Solar PV Manufacturing Update

The Solar Shakeout

Future Energy Conference
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Solar PV = Boom and Bust!

"Solar manufacturers struggle to meet demand"

DJC Oregon (Daily Journal of Commerce)
BY: Nathalie Weinstein – July 28, 2010

"Manufacturers are producing solar modules as fast as they can, but not fast enough to meet demand. Manufacturers and solar installers say demand for modules is increasing because of low prices, new feed-in tariff programs and greater public awareness. Now, some people are predicting that a module supply shortage could be on the horizon."

- Concern at that time was that demand pressure would push prices up higher and higher.
- In Oregon, SolarWorld said large commercial projects were backlogged until EoY 2010.
- Sanyo NA, which operates a wafer production plant in Salem, didn't have enough supply to meet demand had been back-ordering its product for several years.
- Local Oregon solar installer quoted in article, "It's a great time for solar."

Seems like just yesterday, doesn't it?!

Global PV Manufacturing Update

- The current module capacity is estimated have the capacity to manufacture between 60 and 70 gigawatts' worth of solar panels a year, but demand in 2013 is only expected to be about 30 gigawatts.
- This has led to fierce competition and a sharp price erosion, which has been forcing faster cost reduction and industry consolidation.
- While the surplus has been good news for consumers and installers because it's helped drive a precipitous drop in solar panel prices, the current low prices are driving technology manufacturers into bankruptcy.
- The price of solar panels has declined 60% since the beginning of 2011 according to GTM Research.
- The rapid decline in prices has been hard for solar manufacturers. As prices have dropped, they have been able to lower costs because the price of materials has been falling and they've made incremental improvements to existing manufacturing equipment.
- Huge solar manufacturers like Suntech are struggling to survive, but many analysts say that hundreds need to die in order for the industry to recover.
- The current situation is not one of natural selection – it came about because of choices that were made by industry participants.

Global PV Manufacturing Update

- PV industry participants are at each other's throats with manufacturers struggling to survive and demand side participants refusing to accept the possibility that an increase in price would be good for the entire industry.
- Declining prices for solar products and global trade spats have taken a toll on the nascent solar industry in recent years, leading to the failure of several firms heavily dependent on government support. Today, the solar industry faces mergers and bankruptcies amid a spiral of reduced subsidies, weaker demand, overcapacity, plummeting prices and diminishing profits.
- PV cell and module manufacturers are tired of low to negative margins and failure. Startup technology manufacturers are reducing costs and trying to wait out the current period. R&D budgets are suffering. Failures continue.
- GTM Research forecasts 21 gigawatts of PV module manufacturing capacity coming offline by 2015 as the global market reconciles a dire supply-demand imbalance. Capacity coming offline means less-efficient companies closing down.
- Conventional wisdom says that PV technology manufacturing will now be mostly in Asia. Aside from the fact that if all manufacturers in all regions are losing money and struggling to survive regional leadership has switched over time.

Solar PV Ecosystem, A Brief History

- Since 2004, the solar industry enjoyed extraordinarily strong growth. This growth was stimulated by the European FiT incentive model. The FiT model was hailed as the savior of the industry and was expected to propagate rapidly and seamlessly.
- In 2009, manufacturers from China and other low cost manufacturing regions, entered with aggressive pricing strategies that were supported by healthy manufacturing subsidies. These manufacturing regions were initially developed as export markets to feed growing demand in Europe.
- This model led to innovation and also to overheated markets. As prices swiftly declined, demand ramped up, markets overheated, significant and sometimes retroactive changes were made to FiTs, the global financial system came close to collapse over derivative trading and a global recession ensued.
- Currently, the low price of PV modules (technology) has placed the manufacturing side of the solar ecosystem in dire straits and suffering low margins and failure. Virtually no global PV technology (referring to cells/modules) manufacturer has remained untouched.

So, today we find ourselves in a period pundits are calling "The Solar Shakeout"!

Global PV Manufacturing Top Ten (2002-2012)

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 Est (1)
Sharp Solar	Sharp Solar	Sharp Solar	Sharp Solar	Sharp Solar	Sharp Solar	Q-Cells	First Solar	Suntech	Suntech	Yingli
BP Solar	BP Solar	Kyocera	Kyocera	Q-Cells	Q-Cells	Suntech	Suntech	JA Solar	First Solar	First Solar
Kyocera	Kyocera	BP Solar	Q-Cells	Kyocera	Suntech	Sharp	Sharp Solar	First Solar	JA Solar	Suntech
Shell Solar	Shell Solar	Shell Solar	Schott Solar	Suntech	Kyocera	First Solar	Yingli	Yingli	Yingli	JA Solar
RWE/Schott	RWE/Schott	Q-Cells	BP Solar	Sanyo	First Solar	Kyocera	Q-Cells	Q-Cells	Gintech	Canadian Solar
AstroPower	Mitsubishi Electric	Schott Solar	Mitsubishi Electric	Mitsubishi Electric	Motech	Motech	JA Solar	Sharp	Trina	Hanwha(2)
Isofoton	Sanyo	Sanyo	Sanyo	Schott Solar	Sanyo	Sanyo	Trina	Trina	Motech	Trina
Mitsubishi Electric	Isofoton	Mitsubishi Electric	Shell Solar	Motech	SolarWorld	SunPower	SunPower	Motech	Canadian Solar	Motech
Sanyo	Q-Cells	Isofoton	Motech	BP Solar	Mitsubishi Electric	JA Solar	Kyocera	Gintech	Sharp Solar	Sharp Solar
Photowatt	Photowatt	Motech	Isofoton	SunPower	SunPower	BP Solar	Motech	Kyocera	Jinko Solar	NeoSolar
554.9	675.3	1049.8	1407.7	1984.6	3073.0	5491.8	7913.3	17402.3	23579.3	24435.1

(1)The counting is not complete for 2012

(2)Hanwha acquired Q-Cells in 2012 and Q-Cells data has been included. A detailed analysis of manufacturer shipments will be presented in the SPV Market Research/Strategies Unlimited Q4 2012 Update (February) and the Annual Manufacturer Shipment Report (April)

Regional PV Shipment Leadership (2002-2012)

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Japan	Japan	Japan	Japan	Japan	Europe	Europe	China	China	China	China
Europe	Europe	Europe	Europe	Europe	Japan	Japan	Europe	Taiwan	Taiwan	Taiwan
US	US	US	US	China	China	China	Japan	Europe	Japan	ROW
ROW	ROW	ROW	ROW	US	Taiwan	Taiwan	Taiwan	ROW	ROW	Japan
Taiwan	Taiwan	Taiwan	Taiwan	ROW	US	ROW	ROW	Japan	Europe	Europe
China	China	China	China	Taiwan	ROW	US	US	US	US	US
554.9	675.3	1049.8	1407.7	1984.6	3073.0	5491.8	7913.3	17402.3	23579.3	24435.1

SOLAR SHAKEOUT (PV) 2009 to 2013

List of Deceased Solar Companies

Here's an partial & incomplete list of the solar firms that are no longer with us, filed bankruptcy, or have been acquired: Source: GTM Research / GreenTechSolar by Eric Wesoff: April 6, 2013

- Ascent Solar (CIGS) acquired by TFG Radiant
- BP (c-Si panels) exits solar business
- ECD (a-Si) bankrupt
- EPV Solar (a-Si) bankrupt
- Evergreen (drawn Si) bankrupt
- HelioVolt (CIGS) acquired by Korea's SK Innovation
- Hoku (polysilicon) shut down its Idaho polysilicon facility
- MiaSolé (CIGS) acquired by China's Hanergy
- Nanosolar (CIGS) restructuring for sale
- OptiSolar (a-Si on a grand scale) closed
- Q.Cells (c-Si) insolvent, acquired by South Korea's Hanwha
- Schott (c-Si) exits c-Si business
- Schuco (a-Si) shutting down its a-Si business
- Sharp (a-Si) backing away from a-Si, retiring 160 of its 320 megawatts in Japan
- Signet Solar (a-Si) bankrupt
- Solon (c-Si) acquired by UAE's Microsol
- Solyndra (CIGS) bankrupt
- SpectraWatt (c-Si) bankrupt
- Suntech Wuxi (c-Si) bankrupt

SOLAR SHAKEOUT
Closer to home

The global situation has certainly had an impact on Oregon!

Labor data report released by the *Oregon Fair Trade Campaign*, a fair trade advocacy coalition, showed that Oregon lost the fourth most jobs to offshoring out of any state in the country in 2012 when measured by population.

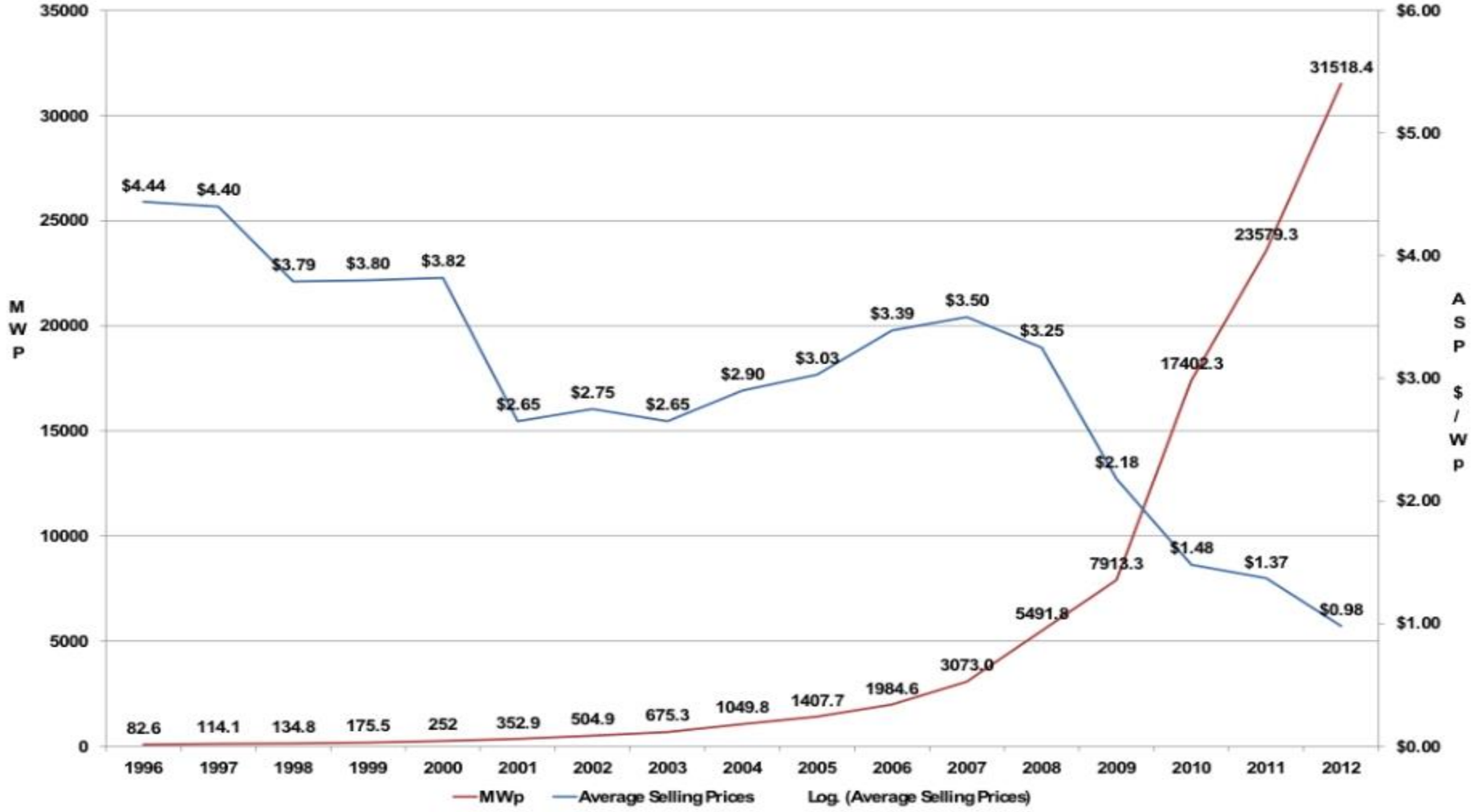
Some local victims of the solar shakeout are:

- Azuray (Tigard) - (microinverters) closed
- Sanyo Solar (Salem) - Acquired by Panasonic
- Solaicx / MEMC (Portland) silicon ingots for solar cells – Massive layoffs
- SolarWorld NA (Hillsboro) – Workforce reduction
- Solexant (Gresham) Thin-film mfg struggling as it switches from cadmium telluride to CIGS
- Solopower (Portland) - Workforce reduction, with little production to market

Not to mention the relatively large number of solar contractors that have reduced staff, or have gone out of business, over this past year!

“Equilibrium Price”

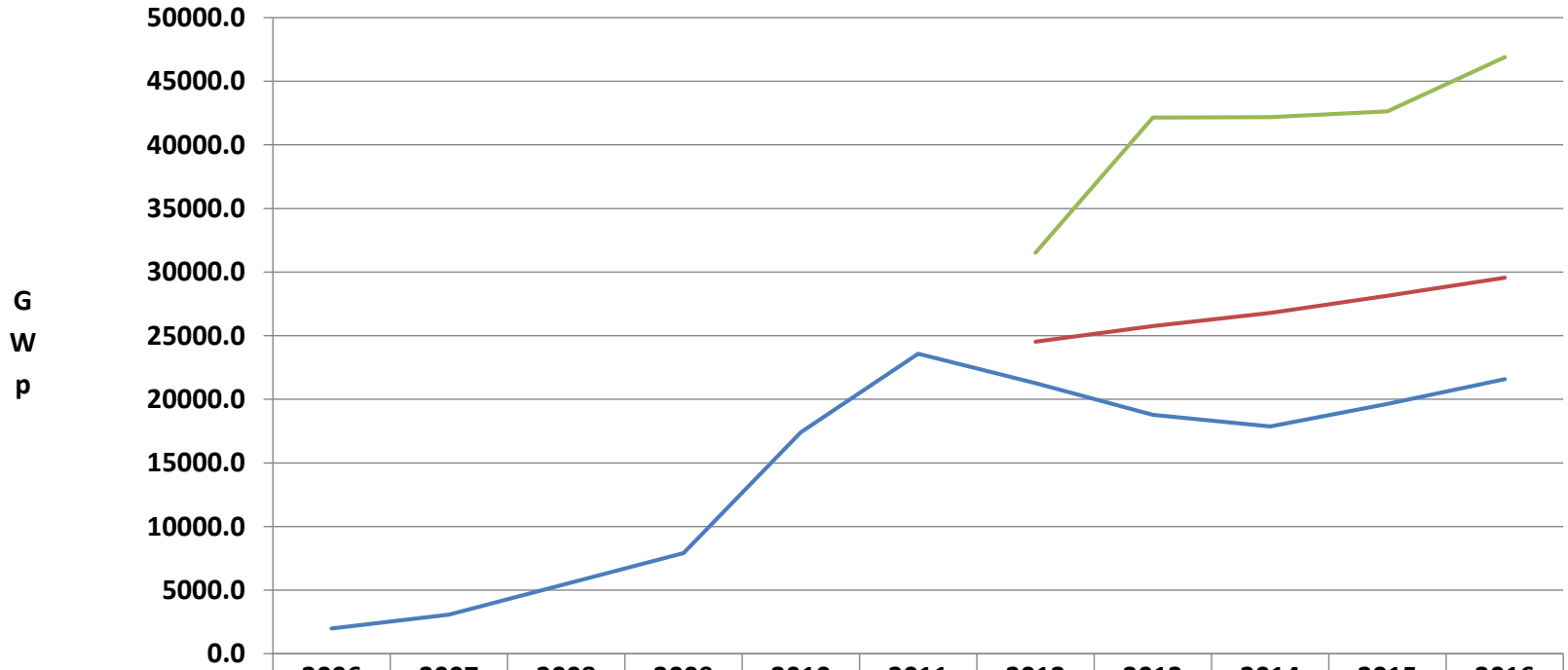
Solar PV prices should be somewhere between $1.48/Wp and $2.00/Wp. Instead, the average price for PV technology to the first point of sale in 2012 was closer to ~$0.98/Wp with inventory prices averaging $0.69/Wp for the year. 2013 estimates have these numbers dropping even further which is simply not sustainable.



Global PV Manufacturing – Looking Ahead

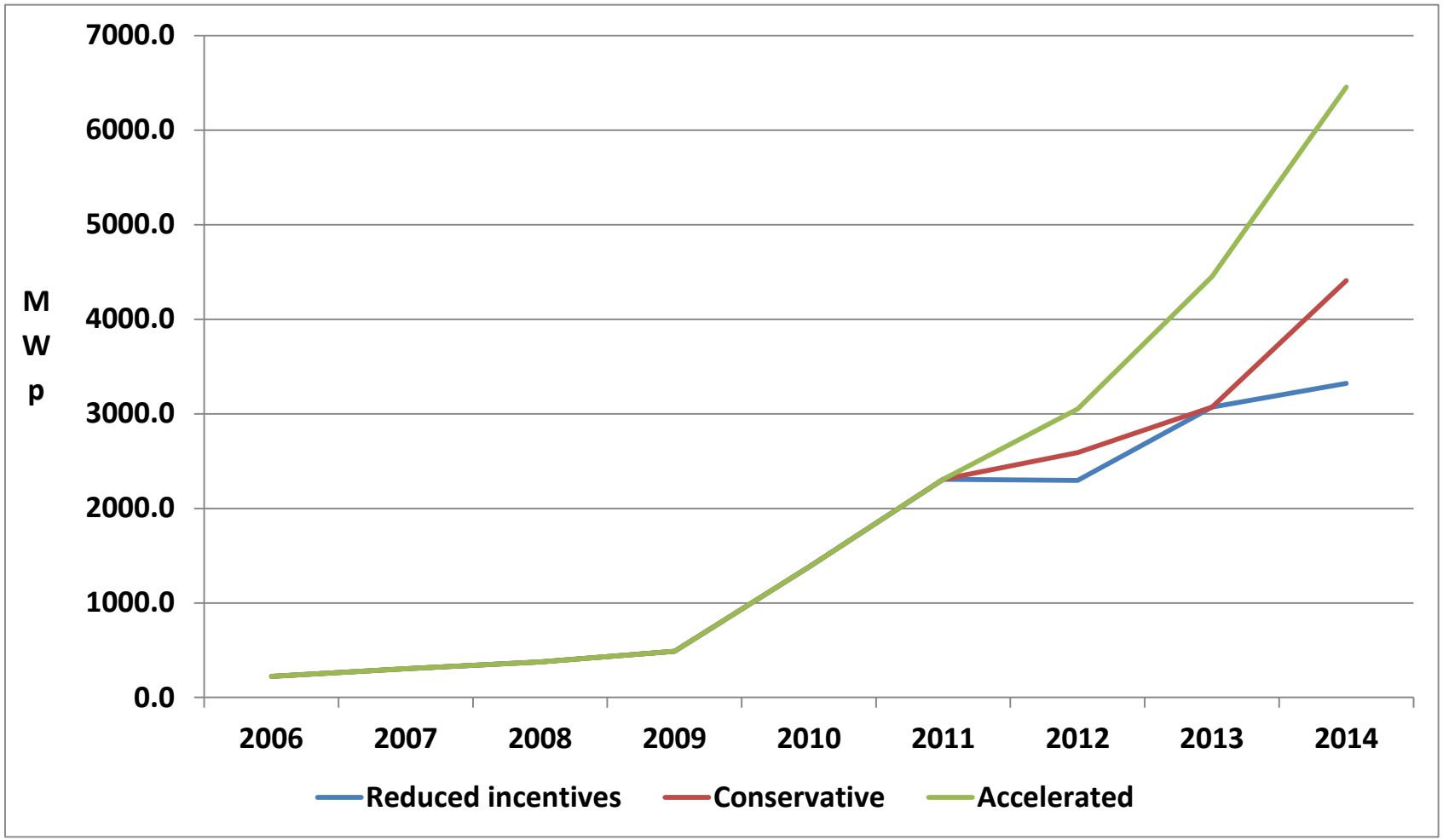
- The recovery of the solar market will depend in part on how fast companies are allowed to fail. It will also depend on expansion of the worldwide market.
- As PV system prices go down, many countries and regions have began to accept PV, especially for the countries with growing energy needs, such as, China, India, Japan and the US (California). Many analysts predict that, by 2016, the US will be the largest PV market in the world.
- With the current declining price trend, the cost of PV electricity soon will be equivalent to the cost of traditional electricity in many areas.
- As to innovation, despite the desperate climate for technology manufacturers, ideas are percolating. The solar industry is global, it will recover, and progress towards a sustainable future will be made with the participation of all regions, as partners.
- The bottom line is, the prices need to stop falling if we want healthy manufacturers around to support the 25+ year warranties and advance R&D. Otherwise the warranty is worth nothing because they go bankrupt and the new owners who buy up the manufacturing plants at pennies on the dollar, may or may not honor those warranties.
- We need to get back to the entire value of solar and the industry, not just the price of solar modules.
- I am in agreement with many of the pundits who say that the solar industry will emerge from this period of consolidation stronger, more nimble and more competitive. (We've seen this before!)

Aggregate Forecast to 2016



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
History/Reduced Incentives	1984.2	3073.0	5491.8	7913.3	17402.7	23579.3	21269.5	18770.0	17863.7	19629.9	21586.3
Conservative							24528.4	25759.0	26798.1	28145.9	29562.5
Accelerated							31518.4	42151.3	42181.7	42633.0	46894.8

Aggregate Reduced incentives, Conservative and Accelerated US Demand Forecast



SOLAR OREGON

ENCOURAGING OREGONIANS TO CHOOSE › SOLAR ENERGY

Our mission: Leading the way to a clean energy future by demonstrating the successful use of solar energy in Oregon

Founded in 1979, we are non-profit that is supported by its member organizations, individuals, corporations and partners. For 33 years, Solar Oregon has built a reputation as a trusted, unbiased source of solar information and is an industry connector. Under the leadership of a strong board and executive director, and supported by a dedicated staff, Solar Oregon is a driving force for solar advocacy in the Pacific Northwest.

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Source / Citations

1. 2013 Q1 Supply/Demand and Full Year 2012 Update
Solar PV Market Research and Strategies Unlimited
Paula Mints, Founder, Chief Market Research Analyst

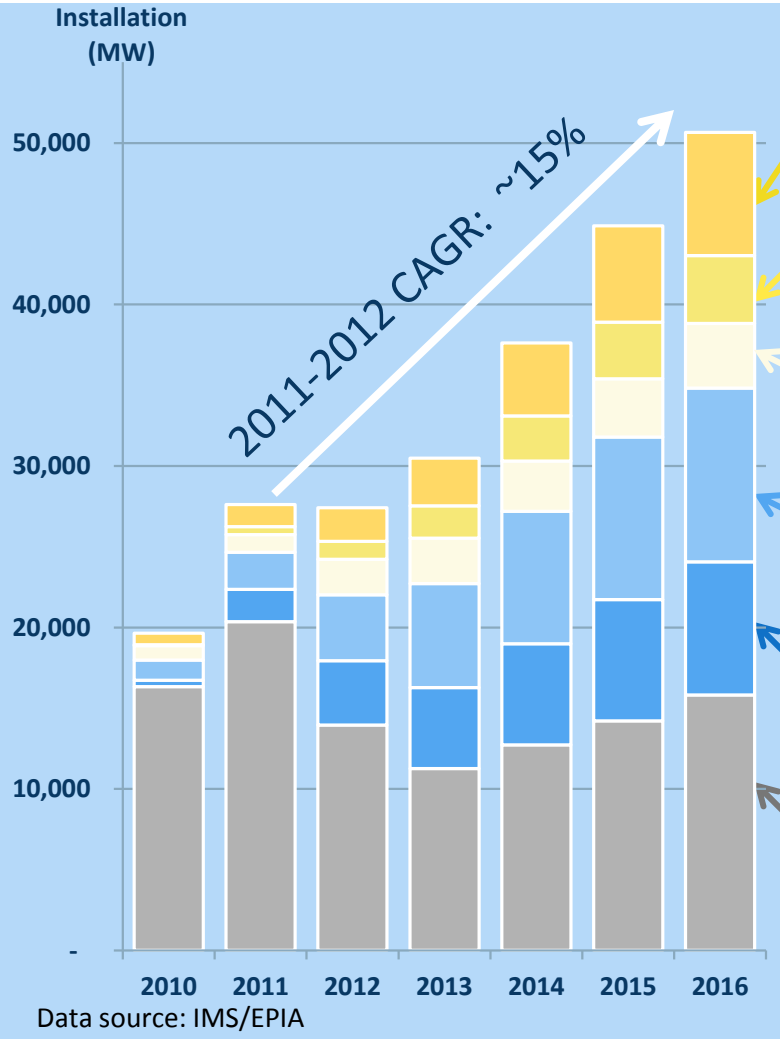
2. Renewable Energy World
"The Solar PV Ecosystem, A Brief History and a Look Ahead"
By Paula Mints, SPV Market Research/Strategies Unlimited – November 20, 2012

3. MIT technology Review
"Why We Need More Solar Companies to Fail"
By Kevin Bullis – March 18, 2013

4. GreenTech Media Research / GreenTech Solar
by Eric Wesoff: April 6, 2013

5. CNN Money
"Solar power has record year despite bankruptcies"
By Steve Hargreaves – March 14, 2013

Global PV Demand Forecast and Drivers



Data source: IMS/EPIA

41% — **ROW**: several small, but high-growth markets in EMEA, Latin America, South-east Asia, Eastern Europe

53% — **India**: Solar market driven both by national solar mission and state level programs (e.g. Gujarat, Rajasthan, Karnataka)

24% — **Japan**: New renewable energy law supports solar in the long-term, especially in the aftermath of the Fukushima accident. New FIT values are expected in July.

35% — **USA**: By 2016, the US will be the largest market, driven by multiple state-level incentives and RPS goals (e.g. CA's 33% RPS goal by 2020)

28% — **China**: With the new national PV target of 50 GW by 2020, national FiT and recent regional incentive programs will drive strong growth of demand.

-3% — **Europe**: Led by Germany and Italy, Europe has been the engine for the PV industry growth till today. With reduction of subsidies, the European market is expected to see flat to negative growth for the next several years.