such as what happened with the solar thermal tax credit. Working a degression in the tariff design would provide a predictable decrease in subsidy. France will need a stable policy able to attract investors when German and Spanish feed-in tariffs come down closer to parity with the French FiT.

Improvements are still needed to decrease bureaucratic hurdles. The ADEME report notes that while there has been significant progress, more efforts are needed to clarify "the administrative, legal and fiscal status of small residential producers". ADEME also calls for the introduction of a scheme to render permitting procedures more efficient.

On a broader note, the country would be well served by diversifying its energy portfolio and embracing renewable sources. Two nuclear accidents in France this summer should give the French pause when hearing government plans to address global warming and rising fossil fuel prices with more nuclear investment.

To sum up, France ought to:

- Adopt the new targets proposed in the context of the "Grenelle Environnement" for 1100 MW of solar by end 2012 and 5400 MW by 2020.
- Revise the Feed-in Tariff
- Raise tariff for non-building integrated PV so that the differential between non-BIPV and BIPV is not so large, which will enable the development of the PV market in France beyond new construction or rehabilitation/renovation segments.
- Eliminate or raise the 160 MW cap which is low for a market such as France's, which was 75 MW at the end of 2007 and was expected to reach 150 MW by the end of 2008.
- Eliminate the cap on buy-back overall. Currently, solar system owners can only sell 1500 to 1800 hours per unit of peak capacity.
- Make tariffs degressive and adjustable to market take-up so that incentive levels decrease with technological improvements (or at least provide downward pressure on PV prices) and correspond to the success of the PV market.
- Simplify and accelerate connection procedures
- Under the current requirements, EDF, the country's utility is only able to connect between a quarter and a third of applications. There is consequently a large backlog. It was reported that as of March 2008, 70 MW worth of applications were waiting to be connected; that is about the size of the national market. It is therefore imperative that application and connection procedures be simplified.
- Diversify its electricity portfolio by replacing nuclear generation with clean, safe and renewable solar.

Endnotes

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GERMANY

Grade A-

Source: PVGIS © European Communities, 2001-2007[1]

Solar Insolation: ~ 950 kWh/kWp/yr Yearly Average Solar yield
~ 2.4-4.4 kWh/m²/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **3,862 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 2,863 MW[2] (99% grid-connected)

Cumulative installed end 2007: 3,862 MW[3]

Cumulative installations growth rate: 2005-2006: +49.9% 2006-2007: +34.9%

Annual installations growth rate: 2005-2006: +10.1% 2006-2007: +19.1%

Population: 82M PV/capita: 46.8 W/capita

Drivers for Future Development

Financial Incentives

Feed-in Tariff: The Renewable Energy Sources Law (EEG)

Germany has had a feed-in law since 1991. However, the current feed-in law -the Renewable Energy Sources Act (EEG)- has been in place since 2000. It was preceded by a 1999 '100,000 roof' program, which aimed at fostering installation of 300 MWp of PV through a 35% subsidy of PV systems (with 0% interest rate loans). The subsidy ended in 2003 with 346 MWp installed, and cost about 1 billion Euros.[4]

EEG 2004

- Rates guaranteed for 20 years
- 100% of the system's production (not net production)
- Differentiated according to size with a 5 Euro cents bonus for façade-integrated systems
- 5% annual degression rate for rooftop and façade installations, and 6.5% for ground-mounted systems.
- No cap on system size
- No cap on program

Financial Incentives

	Evolution of EEG rates over time in Euro cents per kWh									
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
<30 kWp	48.1 *$0.59*	45.7 *$0.56*	57.40 *$0.70*	54.53	51.80	49.21 *$0.74*	46.75	43.01	39.57	36.01
30-100 kWp			54.60 $0.67	51.87	49.28	46.82	44.48 $0.70	40.91	37.64	34.25
> 100 kWp			54.00 $0.66	51.30	48.74	46.30	43.99 $0.69	39.58	35.62	32.42
Façade-integrated bonus	+ 5.00							–	–	–
> 1,000 kWp	–	–	–	–	–	–	43.99 $0.69	33.00	29.70	27.03
Open-space			45.70 $0.56	43.42	40.60	37.96	35.49 $0.56	31.94	28.75	26.16

EEG 2009 (for all systems installed after January 1, 2009)

- Rates guaranteed for 20 years.
- 5 Euro cents bonus for façade-integrated systems eliminated.
- No program cap.
- Faster and adjustable degression rates (see below).

Source: G. Stryi-Hipp, 2004, Federal Ministry for the Environment (BMU) 2008, EuPD Research 2008.

EEG 2009

- Faster and adjustable degression rates. The new law stipulates that the degression rates in the table below will apply if annual installations remain within the following 'growth corridors':
  - 2009: 1000-1500 MW
  - 2010: 1100-1700 MW
  - 2011: 1200-1900 MW

In case annual installations (from Oct 1st to Sept 30) exceed the upper limit of the growth corridor, the degression rate for the following year will increase by 1%.
Conversely, if annual installations are less than the lower limit of the growth corridor, the degression rate for the following year will decrease by 1%.

	Changes in the EEG Degression Rates			
	2004 EEG	**2008 EEG**		
	2004-2008	**2008-2009**	**2009-2010**	**2010-2011**
<30 kWp	5%	8%	8%	9%
30-100 kWp	5%	8%	8%	9%
> 100 kWp	5%	10%	10%	9%
> 1,000 kWp	–	25%	10%	9%
Open-space	6.5%	10%	10%	9%

Subsidized Loans

The German Development Bank, KfW Förderbank, offers a soft loan program called "Solar Power Generation". It provides loans for PV investment at an interest rate that is fixed for 5 or 10 years (usually about 5.2%), up to 20-year terms and for a maximum of € 50,000.[5]

For investments over □50,000, other loan programs are available such as the ERP Environmental Protection and Energy Saving Programme and the KfW Environmental Protection Programme which provide low interest rates in relation to 50 to 75% of the investment.[6]

Drivers for Future Development (continued)

Regulatory Incentives

Net Metering

Germany does not have net metering.

Interconnection

Under the terms of the EEG, renewables have priority grid access and must be connected if certain minimum conditions are met. Costs for grid connections are also regulated.[7]

Solar Energy Policy Context

Renewable Energy Targets

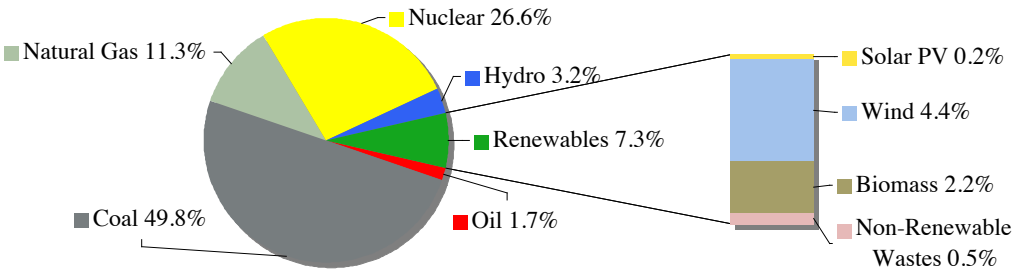
12.5% of total electricity consumption from renewable sources by 2010.

Germany surpassed this target in 2007 and is considering raising its 20% by 2020 target to 27% by 2020. For the long term, a government study has suggested the feasibility of 45% by 2030 and 77% by 2050.[8]

Solar Targets

None found.

Electricity Generation by Fuel (2005)[9]



In 2007, renewable sources provided 87.5 TWh (including 23.7% large hydro) or 14.2% of total gross electricity consumption.[10] That is, excluding large hydro, 10.8% of electricity came from renewable sources in 2007, 3.5% from PV.

Energy Subsidies

While the German government has reached an agreement to completely phase out hard coal subsidies by 2018 (and shut down the remaining 8 plants), annual subsidies for coal remain on average at the □2.5 billion level (about a 50% cut from late 1990's levels).[11]

Germany also has plans to phase out nuclear power. All nuclear power stations should be out of service by 2022.[12]

Estimates cited by the OECD/IEA rate the amount paid to renewables through the Renewable Energy Sources Law (EEG) between 2000 and 2012 at □68 billion (20% to Solar PV).

In 2005, payments under the feed-in tariff (for all renewables) were about EUR 4.4 billion (for 44 TWh of clean electricity).[13] However, it is important to note that while mandated by law, this payment does not come from the government's budget but is instead paid by the utilities and redistributed over all electric utilities customers.

2006 Energy R&D Budgets (in million USD)[14]

Fossil Fuels	28.88
Nuclear	176.26
Renewable Energy	113.51
Total Solar	63.42
Photovoltaics	51.15
Total Energy	534.81

Public Budgets for PV

in million €	2006	2007
Federal Ministry of the Environment (BMU) support for R&D projects on PV	38[15]	32.1[16]
Additional BMU Grants	43.4	41.7
Federal Ministry of Education and Research (BMBF)		22
The soft loan "Solar Power Generation" program (see 'Policies' section) has also provided "43 000 loans representing a total volume of 338,1 MW equivalents to 1 335 MEUR investments" since 2005.[17]		

Solar Energy Policy Context

Energy Efficiency Measures

As an EU member state, Germany is bound by the EU Energy Performance of Buildings Directive. This directive was implemented in Germany in 2006 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. It is up to member states to decide the level of energy efficiency requirements, however these levels must be revised at least every 5 years and updated based on technological developments.[18] Aspects of residential buildings that are taken into account include the building shell including air-tightness, heating and cooling installations, ventilation, the orientation and position of the building, passive solar systems and solar protection.

In addition to EU requirements, Germany has implemented national energy efficiency initiatives. These include the 2007 Energy Conservation Legislation, which requires the introduction of energy certificates for existing buildings. This legislation will become mandatory for both residential and non-residential buildings on 1 January 2009.

Other programs include the KfW Build Ecologically Programme and the KfW Housing Modernization Program. These programs were implemented in 2005 and provide long-term, low-interest loans for the building of new energy-saving houses, and for improving the energy efficiency of existing houses.

Summary of PV Support Measures in Germany

PV Support Measures	**Federal**
Feed-in tariffs	€ 0.4675/kWh for systems <30 kWp for ex.
Direct capital subsidies	No
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	No
Subsidized Loans	Yes. Low interest loans for 100% of costs for projects under □50,000 and 50-75% for projects over □50,000.
Net metering	No
Net billing	No
Interconnection	Mandatory

Conclusion

Germany remains the leader in integration of solar as a substantial part of energy solutions. The latest revisions to the feed-in tariff demonstrate the country's dedication to supporting the technology in the face of political difficulties. They also provide an example of policy adaptation to an evolving market, through the reduction of the incentive and adjustable degression rates.

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Solar Energy, 81, 1295–1305, http://re.jrc.ec.europa.eu/pvgis/

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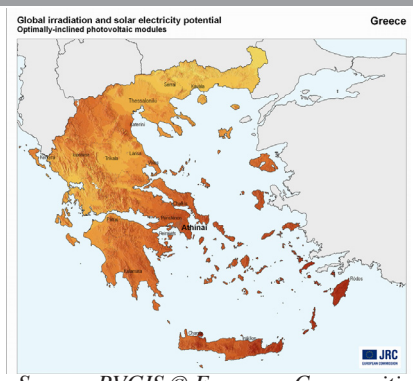
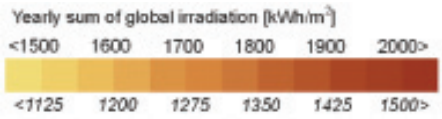
GREECE

Grade C-





Yearly electricity generated by 1 kW_{peak} system with performance ratio 0.75 (kWh/kW_{peak})

Source: PVGIS © European Communities, 2001-2007[1]

Solar Insolation: ~1,150-1,500 kWh/kWp/yr Yearly Average Solar yield
~3.8-5.2 kWh/m^2/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **9.17 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 6.7 MW[2] (24% grid-connected)

Cumulative installed end 2007: 9.17 MW[3] (36% grid-connected)

[HELPACO, the Hellenic Association of Photovoltaic Companies, estimates a market of 10-15 MWp for 2008]

Cumulative installations growth rate: 2005-2006: +24% 2006-2007: +37%

Annual installations growth rate: 2005-2006: +39% 2006-2007: +98%

Population: 11 M PV/capita: 0.83 W/capita

Drivers for Future Development

Financial Incentives

Feed-in Tariff

In June 2006 the Greek government passed legislation to promote electricity generation from Renewable Energy Sources. 3468/2006 seeks to facilitate the development of RE and remove some of the hurdles which have been common complaints of RE in Greece in recent years, notably in the 2006 Review of Greece's energy policies by the International Energy Agency (IEA).[4] It includes amendments to the licensing procedure, which used to be a 2-3 year process, as well as financial incentives (a feed-in tariff) and administrative reform.

The new law also decoupled PV policy from other Renewable Energy Policy by creating a distinct FIT for PV systems.

	2007 Feed in Tariffs -in €/kWh (2006 rates adjusted for inflation)		end 2008 Feed-in Tariffs -in €/kWh	
PV System Size	**Mainland Grid**	**Island Grids**	**Mainland Grid**	**Island Grids**
≤ 100 kWp	0.45282	0.50282	0.45714	0. 50714
> 100 kWp	0.40282	0.45282	0.40714	0.45714
• Contract terms: 10 + 10 years (see below) • Rates non degressive and annually adjusted for inflation			• Contract terms 20 years • Rates decrease 1%/month in 2010-2013 and 0.5%/month in 2014 • Inflation indexation at 25% of last year's inflation rate	
• Non-incorporated individuals unable to sell more than 20% of their production.				

Source: Incentives for PV-Hellenic Association of Photovoltaic Companies (HELAPCO) September 2007, RAE December 2008.

Financial Incentives (continued)

The 2006 rates were a drastic increase from the previous tariff, which guaranteed 0.075 □/kWh for systems up to 100 kWp connected to the mainland grid.

- Term: 10 + 10 years. The tariff is guaranteed for 10 years at which time contracts extensions are available for a second 10-year term.[5]
- Program ends on December 31, 2020.
- Changes in licensing requirements:[6]
  - Systems up to 150 kWp do not require production, installation or operation permits;
  - Systems above 20 kWp though require an exemption decision from the above permits, issued by RAE (the Regulatory Authority for Energy);
  - Systems up to 20 kWp are exempt from environmental permits unless they are installed in environmentally sensitive areas or historic buildings in which case consent is required from the Planning Authority;
- The new tariffs are adjusted annually for increases in retail electricity prices and/or the inflation rate.
- There is no degression rate.
- The feed-in tariff is financed through a surcharge on electricity customers' bills in proportion to their consumption. (Currently, the charge, which finances about 900 MW of grid-connected renewable energy installations -mostly wind, amounts to €0.30/MWh[7]).
- Non-incorporated individuals are only allowed to sell up top 20% of their production (which cannot exceed 50,000 MWh). Incorporated owners of PV systems may sell 100% of their production, though incorporating may not be financially viable for systems under 10 kW.

Despite the changes in licensing requirements, there are still complaints of bureaucratic obstacles impeding the development of the PV market.

Upcoming Feed-in Tariff Changes?[8]

A new feed-in was to be introduced in September 2008. Lower tariffs and changes in the permitting process were expected to reshape the market. However, in December the Greek Regulatory Authority for Energy (RAE) released new inflation-adjusted rates. Below a list of measures that were expected with the FiT revision:

- Applications for permits already filed (3,757 MWp) will be processed steadily until mid-2012.
- Permit and application trade now possible through a simple name transfer.
- A separate program for rooftop PV will be introduced as of 2009, aiming at 750 extra MWp (time frame for this target is still unknown). Rooftop systems will receive a higher tariff for 20 years but no grant.
- The 40% grant (see below) will still be available for commercial applications in addition to a new feed-in rate for ground-mounted systems.
- The provision prohibiting non-incorporated individuals to sell 100% of their production is likely to be revised.

Greek Program for the Development of PV

A detailed program for PV development was published in June 2007 to achieve the overall goal of 840 MW by 2020. It outlined PV targets for the period 2007-2010 according to system size and for different regions (see conclusion graph). Because this plan was published after the feed-in tariff and placed capacity limits according to installation sizes, the government was criticized for changing the rules ex post facto.

The National Development Law (3299/04)[9]

Passed: 2004
Amended: December 22, 2006
The National Development Law is an investment law that covers all economic sectors and under which investments in RES installations are eligible for a subsidy. This can be from 20% to 60% of the total investment cost.

Grants

- Commercial PV applications benefit from a grant covering 20 to 40% of total installed cost, depending on the size of the company investing in the system and the geographic region:

Financial Incentives (continued)

Enterprise Size	Investment Zones Level of Subsidy		
	A	B	C
Large	20%	30%	40%
Medium	30%	40%	40%
Small	40%	40%	40%
Very small	40%	40%	40%

- Residential systems do not benefit from this grant.

Tax Credits
Residential systems are eligible for a 20% tax deduction capped at 700□.[10]

Subsidized Loans
Small enterprises are eligible for an interest rate subsidy (not limited to PV investments).

The Credit Guarantee Fund of Small and Very Small Enterprises (TEMPME) is offering 5 loan programs until the end of 2008. "The guaranteed loans vary depending on the program from □10.000-□400.000, whereas the guarantee rate varies from 45%-70% and the annual guarantee fee approximates on average 1% of the outstanding loan".[11]

The TEMPME Program covers 4% of the interest rate for loans capped at □400,000 (~$615,000).

Regulatory Incentives

Net Metering
There is no net metering in Greece at this time.

Interconnection
Interconnection is mandatory.

Educational Programs

There have been programs on installation of demonstration PV systems at schools.

Solar Energy Policy Context

Renewable Energy Targets

Greek legislation sets renewable energy targets in accordance with European Union Directive 2001/77/EC. This was codified by Greek Law 3468/2006 (See section VI). The targets require Greek national consumption on renewable energies must equal[12]:

- 20.1% of gross electricity consumption by 2010; and
- 29% of its net domestic power consumption by 2020.
- Meeting the 20.1% target will require 7,652 MW of installed capacity to generate 14.45 TWh of energy. The Greek National Report on article 3 of Directive 2001/77/EC notes the following breakdown for this installed capacity by sources:

	Requirements in installed capacity by 2010, in MW	Energy generated in 2010 in TWh	Percentage share of every renewable energy source in 2010
Wind farms	3,648	7.67	10.67
Small-scale hydro	364	1.09	1.52
Large-scale hydro	3,325	4.58	6.37
Biomass	103	0.81	1.13
Geothermal	12	0.10	0.14
Photovoltaics	200	0.20	0.28
Total	**7,652**	**14.45**	**20.10**

Estimates from the Ministry of Development suggest that Greece is not on schedule to meet these targets. RE could generate only 70% of the set targets or 14.4% of the electricity consumption.[13]

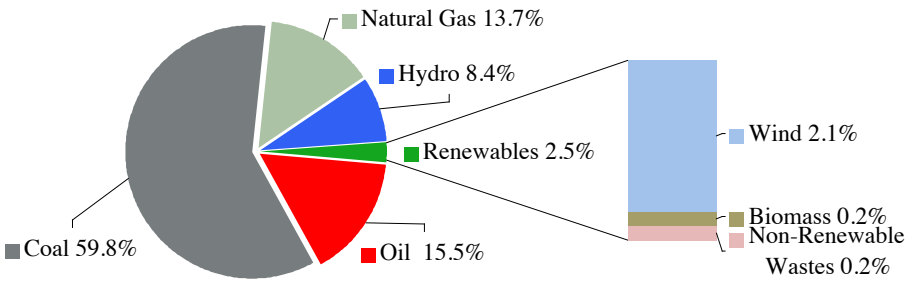
RE accounted for 10.9% of electricity generated in 2005 (2.5% excluding large hydro).

Solar Targets

The Solar target is set to change soon. However, the most recent PV target (set in 2007) is "At least 840 MWp by 2020"[14] (increased from 700 MWp by 2020).
(The 2010 target set by the government in 2005 for Solar PV was 18 MW by 2010[15])

Solar provided 0% of generating capacity by RE sources in 2005 and only 1 GWh or 0% of gross electricity production in 2005.[16]

Electricity Generation by Fuel (2005)[17]



The country is also heavily dependant on oil imports to satisfy its energy needs. So far, wind energy has been the focus for Renewable Energy (RE) development.

The current RE situation includes:[18]

- Installed wind capacity 890 MW;
- Installed capacity of small hydro plants >140 MW;
- More than 20% of households use solar water heaters

Solar Energy Policy Context (continued)

Energy Subsidies

Renewable energy R&D annual funding:

According to the European Photovoltaic Technology Platform's 2005 information, "there is no specific budget for research in Renewable Energy Sources. Estimation gives an annual funding in the range of □2 to 3 million."[19]

R&D Energy Budgets (in 2002 □M)			
Fossil Fuels	Nuclear	Renewables	Total Energy R&D
0.60	1.08	3.25	8.8

**According to IEA statistics, no total R&D energy budget has been published since 2002. The main funding source has been EU Community Framework projects.*[20]

The Ministry of Development (MoD), recognizing the barrier that lack of credible research and information represents for RE development, has made a concerted effort to reorganize and improve the research and technology development system. The General Secretariat for Research and Technology within the MoD created Measure 3.3 to "improve the infrastructure and the scientific human resources of the country's universities, enterprises and other R&T organizations and help them to develop into centers of excellence and increase their competitiveness at national and international levels."[21]

Despite these efforts, lack of reliable data and information continues to be a major barrier to realizing the RE and PV targets.

Public Budget for PV

Current annual funding for PV R&D is estimated between 1 and 1.5 million Euros.[22]

PV program demonstration and deployment state support (in concert with the EU) amounts to about □3 million.[23]

The 2002-2006 total PV project budget was € 38.3 M with € 17.30 M in public expenditure co-financed from the EU 3rd Community Support Framework[24], or about □4.2 million annually from Greece.

Energy Efficiency Measures

As an EU member state, Greece is bound by the EU Energy Performance of Buildings Directive. This directive was implemented in Greece in 2006 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. It is up to member states to decide the level of energy efficiency requirements, however these levels must be revised at least every 5 years and updated based on technological developments.[25] Aspects of residential buildings that are taken into account include the building shell including air-tightness, heating and cooling installations, ventilation, the orientation and position of the building, passive solar systems and solar protection.[26]

The Greek Government has also established regulations on the thermal insulation requirements of buildings. This is in conjunction with the established minimum energy standards for new and renovated buildings, energy audits, and energy labeling of buildings.[27]

In recent years, under the framework of Greek development laws and the partially EU-funded operational programs, there have also been several investment subsidies available in Greece for energy efficiency-related projects.[28]

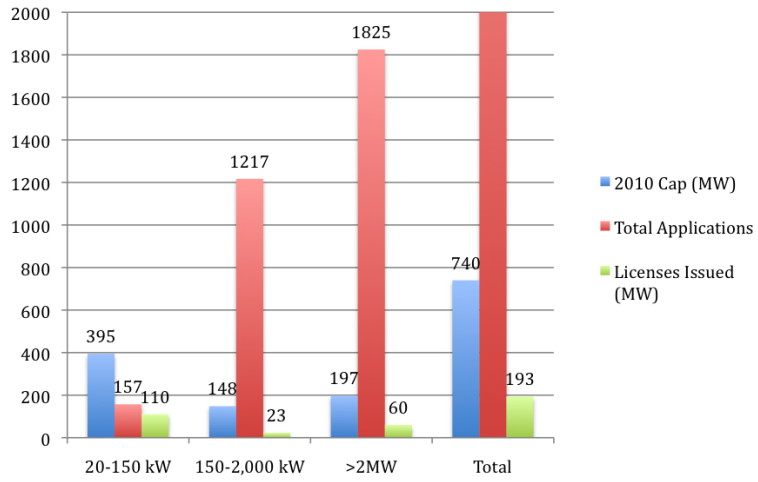
From 2000, new public buildings, and from 2004, all public buildings, were required to have an energy certificate stating the energy performance of the building based on an energy audit.[29]

Summary of PV Support Measures in Greece

PV Support Measures	National / Regional / Local
Feed-in tariffs	≤100 kWp: 0.45-0.50 €/kWh
	>100 kWp: 0.40-0.45 □/kWh
Direct capital subsidies	20-40% of total installed cost for commercial PV systems
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	Residential applications are eligible for a 20% tax deduction capped at □ 700 per system
Subsidized Loans	4% of interest rate covered by state for small enterprises
Net metering	No
Interconnection	Mandatory

Conclusion

The Greek feed-in tariff has been very successful in spurring PV development. As of May 2008, there were already 3,757 MW of applications (off the chart red column below), about the size of the entire German market. However, due its desire to control the development of the market, especially its concern for even growth geographically, the government has parceled out the market into more than 200 categories, which has made the application process more than cumbersome for all parties involved.[30] Licensing for projects, which was to take place until 2010, was reportedly suspended in 2008 until the Greek Regulatory Authority for Energy (RAE) can amend the process and clear the backlog. The 2008 market has been estimated at between 3 MW and 15 MW, a far cry from the 3,757 MW of applications.



The graph does not include a 50 MW cap on systems under 20 kW, which do not require licensing.

Sources: HELPACO, 2008[31], RAE 2008[32]

Unfortunately, the residential market remains weak. Indeed under the current law, while systems below 20 kW are exempt from some licensing, (non-incorporated) individuals do not benefit from investment grants and can only sell 20% of their production. In sum, the only financial support they are eligible for is a tax credit limited at □700 (~$1,000).

Hopefully, the upcoming FiT revision will provide support and remove hurdles for residential installations, replace the 10+10 year contract with a 20-year guarantee so as to promote investor confidence, and shorten the application process overall.

A recent study calculating the cost of the Greek FiT for the introduction of 2400 MWp of PV systems and 6000 MW of wind parks by the year

Conclusion (continued)

2020 (to provide about a 16.7% share of electricity consumption), estimates that the average surcharge on Hellenic households' electricity bills peaks at □ 22/yr (USD 33.8) or □ 4.5/MWh around 2014-2015 (which represents less than 5% of the annual electricity bill).[33]

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Solar Energy, 81, 1295–1305, http://re.jrc.ec.europa.eu/pvgis/

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[32] Cited in Bret Young, SMA America, "The Greek PV Market", Presented on July 16 2008.

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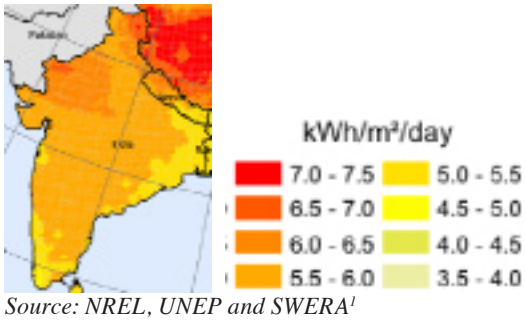
INDIA

Grade C



Source: NREL, UNEP and SWERA[1]

Source: Government of India

Solar Insolation: ~1700-2500 kWh/kWp/yr Yearly Average Solar yield
6 kWh/m²/day Average Solar Radiation on collector surface varies between 4-7 kWh/m²/day

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **112 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: ~100*MW** (98% off-grid)

Cumulative installed as of September 2007: 112 MW[2] (97.3% off-grid)

Cumulative installations growth rate: 2005-2006: +16.3% 2006-2007: +12%

Annual installations growth rate 2006-2007: -14%

Population: 1,100 M PV/capita: 0.1 W/capita

Drivers for Future Development

Financial Incentives

Generation Based Incentive (Feed-in Tariff)[3] [4]

In January 2008, the Ministry of New and Renewable Energy announced that in addition to any PV feed-in tariffs approved by the 28 states, it would also offer:

- To registered companies, utilities and public/private sector PV power project developers through Power Purchase Agreements with utilities (Individuals, NGOs, financial institutions, societies and other unorganized investors are not eligible to participate directly),
- An additional incentive limited to Rs. 12/kWh ($0.30) for 10 years, so that the maximum subsidy a project may receive after state support and Power Purchase Agreement (PPA) terms is Rs. 15/kWh.
- For installations of at least 1 MW, with a maximum of 5 MW per developer.
- 5% degression starting 2010: Rs. 11.40/kWh.
- 50 MW countrywide program cap. [Deepak Gupta, secretary of MNRE (Ministry of New and Renewable Energy), announced in October 2008 the government intended on lifting the 50 MW program cap].
- 10 MW cap per state.
- Priority consideration is given to projects in states with solar feed-in tariff programs.
- Not available in conjunction with the 80% accelerated depreciation scheme
- Only power fed to the grid is available for tariff (not 100% of generation regardless of consumption).

* 86 MW installed as of 06/2006 (IEA-PVPS), 2.92 MW grid-tied by 01/2007 (Ministry of New and Renewable Energy).

** Figures in MW are only available for grid-connected installations, as decentralized systems are expressed in numbers of home systems, villages, solar lanterns, etc. (301,603 cumulative PV Home Lighting Systems installed for example).

Financial Incentives (continued)

- Not PV specific: available for solar thermal as well (Rs. 10/kWh). 50 MW program cap includes solar thermal.
- Financed through government budget, not ratepayers.

As of August 2008, at least 3 states had reportedly registered projects up to the allotted 10 MW.

Examples of state-level feed-in tariffs:[5]

- Punjab : ~Rs 8.93/kWh NSRE policy
- West Bengal: Rs 11/kWh
- Haryana: ~Rs 15.75/kWh

Direct Capital Subsidies

Solar PV Systems in Urban Areas[6]

- Building Integrated PV systems: 50% of costs for modules of 5 kWp maximum, capped at Rs. 200,000/kWp (US$ 4,860).
- Solar power packs': 50% of cost for modules of 1 kWp maximum capped at Rs. 100,000/kWp (US$ 2,430).

Tax Credits[7]

- 80% accelerated depreciation in the first year for grid-connected systems. Not available in conjunction with the Generation Based Incentive. No cap.
- Ten consecutive-year tax exemption on income from sale of electricity -with in 15 years of setting up of the project.
- Import duty exemptions

Subsidized Loans

IREDA may provide loans at 9-10%.

Akshay Urja Shops[8]

The Ministry of New and Renewable Energy has been encouraging private entrepreneurs and NGOs to set up and operate Solar Shops (now expanded to Renewable Energy Systems Shops) in major cities of the country with a view to make solar energy products easily available and to provide after sales repair and maintenance services. So far 268 such shops have been supported through:

- 5-year loans up to Rs. 1 million (US$ 24,300)
- At 7% interest rate for a maximum of 85% of cost of shop for establishment
- Monthly Rs. 5,000 ($ 120) grants for the first 2 years.
- Additional monthly Rs. 5,000 grant for the first 2 years based on turnover with 50% to be spent on publicity (see http://mnes.nic.in/swhs-finsupp.htm for details).

Regulatory Incentives

Renewable Portfolio Standard

All conventional power-generating companies have to provide 2% from renewable energy sources. Failure to comply carries a penalty, though it's not clear how much that is and is reportedly not enforced. The mandate does not include a solar provision.

Net Metering

No net metering in India.

Interconnection

Only in context of generation based incentive Power Purchase Agreements. (97% of installed PV: off-grid)

Drivers for Future Development (continued)

Educational Programs

The ministry of New and Renewable Energy has a web page detailing all 'information and public awareness programs' geared towards generating "mass awareness of the non-conventional energy products and [their] benefits, ... and disseminating information on technological developments and promotional activities".

http://mnes.nic.in/prog-ipa.htm, see also http://mnreda.gov.in/publicawareness.htm

The Government also supports Solar PV demonstration Systems in Urban Area.[9]

Renewed yearly since 2005.

- Building Integrated PV systems: 2 demonstration buildings per state. 50% of costs for modules of 5 kWp maximum, capped at Rs. 200,000/kWp (US$ 4,860).
- 'Solar power packs': A maximum of 150 power packs will be supported. 50% of cost for modules of 1 kWp maximum (for minimum 6 hours backup for installation in public sector banks, Government clinics, Government shops, for computer/ emergency back-up), capped at Rs. 100,000/kWp (US$ 2,430).

Solar Energy Policy Context

Renewable Energy Targets

10% of primary energy and 4-5% of electricity from renewables by 2012.

20% of power generation capacity added between 2007 and 2012 from renewables or 15,000 MW.[10]

On target?

Renewables accounted for 8.4% of power generation capacity (with 12194.6 MW, excluding hydro) as of August 2008.

As of January 2007, India had 9,497 MW of grid-connected renewable power installations (6,315 MW from wind power -the fourth largest capacity in the world), which amounted to over 7% of the installed power generating capacity of the country[11] and about 2% of total electricity.[12]

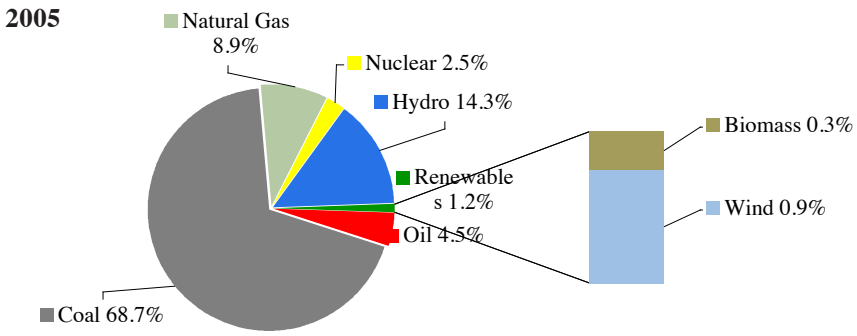
This is up from 7,169 MW of grid-connected renewable installations as of January 2006[13], which essentially doubled a 10% target for additional generating capacity installed between 2002-2007 to come from renewable sources.

Solar Target

50 MW of grid-connected PV by 2012.

The government outlined its "National Solar Mission" in its June 2008 National Action Plan on Climate Change[14], which aims at the development of a solar industry competitive with fossil fuels within the next 20-25 years. Specifically, it states the goals of 10,000 MW of installed PV capacity by 2020, increasing production of photovoltaics to 1000 MW/year; installing 1000 MW of Concentrating Solar Power and sets goals for solar thermal installations by 2017.

Electricity Generation by Fuel[15]



Energy Subsidies

The International Energy Agency gauged the economic value of energy subsidies in India for 2005 at around $20 billion, $10 billion of which went to electricity.[16]

Liquid Petroleum Gas

$1.7 billion was spent in the first half of FY 2008 on Liquid Petroleum Gas subsidies in India, according the a report by the United Nations Environment Programme. While intended to get the fuel into poor households, the report notes, "LPG subsidies are mainly benefiting higher-income households...despite the ineffectiveness of the subsidy, the program is being extended until 2010."[17]

Renewables

The Ministry of New and Renewable Energy (MNRE) estimated the investment requirement for setting up 15,000 MW of grid interactive/ distributed renewable power generation (2007-2012) at around Rs. 60,000 crore (US$ 14.5 billion) which would amount to leveraging 15.5 times the proposed budgetary support of Rs. 3,925 crore (US$ 950 million).[18]

A report on the performance of previous efforts noted that out of $1.8 billion (Rs.7167 crore) allocated for the development of renewables during 2002-2007, only $1 billion (Rs. 4000 crore) had been disbursed by 10/06; this in part because the cost of solar was deemed too high and not viable, and all subsidies for grid-interactive solar power were totally withdrawn.

Since, the MNRE had recommended holding subsidies for solar PV until technology improved, costs came down, and unit cost of generation was at par with small hydro power, however, this course of action was reversed with the implementation of a generation based incentive for solar in January 2008.

Research, Design and Development budget for renewables (2007-2012): Rs. 1,500 crore (US$ 363 million) or $75.6 million/yr.

Solar Energy Policy Context (continued)

Public Budgets for PV

A budget provision of Rs. 2.0 billion (US$ 48.4 million) has been passed and is intended to support 50 MW of PV by 2012.[19]

Research, Design and Development budget (2007-2012)[20]

Total Solar: Rs. 400 crore (US$ 96.8 million) or 19.4/yr.

Photovoltaic: RS. 220 crore (US$ 53.24 million) or $11 million/yr.

Demonstration and Promotion of Solar Photovoltaic Devices/ Systems in Urban Areas

$6.63 million for urban solar Demonstration and Promotion 2005-06, same for 2007-08 (or Rs. 26.30 crore).[21]

Energy Efficiency Measures[22]

In June 2007, the first Energy Conservation Building Code was adopted in India. It addresses the design of new, large commercial buildings, and aims at optimizing the buildings' energy demand according to their location. It includes a prescriptive and an energy performance method, with a particular focus on shading (due to the high energy consumption of cooling in India).[23]

Compliance with this code, however, will be voluntary until each state in India implements the code. The Ministry of Power has estimated that it would take 1 year for the code to become mandatory and further 1 - 2 years before sufficient control and sanction systems are in place.[24]

The introduction and enforcement of a building code in India, particularly for large commercial buildings, is crucial due to the current and projected industrial and commercial growth. Since March 2007, large industrial energy consumers are required to undergo energy audits and report their consumption and energy conservation data annually.

Summary of PV Support Measures in India

PV Support Measures	National
Feed-in tariffs	For utilities and PV-power project developers only: Rs. 12/kWh maximum ($0.30) 10 years 5% degression starting 2010 Installations at least 1 MW 5 MW cap per developer 50 MW program cap
Direct capital subsidies	• For Residential and Commercial installations Rs. 30,000/kW, capped at Rs. 50,000 per household (US$ 1,200) • For Community and Institutional installations Rs. 50,000/kW.
Renewable portfolio standards (RPS)	Utilities to provide 2% from renewable energy sources. Non-compliance carries penalty, but not enforced.
PV requirement in RPS	No
Solar Renewable Energy Certificates	
Tax credits	80% accelerated depreciation in the first year for grid-connected systems. Not available in conjunction with feed-in tariff Ten consecutive-year tax exemption on income from sale of electricity -with in 15 years of setting up of the project. No import duties.
Subsidized Loans	IREDA loans Loans for "Solar shops" also. (see Akshay Urja Shops)
Net metering	No
Interconnection	Only in context of generation based incentive

Conclusion

India has apparently reversed its stance on supporting solar: it had set aside US $50 million for subsidizing solar power when its costs would match those of small hydro[25], but then allocated them to fund 50 MW of PV by 2012 through a feed-in tariff. It is unclear however, how the government intends on reaching the 10,000 MW goal of installed PV capacity by 2020, laid out in its 2008 National Solar Mission.

While the government has taken a step toward supporting solar through the MNRE feed-in tariff, the policy seems to have been designed as a demonstration program more than a bona fide support measure. It is restricted to large installations, imposes a very low program cap, and is funded directly though the government's budget. While there were complaints about the feed-in not be available in conjunction with the tax credit, which had supposedly caused major projects to be reconsidered[26], the program was a huge success: barely four months after the publication of the feed-in, 1000 MW of applications had already been submitted[27].

In October, the ministry of new and renewable energy (MNRE) announced its plan to increase the 50 MW cap. It is unclear what the new cap will be, but is a good sign that the government is committing to its Solar Mission to install 10 GW of PV by 2020.

Endnotes

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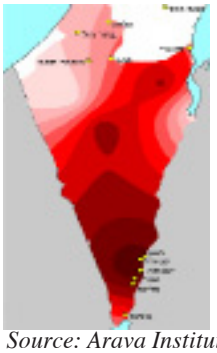
ISRAEL

Grade D-

Source: NREL, UNEP and SWERA[1]



Source: Arava Institute[2]

Solar Insolation: 1700-2200 kWh/kWp/yr Yearly Average Solar yield
5.48 kWh/m²/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **1.82 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2007: 1.82 MW[4]
Cumulative installed end 2006: 1.32 MW[3] (98% off grid)

Only 1 MW expected for 2008 in spite of enthusiasm due to feed-in tariff because of bureaucratic hurdles.

Annual installation growth rate 2006-2007: +82% 2005-2006: +60%

Cumulative installations growth rate 2006-2007: +21% 2005-2006: +27%

Population: 7.28 M PV per capita: 0.25 W/capita

Drivers for Future Development[5]

Financial Incentives

Feed-in Tariff

In September 2006, the Public Utility Authority (PUA) published the following feed-in tariffs for solar (non-technology specific/includes CSP):

	2006 Feed-in Tariff
100 kW - 20 MW	0.876 ILS /kWh (0.26 USD)
Above 20 MW	0.7025 ILS /kWh (0.208 USD)

However, the rates were too low to spur any PV development and in June 2008, the PUA published a new PV tariff:

	July 2008 Feed-in Tariff [6]	Large-scale solar feed-in rates (end 2008)	
Up to 15 kW -residential	2.01 ILS /kWh (0.604 USD)	100 kW - 20 MW	0.8760 ILS/kWh
Up to 50 kW -commercial		Above 20 MW	0.7005 ILS/kWh
• Rates guaranteed 20 years • Program cap of 50 MW or 7 years whichever comes first (15 MW for the residential segment, 35 MW for commercial) • Systems must be installed on a built structure. • Starting 2011, rates will be reduced by 4% annually.		• Rates guaranteed 20 years	

Source: SolarPower Ltd.[7], E. Despotou[29]

Drivers for Future Development (continued)

Financial Incentives (continued)

- The feed-in tariff will be financed by a surcharge on electric bills for all ratepayers. Photon International reported in March 2008, when the feed-in was close to being published, the surcharge would be "roughly 0.5%/kWh."[8]

While the Israeli government had reportedly considered a 20-year feed-in tariff of about 1.50 ILS (42.4¢) for larger PV installations (with a 7 MW limit on system size and a program cap of 200 MW)[9], government officials said recently there were no plans for such a feed-in and that an international tender had been issued instead in April 2008 for a 15 MW PV power plant.

The potential for large solar field installations on kibbutzim has been estimated at 1 GW by 2015 by an Israeli solar company that just signed an exclusive agreement with 15 kibbutzim for 500 MW. Indeed, until recently, kibbutzim were only allowed to connect 1 system under 50 kW but this limit has now been lifted. In order to take advantage of this large potential market, Arava Power Company has been petitioning the government and the PUA to implement a feed-in tariff for systems up to 5 MW at 1.8 ILS/kWh, capped at 125 MW/yr for 4 years. Photon International reported in October the PUA may indeed consider a feed-in for systems between 50 kW and 5 MW in early 2009.[10]
In the end however, a feed-in for large-scale solar was released for systems between 100 kW and 20 MW, ranging from 0.70 to 0.87 ILS/kWh.

Tax Credit

Photon reported in August 2008, "owners of systems up to 4 kW will also be able to get a tax exemption of up to 18,000 ILS ($5,400) annually"[11], but according to sources at the Ministry of National Infrastructures, there is still no tax credit in place to date.

Subsidized Loans

Low-interest financing for a 10-year term is available from a local bank for PV systems purchases, though not government subsidized. Current loan terms for the purchase of a €20,000-3kWp system are a floating interest rate at prime (now 5.25%) +2%.[29]

Regulatory Incentives

Interconnection

Interconnection is mandatory in the context of the feed-in tariff. The Israel Electric Corporation (IEC), which is essentially the country's sole electric utility, has been very supportive of PV's expansion.

However, major bureaucratic barriers at the municipal level seem to be halting the interconnection process.

Net Metering

There is no net metering policy in Israel. PV electricity generators will have two meters; one for production for which they'll receive the feed-in tariff, the other for consumption at the prevailing IEC rate.

Rate Structure

According to an Eco-Energy study[12] submitted to the Israeli Ministry of Environmental Protection, the PUA has mandated customers with annual consumption over 60,000 kWh be on a time-of-use rate schedule. Although only 1.7% of IEC customers are billed at time-of-use rates, they represent 55% of IEC load.

Educational Programs

The Eilot region, at the southeastern edge of Israel, is promoting the use of renewables through various means, one of them include an educational program for schools and pre-schools, with a focus on clean energy.[13]

Also, 'Solar Energy in Israel' (www.solar.co.il) provides a lot of well-organized and accessible information on solar (Water heaters, PV as well as large scale utility).

A Note on the Domestic Industry

According to a 2007 report by Dr. Arbib on the status of PV in Israel[14], while there is no local production of either PV cells or inverters, Israel still produces systems, which it exports for the most part. "The technological infrastructure required to produce all the components needed for integration in PV systems is available; however, due to economic considerations, components such as modules are imported. In spite of this, some unique Israeli PV systems have high added value related to the balance of system (in particular, control systems), and therefore they have international market potential."

Solar Energy Policy Context

Renewable Energy Targets

In April 2008, National Infrastructure Minister Binyamin Ben-Eliezer announced a commitment to increase the share of renewable energies to 15-20% of Israel's total energy use by 2020 (from 10% of primary energy by 2020).[15] [16]

According to a June 2008 Ministry of National Infrastructures (MNI) document:[17]

- A recent government resolution mandates a minimum quota of 10% for electricity from renewable energy resources by 2020. (Might be increased to 20%; presently only about 0.1% of electricity is generated from renewables).
- "A new Energy Masterplan is being drafted, which emphasizes the introduction of new energy sources ... and includes 2,000 MW of electricity from renewables by 2020 (1,000 MW from solar energy)."

Target set in 2002: 2% of electricity from renewable energy resources by 2007 and 5% in 2016.

Target attributed to National Infrastructure Minister Ben-Eliezer in February 2008: 600 MW of electricity from renewables by 2011-2012 (300 MW from solar and 300 MW from wind).[18]

On target? No: 0.08% of electricity from renewable energy resources (0.06% Hydro + 0.02% Wind).

But with 2 new solar power plants providing 250 MW, perhaps (see below).

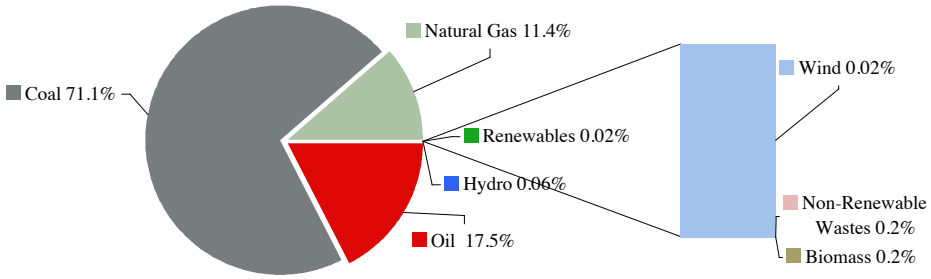
Solar Target

300 MW from solar by 2011-2012.[19]

1000 MW from solar by 2020.[20]

The National Infrastructure Ministry published in March 2008, a tender to build two 80-125 MW solar thermal power plants in the southern Negev desert. The two plants would supply 250 MW of electricity, equal to 3 percent of Israel's electricity consumption. A tender for a 15 MW PV power plant was issued in April 2008.

Electricity Generation by Fuel (2005)[21]



- *Coal and oil (or 88.6% of fuel for electricity) are imported.*
- *Israel has over 1.3 million solar water heaters producing the equivalent of over 4% of Israel's electricity consumption as a result of mandatory solar water heating installations*[22]

Energy Subsidies

According to Dr. H. Avraham Arbib of the Ministry of National Infrastructures, electricity is not subsidized in Israel.

Renewable Energy:

The Resources Management Division (RMD) at the Ministry of National Infrastructures (MNI) and the Office of the Chief Scientist of MNI are in charge of renewable energy R&D, policy design and enforcement. RMD has staff of 5 and intervention budget of $ 1.2M.[23]

Public Budget for PV

Public budget for R&D, demonstration/field trials and market stimulation in 2005: USD 470,000.

The Israel Ministry of National Infrastructures spent USD 75,000 on R&D in 2006.

In April 2007, the Israel Ministry of National Infrastructures announced a three-fold increase of the budgets allocated for support of new initiatives aimed at the development of alternative and renewable energy sources.

Solar Energy Policy Context (continued)

Energy Efficiency Measures

Government standards for energy efficiency have been in place since 1989, when Israel's parliament passed the Energy Resources Law.[24] Two new-building energy-rating standards were adopted for residential buildings (2005) and for office buildings (2007).[25]

The Ministry of National Infrastructure has implemented a diverse range of policies and programs to maximize energy conservation and efficiency in Israel. These include initiatives to educate Israelis and increase public awareness of energy efficient products, programs which give financial support to energy consumers for transforming buildings to meet EE standards, and regulations which cover energy labeling systems for electric heating and cooling devices. The Ministry of National Infrastructure continues to monitor energy consumption efficiency.[26]

Summary of PV support measures in Israel

PV Support Measures	**National / Regional / Local**
Feed-in tariffs	For residential systems up to 15 kW and Commercial systems up to 50 kW: 2.01 ILS / kWh (0.604 USD)
Direct capital subsidies	No
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	No
Subsidized Loans	No
Net metering	No
Interconnection	Mandatory in the context of 2008 feed-in

Conclusion

Israel is on the verge of an electricity shortage. The Jerusalem Post reports that Israel's Public Utility Authority has plans to launch deliberate rolling brownouts this summer to deal with peak load problems.[27] Furthermore Israel is dependent upon imports for more than 88% of its electricity need and these come from dirty fuels.

With less than 2 MW installed, the PV market in Israel has been until now practically non-existent and 98% off-grid. However, the July 2008 feed-in tariff seems to be stirring a lot of excitement. Given its solar resources and the strategic interest in national and distributed generation, Israel should keep with its commitment to solar energy and,

- Incentivize domestic PV production and increase R&D funding
- Raise/eliminate the feed-in program cap of 50 MW. As pointed out by Eleni Despotou's calculations, the entire 50 MW program would result in the generation of 100 GWh, which, at current rates for systems under 50 kW, would amount to a □ 40 million cost to the utility (with annual revenues of □ 3,450 million from the sale of 50,000 GWh) or in the end a 1% cross-subsidy from the net tariff.[29]
- Help eliminate bureaucratic hurdles at the municipal level that are causing bottlenecks and stalling the growth of a market in high demand.

The political will seems to be there:

National Infrastructure Minister Binyamin Ben-Eliezer pledged to adopt a plan to build one new solar station per year for the next 20 years. Israel President Shimon Peres has stated, "I believe Israel should go from oil to solar energy. Oil is the greatest problem of all time-the great polluter and promoter of terror. We should get rid of it."[28]

Endnotes

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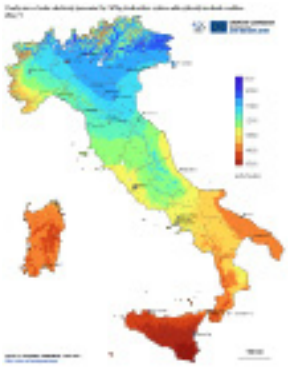
ITALY



Source: PVGIS © European Communities, 2001-2007[1]

Solar Insolation: ~1000-1500 kWh/kWp/yr Yearly Average Solar yield
~3.4-5.4 kWh/m2/day Average Solar Radiation on collector surface

Grade **C+**

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **120.2 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 50 MW*[2] (64% grid-connected)

Cumulative installed end 2007: 120.2 MW[3]

(42.2 MW installed as of June 2008 with an estimated total for 2008 of 112.2 MW)[4]

*216 MW approved under 2005-06 Feed-in tariff but not built as of 10/2007[5]

Cumulative installations growth rate 2005-2006: +33% 2006-2007: +140%

Annual installations growth rate 2005-2006: +83.8% 2006-2007: +461.6%

Population: 58 M PV per capita: 2 W/capita (growing quickly)

Drivers for Future Development[6]

Financial Incentives

Two previous PV policy efforts:

2001 10,000 PV Roofs Program (21 MW): not performance-based incentives, up to 70% for PV systems installation.
2005 Feed-in tariff (31 MW+ 216 MW approved but not yet installed): burdensome bureaucracy, had a 1 MW system cap size.

2nd Conto Energia: Feed-in Tariff

The latest feed-in tariffs went into effect in April 2007 and are valid until 31 December 2008:

	System Integration in building's architecture		
	Not integrated (Ground Mounted)	Partially integrated (Roof Mounted)	Fully integrated (BIPV)
1 kW to 3 kW	0.40	0.44	0.49 (0.78 USD)
3 kW to 20 kW	0.38	0.42	0.46
Above 20 kW	0.36 (0.57 USD)	0.40	0.44

Financial Incentives (continued)

The tariffs are fixed for 20-year terms.

In 2009 and 2010, the feed-in rates will decrease by 2% each year.

The new scheme gets rid of the annual cap of 85 MW and intends to ultimately support 3000 MW of PV installations. It also gets rid of the 1 MW cap size for a single system.

The law will be revised when the 1200 MW mark is reached; a 14-month grace period will allow for approved applications to complete installation under current terms.[7]

A 5% premium is provided for:

- the electricity producer if he/she uses at least 70% of the electricity generated,
- public schools and public health centers;
- installations integrated to building substituting asbestos roofs;
- municipalities with less than 5.000 inhabitants.
- increased energy efficiency: "If the consumption of energy of the building is reduced by at least 10%, an increase in the incentive tariff is awarded in a percentage equal to half of the percentage of electricity saved, but not exceeding 30% of the standard tariff."[8]

Regulatory Incentives

Renewable Portfolio Standard

Under the EU's 2001/77/EC directive, which requires that 21% of electricity generated in the EU come from renewables by 2020, Italy pledged 25% of its electricity would come from renewable sources. It is not on track to meet this target.

Italy has had an RPS in place since 2002, which required electricity producers to provide 2% of their electricity annually from renewable sources or purchase green certificate equivalents. As the minimum obligation increases annually (0.75% for the years 2007-12), the minimum obligation quota will be: 3.80% in 2007, 4.55% in 2008, 5.30% in 2009, 6.05% in 2010 and 6.80% in 2011.[9]

Non-compliance carries sanctions, which seem hard to enforce.

The RPS does not contain a solar carve-out.

Interconnection

Renewable electricity producers are supposed to be given priority connection to the grid.

Grid operators are obliged to connect these producers under a limited amount of time, failing which fines are imposed. Also, in case the grid is not technically able to receive the electricity produced, works to the grid must be carried out in order to allow such connection.

Net Metering

There is a net metering law in place in Italy that applies in addition to the feed-in tariff.

Renewable electricity generators are equipped with 2 meters, the first to determine the electricity generation which qualifies for feed-in rates, the second to determine usage (net-metering) and grid-delivery compensation.

In addition to receiving compensation at the feed-in rate for all electricity generated, systems with a capacity lower than 20 kWp* can also elect to:

1. Net-meter all production in excess of consumption: net generation accrues in an account where it can be saved and consumed for the following 3 years.
2. Deliver part or 100% of the electricity to the grid and get compensated at the rate set yearly by the AEEG -the Italian electricity & gas regulator- currently: 0.095 □/kWh.

Systems over 20 kWp* do not benefit from net metering. In addition to the feed-in rate for all electricity generated, they can either sell to the grid 100% of their production or the balance of electricity unused for the AEEG rate (0.095 □/kWh) up to 500 MWh annually.

* The ministries of Environment and Economic Development are considering extending this 20 kWp capacity cut off point to 200 kWp.

Solar Energy Policy Context

Renewable Energy Targets[10]

25% of electricity output by 2010

Not on track to achieve this target. 16.5% in 2005 (5.1% excluding large hydro)

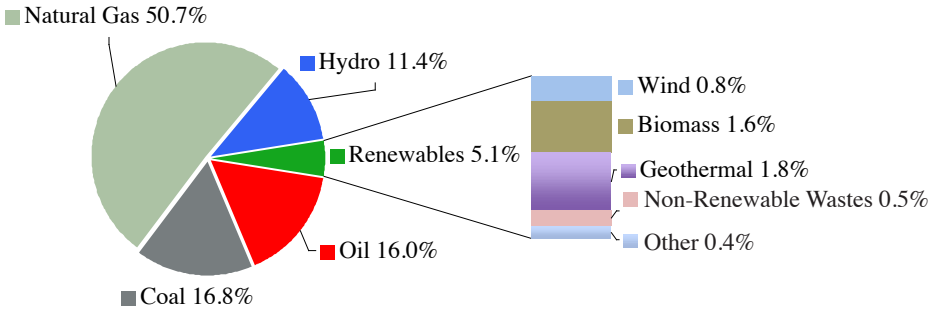
Solar Target[11]

As of February 2007 the target was 1.2 GW of installed (not applied for) PV capacity by 2010, 3 GW by 2016 and 8 GW by 2020.

On target?

0.1 GW was installed by end 2007 so that would require the market grow at 130% annually, which is possible.

Electricity Generation by Fuel (2005)[12]



Energy Subsidies

Energy R&D Budgets (in million USD)[13]

	2005	2006
Fossil Fuels	17.28	53.95
Nuclear	102.38	125.47
Renewable Energy	63.35	67.75
Total Solar	60.66	62.74
Photovoltaics	13.18	20.08
Total Energy	330.17	505.4

Public Budget for PV

The International Energy Agency Photovoltaic Power Systems Programme report the public budget for Solar PV R&D, demonstration/field trials and market stimulation in 2005 was $ 43.20M.[14]

In 2006, the public budget for R&D and market incentives totaled $15M. In particular, expenditure on PV research and demonstration has been about $6.8M, remaining essentially flat with respect to the previous years while the ones for market stimulation have been around $8.2M.[15]

Energy Efficiency Measures

"If the consumption of energy of the building in which a photovoltaic plant is installed is reduced by at least 10 per cent, an increase in the incentive tariff is awarded in a percentage equal to half of the percentage of electricity saved, but not exceeding 30 per cent of the standard tariff."[16]

As an EU member state, Italy is bound by the EU Energy Performance of Buildings Directive. This directive was implemented in Italy in 2006 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. Aspects of residential buildings that are taken into account include the building shell including air-tightness, heating and cooling installations, ventilation, the orientation and position of the building, passive solar systems and solar protection.[17]

In addition to the mandated EU directive, Italy has established national energy efficiency measures. Since July 2007, existing buildings and those under construction have been required to issue an energy certificate when entering the real estate market, all new buildings have been required to satisfy at least 50% of hot water demand by mean of solar generation, 200 Wp of photovoltaic system for each apartment built (e.g. 10 apartments in a single building = 2000 Wp, etc.) and energy audits have been conducted in public schools, public lighting, public buildings, residential buildings and hospitals resulting in cost-effective energy efficient interventions[18].

Solar Energy Policy Context

Indirect Policy Measures:

An inter-ministerial decree has introduced tax credits for energy saving improvements as well as solar thermal utilization, up to 55% of capital cost.

A recent inter-ministerial decree (July 2008) has also determined that installation of a rooftop PV system which is parallel mounted on the roof and does not exceed the actual roof surface, should be considered a standard maintenance action, and consequently benefit from an expedited permitting procedure (no DIA required).

Summary of PV Support Measures in Italy

PV Support Measures	National
Feed-in tariffs	□ 0.36-0.49/kWh
Direct capital subsidies	Only in some Regions (e.g. Sardinia) and max 20% of the investment.
Renewable portfolio standards (RPS)	+0.75% annually for a share of electricity from RES of 4.55% in 2008, 6.80% in 2011.
PV requirement in RPS	No
Solar Renewable Energy Certificates	Yes
Tax credits	55% only for solar thermal
Subsidized Loans	Government (GSE) enters into security agreements for feed-in related loans
Net metering	Yes (in addition to Feed-in)
Net billing	Yes
Interconnection	Priority connection mandated by law but no significant enough fines for grid operators that don't.

Conclusion

The second "Conto Energia" feed-in was undoubtedly an improvement on the first, as seen in the growth of cumulated installations before and after. It was also a genuine attempt at reducing bureaucratic hurdles. However these remain significant. According to Gualtiero Seva, Director of the Italian Solar Industry Association Assosolare, the application for the feed-in is still about a 55-page process and is not uniform across regions. Additionally, there is a need to educate regional and municipal governments about the benefits of solar and the laws in place. In some cases, municipalities remain unaware of their role in the process.

Finally, Photon reported in October 2007 grid operators were dragging their feet in the interconnection process and were responsible for the bottleneck between approved and installed systems. Indeed, the article noted network operators faced an absurdly low fine for each installation they failed to connect.

Given solar electricity's proximity to grid parity in Italy (retail electricity prices for residential accounts stand at □0.188/kWh or about 0.258 USD/kWh), Italy's almost total dependence on energy imports and Italy's solar resources, the country has a lot to gain by sustained support for solar deployment. The country should strive to improve the following areas:

- Education of regional and municipal governments
- Simplification and homogenization of the application process across regions
- Greater incentives for grid operators to connect systems
- Clear and significant sanctions for energy producers that fail to comply with the Renewable Quota.
- Establish a solar carve-out in the Renewable Quota.

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Solar Energy, 81, 1295–1305, http://re.jrc.ec.europa.eu/pvgis/

[2] International Energy Agency Co-operative Programme on Photovoltaic Power Systems (IEA PVPS), "National Survey Report of PV Power Applications in Italy 2006", May 2007.

[3] IEA PVPS, "Cumulative installed PV power capacity in reporting IEA PVPS countries as of the end of 2007". http://www.iea-pvps.org/trends/download/2007/Table%201.pdf

[4] G. Seva, Assosolare, "Italian PV Market", July 2008.

[5] Stefano Eleuteri, "My heart bleeds", Photon International, October 2007, page 37.

[6] Compiled from "A labyrinth of feed-in rates", Photon International, January 2008, page 38, and IEA/JREC 2007, Renewable Energy Targets, Global Renewable Energy Policy and Measures, "New feed-in tariff to promote photovoltaic systems and increase energy efficiency in the building sector", http://www.iea.org/textbase/pm/?mode=re&id=3813&action=detail, and Gestore dei Servizi "Elettrici,Incentivazione degli impianti fotovoltaici, Relazione delle attività ottobre 2006 –settembre 2007", 01/14/08. http://www.gsel.it/ita/index.asp

[7] G. Seva, "Italian PV Market", Assosolare, July 2008.

[8] Norton Rose Group, Regulatory regimes for solar power: Italy, January 2008. http://www.nortonrose.com/knowledge/publications/2008/pub15987.aspx?page=080623142324&lang=en-gb

[9] Watson, Farley & Williams, "Green Certificates regime as amended by Budget Law 2008", January 2008, www.wfw.com/Publications/Publication459/$FILE/Italy's%20Green%20Certificates%20Regime%202008.pdf

[10] Renewable Energy Targets, Global Renewable Energy Policy and Measures, IEA/JREC 2007, http://www.iea.org/textbase/pm/?mode=re&action=view

[11] Stefano Eleuteri, "My heart bleeds", Photon International, October 2007,, page 34.

[12] IEA Energy Statistics 2007, "Italy-Electricity Generation by Fuel 2005". http://www.iea.org/textbase/pm/JRECPIC/Electricity%20Generation%20by%20Fuel%202005%20-%20Italy.gif

[13] IEA 2008, Beyond 20/20 Web Data Server (WDS), http://wds.iea.org/WDS/TableViewer/tableView.aspx

[14] IEA Photovoltaic Power Systems Programme, "Public budgets for R&D, demonstration/field trials and market stimulation in 2005".

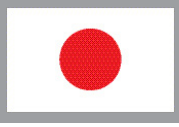
[15] International Energy Agency Co-operative Programme on Photovoltaic Power Systems (IEA PVPS), "National Survey Report of PV Power Applications in Italy 2006", May 2007. http://iea-pvps.org/countries/download/nsr06/06itansr.pdf

[16] Norton Rose Group, Regulatory regimes for solar power: Italy, January 2008. http://www.nortonrose.com/knowledge/publications/2008/pub15987.aspx?page=080623142324&lang=en-gb

[17] International Energy Agency, Energy Efficient Building Codes 2008, http://www.iea.org/g8/2008/Building_Codes.pdf

[18] International Energy Agency, Energy Efficiency Policies and Measures Database, http://www.iea.org/textbase/pm/Default.aspx?mode=pm

JAPAN



Grade C

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

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date 1,919 MW

Financial Incentives

Regulatory Incentives

Installed PV capacity

Cumulative installed end 2006: 1,709 MW[1] (95% grid-connected)

Cumulative installed end 2007: 1,919 MW[2]

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 it 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 Energy[10]

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 Operators[11]

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.

Drivers for Future Development (continued)

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 pivate-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.

Solar Energy Policy Context

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]

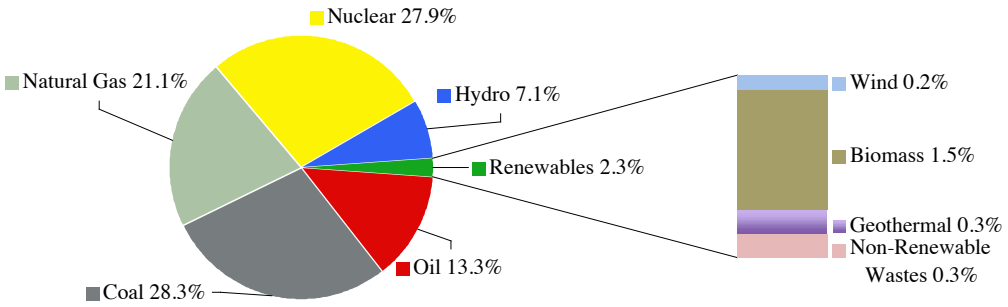
Overall, Japan seems to be on track with its RPS but the RPS targets are very low (less than 2% of electricity generated by 2014).

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 FY2006[18]

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 Energy Policy Context (continued)

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 over arching 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 subsides 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	*"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%)*
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]

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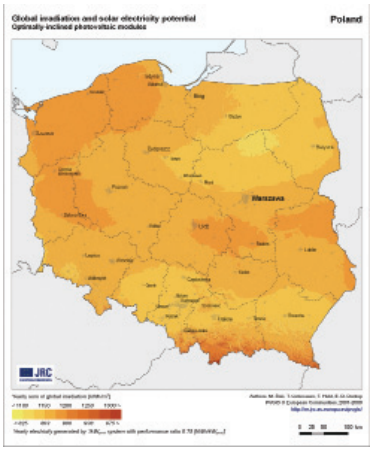
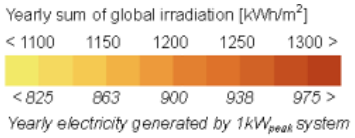
POLAND





Source: PVGIS © European Communities, 2001-2008[1]

Grade **F**

Solar Insolation: 825-975 kWh/kWp/yr Average Annual Solar yield
3-3.56 kWh/m2/day Average Solar Radiation

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **0.64 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity[2]

Cumulative installed end 2007: 0.64 MW

Cumulative installed end 2006: 0.44 MW (25% grid-connected)

Cumulative installations growth rate: 2005-2006: +50% 2006-2007: +46%

Population: 38M PV/capita: 0 W/capita

Drivers for Future Development

Financial Incentives

Green Certificates

Green Certificates are the main financial incentive in place for renewables in Poland. These are tradable titles granted to electricity suppliers for each MWh generated from renewables. As of November 2008, the market rate was around 0.25 PLN/kWh (~USD 80/MWh). These are not solar PV specific and at that rate are unlikely to support solar development. Using a multiplier for solar may be a way to provide a viable incentive for PV. A multiplier of 3 for example would allow producers to get 750 PLN ($240) for each MWh of electricity generated from solar.

Grants

The National Fund for Environmental Protection and Water Management provides grants for 'new technologies' pilot projects undertaken by public, private and NGO entities. The specific terms of the grants depend on the category of the recipient.

Information from the Fund also suggests that grants for up to 3600 PLN/kW (or about US$1.1/W installed) are available for projects costing more than 20 millions PLN ($6.6 million).[3]

Subsidized loans

- The Environment Protection Bank provides 7-year loans at half the commercial rate for renewable energy projects.
- The National Fund for Environmental Protection and Water Management also provides loans for medium-sized PV systems covering 30% of costs; and for small scale projects, interest rate subsidies of 4 percentage points through banks cooperating with the Fund.

Drivers for Future Development (continued)

Regulatory Environment

Renewable Portfolio Standard

Utilities, power plants, and transmission companies will be required to annually source 10.4% of their electricity sales from renewables for the period 2010-2012.[4] This obligation was increased from a previous 9% by 2010. Non-compliance with the obligation carries a penalty. However the amount of the fine has reportedly not been set and the quota is consequently ill enforced. This quota does not include a solar provision and is therefore unlikely to promote the development of solar.

Interconnection

There are no interconnection standards defined. Additionally, the interconnection process is very cumbersome. While renewable energy systems under 5 MW used to be exempt from acquiring a license to interconnect to the grid, a 2007 amendment to the Energy Law extended that obligation to all systems, which, for small systems may represent a prohibitive hurdle.

Net Metering

There are no net metering provisions in Poland. Additionally, 20 different permits are required to sell electricity after interconnection.

Education and Outreach

Although a lot more needs to be done in Poland to raise awareness on the potential and benefits of PV mainly amongst the public at large but also amongst lawmakers, the government does provide some support for educational initiatives and demonstration projects using Renewable Energy (not PV-specific) through the National Fund of Environmental Protection and Water Supplies Management.

The Center for Photovoltaics is responsible for the bulk of the education and outreach programs within Poland, as it sponsors lectures, classes, laboratories and training programs designed to educate the public and students.

Solar Energy Policy Context

Renewable Energy Targets

Target Shares of Electricity from Renewables Economy Minister's Decree - 14 August 2008			
2008	7%	2013	10.9%
2009	8.7%	2014	11.4%
2010	10.4%	2015	11.9%
2011	10.4%	2016	12.4%
2012	10.4%	2017	12.9%

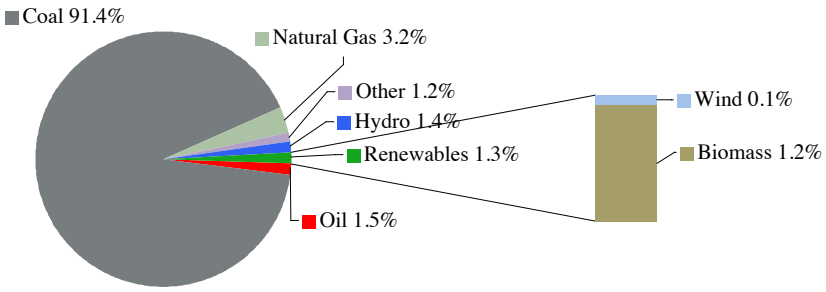
Source: Wierzbowski[5]

In January 2008, a proposed European Union Directive suggested a 15% share of final energy consumption from renewables by 2020. However, the target has not been approved yet and the most recent Polish target -set in 2006- remains 7.5% of primary energy by 2010.

Solar Target

The target for installed PV capacity is 2 MW by 2010.[6] Poland is not on track to reach this target.

Electricity Generation by Fuel (2005)[7]



According to the European Renewable Energy Council, the share of renewables in the gross electricity consumption was 2.99% in 2006.[8]

Energy Subsidies

Although difficult to quantify, substantial subsidies are provided to the producers of hard coal; not only does this industry represent a significant portion of Poland's own economy, but it is also a major export to Russia and other European countries.

Public Budget for PV

According to the Polish Center for Photovoltaics, annual budgets allocated to PV research and technology development, demonstration and dissemination activities between 2004 and 2006 varied between □400,000 and 600,000, with an additional 34% coming from foreign sources.[9]

Poland has an active research effort underway for PV technology, through the Center for Photovoltaics, which has designed and installed the largest PV system in Poland, a 60 kW system at the University of Warsaw.

PV R&D

Poland has an active research effort underway for PV technology, through the Center for Photovoltaics, which has designed and installed the largest PV system in Poland, a 60 kW system at the University of Warsaw.

Summary of PV support measures in Poland

PV Support Measures	National
Feed-in tariffs	No
Green Certificates	Yes. Not PV specific; ~0.25 PLN/kWh (~80 USD/MWh)
Rebates/Grants	For demonstration and pilot projects (not PV specific) And large scale projects of more than 20 millions PLN ($6.6 million): 3600 PLN/kW (or about US$1.1/W installed).
Tax Credits	No
Subsidized Loans	Yes several soft loans programs. Loan for 30% of costs for medium size projects. 7-yr loans at 1/2 market rate for RE
Renewable portfolio standard (RPS)	10.4% by 2010
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Interconnection	No
Net metering	No

Conclusion

With less than 1 MW of installed PV, the solar market in Poland is basically non-existent. There is a place for solar in the Polish electricity portfolio however, as for any other country, especially in light of the country's reliance on coal for over 90% of its electricity.

To truly begin to spur solar growth in Poland, a multifaceted government-led approach must be initiated.

- First, the government must reconsider its regulatory infrastructure which is currently making it very difficult for system owners to connect to the grid. Namely,
  - Technical requirements for interconnection should be defined so as to make the process more transparent and expedient, and the obligation for small systems to obtain a license for connection should be lifted.
  - A national net metering policy should be adopted, allowing PV system owners to be credited for the electricity they feed into the grid. Additionally the cumbersome 20-permit requirement to do so should be revised.
- Second, the government ought to reduce coal subsidies, which prevent solar from being competitive and make financial support for solar appear more expensive than it needs to be. The feasibility of a renewable energies feed-in tariff (with PV provision) should be explored or a performance-based rebate program adopted. Without significant financial incentives, the Polish solar market will be unable to compete with cheap coal.
- What the country could do immediately however, and at no cost, would be to include a solar provision in its RPS. Integrate in its Green Certificate scheme a multiplier of 3 for solar for example, so that generators of solar electricity may get 3 times the market rate for each MWh. Such "Solar Green Certificates" could help in the financing of solar projects and be used in the context of compliance with the RPS solar provision as a "Solar Alternative Compliance Payment". More generally, the requirements for the RPS target of 10.4% from renewable sources by 2010 must be enforced, and new targets for 2015, 2020 and beyond must be developed.
- More needs to be done, perhaps with the help of environmental groups, to raise awareness on the environmental effects of coal, and the merits of solar. Photovoltaics are still largely perceived as an unreliable technology at the experimental stage, which is why support for solar in Poland is mostly focused on demonstration projects.

Endnotes

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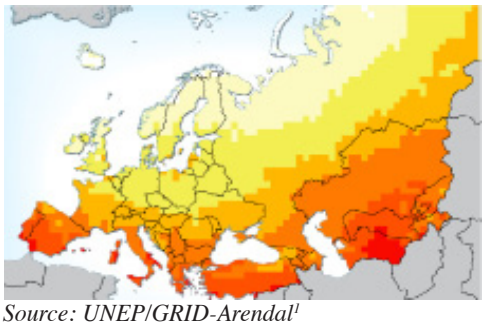
RUSSIA

Grade F

Less than 1700 hours/year
Between 1700 and 2000 hours/year
More than 2000 hours/year
Source: http://ecoclub.nsu.ru



Annual average solar insolation (kWh/m_/day
150 - 200
200 - 250
250 - 300
300 - 350
350 - 400

Source: UNEP/GRID-Arendal[1]

Solar Insolation: ~ 810-1400 kWh/kWp/yr Yearly Average Solar yield
2.22-3.84 kWh/m²/day Average Solar Radiation on collector surface;
Seasonally: 1.69-11.41 kWh/m²/day

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **0.15 MW**

Financial Incentives

Regulatory Incentives

The Russian government has estimated the technical potential for solar energy to be about 19,000 TWh per year[2] or 20 times more than the total electricity generated by the country in 2005: 951.2 TWh.[3]

Installed PV Capacity

Cumulative installed end 2006: 0.15 MW[4]

Population: 141M PV/capita: 0 W/capita

No growth

Drivers for Future Development

Besides recent and limited aid for PV manufacture, there has been basically no support to speak of in Russia for the deployment of PV.

With a $100 million support from the Global Environment Facility (GEF), Russia launched in 2005 the Russian Program for Development of Renewable Energy Sources (RPDRES) to address the lack of regulatory infrastructure and help meet some of the financial risk associated with deploying grid-connected renewables. It is unclear however, what has so far resulted from this program.

Upcoming law "On Supporting Renewable Energy Use"?

Several reports suggest a law for supporting renewable energy has been in the works for a long time, the latest of which sprung from a decree signed by President Medvedev in June 2008 instructing the government "to submit draft legislation to the Duma by October 1, 2008 which would provide incentives for introducing environmentally friendly and energy efficient technologies. The order also calls for allocating funds in the 2009-2011 federal budget for renewable energy and providing subsidies for specific projects."[5]

Photon International reported in its November 2007 issue that a draft legislation similar to the German Renewable Energy Law (EEG) had been debated and was set to be presented to the parliament in the spring of 2008. The article noted, "the draft calls for a uniform rate for all [renewable] sources, about 10 euro cents per kWh ($0.16/kWh)."[6] Such an incentive though would be unlikely to do much for solar PV development.

In his address at the World Refining & Fuels Conference in May 2007, EU Ambassador Vladimir Chizhov had also mentioned a draft law "On Supporting Renewable Energy Use", which he noted would seek to "facilitate federal regulation and promotion of the use of renewable, as well as the delimitation of responsibilities between federal and regional authorities". He had indicated the law aimed at "large-scale involvement of the business community in the renewable energy improvement process through public-private partnerships, which imply [...] fostering a favorable business environment."[7]

Drivers for Future Development (continued)

Russia's government does not seem committed to passing a law to support Renewable Energy. No support measure was found for encouraging the development of solar energy. The dearth of information on governmental measures should also be noted. There is no apparent division in the government (in the Ministry of Industry and Energy for example) dedicated to issues of renewable energies.

Solar Energy Policy Context

Renewable Energy Targets

Many statements have been made by Russian officials on renewable energy, but Russia does not have official targets.

In spite of tremendous resource potential, the share of renewables in electricity production amounted to 0.7% as of May 2007. According to Vladimir Chizhov Russian ambassador to the EU, this will increase to 1.9% in 2010, 2.7% in 2015 and 4,2% in 2020. The ambassador noted the economic potential of renewable energy resources has been conservatively estimated at some 20% of the current domestic energy consumption, but the technical potential is far greater (16 times greater).[8]

According to Mr. Vladimir Maksimov of the Russian Ministry of Economic Development and Trade, the plan as of 2006 was to increase the use of renewable energy from 0.1% of total energy supply to 1% by 2020.[9] Renewable energy sources account today for only 1.2 percent of Russia's total primary energy supply, and by 2010 might account for about 1.9 percent.[10]

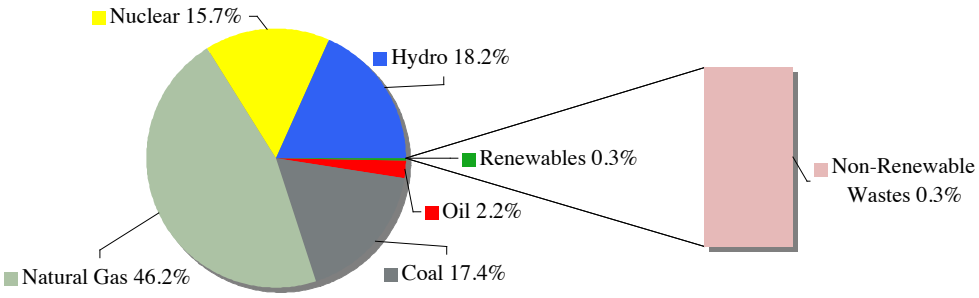
It was reported that the Duma passed a bill in April 2008 requiring Russia to meet 21% of its electricity with renewables by 2020. However, there is no evidence supporting this claim.

The 2003 "Energy Strategy to 2020" noted that a goal of 1000 MW of electric power capacity from renewable sources was achievable by 2010[11], but did not lay out a plan to accomplish this. (Russia had a total electric generation capacity of 214,4 GW in 2003[12], so that 1000 MW in 2010 would be less than 0.005% of 2003 total capacity.)

Solar Target

None.

Electricity Generation by Fuel (2005)[13]



A comparative review of G8 countries' climate change strategies reports Russia's energy plans, "In April 2007, the Industry and Energy Ministry unveiled the Draft General Scheme of Construction of Electric Energy Facilities until 2020. The Draft Scheme, which is subject to Cabinet approval, prioritizes the development of hydro and nuclear energy-generating facilities. [...] The development of other sustainable sources of energy does not feature prominently in the Draft Scheme."[14]

Indeed, between late 2006 and mid 2007, the government announced the construction of several hydroelectric power stations with a joint capacity of about 1,470 MW[15] and in 2006 the government announced its intentions to build 40 new reactors by 2030 (4 of them by 2010 with a capacity of 4 GW), which would increase the proportion of nuclear-generated energy to 25% by 2030 and cost an estimated $60 billion.[16]

Energy Subsidies

The IEA estimates total energy subsidies in Russia amount to $40 billion a year (the largest in the world in dollar terms): "Most of these subsidies go to natural gas and the rest to electricity (which includes the underpricing of gas delivered to power stations). Subsidies of $25 billion per year to final consumption of gas are alone more than twice the annual investment projected for the entire Russian gas industry."[17]

Russia started to decrease electricity consumption subsidies in 2000 and has come a long way. However, in 2005 the IEA noted Russian electricity prices were still very low by international standards, "Average prices for residential consumers and government agencies were about 2.3 US cents/kWh in 2003. Industrial users paid about 2.5 cents. By comparison, average prices in IEA countries in 2002 were about 11.4 cents for residential consumers and about 5.9 cents for large industrial users."[18]

Total electricity allowances to households in 2006 were estimated at RUB 30 billion (~US $1.3 billion). The Federal Law On the Federal Budget for 2007 provides for "the right of the Government to grant up to RUB 15 billion in subsidies to the constituent entities of the Russian Federation to eliminate interregional cross subsidies."[19]

34% of the true economic value of electricity consumption is subsidized in Russia.[20]

Solar Energy Policy Context (continued)

Support for Renewables

According to REN 21[21], in late 2007, Russia joined the category of countries that offer some type of direct capital investment subsidy, grant or rebate, with legislation providing investment subsidies for grid interconnection of renewable electricity producers, along with renewable energy certificates and other measures.

Public Budget for PV

Subsidies are available for PV production but not deployment. The government has invested in silicon and module production factories.

Energy Efficiency Measures

Energy Efficiency has been of great concern in Russia as the country exhibits one of the most energy intensive economies in the world (2.3 times the world average) and twice as high as the US.

In February 2003, the national Thermal Performance of Buildings was revised. At this time, Russia mandated energy efficiency performance targets (corresponding to world levels), classified buildings according to their energy efficiency, created a mechanism for identifying low-performing buildings and mandated necessary upgrades. While these were national regulations, they were implemented at the state level.[22] Russian states employed various techniques to ensure energy efficiency compliance, for example, some states introduced financial incentives for buildings that exceeded minimum energy efficiency requirements, and other states mandated energy audits.

Summary of PV Support Measures in Russia

PV Support Measures	National
Feed-in tariffs	No
Direct capital subsidies	No
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	No
Subsidized Loans	No
Net metering	No
Interconnection	No

Conclusion

With less than 0.2 MW of installed capacity in 2006 and no support measures, Russia's PV market is basically non-existent. PV, as well as renewable energy sources more generally, face considerable challenges in Russia:

- Tremendous fossil fuels resources; Russia has the world's largest natural gas reserves, the second largest coal reserves and the eighth largest oil reserves.[23]
- Russia's economy is dependent upon energy exports; in 2006, export of crude oil, petroleum products and natural gas accounted for 65 percent of the economy's total exports and for approximately 30% of GDP.[24]
- Russia's electricity is subsidized at the tune of $15 billion a year, keeping traditional sources artificially low, and thus alternatives uncompetitive.
- The lack of awareness about climate change and the need to increase renewables capacity, combined with the perception that Russia is facing more pressing issues, make it unlikely that the government will feel any pressure to support Renewable Energy and solar in particular.

However, Russia is also in the process of reducing subsidies and is facing a rising electricity demand with a need for sector investment estimated at about $380 billion between 2003 and 2030.[25]

So it would behoove Russia to start including renewables in its portfolio, especially given the country's renewable energy resources.

Solar PV production facilities are already in place and can provide a starting point for a domestic market. With greater access to silicon, Russia could readily expand it production capacity.

Russia must make a clear commitment to embrace and support clean technologies, set ambitious targets, and redirect some of its large fossil fuel subsidies to encourage, among others, solar electricity. It must also educate the public about the challenge of climate change and the necessity to revise traditional ways of consuming and producing energy, so that RE policies may become more politically feasible. Concerns about climate change have not yet entered the popular discourse and dealing with its consequences is thus not high on the political agenda. Russia is perceived to be facing greater threats.

Finally, Russia needs to start building a regulatory infrastructure that will provide a fertile ground for the growth of renewable energy industries, one that may be overseen by a yet non-existent Ministry of the Environment.

Endnotes

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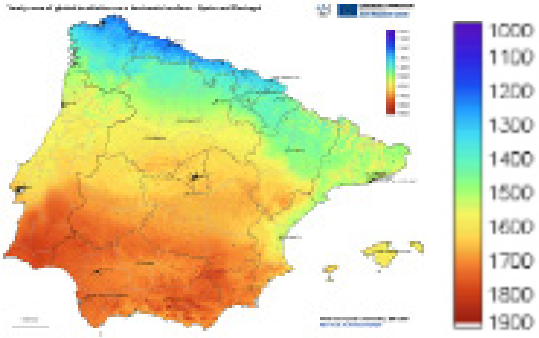
SPAIN

Grade C+

Yearly sum of global irradiation in kWh/m²



Source: PVGIS© European Communities, 2001-2007[1]

Solar Insolation: ~1300 kWh/kWp/yr Yearly Average Solar yield
~3.33-5.20 kWh/m²/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **655 MW**
~1,000 MW in 2008

Financial Incentives

Regulatory IncentiveS

Installed PV capacity

Cumulative installed end 2006: 118.2 MW[2] (85% grid connected)

Cumulative installed end 2007: 655 MW[3]

830 MW cumulative installed by July 2008

Cumulative installations growth rate 2005-2006: +105.9% 2006-2007: + 454%

Annual installations growth rate 2005-2006: +196.6% 2006-2007: + 427.8%

Population: 40M PV/capita: 16.4 W/capita

Drivers for Future Development

The Renewable Energy Plan for 2005-2010 (PER)[4]

On August 26, 2005 the Spanish government approved the new Renewable Energy Plan (Plan de Energias Renovables, PER), superseding the Renewable Energy Promotion Plan, which dated back to 1999. The PER is governed by Royal Decree 661/2007, which guarantees a high feed-in tariff for solar electricity generated over a period of 25 years. The overall aim was to make it possible to achieve the target of 12% of primary energy being met from renewable sources by 2010.

A new PER is under review for the period 2011-2020.

Financial Incentives

Royal Decree 661/2007

The Royal Decree regulates the production of electricity from renewable sources. It came into force on June 1, 2007.

	2007-2008 PV Feed-in Tariff - All Types of Installations* expired Sept. 2008 *(in Euro cents/kWh)	
	First 25 years	*After 25 years*
< 100 kW	*44.04*	*35.23*
100 kW - 10 MW	*41.75*	*33.40*
10 MW - 50 MW	*22.97*	*18.38*

Financial Incentives (continued)

(2007-08 Feed-in Tariff Continued)

- No degression rate. Rates are adjusted annually for inflation.
- Originally the program had a cap of 371 MW of installations by 2010. When 85% or 315 MW were connected to the grid, companies had a 12-month grace period to finish projects that had already been started. The 85 % were reached in September 2007 and in October, the government increased the program cap to 1,200 MW by 2010.
- Funded through government budget.

In anticipation of the grace period set to expire at the end of September 2008, the Spanish government and solar industry representatives negotiated a new feed-in for 2009. Some industry representatives acknowledged the 400%+ rate of growth had been unsustainable. Javier Anta, President of Spain's Photovoltaics Industry Association (ASIF) had suggested self-adjustable feed-in rates 10 to 30% lower would be acceptable and proposed a 480 MW new installations cap for 2009, hoping to see growth stabilizing at an annual rate of 20% thereafter.[5]

2009 Feed-in Tariff

After suggesting a 300 MW cap on new installations for 2009 (200 MW of rooftop and 100 MW of open-space installations), the Spanish government settled on a 500 MW cap (267 MW rooftop and 233 MW open-space). Industry lobbies argued the 300 MW cap would kill the solar industry in Spain and had proposed a 600 MW cap (480 MW new installations + 120 MW for projects still in development).[6]

The new feed-in will come into force in January 2009.

	2009 Feed-in Tariff		
	Tariff (€/kWh)	**Annual Caps**	**Quarterly Caps**
Open-space <10 MW	0.32	133 MW + 100 MW *(60 MW in 2010)*	58.25 MW
Roof top < 20 kW	0.34	26.7 MW	66.75 MW
Roof top 20 kW - 2 MW	0.32	240.3 MW	

- Rates guaranteed 25 years
- 500 MW cap for 2009 (267 MW rooftop and 233 MW open-space)
- See below for details on tariff degression.
- The annual degression rate is capped at 10%. Annual caps adjust in inverse proportion to degression (If rates decrease by 8%, caps will increase by 8%).

- Tariffs adjusted quarterly according to demand in previous quarter.

  - If at least 75% of the cap for the previous quarter is reached, rates decrease by a maximum of 2.5%, and the cap is increased by the same amount.

  - Conversely, if less than 50% of the cap is reached, rates increase and caps decrease by the same amount.

  - If between 50 and 75% of the caps are reached, incentive levels and caps remain the same.

Tax Credit

Law 35/2006 establishes a tax rebate of 6% (2008), 4% (2009), 2% (2010) from the total amount invested in Renewable Energy systems.[7]

Regulatory Incentives

Interconnection

Mandatory and as defined in context of Feed-in Tariff.

Drivers for Future Development (continued)

Education and Outreach

While courses on photovoltaics are being incorporated into curricula, there is no significant impact on the population at large. There is apparently no government-sponsored campaign to raise awareness about solar. No webpage dedicated to solar on a government website was found.

Solar in Building Codes

The Royal Decree 314/2006 amended the Technical Building Code, which now requires the incorporation of solar in new construction and major renovations:

- Installation of PV on new large buildings (offices, government buildings, hospitals, etc.), depending on building use, building size and geographical area, with a minimum capacity of 6.25 kWp.
- Solar thermal systems in new or refurbished buildings to cover between 30%-70% of the demand.

Solar Energy Policy Context

Renewable Energy Targets

30.3% of electricity generated from renewables by 2010.[8]

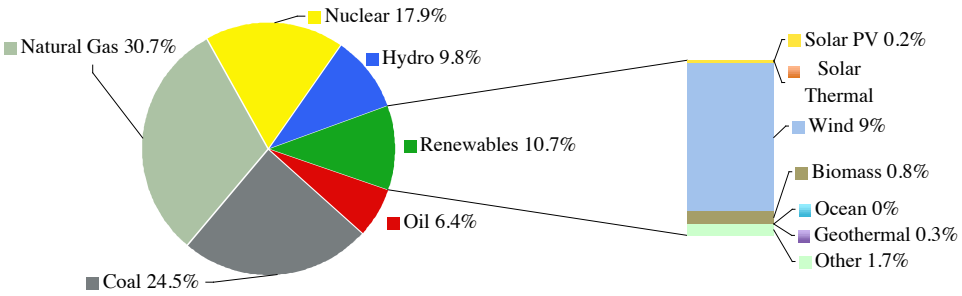
12% of total energy consumption from renewables by 2010 and 20% by 2020.[9]

Renewables provided 8.7 % of final energy consumption and 10.1% of electricity generation in 2005, (19% in 2006 including hydro[10]).

Solar Target

Target of 400 MW by the end of 2010 - reached 3 years early.
Revised targets 3,000 MW by 2010 and 10,000 MW by 2020.

Electricity Generation by Fuel (2007)[11]



Energy Subsidies

Spain subsidizes electricity.

2006 Energy R&D Budgets (in million USD)[12]

Fossil Fuels	6.27
Nuclear	21.14
Renewable Energy	32.53
Total Solar	15.34
Photovoltaics	2.54
Total Energy	66.73

Solar PV Subsidies

According to the Renewable Energy Plan[13], □ 8.89 million were earmarked as solar PV subsidies for 2005, as well as □ 3.80 for 2006 and □ 4.97 for 2007.

National investment for 2008-2010: □ 18.87 million[14] (excludes the feed-in tariff)

Photon Magazine, citing Spain's National Energy Commission figures, reported, "In 2007, when the installed capacity was 576 MW, the government paid about □ 200 million ($311.2 million)."[15]

Energy Efficiency Measures

As a EU member state, Spain is bound by the EU Energy Performance of Buildings Directive. This directive was implemented in Spain in 2007 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. It is up to member states to decide the level of energy efficiency requirements, however these levels must be revised at least every 5 years and updated based on technological developments.[16] Aspects of residential buildings that are taken into account include the building shell including air-tightness, heating and cooling installations, ventilation, the orientation and position of the building, passive solar systems and solar protection.[17]

Additionally, in 2007 the Spanish government released an Energy Efficiency Action Plan for 2008-2012 to assist with implementation of the Spanish Energy Efficiency Strategy (E4) 2004-2012.[18]

Summary of PV support measures in Spain

PV Support Measures	National / Regional / Local
Feed-in tariffs	0.32-0.34 □/kWh guaranteed 25 years, 500 MW for 2009.
Direct capital subsidies	No
Renewable portfolio standards (RPS)	No
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	Tax rebate 6% (2008), 4% (2009), 2% (2010) from the total amount invested in RE system
Net metering	No
Subsidized Loans	No
Interconnection	Grid access guaranteed
Sustainable building requirements	Building Technical Code, approved in March 2006 through Royal Decree 314/2006, requires all new or renovated buildings to cover 30-70% of Domestic Hot Water demand with solar thermal energy.[19] As of October 2007 Spain complies with EU Energy Performance in Buildings Directive[20]

Conclusion

Spain saw an unprecedented boom in solar market development when it put in place a feed-in tariff that, combined with favorable insolation rates, provided the most profitable incentive scheme in the world: PV systems under 100 kW received up to 575% of the prevailing electricity price[21]. As a result the Spanish market grew at a rate of more than 400%, but the country committed to payments estimated at □18 billion ($26.4 billion) for 1.58 GW of installed capacity[22].

The political and financial backlash resulted in a feed-in tariff revision that imposes a cap of 500 MW for 2009 -equivalent to less than half of 2008's installations. Spain's experience provides an example of a financial incentive that can overheat a market. The lesson therefore is to pay careful attention to policy and rate design. It is unfortunate that Spain has now resorted to capping their market so tightly. However, the government understandably is wishing to rein in an explosive growth that has in large part benefited foreign markets. Ultimately, the latest feed-in revisions are an improvement over the previous policy, having decreased incentive levels and incorporated adjustable degressions.

The Spanish feed-in experience also indicates that feed-in programs are best funded through a redistribution over electricity ratepayers rather than government budget allocation, which makes the program more vulnerable to political and economic factors.

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. "Potential of solar electricity generation in the European Union member states and candidate countries". Solar Energy, 81, 1295–1305, http://re.jrc.ec.europa.eu/pvgis/

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[18] International Energy Agency, Energy Efficiency Policies and Measures Database, http://www.iea.org/textbase/pm/Default.aspx?mode=pm

[19] International Energy Agency Solar Heating and Cooling Programme, "Spain: 2008 National Program Report" http://www.iea-shc.org/countries/reports/report.aspx?Country=Spain

[20] International Energy Agency, Energy Efficiency Policies and Measures, http://www.iea.org/Textbase/pm/?mode=pm&id=3667&action=detail

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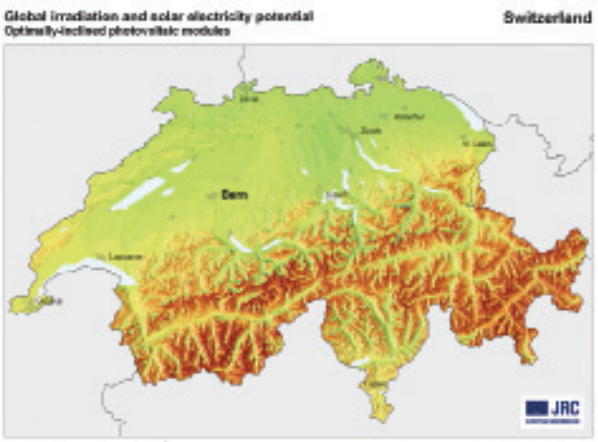
SWITZERLAND

Grade **F**



Source: PVGIS © European Communities, 2001-2008[1]

Solar Insolation: ~850-950 kWh/kWp/yr Average Annual Solar yield

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **31.4 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2007: 34.1 MW

Cumulative installed end 2006: 29.7 MW

Cumulative installations growth rate: 2005-2006: +11.8 % 2006-2007: + 15.9 %

Population: 7.5 M PV/capita: 3.96 W/capita

Drivers for Future Development

Financial Incentives

Feed-in Tariff

The new National Energy Law which takes effect on January 1, 2009 stipulates feed-in tariffs for renewable energy sources including solar. The tariffs replace all financial incentives previously in place at the regional level such as tax credits and grants.

2009 Feed-in Tariffs in Rp./kWh (USD)			
System Size	**Open Space**	**Partially Integrated (Roof mounted)**	**Integrated**
≤10 kW	65 (0.54 USD)	75 (0.62 USD)	90 (0.75 USD)
≤30 kW	54	65	74
≤100 kW	51	62	67
>100 kW	49 (0.40 USD)	60 (0.50 USD)	62 (0.52 USD)

- Capped at 5% of 320 M Feed-in for all Renewables or 16 million CHF/yr
- Share of feed-in rate for PV (5%) to go up to 10% as PV price drops below 0.6 CHF.
- Cost of whole feed-in law financed through a surcharge of 0.6 CHF/kWh on electricity rates (320 M/yr).

Drivers for Future Development (continued)

Financial Incentives (continued)

The level of support for PV as defined in the upcoming feed-in, is expected to only accommodate an additional 4 MW in 2009[2]. This would actually represent an 11% growth in annual installed capacity (compared to 14% from 2006 to 2007), which means that the feed-in tariff, instead of spurring solar development, may end up slowing it.

In fact, 4,000 applications have already been submitted by private entities and only 1,100 approved; the other 3,000 were placed on a waiting list for coming years.

Subsidized Loans
Many private banks offer soft loans (0.4 - 0.75 % interest rebate) for renewable energy projects but there is no federal soft loan program in place.

Regulatory Incentives

There is no Renewable Portfolio Standard at this time in Switzerland.

Net Metering
Net Metering is no longer available in the context of the new feed-in, which requires that every producer install a second electric meter.

Education and Outreach

Much remains to be done in the field of education about solar energy.

For professionals (electricians for example), the Swiss Professional Solar Association (Swissolar) offers a brief one-day certification course. Swissolar is working on initiatives to increase the number of certification courses.

Solar Energy Policy Context

Renewable Energy Targets

2010 Targets[3]

- 1%, or 500 GWh more electricity is to be produced from renewable energy sources than the amount produced in 2000
- The production of electricity from hydropower is to be maintained at the level recorded in 2000.

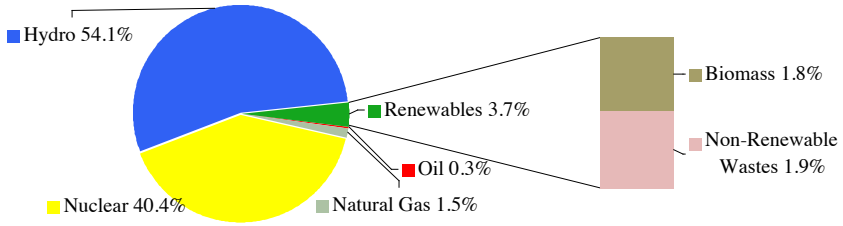
2030 Target

5400 GWh a year from renewable sources, which represents about 10% of today's electricity consumption.

Solar Target

There is no official target for solar energy.

Electricity Generation by Fuel (2005)[4]



As of June 2008, renewables accounted for 5.7% of Switzerland's electricity production, with 3.63% from biomass, 1.22% from incineration plants, 0.12% from solar energy and 0.003% from wind.[5]

Energy Subsidies

Public Budgets for PV

At the moment about 10 Million CHF a year are available for R&D from public funds.

R&D is being led by the School of Engineering and Computer Science (Bern), the Institut de Microtechnique (Neuenburg) and the SUPSI/DACD (Canobbio).

Summary of PV Support Measures in Switzerland

PV Support Measures	National
Feed-in tariffs	Around 0.65 Rp. Capped at 16 M CHF/yr (USD 13.4 M/yr)
Rebates/Grants	No. (Regional programs ended with the Feed-in-tariff)
Tax Credits	No. (Regional programs ended with the Feed-in-tariff)
Subsidized Loans	No. Some soft loans from private banks.
Renewable portfolio standard (RPS)	No.
PV requirement in RPS	No.
Solar Renewable Energy Certificates	Not in the context of RPS. Green electricity voluntary scheme from Naturemade.
Interconnection	Requirements enforced by cantons with the support of the Swiss Federal Office of Energy.
Net metering	Ended with Feed-in-tariff.

Conclusion

While Switzerland has taken the step to implement a feed-in tariff, it has capped the development of its solar market to about 4 MW a year, which is quite low. This is especially unfortunate given the obvious interest in solar investments as shown by the very high number of applications submitted for the feed-in tariff. The share of the feed-in program allocated to solar, currently 5%, should be increased so that solar may take its place in the Swiss electricity portfolio. Currently Switzerland exports its manufacture, as opposed to installing it.

Additionally, as a result of the feed-in implementation, previously available incentives such as rebates, tax credits and net-metering have been canceled. If the feed-in was uncapped as in the German model, it may be sufficient to sustain the market, but with an incentive limited to a 16 million annual budget (~13 M USD), more support would be needed, in the form of a tax credit for example.

On regulatory aspects, a Renewable Energy Portfolio should be adopted to mandate utilities source a set share of their electricity from renewables, with a specific provision for solar. Solar system owners could sell Solar Energy Certificates, titles delivered for each MWh generated from solar, to power providers who may be unable to fulfil the requirement directly. These "Solar Alternative Compliance Payments" can provide a helpful piece of solar systems financing at no cost to the government.

It is hoped the government will soon recognize the potential benefits of supporting a solar industry and installations within the country.

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Solar Energy, 81, 1295-1305, http://re.jrc.ec.europa.eu/pvgis/

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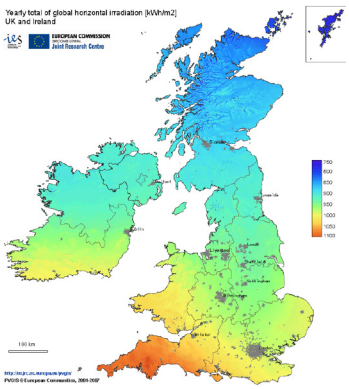
UNITED KINGDOM

Grade **D-**



Irradiation in kWh/m²/yr

750
800
850
900
950
1000
1050
1100

Source: PVGIS © European Communities, 2001-2007[1]

Solar Insolation: 750 kWh/kWp/yr Yearly Average Solar yield
2.4-3.4 kWh/m²/day Average Solar Radiation

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **18 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 14.26 MW[2] (91% grid-connected)

Cumulative installed end 2007: 18 MW[3]

Annual installations growth rate: 2005-2006: +25% 2006-2007: +10.3%

Population: 60M PV/capita: 0.3 W/capita

Drivers for Future Development

Financial Incentives

Feed-in Tariff

An earlier attempt at developing a feed-in tariff was dropped. Instead government support shifted to the Low Carbon Buildings Programme, which aims at spurring deployment of distributed renewable energy systems (see below for details).

The UK's solar policies have long been described as having "no financial support worth mentioning, constantly changing grant programs that are consistently exhausted prematurely."[3] The IEA's PVPS Newsletter indeed reported in June 2007 that the flagship Low Carbon Buildings Programme had been temporarily suspended after an "unexpectedly high public demand placed severe strain on funding allocations [...] the available funds for March were exhausted within just 75 minutes of the monthly allocation being opened to applicants, prompting a major rethink of the funding process."[4] The details on the Low Carbon Building Programme reflect the new grant levels.

However, that time of stop and go programs may be over: on November 26, 2008, the Queen gave her royal assent for the implementation of a Feed-in to operate in parallel with the UK's Renewable Obligation (RO).[24] Details for the feed-in scheme, which is scheduled to be introduced before end 2010, are still unknown besides that it will serve systems under 5 MW of capacity (and the RO will apply to larger systems).

The Low Carbon Buildings Programme

- April 2006 - June 2010 (or however long the funds last). Initially £30 million budget ($55.3 million).
- Incentives for householders, public and private sector organizations to install low carbon technologies. Not a PV-specific program.
- Phase I; Residential PV grants (after a number of efficiency requirements are fulfilled):

Financial Incentives (continued)

- Maximum of £2,000 per kW of installed capacity, subject to an overall maximum of £2,500 or 50% of the relevant eligible costs, whichever is lower.[5]
- Out of a total £8.95 million ($17.7 M) committed through the program, £4.97 million or 55.5% were allocated to PV systems.[6]

- Phase II; new grant levels launched April 2008. £50m program with £17.5m earmarked for PV. For public sector buildings and non-profits:
  - 50% of total project costs with a maximum of up to £1.0 million in grant funds per site.

Regulatory Incentives

Renewable Portfolio Standard: The Renewables Obligation Order[7]

"The Renewables Obligation (RO) was introduced in 2002 and represents the Government's main policy measure for stimulating the growth of electricity generation from renewable sources and for achieving the target of 10% of electricity from renewable sources by 2010 and the aspiration to double this to 20% by 2020."[8]

It requires electricity suppliers to source an increasing portion of the electricity they sell from renewables. Renewables Obligation Certificates (ROCs) are delivered to generators for each MWh of electricity from renewable sources. So that electricity suppliers can meet their obligation by either presenting ROCs for the set percentage or by using a buy-out option which allows them to pay a set price per MWh for any shortfall (see table below). They can also use a combination of ROCs and buy-out. The buy-out price is set annually by the electric industry regulator (Ofgem), which adjusts it "to reflect changes in the Retail Prices Index."[9]

The Renewable Obligation Order for England, Wales and Scotland

	Obligation as % of electricity supplied	Obligation in MWh	Buy-out Price in £/MWh	Estimated Renewable Generation Required in TWh
2002-2003	3%	13,627,412	£30.00	
...				
2006-2007	6.7%	21,412,807	£33.24	23
2007-2008	7.9%	25,477,265	£34.30	27
2008-2009	9.1%	-	£35.76 (70 USD)	32
...				
2015-2016 until 2026-2027	15.4%	-	-	101

Source: Ofgem and FIM for "Estimated Renewable Generation Required"

According to government statistics, in 2007, 15,953 GWh were generated from renewable sources as a result of the obligation.[10]
According to FIM, an investment managing company, "The actual level of renewable supply continues to fall well short of the set targets. The shortfall in 2005/2006 was 24%."[11]

Interconnection

The UK has defined Interconnection Standards.

Net Metering

There is no net metering law in the UK. Some utilities offer it.

Educational Programs

The government information portal www.direct.gov.uk, contains a page explaining solar technology and an explanation of incentives available to people who wish to install PV systems.

Solar Energy Policy Context

Renewable Energy Targets

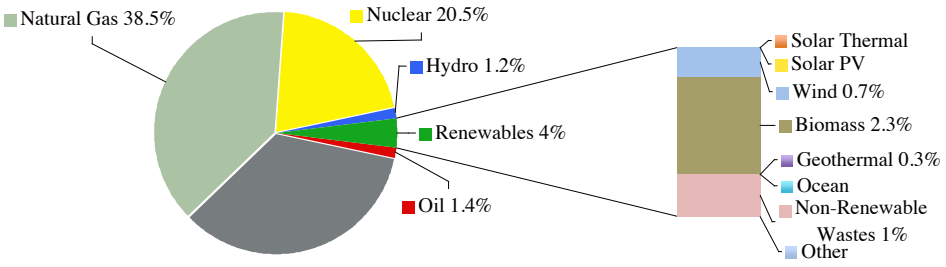
10% of electricity from renewables by 2010 and 20% by 2020.

On target? Renewables accounted for 4.6% of electricity generated in the UK in 2006 (or 18.13 TWh), up from 4.2% in 2005.[12]
(Pledged to build 6 new offshore wind farms to bring wind generation capacity to nearly 1 GW by 2010 and to develop an additional 7-8 GW of offshore wind power).

Solar Target

None.

Solar provided 0.1% of generating capacity by renewable sources in 2005[13] and 0.002% of electricity production in 2005.[14]



Electricity Generation by Fuel (2005)

The UK had 5,699.5 MW of renewable electricity capacity installed in 2007 (including 1358.7 MW from large hydro), which generated 19,664 GWh of electricity (4554 GWh from large hydro and 11 GWh from Solar PV).[15]

Energy Subsidies

Fossil Fuel subsidies: In 2003 it was reported that "every year the government gives some £6-8 ($10-13) in fossil fuel subsidies for every £1 to support clean and renewable energy."[16]

The European Commission reports that the UK allocated 45 million Euros in 2005 (and 0 in 2006) of aid to the coal sector.[17]

2005 Renewables R&D budget: US$ 68.82 million or 51% of total energy R&D budget.[18]

Solar PV R&D

Budgets for solar PV R&D and Demonstration Field Trials (Dept for Trade and Industry and The Engineering and Physical Science Research Council) £15.03 million in 2006 (US$ 27.7 million); £12.06 million in 2005 (US$ 22.3 million).[19]

A four-year £6.3 million (US$ 12.5 million) solar research project has been launched in the UK. The goal of "the largest ever photovoltaic (PV) solar energy research project to take place in the UK"[20] is to make a major contribution to achieving competitive photovoltaic solar energy.

Energy Efficiency Measures

In June 2007, the UK released the Energy Efficiency Action Plan (EEAP) 2007, which brings together all measures and policies adopted concerning Energy Efficiency, such as the EU directive and the 2006 Energy Efficiency Commitment (EEC), discussed below.

The Carbon Emissions Reduction Target (CERT) - which came into effect on 1 April 2008 and will run until 2011 - is an obligation on energy suppliers to achieve targets for promoting reductions in carbon emissions in the household sector by "promoting qualifying actions to domestic energy users", pertaining to insulation, low-energy light bulbs, and high-efficiency appliances and boilers.[21]

As an EU member state, the UK is bound by the EU Energy Performance of Buildings Directive (EPBD). This directive was implemented in the UK in 2005 and requires the creation of standards for energy efficiency in new buildings based on the energy performance of the building. It is up to member states to decide the level of energy efficiency requirements, however these levels must be revised at least every 5 years and updated based on technological developments.[22]

In 2006, the UK government also published a rating system for the sustainability of new homes. This code gives buyers a clear, easy to understand measure of each house's environmental footprint.

Finally, householders that wish to apply for a grant under the Low Carbon Buildings Programme must undertake a number of energy efficiency measures before becoming eligible such as insulation, low energy light bulbs in and basic controls for heating systems.

Summary of PV Support Measures in the UK

PV Support Measures	National
Feed-in tariffs	No
Direct capital subsidies	The Low Carbon Buildings Programme - Grants • Residential: £2,000/kW; £2,000 max. or 50% of project cost, whichever is lower. • Public sector buildings and non-profits: 50% of total project costs; £1.0 million max. Household scale installations are automatically awarded a grant provided they meet minimum energy efficiency criteria and use approved installer.
Renewable portfolio standards (RPS)	The Renewables Obligation Order places an obligation on electricity suppliers to source 9.1% in 2008/09 and 15.4% by 2015 and until 2027. For each MWh a supplier falls short of its obligation, it must pay £35.76 (2008/09).
PV requirement in RPS	No
Solar Renewable Energy Certificates	No. RECs (ROCs) not PV-specific.
Tax credits	VAT on professional installations of PV systems for domestic customers has been set at the reduced rate of 5% since April 2000.
Subsidized Loans	Not nationally.
Net metering	Not nationally. At utility level.
Net billing	Not nationally. At utility level.
Electricity utility activities	Northern Ireland Electricity has provided top up grants for installations in Northern Ireland which are awarded a government grant.
Interconnection mandate	No

Sources: IEA PVPS National Survey Report of PV Power Applications in the United Kingdom 2006, 10/2007 and "Meeting the Energy Challenge, A White Paper on Energy", UK Department of Trade and Industry, May 2007.

Conclusion

As noted above, the RO has not been an effective mechanism in encouraging renewable energy development. With no PV installed in 2007, the RO has certainly failed to provide any support for solar PV. The government's own Ofgem (the electric industry regulator) and EFRA (the Department for Environment) have called on the administration to explore the use of a fixed, per kWh incentive to achieve the targets of 10% of electricity by 2010, and 20% by 2020 from renewable sources. The Conservative party was the one leading efforts to adopt a feed-in tariff. Until recently, the Labour government had remained committed to its Renewable Obligation Order.[23] In October however, the government suggested it would consider a tariff for renewable energy systems under 3 MW (above 3 MW presumably being the utilities' turf under the RO), and in November, the Queen gave her assent for a feed-in law to be implemented before the end of 2010. The details remain unclear at this point but a feed-in tariff will complement the RO for systems under 5 MW. The government is slated to be looking into specifics around Summer 2009 to introduce legislation in Spring 2010. Until then, the PV market is unlikely to grow in the UK.

Endnotes

[1] Map source: Šúri M., Huld T.A., Dunlop E.D. Ossenbrink H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Solar Energy, 81, 1295–1305, http://re.jrc.ec.europa.eu/pvgis/

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[14] "The island isn't ready", Photon International, November 2006, p36.

[15] BERR, Energy statistics: renewables, "Capacity of, and electricity generated from, renewable sources".

[16] Myers, Norman and Crispin Tickell, "The no-win madness of Catch-22 subsidies", Financial Times, July 28, 2003.

[17] Commission of the European Communities, "Report from the Commission: State Aid Scoreboard-Autumn 2007 Update, COM (2007) 791 final", Brussels, 13 December 2007.

[18] International Energy Agency Data Services, http://wds.iea.org/WDS.

[19] IEA PVPS National Survey Report of PV Power Applications in the United Kingdom 2006, October 2007. http://www.iea-pvps.org/countries/uk/UK_IEA_PVPS_NSR_2006.pdf

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[21] Department for Environment, Food and Rural Affairs, "Energy supplier obligations: Carbon Emissions Reduction Target (CERT)", http://www.defra.gov.uk/environment/climatechange/uk/household/supplier/cert.htm

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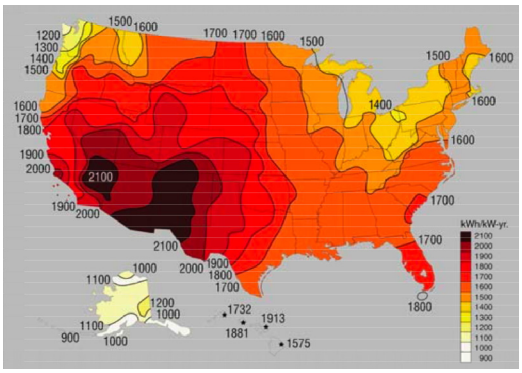
[24] Paul Gipe, "British Feed-in Tariff Policy Becomes Law--Was Once Unthinkable", November 28, 2008.

UNITED STATES

Grade C+



Source: SEIA[1]

Solar Insolation: ~1000-2100 kWh/kWp/yr Yearly Average Solar yield
~3.0-7.0 kWh/m²/day Average Solar Radiation on collector surface

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **830.5 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 624 MW[2] (57% grid-connected)

Cumulative installed end 2007: 830.5 MW[3]

Cumulative installations growth rate 2005-2006: +30.3% 2006-2007: +33%

Annual installations growth rate 2005-2006: +34.3% 2006-2007: +42.4%

Population: 300M PV/capita: 2.76 W/capita

Drivers for Future Development

National Solar Support Programs

Policies to promote PV in the US are increasing both at the federal and states levels. However, the United States does not have a coordinated national program to develop PV markets.[4] In particular the lack of net-metering (which allows system owners to get credited for the generated electricity they feed into the grid) and interconnection standards (grid-connection) is a major impediment to the development of PV in the US. Electricity generation being a states' rights issue, most policies affecting the deployment of PV have taken place at the state level. The 2 main exceptions are the Solar America Initiative (see below) and the Investment Tax Credit.

Financial Incentives

Federal Investment Tax Credit (ITC)

The 2005 Federal Energy Bill ITC went into effect in 2006 and scheduled to be available until December 31, 2008. It was a 30% credit off the system's cost, valid for 2 years, and after 2008 reverted to 10% credit.

- Residential grid-connected systems were capped at 2,000 USD per system.
- Commercial grid-connected systems: no cap.
- Utilities could not benefit from the tax-credit.

National Solar Support Programs (continued)

Financial Incentives (continued)

In 2008 alone, the Senate voted and failed to pass eight times renewable energy bills that would have extended the ITC. Finally, in October 2008, the ITC was extended in the context of the so-called "$700 billion stimulus package".

- The ITC was extended for another 8 years for both residential and commercial installations,
- the $2,000 cap for residential applications was lifted, and
- utilities can now benefit for the credit as well.

Regulatory Incentives

Interconnection

As per the Energy Policy Act of 2005, all public electric utilities are now required to offer to their customers on request interconnection to the power grid. Utilities have three years to implement this requirement.

However, there are limited interconnection standards in place nationally. Interconnection requirements currently vary from state to state and even utility to utility. The US Department of Energy is actively involved in the development of national interconnection standards.

The Federal Energy Regulatory Commission (FERC) has put in place standards for the interconnection of distributed generating systems. DSIRE, the Database of State Incentives for Renewables and Efficiency reports, "The FERC's standards apply only to facilities subject to the jurisdiction of the commission; mostly, these are systems that interconnect at the transmission level. The standards generally do not apply to distribution-level interconnection, which is regulated by state public utilities commissions. However, the FERC has noted that its interconnection standards for small generators should serve as a useful model for state-level standards."[5]

Net Metering

As part of the Energy Policy Act of 2005, all public electric utilities are now required to offer net metering on request to their customers. However, utilities have three years to implement this requirement.[6]

For a recent (November 2008) map of Net-metering policies by state see: http://www.dsireusa.org/documents/SummaryMaps/Net_Metering_Map.ppt

Education and Outreach

The DoE's Energy Efficiency and Renewable Energy website contains clear information about Solar Technology. The Solar America Initiative also includes an educational component. Finally, the DoE-funded Solar Decathlon competition, for which 20 teams install their submission for best-designed solar home on the National Mall in Washington, D.C., plays a part in raising awareness about the technology's potential amidst the general public.

Solar America Initiative (started FY 2007)

The Solar America Initiative is a Department of Energy (DOE) effort to make solar energy cost-competitive with conventional forms of electricity by 2015. The strategy is to support research and development and market transformation. It is intended that by 2015, photovoltaics will provide 5-10 GW of new electric capacity (enough to power 1-2 million homes) to the US grid.[7]

The initiative aims to:

- Provide Research and Development funding and collaboration opportunities "among industry, university, and national laboratory researchers" to improve photovoltaics and concentrating solar power technologies.
- Provide funding and technical assistance to Solar America Cities and Solar America Showcases (high-visibility demonstration projects). The Solar America Cities program will invest $2.4 million to help selected cities integrate solar technology.
- Develop education and training programs for solar installers and officials.
- Develop, through the Solar America Board for Codes and Standards (Solar ABCs), codes and standards to facilitate the installation of solar technologies.

Main State Level Incentives

Please check DSIRE[8] website for updates

Arizona

- Corporate Tax Credit & Personal Tax Credit (Non-residential systems): 10% of the installed cost of qualified "solar energy devices", capped at $25,000 per taxpayer and $50,000 in total credits per year.
- Personal tax credit (Residential): 25% of system cost, capped at $1,000. (not PV specific)
- RPS with distributed generation requirement: 15% from renewable sources by 2025 with 30% of the standard from distributed generation starting 2012 (4.5% of retail sales from DG by 2025)
- *Utilities rebates for solar; Grid-tied residential PV: $3/watt DC capped at 50% of project costs. Up-front incentive payment limited to $75,000. Commercial applications: $2.50/watt DC or production-based incentives set according to 10-, 15- or 20-year contract. Utilities purchase RECs.*

California

(see California Report Card)

Colorado

- RPS with 4% solar carve-out by 2020 (Investor-owned utilities).
- *Not State Level, but still noteworthy: Utility Rebate Program (Xcel Energy): Systems between 0.5 kW and 10 kW: $2/W DC plus REC payment of up to $2.50/W. Systems between 10 kW and 100 kW: $2/W DC plus REC payment of $0.115/kWh for 20 yrs. Capped at $45,000 for systems up to 10 kW; $200,000 for systems between 10 kW and 100 kW.*

Connecticut

- State Rebate program for systems up to 10 kW; $11.5M

  Residential: $5/watt for first 5 kW; $4.30/W for next 5 kW, adjusted based on expected performance. Capped at $46,500.

  Gov't/Non-profit: $5/watt adjusted based on expected performance; capped at $50,000.
- State Rebate for solar on Affordable Housing: $6/watt capped at $60,000 for single-family residential and $850,000 for multi-family residential projects.
- Solar Lease Program: No up-front cost option with fixed monthly payment (~$120), designed to make solar energy systems available to moderate income homeowners.
- The State also provides a 100% sales and use tax exemption for the purchase of solar systems and a 100% property tax exemption (municipalities eligible).

Delaware

- RPS: 2.005% PV carve-out by 2019
- 40% rebate for residential customers capped at $31,500.
- 60% rebate for non-residential (commercial) customers, capped at $250,000.

District of Columbia

RPS: 0.386% solar carve-out by 2022

Florida

- State Rebate Program for PV systems 2 kW and above: $4/watt DC capped at $20,000 for Residential - $100,000 Non-residential.
- Sales Tax Exemption
- 100% Property Tax Exemption starting 2009

Main State Level Incentives (continued)

Georgia

- Corporate 35% Tax Credit capped at $500,000
- Personal 35% Tax Credit capped at $10,500

Hawaii

- 35% tax credit with a cap for single-family properties at $2,250, multi-family properties at $350 per unit, and commercial property at $250,000.
- RPS: 20% by the end of 2020 (10% by 2010 and 15% by 2015)- no solar carve out.
- Farmers and aquaculturists may receive 1% interest loans over 40 years for projects involving PV energy for 85% of the project cost capped at $1,500,000.

Idaho

- State Loan Program -- Residential: $1,000 to $15,000; Commercial: $1,000 to $100,000; Agricultural: Up to $100,000; Renewable Loans: Up to $100,000; Schools, Hospitals, Healthcare Facilities: Up to $100,000; all at 4% interest with 5-yr term for retrofit only
- Sales Tax Exemption 100% sales tax exemption on equipment that serves a facility capable of generating at least 23 kW, as certified by a public utility
- 40% tax deduction for first year, 20% next three years with a maximum amount of $5,000 per year or $20,000 total deduction

Illinois

- State Grant Program: up to $3.25/$W_{dc}$ with a $250,000 maximum on individual project. Project must have a minimum cost of at least $50,000 to be eligible.
- State Rebate Program: up to 30% on the total cost of an individual PV system with a design capacity of at least 1 kW. There is a maximum individual award of $10,000.

Iowa

- Low interest loan funds with 50% of the total loan at 0% interest, for a maximum of $1 million. The maximum loan term is 20 years
- Property Tax Exemption: market value added to a property by a solar system is exempt from the state's property tax.
- Sales Tax Exemption: 100% of state sales tax on the total cost of any solar equipment used to convert incident solar radiation to energy, or to store that energy.

Kansas

Property Tax Exemption

Kentucky

Corporate & Personal Tax Credit equal to $3.00/Wdc.

Louisiana

- Property Tax Exemption on value added.
- Corporate & Personal Tax Credit for residential applications: 50% tax credit on the first $25,000 of the cost of each system, including installation costs. $12,500 maximum per installed system.

Maine

Rebate Program: An owner or tenant who purchases a PV system qualifies for a rebate of $2/Wac capped at $2,000.

Main State Level Incentives (continued)

Maryland

- 20% by 2022 RPS with 2% solar carve-out by 2022. "The set-aside is projected to result in the development of roughly 1,500 MW of solar capacity by 2022". 15-yr contract for purchase of SRECs. Alternative Compliance Penalty: $0.45/kWh in 2008 to 0.05/kWh in 2023.
- Corporate & Personal Income Tax Credits for nonresidential and residential multifamily buildings of at least 20,000 square feet that are constructed or rehabilitated to meet criteria set forth by the U.S. Green Building Council or other similar criteria. There is a 20-25% tax credit for the incremental costs of PV systems.
- Production Tax Credit: $0.85/kWh generated for 5 years, capped at $2,500,000.
- State Rebate Program for PV systems up to 20 kW: $2.50/W rebate with a maximum of $10,000 to homeowners, businesses, local governments and non-profit organizations.
- 100% Sales and Property Tax Exemptions

Massachusetts

- State Rebate Program ($68 million over 4 years- 27 MW by 2011)
- $2.00 - $5.50/W DC for systems of 1 kW DC and more. Maximum incentive based on 5 kW for residential systems and 500 kW ($1.6 million/yr) for non-residential systems. (Average Rebate level ~40% of system cost). Degressive.
- 100% sales tax exemption on PV system purchase for an individual's principal residence.
- 20 year Property Tax Exemption
- Personal 15% Tax Credit capped at $1,000.
- RPS "creates utility-owned PV opportunity 25 MW per utility by 2009 and 50 MW by 2010" (DOER) but does not include solar carve-out.

Michigan

Considering Feed-in

Minnesota

- 100% Sales Tax Exemption
- State Rebate Program: $2.00/Wdc , with a maximum award of $20,000 per system.
- Property Tax Exemption from value added. However, the land on which the system is located remains taxable.

Montana

- Corporate and Personal 35% Tax Credit for investments of $5,000 and above.

Nevada

- RPS with Solar Carve-out: 5% by 2015, 2.4 multiplier for PV portfolio energy credits.
- Property Tax Exemption from value added.

New Hampshire

RPS with 0.3% solar carve-out by 2014.

New Jersey

- RPS with 2.12% solar carve-out by 2021. ~1,500 MW
- Solar Renewable Energy Certificates (SRECs)- Production incentive of about $230 per MWh ($0.23 per kWh), maximum of about $711 per MWh.

Main State Level Incentives (continued)

- State Rebate Program: $1.75-$4.10 per watt based on the system capacity size. Approved projects installed by residential, commercial and industrial applicants are eligible for an additional rebate of $0.25 per watt for PV modules manufactured in New Jersey. Furthermore, PV systems up to 10 kW in capacity participating in the New Jersey Home Performance with Energy Star Program also will receive an additional rebate of $0.25 per watt.
- 100% Sales Tax Exemption available to all taxpayers.

New Mexico

- RPS with 4% solar carve-out by 2020, 0.6% of distributed generation by 2015. (20% of RPS from solar for investor-owned utilities).

New York

- RPS with 0.1542% customer-sited solar carve-out by 2013.
- Sales Tax Exemption for cost and installation of systems
- 15-year real property tax exemption for solar systems constructed in New York State.

North Carolina

- Corporate & Personal Tax Credit: 35% of the cost of PV system with a $10,500 cap per installation for residential use, and $2,500,000 per installation for all commercial and industrial uses.
- RPS with 0.2% solar electricity carve-out by 2018

North Dakota

- Corporate & Personal Tax Credit: 15% (3% per year for 5 years) for the cost of equipment and installation.
- 5-year local property tax exemption

Ohio

RPS with 0.5% solar carve-out by 2024.

Oregon

- Corporate Tax Incentive: 50% of total project costs distributed over five years (at 10%/yr) with a maximum incentive of $20 million for renewable energy equipment manufacturing facilities and $10 million for all other projects. Any unused credit may be carried forward up to eight years. Those with eligible project costs under $20,000 may take the tax credit in one year. Credit amount based on $3/W of installed PV capacity.
- Personal Tax Credit for homeowners and renters: $3/Wp capped at $6,000 for up to 50% of the installed cost. However, the amount claimed in any tax year may not exceed $1,500 or the taxpayer's tax liability, whichever is less. Unused credits may be carried forward for five years.
- State Rebate Program for new or existing homes, commercial and community buildings, farms, and municipal facilities.

  Residential: $2.00-2.25/Wdc -$10,000 cap per site;

  Commercial, Industrial: $1- 1.50/W - $100,000 - $175,000 cap depending on utility.

  Nonprofit, Gov't: $1.50-2.00/W; $150,000- $175,000 cap
- Value-added Property Tax Exemption
- Low-interest, fixed-rate and long-term loans.
- RPS 25% by 2025. All additional load must come from RE.

Main State Level Incentives (continued)

Pennsylvania

- RPS with Solar PV set-aside of 0.5% by 2020
- State fund with $80 million in grants and loans for solar energy projects,

$100 million in grants, loans, and rebates for up to 35% of the cost of solar energy projects at residences and small businesses.

Rhode Island

- Sales Tax Exemption
- Corporate & Personal Tax Credit: 25% of the system cost only for residential installations. PV systems up to $15,000 are eligible for the full 25% credit.

South Carolina

- Corporate & Personal Tax Credit: 25% of the costs of purchasing and installing a solar system in a building owned by the taxpayer. The maximum credit in any year is $3,500 for each facility or 50% of the taxpayer's tax liability for that taxable year, whichever is less.

South Dakota

- Property Tax Exemption. The minimum value of the credit is the actual installed cost of the system. For commercial systems, the exemption applies to 50% of the installed cost of commercial systems, and cannot be transferred when the property is sold under any circumstances.

Texas

- Property Tax Exemption for value-added.
- Franchise tax (corporate tax) exemption for solar manufacturers.

Utah

- Sales Tax Exemption for purchase or lease of PV equipment.
- Renewable Portfolio Goal: 20% of adjusted retail sales by 2025 "to the extent that it is cost-effective to do so" --each kWh of electricity produced using solar energy counts as 2.4 kWh for the purposes of meeting the goal.
- Individual income tax credit for residential systems: 25% of the reasonable installed system costs capped at $2,000/unit.
- Individual income tax credit for commercial systems: 10% of the reasonable installed costs up to $50,000.

Vermont

- Clean Energy Development Fund (CEDF) Loan Program: Fixed 2% interest loans available to individuals, companies, non-profits and municipalities for purchase and installation of solar systems. Loan amounts between $50,000 and $1 million, may not be used for more than 90% of project costs.
- 30% Corporate Income Tax Credit (Federal business solar tax credit match)
- State Rebate Program: $1.75/W DC for individuals and businesses capped at $8,750; $3.50/W DC for multi-family, low-income capped at $35,000 or 50%.

U.S. Virgin Islands

State Rebate Program; PV: $3.50/ W for systems <1 kW, available to Commercial and Residential installations.

Virginia

- $4.5 million/yr Solar Manufacturing Incentive Grant (SMIG): $0.75/W for panels sold in a calendar year, with a maximum of 6 MW.
- Property Tax Exemption

Drivers for Future Development (continued)

Main State Level Incentives (continued)

Washington

- Production incentive of $0.15 to $0.432/kWh (depending on whether system is manufactured in or out-of state), capped at $2,000/yr for individuals, businesses, and local governments. The state's utilities will pay the incentives and earn a tax credit equal to the cost of those payments.
- Sales Tax 100% Exemption for equipment and installations of systems >200 W.

Wisconsin

Utility buy-back program: $0.225 per kilowatt-hour (22.5¢/kWh); 10-year contract

Wyoming

Rebate Program for Residential applications: 50% capped at $3,000.

Renewable Energy Targets

No federal renewable energy target.

As of July 2008 however, 32 states (and the District of Columbia) had targets based on renewables portfolio standards.[9]

Renewables (excluding hydro) accounted for 2.4% of electricity generated in the US in 2006[10], same as in 2005.[11]

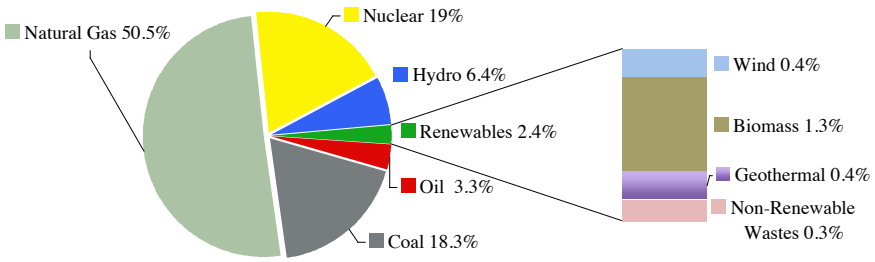
Solar Targets

Solar America Initiative (2006):

- "To make PV cost competitive by 2015 by reducing the cost of PV to between $.05 and $.10 per kWh (in 2005 dollars and indexed for inflation) by 2015"
- 5-10 GW of PV by 2015
- 70-100 GW of PV by 2030.

Solar provided 0.4% of generating capacity by renewable sources in 2005.[12]

Electricity Generation by Fuel (2005)[13]



Energy Subsidies

A study of US subsidies in the energy sector estimated federal support for 2006 at between $49 and $100 billion per year. Fossil fuel subsidies amounted to $49 billion per year (or 66.2% of an averaged $74bn of total energy subsidies), against $6 billion (7.5%) for renewables (excluding ethanol).[14]

Energy R&D

Another study by the Government Accountability Office[15] (GAO) focusing on the Department of Energy's (DOE) appropriations in the form of R&D and tax-related expenditures estimated that in 2007 alone these amounted to $6.3 billion, 51% of which were allocated to fossil fuels against 17.4% to renewables combined.

According to GAO figures, the 2007 Renewables R&D budget was US$ 305 million or 13.4% of total energy R&D budget for that year.

Summary of GAO findings (In Billion $):

	R&D FY 2002	R&D FY 2007	R&D (2002-07)	Tax-Related Expenditures FY 2002	Tax-Related Expenditures FY 2007	Tax-Related Expenditures (2002-07)	Total 2007 only (%2007)
Fossil Fuels	0.531	0.531 (24%)	3.1	1.9	2.7	13.7	3.231 (51%)
Nuclear	0.775	1.235 (56%)	6.2	0	0	0	1.235 (19.6%)
Renewables	0.248	0.305 (13.4%)	1.4	0.238	0.790	2.8	1.095 (17.4%)
Solar	0.126	0.203	--	--			
Total	1.6	2.2 (100%)	11.5	2.2	4.1	18.2	6.3 (100%)

Solar Energy Policy Context (continued)

Renewable Energy and Energy Efficiency DoE pledges

At the Washington International Renewable Energy Conference (WIREC) in March 2008, the Department of Energy committed to issuing $10 billion in loan guarantees for renewable energy and energy efficiency systems and reiterated the Solar America Initiative's goal of making Solar PV cost -competitive by 2015.

Public Budgets for PV

The GAO study cited above notes that the Solar program (see Policies below), which made up the largest share of renewable R&D funding, more than doubled between fiscal year 2006 and 2007, rising from $99 million to $203 million.

Solar America Initiative FY 08 Appropriations: $138M (DOE)
FY 09 Request: $137M (DOE)
Future funding is subject to Congressional appropriations.[16]

In November 2007, the US Department of Energy (DOE) announced that it would invest US$21.7 million over three years in researching the next generation of photovoltaic solar cell technology.[17]

Energy Efficiency Measures

Most of the Federal government's stipulations about the energy efficiency requirements for buildings focuses on Federal Buildings, as it leaves it to the States to establish frameworks and codes for EE in new and existing construction.

The Energy Independence and Security Act of 2007 calls for several energy efficiency improvements for government buildings and public housing projects. It also establishes the "Zero Net Energy Commercial Buildings Initiative", which seeks zero net energy requirements for any newly constructed commercial buildings in the US by 2030; 50 percent of the commercial building stock by 2040; and all commercial buildings in the US by 2050.

The Federal government does provide incentives though for EE improvements such as a tax deduction for a maximum $1.80/sq.ft to owners of new or existing buildings who install energy saving systems that reduce the building's total energy and power cost by 50% or more. The Federal government also backs loans for energy efficiency improvements in homes, and grants a corporate tax credit for builders of new energy-efficient homes.

Summary of PV support measures in the US

PV Support Measures	**Federal**
Feed-in tariffs	No. (State level)
Direct capital subsidies	No. (State level)
Renewable portfolio standards (RPS)	Federal level: None State level: 32 states + DC, 4 states with voluntary schemes
PV requirement in RPS	Federal level: N/A State level: 13 states + DC
Solar Renewable Energy Certificates	No. State level.
Investment funds for PV	Federal: Blended in several socially responsible investment funds and equated to $5,3 billion in 2005
Tax credits	Federal investment tax credit-30% for commercial, residential and utility PV
Subsidized Loans	No
Net metering	Federal level: All public electric utilities now required to offer net metering upon customer's request. Utilities have 3 years to comply. State level: Net-metering available in 42 states +DC.
Interconnection Standard	Interconnection Standard Nationwide limited. DoE working on national standard. All public electric utilities now required to offer interconnection upon customer's request. Utilities have 3 years to comply.

Sources: US Dept of Energy, Energy Efficiency and Renewable Energy; IEA PVPS National Survey Report of PV Power Applications in the United States of America 2006, August 2007; "Solar/DG Provisions in RPS Policies", Interstate Renewable Energy Council, January 2008.

Conclusion

With the explosion of the Spanish market, the US installed PV market will end up in 4th place (down from 3rd) by end 2008. The US PV market experienced a slowdown in 2008, due to the many failed attempts to extend the tax credit, which created uncertainty, and to the financing difficulties resulting from the economic downturn. There is tremendous opportunity for solar market development in the United States however and Global PV industry participants facing diminishing incentives in European countries are looking expectantly to the US market.

The US however, seems unlikely to implement a feed-in type payment at the Federal level. The incoming administration may be more likely than the previous to consider such a mechanism though traditionally the US has opted for 'market based' incentives such as Renewable Portfolio Standards. Additionally, with the long awaited tax credit extension finally passed, it is unclear what specific considerations will be given to solar in the near future.

There still is a need for the federal government to provide regulatory uniformity across the country. As pointed out in the IEA PVPS US report, "The United States does not have a coordinated national program to develop PV markets: *Net-metering standards* dictate the value of PV and allow system owners to sell back electricity to the local utility (economic benefit). *Interconnection standards* provide uniformity across utility service territories and render the entire process transparent for installers and consumers (infrastructure benefit). A lack of consistent net-metering (economics) and interconnection (infrastructure) standards from state to state creates barriers to growth of the U.S. PV market."[18]

Endnotes

[1] Map source: Solar Energy Industries Association, "Basic information about Photovoltaic (PV) Solar Power and America's solar resources", http://www.seia.org/galleries/pdf/PV_general_one_pager_Final.pdf

[2] International Energy Agency, Co-operative Programme on Photovoltaic Power Systems (IEA PVPS), "National Survey Report of PV Applications in the United States of America, 2006", August 2007. http://www.iea-pvps.org/countries/download/nsr06/06usansr.pdf

[3] IEA PVPS, "Cumulative installed PV power capacity in reporting IEA PVPS countries as of the end of 2007". http://www.iea-pvps.org/trends/download/2007/Table%201.pdf

[4] IEA PVPS, "National Survey Report of PV Power Applications in the United States of America 2006", August 2007. http://www.iea-pvps.org/countries/download/nsr06/06usansr.pdf

[5] Database of State Incentives for Renewables and Efficiency, Federal Incentives for Renewable Energy, http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US06R&State=federal&currentpageid=1&ee=0&re=1

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[9] Database of State Incentives for Renewables and Efficiency, Summary Maps, Renewable Portfolio Standards, http://www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt

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[13] IEA Energy Statistics 2007, "Electricity Generation by Fuel-United States 2005", http://www.iea.org/textbase/pm/JRECPIC/Electricity%20Generation%20by%20Fuel%202005%20-%20United%20States.gif

[14] "Distribution of US Federal Energy Subsidies, 2006", Doug Koplow in OECD 2007, "Subsidy Reform and Sustainable Development: Political Economy Aspects", Chapter 4: Energy. (**Renewables Subsidy data does not include ethanol).

[15] United States Government Accountability Office, "Federal Electricity Subsidies: Information on Research Funding, Tax Expenditures, and Other Activities That Support Electricity Production", October 2007.

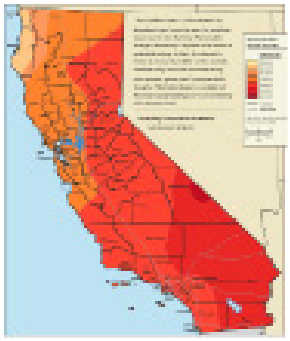
[16] REN 21, Renewable Energy Policy Network for the 21st century, WIREC 2008 Pledge, http://www.ren21.net/wiap/detail.asp?id=238

[17] IEA/JREC, Global Renewable Energy Database, Policies and Measures, "Investment in Next-Generation Solar Cell Research" http://www.iea.org/textbase/pm/?mode=re&id=3772&action=detail

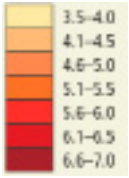
[18] IEA PVPS, "National Survey Report of PV Power Applications in the United States of America 2006".

CALIFORNIA

Grade **B**



Yearly Solar Insolation
Average in kWh/m²/day



Source: Energy Atlas; California[1]

Solar Insolation: ~1,338 kWh/kWp/yr Yearly Average Solar yield[2]
~6.0 kWh/m²/day Yearly Average Solar Insolation

Solar Policy Context

Carbon Intensity

Solar Resources

Proximity to Parity

Grade Breakdown

Progress to date **301 MW**

Financial Incentives

Regulatory Incentives

Installed PV Capacity

Cumulative installed end 2006: 220 MW[3] (90% Grid Connected)

Cumulative installed end 2007: 301 MW*

Annual installations growth rate: 2005-2006: ~+36% 2006-2007: ~+39%

Population: 38 M PV/capita: 7.92 W/capita

Drivers for Future Development

Although not a California policy, the 30% Federal Investment Tax Credit does apply to California system owners (except government and non-profit entities).

Financial Incentives

Senate Bill 1 (SB1) includes:

- California Public Utility Commission (CPUC) California Solar Initiative Program,
- The California Energy Commission (CEC) New Solar Homes Partnership (NSHP),
- The Publicly Owned Utilities (POU) Component.

Enacted: January 2007

Total Budget: $3,350,800,000 by 2017

Target: 3,000 MW by 2017

Funded by California electricity ratepayers.

* Assuming all installations in 2007 were grid-connected (no data available for off-grid installations). 220 MW+ 81 MW (grid-connected installed in '07 as per CEC).

Financial Incentives (continued)

Go Solar California campaign summarized by program component, 2007-2016

Program Authority	California Public Utilities Commission	California Energy Commission	Publicly Owned Utilities (POU)
Budget	$2,167 million	$400 million	$784 million
Solar Goals (MW)	1,940 MW	360 MW	700 MW
Scope	All systems in IOU areas except new homes	New homes in IOU territories	All systems in POU areas
Audience	Various	Builders, home buyers	Various
Begins	January 2007	January 2007	January 2008

Source: California Solar Initiative, CPUC Staff Progress Report, July 2008

CPUC California Solar Initiative (CSI)

Enacted: January, 2007 - Expires: January 1, 2017

Total budget: $2.1672 billion

Target: 1940 MW*

In less than 18 months, the California Solar Initiative has installed a total of 78.6 MW of new solar, 19.2 MW in 2007 and 59.4 MW in the first half of 2008 alone.[4]

- The CSI offers two types of incentives for grid-connected systems according to size:[5]
  - Expected Performance-Based Buydown (EPBB): for systems <100 kW in 2008 and <50 kW after 2008, an up-front, one-time payment.
  - Performance-Based Incentives (PBI): for systems ≥100 kW in 2008 and 50 kW after 2008 (although any project size may opt in for a PBI), a monthly payment for each kWh generated for the first 5 years.[6]
- Payment levels will decrease in 10 steps over the duration of the CSI at an estimated average level of 7% annually.

Step	Statewide MW in Step	EPBB Payments (per watt)			PBI Payments (per kWh)		
		Res	Non-Res	Non-Tax	Res	Non-Res	Non-Tax
1	50	$2.80	$2.80	$2.80	**	**	**
2	70	$2.50	$2.50	$3.25	$0.39	$0.39	$0.50
3*	100	$2.20	$2.20	$2.95	$0.34	$0.34	$0.46
4	130	$1.90	$1.90	$2.65	$0.26	$0.26	$0.37
5	170	$1.55	$1.55	$2.30	$0.22	$0.22	$0.32
6	190	$1.10	$1.10	$1.85	$0.15	$0.15	$0.26
7	215	$0.65	$0.65	$1.40	$0.09	$0.09	$0.19
8	250	$0.35	$0.35	$1.10	$0.05	$0.05	$0.15
9	285	$0.25	$0.25	$0.90	$0.03	$0.03	$0.12
10	250	$0.20	$0.20	$0.70	$0.03	$0.03	$0.10

Source: Go Solar California

* Total target for SB1 initiatives is 3,000MW. The POU component and NHSP combined target is 1060.

Financial Incentives (continued)

As of June 25, 2008, the current steps were between 3 and 5, depending on the administering utility and customer class (government and non-profits do not benefit from the federal tax credit):

	Pacific Gas & Electric			Southern California Edison			California Center for Sustainable Energy		
	Residential	Non-Residential	Govt & Non-Profit	Residential	Non-Residential	Govt & Non-Profit	Residential	Non-Residential	Govt & Non-Profit
Expected Performance-Based Buydown ($/W)	1.90	1.55	2.30	2.20	1.55	2.30	2.20	1.90	2.65
Performance-Based Incentive ($/kWh)	0.26	0.22	0.32	0.34	0.22	0.32	0.34	0.26	0.37

Source: CPUC Staff Progress Report, July 2008

- Starting in 2010, incentives for all systems greater than 30 kW in size will be paid based on actual energy produced.
- PV Systems up to 5 MW may apply although the incentives only apply to the first 1 MW.

CEC New Solar Homes Partnership (NSHP)[7]

Enacted: January, 2007 - Expires: January 1, 2017

Total budget: Up to $400 Million

Target: 400 MW of installed solar electric capacity on new homes, and to have solar electric systems on 50% of all new homes built in California by the end of 2016

In 2007 CEC's New Solar Homes Partnership installed 8 MW[8]

- Expected Performance-Based Incentive (EPBI):[9]
    1. Base Incentive - $2.50/watt
    2. Solar as a Standard Feature Incentive - $2.60/watt
    3. Residential Areas of Affordable Housing Projects - $3.50/watt
    4. Common Areas of Affordable Housing Projects - $3.60/watt
- Incentives decline by 10% as the installed MW targets are met.

POU Component of Senate Bill 1[10]

Enacted: January, 2008 MW - Expires: January 1, 2017

Total budget: $784 Million

Target: 660 MW

In 2007 POUs installed 3 MW.[11]

- Each municipal utility must offer a solar incentive program to its customers

Financial Incentives (continued)

Feed-in-Tariff (FIT)[12] [13] **(AB 1969)**

CA Public Utilities Code § 399.20 enhanced by CPUC Resolution E-4137

Enacted: September, 2006 - Enhanced: February 14, 2008

Originally this feed-in policy called for California's 3 largest investor-owned utilities (PG&E, SCE and SDG&E) as well as 4 other utilities under the CPUC's jurisdiction, to purchase renewable electricity generated by systems located on public water and wastewater facilities. It had a statewide cap of 250 MW.

In 2007, the CPUC extended the tariff (which went into effect 02/08) to facilities other than public water and wastewater facilities in PG&E and SCE service territories with renewable energy systems below 1.5 MW.

- No PV-specific rate: tariff is based on CPUC market price referent (MPR) and is adjusted by time-of-use factors. Consequently, solar benefits from higher rates provided between 8 a.m. and 6 p.m. (though no higher rate is specified for solar).
- For systems below 1.5 MW
- Statewide cap 478.4 MW
- 10, 15, or 20 year contracts;
- Can cover 100% of generation or only excess generation
- Not available to facilities that have participated in other state RE incentive programs (net-metering or CSI for example).

Adopted 2007 Market Price Referents (Nominal - dollars/kWh)			
Resource Type	**10-Year**	**15-Year**	**20-Year**
2008 Baseload MPR	0.09271	0.09383	0.09572
2009 Baseload MPR	0.09302	0.09475	0.09696
2010 Baseload MPR	0.09357	0.09591	0.0984
2011 Baseload MPR	0.09412	0.09696	0.09969
2012 Baseload MPR	0.09518	0.09844	0.10139
...	...	...	...

Table data from Terms and Condition of Feed-in-Tariffs[14]

In June 2008, the CPUC released a draft Proposed Decision to extend feed-in tariffs up to 1.5 MW to customers of San Diego Gas & Electric and expand feed-in tariffs to projects larger than 1.5 MW up to 20 MW.

The CEC is exploring the use of feed-in tariffs for RPS-eligible electricity generation projects over 20 MW.

Property Tax Exemption[15]

Amended: May 2005 with AB 1099 - Expires: December 21, 2009

- 100% property tax exemption for renewable energy systems including PV;
- Available to all sectors: residential, commercial, industrial;
- No maximum limit.

Personal Tax Exemption[16]

Enacted: October 1, 2001

- Residential Only;
- 100% deduction of interest paid on loan to purchase energy efficient products or equipment including PV;
- No maximum limit.

Drivers for Future Development (continued)

Regulatory Incentives

Renewable Portfolio Standards (RPS)

Senate Bill 107

Enacted: 2002 as Senate Bill 1078 - Amended: 2006

- Electric corporations must increase their procurement from eligible RE sources by at least 1% of their retail sales annually until they reach 20% by December 31, 2010.[17]
- As of August 1, 2007, California's three large Investor-Owned Utilities collectively served 13.2 percent of their 2006 retail electricity sales with renewable power.[18]

California is not on track to have 20% of its electricity sales come from renewables by 2010. While utilities are increasing delivery of electricity from renewable sources, they are not increasing at a fast enough rate to keep up with load increase (RPS renewable generation as a % of retail sales was actually down 1% overall in 2006 compared to 2003).

The CPUC has approved 95 contracts for 5,900 MW for new and existing RPS capacity, which would more than achieve the RPS target were all approved capacity online by 2010.[19] However, the CEC's 2008 Integrated Energy Policy Report noted that 35% of the contracts signed under the Renewables Portfolio Standard have been either delayed or canceled.[20]

The CEC is exploring the use of feed-in tariffs for RPS-eligible electricity generation projects over 20 MW.

Interconnection

There is no mandate in California for utilities to give priority interconnection to renewable energy systems. However, there are provisions and standards to simplify the interconnection process: small photovoltaic and wind-energy systems under 10 kW qualify for "simplified interconnection," under which no supplemental review or interconnection studies are necessary.[21]

The CPUC's Rule 21 defines grid access requirements and interconnection procedures for systems up to 10 MW.

The new Feed-in provision suggests using Rule 21 or FERC-Small Generator Interconnection Procedures (SGIP) "as long as the process follows the principles of timely review and disposition, and does not present a barrier to project completion."

Net Metering

All utilities in California -except utilities with more than 750,000 customers that also provide water (LADWP)- are required to provide net metering (and a bi-directional meter) to their renewable energy generating customers with systems up to 1 MW. (Customers wishing to be on a time of use rate schedule must pay for the second meter).

Customers whose production exceeds consumption are allowed to carry over their net generation for 12 months, after which the net excess generation is 'donated' to the customer's utility.

Senate Bill 1 increased the aggregate limit of net-metered systems in a utility's service territory from 0.5% to 2.5% of the utility's aggregate customer peak demand.[22]

Net metering is not available to feed-in tariff recipients.

Education and Outreach

The California Energy Commission's website contains several pages (including a somewhat kid-friendly one) dedicated to facts about solar and the kinds of incentives available to people wishing to install solar systems, a database of registered retailers and installers, etc.

Solar Energy Policy Context

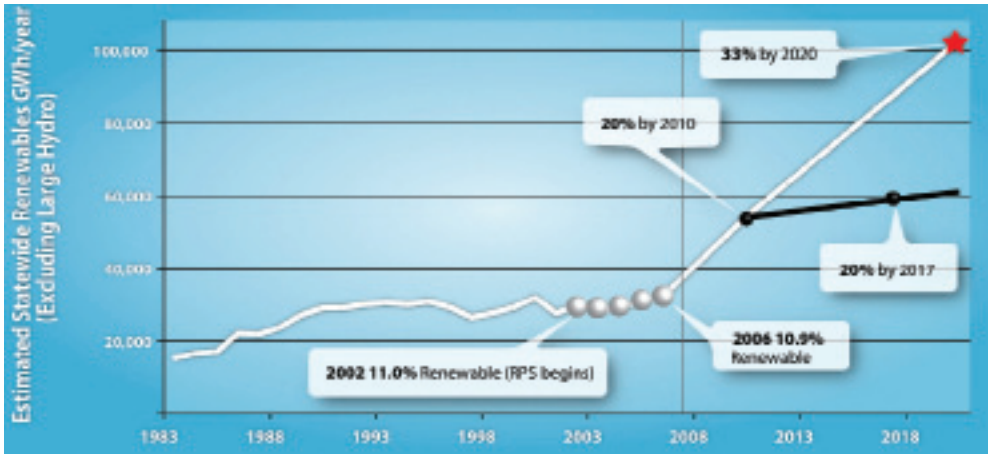
Renewable Energy Targets

- 20% of total electricity derived from renewable resources and sold to retail customers by 2010 (as per the state's RPS)
- 33% by 2020 goal under consideration as per the Energy Action Plan[23]

Is California on target?

- As per the California Energy Commission's Integrated Energy Policy Report, California is not on track. However utilities may have contracted (but not installed) the necessary amount by 2010;
- Investment in transmission infrastructure must increase and key policies must change in order to meet the 33% goal by 2020.[24]

Progress toward California's Renewable Energy Goals



Source: California Energy Commission[25]

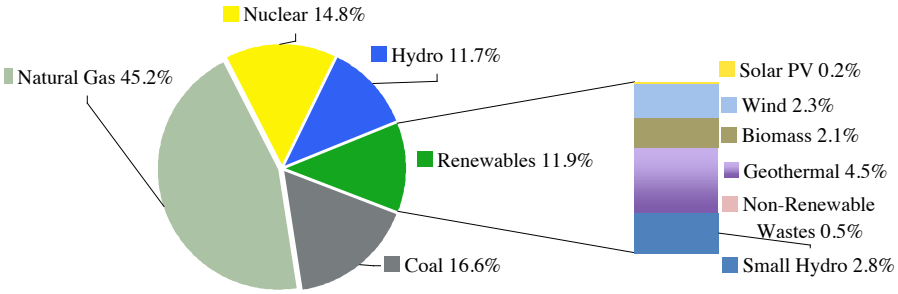
Solar Target

- 3,000 MW Distributed PV by 2017 (As per California's SB1)
- No solar carve-out in California's RPS

On target?

- As of June 2008, the CPUC's California Solar Initiative had applications equaling 251.5 MW of new solar, including 59.4 MW added in the first 6 months of 2008[26]
- The July 2008 CPUC progress report noted California is "roughly on target to meet its 10-year goal of adding 1,750 MW of solar generating capacity by 2016." It adds, "At this level of program demand, the CSI would add 1640 MW over 10 years."
- Due to the quick decline rate in incentives for CSI, the ability to meet PV target will depend on success achieved in reducing systems costs.
- The CEC's New Solar Homes Partnership has received/pending applications totaling 8 MW

Electricity Generation by Fuel (2007)[27]



In 2004, 10.2 percent of all electricity came from renewable resources such as wind, solar, geothermal, biomass and small hydroelectric facilities.[28]

Solar provided 495 GWh in 2006 (or 97.85% of US generation from solar).[29]

Energy Subsidies

California disbursed $771 million for 809 MW from renewable sources between 1998 and 2007, and has $750 million allocated to renewable sources for the period 2007-2012.[30]

Public Budget for PV

$3,350,800,000 for 2007-2017 (programs operating under SB1)

$ 50 million are also set aside for Research, Development, Deployment and Demonstration (RD&D) in the context of the California Solar Initiative for 2007-2016.[31]

In 2006, California accounted for 60% of state tax credits for PV systems in the US or $180 million.

Energy Efficiency Measures[33]

California has aggressively pursued energy efficiency goals, which have enabled the state's electricity consumption to remain essentially flat.

The California Public Utilities Commission has launched what it describes as "the most ambitious energy efficiency and conservation campaign in the history of the utility industry in the U.S.". It has provided $2 billion in funding for 2006-2008 for utilities' energy efficiency plans.

California has incorporated building energy efficiency measures in its State Energy Code and has set energy standards for public buildings (the Green Building Action Plan): state-owned buildings are required to reduce their energy use by 20 percent by 2015 (from a 2003 baseline).

The California Energy Commission will provide up to $26 million in low and fixed interest rate loans to schools, hospitals, and local governments for the installation of energy-saving measures or for energy audits and studies. There are also $3 million available in similar loans for the agricultural and food processing industries to purchase proven cost-effective energy efficient and renewable emerging technologies (including PV).

Finally, California also offers a personal tax deduction on the interest paid on loans used to purchase energy efficient products or equipment for a residence in California.

Summary of PV support measures in California

PV Support Measures	
Feed-in tariffs	Yes but not PV-specific. Not available in conjunction with other incentives.
Direct capital subsidies	California Solar Initiative
Renewable portfolio standards (RPS)	1% of annual retail sales, for a target of 20% of electricity produced from RE by 12/2010.
PV requirement in RPS	No
Solar Renewable Energy Certificates	No
Tax credits	State and National: US Federal investment tax credit of 30% for commercial PV (expires 12/2008).
Subsidized Loans	No
Net metering	Yes, up to 1 MW systems. 12 month excess generation roll over. Statewide cap: 2.5% of a utility's peak demand. Includes provisions for time of use schedule. No interconnection fee.
Interconnection Standards	No mandate for utilities to give priority connection to renewable systems. CPUC Rule 21 defines standard interconnection requirements for systems up to 10 MW. Simplified Interconnection for systems up to 10 kW and no interconnection fee for net-metered systems up to 1 MW.
Sustainable Building Requirements	Yes statewide; some municipal requirements.

Conclusion

Discussions are underway to address the development of large scale distributed PV, which is a market segment with great potential that remains unaddressed by California's main support frameworks. CSI has encouraged the development of small and medium residential and commercial distributed PV generation. Both the CSI's de facto 1 MW system cap size and the net-metering 1 MW cap size have restricted the development of the larger distributed generation market segment. In parallel, the California RPS has provided an avenue for the development of large-scale centralized solar generation, which is in turn constrained by permitting and transmission limitations.

The CPUC's is exploring a system cap extension of its feed-in tariff up to 20 MW. The CEC is exploring the use of feed-in tariffs for RPS-eligible electricity generation projects over 20 MW.

Legislative efforts such as SB 1714, seek to increase "the maximum capacity of eligible energy facilities to 4 MW (up to a statewide capacity of 250 MW), allow third party ownership, and adjust the rate of the FIT to more accurately reflect the environmental and system benefits of renewable energy."[34]

In any case, it seems crucial that if California is going to further incentivize PV deployment through a feed-in mechanism, a PV-specific tariff should be adopted. The current feed-in tariff does not offer a rare that can support any significant deployment of PV.

Furthermore, California's RPS does not include a solar carve-out, which implies that utilities will probably meet their renewable electricity obligations with technologies other than solar. If the RPS was amended to include a solar carve-out, this would also allow for the creation of Solar RECs, which are an important component of project financing.

Endnotes

[1] Map source: Energy Atlas; California. http://www.energyatlas.org/PDFs/atlas_state_CA.pdf

[2] Demet Suna et al., "Demand Side Value of PV; Report of the IEE project/PV Upscale-Urban Scale Photovoltaic Systems", Vienna, December 2006.

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[8] CPUC Staff Progress Report

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[10] The California Solar Initiative; Frequently Asked Questions. http://www.gosolarcalifornia.ca.gov/csi/index.html

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[12] California Public Utilities Commission, "Feed-In Tariffs Available for the Purchase of Eligible Small Renewable Generation", http://www.cpuc.ca.gov/PUC/energy/electric/RenewableEnergy/feedintariffs.htm

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Appendix

Exchange Rates Used

	2001	2002	2003	2004	2005	2006	2007	2008
Japanese Yen JPY	0.00824	0.008	0.00864	0.00925	0.0091	0.0086	0.0085	0.00951
Euro EUR					1.245	1.256	1.37	1.53712
New Israeli Shekel ILS					0.222	0.225	0.243	0.28558
Australian Dollar AUD					0.762	0.753	0.838	0.93
British Pound GBP					1.82	1.842	2	1.977
Canadian Dollar CAD					0.826	0.881	0.935	0.992
Russian Ruble RUB					0.0353	0.0368	0.0391	0.0419
Indian Rupee INR						0.0221	0.0242	0.0243
Chinese Yuan CNY					0.122	0.125	0.131	0.142
Polish Zloty PLN								0.3281
Swiss Franc CHF								0.84