



# **Seminar on Renewable Energy Technology implementation in Thailand Experience transfer from Europe**

*co-organised by  
the Delegation of the European Union to Thailand and  
the Department of Alternative Energy Development and  
Efficiency, Ministry of Energy*

Development of Thailand's PV Roadmap

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# Outline



- Context: why solar PV Roadmap
- Current Limitations of Thailand's Solar Policy
- 2 Big, Game-Changing Trends
- 4 Myths about Solar Energy in Thailand that are misleading policy design
- Prioritized Actions in the Solar Value Chain

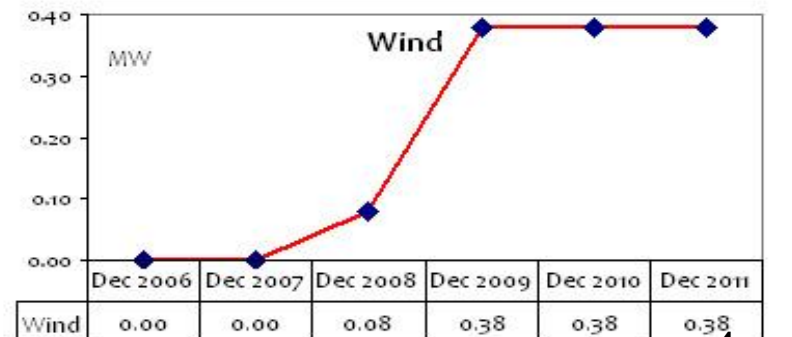
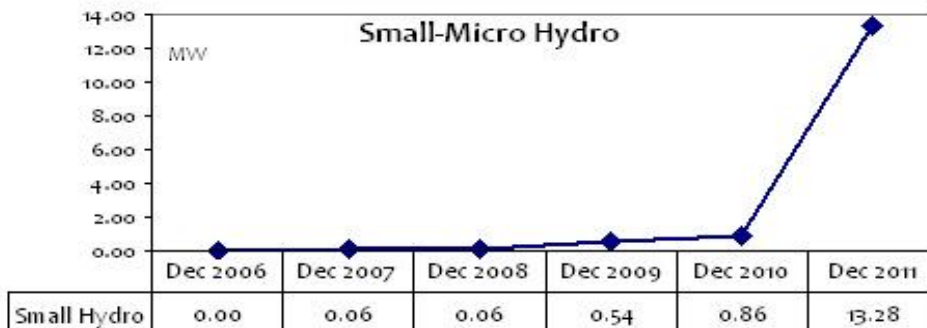
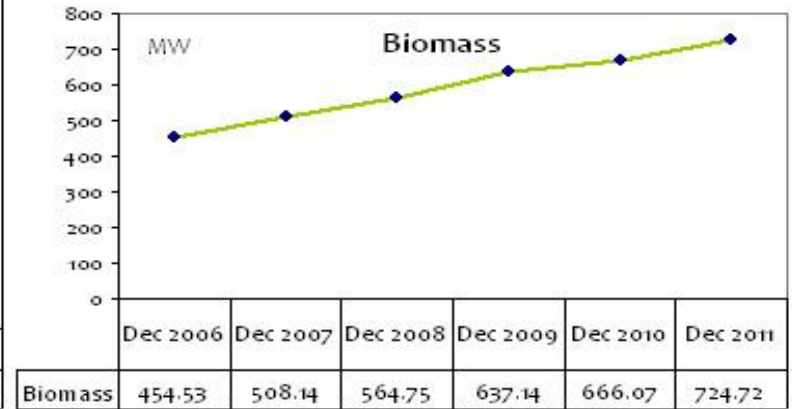
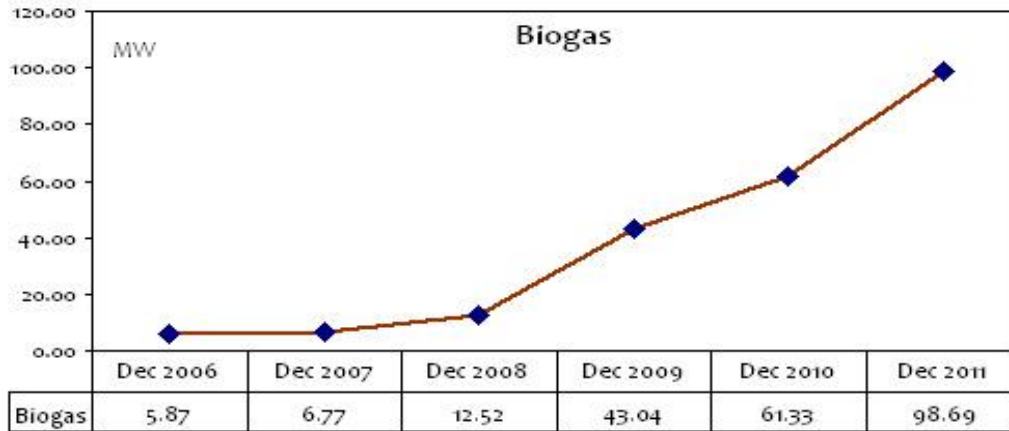
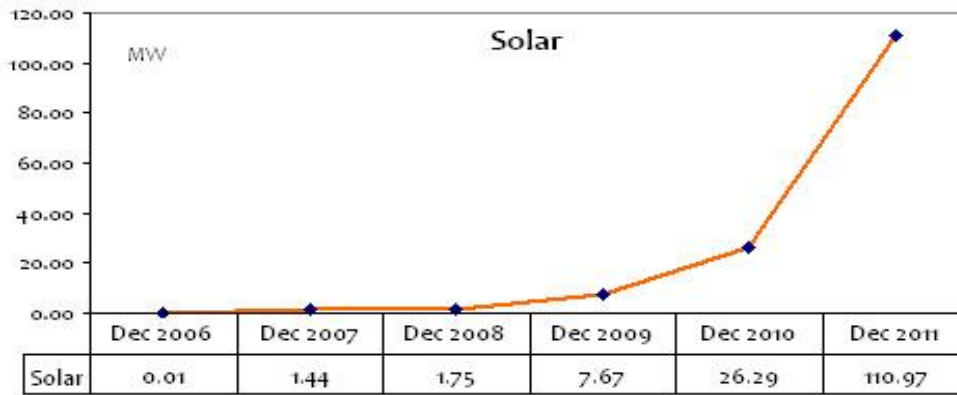


# Context



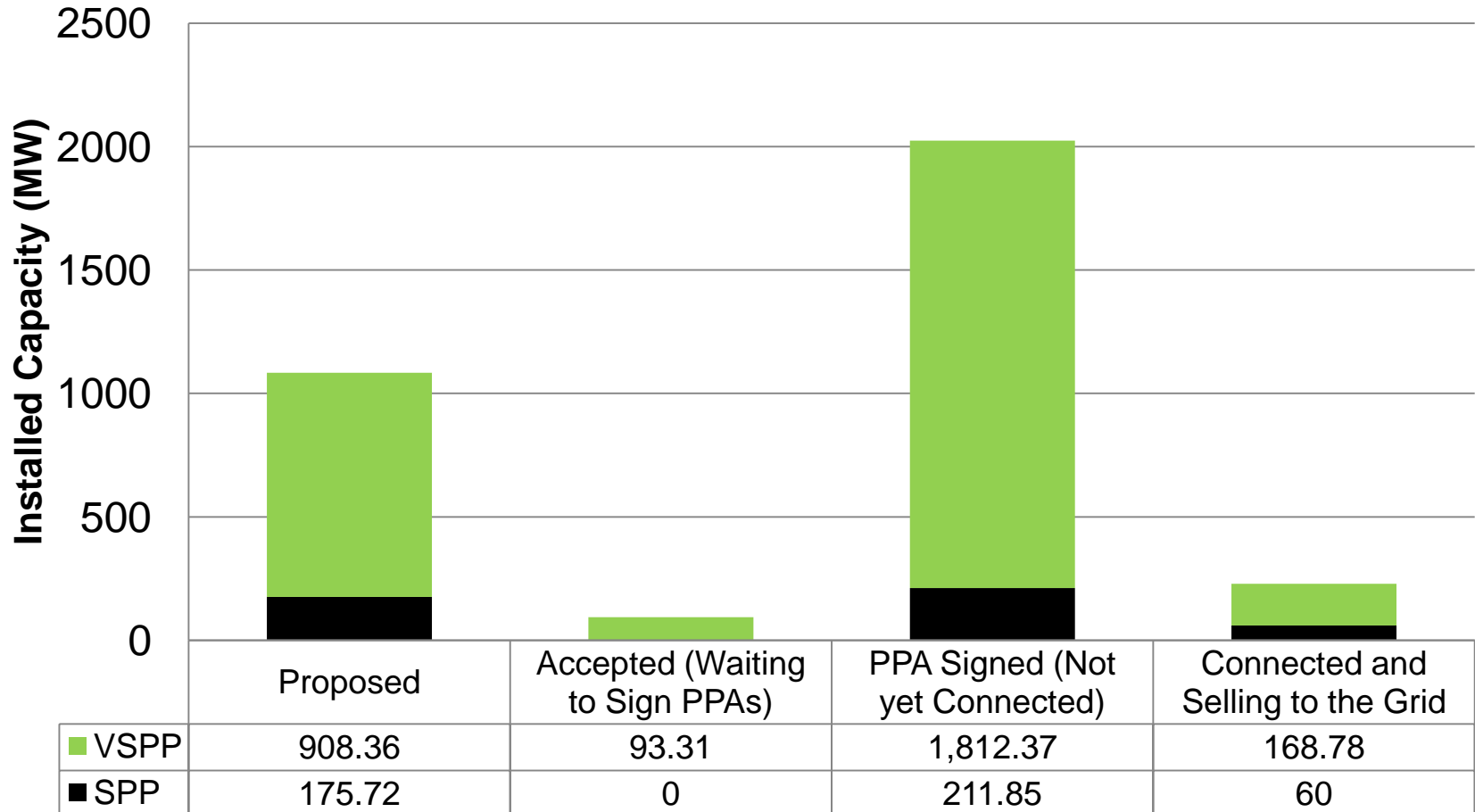
- Thailand's solar target (AEDP 2012-2021)- highest among ASEAN countries
- Highest growth rate among all renewables
- Strong investors' interest...lots of opportunities for market expansion
- However, challenges exist in the management of support measures, regulation, and grid integration.
- Opportunities for developing a roadmap based on shared vision of different stakeholders

# Trends in Thailand's Grid-Connected RE



# Thailand's Solar Capacity

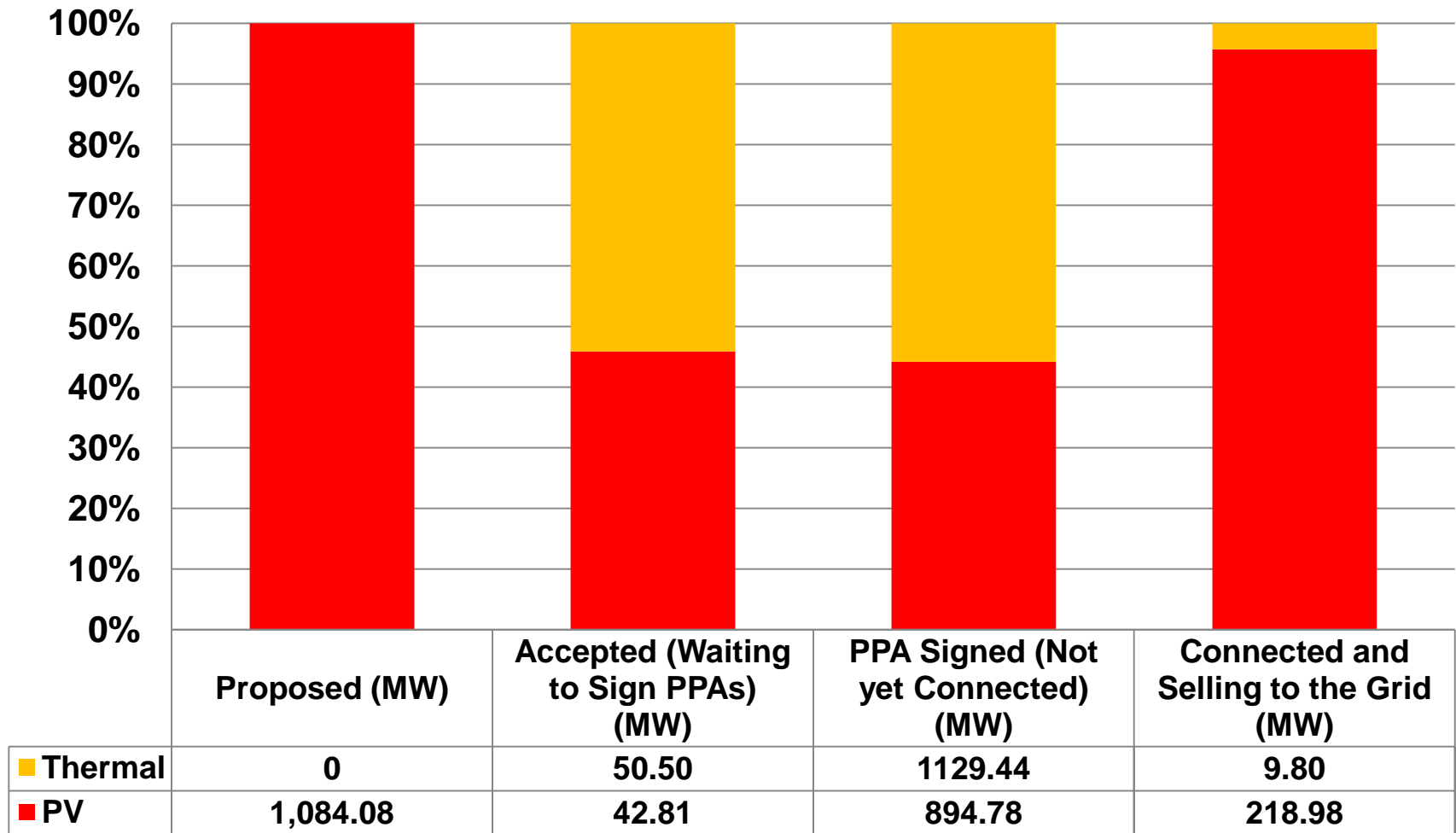
(Status as of March 2012)



Source: Analyzed from EPPO (March 2012)

# Thailand's Solar Systems by Technology

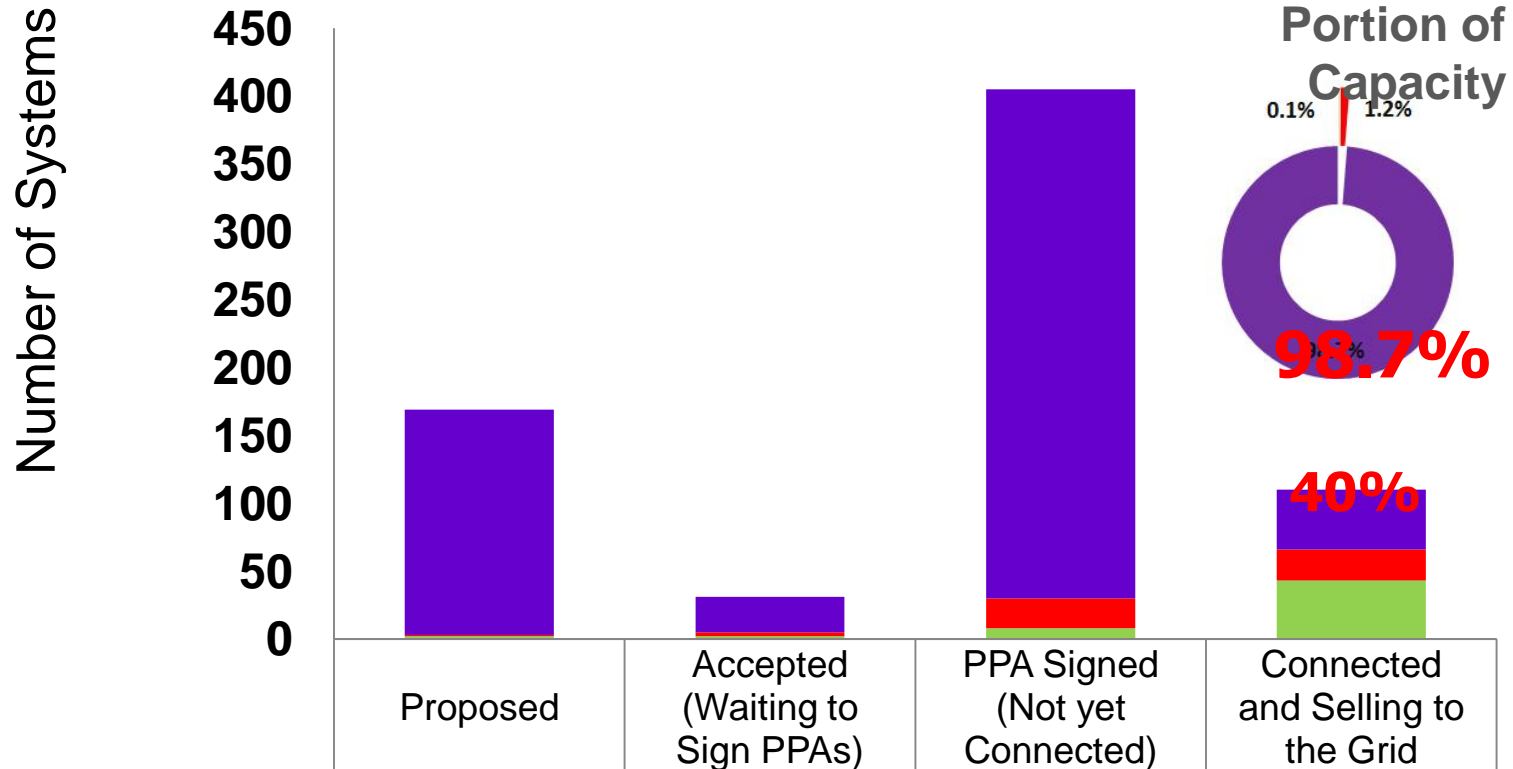
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Source: Analyzed from EPPO (March 2012)

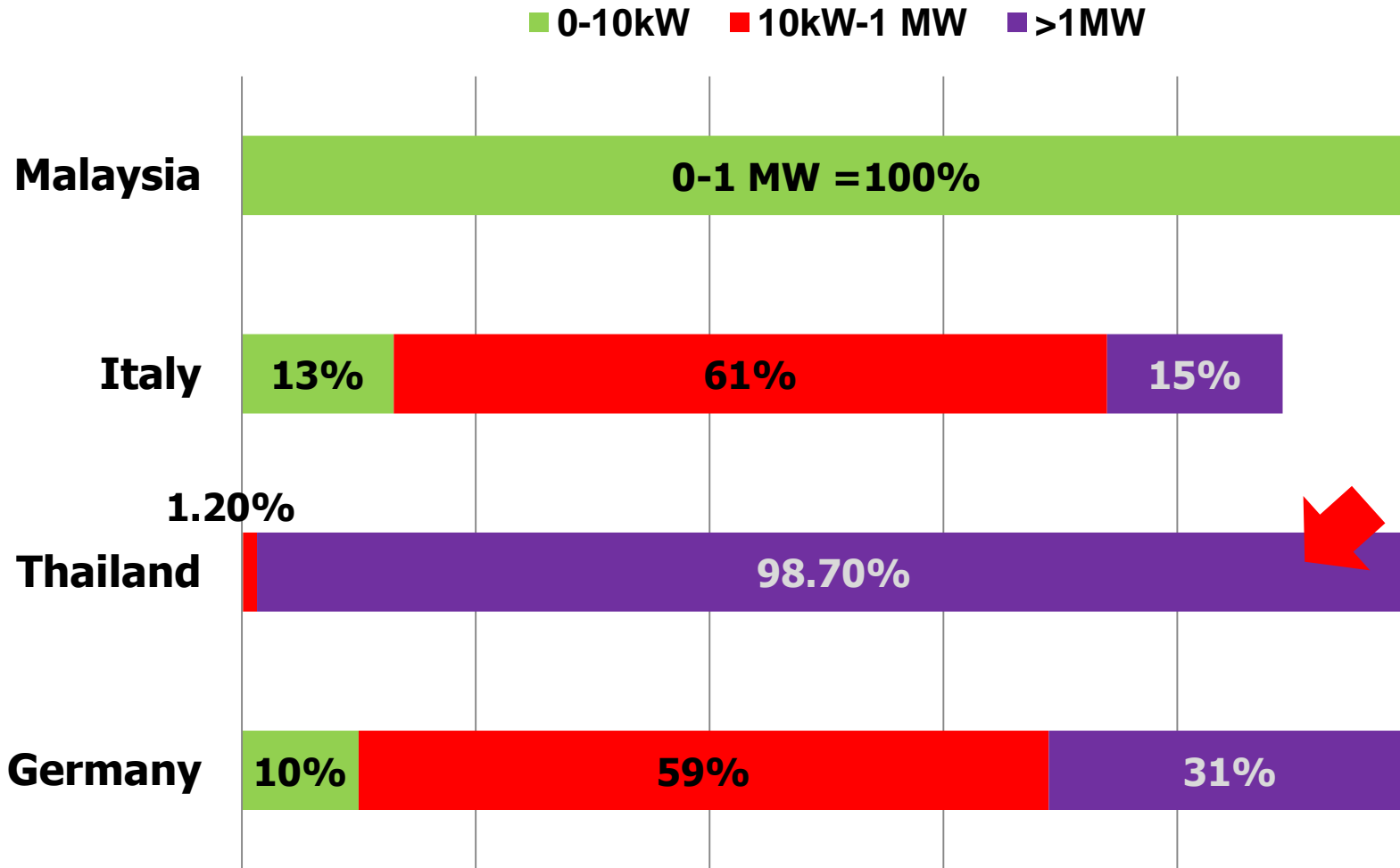
# Thailand's Solar Market Segmentation: System Sizes

(Number of Systems as of March 2012)



■ Utility-Scale (SIZE ≥1MW)	166	26	375	44
■ Commercial (10kW ≤ SIZE <1MW)	1	3	22	23
■ Residential (0 <SIZE <10 kW)	2	2	8	43

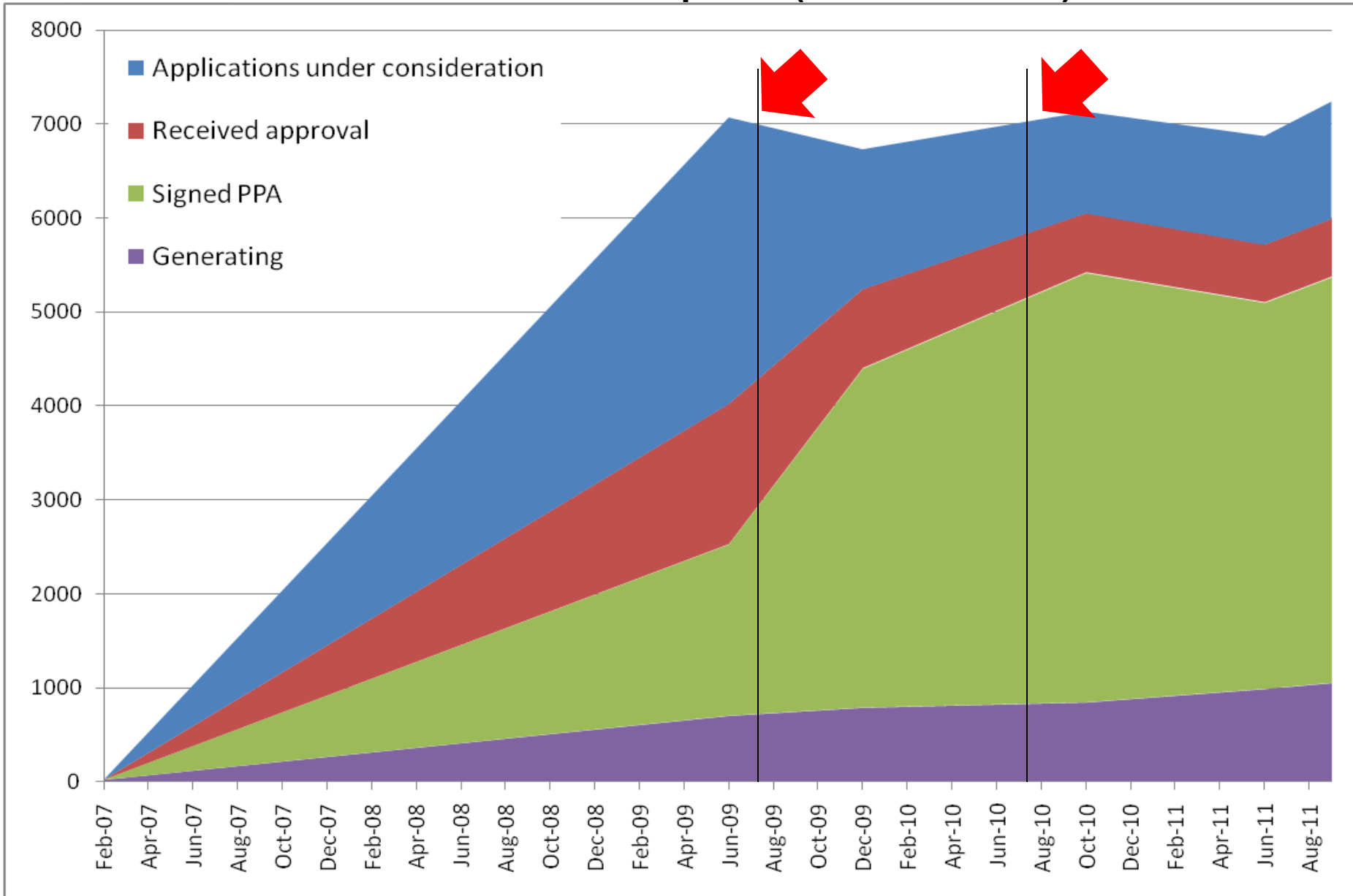
# Proportion of Installed Solar Capacity by Scale



**Source:** Analyzed from Malaysia---SEDA (2012); Italy –Renewable Energy World (2012); Thailand –EPPO (2012); Germany --Schoenfeld (2012)



# Trend of MW in the Pipeline (All Renewables)



“Healthy Pipeline?”

# Current Limitations of Thailand's Solar Policy

- One policy, one measure, one price –for too long
- Simplified and streamlined regulations, previously designed for <1MW; since 2006 applied to >>1 MW
- A lack of monitoring and evaluation system results in policy and measures that are not quick enough to adapt to rapidly changing market conditions
- A lack of clear objectives for solar energy support
- A vision will yet to be developed

# Thailand's Solar PV Platform

Open Space for  
Discussion



Ideas and Data  
Exchange



Awareness Raising



Joint Fact Finding



Collaborative Policymaking:  
**PV Roadmap**

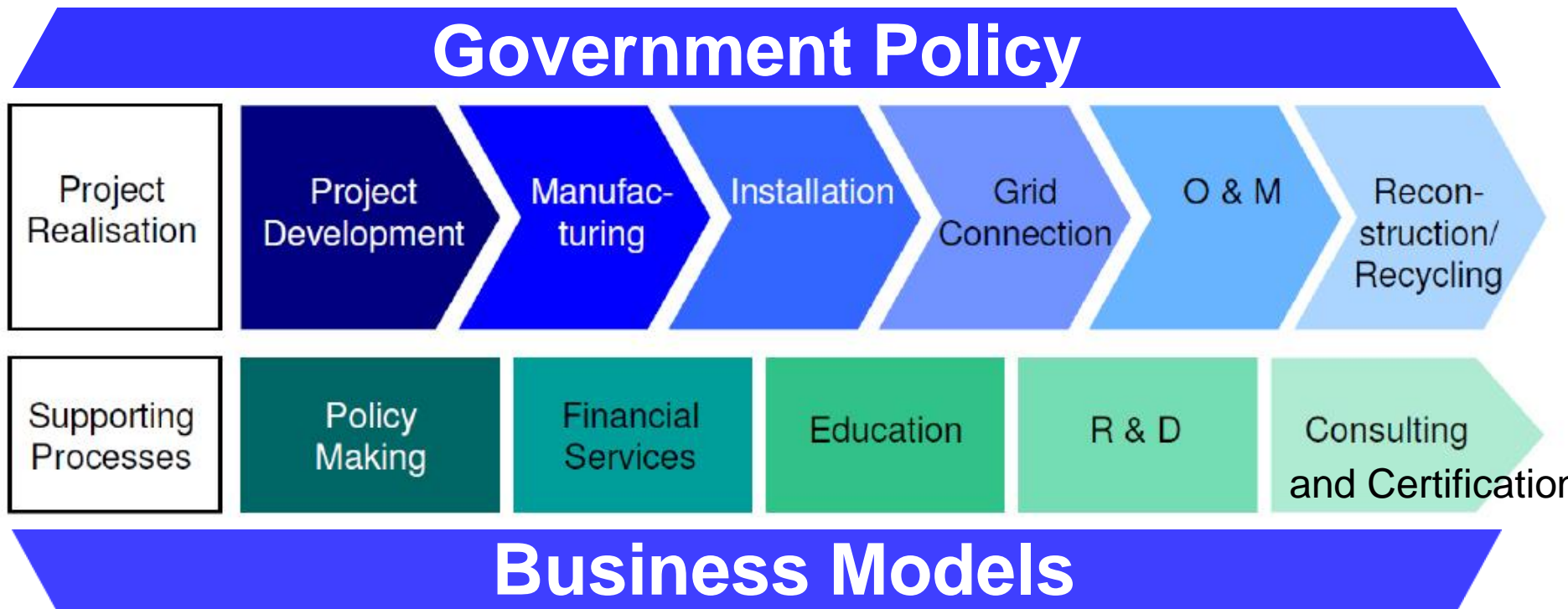
# Big, Game-Changing Trends

- Rapid cost reduction- what if solar PV becomes another consumer product?
  - McKinsey & Co. (2012) predicts that the cost of a fully installed residential system could fall to \$1/Wp by the end of this decade.
  - Implications for conventional power systems planning
- AEC 2015 - foreign manufacturing firms have an interest to locate their plants in the region to avoid tariffs
- Whether Thailand can add and capture value depends upon matching our strategies to the strategies of the global players



# How can Thailand Add and Capture Value in a Global Solar Industry?

# The Solar Value Chain



1. How can policy be designed to enhance domestic value creation along the solar value chain?
2. What are innovative business models that can add to value creation & value capture?



# **4 Myths** about Solar Energy in Thailand



## Myth#1

Solar Energy is too Expensive



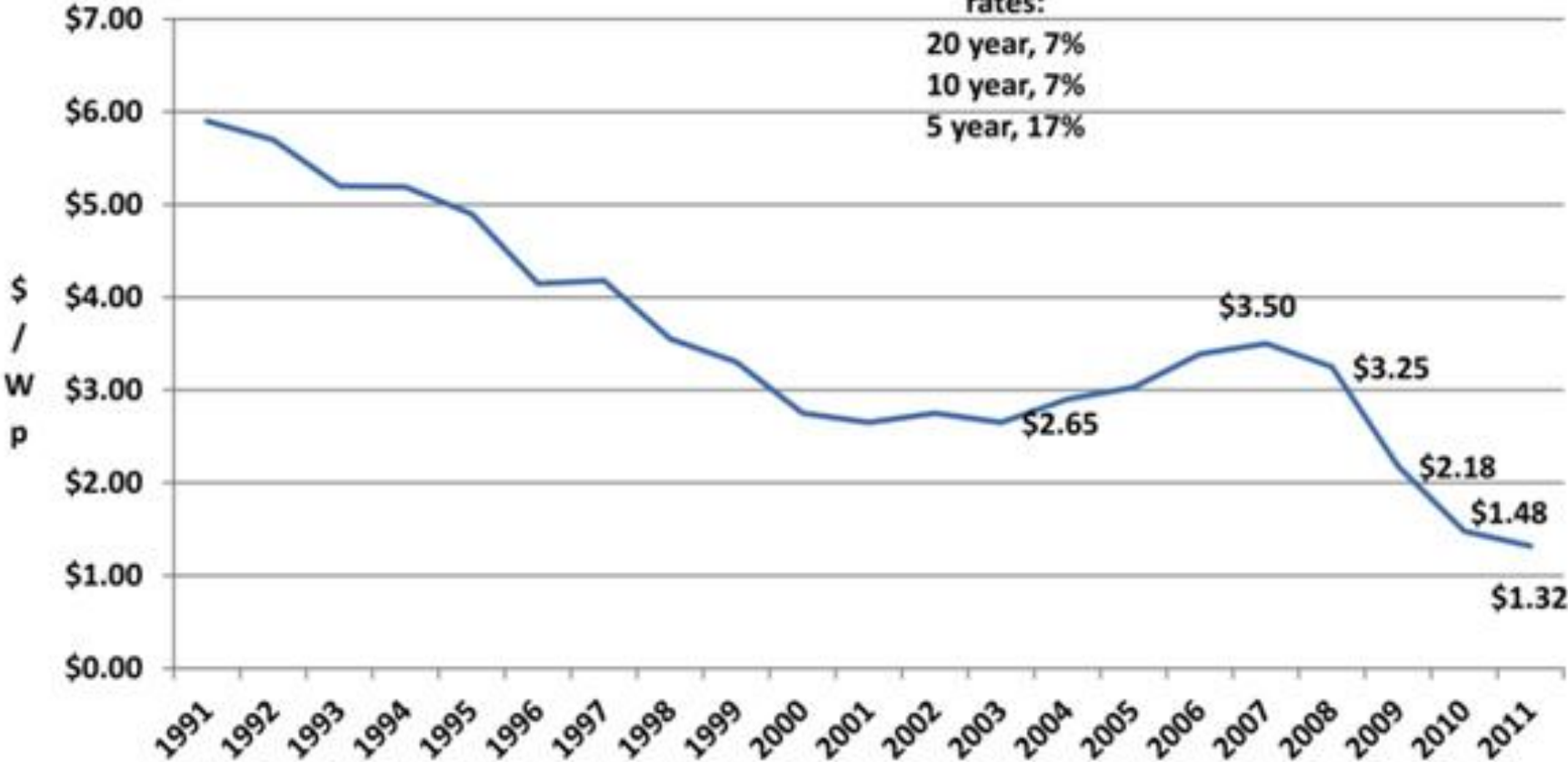
# PV Price Trend

Currently, first tier Modules are available for ~\$1.10/Wp

Average Selling Prices  
Lowest Current 50 Cents/Wp  
Highest Current \$3.25/Wp

ASPs decreased at the following compound annual rates:

- 20 year, 7%
- 10 year, 7%
- 5 year, 17%



Source: Navigant Consulting PV Services Program (2011)

# Cost Reduction Forecast for Commercial Rooftop Solar Systems

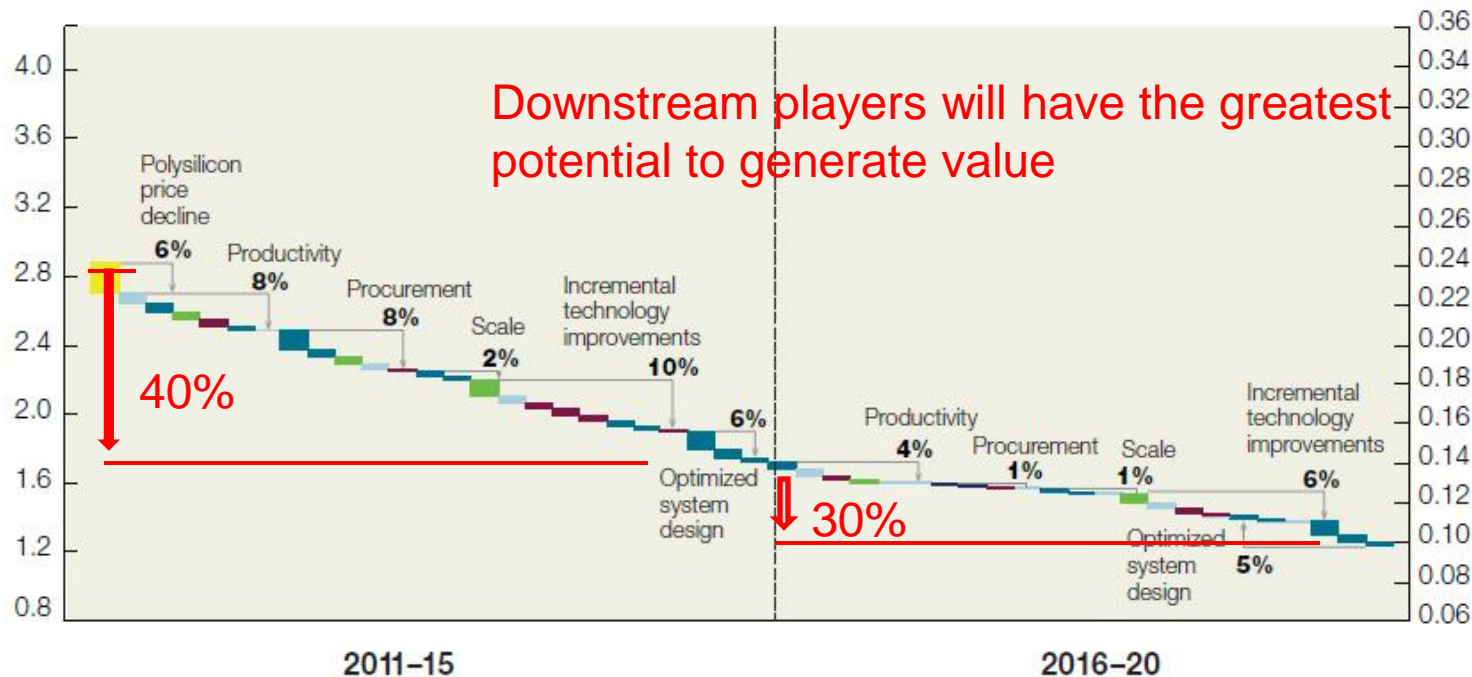
**Industrialization will yield significant cost reductions.**

c-Si multicrystalline solar-photovoltaic system

Polysilicon    Module    Cell    Wafer    Balance of system (BOS)

**Best-in-class installed system cost (no margins)**  
\$ per watt peak, 2011 dollars

**Levelized cost of electricity<sup>1</sup>**  
\$ per kilowatt hour, 2011 dollars



<sup>1</sup>Levelized cost of energy; assumptions: 7% weighted average cost of capital, annual operations and maintenance equivalent to 1% of system cost, 0.9% degradation per year, constant 2011 dollars, 15% margin at module level (engineering, procurement, and construction margin included in BOS costs).

Source: McKinsey (2012)



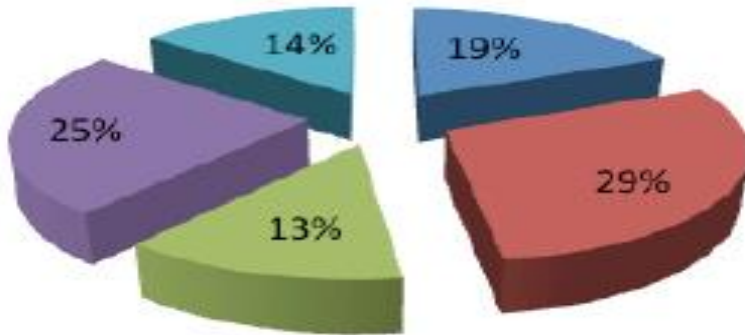
## Myth#2

Solar PV is an imported technology

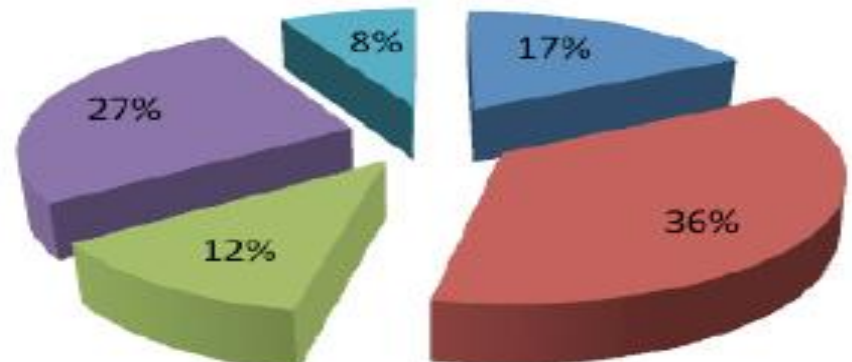
It cannot benefit the local industries  
and will burden the ratepayers

# Value chain breakdown of solar jobs: highest in installation

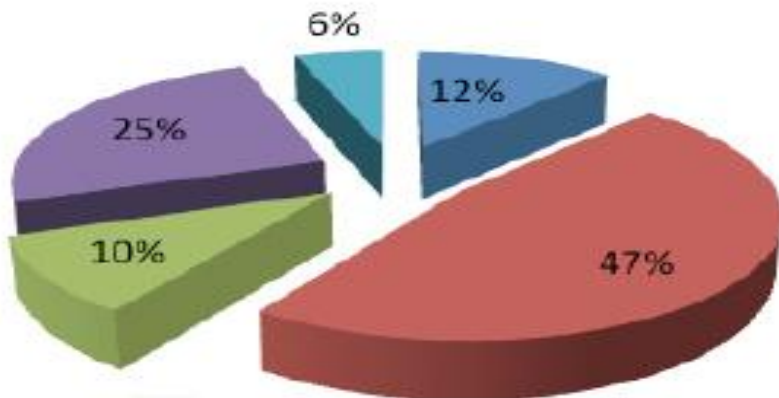
## California



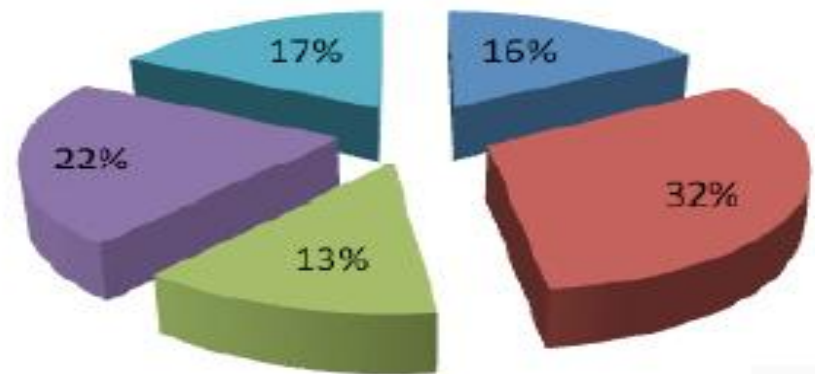
## Arizona



## Pennsylvania

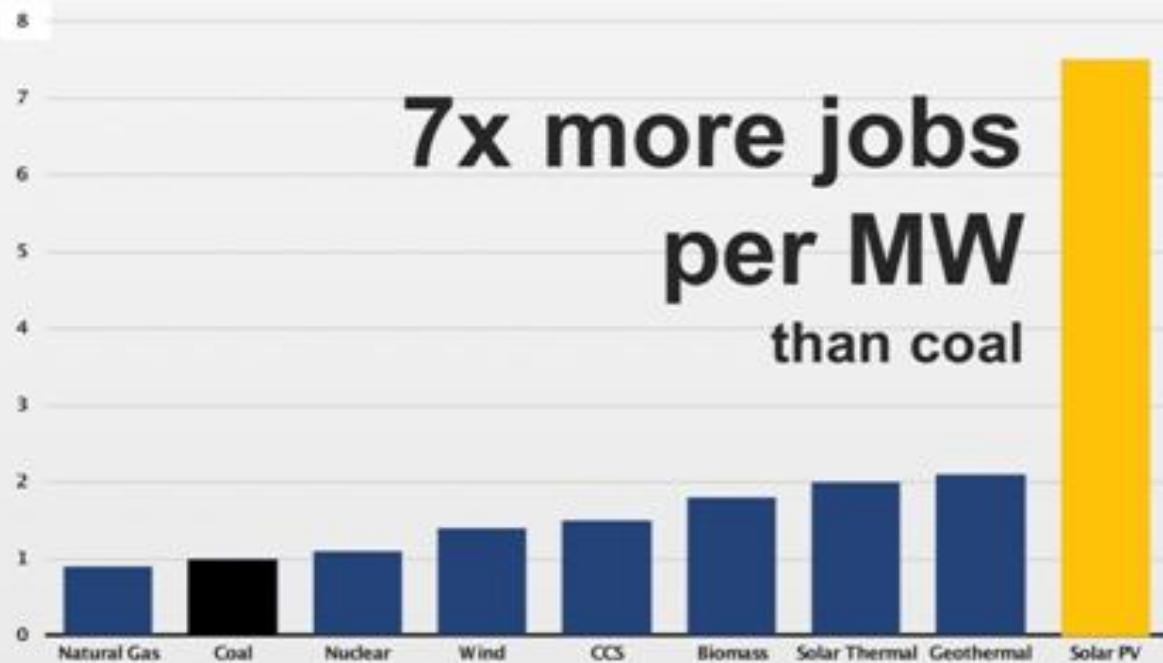


## New York



■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other

# Solar Investments Create More Jobs than Any Other Energy Sources

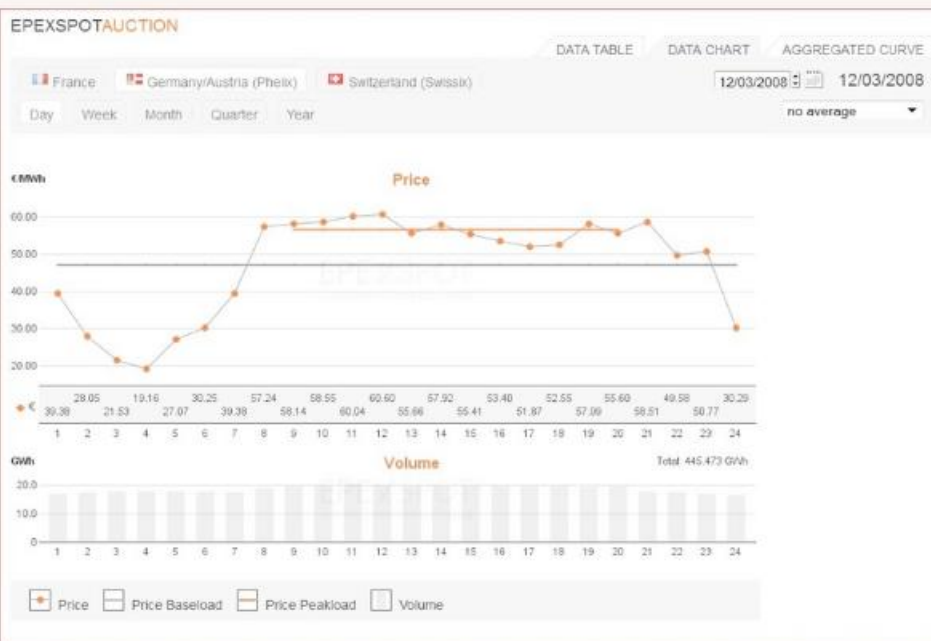


Sources: Kammen, David M et al, 2004, Report of the Renewable and Appropriate Energy Lab, Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?, Energy Resources Group, Goldman School of Public Policy, University of California, Berkeley. Wei, Max et al, 2010, Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?, Energy Resources Group, Goldman School of Public Policy and the Haas School of Business, University of California, Berkeley, in Energy Policy, vol 38, issue 2, February 2010. Solar Foundation 2011 National Jobs Census

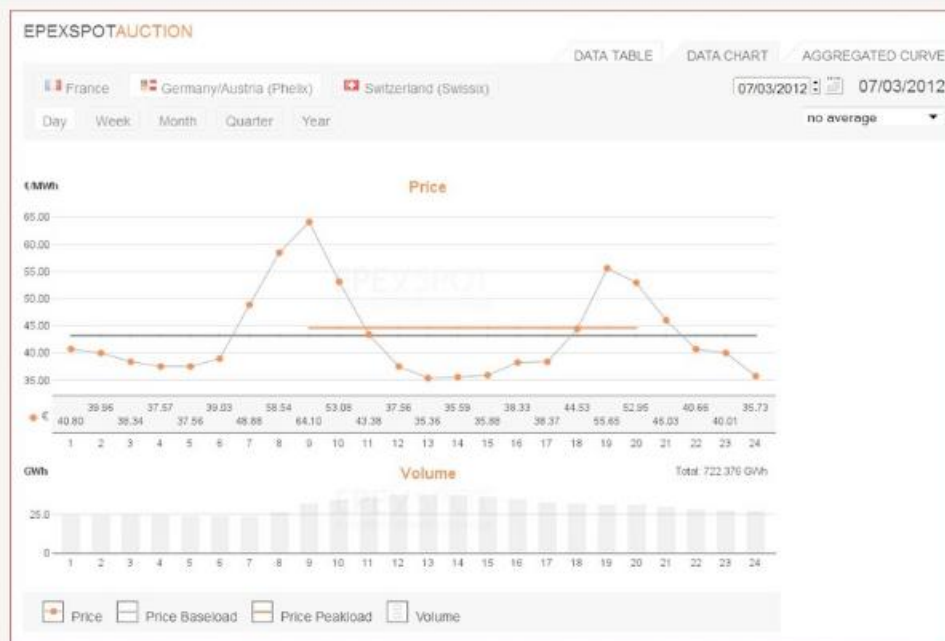
U.S. Bureau of Labor Statistics: May 2010 National Industry-Specific Occupational Employment and Wage Estimates

Source: UC Berkeley Energy Resources Group

# Potential Benefits to consumers: Lower Electricity Prices



**March 2008 Spot Market Price  
on the German Power Exchange**



**Same day in March 2012:  
Spot Market Price  
on the German Power Exchange**

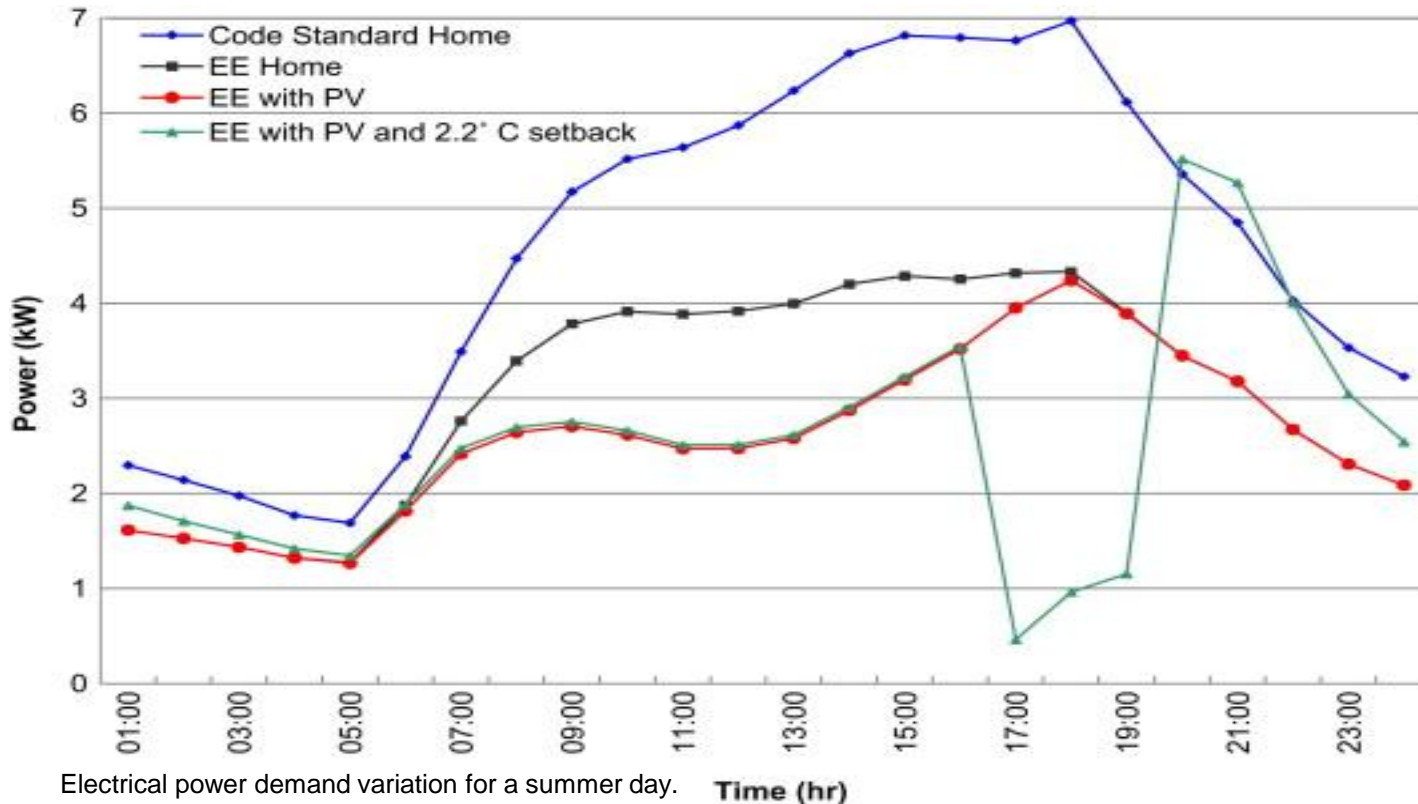
Source: Renewables International Magazine (2012)



## Myth#3

**Solar Systems will Burden the Grid  
and cause the utilities to double  
invest in back-up capacity**

# Benefits to the Utility Grid

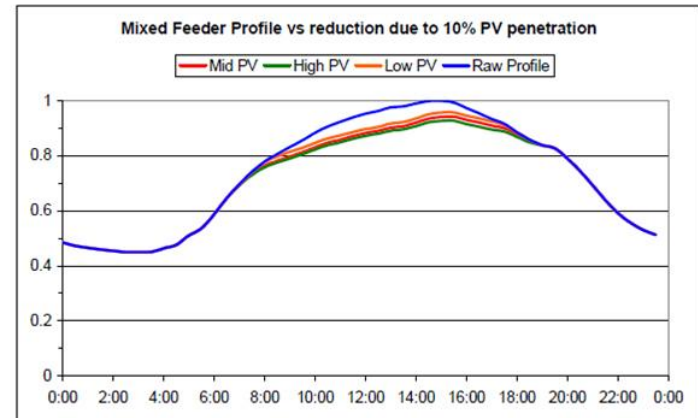
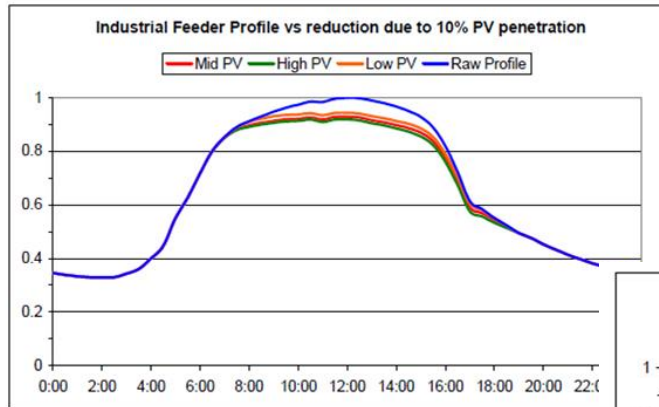
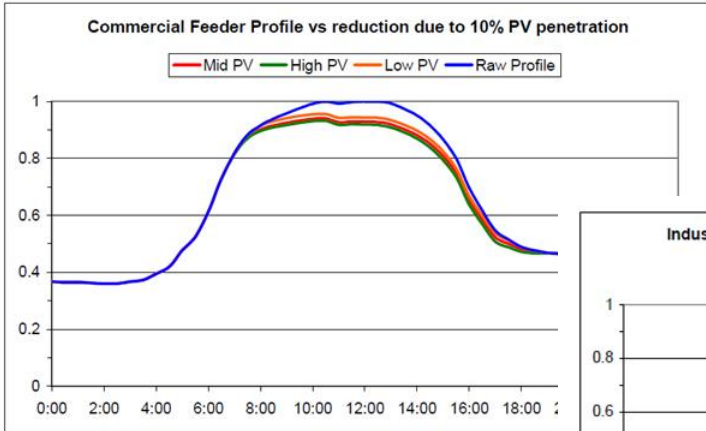


Electrical power demand variation for a summer day. **Time (hr)**

Source: Sadineni and Boehm (2012) "Measurements and simulations for peak electrical load reduction in cooling dominated climate," *Energy*, 37(1 2012 ): 689 – 697.



# Benefits to the Utility Grid: need systematic study & forecast



The effect of solar PV on peak in Western Power's grid systems,  
assuming 10% PV penetration

Source: Western Power (2011) Photovoltaic (PV) Forecast

# The Solar Value Chain

## Government Policy

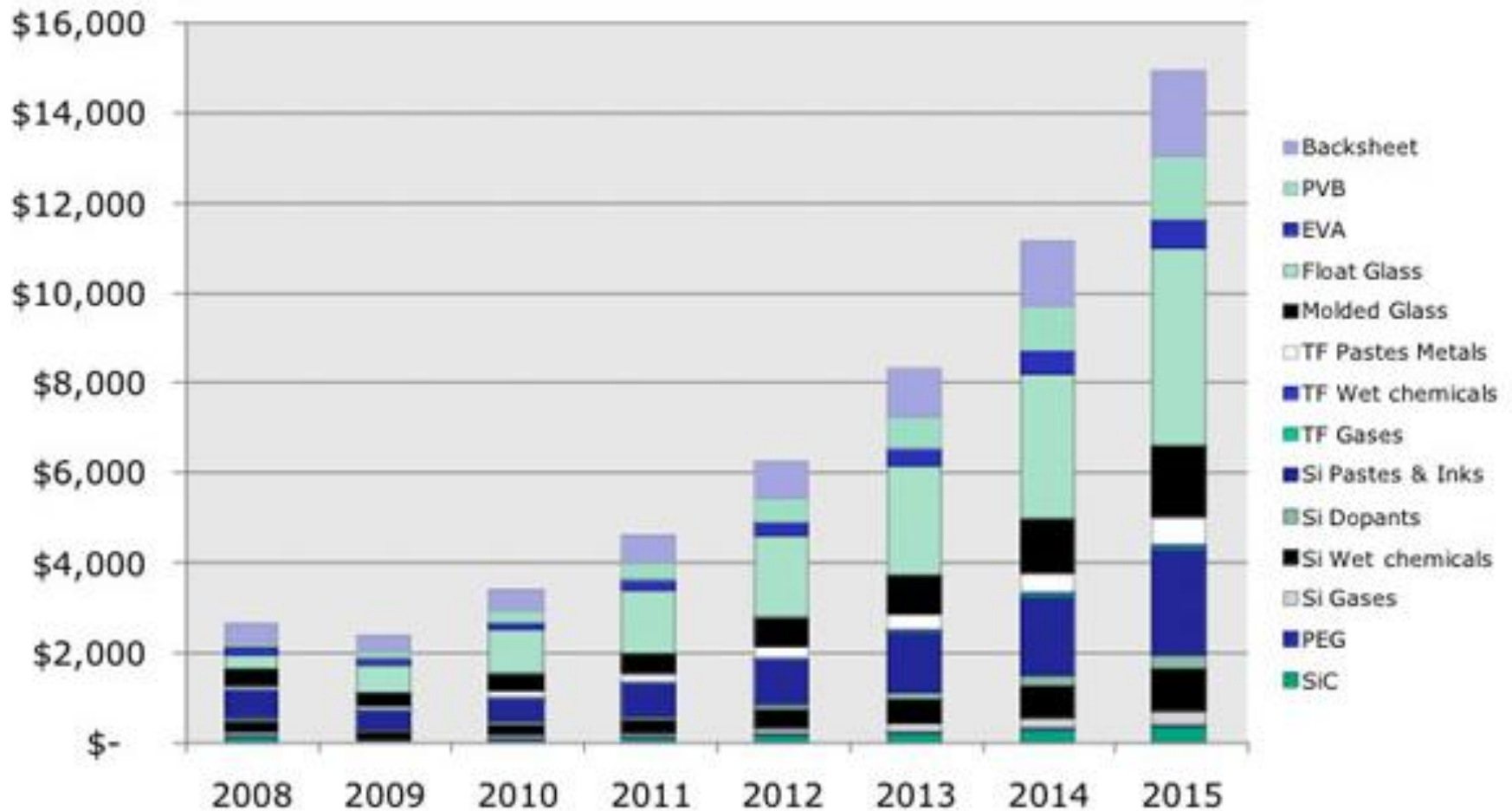


**Policy  
Intervention  
to encourage  
Technology  
Transfer**

**Facilitate  
Cluster  
Formation**

**Attract  
Manufacturing  
Plants**

# PV Materials and Market Revenues (\$millions)



Source: Linx Consulting (2008). Chemicals and Materials for Photovoltaic Cells and Modules 2009.

**Glass represents the largest material cost of module manufacturing plants –opportunities for upstream value creation in Thailand?**

# The Solar Value Chain

## Government Policy



# Innovative Business Models:

Great potential for Thai business development

- Solar Leasing: SolarCity, Sungevity
- Solar Bulk Purchasing: Portland's Solarize Campaign
- Municipal Financing: Berkeley FIRST

## Your full service solar company

When you want to join the solar movement count on SolarCity's all-in-one service for its home, commercial and government customers. From one company, you can rely on SolarCity to get you generating clean, affordable energy.



• CONSULTATION



• DESIGN  
• INSTALLATION



• MONITORING  
• MAINTENANCE  
• GUARANTEED PERFORMANCE

## What Will My Electricity Cost?

SolarCity makes it easy and affordable to **save with solar**



# Characteristics of the next wave of solar companies

- Not manufacturing companies, but downstream installation companies, utilizing cheap, innovative modules
- Skilled at customers acquisition across the global network
- Advanced logistics
- Know customers well
- Tailor-made solar applications according to end-use needs
- Ability to secure innovative, low-cost financing
- Minimizing installation cost



# Final Remarks



We have to find our positioning in the global solar industry before it is too late!