



## **SPV Market Research Solar PV Supply and Demand 2018: Is this a crossroads for the PV Industry?**

**Paula Mints**

**1408-221-1564**

**[pmints@spvmarketresearch.com](mailto:pmints@spvmarketresearch.com)**

**[www.spvmarketresearch.com](http://www.spvmarketresearch.com)**

**[www.paulamspv.com](http://www.paulamspv.com)**

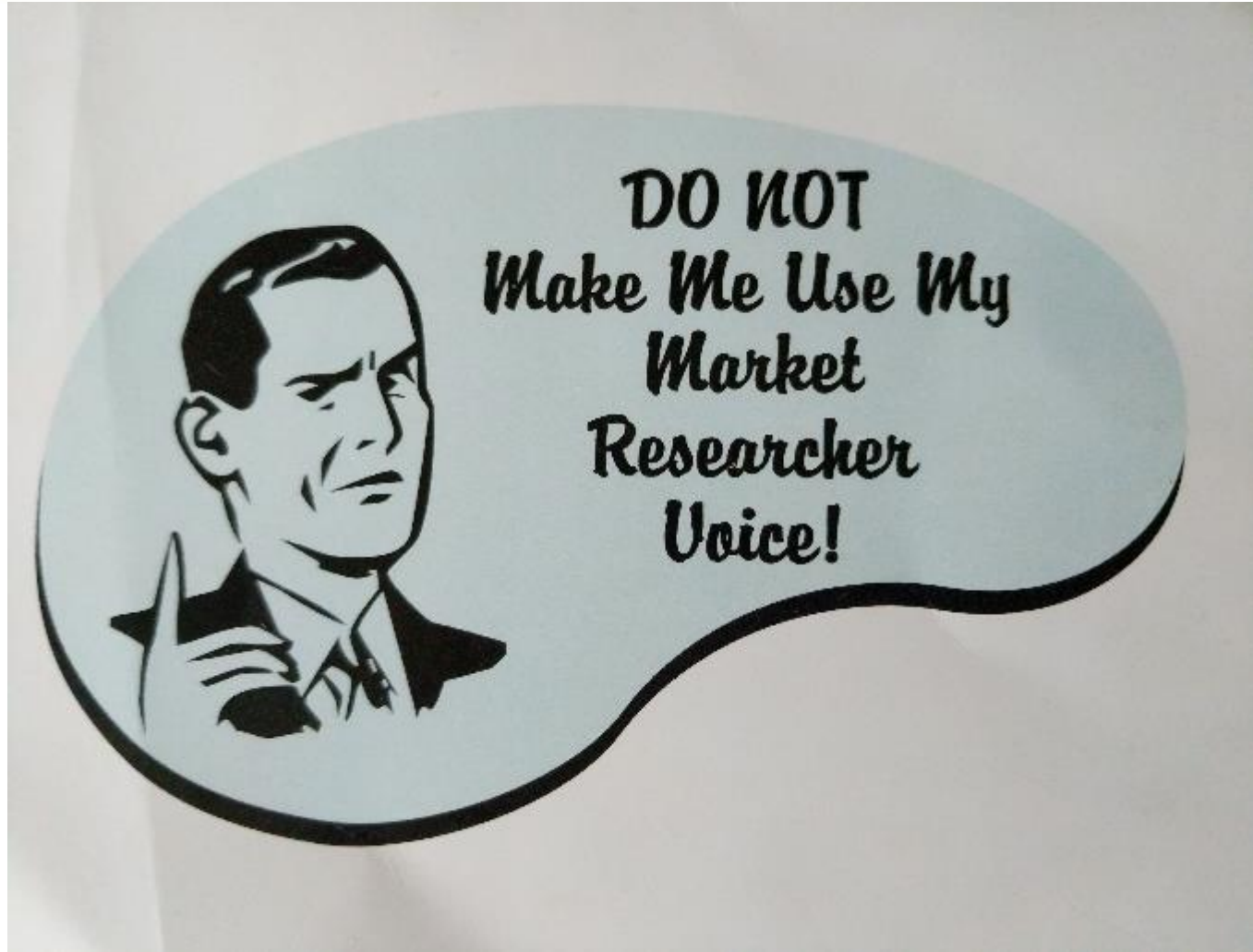
“Research is a slow rigorous process that does not lend itself to sweeping conclusions.” John Oliver, comedian, political commentator, television host and actor

“Anyone who thinks that exponential growth can go on forever in a finite world is either a madman or an economist.” Economist Kenneth Boulding

The market researcher’s conundrum: “Your analysis does not conform to my preconceived notions, so my gut instinct is telling me that you are wrong.” Dilbert’s Pointy Haired Boss

Poet Antonio Machado: Sólo el necio confunde valor y precio (Only fools confuse value and price)





**2018 was another tumultuous year in a historically tumultuous, and young, industry. A short recap as we move into 2019:**

India continues to delay tenders due to low interest. The market is expected to be flat to slightly lower..

China's market for PV deployment expected at 43-GWp to 49-GWp, an expected decrease over 2017 53-GWp. Central government attempting to slow all infrastructure building in a way that does not negatively affect employment. As a result, manufacturers have tended to ignore tariffs when shipping product to US.

EU ended its MIP and the markets in various countries show signs of increasing primarily driven by government mandated bidding schemes.

Latin America: Market in Mexico did not increase as expected. Other markets problematic due to fragile economies and unstable political climates

The US: Capacity announcements from several manufacturers (Hanwha, Jinko Solar, LG, SunPreme, SunPower (acquisition of SolarWorld) moving more slowly than previously announced and, other than SunPower's resuscitation of SolarWorld, unlikely to reach announced capacities. Meanwhile, the original 2012 tariffs are up for review and the high likelihood is that they will be extended. SunPower (new owner of SolarWorld) would have to step up and argue against them for the tariffs to sunset.

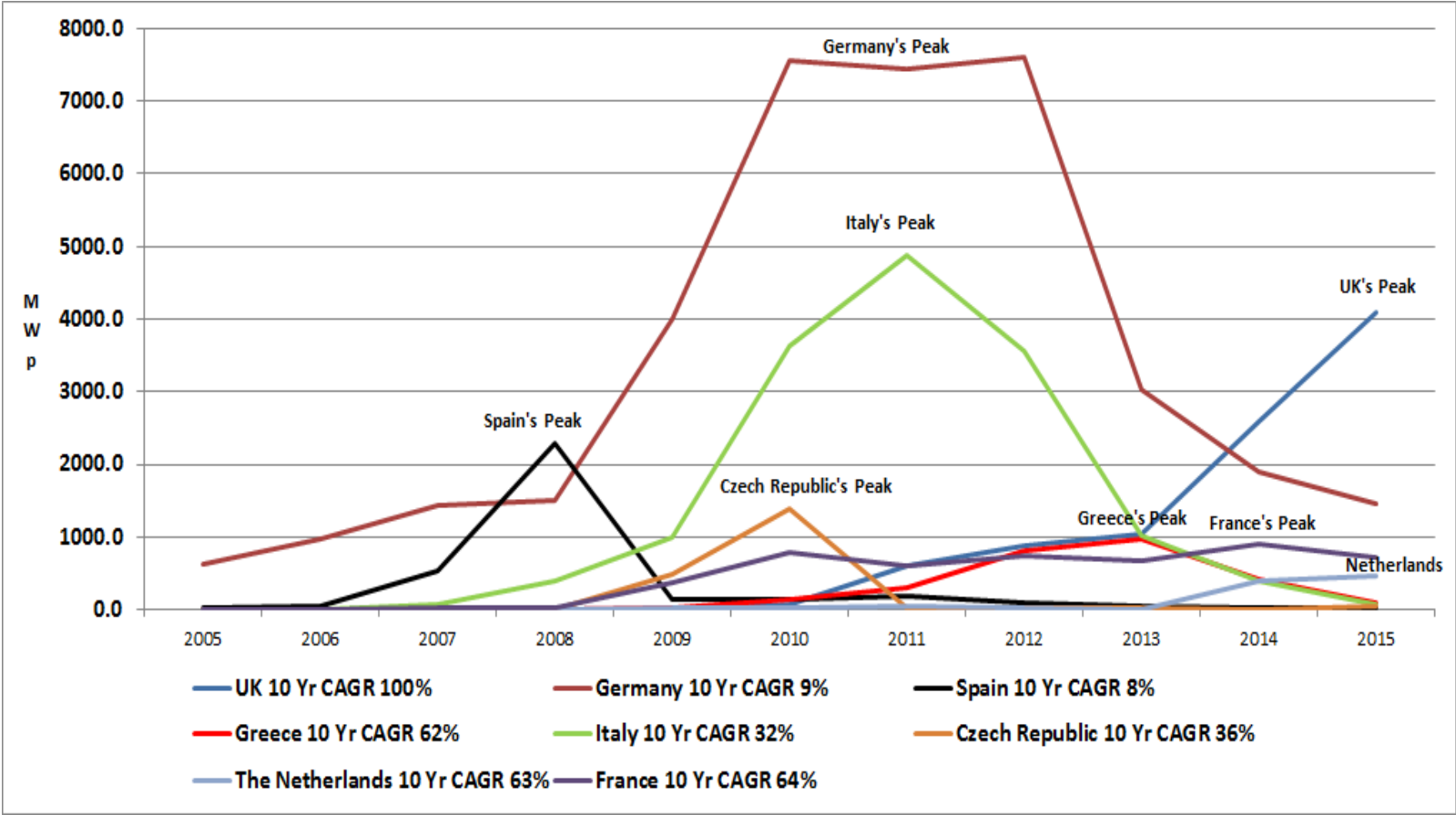
Concerning module prices, the slowing market in China overrode tariff concerns as manufacturers from China largely absorbed the tariff and others were forced to compete in kind. Module prices have not hit bottom yet and consolidation is likely.

PPA/Tender bidding continues to decrease as governments set minimum and maximum bid expectations based on the cost of components without considering whether the margins are sustainable (India a good example of an unsupportable market)

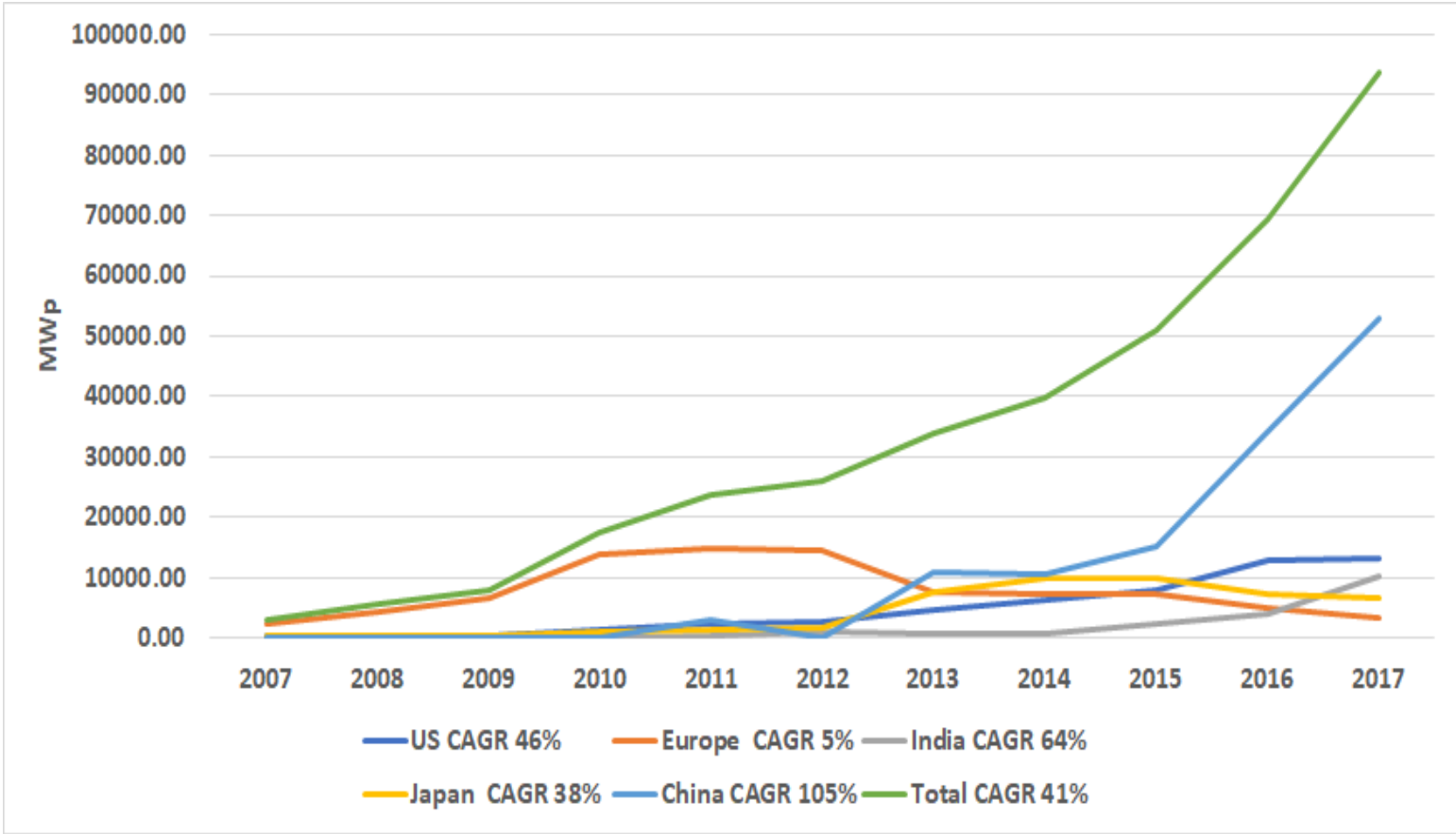
# The Rise and Fall of Markets during the FiT Period in Europe

Europe serves as an example of the volatility of incentive, subsidy and mandate driven markets  
 All energy markets are subsidized at some point in the chain  
 Solar is no different.

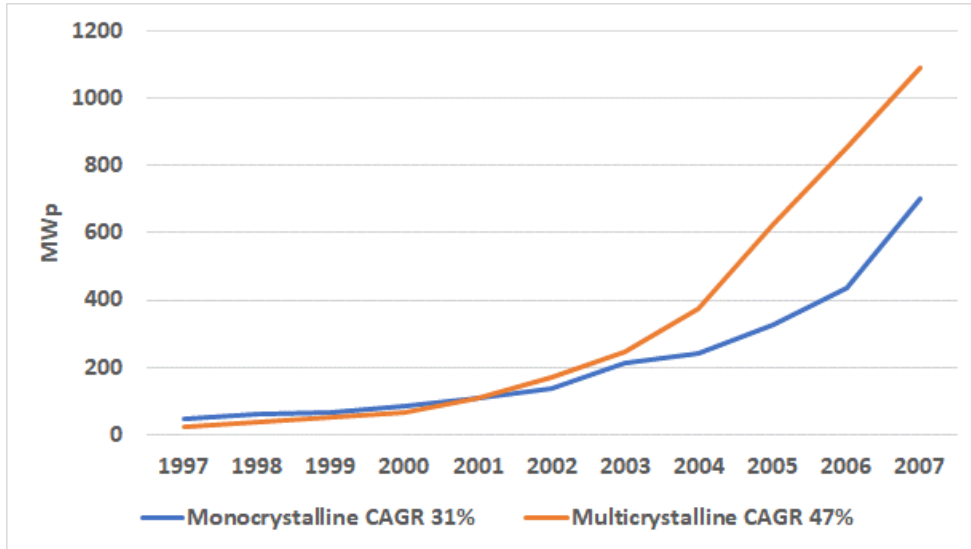
Mandates are the current policy driving solar, that is, government auctions for set MWs.



# Shifting Demand is a PV Market Constant

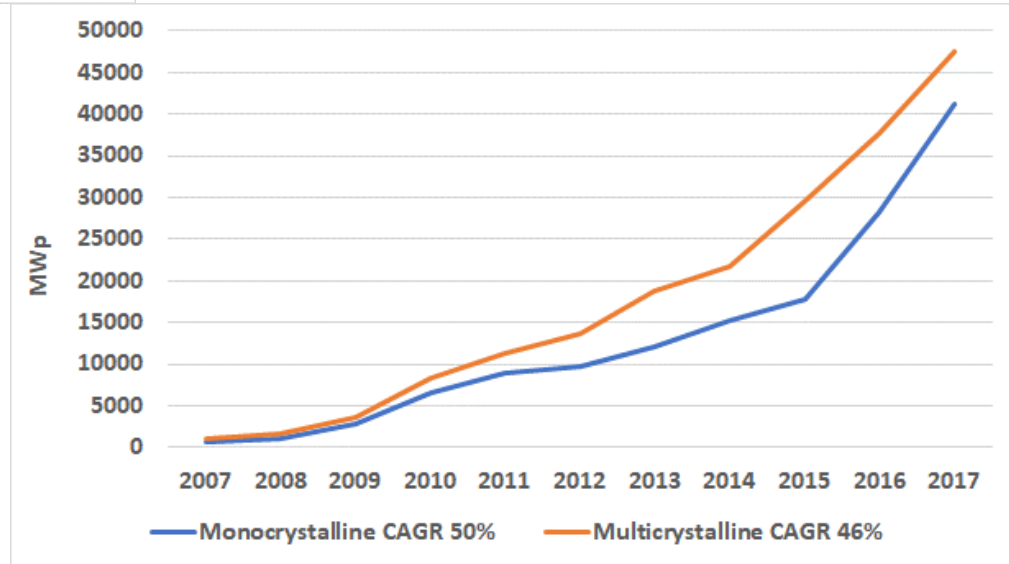


# Crystalline – Mono the leader, then Multi the Leader, is Mono the Future?



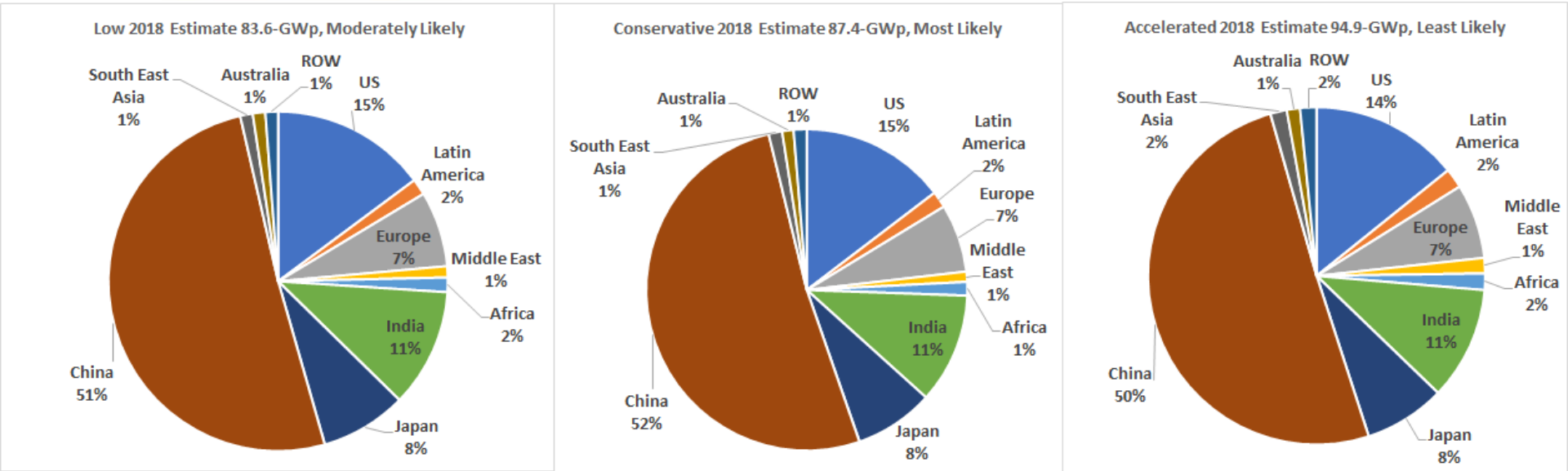
1997 through 2007: Lower manufacturing costs & slight margin advantage for multi drives demand & multi begins to dominate shipments in 2002

2007 through 2017: Shipments of multi dominate with mono, particularly p-type, gaining share in 2017 under the assumptions of slight price premium for PERC





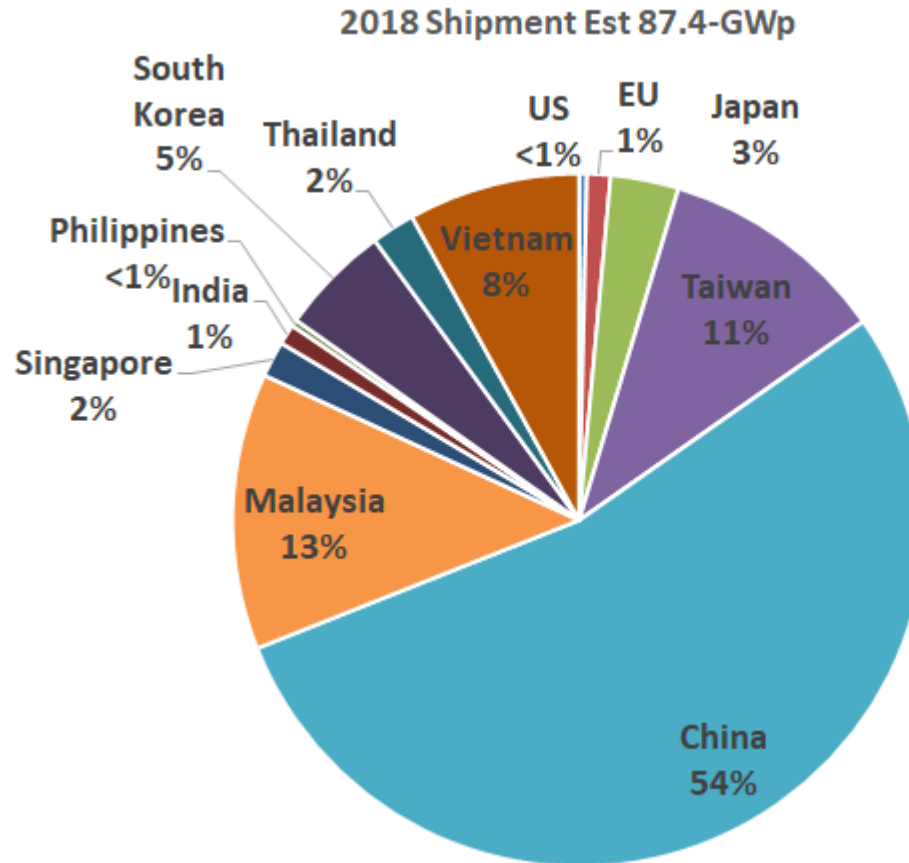
# 2018 Estimated Demand



China’s market for PV deployment slowed in 2018 following efforts by the Central Government. The orphaned capacity currently has no market available to readily absorb the excess. Low prices are leading developers to buy and inventory the excess, thus potentially shifting up to 11.3-GWp of demand side inventory into 2019 and indicating another slow growth year.



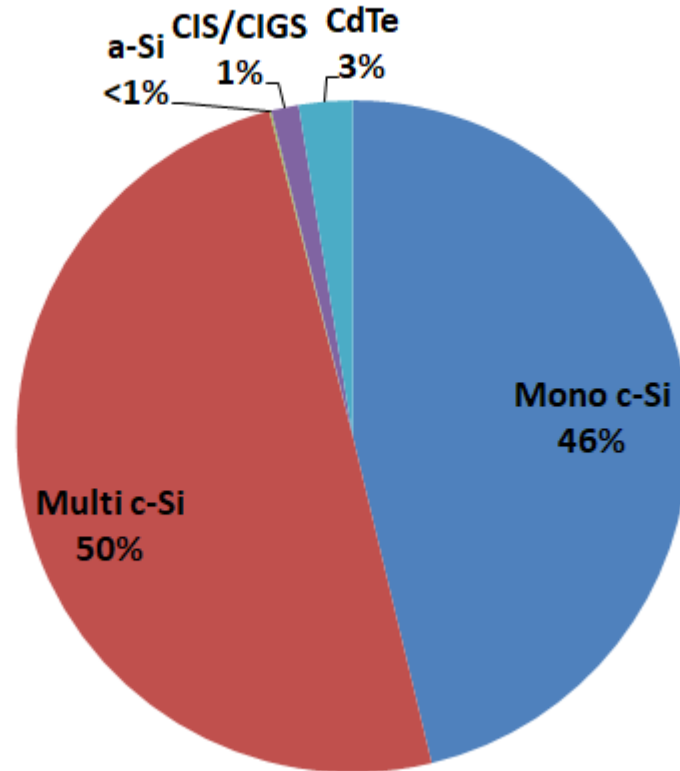
China continues to lead in capacity and shipments with Malaysia, Taiwan and Vietnam increasing in Activity.



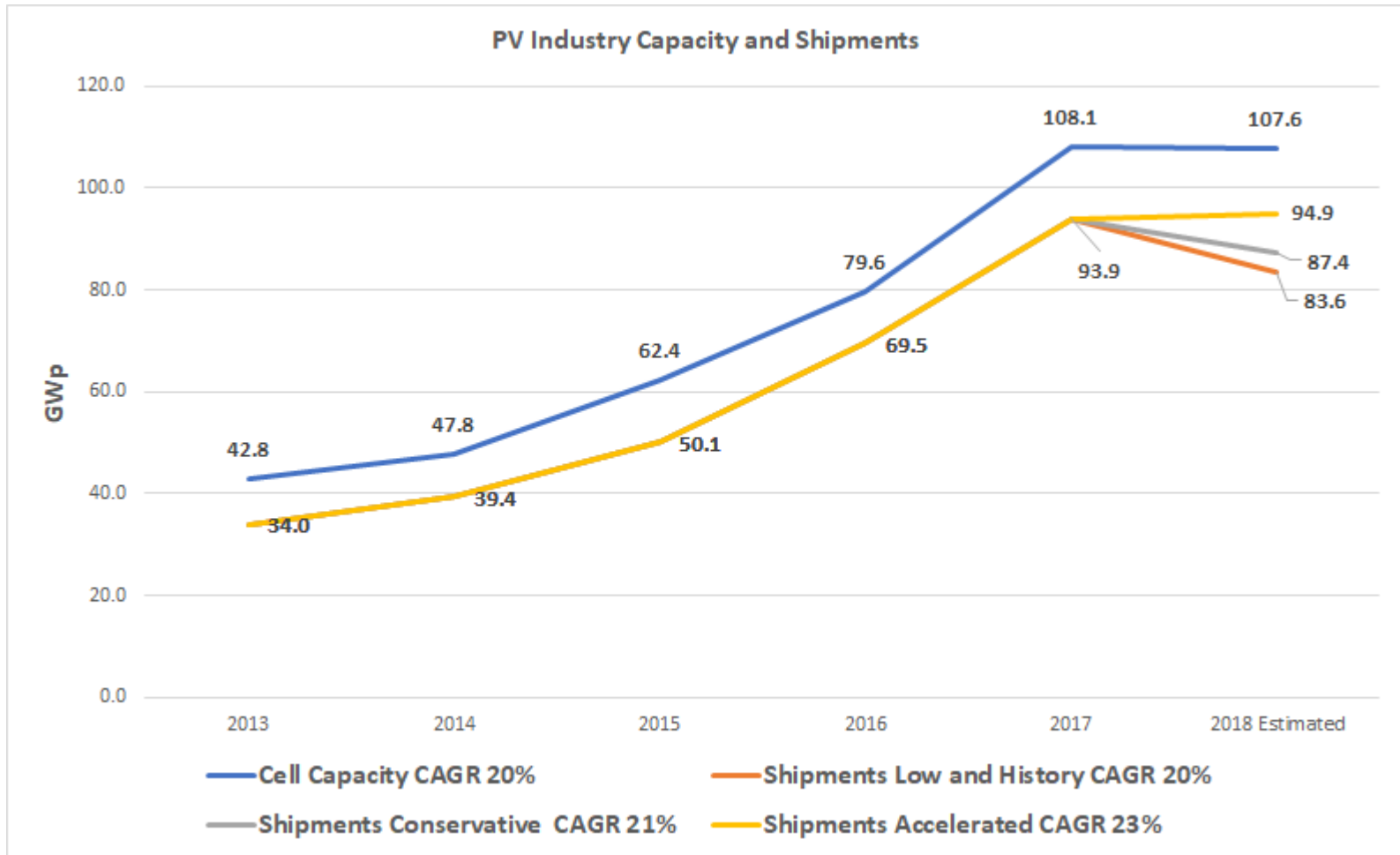
Multi continues to lead, with Mono gaining Share as manufacturers shift to P-type PERC.

There is also growing interest in N-Type As a premium product category.

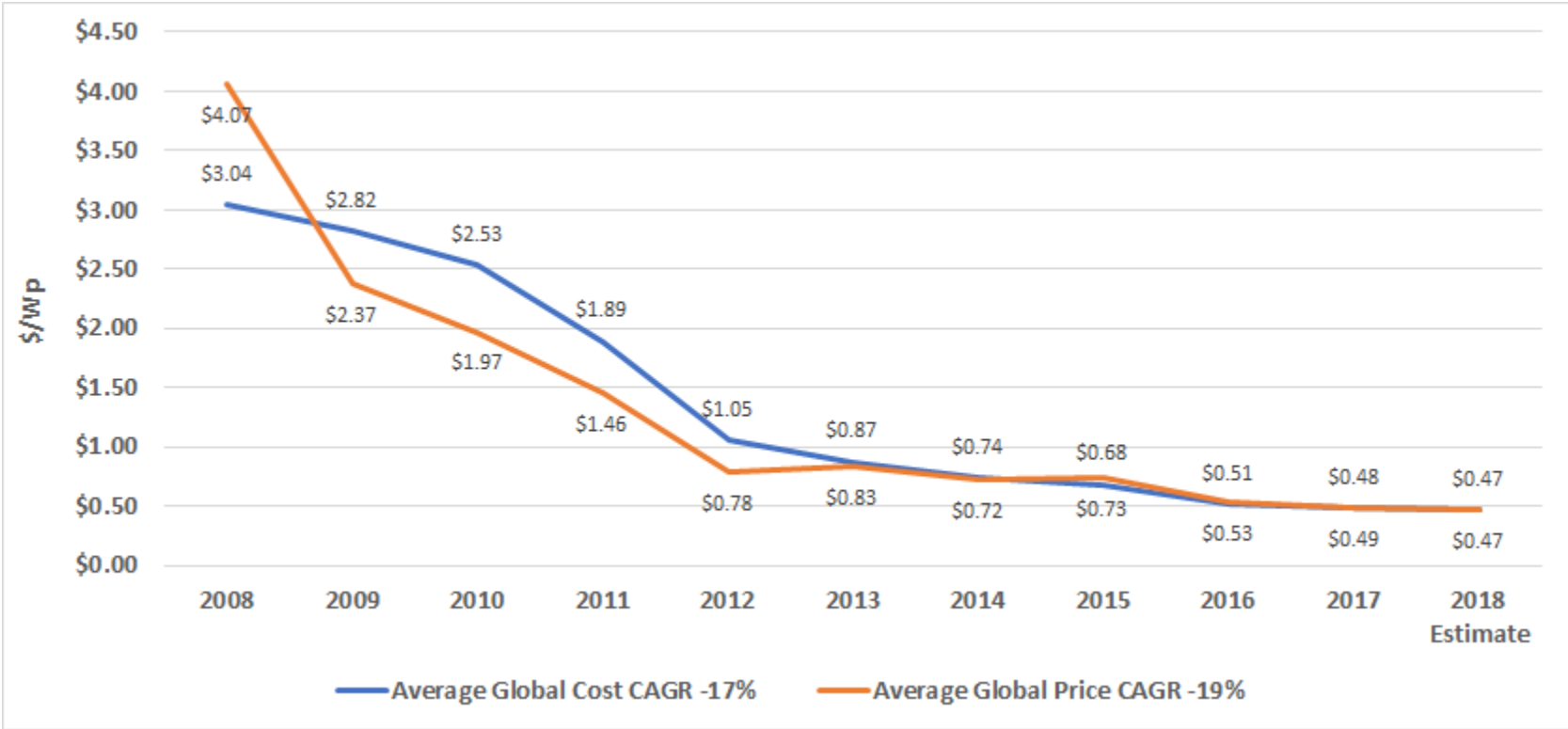
**2018 Estimated Shipments 87.4-GWp**



# Shipments 2013 through 2018 Estimate



# PV Industry Cost, Price and Shipments, 2008 - 2018



Following the slowing of China’s market for PV deployment, prices to the first buyer dropped in some cases to <\$0.30/Wp – prices this low are not the average.

Continued low pricing has encouraged manufacturers, such as SunPower, to shift to larger wafers in an attempt to control costs.

**Is the solar industry at a crossroads?**

**For decades PV manufacturers have had to choose between sales (shipments), industry growth and margins.**

**It chose growth over margins.**

**The PV industry has the lowest margins of other like industries – for example: Coal 40% to 50%, Iron and Steel 20%, Construction ~30%, Appliances 30%, Aluminum 20%, Industrial Machinery and Components 40%, Aerospace 40% and Agriculture 8%.**

**PV industry margins are on a par with agriculture.**

**On the demand side, low bidding at auctions threaten quality in the field and higher O&M costs – already underfunded.**

**Eventually the industry will need to choose between growth and margins, focusing on finding a balance.**

**Meanwhile governments, which widely hold that access to electricity is a right, will need to choose to support a switch in the way electricity is sourced and in doing so take a firm stand on climate change.**

Economist Kenneth Boulding said: Anyone who thinks that exponential growth can go on forever in a finite world is either a madman or an economist.

The problem with jumping to conclusions is that once the goal is reached it is almost never worth the leap – objectivity and consideration should always be the goals of research.



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“There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle.” Albert Einstein



Paula Mints, Founder, Chief Market Research Analyst  
1408-221-1564, [pmints@spvmarketresearch.com](mailto:pmints@spvmarketresearch.com)  
[pmints@spvmarketresearch.com](mailto:pmints@spvmarketresearch.com)  
[www.spvmarketresearch.com](http://www.spvmarketresearch.com)  
[www.paulamspv.com](http://www.paulamspv.com)