



## The United States Suffered a Dramatic Reversal in Solar Trade Balance for 2011, Resulting in Significant Trade Deficits with China and the World

### Key Findings

#### 2011 U.S. Solar Product Trade<sup>1</sup>

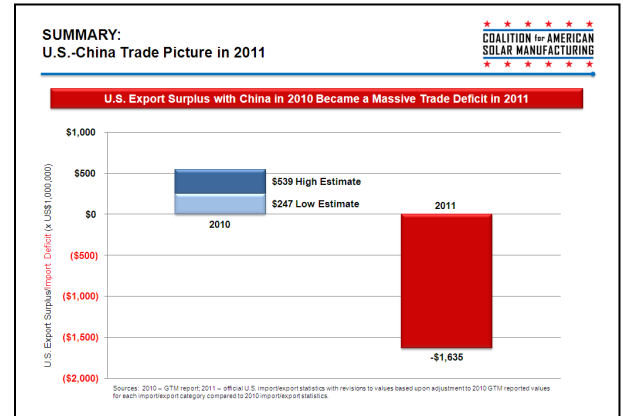
- Trade deficit with China – \$1.635 billion
- Trade deficit with the world – \$1.598 billion

#### 2010 U.S. Solar Product Trade<sup>2</sup>

- Trade surplus with China – \$250-\$540 million
- Trade surplus with the world – \$1.9 billion

#### 2010 to 2011 Significant Trade Facts<sup>3</sup>

- 303% and 309% = Increase in volume of Chinese shipments of solar cells and modules to the United States, respectively
- -22% and -20% = Decrease in value of U.S. exports to China of polysilicon and solar manufacturing equipment, respectively



### Introduction

In August 2011, the Solar Energy Industries Association (“SEIA”) released a report by Greentech Media (“GTM”) titled *U.S. Solar Energy Trade Assessment 2011: Trade Flows and Domestic Content for Solar Energy-Related Goods and Services in the United States* (“GTM report”).<sup>4</sup> The report, which analyzed 2010 global trade flows in solar energy-related products, found that the United States was a net exporter of such products to China and to the world. It described a burgeoning U.S. manufacturing base in solar products and predicted a prosperous future for the U.S. industry and its highly skilled workforce.

However, even at the time the GTM report was issued, a dramatic trade reversal was under way. This reversal has been noted in a number of recent independent reports that have studied U.S.-China trade in solar and other renewable energy-related

<sup>1</sup> Figures rounded and based on data and analysis of data from Commerce, the ITC and GTM report.

<sup>2</sup> Figures rounded and based on GTM report.

<sup>3</sup> Figures for solar cells and modules are based on volume and ITC data. Figures for polysilicon and solar manufacturing equipment are by value and are based on the methodology described in the Addendum.

<sup>4</sup> The GTM report is available at [www.seia.org/galleries/PDF/GTM-SEIA\\_U.S.\\_Solar\\_Energy\\_Trade\\_Balance\\_2011.pdf](http://www.seia.org/galleries/PDF/GTM-SEIA_U.S._Solar_Energy_Trade_Balance_2011.pdf).

products. This includes two reports from the staff of Sen. Ron Wyden (D-Ore.), the chairman of the U.S. Senate Finance Committee's Subcommittee on International Trade, Customs and Global Competitiveness – *Losing the Environmental Goods Economy to China* (February 2012) and *China's Grab for Green Jobs* (October 2011) – and separate reports from two think tanks: *Shining a Light on U.S.-China Clean Energy Cooperation* from the Center for American Progress (February 2012) and *China's Trade Barrier Playbook* from Third Way (February 2012).

The following report, issued by the Coalition for American Solar Manufacturing ("CASM"), is based on the import and export data from the U.S. Department of Commerce ("Commerce") and the U.S. International Trade Commission ("ITC"), as well as information from the GTM report. These sources reaffirm the finding in Sen. Wyden's February 2012 report that the United States is no longer a net exporter of solar energy-related products to China or the world.

### **Significant Changes Occurred in Solar Trade Flows in 2011**

The balances of trade in solar products between both the United States and China and the United States and the world dramatically reversed course from 2010 to 2011. As a result, the United States now has a significant solar trade deficit, both with China and the world. A leading cause of this reversal is a massive surge in Chinese exports of dumped and subsidized solar cells and modules, which, in 2011, more than doubled the totals of 2010, increasing from more than \$1.2 billion to more than \$2.8 billion. Further, exports to China of products for which the United States had a significant trade surplus in 2010 – polysilicon (the main raw material used to produce solar cells) and solar manufacturing equipment – declined precipitously in 2011, falling by \$194 million and \$170 million, respectively (a 21 percent combined decrease).

The reversal in trade flows has been accompanied by an unprecedented deterioration in U.S. manufacturing capabilities, as at least 12 domestic producers have gone bankrupt, closed plants or undertaken layoffs across all regions of the U.S. over the past two years. As detailed further, China's predicted increases in capacity and production in the solar cell, module and polysilicon sectors strongly suggest that the United States will experience additional and sustained solar product trade deficits, export market erosion and layoffs into the foreseeable future, accompanied by further deterioration of its manufacturing base and innovation resources.

### **Greentech Media Findings for 2010**

The GTM report concluded that the United States was a net exporter of solar energy-related products China and the world in 2010, with total net exports ranging from \$247 million to \$539 million with China and reaching \$1.88 billion with the world.<sup>5</sup> Significant U.S. exports of solar manufacturing equipment and polysilicon, in particular, contributed to the United States' status as a net exporter.<sup>6</sup>

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<sup>5</sup> GTM report at 10. As discussed in the Addendum describing this report's methodology, the GTM report was based on both official statistics from the ITC and, especially for the category of solar manufacturing equipment, surveys from U.S. industry.

<sup>6</sup> The United States exported \$2.5 billion in polysilicon and \$1.4 billion in solar manufacturing equipment in 2010. GTM report at 10. U.S. exports to China in 2010 were driven largely by exports of solar manufacturing equipment (\$708 million - \$1 billion) and polysilicon (\$873 million). GTM report at 16.

The GTM findings have been widely cited as evidence that the U.S. solar industry was in a strong and competitive leadership position in this cutting-edge clean technology field. As global demand for solar technology rose, there was an expectation that the American producers' share of U.S. and foreign markets would continue to increase. However, data reveal that by the time the GTM report was released in mid-2011, the trade balance had already shifted, and throughout 2011, U.S. solar-related exports and market share steeply declined. The data show not only a rapid increase in imports of Chinese solar products but also an abrupt downturn in the U.S. trade surplus in solar manufacturing equipment and polysilicon.

### **U.S.-China Solar Trade Deficit in 2011**

**U.S. Imports from China.** In 2011, Chinese exports of solar cells and modules to the U.S. increased by an overwhelming 296 percent and 130 percent, respectively, in value and 303 percent and 309 percent, respectively, in volume, compared with 2010. This import expansion created a significant U.S.-China trade imbalance. As shown in the table below, imports of five solar product groups from China reached \$1.4 billion in 2010, while in 2011, imports from China totaled more than \$3.0 billion.<sup>7</sup> This import surge is consistent with Chinese solar producers' increasingly aggressive export behavior over the past several years. From 2008 to 2011, Chinese exports of cells and modules to the United States shot up a remarkable 1,116 percent by value and 1,745 percent by quantity.<sup>8</sup>

#### **U.S. Imports from China by Value**

Product	Annual Trade Flow		Percent Change
	2010	2011	
Value (millions of U.S. dollars)			
PV Capital Equipment	\$ 93	\$ 82	-12.06%
PV Polysilicon	\$ 4	\$ 6	56.62%
PV Wafers	\$ 120	\$ 128	6.66%
PV Cells	\$ 38	\$ 150	295.96%
PV Modules	\$ 1,154	\$ 2,651	129.69%
Total	\$ 1,409	\$ 3,017	114.13%

Sources: 2010 data - GTM report. 2011 values were calculated based on official U.S. import/export statistics as reported by the ITC for calendar year 2011 and utilizing the methodology described in the Addendum.

China's exponential increase in exports of solar photovoltaic products is consistent with the renewable-energy goals found in China's last two five-year plans. China is achieving its goals by providing a myriad of massive and trade-distorting subsidies to its solar technology producers. These subsidies include cash grants; discounted inputs such as polysilicon and aluminum; discounted land, power and water; preferential loans and directed credit, including multi-billion dollar loans and loan guarantees to individual Chinese solar manufacturers; tax incentives and rebates; export assistance grants; and many others. These subsidies have enabled China's industry to export 95 percent of its production and sell solar cell and modules globally at below-market prices.<sup>9</sup>

<sup>7</sup> Trade flows for thin film photovoltaic ("PV") feedstock, PV inverters and solar heating and cooling ("SHC") are including in the Attachment at Chart 2.

<sup>8</sup> Source: U.S. International Trade Commission.

<sup>9</sup> See Goldman Sachs Global Investment Research, Global: Clean Energy: Solar (July 7, 2011) ("GS Research")

Import figures by volume also demonstrate a surge of solar product shipments from China to the United States in 2011. Chinese exports of solar cells and modules have increased by more than 300 percent since 2010, and Chinese shipments of polysilicon and wafers also have increased, albeit less dramatically.

### U.S. Imports from China by Volume

Product	Unit of Measure	Annual Trade Flow		Percent Change
		2010	2011	
PV Polysilicon	Kilograms	151,022	155,661	3.07%
PV Wafers	Kilograms	85,730	106,589	24.33%
PV Cells	Units	6,561,970	26,456,436	303.18%
PV Modules	Units	10,809,651	44,177,337	308.68%

Source: U.S. International Trade Commission

The huge increases in Chinese solar production and exports to the United States in 2011 resulted in a complete reversal of 2010 trade flows. As discussed above, the GTM report concluded that for 2010, the United States had net exports of between \$247 million and \$539 million to China in 2010. In 2011, however, the United States was a net *importer* from China, with a staggering \$1.635 billion in net solar-related imports, as detailed in Chart 2 in the Attachment. If solar modules are considered alone, the U.S. trade deficit with China in 2011 was \$2.64 billion.<sup>10</sup>

U.S. Exports to China. Shifts in U.S. exports to China between 2010 and 2011 are also troubling. U.S. producers' exports to China declined precipitously for key products, such as solar manufacturing equipment and polysilicon, which had contributed to the 2010 export surplus. As discussed below, decreases in U.S. exports to China, especially for polysilicon, may continue well into the future, further increasing the U.S. trade deficit with China in solar products. The tables below demonstrate the dramatic decrease in U.S. solar exports to China in 2011.

### U.S. Exports to China by Value

Product	Annual Trade Flow		Percent Change
	2010	2011	
Value (millions of U.S. dollars)			
PV Capital Equipment	\$ 854	\$ 684	-19.86%
PV Polysilicon	\$ 873	\$ 679	-22.28%
PV Wafers	\$ 26	\$ 31	18.62%
PV Cells	\$ 65	\$ 14	-78.42%
PV Modules	\$ 17	\$ 9	-49.38%
Total	\$ 1,835	\$ 1,416	-22.81%

Sources: 2010 data - GTM report. 2011 values were calculated based on official U.S. import/export statistics as reported by the ITC for calendar year 2011 and utilizing the methodology described in the Addendum.

<sup>10</sup> See Chart 2 in the Attachment.

## U.S. Exports to China by Volume

Product		Annual Trade Flow		Percent Change
	Unit of Measure	2010	2011	
PV Polysilicon	Kilograms	19,480,394	17,392,779	-10.72%
PV Wafers	Kilograms	488,317	758,153	55.26%
PV Cells	Units	10,430,607	530,756	-94.91%
PV Modules	Units	47,607	29,288	-38.48%

Source: U.S. International Trade Commission

### Projected Solar Trade with China

The U.S. trade deficit in solar products, with China in particular, is expected to worsen in 2012, given projections for Chinese solar production and capacity increases. For example, as discussed above, U.S. exports of polysilicon, the raw material constituting the largest U.S. solar export in 2010 (\$2.5 billion), declined 20 percent by value in 2011 to China. U.S. polysilicon exports to China will likely decline further, as Chinese polysilicon producers continue to ramp up production and capacity,<sup>11</sup> often with the help of significant government subsidies.<sup>12</sup> This trend will undoubtedly exacerbate polysilicon oversupply in the Chinese market, causing a further decrease in U.S. exports to China. This trend could also affect U.S. exports globally, as pricing is further depressed and Chinese producers inevitably seek to export their excess polysilicon supply throughout the world. Moreover, if China continues to have unfettered access to the U.S. market, its market share, which has grown from 19 percent of imports in 2008 to 56 percent from January to August 2011,<sup>13</sup> will likely further increase, squeezing out U.S. producers.

Chinese production and capacity in other solar products are increasing far beyond global demand as well, and seriously hindering U.S. exports. In fact, Chinese capacity to produce solar cells and modules nearly doubled in each year from 2007 to 2009 and nearly tripled from 2009 to 2010, increasing from 5.9 gigawatts (“GW”) to 16.1 GW. Chinese capacity is estimated to have nearly doubled from 2010 to 2011.<sup>14</sup> Such capacity increases are taking place without regard to global demand. For example, Goldman Sachs Global Investment Research predicts that China’s capacity to manufacture solar end-products will grow by 3.5 GW in 2012, while global demand is projected to increase by only 1.2 GW this year.<sup>15</sup> If Chinese solar capacity and production continue to increase dramatically, without regard to slower increases in global demand, U.S. exporters will be forced out of the Chinese and global markets, and the U.S. trade deficit in solar products will increase well beyond 2011 levels in coming years.

<sup>11</sup> See, e.g., Becky Stuart, *Polysilicon latest trade war victim*, pv magazine (Nov. 25, 2011), available at [http://www.pv-magazine.com/news/details/beitrag/polysilicon-latest-trade-war-victim\\_100005046/](http://www.pv-magazine.com/news/details/beitrag/polysilicon-latest-trade-war-victim_100005046/) (estimating that Chinese polysilicon production will grow by 30,000 metric tons in 2012); Dominique Patton, *LDK set to treble polysilicon capacity as price plunges*, rechargenews.com (Nov. 2, 2011).

<sup>12</sup> See, e.g., *China Development Bank Makes Another Huge Loan to Support Solar Industry*, www.sustainablebusiness.com (Sept. 14, 2011), available at <http://www.sustainablebusiness.com/index.cfm/go/news.display/id/22900>

<sup>13</sup> See GS Research.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

### **U.S. Global Trade Deficit in 2011**

The influx of huge volumes of solar products from China in 2011 injured the U.S. solar industry in the United States, and caused its position in overall global trade to decline as well. As opposed to the United States' nearly \$1.9 billion net exports to the world in 2010, the United States became a net importer of solar products from the world in 2011, a change nearly entirely attributable to Chinese imports. In 2011, the United States had net imports of nearly \$1.6 billion, a dramatic change from its status as a significant net exporter in 2010.<sup>16</sup>

U.S. exports of solar manufacturing equipment and polysilicon are on a downward trajectory, contributing to the nation's loss of its net exporter status. In 2011, U.S. exports of solar manufacturing equipment were down 20 percent and 25 percent to China and to the world, respectively from 2010 totals.

### **Conclusion**

The position of the United States as a net exporter of solar and solar-related products to the world and to China in 2010 has evaporated. The United States became a significant net importer of solar products from China and the world in 2011. Given China's increases in solar cell and module capacity, its projected increases in polysilicon production, and the deterioration of the U.S. manufacturing base, the nation could be on course to lose multiple clean energy industries.

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*See, Attachment.*

## ADDENDUM

### Methodology

This analysis is based on a GTM study prepared for release in August 2011 by SEIA.<sup>17</sup> The GTM report employs a combination of official U.S. government data on imports and exports, industry surveys and other informational sources to isolate U.S. trade in solar energy-related goods during calendar year 2010.<sup>18</sup> This analysis was prepared to update the GTM report data to reflect the actual trade flow through full year 2011. GTM did not participate in the CASM study and has not reviewed these findings.

The values of U.S. imports and exports through full year 2011 are publically available, and were obtained from the DataWeb service of the ITC for solar manufacturing equipment (*i.e.*, PV capital equipment), PV polysilicon, PV wafers, PV cells, PV modules and PV inverters.<sup>19</sup> Because the tariff classifications that include PV capital equipment, PV polysilicon and PV inverters also include non-solar-related items, solar-specific 2011 trade values for these categories were estimated by applying the observed 2010 ratio of GTM's solar-specific estimates to total 2010 trade on a category specific basis to the 2011 data, except for U.S. exports of PV capital equipment.

The GTM report estimated a range of 2010 exports to China of PV capital equipment of \$708 million to \$1 billion, or an average of \$854 million. Based on the ratio of GTM's average PV capital equipment exports (\$854 million) to 2010 trade data, it was estimated that the value of total U.S. exports for 2011 declined by about 20 percent and 25 percent to China and to the world, respectively from 2010 totals.

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<sup>17</sup> See GTM report at Figure 1-1 at 7, "Aggregate Findings" at 79-81.

<sup>18</sup> See GTM report at 87 ("Sources for Trade Flow Analysis").

<sup>19</sup> The value of U.S. imports and exports for two smaller categories, thin-film PV feedstock and solar heating and cooling, which were estimated to represent less than 0.1 percent of U.S. PV solar trade and for which specific government trade data are not available, have been assumed to remained unchanged in 2011 for both imports and for exports.

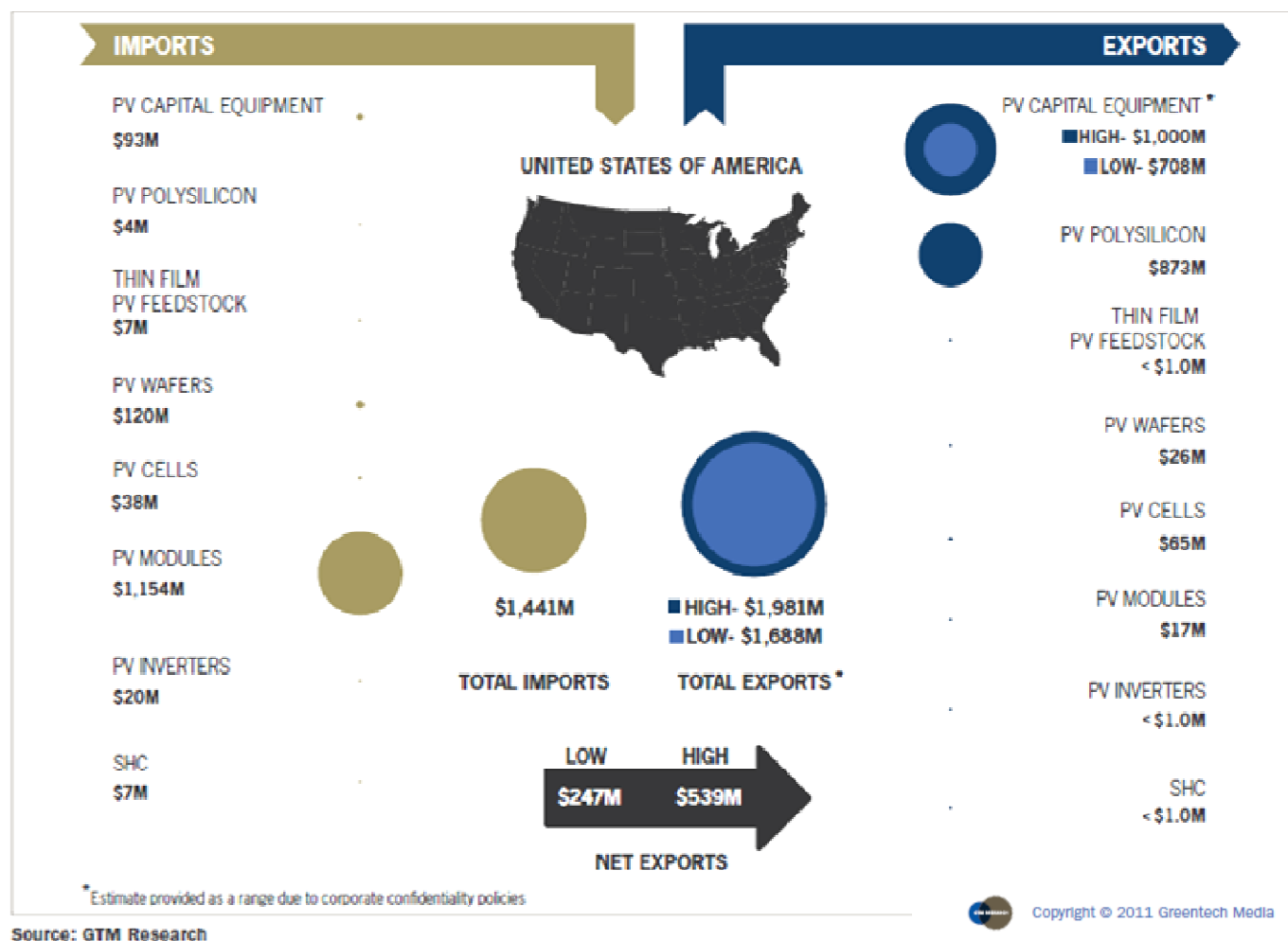
# **ATTACHMENT**

## **CHARTS**



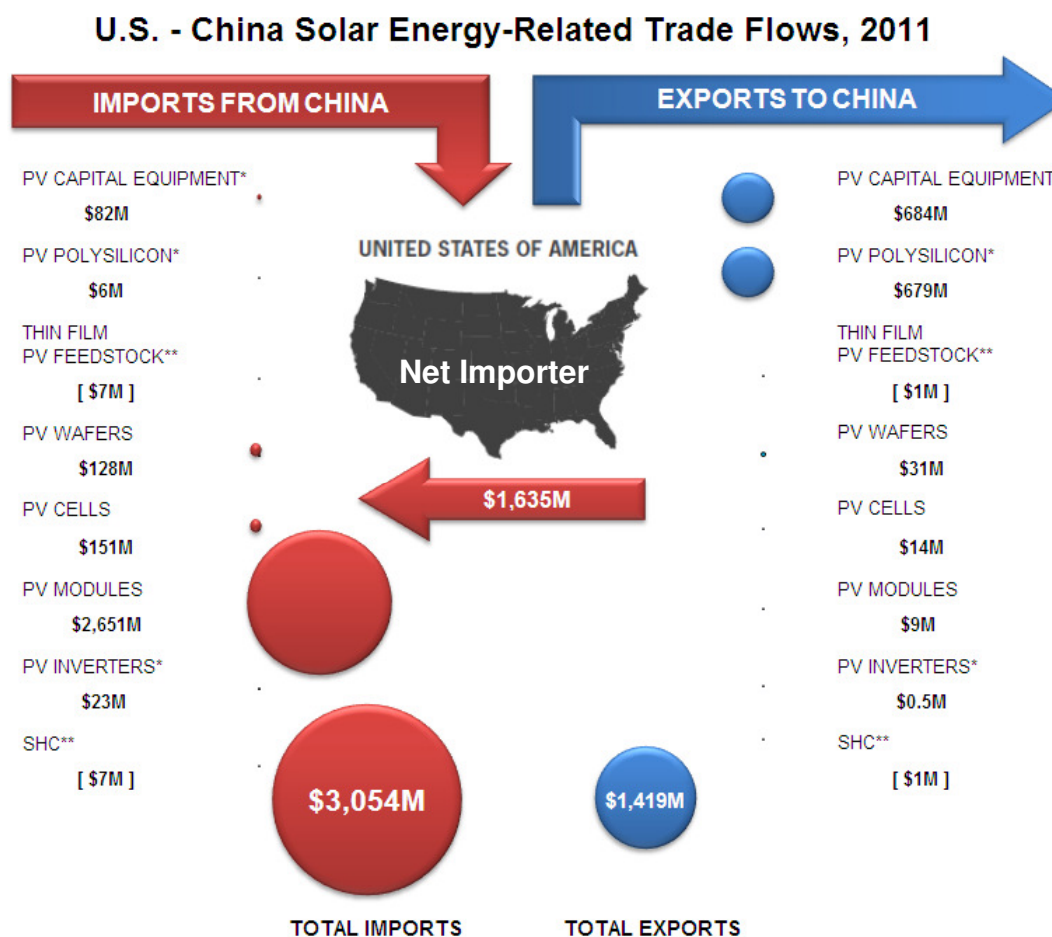
## 2010 U.S.-China Solar Trade Picture: U.S. Was A Net Exporter

**Figure 1-10:**  
 U.S.-China Solar  
 Energy - Related  
 Trade Flows, 2010



**Chart 1:** In 2010, the United States ran a net solar trade surplus with China of between \$247 million and \$539 million.

## 2011 U.S.-China Solar Trade Picture: U.S. Became A Net Importer



- \* Values derived using ratio of imports/exports found in the GTM report to the official U.S. import/export statistics as reported by the U.S. International Trade Commission for calendar year 2010 applying the ratio to official U.S. import/export statistics for calendar year 2011.
- \*\* Data taken from the GTM report for calendar year 2010.

**Chart 2:** In 2011, a dramatic shift occurred in the balance of solar trade. The United States ran a net deficit in solar trade with China of \$1.635 billion. Solar modules/panels constituted the largest product import, increasing 130 percent in value over 2010 imports.

## SUMMARY: U.S.-China Trade Picture in 2011



### U.S. Export Surplus with China in 2010 Became a Massive Trade Deficit in 2011



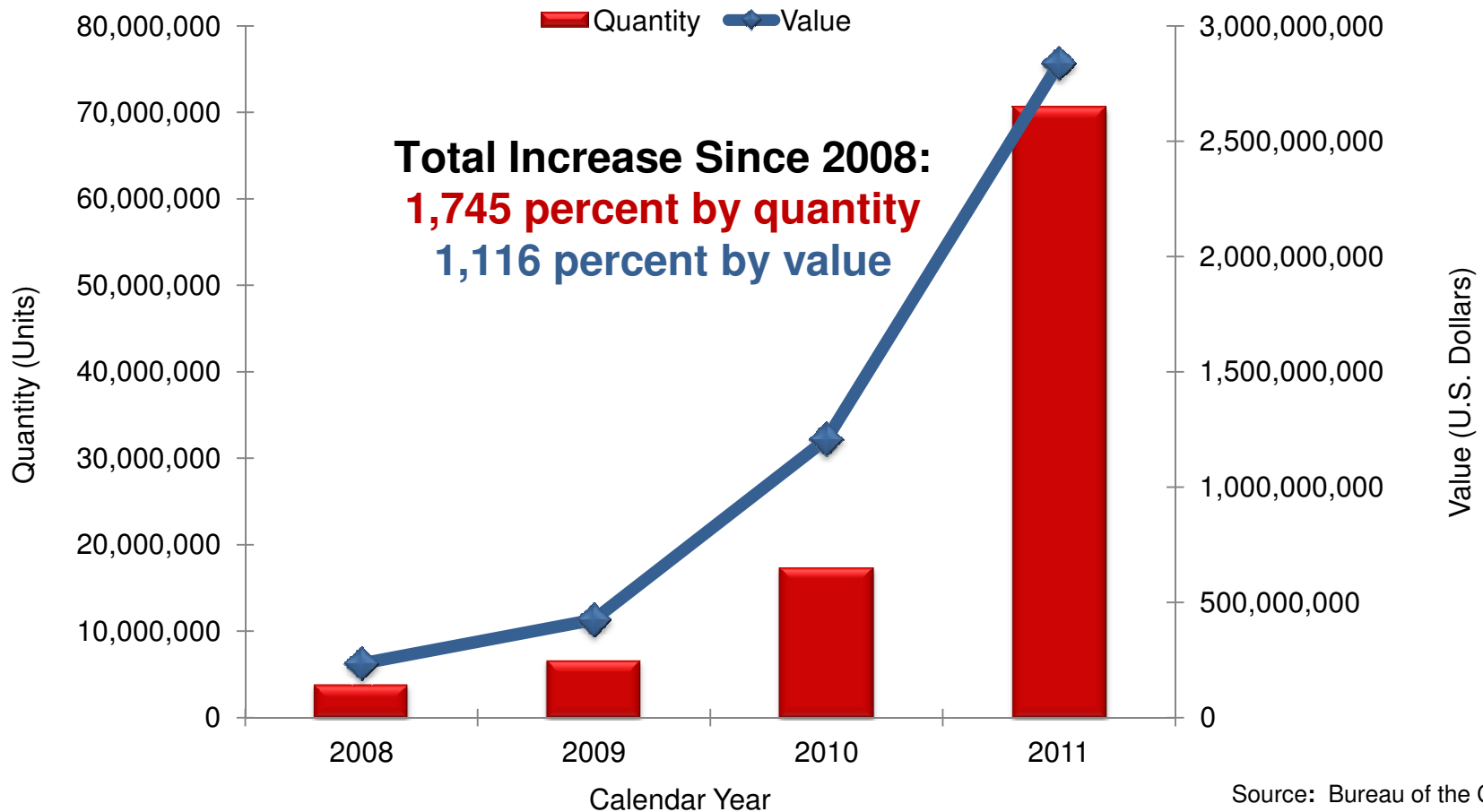
Sources: 2010 – GTM report; 2011 – official U.S. import/export statistics with revisions to values based upon adjustment to 2010 GTM reported values for each import/export category compared to 2010 import/export statistics.

**Chart 3:** In 2010, a U.S. surplus in solar trade with China amounted to between \$247 million and \$539 million. The surplus vanished in 2011; resulting in a deficit of \$1.635 billion.

## Dumped and Subsidized Chinese Imports into U.S. Market Have Surged



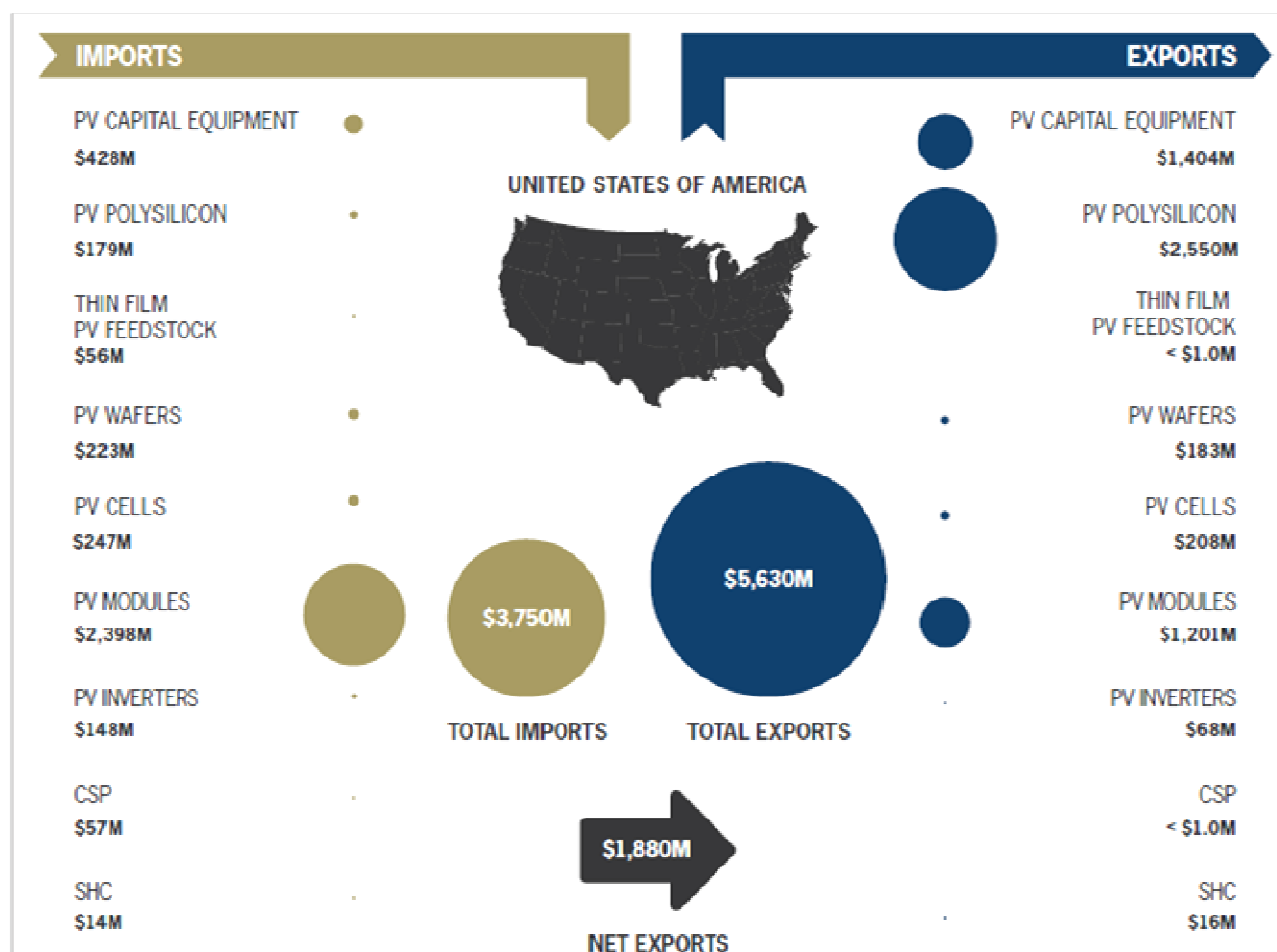
### Total U.S. Imports of Chinese Solar Cells and Panels, 2008-2011



**Chart 4:** A massive surge in solar cells and panels from China into the United States occurred from 2008 through 2011. Import volumes of cells and panels rose, respectively, by 303 percent and 309 percent.

## 2010 U.S.-World Solar Trade Picture: U.S. Was A Net Exporter

**Figure 1-1: Solar  
Industry Trade  
Flows, 2010**

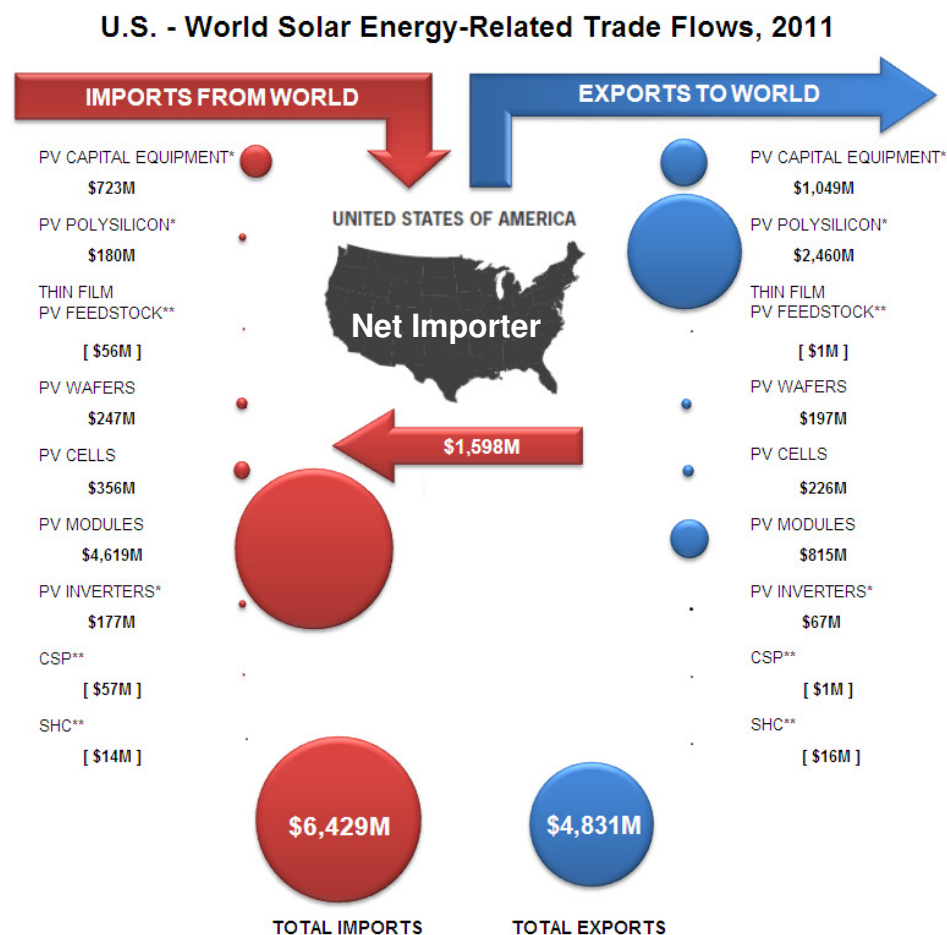


Source: GTM Research, International Trade Commission

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**Chart 5:** In 2010, the United States enjoyed a more than \$1.8 billion net surplus in solar trade with the rest of the world. Polysilicon and solar manufacturing equipment comprised the majority of U.S. exports.

## 2011 U.S.-World Solar Trade Picture: U.S. Became A Net Importer



\* Values derived using ratio of imports/exports found in the GTM report to the official U.S. import/export statistics as reported by the U.S. International Trade Commission for calendar year 2010 applying the ratio to official U.S. import/export statistics for calendar year 2011.

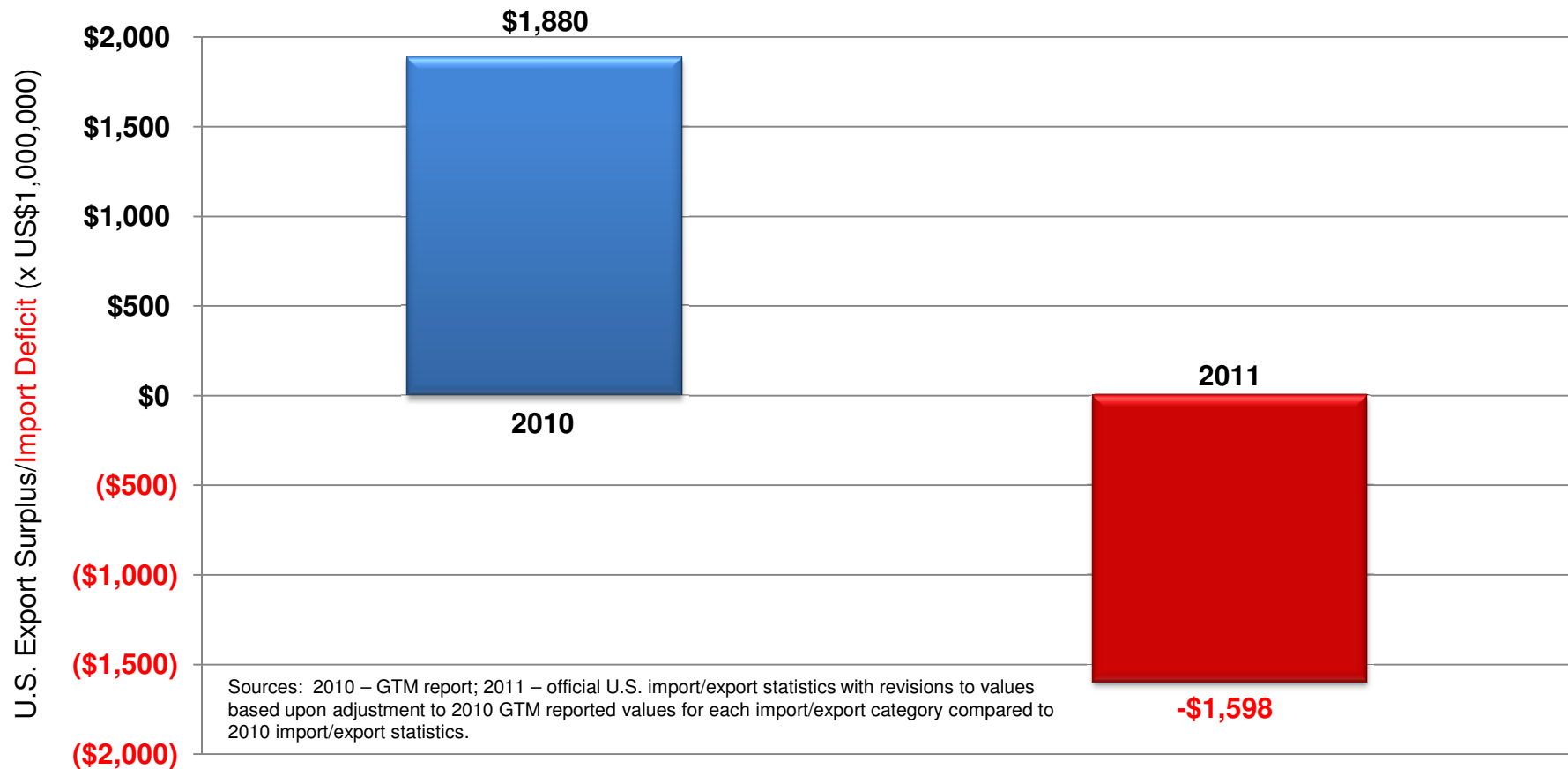
\*\* Data taken from the GTM report for calendar year 2010.

**Chart 6:** A dramatic shift in the U.S.-world balance of solar trade unfolded 2011, producing a solar trade deficit of \$1.59 billion. Ever-rising imports of Chinese-made solar cells and panels primarily drove the shift.

## SUMMARY: U.S. Trade Picture with the World in 2011



### 2010 U.S. Export Surplus with the World Became a Massive Trade Deficit in 2011



**Chart 7:** In 2010, the United States had a solar trade surplus with the world of \$1.88 billion. This surplus came to a dramatic end in 2011 as the United States incurred a deficit of \$1.59 billion, led by fast-rising U.S. imports of a solar cells and modules from China.