Crystalline Silicon Photovoltaic Cells and Modules from China

Investigation Nos. 701-TA-481 and 731-TA-1190 (Review)

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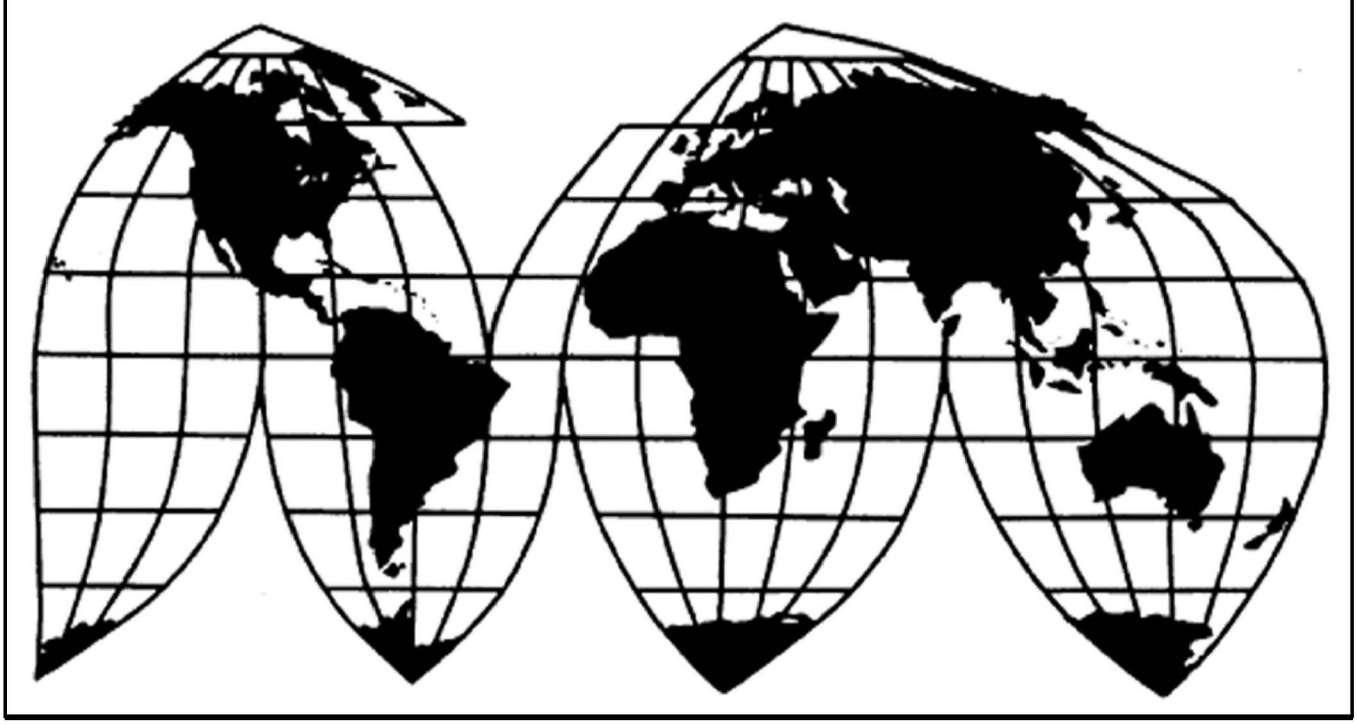
U.S. International Trade Commission



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UNITED STATES INTERNATIONAL TRADE COMMISSION

Investigation Nos. 701-TA-481 and 731-TA-1190 (Review)

Crystalline Silicon Photovoltaic Cells and Modules from China

DETERMINATIONS

On the basis of the record[1] developed in the subject five-year reviews, the United States International Trade Commission ("Commission") determines, pursuant to the Tariff Act of 1930 ("the Act"), that revocation of the antidumping and countervailing duty orders on Crystalline Silicon Photovoltaic Cells and Modules from China would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time.

BACKGROUND

The Commission, pursuant to section 751(c) of the Act (19 U.S.C. 1675(c)), instituted these reviews on November 1, 2017 (82 FR 50681) and determined on February 5, 2018 that it would conduct full reviews (83 FR 8296, February 26, 2018). Notice of the scheduling of the Commission's reviews and of a public hearing to be held in connection therewith was given by posting copies of the notice in the Office of the Secretary, U.S. International Trade Commission, Washington, DC, and by publishing the notice in the *Federal Register* on July 23, 2018 (83 FR 34873)(as revised, effective October 22, 2018 (83 FR 54138, October 26, 2018) and January 31, 2019 (84 FR 2249, February 6, 2019).[2] The hearing was held in Washington, DC, on November 27, 2018, and all persons who requested the opportunity were permitted to appear in person or by counsel.

[1] The record is defined in sec. 207.2(f) of the Commission's Rules of Practice and Procedure (19 CFR 207.2(f)).

[2] Due to the lapse in appropriations and ensuing cessation of Commission operations, all import injury reviews conducted under authority of Title VII of the Tariff Act of 1930 accordingly have been tolled pursuant to 19 U.S.C. §§ 1675(c)(5).

Views of the Commission

Based on the record in these five-year reviews, we determine under section 751(c) of the Tariff Act of 1930, as amended ("the Tariff Act"), that revocation of the antidumping duty and countervailing duty orders on crystalline silicon photovoltaic ("CSPV") cells and modules from China would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time.[1]

I. Background

Original Investigations. In October 2011, SolarWorld Industries America, Inc. ("SolarWorld") filed antidumping and countervailing duty petitions concerning CSPV cells and modules from China. In November 2012, the Commission determined that an industry in the United States was materially injured by reason of imports of CSPV cells and modules from China.[2] Subsequently, the Department of Commerce ("Commerce") issued antidumping and countervailing duty orders ("*CSPV 1* orders").[3] These orders covered CSPV cells produced in China, CSPV modules assembled in China from CSPV cells made in China, and CSPV modules assembled in a third country from CSPV cells made in China.[4]

Three producers in China and four U.S. importers subsequently appealed the Commission's affirmative determinations to the U.S. Court of International Trade; the Court sustained the determinations as supported by substantial evidence and otherwise in accordance with law.[5] On appeal, the U.S. Court of Appeals for the Federal Circuit rejected the Chinese respondents' claims and affirmed the Court of International Trade's judgment.[6]

Current Reviews. In November 2017, the Commission instituted these first five-year reviews to determine whether revoking the *CSPV 1* orders would be likely to lead to

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[1] Due to the lapse in appropriations and ensuing cessation of Commission operations, all import injury reviews conducted under authority of Title VII of the Tariff Act of 1930 accordingly have been tolled pursuant to 19 U.S.C. §§ 1675(c)(5).

[2] *Crystalline Silicon Photovoltaic Cells and Modules from China*, Inv. Nos. 701-TA-481 and 731-TA-1190 (Final), USITC Pub. 4360 (Nov. 2012) ("*CSPV 1*"). The Coalition for American Solar Manufacturing supported the petitions. Confidential Report, Memorandum INV-QQ-151 at I-2 n.7 (Dec. 18, 2018) ("CR"); Public Report ("PR") at I-2 n.7.

[3] *Crystalline Silicon Photovoltaic Cells and Modules from China*, 77 Fed. Reg. 73017 (Dec. 7, 2012) (countervailing duty order); *Crystalline Silicon Photovoltaic Cells and Modules from China*, 77 Fed. Reg. 73018 (Dec. 7, 2012) (antidumping duty order).

[4] *Countervailing Duty Order*, 77 Fed. Reg. 73017; *Antidumping Duty Order*, 77 Fed. Reg. 73018.

[5] *Changzhou Trina Solar Energy Co. v. United States Int'l Trade Comm'n*, 100 F. Supp. 3d 1314 (Ct. Int'l Trade 2015).

[6] *Changzhou Trina Solar Energy Co. v. United States Int'l Trade Comm'n*, 879 F.3d 1377 (Fed. Cir. 2018).

continuation or recurrence of material injury to a domestic industry.[7] The Commission received a response to its notice of institution from SolarWorld. The Commission also received a joint response from the following nine respondent interested parties: Canadian Solar (USA) Inc.; Canadian Solar Inc.; Canadian Solar Manufacturing (Changshu) Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; CSI Cells Co., Ltd.; CSI-GCL Solar Manufacturing (Yancheng), Ltd.; Canadian Solar Sunenergy (Baotou) Co., Ltd.; Canadian Solar Sunenergy (Suzhou) Co., Ltd.; and Canadian Solar International, Ltd., producers, exporters, and U.S. importers of subject merchandise in China.

On February 5, 2018, the Commission determined to conduct full reviews pursuant to section 751(c)(5) of the Act.[8] The Commission found both the domestic interested party group response to its notice of institution and the respondent interested party group response to be adequate. The Commission further found that circumstances, including changes in the conditions of competition in light of recent U.S. safeguard measures imposed on CSPV cells and modules, warranted full reviews.[9]

In these reviews, the Commission received prehearing and posthearing briefs and final comments from SolarWorld. It also received prehearing and posthearing briefs from Sunpower Manufacturing Oregon, LLC ("SunPower"), a U.S.-based global manufacturer and distributor of CSPV products that acquired SolarWorld in October 2018.[10] Representatives of SolarWorld and SunPower appeared at the Commission's hearing accompanied by counsel. The Commission also received prehearing and posthearing briefs and final comments filed jointly by Canadian Solar Inc.; Canadian Solar International, Ltd.; Canadian Solar Manufacturing (Changshu) Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; and Canadian Solar (USA) Inc. (collectively "Canadian Solar"), which are variously producers, exporters, and U.S. importers of subject merchandise from China. Representatives of Canadian Solar appeared at the Commission's hearing accompanied by counsel. The Government of Indonesia also submitted a prehearing brief and appeared at the hearing.[11]

U.S. industry data for these reviews are based on the questionnaire responses of four U.S. producers of CSPV cells that are believed to account for *** percent of total U.S. capacity of CSPV cells in 2017 and of 11 U.S. producers of CSPV modules that are believed to account for approximately *** percent of total U.S. capacity of CSPV modules that year.[12] U.S. import data and related information are based on Commerce's official import statistics; questionnaire

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[7] *Crystalline Silicon Photovoltaic Cells and Modules from China*, 82 Fed. Reg. 50681 (Nov. 1, 2017) (institution of five-year reviews).

[8] *Crystalline Silicon Photovoltaic Cells and Modules from China*, 83 Fed Reg. 8296 (Feb. 26, 2018) (notice of Commission decision to conduct full five-year reviews).

[9] *Crystalline Silicon Photovoltaic Cells and Modules from China*, 83 Fed. Reg. 8296 (Feb. 26, 2018). Chairman Schmidtlein and Commissioner Williamson determined that the respondent interested party group response was inadequate and voted to conduct expedited reviews.

[10] CR at III-14-15, PR at III-9-10.

[11] Indonesian exports of CSPV modules using Chinese cells are covered by the scope of these five-year reviews.

[12] CR at I-21, PR at I-16.

responses submitted by 47 U.S. importers in these reviews that are believed to account for 26.2 percent of total U.S. imports of CSPV cells and modules from China and 56.4 percent of total U.S. imports of CSPV cells and modules from nonsubject countries in 2017; and questionnaire responses submitted by 56 U.S. importers of CSPV products in the Commission's 2017 Section 201 global safeguard investigation that are believed to have accounted for approximately 82.6 percent of total U.S. imports of CSPV products from all sources in 2016.[13] Foreign industry data and related information are based on the questionnaire responses of nine subject producers and exporters of CSPV cells and modules that are believed to account for approximately *** percent of total CSPV cell production in China and *** percent of total CSPV module production in any country, including China, using Chinese-origin cells in 2017, and other public sources.[14]

II. Domestic Like Product and Industry

A. Domestic Like Product

In making its determination under section 751(c) of the Tariff Act, the Commission defines the "domestic like product" and the "industry."[15] The Tariff Act defines "domestic like product" as "a product which is like, or in the absence of like, most similar in characteristics and uses with, the article subject to an investigation under this subtitle."[16] The Commission's practice in five-year reviews is to examine the domestic like product definition from the original investigation and consider whether the record indicates any reason to revisit the prior findings.[17]

Commerce, in its expedited five-year reviews, defined the scope of the antidumping and countervailing duty orders as follows:

> The merchandise covered by the order are crystalline silicon photovoltaic cells, and modules, laminates, and panels, consisting of crystalline silicon photovoltaic cells, whether or not partially or fully assembled into other products, including, but not limited to, modules, laminates, panels and building integrated materials. The order covers crystalline silicon photovoltaic cells of thickness equal to or greater than 20 micrometers, having a p/n junction formed by any means,

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[13] CR at IV-1-3, PR at IV-1-2.

[14] CR at I-22, PR at I-16-17.

[15] 19 U.S.C. § 1677(4)(A).

[16] 19 U.S.C. § 1677(10); *see*, *e.g., Cleo Inc. v. United States*, 501 F.3d 1291, 1299 (Fed. Cir. 2007); *NEC Corp. v. Department of Commerce*, 36 F. Supp. 2d 380, 383 (Ct. Int'l Trade 1998); *Nippon Steel Corp. v. United States*, 19 CIT 450, 455 (1995); *Timken Co. v. United States*, 913 F. Supp. 580, 584 (Ct. Int'l Trade 1996); *Torrington Co. v. United States*, 747 F. Supp. 744, 748-49 (Ct. Int'l Trade 1990), *aff'd*, 938 F.2d 1278 (Fed. Cir. 1991); *see also* S. Rep. No. 249, 96th Cong., 1st Sess. 90-91 (1979).

[17] *See, e.g.*, *Internal Combustion Industrial Forklift Trucks from Japan*, Inv. No. 731-TA-377 (Second Review), USITC Pub. 3831 at 8-9 (Dec. 2005); *Crawfish Tail Meat from China*, Inv. No. 731-TA-752 (Review), USITC Pub. 3614 at 4 (July 2003); *Steel Concrete Reinforcing Bar from Turkey*, Inv. No. 731-TA-745 (Review), USITC Pub. 3577 at 4 (Feb. 2003).

whether or not the cell has undergone other processing, including, but not limited to, cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell.

Merchandise under consideration may be described at the time of importation as parts for final finished products that are assembled after importation, including, but not limited to, modules, laminates, panels, building-integrated modules, building-integrated panels, or other finished goods kits. Such parts that otherwise meet the definition of merchandise under consideration are included in the scope of the orders.

Excluded from the scope of the order are thin film photovoltaic products produced from amorphous silicon (a-Si), cadmium telluride (CdTe), or copper indium gallium selenide (CIGS).

Also excluded from the scope of the order are crystalline silicon photovoltaic cells, not exceeding 10,000 mm^2 in surface area, that are permanently integrated into a consumer good whose function is other than power generation and that consumes the electricity generated by the integrated crystalline silicon photovoltaic cell. Where more than one cell is permanently integrated into a consumer good, the surface area for purposes of this exclusion shall be the total combined surface area of all cells that are integrated into the consumer good.

Additionally, excluded from the scope of this order are panels with surface area from 3,450 mm^2 to 33,782 mm^2 with one black wire and one red wire (each of type 22 AWG or 24 AWG not more than 206 mm in length when measured from panel extrusion), and not exceeding 2.9 volts, 1.1 amps, and 3.19 watts. For the purposes of this exclusion, no panel shall contain an internal battery or external computer peripheral ports.

Modules, laminates, and panels produced in a third-country from cells produced in China are covered by the orders; however, modules, laminates, and panels produced in China from cells produced in a third-country are not covered by the order.

Merchandise covered by this order is currently classified in the Harmonized Tariff System of the United States (HTSUS) under subheadings 8501.61.0000, 8507.20.80, 8541.40.6020, 8541.40.6030, and 8501.31.8000. These HTSUS

subheadings are provided for convenience and customs purposes; the written description of the scope of the order is dispositive.[18]

The scope definition has not changed substantively since the original investigations.

CSPV cells typically measure approximately 6 by 6 inches, have an output of 4 to more than 5 watts, and have a positive layer, a negative layer, and a positive-negative junction ("p/n junction").[19] CSPV cells use either monocrystalline silicon or multicrystalline silicon to convert sunlight into electricity.[20]

In order to achieve the desired wattage and power requirements, manufacturers typically solder CSPV cells together in strings and then lay them in a rectangular matrix on top of a piece of glass that is covered with a sheet of ethyl vinyl acetate.[21] Manufacturers will then add a sealant and a back sheet before laminating the cells in a vacuum and curing the product.[22] The "laminate" is then attached to a frame, and a junction box is mounted on the back.[23] The resulting CSPV modules route electricity generated by the interconnected cells to the junction box.[24] Some manufacturers use CSPV cells to make building-integrated photovoltaic products that are integrated into the building envelope, replacing conventional construction materials such as glass or roof shingles.[25]

CSPV modules are the main component of solar CSPV systems that use crystalline silicon to convert sunlight into electricity either for on-site use or for distribution through the electric grid.[26] The other components of grid-connected solar CSPV system installations, referred to as the balance of system ("BOS"), are items such as the inverter and the racking on which the system is installed.[27] Additionally, there are a number of services and expenses associated with

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[18] *Certain Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from China*, 83 Fed. Reg. 10663, Issues and Decision Memorandum (Mar. 12, 2018) (final results of expedited first sunset review of antidumping duty order); *Certain Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from China*, 83 Fed. Reg. 10431, Issues and Decision Memorandum (Mar. 9, 2018) (final results of expedited first sunset review of countervailing duty order).

[19] CR at I-37, PR at I-30.

[20] CR at I-41, PR at I-33. Monocrystalline cells are made from a single grown crystal and tend to have a higher conversion efficiency than multicrystalline cells, which have a random crystal structure. CR at I-41, PR at I-33; CR/PR at Figure I-4. Conversion efficiency is the percent of sunlight that is converted to electricity. CR at I-41 n.74, PR at I-33 n.74.

[21] CR at I-61, PR at I-49.

[22] CR at I-61, PR at I-49.

[23] CR at I-61, PR at I-49.

[24] CR at I-37 n.65, PR at I-30 n.65. The junction box can be attached to other modules, an inverter (which converts the direct current generated by the system to alternating current), or, in the case of off-grid modules, a battery and charge controller (which controls battery charging). CR at I-39, PR at I-32.

[25] CR at I-48, PR at I-38.

[26] CR at I-37, PR at I-30.

[27] CR at I-50, PR at I-40.

the installation of a photovoltaic ("PV") system, including site assessment and design work, permitting and labor fees, and operations and maintenance services.[28] CSPV modules may be used in on-grid applications for residential, non-residential, and utility purposes and in off-grid applications for purposes such as power generation in remote locations, mobile power solutions, telecommunications power and lighting systems.[29]

In the original investigations, the Commission found a single domestic like product corresponding to the scope. In doing so, the Commission considered whether to define the domestic like product more broadly than the scope to include thin-film products.[30] The Commission analyzed the issue under its traditional six-factor analysis. The Commission, finding that the record demonstrated a number of differences between CSPV and thin-film products, concluded that thin-film products should not be included in the domestic like product consisting of CSPV cells and modules.[31]

In the current reviews, there is no new information to warrant a domestic like product definition that is different than that reached by the Commission in the original investigations. Moreover, the domestic industry has stated that it agrees with the Commission's prior definition of the domestic like product, and Chinese respondents do not raise any arguments to the contrary.[32] We therefore continue to define a single domestic like product consisting of all domestically produced CSPV cells and modules that correspond to the scope description.[33]

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[28] CR at I-50 n.84, PR at I-40 n.84.

[29] CR at I-50-53, PR at I-40-43.

[30] *CSPV 1*, USITC Pub. 4360 at 6-12. In the preliminary phase of the original investigations, the Commission also considered whether to treat CSPV cells and modules as separate domestic like products. It further considered whether to define "off-grid" CSPV modules, which are used in CSPV systems that are designed to operate outside an electrical grid, as a separate domestic like product. *Crystalline Silicon Photovoltaic Cells and Modules from China*, Inv. Nos. 701-TA-481 and 731-TA-1190 (Preliminary), USITC Pub. 4295 at 10-12 (Dec. 2011). The Commission, noting that no party had advocated in favor of finding any of these items to be separate domestic like products, found no basis in the record to do so. *See id.* In the final phase of the investigations, the Commission found that the record continued to support the Commission's findings on these issues in its preliminary determinations. *CSPV 1*, USITC Pub. 4360 at 6.

[31] Specifically, the Commission found that the two products were manufactured using different raw materials, manufacturing facilities, manufacturing processes, and production employees. Additionally, differences between the two products in terms of chemical composition, weight, size, conversion efficiency, output, inherent properties, and other factors limited their interchangeability after the design phase and in specific projects. These differences also limited overlap in distribution channels, particularly for non-utility sales. Further, a number of market participants reported viewing CSPV and thin-film products as sometimes competitive, but generally different products; they reported CSPV products to be generally higher priced than thin-film products. *CSPV 1*, USITC Pub. 4360 at 8-12.

[32] SolarWorld Response to the Notice of Institution at 18 (Dec. 1, 2017); SolarWorld Prehearing Br. at 5 (Nov. 14, 2018); *see generally* Canadian Solar Prehearing Br. and Canadian Solar Posthearing Br.; Hearing Tr. at 223 (Stoel).

[33] Commissioner Broadbent notes that in the underlying original final investigations in *CSPV 1*, she found a single domestic like product consisting of CSPV cells and modules. However, based on the

B. Domestic Industry

Section 771(4)(A) of the Tariff Act defines the relevant industry as the domestic "producers as a whole of a domestic like product, or those producers whose collective output of a domestic like product constitutes a major proportion of the total domestic production of the product."[34] In defining the domestic industry, the Commission's general practice has been to include in the industry producers of all domestic production of the like product, whether toll-produced, captively consumed, or sold in the domestic merchant market.

In the original investigations, the Commission addressed whether U.S. firms that assembled CSPV cells into CSPV modules engaged in sufficient production-related activities to be considered part of the domestic industry.[35] The Commission found that module assembly operations involved non-insubstantial capital expenditures, ongoing research and development ("R&D") expenses, some automation and technical expertise, and higher employment levels, although with generally less technically skilled workers than for CSPV cell production. Additionally, it found that CSPV module operations provided lower value-added than CSPV cell manufacturing but still provided meaningful value-added. Although a relatively large portion of U.S.-made CSPV modules used CSPV cells that were imported from nonsubject or subject sources, the majority were made from domestically produced CSPV cells by the end of the period of investigation. The Commission concluded that, on balance and absent contrary argument by the parties, U.S. firms assembling CSPV cells into modules engaged in sufficient production-related activities to be included in the domestic industry.[36] No new facts have been

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record in the subsequent original final investigations on Certain Crystalline Silicon Photovoltaic Products from China and Taiwan ("*CSPV 2*"), she found two separate domestic like products: CSPV cells and CSPV modules. While practically all CSPV cells produced in the United States were ultimately used in the production of modules, other factors supported a finding that CSPV cells and CSPV modules were separate products. Specifically, there was a significant separate market for cells that was independent of the market segments in which modules are sold, and there were clear differences between cells and modules in terms of characteristics and function. Finally, module production, like cell production, was a substantial processing step in the supply chain that added significant value to the final product. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan*, Inv. Nos. 701-TA-511 and 731-TA-1246-47 (Final), USITC Pub. 4519 at 52-56 (Feb. 2015).

In these reviews, she finds that there continue to be differences between CSPV cells and CSPV modules. The section 201 safeguard actions, which include duty-free treatment for imports of up to 2.5 GW of CSPV cells but no such TRQ for CSPV modules, reinforce these differences. However, she notes that no party has argued for CSPV cells and CSPV modules to be separate domestic like products, nor does she find any other reason to perform separate analyses of these products in these reviews. Therefore, she has not reexamined this issue for purposes of the orders currently under review, and defines a single domestic like product consisting of all domestically produced CSPV cells and modules.

[34] 19 U.S.C. § 1677(4)(A). The definitions in 19 U.S.C. § 1677 are applicable to the entire subtitle containing the antidumping and countervailing duty laws, including 19 U.S.C. §§ 1675 and 1675a. *See* 19 U.S.C. § 1677.

[35] *CSPV 1*, USITC Pub. 4360 at 12-13.

[36] *CSPV 1*, USITC Pub. 4360 at 12-13.

presented to warrant an approach different from that followed by the Commission in the original investigations and no party has argued for the Commission to revisit its domestic industry definition in these reviews. Therefore, we find that U.S firms assembling CSPV modules engage in sufficient production-related activities to include these firms in the domestic industry.

We must also determine whether any producer of the domestic like product should be excluded from the domestic industry pursuant to section 771(4)(B) of the Tariff Act. This provision allows the Commission, if appropriate circumstances exist, to exclude from the domestic industry producers that are related to an exporter or importer of subject merchandise, or are themselves importers.[37] Exclusion of such a producer is within the Commission's discretion based upon the facts presented in each investigation.[38]

In the final phase of the original investigations, two U.S. producers, Suntech and Motech, qualified as related parties by virtue of their imports of subject merchandise from China.[39] Additionally, both companies were affiliated with producers and exporters of subject merchandise in China. The Commission determined that appropriate circumstances did not exist to exclude Motech from the domestic industry as a related party, but that appropriate circumstances existed to exclude Suntech from the domestic industry because its interests lay more with importing than domestic production.[40]

In these reviews, the record indicates that *** is a related party because it directly imported subject merchandise from China during the period of review.[41] The record further indicates that *** is a related party because it is related to a Chinese exporter of subject merchandise to the U.S. market.[42] No party has argued for the exclusion of any U.S. producer from the domestic industry.

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[37] 19 U.S.C. § 1677(4)(A).

[38] The primary factors the Commission has examined in deciding whether appropriate circumstances exist to exclude a related party include the following:

(1) the percentage of domestic production attributable to the importing producer;

(2) the reason the U.S. producer has decided to import the product subject to investigation (whether the firm benefits from the LTFV sales or subsidies or whether the firm must import in order to enable it to continue production and compete in the U.S. market);

(3) whether inclusion or exclusion of the related party will skew the data for the rest of the industry;

(4) the ratio of import shipments to U.S. production for the imported product; and

(5) whether the primary interest of the importing producer lies in domestic production or importation. *Changzhou Trina Solar Energy Co. v. USITC*, 100 F. Supp.3d 1314, 1326-31 (Ct. Int'l. Trade 2015); *see also Torrington Co. v. United States*, 790 F. Supp. at 1168.

[39] *CSPV 1*, USITC Pub. 4360 at 14-16.

[40] *CSPV 1*, USITC Pub. 4360 at 14-16.

[41] CR/PR at Table III-17.

[42] CR/PR at Table I-8. The record also indicates that prior to its closure in 2013, domestic producer *** shared the same parent company *** as ***, a subject producer in China. *** during the

***. *** is a relatively small U.S producer (accounting for *** percent of reported CSPV module production in the United States in 2017) that imported subject merchandise in the first two years of the period of review.[43] Specifically, *** imported *** kW of subject merchandise from China in 2012 and *** kW in 2013.[44] These imports were equivalent to *** percent of the firm's domestic production in 2012 and *** percent of its domestic production in 2013.[45]

We find that appropriate circumstances do not exist to exclude *** from the domestic industry as a related party. The absolute volume of ***'s imports of subject merchandise fell from 2012 to 2013 and it did not report any imports of subject merchandise after 2013.[46] As *** reduced its volume of subject imports, it ramped up its U.S. production from *** kW in 2012 to *** kW in 2017.[47] In addition, *** states that it ***.[48] This evidence, along with the fact that it *** the continuation of the orders in these reviews,[49] indicates that the interests of *** lie in its domestic production operations.

***. *** accounted for *** percent of reported CSPV cell production and *** percent of reported CSPV module production in the United States in 2017.[50] In October 2015, ***, a producer and exporter of subject merchandise, ***.[51]

We find that appropriate circumstances do not exist to exclude *** from the domestic industry as a related party. *** did not directly import or purchase subject CSPV products from China during the period of review.[52] Moreover, it made significant capital expenditures to its domestic production operations. Specifically, ***.[53] In April 2017, it ***, citing *** as having had a ***.[54] The record provides no indication that ***'s relationship with *** benefitted the firm during the time it was a domestic producer. This evidence, along with the fact that it *** the continuation of the orders in these reviews,[55] indicates that the primary interests of *** lay in its domestic production operations.

Accordingly, given our definition of the domestic like product, we define the domestic industry as all U.S. producers of CSPV cells and modules.

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period of review. EDIS Doc. 664937. Consequently, *** is not a related party under 19 U.S.C. § 1677(4)(B)(ii).

[43] CR/PR at Table I-7 and Table III-18.

[44] CR/PR at Table III-18.

[45] CR/PR at Table III-18.

[46] CR/PR at Table III-18.

[47] CR/PR at Table III-18.

[48] *** U.S. Producer Questionnaire Response at III-11 (Sept. 19, 2018).

[49] CR/PR at Table I-7.

[50] CR/PR at Table I-7.

[51] CR/PR at Table III-4. According to *** during the period of review. EDIS Doc. 664937.

[52] CR/PR at Tables III-17-18.

[53] CR/PR at Table III-4.

[54] CR/PR at Table III-4; CR at III-16, PR at III-10.

[55] CR/PR at Table I-7.

III. Revocation of the Antidumping and Countervailing Duty Orders Would Likely Lead to Continuation or Recurrence of Material Injury Within a Reasonably Foreseeable Time

A. Legal Standards

In a five-year review conducted under section 751(c) of the Tariff Act, Commerce will revoke an antidumping or countervailing duty order unless: (1) it makes a determination that dumping or subsidization is likely to continue or recur and (2) the Commission makes a determination that revocation of the antidumping or countervailing duty order "would be likely to lead to continuation or recurrence of material injury within a reasonably foreseeable time."[56] The SAA states that "under the likelihood standard, the Commission will engage in a counterfactual analysis; it must decide the likely impact in the reasonably foreseeable future of an important change in the status quo – the revocation or termination of a proceeding and the elimination of its restraining effects on volumes and prices of imports."[57] Thus, the likelihood standard is prospective in nature.[58] The U.S. Court of International Trade has found that "likely," as used in the five-year review provisions of the Act, means "probable," and the Commission applies that standard in five-year reviews.[59]

The statute states that "the Commission shall consider that the effects of revocation or termination may not be imminent, but may manifest themselves only over a longer period of time."[60] According to the SAA, a "'reasonably foreseeable time' will vary from case-to-case, but

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[56] 19 U.S.C. § 1675a(a).

[57] SAA at 883-84. The SAA states that "{t}he likelihood of injury standard applies regardless of the nature of the Commission's original determination (material injury, threat of material injury, or material retardation of an industry). Likewise, the standard applies to suspended investigations that were never completed." *Id*. at 883.

[58] While the SAA states that "a separate determination regarding current material injury is not necessary," it indicates that "the Commission may consider relevant factors such as current and likely continued depressed shipment levels and current and likely continued {sic} prices for the domestic like product in the U.S. market in making its determination of the likelihood of continuation or recurrence of material injury if the order is revoked." SAA at 884.

[59] *See NMB Singapore Ltd. v. United States*, 288 F. Supp. 2d 1306, 1352 (Ct. Int'l Trade 2003) ("'likely' means probable within the context of 19 U.S.C. § 1675(c) and 19 U.S.C. § 1675a(a)"), *aff'd mem.*, 140 Fed. Appx. 268 (Fed. Cir. 2005); *Nippon Steel Corp. v. United States*, 26 CIT 1416, 1419 (2002) (same); *Usinor Industeel, S.A. v. United States*, 26 CIT 1402, 1404 nn.3, 6 (2002) ("more likely than not" standard is "consistent with the court's opinion;" "the court has not interpreted 'likely' to imply any particular degree of 'certainty'"); *Indorama Chemicals (Thailand) Ltd. v. United States*, 26 CIT 1059, 1070 (2002) ("standard is based on a likelihood of continuation or recurrence of injury, not a certainty"); *Usinor v. United States*, 26 CIT 767, 794 (2002) ("'likely' is tantamount to 'probable,' not merely 'possible'").

[60] 19 U.S.C. § 1675a(a)(5).

normally will exceed the 'imminent' timeframe applicable in a threat of injury analysis in original investigations."[61]

Although the standard in a five-year review is not the same as the standard applied in an original investigation, it contains some of the same fundamental elements. The statute provides that the Commission is to "consider the likely volume, price effect, and impact of imports of the subject merchandise on the industry if the orders are revoked or the suspended investigation is terminated."[62] It directs the Commission to take into account its prior injury determination, whether any improvement in the state of the industry is related to the order or the suspension agreement under review, whether the industry is vulnerable to material injury if an order is revoked or a suspension agreement is terminated, and any findings by Commerce regarding duty absorption pursuant to 19 U.S.C. § 1675(a)(4).[63] The statute further provides that the presence or absence of any factor that the Commission is required to consider shall not necessarily give decisive guidance with respect to the Commission's determination.[64]

In evaluating the likely volume of imports of subject merchandise if an order under review is revoked and/or a suspended investigation is terminated, the Commission is directed to consider whether the likely volume of imports would be significant either in absolute terms or relative to production or consumption in the United States.[65] In doing so, the Commission must consider "all relevant economic factors," including four enumerated factors: (1) any likely increase in production capacity or existing unused production capacity in the exporting country; (2) existing inventories of the subject merchandise, or likely increases in inventories; (3) the existence of barriers to the importation of the subject merchandise into countries other than the United States; and (4) the potential for product shifting if production facilities in the foreign country, which can be used to produce the subject merchandise, are currently being used to produce other products.[66]

In evaluating the likely price effects of subject imports if an order under review is revoked and/or a suspended investigation is terminated, the Commission is directed to consider whether there is likely to be significant underselling by the subject imports as

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[61] SAA at 887. Among the factors that the Commission should consider in this regard are "the fungibility or differentiation within the product in question, the level of substitutability between the imported and domestic products, the channels of distribution used, the methods of contracting (such as spot sales or long-term contracts), and lead times for delivery of goods, as well as other factors that may only manifest themselves in the longer term, such as planned investment and the shifting of production facilities." *Id*.

[62] 19 U.S.C. § 1675a(a)(1).

[63] 19 U.S.C. § 1675a(a)(1). Commerce has not made duty absorption findings on the subject merchandise. Commerce's Issues and Decision Memorandum for the Expedited First Sunset Review of the Antidumping Duty Order on Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China at 6 (March 5, 2018).

[64] 19 U.S.C. § 1675a(a)(5). Although the Commission must consider all factors, no one factor is necessarily dispositive. SAA at 886.

[65] 19 U.S.C. § 1675a(a)(2).

[66] 19 U.S.C. § 1675a(a)(2)(A-D).

compared to the domestic like product and whether the subject imports are likely to enter the United States at prices that otherwise would have a significant depressing or suppressing effect on the price of the domestic like product.[67]

In evaluating the likely impact of imports of subject merchandise if an order under review is revoked and/or a suspended investigation is terminated, the Commission is directed to consider all relevant economic factors that are likely to have a bearing on the state of the industry in the United States, including but not limited to the following: (1) likely declines in output, sales, market share, profits, productivity, return on investments, and utilization of capacity; (2) likely negative effects on cash flow, inventories, employment, wages, growth, ability to raise capital, and investment; and (3) likely negative effects on the existing development and production efforts of the industry, including efforts to develop a derivative or more advanced version of the domestic like product.[68] All relevant economic factors are to be considered within the context of the business cycle and the conditions of competition that are distinctive to the industry. As instructed by the statute, we have considered the extent to which any improvement in the state of the domestic industry is related to the orders under review and whether the industry is vulnerable to material injury upon revocation.[69]

B. Conditions of Competition and the Business Cycle

In evaluating the likely impact of the subject imports on the domestic industry if an order is revoked, the statute directs the Commission to consider all relevant economic factors "within the context of the business cycle and conditions of competition that are distinctive to the affected industry."[70] The following conditions of competition inform our determinations.

Demand Conditions. In the original investigations, the Commission found that despite a severe downturn in macroeconomic conditions, apparent U.S. consumption for CSPV products increased from 2009 to 2011.[71] The Commission observed that demand for CSPV products was derived from the demand for solar electricity, which was affected by factors such as total energy consumption, environmental concerns, cost competitiveness with traditional energy

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[67] *See* 19 U.S.C. § 1675a(a)(3). The SAA states that "{c}onsistent with its practice in investigations, in considering the likely price effects of imports in the event of revocation and termination, the Commission may rely on circumstantial, as well as direct, evidence of the adverse effects of unfairly traded imports on domestic prices." SAA at 886.

[68] 19 U.S.C. § 1675a(a)(4).

[69] The SAA states that in assessing whether the domestic industry is vulnerable to injury if the order is revoked, the Commission "considers, in addition to imports, other factors that may be contributing to overall injury. While these factors, in some cases, may account for the injury to the domestic industry, they may also demonstrate that an industry is facing difficulties from a variety of sources and is vulnerable to dumped or subsidized imports." SAA at 885.

[70] 19 U.S.C. § 1675a(a)(4).

[71] *CSPV 1*, USITC Pub. 4360 at 24.

sources, and the availability of Federal, state, and local incentives.[72] Competition with renewable-energy electricity-generators such as thin-film solar systems also affected demand for CSPV systems and their components.[73]

In the current reviews, we find that U.S. demand for CSPV cells and modules remains dependent on the demand for solar electricity, which continues to be impacted by factors such as cost competitiveness with other energy sources.[74] Specifically, electricity in the United States is supplied by conventional sources (*e.g.*, coal and natural gas) as well as renewable sources (*e.g.*, solar, wind, geothermal, and biomass). Electricity providers using renewable energy sources seek to achieve "grid parity" with other sources of electricity (the price at which the levelized cost of electricity generated from renewable sources is competitive with the cost of electricity generated by conventional sources) and their ability to do so affects demand for these products.[75] The levelized cost of electricity varies by region, time of the day, and availability of other electricity sources.[76] During periods of non-peak electricity demand in the United States, only lowest cost "baseload" generators are able to sell electricity to the transmission or distribution grid, whereas during periods of peak electricity demand, even generators with somewhat higher costs may be able to sell electricity to the grid.[77] For peak periods, natural-gas generated electricity generally sets the levelized cost of electricity that CSPV and other renewable energy systems seek to meet, especially for utility sales.[78]

Changes in Federal, state, and local government incentives and regulations also continue to play a role in demand for CSPV products.[79] These programs offset the cost of generating solar energy, mandate or encourage its use, or otherwise influence its price, thereby stimulating demand for renewable energy-generated electricity and assisting developers of solar power and other renewable energy sources to achieve economies of scale to become more competitive with conventional sources of electricity.[80] Several types of tax credits, the most common form of Federal incentives, were modified and extended during the period of review, which affected the timing of the development of solar projects. These incentives, however, are designed ultimately to decline over time as the cost to generate solar-powered

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[72] *CSPV 1*, USITC Pub. 4360 at 21. The Commission observed that Federal, state, and local government programs, which were intended to reduce the cost of solar-generated electricity (and electricity generated by other renewable energy sources), successfully stimulated demand for CSPV products in the United States. *See id.* at 22-23.

[73] *CSPV 1*, USITC Pub. 4360 at 22.

[74] CR at II-28-31, PR at II-19-21; Canadian Solar Prehearing Br. at 34-40.

[75] CR at II-28-29, PR at II-19. The levelized cost of electricity represents the per kilowatt hour cost of building and operating a generating plant over an assumed financial life. CR at II-28, PR at II-19. The availability of both state and federal tax credits can also impact the calculation of the levelized cost of electricity. *Id*.

[76] CR at II-28, PR at II-19.

[77] CR at II-28, PR at II-19.

[78] CR at II-28-29, PR at II-19.

[79] CR at II-20-28, PR at II-13-18.

[80] CR at II-20-28, PR at II-13-18.

electricity declines.[81] A plurality of U.S. producers, importers, and purchasers reported that state and local government incentives increased demand for CSPV cells and modules during the period of review, while Federal government incentives had no effect on demand.[82] A plurality of U.S. producers and importers reported that they anticipate state and local government incentives to increase demand for CSPV cells and modules in the future while a plurality of purchasers reported that they anticipate such incentives will cause demand to fluctuate.[83] A plurality of U.S. producers and importers further reported that they anticipate Federal government incentives to have no impact on demand for CSPV cells and modules while most purchasers reported that they anticipate Federal government incentives to decrease demand for CSPV cells and modules.[84]

Apparent U.S. consumption of CSPV cells and modules grew substantially by *** percent during the period of review.[85] It increased from *** kW in 2012 to *** kW in 2013, *** kW in 2014, *** kW in 2015, and *** kW in 2016, before declining to *** in 2017.[86] Apparent U.S. consumption of CSPV cells and modules was *** percent lower in January-June 2018 ("interim 2018"), at *** kW, than in January-June 2017 ("interim 2017"), at *** kW.[87] The majority of market participants reported that demand for CSPV cells and modules increased since January 1, 2012 and that they anticipate demand to continue to increase in the foreseeable future.[88] According to data from GTM Research, photovoltaic installations increased from 3.4 gigawatts ("GW") in 2012 to 15.1 GW in 2016, and then decreased to 10.6 GW in 2017.[89] GTM projected

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[81] CR at II-20-21, PR at II-13-14. For instance, solar projects that commence construction by 2019 would qualify for a 30 percent Investment Tax Credit if placed in service before 2024, which will decrease to 26 percent for projects commenced by 2020, and to 22 percent for projects commenced by 2021. CR at II-21-22, PR at II-14-15.

[82] CR/PR at Table II-9.

[83] CR/PR at Table II-9.

[84] CR/PR at Table II-9. Purchasers explained that decreases and reductions in Federal government tax credits for CSPV cells and modules will result in decreased demand for CSPV cells and modules in the future. CR at II-28, PR at II-18.

[85] CR/PR at Table C-1. Commercial sales of CSPV modules were considerably larger than commercial sales of CSPV cells. Apparent U.S. consumption of CSPV modules increased by *** percent between 2012 and 2017, growing from *** kW in 2012 to *** kW in 2013, *** kW in 2014, *** kW in 2015, and *** kW in 2016, before declining to *** kW in 2017. Apparent U.S. consumption of CSPV modules was lower in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table C-2. Apparent U.S. consumption of CSPV cells in the merchant market declined by *** percent between 2012 and 2017, decreasing from *** kW in 2012 to *** kW in 2013 and *** kW in 2014, increasing to *** kW in 2015 and *** kW in 2016, and decreasing to *** kW in 2017. Apparent U.S. consumption of CSPV cells was higher in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table C-3.

[86] CR/PR at Table I-10.

[87] CR/PR at Tables I-10, C-1.

[88] CR/PR at Table II-5.

[89] GTM Research and SEIA, *U.S. Solar Market Insight*, 2017 Year in Review and Q4 2018, EDIS Document 664355. Photovoltaic installations are primarily comprised of CSPV products, but also include out-of-scope photovoltaic products such as thin film. *See, e.g.*, International Energy Agency

2018 installations of 11.1 GW.[90] Although demand grew throughout the period prior to 2016, the temporary surge in demand in 2016 was due to the anticipated expiration of the Federal Investment Tax Credit in December 2016, as purchasers sought to initiate installations by that time to take advantage of the tax credits that were to be phased out after that year.[91] Following the temporary spike in demand in 2016, the number of PV installations declined in 2017 to a level more consistent with long-term growth trends.[92] More recently, apparent U.S. consumption was affected by the Section 201 global safeguard investigation, which caused purchasers to stockpile imports in the second half of 2017 and which led to an increase in apparent U.S. consumption at that time, and a subsequent drop-off in the first half of 2018.[93]

During the period of review, the vast majority of CSPV modules were sold in the following three U.S. market segments – residential, non-residential/commercial, and utility.[94] All three market segments experienced considerable growth from 2012 to 2017,[95] with the domestic industry and subject importers both selling CSPV products to distributors, residential and commercial installers, and utility customers.[96]

Supply Conditions. In the original investigations, the Commission found that the U.S. market was supplied by the domestic industry, subject imports, and imports from nonsubject countries.[97] The Commission observed that during the period of investigation, a number of U.S. firms began production of CSPV cells and/or CSPV modules in the United States as demand

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Photovoltaic Power Systems Programme, *Trends 2018 in Photovoltaic Applications*, Report IEA PVPS T1-34:2018, pp. 5, 58–59, EDIS Document 664355.

[90] GTM Research and SEIA, *U.S. Solar Market Insight*, 2017 Year in Review and Q4 2018, EDIS Document 664355.

[91] GTM Research and SEIA, *U.S. Solar Market Insight Report: 2016 Year in Review*, 2017, pp. 7–8, EDIS Document 664355. The program was subsequently extended for several more years.

[92] GTM Research and SEIA, *U.S. Solar Market Insight Report: 2017 Year in Review*, 2018, p. 6, EDIS Document 664355.

[93] Canadian Solar Posthearing Br., Appendix at 20-24.

[94] CR at I-50, PR at I-40. These three market segments are connected to the grid. *See id.* As previously discussed, there is also an off-grid market for a broad range of applications such as power generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods. CR at I-53, PR at I-43.

[95] CR/PR at II-3, Figure II-3 & Tables I-11-13. Photovoltaic ("PV") installations in the residential segment increased from 496 MW in 2012 to 2,227 MW in 2017, installations in the non-residential segment increased from 1,075 MW in 2012 to 2,147 MW in 2017, and installations in the utility segment, the largest sector of the U.S. market, increased from 1,803 MW in 2012 to 6,234 MW in 2017. *See id.*

[96] CR/PR at Tables I-11-13. In 2017, U.S. producers accounted for *** percent of total U.S. sales to distributors, *** percent of total U.S. sales to residential and commercial installers, and *** percent of total U.S. sales to utility customers. U.S. imports from China accounted for *** percent of total U.S. sales to distributors, *** percent of total U.S. sales to residential and commercial installers, and *** percent of total U.S. sales to utility customers. U.S. imports from nonsubject sources accounted for the remaining sales to each segment of the market. CR at I-76, PR at I-58-59.

[97] *CSPV 1*, USITC Pub. 4360 at 25-26.

increased, but that a substantial number of domestic producers also shuttered facilities and/or declared bankruptcy.[98] The Commission found that the domestic industry's market share, in terms of quantity, declined while the market share of subject imports and nonsubject imports increased.[99]

In the current reviews, the U.S. market has continued to be supplied by domestically produced CSPV cells and modules and imports from subject and nonsubject countries. The domestic industry accounted for *** percent of apparent U.S. consumption in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017; it was lower in interim 2018 at *** percent than in interim 2017 at *** percent.[100] In 2012, five firms accounted for all known U.S. production of CSPV cells and approximately two dozen firms that manufactured CSPV modules in the United States. There was substantial turnover between domestic producers of CSPV products over the period of review. In each full year of the period of review, several firms exited the domestic industry.[101] Suniva *** as part of its Chapter 11 bankruptcy filing.[102] SolarWorld ***, and was acquired by SunPower in October 2018.[103] At the same time, a number of firms began manufacturing CSPV cells and/or CSPV modules.[104] Panasonic started ***.[105] Recently, six companies – GreenBrilliance, Hanwha, Heliene, Jinko, LG, and Sunpreme – have announced plans to open CSPV module plants in the United States and one of those firms, Sunpreme, reported that it intends to produce CSPV cells.[106]

Subject imports' market share increased irregularly during the period of review, although it remained lower than during the peak levels of the original period of investigation. It declined from *** percent in 2012 to *** percent in 2013, increased to *** percent in 2014 and *** percent in 2015, and declined to *** percent in 2016 and *** percent in 2017.[107] It was lower in interim 2018 at *** percent than in interim 2017 at *** percent.[108]

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[98] *CSPV 1*, USITC Pub. 4360 at 25-26.

[99] *CSPV 1*, USITC Pub. 4360 at 25.

[100] CR/PR at Tables I-10, C-1.

[101] CR/PR at Tables III-1-2. During the period of review, Mission Solar, Solar Power Industries, Suniva, Transform Solar, and Twin Creeks Technologies closed their CSPV cell facilities. CR/PR at Table III-1. Additionally, 1Soltech, Advanced Solar Photonics, Alternative Energies Kentucky, Flextronics/SunPower, Helios, Isofoton, Kyocera, Mage Solar, Motech, MX Solar, Navajo Universal, NuSun, PureSolar, Schott Solar, Sharp, Silicon Energy, Solar Power Industries, Solartech Renewables, SolarWorld, Suniva, Suntech, and tenKsolar closed their CSPV module facilities. CR/PR at Table III-2.

[102] CR at III-16, PR at III-10.

[103] CR at III-14, PR at III-9.

[104] CR/PR at Tables III-1-2.

[105] CR at III-17, PR at III-11. Panasonic reported ***. It ***. Email from Panasonic (Jan. 31, 2019) (EDIS Doc. No. 665541).

[106] CR/PR at Table III-3.

[107] CR/PR at Table I-10.

[108] CR/PR at Table I-10.

Nonsubject imports' market share also increased irregularly during the period of review. It increased from *** percent in 2012 to *** percent in 2013, declined to *** percent in 2014 and *** percent in 2015, and increased to *** percent in 2016 and *** percent in 2017.[109] According to official import statistics, Malaysia, Korea, Vietnam, and Thailand were the leading suppliers of nonsubject CSPV products to the United States in 2017. Altogether, these four countries accounted for a majority of nonsubject imports that year.[110]

Substitutability. In the original investigations, the Commission found that a high degree of substitutability existed between the domestic like product and subject imports from China and that price was an important consideration in purchasing decisions.[111]

In the current reviews, we continue to find that there is a high degree of substitutability between domestically produced CSPV cells and modules and subject imports.[112] The vast majority of market participants reported that the domestic like product and subject imports are always or frequently interchangeable.[113] These responses are consistent with other record evidence indicating that CSPV products made in the United States and China always or usually meet minimum quality specifications.[114] Further, the record indicates that during the period of review, the domestic like product and subject imports were sold in both 60-cell and 72-cell forms and that domestic and subject producers supplied CSPV products to overlapping market segments through overlapping channels of distribution.[115]

We also find that purchasers consider a variety of factors in their purchasing decisions, but that price continues to be an important consideration. When identifying the top three factors in purchasing decisions, purchasers listed quality most frequently as the first-most

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[109] CR/PR at Table I-10. It was higher in interim 2018 at *** percent than in interim 2017 at *** percent. *Id*.

[110] CR at II-13 and IV-7, PR at II-9 and IV-5.

[111] *CSPV 1*, USITC Pub. 4360 at 27-28.

[112] CR at II-31, PR at II-21.

[113] CR/PR at Table II-18. Seven of eight U.S. producers reported that domestically produced CSPV cells and modules and subject imports were always or frequently interchangeable, while one producer reported that they were sometimes interchangeable. Twenty-six of 32 U.S. importers reported that domestically produced CSPV cells and modules and subject imports were always or frequently interchangeable, while six importers reported that they were sometimes or never interchangeable. Seven of 11 U.S. purchasers reported that domestically produced CSPV cells and modules and subject imports were always or frequently interchangeable, while four purchasers reported that they were sometimes or never interchangeable. CR/PR at Table II-18.

[114] CR/PR at Table II-19. Nine of 12 U.S. purchasers reported that the domestically produced product always or usually meets minimum quality specifications, while three producers reported that it rarely/never meets minimum quality specifications. Nine of 12 U.S. purchasers reported that subject imports from China always or usually meets minimum quality specifications, while three purchasers reported that it sometimes or rarely/never meets minimum quality specifications. *See id.*

[115] CR/PR at Tables I-11-13, II-2, & V-3-10. Other configurations accounted for a relatively minor share of both the domestic like product and subject imports throughout the period of review. CR/PR at Tables III-13, IV-2.

important factor, followed by price and availability.[116] The vast majority of purchasers reported that price is very important in their purchasing decisions.[117] In response to a question regarding the significance of non-price factors when comparing the domestic like product and CSPV cells and modules from China, a plurality of U.S. producers, importers, and purchasers reported that non-price factors are sometimes significant.[118] Most responding purchasers reported that the U.S. product was comparable to imports from China on a majority of 21 specified purchasing factors.[119]

Raw Materials. In the original investigations, the Commission recognized that polysilicon was a key raw material used in the production of CSPV products and that spot and contract prices for polysilicon fell as global supply, which was inadequate to meet global demand in prior years, exceeded global demand by 2008.[120]

In the current reviews, we find that raw material costs accounted for a substantial share of the cost of goods sold ("COGS"). Specifically, raw material costs for the production of CSPV modules, much of which is the cost of CSPV cells, accounted for between *** percent and *** percent of U.S. modules producers' total COGS.[121] Raw material costs for the production of CSPV cells accounted for between *** percent and *** percent of U.S. cell producers' total COGS.[122] Polysilicon is the main raw material input used in the production of wafers that are used to manufacture CSPV cells.[123] The cost of polysilicon decreased by 43.9 percent from $31.62 per kg in the first quarter of 2012 to $17.75 per kg in the second quarter of 2018 and the cost of wafers fell by 57.5 percent during this period, from $330 per kW in the first quarter of 2012 to $140 per kW in the second quarter of 2018.[124]

Global Demand. Global demand for CSPV products has increased substantially since the original investigations. Indeed, global PV installations increased from 30 GW in 2012 to 99 GW in 2017.[125] In 2017, the largest markets were China (53.1 GW), followed by the United States (10.7 GW), India (9.1 GW), and Japan (7.5 GW).[126] The record indicates that demand in these three markets, as well as demand globally, will continue to grow in the foreseeable future.[127]

Other Trade Measures. CSPV products from China have also been the subject of other antidumping and countervailing duty investigations, a Section 201 global safeguard investigation, and tariffs imposed pursuant to a Section 301 investigation.

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[116] CR/PR at Table II-13.

[117] CR/PR at Table II-14.

[118] CR/PR at Table II-20.

[119] CR/PR at Table II-17. Most responding purchasers reported that the U.S. product was inferior compared to product from China with respect to price and product range. *See id.*

[120] *CSPV 1*, USITC Pub. 4360 at 28.

[121] CR/PR at Table III-24; CR/PR at V-1.

[122] CR/PR at Table III-22.

[123] CR/PR at V-1.

[124] CR at V-1-2, PR at V-1; CR/PR at Figure V-1.

[125] CR at IV-49, PR at IV-25.

[126] CR/PR at Table IV-14.

[127] CR/PR at Table IV-15.

CSPV 2. In response to antidumping and countervailing duty petitions filed by SolarWorld, the Commission determined in February 2015 that an industry in the United States was materially injured by reason of certain CSPV cells and modules from China and Taiwan.[128] Effective February 18, 2015, Commerce issued antidumping and countervailing duty orders on subject merchandise from China and an antidumping duty order on subject merchandise from Taiwan ("*CSPV 2* orders").[129] The scope of the *CSPV 2* investigations was different than the scope of the *CSPV 1* orders and covered U.S. imports of the following products: (1) CSPV modules assembled in China from non-Chinese origin CSPV cells (*i.e.*, cells from Taiwan or third countries); (2) CSPV cells made in Taiwan; (3) CSPV modules assembled in Taiwan from CSPV cells made in Taiwan; and (4) CSPV modules assembled in third countries other than China from CSPV cells made in Taiwan.[130]

Section 201 Actions. On May 17, 2017, Suniva filed a petition for Section 201 global safeguards on imports of CSPV cells, whether or not partially or fully assembled into other products.[131] In September 2017, the Commission determined that CSPV products were being imported into the United States in such increased quantities as to be a substantial cause of serious injury to the domestic industry producing an article like or directly competitive with the imported article.[132] Following the Commission's submission of remedy recommendations, the President of the United States issued Proclamation 9693 ("Proclamation") in January 2018, which imposed the following temporary safeguard duties on import entries of certain CSPV products: 30 percent (if entered from February 7, 2018 through February 6, 2019); 25 percent (if entered from February 7, 2019 through February 6, 2020), 20 percent (if entered from February 7, 2020 through February 6, 2021), and 15 percent (if entered from February 7, 2021 through February 6, 2022).[133] The Proclamation exempted from the safeguard duties an annual

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[128] *See Certain Crystalline Silicon Photovoltaic Products from China and Taiwan*, Inv. Nos. 701-TA-511 and 731-TA-1246-47 (Final), USITC Pub. 4519 at 1 (Feb. 2015) ("*CSPV 2*"). Chairman Schmidtlein, Vice Chairman Johanson, and Commissioners Williamson and Pinkert voted in the affirmative. Commissioner Broadbent voted in the affirmative with respect to CSPV modules from China and Taiwan and in the negative with respect to CSPV cells from Taiwan.

[129] *Certain Crystalline Silicon Photovoltaic Cells and Modules from Ch*ina, 80 Fed. Reg. 8592 (Feb. 18, 2015) (antidumping and countervailing duty orders); *Certain Crystalline Silicon Photovoltaic Cells and Modules from Taiwan*, 80 Fed. Reg. 8596 (Feb. 18, 2015) (antidumping duty order).

[130] *Certain Crystalline Silicon Photovoltaic Cells and Modules from China*, 79 Fed. Reg. 76962 (Dec. 23, 2014) (final affirmative countervailing duty determination); *Certain Crystalline Silicon Photovoltaic Cells and Modules from China*, 79 Fed. Reg. 76970 (Dec. 23, 2014) (final determination of less than fair value). The Court of International Trade affirmed Commerce's scope determinations, as further explained by Commerce on remand. *See Sunpower Corp. v. United States*, 253 F. Supp. 3d 1275 (Ct. Int'l Trade 2017); *Kyocera Solar, Inc. v. United States*, 253 F. Supp. 3d 1294 (Ct. Int'l Trade 2017).

[131] SolarWorld joined the petition on May 25, 2017. CR at I-5-6; PR at I-5.

[132] *See Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled into Other Products*, Inv. No. TA-201-75, USITC Pub. 4739 at 1 (Nov. 2017).

[133] *Proclamation No. 9693*, 83 Fed. Reg. 3541 (Jan. 25, 2018) ("*Proclamation*").

aggregate quantity of 2.5 GW of CSPV cells, but not cells assembled into modules or other products.[134] [135]

Section 301 Tariffs. On August 18, 2017, the United States Trade Representative ("USTR") initiated an investigation under Section 301 of the Trade Act of 1974, as amended, of certain acts, policies, and practices of the government of China related to technology transfer, intellectual property, and innovation.[136] It determined that China's acts, policies, and practices were unreasonable or discriminatory and that they burden or restrict U.S. commerce, and found that it was appropriate to take action.[137] The President imposed, in two tranches, an additional *ad valorem* duty of 25 percent on imports under certain tariff subheadings.[138] Certain CSPV products were included in the second tranche of articles subject to the additional duty effective August 23, 2018.[139] In September 2018, the President further imposed, in a third

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[134] *Proclamation*, 83 Fed. Reg. at 3549. Certain CSPV products were also excluded from the safeguard measure. These excluded products fall into three general categories: (1) off-grid products, (2) modules using only U.S.-made solar cells, and (3) certain cells and modules with no visible busbars or gridlines on the front of the cell, and more than 100 interdigitated fingers of tin-coated solid copper adhered to the back of the cell. *Exclusion of Particular Products from the Solar Products Safeguard Measure*, 83 Fed. Reg. 47393 (Sept. 19, 2018).

[135] Three Canadian producers of CSPV modules and one U.S. importer of CSPV modules from Canada filed suit in the Court of International Trade challenging the global safeguard measure on imports of solar cells and modules. They alleged, among other things, that the Commission violated Section 202 of the Trade Act by failing to make a remedy recommendation in its report to the President. They sought a temporary restraining order and preliminary injunction preventing implementation of the Section 201 tariffs only as applied to them. The Court of International Trade, finding that plaintiffs failed to demonstrate a likelihood of success on the merits on any of their claims and to demonstrate that the imposition of the relief they sought would be in the public interest, denied these motions. *Silfab Solar, Inc. v. United States*, 296 F. Supp. 3d 1295 (2018). Plaintiffs appealed the Court of International Trade's decision to the Federal Circuit. The Federal Circuit found that the President's actions were lawful and held that plaintiffs/appellants failed to establish a probability of success on the merits as required for a preliminary injunction. *Silfab Solar, Inc. v. United States*, 892 F.3d 1340 (Fed. Cir. 2018). Subsequently, plaintiffs voluntarily dismissed their case at the Court of International Trade.

Several countries, including China, have initiated dispute settlement proceedings against the United States at the World Trade Organization ("WTO") challenging the Section 201 tariffs. These matters are currently pending at the WTO.

[136] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 82 Fed. Reg. 40213 (Aug. 24, 2017) (initiation of Section 301 investigation).

[137] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 14906 (April 6, 2018) (notice of determination).

[138] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 28710 (June 20, 2018) (notice of action); *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 40823 (Aug. 16, 2018) (notice of action).

[139] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 40823. Relevant HTS codes for solar products in the Tranche 2 list included

tranche, an *ad valorem* duty of 10 percent to increase to 25 percent on January 1, 2019, on products under certain tariff subheadings, including certain other CSPV products.[140] In December 2018, the President decided to delay increasing the tariff rate to 25 percent on the third tranche of articles from January 1, 2019 to March 2, 2019.[141]

C. Likely Volume of Subject Imports

1. Original Investigations

In the original investigations, the Commission found that the volume of subject imports from China was significant, both in absolute terms and relative to apparent U.S. consumption and production in the United States, and that the increase in subject import volume absolutely and relative to domestic production and apparent U.S. consumption was also significant.[142] The Commission observed that the volume of U.S. shipments of subject imports increased substantially faster than the explosive growth in apparent U.S. consumption throughout the period of investigation.[143] As a result, subject imports increased their market share at the domestic industry's expense, and the ratio of subject imports to domestic production grew significantly over the period examined.[144] The Commission attributed the substantial and growing presence of subject imports in the U.S. market to the subject imports' high substitutability for the domestic like product and their competition with the domestic like product in the same geographic markets and U.S. market segments.[145]

2. Current Reviews

We find that if the orders were revoked, the likely volume of subject imports from China would be significant.

As an initial matter, the record indicates that the Commission received questionnaire responses from nine subject producers in China that accounted for only an estimated *** and *** percent, respectively, of CSPV cell and module production in China in 2017.[146] Because the questionnaire data provide only limited coverage of the Chinese industry and understate total

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8541.40.60, 8501.31.80, and 8501.32.60. These codes cover the vast majority of subject and nonsubject solar products. CR at I-34, PR at I-11.

[140] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 28710 (Sept. 21, 2018) (notice of modification of Section 301 Action). Relevant HTS codes for solar products in the Tranche 3 list included 8501.61.00 and 8502.20.80.

[141] *China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 Fed. Reg. 65198 (Dec. 19, 2018) (notice of modification of Section 301 Action).

[142] *CSPV 1*, USITC Pub. 4360 at 28-30.

[143] *CSPV 1*, USITC Pub. 4360 at 28-29.

[144] *CSPV 1*, USITC Pub. 4360 at 29.

[145] *CSPV 1*, USITC Pub. 4360 at 29.

[146] CR at IV-23, PR at IV-12.

industry figures, we rely primarily on the publicly available data (consisting of data from the China Photovoltaic Industry Association ("CPIA"), Chinese National Energy Administration ("NEA"), and official export statistics) in examining the subject industry.[147]

The publicly available data show that there is enormous and growing CSPV cell and module production capacity in China and substantial unused capacity.[148] Specifically, CSPV cell production capacity grew from 40 GW in 2012 to 82.8 GW in 2017.[149] CSPV module production capacity increased from 40 GW in 2012 to 105 GW in 2017, exceeding the total number of PV systems installed globally that year (99 GW).[150] Thus, the Chinese industry had enough production capacity to supply the entire world market in 2017. Chinese producers also significantly increased production of both CSPV cells and modules, with production of CSPV cells in China increasing from 21 GW in 2012 to 72 GW in 2017[151] and production of CSPV modules in China increasing from 23 GW in 2012 to 75 GW in 2017.[152] Despite these significant production increases, the subject industry maintained unused capacity to produce both cells and modules throughout the period of review.[153] In 2017, the subject industry had over 10 GW in unused cell capacity and over 30 GW in unused module capacity, both figures exceeding the size of apparent U.S. consumption in 2017.[154]

Subject producers in China, with their substantial and growing production capacity and excess capacity, are also highly export-oriented. The Chinese industry, with CSPV production

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[147] CR at IV-15-16, PR at IV-7; CR/PR at Table IV-5. The record also contains information reported by *** and ***. *See id.* The publicly available data provide comparatively conservative estimates on Chinese production and capacity.

[148] While the scope of the *CSPV 1* orders covers modules containing Chinese cells, it does not cover Chinese modules containing cells manufactured in third countries. Consequently, we have focused on the subject industry's CSPV cell production, capacity, and capacity utilization figures.

[149] CR/PR at IV-29, PR at IV-14. In 2017, ***. CR at IV-52, PR at IV-28. The subject industry's CSPV cell capacity continued to grow in 2018. CR IV-15-16, PR at IV-7-8. The four responding subject producers reported an increase in CSPV cell capacity from *** kW in 2012 to *** kW in 2017. CR/PR at Table IV-11.

[150] CR at IV-33, IV-49, PR at IV-15, IV-25. The five responding subject producers reported an increase in CSPV module capacity from *** kW in 2012 to *** kW in 2017. CR/PR at Table IV-12.

[151] CR at IV-29, PR at IV-14. The four responding subject producers reported an increase in CSPV cell production from *** kW in 2012 to *** kW in 2017. CR/PR at Table IV-11.

[152] CR at IV-33, PR at IV-15. In 2017, China was the leading module producer in the world, accounting for 72 percent of global production. CR at IV-54, PR at IV-29. The five responding subject producers reported an increase in CSPV module production from *** kW in 2012 to *** kW in 2017. CR/PR at Table IV-12.

[153] *See* Select Data from 201 Investigations at CR/PR at Tables IV-21-22.

[154] CR/PR at Table IV-5. The limited data from the four foreign producers show that the responding CSPV cell producers reported capacity utilization rates of *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017. CR/PR at Table IV-11. The responding CSPV module producers reported capacity utilization rates of *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017. CR/PR at Table IV-12.

quantities that consistently exceeded the amount consumed in the home market, exported substantial quantities of CSPV products to multiple countries and regions throughout the period of review.[155] Moreover, the subject industry will have a strong incentive to increase shipments to export markets in the foreseeable future due to declining demand in China. The record shows that in May 2018, the Chinese government revised its feed-in tariff ("FIT") policy, capping the number of new solar projects eligible for the PV-generated electricity rate established under the policy and halting the approval of utility-scale projects.[156] As a result, PV installations in China declined from a high of 53.1 GW in 2017 to 44 GW in 2018, while exports increased.[157] Chinese respondents point out that the NEA indicated in November 2018 that it may raise the current target of 105 GW of total cumulative PV installations by 2020, which has already been surpassed, to 210-270 GW of total PV installations by 2020.[158] We find, however, that even if NEA decides to revise the total PV installation target, the number of annual installations in 2019 and 2020 likely would still remain below the number of installations in 2017 and well below Chinese production levels in recent years.[159] The Chinese industry, therefore, will have increasing production capacity and reduced home market demand, which will create a significant incentive to increase export shipments.

Moreover, the United States, which in 2017 had the second-largest number of PV installations in the world behind China, is likely to remain an attractive market for subject producers.[160] Indeed, even with the *CSPV 1* orders in place, the United States was among the top three destination markets for CSPV cell and module exports from China for most of the period of review.[161] Consequently, subject imports maintained a presence in the U.S. market, increasing irregularly from 2012 to 2017. The volume of subject imports decreased from 326,846 kW in 2012 to 82,264 kW in 2013, increased to 1.3 million kW in 2014, 3.3 million kW in 2015, and 2.7 million kW in 2016, and decreased to 1.3 million kW in 2017; it was 50,760 kW

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[155] CR/PR at Table IV-5 & Tables-13-14. Exports of CSPV cells and modules from China totaled $12.8 billion in 2012, $10.2 billion in 2013, $12.3 billion in 2014, $12.9 billion in 2015, $11.3 billion in 2016, and $11.3 billion in 2017. CR/PR at Table IV-13. In 2018, exports of CSPV cells and modules from China totaled $13.6 billion. *See* GTA data, EDIS Doc. 665523.

[156] CR at IV-18, PR at IV-10; Canadian Solar Prehearing Br. at 62-63; Canadian Solar Posthearing Br., Appendix at 55-56; Canadian Solar Final Comments at 8; Hearing Tr. at 151-52 (Lewis); SolarWorld Prehearing Br. at 12.

[157] *See, e.g.*, CR/PR at Table IV-14; EDIS Doc. 665523; CR/PR at Table IV-13.

[158] Canadian Solar Prehearing Br. at 19; Canadian Solar Posthearing Br. at 5, Appendix at pp. 55-56; Hearing Tr. at 152 (Lewis); CR at IV-19, PR at IV-10.

[159] CR at IV-19, PR at IV-10; *see also* CR/PR at Table IV-6. Analysts estimate that the lower proposed total PV installation target would mean that the Chinese government was only targeting an additional 20 to 25 GW in annual installations in 2019 and 2020, while the higher proposed target would mean that the government was targeting an additional 40 to 50 GW in annual installations in 2019 and 2020. The NEA has not reached a final decision with respect to any revision of the 2020 target. *See id.*

[160] CR/PR at Table IV-14. Different forecasters estimate that the number of annual PV installations in the U.S. market will increase in 2019 and 2020. CR/PR at Table IV-16.

[161] CR/PR at Table IV-13.

in interim 2017 and 22,962 kW in interim 2018.[162] Subject imports accounted for *** percent of apparent U.S. consumption in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017; they accounted for *** percent in interim 2017, and *** percent in interim 2018.[163]

We do not find persuasive Chinese respondents' argument that the volume of subject imports from China will not likely be significant if the orders were revoked due to the global restructuring of the industry, which has entailed major long-term investments in new production facilities outside China since 2016.[164] The record evidence indicates that notwithstanding any new investments in production facilities outside of China, subject producers added substantial capacity and increased production in China throughout the period of review.[165] Further, some subject producers have not invested in production outside of China and do not have the option to source from non-Chinese production facilities.[166] We therefore find that the investments in production facilities outside of China will not likely deter a significant volume of subject imports from entering the U.S. market if the orders were revoked, in light of the other factors discussed above. Indeed, in the second half of 2017 prior to the imposition of Section 201 tariffs, subject imports from China surged into the U.S. market, thus demonstrating a continuing and strong interest of subject producers to export product to the

[162] CR/PR at Table IV-1.

[163] CR/PR at Table I-10. Additionally, we note that other third countries have imposed duties on imports of CSPV products from China, including Canada, Turkey, and India. CR/PR at Table I-12; CR at I-48, PR at I-24; Canadian Solar Posthearing Br. at 6 & Appendix at 47-48.

[164] Canadian Solar Prehearing Br. at 58-59; Canadian Solar Posthearing Br. at 3-4, Appendix at 33-34; Hearing Tr. at 18 (Stoel), 132-33 (Ambrose). Chinese respondents claim that subject producers will largely focus their exports on third country markets such as India and Europe, which terminated trade measures against CSPV products from China in September 2018. Canadian Solar Prehearing Br. at 18-19, 23-26, 27-28, 65-67; Canadian Solar Posthearing Br. at 6-7, Appendix at 45-50, 55. AUV data, however, suggest that the U.S. market generally was priced higher than the Asian market, which includes India. CR/PR at Table IV-12. Although it appears that prices in Europe were higher than the U.S. market during the period of review, the record indicates that prices in Europe are expected to decline by as much as 30 percent in the foreseeable future. CR/PR at Table IV-12; SolarWorld Posthearing Br. at 9, Ex. 11. In any event, demand in Europe and India is unable to absorb the entirety of the subject industry's substantial and increasing production and excess capacity. CR/PR at Table IV-15. The largest markets outside of China (U.S., India, Japan, and EU) had combined installations of 33.4 GW in 2017. CR/PR at IV-49. Given anticipated installations in China of 40-44 GW in 2019, the Chinese industry has ample capacity to supply all of the world's largest CSPV markets.

[165] CR at IV-29, IV-33; PR at IV-14, IV-15. Subject producers in China are continuing to add capacity and to increase production of CSPV cells and modules. CR IV-15-16, PR at IV-7-8.

[166] *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)*, Inv. No. TA-201-75, USITC Publication 4739, November 2017, p. IV-40; Colville, Finlay, "Top-10 Solar Cell Producers of 2018," *PV Tech*, January 9, 2019, EDIS Document 665523.

U.S. market and the ability of Chinese producers to increase rapidly exports of subject merchandise to the United States.[167]

We have also examined whether the Section 201 and Section 301 tariffs together provide sufficient disincentive for Chinese producers to export product to the U.S. market upon revocation of the orders.[168] As explained above, imports from all sources are currently subject to the Section 201 tariffs of 25 percent *ad valorem*, with the exception of an annual volume of 2.5 GW of cells. These tariffs will decline to 20 percent on February 7, 2020 and 15 percent on February 7, 2021.[169] Imports of CSPV cells and modules from China are subject to an additional 25 *ad valorem* tariff pursuant to the Section 301 investigation. The pricing data on the record show that in 2018, CSPV module prices in the United States were substantially higher than those in China, demonstrating that the U.S. market is still an attractive export destination despite the Section 201 and 301 tariffs.[170]

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[167] Subject imports grew from *** percent U.S. market share in January to June 2017 to *** percent share in July to December 2017, during the pendency of the section 201 investigation. *Derived from* CR/PR at Table I-10. Canadian Solar claims that subject imports from China have been replaced by nonsubject imports in the U.S. market as evidenced by the *de minimis* levels of subject imports in interim 2018. Canadian Solar Posthearing Br., Appendix at 25. Contrary to Canadian Solar's contention that purchasers switched to nonsubject imports once "alternative import sources" became available, the volume of nonsubject imports far exceeded the volume of subject imports in the U.S. market during every year of the POR; there was no demonstrative shift. Canadian Solar Posthearing Br., Appendix at 25; CR/PR at Table C-1. Moreover, with respect to the volume of subject imports in 2017 and interim 2018, the trend in subject imports generally tracked the rise and fall of overall U.S. apparent consumption. Specifically, consistent with overall U.S. apparent consumption, the volume of subject imports was lower in the first half of 2017 following the temporary surge in consumption in 2016 due to the expected phase out of federal investment tax credits, rose in the second half of 2017 during the pendency of the safeguard investigation, and fell in interim 2018 as consumption declined. CR/PR at Tables C-1 and F-1. We do not find that the relatively low volume of subject imports in interim 2018 is indicative of likely future behavior if the orders were to be revoked, particularly in light of the declining home market demand in China and increasing incentive for subject producers to seek out additional export opportunities.

[168] Canadian Solar Prehearing Br. at 68-76; Canadian Solar Posthearing Br. at 8. The *CSPV 2* orders cover different CSPV products than the *CSPV 1* orders and do not provide overlapping remedies.

[169] *Proclamation*, 83 Fed. Reg. at 3549.

[170] In the second quarter of 2018, average prices of CSPV modules sourced from China were approximately $*** per watt whereas average prices of CSPV modules in the United States were approximately $*** per watt. CR/PR at Figures IV-3 & V-10. Following the Chinese government's revision of its FIT policy, average prices of CSPV modules sourced from China fell to $*** per watt. CR/PR at Figure IV-3. U.S. prices declined to $*** per watt. SEIA and Wood Mackenzie Renewables, *U.S. Solar Market Insight: Q4 2018*, December 2018, EDIS Doc. 664355. We further note that the Section 201 tariff exempts an annual aggregate quantity 2.5 GW of imported CSPV cells. *Proclamation*, 83 Fed. Reg. at 3549. Moreover, whether the Section 301 tariff is actually applied to CSPV modules assembled in third countries from CSPV cells made in China depends upon U.S. Customs and Border Protection's application of the rules of origin. In addition, the record also shows that several of the world's leading

Accordingly, based on the subject producers' behavior during the original investigations, subject imports' continued presence in the U.S. market, and information available regarding the subject producers' substantial and growing production capacity, excess capacity, and export orientation, and the attractiveness of the U.S. market, we find that the likely volume of subject imports would be significant in the event of revocation of the orders.[171]

D. Likely Price Effects

1. Original Investigations

In the original investigations, the Commission found that, given the high degree of substitutability between the subject imports from China and the domestic like product,

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CSPV cell manufacturing companies and module suppliers, including ***, are subject to the 249.96 percent China-wide deposit rate, which exceeds the Section 201 and Section 301 tariffs combined. CR at IV-53, IV-55, PR at IV-28, IV-29; *Certain Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from China*, 77 Fed. Reg. 63791 (Dep't of Commerce Oct. 17, 2012) (final determination of sales at less than fair value).

[171] We have also considered the other factors enumerated in the statute regarding analysis of likely subject import volume. We examined inventories in our analysis of the likely volume of subject imports. The four subject CSPV cell producers that responded to the Commission's questionnaire reported end-of-period inventories of *** kW in 2012, *** kW in 2013, *** kW in 2014, *** kW in 2015, *** kW in 2016, and *** kW in 2017. End-of-period inventories were *** kW in interim 2017 and *** kW in interim 2018. CR/PR at Table IV-11. As a share of total shipments, they reported that inventories were *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017. The ratio of inventories to total shipments was *** percent in interim 2017 and *** percent in interim 2018. *See id.* The eight subject CSPV modules producers that responded to the Commission's questionnaire reported end-of-period inventories of *** kW in 2012, *** kW in 2013, *** kW in 2014, *** kW in 2015, *** kW in 2016, and *** kW in 2017. End-of-period inventories were *** kW in interim 2017 and *** kW in interim 2018. CR/PR at Table IV-12. As a share of total shipments, they reported that inventories were *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017. The ratio of inventories to total shipments was *** percent in interim 2017 and *** percent in interim 2018. *See id.* Thus, the limited data from foreign producers show a significant increase in inventory levels in the latter years of the POR, particularly in interim 2018. This likely reflects the declining demand in China and supports our conclusion that Chinese CSPV producers have the ability and increasing incentive to seek out additional export opportunities. We note again that producers accounting for only a modest share of Chinese cell and module capacity provided data; thus, industry-wide inventory figures are likely to be significantly larger. The evidence in the record with respect to inventories of subject merchandise held by importers in the United States shows that end-of-period inventories of CSPV cells and modules from subject sources were *** in 2012, *** in 2013, *** in 2014, *** in 2015, *** in 2016, and *** in 2017. They were *** in interim 2017 and *** in interim 2018. CR/PR at Table IV-4. With respect to product shifting, the nine responding subject producers reported that ***. *See* Foreign Producers' Questionnaire Responses at II-3a, II-3b.

competition in the U.S. CSPV market was based primarily on price.[172] The Commission examined the quarterly pricing comparison data, which showed that subject imports undersold the domestic like product in 35 of 46 possible quarterly comparisons, or 76.0 percent of the time, at margins ranging as high as *** percent. The Commission concluded that there had been significant underselling of the domestic like product by subject imports from China.[173]

The Commission further concluded that the significant underselling enabled subject importers to gain market share at the expense of the domestic industry, and leading to significant depression and suppression of the domestic industry's prices, causing the domestic producers to lose revenue.[174] In particular, the Commission observed that the quarterly pricing data showed a steady decline in domestic like product and subject imports prices, as the domestic industry lowered its prices in response to low-priced CSPV products from China.[175] The Commission further observed that the domestic industry's ratio of COGS to net sales was high between January 2009 and June 2012 and that it increased overall during this period.[176] Even though the domestic industry's unit COGS declined overall during the period of investigation, the Commission found that the extremely high and increasing COGS to net sales ratio demonstrated that the substantial and increasing volume of low-priced subject imports from China undersold the domestic industry at substantial margins and prevented the domestic industry from pricing the domestic like product at levels that would permit it to recover its costs during the period examined.[177]

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[172] *CSPV 1*, USITC Pub. 4360 at 30.

[173] *CSPV 1*, USITC Pub. 4360 at 31-33. The Commission rejected respondents' argument that there was limited head-to-head competition between subject imports and the domestic like product, observing that the pricing data showed that both U.S. importers and domestic producers offered and sold higher-wattage products as well as lower-wattage modules and that subject imports of both lower- and higher-wattage products pervasively undersold the domestic like product at wide margins in sales to all segments of the U.S. market – residential, non-residential, and utility. The Commission also rejected respondents' argument that the underselling by subject imports was not significant because the price differential between the products reflected that a significant portion of the domestic industry's pricing data consisted of higher-cost monocrystalline modules whereas subject imports largely reflected multi-crystalline modules that did not command comparable prices. The Commission observed that the record demonstrated that, to the contrary, the domestic industry, like importers of subject merchandise from China, sold both mono- and multi-crystalline CSPV products in the U.S. market. *CSPV 1*, USITC Pub. 4360 at 32-33.

[174] *CSPV 1*, USITC Pub. 4360 at 33-35.

[175] *CSPV 1*, USITC Pub. 4360 at 33.

[176] *CSPV 1*, USITC Pub. 4360 at 33.

[177] *CSPV 1*, USITC Pub. 4360 at 33. The Commission acknowledged that there might have been other factors exerting downward price pressure on CSPV products – such as technological improvements in CSPV production manufacturing, the decline in prices for polysilicon, the need to attain grid parity, competition from thin-film products, and the decline in Federal, state and local incentives – but found that these factors did not individually or collectively account for the substantial margins of underselling by subject imports, the accelerating decline in prices in the U.S. market during the period examined, and the inability of the domestic industry to price its products at levels that would permit the recovery of its

2. Current Reviews

As discussed in Section 3.B above, we find that there is a high degree of substitutability between subject imports and the domestic like product, and that purchasers consider price to be an important buying consideration along with other factors.

Six U.S. producers and nine importers provided usable quarterly price data for six pricing products for the period January 2012 to June 2018, although not all firms reported pricing for all products for all quarters.[178] According to these pricing data, prices of subject imports from China were below those of the domestic like product in 62 of 85 instances (involving 1.5 million kW of CSPV modules imported from China), with margins ranging from *** percent. In the remaining 23 instances (involving 131,481 kW of CSPV modules imported from China), prices for subject imports from China were above prices for the domestic like product, with margins ranging from *** percent.[179] Prices for domestically produced CSPV modules fell by *** percent to *** percent during the period of review.[180] Thus, subject imports continued to significantly undersell the domestic like product even with the orders in place. Indeed, the average underselling margin was higher during the POR (20.1 percent) than during the original investigation (15.1 percent).[181]

In light of the underselling observed during the original investigations and during the current period of review with the orders in place, the significance of price in purchasing decisions, and the high substitutability between the domestic like product and subject imports, we find that significant underselling by subject imports is likely in the event of revocation of the orders. Additionally, the likely increased and significant volumes of subject merchandise offered at low prices would require the domestic industry to cut prices and/or restrain price

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costs during a period of significant demand growth. The Commission further found that these factors also did not explain the pace at which subject imports captured market share at the domestic industry's expense throughout the period of investigation. *CSPV 1*, USITC Pub. 4360 at 34-35.

[178] CR at V-7, PR at V-5. The pricing products include the following: (1) 60-cell multicrystalline silicon module, with a peak power wattage between 240w to 265w, inclusive, p-max or Wp; (2) 60-cell multicrystalline silicon module, with a peak power wattage between 266w to 290w, inclusive, P-max or Wp; (3) 60-cell monocrystalline silicon module, with a peak power wattage between 250w to 280w, inclusive, P-max or Wp; (4) 60-cell monocrystalline silicon module, with a peak power wattage between 281w to 310w, inclusive, P-max or Wp; (5) 72-cell multicrystalline silicon module, with a peak power wattage between 290w to 315w, inclusive, P-max or Wp; (6) 72-cell multicrystalline silicon module, with a peak power wattage between 316w to 340w, inclusive, P-max or Wp; (7) 72-cell monocrystalline silicon module, with a peak power wattage between 300w to 330w, inclusive P-max or Wp; and (8) 72-cell monocrystalline silicon module, with a peak power wattage between 331w to 360w, inclusive, P-max or Wp. PR at V-6-7, PR at V-4-5. These pricing data accounted for approximately 74.8 percent of U.S. producers' commercial shipments of CSPV modules and 98.2 percent of U.S. commercial shipments of CSPV modules from China in 2017. CR at V-7, PR at V-5.

[179] CR at V-25, PR at V-8; CR/PR at Tables V-3-10. Widespread underselling of the domestic like product by subject imports occurred regardless of cell count (60-cell and 72-cell). CR/PR at Table V-12.

[180] CR at V-24, PR at V-7.

[181] CR/PR at Table V-12; EDIS Doc. 466537 at Table V-8.

increases to cover costs in order to retain sales. Consequently, we find that subject imports from China would likely have significant price depressing and/or suppressing effects, and/or would likely gain market share at the domestic industry's expense, upon revocation of the order within a reasonably foreseeable time.[182]

The respondents contend that the Section 201 and 301 tariffs will deter subject imports and ameliorate any potential adverse price effects in the market.[183] As explained above, the record shows that even with the additional tariffs in place, the United States remains an attractive market for subject imports with substantially higher prices.[184] Moreover, the subject producers have maintained aggressive pricing practices during the POR, despite the existence of the antidumping and countervailing duty orders, which operate differently than the Section 201 and 301 *ad valorem* tariffs. The antidumping and countervailing duties imposed under the *CSPV 1* orders are subject to annual reviews and recalculation by Commerce to ensure that they address actual levels of dumping and subsidization. Section 201 and 301 tariffs are not subject to such review or modification, and producers therefore could lower prices without the possibility of incurring higher duties. Additionally, unlike the antidumping duty statute, neither the Section 201 nor Section 301 tariffs have mechanisms to account for duty absorption. Given the aggressive pricing exhibited by the subject imports with the orders in place, and the incentives discussed above that subject producers have to increase export shipments notwithstanding the existence of the additional tariffs, we find that the Section 201 and 301 tariffs are unlikely in themselves to prevent aggressive pricing by subject producers or prevent the domestic industry from experiencing adverse price effects.

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[182] Statements from U.S. producers, importers, and purchasers support our findings that the likely increase in subject imports upon revocation of the orders would adversely impact prices to the detriment of the domestic industry. CR/PR at Tables D-1-3. For instance, U.S. producer ***. ***. U.S. importer ***. U.S. purchasers stated that revocation would ***. *Id*.

[183] Canadian Solar Posthearing Br., Appendix at 81.

[184] *See* CR/PR at Figures IV-3 & V-10; SEIA and Wood Mackenzie Renewables, *U.S. Solar Market Insight: Q4 2018*, December 2018, EDIS Doc. 664355.

E. Likely Impact[185]

1. Original Investigations

In the original investigations, the Commission found that the domestic industry was materially injured by reason of subject imports.[186] It examined the relevant economic factors bearing on the industry in the United States. It found that some of the domestic industry's performance factors, including production and U.S. shipments, appeared to improve during the period of investigation, but explained that these improvements occurred during a period of significant growth in demand for CSPV products.[187] It found that, notwithstanding improvements in certain factors, the domestic industry's market share declined significantly and its financial condition deteriorated throughout the period of investigation because of the significant volume and adverse price effects of subject imports.[188] The domestic industry incurred operating losses during the entire period of investigation, the industry's net sales value declined in 2011 and interim 2012, and its capital and research and development expenditures declined steadily.[189] In addition, a substantial number of domestic producers shuttered facilities and/or declared bankruptcy.[190]

The Commission considered whether other factors may have had an impact on the domestic industry.[191] It rejected respondents' argument that the domestic industry was unable or unwilling to supply products demanded by the utility segment, observing that the record showed that the domestic industry supplied higher-wattage modules as well as mono- and multi-crystalline modules; in any event, the Commission found that that the record did not support that the utility segment preferred 72-cell modules, as significant volumes of 60-cell and lower-wattage pricing products were sold to utilities/developers during the period of investigation.[192] The Commission also rejected respondents' suggestion that the domestic industry was adversely affected by unfavorable long-term polysilicon contracts. It observed that polysilicon prices began their substantial declines well before the period of investigation.

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[185] Section 752(a)(6) of the Act states that "the Commission may consider the magnitude of the margin of dumping" in making its determination in a five-year review. 19 U.S.C. § 1675a(a)(6). The statute defines the "magnitude of the margin of dumping" to be used by the Commission in five-year reviews as "the dumping margin or margins determined by the administering authority under section 1675a(c)(3) of this title." 19 U.S.C. § 1677(35)(C)(iv); *see also* SAA at 887. In its expedited review of the antidumping duty order for China, Commerce found likely dumping margins of up to 249.96 percent. *Certain Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from China*, 83 Fed. Reg. 10663; CR/PR at Table I-6.

[186] *CSPV 1*, USITC Pub. 4360 at 38.

[187] *CSPV 1*, USITC Pub. 4360 at 35.

[188] *CSPV 1*, USITC Pub. 4360 at 35-36.

[189] *CSPV 1*, USITC Pub. 4360 at 36.

[190] *CSPV 1*, USITC Pub. 4360 at 36.

[191] *CSPV 1*, USITC Pub. 4360 at 37-38.

[192] *CSPV 1*, USITC Pub. 4360 at 37.

Further, domestic producers had termination provisions or were able to renegotiate their contracts and some domestic producers did not purchase polysilicon through long-term contracts.[193] The Commission also found, despite respondents' claims that domestic producers made "bad bets" on technology, that almost all purchasers reported U.S. CSPV modules as being superior or comparable to subject imports in terms of conversion efficiency and quality.[194] The Commission further observed that nonsubject imports declined over the investigation period, both in absolute and relative terms and, unlike subject imports, nonsubject imports frequently oversold the domestic like product.[195]

2. Current Reviews

We consider whether the domestic industry is in a vulnerable condition. During the period of review, the domestic industry's production and U.S. shipments increased, but did not keep pace with the substantial increases in apparent U.S. consumption. The domestic industry lost market share and its financial performance was poor. It experienced operating and net *** throughout the period of review.

As previously discussed, despite strong and increasing demand, 5 U.S. firms shuttered their CSPV cell production plants and 25 U.S. firms shuttered their CSPV module facilities during the period of review.[196] At the same time, a number of firms began production of CSPV cells and/or modules.[197] Recently, in ***, Panasonic began *** in Buffalo, New York.[198] Moreover, six firms have announced plans for new facilities, but those facilities are not yet operational.[199]

The data, which reflect these numerous plant closures and openings, show that the domestic industry's cell capacity decreased irregularly by *** percent during the period of review, increasing from *** kW in 2012 to *** kW in 2013, declining to *** kW in 2014, increasing to *** kW in 2015, and declining to *** kW in 2016 and *** kW in 2017.[200] Production of cells decreased irregularly by *** percent overall, increasing from *** kW in 2012 to *** kW in 2013, *** kW in 2014, *** kW in 2015, and *** kW in 2016, and declining to *** kW in 2017.[201] Capacity utilization for CSPV cells increased irregularly but remained below full capacity, with capacity utilization increasing from *** percent in 2012 to *** percent in 2013

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[193] *CSPV 1*, USITC Pub. 4360 at 37.

[194] *CSPV 1*, USITC Pub. 4360 at 37.

[195] *CSPV 1*, USITC Pub. 4360 at 37-38.

[196] CR/PR at Tables III-1-2.

[197] CR/PR at Tables III-1-2.

[198] CR at III-16-17, PR at III-10-11.

[199] CR/PR at Table III-3.

[200] CR/PR at Tables III-4 and C-3. U.S. cell capacity was lower in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-4.

[201] CR/PR at Tables III-4 and C-3. Production was lower in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-4.

and *** percent in 2014, declining to *** percent in 2015, increasing to *** percent in 2016, and declining to *** percent in 2017.[202]

The domestic industry's module capacity increased steadily by *** percent from 2012 to 2017, increasing from *** kW in 2012 to *** kW in 2013, *** kW in 2014, *** kW in 2015, and *** kW in 2016 and 2017.[203] Production of modules increased irregularly by *** percent overall, decreasing from *** kW in 2012 to *** kW in 2013, increasing to *** kW in 2014, *** kW in 2015, and *** kW in 2016, and declining to *** kW in 2017.[204] Capacity utilization for CSPV modules decreased irregularly and remained below full capacity, with capacity utilization decreasing from *** percent in 2012 to *** percent in 2013, increasing to *** percent in 2014 and *** percent in 2015, and declining to *** percent in 2016 and *** percent in 2017.[205]

The domestic industry's U.S. shipments increased by *** percent from 2012 to 2017, decreasing from *** kW in 2012 to *** kW in 2013, increasing to *** kW in 2014 and *** kW in 2015, and decreasing to *** kW in 2016 and *** kW in 2017.[206] Because this overall increase was dwarfed by the *** percent growth in apparent U.S. consumption during this period, the domestic industry's market share decreased overall from 2012 to 2017, decreasing from *** percent in 2012 to *** percent in 2013, increasing to *** percent in 2014, and decreasing to *** percent in 2015, *** percent in 2016, and *** percent in 2017.[207] The domestic industry's end-of-period inventories fell overall by *** percent from 2012 to 2017, decreasing from *** kW in 2012 to *** kW in 2013 and *** kW in 2014, increasing to *** kW in 2015 and *** kW in 2016, and decreasing to *** kW in 2017.[208]

The domestic industry's employment indicators declined over the period of review. The number of production and related workers ("PRWs") engaged in CSPV cell and module operations declined overall by *** percent, decreasing from *** PRWs in 2012 to *** PRWs in 2013 and *** PRWs in 2014, increasing to *** PRWs in 2015 and *** PRWs in 2016, and decreasing to *** PRWs in 2017.[209] Total hours worked fell by *** percent from 2012 to 2017, decreasing from *** hours in 2012 to *** hours in 2013, increasing to *** hours in 2014, ***

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[202] CR/PR at Tables III-4 and C-3. Capacity utilization for CSPV cells was lower in interim 2018 at *** percent than in interim 2017 at *** percent. CR/PR at Table III-4.

[203] CR/PR at Tables III-7 and C-2. U.S. module capacity was higher in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-7.

[204] CR/PR at Tables III-7 and C-2. Production was higher in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-7.

[205] CR/PR at Tables III-7 and C-2. Capacity utilization for CSPV modules was higher in interim 2018 at *** percent than in interim 2017 at *** percent. CR/PR at Table III-7.

[206] CR/PR at Tables III-13 and C-1. U.S. shipments were lower in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-13.

[207] CR/PR at Table C-1. The domestic industry's market share was lower in interim 2018 at *** percent than in interim 2017 at *** percent. *See id.*

[208] CR/PR at Tables III-16 and C-1. End-of-period inventories were lower in interim 2018 at *** kW than in interim 2017 at *** kW. CR/PR at Table III-16.

[209] CR/PR at Tables III-21 and C-1. Employment was lower in interim 2018 at *** PRWs than in interim 2017 at *** PRWs. CR/PR at Table III-21.

hours in 2015 and *** hours in 2016, and decreasing to *** hours in 2017.[210] Wages paid to CSPV cell employees fell by *** percent from 2012 to 2017, decreasing from $*** in 2012 to $*** in 2013, increasing to $*** in 2014, $*** in 2015, and $*** in 2016, and decreasing to $*** in 2017.[211]

The domestic industry's financial performance was exceedingly weak during the period of review. Net sales value fell by *** percent from 2012 to 2017, decreasing from $*** in 2012 to $*** in 2013, increasing to $*** in 2014, $*** in 2015, and $*** in 2016, and decreasing to $*** in 2017.[212] Its COGS to net sales ratio was high, near or exceeding *** percent for most of the period of review at *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017.[213] Gross profits were *** in 2012, *** in 2013, *** in 2014, *** in 2015, *** in 2016, and *** in 2017.[214] Consistent with its overall decline in net sales value and high COGS to net sales ratio, the domestic industry experienced operating and net *** throughout the period of review.[215] The industry's operating income margin was *** percent in 2012, *** percent in 2013, *** percent in 2014, *** percent in 2015, *** percent in 2016, and *** percent in 2017.[216] [217] In addition to the *** throughout the period of review, the domestic industry's dismal financial performance is further illustrated by the numerous plant closures. In light of the foregoing, we find the domestic industry to be in a vulnerable condition.

As discussed above, we have found that revocation of the orders would likely result in a significant increase in the volume of low-priced subject imports that would likely have adverse price effects on the domestic industry. The likely significant volume of the subject imports would likely have an adverse impact on the production, shipments, sales, market share, and revenues of the domestic industry. These reductions would likely have a direct adverse impact on the industry's profitability and employment, as well as its ability to raise capital and make

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[210] CR/PR at Tables III-21 and C-1. Hours worked were lower in interim 2018 at *** hours than in interim 2017 at *** hours. CR/PR at Table III-21.

[211] CR/PR at Tables III-21 and C-1. Wages paid were lower in interim 2018 at $*** than in interim 2017 at $***. CR/PR at Table III-21.

[212] CR/PR at Tables C-1. Net sales value was higher in interim 2018 at $*** than in interim 2017 at $***. CR/PR at Table C-1.

[213] CR/PR at Table C-1. Its COGS to net sales ratio was *** percent in interim 2017 and *** percent in interim 2018. CR/PR at Table C-1.

[214] CR/PR at Table C-1. Gross profits were *** in interim 2017 and *** in interim 2018. *See id.*

[215] CR/PR at Table C-1. Operating income was *** in 2012, *** in 2013, *** in 2014, *** in 2015, *** in 2016, and *** in 2017; it was *** in interim 2017 and *** in interim 2018. CR/PR at Table C-1.

Net income was *** in 2012, *** in 2013, *** in 2014, *** in 2015, *** in 2016, and *** in 2017; it was *** in interim 2017 and *** in interim 2018. CR/PR at Table C-1.

[216] CR/PR at Tables III-14 and C-1. The operating income margin for CSPV cells was *** percent in interim 2017 and *** percent in interim 2018. CR/PR at Table III-22.

[217] Capital expenditures increased while research and development expenses decreased from 2012 to 2017. CR/PR at Table III-26.

and maintain necessary capital investments. We therefore conclude that subject imports from China would likely have a significant adverse impact on the domestic industry upon revocation of the orders within a reasonably foreseeable time.

We have considered respondents' assertion that future harm to the domestic industry may be attributable to the domestic producers' inability to sufficiently supply the utility segment of the market.[218] Importantly, the U.S. market consists of more than just the utility sector; residential and commercial installations account for substantial portions of U.S. consumption of CSPV cells and modules.[219] The record shows that during the period of review, subject imports were sold in all segments of the market – to utilities,[220] distributors, and residential and commercial installers.[221] Thus, regardless of the domestic industry's alleged supply constraints in the utility sector, the domestic producers have faced, and will continue to face, direct competition from the subject imports.

We have also considered the role of nonsubject imports in the U.S. market. There is no indication on this record that the presence of nonsubject imports would prevent subject imports from China from significantly increasing their presence in the U.S. market in the event of revocation of the orders, given the export orientation of the subject industry and the relative attractiveness of the U.S. market. Given the high substitutability between the subject imports and the domestic like product, the likely increase in subject imports upon revocation would likely take significant market share from the domestic industry or otherwise cause significant

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[218] Canadian Solar Posthearing Br., Appendix at 78-79.

[219] CR/PR at Tables I-11-13. Respondents highlight statements from solar developers who testified that they currently do not purchase CSPV cells and modules from China and would continue to purchase their CSPV products from nonsubject sources for the reasonably foreseeable future in the event of revocation of the orders. Canadian Solar Posthearing br. at 12-13. While we do not question the veracity of these statements, we note that they consist of a limited number of industry participants in one segment of the market. Indeed, as noted above, other statements on the record show that importers and purchasers expect that revocation of the orders would result in increased volumes of subject imports and lower prices in the U.S. market. CR/PR at Tables D-2 & D-3.

[220] Although *** subject imports sold directly to utilities in 2017 and interim 2018, there were *** 2016, and Chinese producers continue to service utilities customers in their home market and other export markets. *See, e.g.*, CR/PR at Table I-13; GTM Research and SEIA, *U.S. Solar Market Insight*, 2017 Year in Review and Q4 2018, EDIS Document 664355; Mark Osborne, "Impact from China's Solar Deployment Cuts Start Hitting Companies Q3 Financials," *PV Tech*, October 18, 2018, EDIS Document 664355; LV Fang, *National Survey of PV Power Applications in China*, 2018, pp. 4, 19, 26, EDIS Document 664355.

The record shows that the domestic industry increased its capacity in an attempt to supply more product to the utility portion of the market. Indeed, SolarWorld and Suniva both provided information indicating that they had made investments and added capacity to produce 72-cell modules to supply the utility market. CR at III-14-16, PR at III-9-10. However, both reported that imports had negatively affected capacity utilization, production, or returns on investment. *Id.* At the end of the period of review, *** producing CSPV products for the utility portion of the market. CR at III-15-16, PR at III-9-10; CR/PR at Tables III-1, III-2.

[221] CR/PR at Table I-11-13.

adverse price effects despite the growing and significant presence of nonsubject imports in the U.S. market.[222] Competition for sales between low-priced subject imports and nonsubject imports would in any event likely affect market prices negatively to the detriment of the domestic industry. Therefore, the subject imports are likely to have adverse effects on the domestic industry distinct from the effects of nonsubject imports in the event of revocation.[223]

Accordingly, we find that revocation of the antidumping and countervailing duty orders on CSPV cells and modules from China would likely have a significant adverse impact on the domestic industry.

IV. Conclusion

For the above-stated reasons, we determine that revocation of the antidumping and countervailing duty orders on CSPV cells and modules from China would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time.

[222] CR/PR at Tables I-10, C-1.

[223] *See, e.g.*, *Nippon Steel Corp. v. United States*, 345 F.3d 1379, 1381 (Fed. Cir. 2003); *see also* SAA at 885 (factors other than subject imports may be causing injury to the industry but "also may demonstrate that an industry is facing difficulties from a variety of sources and is vulnerable to dumped or subsidized imports. . . If the Commission finds that an industry is vulnerable to injury from subject imports, it may determine that injury is likely to continue or recur, even if other causes, as well as future imports, are likely to contribute to future injury").

PART I: INTRODUCTION

BACKGROUND

On November 1, 2017, the U.S. International Trade Commission ("Commission" or "USITC") gave notice, pursuant to Section 751(c) of the Tariff Act of 1930, as amended ("the Act"),[1] that it had instituted reviews to determine whether revocation of the antidumping and countervailing duty orders on crystalline silicon photovoltaic ("CSPV") cells and modules from China would likely lead to the continuation or recurrence of material injury to a domestic industry.[2] [3] On February 5, 2018, the Commission determined that it would conduct full reviews pursuant to Section 751(c)(5) of the Act.[4] The following tabulation presents information relating to the background and schedule of this proceeding:[5]

[1] 19 U.S.C. 1675(c).

[2] *Crystalline Silicon Photovoltaic Cells and Modules From China; Institution of Five-Year Reviews*, 82 FR 50681, November 1, 2017. All interested parties were requested to respond to this notice by submitting the information requested by the Commission.

[3] In accordance with Section 751(c) of the Act, the U.S. Department of Commerce ("Commerce") published a notice of initiation of five-year reviews of the subject antidumping and countervailing duty orders concurrently with the Commission's notice of institution. *Initiation of Five-Year (Sunset) Reviews*, 82 FR 50612, November 1, 2017.

[4] *Crystalline Silicon Photovoltaic Cells and Modules From China; Notice of Commission Determinations To Conduct Full Five-Year Reviews*, 83 FR 8296, February 26, 2018. The Commission found that both the domestic and respondent interested party group responses to its notice of institution (82 FR 50681, November 1, 2017) were adequate. The Commission also found that other circumstances warranted conducting full reviews. Chairman Rhonda K. Schmidtlein and Commissioner Irving A. Williamson determined that the respondent interested party group response was inadequate and voted to conduct expedited reviews.

[5] The Commission's notice of institution, notice to conduct full reviews, scheduling notices, and statement on adequacy are referenced in appendix A and may also be found at the Commission's web site (internet address *www.usitc.gov*). Commissioners' votes on whether to conduct expedited or full reviews may also be found at the web site. The list of witnesses that appeared at the Commission's hearing is presented in appendix B.

Effective date	Action
December 7, 2012	Commerce's antidumping and countervailing duty orders on CSPV cells and modules from China (77 FR 73017 (CVD) and 77 FR 73018 (AD))
November 1, 2017	Commission's institution of five-year reviews (82 FR 50681)
November 1, 2017	Commerce's initiation of five-year reviews (82 FR 50612)
February 5, 2018	Commission's determinations to conduct full five-year reviews (83 FR 8296, February 26, 2018)
March 9, 2018	Commerce's final results of expedited five-year reviews of the countervailing duty order (83 FR 10431)
March 12, 2018	Commerce's final results of expedited five-year reviews of the antidumping duty order (83 FR 10663)
July 16, 2018	Commission's scheduling of the reviews (83 FR 34873, July 23, 2018); as revised, effective October 22, 2018 (83 FR 54138, October 26, 2018)
November 27, 2018	Commission's hearing
February 8, 2019	Commission's vote
March 1, 2019	Commission's determinations and views[6]

THE ORIGINAL INVESTIGATIONS

Crystalline Silicon Photovoltaic Solar Cells and Modules from China (Investigation Nos. 701-TA-481 and 731-TA-1190, November 2012)

The original investigations resulted from petitions filed by SolarWorld Industries America, Inc. ("SolarWorld"), Hillsboro, Oregon,[7] on October 19, 2011, alleging that an industry in the United States is materially injured and threatened with material injury by reason of less-than-fair-value ("LTFV") and subsidized imports of CSPV cells and modules from China ("*CSPV 1*").[8] Following notification of a final determination by Commerce that imports of CSPV cells and

[6] The deadline for this proceeding was tolled due to the lapse in appropriations and ensuing cessation of Commission operations from December 22, 2018, through the resumption of operations on January 28, 2019.

[7] The petitions stated that they are also supported by the Coalition for American Solar Manufacturing, which includes U.S. producers SolarWorld, ***. Confidential treatment for the identities of the members of the coalition, with the exception of SolarWorld, was requested. *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report*, INV-PP-119, September 11, 2017, p. I-1 and table III-1.

[8] See the section of this report titled "Commerce's Scope" for a description of the items covered by Commerce's scope in this first five-year review. The physical description of the items covered by Commerce's scope of the merchandise in *CSPV 1* is largely the same as that in related *CSPV* proceedings at the Commission, except that the following items were listed as exclusions as a result of a 2018 changed circumstances review in only *CSPV 1*: panels with surface area from 3,450 mm^2 to 33,782 mm^2

(*continued*...)

modules from China were being subsidized and sold at LTFV, the Commission determined on November 30, 2012, that a domestic industry was materially injured by reason of subsidized and LTFV imports of CSPV cells and modules from China.[9] Commerce published the antidumping and countervailing duty orders on subject imports of CSPV cells and modules from China on December 7, 2012.[10]

PREVIOUS AND RELATED INVESTIGATIONS

Certain Crystalline Silicon Photovoltaic Solar Cells and Modules from China and Taiwan (Investigation Nos. 701-TA-511 and 731-TA-1246-1247, February 2015)

In February 2015, the Commission determined that an industry in the United States was materially injured by reason of imports of certain crystalline silicon photovoltaic solar cells and modules from Taiwan that Commerce found were sold in the U.S. market at LTFV and imports from China that Commerce found were sold at LTFV and subsidized by the Government of China ("*CSPV 2*").[11] Those investigations resulted from antidumping and countervailing duty petitions filed by SolarWorld on December 31, 2013.[12] Effective February 18, 2015, Commerce

(…*continued*)
with one black wire and one red wire (each of type 22 AWG or 24 AWG not more than 206 mm in length when measured from panel extrusion), and not exceeding 2.9 volts, 1.1 amps, and 3.19 watts. For the purposes of this exclusion, no panel shall contain an internal battery or external computer peripheral ports. *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Results of Changed Circumstances Reviews, and Revocation of Antidumping and Countervailing Duty Orders, in Part*, 83 FR 2617, January 18, 2018; and *Issues and Decision Memorandum for the Expedited First Sunset Review of the Antidumping Duty Order on Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China*, March 5, 2018.

[9] *Crystalline Silicon Photovoltaic Cells and Modules From China—Determinations*, 77 FR 72884, December 6, 2012.

[10] *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Countervailing Duty Order*, 77 FR 73017, December 7, 2012; and *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Amended Final Determination of Sales at Less Than Fair Value, and Antidumping Duty Order*, 77 FR 73018, December 7, 2012.

[11] Chairman Schmidtlein, Vice Chairman Johanson, and Commissioners Williamson and Pinkert voted in the affirmative. Commissioner Broadbent voted in the affirmative with respect to CSPV modules from China and Taiwan and in the negative with respect to CSPV cells from Taiwan (CSPV cells from China were not included in the scope as they were already covered by the *CSPV 1* orders). Commissioner Kieff did not participate in the *CSPV 2* investigations. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan, Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final)*, USITC Publication 4519, February 2015, p. 1.

[12] Effective October 1, 2014, SolarWorld Industries America, Inc. changed its name to SolarWorld Americas, Inc. The petitions stated that they were also supported by the Coalition for American Solar Manufacturing, which included U.S. producers SolarWorld, ***. *Investigation Nos. 701-TA-511 and 731-*
(*continued*...)

issued antidumping and countervailing duty orders on those imports from China and an antidumping duty order on those imports from Taiwan.[13]

In its final *CSPV 2* determinations, Commerce defined the subject merchandise from China to include U.S. imports of the following: (1) CSPV modules assembled in China from CSPV cells made in Taiwan and (2) CSPV modules assembled in China from CSPV cells made in third countries. Commerce defined the subject merchandise from Taiwan to include U.S. imports of: (1) CSPV cells made in Taiwan; (2) CSPV modules assembled in Taiwan from CSPV cells made in Taiwan; and (3) CSPV modules assembled in third countries other than China from CSPV cells made in Taiwan.[14] Therefore, the module assembly location determined the country of origin for U.S. imports of modules from China, except for modules covered by the prior *CSPV 1* orders (which were considered nonsubject merchandise from China); the cell manufacture location determined the country of origin for U.S. imports of cells and modules from Taiwan.[15]

(…*continued*)
TA-1246-1247 (Final): Certain Crystalline Silicon Photovoltaic Products from China and Taiwan—Staff Report, INV-MM-134, December 23, 2014, p. I-1.

[13] *Certain Crystalline Silicon Photovoltaic Products From the People's Republic of China: Antidumping Duty Order; and Amended Final Affirmative Countervailing Duty Determination and Countervailing Duty Order*, 80 FR 8592, February 18, 2015; and *Certain Crystalline Silicon Photovoltaic Products From Taiwan: Antidumping Duty Order*, 80 FR 8596, February 18, 2015.

[14] The physical description of the items covered by Commerce's scope of the merchandise in *CSPV 2* is largely the same as that in *CSPV 1*, except that the following items were listed as exclusions only in *CSPV 2*: (1) less than 300.000 mm^2 in surface area; (2) less than 27.1 watts in power; (3) coated across their entire surface with a polyurethane doming resin; and (4) joined to a battery charging and maintaining unit (which is an acrylonitrile butadiene styrene ("ABS") box that incorporates a light emitting diode ("LED")) by coated wires that include a connector to permit the incorporation of an extension cable. The battery charging and maintaining unit utilizes high-frequency triangular pulse waveforms designed to maintain and extend the life of batteries through the reduction of lead sulfate crystals. The above-described battery charging and maintaining unit is currently available under the registered trademark "SolarPulse." *Issues and Decision Memorandum for the Final Results of the 2014-2016 Administrative Review of the Antidumping Duty Order on Certain Crystalline Silicon Photovoltaic Products from Taiwan*, June 29, 2017.

[15] *Countervailing Duty Investigation of Certain Crystalline Silicon Photovoltaic Products From the People's Republic of China: Final Affirmative Countervailing Duty Determination*, 79 FR 76962, December 23, 2014; and *Certain Crystalline Silicon Photovoltaic Products From the People's Republic of China: Final Determination of Sales at Less Than Fair Value*, 79 FR 76970, December 23, 2014; *see also* USITC Publication 4519 at 3-4, 6. The U.S. Court of International Trade affirmed Commerce's scope determinations, as further explained by the agency on remand. See Sunpower Corp. v. United States, CIT Ct. No. 15-00067, Slip Op. 17-89 (Ct. Int'l Trade Jul. 21, 2017); Kyocera Solar, Inc. v. United States, CIT Ct. No. 15-00081, Slip Op. 17-90 (Ct. Int'l Trade Jul. 21, 2017).

Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products) (Investigation No. TA-201-75, November 2017)

Effective May 17, 2017, the Commission instituted investigation No. 201-TA-75 in response to a petition, as amended and properly filed on May 17, 2017 by Suniva, Inc. ("Suniva"), a producer of CSPV cells and CSPV modules in the United States ("*CSPV 3*").[16] On May 25, 2017, SolarWorld publicly stated its support for the petition as a co-petitioner. The Commission voted with respect to injury and remedy issues on September 22, 2017, and October 31, 2017, respectively, and transmitted its report to the President on November 13, 2017.[17] The Commission determined pursuant to Section 202(b) of the Trade Act of 1974 that crystalline silicon photovoltaic cells (whether or not partially or fully assembled into other products) ("CSPV products") are being imported into the United States in such increased quantities as to be a substantial cause of serious injury to the domestic industry producing an article like or directly competitive with the imported article.[18] After receiving the Commission's report, the President requested additional information from the Commission. The Commission issued a supplemental report on December 27, 2017, and the President had 30 days from when

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[16] *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products); Institution and Scheduling of Safeguard Investigation and Determination That the Investigation Is Extraordinarily Complicated*, 82 FR 25331, June 1, 2017.

[17] *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled into Other Products), Inv. No. 201-TA-75*, USITC Publication 4739, November 2017, pp. 7 and I-1.

[18] Having made an affirmative injury determination pursuant to Section 202(b) of the Trade Act of 1974, the Commission was required to make certain additional findings under the implementing statutes of certain free trade agreements ("FTAs") or under statutory provisions related to certain preferential trade programs. Under Section 311(a) of the NAFTA Implementation Act (19 U.S.C. § 3371(a)), the Commission found that imports of CSPV products from Mexico account for a substantial share of total imports and contribute importantly to the serious injury caused by imports. Under 19 U.S.C. § 3371(a), the Commission also found, with Chairman Rhonda K. Schmidtlein dissenting, that imports of CSPV products from Canada do not account for a substantial share of total imports and do not contribute importantly to the serious injury caused by imports. The Commission further found that imports of CSPV products from Korea are a substantial cause of threat of serious injury, but that imports of CSPV products from Australia, the U.S.-Dominican Republic-Central America Free Trade Agreement ("CAFTA-DR") countries, Colombia, Jordan, Panama, Peru, and Singapore, individually, are not a substantial cause of serious injury or threat thereof, under the respective implementing legislation for the FTAs with these countries. See 19 U.S.C. § 2112 note (Jordan); 19 U.S.C. § 3805 note (Australia, Colombia, Korea, Panama, Peru, Singapore); 19 U.S.C. § 4101 (CAFTA-DR). The Commission also found that the serious injury substantially caused by imports to the domestic industry producing a like or directly competitive article does not result from the reduction or elimination of any duty provided for under the U.S.-Israel Free Trade Agreement or from duty-free treatment provided for under the Caribbean Basin Economic Recovery Act ("CBERA") provisions of the Caribbean Basin Initiative Trade Program or the Generalized System of Preferences ("GSP") program. 19 U.S.C. § 2112 note (Israel); 19 U.S.C. § 2703(e) (CBERA); 19 U.S.C. § 2253(e)(6) (GSP). *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products)*, 82 FR 55393, November 21, 2017.

the supplemental report was issued, or until January 26, 2018, to decide whether to provide a remedy to the U.S. industry, and if so, the type and duration of the remedy.

On January 22, 2018, the Office of the U.S. Trade Representative ("USTR") announced that the President approved recommendations to provide relief to U.S. manufacturers and impose safeguard tariffs on imported solar cells and modules, based on the investigations, findings, and recommendations of the Commission. After consultation with the interagency Trade Policy Staff Committee ("TPSC") and recommendations of USTR, the President approved the application of the following additional safeguard tariffs on imported CSPV cells and modules, with the first 2.5 GW of imported cells being excluded from the additional tariff: 30 percent (year 1); 25 percent (year 2); 20 percent (year 3); and 15 percent (year 4).[19] [20] The Presidential Proclamation implemented the action according to the following CSPV products: (a) solar cells, whether or not assembled into modules or made up into panels provided for in subheading 8541.40.60; (b) parts or subassemblies of solar cells provided for in subheadings 8501.31.80, 8501.61.00, and 8507.20.80; (c) inverters or batteries with CSPV cells attached provided for in subheadings 8501.61.00 and 8507.20.80; and (d) DC generators with CSPV cells attached provided for in subheading 8501.31.80.[21]

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[19] *Presidential Documents, Proclamation No. 9693 of January 23, 2018, To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes*, 83 FR 3541, January 25, 2018. United States law requires the exclusion of Canada or Mexico from a Section 201 action if the President determines that imports from that country do not account for a substantial share of imports and do not contribute importantly to serious injury to domestic producers. The President determined that both Canada and Mexico are included in the solar remedy. Also consistent with the statute, the President concluded that it is appropriate to include Korea in the safeguard measure. Consistent with WTO obligations and past practice, the United States excludes all Generalized System of Preferences ("GSP") beneficiary countries that account for less than three percent of total exports from the safeguard measure. The President determined that, although Thailand and the Philippines are GSP beneficiary countries, they accounted for more than three percent of total imports and are included in the safeguard measure.

[20] *Presidential Documents, Proclamation 9693 of January 23, 2018, To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes*, 83 FR 3541, January 25, 2018; Fact Sheet, "Section 201 Cases: Imported Large Residential Washing Machines and Imported Solar Cells and Modules," Executive Office of the President of the United States, Office of the United States Trade Representative, January 22, 2018, https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/january/section-201-cases-imported-large, retrieved January 23, 2018.

[21] *Presidential Documents, Proclamation 9693 of January 23, 2018, To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes*, 83 FR 3541, January 25, 2018.

201 Definition of Imported Articles

In its *CSPV 3* safeguard investigation, the Commission defined the imported articles as follows:

> CSPV cells, whether or not partially or fully assembled into other products, including, but not limited to modules, laminates, panels, and building-integrated materials. The investigation covers crystalline silicon photovoltaic cells of a thickness equal to or greater than 20 micrometers, having a p/n junction (or variant thereof) formed by any means, whether or not the cell has undergone other processing, including, but not limited to cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell.
>
> Included in the scope of the investigation are photovoltaic cells that contain crystalline silicon in addition to other photovoltaic materials. This incudes, but is not limited to passivated emitter rear contact ("PERC") cells, heterojunction with intrinsic thin-layer ("HIT") cells, and other so-called "hybrid" cells.
>
> Articles under consideration also may be described at the time of importation as components for final finished products that are assembled after importation, including, but not limited to, modules, laminates, panels, and panels, and building-integrated materials.[22]

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[22] CSPV cells, whether or not partially or fully assembled into other products, were excluded from the scope of the investigation if the CSPV cells were manufactured in the United States. Also excluded from the investigation were thin film photovoltaic products produced from amorphous silicon ("a-Si"), cadmium telluride ("CdTe"), or copper indium gallium selenide ("CIGS"). Also excluded from the scope of the investigation were crystalline silicon photovoltaic cells, not exceeding 10,000 mm^2 in surface area, that were permanently integrated into a consumer good whose function was other than power generation and that consumed the electricity generated by the integrated crystalline silicon photovoltaic cell. Where more than one cell was permanently integrated into a consumer good, the surface area for purposes of this exclusion was the total combined surface area of all cells that were integrated into the consumer good. The Commission noted that for Customs purposes, the CSPV cells covered by the investigation are provided for under Harmonized Tariff Schedule of the United States ("HTSUS") subheading 8541.40.60. Within that 8-digit subheading, CSPV cells that are assembled into modules or panels are imported under HTSUS statistical reporting number 8541.40.6020, while CSPV cells that are not assembled into modules and are presented separately are imported under statistical reporting number 8541.40.6030. Inverters or batteries with CSPV cells attached are provided for under HTSUS subheadings 8501.61.00 and 8507.20.80, respectively. In addition, CSPV cells covered by the investigation may also be classifiable as DC generators of subheading 8501.31.80, when such generators are imported with CSPV cells attached. While HTSUS provisions are provided for convenience, the written scope is dispositive. *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully*

(*continued*...)

The investigation's scope covers the non-cell portion of a finished CSPV module (such as the aluminum frame), assuming that the CSPV cells are covered.[23]

201 Exclusion Requests

On February 14, 2018, USTR issued a notice establishing the procedures to request the exclusion of a particular product from the safeguard measure with a request deadline of March 16, 2018.[24] Pursuant to that notice, USTR received 48 product exclusion requests and 213 subsequent comments responding to various requests.[25] On September 19, 2018, USTR published a determination that certain CSPV products should be excluded from the safeguard measure.[26] Eight products were granted exclusion requests. These products fell into three general categories: (1) off-grid products, (2) modules using only U.S.-made solar cells, and (3) certain cells and modules with no visible busbars or gridlines on the front of the cell, and more than 100 interdigitated fingers of tin-coated solid copper adhered to the back of the cell.[27] News reports indicated that SunPower would be a primary beneficiary of the third product exclusions.[28]

Section 301 proceeding

Section 301 of the Trade Act of 1974, as amended ("Trade Act"),[29] authorizes USTR, at the direction of the President, to take appropriate action to respond to a foreign country's unfair trade practices. On August 18, 2017, USTR initiated an investigation into certain acts, policies, and practices of the Government of China related to technology transfer, intellectual property, and innovation.[30] On April 6, 2018, USTR published its determination that the acts,

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(…*continued*)
Assembled Into Other Products); Institution and Scheduling of Safeguard Investigation and Determination That the Investigation Is Extraordinarily Complicated, 82 FR 25331, June 1, 2017.

[23] *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled into Other Products)*, Inv. No. 201-TA-75, USITC Publication 4739, November 2017, p. 13.

[24] *Procedures To Consider Additional Requests for Exclusion of Particular Products From the Solar Products Safeguard Measure*, 83 FR 6670, February 14, 2018.

[25] *Exclusion of Particular Products From the Solar Products Safeguard Measure*, 83 FR 47393, September 19, 2018.

[26] Ibid.

[27] Ibid.

[28] Merchant, Emma, "*SunPower Wins Big in Section 201 Trade Case Exclusions*," GTM, September 18, 2018, https://www.greentechmedia.com/articles/read/trump-ustr-solar-tariff-trade-case-exclusions#gs.1ZBb0CY, retrieved December 6, 2018.

[29] 19 U.S.C. § 2411.

[30] *Initiation of Section 301 Investigation; Hearing; and Request for Public Comments: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 82 FR 40213, August 24, 2017.

policies, and practices of China under investigation are unreasonable or discriminatory and burden or restrict U.S. commerce, and are thus actionable under Section 301(b) of the Trade Act.[31] The USTR further determined that it was appropriate and feasible to take action and proposed the imposition of an additional 25 percent duty on products of China with an annual trade value of approximately $50 billion. The additional 25 percent duty was issued in two tranches. Tranche 1 covered 818 tariff subheadings, with an approximate annual trade value of $34 billion.[32] Tranche 2 covered 279 tariff subheadings, with an approximate annual trade value of $16 billion.[33]

On September 21, 2018, USTR published a notice in the *Federal Register* modifying its prior action in accordance with the specific direction of the President under his authority pursuant to Section 307(a)(1) of the Trade Act, determining to include 5,745 full and partial tariff subheadings with an approximate annual trade value of $200 billion, while maintaining the prior action (i.e., Tranche 3). At that time, USTR determined that the rate of additional duty to be initially 10 percent ad valorem, effective September 24, 2018, and that the rate of additional duty was to increase to 25 percent ad valorem on January 1, 2019.[34] However, on December 1, 2018, President Trump announced that the United States would delay increasing the tariff rate on Tranche 3 to 25 percent.[35] In a Federal Register notice scheduled for publication on December 19, 2018, USTR determined, in accordance with the direction of the President, to postpone the date on which the rate of the additional duties will increase to 25 percent for the products of China covered by the September 2018 Section 301 action. The rate of additional duty for the products covered by the September 2018 Section 301 action will increase to 25 percent on March 2, 2019.[36]

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[31] *Notice of Determination and Request for Public Comment Concerning Proposed Determination of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 14906, April 6, 2018.

[32] *Notice of Action and Request for Public Comment Concerning Proposed Determination of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 28710, June 20, 2018.

[33] Relevant HTS codes for solar products in the Tranche 2 list include the following: 8541.40.60, 8501.31.80, and 8501.32.60. *Notice of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 40823, August 16, 2018.

[34] Relevant HTS codes for solar products include the following: 8501.61.00, and 8507.20.80. *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 47974, September 21, 2018.

[35] EY, "US Announces Temporary Pause on Planned Increase of List 3 Tariffs on China Origin Goods," December 3, 2018, https://www.ey.com/gl/en/services/tax/international-tax/alert--us-announces-temporary-pause-on-planned-increase-of-list-3-tariffs-on-china-origin-goods---duties-remain-in-force-and-key-issues-remain-unresolved, December 18, 2018.

[36] *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation* (scheduled for publication in the Federal Register on December 19, 2018 and available online at https://federalregister.gov/d/2018-27458),

(*continued*...)

CSPV modules and cells, which are primarily classified in HTS subheading 8541.40.60, were included in the list of articles subject to the additional 25 percent duties effective August 23, 2018, under Section 301 of the Trade Act of 1974.[37] [38] See the section of this report entitled "Tariff treatment" for further information on HTS numbers applicable to CSPV cells and modules subject to these reviews.

The respondent interested parties argued that the applicable 25 percent Section 301 tariffs impede U.S. imports of CSPV cells and modules from China and are likely to remain in effect during the foreseeable future examined by the Commission in these reviews. They added that it was the domestic interested parties that petitioned USTR to add the CSPV cells and modules primary HTS subheading to the second list of products subject to the Section 301 duty.[39] The domestic interested parties argue that the Section 301 tariffs are uncertain in duration and level and do not address unfair dumping and subsidization.[40] They testified at the hearing in these reviews that they were facing increased costs stemming from these duties, characterizing them as a "double-edged sword" for the U.S. industry because the duties affect both imports of finished CSPV products as well as raw materials and other inputs, stating that it is "unclear that the 301 provides any net benefit."[41]

Section 232 proclamations

Section 232 of the Trade Expansion Act of 1962, as amended (19 U.S.C. 1862), authorizes the President, on advice of the Secretary of Commerce, to adjust the imports of an article and its derivatives that are being imported into the United States in such quantities or under such circumstances as to threaten to impair the national security. On March 8, 2018, the President issued Proclamations 9704 and 9705 on Adjusting Imports of Steel and Aluminum into the United States, under Section 232 of the Trade Expansion Act of 1962, as amended, providing for additional import duties for steel mill and aluminum articles, effective March 23, 2018.[42] On March 22, 2018, April 30, 2018, May 31, 2018, August 10, 2018, and August 29, 2018, the President issued Proclamations 9710, 9711, 9739, 9740, 9758, 9759, 9772, 9776, and

(…*continued*)
https://s3.amazonaws.com/public-inspection.federalregister.gov/2018-27458.pdf, retrieved December 18, 2018.

[37] *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 47974, September 21, 2018.

[38] See U.S. notes 20(e) and 20(f), subchapter III of chapter 99 which discuses articles and products from China. *HTSUS (2018) Revision 13*, USITC Publication No. 4832, October 2018, pp. 99-III-21 - 99-III-22, 99-III-60 - 99-III-62.

[39] Canadian Solar's prehearing brief, pp. 9-11.

[40] SolarWorld's posthearing brief, p. 5.

[41] Hearing transcript, pp. 49 (Boken and Brightbill) and 53 (Szamosszegi).

[42] 83 FR 11619 and 83 FR 11625, March 15, 2018.

9777 on Adjusting Imports of Steel and Aluminum into the United States.[43] Under these Presidential Proclamations, in addition to reporting the regular Chapters 72 and 73 of the Harmonized Tariff Schedule ("HTS") classification for the imported steel merchandise and the regular Chapter 76 of the HTS classification for the imported aluminum merchandise, importers shall report the following HTS classification for imported merchandise subject to the additional duty: 9903.80.01 (25 percent ad valorem additional duty for steel mill products) and 9903.85.01 (10 percent ad valorem additional duty for aluminum products). These duty requirements are effective with respect to goods entered, or withdrawn from warehouse for consumption, on or after March 23, 2018.[44]

As explained in the section entitled "The product" of this report, both steel and aluminum are raw material inputs in the production of CSPV cells and modules.[45]

SUMMARY DATA

Table I-1 presents a summary of data from the terminal years of the original investigations and the current full five-year reviews. Figure I-1 presents apparent U.S. consumption data for 2009-17.[46] Data from the original investigations and these current five-year reviews are not comparable in the following respects. First, the import component of apparent U.S. consumption in 2017 is derived from adjusted official U.S. import statistics and may include items that are not in scope.[47] In these reviews, 47 importers that accounted for approximately 26.2 percent of U.S. imports of CSPV cells and modules from China and 56.4 percent of U.S. imports from nonsubject countries in 2017 submitted usable questionnaire

[43] 83 FR 13355 and 83 FR 13361, March 28, 2018; 83 FR 20683 and 83 FR 20677, May 7, 2018; 83 FR 25849 and 25857, June 5, 2018; 83 FR 40429, August 15, 2018; and 83 FR 45019 and 45025, September 4, 2018.

[44] *Section 232 Tariffs on Aluminum and Steel Duty on Imports of Steel and Aluminum Articles under Section 232 of the Trade Expansion Act of 1962*, https://www.cbp.gov/trade/programs-administration/entry-summary/232-tariffs-aluminum-and-steel, retrieved December 12, 2018.

[45] For both CSPV cells and modules, total raw material cost is the most substantial component of total COGS. For cells, total raw material cost reflects a combination of polysilicon, wafers, and all other raw material costs; however, the main underlying raw material input for CSPV cells is wafers made from polysilicon.

[46] Complete summaries of these data from the final *CSPV 1* investigations for 2009-11, January-June 2011, and January-June 2012 appear in appendix C. Select data from *CSPV 3* are also presented in appendix C.

[47] Import statistics for 2017 were adjusted to remove the following: (1) known imports of modules that contained U.S.-produced cells and (2) an estimated amount of thin film products (based on the ratio of total imports held by thin film products in July and August 2018 under HTS statistical reporting numbers 8541.40.6035 and 8541.40.6045). However, the adjusted import statistics presented may include additional items that are specifically excluded from the scope of these orders.

responses;[48] whereas, 49 firms that accounted for approximately 67.1 percent of U.S. imports of CSPV cells and modules from China and 37.3 percent from nonsubject countries in 2011 provided responses in the original investigations.

Table I-1
CSPV cells and modules: Comparative data from the original investigations and current first reviews, by terminal year, 2011 and 2017

Item	Original investigations	First reviews
	2011	2017
	Quantity (kilowatts)	
U.S. consumption quantity	2,601,766	***
	Share of quantity (percent)	
Share of U.S. consumption:		
U.S. producers' share	32.5	***
U.S. importers' share:		
China	49.2	***
Nonsubject sources	18.3	***
All import sources	67.5	***
	Value (1,000 dollars)	
U.S. consumption value	3,720,831	***
	Share of value (percent)	
Share of U.S. consumption:		
U.S. producers' share	32.7	***
U.S. importers' share:		
China	48.1	***
Nonsubject sources	19.2	***
All import sources	67.3	***
	Quantity (kilowatts); value (1,000 dollars); and unit value (dollars per kilowatt)	
U.S. imports.--		
China		
Quantity	1,278,965	1,307,134
Value	1,788,744	441,381
Unit value	$1,399	$338
Nonsubject sources		
Quantity	477,226	6,864,094
Value	713,838	3,354,314
Unit value	$1,496	$489
All import sources		
Quantity	1,756,191	8,171,228
Value	2,502,582	3,795,695
Unit value	$1,425	$465

Table continued on next page.

[48] Based on a comparison of the value of U.S. imports of CSPV cells and modules reported in the responses to the Commission's U.S. importer questionnaire with total landed-duty paid value of U.S. imports of cells and modules as reported by official Commerce import statistics (HTS 8541.40.6030 and 8541.40.6020), as adjusted to remove nonsubject modules containing U.S.-origin cells and an estimated amount of thin film products. Questionnaire data coverage percentages may be understated because official Commerce statistics include other products not within the scope of these orders.

Table I-1—Continued
CSPV cells and modules: Comparative data from the original investigations and current first reviews, by terminal year, 2011 and 2017

Item	Original investigations	First reviews
	2011	2017
	Quantity (kilowatts); value (1,000 dollars); and unit value (dollars per kilowatt)	
U.S. industry:		
CSPV cells:		
Capacity (quantity)	***	***
Production (quantity)	***	***
Capacity utilization (percent)	***	***
CSPV modules:		
Capacity (quantity)	***	***
Production (quantity)	***	***
Capacity utilization (percent)	***	***
U.S. shipments:		
Quantity	***	***
Value	***	***
Unit value	***	***
Ending inventory	***	***
Inventories/total shipments (percent)	***	***
Production workers	***	***
Hours worked (1,000)	***	***
Wages paid (1,000 dollars)	***	***
Hourly wages	***	***
Financial data:		
Net sales:		
Quantity	***	***
Value	***	***
Unit value	***	***
Cost of goods sold	***	***
Gross profit or (loss)	***	***
SG&A expense	***	***
Operating income or (loss)	***	***
Unit COGS	***	***
Unit operating income	***	***
COGS/sales (percent)	***	***
Operating income or (loss)/sales (percent)	***	***

Source: Office of Investigations memorandum INV-X-160 (July 18, 2000), memorandum INV-DD-073 (May 30, 2006), memorandum INV-KK-084 (May 3, 2012), adjusted official U.S. import statistics, and compiled from data submitted in response to Commission questionnaires.

Figure I-1
CSPV cells and modules: Apparent U.S. consumption, 2009-17

* * * * * * *

Second, apparent U.S. consumption and U.S. producers' shares in 2017 may be understated due to an underreporting of U.S. producer data. Four U.S. producers of CSPV cells, which are believed to have accounted for *** percent of total 2017 U.S. CSPV cell production capacity,[49] and 11 U.S. producers of CSPV modules, which are believed to have accounted for approximately *** percent of total 2017 U.S. production capacity of CSPV modules,[50] submitted usable questionnaire responses in these five-year reviews. Previously, two U.S. producers of CSPV cells, which accounted for approximately *** percent of total 2011 U.S. CSPV cell production, and 14 U.S. producers that produce CSPV modules, which accounted for approximately *** percent of total 2011 U.S. production of CSPV modules submitted usable questionnaire responses in the original investigations.[51]

STATUTORY CRITERIA AND ORGANIZATION OF THE REPORT

Statutory criteria

Section 751(c) of the Act requires Commerce and the Commission to conduct a review no later than five years after the issuance of an antidumping or countervailing duty order or the suspension of an investigation to determine whether revocation of the order or termination of the suspended investigation "would be likely to lead to continuation or recurrence of dumping or a countervailable subsidy (as the case may be) and of material injury."

Section 752(a) of the Act provides that in making its determination of likelihood of continuation or recurrence of material injury—

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[49] Cell production coverage data are based on reported production capacity of *** and *** of industry-wide capacity including Solaria's 40,000 kW of capacity. ***. Pickerel, Kelly, "Solaria Expands Silicon Valley Manufacturing Line of 330-W Solar Modules," Solar Power World, June 26, 2017, https://www.solarpowerworldonline.com/2017/06/solaria-expands-silicon-valley-manufacturing-line-330-w-solar-modules/, retrieved December 18, 2018; SunPower's U.S. producer questionnaire response; Tesla's U.S. producer questionnaire response.

[50] Module coverage data are based on a comparison of U.S. producers' reported CSPV production capacity in 2017 of *** and industry-wide total capacity of *** (based on end-of-year 2017 capacity for firms that did not submit usable questionnaire responses of *** (see table III-8).

[51] Based on a comparison of U.S. producers' reported production of CSPV cells and modules in 2011 with total U.S. production of cells (***) as reported in *PV News*, Volume 31, Number 5, May 2012, pp. 8-9, and modules (***) as reported in *U.S. Solar Market Insight, 2011 Year-in-Review*, Solar Energy Industries Association, p. 13.

(1) IN GENERAL.-- . . . the Commission shall determine whether revocation of an order, or termination of a suspended investigation, would be likely to lead to continuation or recurrence of material injury within a reasonably foreseeable time. The Commission shall consider the likely volume, price effect, and impact of imports of the subject merchandise on the industry if the order is revoked or the suspended investigation is terminated. The Commission shall take into account--

(A) its prior injury determinations, including the volume, price effect, and impact of imports of the subject merchandise on the industry before the order was issued or the suspension agreement was accepted,

(B) whether any improvement in the state of the industry is related to the order or the suspension agreement,

(C) whether the industry is vulnerable to material injury if the order is revoked or the suspension agreement is terminated, and

(D) in an antidumping proceeding . . ., (Commerce's findings) regarding duty absorption . . ..

(2) VOLUME.--In evaluating the likely volume of imports of the subject merchandise if the order is revoked or the suspended investigation is terminated, the Commission shall consider whether the likely volume of imports of the subject merchandise would be significant if the order is revoked or the suspended investigation is terminated, either in absolute terms or relative to production or consumption in the United States. In so doing, the Commission shall consider all relevant economic factors, including--

(A) any likely increase in production capacity or existing unused production capacity in the exporting country,

(B) existing inventories of the subject merchandise, or likely increases in inventories,

(C) the existence of barriers to the importation of such merchandise into countries other than the United States, and

(D) the potential for product-shifting if production facilities in the foreign country, which can be used to produce the subject merchandise, are currently being used to produce other products.

(3) PRICE.--In evaluating the likely price effects of imports of the subject merchandise if the order is revoked or the suspended investigation is terminated, the Commission shall consider whether--

(A) there is likely to be significant price underselling by imports of the subject merchandise as compared to domestic like products, and

(B) imports of the subject merchandise are likely to enter the United States at prices that otherwise would have a significant depressing or suppressing effect on the price of domestic like products.

(4) IMPACT ON THE INDUSTRY.--In evaluating the likely impact of imports of the subject merchandise on the industry if the order is revoked or the suspended

investigation is terminated, the Commission shall consider all relevant economic factors which are likely to have a bearing on the state of the industry in the United States, including, but not limited to–

> *(A) likely declines in output, sales, market share, profits, productivity, return on investments, and utilization of capacity,*
> *(B) likely negative effects on cash flow, inventories, employment, wages, growth, ability to raise capital, and investment, and*
> *(C) likely negative effects on the existing development and production efforts of the industry, including efforts to develop a derivative or more advanced version of the domestic like product.*

The Commission shall evaluate all such relevant economic factors . . . within the context of the business cycle and the conditions of competition that are distinctive to the affected industry.

Section 752(a)(6) of the Act states further that in making its determination, "the Commission may consider the magnitude of the margin of dumping or the magnitude of the net countervailable subsidy. If a countervailable subsidy is involved, the Commission shall consider information regarding the nature of the countervailable subsidy and whether the subsidy is a subsidy described in Article 3 or 6.1 of the Subsidies Agreement."

Organization of report

Information obtained during the course of the reviews that relates to the statutory criteria is presented throughout this report. A summary of trade and financial data for CSPV cells and modules as collected in the reviews is presented in appendix C. U.S. industry data are based on the questionnaire responses of 4 U.S. producers of CSPV cells that are believed to have accounted for *** percent of domestic capacity of CSPV cells in 2017 and 11 U.S. producers of modules that are believed to have accounted for *** percent of domestic capacity of CSPV modules in 2017. U.S. import data and related information are based on Commerce's official import statistics, the importer questionnaire data submitted in *CSPV 3*, and the questionnaire responses of 47 U.S. importers of CSPV cells and modules that are believed to have accounted for 26.2 percent of total U.S. imports from China and 56.4 percent of total U.S. imports from nonsubject countries during 2017.[52] Foreign industry data and related information are based on the questionnaire responses of nine firms that produce CSPV cells in

[52] Based on a comparison of the value of U.S. imports of CSPV cells and modules reported in the responses to the Commission's U.S. importer questionnaire with total landed-duty paid value of U.S. imports of cells and modules as reported by official Commerce import statistics (HTS 8541.40.6030 and 8541.40.6020), as adjusted to remove nonsubject modules containing U.S.-origin cells and an estimated amount of thin film products. Questionnaire data coverage percentages may be understated because official Commerce statistics may include other products not within the scope of these orders.

China and/or modules that contain Chinese-origin cells in any country. These firms are believed to have accounted for approximately *** and *** percent of total CSPV cell and module production in China in 2017, respectively.[53] Responses by U.S. producers, importers, purchasers, and foreign producers of CSPV cells and modules to a series of questions concerning the significance of the existing antidumping and countervailing duty orders and the likely effects of revocation of such orders are presented in appendix D.

COMMERCE'S REVIEWS

Commerce has not conducted any critical circumstances reviews, made any anti-circumvention or duty absorption findings, or issued any company revocations since the imposition of the orders.[54] Commerce's scope rulings, administrative reviews, and changed circumstances findings are summarized in the following sections.

Administrative reviews

Commerce has completed four administrative reviews of the outstanding countervailing duty order and four administrative reviews of the outstanding antidumping duty order on CSPV cells and modules from China. The calculated dumping margins in the first, second, third, and fourth administrative reviews of the antidumping duty order ranged from 0.79-33.08 percent, 6.12-12.19 percent, 5.82-13.07 percent, and 15.85 percent, respectively. The China-wide rate in the first antidumping administrative review was 238.95 percent, which continued to be the China-wide rate in the subsequent antidumping administrative reviews. The calculated net countervailable subsidy rate in the first, second, third, and fourth administrative reviews of the countervailing duty order ranged from 15.43-23.28 percent, 24.66 percent, 17.14-18.16 percent, and 9.12-11.59 percent, respectively. The final results of Commerce's administrative reviews of the antidumping and countervailing duty orders are summarized in table I-2.

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[53] The production response rate in China is calculated based on a comparison of the quantity of 2017 CSPV cell and module production in China as reported in the responses to the Commission's foreign producer questionnaires (8.6 GW (cells) and 11.6 GW (modules)) with total production in China during 2017 (72 GW (cells) and 75 GW (modules)) as reported in National Survey Report of PV Power Applications in China 2017, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, 2018, p. 19, http://www.iea-pvps.org/?id=93. The response rate of module production may be understated because published data on total module production in China may include nonsubject modules produced from non-Chinese origin cells.

[54] *Issues and Decision Memorandum for the Expedited First Sunset Review of the Antidumping Duty Order on Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China*, March 5, 2018.

Table I-2
CSPV cells and modules: Commerce's administrative reviews

Federal Register cite	Exporter	Weighted average dumping margin (percent)
Antidumping duty order		
	Yingli Energy (China) Co. Ltd./Baoding Tianwei Yingli New Energy Resources Co., Ltd./Tianjin Yingli New Energy Resources Co., Ltd./Hengshui Yingli New Energy Resources Co., Ltd./Lixian Yingli New Energy Resources Co., Ltd./ Baoding Jiasheng Photovoltaic Technology Co., Ltd./Beijing Tianneng Yingli New Energy Resources Co., Ltd./Hainan Yingli New Energy Resources Co., Ltd.	0.79
	Wuxi Suntech Power Co., Ltd./Luoyang Suntech Power Co., Ltd.	33.08
80 FR 40998 July 14, 2015	Canadian Solar International Ltd.; Canadian Solar Manufacturing (Changshu) Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; Changzhou Trina Solar Energy Co., Ltd./Trina Solar (Changzhou) Science and Technology Co., Ltd.; Chint Solar (Zhejiang) Co., Ltd.; De-Tech Trading Limited HK; Eoplly New Energy Technology Co., Ltd.; Hangzhou Zhejiang University Sunny Energy Science and Technology Co., Ltd.; Jinko Solar Import and Export Co., Ltd.; Ningbo Qixin Solar Electrical Appliance Co., Ltd.; Renesola Jiangsu Ltd.; Shanghai BYD Co., Ltd.; Shenzhen Topray Solar Co. Ltd.; Sopray Energy Co., Ltd.; Star Power International Ltd.; Sun Earth Solar Power Co., Ltd.; Yingli Green Energy Holding Co. Ltd.; Yingli Green Energy International Trading Co. Ltd.; Zhejiang Sunflower Light Energy Science & Technology Ltd. Liability Co.	9.67
	PRC-Wide Entity	238.95
81 FR 39905 June 20, 2016	Yingli Energy (China) Co. Ltd./Baoding Tianwei Yingli New Energy Resources Co., Ltd./Tianjin Yingli New Energy Resources Co., Ltd./Hengshui Yingli New Energy Resources Co., Ltd./Lixian Yingli New Energy Resources Co., Ltd./ Baoding Jiasheng Photovoltaic Technology Co., Ltd./Beijing Tianneng Yingli New Energy Resources Co., Ltd./Hainan Yingli New Energy Resources Co., Ltd./Shenzhen Yingli New Energy Resources Co., Ltd.	12.19
	Changzhou Trina Solar Energy Co., Ltd./Trina Solar (Changzhou) Science and Technology Co., Ltd./Yancheng Trina Solar Energy Technology Co., Ltd./ Changzhou Trina Solar Yabang Energy Co., Ltd./Turpan Trina Solar Energy Co., Ltd./Hubei Trina Solar Energy Co., Ltd.	6.12
	BYD (Shangluo) Industrial Co., Ltd.; Canadian Solar International Ltd.; Canadian Solar Manufacturing (Changshu) Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; Dongguan Sunworth Solar Energy Co., Ltd.; ERA Solar Co., Ltd.; ET Solar Energy Ltd.; JA Solar Technology Yangzhou Co., Ltd.; Jiangsu High Hope Int'l Group; JingAo Solar Co., Ltd.; Ningbo Qixin Solar Electrical Appliance Co., Ltd.; Shanghai BYD Co., Ltd.; Shenzhen Glory Industries Co., Ltd.; Shenzhen Topray Solar Co., Ltd.; Wuxi Suntech Power Co., Ltd./Luoyang Suntech Power Co., Ltd.	8.52

Table continued on next page.

Table I-2—Continued
CSPV cells and modules: Commerce's administrative reviews

Federal Register cite	Exporter	Weighted average dumping margin (percent)
82 FR 29033 June 27, 2017 (amended 82 FR 40562 August 25, 2017)	Canadian Solar International Ltd./Canadian Solar Manufacturing (Changshu), Inc./Canadian Solar Manufacturing (Luoyang) Inc./CSI Cells Co., Ltd./CSI–GCL Solar Manufacturing (YanCheng) Co., Ltd./CSI Solar Power (China) Inc.	13.07
	Changzhou Trina Solar Energy Co., Ltd./Trina Solar (Changzhou) Science and Technology Co., Ltd./Yancheng Trina Solar Energy Technology Co., Ltd./Changzhou Trina Solar Yabang Energy Co., Ltd./Turpan Trina Solar Energy Co., Ltd./Hubei Trina Solar Energy Co., Ltd.	5.82
	Chint Solar (Zhejiang) Co., Ltd.; ERA Solar Co., Ltd.; ET Solar Energy Ltd.; Hangzhou Sunny Energy Science & Technology Co., Ltd.; Hengdian Group DMEGC Magnetics Co., Ltd.; JA Solar Technology Yangzhou Co., Ltd.; Jiawei Solarchina (Shenzhen) Co., Ltd.; Jiawei Solarchina Co., Ltd.; JingAo Solar Co., Ltd.; Lightway Green New Energy Co., Ltd.; Ningbo ETDZ Holdings, Ltd.; Risen Energy Co., Ltd.; Shanghai BYD Co., Ltd.; Shanghai JA Solar Technology Co., Ltd.; Shenzhen Sungold Solar Co., Ltd.; Shenzhen Topray Solar Co., Ltd.; Star Power International Ltd.; Systemes Versilis, Inc.; Taizhou BD Trade Co., Ltd.; tenKsolar (Shanghai) Co., Ltd.; Toenergy Technology Hangzhou Co., Ltd.; Wuxi Tianran Photovoltaic Co., Ltd.; Yingli Energy (China) Co. Ltd./Baoding Tianwei Yingli New Energy Resources Co., Ltd./Tianjin Yingli New Energy Resources Co., Ltd./Hengshui Yingli New Energy Resources Co., Ltd./Lixian Yingli New Energy Resources Co., Ltd./Baoding Jiasheng Photovoltaic Technology Co., Ltd./Beijing Tianneng Yingli New Energy Resources Co., Ltd./Hainan Yingli New Energy Resources Co., Ltd./Shenzhen Yingli New Energy Resources Co., Ltd.; Zhejiang Era Solar Technology Co., Ltd.; Zhejiang Sunflower Light Energy Science & Technology Limited Liability Co.	7.82
83 FR 35616 July 27, 2018	Changzhou Trina Solar Energy Co., Ltd./Trina Solar (Changzhou) Science and Technology Co., Ltd./Yancheng Trina Solar Technology Co., Ltd./Changzhou Trina Solar Yabang Energy Co., Ltd./Turpan Trina Solar Energy Co., Ltd./Hubei Trina Solar Energy Co., Ltd./Trina Solar (Hefei) Science and Technology Co., Ltd.; Anji DaSol Solar Energy Science & Technology Co., Ltd.; Chint Solar (Zhejiang) Co., Ltd.; ET Solar Energy Ltd.; Hangzhou Sunny Energy Science and Technology Co., Ltd.; Hengdian Group DMEGC Magnetics Co. Ltd.; JA Solar Technology Yangzhou Co., Ltd.; Jiawei Solarchina (Shenzhen) Co., Ltd.; JingAo Solar Co., Ltd.; LERRI Solar Technology Co., Ltd. (aka LONGi Solar Technology Co. Ltd.); Lightway Green New Energy Co., Ltd.; Ningbo Qixin Solar Electrical Appliance Co., Ltd.; Risen Energy Co., Ltd.; Shanghai JA Solar Technology Co., Ltd.; Shenzhen Topray Solar Co., Ltd.; Sumec Hardware & Tools Co., Ltd.; Sunpreme Jiaxing Ltd.; tenKsolar (Shanghai) Co., Ltd.; Wuxi Suntech Power Co., Ltd/Luoyang Suntech Power Co., Ltd.; Yingli Energy (China) Company Limited/Baoding Tianwei Yingli New Energy Resources Co., Ltd./Tianjin Yingli New Energy Resources Co., Ltd./Hengshui Yingli New Energy Resources Co., Ltd./Lixian Yingli New Energy Resources Co., Ltd./Baoding Jiasheng Photovoltaic Technology Co., Ltd./Beijing Tianneng Yingli New Energy Resources Co., Ltd./Hainan Yingli New Energy Resources Co., Ltd.; Zhejiang ERA Solar Technology Co., Ltd.; Zhejiang Sunflower Light Energy Science & Technology Limited Liability Company	15.85

Table continued on next page.

Table I-2—Continued
CSPV cells and modules: Commerce's administrative reviews

Federal Register cite	Exporter	Net countervailable subsidy rate (percent)
Countervailing duty order		
80 FR 41003 July 14, 2015	Lightway	23.28
	BYD Group	15.43
	Non-reviewed companies	20.94
81 FR 46905 July 19, 2016 (amended 83 FR 15364, April 10, 2018)	JA Solar Technology Yangzhou Co., Ltd. and its cross-owned affiliates (Donghai JA Solar Technology Co., Ltd.; Hebei Ningjin Songgong Semiconductor Co., Ltd.; Hebei Ningtong Electronic Materials Co., Ltd.; Hebei Yujing Electronic Science and Technology Co., Ltd.; Hefei JA Solar Technology Co., Ltd.; JA (Hefei) Renewable Energy Co., Ltd.; JA Solar Technology Yangzhou Co., Ltd.; Jing Hai Yang Semiconductor Material (Donghai) Co., Ltd.; JingAo Solar Co., Ltd.; JingLong Industry and Commerce Group Co., Ltd.; Jingwei Electronic Material Co., Ltd.; Ningjin Changlong Electronic Materials Manufacturing Co.; Ningjin County Jingyuan New Energy Investment Co., Ltd.; Ningjin Guiguang Electronic Investment Co., Ltd.; Ningjin Jingfeng Electronic Materials Co., Ltd.; Ningjin Saimei Ganglong Electronic Materials Co., Ltd.; Ningjin Songgong Electronic Materials Co., Ltd.; Ningjing Sunshine New Energy Co., Ltd.; Ninjing Jingxing Electronic Materials Co., Ltd.; Shanghai JA Solar Technology Co., Ltd.; Solar Silicon Valley Electronic Science and Technology Co., Ltd.; Xingtai Jinglong Electronic Materials Co., Ltd.; and, Yangguang Guifeng Electronic Technology Co., Ltd.); Changzhou Trina Solar Energy Co., Ltd; and Wuxi Suntech Power Co., Ltd.	24.66
82 FR 32680 July 17, 2017 (amended 82 FR 46760 October 6, 2017)	Canadian Solar Manufacturing (Changshu) and its Cross-Owned Affiliates (Canadian Solar Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; CSI Cells Co., Ltd.; CSI Solar Power (China) Inc.; CSI Solartronics (Changshu) Co., Ltd.; CSI Solar Technologies Inc.; and CSI Solar Manufacture Inc.)	18.16
	Changzhou Trina Solar Energy Co., Ltd. and its Cross-Owned Affiliates (Trina Solar Limited; Trina Solar (Changzhou) Science & Technology Co., Ltd.; Yancheng Trina Solar Energy Technology Co., Ltd.; Changzhou Trina Solar Yabang Energy Co., Ltd.; Hubei Trina Solar Energy Co., Ltd.; Turpan Trina Solar Energy Co., Ltd.; and Changzhou Trina PV Ribbon Materials Co., Ltd.)	17.14
	BYD (Shangluo) Industrial Co., Ltd.; Chint Solar (Zhejiang) Co., Ltd.; ET Solar Energy Limited; ET Solar Industry Limited; Hangzhou Sunny Energy Science and Technology Co., Ltd.; Jiawei Solarchina Co., Ltd.; Jiawei Solarchina (Shenzhen) Co., Ltd.; Lightway Green New Energy Co., Ltd.; Luoyang Suntech Power Co., Ltd.; Ningbo Qixin Solar Electrical Appliance Co., Ltd.; Shanghai BYD Co., Ltd.; Shenzhen Topray Solar Co. Ltd.; Systemes Versilis, Inc.; Taizhou BD Trade Co., Ltd.; tenKsolar (Shanghai) Co., Ltd.; Toenergy Technology Hangzhou Co., Ltd.; Wuxi Suntech Power Co., Ltd.	17.49

Table continued on next page.

Table I-2—Continued
CSPV cells and modules: Commerce's administrative reviews

Federal Register cite	Exporter	Net countervailable subsidy rate (percent)
	Canadian Solar and its Cross-Owned Affiliates (Canadian Solar Inc.; Canadian Solar Manufacturing (Luoyang) Inc.; Canadian Solar Manufacturing (Changshu) Inc.; CSI Cells Co., Ltd.; CSI Solar Power (China) Inc.; CSI Solartronics (Changshu) Co., Ltd.; CSI Solar Technologies Inc.; CSI Solar Manufacture Inc. (name was changed to CSI New Energy Holding Co., Ltd. in July 2015); CSI–GCL Solar Manufacturing (Yancheng) Co., Ltd.; Changshu Tegu New Materials Technology Co., Ltd.; Changshu Tlian Co., Ltd.; and Suzhou Sanysolar Materials Technology Co., Ltd.)	11.59
	Trina Solar and its Cross-Owned Affiliates (Changzhou Trina Solar Energy Co., Ltd.; Trina Solar (Changzhou) Science and Technology Co., Ltd.; Yancheng Trina Solar Energy Technology Co., Ltd.; Changzhou Trina Solar Yabang Energy Co., Ltd.; Hubei Trina Solar Energy Co., Ltd.; Turpan Trina Solar Energy Co., Ltd.; and Changzhou Trina PV Ribbon Materials Co., Ltd.)	9.12
83 FR 34828 July 23, 2018 (amended 83 FR 54566 October 30, 2018)	Non-selected companies: Baoding Jiasheng Photovoltaic Technology Co., Ltd.; Baoding Tianwei Yingli New Energy Resources Co., Ltd.; Beijing Tianneng Yingli New Energy Resources Co., Ltd.; Canadian Solar International, Ltd.; Chint Solar (Zhejiang) Co., Ltd.; Dongguan Sunworth Solar Energy Co., Ltd.; ERA Solar Co., Ltd.; ET Solar Energy Limited; ET Solar Industry Ltd.; Hainan Yingli New Energy Resources Co., Ltd.; Hangzhou Sunny Energy Science and Technology Co., Ltd.; Hangzhou Zhejiang University Sunny Energy Science and Technology Co., Ltd.; Hengdian Group DMEGC Magnetics Co., Ltd.; Hengshui Yingli New Energy Resources Co., Ltd.; JA Solar Technology Yangzhou Co., Ltd.; Jiangsu High Hope Int'l Group; Jiawei Solarchina Co., Ltd.; Jiawei Solarchina (Shenzhen) Co., Ltd.; JingAo Solar Co., Ltd.; Jinko Solar Co., Ltd.; Jinko Solar Import and Export Co., Ltd.; Jinko Solar International Ltd.; Jinko Solar (U.S.) Inc.; Lightway Green New Energy Co., Ltd.; Lixian Yingli New Energy Resources Co., Ltd.; Luoyang Suntech Power Co., Ltd.; Ningbo Qixin Solar Electrical Appliance Co., Ltd.; Risen Energy Co., Ltd.; Shanghai JA Solar Technology Co., Ltd.; Shenzhen Glory Industries Co., Ltd.; Shenzhen Topray Solar Co., Ltd.; Sumec Hardware & Tools Co. Ltd.; Systemes Versilis, Inc.; Taizhou BD Trade Co., Ltd.; tenKsolar (Shanghai) Co., Ltd.; Tianjin Yingli New Energy Resources Co., Ltd.; Toenergy Technology Hangzhou Co., Ltd.; Wuxi Suntech Power Co., Ltd.; Yingli Energy (China) Co., Ltd.; Zhejiang Era Solar Technology Co., Ltd.; Zhejiang Jinko Solar Co., Ltd.; Zhejiang Sunflower Light Energy Science & Technology LLC	10.64

Source: Cited *Federal Register* notices.

Changed circumstances reviews

Commerce has conducted five changed circumstances reviews concerning the antidumping duty order on CSPV cells and modules from China. The final results of Commerce's changed circumstances reviews are summarized in table I-3.

Table I-3
CSPV cells and modules: Commerce's changed circumstances reviews

Federal Register cite	Commerce's finding
81 FR 9427 February 25, 2016	Neo Solar Power Corp. is not the successor-in-interest to DelSolar Co., Ltd.
81 FR 43582 July 5, 2016	Hangzhou Sunny Energy Science and Technology Co., Ltd. is the successor-in-interest to Hangzhou Zhejiang University Sunny Energy Science and Technology Co., Ltd.
81 FR 91909 December 19, 2016	Zhejiang ERA Solar Technology Co., Ltd. is the successor-in-interest to Era Solar Co., Ltd.
82 FR 17797 April 13, 2017	(1) Hanwha Q CELLS (Qidong) Co. Ltd. is the successor-in-interest to Hanwha SolarOne (Qidong) Co., Ltd. and (2) Hanwha Q CELLS Hong Kong Limited is the successor-in-interest to Hanwha SolarOne Hong Kong Limited.
83 FR 2617 January 18, 2018	Excluded from the scope of the orders are panels with surface area from 3,450 mm^2 to 33,782 mm^2 with one black wire and one red wire (each of type 22 AWG or 24 AWG not more than 206 mm in length when measured from panel extrusion), and not exceeding 2.9 volts, 1.1 amps, and 3.19 watts. For the purposes of this exclusion, no panel shall contain an internal battery or external computer peripheral ports.

Source: Cited *Federal Register* notices.

Commerce's sixth changed circumstances review is currently ongoing. Its preliminary determination concerning the sixth changed circumstances review was published on August 20, 2018. In that preliminary determination, Commerce indicated its intent to revoke the orders, in part, for certain off-grid CSPV producers because producers accounting for substantially all of the domestic production of certain off-grid solar panels lacked interest in the relief provided by the antidumping and countervailing duty orders. The scope of the changed circumstances reviews includes the following off-grid solar panels requested for revocation by Goal Zero: (1) Off-grid CSPV panels in rigid form with a glass cover, with the following characteristics: (A) A total power output of 100 watts or less per panel; (B) a maximum surface area of 8,000 cm^2 per panel; (C) do not include a built-in inverter; (D) must include a permanently connected wire that terminates in either an 8mm male barrel connector, or a two-port rectangular connector with two pins in square housings of different colors; (E) must include visible parallel grid collector metallic wire lines every 1–4 millimeters across each solar cell; and (F) must be in individual retail packaging (for purposes of this provision, retail packaging typically includes graphics, the product name, its description and/or features, and foam for transport); and (2) Off-grid CSPV panels without a glass cover, with the following characteristics: (A) A total power output of 100 watts or less per panel; (B) a maximum surface area of 8,000 cm^2 per panel; (C) do not include a built-in inverter; (D) must include visible parallel grid collector metallic wire lines every 1–4 millimeters across each solar cell; and (E) each panel is 1. Permanently

integrated into a consumer good; 2. encased in a laminated material without stitching, or 3. has all of the following characteristics: (i) The panel is encased in sewn fabric with visible stitching, (ii) includes a mesh zippered storage pocket, and (iii) includes a permanently attached wire that terminates in a female USB–A connector.[55]

Scope rulings

Commerce has issued six scope rulings since the imposition of the orders subject to these first five-year reviews. These rulings are summarized in table I-4.

Table I-4
CSPV cells and modules: Commerce's scope rulings

Requestor	Product to be excluded	Commerce ruling	Federal Register cite
OYAMA Life Impact Energy Co. Ltd.	Solar cells in the OY340–XA Hybrid Solar Tablet Charger	Denied	79 FR 6165 February 3, 2014
NVT LLC (d/b/a SunEdison)	Modules assembled in Malaysia from solar cells manufactured in Taiwan, where all manufacturing of the modules/cells took place in Malaysia and Taiwan, are not subject to the scope of the AD and CVD orders because neither the solar modules nor the solar cells therein were manufactured in China.	Granted	79 FR 30821 May 29, 2014
Outdoor Tactical Enterprises	Solar chargers imported by Outdoor Tactical Enterprises (i.e., solar modules produced in China from solar cells that are manufactured in Taiwan).	Granted	(1)
Goal Zero, LLC	Torch 250 Flashlight	Denied	82 FR 26454 June 7, 2017
SolarCity Corp. and Silevo LLC	Triex photovoltaic cells	Denied	(2)
Sunpreme Inc.	Solar modules containing bifacial thin film cells made with amorphous silicon (bifacial solar products)	Denied	(3)

Footnotes continued on next page.

[55] *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Preliminary Results of Changed Circumstances Reviews, and Consideration of Revocation of the Antidumping and Countervailing Duty Orders, in Part*, 83 FR 42112, August 20, 2018.

Table I-4
CSPV cells and modules: Commerce's scope rulings—Continued

[1] Memorandum from Mark Hoadley, Program Manager, AD/CVD Operations, Office VII, to Edward C. Yang, Director, AD/CVD Operations, Office VII, "Antidumping and Countervailing Duty Orders on Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, from the People's Republic of China; Final Scope Ruling for the Scope Request from Outdoor Tactical Enterprises," dated August 5, 2015.

[2] Memorandum to Christian Marsh, Deputy Assistant Secretary for Antidumping and Countervailing Duty Operations, from Edward Yang, Senior Director, AD/CVD Operations, Office VII, "Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China: Final Ruling in the Triex Photovoltaic Cell Scope Inquiry," dated June 17, 2016.

[3] Memorandum from Mark Hoadley, Program Manager, AD/CVD Operations, Office VII, to Edward C. Yang, Senior Director, AD/CVD Operations, Office VII, "Crystalline Silicon Photovoltaic Cells, Whether or Not assembled into Modules, from the People's Republic of China: Final Ruling in the Sunpreme Scope Inquiry," dated July 29, 2016.

Note.--The scope rulings presented in the table relate to the *CSPV 1* orders only; however, one scope ruling concerning the *CSPV 2* orders was published by Commerce in 2017. In that scope ruling, requested by Aireko Construction, LLC, Commerce found that solar modules assembled in China using solar cells produced in the United States are within the scope of the antidumping duty orders because the scope of the orders explicitly includes solar modules assembled in China consisting of solar cells produced in a third country. *Notice of Scope Rulings*, 81 FR 69784, October 7, 2016.

Source: Cited *Federal Register* notices and Commerce memoranda.

Five-year reviews

On March 9, 2018, Commerce issued the final results of its expedited reviews with respect to CSPV cells and modules from China.[56] Table I-5 presents the countervailable subsidy margins calculated by Commerce in its original investigation and first review.

Table I-5
CSPV cells and modules: Commerce's original and first five-year countervailable subsidy margins for producers/exporters in China

Producer/exporter	Original margin (percent)	First five-year review margin (percent)
Wuxi Suntech Power Co., Ltd. and its cross-owned affiliates Luoyang Suntech Power Co., Ltd., Suntech Power Co., Ltd., Yangzhou Rietech Renewal Energy Co., Ltd., Zhenjiang Huantai Silicon Science & Technology Co., Ltd., Kuttler Automation Systems (Suzhou) Co., Ltd., Shenzhen Suntech Power Co., Ltd., Wuxi Sunshine Power Co., Ltd., Wuxi University Science Park International Incubator Co., Ltd., Yangzhou Suntech Power Co., Ltd., and Zhenjiang Rietech New Energy Science & Technology Co., Ltd. (collectively "Suntech")	14.78	18.22
Trina Solar (Changzhou) Science & Technology Co., Ltd.; Changzhou Trina Solar Energy Co., Ltd.	15.97	19.41
All others	15.24	18.82

Source: 77 FR 63788, October 17, 2012; and 83 FR 10431, March 9, 2018.

[56] *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Results of the Expedited First Sunset Review of the Countervailing Duty Order*, 83 FR 10431, March 9, 2018.

Table I-6 presents the dumping margins calculated by Commerce in its original investigation and first review.

Table I-6
CSPV cells and modules: Commerce's original and first five-year dumping margins for producers/exporters in China

Producer/exporter	Original margin (*percent*)	First five-year review margin (*percent*)
Trina Solar (Changzhou) Science & Technology Co., Ltd.; Changzhou Trina Solar Energy Co., Ltd.	18.32	
Wuxi Suntech Power Co., Ltd.	31.73	
List of 59 named foreign producers/exporters[1]	25.96	
All others	249.96[2]	Up to 249.96

[1] *See* 77 FR 63791, October 17, 2012 for list of Chinese foreign producers/exporters named.
[2] On August 4, 2015, the U.S. Trade Representative ("USTR") instructed Commerce to implement its determinations under Section 129 of the Uruguay Round Agreements Act ("URAA") regarding the antidumping duty investigation of CSPV cells and modules from China. Accordingly, Commerce revised the antidumping cash deposit rates to account for double remedies, reflecting rates ranging from 6.68 percent to 238.88 percent.

Source: 77 FR 63791, October 17, 2012; 80 FR 48812, August 14, 2015; and 83 FR 10663, March 9, 2018.

THE SUBJECT MERCHANDISE

Commerce's scope

In the current proceeding, Commerce has defined the scope as follows:

> The merchandise covered by the order are crystalline silicon photovoltaic cells, and modules, laminates, and panels, consisting of crystalline silicon photovoltaic cells, whether or not partially or fully assembled into other products, including, but not limited to, modules, laminates, panels and building integrated materials. The order covers crystalline silicon photovoltaic cells of thickness equal to or greater than 20 micrometers, having a p/n junction formed by any means, whether or not the cell has undergone other processing, including, but not limited to, cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell.
>
> Merchandise under consideration may be described at the time of importation as parts for final finished products that are assembled after importation, including, but not limited to, modules, laminates, panels, building-integrated modules, building-integrated panels, or other finished goods kits. Such parts that otherwise meet the definition of merchandise under consideration are included in the scope of the orders.

Excluded from the scope of the order are thin film photovoltaic products produced from amorphous silicon (a-Si), cadmium telluride (CdTe), or copper indium gallium selenide (CIGS).

Also excluded from the scope of the order are crystalline silicon photovoltaic cells, not exceeding 10,000 mm^2 in surface area, that are permanently integrated into a consumer good whose function is other than power generation and that consumes the electricity generated by the integrated crystalline silicon photovoltaic cell. Where more than one cell is permanently integrated into a consumer good, the surface area for purposes of this exclusion shall be the total combined surface area of all cells that are integrated into the consumer good.

Additionally, excluded from the scope of this order are panels with surface area from 3,450 mm^2 to 33,782 mm^2 with one black wire and one red wire (each of type 22 AWG or 24 AWG not more than 206 mm in length when measured from panel extrusion), and not exceeding 2.9 volts, 1.1 amps, and 3.19 watts. For the purposes of this exclusion, no panel shall contain an internal battery or external computer peripheral ports.

Modules, laminates, and panels produced in a third-country from cells produced in China are covered by the orders; however, modules, laminates, and panels produced in China from cells produced in a third-country are not covered by the order.

Merchandise covered by this order is currently classified in the Harmonized Tariff System of the United States (HTSUS) under subheadings 8501.61.0000, 8507.20.80, 8541.40.6020, 8541.40.6030, and 8501.31.8000. These HTSUS subheadings are provided for convenience and customs purposes; the written description of the scope of the order is dispositive.[57]

[57] *Issues and Decision Memorandum for the Expedited First Sunset Review of the Antidumping Duty Order on Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China*, March 5, 2018.

Tariff treatment

The subject merchandise is provided for in subheading 8541.40.60 of the Harmonized Tariff Schedule of the United States ("HTS"), and has been free of duty under the general duty column since at least 1987. Within subheading 8541.40.60, the subject merchandise was included in statistical reporting numbers 8541.40.6020 ("solar cells, assembled into modules or made up into panels") and 8541.40.6030 ("solar cells, other") through June 30, 2018. As of July 1, 2018, a superior text for crystalline silicon photovoltaic cells (described in statistical note 11 to chapter 85) applies to two subordinate reporting categories, 8541.40.6015 ("assembled into modules or made up into panels") and 8541.40.6025 ("other").[58] Under subheading 9903.45.22, imports of cells in excess of the prescribed tariff-rate quota quantity are subject to a general duty rate of 30 percent ad valorem (unless the product of an exempt country); under subheading 9903.45.25 all covered modules from nonexempt countries are dutiable at 30 percent ad valorem.

These articles may also be imported as parts or subassemblies of goods provided for in subheadings 8501.31.80, 8501.61.00, and 8507.20.80.[59] Inverters or batteries with CSPV cells attached are provided for under HTSUS subheadings 8501.61.00 and 8507.20.80, respectively. In addition, CSPV cells covered by the reviews may also be classifiable as DC generators of subheading 8501.31.80, when such generators are imported with CSPV cells attached. Goods classified in subheadings 8501.31.80 and 8501.61.00 have general duty rates of 2.5 percent ad valorem, and goods classified in subheading 8507.20.80 have a general duty rate of 3.5 percent ad valorem. The following statistical reporting numbers were added on March 1, 2018: 8501.31.8010 (covering DC generators of an output not exceeding 750 W: photovoltaic generators of a kind described in statistical note 9 to subchapter 85),[60] 8501.32.6010 (DC

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[58] Statistical Note 11: For the purposes of statistical reporting numbers 8541.40.6015 and 8541.40.6025, the term "crystalline silicon photovoltaic cells" means crystalline silicon photovoltaic cells of a thickness equal to or greater than 20 micrometers, having a p/n junction (or variant thereof) formed by any means, whether or not the cell imported under statistical reporting number 8541.40.6025 (or subassemblies thereof imported under statistical reporting number 8541.40.6015) has undergone other processing, including, but not limited to, cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell. Such cells include photovoltaic cells that contain crystalline silicon in addition to other photovoltaic materials. This includes, but is not limited to, passivated emitter rear contact cells, heterojunction with intrinsic thin-layer cells, and other so-called hybrid cells.

[59] The subject cells may be presented as integral elements of subassemblies of components or of goods of these three subheadings, even if not treated as "parts" for tariff purposes.

[60] Statistical Note 9 to chapter 85 provides as follows: For the purposes of heading 8501, photovoltaic generators consist of panels of photocells combined with other apparatus, e.g., storage batteries and electronic controls (voltage regulator, inverter, etc.) and panels or modules equipped with elements, however simple (for example, diodes to control the direction of the current), which supply the power directly to, for example, a motor, an electrolyser. In these devices, electricity is produced by means of solar cells which convert solar energy directly into electricity (photovoltaic conversion).

generators of an output exceeding 750 W but not exceeding 75 kW: photovoltaic generators of a kind described in statistical note 9), 8501.61.0010 (AC generators (alternators): photovoltaic generators of a kind described in statistical note 9), and 8507.20.8010 (other lead-acid storage batteries: of a kind described in subheading 9903.45.25).[61]

As a result of Section 301 determinations, products of China under certain applicable subheadings are assessed up to an additional duty of 25 percent ad valorem.[62] See the section of this report entitled "Section 301 proceeding" for further information on the USTR determinations.

Decisions on the tariff classification and treatment of imported articles are within the authority of U.S. Customs and Border Protection ("Customs"). As stated in Commerce's notices of antidumping and countervailing duty orders, the HTS subheadings and reporting numbers are provided for convenience and customs purposes; the written description of the scope of these orders is dispositive.[63]

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[61] HTS 9903.45.25: Modules as defined in note 18(g) to this subchapter (subchapter III of chapter 99), when the product or originating good of a country other than a country described in note 18(b) to this subchapter.

U.S. Note 18(g) to subchapter III, chapter 99: Subject to the provisions of subdivision (c)(iii) of this note, for purposes of subheading 9903.45.25 to this subchapter, the term "modules" shall include the following goods provided for in subheading 8541.40.60 of the tariff schedule: a module is a joined group of CSPV cells, as such cells are defined in subdivision (c) of this note, regardless of the number of cells or the shape of the joined group, that are capable of generating electricity. Also included as a "module" are goods each known as a "panel" comprising a CSPV cell that has undergone any processing, assembly, or interconnection (including, but not limited to, assembly into a laminate). Such CSPV cells assembled into modules or made up into panels include goods of a type reported for statistical purposes under statistical reporting number 8541.40.6020. Such goods also include (i) CSPV cells which are presented attached to inverters or batteries of subheading 8501.61.00 or 8507.20.80, respectively; and (ii) CSPV cells classifiable as DC generators of subheading 8501.31.80.

[62] *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 47974, September 21, 2018; *Notice of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 40823, August 16, 2018; EY, "US Announces Temporary Pause on Planned Increase of List 3 Tariffs on China Origin Goods," December 3, 2018, https://www.ey.com/gl/en/services/tax/international-tax/alert--us-announces-temporary-pause-on-planned-increase-of-list-3-tariffs-on-china-origin-goods---duties-remain-in-force-and-key-issues-remain-unresolved, December 18, 2018; *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation* (scheduled for publication in the Federal Register on December 19, 2018 and available online at https://federalregister.gov/d/2018-27458), https://s3.amazonaws.com/public-inspection.federalregister.gov/2018-27458.pdf, retrieved December 18, 2018.

[63] *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Amended Final Determination of Sales at Less Than Fair Value, and Antidumping Duty Order*, 77 FR 73018, December 7, 2012; and *Crystalline Silicon Photovoltaic Cells, Whether or Not*

(*continued*...)

THE PRODUCT

Description and applications

Description[64]

CSPV cells (figure I-2) use crystalline silicon to convert sunlight to electricity and are the basic elements of a module. They have a positive layer, a negative layer and a positive-negative junction (p/n junction). Electricity is generated when sunlight strikes the CSPV cell, knocking electrons loose that flow onto thin metal "fingers" that run across the CSPV cell and conduct electricity to the busbars.[65] Most CSPV cells, as of 2017, were 156.0 mm by 156.0 mm (6.14 inches by 6.14 inches) or 156.75 mm by 156.75 mm (6.17 inches by 6.17 inches).[66] As of 2017, CSPV cells typically have wattages[67] ranging from 4 watts to more than 5 watts per cell. Cells are the essential element in CSPV modules (also commonly referred to as panels), which in turn are the main components of CSPV systems. Solar CSPV systems[68] convert sunlight into electricity for on-site use or for distribution through the electric grid.

(…*continued*)
Assembled Into Modules, From the People's Republic of China: Countervailing Duty Order, 77 FR 73017, December 7, 2012.

[64] This section is primarily from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. I-11–17 and I-31–I-38. Citations to direct quotes, pictures, and data were retained.

[65] Electricity is carried from the thin metal strips on solar cells to wider metal strips known as busbars. These busbars are interconnected during the manufacturing process so that electricity is carried from the cell to the junction box.

[66] International Technology Roadmap for Photovoltaic ("ITRPV"), Results 2017 Including Maturity Report, Ninth Edition, September 2018, pp. 40–41, http://www.itrpv.net/.cm4all/uproc.php/0/ITRPV%20Ninth%20Edition%202018%20including%20maturity%20report%2020180904.pdf?cdp=a&_=165a39bbf90, retrieved December 18, 2018.

[67] This report discusses data in terms of watts ("W"), kilowatts ("kW" (equal to 1,000 watts)), megawatts ("MW" (1,000 kW)), and gigawatts ("GW" (1,000 MW)).

[68] In addition to CSPV products, there is commercial production of thin film photovoltaic products (which are not included in the scope of the investigation). Thin film cells and modules use a several micron thick layer of a photosensitive semiconductor material such as amorphous silicon ("a-Si"), cadmium telluride ("CdTe"), copper indium (gallium) (di)selenide ("CIS" or "CIGS") to convert sunlight to electricity.

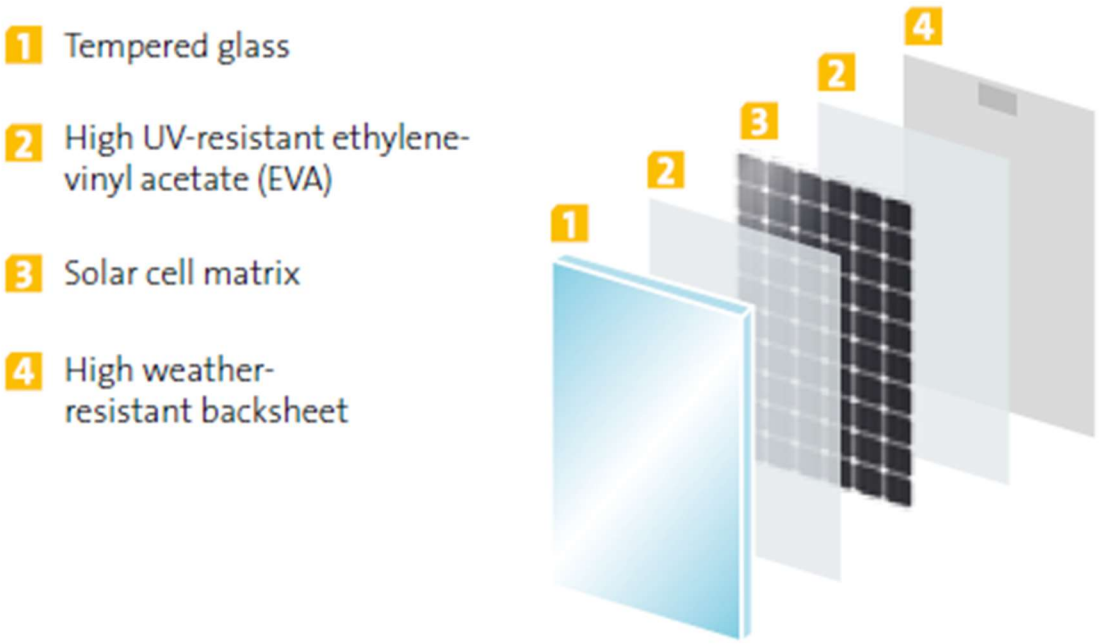
Figure I-2
CSPV cells

Source: SolarWorld Website, http://www.solarworld.de/en/group/from-sand-to-module/solar-cells/, retrieved July 6, 2017.

CSPV laminates consist of the CSPV cells that are connected, encapsulated in an ethyl vinyl acetate ("EVA") film,[69] and covered with a glass front sheet and a back sheet (figure I-3). The back sheet is most commonly a plastic film composite, though glass is also used in some applications such as bifacial modules.

[69] There are other encapsulation materials that are used, but EVA accounted for more than 90 percent of the market in 2017. ITRPV, Results 2017 Including Maturity Report, Ninth Edition, September 2018, p. 19.

Figure I-3
Layers of a typical CSPV laminate



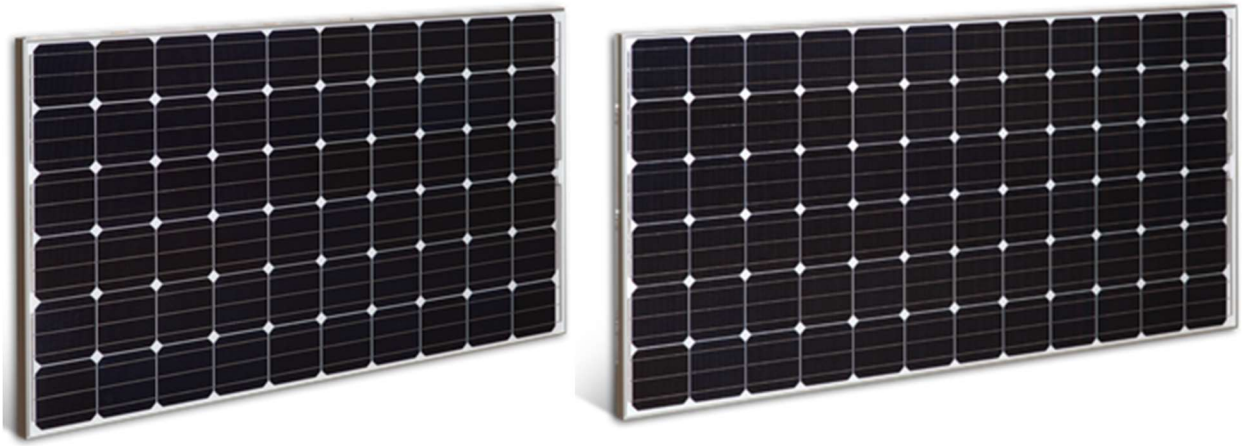
Source: SolarWorld, "SolarWorld Quality," brochure, May 2014, p. 10, https://www.solarworld-usa.com/~/media/www/files/brochures/sw-01-7182us-flyer-solarworldquality.pdf.

CSPV modules typically consist of the laminate that is "framed" in aluminum, and then attached to a junction box. CSPV modules can be used in both ground-mounted and rooftop-mounted systems and in both the off-grid market segment and the three on-grid market segments—residential, nonresidential, and utility.[70] The junction box can be connected to other modules, an inverter (which converts the direct current generated by the system to alternating current), or, in the case of off-grid modules, a battery and a charge controller (which controls battery charging). Typical on-grid modules have 60, 72, or 96 CSPV cells, though in some instances CSPV cells are cut in half resulting in 120 or 144 half-cut CSPV cells (figure I-4).[71] CSPV 60-cell modules are, on average 65 inches long and 39 inches wide, and are typically 1.5 to 2 inches in depth. CSPV 60-cell modules commonly weigh between 33 to 51 pounds. CSPV 72-cell

[70] Photovoltaics ("PV") do not include solar water heat and concentrated solar power ("CSP"). While PV uses a photosensitive semiconductor material to convert sunlight directly to electricity, solar water heat uses sunlight to heat water and CSP uses reflected sunlight to generate steam or a vapor that turns a turbine to generate electricity.

[71] Schwartz, Joe, "High-Power c-Si PV Module Specifications," *SolarPro*, Issue 10.3, May/June 2017, pp. 48–59, https://solarprofessional.com/articles/products-equipment/modules/high-power-c-si-pv-module-specifications-2017#.WV-8AP6Wx-A, retrieved December 18, 2018.

Figure I-4
CSPV 60-cell module (left) and 72-cell module (right)



Source: Suniva, Suniva Optimus Series Monocrystalline Solar Modules, OPT Series: OPT 72 cell modules (silver frame), brochure, January 18, 2017, http://suniva.com/documents/[SAMD_0060]%20Suniva%20Optimus%2060%20Silver%20OCOF%20Rev%205%202017%2001%2018.pdf, retrieved December 18, 2018; Suniva, Suniva Optimus Series Monocrystalline Solar Modules, OPT Series: OPT 60 cell modules (silver frame), brochure, January 18, 2017, http://suniva.com/documents/[SAMD_0051]%20Suniva%20Optimus%2072%20cell%2038mmOCOF%20-%20Rev%209%20-%202017%2001%2018.pdf, retrieved December 18, 2018.

modules are generally around 78 inches long, 39 inches wide, and 1.5 to 2 inches thick.[72] CSPV 72-cell modules generally weigh from 45 to 61 pounds.[73]

The two main types of CSPV cells and modules are monocrystalline silicon and multicrystalline (or polycrystalline) silicon, though there are various products within these two categories. Monocrystalline cells are made from a single grown crystal and tend to convert sunlight into electricity more efficiently. Multicrystalline cells have a random crystal structure and tend to have a lower conversion efficiency, though there are a range of conversion efficiencies for monocrystalline and multicrystalline modules.[74] For example, efficiencies for 72-cell or more multicrystalline modules listed in SolarPro's 2017 module specifications range

[72] EnergySage, "What is the Average Solar Panel Size and Weight?" n.d., http://news.energysage.com/average-solar-panel-size-weight/, retrieved July 7, 2017.

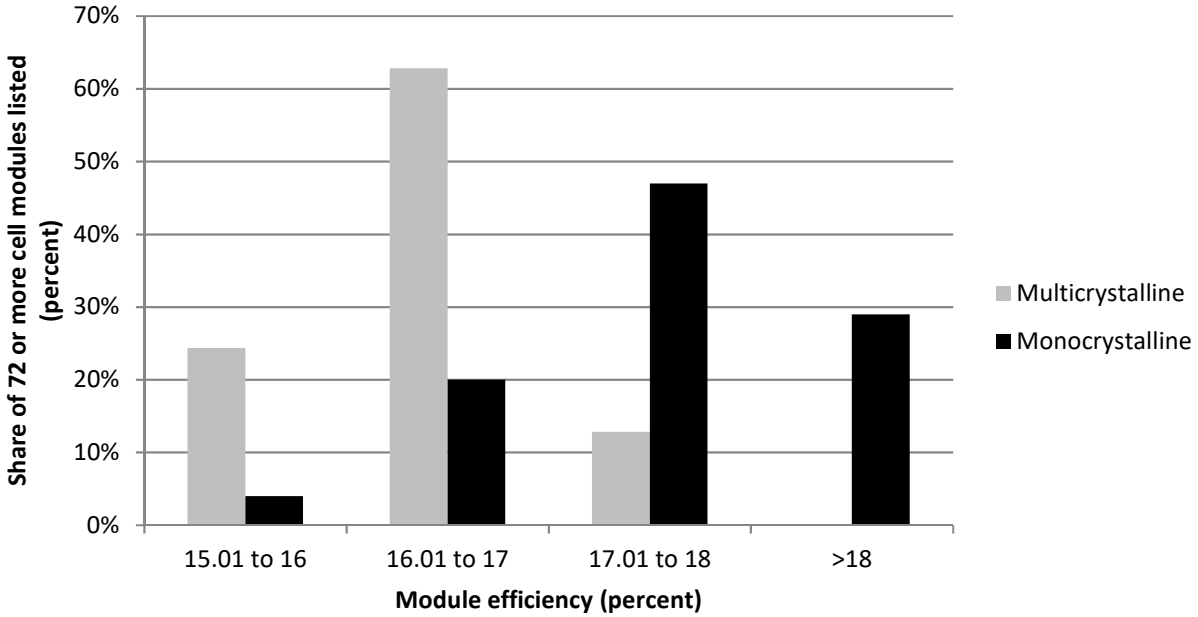
[73] Schwartz, Joe, "High-Power c-Si PV Module Specifications," *SolarPro*, Issue 10.3, May/June 2017, 48–59, https://solarprofessional.com/articles/products-equipment/modules/high-power-c-si-pv-module-specifications-2017#.WV-8AP6Wx-A, retrieved December 18, 2018.

[74] Conversion efficiency is the percent of sunlight that is converted to electricity.

from 15.2 to 17.8 percent, while efficiencies for monocrystalline modules range from 15.5 to 21.5 percent (figure I-5).[75]

Figure I-5

CSPV: Efficiencies of modules (72 or more cells, 300 or more watts) listed in SolarPro's 2017 module specifications



Note.--According to *SolarPro*, its 2017 list of CSPV module specifications includes "232 models with rated outputs of 300 W STC and greater from 29 manufacturers. The included models are listed and available for deployment in US-based projects. This c-Si specifications table is not intended to be exhaustive or all-inclusive; rather, our goal is to present comparative information on a wide cross-section of high-power PV solutions for utility, commercial and select residential projects." For comparison purposes, the data presented here include the models with 72 or more CSPV cells and for which a module efficiency was included.

Source: Schwartz, Joe, "High-Power c-Si PV Module Specifications," SolarPro, Issue 10.3, May/June 2017, pp. 48–59, https://solarprofessional.com/articles/products-equipment/modules/high-power-c-si-pv-module-specifications-2017#.WV-8AP6Wx-A, retrieved December 18, 2018.

[75] Schwartz, Joe, "High-Power c-Si PV Module Specifications," *SolarPro*, Issue 10.3, May/June 2017, pp. 48–59, https://solarprofessional.com/articles/products-equipment/modules/high-power-c-si-pv-module-specifications-2017#.WV-8AP6Wx-A, retrieved December 18, 2018.

The average output of 60-cell multicrystalline modules listed in SolarPro's 2017 module specifications was 268 watts and the average output of monocrystalline modules was 293 watts.[76] The average output of 72-cell multicrystalline modules listed in SolarPro's 2017 module specifications was 319 watts, while the average power output of 72-cell monocrystalline modules was 340 watts.[77]

The conversion efficiency of CSPV modules has increased over time, with the median efficiency of modules installed in U.S.-distributed systems, for example, increasing from 15.4 percent in 2012 to 17.3 percent in 2016 (figure I-6). The median efficiency of multicrystalline[78] modules (the only type for which separate data were available) installed in U.S. distributed systems increased from 14.7 percent to 16.8 percent during 2012–16.[79] Larger sized CSPV modules have also become more common, with 72-cell modules accounting for around 30 percent of global production in 2017.[80]

[76] Schwartz, Joe, "60-Cell PV Modules Specifications (2017)," *SolarPro*, Issue 10.6, November/Dec ember 2017, pp. 42–53, http://solarprofessional.com/articles/products-equipment/modules/60-cell-pv-modules-specifications-2017#.W4_wns5JGUk, retrieved December 18, 2018.

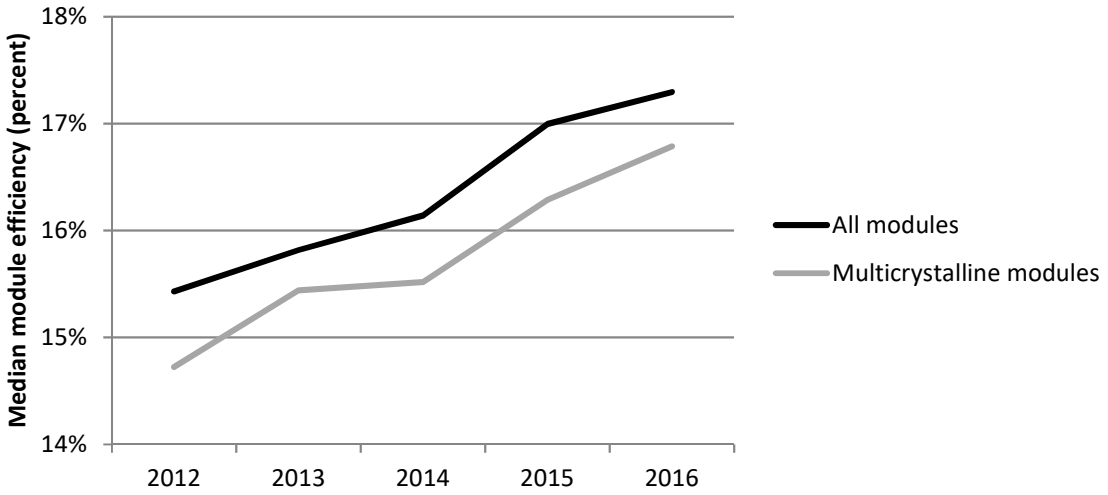
[77] *SolarPro's* module specifications only include modules of 300 watts or more. Data presented here for 72 cell modules include those with 144 half-cut cells. Schwartz, Joe, "High-Power c-Si PV Module Specifications," *SolarPro*, Issue 10.3, May/June 2017, pp. 48–59, https://solarprofessional.com/articles/products-equipment/modules/high-power-c-si-pv-module-specifications-2017#.WV-8AP6Wx-A, retrieved December 18, 2018.

[78] See "Description and uses" section of this report for further information on multicrystalline (or polycrystalline) silicon and monocrystalline silicon cells and modules.

[79] Data for all products may include some thin-film modules. Barbose, Galen and Naïm Darghouth, *Tracking the Sun X: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States*, Data file, Lawrence Berkeley National Laboratory, September 2017, https://emp.lbl.gov/publications/tracking-sun-10-installed-price, retrieved December 18, 2018.

[80] ITRPV, Results 2017 Including Maturity Report, Ninth Edition, September 2018, p. 48.

Figure I-6
CSPV: Median efficiency of modules installed in U.S.-distributed systems, by year of installation



Note.--The "all modules" category may include some thin film products. This figure does not include 2017 data since data in the 2018 *Tracking the Sun* report are not comparable to earlier years.

Source: Barbose, Galen and Naïm Darghouth, *Tracking the Sun X: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States*, Data file, Lawrence Berkeley National Laboratory, September 2017, https://emp.lbl.gov/publications/tracking-sun-10-installed-price, retrieved December 18, 2018; Barbose, Galen and Naïm Darghouth, *Tracking the Sun XI: Installed Price Trends for Distributed Photovoltaic Systems in the United States*, Lawrence Berkeley National Laboratory, September 2018, pp. 14–15, https://emp.lbl.gov/tracking-the-sun, retrieved December 18, 2018.

Within the broad areas of monocrystalline and multicrystalline products, there are a number of cell and module technologies. The production of passive emitter rear contact ("PERC") and related technologies is rapidly increasing, and these technologies accounted for more than 20 percent of cell production in 2017.[81] Manufacturers have also increased the number of busbars used in cells, with cells containing five or more busbars accounting for about 30 percent of global production in 2017.[82] Select cell and module technologies are described below:

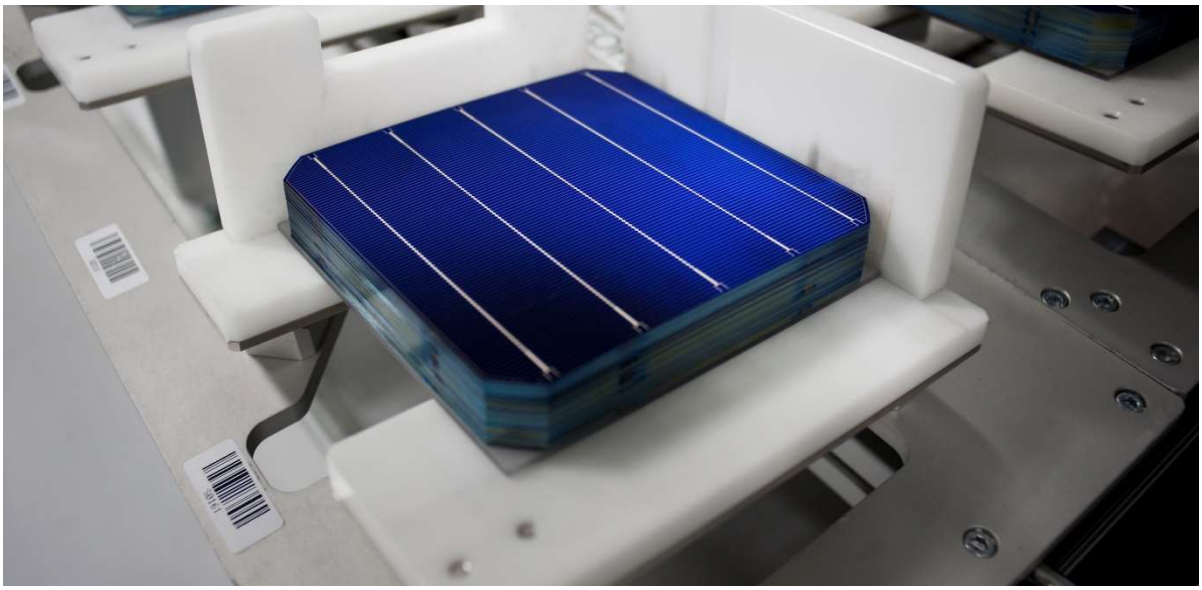
- **Back contact cells:** Some manufacturers place metal contacts onto the rear side of the cell, creating back (or rear contact) cells. This provides several advantages such as reduced shading, improved cell interconnection, and better aesthetics.
- **Bifacial:** Bifacial cells convert light that hits both the front and back of the CSPV cell into electricity. Whereas most CSPV cells have a metalized back layer, bifacial cells allow light through to the back side of the CSPV cell. They often incorporate either the PERC or heterojunction technologies discussed below. When incorporated into

[81] ITRPV, Results 2017 Including Maturity Report, Ninth Edition, September 2018, p. 42.
[82] Ibid., p. 35.

modules, they use a transparent back sheet or rear glass layer to allow reflected sunlight on the rear of the CSPV cell. Bifacial cells increase energy production, but are also more expensive to produce.

- **Busbars:** Manufacturers are increasing the number of busbars in PV cells, which results in higher efficiency and greater power output (figure I-7). Some manufacturers have eliminated busbars, which can provide benefits such as reducing electrical losses and increasing the surface area of the cell that can absorb sunlight.

Figure I-7
CSPV cell containing five busbars



Source: SolarWorld Website, https://www.solarworld-usa.com/newsroom/media-downloads, retrieved September 4, 2017.

- **Frameless modules:** Some PV modules do not use a frame, which reduces costs. These modules typically use glass as the rear layer to ensure mechanical stability.
- **Half-cut cells:** Some manufacturers have switched to modules with half-cut cells. These are standard cells that are cut in half, such that a standard 60-cell module would instead have 120 half cells. Half-cut cells result in lower cell currents and, therefore, reduce power losses and increase cell efficiency and overall module output.
- **Heterojunction:** Heterojunction cells, which include heterojunction with intrinsic thin layer (HIT), add thin layers of photosensitive semiconductor materials (typically amorphous silicon) on top of a monocrystalline wafer. These additional layers increase the absorption of sunlight, and the overall efficiencies of the CSPV cells. They also perform better in hot climates than typical monocrystalline cells. They are more expensive to produce and are difficult to scale up to commercial production, however, so only a few companies currently produce this technology.

- **n-type mono:** In the production of most types of monocrystalline CSPV wafers, the silicon is doped with boron to create a positive electrical orientation. In the production of n-type mono wafers, the silicon is doped with phosphorous to create a negative electrical orientation. In the cell production process, a positive layer is added to create the p/n junction. n-type cells can be more expensive to produce, but have a number of benefits, such as higher conversion efficiencies, no light-induced degradation, and the potential use of less pure wafers.
- **Passive Emitter Rear Contact (PERC):** PERC cells incorporate an additional rear dielectric layer that reflects light that did not generate electricity as it initially passed through the CSPV cell back into the CSPV cell. There is, therefore, another opportunity for the CSPV cell to absorb this light. PERC cells have a higher efficiency, and improved performance in certain conditions, such as low light and high heat conditions. Existing CSPV cell production lines can be reconfigured to produce PERC cells with the addition of two steps. Therefore, the changeover to PERC technology is relatively straightforward, though there are some challenges with PERC technology such as the potential for more rapid cell degradation. Related technologies include Passivated Emitter Rear Totally Diffused (PERT) and Passivated Emitter Rear Locally Diffused (PERL).

In addition to standard size modules, CSPV cells can be used in building-integrated PV ("BIPV modules" or "BIPV products"). BIPV products are materials integrated into the building envelope, such as the façade or roof, containing CSPV cells. These building integrated materials replace conventional construction materials, such as glass or roof shingles, taking over the function that conventional materials would otherwise perform while also producing electricity (figure I-8).

CSPV modules are also used in off-grid applications. In many instances, modules typically used in on-grid applications may also be used in off-grid applications. For example, a house that is not connected to the electrical grid could use the same modules as a house that is grid-connected. However, there are a broad range of off-grid applications, such as power generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods (such as systems for recharging consumer electronics like tablets and phones) (figure I-9). The CSPV modules used in some of these applications may be different from those typically used in on-grid applications. For example, these products are often designed for specific power and portability requirements, and some modules have different wattages than modules used in grid-connected applications.

Figure I-8
Building-integrated CSPV

Source: Photo courtesy of U.S. Department of Energy (DOE)/National Renewable Energy Lab (NREL), credit Atlantis Energy, Inc.

Figure I-9
CSPV: Off-grid solar lighting

Source: Photo courtesy of DOE/NREL, https://www.nrel.gov/.

Applications[83]

There are four primary market segments for CSPV products. There are three grid-connected market segments–residential, nonresidential, and utility–and an off-grid market. In the grid-connected market, installations are usually either ground-mounted or roof-mounted. In addition to the module, there are a number of other components of the installation called the balance of system ("BOS"). The BOS includes components such as the inverter and the racking on which the modules are installed.[84]

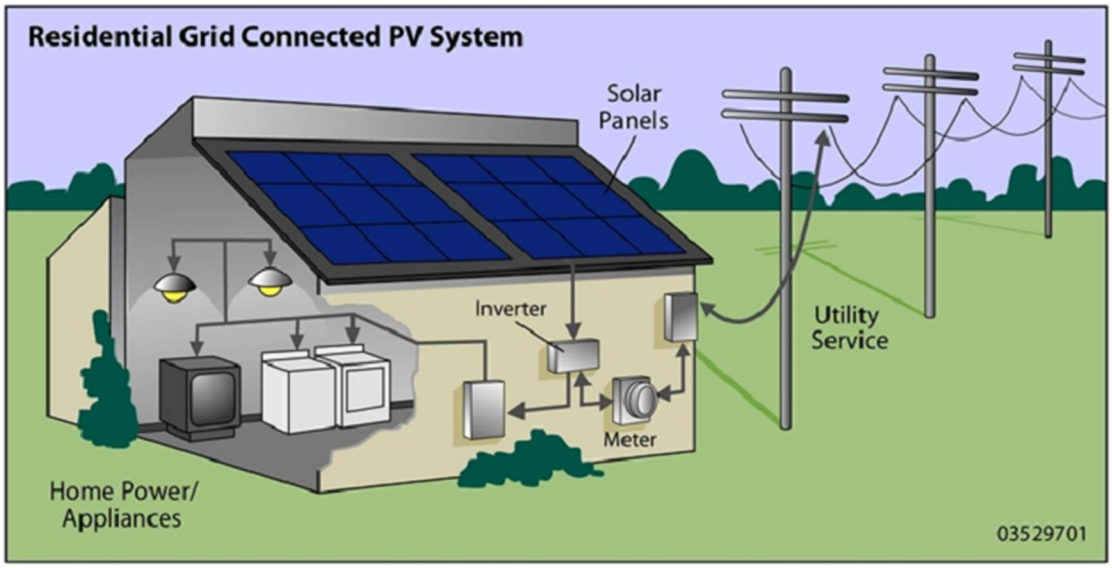
Residential grid-connected systems are installed at individual homes. CSPV modules are typically installed on the roof, though they can also be ground-mounted, and connected to an inverter. The system can use a central inverter, which converts the power from multiple modules, or each module can have its own microinverter attached. In residential installations, the electricity generated by the system is used for power in the individual home (figure I-10). Homeowners use grid energy when solar electricity generation is not sufficient to meet demand, and often feed energy back into the grid when solar electricity generation exceeds home use. In the United States, the median size of a residential PV installation was 6.3 kW in 2017.[85]

[83] This section is primarily derived from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. I-24–I-28. Citations to direct quotes, pictures, and data were retained.

[84] In addition to equipment, there are a number of services associated with installing a PV system such as site assessment and design, permitting, financing, and the system installations, as well as operations and maintenance services after the installation is completed.

[85] Barbose, Galen and Naïm Darghouth, *Tracking the Sun XI: Installed Price Trends for Distributed Photovoltaic Systems in the United States*, Lawrence Berkeley National Laboratory, September 2018, p. 12, https://emp.lbl.gov/tracking-the-sun, retrieved December 18, 2018.

Figure I-10
Residential grid-connected CSPV system



Source: DOE, Office of Energy Efficiency and Renewable Energy (EERE) Website, http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10720, retrieved November 9, 2011.

Nonresidential systems are installed at commercial, industrial, government, and similar buildings and sites (figure I-11). Nonresidential installations are typically larger than residential installations—for nonresidential systems 500 kW or less, the median size in 2017 was 36 kW, though systems can be substantially larger.[86] However, they function similarly to residential installations, providing electricity to meet onsite needs, pulling additional electricity from the grid when needed, and feeding excess electricity back into the grid when it is not needed.

[86] Nonresidential systems can be substantially larger than residential systems. The *Tracking the Sun* report also includes the median size of systems 500 kW or larger, which was 1,069 kW in 2016. However, their definition of system size likely includes systems that would be classified as utility projects in other definitions. Barbose, Galen and Naïm Darghouth, *Tracking the Sun XI: Installed Price Trends for Distributed Photovoltaic Systems in the United States*, Lawrence Berkeley National Laboratory, September 2018, pp. 7, 12, https://emp.lbl.gov/tracking-the-sun, retrieved December 18, 2018.

Figure I-11
Installation of a nonresidential CSPV system

Source: Photos courtesy of DOE/NREL, credit Dennis Schroeder, https://www.nrel.gov/.

Utility systems are generally the largest systems, and provide electricity directly to the electric grid for sale to customers rather than for on-site use (figure I-12). The median size of utility projects was 4.9 MW and the mean size was 17.15 MW during 2012-16.[87] These systems are generally ground-mounted and currently tend to use central inverters rather than microinverters. CSPV utility systems may involve fixed-tilt, single-axis tracking (panels rotate to follow the east-west movement of the sun), or dual-axis tracking (panels also move to follow the north-south movement of the sun during the year). During 2012-17, 79 percent of installed systems larger than 5 MW used tracking, with most systems using single-axis tracking.[88] While prior to 2012 most utility systems installed in the United States were 600 volts, higher 1,000-volt utility systems became increasingly common during 2012-16 and toward the end of this time period 1,500-volt systems were introduced in the U.S. market. These higher voltage systems use fewer BOS components, require less installation time, reduce electricity losses, and lead to higher inverter efficiencies. This results in lower energy costs.[89]

[87] This is based on data from GTM Research and the August 2017 Utility PV tracker for 1,850 projects. The definition of utility systems, however, can vary by source of information.

[88] In their utility-scale report, LBNL uses alternating current for capacity rather than direct current. Bolinger, Mark and Joachim Seel, *Utility-Scale Solar: Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States - 2018 Edition,* Data file, Lawrence Berkeley National Laboratory, September 2018, https://emp.lbl.gov/utility-scale-solar, retrieved December 18, 2018.

[89] One thousand volt systems are also used in some commercial installations.

Figure I-12
La Ola PV plant, a utility CSPV system on Lanai, Hawaii

Source: Photo courtesy of DOE/NREL, credit Jamie Keller, https://www.nrel.gov/.

As noted above, there are a broad range of off-grid applications, such as power generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods (such as systems for recharging consumer electronics like tablets and phones). These systems often have additional BOS components, such as a battery and charge controller, though inverters are not needed for all off-grid applications.

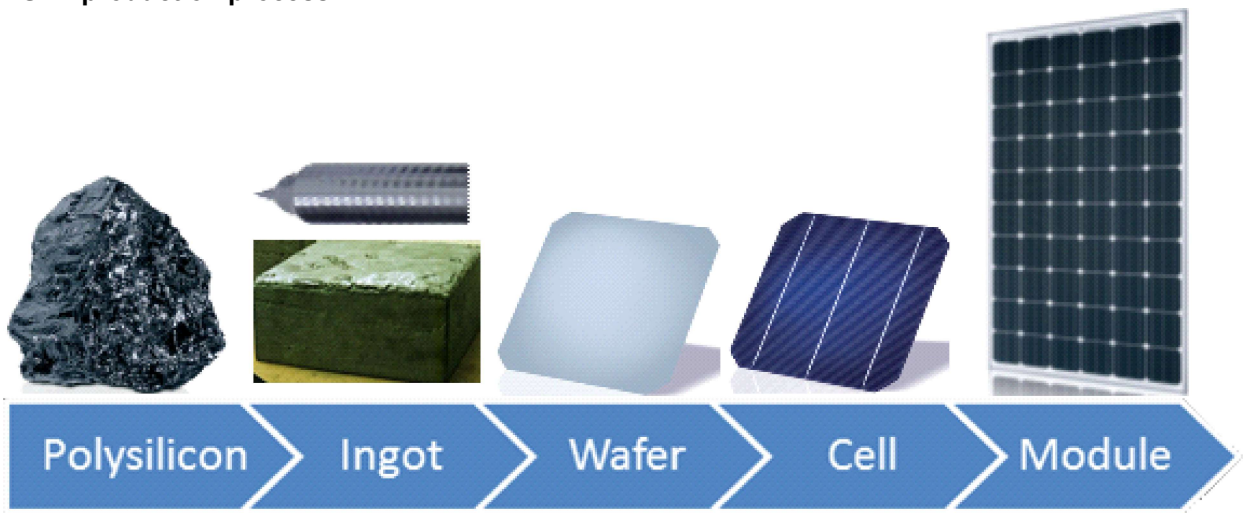
Manufacturing processes[90]

There are five principal stages involved in the manufacture of CSPV products. First, polysilicon is refined, then it is formed into ingots, which are sliced into wafers, converted to CSPV cells, and assembled into the finished product, modules (figure I-13). These are discrete production steps that may be done in different plants or locations. Companies may source products at each stage of the value chain or produce the products in-house. CSPV cells and modules are tested and inspected during the production process.[91] The ingot and wafer production process differs for monocrystalline and multicrystalline cells, as discussed below.

[90] This section is derived from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. I-18–24. Citations to direct quotes, pictures, and data were retained.

[91] SolarWorld, "Real Value," 2016, https://www.solarworld-usa.com/why-choose-solarworld/the-solarworld-standard#Product_certifications, retrieved December 18, 2018.

Figure I-13
CSPV production process



Note.--For ingots, the top picture is a crystal used in monocrystalline wafers, while the bottom picture is an ingot used in making multicrystalline wafers.

Source: SolarWorld, "Energy for You and Me" brochure, pp. 6–7, 9; ingot photo courtesy of DOE/NREL, credit John Wohlgemuth, Solarex, https://www.nrel.gov/.

Silicon refining

The first step in the CSPV value chain is refining polysilicon. There are multiple approaches to polysilicon refining. This discussion will focus on the Siemens method, which accounted for more than 85 percent of global production in 2017, and fluidized bed reactor ("FBR") technology, which accounts for most of the remaining market.[92]

In the first step in the Siemens process, quartz (silicon dioxide) and carbon are heated to around 1,800 degrees Celsius. The carbon reacts with the oxygen, resulting in carbon dioxide and silicon with a purity of around 98 to 99 percent. The silicon is then combined with hydrogen chloride gas at 300 to 350 degrees Celsius, with the reaction resulting in the liquid trichlorosilane. Next, heated silicon rods are inserted into a Siemens reactor, where they are further heated to 1,000 degrees Celsius or more. Hydrogen and trichlorosilane gas are fed into the reactor. The silicon from the trichlorosilane is deposited onto the rods, which steadily increase in size until they are removed from the reactor about a week later. The resulting products are high purity polysilicon chunks or rocks.

Instead of inserting rods, "FBR uses seed granules of purified silicon. The seed granules are fed into a chamber that has heated silane gas entering from below and exiting above. The flow of gas 'fluidizes' the silicon granules, causing them to flow like a liquid, as the silane gas breaks down and deposits silicon layers on them. The granules grow larger and heavier and exit

[92] ITRPV, Results 2017 Including Maturity Report, Ninth Edition, September 2018, p. 8.

when they are sufficiently large. As they do so, new seed granules and gas are introduced into the chamber and the process continues."[93] The FBR process, which is newer than the Siemens process, uses 80 to 90 percent less energy, requires a smaller footprint, is a continuous process, takes up less space in shipping, and can increase downstream production efficiency. However, the process is difficult to scale and achieve high purity production at low cost.

Ingots and wafers for monocrystalline cells

In the Czochralski process[94] for producing crystals used in monocrystalline wafers, polysilicon rocks are first placed into a quartz crucible along with a small amount of boron, which is used to provide a positive electric orientation (figure I-14). The crucible is then loaded into a Czochralski furnace and heated to about 2,500 degrees Fahrenheit. Once the polysilicon is melted, a seed crystal is lowered into the material and rotated, with the crucible rotated in the opposite direction. The melt starts to solidify on the seed and the seed is slowly raised out of the melt—creating a single long crystal. The crystal is then cooled before it is moved onto the next step. The process of growing the crystal takes about 2.5 days.

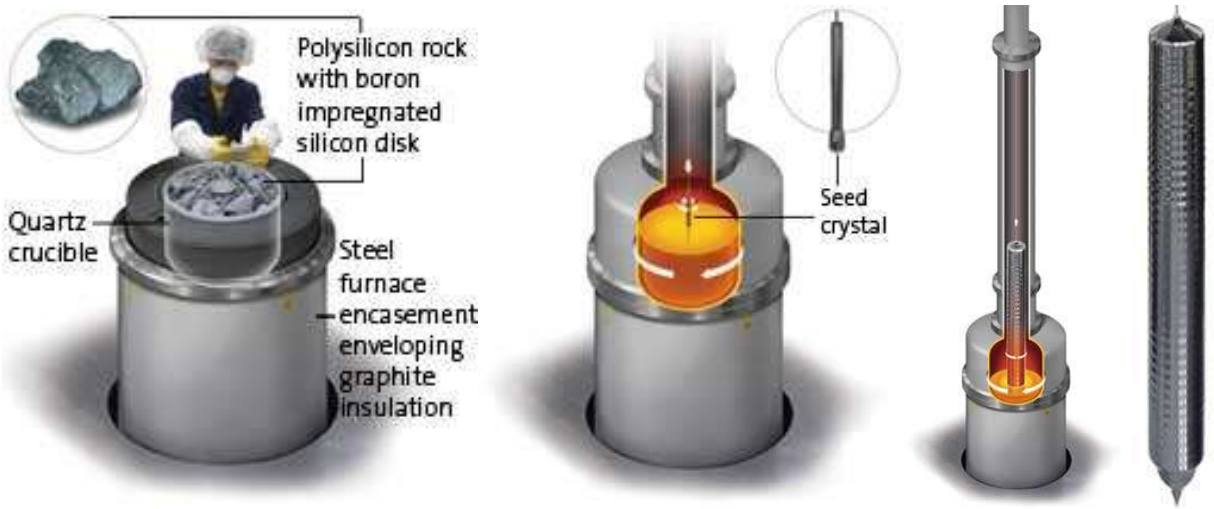
Once the crystal has cooled, it is processed into wafers. The top and tail (each end of the cylindrical crystal) are cut off (figure I-15). The remaining portion of the crystal (or ingot) is cut into equal length pieces and then it is squared. In squaring, the rounded sides of the ingot are cut into four flat sides, leaving only rounded corners. A wire saw then slices the ingots into wafers. A majority of global manufacturers have switched to diamond wire saws for monocrystalline wafer slicing, which has several benefits including increasing the speed of the production process. The wafers are then cleaned, dried, and inspected.

[93] REC Silicon website, http://www.recsilicon.com/technology/rec-silicons-fluidized-bed-reactor-process, retrieved June 12, 2017.

[94] This discussion will focus on the Czochralski process, which accounted for more than 95 percent of production in 2016. ITRPV, 2016 Results, March 2017, p. 19, http://www.itrpv.net/.cm4all/iproc.php/ITRPV%20Eighth%20Edition%202017.pdf?cdp=a, retrieved December 18, 2018.

Figure I-14

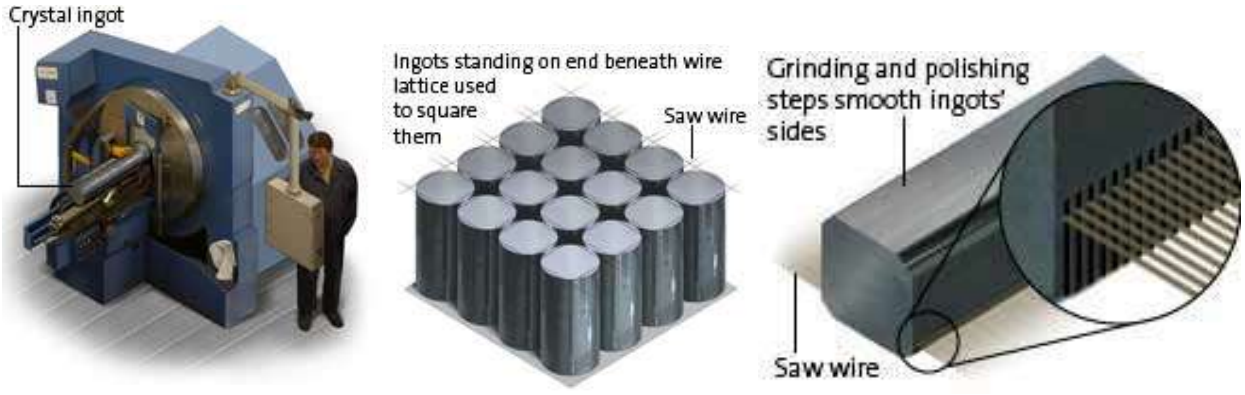
Czochralski process, crucible loading/charging (left), seed crystal (second from left), crystal growing (second from right), and finished crystal (right)



Source: SolarWorld Website, https://www.solarworld-usa.com/solar-101/making-solar-panels, retrieved July 15, 2017.

Figure I-15

Wafer production: Cutting off the top and tail (left), squaring (middle), and slicing into wafers (right)



Source: SolarWorld Website, https://www.solarworld-usa.com/solar-101/making-solar-panels, retrieved July 15, 2017.

Ingots and wafers for multicrystalline cells

For multicrystalline ingots, the first step is also loading polysilicon into a crucible. This crucible is then loaded into a directional solidification systems ("DSS") furnace, where it is cast into ingots. The ingot is then cut into blocks. These blocks are tested and any parts of the block that do not pass these tests are cropped off. The blocks are sliced into wafers using a wire saw.

Finally, the wafers are cleaned, dried, and inspected. This process results in square wafers, while the monocrystalline process results in wafers with rounded corners.

CSPV cells[95]

The monocrystalline and multicrystalline wafers, which are 180 to 200 micrometers thick, are next processed into CSPV cells. CSPV cell production is capital intensive and requires a skilled workforce. Some firms use a highly automated manufacturing process, while others mix automation and manual labor in their production processes. The main steps in CSPV cell production are as follows: [96]

- **Cleaning and texturing:** First, the wafers are cleaned, then the surface of the wafer undergoes a chemical treatment that reduces the reflection of sunlight and increases light absorption (figure I-16).
- **Diffusion:** In the next step, "phosphorus is diffused into a thin layer of the wafer surface. The molecular-level impregnation occurs as the wafer surface is exposed to phosphorus gas at a high heat, a step that gives the surface a negative potential electrical orientation. The combination of that layer and the boron-doped layer below creates a positive-negative, or p/n, junction–a critical partition in the functioning of a PV cell."[97]
- **Edge isolation:** A thin layer of silicon is then removed from the edge of the CSPV cell to separate the positive and negative layers.
- **Coating:** Next, a silicon nitride antireflective coating is added to the PV cells to increase the absorption of sunlight.
- **Printing:** Metals are then printed on the solar CSPV cell to collect the electricity. On the front of the CSPV cell, these metals are printed in thin metal strips called fingers, which are connected to the rest of the module via busbars. A metal layer, typically aluminum, is also printed on the back of the CSPV cell.
- **Co-firing:** The CSPV cells then enter a furnace, where the "high temperature causes the silver paste to become imbedded in the surface of the silicon layer, forming a reliable electrical contact."[98]
- **Testing and sorting:** The final step in the process is the testing and sorting of the CSPV cells based on their characteristics and efficiency.

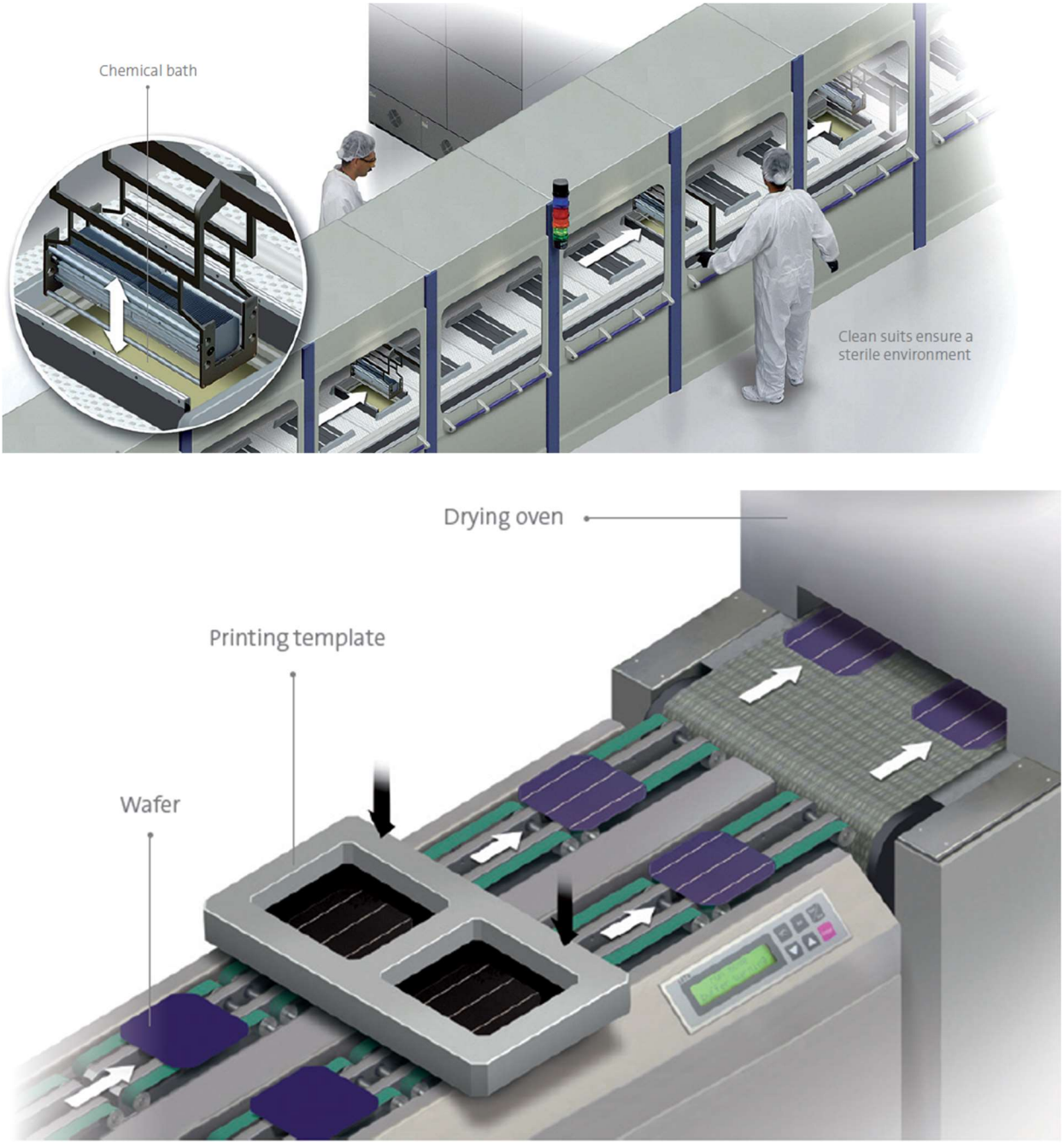
[95] The cell manufacturing process varies by company and technology.

[96] This section will discuss the general manufacturing process. There may be additional steps for certain technologies.

[97] SolarWorld, "Energy for You and Me" brochure, p. 12.

[98] JA Solar, "Form 20-F," April 16, 2013, p. 41.

Figure I-16
CSPV cell production: Texturing (top) and screen printing (bottom)

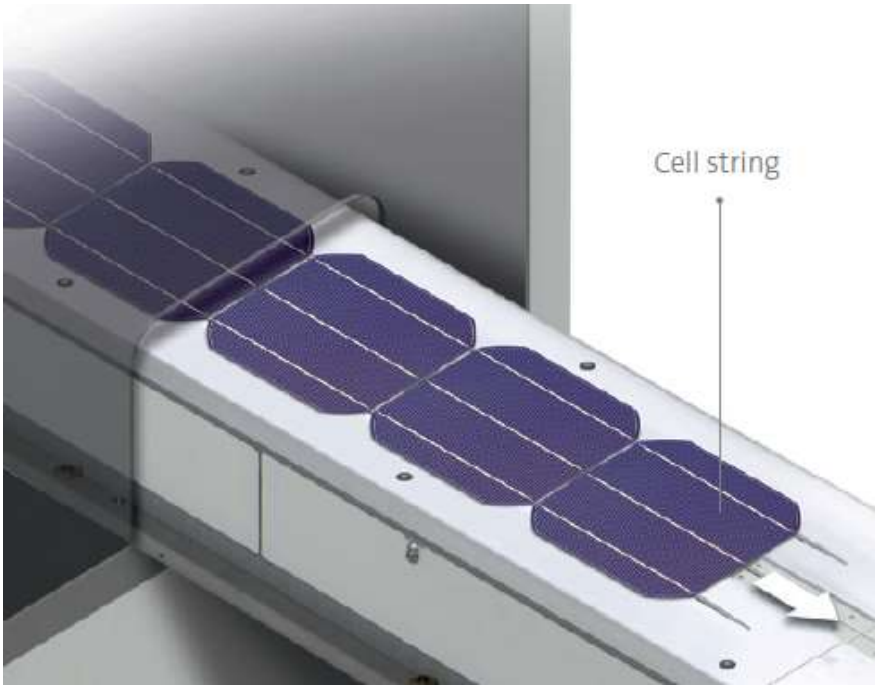


Source: SolarWorld, “Energy for You and Me” brochure, pp. 12–13.

Modules

The CSPV cells are next assembled into modules. The extent of automation and manual labor involved in module assembly varies depending on the company, though it is generally the most labor-intensive part of the manufacturing process. First, a string of CSPV cells is soldered together (figure I-17). A piece of glass is placed on the production line, on top of which is added a piece of ethyl vinyl acetate ("EVA"). The CSPV cells are laid out in a rectangular matrix that will provide the appropriate wattage and power requirements. Typically, a sealant is added, often EVA, and a back sheet is added. The CSPV cells are then laminated in a vacuum and are cured. At this stage, the CSPV cells are referred to as a "laminate." Frames are then usually attached to the laminate, and a junction box is attached to the back. In the final step, modules are cleaned and inspected.

Figure I-17
Soldering CSPV cells together into strings



Source: SolarWorld, "Energy for You and Me" brochure, pp. 12–13.

DOMESTIC LIKE PRODUCT ISSUES

The domestic like product is defined as the domestically produced product or products which are like, or in the absence of like, most similar in characteristics and uses with, the subject merchandise. In the previous *CSPV 1* and *CSPV 2* antidumping and countervailing duty determinations, the Commission found one domestic like product consisting of CSPV cells and

CSPV modules, but not including thin film products.[99] In its *CSPV 1* final investigations, the Commission determined not to define CSPV cells and CSPV modules as separate domestic like products, and no party argued otherwise. In the *CSPV 2* investigations, the Taiwan respondents argued that the Commission should define CSPV cells and CSPV modules as separate domestic like products based on a "semi-finished" domestic like product analysis. In its analysis under the "semi-finished products" factors in *CSPV 2*, the Commission found that (1) the upstream article (i.e., CSPV cells) is dedicated for use in the production of the downstream article (i.e., CSPV modules), (2) there are no separate markets for CSPV cells and CSPV modules, (3) CSPV cells and CSPV modules share the same primary physical characteristics and functions, (4) CSPV cells undergo only one major manufacturing step (assembly) to become CSPV modules and that process does not change the essential characteristics of the CSPV cells, and (5) CSPV cells represent a substantial portion of the total cost of finished CSPV modules.[100]

In its *CSPV 3* safeguard determination, the Commission found a single domestic product consisting of all forms of CSPV cells, whether or not partially or fully assembled into other products, corresponding to the imported articles within the scope of the investigation. This was the definition advocated by petitioners. No party requested that the Commission collect data concerning other possible alternative products in their comments on the Commission's draft questionnaires and no party requested a different definition at the injury hearing or in their prehearing or posthearing injury briefs.[101]

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[99] The Commission found that due to differences in their underlying raw materials, manufacturing facilities, manufacturing processes, and production employees, CSPV and thin film products differ significantly in physical characteristics, conversion efficiency, output, and other capabilities. The Commission noted that these physical limitations affect their relative prices, limit their interchangeability, and limit any overlap in channels of distribution, particularly for non-utility sales.

[100] The Commission concluded that CSPV cells are dedicated for use in CSPV modules, and the vast majority of the CSPV cells manufactured in the United States are consumed by the CSPV cell manufacturer in its own production of CSPV modules. It found further that the fraction of CSPV cells manufactured in the United States that are sold in the commercial market are used to manufacture CSPV modules, thereby indicating a lack of separate markets for the upstream and downstream products. The Commission noted that the processes used to manufacture CSPV modules from CSPV cells are technologically sophisticated, more labor intensive than manufacturing CSPV cells, and add value to the product, but they enhance rather than change the basic function of the CSPV cells, which is to convert sunlight into electricity. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan, Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final)*, USITC Publication 4519, February 2015, pp. 8-15 (Commissioner Broadbent dissenting and finding that CSPV cells and CSPV modules were separate domestic like products). *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. I-9—I-10.

[101] *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. 13-16 and I-10.

No party requested that the Commission collect data concerning other possible domestic like products in their comments on the Commission's draft questionnaires.[102] In these full five-year reviews, the domestic interested party, SolarWorld, argues that the Commission should again determine that there is one domestic like product that includes both CSPV cells and modules. It adds that, "under the Commission's semi-finished product analysis, cells are dedicated to the production of modules; both cells and modules are sold in similar markets and share the same primary physical characteristics; cells represent a substantial portion of the cost and value of a module; and cells undergo only one major production step before transformation into modules."[103] The respondent interested parties do not disagree with the Commission's prior determinations concerning the domestic like product.[104]

U.S. MARKET PARTICIPANTS

U.S. producers

During the original investigations, two U.S. producers of CSPV cells, which accounted for approximately *** percent of total 2011 U.S. CSPV cell production, and 14 U.S. producers that produced CSPV modules, which accounted for approximately *** percent of total 2011 U.S. production of CSPV modules submitted usable questionnaire responses.[105] [106] In these current proceedings, the Commission issued U.S. producers' questionnaires to 62 firms, 11 of which provided the Commission with usable information on their production operations, 4 of which produce cells and 11 of which produce modules. The four responding U.S. producers of CSPV cells are believed to have accounted for *** percent of domestic capacity of CSPV cells in

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[102] Canadian Solar's Comments on Draft Questionnaires, July 30, 2018; and SolarWorld's Comments on Draft Questionnaires, July 30, 2018.

[103] SolarWorld's prehearing brief, p. 5.

[104] Hearing transcript, p. 223 (Stoel) ("To be candid, we reviewed your earlier decisions and found that it was very difficult to make the argument they should be considered separate domestic like products.").

[105] Based on a comparison of U.S. producers' reported production of CSPV cells and modules in 2011 with total U.S. production of cells (***) as reported in *PV News*, Volume 31, Number 5, May 2012, pp. 8-9, and modules (***) as reported in *U.S. Solar Market Insight, 2011 Year-in-Review*, Solar Energy Industries Association, p. 13.

[106] The two U.S. producers of CSPV cells that supplied the Commission with usable questionnaire information during the original investigations were SolarWorld (petitioner) and Suniva. The 14 U.S. producers of CSPV modules that supplied the Commission with usable questionnaire information during the original investigations were cell producers SolarWorld and Suniva, as well as module assemblers Advanced Solar Photonics ("ASP"); GE Energy (USA), LLC (acquired by Motech) ("GE"); Kyocera Solar, Inc. ("Kyocera"); Mage Solar Products, Inc. ("Mage"); Motech Americas LLC ("Motech"); MX Solar USA LLC ("MX"); Schott Solar PV, Inc. ("Schott"); Sharp Manufacturing Co. of America ("Sharp"); Silicon Energy, LLC ("Silicon Energy"); Solon Corp. ("Solon"); and Suntech Arizona, Inc. ("Suntech").

2017 and the 11 responding U.S. producers of modules are believed to have accounted for *** percent of domestic capacity of CSPV modules in 2017. Presented in table I-7 is a list of current domestic producers of CSPV cells and modules and each company's position on the continuation of the orders, production locations, and share of reported production in 2017.

Table I-7
CSPV cells and modules: U.S. producers, their position on the continuation of the orders, location of production, and share of reported production, 2017

Firm	Position on continuation of orders	Production location(s)	Share of cell production (percent)	Share of module production (percent)
Auxin Solar	***	San Jose, CA	***	***
Heliene USA	***	Mountain Iron, MN	***	***
Kyocera	***	San Diego, CA Tijuana, Baja CA, Mexico	***	***
Merlin	***	San Jose, CA	***	***
Mission	***	San Antonio, TX	***	***
Panasonic	***	Buffalo, NY	***	***
SBM Solar	***	Concord, NC	***	***
SolarTech Universal	***	Riviera Beach, FL	***	***
SolarWorld Americas[4]	***	Hillsboro, OR Camarillo, CA	***	***
Suniva	***	Norcross, GA Saginaw, MI	***	***
Wanxiang	***	Rockford, IL	***	***
Total			100.0	100.0

1 ***.
2 ***.
3 ***.
[4] As of October 1, 2018, SunPower acquired certain assets of SolarWorld Americas, including its U.S. manufacturing plant.

Source: Compiled from data submitted in response to Commission questionnaires.

As indicated in table I-8, two U.S. producers are related to foreign producers of the subject merchandise in China: ***. In addition, SunPower announced on October 1, 2018 that it completed its acquisition of certain assets of SolarWorld Americas, including its U.S. manufacturing plant.[107] In these reviews, SunPower provided responses to the Commission's questionnaires indicating that it *** in the United States.[108] It has a ***,[109] but *** since

[107] SunPower, "SunPower Begins a New Chapter in American Solar Manufacturing," News release, October 1, 2018, http://newsroom.sunpower.com/2018-10-01-SunPower-Begins-A-New-Chapter-in-American-Solar-Manufacturing, retrieved December 18, 2018.
[108] In its reply to the U.S. producer questionnaire, SunPower explained ***.
[109] SunPower indicated ***.

January 1, 2012.[110] As discussed in greater detail in Part III, only one U.S. producer (***) directly imported the subject merchandise from China.

Table I-8
CSPV cells and modules: U.S. producers' ownership, related and/or affiliated firms, since January 2012

* * * * * * *

U.S. importers

In the original investigations, 49 firms that accounted for approximately 67.1 percent of U.S. imports of CSPV cells and modules from China and 37.3 percent of U.S. imports from nonsubject countries in 2011 provided responses.[111] *** of the fourteen reporting U.S. producers in the original investigations reported U.S. imports or purchases of imports from China. *** U.S. producers reported purchasing or importing CSPV modules (***) and *** firms reported importing CSPV cells to be assembled into modules in the United States (***).

In the current proceedings, the Commission issued U.S. importers' questionnaires to 260 firms that were possible importers of CSPV cells or modules. Usable questionnaire responses were received from 47 firms that accounted for approximately 26.2 percent of total U.S. imports from China and 56.4 percent of total U.S. imports from nonsubject countries in 2017.[112]

Table I-9 lists all responding U.S. importers of CSPV cells and modules from China and other sources, their locations, and their shares of U.S. imports in 2017.

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[110] SunPower explained ***.

[111] Based on a comparison of the value of U.S. imports of CSPV cells and modules reported in the responses to the Commission's U.S. importer questionnaire with total landed-duty paid value of U.S. imports of cells and modules as reported by official Commerce import statistics (HTS 8541.40.6030 and 8541.40.6020). Questionnaire data coverage percentages may have been understated because official Commerce statistics may include other products not within the scope of these orders, such as thin film solar products and other specifically excluded items.

[112] Response rate is calculated based on a comparison of the value of 2017 U.S. imports of CSPV cells and modules as reported in the responses to the Commission's U.S. importer questionnaires ($115.8 million (China), $1.9 billion (other countries), and $2.0 billion (all countries)) with total landed-duty paid value of 2017 U.S. imports of cells and modules as reported by official Commerce import statistics under HTS statistical reporting numbers 8541.40.6020 and 8541.40.6030, as adjusted to remove nonsubject modules containing U.S.-origin cells and an estimated amount of thin film products, ($441.4 million (China), $3.4 billion (other countries), and $3.8 billion (all countries)). Questionnaire data coverage presented may be imprecise because the official Commerce statistics under these two HTS numbers may include other products not within the scope of these reviews. In addition, minor amounts of in-scope merchandise may be included under other basket HTS categories.

Table I-9
CSPV cells and modules: U.S. importers, headquarters, and share of total imports by source, 2017

Firm	Headquarters	Share of imports by source (percent)		
		China	Nonsubject sources	All import sources
Alps	Walnut, CA	***	***	***
Ameresco	Framingham, MA	***	***	***
Attic Breeze	Gatesville, TX	***	***	***
AUO Green Energy	Milpitas, CA	***	***	***
Auxin Solar	San Jose, CA	***	***	***
Axitec	Delran, NJ	***	***	***
Canadian Solar	Walnut Creek, CA	***	***	***
Cantex	Houston, TX	***	***	***
Carmanah	Victoria, BC, Canada	***	***	***
Chamberlain	Oak Brook, IL	***	***	***
EcoSolargy	Irvine, CA	***	***	***
First Solar	Tempe, AZ	***	***	***
Goal Zero	Bluffdale, UT	***	***	***
Grand View	New York, NY	***	***	***
Grape	Eugene, OR	***	***	***
Hanwha	Teaneck, NJ	***	***	***
Hanwha Q Cells America	Irvine, CA	***	***	***
Hanwha Q Cells USA	Irvine, CA	***	***	***
Heliene	Sault Ste. Marie, ON, Canada	***	***	***
Hyundai	Torrance, CA	***	***	***
IES	Stafford, TX	***	***	***
Industrial Supplies	St Louis, MO	***	***	***
JA Solar	San Jose, CA	***	***	***
Kyocera	San Diego, CA	***	***	***
LG Electronics	Englewood Cliffs, NJ	***	***	***
Longi Solar	San Ramon, CA	***	***	***
Merlin	San Jose, CA	***	***	***
Mission	San Antonio, TX	***	***	***
Nishati	McLean, VA	***	***	***
Panasonic Eco	Newark, NJ	***	***	***
PowerFilm	Ames, IA	***	***	***
QMS	Birmingham, MI	***	***	***
RDA Solutions	Fort Worth, TX	***	***	***
RDK	Buford, GA	***	***	***
REC Americas	San Mateo, CA	***	***	***
Rotech	Markham, ON, Canada	***	***	***
SBM Solar	Concord, NC	***	***	***
Silfab Solar	Mississauga, ON	***	***	***
SolarTech Universal	Riviera Beach, FL	***	***	***
SolartTech Power	Ontario, CA	***	***	***
SolarWorld	Hillsboro, OR	***	***	***
Sonali	Closter, NJ	***	***	***
SUMEC	Chatsworth, CA	***	***	***
Suniva	Norcross, GA	***	***	***
Upsolar	San Francisco, CA	***	***	***
Wanxiang	Rockford, IL	***	***	***
Winaico	Southampton, PA	***	***	***
Total		100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. purchasers

The Commission received 13 usable questionnaire responses from firms that bought CSPV cells and modules during January 2012-June 2018. Of the 13 responding purchasers, 4 purchased the domestic CSPV cells and modules, 3 purchased imports of the subject merchandise from China, and 9 purchased imports of CSPV cells and modules from other sources. Four responding purchasers are distributors, four are residential installers, eight are commercial installers, four are utility companies or developers, and one is a module assembler. In general, responding U.S. purchasers are located in all regions of the United States. Large purchasers of CSPV cells and modules include ***.

APPARENT U.S. CONSUMPTION AND MARKET SHARES

Data concerning apparent U.S. consumption and market shares of CSPV cells and modules are shown in table I-10 and figure I-18.

The apparent U.S. consumption data presented consist of the sum of U.S. producers' U.S. shipments of CSPV cells and modules and U.S. imports of CSPV cells and modules. The U.S. producers' U.S. shipments component of apparent U.S. consumption by quantity (in kW) reflects the U.S. producers' U.S. shipments of (1) modules that contain U.S.-produced CSPV cells, (2) U.S.-produced CSPV cells that are otherwise not reported by module assemblers, and (3) re-imports of U.S.-origin CSPV cells. This quantity measure excludes any CSPV modules produced in the United States from imported CSPV cells, as those are reported for the purposes of apparent U.S. consumption as imports to avoid double-counting. However, the U.S. component for value does include the incremental value added in the United States for the module assembly of foreign-origin CSPV cells.

Table I-10
CSPV cells and modules: Apparent U.S. consumption and market shares, 2012-17, January to June 2017, and January to June 2018

Item	Calendar year						January to June	
	2012	2013	2014	2015	2016	2017	2017	2018
	Quantity (kilowatts)							
U.S. producers' U.S. shipments	***	***	***	***	***	***	***	***
U.S. imports from.-- China	326,846	82,264	1,263,270	3,311,513	2,720,193	1,307,134	50,760	22,962
Nonsubject sources	1,835,542	3,019,148	3,319,628	5,118,880	10,093,375	6,864,094	2,244,954	2,350,780
All import sources	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568	8,171,228	2,295,714	2,373,742
Apparent consumption	***	***	***	***	***	***	***	***
	Value (1,000 dollars)							
U.S. producers' U.S. shipments.-- Fully domestic	***	***	***	***	***	***	***	***
Value added to cell Imports	***	***	***	***	***	***	***	***
Total U.S. value	***	***	***	***	***	***	***	***
U.S. imports from.-- China	291,878	69,976	747,148	1,680,733	1,258,864	441,381	25,860	12,670
Nonsubject sources	1,612,786	2,144,481	2,267,713	3,287,132	5,801,625	3,354,314	1,053,465	1,023,168
All import sources	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489	3,795,695	1,079,325	1,035,838
Apparent consumption	***	***	***	***	***	***	***	***
	Share of quantity (percent)							
U.S. producers' U.S. shipments	***	***	***	***	***	***	***	***
U.S. imports from.-- China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
	Share of value (percent)							
U.S. producers' U.S. shipments.-- Fully domestic	***	***	***	***	***	***	***	***
Value added to cell Imports	***	***	***	***	***	***	***	***
Total U.S. value	***	***	***	***	***	***	***	***
U.S. imports from.-- China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***

Source: Compiled from data reported in INV-PP-119 (*CSPV 3*, solar 201 staff report) for 2012-16, and compiled from data submitted in response to Commission questionnaires and official U.S. import statistics under HTS statistical reporting numbers 8541.40.6020 and 8541.40.6030, accessed October 30, 2018, for 2017, January to June 2017, and January to June 2018, as adjusted. See detailed explanation of the methodology for adjusted official U.S. import statistics in the narrative discussion in this section of the report.

Figure I-18
CSPV cells and modules: Apparent U.S. consumption, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Because official U.S. import statistics (a) include noticeable volumes of out-of-scope merchandise, such as thin-film CSPV products, and (b) define country-of-origin that is not wholly consistent the scope of these reviews, and because of the relatively low importer questionnaire response rate in these reviews, the U.S. import component of the apparent U.S. consumption calculation (quantity and value) presented in this report for 2012-16 is based on importer questionnaire data from *CSPV 3*. The U.S. import value component of the apparent consumption calculation for 2017 and the partial periods (January-June) of 2017 and 2018 is derived from official U.S. import statistics for CSPV cells (HTS 8541.40.6030) and CSPV modules (HTS 8541.40.6020).[113] Because import quantity data are not compiled in official Commerce statistics on the basis of kilowatts, Commission staff derived the import quantity data presented in this report by applying the unit value data provided in response to Commission's importer questionnaires to the official U.S. import value statistics.

Apparent U.S. consumption of CSPV cells and modules, by quantity, increased from 2012 to 2016, and fell in 2017 to a level that was *** percent higher than that reported in 2012. The quantity of apparent consumption was *** percent lower in the first half of 2018 than in the comparable period in 2017. The value of apparent U.S. consumption of CSPV cells and modules followed a similar trend as quantity during 2012-17, ending up in 2017 at a level that was *** percent higher than that reported in 2012. The value of apparent consumption was *** percent lower in the first half of 2018 than in the comparable period in 2017.

The quantity of U.S. producers' U.S. shipments of CSPV cells and modules, which accounted for a relatively small share of the entire U.S. market, fluctuated downward from *** percent of apparent U.S. consumption in 2012 to *** percent in 2017. The U.S. producers' share of apparent U.S. consumption was *** percent in the first half of 2017 and *** percent in the comparable period of 2018. A similar trend was experienced in the share of the total value of apparent consumption held by U.S. producers' U.S. shipments, which accounted for *** percent in 2012, *** percent in 2017, and *** percent in January-June 2018.

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[113] The value of official U.S. import statistics may be imprecise for the measurement of U.S. imports because the two primary HTS numbers for CSPV cells and CSPV modules may include other products not within the scope of these reviews, such as thin film photovoltaic products or other items specifically excluded from the scope. On the other hand, some in-scope items may not be reflected in these data because they entered the United States under other HTS numbers (e.g., it is not clear whether ***). Official U.S. import statistics presented in this report for 2017, January-June 2017, and January-June 2018 were adjusted to remove the following: (1) known imports of modules that contained U.S.-produced cells (from questionnaire responses) and (2) an estimated amount of thin film products (based on the ratio of total imports held by thin film products in July and August 2018 under HTS statistical reporting numbers 8541.40.6035 and 8541.40.6045).

Even as U.S. demand for CSPV products increased overall from 2012 to 2017, nonsubject foreign suppliers, primarily Malaysia, Korea, and Vietnam, captured a slightly larger share of the U.S. market. The nonsubject countries' share of apparent U.S. consumption fluctuated upward from *** percent in 2012 to *** percent in 2017, and was *** percent in January-June 2017 and *** percent in January-June 2018. The market share held by subject imports, on the basis of quantity and value, respectively, fluctuated from a low of *** and *** percent in 2013 (the first full year after the orders in these reviews went into effect) to a high of *** and *** percent in 2015 (the first full year after the order in the related reviews on China and Taiwan went into effect), and was *** and *** percent in 2017, *** and *** percent during the first half of 2017, and *** and *** percent during the first half of 2018.

For purposes of comparison, apparent consumption and market share data collected from questionnaire responses (import country-of-origin based on cell manufacture location) for calendar years 2012-16 in the Commission's Section 201 investigation are presented in appendix C.

U.S. MARKET, BY SECTOR

Data collected from U.S. producer and importer questionnaire responses on the U.S. market, by sector, are shown in tables I-11 (distributors), I-12 (residential and commercial installers), and I-13 (utilities).[114] These data show that *** percent of total apparent U.S. consumption of CSPV cells and modules during the period of review (i.e., calendar years 2012-17, January-June 2017, and January-June 2018) were direct shipments to distributors, *** percent were direct shipments to installers (residential and commercial combined), and *** percent were direct shipments to utilities. During the period of review, *** percent of U.S. shipments to distributors were by U.S. producers, *** percent were by U.S. importers from nonsubject sources, and *** percent were by U.S. importers from China. U.S. producers accounted for *** percent of all U.S. shipments to installers and *** percent of all U.S. shipments to utilities during the period of review, whereas U.S. importers from China accounted for *** percent of U.S. shipments to installers and *** percent of U.S. shipments to utilities and U.S. importers from nonsubject sources accounted for *** percent of U.S. shipments to installers and *** percent of U.S. shipments to utilities. During 2017, U.S. importers from nonsubject sources accounted for the majority of the U.S. market for distributors (*** percent), installers (*** percent, and utilities (*** percent), whereas U.S. producers accounted for a smaller share of the U.S. market for distributors (*** percent), installers (*** percent), and utilities (*** percent). U.S. imports from China accounted for ***

[114] Note that the data presented in this section on the U.S. market will not add to the total presented in the previous section on "Apparent U.S. consumption" because the import component in the tables presented in this section are derived from importer questionnaire responses, whereas the import component in the table present in the previous section are from the 201 proceeding (2012-16) and adjusted import statistics (2017 and first half 2018).

Table I-11
CSPV cells and modules: Market through distributors, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Table I-12
CSPV cells and modules: Market directly to installers (residential and commercial combined), 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Table I-13
CSPV cells and modules: Market directly to utilities, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

and *** percent of the U.S. market for distributors and installers, respectively, in 2017 and *** of the U.S. market for utilities.

PART II: CONDITIONS OF COMPETITION IN THE U.S. MARKET

CSPV cells and modules are used to generate electricity for use by commercial and residential consumers and produced for retail sales to the general public by electric distributors. Modules vary in size, nominal power output, and efficiency. There are four primary market segments for CSPV products.[1] The three on-grid market segments are residential, commercial, and utility. The off-grid market segment is relatively small and includes systems used in mobile power solutions, telecommunications power and lighting, and portable consumer goods. However, the vast majority of CSPV modules sold in the United States are connected to the electric grid.[2]

The U.S. market for CSPV cells and modules increased by approximately *** percent from 2012 to 2017. Apparent U.S. consumption of CSPV cells and modules increased from *** in 2012 to *** in 2016 before declining to *** in 2017.[3] However, the value of apparent U.S. consumption increased from approximately *** in 2012 to approximately *** in 2016 before declining to *** in 2017. Apparent U.S. consumption was *** in interim 2018 compared to *** in interim 2017. In value terms, apparent U.S. consumption was *** in interim 2017 and *** in interim 2018.

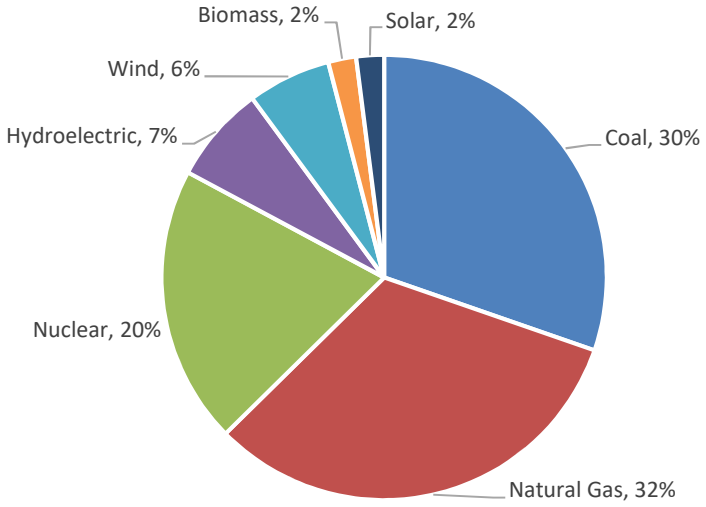
Electricity in the United States is supplied primarily by conventional sources, with coal and natural gas accounting for almost two-thirds of all U.S. electricity generated in 2017 (figure II-1). Renewable energy sectors (excluding hydroelectric) accounted for 10 percent of electricity generated in the United States in 2017, with solar energy accounting for 2 percent of total generated electricity.

[1] CSPV products are defined as certain crystalline silicon photovoltaic cells, whether or not partially or fully assembled into other products.

[2] *Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled into Other Products), Inv. No. 201-TA-75*, USITC Publication 4739, November 2017, V-1.

[3] Compiled from data submitted in response to Commission questionnaires.

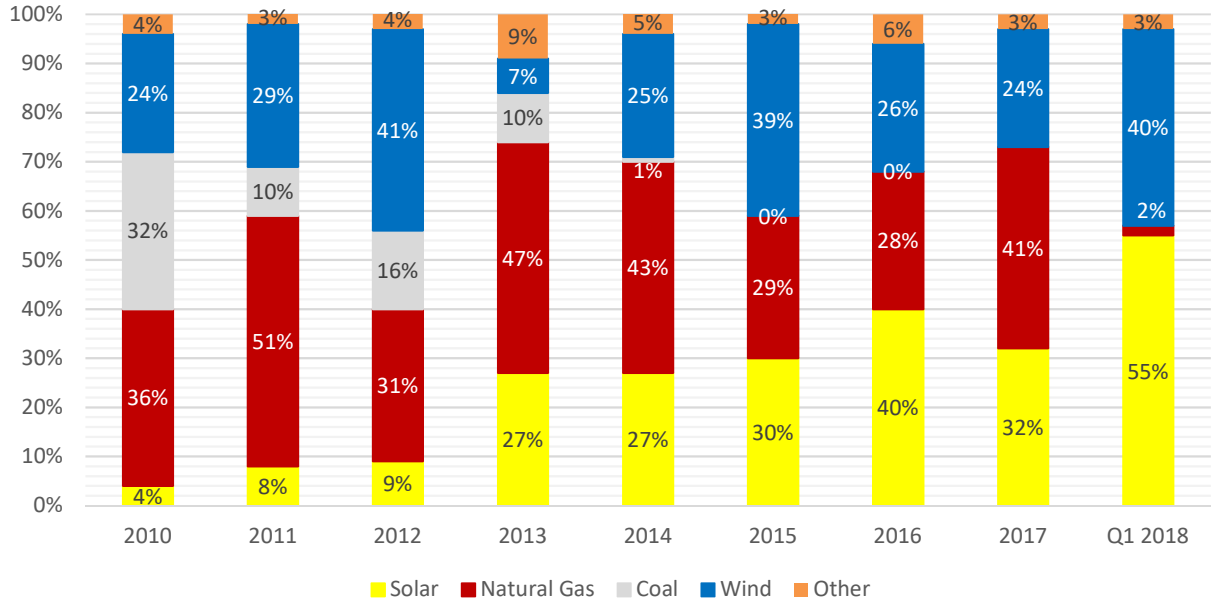
Figure II-1
Net U.S. electricity generation, by sector, 2017



Source: U.S. Energy Information Administration, http://www.eia.gov/electricity/data/browser/, retrieved October 16, 2018.

The share of electricity generated from renewable energy sources, such as solar, has been steadily increasing. While solar-generated electricity is one of the smallest sectors, solar was the largest source of new electric generating capacity, accounting for 32 percent of all new electric generating capacity installed in the United States in 2017 (figure II-2).

Figure II-2
New U.S. electricity generating capacity additions by type yearly, 2010-2017 and Jan-Mar 2018

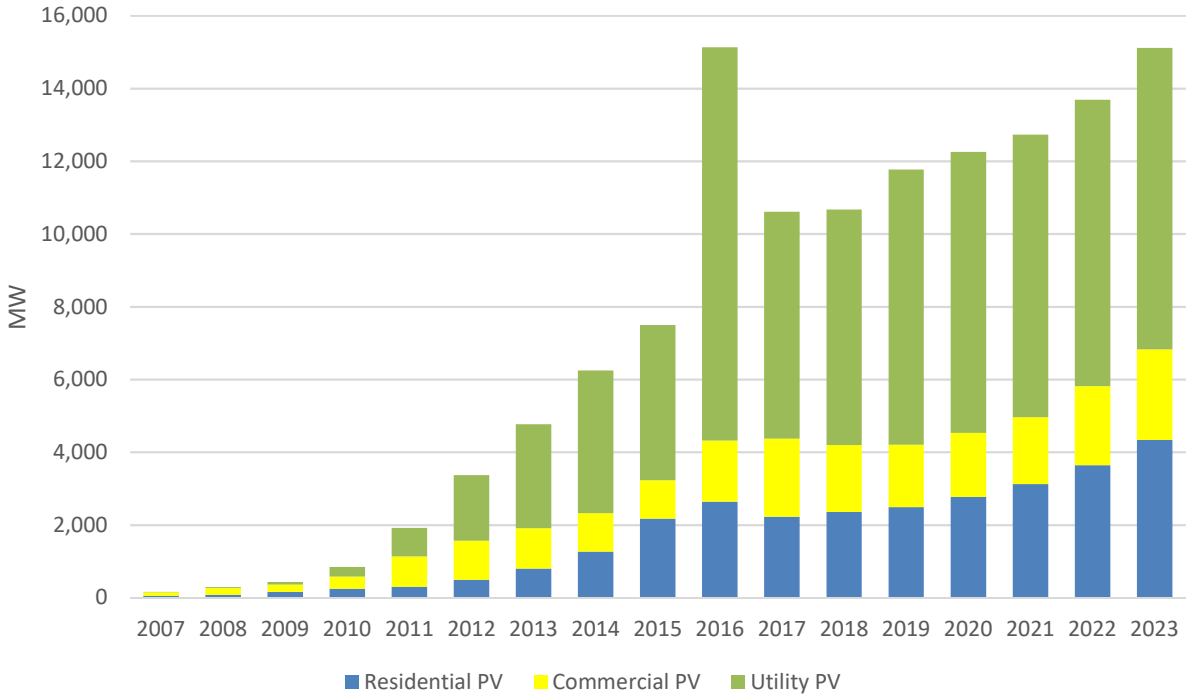


Source: GTM Research and the Solar Energy Industries Association (SEIA), U.S. Solar Market Insight: 2018 Year in Review, Executive Summary, 2018, p. 6.

This increase in installed capacity is partially due to an increase in the consumption of CSPV cells and modules but is also partially due to increases in the efficiency and power generation capacity of CSPV cells and modules. *** reported increased module efficiency that allows for increased power generation.

U.S. capacity has expanded significantly from 496 MW of residential capacity, 1,075 MW of commercial capacity, and 1,803 MW of utility capacity in 2012 to 2,227 MW of residential capacity, 2,147 MW of commercial capacity and 6,234 MW of utility capacity in 2017. Although U.S. capacity declined from 2016 to 2017 in all three sectors, total U.S. capacity is forecast to increase from 2018 through 2023 because of growth in the residential and utility sectors (Figure II-3).

Figure II-3
Actual and forecast annual photovoltaic production capacity additions 2007-2023



Note.--Photovoltaic capacity included products in addition to CSPV Cell and Modules.

Source: Data compiled from GTM Research and SEIA (2010-2016), IREC Data Collection, and LBNL Databases.

Several industry events have altered competitive conditions in the U.S. CSPV market since 2012. Multiple unfair trade investigations with respect to CSPV cells and modules, including another AD/CVD investigation in 2015 and a section 201 investigation on solar cells and modules in 2017, have been completed. In addition to these investigations, the levels and durations of both federal and local governments' financial incentives for solar power have fluctuated. Further, several U.S. producers have exited and entered the market since 2012.

Impacts of the 201 safeguard measure

U.S. producers reported that the 201 safeguard measure had different impacts on CSPV cells than CSPV modules. Half of reporting producers reported that the 201 safeguard measure had no impact or had a negative impact on demand for CSPV modules in the U.S. market. The majority of firms reported that the 201 safeguard measure had a negative impact on prices and no impact on their firm operations. However, U.S. producer *** stated that *** and *** stated that ***.

The majority of U.S. importers reported that the section 201 safeguard measure on CSPV cells had no impact on demand, price, and on their firm's operations. The majority of U.S. importers reported that section 201 safeguard measure on CSPV modules had no impact on price or their firm's operations, but a negative impact on demand (table II-1).

Table II-1
CSPV cells and modules: Firms' responses regarding the impact of the section 201 safeguard measure

* * * * * * *

SEIA contends that the implementation of the section 201 tariffs will "drive developers to anchor projects in 2019 but procure modules in 2020 or later, thereby driving target commercial operations dates (COD) further out."[4] This would cause demand for CSPV cells and modules to be pushed from 2019 to later years but will have little to no impact on aggregate demand in the next few years. Domestic interested parties reported that subject imports continued to undersell domestic products even with the 201 orders in effect and prices were expected to fall if the orders were revoked.[5] Respondent interested parties reported that spikes in imported CSPV cells and modules into the market were due to the uncertainty in the marketplace as to what form the 201 safeguard remedy would take and concern on the part of purchasers that there would be shortages in supply.[6] Respondent interested parties further reported that 201 tariffs have provided a significant disincentive for Chinese producers to ship to the U.S. market as evidenced by negligible imports in 2018.[7]

[4] GTM Research and the Solar Energy Industries Association (SEIA), *U.S. Solar Market Insight: Q3 2018*, Executive Summary, 2018, p. 8.

[5] Hearing transcript, p. 25 (El-Sabaawi).

[6] Hearing transcript, p. 170 (Stoel).

[7] Hearing transcript, p. 172 (Dougan).

CHANNELS OF DISTRIBUTION

CSPV cells are sold primarily through five channels of distribution (module assemblers, distributors, residential installers, commercial installers, and utilities or developers).[8] As shown in table II-2, the largest share of U.S.-produced cells were sold to assemblers from 2012 to 2016, although this share decreased irregularly over the period.[9] By 2017, a plurality of U.S.-produced cells were sold to distributors, a pattern that has continued in interim 2018.

Table II-2
CSPV cells and modules: U.S. producers' and importers' share of reported U.S. shipments, of cells whether or not assembled in modules by sources and channels of distribution, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

A majority of shipments of imports of CSPV cells and modules from China were sold to utilities or developers from 2012 to 2016, with the exception of 2013 when a majority of imported Chinese cells and modules were sold to commercial installers.[10] In 2017, and January to June 2018, a majority of Chinese CSPV cells and modules were sold to commercial installers. U.S. shipments of CSPV cells and modules imported from nonsubject countries are not concentrated in any one channel of distribution in the U.S. market. Importers sold the smallest share of nonsubject imports for January 2014 through June 2018 to module assemblers. Importers sold residential installers, distributors, commercial installers, and utility developers a fluctuating share of nonsubject imports from January 2012 through June 2018.

GEOGRAPHIC DISTRIBUTION

U.S. producers and importers reported selling CSPV cells and modules to all regions in the contiguous United States (table II-3). For U.S. producers, 14.2 percent of sales were within 100 miles of their production facility, 50.7 percent were between 101 and 1,000 miles, and 35.1 percent were over 1,000 miles. Importers sold 30.2 percent within 100 miles of their U.S. point of shipment, 41.5 percent between 101 and 1,000 miles, and 28.3 percent over 1,000 miles.

[8] Typically cells are sold either as part of a module assembly or unassembled for module assembly

[9] *** firms (***) reported U.S. shipments of cells to assemblers; the vast majority were used for internal consumption for their module production.

[10] The majority of Chinese imports are assembled modules and only small quantities of Chinese cells ae being sold in the U.S. market.

Table II-3
CSPV cells and modules: Share of U.S. commercial shipment values by geographical market areas in the United States served by domestic producers and importers, 2017

Region	U.S. producers	Importers from China
Northeast[1]	9	15
Midwest[2]	8	13
Southeast[3]	7	11
Central Southwest[4]	7	11
Mountains[5]	6	10
Pacific Coast[6]	7	16
Other[7]	4	7
All regions (except Other)	6	9
Reporting firms	10	21

[1] Includes all other markets in the United States not previously listed, such as AK, HI, PR, and VI.

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from data submitted in response to Commission questionnaires.

SUPPLY AND DEMAND CONSIDERATIONS

U.S. supply

According to most firms' responses, the availability of both domestically produced and imported CSPV products in the U.S. market has changed since 2012. Several firms stated that total U.S. production of CSPV cells and modules had increased while others reported that several U.S. producers had exited the market. Firms reported that the availability of Chinese CSPV cells and modules decreased due to increases in tariff rates.

Most U.S. producers and purchasers anticipate further changes to the availability of both domestically produced and imported CSPV products from China while most importers did not anticipate further changes.

Table II-4 provides a summary of the supply factors regarding CSPV cells and modules from U.S. producers and from China.

Table II-4
CSPV cells and modules: Supply factors that affect the ability to increase shipments to the U.S. market

Country	Capacity (megawatts)		Capacity utilization (percent)		Ratio of inventories to total shipments (percent)		Shipments by market, 2017 (percent)		Able to shift to alternate products
	2012	2017	2012	2017	2012	2017	Home market shipments	Exports to non-U.S. markets	No. of firms reporting "yes"
United States cells	***	***	***	***	***	***	***	***	0 of 10
United States modules	***	***	***	***	***	***	***	***	0 of 11
China cells	***	***	***	***	***	***	***	***	0 of 9
China modules	***	***	***	***	***	***	***	***	0 of 9

Note.-- Responding U.S. producers accounted for more than 75 percent of U.S. production of CSPV cells and over half of module production in 2017. Responding foreign producer/exporter firms accounted for approximately 25 percent of U.S. imports of CSPV cells and modules from China during 2017. For additional data on the number of responding firms and their share of U.S. production and of U.S. imports from each subject country, please refer to Part I, "Summary Data and Data Sources."

Note.-- CSPV cells are often used to construct CSPV panels. While reporting cells and modules separately provides a better overview of the CSPV module, there is some double counting of CSPV cells and modules. This has resulted in this report overstating the total capacity. Actual capacity is somewhat less than reported.

Note.-- Responses to the Commission's questionnaires did not capture imports of CSPV modules into the U.S. covered by trade data.

Note.-- While subject imports of CSPV cells were steady from 2012 to June 2018, subject imports of CSPV modules varied throughout the period. Subject exports of CSPV modules were 12.6 percent of Chinese production in 2015 and 9.6 percent in 2016.

Source: Compiled from data submitted in response to Commission questionnaires.

Domestic production

Domestic producers have substantial excess capacity and are mostly focused on supplying the domestic market. Based on available information, U.S. CSPV cell and module producers have the ability to respond to changes in demand with moderately large to large changes in the quantity of U.S. produced CSPV cells and modules to the U.S. market. The main contributing factor to this degree of responsiveness of supply is the availability of unused capacity. Factors mitigating responsiveness of supply include low inventories, limited ability to shift shipments from alternate markets, and an inability to shift production to or from alternate products.

Domestic capacity decreased from *** megawatts to *** megawatts (*** percent) during 2012-17. Capacity utilization of cell production increased from *** percent to *** percent during 2012-17. This suggests that U.S. producers may have substantial ability to increase production of CSPV cells in response to an increase in price. Exports of CSPV cells as a share of total CSPV cell shipments decreased from *** percent in 2012 to *** percent in 2015 before increasing to *** percent in 2016, and remained below *** percent of total U.S. producer shipments in 2017. Inventories of CSPV cells decreased irregularly from *** percent as a ratio to total shipments in 2012 to *** percent as a ratio to total shipments in 2017. No domestic producer of CSPV cells stated that they could switch to producing other products using the same equipment.

Domestic capacity utilization of CSPV module production decreased by *** percentage points during 2012-17, from *** percent to *** percent, as a result of increasing capacity. Inventories of CSPV modules fluctuated during this period. Overall, inventories as percentage of total shipments of CSPV modules decreased irregularly from *** percent in 2012 to *** percent in 2017. No responding U.S. producers of CSPV modules stated that they could switch production from CSPV modules to other products. Exports of CSPV modules were *** percent of total producer shipments in 2012 but exports of U.S. modules decreased in subsequent years and were below *** percent of total producer shipments from 2013 to 2016. Exports of CSPV modules in 2017 remained below *** percent of total U.S. producer shipments.

Subject imports from China

Based on available information, producers of CSPV cells and modules from China have the ability to respond to changes in demand with moderate changes in the quantity of shipments of CSPV cell and modules to the U.S. market. The main contributing factors to this degree of responsiveness of supply are responding Chinese producers are producing *** and module producers are oriented toward the Chinese market and markets other than the United States.

Chinese producers' capacity utilization of CSPV cells increased by *** percentage points, from *** percent to *** percent while capacity increased *** percent during 2012-2017. Chinese inventories of CSPV cells increased from *** percent of total shipments in 2012 to *** percent in 2017. Responding Chinese producers reported that *** percent of Chinese-produced CSPV cells were shipped to the Chinese home market in 2017 and the remaining *** percent of Chinese production that was exported went to non-U.S. markets. No firms reported exports to the U.S. market during the period or indicated that they could shift production from CSPV cells to other products.

Chinese producers' capacity utilization for CSPV modules increased from *** percent in 2012 to *** percent in 2017 while overall capacity increased nearly *** percent. Inventories as a percentage of total shipments decreased from *** percent in 2012 to *** percent in 2017. Chinese producers shipped *** percent of their total production of CSPV modules to their home market in 2017 and the remaining *** percent of production that was exported went to non-U.S. markets. No Chinese producer of CSPV modules stated they could switch production from CSPV modules to other products.

Domestic interested parties reported that there were 34 gigawatts of excess capacity in China, which is more than three times the total volume of installed solar power in the United States and one-third of total global installations in 2017.[11] Respondent interested parties stated that Chinese capacity utilization is high[12]; Chinese demand for CSPV cells and modules will remain very strong in the foreseeable future[13] and that Chinese producers have focused their shipments of CSPV cells and modules to markets other than the United States.[14]

Imports from nonsubject sources

Nonsubject imports accounted for *** percent of total reported U.S. imports in 2017. The largest sources of nonsubject imports during 2017 were Malaysia, Korea, Vietnam, and Taiwan. Combined, these countries accounted for the majority of nonsubject imports in 2017.

Supply constraints

The majority of responding U.S. producers (7 of 9) reported that there have been no supply constraints since January 2012. However, U.S. producers *** reported ***. Most importers (26 of 41) reported no supply constraints since January 2012. Importer *** reported that the suddenness of the most recent 201 tariffs caused delays at port and inspection, importer *** reported that it becomes more difficult to buy any components from U.S.-based companies, and importer *** stated that new tariffs have led to a shortage of solar cells and other raw materials.

In contrast, the majority of responding purchasers (9 of 13) reported the existence of supply constraints since January 2012. Purchaser *** reported that in the normal course of business there have been fluctuations based on the ebbs and flows of availability and manufacturing. Purchaser *** stated that occasional supply constraints from a single supplier has lead the firm to source panels from other qualified suppliers. Purchasers *** stated that the 201 investigation on solar panels in 2017 and resulting tariffs which went into effect in 2018 have caused supply constraints. Purchaser *** stated that shortages have been rare over the last 6 years, and only occur if it is looking for specific parameters.

The respondent interested parties stated that they required 1500-volt CSPV modules for utility-scale solar power installations and that the domestic industry did not produce these panels, presumably because they earned higher margins producing residential panels. Respondent interested parties further stated that they had sought to purchase 1500-volt CSPV modules from domestic producers following the imposition of the 201 tariffs and that domestic producers were unable to supply the demanded quantities.[15] Petitioners stated that SolarWorld had produced a 1500-volt panel in 2016 but was unable to market it.[16]

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[11] Hearing transcript, pp. 39-40 (Kaplan)
[12] Hearing transcript, p. 164 (Lewis)
[13] Hearing transcript, p. 17 (Stoel)
[14] Hearing transcript, p0. 17-18 (Stoel)
[15] Hearing transcript, p. 157 (Strange).
[16] Hearing transcript, p. 273 (Brightbill).

New suppliers

The majority of purchasers (8 of 13) indicated that new suppliers have entered the U.S. market since January 1, 2012. The firms that purchasers identified as having entered the market were both foreign and domestic. Nine purchasers reported that they expect firms to enter the U.S. market in the next two years. *** stated that they know there is manufacturing being moved to the United States because of tariffs and *** stated that Panasonic in Buffalo, New York, is ramping up production of solar cells. However, *** stated that the "tariff from earlier in 2018 called out several dozen GSP nations as exempt from certain tariff regulations. Since that announcement, we have seen suppliers from those countries, such as India, Turkey, and South Africa, start to make headway within the U.S. market."

U.S. demand

Based on available information, the overall demand for CSPV cells and modules is likely to experience large changes in response to changes in price. The main contributing factors are a number of substitute products and the large cost share of CSPV cells and modules in most of end-use products.

Demand trends

Most firms reported an increase in U.S. demand for CSPV cells and modules since January 1, 2012 (table II-5) and expect that increased demand to continue into the future. This increase in U.S. demand took place in both the residential and utility sectors, and was reported by the majority of producers, importers, purchasers, and foreign producers.

Table II-5
CSPV cells and modules: Firms' responses regarding U.S. demand

* * * * * * *

End uses and cost share

CSPV cells and modules account for a high share of the cost of the end-use products in which they are used. The primary end use for CSPV cells are modules, and for CSPV modules the primary end uses are some form of solar power generation installation or system (see Part I for more information). Generally, the cost share of a CSPV module increases as the size of the installation project increases. Firms reported the share of the total production cost of the end-use products (modules, residential systems, commercial systems, utility systems) accounted for by CSPV cells (table II-6). Nine of 11 U.S. producers, 29 of 48 importers, and 3 of 13 purchasers reported that the cost share of CSPV cells in modules generally averaged 49 to 52 percent. For residential systems, 3 U.S. producers, 13 importers, and 4 purchasers reported that the cost share of CSPV cells averaged between 17 and 35 percent. Two U.S. producers, 11 importers, and 5 purchasers reported that the cost of CSPV cells averaged between 21 and 39 percent for

Table II-6
CSPV cells and modules: Firm estimates of cost shares for CSPV cells and modules, in percent

Item	Producers		Importers		Purchasers	
	Average	Range	Average	Range	Average	Range
Module	50	26 to 62	49	9 to 80	52	27 to 75
Residential system	35	11 to 70	31	10 to 67	17	12 to 20
Commercial system	24	17 to 30	38	14 to 80	21	15 to 30
Utility system	30	30 to 30	38	15 to 67	35	15 to 50
Off-grid portable consumer goods	---	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

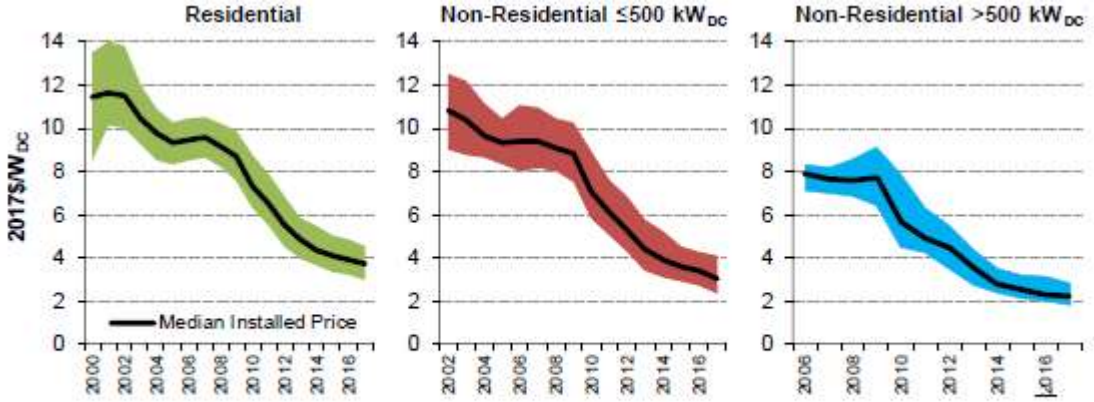
commercial systems. For utility systems, 2 U.S. producers, 10 importers, and 4 purchasers reported that the cost share of CSPV cells averaged between 30 and 38 percent. Thirteen importers reported that the cost of CSPV cells averaged 49 percent for off-grid portable consumer goods.

According to several industry sources, average installed prices for PV solar installations have declined steadily in all three market segments during the period. The price of an installed PV system is comprised of the price of the module and non-module costs which include inverters, mounting hardware, labor, permitting fees, overhead, and profit margin. One industry source stated that the price of solar power has decreased since 2012 for residential systems, small non-residential systems (≤500 kW), and for large non-residential systems (>500kW). In 2012 and 2013, the price of solar power for all three systems fell $1/W per year on average. Since 2014, declines in mean prices has slowed to $0.20/W (6 percent) per year on average for residential systems, $0.40/W (11 percent) per year on average for small non-residential systems, and $0.10/W (5 percent) per year on average for large non-residential systems (figure II-4).[17] Another industry report stated that the steep decline in PV system prices during the period is attributed to large decreases in module prices combined with substantial declines in hardware costs.[18] Both reports noted that installed PV system prices vary greatly from state-to-state and from project-to-project, with a considerable spread among the prices in each market segment.

[17] Tracking the Sun 2018 Edition, National Renewable Energy Laboratory (NREL), https://emp.lbl.gov/tracking-the-sun, retrieved December 3, 2018.

[18] GTM Research and the Solar Energy Industries Association (SEIA), *U.S. Solar Market Insight: 2016 Year in Review*, Executive Summary, 2017, p. 15.

Figure II-4
Average installed price of residential and non-residential PV systems, by system size, 2000-2017



Note.-- Solid lines are median price, and shaded areas are 20th-to-80th percentile ranges.

Source: Tracking the Sun 2018 Edition, National Renewable Energy Laboratory, https://emp.lbl.gov/tracking-the-sun, retrieved December 3, 2018.

Business cycles

Six of 9 U.S. producers, 21 of 41 importers, and 9 of 13 purchasers indicated that the market was subject to business cycles or conditions of competition distinct to the CSPV market. U.S. producers, importers, and purchasers reported that seasonality was the major factor that impacts the business cycle. Specifically, purchasers indicated that seasonality and weather are factors that impact the business cycle. *** stated that sales were heaviest in Q2 and Q3 and installations were heaviest in Q3 and Q4. Purchaser *** stated that the installation season is generally April through October and purchaser *** stated that sales purchasing depended on seasonal and regional weather patterns. Many firms identified seasons associated with higher levels of sunshine as the business season. One purchaser (***) stated that macroeconomic forces such as "inflation expectations, interest rates, expected growth in GDP and demand for electric power" impacted the business cycle.

Substitute products

The majority of firms reported that non-solar renewable energy products could not be substituted for CSPV products at the initial purchase decision. However, 3 of 10 U.S. producers, 6 of 38 importers, and 2 of 13 purchasers indicated that there were non-solar renewable energy substitutes for CSPV products. The most frequently identified non-solar renewable energy substitute product for CSPV products was wind turbines. The U.S. producers, importers, and purchasers which reported the existence of substitutes for CSPV power indicated that changes in substitute energy prices affect the price of CSPV products. Other substitutes cited by firms include wind, biomass, geothermal, and hydroelectric power.

More than half of responding U.S. producers and importers indicated that other solar energy products, such as thin film solar, cannot be substituted for CSPV products at the initial purchase decision. However, 8 of 13 of U.S. purchasers and 17 of 39 importers indicated that thin film can be substituted for CSPV products.[19]

Government incentives

Changes in the availability and scope of federal, state, and local government incentives and regulations continue to affect demand for CSPV products. Various mechanisms were created to help solar electricity reach price parity with traditional energy sources, thereby stimulating demand for solar-generated electricity (table II-7). These mechanisms include fiscal incentives and regulatory measures. These fiscal incentives and regulatory measures benefit system owners, and typically are not directed to any particular domestic or foreign manufacturer of CSPV products.

Table II-7
CSPV products: Selected U.S. fiscal incentives to promote solar energy

Type of incentive	Description	Expiration Date
Production Tax Credit (PTC)	Encourages solar energy production by providing a 10-year production-based tax credit equal to 2.3¢/kWh.	Project must have been under construction by end of 2013.
Investment Tax Credit (ITC)	A 30 percent tax credit on capital expenditures for new solar PV system on residential commercial properties, and utility-scale systems.	Project must start construction by end of 2019 for 30 percent tax credit; by 2020 for the 26 percent tax credit; and by 2021 for the 22 percent tax credit. After 2021 the residential tax credit drops to zero while commercial and utility drop to a permanent 10 percent. Projects that commence construction by December 31, 2021 may still qualify for ITC if they are placed in service before December 31, 2023.
Cash grant program (Treasury 1603 program)	Cash grant equal to up to 30 percent of eligible capital expenditures in lieu of the ITC for commercial solar projects.	Project must be under construction by the end of 2011 and completed by the end of 2016.
Loan guarantee program (DOE 1705 loan program)	Authorized $16 billion in loan guarantees, mostly for wind and solar generation projects.	Must have begun construction before September 30, 2011.
Manufacturing tax credit (MTC)	Allocated $2.3 billion in investment tax credits up to 30 percent of investment in manufacturing facilities of clean energy products.	Project must have been commissioned before February 17, 2013.

Source: *Renewable Energy and Related Services: Recent Developments*, USITC Publication 4421, August 2013, pp. 2-11-12; and SEIA, "Solar Investment Tax Credit," http://www.seia.org/policy/finance-tax/solar-investment-tax-credit, retrieved July 27, 2017.

[19] Thin film was the most often cited solar energy substitute for CSPV products by firms.

There are a wide array of fiscal incentives that are designed to lower the cost of solar project development, including various tax credits, revenues from the sale of solar renewable energy certificates ("SRECs"), cash grants in lieu of credits, accelerated depreciation, and loan guarantees (table II-7). Tax credits are the most common form of federal fiscal incentive; several types of tax credits, which have been modified and extended at various times, have affected the timing of the development of solar projects. However, these incentives were designed to decline over time, as the cost to generate solar-powered electricity declined.[20]

Recently, the IRS released guidance for requirements for the commencement of construction on solar energy projects that qualify for the solar panel Investment Tax Credit (ITC). Solar projects commenced in 2019 will quality for a 30 percent ITC as long as the project is placed into service prior to 2024. The ITC decreases to 26 percent for projects commenced in 2020, 22 percent for projects started in 2021, and then ends in 2022. GTM research and SEIA report that the incentive to begin construction is counter-balanced by potential future price decreases and efficiency increases may outweigh the benefit of beginning construction in time to claim the 30 percent ITC. Developers may choose to wait and sacrifice the 30 percent ITC in hopes of obtaining cheaper more efficient modules because they will still be eligible for a 26 percent ITC.[21]

The Public Utility Regulatory Policies Act of 1978 ("PURPA") has emerged as a significant driver of utility-scale solar installations in certain states.[22] This regulation requires utilities to purchase electricity from qualifying facilities (renewable projects that meet size requirements) at the utility's avoided cost.[23] The declining cost of solar-generated electricity has led to the development of more utility-scale solar under PURPA in a number of states such as North Carolina and Utah.[24] In many other states, however, PURPA has not been a significant driver of solar installations since states set certain criteria related to PURPA (which can make solar projects more or less attractive) and the "Energy Policy Act of 2005 allowed states with competitive electricity markets to opt out of PURPA."[25]

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[20] *Certain Crystalline Silicon Photovoltaic Products from China*, Inv. Nos. 701-TA-481 and 731-TA-1190 (Final), USITC Publication 4360, November 2012, pp. 22-24.

[21] GTM Research and the Solar Energy Industries Association (SEIA), *U.S. Solar Market Insight: Q3 2018*, Executive Summary, 2018.

[22] GTM Research and the Solar Energy Industries Association (SEIA), *U.S. Solar Market Insight: 2016 Year in Review*, Executive Summary, 2017, p. 12; EIA Website, https://www.eia.gov/todayinenergy/detail.php?id=27632, retrieved July 27, 2017; Smith, Colin, "What Drives Utility Solar Growth in a Post-ITC-Extension World?" Greentech Media, March 24, 2016, https://www.greentechmedia.com/articles/read/What-Drives-Utility-Solar-Growth-in-a-Post-ITC-Extension-World.

[23] "Avoided cost is the cost a utility would incur if it chose to either provide the energy itself (by building new capacity) or to purchase the energy from nonqualifying facilities." EIA Website, https://www.eia.gov/todayinenergy/detail.php?id=27632, retrieved July 27, 2017; Federal Energy Regulatory Commission (FERC) Website, https://www.ferc.gov/industries/electric/gen-info/qual-fac/what-is.asp, retrieved July 27, 2017.

[24] EIA Website, https://www.eia.gov/todayinenergy/detail.php?id=27632, retrieved July 27, 2017..

[25] "What Drives Utility Solar Growth in a Post-ITC-Extension World?" EIA Website,

One widespread state regulatory measure is the renewable portfolio standards ("RPSs").[26] RPSs primarily affect demand for renewable energy, including solar electricity, by mandating its use and thereby increasing the demand for CSPV products. In the United States, 29 states plus the District of Columbia had RPS policies in place in 2016. Of these, 18 states plus the District of Columbia had RPS policies with a solar or distributed generation carve out (share of the RPS that must be supplied by these sources).[27] Several of these states with RPSs also set up a market for tradeable certificates.[28] During 2012-16, a majority of utility-scale solar additions were for entities (such as utilities) and markets with RPS requirements.[29] By 2016, many utilities had met interim or final renewable energy mandates and 64 percent of utility PV projects in development were driven by non-RPS mechanisms.[30] At the same time, however, seven states increased their RPS requirements in 2016.[31]

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https://www.greentechmedia.com/articles/read/What-Drives-Utility-Solar-Growth-in-a-Post-ITC-Extension-World, retrieved July 27, 2017.

[26] An RPS is a regulatory mandate that requires entities that supply electricity, such as utility companies, to generate or buy a portion of their retail electricity sales from renewable energy sources, including solar.

[27] An additional three states have credit multipliers, which award additional credit for certain types of renewable energy. Barbose, Galen, *U.S. Renewables Portfolio Standards: 2016 Annual Status Report*, April 2016, pp. 5-6, https://emp.lbl.gov/sites/all/files/lbnl-1005057.pdf. In 2011, California increased its RPS goals to 20 percent by the end of 2013, 25 percent by the end of 2016, and 33 percent by the end of 2020. In October 2015, California increased its renewable energy mandate to 50 percent of all electricity supplied by retail sellers and publicly owned utilities. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan,* Invs. Nos. 701-TA-511 and 731-TA-1246-1247 (Final), USITC Publication 4519, February 2015, p. II-25; California Energy Commission Website, http://www.energy.ca.gov/portfolio/, retrieved July 27, 2017.

[28] A SREC is created for each megawatt-hour of electricity generated from solar energy systems. A large customer or retailer of electricity required to meet renewable energy targets can purchase a certificate in lieu of deploying MW of its own. Renewable energy generators can also sell certificates to entities covered by RPSs. "SREC" markets have emerged in the United States, with New Jersey as the largest market. Prices of tradable certificates can be volatile. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan,* Invs. Nos. 701-TA-511 and 731-TA-1246-1247 (Final), USITC Publication 4519, February 2015, p. II-25.

[29] Lawrence Berkeley National Laboratory defines RPS capacity additions as "capacity contracted to entities subject to an RPS or sold on a merchant basis into regional RPS markets." Barbose, Galen, *U.S. Renewables Portfolio Standards: 2017 Annual Status Report*, July 2017, pp. 17-18, https://emp.lbl.gov/sites/default/files/2017_annual_rps_summary_report.pdf.

[30] According to one industry report, 64 percent of utility PV projects in development are driven by non-RPS mechanisms. GTM Research and the Solar Energy Industries Association (SEIA), *U.S. Solar Market Insight: 2016 Year in Review*, Executive Summary, 2017, p. 12.

[31] Barbose, Galen, *U.S. Renewables Portfolio Standards: 2017 Annual Status Report*, July 2017, p. 10.

States and utilities have implemented a number of programs to encourage the installation of solar power, including rebates and feed-in-tariffs ("FITs").[32] In renewable energy rebate programs (such as the California Solar Initiative), customers that install PV systems receive a refund to cover a portion of the cost of the system installation.[33] FITs primarily affect the supply of solar energy by paying a solar electricity generator a known rate for electricity fed into the grid. In the United States, six states have FITs in place (California, Hawaii, Maine, Oregon, Vermont, and Washington). These payments are generally awarded as long-term contracts set over a period of 15 to 20 years.[34]

Net metering allows residential and commercial customers that generate their own electricity from solar to receive credit for excess electricity fed into the grid.[35] In some states, utilities may offer net metering programs voluntarily or as a result of regulatory decisions. Differences between states' legislation and implementation mean that the benefits of net metering can vary widely for solar customers in different areas of the United States. There were more than 43 states, the District of Columbia, and four territories with some form of net energy metering legislation or regulation in process in 2013.[36] However, since then, Hawaii, Arizona, Maine, and Indiana have begun to phase out their net metering incentives.[37] Utility companies that are forced to credit customers for the solar electricity they generate but do not use, have lobbied against these net metering state incentives. From utilities' perspective, net metering reduces the number of ratepayers that are needed to cover the large costs of traditional power generation and maintenance of the grid.[38]

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[32] A FIT offers a guarantee of payments to solar electricity developers for the electricity they produce. Payments are based on a certain price per kilowatt-hour (kWh) at which electricity is purchased, typically as part of a long-term agreement set over a period of 15-20 years.

[33] NREL Website, http://www.nrel.gov/tech_deployment/state_local_governments/basics_rebates.html, retrieved July 27, 2017; Go Solar California Website, http://www.gosolarcalifornia.ca.gov/about/csi.php, retrieved July 27, 2017.

[34] NREL, "Feed-In-Tariffs," http://www.nrel.gov/tech_deployment/state_local_governments/basics_tariffs.html, retrieved July 17, 2017.

[35] Residential and commercial customers can use this credit to offset the cost of grid electricity used when their CSPV system does not generate enough electricity to cover their needs.

[36] SEIA, "Net Metering," http://www.seia.org/policy/distributed-solar/net-metering, retrieved July 17, 2017.

[37] As of July 2017, 38 states, the District of Columbia, and three territories have mandatory net metering rules in place. Database of State Incentives for Renewables & Efficiency (DSIRE), Net Metering, July 2017, http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/07/DSIRE_Net_Metering_July2017.pdf. National Conference of State Legislatures, "State Net Metering," November 3, 2016, http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx, retrieved July 19, 2017.

[38] New York Times, "Rooftop Solar Dims Under Pressure from Utility Lobbyists," July 8, 2017, https://www.nytimes.com/2017/07/08/climate/rooftop-solar-panels-tax-credits-utility-companies-lobbying.html?mcubz=0&_r=0.

The U.S. government funds the Department of Energy's SunShot initiative which researches and develops PV technologies to improve efficiency and reliability while lowering manufacturing costs competitive with other sources of energy. The annual budget allocation for the SunShot initiative from fiscal year 2015 to fiscal year 2018 is displayed in table II-8. Government funding for the Sunshot has fluctuated with no clear pattern from a low of $207.6 million in FY 2017 and a high of $241.6 million in FY2018.[39]

Table II-8
Solar technologies: U.S. funding for research and development of PV technologies

Fiscal year	Annual budget allocation (millions of USD)
2015	$233
2016	$242
2017	$208
2018	$242

Source: Department of Energy annual budget 2015-2018

Firms were asked to report on the impact of how government incentives affected demand for CSPV cells and modules (table II-9). A plurality of U.S. producers, importers, and purchasers reported that state and local government incentives increase demand for CSPV cells and modules, while federal government incentives had no effect on demand for CSPV cells and modules. Slightly fewer firms reported that federal government incentives increase demand for CSPV cells and modules.

[39] This budget is for all solar technologes including but not limited to CSPV cells and modules.

Table II-9
CSPV cells and modules: Firms' responses regarding the effect of government incentives

Item	Number of firms reporting			
	Increase	No change	Decrease	Fluctuate
Demand from federal government incentives:				
U.S. producers	3	5	---	1
Importers	14	16	2	7
Purchasers	4	5	2	1
Demand from state and local government incentives:				
U.S. producers	5	---	---	4
Importers	16	8	4	10
Purchasers	4	3	3	2
Anticipated demand from federal government incentives:				
U.S. producers	1	4	3	1
Importers	11	13	6	8
Purchasers	---	4	7	1
Anticipated demand from state and local government incentives:				
U.S. producers	4	1	---	4
Importers	13	10	2	12
Purchasers	1	2	4	5

Source: Compiled from data submitted in response to Commission questionnaires.

A plurality of U.S. producers and importers reported that they anticipate state and local government incentives to increase demand for CSPV cells and modules in the future. Slightly fewer producers and importers reported that state and local government incentives are expected to have no effect on demand for CSPV cells and modules. Purchasers reported that they anticipated that local and state government incentives would cause demand to fluctuate. A plurality of U.S. producers and importers reported that they anticipated federal government incentives to have no impact on demand for CSPV cells and modules. Slightly fewer importers reported that they anticipated federal government incentives to increase demand. However, purchasers anticipated federal government incentives to decrease demand for CSPV cells and modules. Purchasers who reported that they anticipated government incentives to decreased demand for CSPV cells and modules reported that decreases and reductions in tax credits for CSPV cells and modules would cause the decreases in demand for CSPV cells and modules.

Levelized cost of solar electricity

Purchasers can use energy and electricity from a wide variety of sources, ranging from traditional fossil fuels to various forms of renewable energy (including wind, solar, geothermal, and biomass). Electricity providers using renewable energy sources seek to achieve "grid parity" with other sources of electricity.[40] The Levelized Cost of Electricity ("LCOE") represents the per-kilowatt hour cost of building and operating a generating plant over an assumed financial life.[41] The availability of both state and federal tax credits can also impact the calculation of LCOE.

LCOE varies by region, time of day, and availability of other electricity sources.[42] During periods of non-peak electricity demand in the United States, only the lowest-cost generators would be able to sell electricity to the grid, whereas during periods of peak electricity demand, even generators with somewhat higher costs may be able to sell electricity into the transmission or distribution grid. For peak periods, natural gas-generated electricity generally sets the levelized cost of electricity that CSPV and other renewable systems must seek to meet, especially for sales to the utility segment.[43]

The levelized cost of electricity, by energy source, can vary widely. According ***, onshore wind had the lowest LCOE, followed by hydroelectric, and then solar PV (figure II-5).[44] *** LCOE estimate for onshore wind was $***, $*** for hydroelectric, and $*** for Solar PV.[45]

Figure II-5
Estimated U.S. levelized cost of electricity ranges for selected technologies, unsubsidized, dollars per MWh, 2017

* * * * * * *

[40] Grid parity is the price at which the levelized cost of electricity generated from renewable sources is competitive with the cost of conventional energy from the grid.

[41] Key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, and an assumed utilization rate for each plant type. However, plant owners or investors who finance plants may also value portfolio diversification due to the uncertainty of future fuel prices and future policies. U.S. Energy Information Administration (EIA), "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2017," April 2017, https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

[42] *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan,* Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final) USITC Publication 4519, February 2015, p. II-21-22.

[43] *Certain Crystalline Silicon Photovoltaic Products from China*, Inv. Nos. 701-TA-481 and 731-TA-1190 (Final), USITC Publication 4360, November 2012, pp. 21-22.

[44] ***

[45] The LCOE of coal has been increasing. According to EIA, regulators and the investment community have continued to push energy companies to invest in technologies that have low to no carbon dioxide emissions. Major investments in power plants with a relatively higher rate of carbon dioxide emissions are considered a financial risk. U.S. Energy Information Administration (EIA), "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2017," April 2017, https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

EIA estimated the average LCOE for new plants entering service in 2022 (table II-10). When tax credits were included, new onshore wind installations had the lowest estimated LCOE, at $37/MWh. The estimated LCOE of new solar PV installations was estimated to be $46.50/MWh when tax credits are included and $59.10/MWh unsubsidized.

Table II-10
Estimated U.S. levelized cost of electricity ranges for selected technologies, unsubsidized, dollars per MWh, 2017

	Total system LCOE	Total LCOE including tax credit
	Dollars/MWh, 2017	
Wind, onshore	$48.00	$37.00
Geothermal	$43.10	$40.30
Solar PV	$59.10	$46.50
Advanced CC	$48.10	$48.10
Conventional CC	$48.30	$48.30
Hydroelectric	$73.90	$73.90
Advanced CT	$79.50	$79.50
Advanced nuclear	$90.10	$90.10
Biomass	$102.20	$102.20
Wind, offshore	$124.60	$106.20

[1] The capacity-weighted average is the average levelized cost per technology, weighted by the new capacity coming online in each region. The capacity additions for each region are based on additions in 2020–2022. Technologies for which capacity additions are not expected do not have a capacity-weighted average and are marked as NB or not built.
[2] The tax credit component is based on targeted federal tax credits such as the PTC or ITC available for some technologies. It reflects tax credits available only for plants entering service in 2022 and the substantial phase out of both the PTC and ITC as scheduled under current law. Technologies not eligible for PTC or ITC are indicated as NA or not available. The results are based on a regional model, and state or local incentives are not included in LCOE calculations. See text box on page 2 for details on how the tax credits are represented in the model.

Source: U.S. Energy Information Administration, Annual Energy Outlook 2018, March 2018.

Firms were asked to report on the impact of prices of electricity generated from conventional energy sources, such as natural gas and coal, on demand for CSPV cells and modules since January 2012 (table II-11). U.S. producers reported mixed impacts across all sectors, a plurality of importers reported that the impact of the price of conventional energy has fluctuated. Importers *** reported that increased energy costs increased the demand for solar. Purchasers *** similarly report that increased conventional energy prices make solar more competitive. A plurality of purchasers reported that the price of conventionally generated energy has had no impact on any sector but residential, with a majority noting that it has had a fluctuating effect.

Table II-11
CSPV cells and modules: Firms' responses regarding the effect of prices of conventional energy sources, by type of user

* * * * * * *

SUBSTITUTABILITY ISSUES

The degree of substitution between domestic and imported CSPV cells and modules depends upon such factors as relative prices, quality (e.g., grades, standards, defect rates, etc.), and conditions of sale (e.g., price discounts/rebates, lead times between order and delivery dates, reliability of supply, product services, etc.). Based on available data, staff believes that there is a high degree of substitutability between domestically produced CSPV cells and modules and CSPV cells and modules imported from China.

Lead times

U.S. produced CSPV cells and modules are sold primarily from inventories while imports are primarily produced-to-order. U.S. producers reported that *** percent of their commercial shipments were produced-to-order with lead times averaging *** days and that *** percent of the commercial shipments were from inventories with lead times averaging *** days. Importers reported that *** percent of their commercial shipments were produced-to-order with lead times of *** days and *** percent of sales were from U.S. inventories with lead times averaging *** days.

Knowledge of country sources

Eight purchasers indicated they had marketing and pricing knowledge of domestic CSPV cells and modules, six of Chinese product, and nine of product from nonsubject countries. *** reported that ***, *** reported that half-cut and multi-busbar cell modules are not available in the U.S., and *** reported that for the most part n-type modules were largely available from Korea.

As shown in table II-12, most purchasers and their customers “always” make purchasing decisions based on the producer and only two “always” make purchasing decisions based on the country of origin. However, purchasers reported that their customers only “sometimes” or “never” make purchasing decisions based on producer and country origin.

Table II-12
CSPV cells and modules: Purchasing decisions based on producer and country of origin

Purchaser decision	Always	Usually	Sometimes	Never
Purchaser makes decision based on producer	6	2	1	3
Purchaser’s customers make decision based on producer	---	2	7	4
Purchaser makes decision based on country	2	---	4	7
Purchaser’s customers make decision based on country	---	1	7	5

Source: Compiled from data submitted in response to Commission questionnaires.

Factors affecting purchasing decisions

The most often cited top three factors firms consider in their purchasing decisions for CSPV cells and modules were quality, availability, bankability/financial stability, and price, as shown in table II-13. Quality was the most frequently cited first-most important factor (6 firms). Price and availability were the most frequently cited second-most important factors (3 firms each), and price was the most frequently reported third-most important factor (3 firms).

Table II-13
CSPV cells and modules: Ranking of factors used in purchasing decisions as reported by U.S. purchasers, by factor

Factor	First	Second	Third	Total
	Number of Firms			
Quality	6	1	2	8
Price	---	3	3	6
Availability	1	3	---	4
Bankability/financial stability	1	1	1	3
Other[1]	5	5	7	NA

[1] Other includes efficiency, contract, and compatibility for the most important; terms, efficiency, reputation of supplier as second-most important; terms, time of delivery, and product line as third-most important.

Source: Compiled from data submitted in response to Commission questionnaires.

Half of responding purchasers (7 of 13) reported that they "sometimes" purchase the lowest-priced CSPV cells and modules. Very few purchasers (1 of 13) reported that they "always" bought CSPV cells and modules that were offered at the lowest price.

Importance of specified purchase factors

Purchasers were asked to rate the importance of 21 factors in their purchasing decisions (table II-14). The factors rated as "very important" by more than half of responding purchasers include: reliability of supply (noted by 13 purchasers); availability, bankability, price, and product consistency (12 purchasers each); delivery terms (11 purchasers); delivery time and quality meets industry standards (10 purchasers each); warranty and quality exceeds industry standards (9 purchasers each); cell count, cell efficiency and extension of credit (8 purchasers); and technical support/service and discounts offered (7 purchasers each).

Table II-14
CSPV cells and modules: Importance of purchase factors, as reported by U.S. purchasers, by factor

Factor	Very important	Somewhat important	Not important
Reliability of supply	13	---	---
Availability	12	1	---
Bankability	12	1	---
Price	12	1	---
Product consistency	12	1	---
Delivery terms	11	2	---
Delivery time	10	3	---
Quality meets industry standards	10	3	---
Warranty	9	3	---
Quality exceeds industry standards	9	4	---
Cell count	8	3	2
Cell efficiency	8	5	---
Extension of credit	8	3	1
Wattage	7	5	1
Technical support/service	7	4	2
Discounts offered	5	5	3
Minimum quantity requirements	4	4	5
Module racking systems	4	7	2
Product range	4	6	3
U.S. transportation costs	3	10	---
Packaging	1	6	6

Source: Compiled from data submitted in response to Commission questionnaires.

Supplier certification

Ten of 13 responding purchasers require their suppliers to become certified or qualified to sell CSPV cells or modules to their firm. Purchasers reported that the time to qualify a new supplier ranged from 5 to more than 365 days. Six purchasers reported that a domestic or foreign supplier had failed in its attempt to qualify product, or had lost its approved status since January 1, 2012.

Changes in purchasing patterns

Purchasers were asked if they had purchased CSPV cells and modules from China before 2012. The majority of purchasers (8 of 13) reported that they had purchased CSPV cells and modules from China prior to 2012. Purchasers were also asked about changes in their purchasing patterns from different sources since 2012 (table II-15); reasons reported for changes in sourcing included: diversification of sourcing materials and components, increased availability of modules with improved efficiencies becoming available from other countries, and the implementation of antidumping and countervailing duties. Specifically, purchasers dropped suppliers sourcing from China or reduced their purchases from China because of the imposition of antidumping and countervailing duties that increased the price for Chinese modules in the U.S. market. Firms added or increased purchases from nonsubject sources because manufacturers from nonsubject countries entered the U.S. market with price-competitive

options to fill the gap in supply that opened up due to the imposition of antidumping and countervailing duties. Firms also reported changes because of increases in technology and efficiency of modules from other countries.

Table II-15
CSPV cells and modules: Changes in purchase patterns from U.S., subject, and nonsubject countries

Source of purchases	Did not purchase	Decreased	Increased	Constant	Fluctuated
United States	3	---	---	6	4
China	4	3	---	---	4
All other sources	3	---	6	1	3
Sources unknown	6	---	1	2	1

Source: Compiled from data submitted in response to Commission questionnaires.

Importance of purchasing domestic product

As shown in table II-16, 11 of 12 purchasers reported that most or all of their purchases did not require purchasing U.S.-produced product. One reported that domestic product was required by law for their purchases, four reported domestic product was required by their customers for 100 percent of their purchases, and no purchasers reported other preferences for domestic product.

Table II-16
CSPV cells and modules: Importance of purchasing domestic product

Factor	Share of purchases (percent)	Count of firms (number)
Purchases no domestic requirements	***	11
Purchases domestic requirements by law	***	1
Purchases domestic requirements by customers	***	4
Purchases domestic requirements other	***	---
Total	***	12

Source: Compiled from data submitted in response to Commission questionnaires.

Comparisons of domestic products, subject imports, and nonsubject imports

Purchasers were asked a number of questions comparing CSPV cells and modules produced in the United States, subject countries, and nonsubject countries. First, purchasers were asked for a country-by-country comparison on the same 21 factors (table II-17) for which they were asked to rate the importance (table II-13).

Most purchasers reported that U.S. and Chinese CSPV cells and modules are comparable on a majority of factors. A plurality of purchasers reported that U.S. CSPV cells and modules are superior to Chinese CSPV cells and modules on delivery time but inferior with respect to price and product range. Respondent interested parties stated that U.S. manufacturers of CSPV cells

and models have not been able to meet the demanding standard for volumes, warranty, bankability, and quality required by U.S. purchasers in the utility market.[46]

Table II-17
CSPV cells and modules: Purchasers' comparisons between U.S.-produced and imported product

Factor	Number of firms reporting								
	U.S. vs. China			U.S. vs. Nonsubject			China vs. Nonsubject		
	S	C	I	S	C	I	S	C	I
Availability	1	5	5	2	5	3	1	7	2
Bankability[2]	1	7	3	1	8	2	---	11	---
Cell count	---	7	4	1	7	3	1	10	---
Cell efficiency	2	6	3	2	7	2	---	9	2
Delivery terms	2	6	3	2	6	3	---	11	---
Delivery time	5	4	2	4	5	2	---	10	1
Discounts offered	---	7	3	---	6	4	---	9	1
Extension of credit	2	8	1	2	8	1	---	11	---
Minimum quantity requirements	---	8	3	---	8	2	---	11	---
Module racking systems	2	8	1	1	10	---	---	10	1
Packaging	---	10	---	---	10	1	---	11	---
Price	---	3	8	1	3	7	2	8	1
Product consistency	3	6	2	1	8	2	---	10	1
Product range	---	5	6	---	7	4	---	10	1
Quality meets industry standards	1	7	3	2	7	2	---	10	1
Quality exceeds industry standards	1	6	3	2	7	2	---	8	3
Reliability of supply	1	5	5	1	5	4	---	9	2
Technical support/service	3	6	1	3	7	1	---	9	2
Warranty	1	7	1	1	7	3	---	9	2
Wattage	1	7	3	1	7	3	---	10	1
U.S. transportation costs	4	6	1	4	6	1	---	11	---

[1] A rating of superior means that price/U.S. transportation costs is generally lower. For example, if a firm reported "U.S. superior," it meant that the U.S. product was generally priced lower than the imported product.
[2] Bankability is the ability to provide financing for purchases.
Note.--S=first listed country's product is superior; C=both countries' products are comparable; I=first list country's product is inferior.

Source: Compiled from data submitted in response to Commission questionnaires.

Most purchasers reported that U.S. and nonsubject CSPV cells and modules were comparable on the majority of factors. The only factor for which a majority of U.S. purchasers reported U.S. CSPV cells and modules as inferior to nonsubject imports was price. The majority of purchasers also reported that Chinese and nonsubject CSPV cells and modules are comparable on all on reported factors.

[46] Hearing transcript, p. 144 (Singh)

Comparison of U.S.-produced and imported CSPV cells and modules

In order to determine whether U.S.-produced CSPV cells and modules can generally be used in the same applications as imports from China, U.S. producers, importers, and purchasers were asked whether the products can always, frequently, sometimes, or never be used interchangeably. As shown in table II-18, the majority of U.S. producers reported that CSPV cells and modules produced in the United States, China, and nonsubject countries are always interchangeable. A plurality of responding importers reported that U.S cells and modules are frequently interchangeable with Chinese and nonsubject cells and modules, and that nonsubject and Chinese cells and modules are always interchangeable. The majority of responding purchasers reported that U.S., Chinese, and nonsubject CSPV cells and modules are frequently interchangeable.

Table II-18
CSPV cells and modules: Interchangeability between CSPV cells and modules produced in the United States and in other countries, by country pair

Country pair	Number of U.S. producers reporting				Number of U.S. importers reporting				Number of purchasers reporting			
	A	F	S	N	A	F	S	N	A	F	S	N
U.S. vs. subject countries:												
U.S. vs. China	4	3	1	---	12	14	3	3	---	7	3	1
Nonsubject countries comparisons:												
U.S. vs. nonsubject	4	3	1	---	12	12	5	2	---	6	3	1
China vs. nonsubject	4	4	---	---	12	11	6	---	1	6	2	---

Note.--A=Always, F=Frequently, S=Sometimes, N=Never.

Source: Compiled from data submitted in response to Commission questionnaires.

As can be seen from table II-19, 9 of 12 responding purchasers reported that domestically produced product “always” or “usually” meets minimum quality specifications. Similarly 9 of 12 responding purchasers reported that the Chinese CSPV cells and modules “always” or “usually” meets minimum quality specifications. Three purchasers reported that U.S.-produced CSPV cells and modules “rarely” or “never” meet minimum quality standards and two reported that Chinese produced CSPV cells and modules “rarely” or “never” do. Ten purchasers reported that CSPV cells from other countries “usually” meet minimum quality specifications and one reported that they “always” do.

Table II-19
CSPV cells and modules: Ability to meet minimum quality specifications, by source[1]

Source	Always	Usually	Sometimes	Rarely or never
United States	2	7	---	3
China	1	8	1	2
Other	1	10	---	---

[1] Purchasers were asked how often domestically produced or imported CSPV cell and modules meets minimum quality specifications for their own or their customers' uses.

Source: Compiled from data submitted in response to Commission questionnaires.

In addition, U.S. producers, importers, and purchasers were asked to assess how often differences other than price were significant in sales of CSPV cells and modules from the United States, subject, or nonsubject countries. As seen in table II-20, a plurality of U.S. producers, importers, and purchasers indicated that differences other than price were "sometimes" significant when comparing domestic and imported CSPV cells and modules. The most commonly identified factors other than price were availability, product range, quality, reliability of supply, and wattage specifications.

Table II-20
CSPV cells and modules: Perceived importance of factors other than price between product produced in the United States and in other countries, by country pair

Country pair	Number of U.S. producers reporting				Number of U.S. importers reporting				Number of purchasers reporting			
	A	F	S	N	A	F	S	N	A	F	S	N
U.S. vs. subject countries:												
U.S. vs. China	2	1	4	1	7	6	14	6	5	2	6	---
Nonsubject countries comparisons:												
U.S. vs. nonsubject	2	1	4	1	6	10	15	3	3	4	4	---
China vs. nonsubject	1	1	4	1	3	10	13	3	3	2	4	---

Note.--A = Always, F = Frequently, S = Sometimes, N = Never.

Source: Compiled from data submitted in response to Commission questionnaires.

ELASTICITY ESTIMATES

Domestic interested parties agreed with staff's initial estimates of U.S. supply and demand elasticity but offered a different estimate of the elasticity of substitution. Respondent interested parties did not comment on the estimates contained in the prehearing staff report.

U.S. supply elasticity

The domestic supply elasticity for CSPV cells and modules measures the sensitivity of the quantity supplied by U.S. producers to a change in the U.S. market price of CSPV cells and modules. The elasticity of domestic supply depends on several factors, including the level of excess capacity, the ease with which producers can alter capacity, producers' ability to shift to the production of other products, the existence of inventories, and the availability of

alternative markets for U.S.-produced CSPV cells and modules. Analysis of these factors indicates that the U.S. industry has the ability to respond to changes in demand with moderately large to large changes in shipments of CSPV cells and modules to the U.S. market. Staff estimates the supply elasticity for CSPV cells and modules is likely between 4 and 7.

U.S. demand elasticity

The U.S. demand elasticity for CSPV cells and modules measures the sensitivity of the overall quantity demanded to a change in the U.S. market price of CSPV cells and modules. This estimate depends on factors discussed earlier such as the availability substitute products, as well as the component share of CSPV cells and modules in the production of downstream products. As discussed earlier, it is likely that any change in the price level of CSPV cells and modules will result in a large change in the quantity of CSPV cells and modules demanded. Based on available information, the demand elasticity for CSPV cells and modules is likely to be in the range of -0.75 to -1.0.

Substitution elasticity

The substitution elasticity measures how easily purchasers switch from the U.S. product to the subject product (or vice versa) when prices change. This elasticity depends upon the extent of product differentiation between the domestic and imported products and therefore such factors as quality and conditions of sale (e.g., service, availability, delivery). Based on this and other available information, the substitution elasticity between U.S. produced CSPV cells and modules and subject imported CSPV cells and modules is likely to be in the range of 3 to 5. Domestic interested parties believe that the substitution of elasticity ranges from 5 to 7.[47]

[47] Domestic interested parties' posthearing brief, p. 17.

PART III: CONDITION OF THE U.S. INDUSTRY

OVERVIEW

The information in this section of the report was compiled from responses to the Commission's questionnaires. Four U.S. producers of CSPV cells, which are believed to have accounted for *** percent of total 2017 U.S. CSPV cell production capacity,[1] and 11 U.S. producers of CSPV modules, which are believed to have accounted for approximately *** percent of total 2017 U.S. production capacity of CSPV modules,[2] submitted usable questionnaire responses in these five-year reviews.[3]

Firm entries and exits

U.S. CSPV cell producer entries and exits during January 2012–September 30, 2018 (from publicly available data sources) are reported in table III-1, and module producer entries and exits are reported in table III-2. These only include firms that opened or closed manufacturing plants, and do not include changes in production capacity. SunPower announced on October 1, 2018 that it completed its acquisition of certain assets of SolarWorld Americas, including its U.S. manufacturing plant. It plans to transition to producing SunPower's P-Series products at the location, though it is continuing to produce SolarWorld products during the transition period.[4]

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[1] Cell production coverage data are based on reported production capacity of *** and *** of industry-wide capacity including Solaria's 40,000 kW of capacity. ***. Pickerel, Kelly, "Solaria Expands Silicon Valley Manufacturing Line of 330-W Solar Modules," Solar Power World, June 26, 2017, https://www.solarpowerworldonline.com/2017/06/solaria-expands-silicon-valley-manufacturing-line-330-w-solar-modules/, retrieved December 18, 2018; SunPower's U.S. producer questionnaire response; Tesla's U.S. producer questionnaire response.

[2] Module coverage data are based on a comparison of U.S. producers' reported CSPV production capacity in 2017 of *** and industry-wide total capacity of *** (based on end of the 2017 capacity for firms that did not submit usable questionnaire responses of ***) (see table III-8).

[3] The four U.S. producers of cells that submitted a usable response to the Commission's questionnaire include Mission, Panasonic, SolarWorld, and Suniva. However, cell data for Panasonic are not included in the aggregate data presented in this section of the report because there was no commercial production by Panasonic prior to July 1, 2018. The responding 11 U.S. producers of modules that submitted a usable response to the Commission's questionnaire include Auxin Solar, Heliene USA, Kyocera, Merlin, Mission, Panasonic, SBM Solar, SolarTech Universal, SolarWorld, Suniva, and Wanxiang. Three U.S. firms (***) provided responses to the Commission's questionnaire with unusable data. ***.

[4] SunPower, "SunPower Begins a New Chapter in American Solar Manufacturing," News release, October 1, 2018, http://newsroom.sunpower.com/2018-10-01-SunPower-Begins-A-New-Chapter-in-American-Solar-Manufacturing, retrieved December 18, 2018.

Table III-1

CSPV cells: U.S. firms with CSPV production facilities opening and/or closing, January 2012-November 30, 2018

Company	State	Opening year	Closing year	Notes
Plants open as of November 30, 2018				
Panasonic	NY	2018	Not applicable	
Solaria	CA	Not available	Not applicable	
SolarWorld	OR	Prior to 2012	Not applicable	
SunPower	CA	2017	Not applicable	SunPower started production of cells in California in 2017. This is a pilot production line.
Closed plants				
Mission Solar	TX	2014	2016	
Solar Power Industries	PA	Prior to 2012	2012	
Suniva	GA	Prior to 2012	2017	
Transform Solar	ID	Prior to 2012	2012	
Twin Creeks Technologies	MS	Prior to 2012	2012	
Status not available from public sources				
Tesla	CA	2015	Status not available	

Notes.--This table is based on publicly available information. Information on producers of off-grid products, such as consumer electronic products or solar generators, is not included. In addition, it does not include changes in production capacity at existing plants.

Sources: Compiled from publicly available information and *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. III-2–III-3.

Table III-2

CSPV modules: U.S. firms with CSPV production facilities opening and/or closing, January 2012-November 30, 2018

Company	State	Start year	Year closed	Notes
Plants open as of November 30, 2018				
Auxin Solar	CA	Prior to 2012	Not applicable	
CBS Solar	MI	2013	Not applicable	
Heliene	MN	2015	Not applicable	Heliene initially started production at a plant owned by SimpleRay in Minnesota, with this production lasting less than one year. From mid-2016, Silicon Energy produced modules for Heliene at its Minnesota plant. Following the closure of Silicon Energy's plant in 2017, Heliene took over the lease and began manufacturing its modules in Minnesota. The plant was shut down for a period in 2018 for retooling.
Itek Energy	MN	2014	Not applicable	There have been no announcements regarding this plant since Silfab's investment in Itek.
Jinko Solar	FL	2018	Not applicable	
Merlin Solar	CA	2016	Not applicable	
Mission Solar	TX	2014	Not applicable	
Panasonic/ Tesla	NY	2017	Not applicable	Opening date is for module production by Panasonic. Tesla is not yet producing roof tiles in commercial quantities.
PowerFilm	IA	2018	Not applicable	
Prism Solar	NY	Prior to 2012	Not applicable	
SBM Solar	NC	Prior to 2012	Not applicable	
Seraphim Solar	MS	2016	Not applicable	
Silfab Solar/Itek Energy	WA	Prior to 2012	Not applicable	This plant was built in 2017 by Itek Energy, and replaced a smaller facility. In August 2018, Itek and Silfab announced a $40 million Silfab investment in Itek. Silfab indicated that it plans to add a second line to more than double capacity to 350 MW.
Solaria	CA	Prior to 2012	Not applicable	
Solartec Energia	TX	2014	Not applicable	For Solartec, opening is based on the announcement date. The date on which it began production is not readily available.
SolarTech Universal	FL	2015	Not applicable	
SolarWorld	OR	Prior to 2012	Not applicable	
Sunergy California	CA	2018	Not applicable	
SunSpark Technology	CA	2015	Not applicable	
Wanxiang New Energy	IL	Prior to 2012	Not applicable	

Table continued on next page.

Table III-2—Continued

CSPV modules: U.S. firms with CSPV production facilities opening and/or closing, January 2012-November 30, 2018

Company	State	Start year	Year closed	Notes
Closed plants				
1Soltech	TX	Prior to 2012	2014	
Advanced Solar Photonics	FL	Prior to 2012	2013	
Alternative Energies Kentucky	KY	Prior to 2012	2013	
Flextronics/ SunPower	CA	Prior to 2012	2016	SunPower partnered with contract manufacturer Flextronics to produce modules. The exact date when this manufacturing ended is not publicly available, but it was no longer listed among SunPower's manufacturing locations in its financial report for the year ending January 1, 2017.
Helios	WI	Prior to 2012	2013	
Isofoton	OH	2012	2013	
Kyocera	CA	Prior to 2012	2013	
Mage Solar	GA	Prior to 2012	2015	The exact closing date is not available, but by 2015, the firm was reportedly no longer manufacturing.
Motech	DE	Prior to 2012	2013	
MX Solar	NJ	Prior to 2012	2012	
Navajo Universal	AZ	2013	2017	
NuSun	IN	2012	2014	
PureSolar	WA	2017	2018	
Schott Solar	NJ	Prior to 2012	2012	
Sharp	TN	Prior to 2012	2014	
Silicon Energy	MN	Prior to 2012	2017	
	WA	Prior to 2012	2016	
Solar Power Industries	PA	Prior to 2012	2012	
Solartech Renewables	NY	Prior to 2012	2014	
SolarWorld	CA	Prior to 2012	2012	
Suniva	GA	Prior to 2012	2015	
	MI	2014	2017	
Suntech	AZ	Prior to 2012	2013	
tenKsolar	MN	Prior to 2012	2017	

Table continued on next page.

Table III-2—Continued

CSPV modules: U.S. firms with CSPV production facilities opening and/or closing, January 2012-November 30, 2018

Company	State	Start year	Year closed	Notes
Status not available from public sources				
Nu-Cell	LA	Prior to 2012	Status not available	
Tesla	CA	2015	Status not available	

Notes.--This table is based on publicly available information. Information on producers of off-grid products is not included. In addition, it does not include changes in production capacity at existing plants. Two companies, German Solar USA and Upsolar, indicate that their products are made in the United States, but they are not included in the table since a U.S. production location for these products could not be identified. In addition, Perlight previously indicated that some of its modules were made in Texas, but this is not currently listed on their website as a manufacturing location was not available. Amerisolar, CertainTeed, Colored Solar, and Lumos Solar offer U.S. manufactured products, but media reports or company websites indicate that these are produced by an OEM. Beamreach had a pilot PV production line in California.

Sources: Compiled from publicly available information and *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. III-2–III-3.

Since the beginning of 2018, six firms have announced plans to open module plants (table III-3). One of the firms also plans to produce cells. Announced changes in production capacity are not included in table III-3.

Table III-3

CSPV cells and modules: Announced new CSPV production facilities

Company	Announcement date	Expected online date	Location	Product	Capacity (MW)	Notes
GreenBrilliance	July 2018	Not available	MD	Modules	125	
Hanwha	May 2018	2019	Dalton, GA	Modules	>1,600	
Heliene	Not available	November 2018	Sheridan, OR	Modules	75	Re-open former plant at federal prison that previously produced for Suniva
Jinko	January 2018	Started pilot production, ramp to full production in early 2019	Jacksonville, FL	Modules	400	
LG	June 2018	Early 2019	Huntsville, AL	Modules	500	Two production lines at location where LG makes other products
Sunpreme	September 2018	Early 2019 (first phase)	TX	Cells and modules	400	First phase is 136 MW, with an additional 260 MW possible later in 2019

Note.--This table is based on publicly available information. Information on producers of off-grid products, such as consumer electronic products or solar generators, is not included. In addition, this table does not include changes in production capacity at existing plants. Other firms have indicated plans to open new plants, as well, but have not set expected times for the plants to become operational. As of January 2018, one report indicated that Solaria was looking for a location for a new plant in the United States. SolarTech Universal planned to start production at a new plant in Puerto Rico, but following hurricane Maria decided to expand in South Florida instead. As of May 2018, the firm was looking for a site in South Florida. United Renewable Energy, which will be formed by the merger of three Taiwanese producers (Neo Solar Power, Gintech Energy Corp., and Solartech Energy Corp.), is also considering a U.S. manufacturing plant. This potential plant is not included here since details and a production location have not been finalized.

Sources: Compiled from publicly available information.

Reported changes experienced by the industry

In the U.S. producers' questionnaire, domestic producers were asked to indicate whether their firm had experienced any plant openings, relocations, expansions, acquisitions, consolidations, closures, or prolonged shutdowns because of strikes or equipment failure; curtailment of production because of shortages of materials or other reasons, including revision of labor agreements; or any other change in the character of their operations or organization relating to the production of CSPV cells and modules since 2012. Eight of the ten domestic producers of cells and modules that provided responses in these reviews indicated that they had experienced such changes; their responses are presented in table III-4.

Table III-4
CSPV cells and modules: U.S. producers' reported changes in operations since January 1, 2012

* * * * * * *

Anticipated changes in operations

The Commission asked domestic producers to report anticipated changes in the character of their operations relating to the production of CSPV cells and modules. Their responses appear in table III-5.

Table III-5
CSPV cells and modules: Anticipated changes in the character of U.S. operations

* * * * * * *

U.S. PRODUCTION, CAPACITY, AND CAPACITY UTILIZATION

CSPV cells

Five U.S. producers of CSPV cells are profiled below, inclusive of their module assembly operations, as applicable.

U.S. producer profiles[5]

Mission Solar Energy

Mission Solar Energy ("Mission Solar") is headquartered in San Antonio, Texas and is a fully-owned subsidiary of OCI Solar Power.[6] Mission Solar produced n-type monocrystalline (including bifacial) CSPV solar cells *** and assembled modules with mono and mono-PERC cells in both 60-cell and 72-cell formats for residential, commercial, and utility markets ***.[7]

The company opened its manufacturing plant in San Antonio, Texas, in 2014 with *** of cell capacity and *** of module capacity.[8] Cell production capacity *** and module production capacity ***. In September 2016, however, Mission Solar closed its n-type mono PV cell production lines and then ***. Mission Solar stated that it closed its cell line because "***." Other reports noted that Mission Solar faced technical challenges producing n-type cells, and had difficulty ramping up production. Following the closure of cell production, Mission Solar has continued module assembly with PV cells imported from Asia (***).[9] Mission Solar's module production totaled *** in calendar year 2017, and ***.[10]

Solaria

Solaria is the only U.S. cell manufacturer active in 2017 that did not provide a questionnaire response. The firm expected to have 40 MW of U.S. cell and module capacity in

[5] Historical information in this section is derived from *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, pp. I-5 to I-8 and III-9 to III-17, with updates added from information collected in these reviews.

[6] OCI Solar Power is a subsidiary of OCI Enterprises, the North American subsidiary of OCI Company, Ltd. (Korea). Mission Solar was formerly known as Nexolon America when it was a joint venture of OCI Solar Power and Texas-based CPS Energy.

[7] Mission Solar's producer questionnaire response, I-2.

[8] Mission Solar's producer questionnaire response, II-5 and II-9.

[9] Mission Solar's importer questionnaire response, II-7a.

[10] Mission Solar's producer questionnaire response, II-9.

Fremont, California at the end of 2017. It has additional production capacity in Korea, and also licenses its technology.[11]

SolarWorld Americas Inc.

SolarWorld Americas Inc. ("SolarWorld"), headquartered in Hillsboro, Oregon, produced *** CSPV cells and CSPV modules during 2012-17. SolarWorld previously had a module plant in Camarillo, California. In October 2011, module production ceased at this facility and the work was transferred to its Hillsboro location. SolarWorld *** (see table III-4).

SolarWorld's Hillsboro, Oregon plant opened in 2008 with operations dedicated to growing crystals and producing wafers and CSPV cells. In 2010, SolarWorld added 350 MW of module production to become the first fully integrated monocrystalline plant in the Americas.[12] In addition to the transfer of its Camarillo, California work in 2011, SolarWorld ***, and expanded cell capacity to 435 MW and module assembly to 530 MW in 2014. In 2016, SolarWorld added a 150 MW assembly line to produce 72-cell format modules to supply the utility market. The firm reported that production at this line *** (see table III-4).

SolarWorld reported nameplate production capacity of *** for modules and *** for cells in 2017.[13] On October 1, 2018, SunPower[14] announced that it completed its acquisition of certain assets of SolarWorld Americas, including its U.S. manufacturing plant. It plans to transition to producing SunPower's P-Series products at the location, though it is continuing to

[11] Roselund, Christian, "Solaria Raises $23 Million, Will Triple Manufacturing Capacities," *PV Magazine*, January 11, 2018, https://pv-magazine-usa.com/2018/01/11/solaria-raises-23-million-will-expand-manufacturing-capacities/, retrieved December 18, 2018; Pickerel, Kelly, "Solaria Expands Silicon Valley Manufacturing Line of 330-W Solar Modules," *Solar Power World*, June 26, 2017, https://www.solarpowerworldonline.com/2017/06/solaria-expands-silicon-valley-manufacturing-line-330-w-solar-modules/, retrieved December 18, 2018; Pickerel, Kelly, "China-based DAS Solar to Manufacture Solaria Modules for Distribution in Asian markets," *Solar Power World*, November 6, 2018, https://www.solarpowerworldonline.com/2018/11/china-based-das-solar-to-manufacture-solaria-modules-for-distribution-in-asian-markets/, retrieved December 18, 2018.

[12] An additional 150 MW of module capacity was in place at its Camarillo plant, for a total of 500 MW.

[13] SolarWorld's producer questionnaire response, II-5 and II-9.

[14] SunPower Corporation ("SunPower"), headquartered in San Jose, California, also separately produced cells and modules on a smaller scale during 2012–18. ***. SunPower also a partnered with Flextronics in the production of CSPV modules in Milpitas, California. CSPV module output at this facility during 2012-16 totaled ***, but output ***. SunPower moved module production from the Milpitas, California facility to its other manufacturing facilities, stating that the shift of production occurred because the plant was not adequately scaled. SunPower's producer questionnaire response.

produce SolarWorld products during the transition period.[15] SolarWorld reports that it recently "***." SolarWorld noted that "***."[16]

Suniva

Suniva, headquartered in Norcross, Georgia, produced *** CSPV cells and CSPV modules. Suniva was founded in 2007 as a producer of CSPV cells based on the work of the Georgia Institute of Technology's University Center of Excellence in Photovoltaics. In 2015, Shungfeng International Clean Energy acquired approximately 63 percent of Suniva.

Suniva started CSPV cell production in Norcross, Georgia, in November 2008 with capacity of 32 MW. An additional 64 MW line was added in 2009. In July 2010, Suniva further expanded capacity to 170 MW by adding a third cell line.

In July 2011, Suniva announced it would expand its CSPV module R&D and assembly capabilities by September 2011, with an initial capacity of 25-30 MW at the Georgia plant. Suniva further expanded module assembly capacity in 2013 to produce Buy American Act compliant modules. Suniva expanded production with the opening of a *** module assembly facility in Saginaw, Michigan ***.[17]

In July 2016, Suniva expanded production for cells and modules with power ratings up to 300W (60-cell format) and 350W (72-cell format) at its Norcross facility. Suniva completed an additional expansion in December 2016 to bring the Norcross, Georgia plant capacity for cells and modules up to 450 MW.

Suniva ***, citing *** that "***." Suniva has indicated *** since 2017, as it has ceased operations under Chapter 11 bankruptcy reorganization. ***.[18]

Tesla/Panasonic

Tesla is a U.S. producer of electric vehicles and alternative energy solutions, such as solar modules and battery-powered back-up storage units. Tesla has a factory in Buffalo, New York to produce ***. Tesla has a build-to-suit lease arrangement with the Research Foundation for the State University of New York (Foundation).[19] As part of this arrangement, the Foundation constructed the solar cell and panel manufacturing facility and will own the facility

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[15] SunPower, "SunPower Begins a New Chapter in American Solar Manufacturing," News release, October 1, 2018, http://newsroom.sunpower.com/2018-10-01-SunPower-Begins-A-New-Chapter-in-American-Solar-Manufacturing, retrieved December 18, 2018.

[16] SolarWorld's producer questionnaire, II-2a.

[17] Suniva's producer questionnaire, II-2a.

[18] Suniva's producer questionnaire, II-2a.

[19] As part of this arrangement Tesla is required to meet certain operational milestones during the 10-year lease period, including meeting employment level requirements and spending or incurring $5 billion in capital, operational expenses, and other costs in New York State. Failure to meet these requirements would lead to a $41.2 million "program payment" to the Foundation for each year that Tesla failed to meet the specified milestones.

and any manufacturing equipment purchased by the Foundation. Tesla will lease the manufacturing facility and equipment for an initial 10-year period, with an option to renew.[20] Tesla initially produced cells and modules at a Fremont, California facility, which opened in 2014.[21]

In December 2016, Tesla entered into an agreement with Panasonic to manufacture CSPV cells and modules at the Buffalo, New York plant while Tesla manages factory operations and produces solar roof tiles.[22] Panasonic ***, and in the first half of 2018 *** and had a production capacity of ***. All module shipments have been of ***.[23] Panasonic ***.[24]

In regard to its solar roof tiles production, Tesla said in its third quarter 2018 earnings call "that its volume production ramp at Gigafactory 2 would occur in the 'first half of 2019,' compared to the previous quarter guidance that the ramp would happen 'near the end of 2018.' The company noted that the latest delay was due to the 'complexity of Solar Roof,' and the need to make further design modifications to improve the installation process."[25]

U.S. CSPV cell capacity, production, and capacity utilization

Reported data[26] show that, from 2012 to 2016, total U.S. production of CSPV cells increased by *** percent from *** to ***, with *** largely driving the upward trend (table III-6 and figure III-1). However, U.S. production of CSPV cells declined by *** percent to ***, and production in the first half of 2018 was *** percent lower than reported in the first half of 2017, as (1) SolarWorld *** in 2017, (2) Mission closed its cell production line in September 2016, and (3) Suniva *** as part of its Chapter 11 bankruptcy reorganization.

[20] Tesla will pay the Foundation $2.00 annually plus utilities for the lease of the plant.

[21] Tesla acquired SolarCity in 2016, who was working at its location in Fremont, California, to develop higher efficiency cells and modules in-house through its subsidiary, Silevo, which it had acquired in 2014. As noted in table III-1 above, Tesla was moving production from its initial Fremont, California plant to Buffalo, New York as of the fourth quarter of 2017. Tesla reported in these five-year reviews that it ***. Email from ***, December 7, 2018.

[22] In 2017, Tesla announced a new product, SolarRoof, which are tiles that incorporate solar cells. Tesla's production of SolarRoof at its Buffalo, New York, facility ***. Tesla's producer questionnaire, IV-28. Tesla noted that it is "***." Email from ***, December 7, 2018.

[23] Panasonic's producer questionnaire, II-9, II-12, and II-13.

[24] Panasonic's producer questionnaire, II-7.

[25] Osborne, Mark, "Tesla Peaks at 93MW of Solar Installations for 2018 as Roof Tile System Delayed Again," *PV Tech*, October 24, 2018, https://www.pv-tech.org/news/tesla-peaks-at-93mw-of-solar-installations-for-2018-as-roof-tile-system-del, retrieved December 18, 2018.

[26] Four U.S. firms (***) reported capacity and production data for CSPV cells; however, ***.

Table III-6
CSPV cells: U.S. producers' capacity and production, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Figure III-1
CSPV cells: U.S. producers' capacity, production, and capacity utilization, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Total U.S. cell capacity, which was *** percent lower in 2017 than in 2012, increased by *** percent from *** in 2012 to *** in 2013, but fell to *** in 2014 as ***. Total domestic CSPV cell capacity then increased by *** percent from *** in 2014 to *** in 2015 as Mission Solar ***, as SolarWorld ***, and as Suniva ***.[27] Average capacity utilization of responding domestic CSPV cell producers fluctuated upward from *** percent in 2012 to *** percent in 2016, before declining to *** percent in 2017. Domestic cell capacity utilization was *** percent in January-June 2017 and *** percent in January-June 2018.

Constraints on capacity

All domestic producers of CSPV cells indicated that they do not switch production capacity between CSPV cells and other products using the same equipment and/or labor. None of the domestic producers otherwise noted constraints that limit their capacity to produce CSPV cells.

CSPV modules

U.S. CSPV module capacity, production, and capacity utilization

Eleven U.S. firms reported usable capacity and production data for CSPV modules in this proceeding.[28] The largest responding U.S. assemblers of CSPV modules are ***, accounting for

[27] Tesla ***, but the company's data are not reflected in the table presentation for CSPV cells because only non-commercial production of CSPV cells was reported and the firm's data responses to the Commission's producer questionnaire in these reviews were unusable.

[28] In the Commission's 2017 Section 201 investigation on CSPV products (*CSPV 3*), producer questionnaire responses containing usable data were received from 16 firms that were believed to have accounted for approximately 63.9 percent of U.S. module assembly during 2016. Domestic module assemblers that responded in *CSPV 3* but did not respond with a usable questionnaire response in this proceeding include ***. *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, p. I-54 and table III-7.

*** and *** percent of reported U.S. module assembly, respectively, during 2017 (see part I, table I-7). Reported data show that total U.S. assembly of CSPV modules increased overall from *** in 2012 to *** in 2016, before declining to *** in 2017, a level that was *** percent higher in 2017 than that reported in 2012 (table III-7 and figure III-2). Domestic producers' capacity to assemble modules in the United States increased from *** in 2012 to *** in 2016, before declining to *** in 2017, a level in 2017 that was *** percent higher than that reported in 2012. Average capacity utilization of domestic CSPV module assemblers fluctuated between a low of *** percent in 2017 to a period high of *** percent in 2015.

Table III-7
CSPV modules: U.S. producers' capacity and production, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Figure III-2
CSPV modules: U.S. producers' capacity, production, and capacity utilization, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

In addition to the 11 firms that provided usable questionnaire data, there are 11 plants that also have commercial module production as of November 2018. Combined production capacity at these plants is 1,660,150 kW (table III-8). The largest plants are Sunergy California (600,000 kW), Jinko Solar (400,000 kW, started plot production in November 2018), Seraphim Solar (160,000 kW, in the process of expanding to 500,000 kW), Silfab Solar (150,000 kW), and SunSpark Technology (150,000 kW).

For purposes of comparison, producer data collected from questionnaire responses for calendar years 2012-16 in the Commission's Section 201 investigation are presented in appendix C. The questionnaire response submitted by Tesla in these five-year reviews reported *** and, therefore, are not included in the data presentations in this report.

Table III-8

CSPV modules: Production capacity, end of 2017 and November 2018, for firms that did not provide usable questionnaire responses

Company	Production Location	Capacity, end of 2017 (kW)	Capacity, November 2018 (kW)	Notes
CBS Solar	Copemish, MI	10,000	10,000	
Itek Energy	Minneapolis, MN	60,000	60,000	With the Silfab investment in Itek, the status of this plant is not clear.
Jinko Solar	Jacksonville, FL	Not open	400,000	Jinko Solar started pilot production in 2018. Production capacity is for plant when fully ramped.
Powerfilm	Ames, IA	***	***	Production capacity of *** in 2017, increasing to *** in the first half of 2018.
Prism Solar	Highland, NY	***	***	***. The company employed 30 people as of February 2018.
PureSolar	Tumwater, WA	10,000	Plant closed	The exact closing data of PureSolar is not available, but as of March 2018 its equipment was up for auction. Capacity is the maximum expected first year capacity.
Seraphim Solar USA	Jackson, MS	160,000	160,000	Temporarily stopped production in October 2018 to install tools to make new products and increase production capacity to 500 MW. Jiangsu Seraphim Solar was an initial investor in the company, but Seraphim Solar USA is an independent company.
Silfab Solar	Bellingham, WA	150,000	150,000	The plant was built in 2017 by Itek Energy, and replaced a smaller Itek plant in Washington. In August 2018, Itek and Silfab announced a $40 million Silfab investment in Itek. As a result of this investment, Silfab will own the plant, but both Silfab and Itek products will be produced there. Silfab indicated that it plans to add a second line to more than double capacity to 350 MW.
Solaria	Fremont, CA	40,000	40,000	
Solartec Energia	Houston, TX	30,000	30,000	Mexico-based company that also has production in Mexico.
Sunergy California	McClellan Park, CA	Not open	600,000	Started production in 2018. Subsidiary of Chinese firm CSUN.
SunSpark Technology	Riverside, CA	150,000	150,000	Subsidiary of Chinese firm Yiheng Science & Technology Co. Ltd. (China)
Total		***	***	

Note.--This table only includes currently open plants and does not include plants that closed during 2017 or in prior years. Does not include SunStream, which produces off-grid products. ***.

Sources: Compiled from data submitted in response to Commission questionnaires, *** data for Prism Solar, and publicly available information.

Cell content of U.S.-produced modules

The Commission requested that domestic CSPV module producers provide data concerning the source of the CSPV cells from which their modules were produced. These data show that during the period of review, the domestic cell content for U.S.-produced modules increased from *** percent in 2012 to *** percent in 2014, but declined to *** percent in 2017 (table III-9). The domestic cell content for U.S.-produced modules was *** percent and *** percent in the first half of 2017 and 2018, respectively.

Table III-9
CSPV cells and modules: U.S. producers' module assembly by source of CSPV cell, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. PRODUCERS' SHIPMENTS

CSPV cells

The quantity and value of U.S. producers' total CSPV cell shipments increased overall by *** percent and *** percent from 2012 to 2015, respectively, before declining by *** percent and *** percent from 2015 to 2017, respectively (table III-10). The quantity and value of U.S. producers' total CSPV cell shipments were *** percent and *** percent lower in the first half of 2018 compared with the first half of 2017, respectively. Similar trends were observed for U.S. producers' U.S. CSPV cell shipments, as they comprise the overwhelming majority of U.S. producers' total CSPV cell shipments (*** percent in 2017). The unit value of U.S. producers' total U.S. shipments fluctuated downward from a high of $*** per kW reported in 2012 to an annual low of $*** per kW reported in 2017, a net decline of *** percent. The unit value of U.S. producers' total U.S. shipments was even lower at $*** per kW reported in January-June 2018. Most (*** percent in 2017) of the U.S. producers' total shipments of CSPV cells are internally consumed in the United States, with the majority of the balance (*** percent in 2017) being consumed by related firms outside the United States. Relatively few CSPV cells produced in the United States are sold commercially. In fact, during 2017, *** percent of U.S. producers' total shipments were commercially shipped in the United States and *** percent were exported to unrelated firms.

Table III-10
CSPV cells: U.S. producers' U.S. shipments, exports shipments, and total shipments of cells, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

CSPV modules

The total shipment quantity of CSPV modules assembled in the United States declined from *** in 2012 to *** in 2013, increased each year thereafter until reaching *** in 2016, then declined to *** in 2017, a level that was *** percent higher than that reported in 2012 (table III-11). The value of total module shipments declined from $*** in 2012 to $*** in 2013, increased to $*** in 2016, and declined to $*** in 2017, a level that was *** percent lower than that reported in 2012. The quantity and value of U.S. producers' total CSPV module shipments were *** percent and *** percent higher in the first half of 2018 compared with the first half of 2017, respectively. The average unit value of total shipments fluctuated downward from a high of $*** per kW reported in 2012 to a low of $*** per kW reported in 2017, representing a *** percent decline in average unit values. The unit value of U.S. producers' total U.S. shipments of CSPV modules was $*** per kW in January-June 2018. Most U.S. producers' shipments (*** percent in 2017) of CSPV modules are shipped commercially in the United States, with a relatively minor amount that are internally consumed in other products or exported outside the United States. Transfers to related firms in the United States, which accounted for *** percent of aggregate total shipments in 2016 but only *** percent in 2017, largely represented ***.

Table III-11
CSPV modules: U.S. producers' U.S. shipments, export shipments, and total shipments of modules, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. commercial shipments, by configuration

The Commission requested that domestic CSPV module producers provide commercial U.S. shipment data by configuration, as well (table III-12). These data show that during 2012, most (*** percent of U.S. producers' commercial U.S. shipments of modules were of the 60-cell configuration. The share held by 60-cell configuration modules dropped to *** percent in 2016, but increased to *** percent in 2017. The shares held by 60-cell configuration modules were *** percent in the first half of 2017 and *** percent in the first half of 2018.

Table III-12
CSPV modules: U.S. producers' commercial U.S. shipments, by configuration, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

The majority of the remaining share of U.S. producers' commercial U.S. shipments of modules was of the 72-cell configuration, accounting for a *** percent share in 2017. Other configurations accounted for a relatively minor share from 2012-17, accounting for *** percent in 2017. The larger share of U.S. commercial shipments held by configurations other than 60- and 72-cell modules in the first half of 2018 (*** percent) reflects shipments of ***.

U.S.-origin U.S. shipments for apparent consumption

Apparent U.S. consumption consists of the sum of U.S. producers' U.S. shipments of CSPV cells and modules and U.S. imports of CSPV cells and modules. As shown in table III-13, the U.S. producers' shipments component of apparent U.S. consumption by quantity (in kW) reflects U.S. producers' U.S. shipments of (1) modules that contain U.S.-produced CSPV cells, (2) U.S.-produced CSPV cells that are otherwise not reported by module assemblers, and (3) re-imports of U.S.-origin CSPV cells. This quantity measure excludes any CSPV modules produced in the United States from imported CSPV cells, as those are reported for the purposes of apparent U.S. consumption as imports. However, the U.S. component for value does include the incremental value added in the United States for the module assembly of foreign-origin CSPV cells. The apparent U.S. consumption data that incorporate this U.S. component are presented separately in Part I of this report (table I-11).

Table III-13
CSPV cells and modules: U.S.-origin U.S. shipments for apparent consumption of cells and modules, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. PRODUCERS' INVENTORIES

CSPV cells

All three firms that reported U.S. commercial production of CSPV cells indicated in their questionnaire responses that they maintained inventories at yearend; the ratio of these inventories to shipment and production levels declined from 2012 to 2017, equaling *** percent of production, *** percent of U.S. shipments, and *** percent of total shipments in 2017 (table III-14).

Table III-14
CSPV cells: U.S. producers' cell inventories, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

CSPV modules

All but three of the 11 firms that reported assembly of CSPV modules in the United States indicated in their questionnaire responses that they maintained inventories during at least part of the period from January 2012 to June 2018. These data are presented in table III-15. U.S. module assemblers' end-of-period inventories, as well as the ratios of inventories to shipment and production amounts, declined from 2012 to 2014, but increased in 2015 and 2016, before declining in 2017 to a level lower than reported in 2012. Inventories and the ratios

Table III-15
CSPV modules: U.S. producers' module inventories, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

of inventories to shipment and production amounts were lower in the first half of 2018 compared with the same period in 2017. The ratio of inventories to U.S. assembly operations equaled *** percent in 2017 and the ratio of inventories to U.S. and total shipments of modules equaled *** and *** percent in 2017, respectively.

CSPV cells and modules combined

U.S. producers' inventories of CSPV cells and CSPV modules combined are presented in table III-16. U.S. producers' end-of-period inventories declined by *** percent from 2012 to 2014, but increased by *** percent from 2014 to 2016, before declining in 2017 to a level that was *** lower than reported in 2012. CSPV cell and module inventories held by U.S. producers were *** percent lower in the first half of 2018 compared with the same period in 2017. The ratio of inventories to U.S. and total shipments of modules equaled *** percent and *** percent in 2017, respectively.

Table III-16
CSPV cells and modules: U.S. producers' cell and module inventories, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. PRODUCERS' IMPORTS

Eleven responding U.S. producers of CSPV cells and/or modules reported direct imports of CSPV cells and/or modules since January 1, 2012. The most often cited reasons for imports by U.S. producers include the following: ***.

U.S. imports by domestic CSPV cell producers

Table III-17 presents data on individual U.S. producers' U.S. imports of CSPV cells and U.S. production of cells and the reasons each domestic CSPV cell producer cited for such imports.

Table III-17
CSPV cells: U.S. cell producers' U.S. imports, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. imports by domestic CSPV module producers

Table III-18 presents data on individual U.S. module producers' U.S. imports of CSPV cells and modules and U.S. production of CSPV modules and the reasons each domestic CSPV module producer cited for such imports.

Table III-18
CSPV modules: U.S. module producers' U.S. imports, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

U.S. PRODUCERS' PURCHASES

One of the 11 responding U.S. producers indicated that it domestically purchased CSPV cells or modules since January 1, 2012. U.S. producer *** reported that it domestically purchased ***.

U.S. EMPLOYMENT, WAGES, AND PRODUCTIVITY

CSPV cells

The overall number of production and related workers ("PRWs") employed by the three firms reporting CSPV cell operations in Commission producers' questionnaire responses[29] declined from *** PRWs in 2012 to *** PRWs in 2014, increased to *** PRWs in 2016, then declined to *** in 2017, which was *** percent lower than the level reported in 2012 (table III-19). The overall number of PRWs was lower at *** during the first half of 2018 compared to the same period in 2017. The general declines in CSPV cell employment during the period of review are consistent with the decreases in U.S. production of CSPV cells from 2012 to 2017. Similar to the level of PRWs employed by the domestic industry producing CSPV cells, the total number of hours worked and wages paid declined overall from 2012 to 2017 and were lower in the first half of 2018 compared with the same period in 2017. Hourly wages and productivity were higher during 2017 than reported in 2012 by *** percent and *** percent, respectively, whereas unit labor costs were *** percent lower.

Table III-19
CSPV cells: U.S. cell producers' employment related data, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

[29] Four U.S. firms (***) reported employment data for CSPV cells; however, ***.

CSPV modules

The employment-related indicators for U.S. producers of modules fluctuated during the period of investigation (table III-20). The overall number of PRWs employed by domestic CSPV module producers as reported in Commission questionnaire responses declined from *** in 2012 to *** in 2014, increased to *** in 2016, but declined to *** in 2017, a level that was *** percent lower than that reported in 2012. The overall number of PRWs was lower at *** in the first half of 2018 compared to the same period in 2017. The number of hours worked and wages paid followed the same general fluctuating trend, declining overall from *** to *** and $*** to $***, from 2012 to 2017, respectively. Hourly wages fluctuated between a high of $*** in 2013 to a low of $*** in 2015. Unit labor costs declined from 2012 to 2016, but increased in 2017 to a level that was *** percent below than that reported in 2012, whereas productivity increased from 2012 to 2016, but declined in 2017 to a level that was *** percent higher than that reported in 2012.

Table III-20
CSPV modules: U.S. module producers' employment related data, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

CSPV cells and modules combined

The employment-related indicators for U.S. producers of modules and cells combined are presented in table III-21. As was the case with the employment-related indicators for CSPV modules, the combined data for cells and modules fluctuated during the period of review. The overall number of PRWs employed by domestic CSPV cell and module producers combined as reported in Commission questionnaire responses declined from *** in 2012 to *** in 2014, increased to *** in 2016, and declined to *** in 2017, a level that was *** percent lower than that reported in 2012 (table III-21). The overall number of PRWs were lower at *** in the first half of 2018 as compared to the first half of 2017. The number of hours worked and wages paid followed the same general trend, declining overall from *** to *** and $*** to $***, respectively, from 2012 to 2017. Hourly wages and hours worked per PRW fluctuated throughout the period examined.

Table III-21
CSPV cells and modules: U.S. cell and module producers' employment related data, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

FINANCIAL EXPERIENCE OF U.S. PRODUCERS

BACKGROUND

CSPV producers' financial results, as presented in this section of the report, are divided into two primary categories: operations of CSPV cell producers and CSPV module producers. The financial results on U.S.-produced CSPV cell operations, which include only commercial sales and transfers, reflect ***.[30] [31] [32] The financial results on U.S.-produced module operations reflect ***.[33] [34] [35] [36] [37]

As described earlier in this report, several U.S. producers effectively began their cell and module operations during the period examined, while several others exited and/or substantially modified their operations. During the period, SolarWorld *** and Suniva ***, as detailed earlier in tables III-4, III-6, and III-7.

OPERATIONS ON CSPV PRODUCTS

Tables III-22 and table III-23, respectively, present income-and-loss data for cell operations (commercial sales and transfers) and corresponding changes in average cell per kilowatt values. Income-and-loss data for module operations are presented in table III-24 and table III-25 presents corresponding changes in module average per kilowatt values. Appendix E

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[30] The majority of cells produced by *** were internally consumed in the production of modules and are therefore reflected as part of module cost of goods sold ("COGS"); e.g., ***. U.S. producer questionnaires and *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, p. III-40 (note 48).

[31] SunPower acquired SolarWorld on October 1, 2018. ***. *SunPower webpage,* http://newsroom.sunpower.com/2018-10-01-SunPower-Begins-A-New-Chapter-in-American-Solar-Manufacturing, retrieved October 22, 2018 and ***'s U.S. producer questionnaire, I-7 and II-2a.

[32] Three U.S. producers of cells *** submitted incomplete U.S. producer questionnaires and their responses are not included in the aggregated financial data. ***. ***. *** submitted its U.S. producer questionnaire two months after the deadline with incomplete data and reported no commercial production of CSPV cells or modules. ***. ***'s U.S. producer questionnaire, II-2a, II-2b, II-3, II-4, II-5, II-9, II-9a, III-5, III-9c, and III-15.

[33] ***.

[34] ***. Email from ***. Data from the Section 201 investigation show that SBM accounted for less than 0.001 percent of net sales of reporting domestic producers from 2012 to 2016. *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)--Staff Report,* INV-PP-119, September 11, 2017, table E-3.

[35] ***. ***'s U.S. producer questionnaire, III-3 and III-9f. ***'s incomplete responses are not included in the data tables of U.S. producers.

[36] ***. ***'s U.S. producer questionnaire, II-2a and III-9c.

[37] The majority of U.S. producers reported their financial results for calendar year periods and on the basis of U.S. generally accepted accounting principles. The exceptions were ***, which both reported financial results for fiscal years ending March 31, and ***, which reported their financial results according to International Financial Reporting Standards (IFRS).

Table III-22
CSPV cells: U.S. producers' open market financial operations (commercial sales and transfers), 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Table III-23
CSPV cells: Changes in average cell per kilowatt values, between fiscal years and between partial year periods

* * * * * * *

Table III-24
CSPV modules: U.S. producers' financial operations, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Table III-25
CSPV modules: Changes in average module per kilowatt values, between fiscal years and between partial year periods

* * * * * * *

presents company-specific financial results for cells and modules in table E-1 and table E-2, respectively.

Net sales

Total commercial sales and transfer volume of cells fluctuated during the period with the highest level achieved in 2013 (see table III-22). Following declines in 2014 and 2015, sales volume of cells increased in 2016 to its second highest level of the period before declining in 2017; sales volume of cells were lower in January-June 2018 than in January-June 2017. *** accounted for the largest share of net sales throughout the period while ***.[38]

The average sales value of cells declined in 2013, increased in 2014, and then declined during 2015-17 (see table III-22); average sales value of cells were higher in January-June 2018 than in January-June 2017. With regard to the increase in cell average sales value in 2014, *** contributed to this pattern (see table E-1).

Module sales volume, as reported in table III-24, presents a somewhat different pattern compared to cells. Total module sales volume, which primarily reflects a mix of commercial

[38] ***. ***'s U.S. producer questionnaire, section II-5 and *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)--Staff Report,* INV-PP-119, September 11, 2017, p. III-42 (note 52).

sales and transfers, declined to its lowest level in 2013 and then subsequently increased in each year, reaching its highest level in 2016 before declining in 2017.[39] Total module sales volume was higher in January-June 2018 than in January-June 2017. While the absolute volume of module sales increased during 2014-16, the net sales volume includes the reduction and/or exit of module operations by several U.S. producers.[40] As shown in table E-2, various U.S. producers contributed to the pattern of higher module sales volume; most notably *** in 2014, *** in 2015, and *** in 2016.

On an overall basis and as compared to cells, average module sales value followed a somewhat different pattern: declining in 2013 and 2014, increasing in 2015, decreasing in 2016 and 2017, with average module value in 2017 at almost half of what it was in 2012. Average sales value of modules was lower in January-June 2018 than in January-June 2017. For U.S. module operations as a whole, the pattern of marginally higher average module sales values in 2014 and 2015 is primarily attributable to higher company-specific average sales values reported by *** in 2014-15; i.e., most U.S. producers reported lower average module sales values in 2013 and 2014 (see table E-2). In 2015, the directional pattern of module average sales value was mixed, with *** again reporting the highest module average value. In 2016, U.S. producers reported lower average module sales value, falling to the lowest average module sales value in 2017 (from a high of $*** per kilowatt in 2012 to a low of $*** per kilowatt in 2017).[41] Average module sales values were lower in January-June 2018 than in January-June 2017.

Cost of goods sold ("COGS") and gross profit or (loss)

For both cells and modules, total raw material cost is the most substantial component of total COGS. For cells, total raw material cost reflects a combination of polysilicon, wafers, and all other raw material costs.[42] ***.[43] Total cell raw material costs reported for commercial sales and transfer of cells increased from *** percent of total COGS in 2012 to *** percent in 2015

[39] All four U.S. cell producers' internal consumption of cells for their downstream module operations is excluded from the financial results presented in this report. *** all reported internal consumption of cell operations primarily to support their downstream module production. ***. U.S. producer questionnaires, II-5 and II-9 and *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, p. III-42 (note 53).

[40] ***. ***'s U.S. producer questionnaire, III-9a and *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, p. III-42 (note 54).

[41] Table E-2 shows that U.S. module producers reported a range of average sales values.

[42] The share of total COGS accounted for all other raw material costs for cell production declined in 2014, in conjunction with higher average wafer costs, and then increased in 2015-16, in conjunction with lower average wafer cost. ***. ***. U.S. producer questionnaires, III-9a and *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, p. III-49 (note 56).

[43] ***. Ibid., p. III-50 (note 57) and *** U.S. producer questionnaire, III-9a.

before declining to *** in 2016 and *** in 2017.[44] Total cell raw material costs for cells as a percent of total COGS were also lower in January-June 2018 than in January-June 2017. Average unit raw material costs for cells declined from 2012 to 2017 as well, but were higher in January-June 2018 than in January-June 2017.

Total raw material costs for modules reflect internally produced cells, cells purchased from related and unrelated firms, and all other raw material costs.[45] Company-specific module cost structures varied with the following producers reporting consumption of internally produced cells: ***.[46] These companies also purchased cells during the period.[47] The remaining companies produce modules using purchased finished cells from related and/or unrelated suppliers. The overall share of total module COGS accounted for by module raw material costs ranged from *** percent to *** percent from 2012 to 2017; raw material costs as a share of total module costs were lower in January-June 2018 than in January-June 2017. Average unit raw material costs for modules declined from 2012 to 2017 and were lower in January-June 2018 than in January-June 2017.

With respect to cell and module COGS, *** U.S. producer to include non-recurring items identified as ***. In addition to changes in underlying operations, impairments recognized by *** at the beginning of the period also impacted COGS by reducing subsequent levels of depreciation included in cell and module other factory costs.[48] With respect to module COGS, *** reported nonrecurring items identified as write-downs.[49]

Gross profit was generated on cell and module operations in 2014 and 2015. For both cells and modules, the positive spread between average sales values and COGS was at its highest level in 2015, and subsequently declined to a negative spread in 2016 and 2017. During the period, U.S. module producers reported a wide range of negative and positive gross profit ratios (see table E-2). For cell producers, gross losses were higher in January-June 2018 than in January-June 2017 while module producers had lower gross losses.

Selling general and administrative ("SG&A") expenses and operating income or (loss)

SG&A expense ratios (total SG&A expenses divided by total revenue) calculated for cell operations generally were higher compared to module operations. The higher level of SG&A expenses for cell operations reflects, in part, non-recurring items reported by ***. *** also reported higher absolute SG&A expenses compared to *** throughout the period (see table E-1).[50]

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[44] ***. Ibid., p. III-50 (note 58).

[45] ***. Ibid., p. III-50 (note 59).

[46] ***. Ibid, p. III-50 (note 60) and *** U.S. producer questionnaire, II-2a.

[47] The cost of internally produced raw materials as a share of total module COGS was lower in 2017 (*** percent) compared with 2012 (*** percent), while the share accounted for by purchased cells was higher in 2017 (*** percent) compared with 2012 (*** percent). U.S. producer questionnaires, III-9d.

[48] *** U.S. producer questionnaire, III-10.

[49] U.S. producer questionnaires, III-10.

[50] ***. *** U.S. producer questionnaire, III-10.

Total SG&A expenses assigned to module operations, as well as corresponding SG&A expense ratios, declined in 2013 through 2015, peaked in 2016, then declined in 2017; SG&A expense ratios were lower in January-June 2018 than in January-June 2017 (see table III-24). The 2016 increase in total module SG&A expenses primarily reflects impairments reported by ***.[51] On a company-specific basis, module SG&A ratios cover a relatively wide range (see table E-2). The entry, transition, or exit phase of individual producers during the period examined explains, in part, the large fluctuation of SG&A expense ratios.

The U.S. industry reported cell and module operating losses of varying magnitude throughout the period.[52] Company-specific operating income on cell and module operations was reported in one period *** by *** (see tables E-1 and E-2).[53] *** reported operating losses of varying amounts from 2012 to 2017.[54]

Other expenses

For both cell and module operations, other expenses, including interest expenses and all other expenses fluctuated from 2012 to 2017. For cell operations, other expenses were lower in January-June 2018 than in January-June 2017 while module operations' other expenses were higher ***. Interest expense was reported for cell and module operations throughout the period. For cell operations, interest expense declined irregularly during 2012-15 but increased notably in 2016 before declining in 2017. With regard to module operations, the largest company-specific interest expense was reported by ***. For module operations, interest expense also fluctuated and ended the period somewhat lower. In 2012, *** reported asset impairments related to its *** operations that account for the majority of total other expenses reported in that year for cell and module operations.[55]

Net income or (loss)

The U.S. industry's net losses for both cells and modules were consistently greater than corresponding operating losses throughout the period of review due to the inclusion of interest expense and other expenses. The more pronounced difference between net losses and operating losses in 2012 reflects the impairments noted above. Net losses were lower in January-June 2018 than in January-June 2017 for cell operations but were higher for module operations.

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[51] ***.

[52] A variance analysis is not presented in this report due to ***. The discussion of COGS, gross profit/loss, SG&A expenses, and operating income, as shown in tables III-22, III-24, and III-26, mirrors the results of a variance analysis in these reviews.

[53] ***. *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report*, INV-PP-119, September 11, 2017, p. III-54 (note 68).

[54] ***. Ibid., p. III-54 (note 69).

[55] ***. *Investigation* No. TA-201-75: *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report,* INV-PP-119, September 11, 2017, p. III-55 (note 72).

CAPITAL EXPENDITURES AND RESEARCH AND DEVELOPMENT EXPENSES

Table III-26 presents total capital expenditures and research and development ("R&D") expenses. The level of overall capital expenditures assigned to cell operations fluctuated and increased to its highest level in 2016 (see table III-26), which primarily reflects amounts reported by ***.[56] Capital expenditures assigned to module operations fluctuated and were at their highest level in 2014. ***, which began production in 2014, accounted for the largest share of the period's total module capital expenditures.[57]

Only two firms *** reported R&D expenses for ***. R&D expenses were focused on *** but declined throughout 2012 to 2017 and were lower in January-June 2018 than in January-June 2017 while R&D expenses spent on modules peaked in 2016 due to ***.[58] *** did not report cell-related R&D expenses.[59]

Table III-26
CSPV cells and modules: U.S. producers' capital expenditures and R&D, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

ASSETS AND RETURN ON ASSETS ("ROA")

Table III-27 presents data on the U.S. producers' total assets and their ROA. Total assets reported for cell and module operations fluctuated from 2012 to 2017. *** accounted for the largest share of cell and module assets throughout the period.

Table III-27
CSPV cells and modules: U.S. producers' total assets and ROA, 2012-17

* * * * * * *

[56] ***. ***'s U.S. producer questionnaire, III-13 (note 1).
[57] ***. ***'s U.S. producer questionnaire, response to III-13 (note 3).
[58] ***. ***'s U.S. producer questionnaire, to III-13 (note 2).
[59] ***. ***'s U.S. producer questionnaire, III-15.

PART IV: U.S. IMPORTS AND THE FOREIGN INDUSTRIES

U.S. IMPORTS

Overview

During the final phase of the original investigations, the Commission received U.S. importer questionnaires from 49 firms that had imported CSPV cells or modules from China or nonsubject sources. Reported U.S. imports accounted for 67.1 percent of total 2011 U.S. imports from China by quantity.[1] In the Commission's 2017 Section 201 investigation on CSPV products (*CSPV 3*), importer questionnaire responses containing usable data were received from 56 firms that were believed to have accounted for approximately 82.6 percent of U.S. imports of CSPV products from all sources during 2016.[2]

In these reviews, the Commission issued questionnaires to 260 firms that may have imported CSPV cells and modules since 2012, 47 of which provided usable data and information in response to the questionnaires.[3] Twenty-six firms indicated that they did not import CSPV cells or modules during the period for which data were collected.[4] Based on official Commerce statistics for imports of CSPV cells and modules (in terms of value), importers' questionnaire data accounted for the following shares of imports during 2017:[5]

- 26.2 percent of total U.S. imports from China
- 56.4 percent of total U.S. imports from nonsubject sources
- 54.5 percent of total U.S. imports from all countries

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[1] *Investigation Nos. 701-TA-481 and 731-TA-1190 (Final): Crystalline Silicon Photovoltaic Cells and Modules from China—Staff Report*, INV-KK-103, October 25, 2012, p. I-3.

[2] *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report*, INV-PP-119, September 11, 2017, p. I-5.

[3] Seven additional firms (***) provided responses to the importer questionnaire but did not provide usable data concerning their imports.

[4] The following 26 firms reported that they did not import CSPV cells or modules since January 1, 2012: ***.

[5] Response rate is calculated based on a comparison of the value of 2017 U.S. imports of CSPV cells and modules as reported in the responses to the Commission's U.S. importer questionnaires ($115.8 million (China), $1.9 billion (other countries), and $2.0 billion (all countries)) with total landed-duty paid value of 2017 U.S. imports of cells and modules as reported by official Commerce import statistics under HTS statistical reporting numbers 8541.40.6020 and 8541.40.6030, as adjusted to remove nonsubject modules containing U.S.-origin cells and an estimated amount of thin film products, ($441.4 million (China), $3.4 billion (other countries), and $3.8 billion (all countries)). Questionnaire data coverage presented may be imprecise because the official Commerce statistics under these two HTS numbers may include other products not within the scope of these reviews. In addition, minor amounts of in-scope merchandise may be included under other basket HTS categories.

In light of the data coverage by the Commission's importer questionnaires in this proceeding[6] and because official U.S. import statistics presented for imports from China and nonsubject sources may be overstated or understated to the extent that they do not necessarily define country of origin consistently with the scope of these reviews,[7] import quantities and values presented in this report for 2012-16 are based on importer questionnaire data submitted in *CSPV 3*. The U.S. import values for 2017 and the partial periods (January-June) of 2017 and 2018 are derived from adjusted official Commerce statistics for CSPV cells (HTS 8541.40.6030) and CSPV modules (HTS 8541.40.6020), unless indicated otherwise.[8] [9] Because import quantity data are not compiled in official Commerce statistics on the basis of kilowatts, Commission staff derived the import quantity data presented in this report from unit value data provided in response to Commission's importer questionnaires and quantity data provided in adjusted official import statistics.

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[6] Several relatively large importers that responded in *CSPV 3* but did not respond with a usable questionnaire response in this proceeding include ***.

[7] Imports from China in this report represent imports of Chinese-origin cells or of modules containing Chinese-origin cells regardless of the country of module assembly.

[8] Prior to July 1, 2018, in-scope CSPV cells and modules primarily entered the United States under HTS statistical reporting numbers 8541.40.6020 (CSPV modules) and 8541.40.6030 (CSPV cells). Although a minor amount of in-scope CSPV cells and modules may have also been imported into the United States under HTS subheading 8501.31.80 (DC generators with CSPV cells attached) and HTS subheadings 8501.61.00 and 8507.20.80 (inverters or batteries with CSPV cells attached), the imports associated with these HTS subheadings are not included in the import data presentation in this report because these subheadings also include a large amount of merchandise that fall outside the scope of this proceeding. Also not presented in the import data presentation in this report are ***.

In response to the 201 proclamation, effective July 1, 2018, the primary applicable HTS statistical reporting numbers changed to 8541.40.6015 and 8541.40.6035 (CSPV modules) and 8541.40.6025 and 8541.40.6045 (CSPV cells). The following HTS statistical reporting numbers were also added on March 1, 2018 in response to the 201 proclamation to specifically address certain photovoltaic products: 8501.31.8090, 8501.32.6010, 8501.61.0010, and 8507.20.10. However, trade in these items are believed to be relatively minor.

[9] The value of official U.S. import statistics may be imprecise for the measurement of U.S. imports because the two primary HTS numbers for CSPV cells and CSPV modules may include items specifically excluded from the scope of these reviews. On the other hand, some in-scope items may not be reflected in these data because they entered the United States under other HTS numbers. Staff adjusted official U.S. import statistics presented in this report for 2017, January-June 2017, and January-June 2018 to remove the following data: (1) known imports of modules that contained U.S.-produced cells (from questionnaire responses) and (2) an estimated amount of thin film products (based on the ratio of total imports held by thin film products in July and August 2018 under HTS statistical reporting numbers 8541.40.6035 and 8541.40.6045).

Imports from subject and nonsubject countries

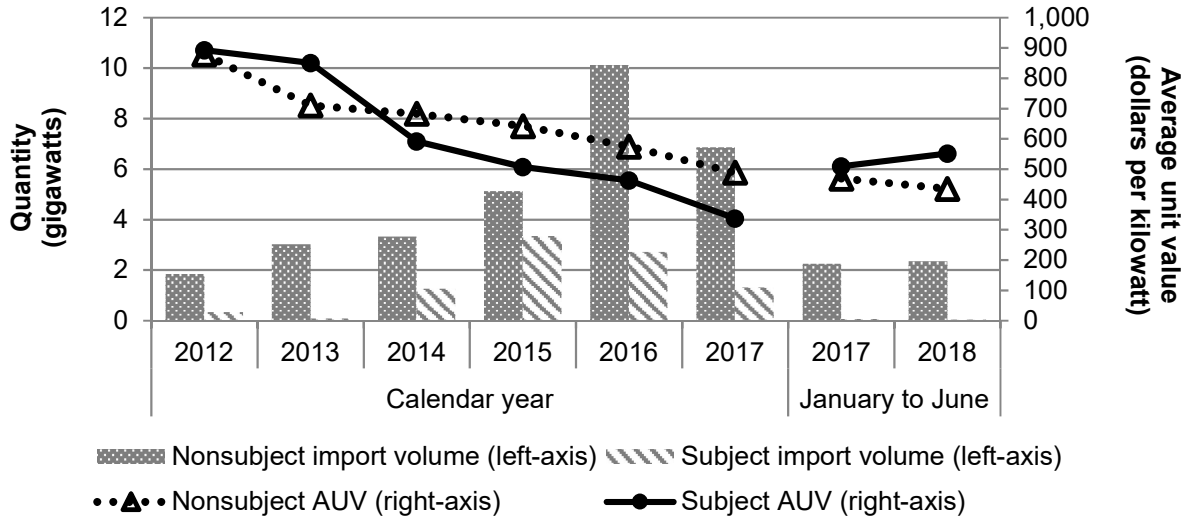
Table IV-1 and figure IV-1 present information on U.S. imports of CSPV cells and modules from China and all other sources over the period examined. Also presented in appendix F are monthly import statistics for January 2016 to August 2018 for U.S. imports of CSPV cells and modules from China and select nonsubject countries.

Table IV-1
CSPV cells and modules: U.S. imports, by source, 2012-17, January to June 2017, and January to June 2018

Item	Calendar year						January to June	
	2012	2013	2014	2015	2016	2017	2017	2018
	Quantity (kilowatts)							
U.S. imports from.--China	326,846	82,264	1,263,270	3,311,513	2,720,193	1,307,134	50,760	22,962
Nonsubject sources	1,835,542	3,019,148	3,319,628	5,118,880	10,093,375	6,864,094	2,244,954	2,350,780
All import sources	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568	8,171,228	2,295,714	2,373,742
	Value (1,000 dollars)							
U.S. imports from.--China	291,878	69,976	747,148	1,680,733	1,258,864	441,381	25,860	12,670
Nonsubject sources	1,612,786	2,144,481	2,267,713	3,287,132	5,801,625	3,354,314	1,053,465	1,023,168
All import sources	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489	3,795,695	1,079,325	1,035,838
	Unit value (dollars per kilowatt)							
U.S. imports from.--China	893	851	591	508	463	338	509	552
Nonsubject sources	879	710	683	642	575	489	469	435
All import sources	881	714	658	589	551	465	470	436
	Share of quantity (percent)							
U.S. imports from.--China	15.1	2.7	27.6	39.3	21.2	16.0	2.2	1.0
Nonsubject sources	84.9	97.3	72.4	60.7	78.8	84.0	97.8	99.0
All import sources	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Share of value (percent)							
U.S. imports from.--China	15.3	3.2	24.8	33.8	17.8	11.6	2.4	1.2
Nonsubject sources	84.7	96.8	75.2	66.2	82.2	88.4	97.6	98.8
All import sources	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Ratio to U.S. production (percent)							
U.S. imports from.--China	110.9	25.2	314.5	627.0	499.0	508.6	27.5	23.6
Nonsubject sources	622.8	923.6	826.5	969.3	1,851.6	2,670.9	1,214.4	2,416.4
All import sources	733.7	948.7	1,141.0	1,596.3	2,350.6	3,179.6	1,241.8	2,440.0

Source: Compiled from data reported in INV-PP-119 (*CSPV 3*, solar 201 staff report) for 2012-16, and compiled from data submitted in response to Commission questionnaires and official U.S. import statistics under HTS statistical reporting numbers 8541.40.6020 and 8541.40.6030, accessed October 30, 2018, for 2017, January to June 2017, and January to June 2018, as adjusted. See detailed explanation of the methodology for adjusted official U.S. import statistics in the narrative discussion in this section of the report.

Figure IV-1
CSPV cells and modules: U.S. import volume and unit values, 2012-17, January to June 2017, and January to June 2018



Source: Compiled from data reported in INV-PP-119 (*CSPV 3*, solar 201 staff report) for 2012-16, and compiled from data submitted in response to Commission questionnaires and official U.S. import statistics under HTS statistical reporting numbers 8541.40.6020 and 8541.40.6030, accessed October 30, 2018, for 2017, January to June 2017, and January to June 2018, as adjusted. See detailed explanation of the methodology for adjusted official U.S. import statistics in the narrative discussion in this section of the report.

According to import data presented in table IV-1, U.S. imports of CSPV cells and modules from all countries increased from 2012 to 2016, and fell in 2017 to a level that was 277.9 percent higher than reported in 2012 (in terms of quantity in kilowatts). The share of the quantity of U.S. imports of CSPV cells and modules held by China declined from 15.1 percent of total U.S. imports in 2012 to 2.7 percent in 2013, and increased to 39.3 percent in 2015 before declining to 16.0 percent in 2017. U.S. imports from China accounted for 2.2 percent of total imports during the first half of 2017 and 1.0 percent in the first half of 2018.

U.S. imports of CSPV cells and modules from China (in terms of quantity in kilowatts) declined by 74.8 percent from 2012 to 2013, following the imposition of the *CSPV 1* orders in December 2012. The quantity of U.S. imports from China then increased by nearly 4,000 percent from 2013 to 2015, before falling 17.9 percent from 2015 to 2016, following the imposition of the *CSPV 2* orders in February 2015.[10] The quantity of U.S. imports from China fell further—by 51.9 percent from 2016 to 2017—resulting in an overall increase in import quantity of 299.9 percent from 2012 to 2017. There were similar trends in the value of U.S. imports from

[10] The value of U.S. imports from Taiwan also fell from $1.3 billion in 2014 to $606.4 million in 2016 following the imposition of the companion Taiwan *CSPV 2* antidumping duty order imposed in February 2015. *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report*, INV-PP-119, September 11, 2017, table II-1.

China (albeit at different magnitudes), resulting in an overall increase of 51.2 percent from 2012 to 2017. The quantity and value of U.S. imports from China were 43.2 percent and 51.0 percent lower, respectively, during the first half of 2018 compared to the first half of 2017, following the implementation of Section 201 relief in February 2018.[11] The average unit value of U.S. imports of CSPV cells and modules from China declined by 62.2 percent from a high of $893/kW in 2012 to a low of $338/kW in 2017. The average unit value of U.S. imports from China was $509/kW during the first half of 2017 compared to $552/kW during the first half of 2018. The ratio of U.S. imports from China to U.S. production fluctuated from a period low of 25.2 percent in 2013 to a high of 627.0 percent in 2015. It was 508.6 percent during 2017, 27.5 percent in January-June 2017, and 23.6 percent in January-June 2018.

The leading suppliers of foreign CSPV cells and modules to the United States during 2012 were Taiwan, China, Philippines, Malaysia, and Japan, representing 49.3 percent, 15.1 percent, 12.4 percent, 9.1 percent, and 6.3 percent of all imports by quantity, respectively. The leading suppliers of foreign CSPV cells and modules to the United States during 2016 were Malaysia, China, Korea, Taiwan, and Thailand, representing 30.7 percent, 21.2 percent, 17.1 percent, 8.7 percent, and 4.6 percent of all imports by quantity, respectively.[12] According to official import statistics, in 2017, Malaysia, Korea, Vietnam, Thailand, and China were the leading suppliers of foreign CSPV cells and modules to the United States, representing 43.8 percent, 24.9 percent, 10.4 percent, 9.2 percent, and 2.1 percent of all unadjusted imports by value, respectively. The share of the quantity of U.S. imports of CSPV cells and modules attributable to nonsubject sources increased from 84.9 percent of total U.S. imports in 2012 to 97.3 percent in 2013, and declined to 60.7 percent by 2015 before increasing to 84.0 percent in 2017. U.S. imports from nonsubject sources accounted for 97.8 percent of total imports during the first half of 2017 and 99.0 percent in the first half of 2018.

U.S. shipments of imports, by module configuration

The Commission collected U.S. shipment data from U.S. importers for CSPV cells and modules, by specific module configurations (i.e., 60-cell, 72-cell, and all other configurations) (table IV-2). These data show that a majority of U.S. shipments of CSPV module imports from China and nonsubject sources are of 72-cell module configurations, with lesser amounts imported as 60-cell modules and other configurations. U.S. shipments of 72-cell module imports from China increased from 63.4 percent of Chinese importers' total U.S. shipments in 2012 to 91.6 percent in 2017. U.S. importers reported that average unit values for 60-cell

[11] *Proclamation 9693 of January 23, 2018 To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes*, 83 FR 3541, January 25, 2018.

[12] *Investigation No. TA-201-75: Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)—Staff Report*, INV-PP-119, September 11, 2017, table II-1.

Table IV-2
CSPV modules: U.S. importers' U.S. shipments, by module configuration, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

module configurations are somewhat higher than for 72-cell module configurations and that the average unit values of other products is substantially higher.[13]

U.S. IMPORTS SUBSEQUENT TO JUNE 30, 2018

The Commission requested that importers indicate whether they had imported or arranged for the importation of CSPV cells and modules from China and other nonsubject sources for delivery after June 30, 2018 (table IV-3). During the four quarters following June 30, 2018, responding importers from China and nonsubject sources reported that there were a total of *** and ***, respectively, of arranged U.S. imports of CSPV cells and modules. Seven importers from China and 20 importers from nonsubject sources reported outstanding orders of CSPV cells and modules during July 2018 to June 2019.

Table IV-3
CSPV cells and modules: U.S. importers' arranged imports

* * * * * * *

U.S. IMPORTERS' INVENTORIES

Table IV-4 presents data for inventories of U.S. imports of CSPV cells and modules from China and all other sources held in the United States. Nine of 20 responding importers from China and 30 of 40 responding importers from nonsubject sources indicated that they maintained inventories of CSPV cells and modules at some point during the period of review. Inventories held by U.S. importers of CSPV cells and modules from China fluctuated upward from 2012 to 2015, before declining from 2015 to 2017 to a level that was *** percent higher than was reported in 2012. U.S. inventories of subject merchandise imported from China were lower during the first half of 2018 than in the comparable period of 2017. The ratio of inventories of subject imports from China to total shipments of such imports increased from *** percent in 2012 to *** percent in 2014, before fluctuating downward to *** percent in 2017. The ratio was *** percent in the first half of 2017 and *** percent in the first half of 2018.

[13] Other products listed include customized modules with a range of configurations from 36-cell to 96-cell modules and 1-watt to 200-watt panels.

Table IV-4
CSPV cells and modules: U.S. importers' end-of-period inventories of imports, by source, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

THE MARKET IN CHINA

China summary public data

Public data on China presented in this section of the report primarily rely on government and industry association data sources. However, there are various estimates of Chinese production, capacity, installations, and exports. Data for 2017 from several of these sources are presented in table IV-5.[14] Some of these sources also have data/projections for 2018. *** projected, as of March 2018, that cell production capacity in China in 2018 would total *** per year and that module production capacity would total *** per year.[15] As of November 1, 2018, *** reported cell production capacity in China of *** per year and module production capacity of *** per year.[16] Projected 2018 installations are included in the installations section below.

[14] Respondents present an alternate metric of capacity utilization, ***. Canadian Solar's posthearing brief, exhibit 5.

[15] SolarWorld's prehearing brief, exhibit 66, ***.

[16] ***.

Table IV-5
CSPV cells and modules: Public information on the Chinese industry and market, 2017

	Official/CPIA[1]	***	***
Cells:			
Production (GW)	72	NA	NA
Capacity (GW)	82.8	***	***
Modules:			
Production (GW)	75	NA	NA
Capacity GW)	105.4	***	***
Installations:			
Installations (GW)	53.1	***	***
Exports:			
Cells:			
Quantity (GW)	4.8	NA	NA
Value ($1,000)	990,000	NA	NA
Modules:			
Quantity (GW)	37.9	NA	NA
Value ($1,000)	NA	NA	NA
All:			
Quantity (GW)	NA	NA	***
Value ($1,000)	11,300,000	NA	***

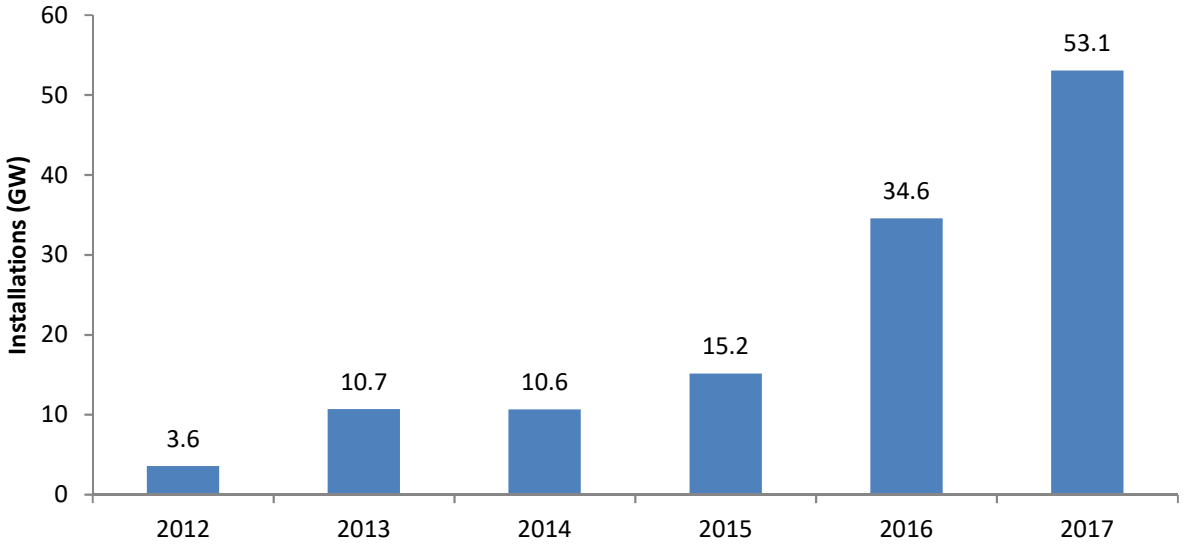
[1] CPIA=China Photovoltaic Industry Association. Official data are from the Chinese National Energy Administration and official export statistics. ***.

Sources: Lv Fang, Xu Honghua, and Wang Sicheng, "National Survey Report of PV Power Applications in China 2017," IEA PVPS, 2018, p. 6 and 19, http://www.iea-pvps.org/index.php?id=93&eID=dam_frontend_push&docID=4461; official Chinese exports statistics under HTS subheadings 8541.40.20, as reported by China Customs in the GTA database, retrieved September 14, 2018; Ng, Eric, "China's Solar Panel Industry Faces a Year of Reckoning Amid Global Protectionism, Slowing Demand at Home," South China Morning Post, March 16, 2018, https://www.scmp.com/business/companies/article/2137539/chinas-solar-panel-industry-faces-year-reckoning-amid-global; SolarWorld's prehearing brief, exhibit 66, ***; ***; Canadian Solar's prehearing brief, exhibit 5, ***.

Installations in China[17]

China was the largest global PV market in 2017, with installations increasing from 3.6 GW in 2012 to 53.1 GW in 2017 (figure IV-2).[18] Full-year 2018 installations are projected to be lower than 2017 levels due to the policy changes described below.[19] China installed 34.5 GW in the first three quarters of 2018, compared to 43 GW in the first three quarters of 2017.[20]

Figure IV-2
China PV installations, 2012–17



Source: Lv Fang, Xu Honghua, and Wang Sicheng, "National Survey Report of PV Power Applications in China 2017," IEA PVPS, 2018, p. 6, http://www.iea-pvps.org/index.php?id=93&eID=dam_frontend_push&docID=4461.

[17] This section is primarily from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. IV-20–23.

[18] Lv Fang, Xu Honghua, and Wang Sicheng, "National Survey Report of PV Power Applications in China 2017," IEA PVPS, 2018, p. 6, http://www.iea-pvps.org/index.php?id=93&eID=dam_frontend_push&docID=4461; IEA PVPS Website, http://www.iea-pvps.org/?id=266, retrieved September 5, 2018.

[19] Rajeshwari, Ankita, "Major Policy Change in China Could Rock the Solar Industry Globally, Reduce Module Prices," Mercom India, June 5, 2018, https://mercomindia.com/major-policy-change-china-affect-global-solar/; Osborne, Mark, "GTM Research Forecasting Global Solar Market to Fall to 85.2GW in 2018," *PVTech*, August 9, 2018, https://www.pv-tech.org/news/gtm-research-forecasting-global-solar-market-to-fall-to-85.2gw-in-2018.

[20] Bhambhani, Anu, "China Installed 34.54 GW PV In 9M/2018," October 31, 2018, http://taiyangnews.info/markets/china-installed-34-54-gw-pv-in-9m2018/.

China's feed-in tariff ("FIT") is one of the main policies that the government used to encourage domestic solar PV installations. China's FIT establishes a rate for PV-generated electricity, with this rate varying by region and type of installation (distributed and ground mounted). FIT rates were revised downward in 2013, 2016, 2017, and 2018. In May 2018, the Chinese government ordered a stop to further approval of utility-scale projects in 2018 under the FIT, and capped 2018 distributed installations under the FIT at 10 GW (though any distributed project completed by the end of May would be eligible).[21]

China has implemented a number of other policies to encourage PV installations. For example, the Solar Poverty Alleviation program provides financial support for low-income households to purchase solar modules and guarantees a set rate for excess electricity sent to the electric grid. The Top Runner Program, which was introduced in 2015, is a reverse auction designed to support the installation, and therefore the development and production, of more advanced solar technologies. Modules installed as part of the program must meet certain minimum energy efficiency levels.

In an early November meeting, the Chinese National Energy Administration ("NEA") indicated that it may raise the 13th Five-Year Plan target for cumulative PV installations. The current target of 105 GW by 2020 was already surpassed, with 165 GW installed as of the end of September 2016. The minimum proposed increase was to 210 GW by 2020 and the maximum proposed increase was to 270 GW by 2020. No final decision was reached and the government was planning an investigation prior to making a decision. Analysts indicated that the lower target would mean that the government was only targeting 20 to 25 GW in annual installations in 2019 to 2020, while the higher target would mean that the government was targeting 40 to 50 GW in annual installations in 2019 and 2020.[22]

Installations in China in 2018 are generally projected to total ***.[23] This is substantially *** than prior to the May 2018 policy revisions, when *** middle scenario for 2018 Chinese

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[21] *PV Magazine*, "China Releases New Provisions for PV Development in 2018," June 1, 2018, https://www.pv-magazine.com/2018/06/01/china-releases-new-provisions-for-pv-development-in-2018/; Rajeshwari, Ankita, "Major Policy Change in China Could Rock the Solar Industry Globally, Reduce Module Prices," Mercom India, June 5, 2018, https://mercomindia.com/major-policy-change-china-affect-global-solar/.

[22] Hill, Joshua S., "China May Increase Its 2020 Solar Target To 200 Gigawatts Or Higher," Clean Technica, November 6, 2018, https://cleantechnica.com/2018/11/06/china-may-increase-its-2020-solar-target-to-200-gigawatts-or-higher/.

[23] Enkhardt, Sandra, "China May Raise 2020 Solar Target to More than 200 GW," PV Magazine, November 5, 2018, https://www.pv-magazine.com/2018/11/05/china-may-raise-2020-solar-target-to-over-200-gw/; ***; Bhambhani, Anu, "IHS Markit Expects 40 GW PV For China In 2018," Taiyang News, November 16, 2018, http://taiyangnews.info/business/ihs-markit-expects-40-gw-pv-for-china-in-2018/; Bhambhani, Anu, "Solar Panel Supply Glut to Extend Into 2019," Taiyang News, December 4, 2018, http://taiyangnews.info/business/solar-panel-supply-glut-to-extend-into-2019/; Bhambhani, Anu, "PV InfoLink Forecast For 2019: 112 GW New PV," Taiyang News, December 4, 2018, http://taiyangnews.info/business/pv-infolink-forecast-for-2019-112-gw-new-pv/.

installations was *** and ***.[24] Table IV-6 presents the latest forecasts for installations in China during 2018–20. All forecasts are from November–December 2018, but may have varying approaches on the extent to which they take into account proposed policy changes in China. Projected installations in 2019 (or module demand in the case of PV InfoLink) range from ***, while in 2020 they range from more than ***.[25]

Table IV-6
CSPV cells and modules: Projected size of the Chinese market, 2018–20

	2018	2019	2020
	Quantity (GW)		
***	***	***	***
***	***	***	***
CPIA (installations)	40	NA	NA
Fitch (installations)	>30	24.4	>20
IHS (installations)	40	40	40
PV InfoLink (module demand)	34	43	NA
***	***	***	***

Note.—Projected module demand for PV InfoLink was calculated by multiplying global demand by the share of demand in China.

Sources: Enkhardt, Sandra, "China May Raise 2020 Solar Target to More than 200 GW," PV Magazine, November 5, 2018, https://www.pv-magazine.com/2018/11/05/china-may-raise-2020-solar-target-to-over-200-gw/; ***; Bhambhani, Anu, "IHS Markit Expects 40 GW PV For China In 2018," Taiyang News, November 16, 2018, http://taiyangnews.info/business/ihs-markit-expects-40-gw-pv-for-china-in-2018/; Bhambhani, Anu, "Solar Panel Supply Glut to Extend Into 2019," Taiyang News, December 4, 2018, http://taiyangnews.info/business/solar-panel-supply-glut-to-extend-into-2019/; Bhambhani, Anu, "PV InfoLink Forecast For 2019: 112 GW New PV," Taiyang News, December 4, 2018, http://taiyangnews.info/business/pv-infolink-forecast-for-2019-112-gw-new-pv/; Canadian Solar's prehearing brief, exhibit 5, ***.

The industry in China

Overview

During the final phase of the original investigations, the Commission received responses from 18 firms that accounted for approximately *** percent of 2011 production of CSPV cells in China and approximately *** percent of 2011 production of CSPV modules in China. Thirteen of

[24] Canadian Solar's posthearing brief, exhibit 5, ***; SolarWorld's prehearing brief, exhibit 66, ***.

[25] ***; Bhambhani, Anu, "IHS Markit Expects 40 GW PV For China In 2018," Taiyang News, November 16, 2018, http://taiyangnews.info/business/ihs-markit-expects-40-gw-pv-for-china-in-2018/; Bhambhani, Anu, "Solar Panel Supply Glut to Extend Into 2019," Taiyang News, December 4, 2018, http://taiyangnews.info/business/solar-panel-supply-glut-to-extend-into-2019/; Bhambhani, Anu, "PV InfoLink Forecast For 2019: 112 GW New PV," Taiyang News, December 4, 2018, http://taiyangnews.info/business/pv-infolink-forecast-for-2019-112-gw-new-pv/.

the 18 responding Chinese producers reported that they produced CSPV cells in China and all 18 of the responding Chinese producers reported that they produced CSPV modules in China.[26]

In their response to the Commission's notice of institution in these current first five-year reviews, Canadian Solar Inc. (including its Chinese producer/exporter affiliates Canadian Solar Manufacturing (Changshu) Inc., Canadian Solar Manufacturing (Luoyang) Inc., CSI Cells Co., Ltd., CSI-GCL Solar Manufacturing (Yancheng) Co., Ltd., Canadian Solar Sunenergy (Baotou) Co., Ltd., Canadian Solar Sunenergy (Suzhou) Co., Ltd., and Canadian Solar International, Ltd.) provided data regarding its Chinese capacity, production, and exports of CSPV cells and modules to the United States. Canadian Solar reported that it accounted for approximately *** percent of the quantity of total exports to the United States of CSPV cells and modules from China in 2016 and approximately *** percent of total production of CSPV cells and modules in China during 2016.[27]

In the full phase of these first five-year reviews, the Commission issued questionnaires to 232 firms in China identified as possible producers of CSPV cells and/or modules and to 307 additional firms worldwide identified as possible assemblers of CSPV modules using Chinese-origin cells. Usable responses to the Commission's questionnaire were received from nine firms, four of which are manufacturers of CSPV cells in China[28] and eight of which are assemblers of modules.[29] Nineteen firms indicated that they did not produce CSPV cells in China or CSPV modules anywhere in the world using cells manufactured in China.[30] [31] The responding nine firms are believed to have accounted for approximately *** and *** percent of total CSPV cell and module production in China in 2017, respectively.[32] Table IV-7 presents summary data on

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[26] *Investigation Nos. 701-TA-481 and 731-TA-1190 (Final): Crystalline Silicon Photovoltaic Cells and Modules from China—Staff Report*, INV-KK-103, October 25, 2012, p. VII-2.

[27] *Canadian Solar's Response to the Notice of Institution*, December 1, 2017, p. 9.

[28] The four responding producers of CSPV cells in China are ***.

[29] Five responding firms in China provided data concerning their assembly of CSPV modules from Chinese cells (***). Two responding firms in India provided data concerning their assembly of CSPV modules from Chinese cells (***). One responding firm in Indonesia provided data concerning its assembly of CSPV modules from Chinese cells (***).

[30] These 19 firms include ***.

[31] In the Commission's 2017 Section 201 investigation on CSPV products (*CSPV 3*), foreign producer questionnaire responses containing usable data were received from 35 firms in China that were believed to have accounted for approximately 57 percent of total CSPV cell production and 67 percent of total CSPV module production in China in 2016. Several relatively large Chinese firms that responded in *CSPV 3* but did not respond with a usable questionnaire response in this proceeding include the following four integrated firms in China that produce both CSPV cells and modules: ***. For purposes of comparison, Chinese producer data collected from questionnaire responses for calendar years 2012-16 in the Commission's Section 201 investigation are presented in appendix C. Note that the producer data presented for module assembly may include modules that contain non-Chinese cells, although most Chinese module assemblers use Chinese or Taiwan-origin CSPV cells.

[32] The production response rate in China is calculated based on a comparison of the quantity of 2017 CSPV cell and module production in China as reported in the responses to the Commission's foreign producer questionnaires (*** (cells) and *** (modules)) with total production in China during 2017 (72

Table IV-7
CSPV cells: Summary data on producers in China, 2017

* * * * * * *

responding CSPV cell producers in China. Table IV-8 presents summary information on responding firms that assemble CSPV modules from Chinese cells.

Table IV-8
CSPV modules: Summary data on producers of modules that contain Chinese cells, 2017

* * * * * * *

Changes in operations

Of the nine responding firms, seven reported operational or organizational changes since January 1, 2012. Two of the reporting firms which noted expansions/acquisitions assemble subject CSPV modules outside of China (i.e., in India and Indonesia) from CSPV cells that are produced in China. Details concerning the changes reported by these nine firms are presented in table IV-9.[33]

Table IV-9
CSPV cells and modules: Reported changes in operations by cell producers in China and module assemblers that use Chinese cells, since January 1, 2012

* * * * * * *

Anticipated changes in operations

Regarding anticipated changes in the character of operations relating to CSPV cells and modules, seven of the nine responding foreign firms reported that they do not anticipate any changes, whereas two firms (both located in China) reported the following details concerning the anticipated changes (table IV-10).[34]

GW (cells) and 75 GW (modules)) as reported in National Survey Report of PV Power Applications in China 2017, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, 2018, p. 19, http://www.iea-pvps.org/?id=93. The response rate of module production may be understated because published data on total module production in China may include nonsubject modules produced from non-Chinese origin cells.

[33] In the Commission's 201 investigation, 27 out of 35 responding producers in China reported operational or organization changes since January 1, 2012. Details concerning those reported changes are presented in their entirety in appendix C.

[34] In the Commission's 201 investigation, 27 Chinese producers reported that they did not anticipate any changes in the character of their operations, whereas 8 firms reported details concerning such

Table IV-10
CSPV cells and modules: Anticipated changes in operations by producers in China

* * * * * * *

Operations on CSPV cells

According to publicly available information, China's production of CSPV cells increased from 21 GW in 2012 to 72 GW in 2017. CSPV cell production capacity totaled 82.8 GW in 2017 (the latest year available), up from more than 40 GW in 2012.[35] Through the first nine months of 2018, cell production totaled 53.6 GW, including 39 GW produced in the first half of the year and 14.6 GW produced in the third quarter.[36]

CSPV cell capacity, production, capacity utilization, inventories, and shipments as reported by the four Chinese CSPV cells producers responding to the Commission's questionnaire in these reviews increased from 2012 to 2017 and were higher during the first half of 2018 compared with the first half of 2017 (table IV-11).[37] Capacity and production increased by *** and *** percent, respectively, from 2012 to 2017, and the capacity utilization for firms producing CSPV cells in China increased from *** percent in 2012 to *** percent in 2016. Capacity and production were *** and *** percent higher in the first half of 2018 than in the comparable period of 2017. Likewise, inventories of CSPV cells increased from *** in 2012 to *** in 2017, and were *** percent higher in the first half of 2018 compared to the same period in 2017.

Table IV-11
CSPV cells: Data on industry in China, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Home market shipments of CSPV cells (including internal consumption and commercial home market sales), which accounted for *** percent of total shipments by the Chinese

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anticipated changes. Details concerning those anticipated changes reported in the 201 investigation are presented in their entirety in appendix C.

[35] National Survey Report of PV Power Applications in China 2012, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, July 16, 2013, p. 16, http://www.iea-pvps.org/?id=93; National Survey Report of PV Power Applications in China 2017, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, 2018, p. 19, http://www.iea-pvps.org/?id=93.

[36] *PV Magazine*, "Nine-month Figures from China Lay Bare Impact of May 31 Policy U-turn," November 2, 2018, https://www.pv-magazine.com/2018/11/02/nine-month-figures-from-china-lay-bare-impact-of-may-31-policy-u-turn/.

[37] As previously indicated, for purposes of comparison, Chinese producer data collected from questionnaire responses for calendar years 2012-16 in the Commission's Section 201 investigation are presented in appendix C.

producers in 2017, increased by *** percent from 2012 to 2017, and were *** percent higher during January-June 2018 than in the comparable period in 2017. Conversely, exports of CSPV cells, which accounted for *** percent of total shipments by the Chinese producers in 2017, fluctuated upward from *** in 2012 to *** in 2017. Responding firms reported *** exports of CSPV cells from China to the United States during January 2012 to June 2018. Export markets for CSPV cells identified by producers in China include ***.

Operations on CSPV modules

According to publicly available information, total production of CSPV modules in China increased from 23 GW in 2012 to 75 GW in 2017. Maximum CSPV module production capacity increased from more than 40 GW in 2012 to 105 GW in 2017.[38] CSPV module production totaled 54.9 GW in the first nine months of 2018, including 42 GW produced in the first half of the year and 12.9 GW in the third quarter.[39]

CSPV module capacity, production, capacity utilization, inventories, and shipments as reported by firms responding to the Commission's foreign producer questionnaire in these reviews[40] increased from 2012 to 2017, and were higher during the first half of 2018 as compared with the first half of 2017 (table IV-12). Capacity and production increased by *** and *** percent, respectively, from 2012 to 2017, and the capacity utilization for firms producing CSPV modules from Chinese-origin cells increased from *** percent in 2012 to *** percent in 2017. Capacity and production were *** and *** percent higher in the first half of 2018 than in the comparable period of 2017. Likewise, inventories of CSPV modules increased by *** percent from 2012 to 2017, and were *** percent higher in the first half of 2018 than in the comparable period of 2017.

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[38] Thin film production is included in the data, but totaled only 0.2 GW in 2017. Also included is module production and capacity for modules that contain non-Chinese cells, although the Commission reported in *CSPV 3* that most Chinese module assemblers use Chinese or Taiwan-origin CSPV cells. National Survey Report of PV Power Applications in China 2012, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, July 16, 2013, p. 17, http://www.iea-pvps.org/?id=93; National Survey Report of PV Power Applications in China 2017, International Energy Agency Co-Operative Programme on Photovoltaic Power Systems, 2018, p. 19, http://www.iea-pvps.org/?id=93; and *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, table IV-16, note.

[39] *PV Magazine*, "Nine-month Figures from China Lay Bare Impact of May 31 Policy U-turn," November 2, 2018, https://www.pv-magazine.com/2018/11/02/nine-month-figures-from-china-lay-bare-impact-of-may-31-policy-u-turn/.

[40] Firms responding to the Commission's foreign producer questionnaire in these reviews include firms that assemble CSPV modules anywhere in the world from Chinese-origin cells. Data on modules assembled in China from non-Chinese cells are not included in the data collected in Commission questionnaires. Five assemblers that responded to the Commission's foreign producer questionnaire are located in China, two are in India, and one is in Indonesia.

Table IV-12
CSPV modules: Data on the industry producing CSPV modules from Chinese-origin cells, 2012-17, January to June 2017, and January to June 2018

* * * * * * *

Home market shipments of CSPV modules (including internal consumption and commercial home market sales), which accounted for *** percent of total shipments of modules in 2017, increased from *** in 2012 to *** in 2017, and was *** percent higher in the first half of 2018 compared with the first half of 2017. Exports of CSPV modules to the United States, which accounted for *** percent of total shipments by the responding firms in 2017, fluctuated during the period of study, falling from *** in 2012 to *** in 2013, before climbing to *** in 2016. Exports fell to *** in 2017, but were higher in the first half of 2018 than in the comparable period of 2017. Export markets other than the United States for CSPV modules that contain Chinese cells, which accounted for *** percent of the responding producers' total shipments in 2017, have represented a declining share of total shipments since 2012. Other major export markets identified by assemblers of CSPV modules from Chinese cells include ***.

The average spot market price for modules made in China was *** (figure IV-3). Following the announcement of policy changes at the end of May, the price of multicrystalline modules made in China ***, while the price of monocrystalline modules ***. From the week of May 28, 2018 to the week of July 9, 2018, ***. From the week of May 28, 2018 to the week of November 26, 2018 ***. [41]

Figure IV-3
CSPV modules: Change in average spot market price for modules made in China, weekly, January 1, 2018 to November 26, 2018

* * * * * * *

Exports

According to official export statistics,[42] the leading export markets for CSPV products from China are India, Japan, Australia, and the United States, which accounted for 29.6, 18.2, 5.9, and 5.5 percent, respectively, of the total exports of CSPV products from China during 2017 (table IV-13).

[41] ***.

[42] Official exports statistics under China-specific HS numbers 8541.40.20 as reported by China's statistical authority in the GTA database, retrieved September 14, 2018.

Table IV-13
CSPV cells and modules: Chinese exports by destination market, 2012-17

Item	Calendar year					
	2012	2013	2014	2015	2016	2017
	Value (1,000 dollars)					
China's exports to the United States	1,402,183	1,206,397	1,816,973	1,634,309	1,342,504	620,880
China's exports to other major destination markets.--						
India	193,756	510,191	488,652	1,356,333	2,448,109	3,359,141
Japan	892,923	2,794,321	4,395,596	3,341,568	2,558,643	2,065,221
Australia	732,282	427,169	397,404	366,473	354,404	668,840
Mexico	8,583	39,222	31,518	72,367	91,981	556,360
Brazil	2,628	4,465	4,969	34,309	341,121	435,822
Korea	109,257	234,524	416,780	378,369	357,115	412,554
United Arab Emirates	17,075	15,102	26,381	103,391	89,165	315,117
Pakistan	8,489	56,056	188,939	366,794	328,211	275,031
All other destinations	9,407,995	4,862,774	4,552,932	5,245,176	3,425,797	2,626,163
Total exports from China	12,775,173	10,150,221	12,320,143	12,899,089	11,337,050	11,335,128
	Share of value (percent)					
China's exports to the United States	11.0	11.9	14.7	12.7	11.8	5.5
China's exports to other major destination markets.--						
India	1.5	5.0	4.0	10.5	21.6	29.6
Japan	7.0	27.5	35.7	25.9	22.6	18.2
Australia	5.7	4.2	3.2	2.8	3.1	5.9
Mexico	0.1	0.4	0.3	0.6	0.8	4.9
Brazil	0.0	0.0	0.0	0.3	3.0	3.8
Korea	0.9	2.3	3.4	2.9	3.1	3.6
United Arab Emirates	0.1	0.1	0.2	0.8	0.8	2.8
Pakistan	0.1	0.6	1.5	2.8	2.9	2.4
All other destinations	73.6	47.9	37.0	40.7	30.2	23.2
Total exports from China	100.0	100.0	100.0	100.0	100.0	100.0

Source: Official Chinese exports statistics under HTS subheadings 8541.40.20, as reported by China Customs in the GTA database, retrieved September 14, 2018.

THIRD-COUNTRY MARKET IMPORT RESTRAINTS[43]

Several countries have imposed antidumping and/or countervailing duties on imports of CSPV products from one or more sources. Such restraints (as well as investigations that did not result in duties) are discussed in detail in the sections that follow, organized by the specific country that has undertaken such measures. A summary of import restraint measures taken by third countries is presented in table IV-14.

Table IV-14
CSPV products: Third country market import restraints in effect, since 2012[1]

Importing country	Product	Measure	Date	Exporting country
Canada	CSPV modules	Antidumping duties (124.4%) Subsidy rate (6.2%)	July 2015	China
China	Solar-grade polysilicon	Provisional antidumping duties (up to 57%) and subsidy rate (2.1%)	January 2014	United States, Korea
Turkey	CSPV modules	Antidumping duties (27%)	February 2017	China
India	CSPV modules	Safeguard duties (25% in first year, 20% in the first six months of the second year, and 15 percent in the last six months of the second year)	July 2018	China, Malaysia

[1] Investigations conducted by India during 2012-14 on CSPV cells and modules originating in China, Taiwan, Malaysia, and the United States, investigations conducted by Australia during 2014-16 on CSPV cells and modules originating in China, and investigations conducted by India on solar cells assembled in modules or panels from 2017-2018 did not result in antidumping duties or subsidy rates. The EU maintained antidumping and anti-subsidy measures on solar cells and modules from China from 2013 to 2018. China maintained antidumping measures on polysilicon from the EU from 2014 to 2018.

Source: Cited public articles in sections that follow.

[43] This section is primarily from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. I-45—I-50.

Australia

On May 14, 2014, the Government of Australia initiated an antidumping duty investigation on CSPV modules or panels from China. The proposed dumping margins ranged from 21.6 percent to 60.3 percent.[44] On October 17, 2016, the Government of Australia terminated the investigation on the grounds that any injury to the Australian industry that had been or may be caused by the exports of dumped CSPV panels from China was "negligible."[45]

Canada

On December 8, 2014, the Canadian International Trade Tribunal ("CITT") initiated antidumping and countervailing duty investigations on CSPV products from China.[46] On July 3, 2015, the CITT determined that the dumping and subsidizing of the CSPV products from China did not cause injury, but threatened to cause injury to the Canadian industry. The Canada Border Services Agency ("CBSA") determined that 100 percent of the subject goods imported into Canada from China had been dumped at a weighted average margin of 124.4 percent, when expressed as a percentage of the export price. The CBSA also determined that 100 percent of the subject goods imported into Canada from China had been subsidized at a

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[44] The investigation excluded CSPV cells and wafers. Antidumping Commission, Government of Australia, May 14, 2014, http://www.adcommission.gov.au/cases/documents/031-ADN-201438-Initiationofaninvestigationintoallegeddumping.pdf; Antidumping Commission, Government of Australia, October 14, 2014, http://www.adcommission.gov.au/cases/documents/094-Notice-Anti-DumpingNotice2014-06ExtentionoftimetoissueSEF.pdf.

[45] *Certain crystalline silicon photovoltaic modules or panels exported from the People's Republic of China: Termination of Investigation*, Anti-Dumping Notice No. 2016/110, Antidumping Commission, Government of Australia, October 17, 2016, http://www.adcommission.gov.au/cases/EPR%20193%20%20250/EPR%20239%20-%20archived%2013%20December%202016/182%20-%20Notice%20-%20ADN%202016-110%20-%20Termination%20of%20Investigation.pdf, retrieved July 9, 2017.

[46] *Notice of Commencement of Preliminary Injury Inquiry, Certain Photovoltaic Modules and Laminates*, Canadian International Trade Tribunal, Inquiry No. PI-2014-003. Canadian solar producers, Eclipsall Energy Corp., Heliene, Inc., Silfab Ontario Inc., and Solgate, Inc. filed the petition on October 1, 2014. The investigation covered photovoltaic modules and laminates consisting of crystalline silicon photovoltaic cells, including laminates shipped or packaged with other components of photovoltaic modules, and thin film photovoltaic products produced from amorphous silicon (a-Si), cadmium telluride (CdTe), or copper indium gallium selenide (CIGS), originating in or exported from China, excluding modules, laminates or thin film products with a power output not exceeding 100 W, and also excluding modules, laminates or thin film products incorporated into electrical goods where the function of the electrical goods is other than power generation and these electrical goods consume the electricity generated by the photovoltaic product. Excluded are 195 W monocrystalline photovoltaic modules made of 72 monocrystalline cells, each cell being no more than 5 inches in width and height.

weighted average amount of subsidy of 6.2 percent, when expressed as a percentage of the export price.[47]

China

On July 20, 2012, the Government of China announced the commencement of an antidumping and countervailing duty investigation of "solar-grade polysilicon," a raw material used in the manufacture of solar panels, from the United States and Korea.[48] In January 2014, China imposed provisional antidumping duties on U.S. and Korean polysilicon as high as 57 percent and provisional countervailing duties of 2.1 percent. On January 20, 2014, the Government of China imposed definitive antidumping duties that ranged from 53.3 to 57.0 percent on imports from the United States and 2.4 to 48.7 percent for imports from Korea; on the same date, the Government of China announced that it found zero or de minimis subsidy rates on imports from U.S. firms REC Solar Grade Silicon LLC, REC Advanced Silicon Materials LLC, and MEMC Pasadena, Inc., but that it was imposing a countervailing duty rate of 2.1 percent on imports from Hemlock Semiconductor Corp., AE Polysilicon Corp., and all other U.S. exporters.[49]

Separately, the Government of China launched an antidumping and subsidy investigation on solar-grade polysilicon originating in the European Union in November 2012.[50] Following the investigation, in May 2014, the Government of China confirmed final antidumping duties of 42 percent and anti-subsidy duties of 1.2 percent on imports of solar-grade polysilicon from the EU.[51]

On April 29, 2016, the Government of China initiated a midterm review investigation into the countervailing measures applicable to imports of solar-grade polysilicon originating in the EU. In an announcement on April 30, 2017, China's Ministry of Commerce proposed to continue countervailing measures for 18 months (starting May 1, 2017) at the same rate as the

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[47] *Photovoltaic Modules and Laminates, Inquiry No. NQ-2014-003*, Canadian International Trade Tribunal, July 3, 2015, http://www.citt.gc.ca/en/node/7411#_Toc426546520, retrieved July 10, 2017.

[48] Ministry of Commerce, People's Republic of China website: http://english.mofcom.gov.cn/aarticle/newsrelease/significantnews/201207/20120708245225.html, retrieved August 30, 2012.

[49] Ministry of Commerce, People's Republic of China, "MOFCOM Released Final Ruling of Anti-dumping investigation against Imports of Solar-Grade Polysilicon," January 21, 2014, http://english.mofcom.gov.cn/article/newsrelease/significantnews/201401/20140100468686.shtml, retrieved November 1, 2018.

[50] "China Moves Forward with Duties on EU Polysilicon," International Centre for Trade and Sustainable Development, May 8, 2014, https://www.ictsd.org/bridges-news/biores/news/china-moves-forward-with-duties-on-eu-polysilicon, retrieved July 20, 2017.

[51] "China Hits EU with Final Duties on Polysilicon," REUTERS, April 30, 2014, https://www.ajot.com/news/china-hits-eu-with-final-duties-on-polysilicon, retrieved July 10, 2017.

findings of the 2014 investigation.[52] The Chinese Ministry of Commerce announced that duties on solar-grade polysilicon imports from the EU expired on October 31, 2018.[53]

The European Union

In July 2012, EU ProSun filed an antidumping duty petition with the European Commission ("EC") regarding imports of CSPV cells and modules from China, and on September 6, 2012, the EC announced its initiation of an antidumping duty investigation on these imports.[54] In response to a countervailing duty complaint filed on September 26, 2012 by EU ProSun, on November 8, 2012 the EC announced its initiation of an antisubsidy investigation concerning imports of crystalline silicon photovoltaic modules and key components (i.e., cells and wafers) originating in China.[55]

In June 2013, the EC announced the imposition of provisional antidumping duties ranging from 37.3 percent to 67.9 percent.[56] Thereafter, the EC and a group of Chinese solar manufacturers, which represented approximately 70 percent of total Chinese exports to the EU, entered into a "price undertaking" agreement, which went into effect in August 2013.[57] Certain named CSPV product manufacturers agreed to volume quotas and minimum prices pursuant to the undertaking, and in return for selling at or above the Minimum Import Price ("MIP"), the antidumping and anti-subsidy duties do not apply to imports of their products into the EU. The EC reported that it constantly monitored the implementation of the price undertaking and occasionally adjusted the MIP to account for market price developments. All imports into the EU from China that were above the quota, as well as those imports of solar cells and solar

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[52] Ministry of Commerce, People's Republic of China, "*Announcement No.23 of 2017 on the Final Review of the Countervailing Measures against Imports of Solar-grade Polysilicon Originated in the EU*," http://english.mofcom.gov.cn/article/policyrelease/announcement/201705/20170502577365.shtml, retrieved September 17, 2018.

[53] Bellini, Emiliano. "Chinese Duties on Polysilicon Imports from EU Have Expired," *PV Magazine*, November 1, 2018. https://www.pv-magazine.com/2018/11/01/chinese-duties-on-polysilicon-imports-from-eu-have-expired/.

[54] *Notice of initiation of an antidumping duty proceeding concerning imports of crystalline silicon photovoltaic modules and key components (i.e., cells and wafers) originating in the People's Republic of China*, Official Journal of the European Union, C/269/5, September 6, 2012.

[55] *Notice of initiation of an anti-subsidy proceeding concerning imports of crystalline silicon photovoltaic modules and key components (i.e., cells and wafers) originating in the People's Republic of China*, Official Journal of the European Union, C/340/6, November 8, 2012.

[56] *Imposing a provisional anti-dumping duty on imports of crystalline silicon photovoltaic modules and key components (i.e., cells and wafers) originating in or consigned from the People's Republic of China and amending Regulation (EU) No 18212013 making these imports originating in or consigned from the People's Republic of China subject to registration*, Commission Regulation (EU) No. 513/2013, June 4, 2013.

[57] European Commission Directorate-General for Trade, *EU imposes definitive measures on Chinese solar panels, confirms undertaking with Chinese solar panel exporters*, Press Release, December 2, 2013.

panels from Chinese producers that were not named in the undertaking, were subject to the final antidumping and countervailing duty rates that the EC imposed on December 5, 2013 ranging from 47.7 percent to 64.9 percent.[58]

On May 29, 2015, the EC initiated investigations into claims that the duties in force concerning imports from China were being circumvented by shipments through Taiwan and Malaysia. On February 11, 2016, the EC determined that circumvention had occurred and extended the duties in force against China to solar cells and modules consigned from Taiwan and Malaysia. However, the EC's circumvention finding (and the extended duties) did not apply to approximately 20 companies in Taiwan and 5 companies in Malaysia that the EC found were "genuine producers" that had not engaged in any circumvention activities.[59]

On March 3, 2017, the EU published an 18-month extension of antidumping and anti-subsidy duties on CSPV products from China, and notified its intention to conduct a partial interim review of the gradual mitigation of the measures over the next 18 months. The EC announced that it expected to complete its interim review within six to nine months in order to examine the applicability and relevance of the measures in light of the fact that several manufacturers in China withdrew from the MIP undertaking or were excluded by the EC for various violations. Antidumping duty margins, which ranged from 27.3 percent to 64.9 percent, and anti-subsidy duties, which ranged from 3.5 percent to 11.5 percent, applied to those companies that were excluded or withdrew from the MIP undertaking. The duties applied to imports of CSPV modules and CSPV cells manufactured in China and to modules assembled in third countries from CSPV cells produced in China.[60]

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[58] *Certain Crystalline Silicon Photovoltaic Cells and Modules from China and Taiwan*, *Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final)*, USITC Publication 4519, February 2015, p. VII-29; *Council Implementing Regulation (EU) No 1239/2013 of 2 December 2013 imposing a definitive countervailing duty on imports of crystalline silicon photovoltaic modules and key components (i.e., cells) originating in or consigned from the People's Republic of China*, Official Journal of the European Union, December 5, 2013; *Council Implementing Regulation (EU) No 1238/2013 of 2 December 2013 imposing a definitive anti-dumping duty and collecting definitively the provisional duty imposed on imports of crystalline silicon photovoltaic modules and key components (i.e., cells) originating in or consigned from the People's Republic of China*, Official Journal of the European Union, December 5, 2013.

[59] *Commission Implementing Regulation (EU) 2016/184 of 11 February 2016 extending the definitive countervailing duty imposed by Council Implementing Regulation (EU) No 1239/2013 on imports of crystalline silicon photovoltaic modules and key components (i.e., cells) originating in or consigned from the People's Republic of China to imports of crystalline silicon photovoltaic modules and key components (i.e., cells) consigned from Malaysia and Taiwan, whether declared as originating in Malaysia and in Taiwan or not*, Official Journal of the European Union, February 11, 2016.

[60] *Notice of initiation of a partial interim review of the anti-dumping and countervailing measures applicable to imports of crystalline silicon photovoltaic modules and key components (i.e., cells) originating in or consigned from the People's Republic of China (2017/C 67/10)*, Official Journal of the European Union, March 3, 2017; "Extension of EU duties on Chinese solar products is now official," *PV Magazine*, March 3, 2017, https://www.pv-magazine.com/2017/03/03/extension-of-eu-duties-on-chinese-solar-products-is-now-official/, retrieved July 9, 2017.

On September 16, 2017, the EU announced that it would progressively reduce the minimum import prices. In particular, the minimum prices would be reduced every three months until July 1, 2018 (i.e., on October 1, 2017, January 1, 2018, April 1, 2018, and July 1, 2018).[61]

In June 2018, at least one EU solar module producer asked the European Commission for a review of existing antidumping and anti-subsidy measures.[62] On August 31, 2018, the European Commission announced that it was ending all EU anti-dumping and anti-subsidy actions against solar cells from China effective September 3, 2018.[63]

India

In October 2012, solar manufacturers in India filed a complaint alleging that solar cells and modules from China, Taiwan, Malaysia, and the United States are being sold at LTFV and unfairly subsidized by those respective governments. On November 23, 2012, India initiated its investigation. After extending the duration of the investigation, in May 2014, the Indian Directorate General of Anti-Dumping and Allied Duties ("DGAD") recommended imposing duties ranging from $0.11 to $0.81 per watt on solar cells imported from the United States, China, Malaysia, and Taiwan. However, the Indian Ministry of Commerce announced in September 2014 that the government would not impose the duties and let the recommendation lapse.[64]

In June 2017, an antidumping petition concerning solar cells and modules imported into India from China, Malaysia, and Taiwan was filed by the Indian Solar Manufacturers Association (on behalf of Indosolar Ltd., Jupitar Solar Power Ltd., Jupitar International Ltd., and Websol Energy Systems Ltd.). DGAD issued a notification on July 21, 2017 of the initiation of an antidumping investigation on imports of "Solar Cells whether or not assembled partially or fully in Modules or Panels or on glass or some other suitable substrates" originating in or exported

[61] "UPDATE 1-China Welcomes EU Decision on solar panel import prices," *Reuters*, September 18, 2017, https://www.reuters.com/article/china-eu-anti-dumping/update-1-china-welcomes-eu-decision-on-solar-panel-import-prices-idUSL4N1LZ2LV, retrieved January 19, 2018.

[62] Blenkinsop, Philip, "EU looks into extending import controls on Chinese solar panels," *Reuters*, June 19, 2018, https://www.reuters.com/article/us-eu-china-solar/eu-looks-into-extending-import-controls-on-chinese-solar-panels-idUSKBN1JF1CB, retrieved September 13, 2018.

[63] Beetz, Becky, "EU officially ends MIP for Chinese solar imports," PV Magazine, August 31, 2018, https://www.pv-magazine.com/2018/08/31/eu-ends-mip-against-chinese/, retrieved September 13, 2018.

[64] *"India Not to Impose Anti-Dumping Duty on Solar Panels: Nirmala,"* Outlook India, September 10, 2014, http://www.outlookindia.com/news/article/India-Not-to-Impose-AntiDumping-Duty-on-Solar-Panels-Nirmala/859279, retrieved July 9, 2017; *Certain Crystalline Silicon Photovoltaic Cells and Modules from China and Taiwan*, Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final), USITC Publication 4519, February 2015, p. VII-30.

from China, Malaysia, and Taiwan.[65] In March 2018, the Indian Solar Manufactures Association withdrew its petition, citing a desire to "contemporize" the investigation to take in to account a longer time period in which it claimed the domestic industry was subject to even greater injury, indicating its intention to file a new petition in the future.[66] DGAD terminated the investigation on March 23, 2018.[67]

Separately, on December 19, 2017, The Government of India initiated a safeguard investigation on "solar cells, whether or not assembled in modules or panels."[68] On July 16, 2018, India's Directorate General of Safeguards Customs and Central Excise affirmed preliminary findings and recommended safeguard duties of 25 percent in the first year, 20 percent for the first six months of the second year, and 15 percent for the next six months of the second year. Developing countries, except China and Malaysia, are exempt from the duties.[69] In September 2018, the Indian Supreme Court cancelled a lower court's interim stay on the safeguard duties, affirming that the duties would be imposed according to the recommendations made by the Directorate General of Safeguards Customs and Central Excise retroactively effective July 30, 2018.[70]

Turkey

The Government of Turkey completed an antidumping investigation of imported modules from China in February 2017, in which it found a dumping rate of 27 percent. On April

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[65] Kenning, Tom, "*India mulling safeguard duties on solar imports with China in sights*," PV-Tech, July 21, 2017, https://www.pv-tech.org/news/india-considers-safeguard-duties-on-solar-imports-with-dumping-investigatio, retrieved July 23, 2017; *Initiation Notification, Case No. OI-33/2017*, F. No. 6/30/2017-DGAD, Government of India, Department of Commerce, Ministry of Commerce & Industry, Directorate General of Anti-Dumping & Allied Duties, July 21, 2017.

[66] Kenning, Tom, "*Indian PV manufacturers to refresh anti-dumping petition to avoid being 'short-changed'*," PV-Tech, March 5, 2018, https://www.pv-tech.org/news/indian-pv-manufacturers-to-refresh-anti-dumping-petition-to-avoid-being-sho, retrieved September 13, 2018.

[67] *Termination Order, Case No. OI-33/2017*, F. No. 6/30/2017-DGAD, Government of India, Department of Commerce, Ministry of Commerce & Industry, Directorate General of Anti-Dumping & Allied Duties, March 23, 2018, http://www.dgtr.gov.in/anti-dumping-cases/solar-cells-whether-or-not-assembled-partially-or-fully-modules-or-panels-or-0, retrieved September 17, 2018.

[68] WTO Website, "India Launches Safeguard Investigation on Solar Cells," December 19, 2017, https://www.wto.org/english/news_e/news17_e/safe_ind_19dec17_e.htm.

[69] India Directorate General of Safeguards Customs and Central Excise, "Safeguard Investigation Concerning Imports of 'Solar Cells Whether or Not Assembled in Modules or Panels' into India – Preliminary Findings," Reference F.No. 22011/68/2017, July 16, 2018, p. 150, http://www.dgtr.gov.in/sites/default/files/Solar-Final_Finding-English_0.pdf.

[70] Upadhyay, Anindya and Vrishti Beniwal, "India Says Solar Safeguard Duty Imposed After Court Delays," Bloomberg, September 14, 2018, https://www.bloomberg.com/news/articles/2018-09-14/india-says-solar-safeguard-duty-imposed-after-court-delays, retrieved September 17, 2018.

1, 2017, the Government of Turkey published a list of China-based CSPV manufacturers that are the subject of antidumping duty fees.[71]

THE GLOBAL MARKET

Global installations[72]

Global PV system installations (including thin film) increased from 30 GW in 2012 to 99 GW in 2017 (table IV-15). The largest markets in 2017 were China (53.1 GW, 54 percent of installations), the United States (10.7 GW, 11 percent), India (9.1 GW, 9 percent), and Japan (7.5 GW, 8 percent). The European Union accounted for a combined 6.1 GW in 2017, representing 6 percent of global installation.[73]

[71] "Turkey publishes antidumping fee and list for China-based PV manufacturers," PV Magazine, April 3, 2017, https://www.pv-magazine.com/2017/04/03/turkey-publishes-antidumping-fee-and-list-for-china-based-pv-manufacturers/, retrieved July 10, 2017.

[72] This section is primarily based on International Energy Agency ("IEA") Photovoltaic Systems Power Programme ("PVPS") data (available from http://www.iea-pvps.org) cited in *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. IV-5–6.

[73] IEA PVPS, "Trends 2018 in Photovoltaic Applications," IEA PVPS T1-34:2018, p. 12, 25, 83, http://www.iea-pvps.org/index.php?id=trends; IEA PVPS, "Trends 2014 in Photovoltaic Applications," IEA-PVPS T1-25:2014, p. 21, http://www.iea-pvps.org/index.php?id=trends.

Table IV-15
Global PV (including thin film) installations, 2012-17

Country	2012	2013	2014	2015	2016	2017
	Quantity (GW)					
China	3.6	10.7	10.6	15.2	34.6	53.1
United States	3.2	4.9	6.2	7.5	15.1	10.7
India	1.0	1.1	0.8	2.1	4.0	9.1
Japan	1.7	7.0	9.7	10.8	7.9	7.5
Turkey	0.0	0.0	0.0	0.2	0.6	2.6
Germany	8.2	2.6	1.2	1.3	1.5	1.8
Australia	1.1	0.8	0.9	1.0	0.9	1.3
Korea	0.3	0.5	0.9	1.1	0.9	1.4
All other sources	10.9	9.4	8.7	11.8	11.0	11.6
Total	29.9	37.1	39.2	51.0	76.4	98.9

Note.--Turkey installed 5 MW in 2012, 6 MW in 2013, and 35 MW in 2014.

Source: IEA PVPS, "Trends 2018 in Photovoltaic Applications," IEA PVPS T1-34:2018, p. 12, 25, 83, http://www.iea-pvps.org/index.php?id=trends, retrieved December 18, 2018; IEA PVPS, "Trends 2014 in Photovoltaic Applications," IEA-PVPS T1-25:2014, p. 21, http://www.iea-pvps.org/index.php?id=trends , retrieved December 18, 2018. Note that IEA reported U.S. installations may vary slightly from GTM reported installations presented elsewhere in this report.

Installations are forecast to total *** in 2018, *** in 2019, and *** in 2020.[74] PV InfoLink, which labels its forecast as module demand, projects 88 GW of demand in 2018 and 112 GW in 2019.[75] *** presented in table IV-16 ***. All other forecasts are from November–December 2018, but may have varying approaches on the extent to which they take into account proposed policy changes in China.

[74] ***; SolarWorld's prehearing brief, exhibit 66, ***; Canadian Solar's prehearing brief, exhibit 5, ***.

[75] Bhambhani, Anu, "PV InfoLink Forecast For 2019: 112 GW New PV," Taiyang News, December 4, 2018, http://taiyangnews.info/business/pv-infolink-forecast-for-2019-112-gw-new-pv/;

Table IV-16
Projected global PV market installations and demand, 2018–20

Forecast	China	United States	Europe	Japan	India	All other sources	Total
	Quantity (GW)						
2018							
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Module demand: PV InfoLink	34	7	10	6	8	23	88
2019							
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Module demand: PV InfoLink	43	12	13	4	12	27	112
2020							
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***
Installations: ***	***	***	***	***	***	***	***

Note.--Projected module demand for PV InfoLink was calculated by multiplying global demand by the share of demand in each country/region. PV InfoLink Europe data are for the EU only.

Source: ***; Bhambhani, Anu, "PV InfoLink Forecast For 2019: 112 GW New PV," Taiyang News, December 4, 2018, http://taiyangnews.info/business/pv-infolink-forecast-for-2019-112-gw-new-pv/; SolarWorld's prehearing brief, exhibit 66, ***; Canadian Solar's prehearing brief, exhibit 5, ***.

Global industry[76]

Global cell production and capacity

Global CSPV cell production *** from *** in 2012 to *** in 2017,[77] while cell production capacity *** from *** in 2012 to *** in 2017, according to GTM Research (figure IV-4). Of the *** in 2017, *** was ramped capacity ("a discount of total capacity, accounting for capacity ramp time, plant downtimes, and plant suspensions").[78] ***.[79]

Figure IV-4
Global CSPV cell production, shipments, and capacity, 2012–17

* * * * * * *

The leading CSPV cell manufacturing companies, in terms of cell manufacturing capacity as of August 1, 2018, in order from largest to smallest, were ***.[80] China remains the largest producer and customer of CSPV cells, though capacity expansions in Malaysia and Vietnam notably increased their production capabilities.[81]

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[76] This section is primarily based on *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. IV-7–11.

[77] Other estimates of cell production in 2017 ranged from 94 to 100 GW, though these estimates include CSPV cell and thin film module production. Jäger-Waldau, Arnulf, "Snapshot of Photovoltaics–February 2018," *EPJ Photovoltaics,* 2018, p. 1, https://www.epj-pv.org/articles/epjpv/abs/2018/01/pv180003/pv180003.html.

[78] SolarWorld's prehearing brief, exhibit 66 (***); Jones, Jade, "Will There Be a PV Module Supply Shortage by the End of 2015?" GTM Research, June 25, 2015, https://www.greentechmedia.com/articles/read/will-there-be-a-pv-module-supply-shortage-by-the-end-of-2015.

[79] SolarWorld's prehearing brief, exhibit 66 (***).

[80] ***.

[81] Hutchins, Mark, "The Weekend Read: Cell Manufacturer Ranking," PV Magazine, March 30, 2018, https://www.pv-magazine.com/2018/03/30/weekend-read-cell-manufacturer-ranking/, retrieved September 20, 2018.

Global module production and capacity

Global CSPV module production *** from *** in 2012 to *** in 2017 (figure IV-5).[82] Global CSPV module production capacity *** from *** in 2012 to *** in 2017. Of the *** in PV (including thin film) capacity at the end of 2017, *** was ramped production capacity.[83] China was the leading module producer in 2017, accounting for 72 percent of production.[84]

Figure IV-5
Global PV module production, shipments, and capacity, 2012–17

* * * * * * *

The leading CSPV module suppliers in 2017, in order from largest to smallest, were Jinko Solar (headquartered in China), Trina Solar (China), JA Solar (China), Canadian Solar (China), Hanwha (Korea), GCLSI/Chaori (China), Longi Green Energy Technology (China), Risen Energy (China), Sunfeng (China), and Yingli (China).[85] Overall, the top 12 module suppliers accounted for almost two-thirds of total market supply in 2017.[86]

Leading nonsubject suppliers

Based on official Commerce statistics for CSPV cells (HTS 8541.40.6030) and CSPV modules (HTS 8541.40.6020), the top five nonsubject suppliers to the United States during 2012–17 were Malaysia, Mexico, Korea, Taiwan, and Vietnam. This section provides brief profiles of the industries in these countries, as well as the industry in Thailand (which was among the top five suppliers in 2017, but not throughout the 6-year period).

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[82] SolarWorld's prehearing brief, exhibit 66 (***). Estimated 2017 shipments were more than 95 GW, with one estimate as high as 106 GW.PV InfoLink, "Module Shipment Rankings: Top10 Companies Represent 55% of Global Shipment, While Rankings Reshuffled in China," January 29, 2018, https://www.pvinfolink.com/post-view.php?ID=9; Colville, Finlay, "Top 10 Module Suppliers in 2017," January 15, 2018, https://www.pv-tech.org/editors-blog/top-10-module-suppliers-in-2017; Crowell, Chris, "GlobalData: Top PV module provider in 2017 was JinkoSolar," *Solar Builder*, May 7, 2018, https://solarbuildermag.com/news/globaldata-top-pv-module-provider-in-2017-was-jinkosolar/.

[83] SolarWorld's prehearing brief, exhibit 66 (***).

[84] IEA PVPS, "Trends 2018 in Photovoltaic Applications," IEA PVPS T1-34:2018, p. 57, http://www.iea-pvps.org/index.php?id=trends.

[85] Colville, Finlay, "PV ModuleTech to showcase top-10 global module suppliers for 2019," PV Tech, August 9, 2018, https://www.pv-tech.org/editors-blog/pv-moduletech-to-showcase-top-10-global-module-suppliers-for-2019.

[86] Colville, Finlay, "PV ModuleTech to showcase top-10 global module suppliers for 2019," PV Tech, August 9, 2018, https://www.pv-tech.org/editors-blog/pv-moduletech-to-showcase-top-10-global-module-suppliers-for-2019.

Malaysia

Malaysia's CSPV cell production capacity totaled more than 6 GW in 2017,[87] while its CSPV module capacity was 4.7 GW. The leading cell producers in 2017, in terms of capacity, were Hanwha (1.6 GW of cell capacity), Jinko (1.5 GW), and JA Solar (1 GW). The leading module producers in 2017, in terms of capacity, were Hanwha (1.6 GW of capacity) and Jinko (1.3 GW).[88] The Malaysian solar industry exported 93 percent of its PV module (including thin film) production in 2017.[89]

Mexico[90]

i3 Group, a holding company, is the only manufacturer of CSPV cells in Mexico, which are produced via its subsidiaries. In contrast, there were 10 CSPV module producers in Mexico in 2017, with a combined annual production capacity of greater than 2 GW. SunPower is the largest producer, with an annual capacity of more than 1.5 GW.[91] The other nine producers are Mexico-based companies with annual production capacity of more than 500 MW and annual production of about 220 MW.[92]

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[87] TS Solartech is included in this total (with 240 MW of annual production capacity), but ended production in the third quarter of 2018. The Star, "Tek Seng Shares Fell 5% after Announcing the End of its Solar Business," July 19, 2018, https://www.thestar.com.my/business/business-news/2018/07/19/tek-seng-shares-fell-5pc-after-announcing-the-suspension-of-solar-business/.

[88] Mak, Gladys, "Solar PV: Policy, Market & Industry in Malaysia," April 7, 2018, pp. 13–14, https://unef.es/wp-content/uploads/dlm_uploads/2018/04/presentation-task-1_malaysia-april-2018.pdf; Panasonic, "Panasonic Begins Full-scale Production at 300 MW HIT Solar Module Factory in Malaysia," News release, August 30, 2013, https://news.panasonic.com/global/press/data/2013/08/en130830-2/en130830-2.html.

[89] During 2014–17, 97 percent of PV modules were exported. Mak, Gladys, "Solar PV: Policy, Market & Industry in Malaysia," April 7, 2018, pp. 11, 29–30, https://unef.es/wp-content/uploads/dlm_uploads/2018/04/presentation-task-1_malaysia-april-2018.pdf.

[90] This section is partially from *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75,* USITC Publication 4739, November 2017, pp. IV-17–20.

[91] According to SunPower's *Annual Report 2017,* the firm has 1.9 GW of module production capacity combined at its plants in France and Mexico. According to France's report to the IEA PVPS, SunPower has 154 MW of production capacity in France, implying an annual production capacity in Mexico of about 1.7 GW. SunPower, *Annual Report 2017,* 2018, p. 10, https://investors.sunpower.com/financial-information/annual-reports; IEA PVPS, *Annual Report 2017*, 2018, p. 91. http://www.iea-pvps.org/index.php?id=6&eID=dam_frontend_push&docID=4412; French Environment and Energy Management Agency, National Survey Report of Photovoltaic Applications in France 2017, May 2018, p. 34, http://www.iea-pvps.org/?id=93.

[92] IEA PVPS, *Annual Report 2017*, 2018, p. 91.

Three companies closed module plants in Mexico during 2012-17. Panasonic closed its 50 MW module plant in 2012, Siliken closed its 75 MW module plant in 2012, and Kyocera closed its 300 MW module plant in 2016. Several other firms (including Flex Ltd., Jabil Circuit, and Fox Energy) produced modules in Mexico on a contract basis during 2012-17, but have closed or the status of their manufacturing operations is unclear.

Korea

Korea's cell production capacity totaled 6.3 GW in 2017, while module production capacity totaled 8.3 GW.[93] The leading firms, in terms of 2017 annual cell production capacity, were Hanwha (3.5 GW of cell capacity and 1.5 GW of module capacity), LG (1.5 GW of cell and module capacity), Hyundai (600 MW of cell and module capacity), and Shinsung E&G (600 MW of cell and 200 MW of module capacity).[94] Other large module producers in 2016 included Solarpark Korea (600 MW), JSPV (400 MW), Hansol Technics (350 MW), and S-Energy (350 MW).[95]

South Korean producers export a significant share of production, with 2017 cell and module exports totaling $1.8 billion. The largest export destinations in 2017 were the United States (58 percent of exports), Japan (14 percent), and the Netherlands (10 percent).[96]

Taiwan

Taiwan is the second-largest CSPV cell manufacturer in the world, with *** of cell production capacity in 2017. Taiwan's module production capacity is more limited, with *** of production capacity in 2017.[97] There has been some recent consolidation in the Taiwan CSPV industry. In October 2017, three of Taiwan's leading solar companies (Gintech, Neo Solar Power, and Solartech) announced plans to merge into United Renewable Energy.[98] Also in

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[93] IEA PVPS, *Annual Report 2017*, 2018, p. 86.

[94] Ibid.

[95] Inchul Hwang, Jaehong Seo, Chinho Park, "National Survey Report of PV Power Applications in Korea 2016," 2018, p. 22.

[96] Korea installed 1.2 GW in 2017. Jung-a, Song, "South Korea's Solar Industry Recovers Its Glow," The Financial Times, November 22, 2017, https://www.ft.com/content/8b7916f0-c9af-11e7-ab18-7a9fb7d6163e, retrieved September 18, 2017; IEA PVPS, "Snapshot of Global Photovoltaic Markets - Report IEA PVPS T1-33:2018," 2018, p. 15; Official Korean export statistics under HTS subheadings 8541.40.9021 and 8541.40.9022 as reported by Korean Customs in the GTA database, https://www.gtis.com, retrieved September 25, 2018.

[97] Tsao, Rhea, "Will Taiwan meet its 20 GW solar goal by 2025?," PV Magazine, September 13, 2018, https://www.pv-magazine.com/2018/09/07/will-taiwan-meet-its-20-gw-solar-goal-by-2025/, retrieved September 18, 2018; SolarWorld's prehearing brief, exhibit 66, ***.

[98] Tsao, Rhea, "Will Taiwan meet its 20 GW solar goal by 2025?," PV Magazine, September 13, 2018, https://www.pv-magazine.com/2018/09/07/will-taiwan-meet-its-20-gw-solar-goal-by-2025/, retrieved September 18, 2018; Clover, Ian, "Taiwan's Gintech, Solartech and NSP merger creates new solar entity,

October 2017, Motech and Gigasolar announced that they signed a joint venture agreement to form Taiwan Solar Module Manufacturing Co. (TSMMC), which would manufacture modules.[99] Motech announced in November 2018 that it would close a 1.1 GW cell plant in Taiwan by the end of January 2019.[100]

Taiwan producers export a majority of their cell and module production. Taiwan's PV cell and module exports totaled $2.2 billion in 2017. China was the leading export destination (accounting for 33 percent of exports), followed by Vietnam (17 percent), Turkey (10 percent), and Germany (6 percent).[101] Taiwan's domestic market is expected to grow, as the government has set a goal of 20 GW of cumulative installed capacity by 2025, up from 2.2 GW as of mid-2018.[102]

Vietnam

Vietnam's estimated CSPV cell production capacity, as of 2018, is estimated to be 3.8 to 4.3 GW and its module capacity is estimated to be 6.4 to 8.2 GW. Vina Solar is the largest producer in Vietnam, with reports ranging from 1.0 to 1.5 GW of cell production capacity and 3.4 to 4.8 GW of module capacity.[103] Vina Solar primarily manufacturers products under arrangements with other solar manufacturers, such as Neo Solar Power, GCL, and Trina Solar.[104]

UREC," October 16, 2017, https://www.pv-magazine.com/2017/10/16/taiwans-gintech-solartech-and-nsp-merger-creates-new-solar-entity-urec/, retrieved September 18, 2018.

[99] Wang, Lisa, "Motech, Gigasolar Ink Joint Venture Pact," Taipei Times, October 18, 2017, http://www.taipeitimes.com/News/biz/archives/2017/10/18/2003680534.

[100] Osborne, Mark, "Motech Closing 1.1GW Cell Plant with Company-wide Job Losses of 916," *PV Tech*, November 30, 2018, https://www.pv-tech.org/news/motech-closing-1.1gw-cell-plant-with-company-wide-job-losses-of-916.

[101] Based on exports in Taiwan customs numbers 8541.40.3000 and 8541.40.4000. Global Trade Atlas database, https://www.gtis.com, retrieved September 24, 2018.

[102] Government of Taiwan, Bureau of Energy, "Solar PV Two-Year Promotion Plan," September 13, 2017, https://www.moeaboe.gov.tw/ECW/english/content/Content.aspx?menu_id=5492, retrieved September 18, 2018; Tsao, Rhea, "Will Taiwan meet its 20 GW solar goal by 2025?," *PV Magazine*, September 13, 2018, https://www.pv-magazine.com/2018/09/07/will-taiwan-meet-its-20-gw-solar-goal-by-2025/, retrieved September 18, 2018.

[103] Wu, Chung-Han, "Vietnam: The New Powerhouse for Cell Manufacturing in Southeast Asia," Boviet Solar, June 2, 2017, https://www.slideshare.net/Jupiter276/vietnam-the-new-powerhouse-for-cell-manufacturing-in-southeast-asia; EAST Group, News release, "Vina Solar Was Acquired by EAST for 2.9 billion RMB," 2018, http://www.eastups.com/en/news_show_15_149.html, retrieved October 2, 2018.

[104] For example, GCL purchased production tools for use in a plant operated by Vina Solar. Osborne, Mark, "GCL System adding 600MW cell capacity in Vietnam with Vina," PVTech, January 3, 2017, https://www.pv-tech.org/news/gcl-system-adding-600mw-cell-capacity-in-vietnam-with-vina; EAST Group, News release, "Vina Solar Was Acquired by EAST for 2.9 billion RMB," 2018, http://www.eastups.com/en/news_show_15_149.html, retrieved October 2, 2018; EnergyTrend, "Vina

In addition to the cell capacity reported above, Vina Solar has a 40 percent stake in Trina's 1 GW cell manufacturing operation in Vietnam.[105] Other major manufactures in Vietnam include Tangshan Haitai Vietnam (at least 300 MW of cell capacity and 1 GW of module capacity), Boviet Solar (700 MW of cell and module capacity), VSUN (600 MW of module capacity), Tainergy (600 MW of cell capacity), IREX (200 MW of cell capacity and 300 MW of module capacity), Canadian Solar (300 MW of module capacity), and Red Sun Energy (75 MW of module capacity).[106] Most Vietnamese production was exported during 2012–17, as cumulative installed domestic capacity at the end of 2017 was only 8 MW.[107]

Solar Wins Cooperations with GCL-SI and Trina Solar for 1.6GW of Solar Cell Capacity," January 9, 2017, https://pv.energytrend.com/news/Vina_Solar_Wins_Cooperations_with_GCL_SI_and_Trina_Solar.html.

[105] EAST Group, News release, "Vina Solar Was Acquired by EAST for 2.9 billion RMB," 2018, http://www.eastups.com/en/news_show_15_149.html, retrieved October 2, 2018; Trina Solar, "Trina Solar in Vietnam," News release, September 10, 2018, https://www.trinasolar.com/en-apac/resources/blog/sun-09092018-1943.

[106] Tangshan Haitai increased module production capacity at its plant in Vietnam from 600 MW to 1 GW. Information on whether the firm also increased cell production capacity is not available. Red Sun Energy Website, http://redsun-solar.com/Channel.asp?ChannelID=4, retrieved October 2, 2018; HT Solar, "Tangshan Haitai Vietnam Factory's Establishment," News release, October 30, 2016, http://www.htsolargroup.com/en/ht_news/81.html; HT Solar Website, http://www.htsolargroup.com/index.html; Fukushima, Sachiko, "Tainergy Tech," presentation, April 2018, p. 10, http://hfs.tainergy.com/Customer Download Upload/Taingery Co profile 20180412 (EN).pdf; Osborne, Mark, "Canadian Solar Increases Capacity Expansion Plans Again in 2016," PVTech, May 11, 2016, https://www.pv-tech.org/editors-blog/canadian-solar-increases-capacity-expansion-plans-again-in-2016; VSUN Website, http://www.vsun-solar.com/index.php?c=content&a=show&id=179, retrieved October 2, 2018; Boviet Solar Website, http://www.boviet.com/, retrieved October 2, 2018; IREX Website, https://irex.vn/wp-content/uploads/2017/11/IREX-Catalogue-ENG-May-2018.compressed.pdf, retrieved October 31, 2018.

[107] Vietnam's domestic consumption is expected to increase. In June 2018, the Government of Vietnam announced a plan to increase the use of renewable energy and increase deployment of residential PV systems. Publicover, Brian, "Residential PV Demand Spikes as Vietnam Eyes New Installation Targets," PV Magazine, June 5, 2018, https://www.pv-magazine.com/2018/06/05/residential-pv-demand-spikes-as-vietnam-eyes-new-installation-targets/; Pearson, James and Khanh Vu, "Vietnam sets out green ambitions with bold targets for solar, rare earth," June 4, 2018, Reuters, https://www.reuters.com/article/us-vietnam-energy/vietnam-sets-out-green-ambitions-with-bold-targets-for-solar-rare-earth-idUSKCN1J00U1, retrieved September 18, 2018.

Thailand

Thailand has more than 4 GW of cell production capacity and almost 4 GW of module production capacity in 2018. The leading cell producers, in terms of annual production capacity, are Trina Solar (1 GW of cell capacity), Talesun (900 MW), Canadian Solar (850 MW), Gintech (750 MW), Astronergy/Chint Solar (350 MW), and Jetion Solar (250 MW).[108] The leading module producers, in terms of 2018 capacity, were Trina Solar (1 GW of module capacity), Talesun (900 MW), Canadian Solar (800 MW), Schutten Solar (500 MW), Jetion Solar (250 MW), and Solartron (200 MW).[109]

Thailand's cell and module exports totaled $1.1 billion in 2017, up from less than $5 million in 2014. The leading export destinations in 2017 were the United States (38 percent of exports), Vietnam (20 percent), the Netherlands (16 percent) and Turkey (5 percent).[110]

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[108] Solartron also has cell production in Thailand. Talesun, "Ghana Project: ACCRA PV 20 MW Project," March 2018, p. 12, http://www.conviviumafrica.org/pdf/GhanaProjectProfile.pdf; Trina Solar, "Trina Solar Chairman Jifan Gao Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 22, 2018, https://www.prnewswire.com/news-releases/trina-solar-chairman-jifan-gao-elaborates-on-the-pv-makers-continued-steady-growth-in-2018-300700790.html; Chint Website, http://energy.chint.com/en/index.php/about/index.html, retrieved October 3, 2018; Wang, Lisa, "Neo Solar Mulls US Plant to Cope with New Levy," Taipei Times, January 25, 2018, http://www.taipeitimes.com/News/biz/archives/2018/01/25/2003686366; CTIEC Website, http://www.ctiec.net/english/business/system3_0.jsp, retrieved October 3, 2018; Qu, Shawn, "Faith in the Future of Solar," https://www.linkedin.com/pulse/faith-future-solar-dr-shawn-qu, retrieved October 3, 2018; Solartron Website, http://www.solartron.co.th/english/about, retrieved October 3, 2018.

[109] Several additional firms had less than 100 MW in annual production capacity as of 2015. Talesun, "Ghana Project: ACCRA PV 20 MW Project," March 2018, p. 12, http://www.conviviumafrica.org/pdf/GhanaProjectProfile.pdf; Trina Solar, "Trina Solar Chairman Jifan Gao Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 22, 2018, https://www.prnewswire.com/news-releases/trina-solar-chairman-jifan-gao-elaborates-on-the-pv-makers-continued-steady-growth-in-2018-300700790.html; CTIEC Website, http://www.ctiec.net/english/business/system3_0.jsp, retrieved October 3, 2018; Schutten Solar Website, http://schutten-solar.co.th/index.php?route=information/information&information_id=13, retrieved October 3, 2018; Qu, Shawn, "Faith in the Future of Solar," https://www.linkedin.com/pulse/faith-future-solar-dr-shawn-qu, retrieved October 3, 2018; http://www.solartron.co.th/english/about, retrieved October 3, 2018; Government of Thailand, Bureau of Solar Energy Development, Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy, "National Survey Report of PV Power Applications in Thailand, 2015," 2016, 19, http://www.iea-pvps.org/?id=93.

[110] Official export statistics in customs numbers 8541.40.90001, 8541.40.21000, and 8541.40.22000 as reported by Thailand Customs in the GTA database, retrieved September 24, 2018.

PART V: PRICING DATA

FACTORS AFFECTING PRICES

Raw material costs

Raw material costs are the largest component of total cost of goods sold ("COGS") for both cells and modules. Raw material costs for the production of CSPV cells accounted for *** percent of U.S. cell producers' total COGS during 2017, down from *** percent in 2012. The main underlying raw material input for CSPV cells is wafers made from polysilicon. The cost of purchased or internally-produced cells is a major portion of raw material costs of CSPV modules. Raw material costs for the production of CSPV modules accounted for *** percent of U.S. module producers' total COGS in 2017, down from *** percent in 2012, but was between *** percent in 2014-2016.

The majority of U.S. producers (7 of 9) and importers (27 of 39) reported that prices of raw materials for CSPV products have declined since 2012. Several firms specifically reported that the cost of polysilicon and other raw materials have declined. One U.S. producer *** stated that raw material prices declined until late 2016 and early 2017, when the price of monocrystalline wafers began to increase due to high global demand.[1]

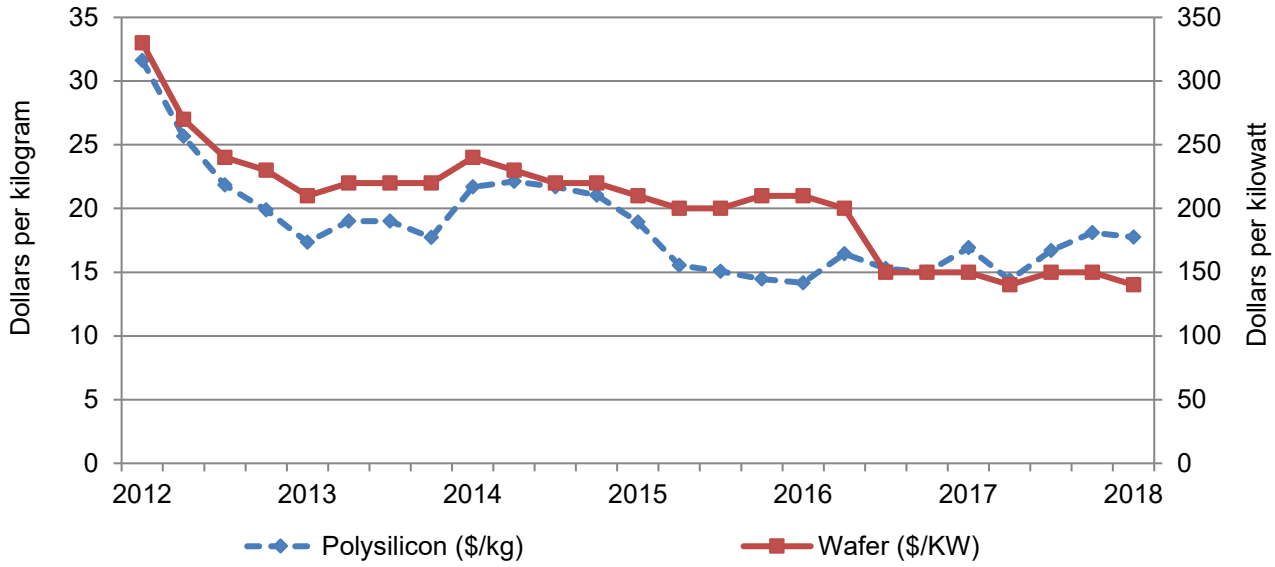
The cost of polysilicon per kilogram decreased by 43.9 percent, from $31.62 per kilogram in the first quarter of 2012 to $17.75 per kilogram in the second quarter of 2018 (figure V-1).[2] The cost of wafers fell by 57.5 percent during this time, from $330 per kilowatt in the first quarter 2012 to $140 per kilowatt in the first quarter of 2018 (figure V-1).

Domestic interested parties stated the section 301 tariffs on solar panels imposed duties on imported CSPV cells and modules but also imposed duties on some of the key raw materials that are imported into the United States to produce CSPV cells and modules.

[1] See Part III for further information regarding CSPV producers' specific raw material costs.

[2] SEIA, "U.S. Solar Market Insight" 2nd Quarter 2018.

Figure V-1
Polysilicon ingots and wafers: Price of polysilicon ingots (dollars per kilogram) and wafers (dollars per kilowatt), quarterly, January 2012-March 2018



Source: SEIA, "U.S. Solar Market Insight", 2nd Quarter 2018.

Transportation costs to the U.S. market

Transportation costs for CSPV cells and modules shipped from China to the United States averaged 3.6 percent during 2017. These estimates were derived from official import data and represent the transportation and other charges on imports.[3]

U.S. inland transportation costs

Six of 9 responding U.S. producers and 24 of 28 importers reported that they typically arrange transportation to their customers. Most U.S. producers reported that their U.S. inland transportation costs ranged from 2 to 3 percent, while one producer reported costs as high as 10 percent. Seven importers reported costs of 1 to 5 percent, six reported costs between 8 and 10 percent, and one importer reported costs as high as 60 percent.

[3] The estimated transportation costs were obtained by subtracting the customs value from the c.i.f. value of the imports for 2017 and then dividing by the customs value based on the HTS subheadings 8501.31.8000, 8501.61.0000, 8507.20.8030, 8507.20.8040, 8507.20.8060, 8507.20.8090, 8541.40.6020, 8541.40.6030.

PRICING PRACTICES

Pricing methods

U.S. producers and importers reported using transaction-by-transaction negotiations, contracts, and price lists to determine prices of CSPV cell and modules. As presented in table V-1, U.S. producers and importers both sell primarily on a transaction-by-transaction basis.

Table V-1
CSPV products: U.S. producers' and importers' reported price setting methods, by number of responding firms[1]

Method	U.S. producers	Importers
Transaction-by-transaction	8	31
Contract	2	17
Set price list	3	12
Other	3	9
Responding firms	10	43

[1] The sum of responses down may not add up to the total number of responding firms as each firm was instructed to check all applicable price setting methods employed.

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. producers reported *** CSPV cells were ***, while *** importers reported ***. U.S. producers reported selling CSPV modules primarily *** while importers reported selling their CSPV modules primarily *** in 2017 (table V-2).[4]

Table V-2
CSPV cells and modules: U.S. producers' and importers' shares of U.S. commercial shipments of CSPV modules, by type of sale, 2017

* * * * * * *

One U.S. producer of CSPV modules reported using long-term contracts, two reported using annual contracts, three reported using short-term contracts and six reported selling on a spot basis. Two U.S. producers of CSPV cell and modules reported price renegotiation during the contract period, three reported fixing price and quantity and one reported only fixing quantity. Four U.S. producers reported that their contracts did not contain meet-or-release provisions.

Three module importers reported using long-term contracts, two reported using annual contracts, three reported using short-term contacts, and six reported selling on a spot basis. Three cell and module importers reported price renegotiations during the contract period, five reported fixing price and quantity and one reported fixing prices only. Five of six importers reported there were no meet-or-release provisions contained in their typical annual contracts.

[4] The vast majority of U.S. CSPV cell production is consumed internally.

Sales terms and discounts

The majority of U.S. producers (6 of 9) and importers (14 of 21) reported that they typically quote prices on a delivered basis. The plurality of U.S. producers *** and importers *** do not offer any type of discount. However, 3 U.S. producers and 18 importers reported offering quantity-based discounts. No U.S. producer offered volume discounts, however nine importers offered volume discounts. In addition, one importer, ***, offered a *** and one importer, ***, offered discounts based on ***. Typical sales terms for most responding producers and importers is net 30 days; however, many firms noted that they required customers to deposit 10 to 50 percent of the purchase upon order.

Price leadership

Purchasers reported that Canadian Solar (4 firms); Jinko (3 firms); and Longi, Panasonic, and Trina (2 firms each) were price leaders. *** reported that Longi has achieved price leadership through technological innovation in its monocrystalline wafers. *** indicated that Canadian Solar, Trina, and Jinko as well as other firms are considered bankable suppliers and therefore they frequently compete with each other on pricing (and other terms). *** reported that Longi is by far the world's largest wafer producer and leads the rest of the world in pricing, a conglomerate of Chinese companies are price leaders in module costs, and Panasonic is the industry leader in efficiency.

PRICE DATA

The Commission requested U.S. producers and importers to provide quarterly data for the total quantity and f.o.b. value of the following CSPV modules shipped to unrelated U.S. customers between January 2012 and June 2018.

Product 1.-- 60-cell multicrystalline silicon module, with a peak power wattage between 240w to 265w, inclusive, p-max or Wp.

Product 2.-- 60-cell multicrystalline silicon module, with a peak power wattage between 266w to 290w, inclusive, P-max or Wp.

Product 3.-- 60-cell monocrystalline silicon module, with a peak power wattage between 250w to 280w, inclusive, P-max or Wp.

Product 4.-- 60-cell monocrystalline silicon module, with a peak power wattage between 281w to 310w, inclusive, P-max or Wp.

Product 5.-- 72-cell multicrystalline silicon module, with a peak power wattage between 290w to 315w, inclusive, P-max or Wp.

Product 6.-- 72-cell multicrystalline silicon module, with a peak power wattage between 316w to 340w, inclusive, P-max or Wp.

Product 7.-- 72-cell monocrystalline silicon module, with a peak power wattage between 300w to 330w, inclusive, P-max or Wp.

Product 8.-- 72-cell monocrystalline silicon module, with a peak power wattage between 331w to 360w, inclusive, P-max or Wp.

Six U.S. producers[5] and 9 importers provided usable pricing data for sales of the requested products, although not all firms reported pricing for all products for all quarters.[6] Pricing data reported by these firms accounted for approximately 74.8 percent of U.S. producers' commercial shipments of CSPV modules and 98.2 percent of U.S. commercial shipments of CSPV modules from China in 2017.

Price data for products 1-8 are presented in tables V-3 to V-10 and figures V-2 to V-9.

Table V-3
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 1, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-4
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 2, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-5
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 3, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-6
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 4, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

[5] U.S. producers *** provided price data. These U.S. producers reported pricing data that exceeded their total commercial shipment and *** included products outside of the product definitions in its pricing data. Despite several attempts by staff, the data submitted could not be reconciled. Accordingly, these data are not included in the pricing analysis.

[6] Per-unit pricing data are calculated from total quantity and total value data provided by U.S. producers and importers. The precision and variation of these figures may be affected by rounding, limited quantities, and producer or importer estimates.

Table V-7
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 5, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-8
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 6, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-9
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 7, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Table V-10
CSPV modules: Weighted average f.o.b. prices and quantities of domestic and Chinese product 8, and margins of underselling/(overselling), by quarter, January 2012-June 2018

* * * * * * *

Figure V-2
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 1, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-3
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 2, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-4
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 3, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-5
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 4, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-6
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 5, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-7
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 6, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-8
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 7, by quarter, January 2012 through June 2018

* * * * * * *

Figure V-9
CSPV modules: Weighted-average f.o.b. prices and quantities of domestic and Chinese product 8, by quarter, January 2012 through June 2018

* * * * * * *

Price trends

In general, prices decreased between January 2012 and June 2018 for all pricing products, with the exception of domestic pricing products 2 and 6 for which there was limited data. Table V-11 summarizes the price trends, by country and by product. Decreases in the price of CSPV modules range from *** percent to *** percent for imported CSPV modules from China, and *** to *** percent for domestically produced CSPV modules.

Table V-11
CSPV modules: Summary of weighted-average f.o.b. prices for products 1-8, from the United States and China

Item	Number of quarters	Low price (dollars per kilowatt)	High price (dollars per kilowatt)	Change in price[1] (percent)
Product 1				
United States	23	***	***	***
China	26	***	***	***
Product 2				
United States	3	***	***	---
China	14	***	***	---
Product 3				
United States	26	***	***	***
China	20	***	***	***
Product 4				
United States	19	***	***	---
China	11	***	***	---
Product 5				
United States	23	***	***	***
China	23	***	***	***
Product 6				
United States	1	***	***	---
China	11	***	***	---
Product 7				
United States	26	***	***	***
China	3	***	***	***
Product 8				
United States	13	***	***	---
China	6	***	***	---

[1] Percentage change (based on unrounded data) from first observed quarter to the last observed quarter of data.

Source: Compiled from data submitted in response to Commission questionnaires.

Price comparisons

As shown in table V-12, prices for CSPV modules imported from China were below those for U.S.-produced CSPV modules in 62 of 85 instances (***), with margins ranging from *** percent. Prices for Chinese CSPV modules were higher in the remaining 23 instances (***), with margins ranging from *** percent.

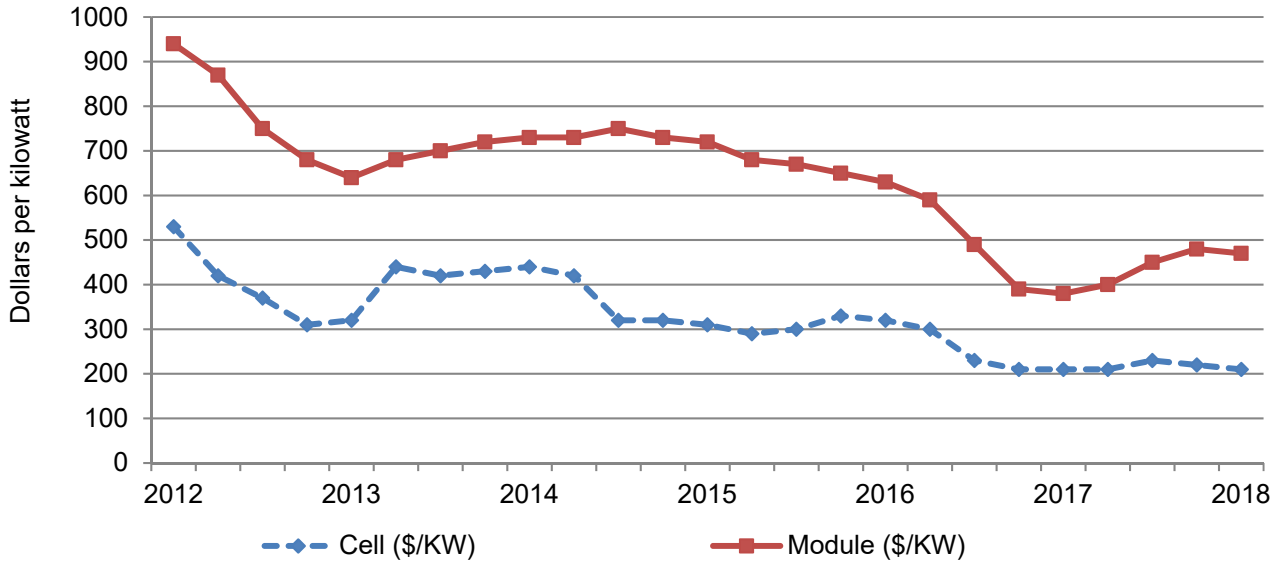
Table V-12
CSPV modules: Instances of underselling/overselling and the range and average of margins, January 2012-June 2018

* * * * * * *

Public price data

As shown in figure V-10, the average prices of both CSPV cells and modules have decreased significantly since 2012. Prices of cells and modules generally have followed the same price trends from the first quarter of 2012 to the first quarter of 2018. The average price of a CSPV cell decreased by 60.3 percent during this time, from $530 per kilowatt in the first quarter 2012 to $210 per kilowatt in the first quarter of 2018. The average price of a CSPV module decreased by 50.0 percent, from $940 per kilowatt in the first quarter of 2012 to $470 per kilowatt in the second quarter of 2018.

Figure V-10
CSPV cells and modules: Average U.S. price of CSPV cells and modules (dollars per kilowatt), quarterly, January 2012-March 2018



Source: SEIA, "U.S. Solar Market Insight", 2nd Quarter 2018.

Purchasers' perceptions of relative price trends

Purchasers were asked how the prices of CSPV cells and modules from the United States had changed relative to the prices of CSPV cells and modules from China since 2012. Seven purchasers reported that the price of U.S. cells and modules had increased relative to the price of Chinese cells and modules, two purchasers reported that the price of U.S. cells and modules had decreased relative to the price of Chinese cells and modules, and four purchases reported that the price of U.S. and Chinese cells and modules changed by the same amount.

APPENDIX A

FEDERAL REGISTER NOTICES

The Commission makes available notices relevant to its investigations and reviews on its website, www.usitc.gov. In addition, the following tabulation presents, in chronological order, *Federal Register* notices issued by the Commission and Commerce during the current proceeding.

Citation	Title	Link
82 FR 50612 November 1, 2017	*Initiation of Five-Year (Sunset) Reviews*	https://www.gpo.gov/fdsys/pkg/FR-2017-11-01/pdf/2017-23763.pdf
82 FR 50681 November 1, 2017	*Crystalline Silicon Photovoltaic Cells and Modules From China; Institution of Five-Year Reviews*	https://www.gpo.gov/fdsys/pkg/FR-2017-11-01/pdf/2017-23654.pdf
83 FR 8296 February 5, 2018	*Crystalline Silicon Photovoltaic Cells and Modules From China; Notice of Commission Determinations To Conduct Full Five-Year Reviews*	https://www.gpo.gov/fdsys/pkg/FR-2018-02-26/pdf/2018-03841.pdf
83 FR 10431 March 9, 2018	*Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Results of the Expedited First Sunset Review of the Countervailing Duty Order*	https://www.gpo.gov/fdsys/pkg/FR-2018-03-09/pdf/2018-04753.pdf
83 FR 10663 March 12, 2018	*Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Results of the Expedited First Sunset Review of the Antidumping Duty Order*	https://www.gpo.gov/fdsys/pkg/FR-2018-03-12/pdf/2018-04897.pdf
83 FR 34873 July 23, 2018	*Crystalline Silicon Photovoltaic Cells and Modules From China; Scheduling of Full Five-Year Reviews*	https://www.gpo.gov/fdsys/pkg/FR-2018-07-23/pdf/2018-15708.pdf
83 FR 54138 October 26, 2018	*Crystalline Silicon Photovoltaic Cells and Modules From China: Revised Schedule for Full Five-Year Reviews*	https://www.gpo.gov/fdsys/pkg/FR-2018-10-26/pdf/2018-23375.pdf

APPENDIX B

LIST OF HEARING WITNESSES

CALENDAR OF PUBLIC HEARING

Those listed below appeared as witnesses at the United States International Trade Commission's hearing:

Subject: Crystalline Silicon Photovoltaic Cells and Modules from China

Inv. Nos.: 701-TA-481 and 731-TA-1190 (Review)

Date and Time: November 27, 2018 - 9:30 a.m.

Sessions were held in connection with these investigations in the Main Hearing Room (Room 101), 500 E Street, S.W., Washington, D.C.

EMBASSY APPEARANCE:

The Embassy of Indonesia
Washington, DC

Reza Pahlevi Chairul, Commercial Attaché

OPENING REMARKS:

In Support of Continuation of Orders (**Laura El-Sabaawi**, Wiley Rein LLP)
In Opposition to Continuation of Orders (**Jonathan T. Stoel**, Hogan Lovells US LLP)

In Support of the Continuation of
Antidumping and Countervailing Duty Orders:

Wiley Rein LLP
Washington, DC
on behalf of

SolarWorld Americas Inc.

John Boken, Chief Executive Officer, SolarWorld Americas Inc.

Dr. Seth T. Kaplan, President, International Economic Research LLC

In Support of the Continuation of
Antidumping and Countervailing Duty Orders (continued):

Andrew Szamosszegi, Principal, Capital Trade, Inc.

Timothy C. Brightbill)
Laura El-Sabaawi) – OF COUNSEL
Usha Neelakantan)

TradeWins LLC
Washington, DC
on behalf of

SunPower Manufacturing Oregon, LLC ("SPMOR")

Thomas Starrs, SPMOR

John R. Magnus)
) – OF COUNSEL
Sheridan S. McKinney)

In Opposition to the Continuation of
Antidumping and Countervailing Duty Orders:

Hogan Lovells US LLP
Washington, DC
on behalf of

Canadian Solar Inc.
Canadian Solar International, Ltd.
Canadian Solar Manufacturing (Changshu), Inc.
Canadian Solar Manufacturing (Luoyang), Inc.
Canadian Solar (USA), Inc.
(collectively "Canadian Solar")

Vincent Ambrose, Senior Director and General Manager Sales, North America, Module System Solutions Business, Canadian Solar (USA), Inc.

Michael Arndt, Managing Director of Development, Recurrent Energy, LLC

Vince Plaxico, Managing Director, Project Finance, Recurrent Energy, LLC

In Opposition to the Continuation of
Antidumping and Countervailing Duty Orders (continued):

Virinder Singh, Director, Regulatory & Legislative Affairs,
Head of U.S. Government Affairs, EDF Renewable
Energy

Hamilton Davis, Director of Regulatory Affairs,
Southern Current LLC

Hewitt Strange, Director of Government Affairs,
Cypress Creek Renewables

James P. Dougan, Vice President, Economic Consulting Services

Jonathan T. Stoel)
Craig A. Lewis) – OF COUNSEL
Nicholas R. Sparks)

REBUTTAL/CLOSING REMARKS:

In Support of Continuation of Orders (**Dr. Seth T. Kaplan**, International Economic Research LLC and **Timothy C. Brightbill**, Wiley Rein LLP)
In Opposition to Continuation to Orders (**Jonathan T. Stoel**, Hogan Lovells US LLP)

APPENDIX C

SUMMARY DATA

Single like product: CSPV cells and modules: Total market

Table C-1
CSPV cells and modules: Summary data concerning the total U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data							
	Calendar year						January to June	
	2012	2013	2014	2015	2016	2017	2017	2018
U.S. total market consumption quantity:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. total market consumption value:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1):								
Fully domestic	***	***	***	***	***	***	***	***
Value added to imports	***	***	***	***	***	***	***	***
Total value	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. imports from:								
China:								
Quantity	326,846	82,264	1,263,270	3,311,513	2,720,193	1,307,134	50,760	22,962
Value	291,878	69,976	747,148	1,680,733	1,258,864	441,381	25,860	12,670
Unit value	$893	$851	$591	$508	$463	$338	$509	$552
Ending inventory quantity	***	***	***	***	***	***	***	***
Nonsubject sources:								
Quantity	1,835,542	3,019,148	3,319,628	5,118,880	10,093,375	6,864,094	2,244,954	2,350,780
Value	1,612,786	2,144,481	2,267,713	3,287,132	5,801,625	3,354,314	1,053,465	1,023,168
Unit value	$879	$710	$683	$642	$575	$489	$469	$435
Ending inventory quantity	***	***	***	***	***	***	***	***
All import sources:								
Quantity	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568	8,171,228	2,295,714	2,373,742
Value	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489	3,795,695	1,079,325	1,035,838
Unit value	$881	$714	$658	$589	$551	$465	$470	$436
Ending inventory quantity	***	***	***	***	***	***	***	***
U.S. cell producers':								
Average capacity quantity	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***
U.S. module assemblers':								
Average capacity quantity	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***
Combined U.S. cell producers and U.S. module assemblers:								
U.S. shipments (fn3):								
Quantity	***	***	***	***	***	***	***	***
Value:								
Fully domestic	***	***	***	***	***	***	***	***
Value added to imports	***	***	***	***	***	***	***	***
Total value	***	***	***	***	***	***	***	***
Unit value (fn4)	***	***	***	***	***	***	***	***
Export shipments (fn5):								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***	***
Total market net sales: (fn6)								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***

Table continued on next page.

Table C-1--Continued
CSPV cells and modules: Summary data concerning the total U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Period changes						
	Comparison years						Jan-Jun
	2012-17	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
U.S. consumption quantity:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. consumption value:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)							
Fully domestic	***	***	***	***	***	***	***
Value added to imports	***	***	***	***	***	***	***
Total value	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. imports from:							
China:							
Quantity	299.9	(74.8)	1,435.6	162.1	(17.9)	(51.9)	(54.8)
Value	51.2	(76.0)	967.7	125.0	(25.1)	(64.9)	(51.0)
Unit value	(62.2)	(4.7)	(30.5)	(14.2)	(8.8)	(27.0)	8.3
Ending inventory quantity	***	***	***	***	***	***	***
Nonsubject sources:							
Quantity	274.0	64.5	10.0	54.2	97.2	(32.0)	4.7
Value	108.0	33.0	5.7	45.0	76.5	(42.2)	(2.9)
Unit value	(44.4)	(19.2)	(3.8)	(6.0)	(10.5)	(15.0)	(7.2)
Ending inventory quantity	***	***	***	***	***	***	***
All import sources:							
Quantity	277.9	43.4	47.8	84.0	52.0	(36.2)	3.4
Value	99.3	16.3	36.1	64.8	42.1	(46.2)	(4.0)
Unit value	(47.3)	(18.9)	(7.9)	(10.4)	(6.5)	(15.7)	(7.2)
Ending inventory quantity	***	***	***	***	***	***	***
U.S. cell producers':							
Average capacity quantity	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***
U.S. module assemblers':							
Average capacity quantity	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***
Combined U.S. cell producers' and U.S. module assemblers':							
U.S. shipments (fn3):							
Quantity	***	***	***	***	***	***	***
Value:							
Fully domestic	***	***	***	***	***	***	***
Value added to imports	***	***	***	***	***	***	***
Total value	***	***	***	***	***	***	***
Unit value (fn4)	***	***	***	***	***	***	***
Export shipments (fn5):							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***
Total market net sales: (fn6)							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***

Table notes on next page.

Table C-1--Continued
CSPV cells and modules: Summary data concerning the total U.S. market, 2012-17, January to June 2017, and January to June 2018

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--The quantity for U.S. producers' U.S. shipments reflects the quantity of U.S.-origin CSPV cells manufactured and sold in the United States regardless of where module assembly occurred; The value for U.S. producers' U.S. shipments reflects the value of U.S.-origin cells manufactured and sold in the United States plus the value added by domestic modules assemblers that imported foreign-origin CSPV cells and assembled them into modules in the United States. In measuring consumption and market share this methodology avoids reclassifying and/or double counting merchandise already reported once as an import.
fn4.--Unit value of U.S. producers' U.S. shipments excludes the value added to imports by domestic module assemblers.
fn5.--A portion of ***.
fn6.--The financial data presented here represents both module assemblers (total market operations) and cell producers (open market operations) combined operations, and, therefore, a portion of the reported net sales quantities includes some volume of merchandise reported as imports within the apparent consumption calculations.

Source: Compiled from data submitted in response to Commission questionnaires. Import data compiled from data reported in Office of Investigations memorandum INV-PP-119 (CPSV 3, solar 201 staff report) for 2012-16 period, and compiled from data submitted in response to commission questionaires and official U.S. import statistics under HTS codes 8541.40.6020 and 8541.40.6030, accessed October 30, 2018, for the 2017, January to June 2017, and January to June 2018 periods with adjustment. See detailed explanation of the methodology for adjusted official U.S. import statistics in part IV of this report.

Split like product: CSPV modules: Total market

Table C-2
CSPV modules: Summary data concerning the total U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data							
	Calendar year						January to June	
	2012	2013	2014	2015	2016	2017	2017	2018
U.S. total market consumption quantity:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. total market consumption value:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. imports from:								
China:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
Nonsubject sources:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
All import sources:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
U.S. producers':								
Average capacity quantity	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***
U.S. shipments:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Export shipments:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***
Total market net sales:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***

Table continued on next page.

Table C-2--Continued
CSPV modules: Summary data concerning the U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Period changes						
	Comparison years						Jan-Jun
	2012-17	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
U.S. consumption quantity:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. consumption value:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. imports from:							
China:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
Nonsubject sources:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
All import sources:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
U.S. module producers':							
Average capacity quantity	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***
U.S. shipments:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Export shipments:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***
Total market net sales:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--U.S. producers' U.S. shipments includes ***.

Source: Compiled from data submitted in response to Commission questionnaires. Import data compiled from data reported in Office of Investigations memorandum INV-PP-119 (CPSV 3, solar 201 staff report) for 2012-16 period, and compiled from data submitted in response to commission questionaires and official U.S. import statistics under HTS statistical reporting number 8541.40.6030, accessed October 30, 2018, for the 2017, January to June 2017, and January to June 2018 periods with adjustment. See detailed explanation of the methodology for adjusted official U.S. import statistics in part IV of this report.

Split like product: CSPV cells: Merchant market

Table C-3
CSPV cells: Summary data concerning the merchant U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data							
	Calendar year						January to June	
	2012	2013	2014	2015	2016	2017	2017	2018
U.S. merchant market consumption quantity:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. merchant market consumption value:								
Amount	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***
Importers' share (fn1):								
China	***	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***
U.S. imports from:								
China:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
Nonsubject sources:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
All import sources:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
U.S. producers':								
Average capacity quantity	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***
Commercial U.S. shipments:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Export shipments:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***
Open market net sales:								
Quantity	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***

Table continued on next page.

Table C-3--Continued
CSPV cells: Summary data concerning the merchant U.S. market, 2012-17, January to June 2017, and January to June 2018

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Period changes						
	Comparison years						Jan-Jun
	2012-17	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
U.S. consumption quantity:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. consumption value:							
Amount	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***
Importers' share (fn1):							
China	***	***	***	***	***	***	***
Nonsubject sources	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***
U.S. imports from:							
China:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
Nonsubject sources:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
All import sources:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
U.S. cell producers':							
Average capacity quantity	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***
Commercial U.S. shipments:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Export shipments:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***
Hourly wages	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***
Open market net sales:							
Quantity	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***
Gross profit of (loss)	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***
Capital expenditures	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.

Source: Compiled from data submitted in response to Commission questionnaires. Import data compiled from data reported in Office of Investigations memorandum INV-PP-119 (CPSV 3, solar 201 staff report) for 2012-16 period, and compiled from official U.S. import statistics under HTS statistical reporting number 8541.40.6020, accessed October 30, 2018, for the 2017, January to June 2017, and January to June 2018 periods with adjustment. See detailed explanation of the methodology for adjusted official U.S. import statistics in part IV of this report.

SELECT DATA FROM THE 201 INVESTIGATION ON CSPV PRODUCTS

CSPV products: Total market: COO petition

Table C-1a
CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. consumption quantity:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. consumption value:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. imports from:										
Canada:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
China:										
Quantity	326,846	82,264	1,263,270	3,311,513	2,720,193	732.3	(74.8)	1,435.6	162.1	(17.9)
Value	291,878	69,976	747,148	1,680,733	1,258,864	331.3	(76.0)	967.7	125.0	(25.1)
Unit value	$893	$851	$591	$508	$463	(48.2)	(4.7)	(30.5)	(14.2)	(8.8)
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Germany:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Indonesia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Japan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Korea:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Malaysia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Mexico:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Philippines:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Signapore:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Taiwan:										
Quantity	1,065,160	2,113,220	2,090,974	852,758	1,118,967	5.1	98.4	(1.1)	(59.2)	31.2
Value	743,337	1,349,271	1,274,305	467,820	606,449	(18.4)	81.5	(5.6)	(63.3)	29.6
Unit value	$698	$638	$609	$549	$542	(22.3)	(8.5)	(4.6)	(10.0)	(1.2)
Ending inventory quantity	128,249	116,508	200,189	170,345	91,083	(29.0)	(9.2)	71.8	(14.9)	(46.5)
Thailand:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Vietnam:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All other sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All import sources:										
Quantity	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568	492.6	43.4	47.8	84.0	52.0
Value	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489	270.7	16.3	36.1	64.8	42.1
Unit value	$881	$714	$658	$589	$551	(37.4)	(18.9)	(7.9)	(10.4)	(6.5)
Ending inventory quantity	303,409	327,638	560,211	1,107,536	1,238,641	308.2	8.0	71.0	97.7	11.8

Table continued on next page.

Table C-1a--Continued
CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. producers': (fn3)										
Average capacity quantity	***	***	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***	***	***
U.S. shipments (fn4):										
Quantity	***	***	***	***	***	***	***	***	***	***
Value (fn5)	***	***	***	***	***	***	***	***	***	***
Unit value (fn6)	***	***	***	***	***	***	***	***	***	***
Export shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***	***	***	***
Hourly wages (dollars)	***	***	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***	***	***
Net sales: (fn7)										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***	***	***	***
Gross profit or (loss)	***	***	***	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***	***	***

Notes:

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--Generally the data for U.S. producers in this table are limited to U.S.-origin cells and modules containing U.S.-origin cells.
fn4.--U.S. producers' U.S. shipments include U.S. producers' exports of cells that have been re-imported after being formed into modules and/or laminates in other countries.
fn5.--The value of U.S. producers' U.S. shipments includes value added to foreign-origin cells. See part IV for details.
fn6.--The average unit values of U.S. producers' U.S. shipments are calculated exclusive of the value added to foreign-origin cells. See part IV for details.
fn7.--Financial results in this table include derived module revenue and costs based on relative production using U.S.-origin cells plus the data from merchant market cell operations.

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-1
CSPV products: U.S. shipments of domestic product, U.S. imports, and apparent U.S. consumption (country-of-origin based on cell manufacture location), 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Quantity (kW)				
U.S. producers' U.S. shipments	***	***	***	***	***
U.S. imports from.--					
Canada	***	***	***	***	***
China	326,846	82,264	1,263,270	3,311,513	2,720,193
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	1,065,160	2,113,220	2,090,974	852,758	1,118,967
Thailand	***	***	***	***	***
Vietnam	---	---	---	161,195	472,682
All other sources	***	***	***	***	***
All import sources	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568
Apparent U.S. consumption	***	***	***	***	***
	Value (1,000 dollars)				
U.S. producers' U.S. shipments	***	***	***	***	***
U.S. imports from.--					
Canada	***	***	***	***	***
China	291,878	69,976	747,148	1,680,733	1,258,864
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	743,337	1,349,271	1,274,305	467,820	606,449
Thailand	***	***	***	***	***
Vietnam	---	---	---	96,336	240,625
All other sources	***	***	***	***	***
All import sources	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489
Apparent U.S. consumption	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table III-4
CSPV cells: U.S. producers' production, capacity, and capacity utilization, 2012-16

* * * * * * *

Figure III-1
CSPV cells: U.S. producers' production, capacity, and capacity utilization, 2012-16

* * * * * * *

Table III-7
CSPV modules: U.S. producers' production, capacity, and capacity utilization, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Capacity (kW)				
Itek	***	***	***	***	***
Kyocera	***	***	***	***	***
Mission Solar	***	***	***	***	***
Motech	***	***	***	***	***
SBM	***	***	***	***	***
Seraphim	***	***	***	***	***
Sharp	***	***	***	***	***
Silicon	***	***	***	***	***
Solaria	***	***	***	***	***
Solartech	***	***	***	***	***
SolarWorld	***	***	***	***	***
Suniva	***	***	***	***	***
SunStream	***	***	***	***	***
TenKsolar	***	***	***	***	***
Tesla	***	***	***	***	***
Wanxiang	***	***	***	***	***
Total capacity for modules	929,827	913,452	716,900	871,603	1,245,807
	Production (kW)				
Itek	***	***	***	***	***
Kyocera	***	***	***	***	***
Mission Solar	***	***	***	***	***
Motech	***	***	***	***	***
SBM	***	***	***	***	***
Seraphim	***	***	***	***	***
Sharp	***	***	***	***	***
Silicon	***	***	***	***	***
Solaria	***	***	***	***	***
Solartech	***	***	***	***	***
SolarWorld	***	***	***	***	***
Suniva	***	***	***	***	***
SunStream	***	***	***	***	***
TenKsolar	***	***	***	***	***
Tesla	***	***	***	***	***
Wanxiang	***	***	***	***	***
Total module assembly	538,633	447,129	440,259	552,968	669,089

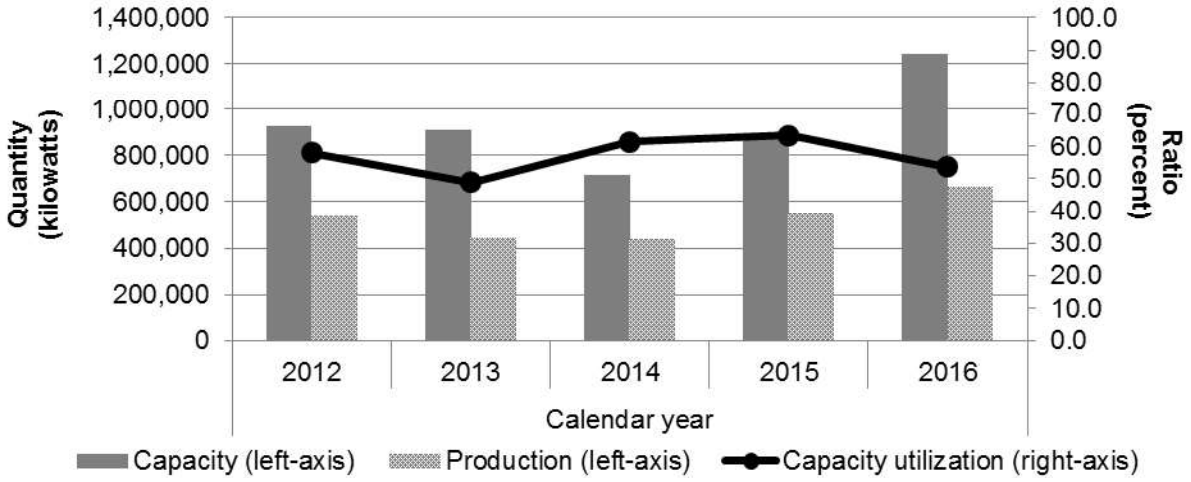
Table continued on following page.

Table III-7--Continued
CSPV modules: U.S. producers' production, capacity, and capacity utilization, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Capacity utilization (percent)				
Itek	***	***	***	***	***
Kyocera	***	***	***	***	***
Mission Solar	***	***	***	***	***
Motech	***	***	***	***	***
SBM	***	***	***	***	***
Seraphim	***	***	***	***	***
Sharp	***	***	***	***	***
Silicon	***	***	***	***	***
Solaria	***	***	***	***	***
Solartech	***	***	***	***	***
SolarWorld	***	***	***	***	***
Suniva	***	***	***	***	***
SunStream	***	***	***	***	***
TenKsolar	***	***	***	***	***
Tesla	***	***	***	***	***
Wanxiang	***	***	***	***	***
Average capacity utilization for CSPV modules	57.9	48.9	61.4	63.4	53.7

Source: Compiled from data submitted in response to Commission questionnaires.

Figure III-2
CSPV modules: U.S. producers' production, capacity, and capacity utilization, 2012-16



Source: Compiled from data submitted in response to Commission questionnaires.

Table II-1

CSPV products: U.S. imports (country-of-origin based on cell manufacture location), by source, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Quantity (kW)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	326,846	82,264	1,263,270	3,311,513	2,720,193
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	1,065,160	2,113,220	2,090,974	852,758	1,118,967
Thailand	***	***	***	***	***
Vietnam	---	---	---	161,195	472,682
All other sources	***	***	***	***	***
All import sources	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568
	Value (1,000 dollars)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	291,878	69,976	747,148	1,680,733	1,258,864
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	743,337	1,349,271	1,274,305	467,820	606,449
Thailand	***	***	***	***	***
Vietnam	---	---	---	96,336	240,625
All other sources	***	***	***	***	***
All import sources	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489

Table continued on following page.

Table II-1--Continued

CSPV products: U.S. imports (country-of-origin based on cell manufacture location), by source, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Unit value (dollars per kW)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	893	851	591	508	463
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	698	638	609	549	542
Thailand	***	***	***	***	***
Vietnam	---	---	---	598	509
All other sources	***	***	***	***	***
All import sources	881	714	658	589	551
	Ratio to U.S. production (percent)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	***	***	***	***	***
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	***	***	***	***	***
Thailand	***	***	***	***	***
Vietnam	***	***	***	***	***
All other sources	***	***	***	***	***
All import sources	***	***	***	***	***

Table continued on following page.

Table II-1--Continued

CSPV products: U.S. imports (country-of-origin based on cell manufacture location), by source, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Share of quantity (percent)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	15.1	2.7	27.6	39.3	21.2
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	49.3	68.1	45.6	10.1	8.7
Thailand	***	***	***	***	***
Vietnam	---	---	---	1.9	3.7
All other sources	***	***	***	***	***
All import sources	100.0	100.0	100.0	100.0	100.0
	Rank based on quantity				
U.S. imports from.--					
1st largest source	Taiwan	Taiwan	Taiwan	China	Malaysia
2nd largest source	China	Malaysia	China	Malaysia	China
3rd largest source	Philippines	Philippines	Malaysia	Taiwan	Korea
4th largest source	Malaysia	Korea	Philippines	Singapore	Taiwan
5th largest source	Japan	China	Singapore	Japan	Thailand
6th largest source	Korea	Japan	Korea	Korea	Vietnam
7th largest source	Singapore	Singapore	Germany	Philippines	Singapore
8th largest source	Germany	Germany	Japan	Germany	Germany
9th largest source	---	---	---	Vietnam	Philippines
10th largest source	---	---	---	Thailand	Japan

Table continued on following page.

Table II-1--Continued

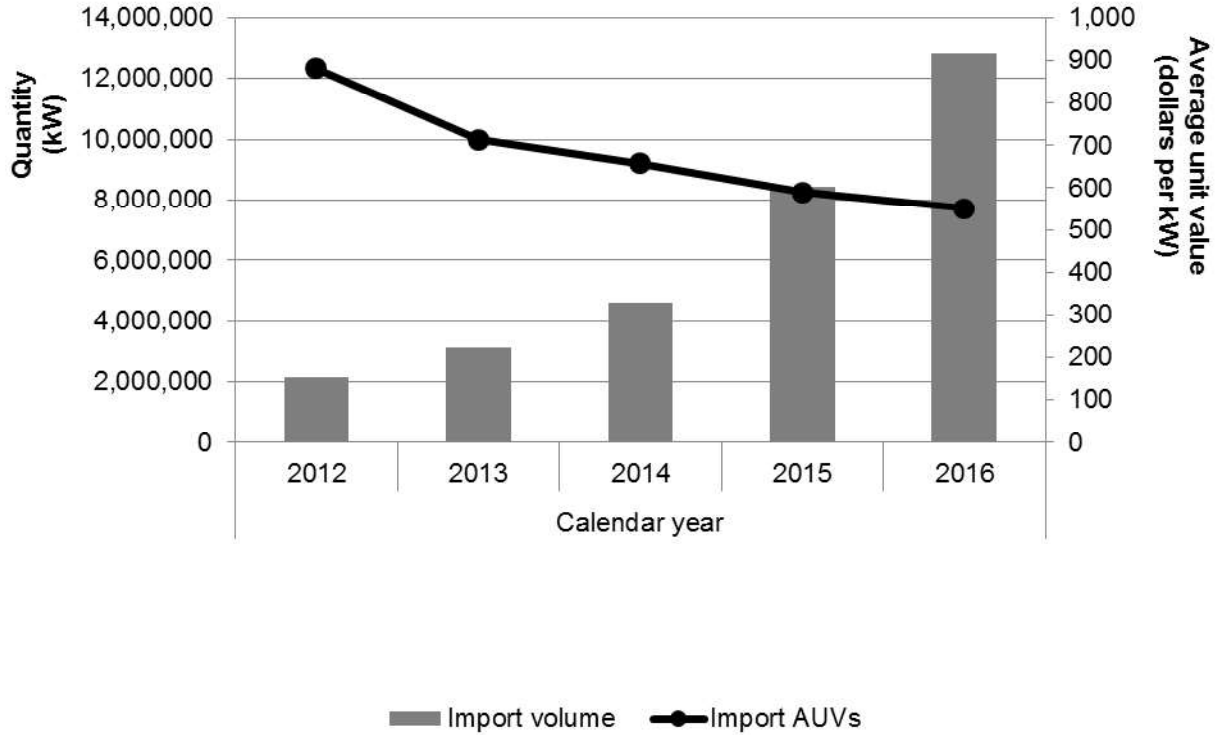
CSPV products: U.S. imports (country-of-origin based on cell manufacture location), by source, 2012-16

Item	Calendar year				
	2012	2013	2014	2015	2016
	Share of value (percent)				
U.S. imports from.--					
Canada	***	***	***	***	***
China	15.3	3.2	24.8	33.8	17.8
Germany	***	***	***	***	***
Indonesia	***	***	***	***	***
Japan	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Mexico	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	39.0	60.9	42.3	9.4	8.6
Thailand	***	***	***	***	***
Vietnam	---	---	---	1.9	3.4
All other sources	***	***	***	***	***
All import sources	100.0	100.0	100.0	100.0	100.0
	Rank based on value				
U.S. imports from.--					
1st largest source	Taiwan	Taiwan	Taiwan	China	Malaysia
2nd largest source	Philippines	Malaysia	China	Malaysia	Korea
3rd largest source	China	Philippines	Malaysia	Taiwan	China
4th largest source	Malaysia	Japan	Philippines	Singapore	Taiwan
5th largest source	Japan	China	Korea	Japan	Philippines
6th largest source	Korea	Korea	Singapore	Philippines	Thailand
7th largest source	Singapore	Singapore	Germany	Korea	Singapore
8th largest source	Germany	Germany	Japan	Germany	Vietnam
9th largest source	---	---	---	Vietnam	Japan
10th largest source	---	---	---	Thailand	Germany

Note.--Shares and ratios shown as "0.0" represent values greater than zero but less than "0.05" percent.

Source: Compiled from data submitted in response to Commission questionnaires.

Figure II-1
CSPV products: U.S. import volumes and average unit values, 2012-16



Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-21
CSPV cells: Data on industry in China, 2012-16 and projected 2017 and 2018

Item	Actual experience					Projections	
	Calendar year						
	2012	2013	2014	2015	2016	2017	2018
	Quantity (kW)						
Capacity	16,698,039	19,299,708	22,186,285	26,457,091	33,133,986	39,838,953	42,936,065
Production	11,124,972	14,027,686	18,537,642	22,720,444	27,779,992	33,929,420	37,287,607
End-of-period inventories	337,542	515,034	889,532	792,602	1,355,270	1,436,005	1,560,587
Shipments:							
Home market shipments:							
Internal consumption/ transfers	9,674,468	11,896,126	16,131,422	18,760,718	24,213,257	29,589,168	32,215,243
Commercial home market shipments	1,003,794	1,162,736	1,175,209	3,502,607	2,551,812	3,136,876	3,245,012
Total home market shipments	10,678,262	13,058,862	17,306,631	22,263,325	26,765,069	32,726,044	35,460,255
Export shipments to:							
United States[1]	***	***	***	***	***	***	***
European Union[2]	***	***	***	***	***	***	***
All other markets[3]	***	***	***	***	***	***	***
Total exports	404,262	810,543	871,646	519,073	504,106	1,153,448	1,735,693
Total Shipments	11,082,524	13,869,405	18,178,277	22,782,398	27,269,175	33,879,492	37,195,948
	Ratios and shares (percent)						
Capacity utilization	66.6	72.7	83.6	85.9	83.8	85.2	86.8
Inventories/production	3.0	3.7	4.8	3.5	4.9	4.2	4.2
Inventories/total shipments	3.0	3.7	4.9	3.5	5.0	4.2	4.2
Share of shipments:							
Home market shipments:							
Internal consumption/ transfers	87.3	85.8	88.7	82.3	88.8	87.3	86.6
Commercial home market shipments	9.1	8.4	6.5	15.4	9.4	9.3	8.7
Total home market shipments	96.4	94.2	95.2	97.7	98.2	96.6	95.3
Export shipments to:							
United States[1]	***	***	***	***	***	***	***
European Union[2]	***	***	***	***	***	***	***
All other markets[3]	***	***	***	***	***	***	***
Total exports	3.6	5.8	4.8	2.3	1.8	3.4	4.7
Total shipments	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Antidumping and countervailing duty orders associated with the *CSPV 1* investigations became effective December 7, 2012. Antidumping and countervailing duty orders associated with the *CSPV 2* investigations became effective February 18, 2015.
[2] European Union country markets include ***.
[3] Other markets include ***.

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-22

CSPV modules: Data on the industry in China, 2012-16 and projected 2017-18

Item	Actual experience					Projections	
	Calendar year						
	2012	2013	2014	2015	2016	2017	2018
	Quantity (kW)						
Capacity	20,131,407	22,767,513	27,994,412	34,715,630	46,399,800	55,038,389	78,766,489
Production	12,462,092	16,326,264	22,071,981	28,792,042	35,470,622	45,703,333	51,174,260
End-of-period inventories	996,167	1,029,494	1,862,398	1,997,237	2,412,340	2,783,744	2,999,914
Shipments:							
Home market shipments:							
Internal consumption/ transfers	968,505	2,092,486	2,523,312	3,057,385	3,520,910	6,332,468	8,201,620
Commercial home market shipments	1,487,587	3,851,669	5,210,754	9,807,680	17,165,586	21,212,011	23,345,830
Total home market shipments	2,456,092	5,944,155	7,734,066	12,865,065	20,686,496	27,544,479	31,547,450
Export shipments to:							
United States[1]	1,316,838	2,115,531	3,409,946	3,655,744	2,916,685	738,216	770,204
European Union[2]	4,394,209	2,953,923	2,633,524	2,157,664	858,562	1,162,273	1,012,757
All other markets[3]	3,896,496	5,323,014	7,601,138	9,812,562	10,153,579	15,889,776	17,325,548
Total exports	9,607,543	10,392,468	13,644,608	15,625,970	13,928,826	17,790,265	19,108,509
Total shipments	12,063,635	16,336,623	21,378,674	28,491,035	34,615,322	45,334,744	50,655,959
	Ratios and shares (percent)						
Capacity utilization	61.9	71.7	78.8	82.9	76.4	83.0	65.0
Inventories/production	8.0	6.3	8.4	6.9	6.8	6.1	5.9
Inventories/total shipments	8.3	6.3	8.7	7.0	7.0	6.1	5.9
Share of shipments:							
Home market shipments:							
Internal consumption/ transfers	8.0	12.8	11.8	10.7	10.2	14.0	16.2
Commercial home market Shipments	12.3	23.6	24.4	34.4	49.6	46.8	46.1
Total home market Shipments	20.4	36.4	36.2	45.2	59.8	60.8	62.3
Export shipments to:							
United States[1]	10.9	12.9	16.0	12.8	8.4	1.6	1.5
European Union[2]	36.4	18.1	12.3	7.6	2.5	2.6	2.0
All other markets[3]	32.3	32.6	35.6	34.4	29.3	35.0	34.2
Total exports	79.6	63.6	63.8	54.8	40.2	39.2	37.7
Total shipments	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Antidumping and countervailing duty orders associated with the *CSPV 1* investigations became effective December 7, 2012. Antidumping and countervailing duty orders associated with the *CSPV 2* investigations became effective February 18, 2015.

[2] European Union country markets include ***.

[3] Other markets include ***.

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-19
CSPV products: Reported changes in operations by producers in China, since January 1, 2012

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Table IV-20
CSPV products: Chinese producers' anticipated changes in operations

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SUMMARY DATA FROM THE FINAL INVESTIGATIONS

Table C-1:
CSPV cells: Summary data concerning the U.S. market, 2009-11, January-June 2011, and January-June 2012

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Table C-2
CSPV modules: Summary data concerning the U.S. market, 2009-11, January-June 2011, and January-June 2012

(Quantity=kilowatts, value=1,000 dollars, unit values, unit labor costs, and unit expenses are per kilowatt; period changes=percent, except where noted)

	Reported data					Period changes			
				January-June					Jan.-June
Item	2009	2010	2011	2011	2012	2009-11	2009-10	2010-11	2011-12
U.S. consumption quantity:									
Amount	282,089	1,035,387	1,962,321	852,638	1,288,193	595.6	267.0	89.5	51.1
Producers' share (1)	38.4	32.0	23.1	28.5	20.0	-15.3	-6.4	-8.9	-8.5
Importers' share (1):									
China	33.0	51.0	62.2	56.9	60.0	29.3	18.0	11.3	3.1
All other sources	28.7	17.0	14.7	14.6	20.0	-14.0	-11.6	-2.4	5.4
Total imports	61.6	68.0	76.9	71.5	80.0	15.3	6.4	8.9	8.5
U.S. consumption value:									
Amount	679,387	1,848,225	3,013,700	1,463,441	1,420,839	343.6	172.0	63.1	-2.9
Producers' share (1)	37.6	30.7	26.2	28.9	20.4	-11.4	-6.9	-4.5	-8.5
Importers' share (1):									
China	29.9	50.5	57.4	55.1	60.0	27.5	20.5	6.9	4.9
All other sources	32.4	18.8	16.4	16.1	19.6	-16.0	-13.6	-2.4	3.5
Total imports	62.4	69.3	73.8	71.1	79.6	11.4	6.9	4.5	8.5
U.S. shipments of imports from:									
China:									
Quantity	92,953	527,845	1,221,395	485,273	772,614	1214.0	467.9	131.4	59.2
Value	203,291	932,845	1,729,560	805,828	852,362	750.8	358.9	85.4	5.8
Unit value	$2,187	$1,767	$1,416	$1,661	$1,103	-35.3	-19.2	-19.9	-33.6
All other sources:									
Quantity	80,860	176,375	287,548	124,087	257,587	255.6	118.1	63.0	107.6
Value	220,318	347,351	493,674	234,963	278,259	124.1	57.7	42.1	18.4
Unit value	$2,725	$1,969	$1,717	$1,894	$1,080	-37.0	-27.7	-12.8	-43.0
All sources:									
Quantity	173,813	704,220	1,508,943	609,359	1,030,201	768.1	305.2	114.3	69.1
Value	423,609	1,280,196	2,223,234	1,040,791	1,130,621	424.8	202.2	73.7	8.6
Unit value	$2,437	$1,818	$1,473	$1,708	$1,097	-39.5	-25.4	-19.0	-35.7
U.S. producers':									
Average capacity quantity	266,777	596,950	1,015,708	528,796	572,804	280.7	123.8	70.1	8.3
Production quantity	187,976	456,026	666,533	366,884	288,513	254.6	142.6	46.2	-21.4
Capacity utilization (1)	70.5	76.4	65.6	69.4	50.4	-4.8	5.9	-10.8	-19.0
U.S. shipments:									
Quantity	108,276	331,167	453,378	243,279	257,992	318.7	205.9	36.9	6.0
Value	255,778	568,029	790,466	422,650	290,219	209.0	122.1	39.2	-31.3
Unit value	$2,362	$1,715	$1,744	$1,737	$1,125	-26.2	-27.4	1.6	-35.2
Export shipments:									
Quantity	85,738	132,186	97,700	69,143	54,296	14.0	54.2	-26.1	-21.5
Value	217,208	281,268	177,111	125,849	66,036	-18.5	29.5	-37.0	-47.5
Unit value	$2,533	$2,128	$1,813	$1,820	$1,216	-28.4	-16.0	-14.8	-33.2
Ending inventory quantity	19,450	17,170	113,244	85,353	80,381	482.2	-11.7	559.5	-5.8
Inventories/total shipments (1)	10.0	3.7	20.5	13.7	12.9	10.5	-6.3	16.8	-0.8
Production workers	1,180	1,866	1,856	1,999	1,516	57.3	58.1	-0.5	-24.1
Hours worked (1,000s)	2,719	4,101	4,098	2,492	1,591	50.7	50.8	-0.1	-36.2
Wages paid ($1,000s)	47,660	77,049	82,840	47,201	32,815	73.8	61.7	7.5	-30.5
Hourly wages	$17.53	$18.79	$20.22	$18.94	$20.63	15.3	7.2	7.6	8.9
Productivity (kilowatts per hour)	0.1	0.1	0.2	0.1	0.2	135.1	60.9	46.2	23.2
Unit labor costs	$253.54	$168.96	$124.37	$128.67	$113.80	-50.9	-33.4	-26.4	-11.6
Net sales:									
Quantity	276,691	560,331	560,742	314,603	320,333	102.7	102.5	0.1	1.8
Value	712,853	1,075,977	954,997	575,114	359,589	34.0	50.9	-11.2	-37.5
Unit value	$2,576	$1,920	$1,703	$1,828	$1,123	-33.9	-25.5	-11.3	-38.6
Cost of goods sold (COGS)	730,149	1,067,284	1,052,050	572,012	376,869	44.1	46.2	-1.4	-34.1
Gross profit or (loss)	(17,296)	8,693	(97,053)	3,102	(17,279)	-461.1	(2)	(2)	(2)
SG&A expenses	63,079	88,967	141,663	55,585	41,362	124.6	41.0	59.2	-25.6
Operating income or (loss)	(80,375)	(80,274)	(238,716)	(52,483)	(58,642)	-197.0	0.1	-197.4	-11.7
Capital expenditures	33,768	77,802	33,544	25,858	3,937	-0.7	130.4	-56.9	-84.8
Unit COGS	$2,639	$1,905	$1,876	$1,818	$1,176	-28.9	-27.8	-1.5	-35.3
Unit SG&A expenses	$228	$159	$253	$177	$129	10.8	-30.4	59.1	-26.9
Unit operating income or (loss)	($290)	($143)	($426)	($167)	($183)	-46.6	50.7	-197.2	-9.7
COGS/sales (1)	102.4	99.2	110.2	99.5	104.8	7.7	-3.2	11.0	5.3
Operating income or (loss)/ sales (1)	(11.3)	(7.5)	(25.0)	(9.1)	(16.3)	-13.7	3.8	-17.5	-7.2

(1) "Reported data" are in percent and "period changes" are in percentage points.
(2) Not applicable.

Note.--Financial data are reported on a fiscal year basis and may not necessarily be comparable to data reported on a calendar year basis. Because of rounding figures may not add to the totals shown. Unit values and shares are calculated from the unrounded figures.

Source: Compiled from data submitted in response to Commission questionnaires.

Table C-3:
CSPV cells and modules: Summary data concerning the U.S. market, 2009-11, January-June 2011, and January-June 2012

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APPENDIX D

COMMENTS ON THE EFFECTS OF ORDERS AND THE LIKELY EFFECTS OF REVOCATION

Appendix D presents data on firms' narratives on the impact of the order and the likely impact of revocation.

Table D-1
CSPV cells and modules: U.S. producers' narratives on the impact of the orders and the likely impact of revocation

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Table D-2
CSPV cells and modules: U.S. importers' narratives on the impact of the orders and the likely impact of revocation

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Table D-3
CSPV cells and modules: U.S. purchasers' narratives on the impact of the orders and the likely impact of revocation

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Table D-4
CSPV cells and modules: Foreign producers' narratives on the impact of the orders and the likely impact of revocation

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APPENDIX E

U.S. PRODUCERS' FINANCIAL RESULTS BY FIRM

Table E-1
CSPV cells: Select results of U.S. producers' open market financial operations, by firm, 2012-17, January to June 2017, and January to June 2018

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Table E-2
CSPV modules: Select results of U.S. producers' financial operations, by firm, 2012-17, January to June 2017, and January to June 2018

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APPENDIX F

SELECT MONTHLY IMPORT DATA

Table F-1
CSPV cells and modules: U.S. imports from China, by month and value components

Item	U.S. imports from China					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Value ($1,000)					
2016.--						
January	169,534	3,981	---	173,515	***	***
February	205,830	4,669	---	210,499	***	***
March	211,990	4,785	---	216,775	***	***
April	170,749	3,581	---	174,331	***	***
May	176,390	3,945	---	180,335	***	***
June	171,581	4,241	---	175,822	***	***
July	104,205	2,279	---	106,483	***	***
August	102,905	3,007	---	105,912	***	***
September	79,616	2,167	---	81,783	***	***
October	45,419	1,213	---	46,632	***	***
November	30,574	938	---	31,513	***	***
December	27,005	738	---	27,743	***	***
2017.--						
January	11,473	408	---	11,880	***	***
February	8,413	277	---	8,690	***	***
March	4,315	147	---	4,461	***	***
April	2,348	68	---	2,416	***	***
May	2,392	109	---	2,501	***	***
June	2,448	96	---	2,543	***	***
July	2,368	91	---	2,459	***	***
August	19,787	863	---	20,650	***	***
September	55,764	2,643	---	58,407	***	***
October	207,138	8,017	---	215,155	***	***
November	172,113	6,182	---	178,295	***	***
December	46,336	1,553	---	47,890	***	***
2018.--						
January	5,257	208	---	5,465	***	***
February	942	48	---	991	***	***
March	1,386	70	---	1,455	***	***
April	1,443	92	---	1,535	***	***
May	2,230	129	105	2,463	***	***
June	3,344	191	337	3,872	***	***
July	1,345	66	53	1,464	***	***
August	2,461	166	257	2,884	***	***
September	1,181	82	3	1,266	***	***

Table continued on next page.

Table F-1—Continued
CSPV cells and modules: U.S. imports from China, by month and value components

Item	U.S. imports from China					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Share across (percent)					
2016.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2017.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2018.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Source: Official U.S. import statistics and proprietary Customs records for HTS statistical reporting numbers 8541.40.6020, 8541.40.6030, 8541.40.6015, 8541.40.6025, 8541.40.6035, 8541.40.6045, accessed December 19, 2018.

Table F-2
CSPV cells and modules: U.S. imports from Korea, by month and value components

Item	U.S. imports from Korea					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Value ($1,000)					
2016.--						
January	60,439	1,601	---	62,041	***	***
February	74,597	1,702	---	76,299	***	***
March	108,456	2,747	---	111,203	***	***
April	102,627	2,484	---	105,112	***	***
May	111,401	2,933	---	114,334	***	***
June	143,992	3,992	---	147,985	***	***
July	128,817	3,334	---	132,151	***	***
August	135,369	3,474	---	138,844	***	***
September	131,309	3,402	---	134,710	***	***
October	118,523	2,592	---	121,115	***	***
November	99,150	2,536	---	101,686	***	***
December	83,853	1,977	---	85,830	***	***
2017.--						
January	59,061	1,423	---	60,485	***	***
February	57,273	1,545	---	58,818	***	***
March	70,791	2,431	---	73,222	***	***
April	44,489	1,405	---	45,894	***	***
May	65,001	1,602	---	66,603	***	***
June	82,111	2,196	---	84,307	***	***
July	104,062	2,286	---	106,348	***	***
August	85,386	1,850	---	87,236	***	***
September	118,934	2,700	---	121,634	***	***
October	120,839	2,781	---	123,620	***	***
November	143,101	3,724	---	146,826	***	***
December	131,440	3,597	---	135,038	***	***
2018.--						
January	106,012	2,520	---	108,531	***	***
February	34,284	687	---	34,972	***	***
March	43,846	668	49	44,563	***	***
April	44,656	657	120	45,433	***	***
May	29,805	455	731	30,990	***	***
June	22,118	407	8	22,533	***	***
July	35,742	432	22	36,196	***	***
August	62,618	582	61	63,261	***	***
September	62,855	1,151	219	64,225	***	***

Table continued on next page.

Table F-2—Continued
CSPV cells and modules: U.S. imports from Korea, by month and value component

Item	U.S. imports from Korea					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Share across (percent)					
2016.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2017.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2018.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Source: Official U.S. import statistics and proprietary Customs records for HTS statistical reporting numbers 8541.40.6020, 8541.40.6030, 8541.40.6015, 8541.40.6025, 8541.40.6035, 8541.40.6045, accessed December 19, 2018.

Table F-3
CSPV cells and modules: U.S. imports from Malaysia, by month and value components

Item	U.S. imports from Malaysia					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Value ($1,000)					
2016.--						
January	197,974	6,680	---	204,654	***	***
February	132,360	3,843	---	136,202	***	***
March	194,357	6,902	---	201,258	***	***
April	244,463	8,532	---	252,995	***	***
May	267,926	8,054	---	275,981	***	***
June	272,172	8,034	---	280,207	***	***
July	219,653	6,693	---	226,346	***	***
August	247,273	7,274	---	254,546	***	***
September	211,578	6,417	---	217,996	***	***
October	213,734	6,732	---	220,466	***	***
November	153,256	4,917	---	158,172	***	***
December	97,560	4,148	---	101,708	***	***
2017.--						
January	58,465	2,630	---	61,095	***	***
February	59,770	2,029	---	61,798	***	***
March	165,855	6,388	---	172,243	***	***
April	102,706	3,768	---	106,475	***	***
May	166,129	5,560	---	171,690	***	***
June	107,927	3,970	---	111,897	***	***
July	123,630	4,560	---	128,191	***	***
August	143,034	5,958	---	148,993	***	***
September	144,566	5,688	---	150,254	***	***
October	156,263	5,515	---	161,778	***	***
November	171,872	6,712	---	178,584	***	***
December	158,372	5,381	---	163,753	***	***
2018.--						
January	117,975	3,213	---	121,188	***	***
February	46,627	1,740	---	48,367	***	***
March	57,270	2,643	---	59,913	***	***
April	57,343	2,392	1	59,736	***	***
May	57,392	2,251	6,065	65,708	***	***
June	79,997	3,524	7,695	91,215	***	***
July	104,433	3,951	10,997	119,381	***	***
August	88,246	3,851	10,583	102,680	***	***
September	120,532	5,400	15,385	141,317	***	***

Table continued on next page.

Table F-3—Continued
CSPV cells and modules: U.S. imports from Malaysia, by month and value components

Item	U.S. imports from Malaysia					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Share across (percent)					
2016.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2017.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2018.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Source: Official U.S. import statistics and proprietary Customs records for HTS statistical reporting numbers 8541.40.6020, 8541.40.6030, 8541.40.6015, 8541.40.6025, 8541.40.6035, 8541.40.6045, accessed December 19, 2018.

Table F-4
CSPV cells and modules: U.S. imports from all other sources, by month and value components

Item	U.S. imports from all other sources					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Value ($1,000)					
2016.--						
January	272,863	2,498	---	275,361	***	***
February	236,830	2,277	---	239,107	***	***
March	271,607	2,911	---	274,518	***	***
April	268,683	2,871	---	271,555	***	***
May	302,432	3,281	---	305,713	***	***
June	314,212	3,672	---	317,884	***	***
July	303,042	3,291	---	306,333	***	***
August	303,345	3,907	---	307,252	***	***
September	273,170	3,731	---	276,901	***	***
October	201,877	3,075	---	204,952	***	***
November	177,427	3,635	---	181,062	***	***
December	130,556	2,625	---	133,180	***	***
2017.--						
January	39,471	1,173	---	40,644	***	***
February	43,836	1,380	---	45,216	***	***
March	82,594	2,673	---	85,268	***	***
April	81,035	2,795	---	83,830	***	***
May	88,035	2,812	---	90,847	***	***
June	108,702	4,263	---	112,965	***	***
July	126,479	4,100	---	130,579	***	***
August	202,706	4,658	---	207,364	***	***
September	222,837	5,100	---	227,938	***	***
October	313,814	7,333	---	321,148	***	***
November	357,869	7,426	---	365,295	***	***
December	334,555	7,414	---	341,969	***	***
2018.--						
January	255,845	5,395	---	261,239	***	***
February	98,252	1,644	---	99,896	***	***
March	51,157	1,346	1	52,505	***	***
April	79,635	1,382	---	81,017	***	***
May	98,301	1,626	10,962	110,890	***	***
June	114,809	3,003	20,721	138,533	***	***
July	145,865	3,708	25,602	175,174	***	***
August	112,979	3,222	23,231	139,432	***	***
September	115,173	3,314	21,682	140,169	***	***

Table continued on next page.

Table F-4—Continued
CSPV cells and modules: U.S. imports from all other sources, by month and value components

Item	U.S. imports from all other sources					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Share across (percent)					
2016.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2017.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2018.--January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Source: Official U.S. import statistics and proprietary Customs records for HTS statistical reporting numbers 8541.40.6020, 8541.40.6030, 8541.40.6015, 8541.40.6025, 8541.40.6035, 8541.40.6045, accessed December 19, 2018.

Table F-5
CSPV cells and modules: U.S. imports from all import sources, by month and value components

Item	U.S. imports from all import sources					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Value ($1,000)					
2016.--						
January	700,810	14,760	---	715,570	***	***
February	649,616	12,490	---	662,107	***	***
March	786,410	17,344	---	803,754	***	***
April	786,523	17,469	---	803,992	***	***
May	858,149	18,213	---	876,362	***	***
June	901,958	19,940	---	921,898	***	***
July	755,716	15,597	---	771,313	***	***
August	788,893	17,662	---	806,555	***	***
September	695,673	15,718	---	711,390	***	***
October	579,553	13,612	---	593,165	***	***
November	460,408	12,025	---	472,433	***	***
December	338,973	9,488	---	348,461	***	***
2017.--						
January	168,470	5,634	---	174,104	***	***
February	169,292	5,230	---	174,522	***	***
March	323,556	11,639	---	335,195	***	***
April	230,579	8,036	---	238,615	***	***
May	321,557	10,083	---	331,640	***	***
June	301,187	10,525	---	311,713	***	***
July	356,539	11,037	---	367,576	***	***
August	450,913	13,330	---	464,243	***	***
September	542,102	16,131	---	558,233	***	***
October	798,054	23,646	---	821,700	***	***
November	844,955	24,044	---	868,999	***	***
December	670,704	17,946	---	688,649	***	***
2018.--						
January	485,087	11,336	---	496,423	***	***
February	180,105	4,121	---	184,225	***	***
March	153,659	4,728	50	158,437	***	***
April	183,078	4,522	121	187,722	***	***
May	187,728	4,461	17,863	210,051	***	***
June	220,268	7,125	28,761	256,154	***	***
July	287,384	8,157	36,674	332,215	***	***
August	266,305	7,820	34,131	308,256	***	***
September	299,741	9,946	37,290	346,977	***	***

Table continued on next page.

Table F-5—Continued
CSPV cells and modules: U.S. imports from all import sources, by month and value components

Item	U.S. imports from all import sources					
	Customs value	International insurance and freight (IIF)	Normal duties	Landed duty paid value (LDPV)	Initial AD/CVD deposits	LDPV + AD/CVD deposits
	Share across (percent)					
2016.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2017.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***
October	***	***	***	***	***	***
November	***	***	***	***	***	***
December	***	***	***	***	***	***
2018.-- January	***	***	***	***	***	***
February	***	***	***	***	***	***
March	***	***	***	***	***	***
April	***	***	***	***	***	***
May	***	***	***	***	***	***
June	***	***	***	***	***	***
July	***	***	***	***	***	***
August	***	***	***	***	***	***
September	***	***	***	***	***	***

Note.--Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Source: Official U.S. import statistics and proprietary Customs records for HTS statistical reporting numbers 8541.40.6020, 8541.40.6030, 8541.40.6015, 8541.40.6025, 8541.40.6035, 8541.40.6045, accessed December 19, 2018.

Figure F-1
CSPV cells and modules: U.S. imports, by month and source, 2016 to 2018

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Figure F-2
CSPV cells and modules: Share of components of U.S. imports, by month, 2016 to 2018

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