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Clean Energy Tax Credits Explained: The Section 45X Advanced Manufacturing Production Tax Credit

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A Practice Note discussing the Section 45X advanced manufacturing production tax credit available for qualifying energy components including solar energy components, wind energy components, inverters, qualifying battery components, and applicable critical minerals. This Note also discusses the amount of the credit available to taxpayers and the eligibility and substantiation requirements that taxpayers must satisfy to qualify for the credit including production in the US and sales to unrelated parties.

The Inflation Reduction Act (IRA) (Pub. L. 117-169, 136 Stat. 1818 (2022)) added Section 45X to the Internal Revenue Code (Code or IRC), which allows taxpayers to qualify for a tax credit for the production in the US and sale to unrelated persons of eligible components. Eligible components include certain solar energy components, wind energy components, inverters, qualifying battery components, and applicable critical minerals. The amount of the credit varies based on the eligible component type.

The Section 45X tax credit is part of a suite of incentives and government programs intended to strengthen the domestic supply of key components needed to spur the development of clean energy technologies and increase US energy security by reducing reliance on foreign suppliers. Other incentives and programs include the Section 48C advanced energy project tax credit (IRC § 48C) and the Section 48D advanced manufacturing investment credit (IRC § 48D), grant funding under the Defense Production Act of 1950 (50 U.S.C. §§ 4501 to 4568), and loans and guarantees from the Department of Energy (DOE)'s Loan Programs Office.

This Practice Note discusses:

- The scope and purpose of the Section 45X tax credit.
- The requirements a taxpayer must satisfy to qualify for the credit.
- The energy components that qualify for the credit.
- The amount of the tax credit available for the different energy components including rules related to calculating the credit.
- The interaction between this credit and the credit available for advanced energy projects under Section 48C of the Code.
- Recordkeeping and reporting requirements.

This Note also discusses outstanding issues relating to this credit including changes the Trump administration may seek to make to Section 45X of the Code and the implementing regulations to address concerns that have been raised by mining companies and other market participants (see Considerations and Challenges).

Eligibility Requirements

The Section 45X advanced manufacturing production credit is available to taxpayers (manufacturers of specified energy components or producers of applicable critical minerals) for eligible components that satisfy the following conditions:

- Are produced by the taxpayer claiming the credit, subject to certain exceptions (see Produced by the Taxpayer and Contract Manufacturing Arrangements).

- Are produced in the US and US territories (see Production in the US).
- Are sold by that taxpayer to an unrelated person during the relevant tax year (Sales to Unrelated Persons).

The Treasury Department and Internal Revenue Service (IRS) are charged with issuing regulations to implement the Section 45X tax credit (IRC § 7805) which they did in October 2024 (the Final Regulations) (89 Fed. Reg. 85798 (Oct. 28, 2024)). The Final Regulations generally apply to eligible components for which production is completed, and sales occur after December 31, 2022, and during a taxable year ending on or after October 28, 2024. Taxpayers may choose to apply the rules of Treasury Regulation Sections 1.45X-1 through 1.45X-4 to eligible components for which production is completed and sales occur after December 31, 2022, and for taxable years ending before October 28, 2024, provided they apply the rules in their entirety and in a consistent manner.

Produced by the Taxpayer

For an eligible energy component to be produced by a taxpayer, the following conditions must be met:

- The taxpayer must substantially transform the constituent elements, materials, or subcomponents into a complete and distinct eligible component.
- The eligible component must be functionally different from the component that would result from minor assembly or superficial modification of the constituent elements, materials, or subcomponents.
- The transformation cannot be partial.

A component is produced by a taxpayer (and therefore an eligible component) whether it is the result of a primary production involving producing an eligible component using non-recycled materials or a secondary production involving producing an eligible component using recycled materials. (Treas. Reg. § 1.45X-1(c)(1).)

Special Production Rules for Certain Eligible Components

The regulations governing the Section 45X credit include special rules for applying the "produced by the taxpayer" requirement for:

- Solar grade polysilicon (see Solar Energy Components).
- Electrode active materials (see Battery Components).
- Applicable critical minerals (see Critical Minerals).

Regarding those materials, produced by the taxpayer means processing, conversion, refinement, or purification of source materials (for example, brines, ores, or waste streams) to derive a distinct eligible component. This includes both primary and secondary production. (Treas. Reg. § 1.45X-1(c)(2).)

Contract Manufacturing Arrangements

Generally, the taxpayer eligible to claim the Section 45X tax credit is the taxpayer that directly performs the production activities that substantially transform the eligible component. However, the production of an eligible component may be performed under a contract manufacturing arrangement.

A contract manufacturing arrangement is any agreement to produce an eligible component if the agreement is entered into before production of the eligible component is completed. These arrangements do not include routine purchase orders for off-the-shelf property that either:

- Require de minimis modifications to tailor it to the customer's specific needs.
- If at the time the agreement is entered into, the contractor knows or has reason to know that the contractor can satisfy the agreement out of existing stocks or normal production of finished goods.

(Treas. Reg. § 1.45X-1(c)(3)(ii).)

Party Claiming the Tax Credit

A taxpayer that produces an eligible agreement under a contract manufacturing arrangement (whether with one or multiple fabricators) may agree with those parties about which of them may claim the Section 45X credit. The IRS will respect this agreement, if the parties follow the applicable certification statement requirements (see Certification Requirements) (Treas. Reg. § 1.45X-1(c)(3)(iii)).

Certification Requirements

Parties using a contract manufacturing agreement must submit to the IRS a certification statement

which includes all required information set out in guidance and a properly signed penalty of perjury statement (Treas. Reg. § 1.45X-1(c)(3)(iv)). If using a contract manufacturing agreement, the parties should be sure to carefully document their agreement regarding which party may claim the Section 45X credit and comply with the certification requirements.

Production in the US

The eligible components must be produced in the US or a US territory (including in each case the seabed and subsoil of those submarine areas which are adjacent to US territorial waters and over which the US has exclusive rights, according to international law, regarding the exploration and exploitation of natural resources) (Treas. Reg. § 1.45X-1(d); IRC § 638(1)).

A taxpayer can claim the Section 45X tax credit for an eligible component only if the production and sale of that component are in a trade or business as this term is understood in Section 162 of the Code (Treas. Reg. § 1.45X-1(e)).

For more information on the domestic production requirement, see Foreign Sourcing of Materials.

Sales to Unrelated Persons

A taxpayer may claim the Section 45X tax credit for each eligible component the taxpayer produces and sells to an unrelated person. This includes any eligible component the taxpayer produces that was used as a constituent element, material, or subcomponent and integrated, incorporated, or assembled into another complete and distinct eligible component or another complete and distinct product (that is not itself an eligible component) that the taxpayer also produces and sells to an unrelated person (Treas. Reg. §§ 1.45X-1(f) and 1.45X-2 (a)-(c)).

The Treasury and the IRS have clarified that this applies only for deemed sale treatment and not deemed production. Specifically, a taxpayer is "treated as having sold" an eligible component to an unrelated person if the taxpayer produced the component and the component is integrated, incorporated, or assembled into another eligible component that is then sold to an unrelated person (IRC § 45X(d)(4); Treas. Reg. § 1.45X-2(e)).

Integrated, Incorporated, or Assembled Definition

For a component to be integrated, incorporated, or assembled into another eligible component the production process must:

- Either:
  - substantially transform the constituent element, material, or subcomponent into another complete and distinct eligible component that is not solar grade polysilicon, an electrode active material, or an applicable critical mineral; or
  - process, convert, refine, or purify the eligible component to derive a distinct eligible component that is solar grade polysilicon, an electrode active material, or an applicable critical mineral.
- Not be minor assembly or superficial modification of an eligible component used as an element, material, or subcomponent and other elements, materials.

For the exempted components (see Special Production Rules for Certain Eligible Components). (Treas. Reg. § 1.45X-1(f).)

Special Rules for Sales to Related Persons

A taxpayer may sell an eligible component to a related person and still claim the tax credit if the related person later sells the eligible component to an unrelated person. In this case, the taxpayer that sold the eligible component to the related person will be treated as selling the component to an unrelated person. A taxpayer may also make an election (a Related Person Election) to treat the sale of an eligible component to a related person as if made to an unrelated person (see Related Person Election).

If a taxpayer makes a valid Related Person Election and the taxpayer produces and then sells an eligible component to a related person, who then integrates, incorporates, or assembles the taxpayer's eligible component into another complete and distinct eligible component that is subsequently sold to an unrelated person, the taxpayer's sale of the eligible component to the related person is treated as if made to an unrelated person in the taxable year in which the sale to the related person occurs (Treas. Reg. § 1.45X-2(e)).

Related persons are those that are treated as being under common control as defined in Section 52(b) of the Code and related implementing Treasury Regulations. Related persons are not required to be "United States persons" within the meaning of Section 7701(a)(30) of the Code. A taxpayer may be eligible for the 45X credit regardless of the location of the related party buyer. (Treas. Reg. § 1.45X-2(c).)

Related Person Election

A taxpayer may elect to treat the sale of an eligible component to a related person as a sale made to an unrelated person. To make this election, the taxpayer must deliver information as the IRS may require to prevent duplication, fraud, or any improper or excessive credit amount.

The Related Person Election:

- Must be made separately regarding related person sales made by a taxpayer for each eligible trade or business of the taxpayer.
- Is irrevocable and applies to all sales to related persons (including between members of the same consolidated group) of eligible components produced by the taxpayer during the taxable year regarding each trade or business for which the Related Person Election is made.
- Must be made annually on a timely (including extensions), originally filed tax return.

(Treas. Reg. § 1.45X-2(d).)

Required Information

The taxpayer must provide to the IRS certain information for all sales of eligible components to related persons, including:

- The taxpayer's name and employer identification number (EIN).
- A description of the taxpayer's trade or business (including principal business activity code).
- The names and EINs of all related persons.
- A list of the eligible components that are sold.
- The intended purpose of any sales of eligible components to or from related persons.

(Treas. Reg. § 1.45X-2 (d).)

Eligible Components

An eligible component is any of the following, as defined in Section 45X of the Code:

- A solar energy component (see Solar Energy Components).
- A wind energy component (see Wind Energy Components).
- An inverter (see Inverters).
- A qualifying battery component (see Battery Components).
- Applicable critical minerals (50 minerals that have been identified as important for energy development) (see Critical Minerals).

Eligible components do not include any property that is produced at a facility if the basis of any property that is part of that facility is taken into account for the qualifying advanced energy project credit allowed under Section 48C after August 16, 2022 (the date of enactment of the IRA) (see Interaction Between Section 45X and Section 48C). (IRC § 45X(c)(1)(B); Treas. Reg. § 1.45X-3.)

Solar Energy Components

A solar energy component is any of the following:

- **A photovoltaic cell:** the smallest semiconductor element of a solar module that performs the immediate conversion of light into electricity that is either a thin film photovoltaic cell or a crystalline photovoltaic cell.
- **A photovoltaic wafer:** a thin slice, sheet, or layer of semiconductor material of at least 240 square centimeters that forms the substrate or absorber layer of one or more photovoltaic cells.
- **A polymeric backsheet:** a sheet on the back of a solar module, composed, at least in part, of a polymer, that acts as an electric insulator and protects the inner components of the module from the surrounding environment. Polymeric backsheet is limited to backsheets made of polymeric materials. This therefore excludes most glass backsheets because they are typically not composed of a polymer, but of soda-lime glass.
- **Solar grade polysilicon:** silicon that is suitable for use in photovoltaic manufacturing and purified to a minimum purity of 99.999999% silicon by mass.

- **A solar module:** 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.
- **Solar tracker:** a mechanical system that moves solar modules according to the position of the sun and to increase energy output.
- **A torque tube:** 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.
- **A structural fastener:** a component that is used to do any of the following:
  - connect the mechanical and drive system components of a solar tracker to the foundation of the solar tracker;
  - connect torque tubes to drive assemblies; or
  - connect segments of torque tubes to one another.

(IRC § 45X(c)(3); Treas. Reg. § 1.45X-3(b).)

Wind Energy Components

A wind energy component is any of the following:

- **Blade:** an airfoil-shaped blade that converts wind energy to low-speed rotational energy.
- **Nacelle:** assembly of the drivetrain and other tower-top components of a wind turbine (except for the blades and the hub) within their cover housing.
- **Tower:** a tubular or lattice structure that supports the nacelle and rotor of a wind turbine.
- **Related offshore wind vessel:** any vessel that is purpose-built or retrofitted to develop, transport, install, operate, or maintain offshore wind energy components.
- **Offshore wind foundation:** the component (including transition piece) that secures an offshore wind tower and any above-water turbine components to the seafloor using either:
  - fixed platforms, such as offshore wind monopiles, jackets, or gravity-based foundations; or
  - floating platforms and associated mooring systems.

(IRC § 45X(c)(4); Treas. Reg. § 1.45X-3(c).)

Inverters

Inverters are end products that are suitable to convert direct current (DC) electricity from one or more solar modules or certified distributed wind energy systems into alternating current (AC) electricity. An eligible inverter is:

- A central inverter.
- A commercial inverter.
- A distributed wind inverter.
- A microinverter.
- A residential inverter.
- A utility inverter.

(IRC § 45X(c)(2); Treas. Reg. § 1.45X-3(d).)

Battery Components

A qualifying battery component is any:

- **Electrode active material:** cathode electrode materials, anode electrode materials, and electrochemically active materials that contribute to the electrochemical processes necessary for energy storage.
- **Battery cell:** an electrochemical cell comprised of one or more positive electrodes and one or more negative electrodes that has volumetric energy density of not less than 100 watt-hours per liter and can store at least 12 watt-hours of energy.
- **Battery module:** may be a module:
  - using battery cells, which is a module with two or more battery cells that are configured electrically, in series or parallel, to create voltage or current, as appropriate, to a specified end use, meaning an end-use configuration of battery technologies; or
  - without battery cells, which is a product with a standardized manufacturing process and form, can store and dispatch useful energy that contains an energy storage medium that remains in the module, and that is not a custom-built electricity generation or storage facility.

Many commenters had raised concerns with the interpretation of the phrase "to a specified end use" in the definition of battery module using battery cells. They had argued that certain types of modules may be transported to the end-use site only partially assembled due to safety considerations, with final assembly performed by the battery manufacturer, the customer, or a third-party contractor.

In response to these concerns, the Treasury and the IRS restated in the Final Regulations that the requirement that battery modules using battery cells that contain battery cells configured to a specified end use, applies irrespective of whether the items are typically called "battery modules" or "battery packs" in industry practice. The Final Regulations clarify that where multiple points in a supply chain may combine cells into a module, the first module produced and sold that is an end-use configuration and meets the kilowatt-hour requirement will be the only module eligible. (IRC § 45X(c)(5); Treas. Reg. § 1.45X-3(e).)

Critical Minerals

The Section 45X tax credit is available for 50 minerals if converted or purified to specified purities and forms including aluminum, cobalt, graphite, lithium, manganese, nickel, platinum, tin, and titanium (IRC § 45X(c)(6)).

The Proposed Regulations defined aluminum to mean aluminum, including commodity-grade aluminum, which is either:

- Converted from bauxite to a minimum purity of 99% alumina by mass.
- Purified to a minimum purity of 99.9% aluminum by mass.

Commodity-grade aluminum was also defined to mean aluminum that has been produced directly from aluminum described above and in a form that is sold on international commodity exchanges. Following receipt of comments, the IRS and Treasury Department will issue further guidance on this issue at a later date.

Credit Amount

The types of energy components that can qualify for this credit vary widely. As a result, the methods for calculating the Section 45X tax credit also vary. Depending on the eligible component, the Section 45X tax credit is calculated based on one of the following:

- A fixed dollar amount per unit of production.
- A fixed dollar amount per unit of electrical capacity.
- A percentage of the cost of production.

For more information, see Box, Credit Amount Per Eligible Component Type.

Phase Out Period

The amount of the Section 45X tax credit is calculated based on the year an eligible component is sold in a trade or business of a taxpayer after December 31, 2022. The full amount of the credit is available for eligible components sold through December 31, 2029.

For any eligible component subject to phaseout sold after December 31, 2029, the credit amount for that component is equal to the credit amount for the eligible component multiplied by the applicable phase out percentage as follows:

- 75% of the credit amount for eligible components sold in 2030.
- 50 % of the credit amount for eligible components sold in 2031.
- 25 % of the credit amount for eligible components sold in 2032.
- 0 % of the credit amount for eligible components sold in 2032.

(Treas. Reg. § 1.45X-3.)

Calculating Production Costs

Special Rules for Electrode Active Material and Applicable Critical Minerals

A taxpayer can receive a credit equal to 10% of the costs incurred by the taxpayer regarding production of electrode active material and applicable critical minerals. The Treasury Regulations take an expansive approach to the costs that may be included for calculating the credit amount. Production costs regarding production of electrode active materials or applicable critical minerals:

- Include direct and indirect materials costs, labor, electricity used in production, storage costs, depreciation or amortization, recycling, and overhead (Treas Reg. §§ 1.45X-3(e)(2)(iv)(A) and 1.45X-4(c)(3) (referencing Treas. Reg. § 1.263A-1(e))).

- Exclude direct or indirect materials costs that relate to the purchase of materials that are an eligible component at the time of acquisition.
- Include extraction costs related to the extraction of raw materials in the US or a US territory.

(Treas. Reg. §§ 1.45X-3(e)(2)(iv) and 1.45X-4(c)(3).)

A material that qualifies as an electrode active material and an applicable critical material is eligible for the Section 45X credit, but a taxpayer may claim the Section 45X credit only regarding one of these eligible components. This requirement is intended to prevent multiple parties claiming the credit for the same activity.

Extraction Costs

A taxpayer that produces applicable critical minerals and electrode active materials can include its direct and indirect materials costs in their production costs if they:

- Do not relate to the purchase of materials that are an eligible component at the time of acquisition (such as an electrode active material or applicable critical mineral).
- Are related to the extraction of raw materials in the US or a US territory, but only if those costs are paid or incurred by the taxpayer that claiming the credit.

Extraction for this purpose is defined as activities performed to harvest minerals or natural resources from the ground or from a body of water and includes operating equipment to:

- Harvest minerals or natural resources from mines and wells and the physical processes involved in refining.
- Extract minerals or natural resources from the waste or residue of prior extraction, including crude oil extraction to the extent that processes applied to that crude oil yield an applicable critical mineral or an electrode active material as a byproduct.

(Treas. Reg. §§1.45X-3(e)(2)(iv) and 1.45X-4(c)(4).)

Foreign Sourcing of Materials

Although Section 45X requires domestic production of an eligible component, it is silent on the location of production or sourcing of constituent elements, materials, and subcomponents. Taxpayers are, therefore, allowed to claim a Section 45X credit even if an eligible component includes materials obtained from foreign suppliers. This provision allows manufacturers to acquire materials that may be difficult to source domestically without jeopardizing their ability to qualify for the credit.

Taxpayers can also claim the credit for:

- An eligible component that incorporates another eligible component that is also a foreign-sourced constituent element, material or subcomponent.
- An eligible component that is a constituent element, material, or subcomponent integrated into another complete and distinct eligible component.

(Treas. Reg. § 1.45X-1(d).)

Other Provisions

Interaction Between Section 45X and Section 48C

The regulations address the interaction between the Section 45X tax credit and the Section 48C tax credit. Generally, production facilities that have previously been awarded a Section 48C credit are not eligible for the Section 45X credit.

Under applicable IRS regulations:

- The only equipment, or other tangible property, that must be included in the Section 45X facility is the equipment used by the taxpayer that is necessary for the taxpayer to be considered the producer of the potential eligible component. If production of a subcomponent is not a requirement to be considered the producer under Section 45X, then the equipment that is part of that Section 48C facility used to produce the subcomponent is not part of the Section 45X facility. It is, therefore, possible for the same taxpayer to receive a Section 48C credit on equipment used to produce a subcomponent and a Section 45X credit on the production of an eligible component.
- Physical proximity of a Section 45X facility to a Section 48C facility does not determine whether a product may be an eligible component. Under the regulations:
  - the general rule is that property that would otherwise qualify as an eligible component (otherwise qualified property) is only an eligible component if the property is produced at a Section 45X facility and no part of that Section 45X facility is also a Section 48C facility.

- a Section 45X facility is the independently functioning tangible property used by the taxpayer that is necessary to be considered the producer of the otherwise qualified property; and
- in the case of a contract manufacturing arrangement where the parties have agreed as to who can claim a Section 45X credit, the Section 45X facility is determined by taking into account the tangible property that substantially transforms the material inputs to complete the production process of an eligible component used to produce the otherwise qualified property, regardless of which party to the arrangement claims the credit.

(Treas. Reg. § 1.45X-1(g).)

Anti-Abuse

The Section 45X tax credit is not permitted if the primary purpose of the production and sale of an eligible component is to obtain the benefit of the Section 45X credit in a wasteful manner (for example, discarding, disposing of, or destroying the component without putting it to a productive use).

There is also an anti-abuse rule for the Related Person Election. A taxpayer may not make a Related Person Election for an eligible component if either:

- The taxpayer fails to provide the information required under the regulations; or
- The eligible component is defective at the time of the deemed sale. Defects arising after the point of sale may occur in the ordinary course of a business do not generally raise the improper claim concerns. Accordingly, the components regarding which defects arise after the deemed sale are not considered defective components for purposes of the anti-abuse rule.

(Treas. Reg. §§ 1.45X-1(i) and 1.45X-2(d)(4).)

Recordkeeping and Reporting Requirements

Taxpayers must keep records to demonstrate and substantiate their eligibility for any credit the taxpayer is claiming (IRC § 6001). The Final Regulations provide additional recordkeeping and reporting requirements for taxpayers to substantiate their qualification for various parts of the Section 45X credit.

Substantiation Requirements for Solar Energy Components

Taxpayers claiming a credit for a solar energy component must provide the following information to the IRS. For:

- Photovoltaic cells or solar modules, a bill of sale or design documentation documenting their capacity.
- Torque tube, a bill of sale, or other similar documentation that explicitly describes the torque tube as part of a solar tracker.
- Structural fastener, a bill of sale or other similar documentation that explicitly describes that the structural fastener is used in a manner described in the regulations.

(Treas. Reg. § 1.45X-3(b).)

Substantiation Requirements for Wind Energy Components

For blades, nacelles, offshore wind foundations, or towers, a taxpayer must document in the component's sale documents, the turbine model for which the component is designed and the total rated capacity of the completed wind turbine.

In the case of related offshore wind vessel, this documentation could include:

- The contract to construct or retrofit (along with retrofit plans).
- A sales contract.
- A US Coast Guard bill of sale.
- A US Coast Guard Certificate of Documentation.
- A US Coast Guard Certificate of Inspection.

(Treas. Reg. § 1.45X-3(c)(7).)

Substantiation Requirements for Inverters

To claim this credit taxpayers must provide documentation that the inverter meets certain specifications. In the case of:

- Central inverters, they meet the core engineering specifications for use in a large utility-scale system and have a capacity greater than 1,000 kilowatts.
- Commercial and utility inverters, they meet the core engineering specifications for use in commercial

or utility-scale systems, and for the inverters' rated output and capacity.

- Residential inverters, they meet the core engineering specifications for use in a residence and for the inverters' rated output and capacity.
- Distributed wind inverters, they are used in a residential or non-residential system that uses one or more certified distributed wind energy systems.
- Microinverters, they meet the core engineering specifications to be suitable to connect with one solar module, and the inverters' rated output and capacity. In the case of a DC optimized inverter system, the taxpayer must also document that the DC optimizers and the inverter in the system were sold as a combined end product.

In each case, this documentation may be in the form of:

- A specification sheet.
- A bill of sale.
- Other similar documents that explicitly describe the central inverter's specifications and capacity.

(Treas. Reg. § 1.45X-3(d).)

Substantiation Requirements for Battery Cells and Modules Without Battery Cells

The amount of the credit for battery cells and battery modules is based on their capacity. Taxpayers must maintain the testing standard and methodology regarding the capacity measurement for modules using battery cells and modules with no battery cells. The testing procedure and method must consistently be used, subject to any updated standard of the same method and testing, for battery modules (with or without cells) sold in the taxpayer's trade or business.

Taxpayers must measure:

- For modules using battery cells, their capacity which may not exceed the total nameplate capacity of the battery cells in the module.
- For modules without battery cells, the capacity of the module. Taxpayers producing thermal and thermochemical battery modules must convert the energy storage to a kilowatt-hour basis and provide both method and testing regarding this conversion. This conversion of the kilowatt-hour basis cannot exceed the total direct conversion of the total nameplate capacity of the thermal battery module to kilowatt-hours.

In each case, the testing procedure must comply with a national or international standard published by a recognized standard setting organization. (Treas. Reg. § 1.45X-3(e).)

Substantiation Requirements for Electrode Active Material or Applicable Critical Mineral Production Costs

To include direct or indirect materials costs as production costs when calculating a Section 45X tax credit for the production and sale of an electrode active material or an applicable critical mineral, a taxpayer must include the following as an attachment to their annual tax return:

- Certifications from any supplier from which the taxpayer purchased any constituent elements, materials, or subcomponents of the taxpayer's electrode active material or an applicable critical mineral, stating among other things that the supplier is not:
  - claiming the Section 45X credit regarding any of the material acquired by the taxpayer; or
  - aware that any prior supplier in the chain of production of that material claimed a Section 45X credit for the material.
- A document (which may be prepared by the taxpayer or ideally by an independent third-party) that provides an analysis of any constituent elements, materials, or subcomponents concluding that the material did not meet the definition of an eligible component (for example, did not meet the definition of applicable critical mineral or electrode active material) at the time of acquisition by the taxpayer.
- A list of all direct and indirect material costs and the amount of the costs included within the taxpayer's total production cost for each electrode active material or an applicable critical mineral.
- A document (which may be prepared by the taxpayer or ideally by an independent third-party)

related to the taxpayer's production activities regarding the direct and indirect material costs establishing the materials were used in the production of the electrode active material or an applicable critical mineral.

- Any other information related to the direct or indirect materials specified in other guidance.

(Treas. Reg. §§ 1.45X-3(e)(2)(iv)(C) and 1.45X-4(c)(4).)

Direct Pay and Credit Transfer Elections

Direct Pay

Taxpayers may use the Section 45X credits to offset their own tax liability or elect to receive a direct payment or refund from the IRS under Section 6417 of the Code. To make a direct pay election, a taxpayer must complete pre-filing registration in the IRS portal for each facility and file Form 3800 with their annual tax return. Unlike most tax credits eligible for a direct payment under Section 6417 of the Code, any taxpayer can claim 45X credit including for-profit businesses, for up to five years.

For more information on direct pay, see Practice Note, Transferability and Direct Pay Provisions for Clean Energy Projects Under the Inflation Reduction Act: Direct Payments.

Tax Credit Transfer

Manufacturers may also transfer the 45X tax credit to an unrelated third party under Section 6418 of the Code. To transfer the Section 45X tax credit, the taxpayer must complete the pre-filing registration process with the IRS and file the relevant forms with their returns.

According to a recent report from Reunion, the Section 45X tax credit is one of the most transactable tax credits in the transferable tax credit market because it has no recapture risk and the manufacturers and producers are generally large and creditworthy entities that can stand behind the indemnifications buyers require in these transactions (see Reunion: Transferable tax credit pricing and market trends (Q3 2024) (download required)).

For more information on tax credit transfers, see Practice Notes, Transferability and Direct Pay Provisions for Clean Energy Projects Under the Inflation Reduction Act: Transferability and Buying and Selling Clean Energy Tax Credits: Key Issues and Risk Mitigation Strategies.

Considerations and Challenges

The Section 45X tax credit and implementing regulations present a great opportunity for US manufacturers and developers. It is expected to strengthen the domestic production of minerals, reduce reliance on foreign sources, and provide the components needed to diversify US energy supplies. However, this credit also presents several issues and challenges manufacturers, developers and their counsel should consider.

Regulatory Changes

There is significant bipartisan support for the Section 45X tax credit which reduces the risk that this credit will be repealed under the Trump administration. However, with different priorities on trade, tariffs, and clean energy development than the Biden administration, the Trump administration may issue revised guidance or support revisions to Section 45X of the Code to:

- Allow mineral processers to qualify for the credit.
- Exclude foreign raw materials from the qualifying production costs for critical minerals.
- Prevent foreign-owned manufacturers and producers from benefiting from the credit.

For more information on the impact of the election, see Legal Updates, Post-Election Analysis: Implications for Energy and Environmental Regulations and Energy Project Development and Legal Update, White House Issues Broad Freeze of Proposed Regulations Pending Review by Trump Appointees.

Limited Mining Support

Under the Final Regulations, a taxpayer may include as qualifying production costs, materials costs, and extraction costs for critical minerals and electrode active materials. However, the credit is only available once the eligible component is produced. The credit is not available to mining companies that do not have mineral processing operations.

This restriction is intended to incentivize the domestic minerals industry to onshore mineral processing which China currently dominates.

According to a report from the International Energy Agency, China's share of refining in 2019 was around 35% for nickel, 50-70% for lithium and cobalt, and nearly 90% for rare earth elements (see IEA: The Role of Critical Minerals in Clean Energy Transitions (May 2021)). However, it does present a challenge since it will take time for US companies to develop the processing capability needed. For more information on this issue, see Bipartisan Policy Center: The Missing Midstream: Identifying Investment Challenges for American Critical Mineral Processing Projects (May 2024).

Limited Access to Foreign-Sourced Raw Materials

The implementing Treasury Regulations note that the Section 45X is silent regarding the location of production or sourcing of constituent materials and presently permit manufacturers to use foreign raw materials while still qualifying for the Section 45X credit. However, it will be interesting to see how the Trump Administration addresses this and other Section 45X Regulations that do not account for potential China sourcing. Moreover, securing these materials may be difficult given recent initiatives to limit the export of certain key minerals (see Article, Geopolitical Outlook for Investors in 2024: Managing Risk and Protecting Cross-Border Investments : Demand for Raw Materials and Export Bans on Key Minerals).

Foreign Beneficiaries

Goods qualifying for the Section 45X credit must be produced in the US and US territories, but there are no prohibitions on foreign ownership of the companies receiving the credits. Legislation has been introduced to reduce the potential influence of foreign adversaries or foreign entities of concern on 45X credit-eligible supply chains. This includes:

- The Protecting American Advanced Manufacturing Act (H.R. 6762; S. 3486) which would prohibit companies from receiving the 45X credit if they are "associated with foreign adversaries," including companies that have 10% or higher ownership from Chinese, Iranian, Russian, or North Korean nationals, or companies that have debt, leasing, or manufacturing arrangements with entities linked to those countries.
- The American Tax Dollars for American Solar Manufacturing Act (S. 4873) which would disallow 45X credits for goods produced by foreign entities of concern, including entities "owned by, controlled by, or subject to the jurisdiction or direction of" the governments of China, Iran, Russia, and North Korea.

Impact on the Oil & Gas Industry

Upstream oil and gas companies may take advantage of the Section 45X tax credit if they are able to extract critical minerals from produced water from oil and gas wells and have the processes to convert or purify the critical minerals to specified forms or purities as discussed above (see Critical Minerals).

Produced water from crude oil production can include several critical minerals including cobalt and lithium. As reported by the DOE, lithium may be recovered from several US shale plays including about 15,500 metric tons of per year from the Permian shale play alone.

While the technologies needed to extract lithium are still in development, this credit may help offset the significant costs associated with the extraction process. The DOE's Office of Fossil Energy and Carbon Management (FECM) is investing in research and development projects to advance water treatment and management technologies to recover critical minerals from produced water. For more information on these initiatives, see Practice Note, Biden Administration Energy and Climate Change Policies and Regulations: 2024 Tracker.

Credit Amount Per Eligible Component Type

This chart sets out the credit amount for the different components eligible under Section 45X of the Code (Treas. Reg. § 1.45X-3(a)).

Solar Energy Components

Eligible Component	Credit Amount
Thin film or crystalline photovoltaic cells	$0.04 multiplied by the cell's capacity.
Photovoltaic wafer	$12 per square meter.
Polymeric backsheet	$0.40 per square meter.
Solar grade polysilicon	$3 per kilogram.
Solar module	$.07 multiplied by the module's capacity.
Solar tracker: torque tube	$0.87 per kilogram.
Solar tracker: structural fastener	$2.28 per kilogram.

Wind Energy Components

Eligible Component	Credit Amount
Blade	$0.02 multiplied by the total rated capacity of the completed wind turbine for which the blade is designed.
Fixed offshore wind foundation	$0.02 multiplied by the total rated capacity of the completed wind turbine for which the fixed offshore wind foundation platform is designed.
Floating offshore wind foundation	$0.04 multiplied by the total rated capacity of the completed wind turbine for which the floating offshore wind foundation platform is designed.
Nacelle	$0.05 multiplied by the total rated capacity of the completed wind turbine for which the nacelle is designed.
Related offshore wind vessel (any vessel purpose-built or retrofitted for purposes of the development, transport, installation, operation, or maintenance of offshore wind energy components)	10% of the sale price of the vessel.
Tower	$0.03 multiplied by the total rated capacity of the completed wind turbine for which the tower is designed.

Inverters

Eligible Component	Credit Amount
Central inverter	$.0025 multiplied by the capacity in alternating current watts.
Commercial inverter	$0.02 multiplied by the capacity in alternating current watts.

Eligible Component	Credit Amount
Distributed wind inverter	$.11 multiplied by the capacity in alternating current watts.
Microinverters	$.11 multiplied by the capacity in alternating current watts.
Residential inverter	$.065 multiplied by the capacity in alternating current watts.
Utility inverter	$0.015 multiplied by the capacity in alternating current watts.

Battery Components

Eligible Component	Credit Amount
Electrode active materials	10% of the costs incurred by the taxpayer regarding production of the materials (including cathode materials, anode materials, anode foils, and electrochemically active materials, including solvents, additives, and electrolyte salts).
Battery cell	$35 multiplied by capacity on a kilowatt-hour basis.
Modules using battery cells	$10 multiplied by capacity on a kilowatt-hour basis.
Module without cells	$45 multiplied by capacity on a kilowatt-hour basis.

Critical Minerals

Eligible Component	Credit Amount
Eligible applicable mineral	10% of the costs incurred by the taxpayer regarding production of the mineral.