CEA
Clean Energy Associates

ACORE
American Council on Renewable Energy

Potential impacts of the 2024 antidumping and countervailing duties on the U.S. solar industry

July 9, 2024

Executive summary

A positive finding in the 2024 antidumping and countervailing duties (AD/CVD) cases could impede the U.S. in achieving national targets.

The U.S. solar photovoltaic (PV) sector is healthy, with a consistent track record for installation volume growth and a likely fivefold increase in module manufacturing.

However, many models suggest the U.S. must reach 500 GW of cumulative PV installations by 2030 to meet the government's target of a 50% reduction in greenhouse gas emissions by that time.

The U.S. PV sector already faces a range of trade barriers that are increasing costs to American module buyers and domestic manufacturers.

Trade barriers range from non-tariff/duty supply restrictions to tariffs and duties that affect cells, modules, and critical inputs for those cells and modules.

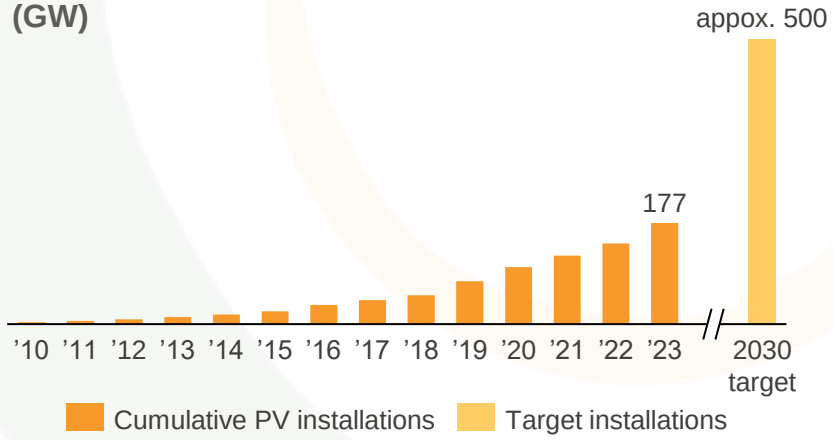
The 2022 AD/CVD decision led to a substantial price increase from 35 to 55 ¢/W that was only mitigated through Presidential action.

An AD/CVD finding could negatively impact the U.S. PV market as domestic module factories need cell imports today and duties could derail otherwise positive PV installation trends.

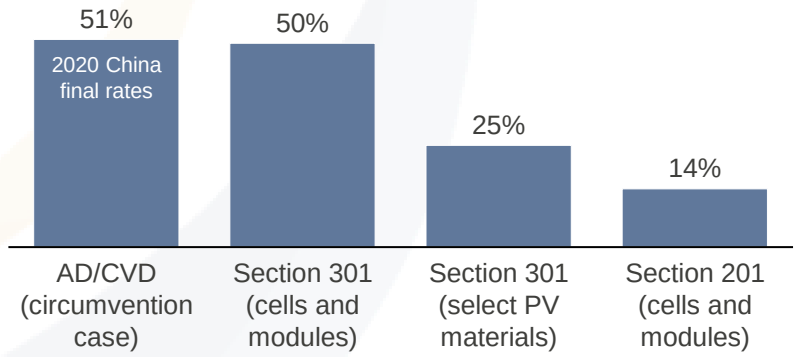
Potential new duties could raise costs 10 ¢/W for domestically produced modules, and 15 ¢/W for imports – significantly impacting project economics.

The U.S. may not sufficiently build enough crystalline silicon (c-Si) PV cell capacity to support domestic module assembly, necessitating the continued use of cell imports to sustain U.S. module factories.

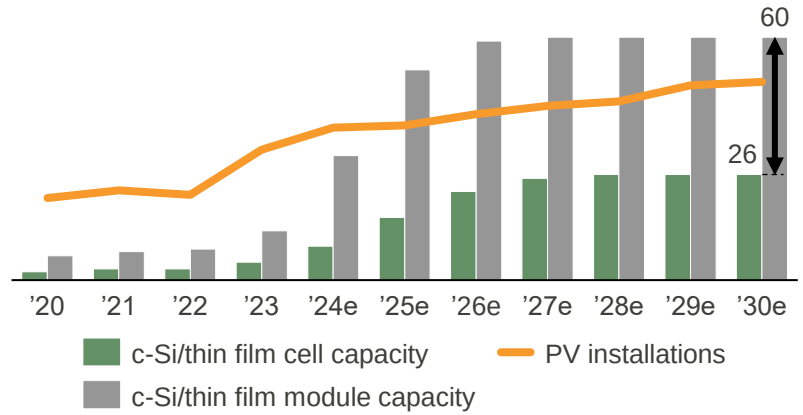
Cumulative U.S. solar installations, all segments (GW)



U.S. policy barriers affecting imports (% tariff/duty)



Thin film & c-Si cell/module capacity vs. PV installs (GW)



Content

The U.S. PV sector is in good health

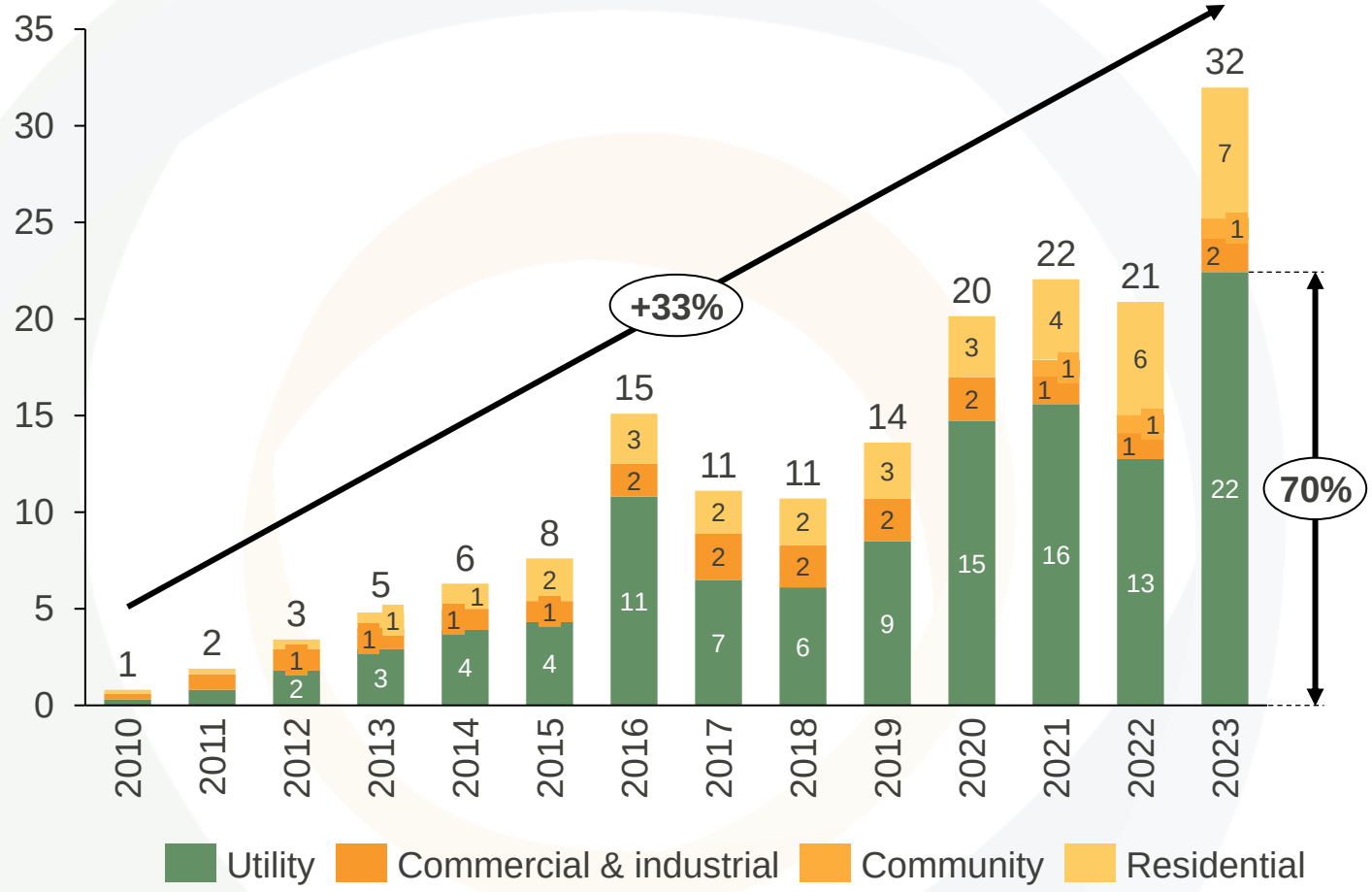
Key points

- The current health of the U.S. PV sector is exceptional, with a strong track record of installation volume growth across end-use segments and a fast-emerging domestic PV manufacturing supply chain.
- Growing U.S. PV installations support job creation in a variety of sectors, with installation, project development, and supporting roles accounting for almost 90% of all U.S. solar employment opportunities.
- The Inflation Reduction Act (IRA) is a crucial piece of legislation supporting the current health of the U.S. PV sector, with positive impacts on both the demand and supply sides of the sector.
- Demand side drivers include the extension of the Investment Tax Credit, Production Tax Credit, and tax credit adders such as the Energy Communities, and Domestic Content Bonuses.
- The Inflation Reduction Act transformed the outlook for domestic PV manufacturing, with announcements for U.S. capacity additions exceeding 130 GW for PV modules and 85 GW of PV cells.

U.S. PV installations have grown at a 33% CAGR from 2010 - 2023

Large-scale utility installations account for ~70% of the U.S. market

U.S. PV installations by market segment (GWdc)



Sector growth drivers

Utility

- Solar's economic competitiveness
- Federal support programs for PV development
- State-level renewable portfolio standards

Commercial, industrial, and community

- Companies acting on net zero targets
- Organizations looking to reduce energy costs

Residential

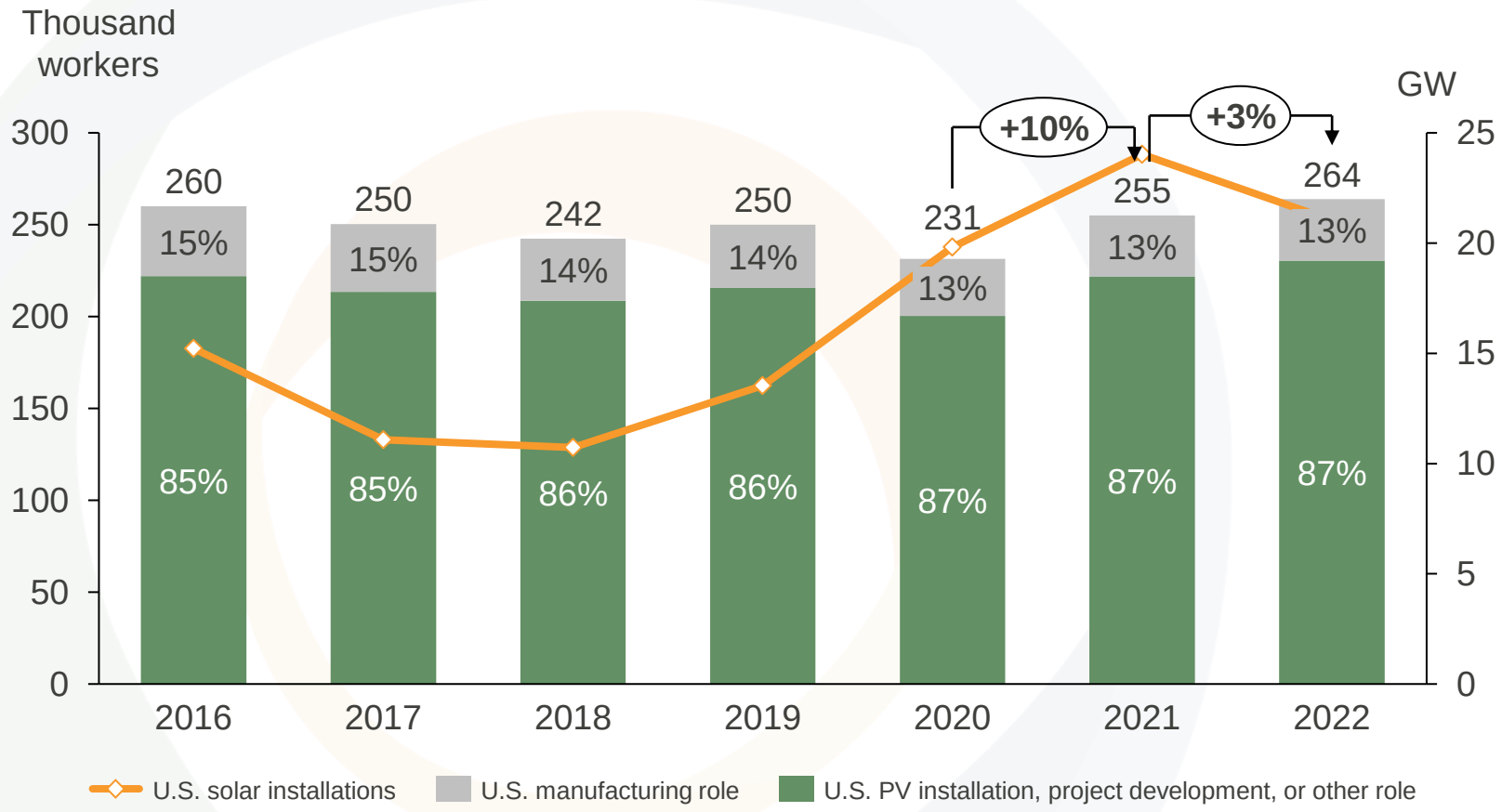
- Falling module prices for homeowners
- Increasing availability of solar and storage solutions for home applications
- Growing demand for backup power systems

Notes | Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review." Compound Annual Growth Rate (CAGR).

The U.S. solar workforce has grown annually since 2020

Employment trends move with installations; most of the PV workforce is in deployment

U.S. PV employment (thousands of workers) vs. U.S. solar installations (GWdc)



87% of the U.S. solar workforce, or nearly 230,000 workers, are engaged in installing, developing, or supporting PV projects.

Many deployment jobs are union-affiliated, meet prevailing wage requirements in the IRA, and/or employ apprenticeship programs.

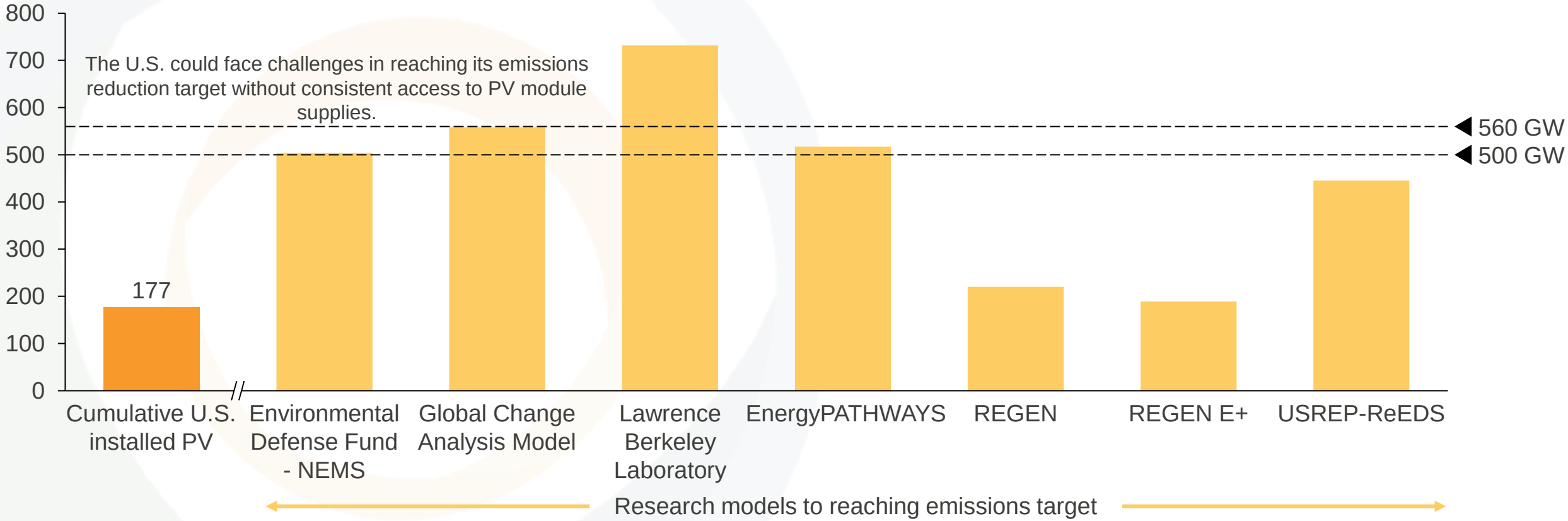
Duties on Southeast Asian cell sources could impact PV installations and new U.S. module factories, decreasing employment in the PV industry's deployment and manufacturing sectors.

Notes | Data were reported by the *National Solar Jobs Census* by IREC and accounts for both full-time and part-time roles. Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight Report. Inflation Reduction Act (IRA).

Need for 500-560 GW of cumulative PV by 2030 to hit emissions goal

~3x PV growth needed to reach Biden's pledge for 50-52% emissions reduction

Cross-model comparison of U.S. PV capacity needed for 50–52% greenhouse gas emissions reductions by 2030 (GWdc)

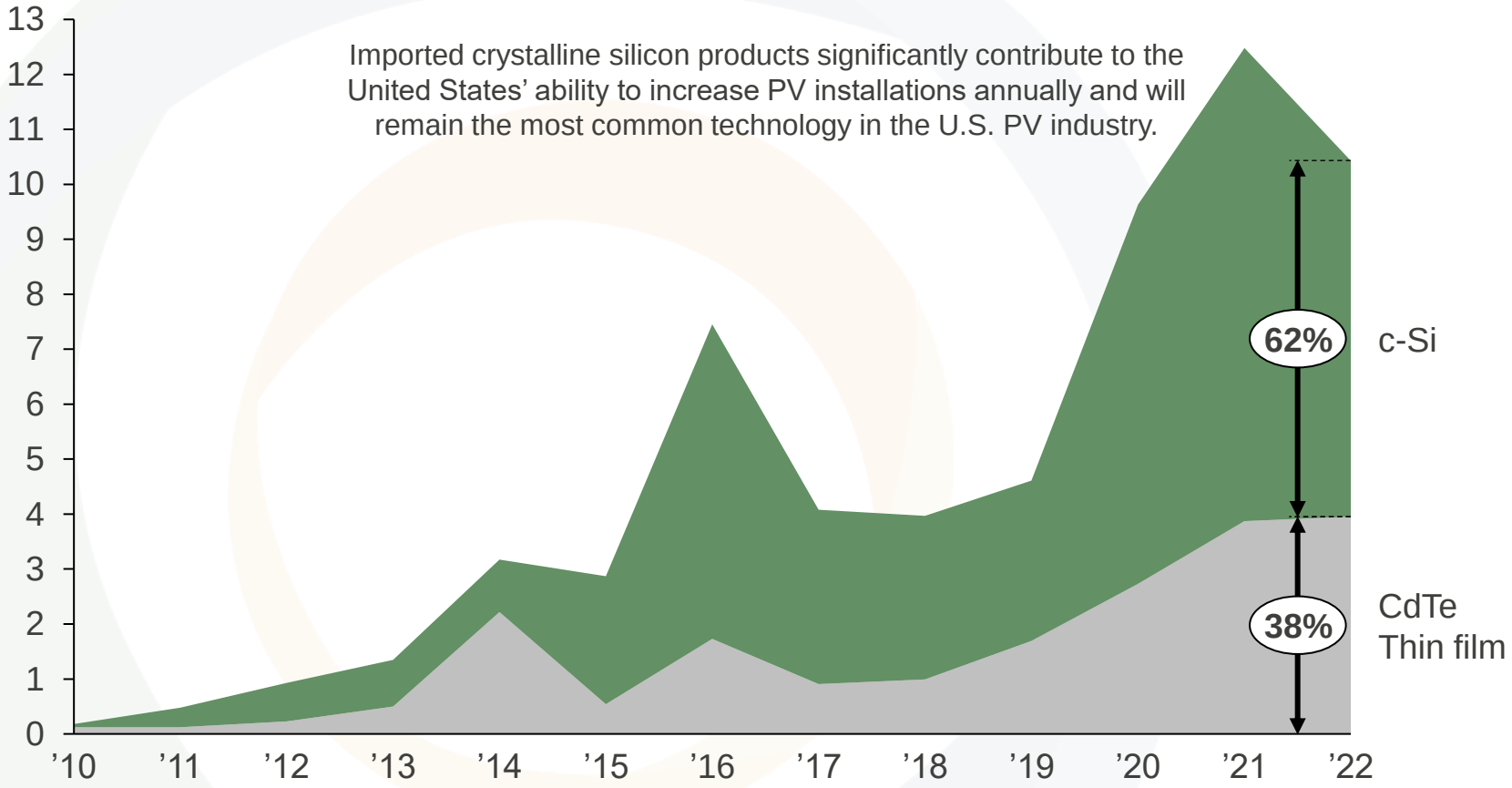


Notes | U.S. strategies to reduce greenhouse emissions are summarized in John Bistline et al., *Actions for reducing U.S. emissions at least 50% by 2030*. National Energy Modeling System (NEMS), U.S. Regional Economy, Greenhouse Gas, and Energy (REGEN) and accelerated Electrification (E+), U.S. Regional Energy Policy model + Regional Energy Deployment System model (USREP-ReEDS).

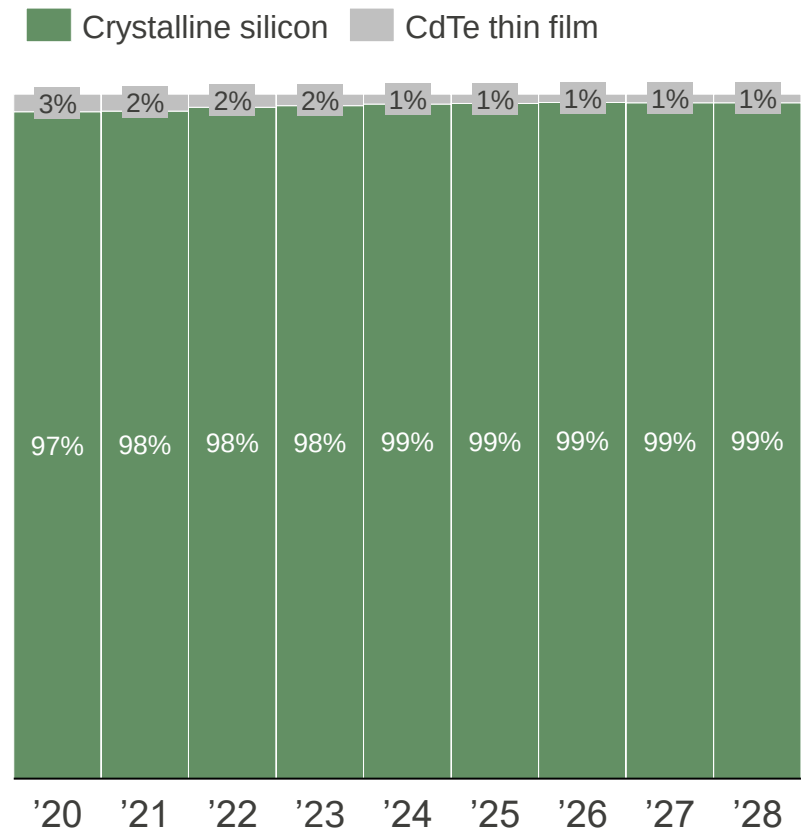
Crystalline silicon products constitute the majority of U.S. PV installs

Crystalline silicon remains the predominant PV technology employed around the world

Utility-scale PV installations by module technology (GWac)



Global PV technology capacity (%)

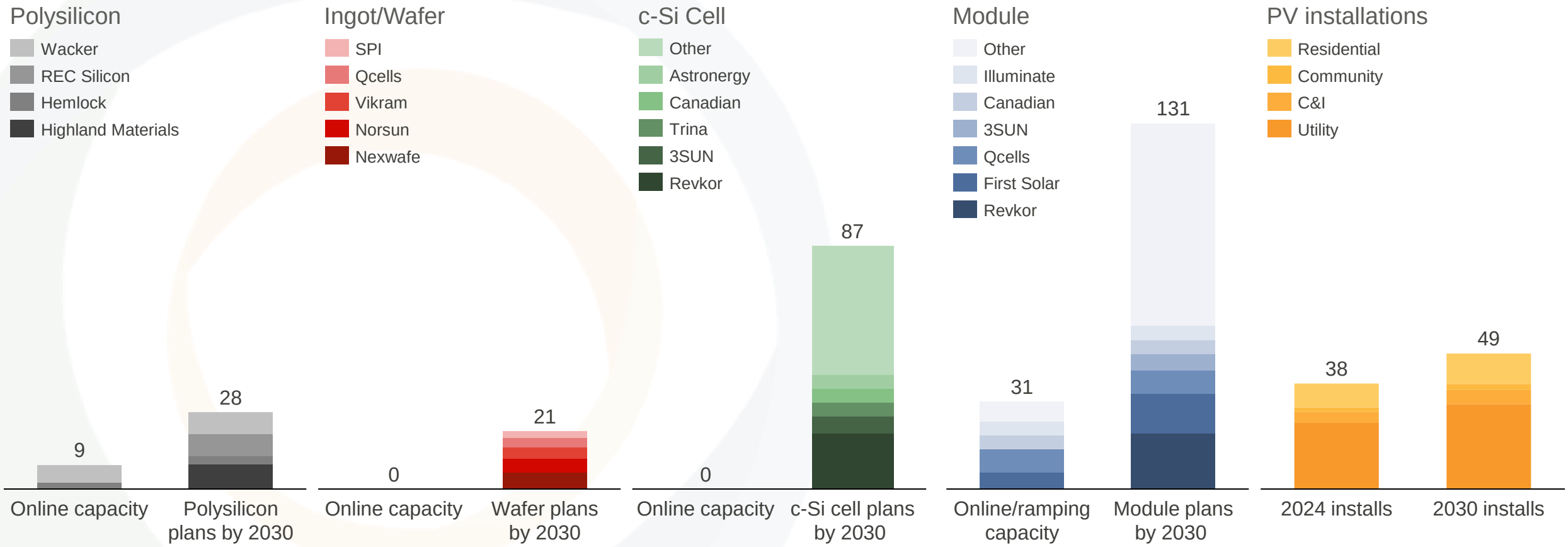


Notes | Data from Berkeley Lab's 2023 Utility Scale Solar Update. Crystalline silicon (c-Si) capacity includes technologies such as Back Surface Field (BSF), Passivated Emitter and Rear Contact (PERC), Tunnel Oxide Passivated Contact (TOPCon), and Heterojunction (HJT). Cadmium Telluride thin film (CdTe) is a non-silicon technology.

The IRA catalyzed a wave of U.S. manufacturing announcements

IRA incentives support domestic capacity announcements throughout the supply chain

U.S. PV supply chain manufacturing capacity plans and installation summary (GW)

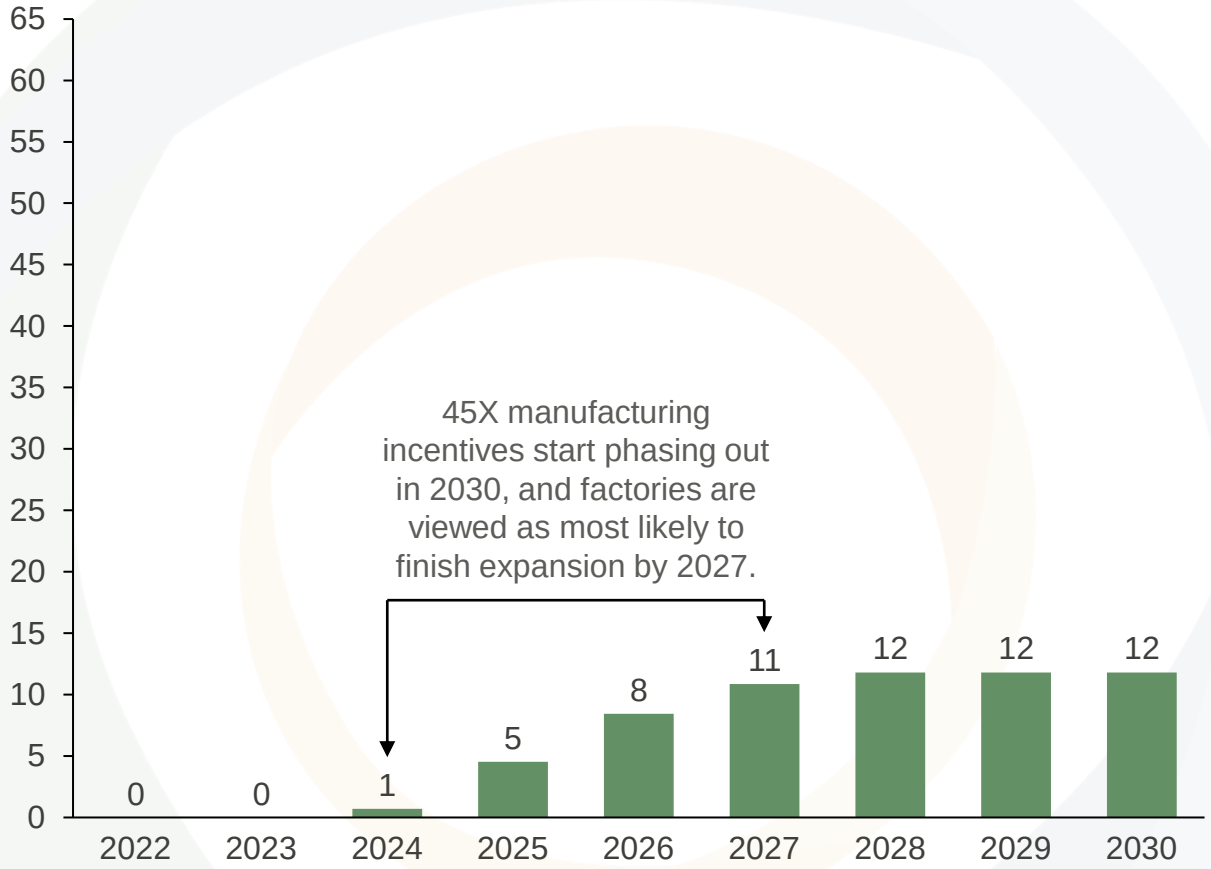


Notes | Data aggregated by CEA based on company announcements and disclosures. "Other" includes all suppliers beyond the top companies as determined by announced totals. Projects not believed to be progressing have been removed. Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review." Inflation Reduction Act (IRA).

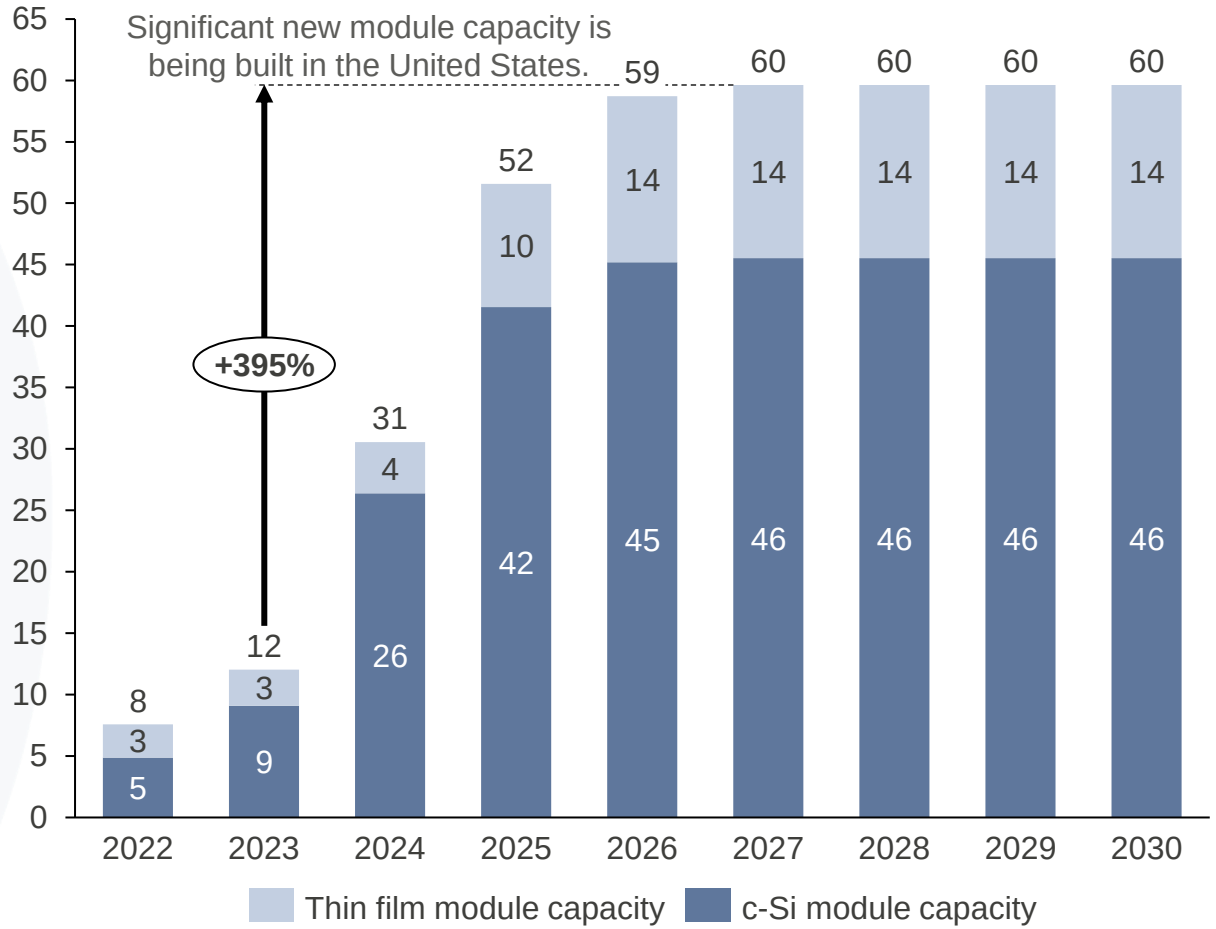
Likely U.S. module capacity could reach 60 GW; cell near 12 GW

Module capacity will grow rapidly over 2024/2025; cell emerging in 2025/2026

Projected U.S. c-Si cell manufacturing capacity (GW)



Projected U.S. module manufacturing capacity (GW)



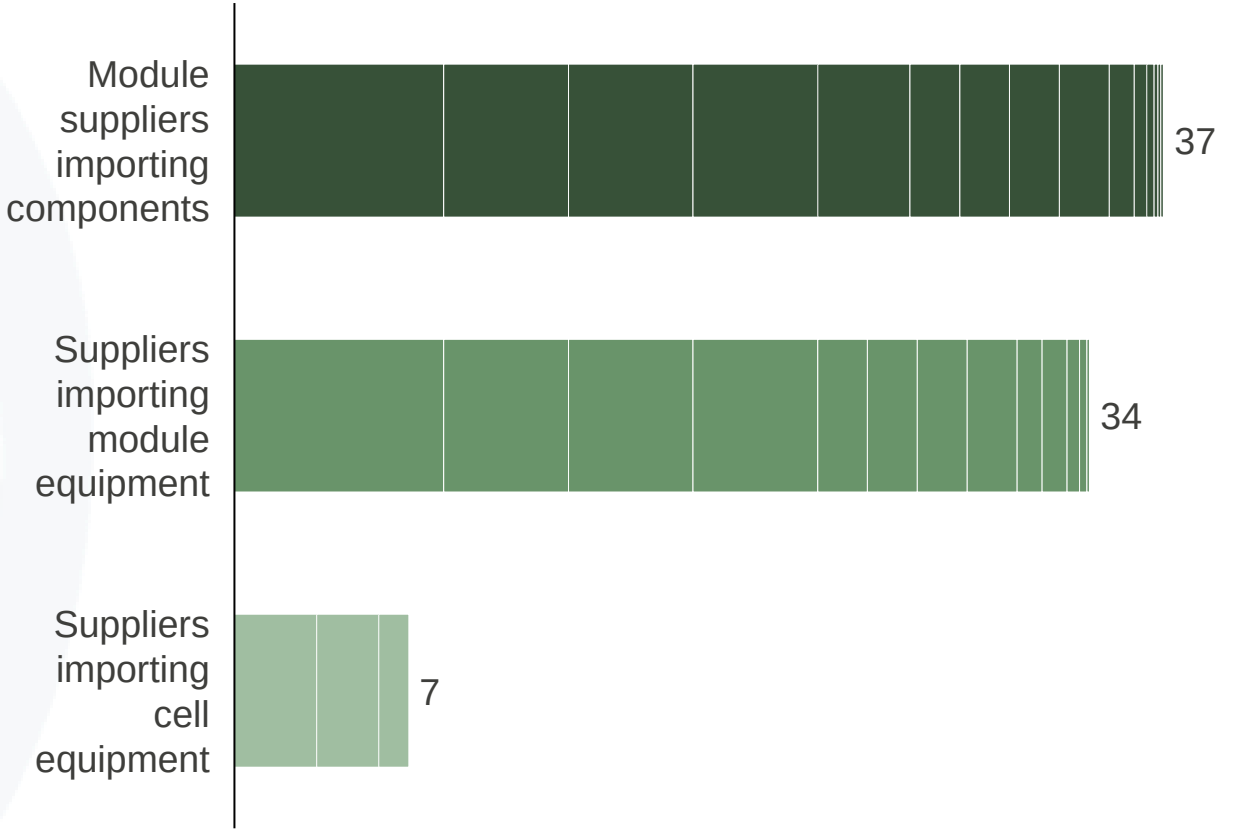
Notes | Data aggregated by CEA based on company announcements and discounted for plans with verifiable forward progress. Data does not account for utilization or other potential production delays, but reasonable new factory ramp times are considered. Timelines are based on supplier statements or industry best practices if suppliers have not provided adequate timeline updates.

The U.S. is on track to build a domestic PV industry

Suppliers are importing equipment & components to build factories, cells, & modules

Import type	Types of product
PV component imports	Cells, glass sheets, aluminum frames, backsheets, junction boxes, encapsulants, cell ribbons, process chemicals, etc.
Module manufacturing equipment	Auto sorting machines, cell laser cutters, bussing equipment, EVA/TPT cutting, layup machines, laminators, soldering stations, inspection systems, etc.
Cell manufacturing equipment	Wafer scribing tools, etching and texturing machines, PECVD coating, laser doping machines, screen printing lines, etc.

U.S. capacity plans for select suppliers per stage (GW)

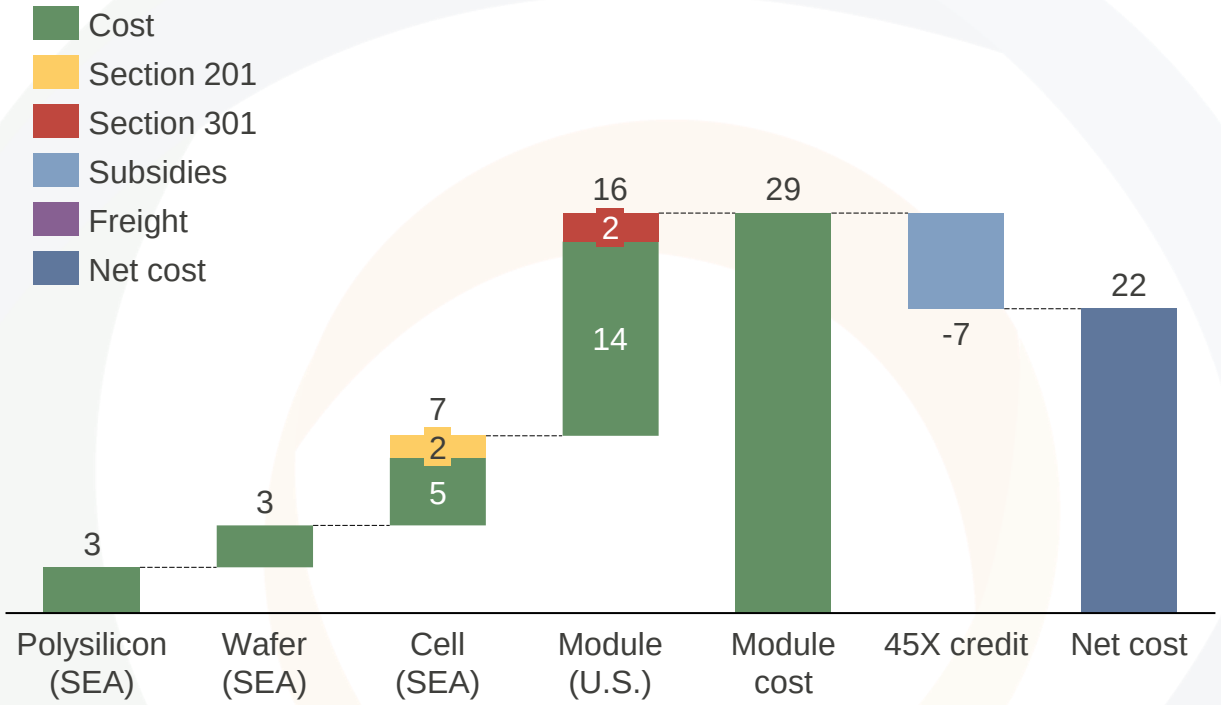


Notes | The suppliers involved per stage are based on a list of suppliers importing the described component or machinery type, with entries available in public customs databases. Other active suppliers may be present if components or equipment are sourced domestically in the United States and not captured in customs data.

IRA 45X credits result in U.S. costs that are competitive with SEA

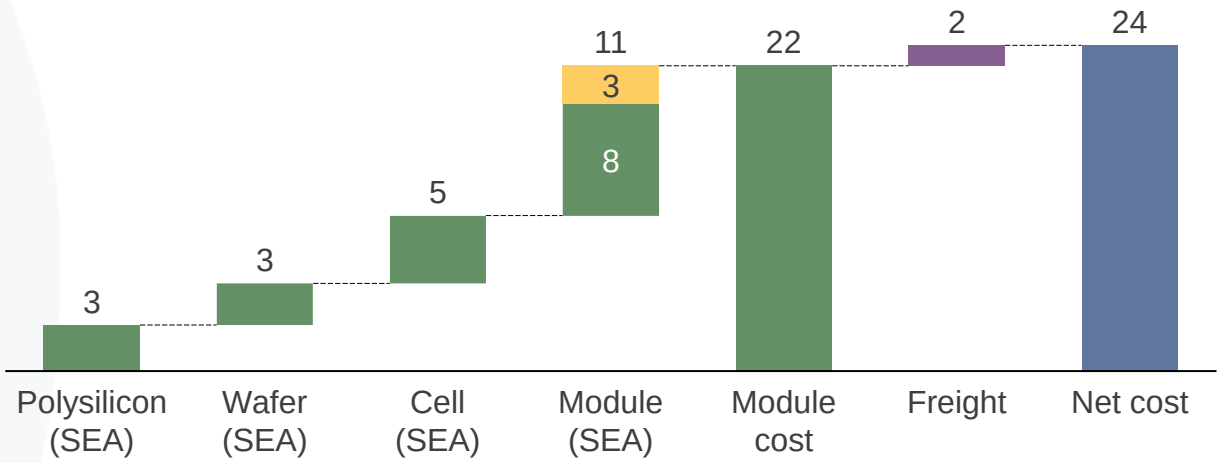
IRA incentives support a competitive U.S. manufacturing ecosystem

U.S. module assembly all-in cost, 2024 (EXW, ¢/W)



- There is currently no crystalline silicon wafer or cell production in the U.S., meaning all U.S. manufacturers must import cells from Southeast Asia or other markets.
- U.S. module assembly using imported cells will remain the main domestic PV supply chain; some U.S. polysilicon, wafer, and cell capacity will emerge, but a combination of 45X valuations, time-gated incentives, and technical hurdles prevents a broader U.S. PV manufacturing ecosystem.

Southeast Asia all-in module cost, 2024 (DDP-port, ¢/W)



- Imported modules have a cost disadvantage over U.S.-made modules, are less likely to support systems in achieving domestic content benefits, and are subject to more U.S. trade policy volatility.
- Cost competitiveness, domestic content considerations, and trade policy concerns have prompted the massive resurgence in U.S. module manufacturing.

Notes | Bifacial double-glass module manufacturing costs are modeled for a large-scale, ingot-to-module integrated supplier. Costs are based on an n-type TOPCon module architecture. Inflation Reduction Act (IRA), Southeast Asia (SEA), Ex-works U.S. factory (EXW), and Delivery Duty Paid to a West Coast U.S. port (DDP).

Content

The U.S. PV market is facing headwinds

Key points

- U.S. PV installation volume growth has taken place notwithstanding high domestic prices for PV modules, and the U.S. solar industry faces a growing number of trade policies that could negatively impact deployment and raise PV costs.
  - **Anti-circumvention duties** extend China's antidumping and countervailing duties to many SEA imports, restricting duty-free cell and module volumes for U.S. PV developers and creating competition for non-China cell and module materials.
  - **Section 301 tariffs** set at 25% to 50% for many PV components raise costs for U.S. manufacturers and increase tariff rates on many module materials.
  - **Section 201 tariffs** are reinstated on bifacial module imports, raising costs for importers by over 14%.

- While the U.S. is actively building the necessary module manufacturing capabilities to support its installation needs, more time is needed to build sufficient cell capacity, and duties on cells could harm growing U.S. module makers.
  - U.S. module capacity is ramping up quickly; cell capacity has a longer build-out timeline (over two years) and needs more time to come online due to stringent permitting requirements.
  - The U.S. will need to import up to 41 GW worth of cells and/or modules to meet projected U.S. installations until the Section 201's phase-out in February 2026; cell imports during this time will add a cost burden to buyers.
  - U.S. module makers will need to import some cells to meet production needs for the foreseeable future.
  - Duties could create a situation where cell buyers and suppliers are unwilling to risk duty, and cell transactions stop.
  - Lower cell buying/selling could reduce module industry utilization and lead to lost factory expansion opportunities.

Notes | Anti-circumvention duties result from a separate trade case from the current anti-dumping and countervailing investigation. The anti-circumvention order extends antidumping and countervailing duties applicable to China to Cambodia, Malaysia, Thailand, and Vietnam due to an anticircumvention investigation that concluded in September 2023. Southeast Asia (SEA).

U.S. module pricing differs from the rest of world due to trade policy

The pricing disparity originates from the 2012 AD/CVD case restricting Chinese imports

2011

The Department of Commerce initiated an AD/CVD investigation on imports of solar cells and modules from China.

2012

The final ruling found dumping and subsidization, levying between 0% and 239% antidumping duties and 3% and 542% countervailing duties.

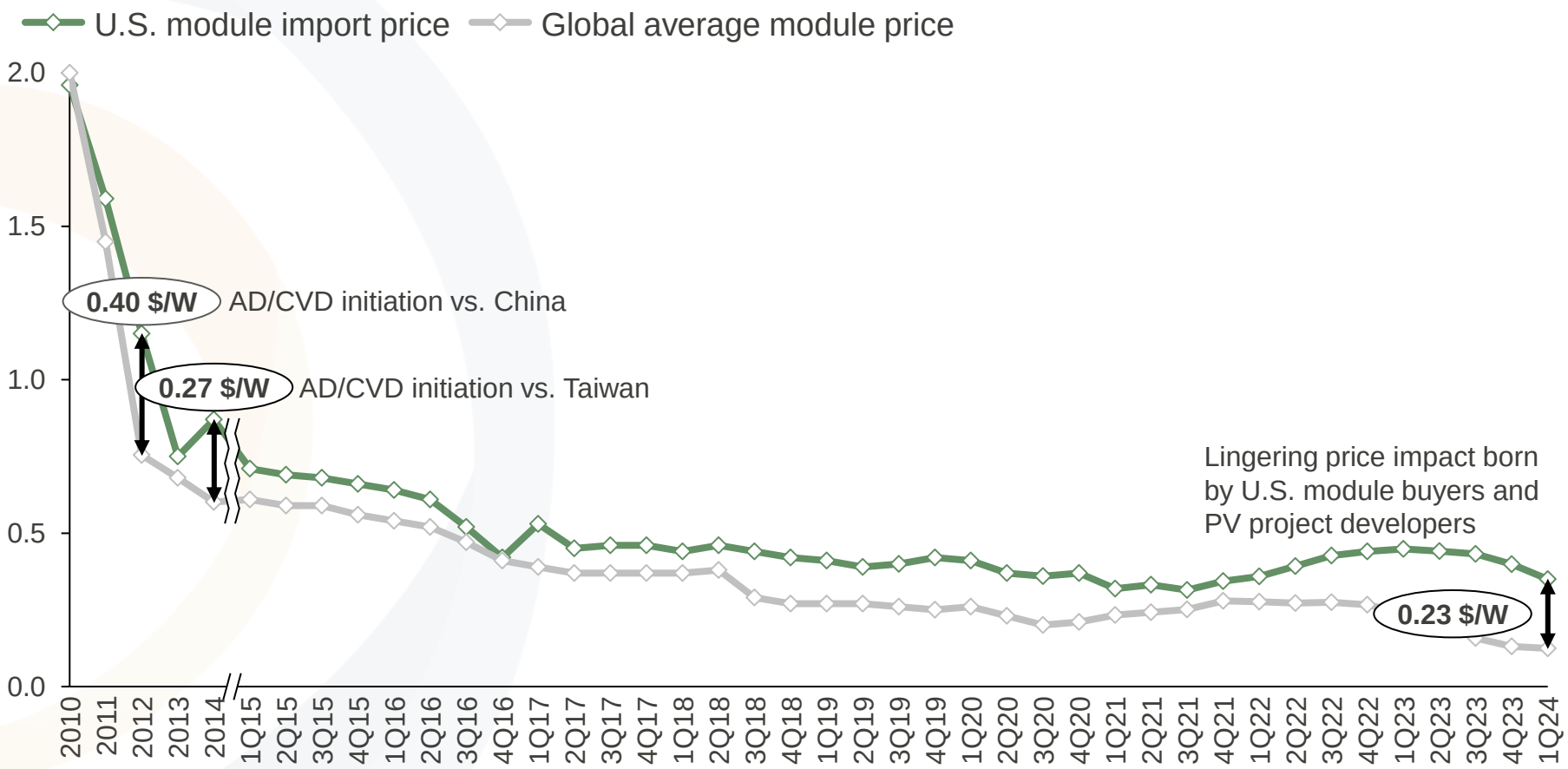
2014

Another antidumping case was initiated against Taiwan in 2014.

Price impact

Module price paid by the United States and the global average module price paid by many peer countries began to deviate significantly as U.S. buyers either paid additional duties for imported modules from China or shifted procurement to other countries with higher production costs.

U.S. vs. global PV module prices (U.S. $/W)

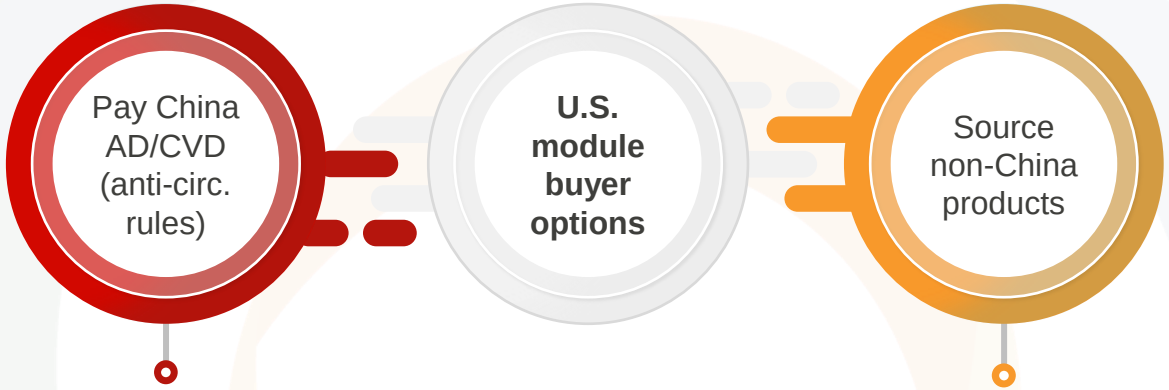


Notes | Pricing from 2010-2020 is a mix of multi and mono products before shifting entirely to PERC modules from 2021 to 2023. U.S. pricing data before 2023 was reported by the U.S. Energy Information Agency, and 2023 pricing was compiled by CEA. RoW price data before 2021 was reported by spot price groups like the EIA, PVxchange, Energy Trend, and others, with 2023 pricing compiled by CEA.

U.S. module buyers face duties on imports due to anti-circ. rules

U.S. factories also compete for limited non-China materials due to these impacts

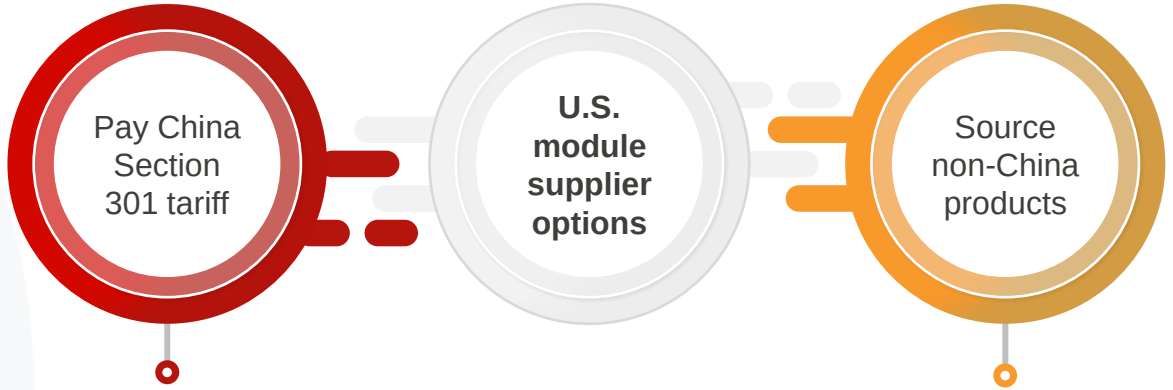
An existing anti-circumvention order applies Chinese duties to Southeast Asian cells and modules



9-248% AD/CVD
U.S. buyers must pay Chinese AD/CVD rates on cells and modules purchased from Cambodia, Malaysia, Thailand, and Vietnam unless the supplier can comply with anti-circumvention requirements.

Product premiums
Three suppliers are exempt from the anticircumvention order, but all other suppliers must use non-China wafers (increasing module costs) or ensure no more than two specific materials are sourced from China (also increasing module costs) to avoid anti-circ. duties.

U.S. module makers face tariffs or growing competition for non-China materials due to the anti-circumvention order



25% Section 301
U.S. suppliers pay tariffs to access China's mature component supply chain.

Product premiums
U.S. suppliers compete with Southeast Asian manufacturers to secure non-China materials; U.S. buyers want to avoid China tariffs while Southeast Asian suppliers want to avoid anti-circumvention duties.

Notes | No more than two specific materials (silver paste, glass, backsheets, frames, EVA, and junction boxes) can be sourced from China to comply with one pathway to avoid the anti-circumvention case's application of Chinese duties. Anti-circumvention (anti-circ.), 2024 Antidumping and Countervailing Duties (AD/CVD).

U.S. installations will exceed domestic c-Si cell & thin film production

Cell imports required by U.S. factories will be partially subject to the Section 201

41 GW
PV product gap

The U.S. must import up to 41 GW worth of cells or modules to meet projected U.S. installations from 2Q24 to the Section 201's phase-out in February '26.

46 GW
c-Si module plans

As more U.S. crystalline silicon module capacity comes online, the U.S. will likely reach or exceed the 5 GW tariff rate quota (TRQ) on cell imports.

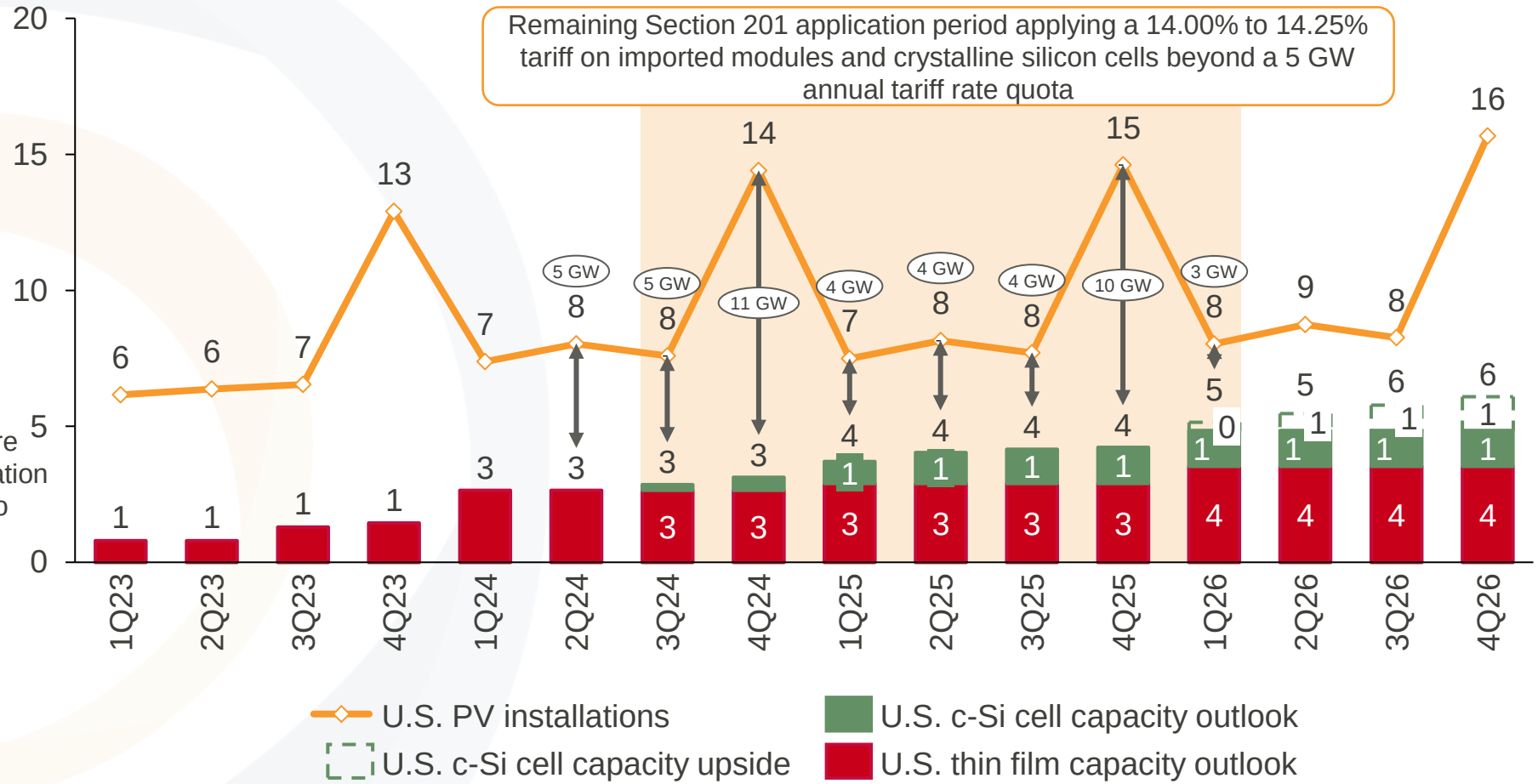
5 GW
Section 201 TRQ is insufficient

Many module factories will finish construction in '24 and need more cell inputs; uncertain implementation of the Administration's promise to raise TRQ to 12.5 GW.

14%+
tariff being passed to U.S. buyers

U.S. module producers are likely to incur some Section 201 tariffs on cell inputs, and these additional tariffs could further pass to U.S. developers.

United States PV installations vs. U.S. cell capacity, base case + upside outlook (GWdc)

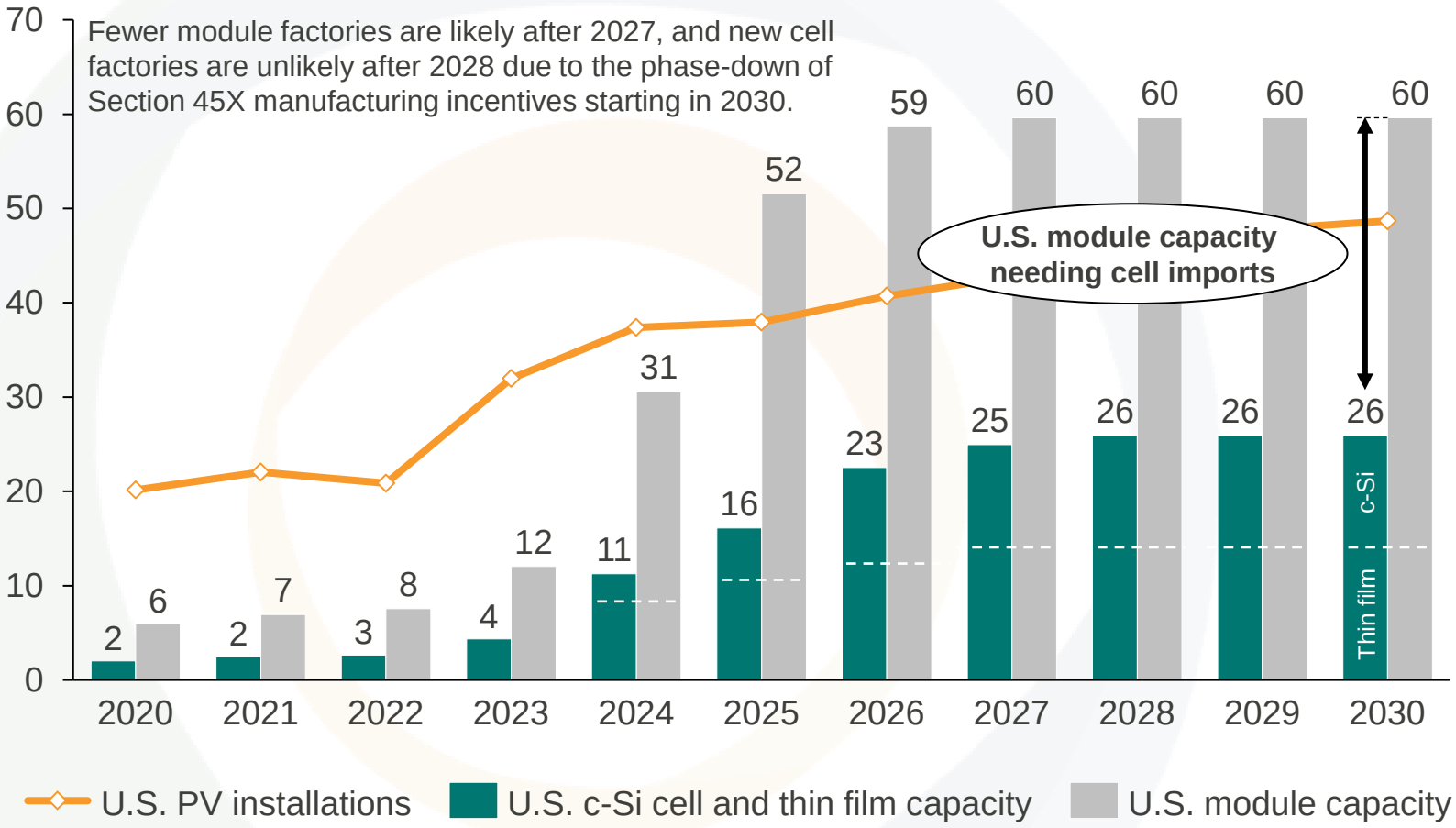


Notes | Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review." Future installations are projected based on historical installation trends by quarter. Quarterly capacity figures are forecast by CEA based on supplier statements and taking into account reasonable new factory ramp rates. Tariff rate quota (TRQ).

U.S. manufacturing capacity expansion anticipated to slow in 2026

Likely cell capacity behind module, indicating structural requirements for cell imports

United States PV installations vs. domestic capacity (GWdc)



Reasons for less, and later, cell capacity

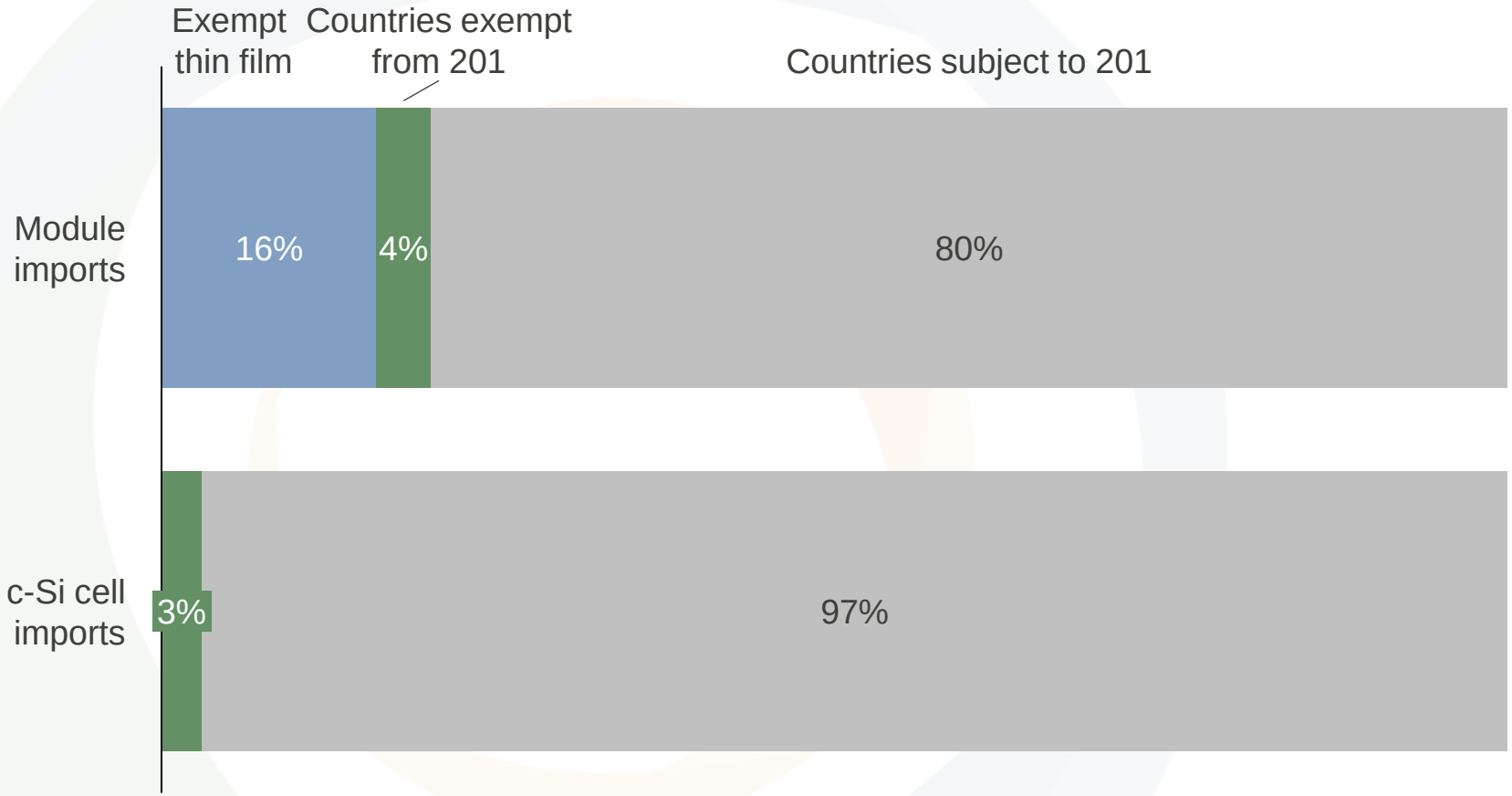
- Cell capacity can take twice the construction, training, and ramp time of module capacity.
- Uncertain domestic content rules make the value of U.S. cells highly variable until the final statutes are published.
- Permitting process chemicals in cell production can make zoning and site selection difficult.
- Cell capital expenditure costs can be 2-3x a module factory, making it difficult for new suppliers to raise funding.
- Ongoing IP concerns create cell technology uncertainty vs. module capacity, which is technology-agnostic.

Notes | Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review." Capacity figures are not adjusted for utilization. Intellectual Property (IP) concerns stem from new suppliers needing to purchase IP to compete, but new firms are unsure if technology providers' IP can hold up in Western legal systems.

Overwhelming majority of U.S. PV imports are subject to Section 201

Imports from key U.S. trade partners like SEA, India, and South Korea are impacted

2023 U.S. PV cell and module imports (%)



The U.S. sources most modules from countries fully subject to the Section 201; the Administration announced action on June 21, 2024, to remove the exclusion for bifacial modules which imposes a 14.25% tariff in 2024.

Section 201 exempt cells are only available from Indonesia, which has only 2 GW of cell capacity; however, the Administration pledged to raise the cell TRQ by 7.5 GW if the U.S. reaches the 5 GW threshold.

Notes | Data were reported as of December 31, 2023, by the United States International Trade Commission (USITC) via module HTS: 854143 and via cell HTS: 854142. Key Section 201 exempt nations include Canada, Indonesia, Jordan, and South Africa. Other countries are exempt from the Section 201, but have little to no PV manufacturing capabilities. Southeast Asia (SEA). Crystalline silicon (c-Si).

Content

An AD/CVD finding could hurt the U.S. PV sector

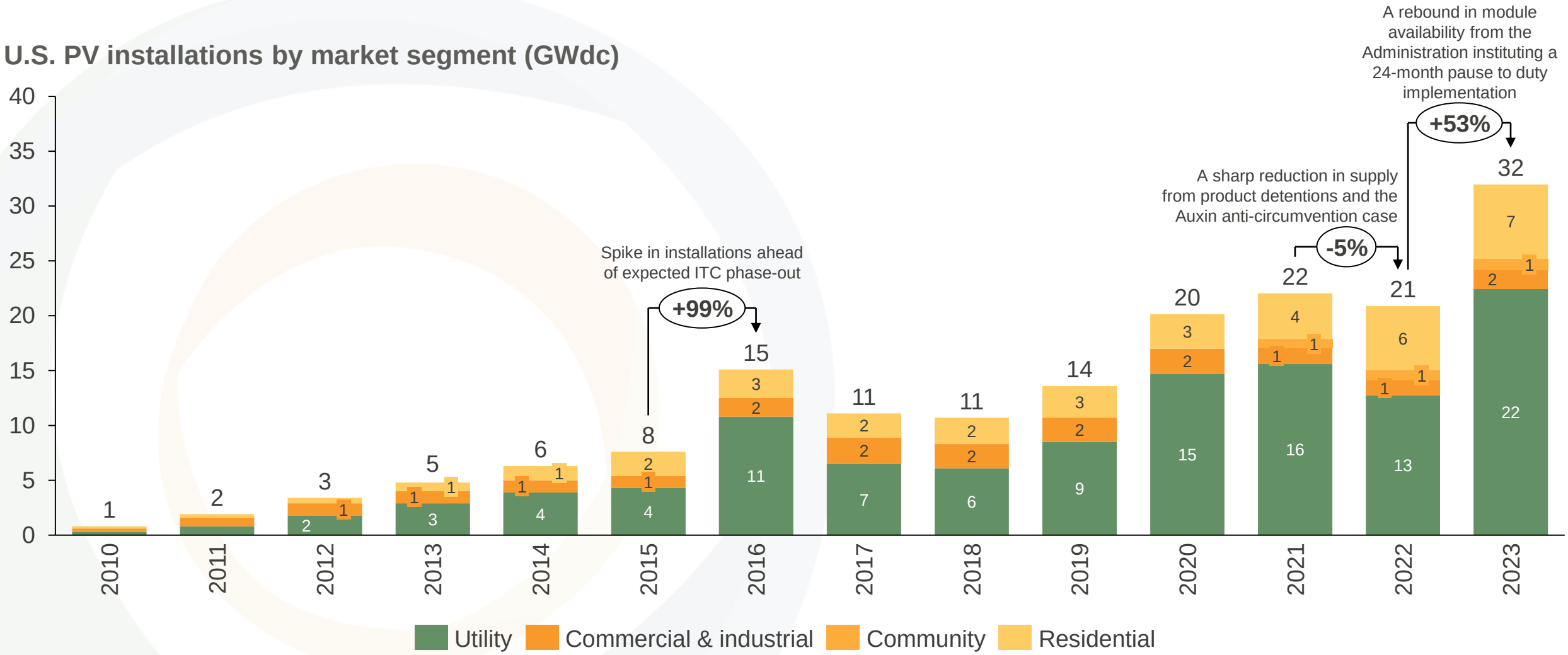
Key points

- The impact of U.S. trade law applications, including past AD/CVD investigations, has restricted the available supply of modules to the U.S. market, resulting in above-market prices for U.S. system developers/installers.
- The most recent example, the 2022 anti-circumvention investigation based on a complaint brought by Auxin, was an important contributing factor to restricting module supply in 2022 and 2023, increasing module prices by nearly 60% vs. a year earlier until the President intervened, and led to an annual decline in total installed solar volume.
- The newly announced 2024 AD/CVD investigation in April 2024 re-introduces significant uncertainty in the U.S. market; if the case proceeds, it could lead to significantly restricted supply and higher module costs of an estimated 10 ¢/W for domestically produced modules and 15 ¢/W for imports.
- Higher prices and restricted supply could likely negatively impact U.S. installations, as occurred in 2022, and lead to a detrimental impact on U.S. jobs, which are primarily based on installation and project development.
- Duties could also hurt U.S. PV manufacturing jobs, as most U.S. factories need imported cells.

U.S. policy and trade law have caused PV market volatility

The ITC supports demand; application of trade law limits supply options

U.S. PV installations by market segment (GWdc)

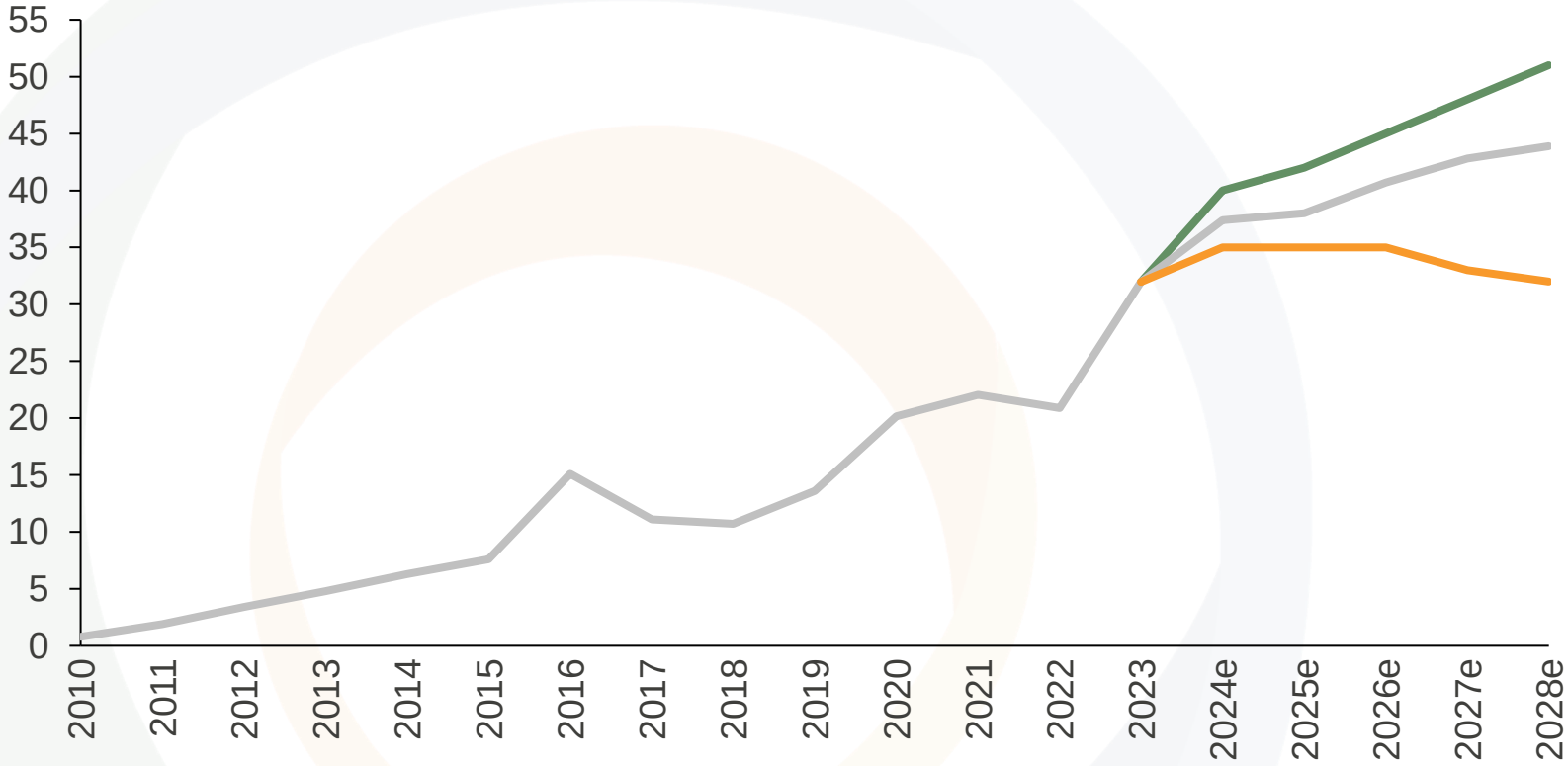


Notes | Installation volumes are reported in the SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review." Product detentions are the result of lengthy U.S. Customs and Border Protection compliance review of PV imports.

New AD/CVD would add to existing headwinds for solar installations

Natural market forces & tailwinds would otherwise maintain an upward installation trend

U.S. PV installations projection range prior to 2024 AD/CVD petition (GWdc)



Bull case: Assumes mitigation of headwinds, such as lowered trade barriers, easier tax credit qualification, better financing conditions, and interconnection queue reform.

Base case: Outlook factors in current domestic barriers and trade policy headwinds without considering additional 2024 AD/CVD impacts.

Bear case: Includes worsening trade policy (not including 2024 AD/CVD impacts), deteriorating financing availability, stagnating queues, etc.

- The U.S. market faced various domestic barriers and trade policy headwinds before the newest 2024 AD/CVD case.

Domestic	Domestic barriers include unclear domestic content guidance, uncertain section 45X incentive allocation for foreign firms, election year volatility, high interest rates, grid capacity concerns, and interconnection constraints.
Trade policy	Existing trade policy obstacles already cover tariff barriers, applied antidumping and countervailing duties from anti-circumvention orders further extending those duties, detention risk under UFLPA, and ongoing supply chain disruptions.

- Existing issues create a growing delta in PV installations per year between bull and bear cases, amounting to a 55 GW+ cumulative difference in installation outcomes from 2023 to 2028.
- Additional duties could push base case installations toward the bear case rate and further depress the bear case outlook.

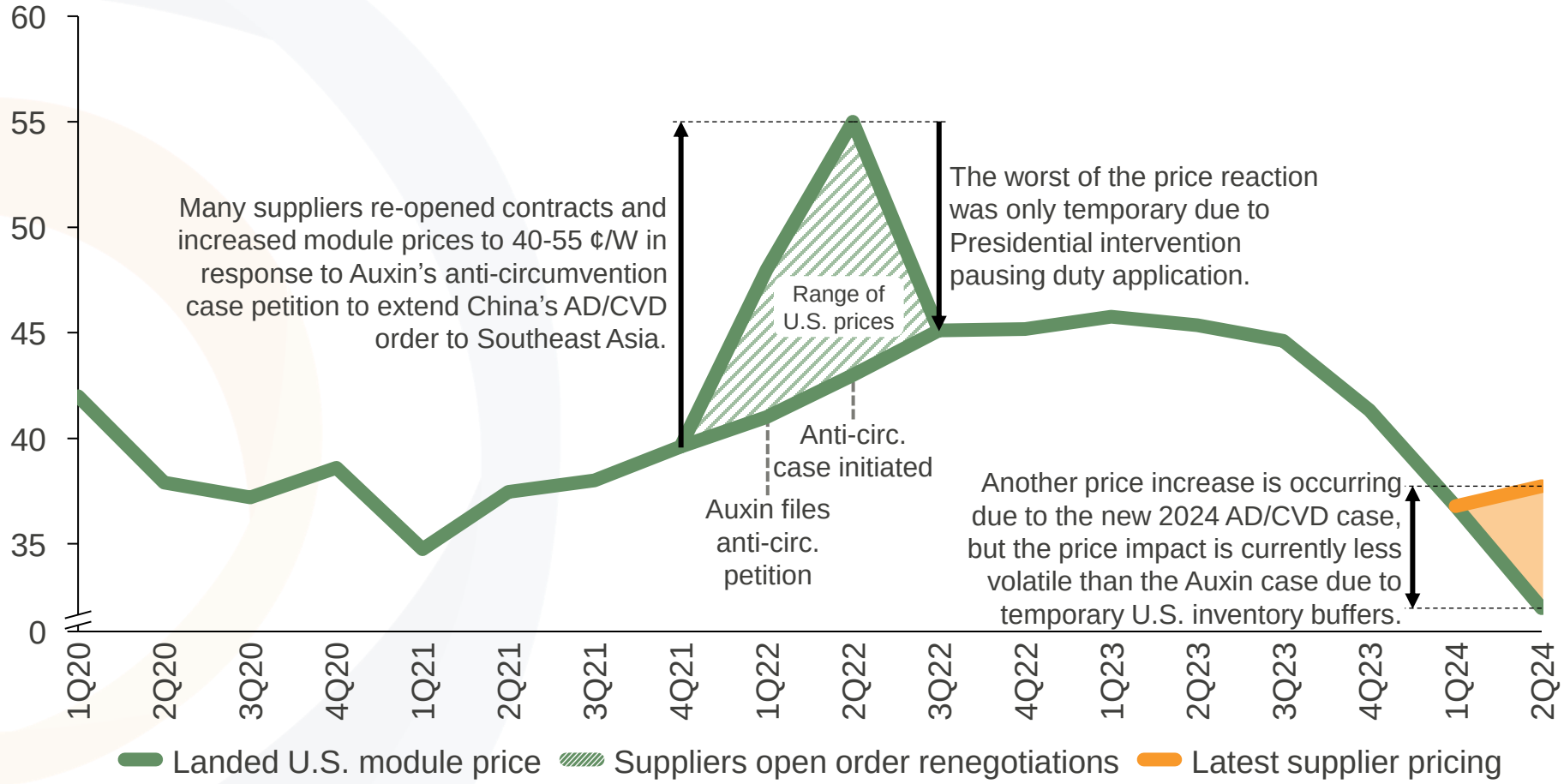
Notes | The SEIA/Wood Mackenzie Power & Renewables' "Solar Market Insight Report 2023 Year in Review" publishes the referenced U.S. PV installation outlook scenarios and defines each case.

The 2024 AD/CVD filing alone caused a U.S. module price increase

The prior anti-circumvention case added duties and caused a price spike in 2022

- A group of petitioners filed a new AD/CVD case, impacting most cell and module capacity serving the U.S. market.
- Many buyers may delay new procurement until the market settles and a preliminary determination provides more clarity.
- Most suppliers are preparing to halt module deliveries, although some may continue shipping if they believe their duties may be lower or more manageable.
- Buyers and suppliers are preparing for price increases as many suppliers must factor in duty risk, and buyers pay a premium to avoid duty risks.

U.S. utility module prices for landed West Coast products (U.S. ¢/W)



Notes | Price tracking compiled by CEA based on declared import values, supplier quoted modules, and observations from buyer and supplier price negotiations during 2022.

U.S. market could face sizeable module cost increases due to duties

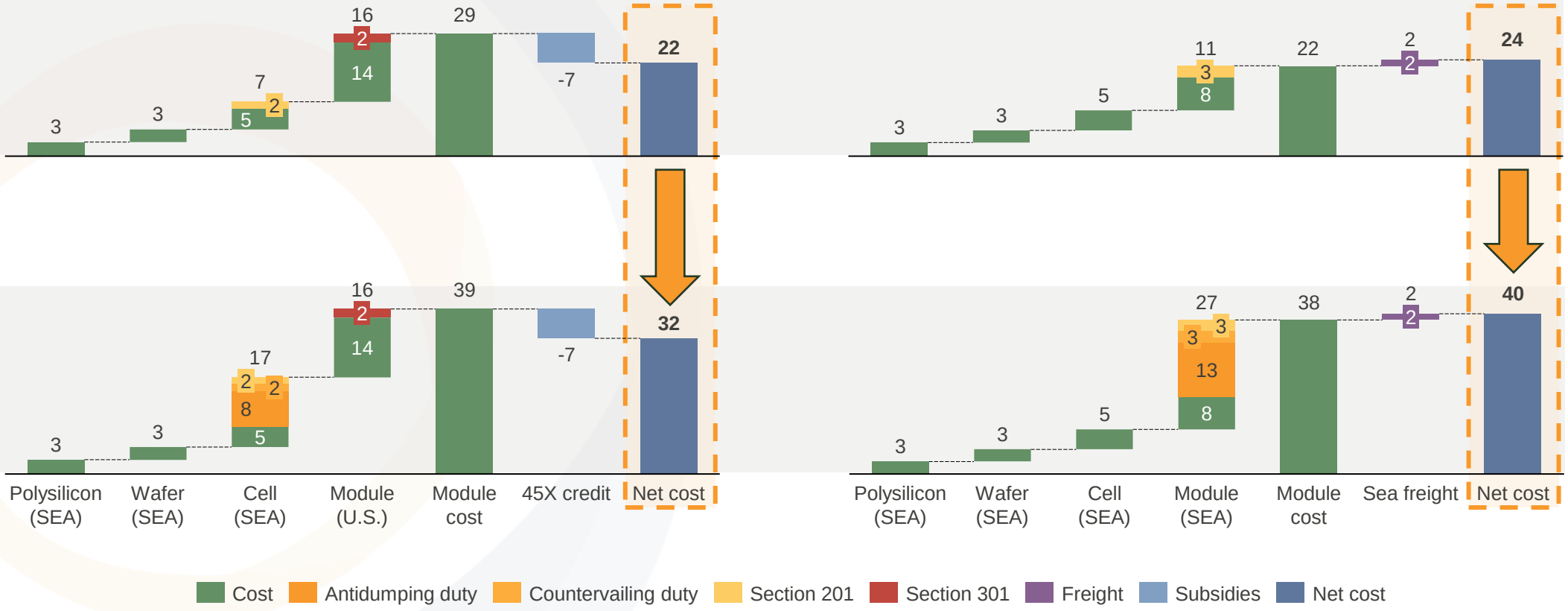
Domestic module costs could increase by ~10 ¢/W; imported modules by ~15 ¢/W

U.S. module assembly all-in cost, 2024 (EXW U.S. ¢/W)

Southeast Asia all-in module cost, 2024 (DDP-port U.S. ¢/W)

U.S. module cost structure today

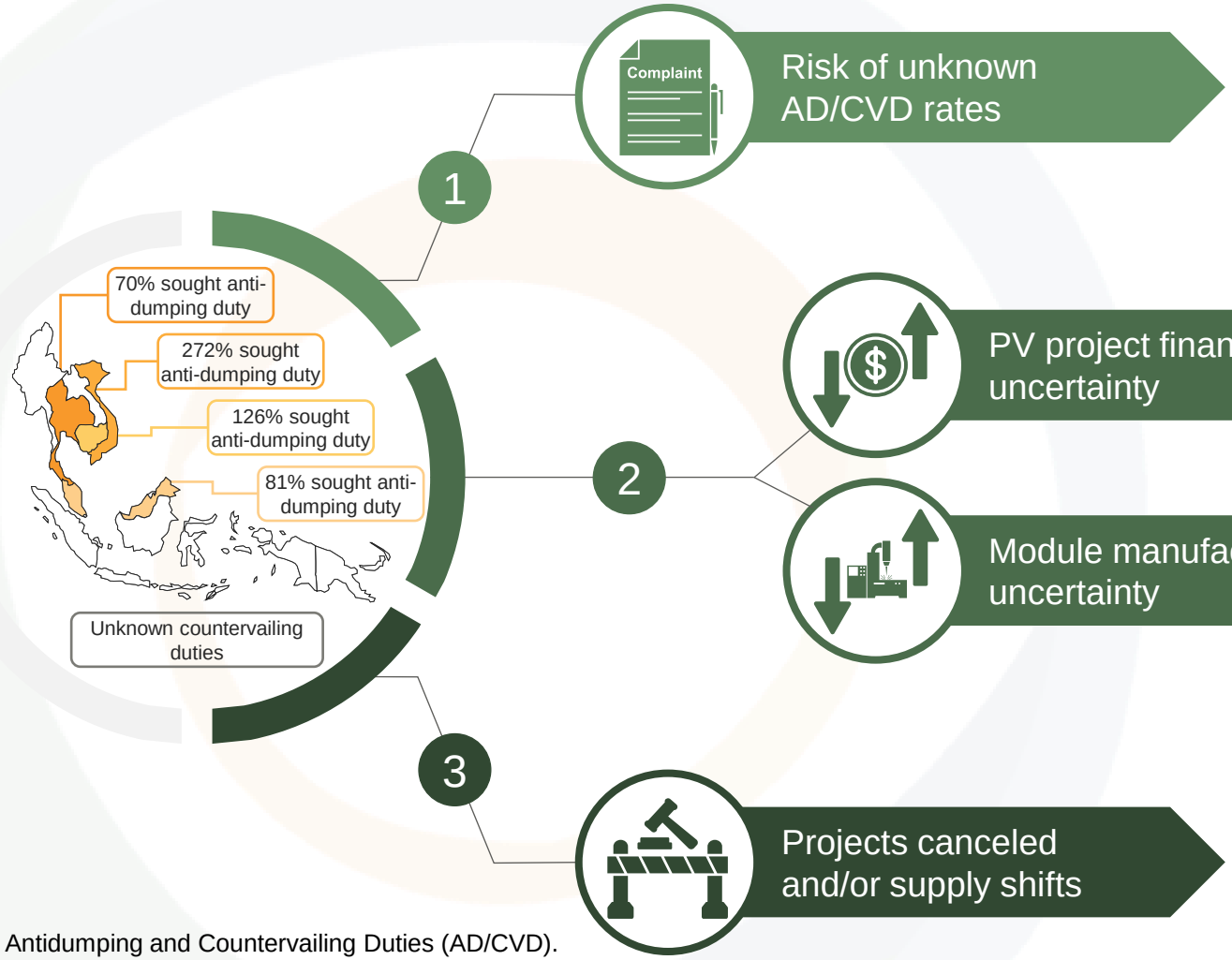
U.S. module cost structure if the 2024 AD/CVD is extended



Notes | Bifacial double-glass TOPCon module manufacturing costs. Section 301 value at 25% on applicable materials, Section 201 value at 14.25%, Countervailing Duty values based on 2020 China rates at 15%, and Antidumping Duty values based on 2024 AD/CVD petition filings at 70% for Thailand, but could be higher given sought rates of 81% (Malaysia), 126.1% (Cambodia), and 272% (Vietnam).

Duty uncertainty impacts PV project development

The 2024 AD/CVD adds financial risks most suppliers & buyers are unwilling to bear



AD/CVD rates are set via administrative review around two years after importing a product.

The long lead time between import and final duty application creates an unknowable financial liability for the importer of record.

Suppliers are typically unwilling to take all duty risk and will insist on at least sharing risk with buyers, but if buyers take on any of this risk, they introduce uncertainty into their financial models.

There is currently no domestic c-Si cell supply and only a limited set of plans are moving forward; until new capacity is built, many U.S. module manufacturers will be disadvantaged compared to peers without duty orders.

The risk introduced by duties of an unknowable amount makes financing PV projects and manufacturing facilities more difficult and expensive, which may cause developers and manufacturers to cancel projects.

The result could be supply shifting to products not subject to AD/CVD orders, the loss of U.S. module manufacturing jobs, and PV installations declining if other supply sources are expensive.

Notes | Antidumping and Countervailing Duties (AD/CVD).

Key takeaways

- Antidumping and countervailing duties are especially harmful to the solar industry given that they are:
  1. **Unknown**, when buyers sign contracts or importers receive products.
  2. **Retroactive**, with duties assigned around two years after an investigation.
  3. **Revised annually**, with rates continually assessed and changed.
  4. **Variable**, with different suppliers and different countries possibly receiving unique rates.

- **Duties could raise manufacturing costs by 10 ¢/W to 15 ¢/W,** leading to net module purchase price increases for buyers:
  1. Projects with marginal economics may no longer meet investment criteria and become canceled.
  2. PV project cancelation reduces deployment, slows U.S. climate goal progress, and negatively impacts deployment jobs.
  3. Some American consumers may be further impacted as PV module price increases translate to higher energy costs.

- 10 ¢/W duties on key cell-producing countries may **raise final module prices from U.S. factories**:
  - Duties also could leave nearly 34 GW of U.S. PV module capacity without competitively priced cell inputs, jeopardizing almost 9,000 U.S. module factory jobs.

Notes | Announced U.S. module factories average around 260 jobs/GW.

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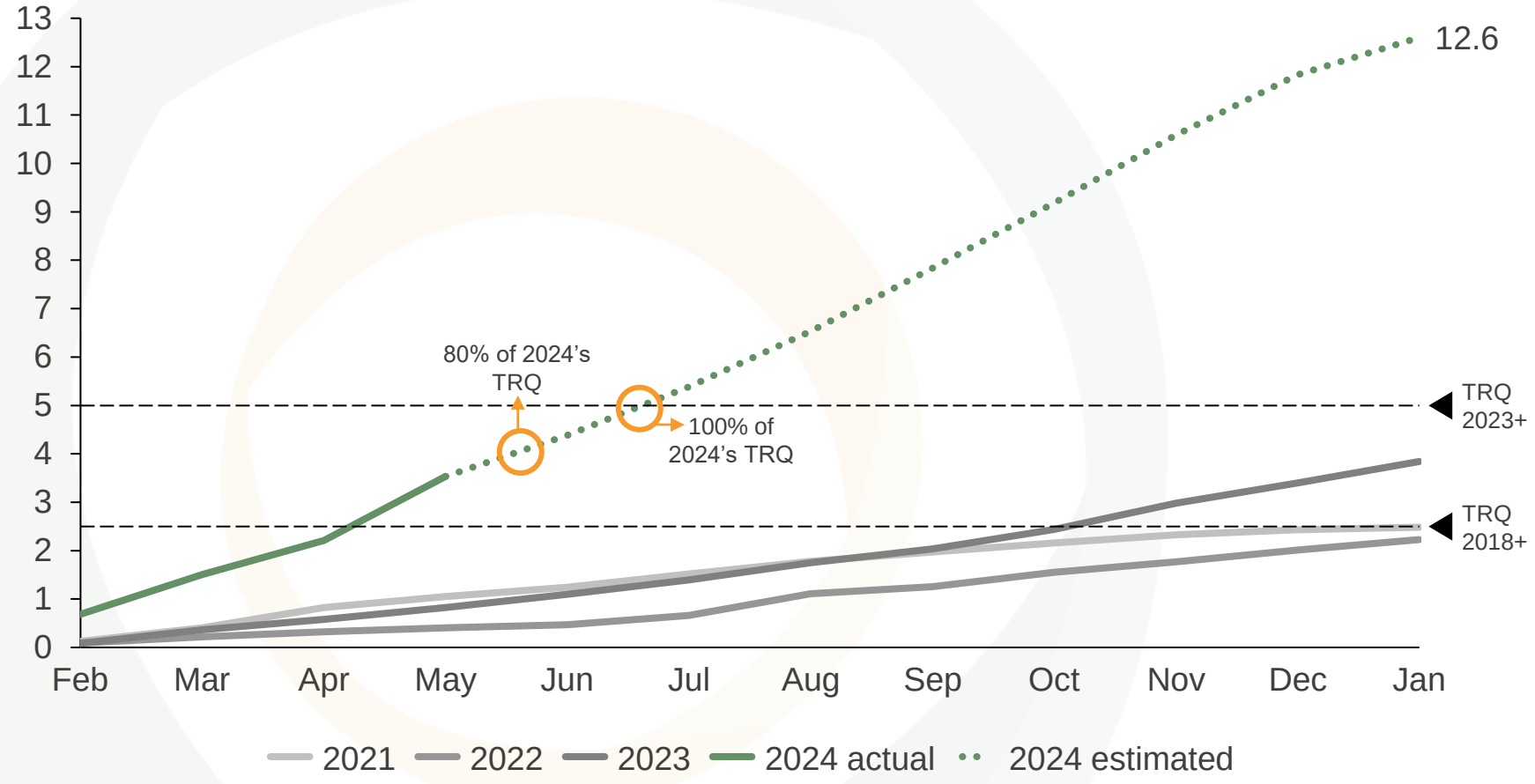
Abbreviations and key terms

ACRONYM	Details	Definition
45X	Section 45X manufacturing credits	Part of the U.S. Inflation Reduction Act that provides manufacturing credits to polysilicon, wafer, cell, and module production segments.
201	Section 201 tariffs	Section 201 tariffs apply a 14% to 15% tariff to U.S. cell and module imports from nearly every country (except a few developing nations).
301	Section 301 tariffs	Section 301 tariffs levy a ~25% tariff on a host of PV components, materials, and equipment HTS codes from China.
AD/CVD	Antidumping and Countervailing duties	Duties the U.S. imposes on China and Southeast Asia (cells and modules) and potentially on other materials (aluminum).
Anti-circumvention	Extension of China Antidumping and Countervailing duties	Applies Chinese AD/CVD rates to select suppliers and products produced in Cambodia, Thailand, Malaysia, and Vietnam.
BoM	Bill of Materials	The list of materials in the PV module.
BSF	Back Surface Field	One of the oldest mainstream cell technologies (aluminum BSF); is being phased out.
C&I	Commercial and Industrial	Distributed generation market segment largely for business use cases.
CdTe	Cadmium Telluride thin film	A non-silicon based PV technology.
c-Si	Crystalline silicon	Main PV technology platform with a silicon backbone (includes multi-BSF, PERC, TOPCon, HJT, and xBC technologies).
G/G or DG	Glass on Glass module or Double Glass	Module with two sheets of glass protecting the cells, most often a bifacial product.
DDP	Delivered Duty Paid	The seller assumes all responsibility, risk, and costs of transporting goods until the buyer receives or transfers them at the destination port. This agreement includes paying for shipping costs, export and import duties, insurance, and other expenses incurred during shipping to an agreed-upon location in the buyer's country.
EXW	Ex Works	The seller makes the goods available at the place of delivery. That place is commonly the seller's own warehouse or factory. The buyer is then responsible for getting the goods to their destination, including loading, transportation costs, insurance, etc. This is commonly used for local module orders (i.e., U.S. factories delivering U.S. orders).
FIT	Feed-in tariff	State subsidy model where a fixed price per kWh is paid to the IPP.
FOB	Free on Board	The buyer accepts the title of the goods at the shipment point and assumes risk once the seller ships the product. The buyer is responsible if the goods are damaged or lost. Typically, quotes to Europe from China specify an FOB price quote, even if the eventual order is DDP.
HJT	Heterojunction technology	High-efficiency cell technology where amorphous silicon is deposited on n-type monocrystalline wafers.
IRA	Inflation Reduction Act	A U.S. policy supporting many clean energy sectors.
N-type	Negative dopant	Ingots/wafers doped elements that create negative charge carriers.
P-type	Positive dopant	Ingots/wafers doped elements that create positive charge carriers.
PECVD	Plasma Enhanced Chemical Vapor Deposition	Process for passivation and anti-reflection treatment for cells.
PERC	Passivated Emitter Rear Contact	Cell architecture with increased efficiency due to improved backside (v. BSF).
PV	Photovoltaic	
R&D	Research & Development	
SEA	Southeast Asia	Region in Asia, primarily describes major PV manufacturing countries including: Vietnam, Malaysia, Thailand, Cambodia. Increasingly inclusive of Indonesia, the Philippines, Laos, and Singapore.
SEIA	Solar Energy Industry Association	Regional PV industry advocacy group.
TOPCon	Tunneling Oxide Passivating Contact	The high-efficiency cell architecture developed by Fraunhofer ISE is widely seen as the next step after PERC/PERT to achieve over 25% cell efficiency in low-cost, mass-produced modules.
UFLPA	Uyghur Forced Labor Prevention Act	U.S. policy.
Utility	Utility market segment	Large scale PV deployment segment focused on selling to utilities and large energy buyers.
WRO	Withhold Release Order	U.S. policy restricting imports of some products from companies on the U.S. government's Entity List.
xBC	x-Back Contact	Very high-efficiency solar cells with clean front surfaces where all the cell junction interconnection is done at the rear. Different suppliers hold acronyms for their own version of back contact such as IBC (Maxeon), ABC (Aiko), HPBC (LONGi), etc.
$/W or ¢/W	Unit of measurement	U.S. dollar or cents per watt
MW	Unit of measurement	Megawatt
GW	Unit of measurement	Gigawatt

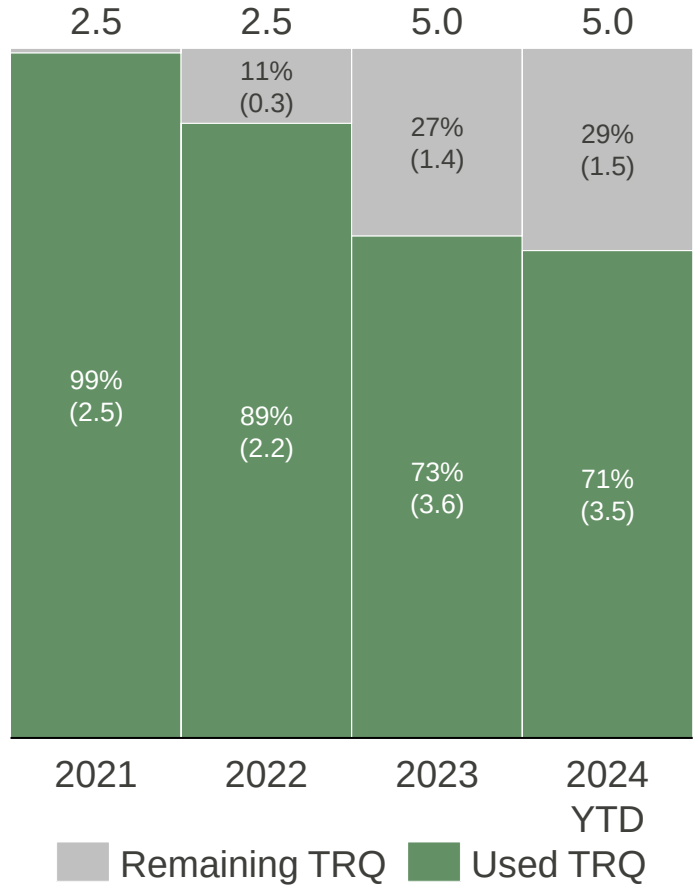
U.S. cell imports could total more than 2x tariff rate quota in 2024

The Administration pledged to raise the TRQ once importers reach 80% of 5 GW

Cumulative U.S. cell imports vs. annual tariff rate quota (GW)



U.S. cell TRQ (% used, GW)



Notes | Data reported as of July 8, 2024 via the United States International Trade Commission's DataWeb portal. Tariff rate quota (TRQ) sets the annual rate of solar cell imports that are exempt from the Section 201 each year. Estimated cell imports needs based on a 60% capacity utilization factor for U.S. module factories needing foreign cells. Cell imports from 201 exempt nations trivial and not counted.