

# Federal Tax Credits for Solar Manufacturers

October 2022

## Disclaimer

This resource from the U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) provides an overview of the federal investment and production tax credits. It does not constitute professional tax advice or other professional financial guidance and may change based on additional guidance from the Treasury Department. Find more information on the federal statutes regarding the federal investment and production tax credits at [www.govinfo.gov](http://www.govinfo.gov). See the [Homeowner’s Guide to the Federal Tax Credit for Solar Photovoltaics](#) for information for individuals. See the [Federal Solar Tax Credit for Businesses](#) for information for businesses.

## Table of Contents

Overview.....	2
Which Tax Credit Should I Choose? .....	2
Advanced Manufacturing Production Tax Credit (45X MPTC).....	3
What qualifies for the 45X MPTC? .....	3
When do the tax credits phase out? .....	5
Advanced Energy Project Credit (48C ITC).....	6
Overview .....	6
Availability of credits.....	6
Selection criterion.....	7
Direct Pay & Transfer of Credit.....	7
More Information.....	8
Ask Questions.....	8
Find Resources.....	8
Endnotes.....	8



Series 4 production line at the First Solar manufacturing plant in Perrysburg, OH. Photo courtesy of Dennis Schroeder / National Renewable Energy Laboratory.

## Overview

Manufacturers are eligible for two federal tax credits that support clean energy manufacturing in the United States: The Advanced Manufacturing Production Tax Credit (45X MPTC) and the Advanced Energy Project Investment Tax Credit (48C ITC). The 45X MPTC provides tax credits for each clean energy component domestically produced, while the 48C ITC provides a tax credit for purchasing and commissioning property to build a manufacturing facility.

The 45X MPTC was established and the 48C ITC was expanded, as part of the Inflation Reduction Act of 2022.

Projects cannot claim both the 45X MPTC and 48C ITC—if components were made at a facility that claimed a 48C ITC, manufacturers cannot also claim the 45X MPTC.

## Which Tax Credit Should I Choose?

The 48C ITC is an upfront tax credit based on the capital investment in an industrial (e.g. recycling) or manufacturing facility and does not vary by how much product a plant sells, while the 45X MPTC is earned over time based on the production and sale of specific, eligible components. Whether to choose the ITC or the MPTC depends foremost on whether the facility will be manufacturing MPTC-eligible components (as the ITC eligibility is broader). If eligible for

both, the decision depends on the comparative significance of capital cost versus operating cost for the facility.

In general, manufacturing facilities which produce components eligible for the 45X MPTC receive more value from the 45X MPTC than the 48C ITC.

## Advanced Manufacturing Production Tax Credit (45X MPTC)

The 45X MPTC is a per-unit tax credit for each clean energy component domestically produced and sold by a manufacturer.<sup>1</sup> The 45X MPTC is claimed on federal corporate income taxes.<sup>2</sup>

The credit varies by eligible component and is multiplied by the number of units produced by the taxpayer that were sold that year. The table below summarizes the eligible solar components, their definitions, and the unit credit amount.

### What qualifies for the 45X MPTC?

Clean energy components that qualify for the 45X MPTC include the PV module and some of its subcomponents, inverters, tracking system components, batteries, and certain critical minerals. Components that are produced at a facility that received a 48C ITC after August 2022 are not eligible.

Table 1: Summary of Eligible Components for Advanced Manufacturing Production Tax Credit

Eligible Components	Definition	Credit Amount
<b>PV module and subcomponents</b>		
<b>Solar-grade polysilicon</b>	Silicon that is suitable for photovoltaic manufacturing and is purified to a minimum purity of 99.999999 percent silicon by mass.	\$3 per kilogram (kg)
<b>PV wafer</b>	A thin slice, sheet, or layer of semiconductor material of at least 240 square centimeters that comprises the substrate or absorber layer of one or more photovoltaic cells. Produced by a single manufacturer either i) directly from molten or evaporated solar grade polysilicon or deposition of solar grade thin film semiconductor photon absorber layer, or ii) through formation of an ingot from molten polysilicon and subsequent slicing.	\$12 per square meter (m <sup>2</sup> )
<b>PV cell (crystalline or thin-film)</b>	The smallest semiconductor element of a solar module that performs the immediate conversion of light into electricity.	4¢ per watt-direct current (W <sub>dc</sub> )
<b>Polymeric backsheet</b>	A sheet on the back of a solar module that acts as an electric insulator and protects the inner components of such module from the surrounding environment.	40¢ per m <sup>2</sup>

<b>PV Module</b>	The connection and lamination of photovoltaic cells into an environmentally protected final assembly that is suitable to generate electricity when exposed to sunlight, and ready for installation without an additional manufacturing process.	7¢ per $W_{dc}$
<b>PV Inverter</b>		
<b>Central inverter</b>	Suitable for large utility-scale systems. >1 megawatt-alternating current ( $MW_{ac}$ )	0.25¢ per watt-alternating current ( $W_{ac}$ )
<b>Utility inverter</b>	Suitable for commercial or utility-scale systems. $\geq 125 kW_{ac}$ , $\leq 1 MW_{ac}$ , with a rated output $\geq 600$ volt three-phase power.	1.5¢ per $W_{ac}$
<b>Commercial inverter</b>	Suitable for commercial or utility-scale applications. $\geq 20kW_{ac}$ , $\leq 125 kW_{ac}$ with a rated output of 208, 480, 600, or 800 volt three-phase power >600 volt three-phase power.	2¢ per $W_{ac}$
<b>Residential inverter</b>	Suitable for a residence. $\leq 20 kW_{ac}$ , with a rated output of 120 or 240 volt single-phase power.	6.5¢ per $W_{ac}$
<b>Microinverter</b>	Suitable to connect with one solar module. $\leq 650 W_{ac}$ with a rated output of i) 120 or 240 volt single-phase power, or ii) 208 or 480 volt three-phase power.	11¢ per $W_{ac}$
<b>PV Tracking Systems</b>		
<b>Torque tube</b>	A structural steel support element (including longitudinal purlins) that is part of a solar tracker, is of any cross-sectional shape, may be assembled from individually manufactured segments, spans longitudinally between foundation posts, supports solar panels and is connected to a mounting attachment for solar panels (with or without separate module interface rails), and is rotated by means of a drive system.	87¢ per kg
<b>Structural fasteners</b>	A component that is used to connect the mechanical and drive system components of a solar tracker to the foundation of such solar tracker, to connect torque tubes to drive assemblies, or to connect segments of torque tubes to one another.	\$2.28 per kg
<b>Batteries</b>		
<b>Electrode active materials</b>	Cathode materials, anode materials, anode foils, and electrochemically active materials, including solvents, additives, and electrolyte salts that contribute to the electrochemical processes necessary for energy storage.	10% of the costs incurred by the taxpayer due to production of such materials
<b>Battery cells</b>	An electrochemical cell comprised of 1 or more positive electrodes and 1 or more negative electrodes, with an energy density of not less than 100 watt-hours per liter, and capable of storing at least 12 watt-hours of energy. The capacity of the cell	\$35 per kilowatt-hour (kWh)

	to the maximum discharge amount of the cell or module (capacity-to-power ratio) cannot exceed 100:1.	
<b>Battery module</b>	A module, in the case of a module using battery cells, with 2 or more battery cells that are configured electrically, in series or parallel, to create voltage or current, as appropriate, to a specified end use, or with no battery cells, and with an aggregate capacity of not less than 7 kilowatt-hours (or, in the case of a module for a hydrogen fuel cell vehicle, not less than 1 kilowatt-hour). The capacity of the module to the maximum discharge amount of the cell or module (capacity-to-power ratio) cannot exceed 100:1.	\$10 (or, in the case of a battery module that does not use battery cells, \$45) per kWh
<b>Critical Minerals</b>		
<b>Critical minerals</b>	In addition to products and components, the mining of certain critical minerals are included. Those most likely to pertain to the solar PV supply chain include: Aluminum that is purified to 99.9% or converted from bauxite to at least 99% purity; graphite that is purified to a minimum purity of 99.9%; tellurium that is purified to at least 99% purity or converted to cadmium telluride; indium that is purified to at least 99 percent, converted to indium tin oxide, or converted to indium oxide of at least 99.9% purity; gallium that is purified to 99% purity; arsenic that is purified to 99% purity; titanium that is purified to 99% purity.	10% of the costs incurred by the taxpayer due to production of such minerals

### When do the tax credits phase out?

Table 2: Tax Credit for Eligible U.S.-produced Components by Year Sold

2023-2029	2030	2031	2032	2032
Full 45X MPTC unit credit	75% of the full unit credit (e.g. PV Module: $75\% \times 7\phi/W_{dc} = 5.25\phi/W_{dc}$ )	50% of the full unit credit	25% of the full unit credit	No credit

The phaseout does not apply to the production of critical minerals, which continue indefinitely.

Manufacturers can also monetize the tax credit through a direct payment from the Internal Revenue Service (IRS) in lieu of a credit against their taxes due, or opt to transfer the credit, as described below:

- **Direct pay option:** Manufacturers can receive a refund for 45X MPTC tax credits for the first five years they are claimed, though are still subject to the 2033 credit sunset. The five-year limitation does not apply if the manufacturer is a tax-exempt organization (i.e.



non-profit), state, municipality, the Tennessee Valley Authority, Indian Tribal government, any Alaskan Native Corporation, or any rural electric cooperative. A penalty of 20% may apply where excess payments occur.<sup>3</sup>

- **Transfer of credit:** Manufacturers may also elect to transfer all, or a portion, of the tax credits for a given year to an unrelated eligible taxpayer. Payments for the credit must be made in cash and are not considered a taxable event (i.e. no taxes are owed on receiving the payment and no deduction is possible for making the payment). A penalty of 20% may apply where excess credits occur.<sup>4</sup>

## Advanced Energy Project Credit (48C ITC)

### Overview

The Advanced Energy Project Credit (48C ITC) is a U.S. Department of Treasury program that awards tax credits for investing in various eligible property:

- designed to produce or recycle advanced energy components, such as solar modules, inverters, and batteries
- re-equip industrial or manufacturing facilities with equipment designed to reduce greenhouse gas emissions by at least 20 percent through the installation of low- or zero-carbon process heat systems (among other things)

The credit can be claimed on federal corporate income taxes and represents a percentage of eligible investment costs placed in service during the tax year.

Starting in 2023, awardees are eligible for an ITC of 30% of qualifying investment if they satisfy the labor requirements issued by the Treasury Department for any labor associated with re-equipping, expansion, or establishment of the manufacturing facility.<sup>5</sup> Projects that do *not* meet the labor requirements are only eligible for a 6% tax credit. These labor requirements do not apply to operating the facilities after they have been placed into service.

Manufacturers must apply to receive the grant at such time and containing such information as Treasury may require. Once an applicant is awarded a credit, it has two years from the date of issuance by Treasury of acceptance of the application, to place the project in service and notify Treasury; the location cannot be materially different from the location specified in the application. Treasury will make the awardees and the credit amounts public after awarding the tax credits.

### Availability of credits

- The 48C program was first initiated under the American Recovery and Reinvestment Act (ARRA) of 2009 to support investments in projects that establish, expand or re-equip clean energy manufacturing facilities that produce solar, storage, and electric grid equipment systems and components (other types of clean energy manufacturing facilities are also eligible for the 48C ITC but are beyond the scope of this guidance).

- Originally funded at \$2.3 billion, tax credits were made available to 183 domestic clean energy manufacturing facilities during Phase I of the program in January 2010. Phase II was launched in 2013 to utilize \$150 million in tax credits that were not used by awardees from the first round.<sup>6</sup>
- The Inflation Reduction Act of 2022 was enacted in August 2022, expanding the types of qualified investments,<sup>7</sup> and allowing for \$10 billion in new 48C tax credits to be allocated to projects in 2023 or later. At least \$4 billion of the credits (40%) must be allocated to projects located in census tracts that are designated in the Act as an “energy community” and that have not been allocated a 48C credit before the enactment of the Inflation Reduction Act.
- Denial of double benefits: projects will lose their ability to claim the 45X MPTC on components made at a facility that has received the 48C ITC after enactment of the Inflation Reduction Act.<sup>8</sup>

## Selection criterion

The ARRA legislation identified six criteria to evaluate 48C ITC applications, but it provided no guidance on how the criteria should be weighted. In coordination with Treasury and with support from the National Renewable Energy Laboratory (NREL), DOE operationalized the legislated criteria into one eligibility criterion and five selection criteria for the 48C ITC application, as follows:

### Applicant eligibility criterion

1. Reasonable expectation of commercial viability;
2. Greatest domestic job creation;
3. Greatest net impact in avoiding or reducing air pollutants or greenhouse gases (GHG);
4. Greatest potential for technological innovation and commercial deployment;
5. Lowest levelized cost of electricity (LCOE) of generated or stored energy; or of measured reduction in energy consumption of GHG emissions; and
6. Shortest project time from certification to completion.

## Direct Pay & Transfer of Credit

- **Direct pay option:** Manufacturers can receive a refund for 48C ITC tax credits *only* if they are a tax-exempt organization (i.e., non-profit), state, municipality, the Tennessee Valley Authority, Indian Tribal government, any Alaskan Native Corporation, or any rural electric cooperative. A penalty of 20% may apply where excess payments occurred.<sup>9</sup>
- **Transfer of credit:** Manufacturers may also elect to transfer all, or a portion, of the tax credits for a given year to an unrelated eligible taxpayer. Payments for the credit must be made in cash and are not considered a taxable event (i.e. no taxes are owed on receiving the payment and no deduction is possible for making the payment). A penalty of 20% may apply where excess credit occurred.<sup>10</sup>



## More Information

### Ask Questions

Internal Revenue Service (IRS), 1111 Constitution Avenue, N.W., Washington, D.C. 20224, (800) 829-1040.

### Find Resources

- Find more information on the federal statutes regarding the ITC and MPTC at [www.govinfo.gov](http://www.govinfo.gov).
- SETO held a webinar on September 27, 2022, to discuss the recent policy changes in the Inflation Reduction Act. [Watch the recording, download the slides, and read the Q&A.](#)
- View SETO's other [federal solar tax credit resources](#).

## Endnotes

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<sup>1</sup> Product must be sold to an unrelated party, i.e., those who are not treated as a single employer under the regulations prescribed under section 52(b), or that are integrated, incorporated, or assembled into another eligible component that is sold to an unrelated party. <https://www.irs.gov/newsroom/faqs-regarding-the-aggregation-rules-under-section-448c2-that-apply-to-the-section-163j-small-business-exemption>.

<sup>2</sup> 26 U.S.C. § 45X.

<sup>3</sup> H.R.5376 - Inflation Reduction Act of 2022, Section 6417. Taxpayers may elect to stop receiving direct payments in subsequent years, however, once stopped, they cannot go back to direct payments.

<sup>4</sup> H.R.5376 – Inflation Reduction Act of 2022, Section 6418. The transferee cannot further transfer any credits it received in the transfer.

<sup>5</sup> The prevailing wage requirement states that all wages any laborers and mechanics employed by the taxpayer or any contractor or subcontractor in the re-equipping, expansion, or establishment of a manufacturing facility must be paid at a rate not less than prevailing rates of that locality as determined by the Secretary of Labor. The apprenticeship requirement states that a certain percentage of the total construction labor hours for a project must be performed by an apprentice. The percentage increases over time, starting at 10% for projects beginning construction in 2022, 12.5% for projects beginning construction in 2023, and 15% for projects beginning construction after 2023. Projects can correct the prevailing wage requirements if they were originally not satisfied, by paying the affected employees the difference in wages plus interest and paying the Secretary of Labor \$5,000 for each impacted individual. The apprenticeship requirements also can be satisfied if a good faith effort was made to comply or if a penalty is paid to the Secretary of Treasury in the amount of \$50/ hour of non-compliance. Both penalties increase if the requirements are intentionally disregarded. For more information see Section 13101(f) of the Inflation Reduction Act of 2022.

<sup>6</sup> <https://www.energy.gov/downloads/fact-sheet-48c-manufacturing-tax-credits>.

<sup>7</sup> The Inflation Reduction Act of 2022 expanded eligible manufacturing facilities to include (but not limited to) investments made to produce energy storage systems and components, grid modernization equipment or components, and electrolyzers run on renewable electricity.

<sup>8</sup> Project investments are also ineligible for the 48C credit if they were claimed for the 48B (qualifying gasification project), 48E (clean electricity investment), 45Q (carbon sequestration credit), or 45V (clean hydrogen) credit.

<sup>9</sup> H.R.5376 - Inflation Reduction Act of 2022, Section 6417. Taxpayers may elect to stop receiving direct payments in subsequent years, however, once stopped, they cannot go back to direct payments.

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DOE/EE- 2660 • October 2022