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# **2025 MANUFACTURING ROADMAP**

*Roadmap to Promote US Competitiveness  
in Clean Technology Manufacturing and  
Industrial Sector Transformation*

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## INTRODUCTION

In 2020, the BlueGreen Alliance (BGA) published a comprehensive policy blueprint for the United States to lead on clean technology manufacturing and industry decarbonization.<sup>1</sup> The future of U.S. manufacturing competitiveness will be closely tied to our advancement on those dual priorities. Since the blueprint's release, the Bipartisan Infrastructure Law (BIL), the Inflation Reduction Act, and the CHIPS and Science Act (CHIPS) were passed into law and included several of our recommendations.

There has been real progress made in the last few years to reinvest in U.S. manufacturing. As of December 2024, there are nearly 13 million manufacturing workers in the United States, marking not just recovery from the impacts of the COVID-19 pandemic but also growth.<sup>2</sup> Because of support from the federal government since 2021, companies have announced investments of nearly \$400 billion for clean technology and semiconductor manufacturing.<sup>3</sup> Indeed, it's not only announcements. Spending on manufacturing facilities has skyrocketed with \$237 billion spent on manufacturing construction in December 2024.<sup>4</sup> Business and consumer investment totaled \$493 billion since 2023, a 71% increase from the two-year period preceding the passage of the Inflation Reduction Act.<sup>5</sup> According to an analysis commissioned by BGA and conducted by the Political Economy Research Institute (PERI) at the University of Massachusetts Amherst, the United States is expected to create 336,000 manufacturing jobs per year throughout the lifetime of the Inflation Reduction Act, BIL, and CHIPS. Two-thirds of the jobs directly created by these three laws are expected to occur in the construction and manufacturing sectors.<sup>6</sup>

Unfortunately, this good news comes after decades of offshoring, bad trade agreements, massive efforts by employers to break unions and thwart union organizing, and poor industrial policy. All of this led to a decline in U.S. manufacturing from which the nation is still recovering. This decline has exacerbated income inequality. Laid-off manufacturing workers have been

forced to compete for lower-paying jobs, putting downward pressure on middle-class wages across the economy and resulting in communities suffering from deindustrialization and under-investment.<sup>7</sup> Although recent federal policy has begun to yield results, there is still a lot of work left to do.

Investment in the manufacturing sector, along with appropriate trade measures, is critical for securing U.S. competitiveness. Manufacturing accounts for one-third of U.S. economic output and more than two-thirds of private sector research and development (R&D).<sup>8</sup> R&D spending has economy-wide benefits including promoting innovation, which is required to remain competitive in a globalized economy. Historically, countries competed for new technologies to give their industrial sectors an edge and that remains the case today. Solar, wind, and battery capacity are being added to global grids at an unprecedented pace. They have emerged as global economic engines worth trillions of dollars and countries are fighting for investments in their supply chains.<sup>9</sup> There's also international competition to secure the competitiveness of heavy industries such as steel, aluminum, and cement with an increased focus on decarbonization, as industry is projected to be the highest emitting sector globally by the early 2030s.<sup>10</sup> <sup>11</sup> Clean energy deployment is also increasing the demand for steel, aluminum, and cement, which serve as essential inputs for solar, wind, and battery supply chains.<sup>12</sup>

The United States cannot remain an economic superpower if we surrender building the technologies of the future to the rest of the world. The COVID-19 pandemic and Russia's invasion of Ukraine painfully exposed the dangers of relying on vulnerable overseas supply chains for critical goods and energy. China and the European Union have invested billions of dollars into their manufacturing sectors and are well positioned to gain investments that otherwise would have gone to the United States.<sup>13</sup> Therefore, it is imperative that the Trump administration and Congress continue to support our industrial sector to ensure its prosperity. Moving forward, the following



considerations should be top-of-mind for policymakers as they attempt to influence the competitiveness of U.S. manufacturing:

- » Manufacturing is capital intensive and requires long time horizons for investment decisions. Individual projects often rely on several different forms of debt and equity financing including critical funding from the government.<sup>14</sup> In a time of elevated interest rates, government funding can be the difference between projects penciling out or ceasing production.
- » The United States was once the world leader in manufacturing solar panels and semiconductors, but due to a mix of domestic policy choices and international policy developments, it lost much of its manufacturing capacity in those sectors.<sup>15</sup> Recent efforts by policymakers have made progress in reshoring those supply chains, but it also demonstrates the difficulty of reshoring manufacturing once it has been lost. If the United States repeals policies supporting its emerging clean technology sectors, such as batteries, it could permanently lose its ability to produce those technologies.
- » The industrial sector represents a large and growing share of emissions and is on pace to become the highest emitting sector by the early 2030s. Regardless of the United States' own position on reducing emissions, countries are increasingly looking for policies to penalize higher carbon emissions from industry. The European Union introduced a Carbon Border Adjustment Mechanism (CBAM) that will add fees to importers of certain goods based on emission thresholds.<sup>16</sup> To avoid paying fees for accessing priority export markets, U.S. manufacturers will need to invest in reducing emissions.
- » Productivity growth fueled by technical innovation is the basis for long term competitive success. Manufacturing productivity in the United States has undergone a slowdown in the last decade for both established and emerging

industries.<sup>17</sup> Reversing this trend is important for staying internationally competitive. A key to improving productivity growth will be sustained investment and collaboration with the federal government on R&D priorities.

- » Energy is one of the most costly and essential inputs into the production process. Studies have consistently shown that funding from the Inflation Reduction Act will bring down energy costs in the United States over the next decade.<sup>18</sup> Removing those incentives will increase the amount manufacturers will need to pay for energy and make them less competitive internationally.
- » Private companies are moving to decarbonize their supply chains. Organizations such as the First Movers Coalition have been formed to utilize the purchasing power of their members to accelerate the decarbonization of heavy-emitting manufacturing sectors.<sup>19</sup> Manufacturers will progressively be impacted by their customers' preferences for low-carbon materials.

This roadmap contains six updated recommendations from our 2020 report that aim to increase investment and promote economic competitiveness of the manufacturing sector while building on the momentum of the past four years:

- 1. Sustain the manufacturing revival that federal action has put in motion;**
- 2. Promote new investments for clean technology manufacturing and industrial transformation;**
- 3. Ensure manufacturing jobs are good jobs;**
- 4. Incorporate full and intentional utilization of the federal government's procurement tools;**
- 5. Utilize U.S. trade policy to support manufacturing competitiveness and emissions reduction; and**
- 6. Develop a national strategy for responsible mining and critical minerals.**



## 1 SUSTAIN THE MANUFACTURING REVIVAL THAT FEDERAL ACTION HAS KICK STARTED

### Ensure the continued funding of tax credits for clean technology manufacturing and industrial decarbonization

- » The 45X Advanced Manufacturing Production Tax Credit provided the largest ever investment in U.S. manufacturing of clean energy technologies and is responsible for billions of dollars of announcements in the solar, battery, wind, and critical material supply chains. It is a critical component of reshoring clean technology supply chains by ensuring that U.S. production is competitive with imports.
- » The 48C Advanced Energy Project Investment Tax Credit provided \$10 billion for investments in clean technology manufacturing and industrial decarbonization, including \$4 billion set aside for coal communities. Over 200 projects have already been announced, providing billions of dollars of additional private sector investment. American Clean Power (ACP) estimates that for every federal dollar spent on 48C, it's being matched by \$4 from the private sector—producing a total benefit worth over \$50 billion.<sup>20</sup> Ensuring this funding is fully allocated is essential for this economic benefit to be realized, especially for capital intensive projects that may rely on several different forms of debt and equity financing—including 48C—to pencil out.
- » The 30D Clean Vehicle Tax Credit with its final assembly, critical mineral, and battery content requirements pushes automakers to support domestic production of electric vehicles (EVs) and especially the batteries that power them. Eliminating 30D could reduce demand for U.S.-made EVs by 27% or by over 300,000 cars per year, which may imperil the battery and battery supply chain investments that have proliferated since passage of the Inflation Reduction Act.<sup>21</sup>
- » The Section 48E and 45Y technology neutral clean energy tax credits were introduced by the Inflation Reduction Act to provide support for a variety of clean technologies that meet emissions criteria. The U.S. Department of Energy (DOE) estimates that the credits are expected to save American families up to \$38 billion on electricity bills through 2030.<sup>22</sup> According to ACP, the clean energy credits will provide a 3.8x economic return on every federal dollar invested. Repealing the tax credits could result in a 10% increase in energy bills, including for industrial customers.<sup>23</sup>
- The credits for the first time provide additional incentives to build in energy and fossil fuels communities and, importantly, to create domestic manufacturing demand. The 48E and

45Y tech neutral tax credits provide a 10% bonus for using domestically sourced materials, contributing to development of a strong U.S. market for domestically manufactured components.

- Repealing the tech neutral tax credits, while maintaining 45X, would reduce demand for the domestically manufactured products that federal funding is helping to support. Therefore, it is likely that without guaranteed offtakers, many manufacturing facilities would become uneconomical and be forced to close, with harmful consequences for the jobs and investment driven by the tax credits that have overwhelmingly flowed to Republican states and districts.<sup>24</sup>
- » The 45Q Carbon Sequestration Tax Credit plays a key role in reducing industrial and power sector emissions—especially in some of the hardest-to-abate industrial processes like cement production—while creating new jobs in construction and operations. A Rhodium Group analysis found that over the next 15 years, up to 64,000 jobs will be made by capital investment in carbon capture utilization and storage retrofits. Additionally, up to 43,000 jobs will be created from retrofit operations.<sup>25</sup> The 45Q credit is also vital for the Direct Air Capture (DAC) industry, a form of carbon dioxide removal (CDR) that removes CO<sub>2</sub> directly from ambient air. One large DAC project is projected to prompt a \$380 to \$980 million capital investment, and jobs in DAC involve similar skill sets to those in oil and gas, making them easily transferrable job opportunities for workers.<sup>26</sup>
- » The 45V Hydrogen Production Tax Credit is vital to scale up the production of low and zero emissions hydrogen. This incentive positions the United States as a world leader in hydrogen production and puts the United States in line to capture a significant share of a market projected to reach up to \$3 trillion by 2050.<sup>27</sup> Clean hydrogen is key to decarbonizing tough

industries, and 45V is needed to ensure domestic industries can meet the rising demand for low-embodied-carbon products produced in the United States such as fertilizer and steel.

### **Implement DOE funding that supports investments in U.S. manufacturing**

- » The Industrial Demonstrations Program (IDP) provided \$6 billion to 30 projects that will bolster the competitiveness of the U.S. industrial sector by adopting cutting edge technologies—especially in the most emissions-intensive industries. Continued support from DOE will be imperative to realizing the full benefits of the funding and enabling the United States to lead the future of energy intensive manufacturing.<sup>28</sup>
- » The Domestic Manufacturing Conversion Grant Program provided 11 awardees with \$1.7 billion for at-risk auto production facilities to transition to produce EVs and parts. It is important that DOE maintains the implementation of this program as vehicle manufacturing is a pivotal part of the U.S. economy and central to the future of U.S. manufacturing.
- » Since 2021, the Loan Programs Office (LPO) has provided funding commitments to over 30 projects, representing nearly \$60 billion across a variety of clean technology sectors. Projects include Ultium Cells in Tennessee which will help finance the construction of three new lithium-ion battery cell manufacturing facilities that use a-state-of-the-art chemistry and QCells in Georgia that will be used to support the construction of the largest ingot and wafer plant ever built in the United States. As of December 2024, there are an additional 182 active applications requesting \$279 billion. LPO provides critical funding to innovative manufacturing and clean energy projects to serve as a “bridge to bankability.” Additionally, LPO provides guidance and technical assistance across the project lifecycle to ensure the success of its portfolio.

## 2 PROMOTE NEW INVESTMENTS FOR CLEAN TECHNOLOGY MANUFACTURING AND INDUSTRIAL TRANSFORMATION

### Authorize additional funding for existing manufacturing and industrial decarbonization programs

- » Federal investments including IDP, 48C, and LPO Title 17 have successfully catalyzed billions of dollars of private investment into U.S. manufacturing. However, there was significantly more demand for IDP and 48C funding than there were funds available to the programs, indicating additional appropriations would be utilized and produce immense economic benefits.<sup>29</sup>

### Utilize tax credits to support the production of low-embodied carbon materials

- » 45X could be modified to include low-embodied carbon materials, such as aluminum, iron, steel, cement, and concrete. This would support increased adoption of cutting-edge technologies by closing the price gap between innovative and incumbent producers.

### Support sector-specific investments to decarbonize and reduce co-pollutants of low-embodied carbon materials

- » Decarbonizing aluminum, steel, cement, chemicals, and other energy intensive materials will require sector specific plans and investment strategies, as each requires unique technological solutions and faces varying investment barriers. Policies such as new production tax credits, investment incentives, and other federal support for energy subsidies and workforce development should be considered.



### Continue federal investments to demonstrate and deploy a world-leading domestic carbon management industry

- » Continue federal investments in carbon capture for hard-to-abate industrial emissions in high-priority use cases such as cement production.
  - Successfully demonstrate first-of-a-kind commercial-scale carbon capture projects with 90+% capture rates at facilities where emissions have medium to low CO<sub>2</sub> purity streams.
- » Explore pathways like federal procurement to boost demand for safe and effective carbon dioxide removal.
- » Support the effective deployment of carbon capture and storage and DAC by developing a strong safety regime for deploying and monitoring CO<sub>2</sub> pipelines.
- » Increase staff capacity at the Environmental Protection Agency Office of Water for the Class VI well program to review permits, primacy applications, and monitor the geologic storage of captured CO<sub>2</sub>.



## **Continue federal incentivizes for the production of low and zero-emissions hydrogen**

- » Ensure 45V helps scale domestic production of low and zero-emissions hydrogen.
- » Implement strong safety rules at Pipeline and Hazardous Materials Safety Administration for hydrogen pipelines.
- » Incentivize the domestic manufacturing of electrolyzers to support the rapid scale-up needed to meet the growing demand for green hydrogen.
- » Target demand-side funding in emerging sectors where hydrogen will become critical to achieving a net-zero economy by 2050 but is not yet deployable at scale today.
- » Prioritize the buildout of hydrogen-ready infrastructure alongside relevant gas bridge technologies.

## **Provide funding for R&D in the industrial sector**

- » DOE estimates that several technologies that will be required to achieve net-zero by 2050 in the industrial sector are currently in the early stages of their viability.<sup>30</sup> Therefore, DOE should establish a program to support the deployment of early Technology Readiness Level (TRL) projects (TRL 1-4).
- » DOE should enforce rules to require domestic manufacturing of technologies and utilization of intellectual property for technologies that they support with funding.

## **Tackle the challenge of load growth on the electricity grid that is emerging from new clean technology manufacturing and industrial decarbonization**

- » Direct utilities, grid operators, and Power Marketing Administrations (PMAs) to adequately plan for much higher electricity demand from new manufacturing facilities and from industrial facilities that are converting various energy-intensive processes from combustion to electricity.<sup>31</sup>
- » Provide funding to scale up clean firm energy generation that will be required for industrial facilities to fully decarbonize.
- » Prioritize power sales from PMAs to industrial customers in critical, globally competitive industries over customers delivering products of dubious public benefit.

## **Invest in DOE offices that support industrial decarbonization and better coordinate manufacturing activities across DOE**

- » Currently, DOE's industrial decarbonization and manufacturing work is spread across several departments. DOE could support better coordination, data collection, and modeling by combining them under one office.





### 3 ENSURE MANUFACTURING JOBS ARE GOOD JOBS

#### **Prioritize and preserve good, family-sustaining union jobs**

- » Emphasize reinvestments in today's industrial plants and communities to ensure that they receive the benefits—and not just the costs—of industrial development.
- » Use a range of policy tools to ensure high wages, good benefits, and the opportunity to organize unions in manufacturing jobs—including, where appropriate, conditioning subsidies and incentives on supporting and protecting labor rights and on the creation or retention of good, union jobs.

#### **Invest in increased training through pre-apprenticeship and registered apprenticeship programs, and postsecondary education programs for workers**

- » As huge demand for new manufacturing workers emerges from recent investments, several occupations could face labor shortages. The absence of additional workforce investments would result in an anticipated total labor shortage of nearly 1.1 million workers lacking the skills to fill these jobs.<sup>32</sup> Most of these jobs will be available to workers in fields and occupations that require education or training past high school, but not a four-year degree.

#### **Develop industry partnerships and local hiring initiatives to validate industry-specific training and credentials, inform industry practices, and shape career advancement paths**

- » Work closely with states, many of which are already stepping forward with commitments to fill the workforce gap with high-road skills training.

#### **Ensure job quality with policies and strategies that protect workers' rights to organize, empower unions, and that help workers advance to higher-skill and high-paid occupations**

- » Embracing strong labor and equity standards is more than a moral imperative. It's also an effective business strategy. Indeed, empirical evidence points to a robust business case for supporting high-road labor and equity standards. Studies show that unionized labor, union apprenticeship programs, living wages, and proactive community engagement, for example, can lead to enhanced workforce productivity, reduced turnover rates, and more timely and efficient projects.<sup>33</sup>



## **4 INCORPORATE FULL AND INTENTIONAL UTILIZATION OF THE FEDERAL GOVERNMENT'S PROCUREMENT TOOLS**

### **Increase policy harmony and deliver a clear and consistent market signal for low-embodied carbon materials**

- » Implement and evaluate existing Buy Clean pilots and encourage better data collection and availability.
- » Implement unified cross-agency standards and metrics for low-embodied carbon that appropriately treat products—especially iron and steel, which are made through two or more fully distinct production processes—with wholly distinct emissions profiles.
- » Prioritize coordination with sub-national entities to improve policy harmony across all levels of government and the private sector, as well as augment embodied emissions data gathering and dissemination.
- » Provide technical and financial support specifically to small and medium-sized enterprises (SMEs).
- » Improve data quality by boosting the quality and quantity of environmental product declarations.
- » Demand that energy, infrastructure, and information technology projects using permitting streamlining under existing or new authorities are required to first use clean and American-made building materials and finished goods (e.g., transformers).
- » Create a domestic steel and aluminum preference for federally procured civilian and defense vehicles, with a further preference for clean primary automotive steel.

### **Explore additional procurement tools available to the federal government**

- » Utilize advanced market commitments (AMC) and “contract for difference” programs for low-embodied carbon materials. Together, these “demand-side” policy tools can ensure a buyer is available for emerging low-embodied carbon materials while enhancing business certainty when planning for expensive capital investments.<sup>34</sup>

## **5 UTILIZE U.S. TRADE POLICY TO SUPPORT MANUFACTURING COMPETITIVENESS AND EMISSIONS REDUCTIONS**

### **Modernize, strengthen, and utilize regulatory trade enforcement tools**

- » Trade enforcement tools like Section 201, 232, and 301 authorities are an essential component of supporting a robust domestic manufacturing ecosystem. They should be utilized strategically to ensure a level playing field.
- » Modernize current antidumping and countervailing duties authorities through new legislation to allow for labor and civil society groups to call for investigations prior to harm being inflicted on workers or U.S. industry and as nonmarket economy actions and national security violations occur in real-time.
- » Develop broadly applicable trade tools akin to the Rapid Response Mechanism (RRM) used in USMCA that has helped to strengthen union organizing and worker standards in Mexico. With appropriate staffing, we should include similar tools as the RRM to ensure enforcement of both high road labor standards in our trade deals, as well as environmental standards that help drive down global emissions.
- » Work closely with Congress to reauthorize the Trade Adjustment Assistance (TAA) program. Trade Adjustment Assistance is a lifeline for workers displaced from their jobs by unfair

trade policies, offering trade-impacted workers a variety of supports including income support, a health coverage tax credit, training, education, and job search assistance. Currently, workers are unable to access these job training benefits because Congress has not reauthorized the program since its expiration on June 30, 2022. As a result, the U.S. Department of Labor cannot issue determinations on the layoff petitions, leaving impacted workers with no assistance.

### **Work to ensure that our trade relationships and agreements bolster U.S. industrial strategy**

- » Support strong labor and environmental standards as top priorities during the 2026 review of USMCA, including ensuring that USMCA is adequately addressing the gaping differentials in labor standards and job quality that have significantly contributed to offshoring of vehicle production and assembly.
- » Add a provision to establish a facility-specific enforcement mechanism, similar to the Rapid Response Mechanism for Labor Violations, for violations of USMCA environmental standards and protections.
- » Add new commitments to reduce emissions from the industrial sector; ensure data transparency in pollution intensity of major energy-intensive products including steel and aluminum; and harmonize approaches to measuring pollution intensity of certain industrial products.

### **Deepen the work of aligning trade and competitiveness goals**

- » Work with Congress to explore legislation that would curb pollution from industrial sectors in the United States and abroad Carbon Border Adjustment Mechanism (CBAM) legislation designed to achieve significant emission reductions and protect U.S. investments in clean manufacturing and IDP projects while sustaining the jobs of U.S. manufacturing workers and strengthening their global competitiveness.

## **6 DEVELOP A NATIONAL STRATEGY FOR RESPONSIBLE MINING AND CRITICAL MINERALS**

### **Develop a comprehensive national critical minerals strategy guided by a commitment to environmentally, economically, and socially responsible mining of minerals necessary to anchor clean technology manufacturing in the United States**

- » The country's current mining and critical minerals policy is disjointed, inadequate, and governed by a patchwork of laws and regulations. As we dramatically increase renewable energy and storage capacity as part of climate mitigation efforts, demand for critical minerals will increase correspondingly. Therefore, we need to:
  - Incentivize and enhance the use of responsibly produced critical minerals and metals in line with that strategy;
  - Jumpstart responsible domestic, critical materials recycling projects and circular economy promotion; and
  - Spur reclamation, remediation, and repurposing of industrial sites and spur economic development in hard-hit communities.





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