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Solar in the Future Energy Mix
NCCAVS
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Paula Mints

Director | Energy | Navigant

Principal Analyst | Solar Services Program

pmints@navigantconsulting.com

Navigant Consulting, Inc.
3000 El Camino Real, Suite 225
Palo Alto, CA, 94306
Paula Mints: (650) 849-1142

Solar going forward

1. The Basics
2. Supply and Demand
3. PV Technology Prices
4. The Future

Part I

The Basics

But first … some common sense …

For the past four years, the PV industry has experienced extraordinarily strong growth – though, along with this growth has come low margins, losses and failures. Economist Kenneth Boulding said: Anyone who things that exponential growth can go on forever in a finite world is either a madman or an economist.

Regarding LCOE models … almost all of them have the same flaw – assuming a constant increase in the cost of conventional energy over time, along with a constant decrease in the cost of solar.

This ignores the true value of solar … it is long running, reliable and clean.

What is Market Research?

Is a specific discipline where something is counted from point a to point b, then point b to point c, and so on. The point is to eliminate double counting and arrive at specific metrics to define a market

In solar, when following the module it is from manufacturer to first point of sale, then first point of sale to the next point and so on, until the module is installed.

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.

Current state of the Industry

Globally, but, particularly in Europe (the largest market for solar products) incentives are decreasing, changing or disappearing

Bidding on power purchase agreement (PPA) prices and tenders (a PPA by another name) are two low and will have to be renegotiated. The alternative to renegotiation is bankrupt systems or, systems that will not be built

PV technology prices are stuck at artificially low levels, and are held down by high levels of inventory and the reselling of that inventory, high levels of capacity, decreasing incentive rates and the expectation that prices will continue to decrease

Manufacturers are idling capacity and cancelling plans to add capacity

Investors have lost or are losing confidence in solar leading to negative articles that lead the general public to question the technology

The current correction could have been avoided had manufacturers, demand side participants and investors paid attention to the one salient fact about incentives:

INCENTIVES ARE DESIGNED TO DECREASE OVER TIME UNTIL DEMAND IS STIMULATED AT WHICH POINT THEY END

However, the industry will emerge leaner from this correction with the business and financial models necessary to move it to a low incentive environment.

In the future

Globally, we are at the beginning of a change in the way we source our energy

Conventional energy (fossil fuel based) is not infinite and, though there is currently a high supply of natural gas in the US, the means to extract this commodity are not benign.

Nuclear is also not benign, and, unfortunately, it takes a significant accident every few years to remind us of this.

Solar is a reliable, clean, long running, low O&M energy source – once the means of production (system) are installed, it can be relied upon to produce energy for 25 years or more. ROI is not the point, as it separates solar from its primary attributes.

During the last four years the industry has been promising to be the cheapest source when it should have been promising to be the highest value source of electricity. Time to change the story.

All technological (industrial) revolutions from the railroad to the telegraph, telephone, automobile and even the indoor toilet were initially expensive to execute and met with resistance. Progress may be painful but it is necessary and worth the effort.

Solar will pay a major role in the portfolio of energy solutions needed to power our future.

Industry Metrics

2010 Inventory into 2011: The megawatts of inventory, primarily on the demand side, at the beginning of 2011.

2011 Announced Capacity: All capacity, nameplate, run rate (commercial) or simply intended, that was announced for 2011.

2011 Announced Production: Manufacturer announced production does not necessarily correspond to what the manufacturer shipped, and, may or may not include outsourced technology. Module assemblers that do not develop the semiconductor technology (the cell) are often included in this number. Announced production is where double and triple counting is found, and is the primary culprit for oversizing PV industry shipments.

2011 Commercial Capacity: Run rate PV manufacturing capacity, that is, what is capable in a calendar year of producing commercial technology, factoring out equipment taken out of service, etc.

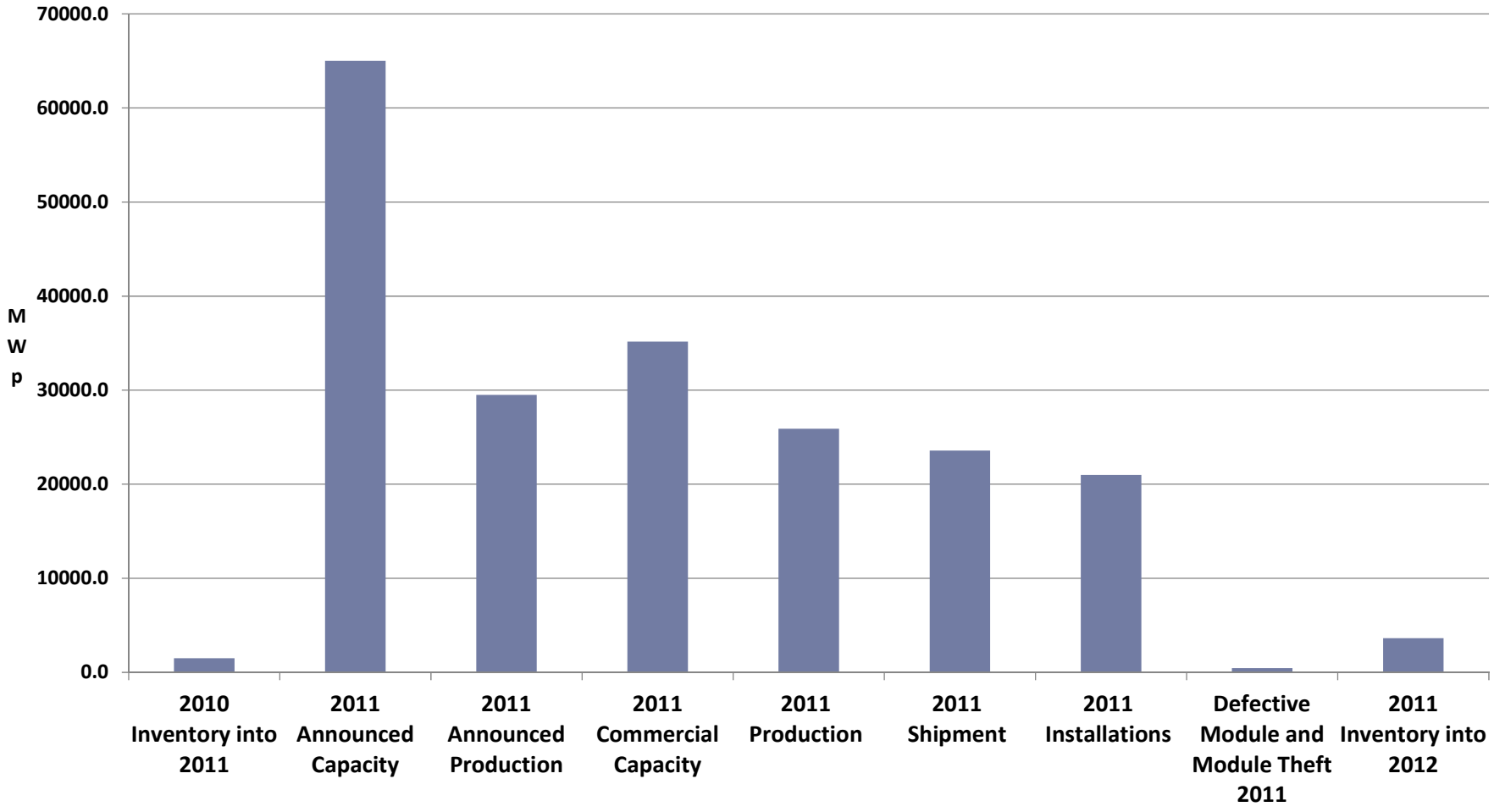
2011 Production: Technology produced, but not necessarily shipped, by the original technology manufacturer in the calendar year that is being studied.

2011 Shipments: Technology shipped from the original manufacturer to the first point of sale (first buyer) in the market. First buyers include installers, system integrators, retailers, distributors, module assemblers, end users and other technology manufacturers

2011 Installations: Technology that was installed in a calendar year. Installations include inventory lag, that is, the inventory represented by the first bar in the chart.

2011 Inventory into 2012: Megawatts of inventory, typically held on the demand side, at the beginning of 2012.

2011 into 2012 Global Statistics



High levels of inventory and manufacturing capacity will continue to be a problem throughout 2012
The difference between production and shipments is supply side inventory
The last bar is demand side inventory

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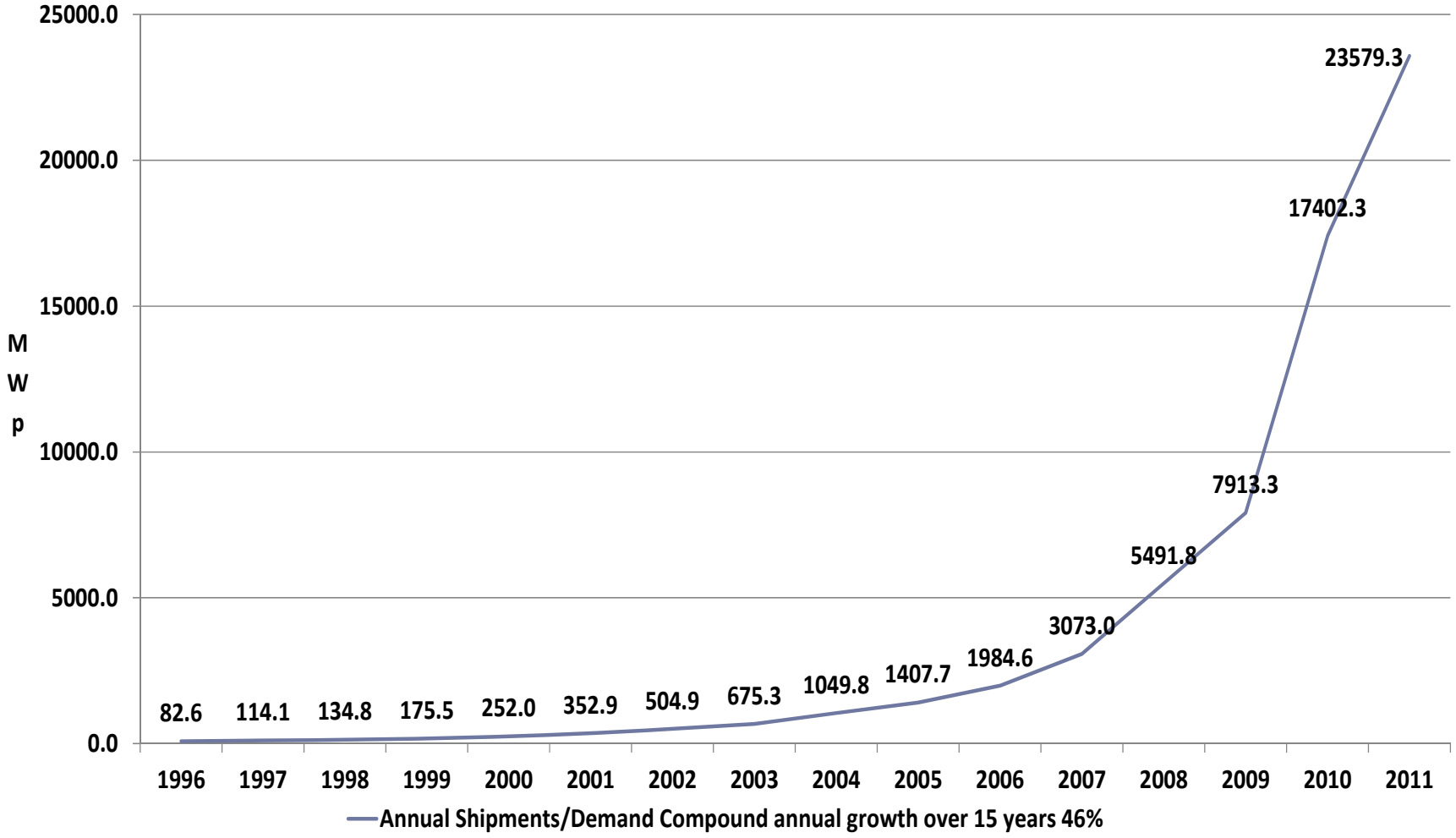
From 2006 through 2011 the PV industry had a 60% compound annual growth rate. From 1996 to 2011 the industry had a 46% CAGR

The high growth experienced by the PV industry is one hallmark of an immature industry
From 2004 through 2010 the PV industry behaved like a teenage boy that had just gotten his driver's license



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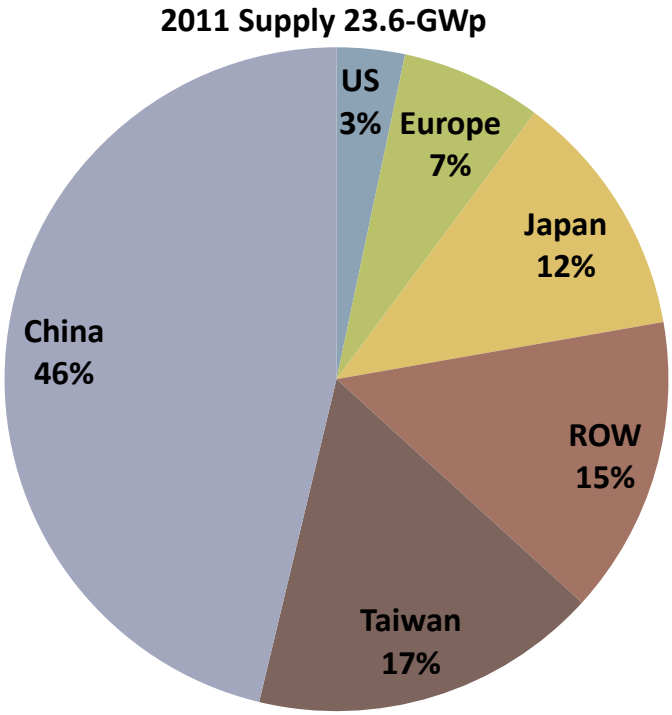
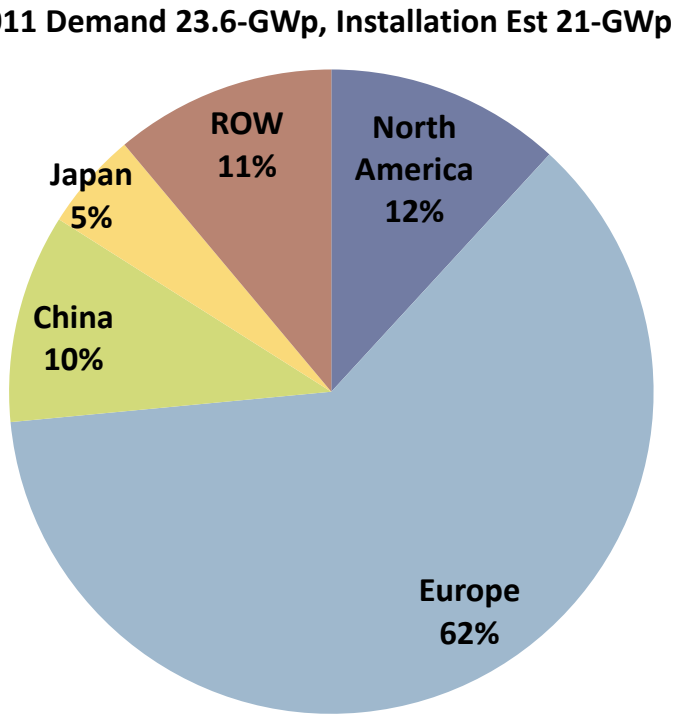
Part 2

Supply and Demand

2011 Supply and Demand shares





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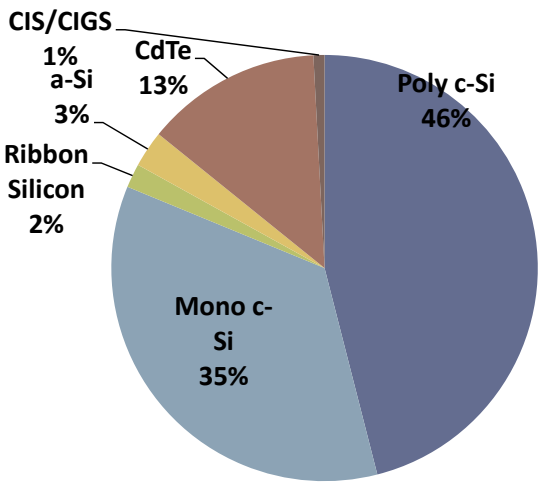
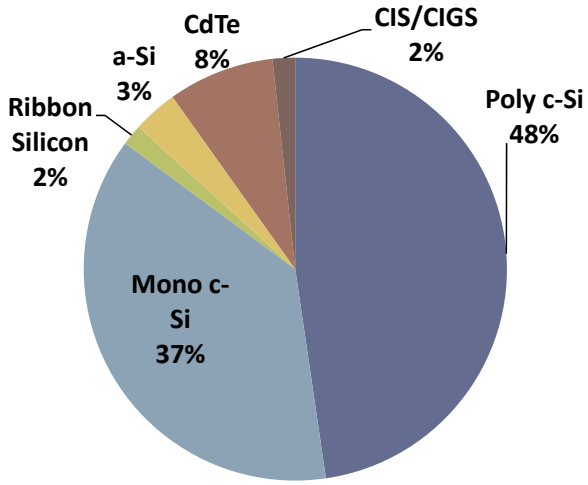
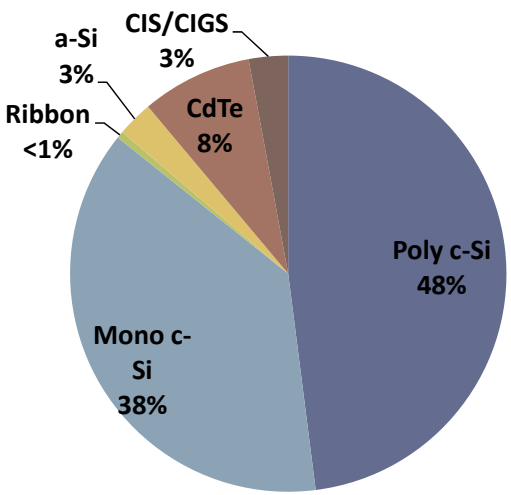
PV Technology Share, 2009, 2010, 2011



2009 7.9-GWp



2010 17.4-GWp



2011 23.6-GWp

Challenging times for thin film manufacturers who must compete with artificially low prices for c-Si.

Price is the ONLY competitive factor currently.

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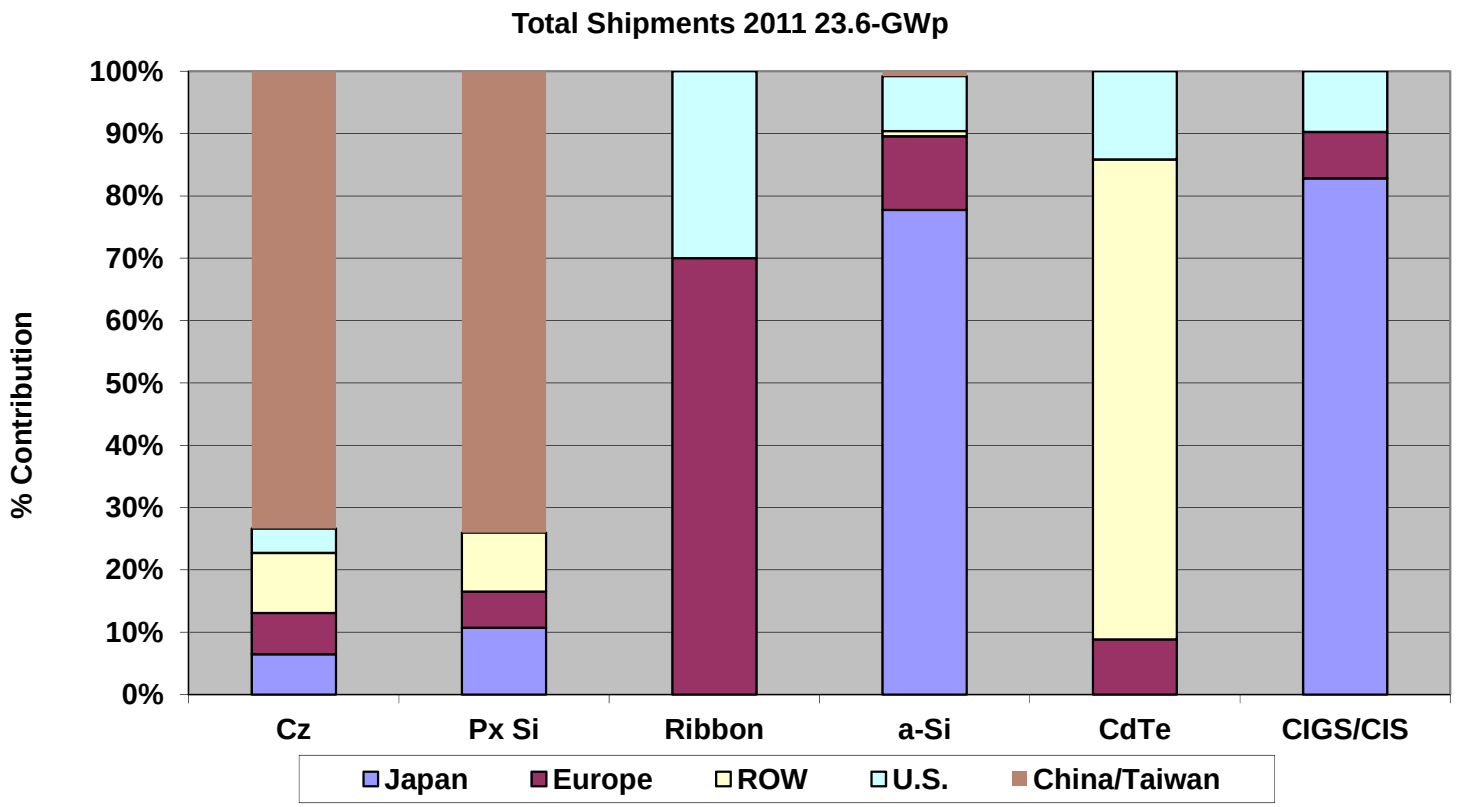
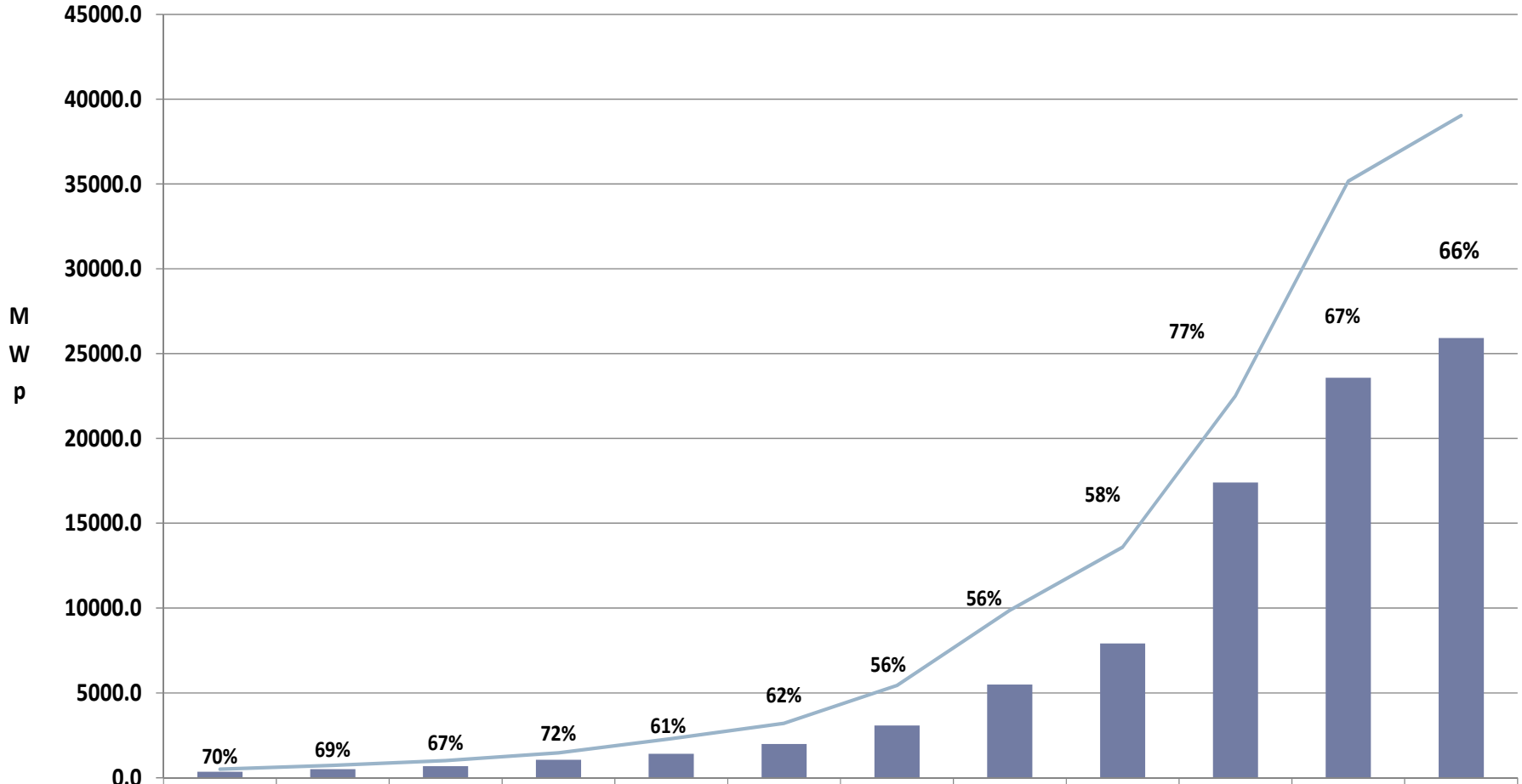
Regional PV Technology Share 2011



PV Industry Capacity



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 Est
Total Shipments	352.9	504.9	675.3	1049.8	1407.7	1984.6	3073.0	5491.8	7913.3	17402.3	23579.3	25915.3
Total Capacity	503.7	728.4	1002.3	1459.8	2303.3	3210.7	5442.6	9863.2	13588.9	22509.5	35165.7	39033.9

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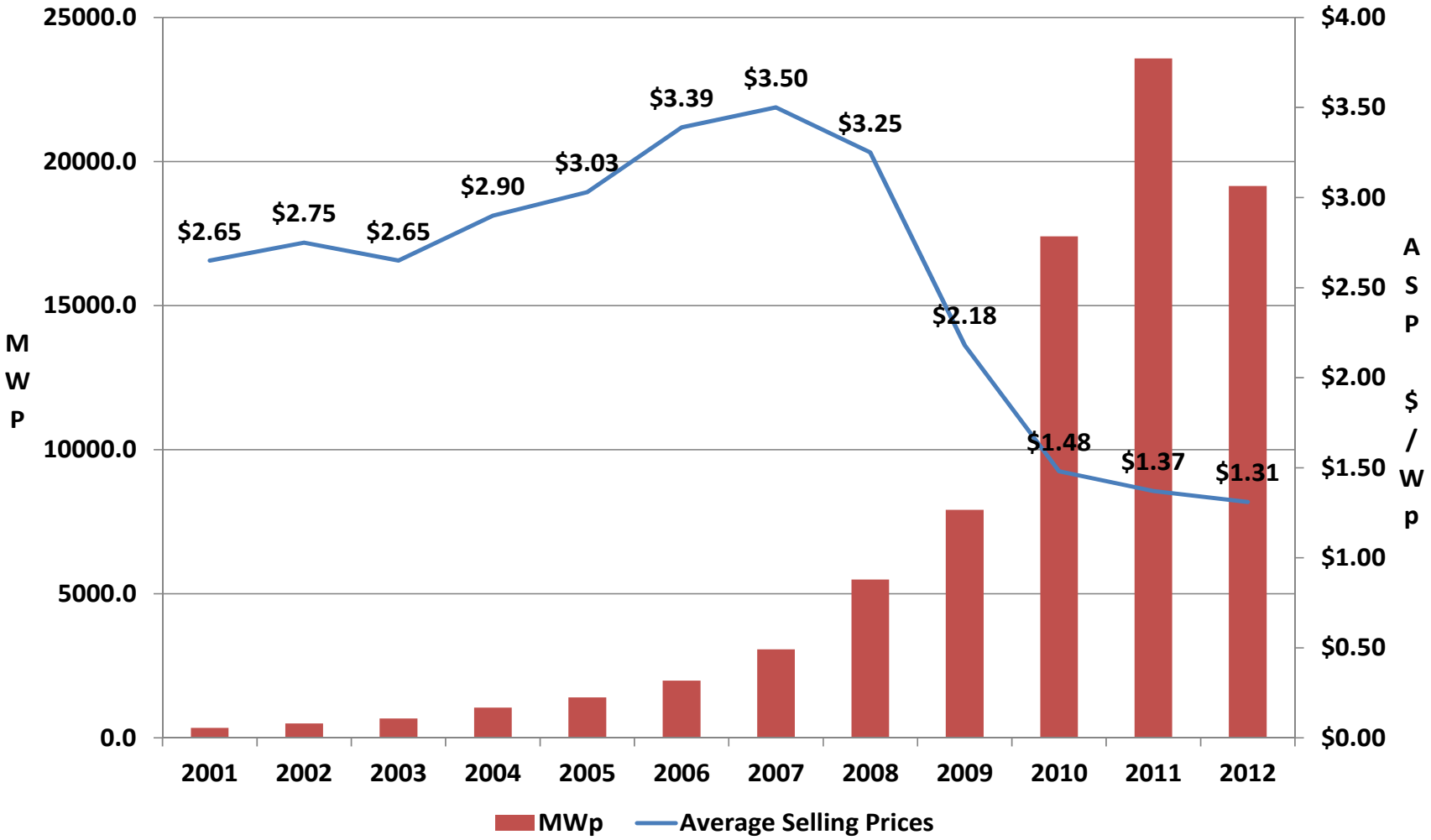
Part 3

Average Module Prices over time

Average module prices: Price is currently the most important competitive factor though, without bankability this loses meaning

The range for modules to first buyer s $0.50/Wp to $3.35/Wp* large quantity buyer average $1.28/Wp in 2011

Reselling of inventory is currently averaging 85 cents



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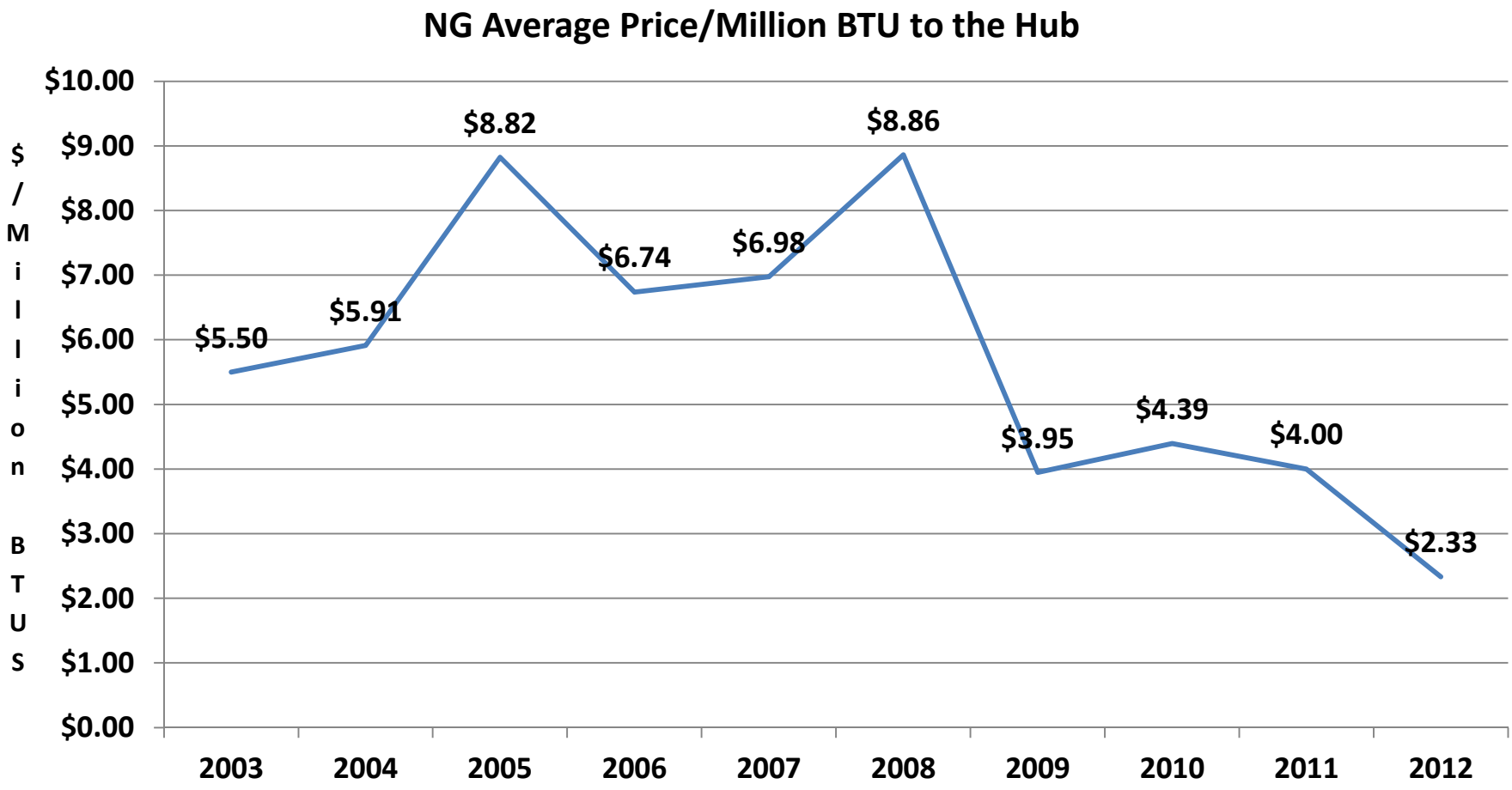
Natural Gas prices per million BTU to the Hub (annual averages)

Offered for comparison, competition with inexpensive NG high for all Solar Technologies



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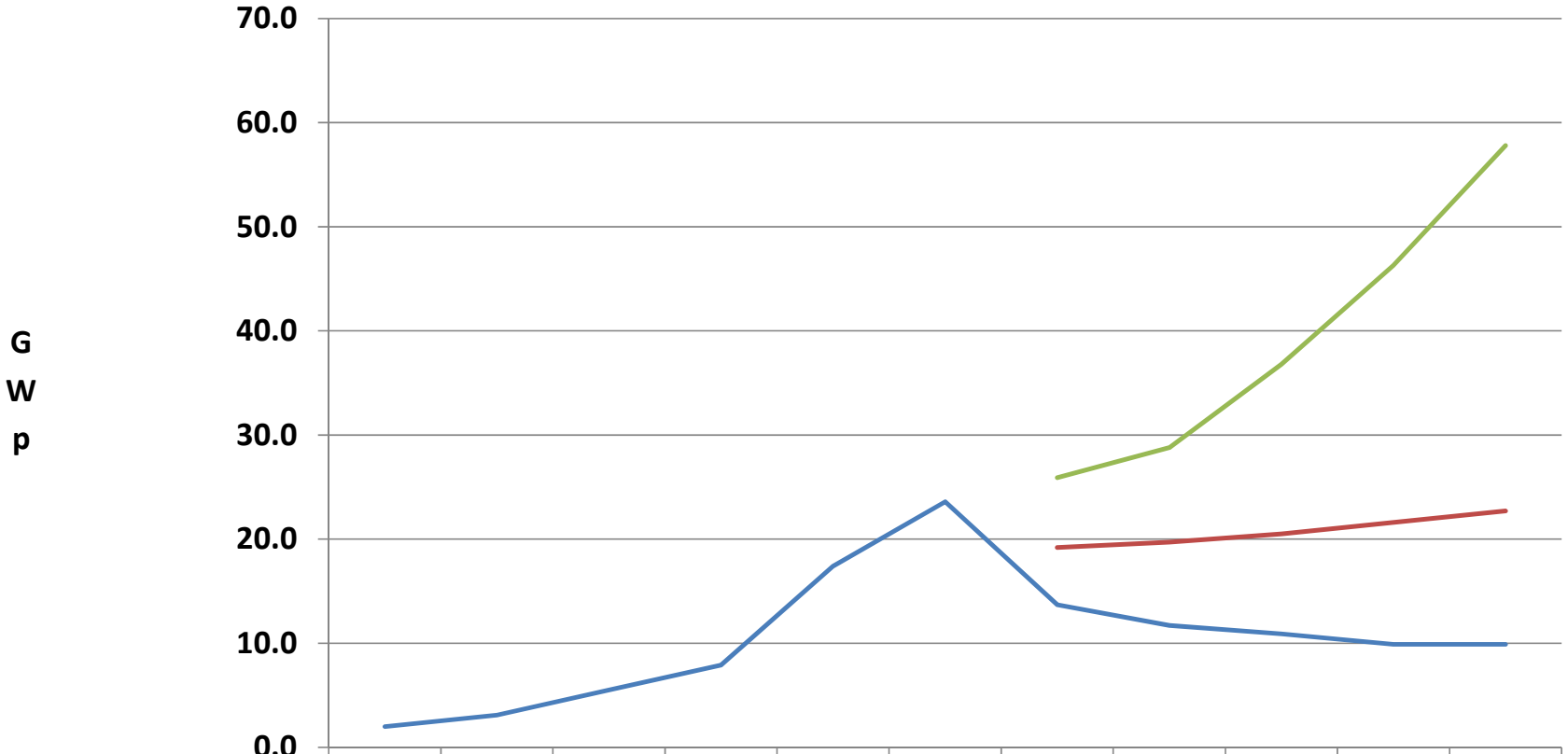
Part 4

The Future

Global Forecast: 2012 is a correction year for solar, with shipments at the conservative forecast or lower



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
History/Reduced Incentives	2.0	3.1	5.5	7.9	17.4	23.6	13.7	11.7	10.9	9.9	9.9
Conservative							19.2	19.7	20.5	21.6	22.7
Accelerated							25.9	28.8	36.8	46.3	57.8

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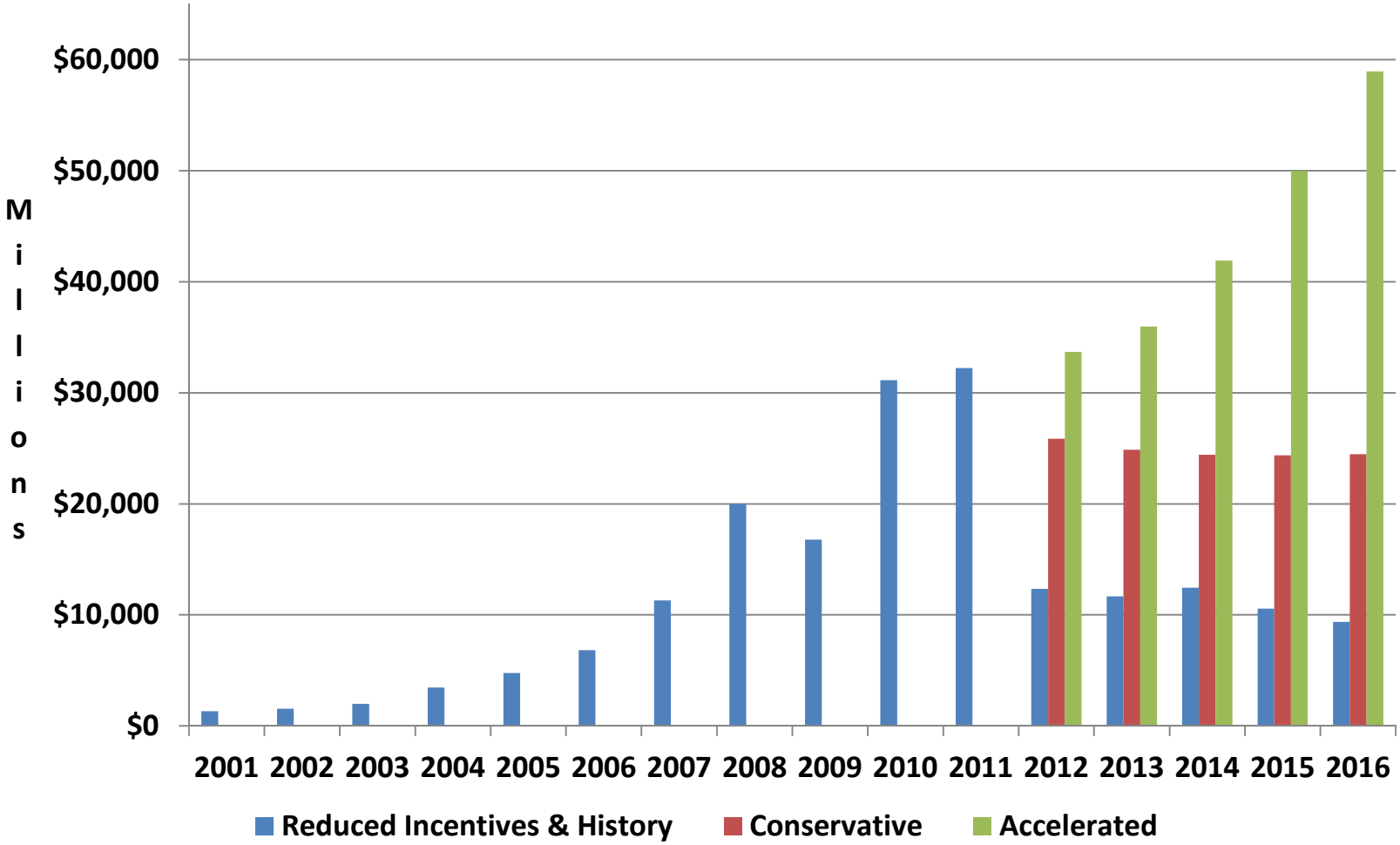
Global Revenue forecast for reduced incentives, conservative and accelerated forecasts, in 2011, revenues flat despite a 34% increase in shipments (sales)

Revenues for Japan decreased by 13% in 2011 over 2010, decreased by 48% for Europe & the US, and increased by 26% for the ROW and by 16% for China/Taiwan



Thank You!

Paula Mints, Principal Analyst, Navigant's Solar Services Program

Director in the Energy Division

pmints@navigant.com 650-849-1142

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Navigant Renewable Energy Service Offerings

We provide our clients renewable energy services from strategic planning through to project implementation.

Navigant Renewable Energy Service Offerings

- Go-to-market strategy
- Competitive positioning
- Market, geographic and partner prioritization
- Business model development and analysis
- Key relationship introductions
- M&A support

- Company/technology due diligence
- REC forecasting
- Job impact evaluation
- Incentive application support
- Policy support and analysis

- Technology evaluation
- Independent engineer support and red flag project review
- Transmission and interconnection analysis
- Project finance and closing
- RFP review
- PPA negotiations

Navigant Solar Service Program and former BTM Consult Provide Primary Market Research on Solar and Wind Supply and Demand

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