

# Global Potential for Solar Electricity, A Supply and Demand Perspective

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**PV Technology To Change the World**  
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# Where are we going and how will we get there?

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# What is Market Research?

**Market research is the objective study of a subject using data gathered through primary research to characterize, analyze and forecast demand and supply for, in this case, the photovoltaic industry.**

**Market research makes use of data to identify trends and customers, and analyze competitors.**

**In the case of this practice, the data go back 30 years.**

**In market research, you get the data, get the data, get the data and then interpret the data.**

**Primary research is direct contact with the person buying and selling the product, technology, widget, etc.**

**The purpose is to provide an objective analysis that managers and executives can use for business planning purposes.**

**This practice analyzes shipments (sales) to the first point of sale in the market.**

**To do so, it analyzes raw material through to the end user – installations.**

## PV Industry Overview

# Supply and Demand

- **Raw material suppliers of silicon, tellurium, indium, silane, machinery, consumables etc. are suppliers to the technology manufacturers.**
- **The supply side of the market are the PV technology manufacturers of crystalline, and thin film cells and modules. In specific, the development and manufacture of the technology. This group is also the demand side for raw material and machinery suppliers.**
- **The demand side of the market are the module assemblers, the distributors, the installers, system integrators, dealers and retailers and sometimes the other technology manufacturers who buy the technology either as a cell or a module. This group is the first point of sale in the market. This group is the supply side for the end user.**
- **The end user can be a residential or commercial system buyer, an investor in a system where the electricity will be sold, a utility or the buyer of the PV generated electricity.**

# Capacity

## Three Categories:

- **Company Statements** made on press releases, etc., typically as enticements to investors, to counteract bad press, in general to affect stakeholder opinion.
- **Nameplate Capacity:** The installed the capacity of the equipment, that is, what can be produced in a perfect world with machinery running at 100% and no downtime. Typically assumes perfect commercial viability of the technology, complete access to raw material, and perfect demand.
- **Run Rate Capacity** assumes raw material conditions, where the manufacturer is on the development timeline (R&D, pilot stage, commercial production), downtime for retooling and other reasons, start up time of new equipment, raw material availability, etc.
- **We are building significant new capacity.** If the market does not support the new capacity, it will either be unused, or sold at a low price.

# Who are the top manufacturers of PV technology?

Ranking	2004	2004 MWp	2005	2005 MWp	2006	2006 MWp	2007	2007 MWp	Top Ten 2007 Technology
1	Sharp Solar	302.0	Sharp Solar	375.2	Sharp Solar	434.7	Sharp Solar	363.0	Crystalline & Amorphous
2	Kyocera	105.0	Kyocera	142.0	Q-Cells	240.4	Q-Cells	344.1	Crystalline
3	BP Solar	84.9	Q-Cells	131.2	Kyocera	180.0	Suntech	309.0	Crystalline
4	Shell Solar	79.0	Schott Solar	95.0	Suntech	152.0	Kyocera	207.0	Crystalline
5	Q-Cells	70.0	BP Solar	85.8	Sanyo	120.5	First Solar	186.0	CdTe
6	Schott Solar	63.0	Mitsubishi Electric	85.0	Mitsubishi Electric	111.0	Motech	167.0	Crystalline
7	Sanyo	60.0	Sanyo	84.0	Schott Solar	96.0	Sanyo	155.0	Crystalline & Amorphous
8	Electric	58.0	Shell Solar	55.0	Motech	91.8	SolarWorld	136.1	Crystalline
9	Isofoton	40.0	Motech	45.0	BP Solar	75.8	Mitsubishi Electric	121.0	Crystalline
10	Motech	31.0	Isofoton	39.3	SunPower	62.7	SunPower	102.0	Crystalline
10b							JA Solar	102.0	Crystalline
10c							BP Solar	101.6	Crystalline
<b>Total Shipments</b>	<b>1049.8</b>		<b>1407.7</b>		<b>1984.6</b>		<b>3073.0</b>		
<b>Total Above</b>		<b>892.9</b>		<b>1137.5</b>		<b>1564.9</b>		<b>2293.8</b>	
<b>% Total Shipments</b>		<b>85%</b>		<b>81%</b>		<b>79%</b>		<b>75%</b>	

# Commercial systems range in size from <3-kWp to Multi-megawatt large fields



19.8-kWp Commercial system in Hawaii by ProVision Technologies



SunPower Systems' 10-MWp large field installation in Bavaria

## Supply Side Statistics

# The U.S. was once the shipment leader

Region	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	CAGR 1997 - 2007	CAGR 2002- 2007
U.S.	47.7	51.0	55.3	76.2	96.7	107.8	91.5	140.6	133.6	136.6	237.30	17%	17%
Japan	28.3	36.4	68.0	95.3	145.0	233.8	350.6	547.0	714.0	882.6	901.90	41%	31%
ROW	17.9	19.7	22.0	22.0	25.8	39.9	60.0	89.2	153.2	354.1	941.40	49%	88%
Europe	20.2	27.7	30.3	58.5	85.4	123.4	173.1	272.9	406.9	611.3	992.40	48%	52%
Total	114.1	134.8	175.5	252.0	352.9	504.9	675.3	1049.8	1407.7	1984.6	3073.00	39%	44%

**But, manufacturing follows the market and low cost areas  
Of production. The U.S. has few, if any, manufacturing  
Incentives to lower the cost of production and Europe  
Is >70% of the market for solar electric products.**

**In 1997, the U.S. had a 42% share of shipments.**

**In 1998, the U.S. had a 38% share of shipments.**

**In 1999, Japan, with a stronger market and supportive of its  
Manufacturing sector, took over leadership.**

**By 2007, the U.S. had an 8% share of shipments.**

# Regional Capacity and Shipments

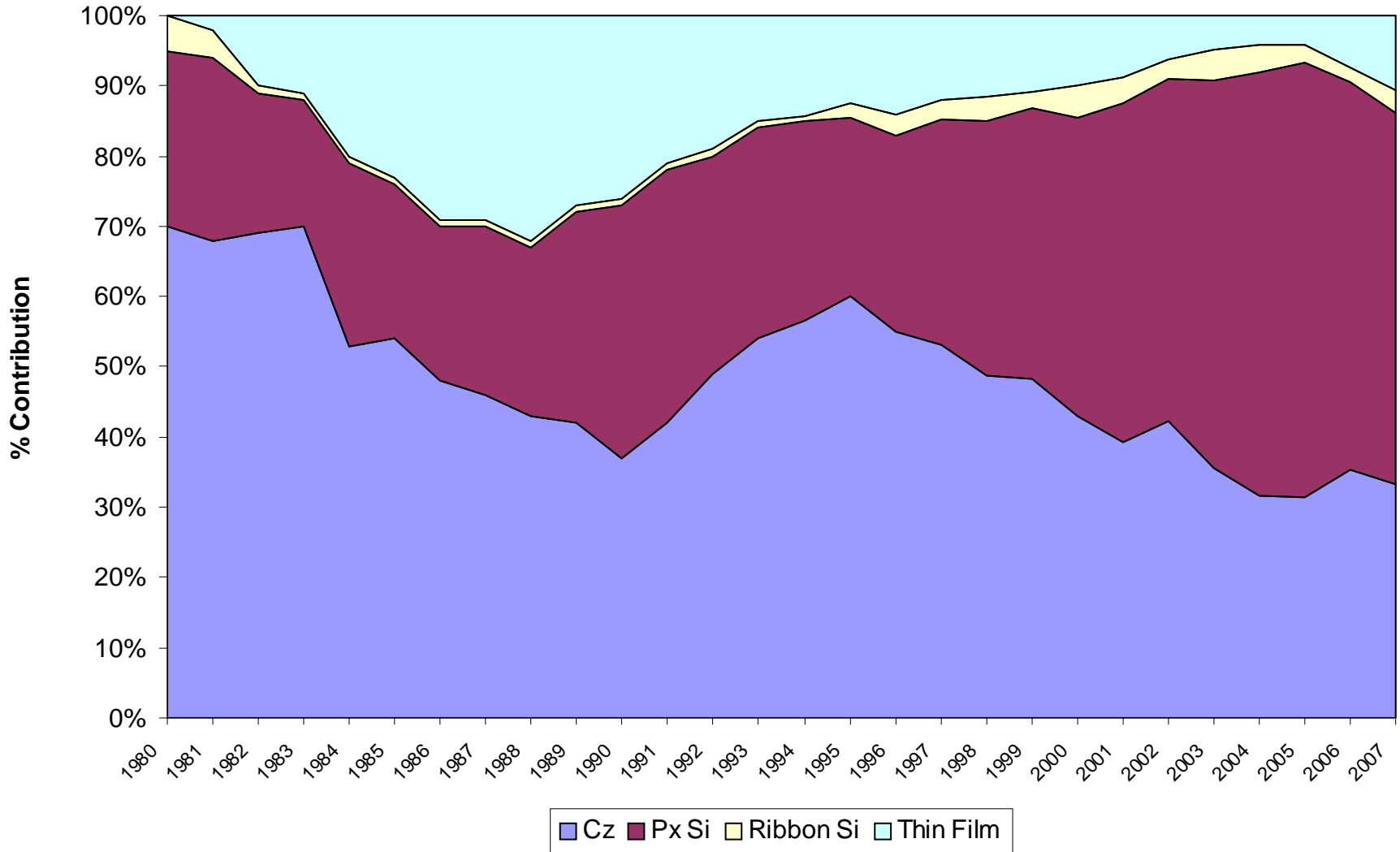
In 2007, Regionally, Europe took the number one market share in terms of shipments of technology and the ROW Region (consisting of India, Australia Taiwan, China, and others) had the highest capacity of all four regions (US., Europe, Japan, ROW).

Regional Capacity	2002	% Chg 02-03	2003	% Chg 03-04	2004	% Chg 04-05	2005	% Chg 05-06	2006	% Chg 06-07	2007	CAGR 02-07
<b>U.S.</b>												
Capacity	179.3	-5%	169.5	9%	185.5	14%	212.0	48%	314.0	18%	366.5	15%
Shipments	107.8	-15%	91.5	54%	140.6	-5%	133.6	2%	136.6	70%	237.3	17%
Utilization	60%		54%		76%		63%		44%		65%	1%
<b>ROW</b>												
Capacity	66.3	33%	88.5	100%	177.2	51%	267.0	153%	675.7	155%	1914.0	96%
Shipments	39.9	50%	60.0	49%	89.2	72%	153.2	131%	354.1	146%	941.4	88%
Utilization	60%		68%		50%		57%		52%		49%	-4%
<b>Europe</b>												
Capacity	187.3	64%	306.3	51%	463.1	60%	742.3	37%	1016.0	59%	1657.6	55%
Shipments	123.4	40%	173.1	58%	272.9	49%	406.9	50%	611.3	62%	992.4	52%
Utilization	66%		57%		59%		55%		60%		60%	-2%
<b>Japan</b>												
Capacity	295.5	48%	438.0	45%	634.0	71%	1082.0	11%	1205.0	25%	1504.5	38%
Shipments	233.8	50%	350.6	56%	547.0	31%	714.0	24%	882.6	7%	901.9	31%
Utilization	79%		80%		86%		66%		73%		60%	-5%
<b>Total</b>												
Capacity	728.4	38%	1002.3	46%	1459.8	58%	2303.3	39%	3210.7	62%	5442.6	50%
Shipments	504.9	34%	675.3	55%	1049.8	34%	1407.7	41%	1984.6	53%	3073.0	44%
Utilization	69%		67%		72%		61%		62%		56%	-4%

# Technology Sales Breakdown

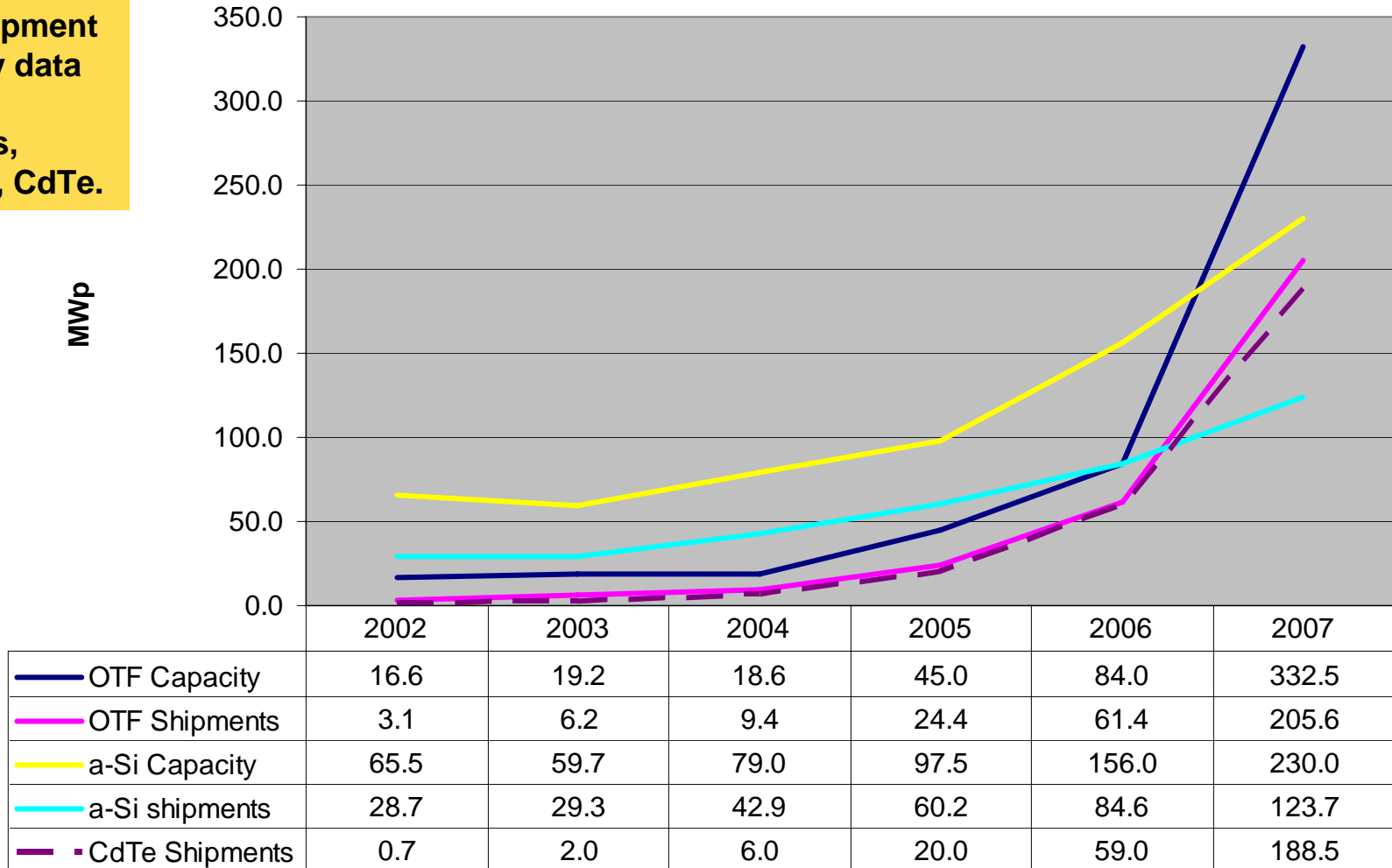
Technology	2000 MWp	2001 MWp	2002 MWp	2003 MWp	2004 MWp	2005 MWp	2006 MWp	2007 MWp	CAGR 00-07	CAGR 02-07
Polycrystalline	107.3	170.5	246.0	373.3	626.8	855.2	1092.4	1626.9	47%	46%
Px % Total	43%	48%	49%	55%	60%	61%	55%	53%		
Px Chg %	59%	59%	44%	52%	68%	36%	28%	49%		
Monocrystalline	108.3	138.3	212.9	240.1	328.6	433.9	702.2	1020.6	38%	37%
Cz % Total	43%	39%	42%	36%	31%	31%	35%	33%		
Cz Chg %	28%	28%	54%	13%	37%	32%	62%	45%		
Ribbon Silicon	11.2	12.9	14.2	29.2	42.0	34.0	44.0	96.2	36%	47%
Ribbon % Total	4%	4%	3%	4%	4%	2%	2%	3%		
Ribbon Chg %	167%	15%	10%	106%	44%	-19%	29%	119%		
Amorphous Silicon	23.3	29.3	28.7	28.9	42.9	60.2	84.6	123.7	27%	34%
a-Si % Total	9%	8%	6%	4%	4%	4%	4%	4%		
a-Si Chg %	30%	26%	-2%	1%	48%	40%	41%	46%		
Other Thin Films	1.9	1.9	3.1	3.8	9.4	24.4	61.4	205.6	95%	131%
OTF % Total	1%	1%	1%	1%	1%	2%	3%	7%		
OTF Chg %	93%	0%	61%	23%	147%	147%	147%	147%		
Total Crystalline	226.8	321.7	473.1	642.6	997.4	1323.1	1838.6	2743.7	43%	42%
Crystalline % Total	90%	91%	94%	95%	95%	94%	93%	89%		
Crystalline Chg %	45%	42%	47%	36%	55%	33%	39%	49%		
Total Thin Films	25.2	31.2	31.8	32.7	52.3	84.6	146.0	329.3	44%	60%
Thin Film % Total	10%	9%	6%	5%	5%	6%	7%	11%		
Thin Film Chg %	41%	24%	2%	3%	60%	62%	73%	126%		
Total Shipments	252.0	352.9	504.9	675.3	1049.8	1407.7	1984.6	3073.0	43%	44%

# Technology Contribution to Shipments 1980 to 2007

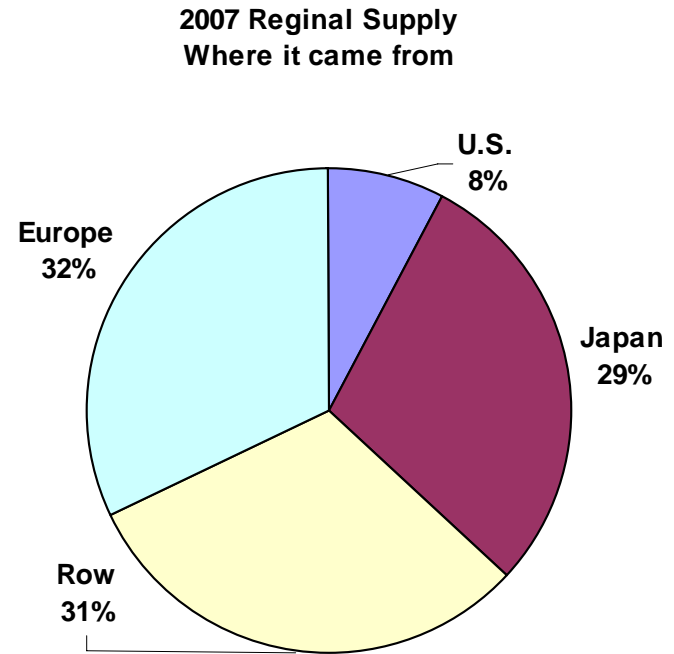
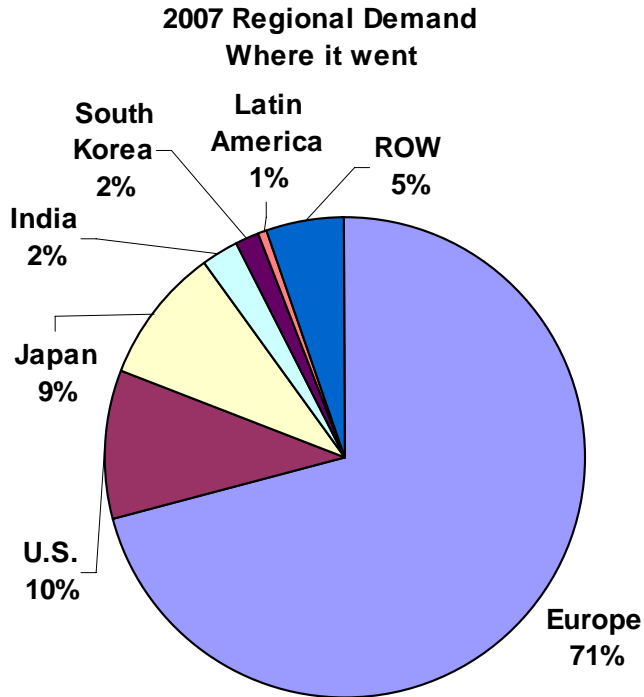


# Thin film Growth from 2002 through 2007 has been significant

This figure presents shipment and capacity data for thin film technologies, in particular, CdTe.



# Supply and Demand 2007



**3073.0-MWp shipped to the first point of sale in the market in 2007.**

**With manufacturing following the market or low cost areas of manufacture, Europe became the manufacturing leader.**

**Asia is the low cost manufacturing region, so the ROW will soon take over.**

## The Market and the Role of Incentives

# PV Market Basics

- **The market for PV products continues to be driven by incentives.**
- **In U.S. states where the price of conventional electricity is at or above the price of PV generated electricity (Hawaii), and where there are no incentives, there is also no market.**
- **In Spain, a new cap on solar electric installations of 300-MWp in 2009, may strand over a gigawatt of product.**
- **Other than Germany, which has implemented controls on its market, there is no where else for the stranded megawatts to go.**
- **Currently the extension of the ITC is highly unlikely in 2008, and without it demand for PV systems and investment systems in the U.S. will decrease significantly.**
- **There is NO demand pull in PV currently.**
- **The manufacturer's customer for PV cells and modules is the PV Selling Channel.**
- **For investor systems, where the product is electricity, the customer varies**
- **The PV selling channel is made up of system integrators, installers, retailers, module assemblers, dealers, distributors and those installing systems and selling electricity (instead of systems).**

# Germany's Feed In Tariff Law sparked a boom in solar in Europe Spain's generous feed in started a second boom



**First Solar  
CdTe 1.3-MWp  
large field  
system in  
Germany.**

# EU Incentive Overview

In Spain, 95% of the market is large field investment Installations and utility installations

Spain has implemented a restrictive 400-MWp cap for 2008/2009 with 100-MWp extension for the old program along with a far less generous tariff.

The market for PV in France is expected to remain moderate, However, with its focus on BIPV, it may provide motivation For product development in the BIPV sub-application.

A strong market for the large commercial application is expected in Greece, however has not developed yet and needs Strong government motivation to do so.

Germany was the dominant market in Europe, until demand in Spain for large field systems exploded. With changes in Spain's feed in law, Germany will temporarily take up the slack.

Germany added complexity (including triggers for steeper declines in its feed in), also increasing the digression significantly beginning in 2009.

There is strong interest in the market in Italy, But also problems including some resistance To the expense of the technology. Still, the market is expected to be significant, though not to the degree of Spain.

# U.S. States with 10+ incentive programs

State	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Rebates	Production Incentive	Grants	Loans	Other	Indust. Recruit.	2007 total
Arizona	1	1	1	1	6				1		11
California	1			1	17	3	1	1	2		26
Colorado			2	1	6			2			11
Connecticut			1	1	1	2	3	2			10
Maryland	2	2		2	1	1		2			10
Massachusetts	1	1	1	1	1	1	5	3		2	16
Montana	1	1		3		1	3	1			10
New York	1	1	1	1	2		1	2		1	10
Oregon	1	1		1	4	2	2	1	1		13
Washington			1		5	4	2	5		1	18
<b>Total</b>	<b>8</b>	<b>7</b>	<b>7</b>	<b>12</b>	<b>43</b>	<b>14</b>	<b>17</b>	<b>19</b>	<b>4</b>	<b>4</b>	<b>135</b>
<b>Total all States</b>	<b>17</b>	<b>21</b>	<b>19</b>	<b>33</b>	<b>60</b>	<b>37</b>	<b>39</b>	<b>32</b>	<b>13</b>	<b>8</b>	<b>279</b>

The U.S. remains, essentially a one state market ... California.

In California, the San Francisco city council recently put a stop to its planned solar rebate and is reconsidering where to put is \$3-million in funding.

If the U.S. ITC is extended, then the investment model will grow significantly, and expand to other states.

RPS drives solar installations only if there is a solar set aside.

The U.S. does not have a feed in tariff model. The feed in model, as with all incentives, is very expensive, and the U.S. is unlikely to adopt it – particularly as more governments in Europe implement changes to programs due to their expensive nature.

## Average Module Prices

# Average selling prices, 1982 through 2007

In 2007, average module prices were flat for the total module category (all module sizes and lowest buying power). As were ASPs for power and large quantity modules.

Large quantity prices are the most important as lower efficiency technologies must be lower than this level, also the majority of product is now sold in this category.

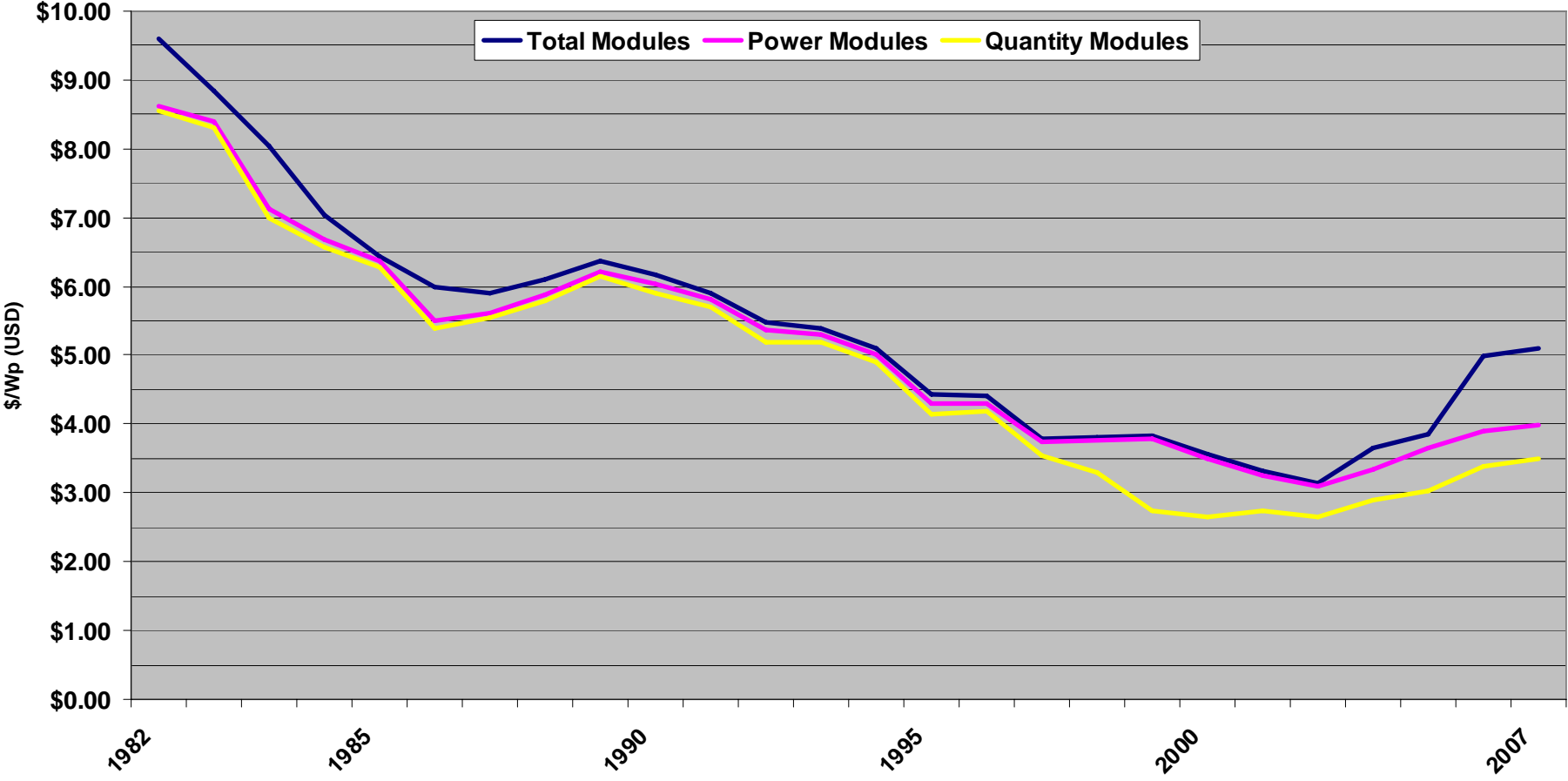
All categories experienced significant increases in 2006.

From 2002 through 2007, ASPs increased on a compound annual basis.

As most product is sold into Europe, higher prices in Europe, along with the exchange rate, are driving worldwide averages.

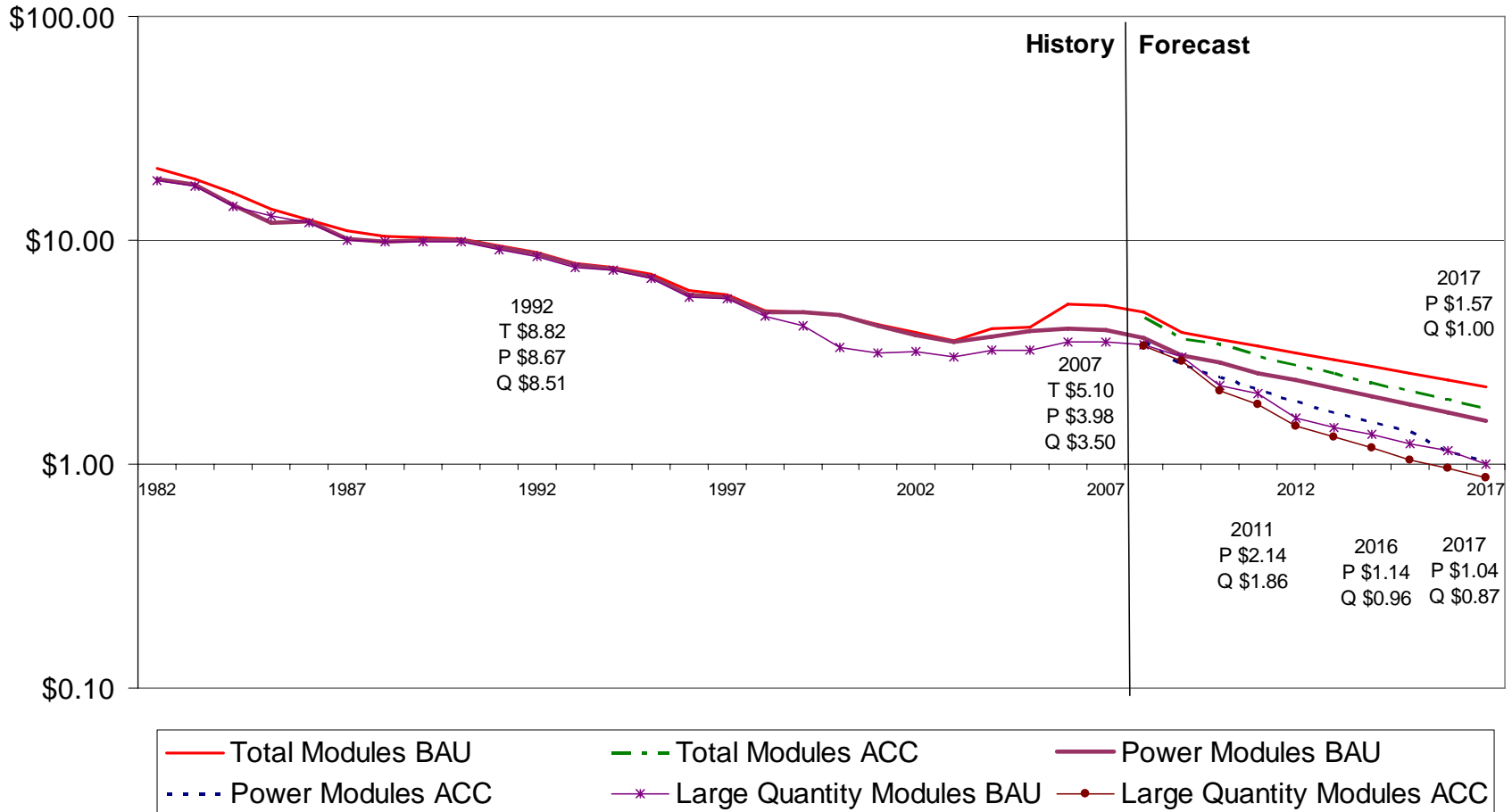
Year	Total Modules		Power Module		Large Modules Sold in Quantity	
	ASP \$/WP	Percent Change	ASP \$/WP	Percent Change	ASP \$/WP	Percent Change
1982	\$9.59	1%	\$8.63	7%	\$8.55	7%
1983	\$8.85	-8%	\$8.40	-3%	\$8.30	-3%
1984	\$8.04	-9%	\$7.12	-15%	\$7.00	-16%
1985	\$7.03	-13%	\$6.68	-6%	\$6.58	-6%
1986	\$6.44	-8%	\$6.37	-5%	\$6.28	-5%
1987	\$5.99	-7%	\$5.49	-14%	\$5.40	-14%
1988	\$5.90	-2%	\$5.61	2%	\$5.55	3%
1989	\$6.10	3%	\$5.89	5%	\$5.80	5%
1990	\$6.37	4%	\$6.21	5%	\$6.15	6%
1991	\$6.16	-3%	\$6.04	-3%	\$5.90	-4%
1992	\$5.91	-4%	\$5.81	-4%	\$5.70	-3%
1993	\$5.47	-7%	\$5.36	-8%	\$5.20	-9%
1994	\$5.39	-1%	\$5.29	-1%	\$5.19	0%
1995	\$5.11	-5%	\$5.01	-5%	\$4.90	-6%
1996	\$4.44	-13%	\$4.30	-14%	\$4.15	-15%
1997	\$4.40	-1%	\$4.29	0%	\$4.18	1%
1998	\$3.79	-14%	\$3.74	-13%	\$3.55	-15%
1999	\$3.80	0%	\$3.77	1%	\$3.30	-7%
2000	\$3.82	1%	\$3.79	1%	\$2.75	-17%
2001	\$3.57	-7%	\$3.50	-8%	\$2.65	-4%
2002	\$3.31	-7%	\$3.25	-7%	\$2.75	4%
2003	\$3.14	-5%	\$3.10	-5%	\$2.65	-4%
2004	\$3.65	16%	\$3.35	8%	\$2.90	9%
2005	\$3.85	5%	\$3.65	9%	\$3.03	4%
2006	\$5.00	30%	\$3.90	7%	\$3.39	12%
2007	\$5.10	2%	\$3.98	2%	\$3.50	3%
CAGR 1982-1992		-5%		-4%		-4%
CAGR 1992-2002		-6%		-6%		-7%
CAGR 2002-2007		9%		4%		5%
CAGR 1982-2007		-2%		-3%		-4%
2007 ASP in Euros	€ 3.49		€ 2.73		€ 2.40	

# Historic PV industry pricing in pictures



# Future Price Forecast

Price forecasts are extremely unreliable because the market sets the price. However, the most reliable forecasts are based on hard data, and a long term history. The history of this forecast goes back to 1974, and has proven 96% accurate over time.



## Five year Forecast

# Solar Electricity is sold into applications ... what are they?

- **The application is the market segment into which the application is sold**
- **There are five major application segments and thirty-five sub-applications**
- **All sales fit into one of these categories – there are no new applications for PV technology**
- **The five major application segments are:**
  - » **Off Grid Industrial**
  - » **Off Grid Habitation**
  - » **Consumer Power (military applications fall into this category)**
  - » **Grid Connected (90% of sales)**
    - Grid Commercial**
    - Grid Residential**
    - Grid Utility**
  - » **Consumer Indoor**

# Aggregate Technology Forecast

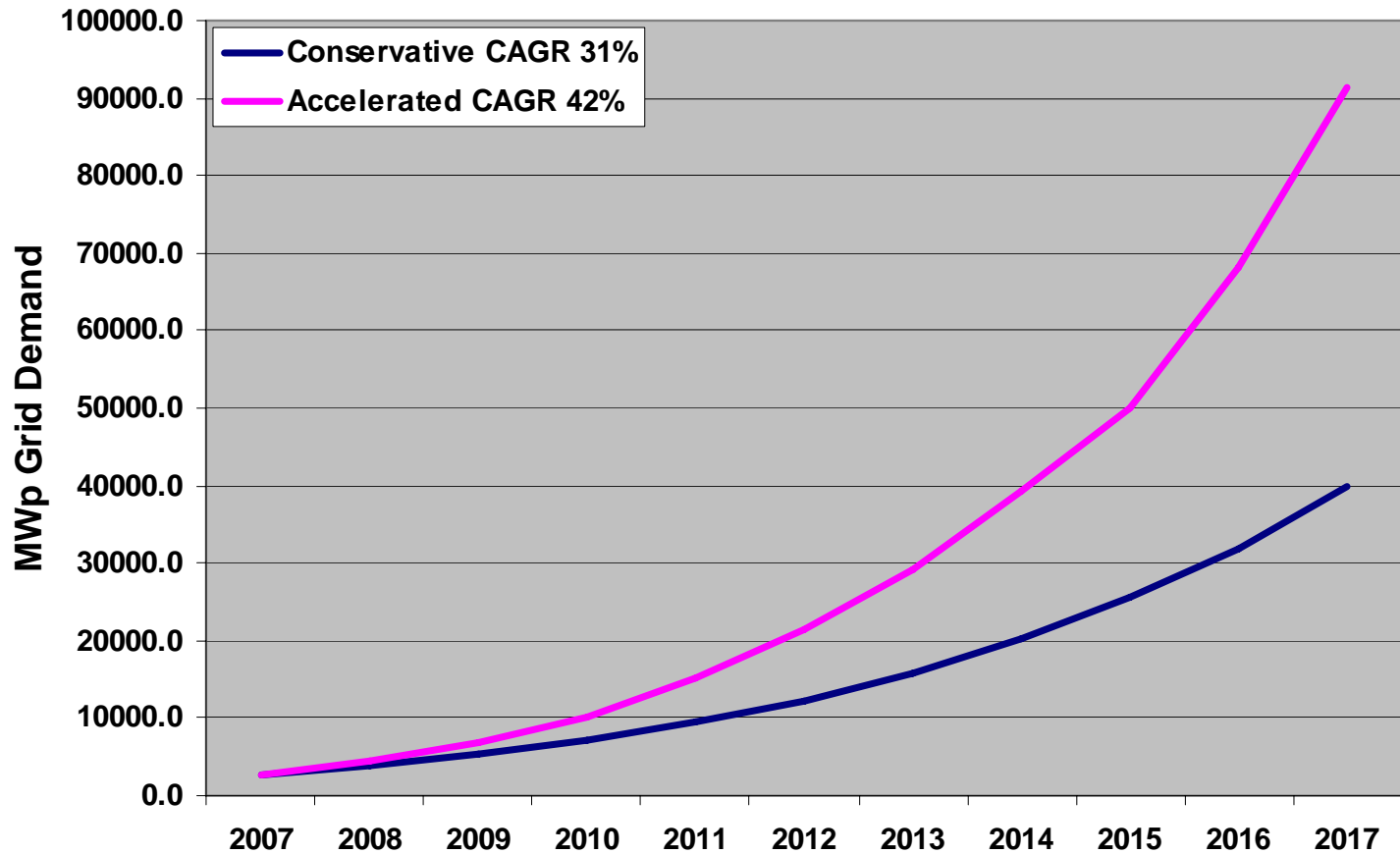
Thin film technologies began gaining share in 2006 and 2007 primarily because of the silicon shortage. The shortage, and demand side anxiety over module supply, gave thin films an opportunity to overcome market wariness of lower efficiency and potential lower reliability.

Specifically, First Solar took advantage of the Market opportunity, focused on sales to Germany, and to Europe in general, built relationships with partners and most important, priced aggressively for entry.

Thin films, as they are more expensive to install, will always need to price below crystalline products.

Conservative	Total MWp	Crystalline MWp	Thin Film MWp	Thin Film % Total
2006	1984.6	1838.6	146.0	7%
2007	3073.0	2743.7	329.3	11%
2008	4250.4	3697.8	552.6	13%
2009	5773.5	4965.2	808.3	14%
2010	7544.0	6412.4	1131.6	15%
2011	9872.4	8391.5	1480.9	15%
2012	12844.0	10917.4	1926.6	15%
Accelerated	Total MWp	Crystalline MWp	Thin Film MWp	Thin Film % Total
2006	1984.6	1838.6	146.0	7%
2007	3073.0	2743.7	329.3	11%
2008	4907.6	4269.6	638.0	13%
2009	7231.7	6219.3	1012.4	14%
2010	10703.8	9098.2	1700.5	16%
2011	15692.0	13338.2	2450.1	16%
2012	22142.9	18821.5	3450.2	16%

# Ten Year Aggregate Forecast



**The PV industry has been enjoying accelerated growth for some time. Accelerated growth is expected to continue for at least the next five years. Even when accelerated growth slows, there is momentum for the use of renewable technologies, and this is unlikely to change.**

# Five Year Grid Connected Forecast

Grid Sub-Application	1997	2002	2007	2012		CAGR	CAGR	CAGR 2007-2012	
	MWp	MWp	MWp	Conservative MWp	Accelerated MWp	1997-2002	2002- 2007	Conserv.	ACC.
Grid-Residential	28.5	296.4	856.5	3936.5	6904.5	60%	24%	36%	52%
Grid-Commercial	7.0	32.5	1519.6	6150.8	10788.3	36%	116%	32%	48%
Grid-Utility	3.5	9.5	386.8	2214.3	3883.8	22%	110%	42%	59%
<b>Total Grid</b>	<b>39.1</b>	<b>338.3</b>	<b>2762.9</b>	<b>12301.6</b>	<b>21576.7</b>	<b>54%</b>	<b>52%</b>	<b>35%</b>	<b>51%</b>
<b>Total Demand</b>	<b>114.1</b>	<b>504.9</b>	<b>3073.0</b>	<b>12844.0</b>	<b>22142.9</b>	<b>35%</b>	<b>44%</b>	<b>33%</b>	<b>48%</b>
<b>Grid % Total</b>	<b>34%</b>	<b>67%</b>	<b>90%</b>	<b>96%</b>	<b>97%</b>				

Investment models (PPA in the U.S.) are driving grid connected market growth. In Europe, these models allow for system owners to profit from system ownership. The market in Europe, at >70% of total demand, is a more mature market than that of the U.S.

For commercial and utility applications, large installations are predominate.

From 2002 to 2007, the grid-utility market has grown at a compound annual rate of 110%, with installations primarily into Spain).

From 2002 to 2007, the commercial market has grown at a CAGR of 116%, again, primarily driven by installations in Europe.

# Five Year Forecast: Regions

Region	2007	2008	2009	2010	2011	2012	CAGR
U.S.	304.8	420.5	514.2	693.8	937.4	1244.6	32%
Europe	2178.7	3185.6	4427.7	5803.6	7576.4	9824.1	35%
Japan	281.3	267.4	346.0	412.3	542.2	716.8	21%
Rest of World	308.2	376.6	485.1	633.6	815.5	1058.5	28%
<b>Total Demand</b>	<b>3073.0</b>	<b>4250.1</b>	<b>5773.0</b>	<b>7543.3</b>	<b>9871.5</b>	<b>12844.0</b>	<b>33%</b>
<b>Accelerated</b>							
Region	2007	2008	2009	2010	2011	2012	CAGR
U.S.	304.8	471.1	767.6	1187.9	1746.7	2566.8	53%
Europe	2178.7	3669.2	5412.6	8020.7	11803.8	16515.9	50%
Japan	281.3	324.0	424.1	563.6	823.5	1191.1	33%
Rest of World	308.2	443.3	627.4	931.6	1316.7	1869.1	43%
<b>Total Demand</b>	<b>3073.0</b>	<b>4907.6</b>	<b>7231.7</b>	<b>10703.8</b>	<b>15690.7</b>	<b>22142.9</b>	<b>48%</b>

The conservative and accelerated forecasts assume that Europe, with its lucrative feed in tariff incentive programs, will continue to absorb volume – that is, though the program in Spain is less robust, and Germany has implemented controls, new markets are emerging.

It takes into account, particularly under the conservative scenario, the economic slowdown in Japan, along with a slowdown in its building market. Japan has announced that it will implement a new subsidy program.

The conservative scenario also considers current economic concerns in the U.S., including the housing crisis, banking crisis, and credit concerns in general.

# U.S Five Year Forecast – how do we make it happen?

The U.S. has enormous potential to be a significant market for grid connected solar products. U.S. demand is expected to be strong, even given the current uncertainty of the federal tax incentive (ITC) for 2008 or long term passage.

The U.S. market will need to climb out of its current period of economic uncertainty, the housing crisis will need to resolve, and for the residential application, new business and financing models that solve the high upfront system cost problem need to develop (and time to develop) for the U.S. to achieve its potential as a rival to Europe in terms of demand, and supply.

Conservative	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	CAGR 02-07	CAGR 07-12
<b>U.S. Total</b>	<b>60.8</b>	<b>76.0</b>	<b>101.8</b>	<b>137.3</b>	<b>222.2</b>	<b>304.8</b>	<b>420.5</b>	<b>514.1</b>	<b>693.7</b>	<b>937.4</b>	<b>1244.5</b>	<b>38%</b>	<b>32%</b>
Grid Commercial	13.7	18.1	26.1	39.9	95.5	128.0	180.8	217.7	293.7	421.8	560.0	56%	34%
Grid Utility	0.1	0.2	0.3	0.8	4.4	10.2	25.2	26.1	35.2	84.4	112.0	172%	61%
Grid Residential	23.3	28.1	40.1	49.9	75.5	103.6	126.2	182.9	263.6	328.1	435.6	35%	33%
Remote	23.7	29.6	35.3	46.7	46.7	62.9	88.3	87.4	101.1	103.1	136.9	22%	17%
Accelerated	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	CAGR 02-07	CAGR 07-12
<b>U.S. Total</b>	<b>60.8</b>	<b>76.0</b>	<b>101.8</b>	<b>137.3</b>	<b>222.2</b>	<b>304.8</b>	<b>470.6</b>	<b>766.4</b>	<b>1185.4</b>	<b>1742.6</b>	<b>2560.0</b>	<b>38%</b>	<b>53%</b>
Grid Commercial	13.7	18.1	26.1	39.9	95.5	128.0	202.4	324.5	501.9	784.2	1152.0	56%	55%
Grid Utility	0.1	0.2	0.3	0.8	4.4	10.2	28.2	38.9	60.2	156.8	230.4	172%	86%
Grid Residential	23.3	28.1	40.1	49.9	75.5	103.6	141.2	272.6	450.5	609.9	896.0	35%	54%
Remote	23.7	29.6	35.3	46.7	46.7	62.9	98.8	130.3	172.8	191.7	281.6	22%	35%
% California of total	54%	47%	59%	54%	57%	58%	56%	55%	54%	52%	49%	CAGR 02-07	CAGR 07-12
California Conservative MWp	32.8	36.0	60.0	74.5	126.7	176.8	235.5	282.8	374.6	487.4	609.8	40%	28%
California Accelerated MWp							263.5	421.5	640.1	906.2	1254.4		48%

## Summary

# **Summary: It's a balancing act, the industry should not overbuild, yet it must be ready for continued strong demand.**

**Raw material supply will begin easing in mid 2009, however, most of the silicon coming on line is already sold under long term contract. In the future, thin films may experience raw material issues that constrain growth ... silane, tellurium and indium as potential bottlenecks to growth.**

**More silicon, along with planned capacities of thin films, will lead to significant downward pressure on prices – this is very good for the distribution channel, and extremely good for investment installations which do not rely on system sales, and require the lowest cost of hardware to be successful.**

**Assuming that the global market will absorb excess module product is problematic, particularly considering the current global economic situation, housing downturn in the U.S. and Japan, continued need for incentives to drive demand – and, the availability of substitutes including energy efficiency.**

**Grid parity only levels the playing field.**

**Solar electricity will narrow the affordability gap eventually. Until that time it needs long term incentives to thrive. Manufacturing costs must decline, efficiencies must rise and the selling channel must be involved in the dialog as they set the price and have access to the end user.**

**All PV technologies must contribute to the solar offering, though not all technologies are appropriate for every application.**

**Thank you!**

**PV is already a disruptive technology and industry.  
It just took a long time to disrupt.**

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