Working Paper 2

How Did China become the largest Solar PV Manufacturing Country?

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The Decade of Chinese March

Globally increasing demand for solar gear and a domestic thrust on solar manufacturing have propelled China to the top position in terms of Solar Photovoltaic (PV) manufacturing countries. Since 2004, China's production march on all fronts of the solar manufacturing value chain began- poly-silicon feedstock, wafers, cells and modules. By 2008, the growth of solar industry became formidable as the Chinese firms started reaping economies of scale in the production of purified silicon. By then, China had become the largest PV manufacturer in the world, with 98% of its product shipped overseas (1).

In 2009, the government identified solar manufacturing as a strategic industry and attempted to accelerate its growth principally through a combination of low cost debt and subsidy. By 2010, China accounted for about half of the global production of solar gear, and four out of the global top 10 solar PV cell manufacturers were Chinese (2)(3).

China's own domestic market for PV installations gathered steam much later. Towards the end of 2007, China's cumulative installation was only about 100 MW, representing only 1% of the total global PV installations(4). So when the financial crisis of 2008-09 struck Europe and slowed down the pace of PV installations, the Chinese government stimulated their domestic demand for solar gear. As Table 1 shows, Chinese annual solar installation grew by over 100 times between 2007 and 2012 to 3.6 GW. However, this was still not comparable with the annual output of PV cells from China (~20 GW). Chinese solar manufacturing policy therefore was driven by its export potential rather than concerns about supporting domestic deployment, which were satisfied by default.

Table 1: Annual Output of PV Cells and Share of Global Cell Production,(5)(6)

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Annual output of PV cells (MWp)	50	200	370	1,087	2,589	4,676	13,018	20,000	23,000
Share of global cell production (%)	4.0	11.0	14.6	27.2	32.9	37.6	47.8	57.3	71.4
Annual PV installations in China (MW)	10	8.9	10	20	40	210	559	2200	3,567

Global Glut in Solar Gear Market

During the financial crisis, China strengthened its grip on the export markets. It also contributed to the global glut in the supply of solar gear, which led to further decline prices. The price decline cannot be attributed to productivity gains alone, but also in large part to the supply-demand mismatch.

By 2011, wafer prices had dropped to about 70%, solar cells by about 60%, and module prices halved(7). As the global production in 2010 reached 20.5 GW (or 160,000 metric tons), the prices of components had fallen from $4.5/Watt in year 2000 to $1.7/Watt in 2010(8). Production of solar cells from China alone was around 10 GW, accounting for 50% of the total global production, and more than 90% of solar cells were exported (5) (9).

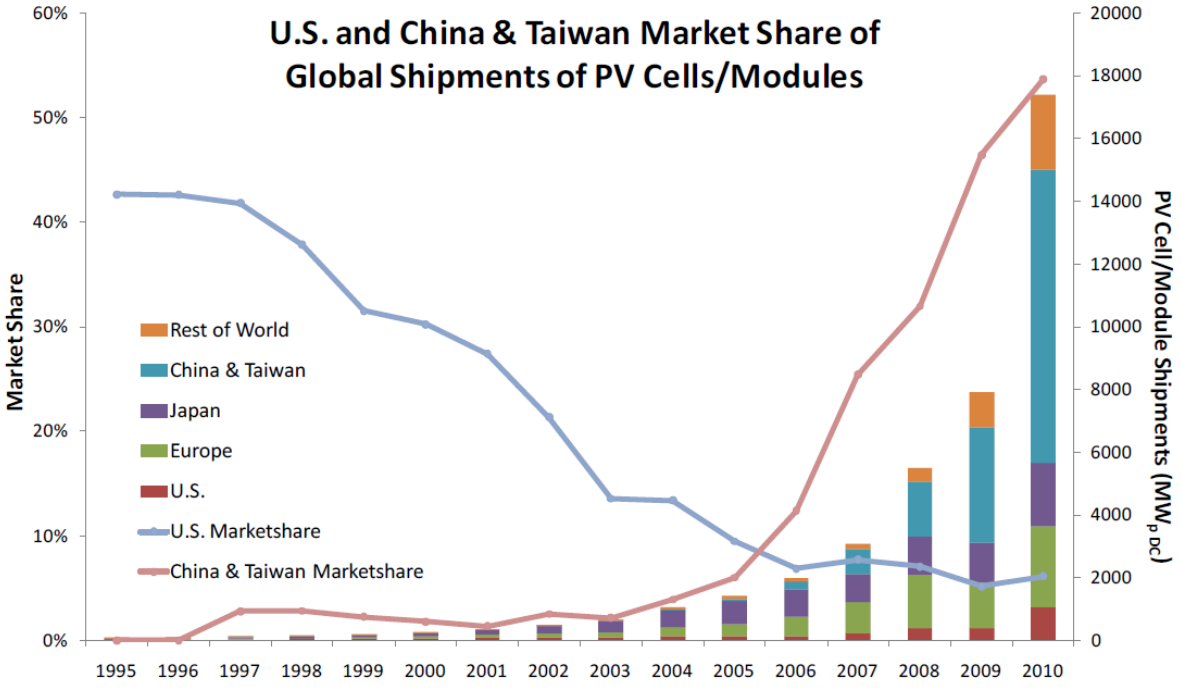

Figure 1: US and China & Taiwan Market Share of Global Shipments of PV Cells/ Modules(10)

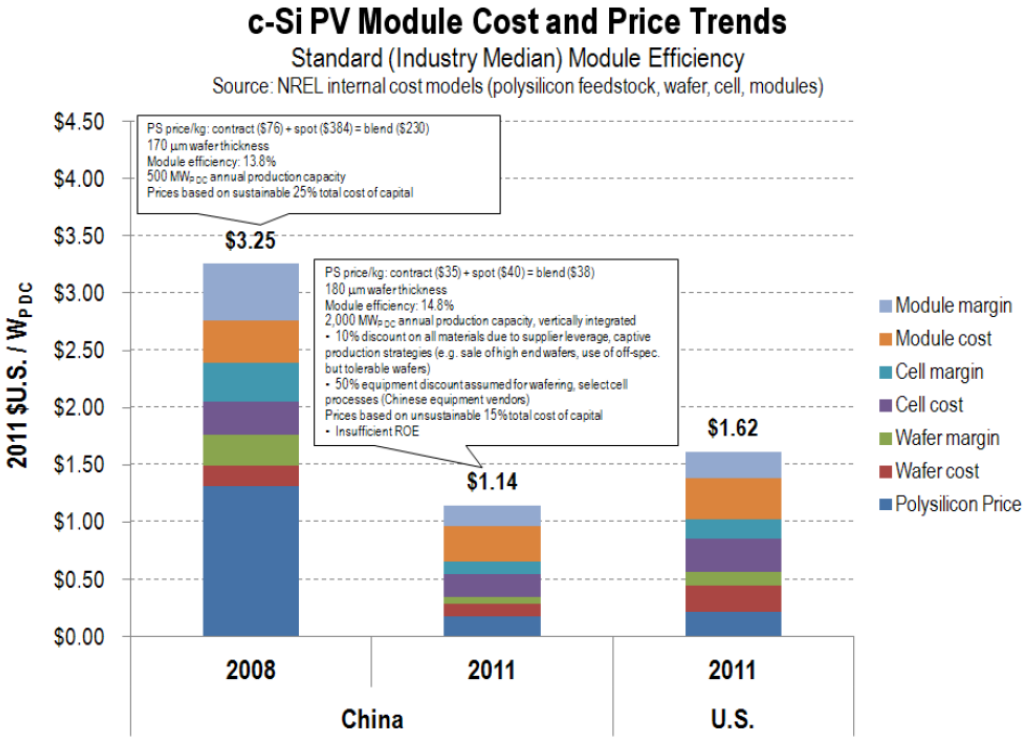

Figure 2: c-Si PV Module Cost and Price Trends of China and US (10)

The U.S. manufacturers, who had clearly taken a hit from the surge of Chinese imports approached the U.S. Department of Commerce. The latter found evidence of dumping by Chinese manufacturers,

and imposed anti-dumping and countervailing duties against them in early 2012. As a result, Chinese PV exports to US dropped significantly and the profitability of its solar manufacturing industry reduced from 30% in 2010 to less than 10% in 2011 (5).

In 2012, the European Union launched a dumping investigation on Chinese panels and arrived at a similar conclusion. China and the EU reached a settlement under which Chinese exporters were required to accept quantitative restrictions and a floor-price to imports below which anti-dumping and anti-subsidy tariffs applied (11)(12).

Therefore, oversupply and ensuing price wars also contributed to China's emergence as a solar manufacturing giant. Solar panel manufacturers around the world did suffer losses as prices of solar panels fell by three-fourths since 2008 due to demand-supply asymmetries. By the end of 2012, the worldwide annual solar PV installed capacity had reached about 31 GW, while global production capacity was 60 GW at least; China alone constituted 40 GW of production capacity(11)(13)(14). This also affected state-owned banks that financed factories with low-rate loans, and provincial governments that provided loan guarantees and land at discounted terms.

Policy Context in China

Support to Solar PV Manufacturing

The Chinese government has strongly supported the development of a world-leading solar manufacturing industry. China's Ministry of Science and Technology (MoST) programme was created in 1999 (MOST 1999), with an aim to support innovation by small high-tech firms. According to MoST, an investment support of about $ 2.9 million (¥ 20 million) was provided to encourage small technology-based firms to promote manufacturing. In addition to this, Chinese municipal governments instated various refund policies to promote investment; China also promoted an industrial policy with measures that included low-rate loans, tax credits, and grants. Some of these measures are given below:

- Innovation fund for small technology based firms
- Refund or exemption of land fee and tax (corporate income tax, VAT and interest on loans) by local government
- Refund of electricity consumption fees
- Loan guarantee by government or government-run entities
- Loan and credit facilities provided by government or state banks

The National Development and Reform Commission (NDRC) programme targeted R&D development and demonstration projects for manufacturers and R&D institutions:

- Refund of import and value-added tax for R&D equipment
- High tech industry development: $ 7. 3 million (¥ 50 million)
- Program for R&D in 863, 973, key technologies: $ 6.2 million (¥ 42 million) (15).

According to National Renewable Energy Laboratory, China's core cost advantage in cell manufacturing comes largely from scale economies and vertical integration. All these factors have provided 18-20% core cost advantage for Chinese cell manufactures (exclusive of shipping costs). In

the context of global glut, Chinese module prices further declined from $3.25/ Wp to $1.14/ Wp from 2008 to 2011 (10).

Solar PV Deployment Policies

China has made a conscious effort towards accelerating solar PV installation by addressing the financial and regulatory barriers that hampered deployment. In March 2009, the Ministry of Finance, togetherwith the Ministry of Urban and Rural Development introduced a national PV subsidy programme to promote the use of Building Integrated PV (BIPV) applications and rooftop systems. This turned out to be a turning point in China's PV market. In July 2009, the Ministry of Finance, together with the Ministry of Science and Technology and NDRC unveiled the second national PV subsidy package- the *Golden Sun Program*- designed to subsidise 6,00MW of PV demonstration projects for the following two to three years. A competitive bidding scheme for price-discovery in solar PV projects was also initiated under the programme. The benchmark tariffs, or 'pre-approved price levels' were set on the basis of competitive bidding for specific quantities of solar PV in different geographic locations (3). As a result of these deployment schemes, the solar PV installations ramped up from 140 MW in 2008 to 6,500 MW in 2012 (15) (16).

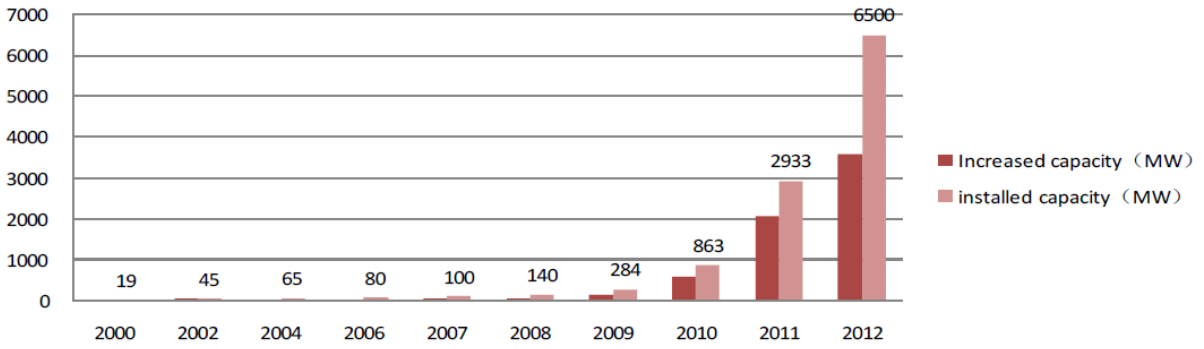

Figure 3: Growth in Chinese PV Installed Capacity,(16)

Conclusion

A strong support to domestic solar manufacturing sector coupled with fortuitous global developments for the industry have enabled Chinese firms to dominate the global market. Although solar PV installations in China are likely to witness high growth (especially in light of its climate commitments ahead of Paris CoP), the thrust on solar manufacturing will most likely remain export-oriented. While Chinese expansion has not come without its discontents in the West and developing countries like India (for details, refer to CSTEP Working Paper 1), it has helped to reduce the cost of solar power leading to its growing deployment. Since solar power is not yet competitive compared to conventional sources like coal, it will be interesting to observe the trajectory global costs of solar gear follow in the light of economic recovery and accelerated deployment around the world.

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