

Natural Gas and PV Solar: “Can’t we all just get along?”

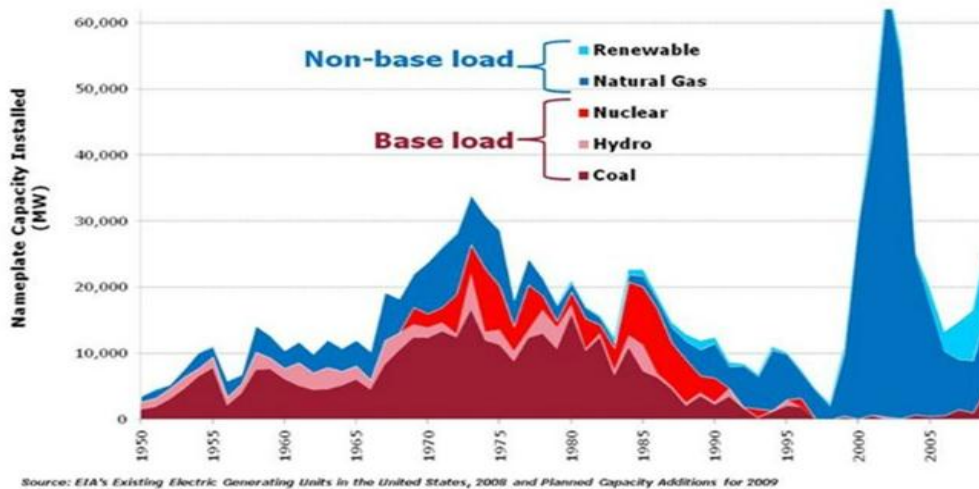
Alta Energy Blog: April 24, 2013

We are often asked “How will solar become competitive when natural gas is so abundant and priced so low in the U.S.?”

A simple question - but one that begs for a complex answer.

First, let’s look at some data on the Natural Gas environment:

- Over 90% of all generation capacity added in the U.S. since late 1990’s have been designed to use Natural Gas (source: EIA 2008)



- >40% of the total generation capacity as of 2011 in the U.S. is based on Natural Gas

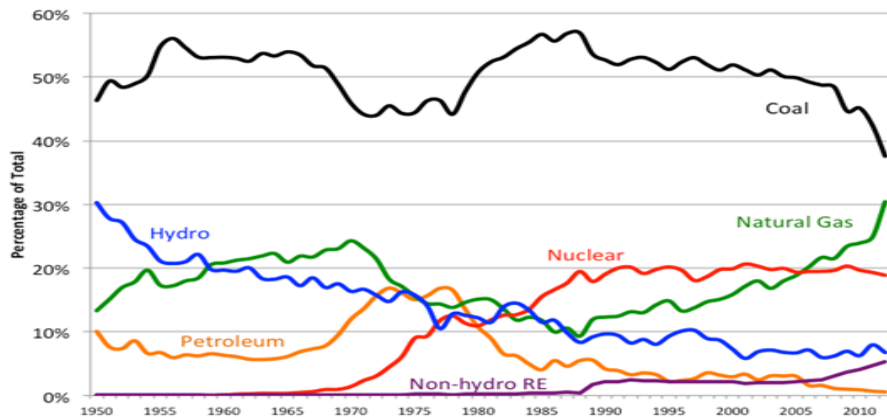
Existing Capacity by Energy Source 2011 (Megawatts)

Energy Source	Generator Nameplate Capacity	% of Capacity
Natural Gas	477,387	41.7%
Coal	343,757	29.8%
Nuclear	107,001	9.3%
Hydro - Conventional	78,194	6.8%
Petroleum	57,537	4.8%
Wind	45,982	4.0%
Hydro Pumped Storage	20,816	1.8%
All Other	20,605	1.8%
Solar Thermal & PV	1,564	0.14%
Total	1,153,149	

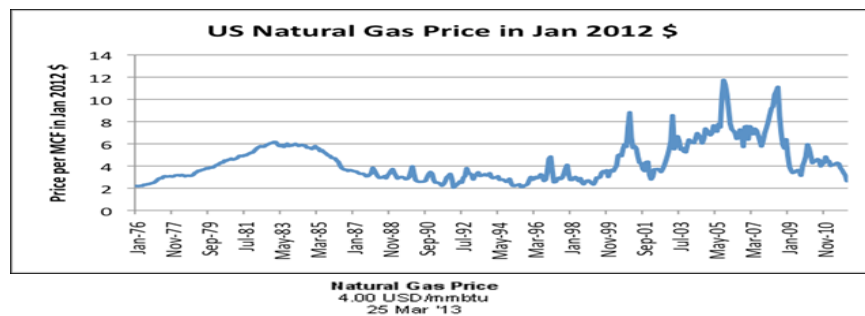
Source: US EIA, Jan 2013

- >30% of all power generated in 2012 in the U.S. was based on Natural Gas (source: NREL 2013).

Net Electricity Generation By Energy Source, as % of U.S. Total, 1950 – 2012: NREL Feb2013



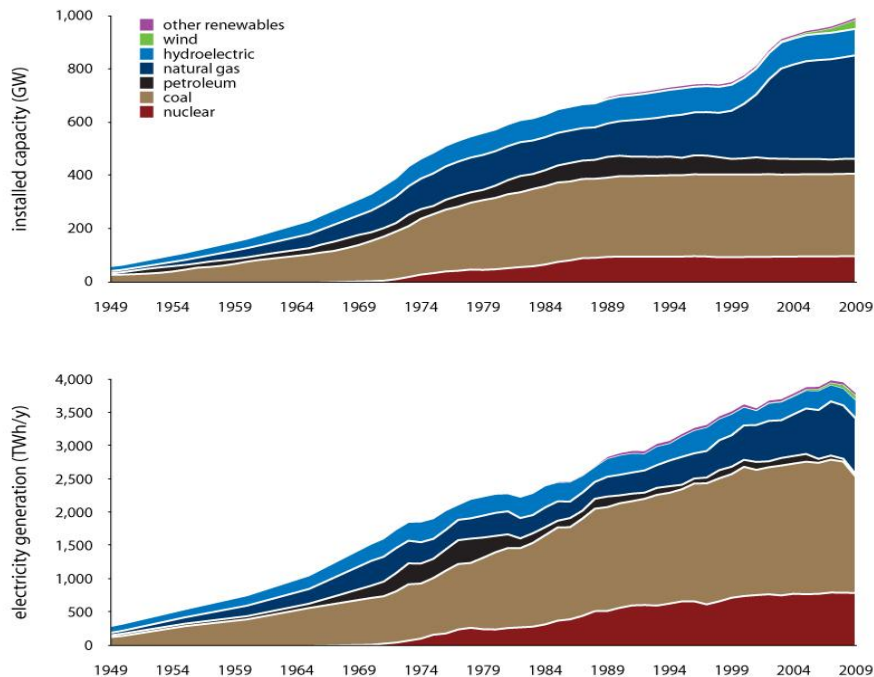
- “[At ~\$3-4/MM BTU] Natural Gas is trading at levels well below the marginal cost of production of traditional extraction, and beneath the cost of extraction for most shale gas fields as well. (source: Peters & Co., Jun’12)
- Natural Gas prices hit a decade low of <\$2/MM BTU in early 2012 but since have steadily increased. Prices have recently stabilized at >\$4/MM BTU. (source: InfoMine.com)



- “Natural Gas Jumps to 20-Month High as Goldman Boosts Outlook” (source: Bloomberg, Apr’13)

- In the world markets, Natural Gas is currently \$8-12/MM BTU.
- There is no significant current (or movement towards) plans for meaningful exports of North American Natural Gas to the world markets.

U.S. installed capacity and electricity generation by energy resource, 1949–2009

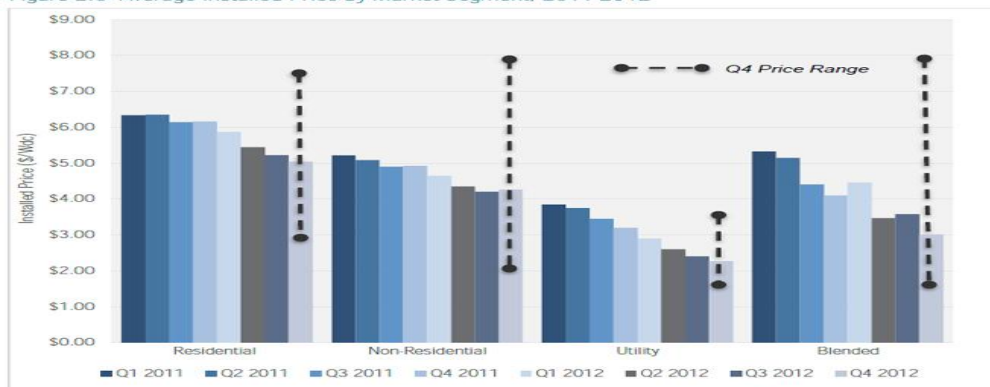


Rocky Mountain Institute © 2011. For more information see www.RMI.org/ReinventingFire.

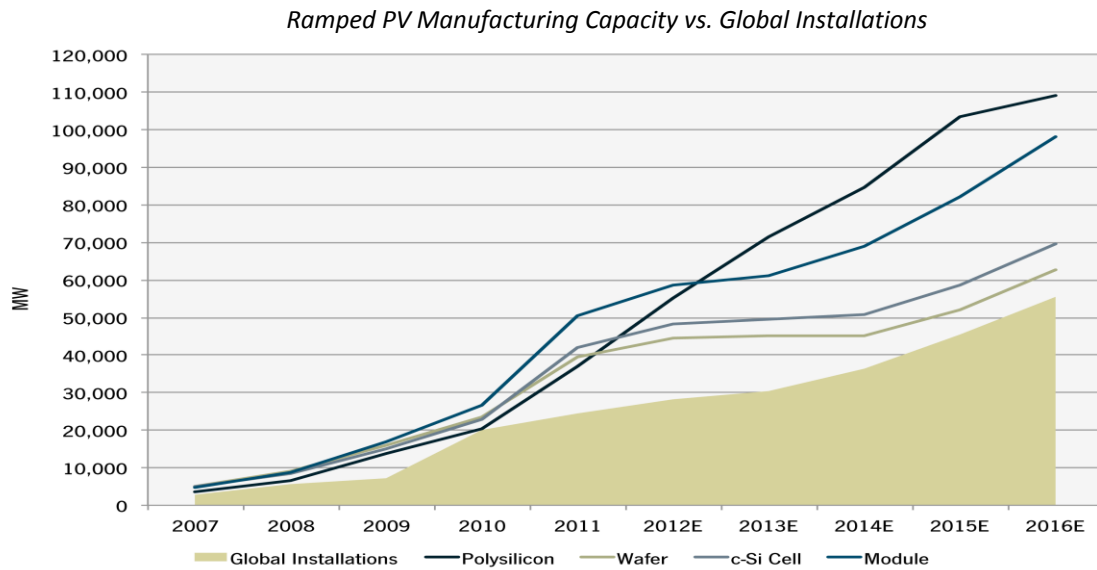
Now, let's look at the PV Solar environment:

- The average price of a solar panel has declined (plummeted) by 60% since the beginning of 2011. (source: seia.org)
- Overall installation costs in the Commercial/Industrial segment of the market have also decreased by ~20% in the same period. (source: SEIA and GTM Research)

Figure 2.6 Average Installed Price by Market Segment, 2011-2012

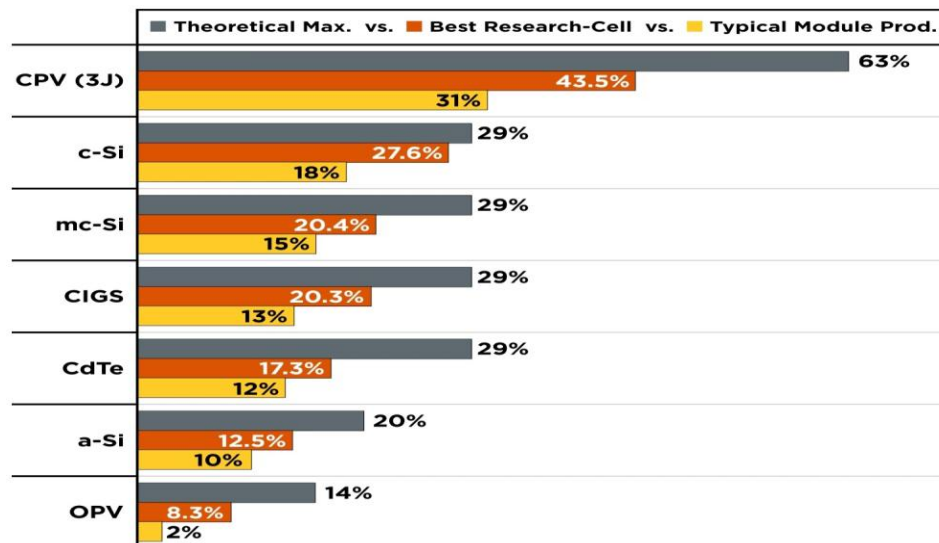


- The projected world-wide capacity for solar module production in 2013 is > 65 GW, still ~2x the forecasted global demand. (source: GTM Research, Jun'12)



- The trend of consistent improvements in PV cell efficiency for virtually every PV technology is expected to continue, albeit with some lag between laboratory cell and manufactured module results. (source: USDOE SunShot, Feb'12)

Production, Laboratory, and Theoretical (Maximum) PV Module Efficiencies



So possible conclusions are:

- The demand for Natural Gas continues to increase and prices have started to reflect that increased demand in North America.
- The arbitrage opportunity between North American Natural Gas prices and World (especially Asian) markets continue to be beckoning (may require a policy change to impact).
- If U.S. economic activity increases in the near term resulting in commensurate rise in demand for electricity, those increases will in turn be translated into higher demand for Natural Gas - for power generation.
- Even if demand for Natural Gas remains steady, the prices will not decrease meaningfully from current levels.
- PV Solar products will continue to commoditize and installed prices will continue to decrease (albeit at a slower pace than seen in past few years).

So what does this all mean? It could be one of the following scenarios:

Price Movement	NG Price Increases	NG Price Stable	NG Price Decreases
PV Price Increases	Not Likely	Not Likely	Not Likely
PV Price Stable	More PV	Stable PV	Not Likely
PV Price Decreases	More++ PV	More+ PV	Not Likely

Regardless of the implications, it is clear that Natural Gas is an important resource that is of strategic interest to all of us in the U.S. It will continue to be a critical component of our march towards energy independence and will provide for cleaner and perhaps cheaper power generation infrastructure for the future. But we need to be cautious in our enthusiasm and near-term over-dependence to what could be merely one piece of our long-term energy solutions - and thus balance the mix with economically viable renewable solutions.

As Thomas Farrell, the CEO of Dominion Energy, recently observed during The Wall Street Journal's Economics conference in Santa Barbara, California (as reported by Fox News!): "If you want to see the price of natural gas rise ... replace our entire fleet, all coal, all nuclear, over the next 20 to 30 years; you're going to regret it."

We welcome your views!