The Economic Impact of Blue Hydrogen

Effects of proposed investment in blue hydrogen on American employment, output, GDP, labor income, and taxes

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Executive Summary

Hydrogen is a versatile and powerful energy resource that stands at the forefront of technologies poised to enable American energy dominance. Today, its primary uses are as a feedstock for ammonia production—a critical input for fertilizer manufacturing—as well as in oil refining and chemical manufacturing. However, hydrogen also has broader potential across the energy system, with promising applications in industrial processes like steelmaking, or as an alternative fuel source for transportation and electricity generation.

Currently, 95% of U.S. production is derived from natural gas in a process known as steam methane reforming ("SMR"), producing what is known as "gray hydrogen." Today, emerging technologies such as SMR paired with carbon capture and storage ("CCS"), methane pyrolysis, or electrolysis offer new opportunities for hydrogen production.[1] This report focuses on hydrogen produced via SMR with carbon capture—commonly referred to as "blue hydrogen"—and uses economic modeling to estimate the potential economic impact of scaling up the blue hydrogen industry over the next ten years.

Blue hydrogen technology is well-positioned to capitalize on the U.S.' abundant supply of affordable natural gas and cutting-edge CCS technologies to expand America's commanding position in energy production. A new global market for lower-emissions hydrogen is taking shape, as economies like Europe and Japan develop ambitious plans to produce and import clean hydrogen. Meanwhile, China aims to lead in the production of hydrogen fuel cell vehicles and electrolyzers.[2,3]

To sustain America's competitiveness and assert leadership in this emerging market, the U.S. must effectively leverage and provide support for emerging technologies such as blue hydrogen. Further, building and operating the infrastructure necessary to produce blue hydrogen will support tens of thousands of jobs during both construction and plant operations, and generate billions in annual tax revenue at the federal, state, and local levels. Blue hydrogen can also benefit the American economy by providing a long-term, low-carbon demand anchor for U.S. natural gas, especially as global power and heating markets decarbonize.

An estimated 9.8 million metric tons per annum ("mmtpa") of blue hydrogen capacity is in development across the U.S.[4] To put this volume into perspective: if used only to

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[1] U.S. Department of Energy, *Hydrogen Production: Natural Gas Reforming* (link)
[2] Electrolyzers are another technology that can be used to produce clean hydrogen by using electricity to split water into hydrogen and oxygen.
[3] CSIS, *China's Hydrogen Strategy* (link)
[4] Estimate based on an analysis of data from the IEA.

generate electricity via fuel cells, 9.8 mmtpa of hydrogen could potentially power over 18 million homes.[5]

According to the modeling analysis conducted for this report:

- Designing, building, and manufacturing the equipment for these plants could support an average of roughly 52,700 jobs each year between 2025 and 2035, as shown in Table 1. For comparison, motor vehicle body manufacturers employ 52,800 workers each year.[6]
- This economic activity would generate billions in federal, state, and local tax revenues and provide meaningful contributions to GDP, nearly $1 billion more than heavy-duty truck manufacturing's contribution.[7]
- Once operational, these blue hydrogen plants could support roughly 62,200 jobs each year. This figure includes direct jobs through plant operations, indirect jobs through natural gas, chemical, and manufacturing supply chains, and induced jobs through consumer spending impacts as workers from both direct and indirect jobs spend their earnings in the local economy.

Table 1 – Summary of Average Annual Economic Impacts (Scenario Average)

Metric	Unit	Construction (Annual Average)	Operations (Annual)
Employment	Jobs	52,700	62,200
Output	2024 $ billions	$12.3	$22.4
GDP	2024 $ billions	$6.6	$12.3
Labor Income	2024 $ billions	$4.3	$5.6
Federal Tax Revenues	2024 $ billions	$1.0	$1.4
State and Local Tax Revenues	2024 $ billions	$0.4	$1.5

[5] Assuming hydrogen energy density of 120MJ/kg, an electricity conversion efficiency of 60%, and average U.S. household electricity consumption of 10,791kWh/year.
[6] Employment figure from IMPLAN's most recent data library.
[7] Ibid.

As global demand for clean hydrogen ramps up and other regions invest heavily in their own production capabilities, federal incentives such as the 45V Clean Hydrogen Production Tax Credit ("45V") are essential for helping the U.S. stay competitive in this emerging market.[8] Advanced, innovative technologies used in blue hydrogen projects often come with high up-front capital costs. Incentives like 45V can help bridge this gap, catalyzing private investment, accelerating deployment, and boosting the export capacity of a nascent domestic industry by reducing the emissions intensity of hydrogen production.

[8] 26 USC 45V: Credit for production of clean hydrogen (link)

Introduction

Clean hydrogen technologies are poised to become a cornerstone of American energy innovation. Hydrogen already plays a critical role in sectors such as ammonia and methanol production, oil refining, and chemical manufacturing. Accelerating the deployment of low-carbon production methods—such as blue hydrogen—will position the United States to lead in emerging applications such as steelmaking, cement manufacturing, electricity generation, and fuel cell vehicles, while also providing existing industries with a cleaner feedstock. Scaling U.S. production of clean hydrogen will be key to maintaining our competitive edge and securing America's influence in global energy markets. This is especially true as economies like the European Union, Japan, and South Korea ramp up efforts to decarbonize their industrial, power, and transportation sectors.

Blue hydrogen—produced from natural gas with carbon capture and storage ("CCS")—stands out as a key opportunity for the United States. The U.S. benefits from abundant natural gas resources and technological leadership in CCS, making it uniquely positioned to become a global leader in blue hydrogen production. With new clean hydrogen markets emerging worldwide, timely federal policy support will be crucial to accelerating deployment.[9]

Federal policies like 45V enhance U.S. energy security by leveraging abundant domestic resources such as natural gas, as well as our established energy infrastructure and industrial expertise, and turning them into low-carbon strategic energy assets. The 45V tax credit also helps strengthen American competitiveness in the nascent clean hydrogen market. The U.S. is already facing stiff competition from countries in Europe and the Middle East, as well as China and Australia.[10] Ultimately, it grows the economy by providing a new avenue for investment in American energy and invigorates American manufacturing by boosting investment and job creation in U.S. industrial basins and manufacturing corridors.

As a nascent sector, blue hydrogen faces potentially high initial costs associated with building infrastructure, scaling production, and achieving market adoption. Without a targeted incentive, private investment may be slow to materialize, and the U.S. would risk ceding leadership in advanced hydrogen technologies to foreign competitors.

Based on announced production capacity, the U.S. could produce over 9.8 mmtpa of blue hydrogen by 2035. This level of output would position the U.S. as a leading

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[9] McKinsey & Company, Global Energy Perspective 2023: Hydrogen outlook (link)
[10] Ibid.

producer and exporter of clean hydrogen while supplying domestic industries with a reliable, low-carbon energy resource.

Blue hydrogen has the potential to transform several U.S. industries that are vital to national interests as they look to decarbonize to increase their global competitiveness:

- **Ammonia and Fertilizer Production:** Hydrogen is a primary feedstock for ammonia production. Ammonia, a key input for fertilizer, is also an efficient hydrogen carrier, as it is easier to transport than hydrogen, especially in large volumes. Stable domestic ammonia production ensures food security, bolsters U.S. exports, and challenges China's hegemony in global ammonia production. In addition, clean ammonia is emerging as a strategic commodity in international energy markets, with growing demand in power generation and maritime fuel applications.
- **Petroleum Refining:** Hydrogen is critical for refining operations, and a reliable supply of blue hydrogen enhances energy security while supporting domestic fuel production. Moreover, refineries can leverage blue hydrogen as a tool to reduce the emissions of both their on-site operations and broader supply chains.[11]
- **Steel Manufacturing:** Clean hydrogen can serve as a low-carbon input for the direct reduction of iron ore for steel production. Increased clean hydrogen production positions the U.S. as a competitive supplier of low-embodied carbon steel—which is also a growing international market.[12]
- **Transportation:** Clean hydrogen can be deployed as an alternative fuel in heavy-duty trucking, aviation, and maritime shipping, making U.S. transportation infrastructure more diverse and robust.
- **Exports:** As global demand for low-carbon fuels rises, blue hydrogen and hydrogen-derived products like clean ammonia offer the U.S. a strategic opportunity to expand its dominance in international energy markets and reinforce its position as a top energy exporter.

By investing in blue hydrogen, the U.S. can bolster its competitive advantage and outpace its rivals in the emerging global clean hydrogen market. China is currently the world's largest producer of hydrogen—generating an estimated 25 mmt in 2022—but this production currently relies largely on traditional, high-emissions methods using unabated coal and natural gas.[13] Backed by substantial state subsidies, China is aggressively expanding its manufacturing capacity of both hydrogen fuel cell electric vehicles ("FCEV") and electrolyzers.[14] In the face of competitors which are heavily

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[11] Inuwa, H., The Way Ahead, Hydrogen's Role in Industrial Decarbonization: Transforming Refineries, Fertilizer Production, and Energy Operations (link)
[12] Embodied carbon represents the sum of all carbon emissions released during the life cycle of a material, including raw materials extraction, manufacturing, transportation, use, and disposal.
[13] IEA, China's hydrogen and CCUS opportunity (link)
[14] CSIS, China's Hydrogen Strategy (link)

subsidizing clean hydrogen technologies, maintaining federal support for the timely scaling up of American clean energy solutions such as blue hydrogen is paramount.

Blue hydrogen also presents a major opportunity for the U.S. to bolster domestic industries. Expanding blue hydrogen infrastructure will create jobs across multiple U.S. economic sectors, from energy production to industrial applications. Furthermore, a robust blue hydrogen sector can reinforce the U.S.' export potential, particularly to Europe and Asia, as they seek reliable suppliers of low-carbon hydrogen and hydrogen-based products such as ammonia. The E.U.'s REPowerEU strategy, for example, establishes a goal of producing 10 mmt and importing 10 mmt of clean hydrogen by 2030.[15] With abundant, low-cost natural gas and advanced CCS capabilities, the U.S. is well-positioned to meet this demand by exporting blue hydrogen and blue ammonia—strengthening its role as a dominant global energy supplier.

Methodology

This report seeks to estimate the potential economic impact of scaling up a blue hydrogen industry in the U.S. over the next ten years using data on total announced production capacity and project-level spending breakdowns. By modeling potential investments using the Impact Analysis for Planning (IMPLAN) model, the analysis estimates direct, indirect supply chain, and downstream induced impacts from the projected construction and operations of announced blue hydrogen projects.[16,17] The IMPLAN model is widely used by governments, academia, and the private sector to estimate the effect of economic activities—such as infrastructure investment—on jobs, incomes, output, GDP, and tax revenues. The model uses input-output ("IO") analysis to estimate how spending in one industry affects the rest of the economy.

Estimating Production and Cost of Announced Blue Hydrogen Plants

Estimates of blue hydrogen's future production capacity are based on public data from the International Energy Agency's ("IEA") hydrogen project database and press releases from projects.[18]

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[15] European Commission, *Hydrogen* (link)
[16] IMPLAN, *Introduction to Economic Analysis* (link).
[17] IMPLAN models direct impacts (jobs supported in that industry), indirect impacts (jobs supported throughout that industry's supply chain), and indirect impacts (jobs created by the spending of direct and indirectly supported jobs).
[18] IEA, *Hydrogen Production and Infrastructure Projects Database* (link)

The cost of equipment and materials for new hydrogen producing facilities were sourced from the National Energy Technology Laboratory (NETL) study titled, *Comparison of Commercial State-of-the-Art, Fossil-Based Hydrogen Production Technologies.* This study provides the component-level cost data for blue hydrogen projects that are used to calculate total capital investment and operating expenditures within each state containing announced blue hydrogen facilities.[19] According to NETL, these cost estimates are conservative because they exclude the cost premiums associated with developing emerging technologies.

This study considers two overarching scenarios of economic impacts. The first relies strictly on cost estimates provided by NETL to project future investment into blue hydrogen facilities. The second scenario relies on the announced costs for an actual project in the advanced development stage. Within each scenario, two sensitivities were modeled to evaluate how the range of benefits could differ under alternate views of the domestic content present in specialized plant equipment. These sensitivities explore 50% and 70% domestic content levels, respectively.

The NETL study provides estimated spending on each project component such as pumps, compressors, and piping. Spending was allocated among appropriate IMPLAN sectors (such as pump manufacturing) to model the full economic benefits of constructing and operating blue hydrogen production facilities throughout the American economy, which extend well beyond the jobs created to directly construct and operate the plants.

Main Results

Construction

The engineering, construction, and manufacturing of equipment for blue hydrogen plants would support between 29,000 and 79,000 annual average jobs from 2025 to 2035. This range is driven by the level of domestic content and the investment required to develop 9.8 mmtpa of blue hydrogen production capacity.

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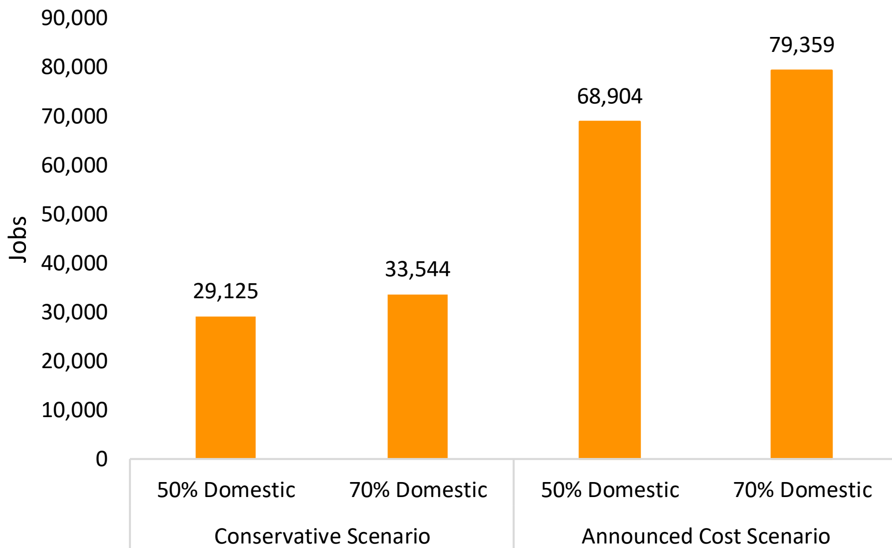
[19] National Energy Technology Laboratory, *Comparison of Commercial, State-of-the-Art, Fossil-Based Hydrogen Production Technologies* (link)

Figure 1 – Annual Average Construction Phase Employment (2025-2035)

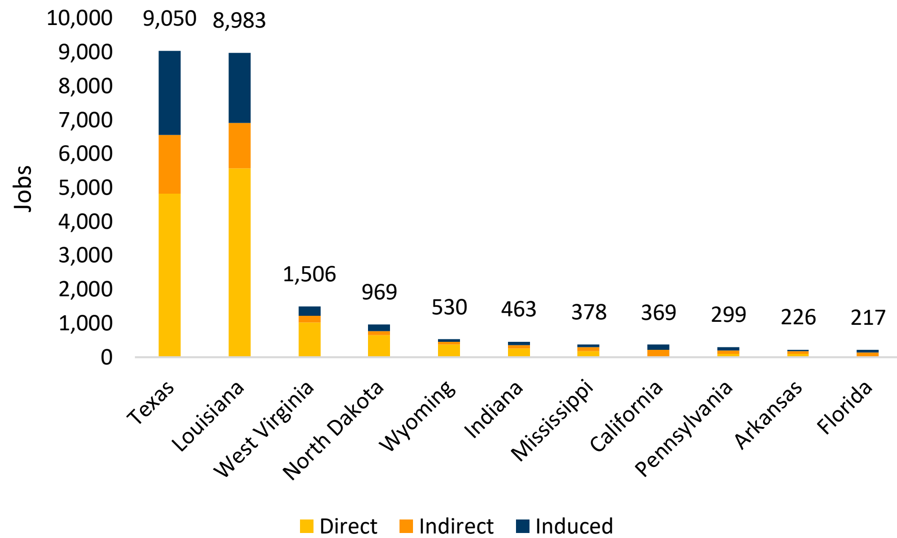


As shown in Figure 2, blue hydrogen's economic impact will be concentrated in the Gulf States of Texas and Louisiana, with about 18,000 jobs supported annually across both states during the construction phase. These results are driven by the distribution of announced projects, with roughly 80% of capacity announced in these two states. It is expected that more hydrogen projects will be announced in the future, especially as "Regional Clean Hydrogen Hubs" develop.[20] Robust infrastructure for natural gas, hydrogen, and ammonia along the Gulf Coast further explain the interest in developing blue hydrogen in the region.

An additional 18,000 U.S. jobs would be supported annually by the industries manufacturing the specialized equipment and materials necessary to construct blue hydrogen plants. These impacts are not allocated to specific states because it is unclear where the supply chain for blue hydrogen plant components will develop. If these manufacturing facilities are built in close proximity to the proposed blue hydrogen plants, the states mentioned in this report would see a greater economic impact.

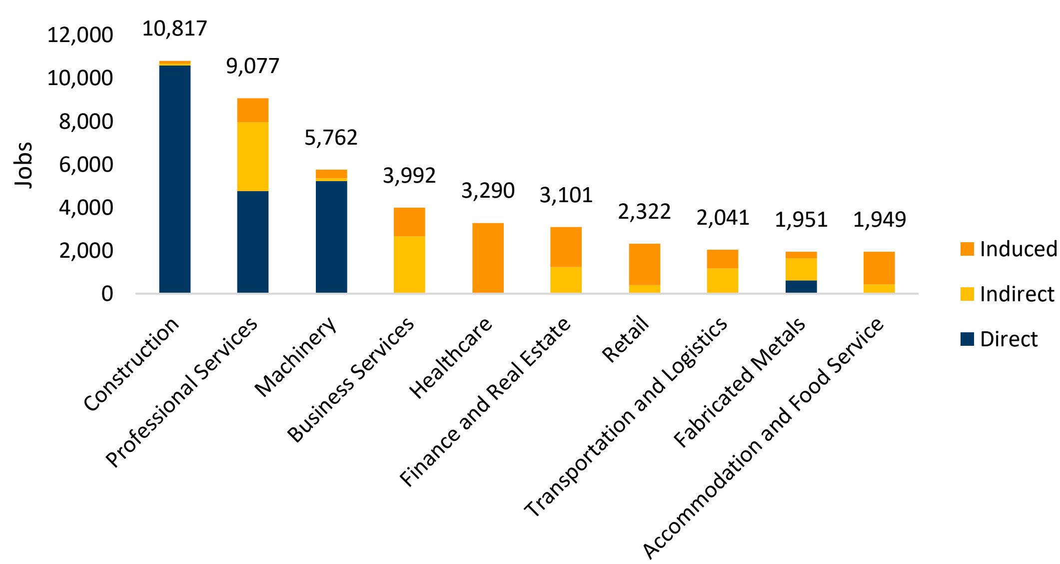
[20] U.S. Department of Energy, *Regional Clean Hydrogen Hubs* (link)

Figure 2 – Annual Average Construction Phase Employment by State, Scenario Average



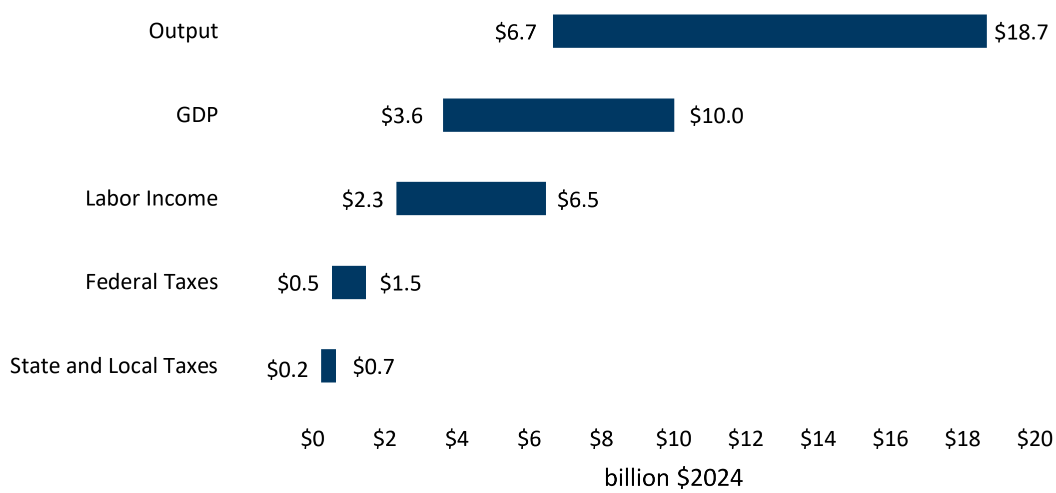
As shown in Figure 3, the construction and professional services (including engineering and design) sectors support the most annual average jobs during plant construction, followed by machinery production and business services.

Figure 3 – Annual Average Construction Phase Jobs by Sector, Scenario Average



In addition to the significant number of jobs supported, Figure 4 highlights that construction of blue hydrogen production and supporting infrastructure is expected to create between $7 to $19 billion in economic output, depending on the scenario. They would also contribute between $4 and $10 billion to GDP, support $2 to $7 billion in labor income, and generate $2 to $3 billion in federal, state, and local taxes each year.

Figure 4 – Average Annual Construction Phase Economic Impacts

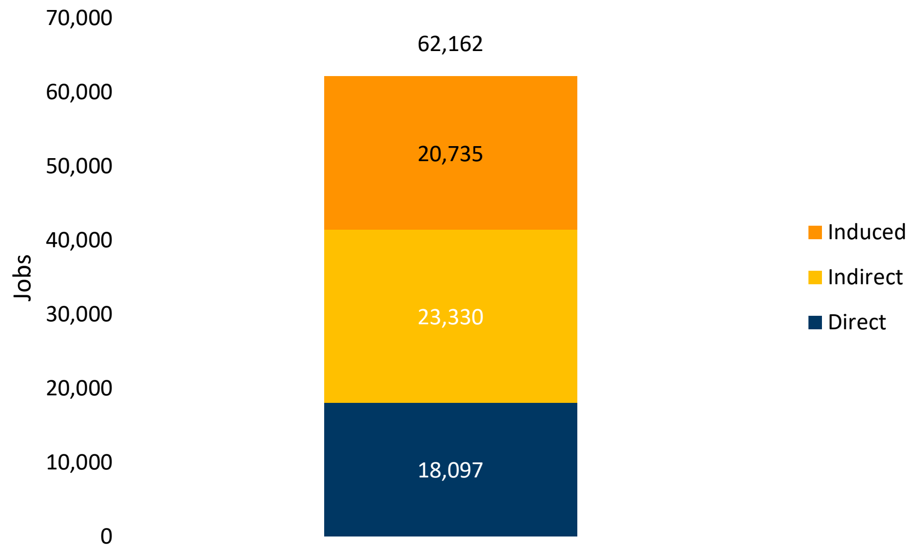


Operations

Once operational, blue hydrogen production facilities would continue to support significant direct economic activity at the plants, indirectly via first tier suppliers in the supply chain, and through increased consumer spending. As shown in Figure 5, 9.8 mmtpa of operating blue hydrogen plants would support more than 62,200 permanent jobs.[21]

[21] Scenario average values are presented in Figure 5 because the difference in employment effects between the 50% and 70% domestic manufacturing content scenarios is negligible.

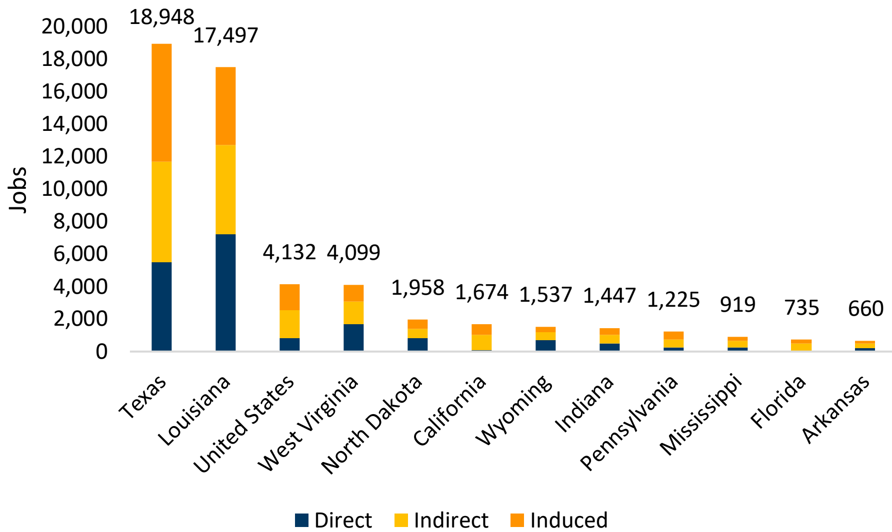
Figure 5 – Annual Operations Phase Employment, Scenario Average



As shown in Figure 6, approximately 55,000 permanent jobs would be supported in states with announced blue hydrogen production capacity, led by Texas and Louisiana. This represents about 88% of all jobs supported during the operations phase. The remaining 12% are generally in the supply chain for specialized equipment. The geographic distribution of jobs could shift as additional blue hydrogen projects are announced or project locations change. For example, potential sites for each project in regional hydrogen hubs such as the ARCH2 hub, which includes West Virginia, Ohio, and Pennsylvania, are still under evaluation.[22]

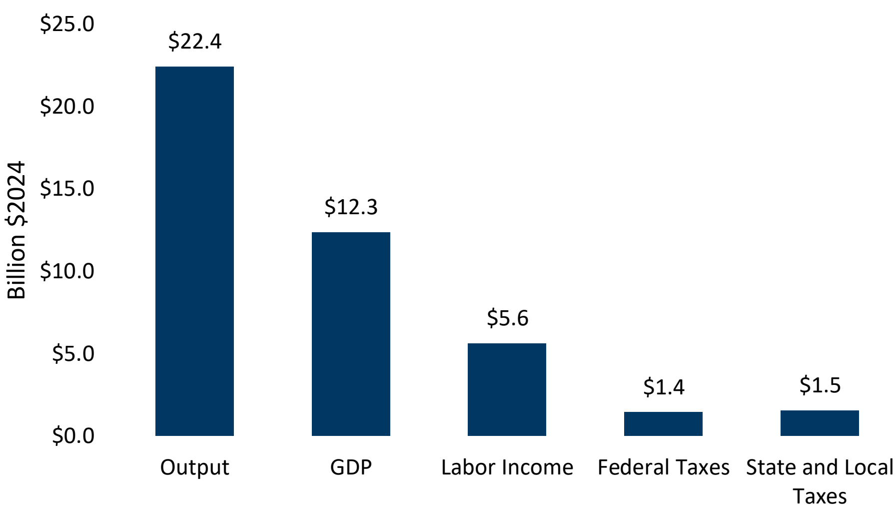
[22] ARCH2, *Frequently Asked Questions* (link)

Figure 6 – Annual Operations Phase Employment by State, Scenario Average



Blue hydrogen production could also support more than $22 billion in economic output, contribute $12 billion to GDP, support $6 billion in labor income, and generate nearly $3 billion in federal, state, and local taxes each year.

Figure 7 – Annual Operations Economic Impacts, Scenario Average



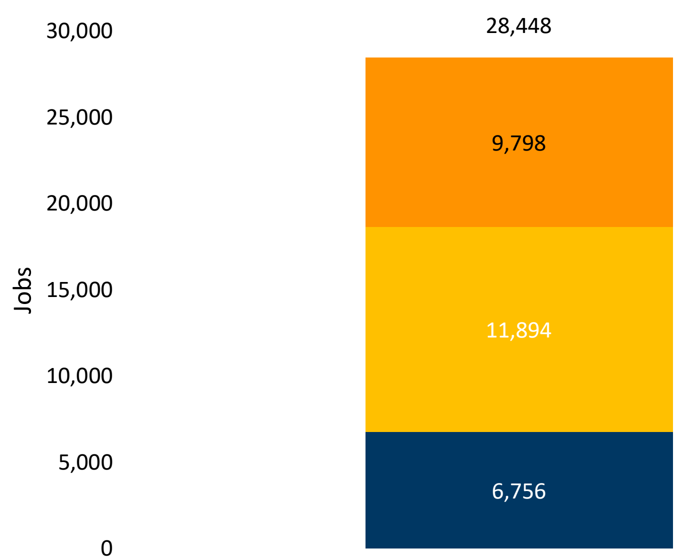
Natural Gas

A burgeoning U.S. blue hydrogen industry would also create a new market and a stable source of demand for American natural gas. This would strengthen domestic natural gas producers, support extraction and pipeline infrastructure jobs, and ensure continued linkage between American energy and key industrial producers.

Total natural gas demand from announced blue hydrogen plants expected to produce 9.8 mmtpa of hydrogen (1,614 bcf) is equivalent to 4% of the total U.S. natural gas production in 2024, 37,779 billion cubic feet ("bcf"). In comparison, the entire U.S. residential sector consumed approximately 14% (4,480 bcf) of total production in 2023.[23,24]

Purchasing natural gas to fuel blue hydrogen production could stimulate job growth throughout the entire supply chain for natural gas, from extraction to pipeline distribution. These jobs would induce further employment through increased consumer spending. Out of the 62,200 permanent jobs that could be supported by blue hydrogen plant operations annually, more than 28,000 would be created within the natural gas industry.

Figure 8 – Employment Supported by Natural Gas Purchases



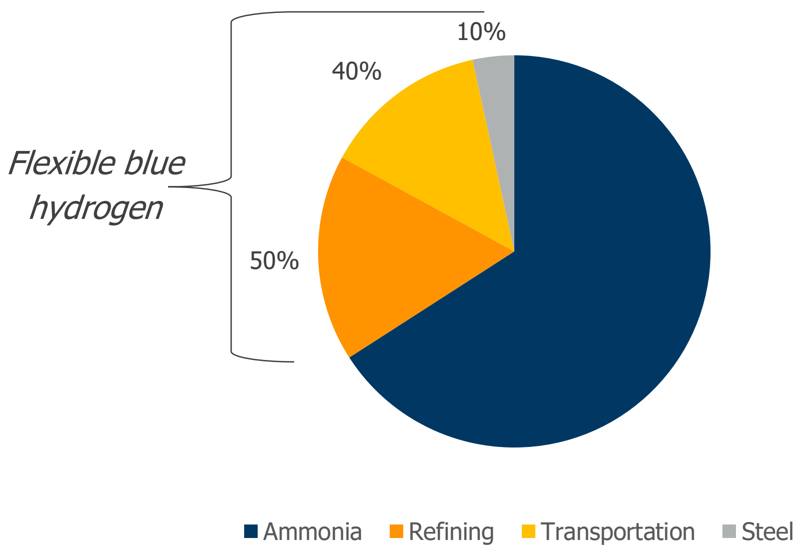
Blue Hydrogen End-Uses

Adding to the advantages of producing blue hydrogen, many domestic industries would benefit from a secure, stable supply chain for American blue hydrogen. Based on an analysis of the announced projects and a review of publicly available studies on potential hydrogen demand, this report identifies four industries that will benefit from expanded blue hydrogen production: fertilizer manufacturing, petroleum refining,

[23] EIA, *Dry Natural Gas Production* (link)
[24] EIA, *Use of natural gas* (link)

steelmaking, and heavy-duty truck transportation.[25] Roughly two-thirds of the currently announced blue hydrogen production capacity is slated to be used to produce ammonia, the primary input for fertilizer. The remaining blue hydrogen capacity ("flexible blue hydrogen") is free to be used in several industries and production processes.

Figure 9 – Hypothetical Allocation of Blue Hydrogen End-Uses (% flexible blue hydrogen)



Fertilizer

Ammonia-based fertilizer production, which depends on hydrogen as a feedstock, is an essential input for agricultural production. An estimated 88% of ammonia produced in America is used to manufacture fertilizer.[26] As a key industry, U.S. fertilizer manufacturing supports more than 85,000 jobs across the country between direct, indirect, and induced effects.[27]

China is the global leader in ammonia production. In 2024, China produced 46 mmt, compared to the U.S.'s 14 mmt.[28] However, announced U.S. ammonia production from blue hydrogen totals 36 mmtpa, more than double the U.S.'s total 2024 demand.[29] Even with stable growth in domestic demand, this major surplus will enable U.S. fertilizer

[25] Embodied carbon represents the sum of all carbon emissions released during the life cycle of a material, including raw materials extraction, manufacturing, transportation, use, and disposal.
[26] EPA, *Anhydrous Ammonia Supply Chain* (link)
[27] According to an IMPLAN industry contribution analysis of the nitrogenous fertilizer manufacturing sector.
[28] USGS, *2025 Mineral Commodity Summaries – NITROGEN (FIXED)-AMMONIA* (link)
[29] 36.2MMT production / 15.0 MMT consumption (link) = 241%

manufacturers to increase international exports and displace less carbon-efficient, coal-based ammonia production in China while ensuring the resilience of America's agricultural supply chain.

Petroleum Refining

Hydrogen is essential to petroleum refining, a critical industry for U.S. domestic manufacturing and energy exports. Strengthening the blue hydrogen supply chain would enhance the resilience of this industry, reduce reliance on foreign energy inputs, and ensure the continued global competitiveness of U.S. fuel exports.

Refineries use hydrogen for hydrocracking, which converts lower-value gas oil into high-value products such as gasoline, jet fuel, and diesel; and hydrotreating, which further enhances petroleum products by removing sulfur and other impurities. In 2023, U.S. refineries demanded more than 80,000 barrels of hydrogen each year for hydrocracking and hydrotreating.[30]

With planned blue hydrogen projects, the U.S. has an opportunity to secure a more diversified and reliable hydrogen supply for refineries. With just half of the flexible planned blue hydrogen, producers could supply up to 17% of hydrogen demand from domestic refineries. Beyond its impact on energy security, expanding blue hydrogen production would also drive job creation and economic growth. The petroleum refining industry directly employs nearly 66,000 Americans and supports an additional 2.5 million jobs through indirect and induced effects.[31]

Transportation

Blue hydrogen provides a viable, low-emissions energy source for trucking that aligns with the industry's operational needs. If 40% of flexible planned blue hydrogen were allocated to trucking via hydrogen fuel cell electric vehicles ("FCEVs"), it could power approximately 3% of all miles driven by single-unit and combination trucks in 2022, representing a meaningful step toward integrating hydrogen into the transportation fuel sector.

The U.S. truck transportation sector, a cornerstone of domestic commerce and industrial supply chains, supports approximately 2.5 million direct jobs and an additional 4 million jobs through indirect and induced effects.[32] By supporting an increased diversification of the fuel mix for long-haul trucking, blue hydrogen can make the

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[30] EIA, *U.S. Refinery and Blender Net Input of Hydrogen* (link)
[31] According to an IMPLAN industry contribution analysis of the petroleum refining sector.
[32] According to an IMPLAN industry contribution analysis of the truck transportation sector.

transportation sector more robust against supply disruptions. Additionally, as a domestically produced, low-emissions fuel, blue hydrogen strengthens U.S. energy security while supporting industrial competitiveness.

Steel

Steelmaking is a critical pillar of the U.S. economy, supporting nearly 1 million jobs through direct, indirect, and induced economic effects.[33] Ensuring the resilience of this industry requires a stable and competitive domestic steel supply, even as global market dynamics shift toward low-embodied carbon steel production.[34] Expanding the blue hydrogen supply chain would strengthen the U.S. steel sector, sustain manufacturing jobs, and enhance the country's position in international trade.

Hydrogen reduces the emissions of steel production by reacting with iron ore to produce direct reduced iron ("DRI") and water vapor. DRI is refined in an electric arc furnace to create low-embodied carbon steel. This process serves as an alternative to traditional blast furnace methods, which produce carbon through the use of coal. Just 10% of the flexible planned blue hydrogen capacity could support approximately 4% of U.S. steel production through the DRI process.

Internationally, demand for low-embodied carbon steel is expected to increase to 30% of the total market by 2050.[35] China is positioning itself to compete in this space, rapidly expanding its low-embodied carbon steel manufacturing capabilities.[36] Scaling up U.S. steel production using blue hydrogen would enhance the global competitiveness of American steel manufacturers, positioning them as preferred suppliers and helping secure access to export markets that increasingly prioritize goods with low embodied carbon.

Conclusions

Unleashing the potential of blue hydrogen with the 45V production tax credit will expand American energy dominance by creating a reliable, low-emissions product from domestically produced natural gas. The industry would support tens of thousands of American jobs and solidify the U.S.' global status as a leading energy exporter. By leveraging the 45V production tax credit, the blue hydrogen sector can solidify

[33] According to an IMPLAN industry contribution analysis of the steel mill sector.
[34] Embodied carbon represents the sum of all carbon emissions released during the life cycle of a material, including raw materials extraction, manufacturing, transportation, use, and disposal.
[35] Watari, T and McLellan, B, *Global demand for green hydrogen-based steel: Insights from 28 scenarios* (link)
[36] Transition Asia, *Will China Win the Green Steel Race?* (link)

America's energy leadership, drive economic growth through job creation, and enhance both domestic supply chain security and global energy dominance.

Important domestic industries such as fertilizer production, petroleum refining, heavy-duty trucking, and steel production can use hydrogen as a key input. The American blue hydrogen industry will not only provide supply chain security for these industries but also create opportunities to export surplus production to reliable trading partners.

The 45V tax credit is not just an investment in energy; it is an investment in America's economic strength, industrial leadership, and long-term global competitiveness. Without it, the U.S. risks ceding ground to international competitors who are aggressively advancing their hydrogen industries. By taking decisive action now, policymakers can ensure that blue hydrogen delivers economic and strategic benefits for decades to come.