
The Rising Tide: How Advanced Energy Policy Strengthens America's Industrial Base

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OVERVIEW

New economic modeling from Cambridge Econometrics reveals an important finding: a comprehensive suite of advanced energy-focused policies doesn't just benefit clean energy companies—it creates substantial economic gains across the entire U.S. industrial sector, including metals manufacturing, chemical production, electric utilities, machinery, and extractive industries.

The Climate Leadership Council engaged Cambridge Econometricsⁱ to examine what happens when the United States implements five commonly discussed policy interventions for boosting advanced energy and decarbonization technologies. These policies function as “a rising tide that lifts all boats.” With accelerating global demand for low-carbon energy and technology, some of the largest beneficiaries exist in established, traditional industrial sectors.

This analysis focuses on five key sectors: electric utilities, metal products, chemical products, machinery and electronics, and fossil fuels and mining. These findings demonstrate that policies designed to accelerate advanced energy deployment can create substantial benefits across incumbent industrial sectors.

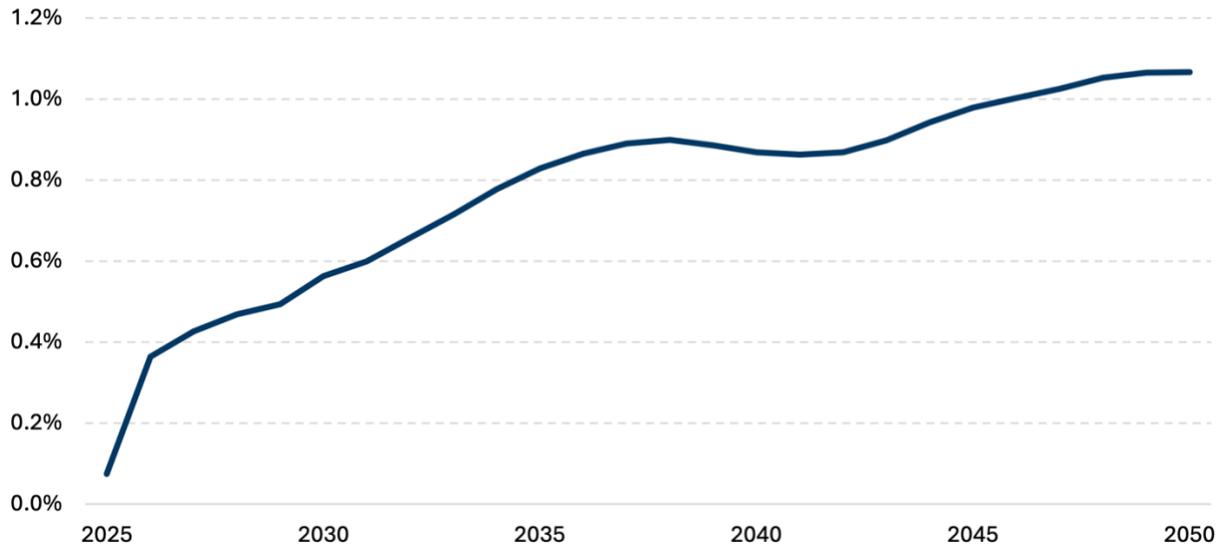
Key Findings

- **Cumulative U.S. output increases** by \$11.2 trillionⁱⁱ between now and 2050, with metal products (\$1.9T), chemical products (\$1.6T), and machinery and electronics (\$776 billion) leading the way.
- **Investment rises** across all five key sectors, with fossil fuels and mining seeing an increase of \$268 billion in cumulative investment through 2050.
- **Increase in net exports** of metal products, chemical products, machinery and electronics, and fossil fuels and mining of around \$450 billion by 2035 and \$1.8 trillion by 2050.

Collectively, these policies would increase the total size of U.S. GDP by 0.8% by 2035 and 1.1% by 2050.ⁱⁱⁱ



“...a comprehensive suite of advanced energy-focused policies doesn't just benefit clean energy companies—it creates substantial economic gains across the entire U.S. industrial sector...”

Figure 1 – Impact on U.S. GDP from supportive policies, increase from baseline (%)

Source: Cambridge Econometrics

The Policy Suite

The analysis modeled five policy interventions that are widely discussed across the political spectrum. The goal was not to suggest the benefits of any single policy approach but to examine how a representative suite of commonly proposed measures in support of advanced energy development and deployment would interact to affect industrial competitiveness:

Permitting Reform streamlines approval processes for energy infrastructure and industrial projects. In the U.S., permitting timelines are lengthy across industries: manufacturing facilities, oil and gas infrastructure, utility-scale renewables, mining projects, and electric transmission can face delays of up to a decade from project inception to commercial operation.^{iv} These delays can substantially increase costs; U.S. projects often overrun their preliminary budgets by more than 80%.^v

The policy scenario assumes broad-based permitting reform across the U.S. energy and industrial sectors that streamlines reviews, reduces legal delays, and improves coordination across agencies. If permitting reform reduces capital project cost overruns by just half, industry can realize effective capital cost reductions across the examined economic sectors of 3–15% by 2050. These cost reductions increase the benefits of investment and make U.S. production more competitive domestically and in export markets.

Tax Incentives lower investment costs through tax credits for advanced energy deployment and industrial modernization. The policy suite includes tax credits for advanced energy technologies,

production credits for nuclear and renewable generation, and subsidies for industrial sector modernization included in the Inflation Reduction Act, and later in the One Big Beautiful Bill Act. By reducing costs to industry and encouraging technology adoption, these incentives enhance competitiveness from commodity manufacturing through advanced energy technology.

Research & Development (R&D) Support increases the amount the U.S. government and industry invest in R&D compared to current and projected levels of investment. The modeling increases R&D spending by 0.15% of U.S. GDP annually through 2050, split evenly between advanced energy technologies and technologies to lower emissions from emissions-intensive manufacturing sectors.

Half the R&D funding goes toward power generation technologies, where it is modeled as reducing investment costs—it makes it cheaper to build new capacity. This boosts deployment by lowering the financial barriers for advanced energy technology.

The other half is allocated to manufacturing sectors based on their emissions intensity, with more emissions-intensive industries receiving proportionally more R&D support. For these manufacturing sectors, the funding is modeled as directly increasing investment, which expands capacity and helps these industries innovate, improve efficiency, and maintain competitiveness as global standards rise.

Pollution Import Fees impose border adjustments based on the carbon intensity of imported goods. The model assumes a pollution import fee imposed by the U.S. on all trade partners based on relative carbon intensity for a set of energy-intensive imports across these manufacturing sectors: chemical manufacturing, iron and steel, nonferrous metals, nonmetallic mineral products, paper and pulp, and refined petroleum products.

The fee structure creates competitive advantages for U.S. producers whose manufacturing processes are cleaner than international competitors. This mechanism rewards domestic efficiency improvements and creates stronger incentives for trading partners to reduce their own emissions intensity.

Targeted Technology Investment supports emerging technologies where the U.S. has a competitive advantage. This analysis modeled investments in direct air capture (DAC) as one emblematic emerging sector where the U.S. currently has a competitive edge, possessing the most advanced technologies, low-cost electricity, and favorable geology for carbon capture and storage.^{vi} DAC investment scales up over time and increases demand for goods and services from a combination of industrial sectors including chemicals, metals, machinery, power, and construction.

Why Traditional Sectors Benefit

The economic gains for traditional industrial sectors flow through several interconnected channels:

Universal cost reductions from permitting reform. Technology agnostic permitting reform accrues benefits across the board. It reduces production costs for electricity and oil and gas infrastructure, mining operations, and manufacturing. When capital-intensive projects move faster through the approval process, all these sectors see lower effective capital costs and improved return on investment.

Supply chain demand. Advanced energy deployment requires massive quantities of traditional industrial materials. New solar installations require aluminum, glass, and chemicals. Wind turbines need steel and specialized metals. Batteries require lithium processing, copper, and advanced materials. Supporting transmission and distribution infrastructure requires conductive metals and specialized machinery and equipment. Every dollar invested in advanced energy creates multiple dollars in demand for metals, chemicals, electronics, machinery, and equipment manufacturing.

R&D for industrial modernization. Half of all new R&D funding flows to emissions-intensive manufacturing sectors to help them innovate and improve efficiency. This affords incumbent industrial sectors with resources to maintain—or increase—international competitiveness as global markets demand improved carbon efficiency.

Competitive advantage from pollution import fees. American manufacturing is substantially more efficient than most of its competitors.^{vii} U.S. steel, aluminum, chemicals, and other basic materials are produced with a fraction of the emissions compared to the average manufacturer in China or India. When import fees assess charges based on carbon intensity, they reward all efficient U.S. producers—whether they're making steel for bridges or steel for wind towers. The pollution advantage creates economic and export opportunities for competitive U.S. manufacturers as markets around the world are valuing lower carbon production.

Growing global demand for advanced energy creates export opportunities for traditional sectors. For instance, global electricity demand is accelerating rapidly, driven by data centers, expanded air conditioning adoption, and electrification of buildings, industry, and transportation. This expansion creates opportunities across all segments of the U.S. energy and industrial sectors, as well as the integrated supply chains that supply them with materials, equipment, and specialized services.

U.S. fossil fuel producers are well-positioned to increase exports in most scenarios. However, the fastest-growing segments of the global energy market will be advanced zero- or low-carbon energy sources.

Investment Growth

The policy suite drives substantial new capital investment across the five key sectors. By 2050, cumulative investment for the five studied industrial sectors increases by approximately \$790 billion above baseline projections.

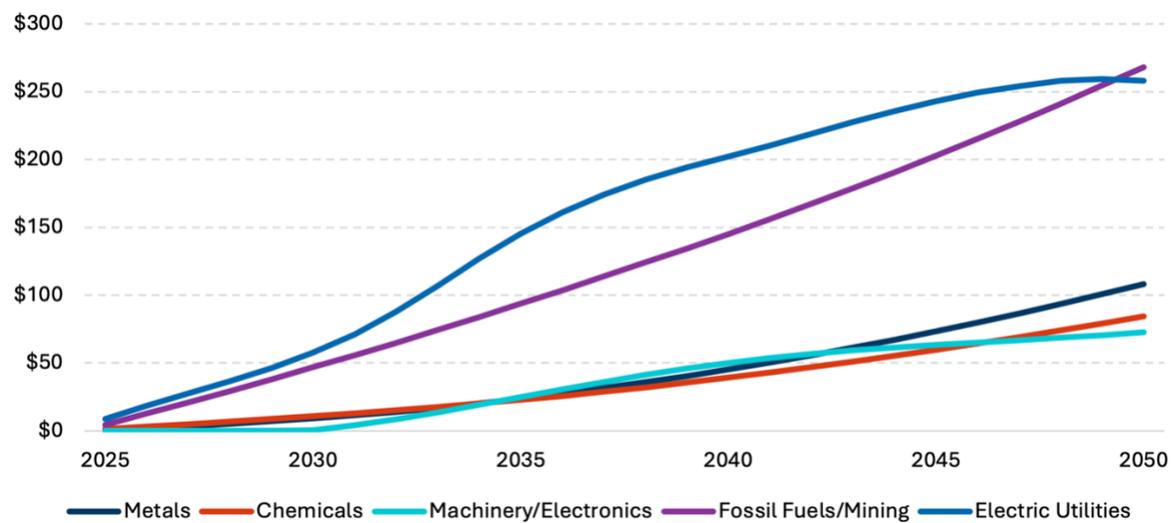
Fossil fuels and mining see approximately \$268 billion more in cumulative investment through 2050. These gains come from multiple channels. Permitting reform reduces approval times for new developments. Export opportunities expand when domestic electricity generation and space and water heating shift more toward renewables. Modernization incentives support efficiency improvements and emissions reductions that maintain long-term competitiveness of U.S. industry.

Electric utilities (electricity generation, transmission, and distribution) would have the second-highest investment growth with more than \$250 billion in cumulative gains, driven by permitting reform and tax

incentives that reduce both deployment timelines and capital costs. The combination of streamlined approvals and production credits accelerates power grid expansion, generation capacity additions, and the supporting transmission and distribution infrastructure.

The metals, chemical products, and machinery and electronics sectors each see expanded investment, attracting \$108 billion, \$84 billion, and \$73 billion in new investment, respectively, by 2050. The policy suite creates strong demand signals across these manufacturing sectors via multiple mechanisms: direct support for industrial modernization, reduced input costs from faster permitting, and increased demand related to accelerated deployment of advanced energy technologies and expansion across incumbent industry.

Figure 1 – Cumulative Impact on U.S. Investment by Sector, above baseline (2025 \$ billions)



Source: Cambridge Econometrics

Output Growth

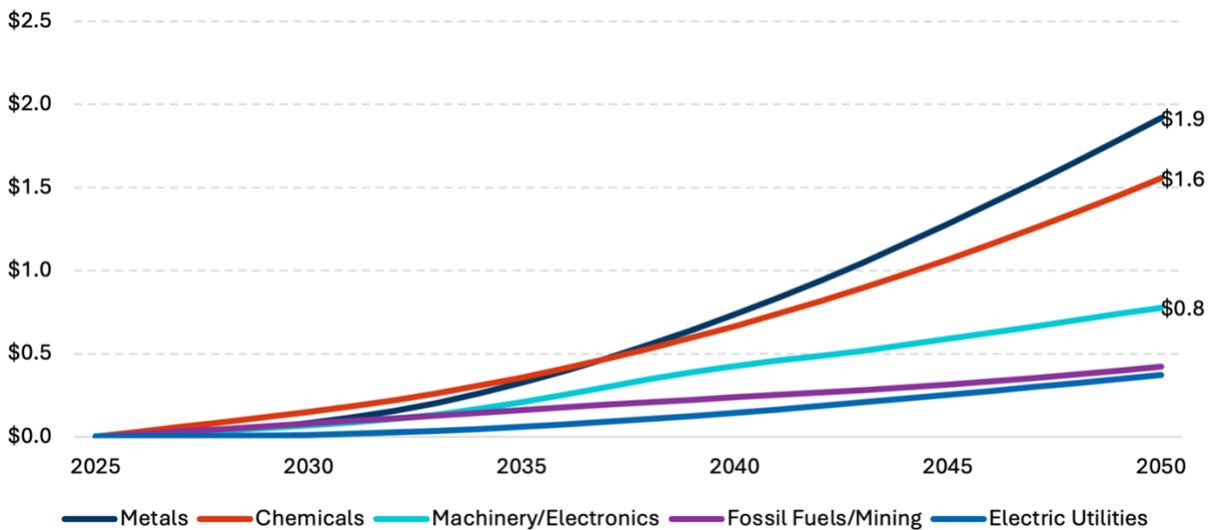
Metal product manufacturing experiences the strongest output impact with cumulative increases of approximately \$323 billion by 2035 and \$1.9 trillion by 2050. Chemical manufacturing sees gains of around \$356 billion by 2035 and \$1.6 trillion by 2050. Machinery and electronics manufacturing would see cumulative output increases of approximately \$207 billion by 2035 and \$776 billion by 2050.

Fossil fuels and mining and electric utilities also experience substantial output gains. These increases are driven both by reduced costs from permitting reform and tax incentives and by increased demand from advanced energy investments and industrial expansion.

Across all sectors, cumulative U.S. economic output increases by approximately \$2.6 trillion by 2035 and \$11.2 trillion by 2050. The five key sectors—electric utilities, fossil fuels and mining, metal products, chemical products, and machinery and electronics—account for more than 44% of overall gains, with

additional benefits flowing to services, construction, distribution, and retail as economic activity increases.

Figure 2 – Cumulative Impact on U.S. Output in Key Sectors, above baseline (2025 \$ trillions)



Source: Cambridge Econometrics

Export Growth

The policy suite significantly improves U.S. export competitiveness. Across the studied sectors (excluding electric utilities, which have only limited trade flows between the U.S. and its immediate neighbors), cumulative net exports increase by approximately \$450 billion by 2035 and \$1.8 trillion by 2050.

Metal products see strong net export gains, approximately \$180 billion by 2035 and \$931 billion by 2050, driven by productivity improvements from permitting reform and larger economies of scale achieved against foreign competitors.

The chemicals and fossil fuels and mining sectors see net export gains of \$160–170 billion by 2035, growing to \$500–530 billion by 2050. For fossil fuels, when energy consumption uses more electricity and when domestic electricity generation incorporates more renewables, production shifts toward export markets where U.S. producers gain competitiveness.

CONCLUSION

Debates regarding energy policy are often framed as zero-sum contests: advanced energy gains must come at the direct expense of incumbent forms of energy, *or* climate progress must come at the expense of industrial competitiveness. This analysis challenges that framing.

Permitting reform reduces costs across the industrial economy. Tax incentives support a new energy system and industrial modernization. R&D funding accelerates technology development and adoption. Pollution import fees reward efficient U.S. producers relative to high emissions imports. With \$11.2 trillion in additional cumulative output gains by 2050, the benefits are broad-based and far-reaching, extending well beyond any single technology or sector.

The economic ceiling for all industrial sectors—including metal products, chemical manufacturing, machinery, *and* fossil fuels—will be determined in large part by how successfully U.S. policy helps the country claim a larger share of the global market for advanced energy technologies.

The Climate Leadership Council (the Council) is a nonprofit think tank dedicated to championing the most fair, effective, and lasting climate solutions. The Council produces groundbreaking research, educates policymakers, and works with a broad set of stakeholders to advance a common goal: meaningfully reduce global emissions while strengthening our economy. It is home to the Center for Climate & Trade.

Research and work products are that of the Climate Leadership Council and not necessarily that of its organizational partners.

ABOUT



Scott Nystrom, Director, Research & Analytics

Scott Nystrom is the director of research and analytics for the Climate Leadership Council. In this capacity, he provides oversight and guidance to research initiatives and policy development across all major focus areas of the organization. He leads the Council's quantitative modeling of economic impacts, energy markets, international trade, and fiscal policy.

Scott comes to the Council after a five-year software career and seven-year consulting career. In these roles, Scott conducted studies related to climate policy, demographics, economic development, the energy sector, fiscal policy, healthcare policy, international trade, labor relations, scope emissions, and transportation.

Prior to the Council, Scott worked for FTI Consulting. He was the co-lead and lead economist of its impacts and policy analysis practice. Prior to his time at FTI Consulting, Scott worked for Regional Economic Models, Inc. ("REMI"). He holds a B.A. in History, B.S. in Economics, and M.A. in Economic History from Iowa State University in Ames, Iowa.



Catrina Rorke, Senior Vice President, Policy and Research

Catrina Rorke is senior vice president of policy and research at the Climate Leadership Council and executive director of the Center for Climate & Trade. She collaborates with an innovative team of experts and diverse stakeholders to conduct and publish pioneering research, explore innovative policy approaches, and educate policymakers in support of effective, fair, and lasting solutions that lower global carbon emissions.

Prior to joining the Council, Catrina founded the energy and environment programs at both the R Street Institute and the American Action Forum. She previously served as a legislative assistant to former U.S. Rep. Bob Inglis of South Carolina and staff to the House Committee on Science, Space, and Technology. In her time on the hill, Catrina helped develop the first Republican-sponsored carbon tax bill. She began her career as a presidential management fellow with the National Oceanic and Atmospheric Association.

Catrina has been recognized for her leadership in energy and climate policy by *E&E News*, *The Hill*, *National Journal*, and *Grist*, and her work has been published in national, local, and trade media. She supports center-right policy work by serving as a board member and advisor to several policy-focused organizations.

CITATIONS

ⁱ Brendan Cox, An Vu, Alistair Smith, and Dan Hodge, "Accelerating Investment and Trade: Opportunities for U.S. Industry in the Advanced Energy Transition," *Cambridge Econometrics*, March 2026, https://www.camecon.com/hubfs/Accelerating%20Investment%20and%20Trade_Opportunities%20for%20U.S.%20Industry%20in%20the%20Advanced%20Energy%20Transition.pdf

ⁱⁱ All dollar units adjusted to 2025 dollars

ⁱⁱⁱ This analysis is based on macroeconomic modeling by Cambridge Econometrics using their E3ME model, which integrates economic, energy, and environmental dynamics across more than 70 regions and 40 industry sectors. The full report examines domestic policy scenarios through 2050 with detailed sectoral impacts.

^{iv} See, for example: Bob Sternfels, Adi Kumar, and Brodie Boland, "Unlocking U.S. federal permitting: a sustainable growth imperative," *McKinsey*, July 28, 2025, <https://www.mckinsey.com/industries/public-sector/our-insights/unlocking-us-federal-permitting-a-sustainable-growth-imperative> or "U.S. Clean Energy Goals Hinge on Faster Permitting," *World Resources Institute*, February 9, 2023, <https://www.wri.org/insights/clean-energy-permitting-reform-us>

^v "Infrastructure and energy capital projects are notorious for being significantly delayed and over-budget. How can we mitigate these risks?" *Prezerv*, October 18, 2021, <https://prezerv.ai/index.php/2021/10/18/infrastructure-and-energy-capital-projects-are-notorious-for-being-significantly-delayed-and-over-budget-how-can-we-mitigate-these-risks/>

^{vi} Karan Mistry, Tina Zuzek-Arden, Thomas Baker, Emma Delrose, "Potential for U.S. Competitiveness in Emerging Clean Technologies," *Boston Consulting Group*, September 2022, <https://web-assets.bcg.com/fc/d4/9a39f69141d9aab29f41900712ad/how-the-us-can-win-in-six-key-clean-technologies-r.pdf>

^{vii} "Carbon Advantage," *Climate Leadership Council*, <https://clcouncil.org/our-solutions/carbon-advantage/>