



Updated October 20, 2026

The Section 45X Advanced Manufacturing Production Credit

P.L. 117-169, commonly known as the Inflation Reduction Act of 2022 (IRA), enacted a tax credit for the production of component parts and critical minerals used in clean energy equipment. The credit is referred to as the *Advanced Manufacturing Production Credit* or the *45X credit* based on its Internal Revenue Code section (26 U.S.C. §45X). This In Focus describes the credit, summarizes its legislative history, and discusses its potential impacts on the economy, the environment, and the federal budget.

Description of the 45X Credit

The 45X credit subsidizes the production of five types of goods: solar energy components, wind energy components, battery components, inverters, and critical minerals.

When the credit was enacted, its list of 50 eligible critical minerals precisely matched the February 2022 list of critical minerals published by the U.S. Geological Survey (USGS). Changes to future USGS lists will not affect which minerals qualify for the credit; adding new minerals to the credit, or removing existing ones, can only be done by an act of Congress. (Congress most recently added metallurgical coal as a qualifying critical mineral in P.L. 119-21.)

Businesses may claim the credit only for production in the United States, including its territories (except for imports of metallurgical coal). Goods produced from recycled materials qualify for the credit. While Section 45X provides credits for a wide array of products, there are three general methods for calculating credit values for different goods:

- **Goods used to produce, transmit, or store energy** receive credits proportional to their output, transmission, or energy storage capacities. For example, solar modules are eligible for a credit equal to 7 cents multiplied by the module's capacity per direct-current watt; commercial inverters are eligible for a credit equal to \$2 multiplied by the inverter's alternating-current-watt capacity; and battery cells are eligible for a credit of \$35 multiplied by the maximum kilowatt-hour capacity of the cell.
- **Subcomponent goods** are eligible for either flat credits or credits proportional to the subcomponents' size or weight. For example, polymeric backsheets (which insulate the backs of solar panels) are eligible for a credit of 40 cents per square meter, and torque tubes (which are used to cojoin and support solar panels) are eligible for a credit of 87 cents per kilogram.
- **Critical minerals and electrode active materials**, except for metallurgical coal, are eligible for credits equal to 10% of the production costs of the given mineral or material. According to a 2024 IRS rule, the costs of extracting, acquiring, processing, purifying, refining, and converting critical minerals and electrode active materials all count as qualifying production costs.

One exception to these general rules is that *offshore wind vessels*—vessels used to transport and install turbines at offshore wind farms—are eligible for a credit equal to 10% of the vessel's sales price. Sales prices are not used to calculate credit amounts for any other good. A second exception is that solar-grade polysilicon, which is arguably more similar to a critical mineral than a subcomponent part, is eligible for a credit of \$3 per kilogram.

For most goods, 45X credits are calculated based on the year the product is sold, which may differ from the year it is produced. Credits for critical minerals are based on the year of production. The 45X credit is in place temporarily, meaning it is scheduled to expire under current law:

- **Wind energy components** qualify for full credits through the end of 2027 and are thereafter ineligible.
- **Metallurgical coal** produced before the end of 2029 qualifies for a credit equal to 2.5% of production costs. Metallurgical coal produced after 2029 is ineligible.
- **Solar energy components, battery components, and inverters** sold before 2030 qualify for full credits. Taxpayers may then receive 75% of normal credit amounts for goods sold in 2030, 50% for goods sold in 2031, and 25% for goods sold in 2032. Credits for these goods expire at the beginning of 2033.
- **Critical minerals other than metallurgical coal** produced before the end of 2030 qualify for full credits. Taxpayers may then receive 75% of normal credit amounts (7.5% of production costs) for critical minerals produced in 2031, 50% (5% of production costs) for critical minerals produced in 2032, and 25% (2.5% of production costs) for critical minerals produced in 2033. Credits for critical minerals expire in 2034.

Facilities that have previously been awarded a credit under 26 U.S.C. §48C are ineligible for the 45X credit.

IRA Enactment and P.L. 119-21 Reforms

The 45X credit was enacted as part of the IRA in 2022. It remained unchanged for three years before being reformed by P.L. 119-21, commonly known as the One Big Beautiful Bill Act, in 2025.

P.L. 119-21 made six changes to the 45X credit. First, the act disallowed the credit for wind energy components produced and sold after December 31, 2027. Under the IRA, credits for wind energy components were subject to the same phaseout schedule as for solar energy components, battery components, and inverters (as described above).

Second, whereas the IRA enacted permanent tax credits for critical minerals, P.L. 119-21 scheduled those credits to gradually phase out from 2031 to 2034, as described above.

Third, P.L. 119-21 allowed metallurgical coal—the type of coal used in steelmaking—to qualify as a critical mineral under Section 45X. The credit equals 2.5% of production costs (as compared to 10% for other critical minerals), and qualifying metallurgical coal must be produced either in the United States or abroad no later than December 31, 2029. Metallurgical coal is the only 45X-eligible product not subject to a domestic production requirement.

Fourth, as described in CRS Report R48611, *Tax Provisions in P.L. 119-21, the FY2025 Reconciliation Law*, P.L. 119-21 applied four “foreign entity” restrictions to the 45X credit. These restrictions were meant to limit the involvement of companies and individuals from China, Russia, Iran, and North Korea in the downstream supply chains of companies qualifying for the credit.

Fifth, P.L. 119-21 modified 26 U.S.C. §45X(d)(4) such that if an eligible “primary component” is integrated, incorporated, or assembled into a “secondary component” produced at the same manufacturing facility, and if the secondary component is sold to an “unrelated person,” then the 45X credit may be allowed for the sale of the secondary component only if at least 65% of the total direct material costs paid or incurred by the taxpayer to produce such secondary component are attributable to primary components mined, produced, or manufactured in the United States. This modification applies to components sold during taxable years beginning after December 31, 2026.

Sixth, P.L. 119-21 required that battery modules qualifying for the credit be composed of all other essential equipment needed for battery functionality, such as current collector assemblies and voltage sense harnesses, or any other essential energy collection equipment.

Direct Payments and Credit Transfers

The 45X credit is eligible for two tax mechanisms known as *direct payments* and *credit transfers*. Both mechanisms apply only to tax credits enacted or modified by the IRA.

Direct payments allow certain untaxed organizations to receive cash payments of equivalent value to energy tax credits. Because credits are used to reduce tax payments, tax-exempt entities usually have no use for credits, as they already owe no taxes. The direct payments mechanism effectively extends the financial value of tax credits to such entities. However, unlike with most IRA credits, the 45X credit can *also* be claimed as a direct payment by taxable entities, including for-profit businesses, for up to five years.

Credit transfers allow businesses to buy and sell certain IRA credits in exchange for cash. With ordinary tax credits, if the value of the credit exceeds a company’s tax liability, the company does not receive a refund for the excess credit amount. By allowing tax credit sales, businesses with large credits and low tax liabilities are more likely to reap the full benefits (or something close to it) of 45X and other credits.

Cost and Impact

According to estimates published by the Joint Committee on Taxation (JCT) in December 2025, the 45X credit is projected to reduce federal revenues by \$20.1 billion from

FY2025 through FY2029. Of the 53 energy and natural resources tax expenditures studied by the JCT, the 45X credit had the fifth-highest projected five-year cost.

The 45X credit could bolster domestic clean energy supply chains, which could lead to lower greenhouse gas (GHG) emissions, increased domestic energy security, and more manufacturing jobs. The credit’s impact on clean energy output and domestic manufacturing depends on its ability to change producers’ behavior. If the 45X credit increases the number of clean energy manufacturing facilities or the amounts produced at existing facilities, it could increase domestic manufacturing and decrease emissions. If the credit is instead claimed by producers who would have manufactured their products absent the credit, then Section 45X mainly provides windfall benefits to credit recipients. If credit-eligible goods mostly displace imports, the credit would have little effect on GHG emissions but may enhance domestic energy security, as much of the world’s clean energy equipment and critical minerals are currently produced in China.

Perhaps due to the relative newness of Section 45X, CRS did not identify any post hoc analyses of the credit’s broad economic or environmental effects. Various forward-looking studies, published from 2023 to 2025, projected the credit’s effects on the prices of clean energy products; such studies did not examine how these lower prices would affect GHG emissions, U.S. reliance on foreign imports, or domestic manufacturing employment. These studies found that the 45X credit would lower the costs of solar and wind components to below average import prices (though the studies were conducted before P.L. 119-21 enacted the end-of-2027 termination date for wind energy components). Studies also projected that the 45X credit would lower the costs of producing electric vehicle (EV) batteries, which would lower the final costs of EVs bought by consumers.

Investment in manufacturing facilities for batteries, solar energy components, wind energy components, and critical minerals has increased since the enactment of the IRA. Between the second quarter of 2022 and the second quarter of 2026, such investment rose from \$1.9 billion to \$6.2 billion in constant 2024 dollars, an increase of 227%. It is not clear how much of this increase is due to the 45X credit as opposed to other policy reforms or nonpolicy factors.

Section 45X subsidizes the production of what economists call *intermediate goods*. Producers use intermediate goods to manufacture *final goods* sold to consumers. Critical minerals, wind blades, and other items subsidized under Section 45X are generally used to produce or transmit electricity (the final good, in this case). Traditional economic theory suggests that taxing or subsidizing intermediate goods is less economically efficient than taxing or subsidizing final goods because it distorts the choice of inputs. The 45X credit may therefore be a less efficient means of reducing GHG emissions than credits that directly subsidize zero-emissions electricity production. (Studies find that credits for renewable electricity generation are a cost-efficient means of cutting emissions.)

Nicholas E. Buffie, Analyst in Public Finance

Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.