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POLICY DESIGN BRIEF

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A Production Tax Credit for Clean Industrial Heat

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Globally, industrial facilities directly emit around a quarter of the world's greenhouse gas emissions, as well as conventional pollutants (like particulates) that cause hundreds of thousands of premature deaths every year. Most of these emissions are from burning fossil fuels to produce heat for industrial processes, such as melting metals, molding plastics, and cooking food. Policies supporting a transition to clean industrial heat can help countries achieve technological leadership, create high-quality manufacturing jobs, improve national security by onshoring supply chains, save lives, and achieve their climate commitments.

PRODUCTION TAX CREDIT DESIGN CONSIDERATIONS

A production tax credit (PTC) for industrial heat would reward firms for using zero-emissions heat in industrial processes, meaning heat produced without the emission of greenhouse gases or conventional air pollutants such as nitrogen oxides (NO_X), sulfur oxides (SO_X), and particulate matter ($PM_{2.5}$ and PM_{10}). It should be simple to understand and administer, avoid paying industrial firms to undertake actions they would have done anyway, and remain effective at driving a transition to modern, clean industrial processes year after year.

- **For manufacturing:** The credit should be available for heat used in manufacturing, defined as activities within the scope of North American Industry Classification System (NAICS) codes 31–33 or International Standard Industrial Classification (ISIC) codes 10–33.

- **Heat for industrial processes, not other uses:** The PTC should apply only to heat used for industrial processes, such as melting materials or driving chemical reactions. Heating air for the comfort of workers or heating water for use in kitchens and bathrooms should not qualify, even in an industrial facility. Zero-emission industrial heating technologies are less mature and thus more expensive than zero-emission technologies for space and water heating in buildings, so a PTC rate that is high enough to reward clean industrial heating would overpay when applied to space and water heating. (Policies that help clean up buildings can be used as a complement to a clean industrial heat PTC.)

- **Delivered heat, not input energy:** The PTC should be based on heat utilized by the manufacturing process. It should not be based on the amount of energy in the fuel or electricity used to create heat because that would penalize efficient technologies such as heat pumps, which deliver a large amount of useful heat per unit of energy they consume.

- **Useful heat, not heat losses:** The PTC should only reward "useful heat," meaning heat used productively (such as to heat equipment, materials, or combustion air). It should exclude heat that is lost from the system (such as in hot exhaust gases or latent heat in formed water vapor). Useful heat can be calculated by subtracting heat losses from the total heat generated. A PTC based on useful heat would incentivize firms to use technologies that minimize heat loss (e.g., electrical heating) or recover lost heat.

- **Refundability:** The PTC should be a refundable tax credit (also known as "direct pay" or "elective pay"), meaning an industrial firm receives the credit whether or not it has enough net tax liability. Many businesses have years in which they are not profitable, especially new businesses seeking to commercialize innovative technologies. If a tax credit is nonrefundable and nontransferable, those businesses must partner with tax equity investors that have tax liability the credit can offset. Since tax equity investors typically take about half of the value of the credit, half of the money spent on the PTC would be wasted. Therefore, a refundable tax credit incents twice as much industrial technology and jobs for the same investment. Making the tax credit transferable (meaning a business may sell tax credits it earns to a third party) is not as efficient as direct pay but far more efficient than nonrefundable, nontransferable credits.

- **Long time horizon:** Industrial firms plan for investments in new production lines and equipment years in advance, and industrial equipment can be used for decades. Therefore, a PTC should be designed with these timeframes in mind. It should come into effect one to two years after enactment, and any phase-out should be triggered by the achievement of specified economy-wide targets (such as over 75 percent of all industrial heat coming from clean sources) rather than occurring in specified years.[1]

- **Only consider direct emissions from industry and use complimentary policies to clean up the electricity sector:** To ensure that it targets emissions from industrial heat rather than from power plants, the PTC should be based on direct emissions from the industrial facility (called "scope 1" emissions) and should disregard emissions associated with purchased electricity ("scope 2" emissions). Including scope 2 emissions could discourage firms from electrifying their heating processes, or it could pay them merely to purchase clean electricity without changing their own processes or equipment. Also, including scope 2 emissions would necessitate including a "three pillars" test (i.e., new clean supply, hourly matching, and deliverability) to evaluate whether the electricity qualifies as zero-emissions. Such a framework can be politically contentious and complex, and it may not be possible for an electricity buyer to determine the degree to which its purchased electricity qualifies. Instead of attempting to accomplish everything with a single policy, separate policies that clean up the electric grid should be used as a complement to a clean industrial heat PTC.

- **Minimum threshold:** The most cost-effective PTC avoids paying for clean heat that would have been produced even in the absence of the PTC. This can be difficult to do perfectly. One approach is to identify the share of industrial process heat that already comes from electricity for each subindustry from

[1] If the country in question is the United States and the PTC is part of a budget reconciliation bill, rather than linking a phase-out to achievement of decarbonization targets, the PTC should remain in effect for as long as possible while being compliant with the 10-year Byrd Rule.

published statistics.[2] At each industrial facility (or cluster of co-located industrial facilities), only clean heat that exceeds this subindustry-wide average share is eligible for the credit. Since this is a subindustry-wide average, it rewards cleaner manufacturers and can be applied to newly built facilities (rather than basing each facility's threshold on its own historical performance).

- **Adjust PTC rate for heat temperature and power (delivery rate):** The cost of zero-emissions industrial heat varies with its temperature and the type of machinery utilizing the heat. For instance, it is cheaper to produce zero-emissions steam at 100 °C for cooking food (which can be supplied by a heat pump) than to produce zero-emissions heat at over 1,000 °C for making glass or brick. Therefore, using the same PTC rate for all industrial processes would overpay in some cases and underpay in others. However, there exist many types of industrial equipment, and making too many distinctions between equipment types could result in rules that are extremely complex and impossible to administer. One approach to make distinctions while limiting complexity is to define PTC rates based on two factors: the useful heat's temperature and its power (the heat delivery rate, e.g., in millions of BTUs per hour). This could be done by dividing temperature and power into three to four bins each (resulting in nine to 16 PTC rates), or better, by defining a smooth mathematical function based on temperature and power, avoiding stairsteps at bin boundaries.[3]

- **Allow for percentage bonuses:** Policymakers can achieve ancillary goals by applying percentage bonuses to the PTC rate for projects that meet certain objectives. For instance, a cumulative 10 percent bonus could be offered to a project for each trait it possesses from a list, such as: located in a disadvantaged community, uses at least 60 percent domestic content in its inputs, adheres to fair labor standards with minimum pay levels and benefits, uses at least 75 percent unionized labor, etc.

- **Exclude byproducts and biomass:** Some subindustries (such as pulp and paper, or wood and wood products) burn byproducts of their input materials for heat. Burning these materials emits conventional pollutants like particulates, may not be carbon-neutral, and would be done even in the absence of the PTC. Therefore, no PTC should be paid for the combustion of byproducts. For similar reasons, it would be prudent to exclude all solid biomass and liquid biofuel combustion, but to include the combustion of biomethane, such as methane from organic waste processed in an anaerobic digester.

A well-designed PTC for clean industrial heat would be a smart investment in manufacturing leadership, jobs, and public health, while helping a nation attain its climate goals.

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[2] For example, data could come from the JRC-IDEES database for European Union member nations, from the EIA Manufacturing Energy Consumption Survey for the United States, from Niti Aayog's India Energy Security Scenarios 2047 for India, and the China Energy Statistical Yearbook for China.

[3] For example, consider the equation $S = (P_e/E_e) - (P_g/E_g) + C$ where S is the subsidy level in $/MJ of delivered heat, P_e is the price of one MJ of electricity, P_g is the price of one MJ of natural gas, E_e is the efficiency with which electricity is converted into useful heat for an industrial process, E_g is the efficiency with which gas is converted into useful heat, and C represents the difference in levelized capital costs between the electrified and gas equipment (i.e., spread across the megajoules of heat expected to be delivered over the equipment's lifetime). E_e, E_g, and C are functions of temperature and/or power. This equation would return a subsidy value, S, that would cover both the capital- and operating-cost premiums for electrified heat.