U.S. Hydrogen Demand Assessment

December, 2025

CLEAN AIR TASK FORCE

Contents

Section I
Summary

Summary

This summary report aims to contextualize hydrogen's current role in the U.S. industrial economy, particularly within petroleum refining and chemical manufacturing industries, to demonstrate where clean hydrogen deployment can deliver the greatest decarbonization gains in the near term.

Leveraging the most recent available production and facility data from 2023 and 2024, this report estimates that **the U.S. currently produces and consumes about 14 million metric tons (MMT) of hydrogen annually**[1], primarily in existing heavy industries.

Over 90% of U.S. hydrogen demand is concentrated in petroleum refining, ammonia, and methanol production, with refining alone accounting for more than half of the total consumption.

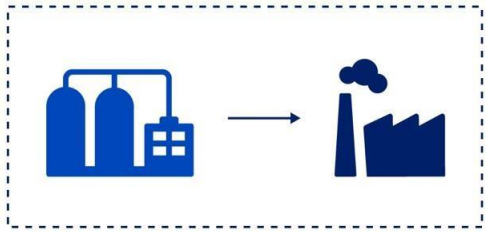
These sectors represent ready-made demand centers and immediate-term decarbonization opportunities for clean hydrogen deployment, especially given existing infrastructure and technical familiarity with hydrogen. This report aims to map these legacy demand centers and take a forward-looking view of emerging and potentially promising applications, such as heavy-duty transport, aviation, and maritime shipping, that are poised to drive future hydrogen demand growth.

Understanding where hydrogen is used today, how much is needed, and where future demand might arise will be essential to guide both federal- and state-level hydrogen strategies. This short report aims to offer a foundation to inform the development of a targeted clean hydrogen industry in the U.S.

[1]Reported estimates for U.S. refinery hydrogen consumption vary widely across sources. This analysis uses ~14 MMT per year as it provides a reasonable total consistent with known dedicated hydrogen production volume and range for process by-products.

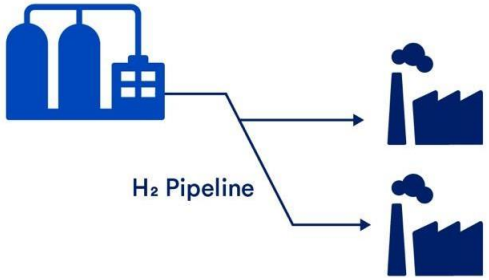
Section II
Hydrogen Production in the U.S.

Types of hydrogen production



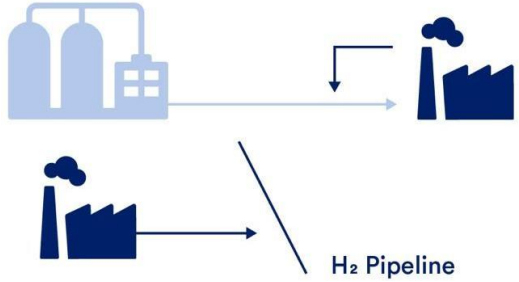
Captive

- Hydrogen is produced on-site.
- Hydrogen plant is owned and operated by final consumer.
- Typical arrangement for refineries, ammonia and methanol plants.
- Large hydrogen consumption volumes generally justify producing hydrogen ‘in-house’.



Merchant

- Hydrogen can be produced on-site or at a distant location.
- Hydrogen supplier owns and operates hydrogen plant.
- Hydrogen consumer enters into a long-term offtake agreement with hydrogen supplier.
- Hydrogen plant may supply one large customer, or numerous customers connected to a pipeline network.



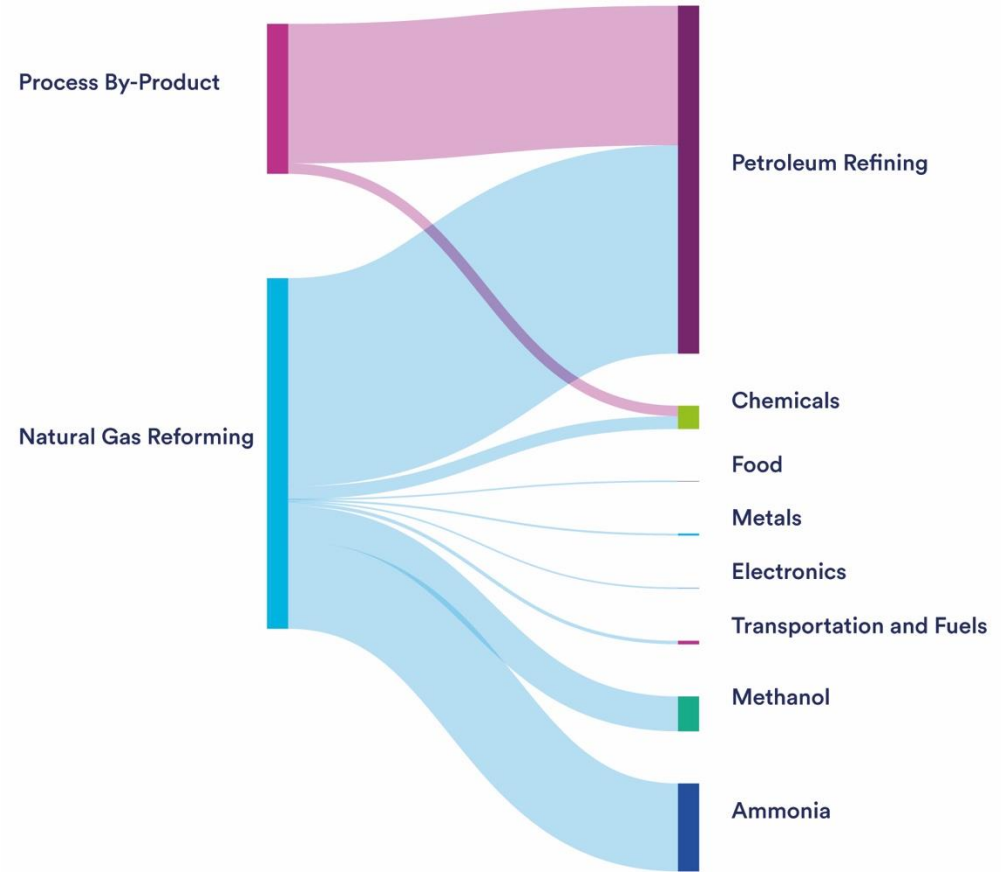
By-product

- Unlike captive and merchant production, byproduct hydrogen is inherently produced as part of the chemical process. In other words, it is not produced ‘on purpose’.
- This hydrogen is generated on site and can supplement hydrogen production from captive or merchant plants (refineries) or can be exported to a hydrogen network pipeline to be used by other users.

U.S. Hydrogen Production Capacity

Total hydrogen production in the U.S. is estimated at **~14 MMT/yr**.[1] Approximately three quarters of this capacity comes from dedicated hydrogen production (including both captive and merchant) while most of the remaining is byproduct hydrogen, primarily from refining and chemicals.

Among all dedicated hydrogen production in the U.S., steam methane reforming (SMR) accounts for about 95%, coal gasification about 4%, while the remaining is produced from electrolysis and partial oxidation of petroleum feedstocks. The latter two are primarily used in pilot projects for mobility, hydrogen refueling infrastructure, and demonstration-scale green hydrogen-to-ammonia or power-to-liquids projects.



[1]Reported estimates for U.S. refinery hydrogen consumption vary widely across sources. This analysis uses ~14 MMT per year as it provides a reasonable total consistent with known dedicated hydrogen production volume and range for process by-products.

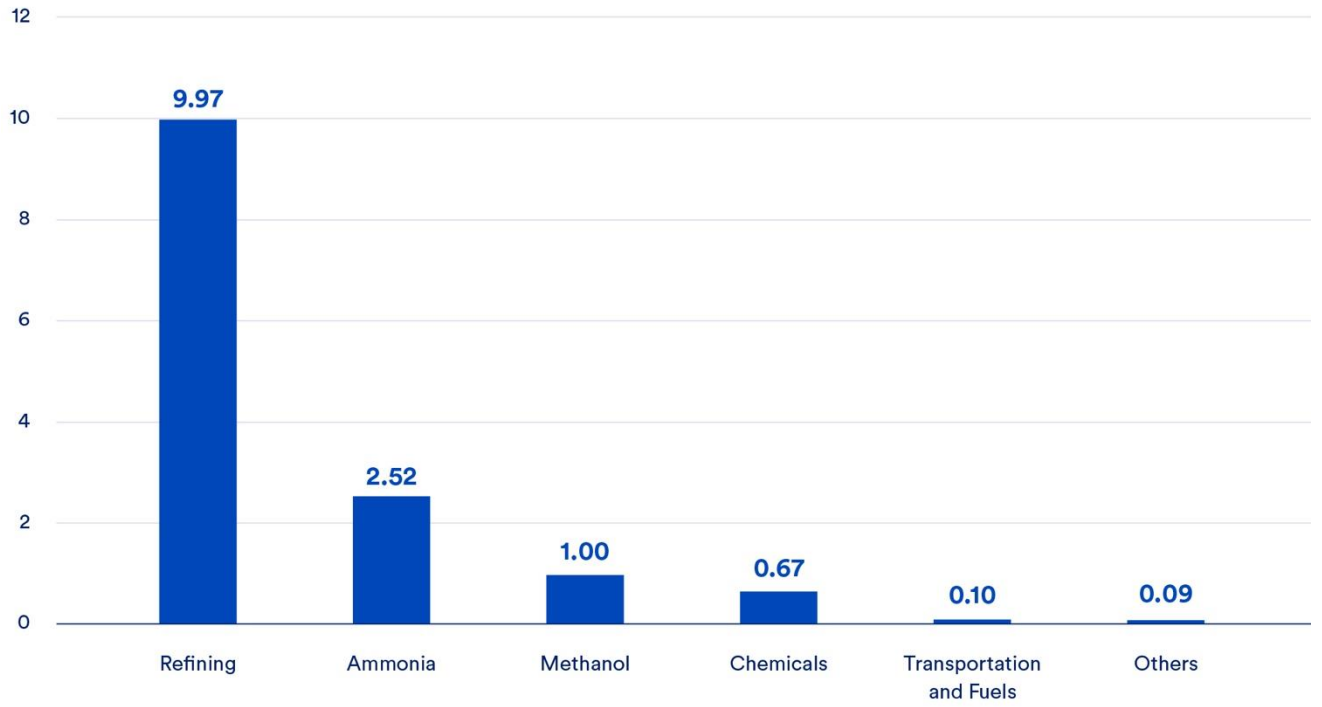
Sources: Author's calculations, EFI Foundation, The Landscape of Clean Hydrogen: An Outlook for Industrial Hubs in the United States, DOE National Clean Hydrogen Strategy and Roadmap; Ruth et al., The Technical and Economic Potential of the H2@Scale Concept within the United States.

Section III
Hydrogen Consumption in the U.S.

Hydrogen Consumption by Sector

The U.S. consumed a total of **~14 MMT per year (MMT/yr)** in 2023.[1] Hydrogen use was primarily concentrated in the industrial sector, with petroleum refining and ammonia accounting for ~94% of hydrogen consumption in the U.S.

Hydrogen Consumption by Sector (MMT/yr)

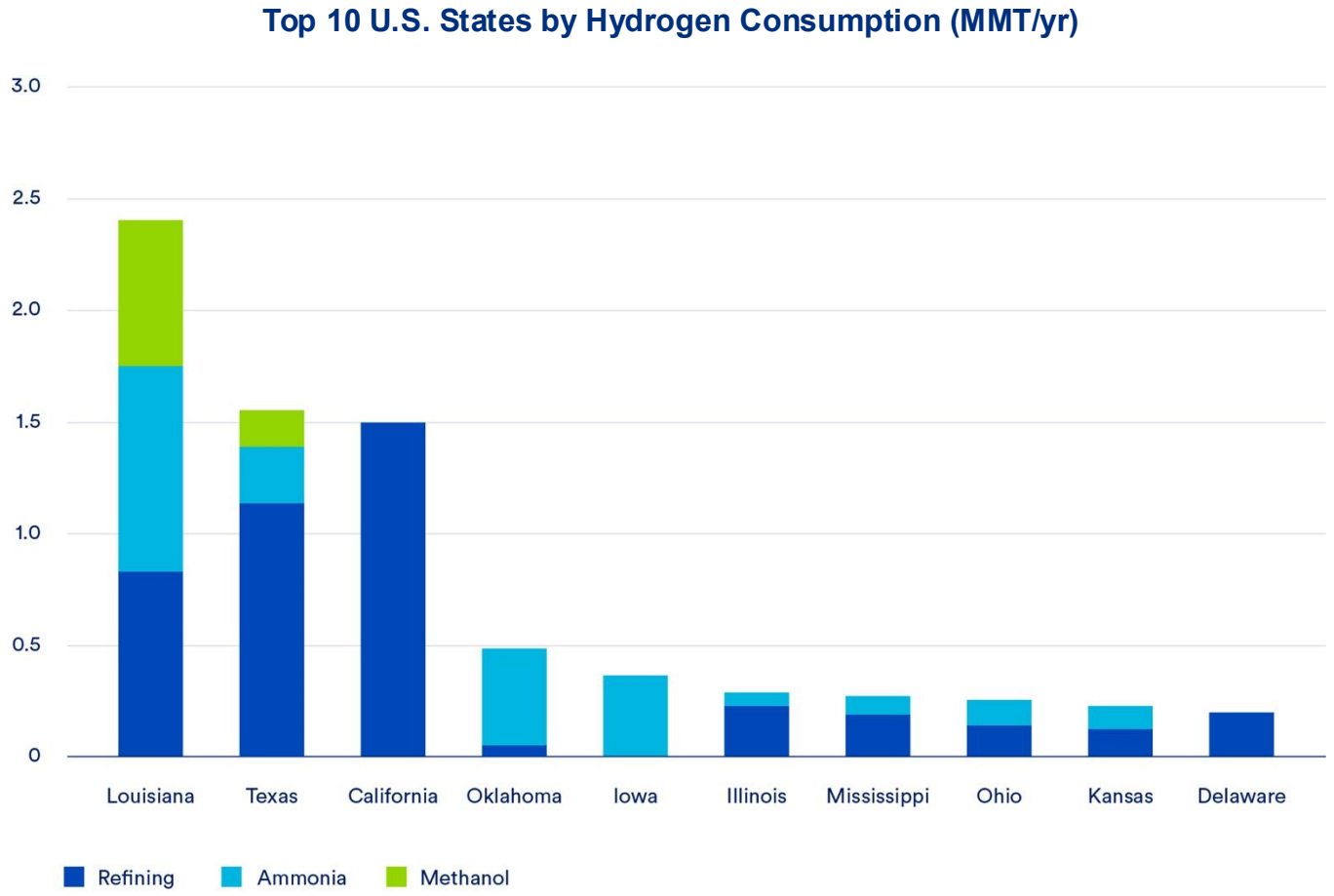


[1]Reported estimates for U.S. refinery hydrogen consumption vary widely across sources. This analysis uses ~14 MMT per year as it provides a reasonable total consistent with known dedicated hydrogen production volume and range for process by-products.

Sources: EFI Foundation; U.S. Environmental Protection Agency (EPA); U.S. Energy Information Administration (EIA)
Note: the "Others" category includes hydrogen consumed by electronics, metals, and food industries.

Hydrogen Consumption by State

Five states, mostly in the U.S. south and west, account for more than 70% of the national dedicated hydrogen production. These states host some of the country's most hydrogen-intensive industrial clusters, primarily driven by refining, ammonia, and methanol production. Targeting decarbonization efforts in these regions with existing hydrogen demand and end users offers the most immediate opportunity to reduce industrial emissions.



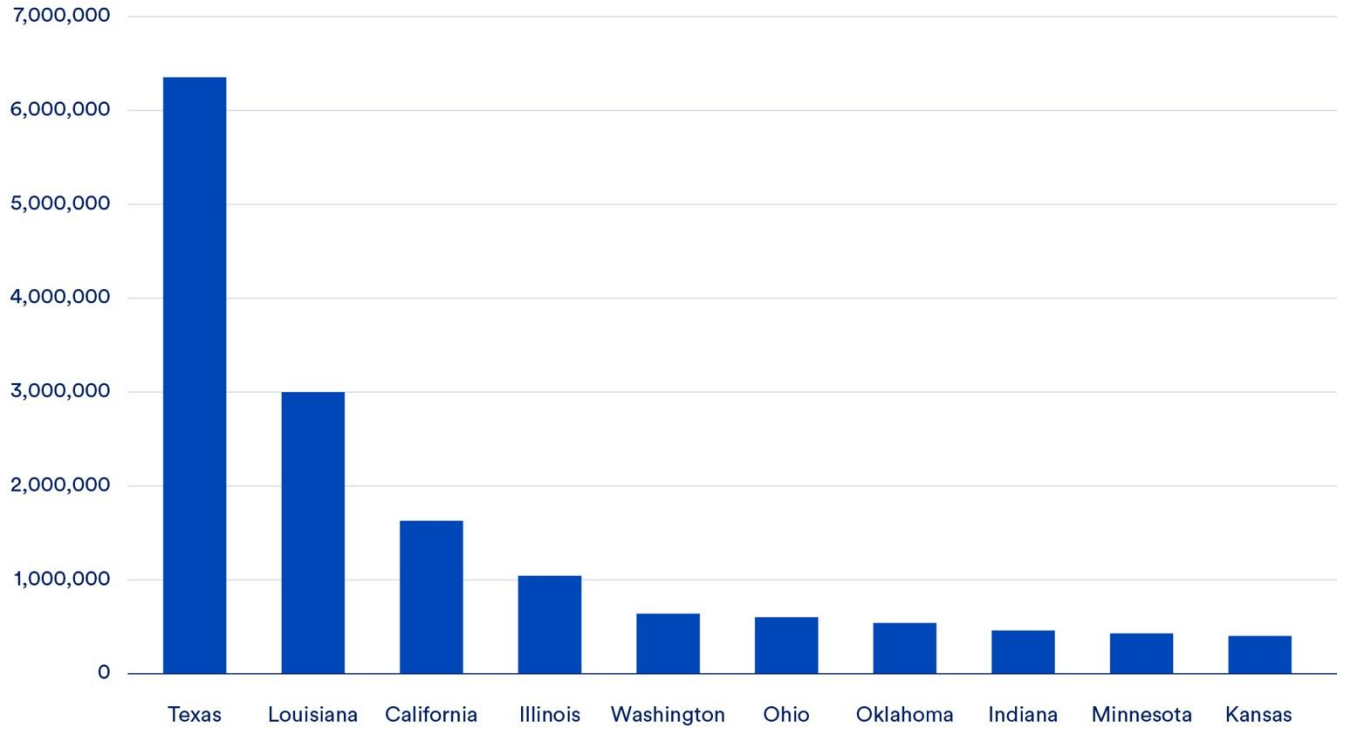
Sources: EFI Foundation; U.S. Environmental Protection Agency (EPA); U.S. Energy Information Administration (EIA)

Petroleum Refining Industry in the U.S.

There are 131 operable crude oil refineries in the U.S. as of January 1, 2025. The combined oil refinery capacity in the U.S. stands at over **18.3 million barrels per calendar day (bpd),** with five states–Texas, Louisiana, California, Illinois, and Washington–accounting for almost 70% of U.S. refining capacity.

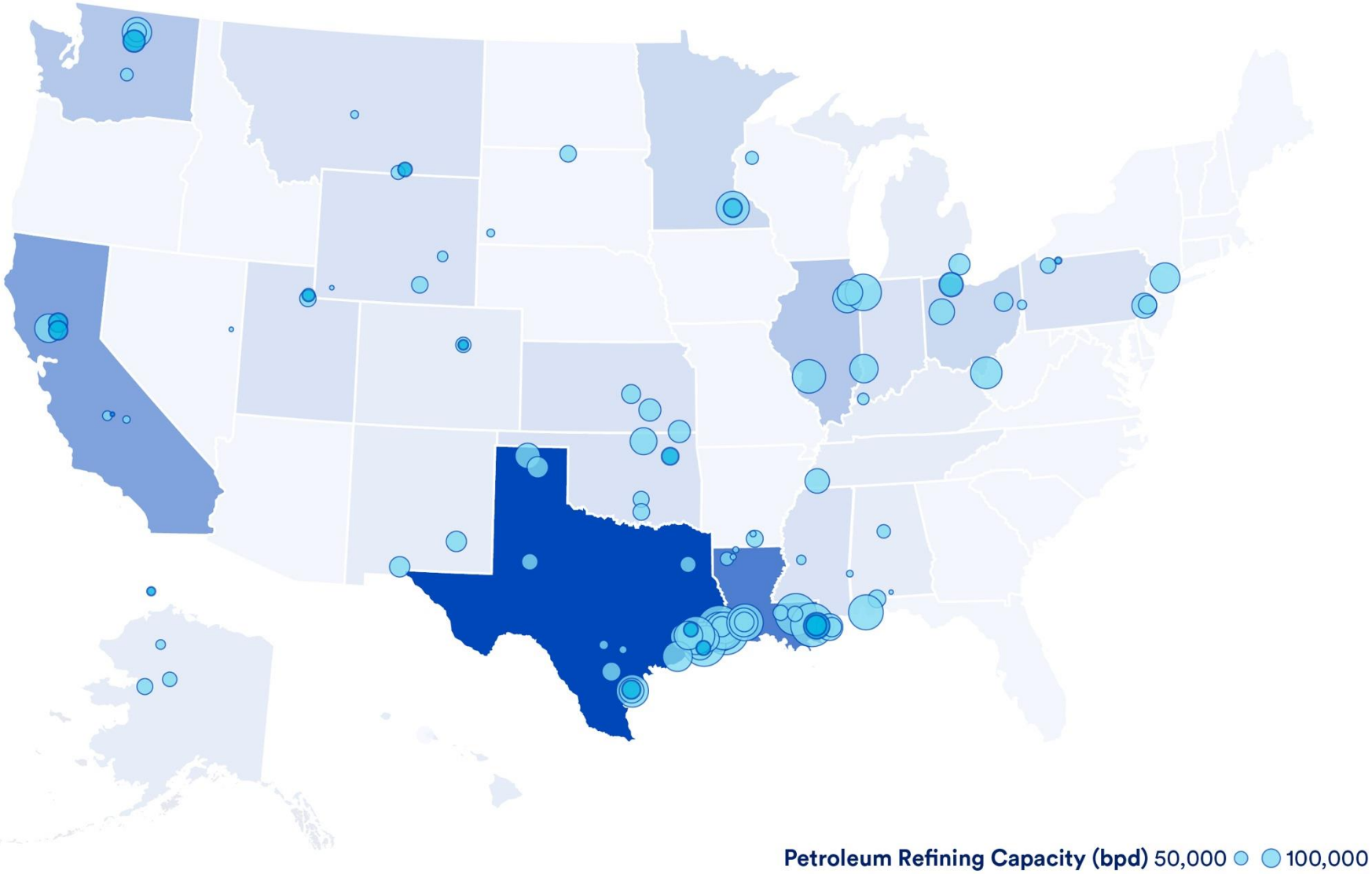
Refinery utilization rates hover around 85% to 95% range, depending on seasonal fuel demand, maintenance cycles, refining margins, crude oil availability, and regulatory constraints.

Top 10 U.S. States by Refining Capacity (bpd)



Source: Energy Information Administration

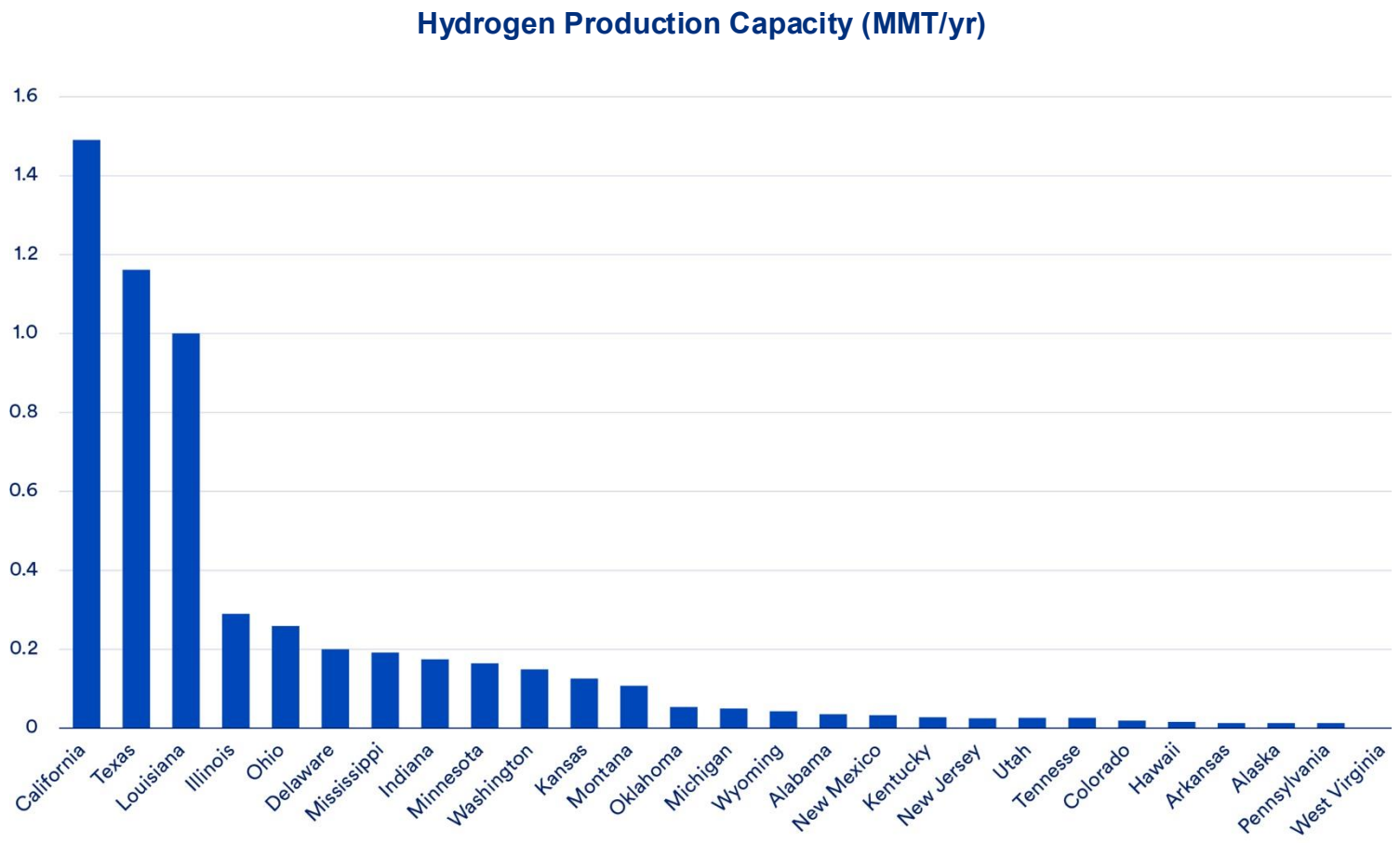
Petroleum Refining Industry in the U.S.



Source: Energy Information Administration

Hydrogen Production in Petroleum Refining in the U.S.

The combined dedicated hydrogen production capacity for the refining industry in the U.S. stands at almost **6 MMT/yr**, where the top five states – California, Texas, Louisiana, Illinois, and Ohio – account for over 70% of this production capacity.



Source: Energy Information Administration, H2 Hydrogen Tools, and CAELP

Hydrogen Consumption in Petroleum Refining

In the U.S., refineries consume large volumes of hydrogen primarily for **hydrotreating and hydrocracking** operations. Hydrotreating removes sulfur, nitrogen, and other impurities from fuel streams, especially for gasoline and diesel, to improve fuel quality. Hydrocracking uses hydrogen to break down heavier hydrocarbons into lighter, higher-value products such as jet fuel and diesel.

Hydrogen consumption in refining includes dedicated hydrogen production from steam methane reforming (SMR) and byproduct hydrogen. On average, ~60% of hydrogen used in oil refining comes from dedicated hydrogen production facilities, both on-site (captive) and purchased from external suppliers (merchant). The remaining ~40% typically comes from by-product hydrogen, which is recovered from other refinery and chemical manufacturing processes such as catalytic reforming or ethylene production, where hydrogen is generated as a byproduct. However, this split can vary significantly by facility, as a refinery's net hydrogen balance depends heavily on its process configuration, available units, and the type of crude processed.

In the U.S. refining sector, approximately **10 MMT/yr** of hydrogen are consumed. Of this, around 6 MMT are produced through dedicated SMR. To decarbonize refining, this hydrogen production would need to be replaced with a low-carbon alternative.

Decarbonization in U.S. Petroleum Refining Industry

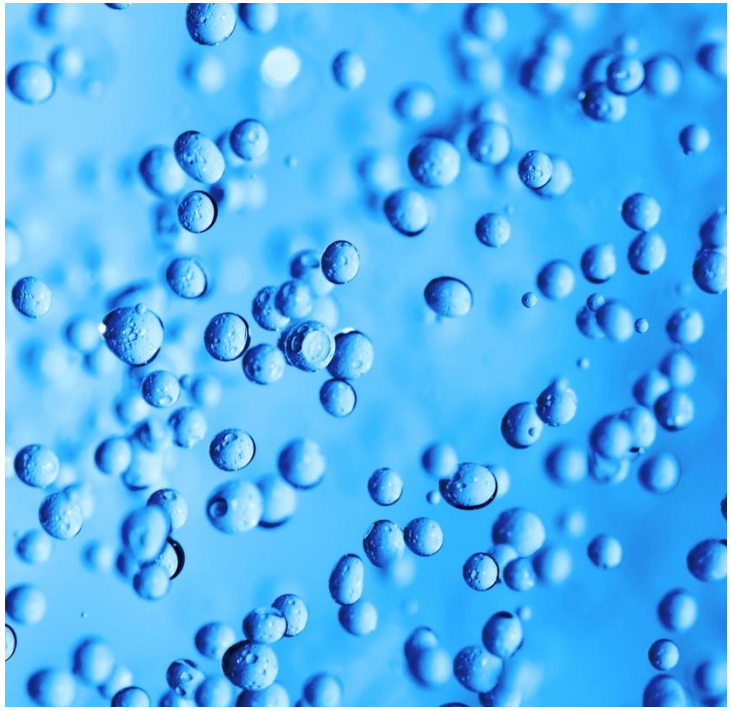
Decarbonization efforts are already under way for petroleum refining industry. Air Products' Port Arthur, TX facility has captured ~1 MMT/yr CO_2 since 2013 from hydrogen SMRs supplying Valero's refinery.

Phillips 66 has also proposed a 5 MW PEM electrolyzer at its Ferndale, WA refinery to supply almost **0.8 MMT/yr of electrolytic hydrogen**, which would cut refinery emissions by reducing reliance on its reformer unit. The project appears to be in the design and permitting phase; however, no information regarding its commissioning timeline has been released publicly.

Ammonia Production in the U.S.

The U.S. had a production capacity of **~17 MMT of ammonia** in 2023 across 38 plants and 33 locations. Operating at about 80% of rated capacity on average, U.S. ammonia facilities consumed **~2.5 MMT of hydrogen** in 2023, almost entirely via captive, on-site SMR.

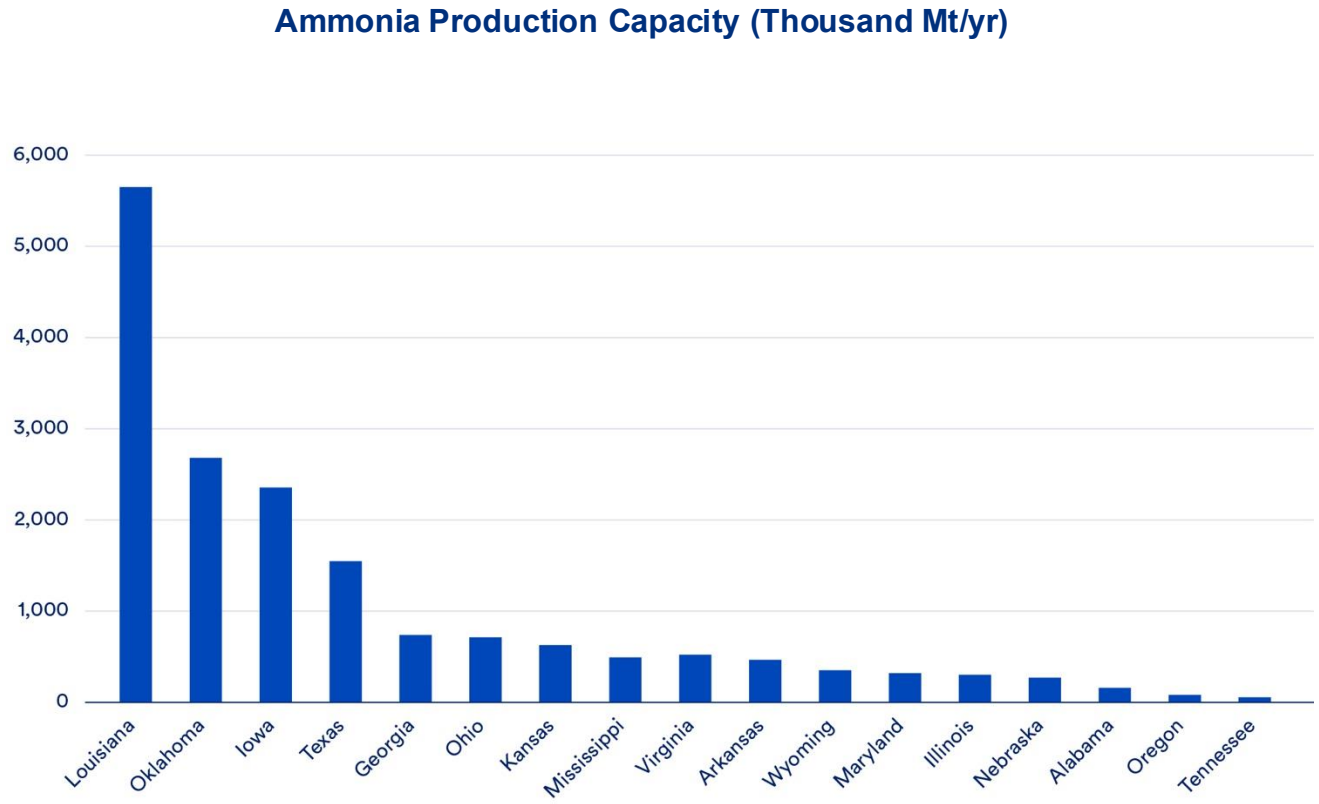
The U.S. used to be a major ammonia importer, but the trade balance has started to shift in recent years. Between 2012 and 2024, ammonia imports dropped from 37% of total domestic consumption to merely 6% as U.S. ammonia production has nearly doubled, though the country is still a net ammonia importer.



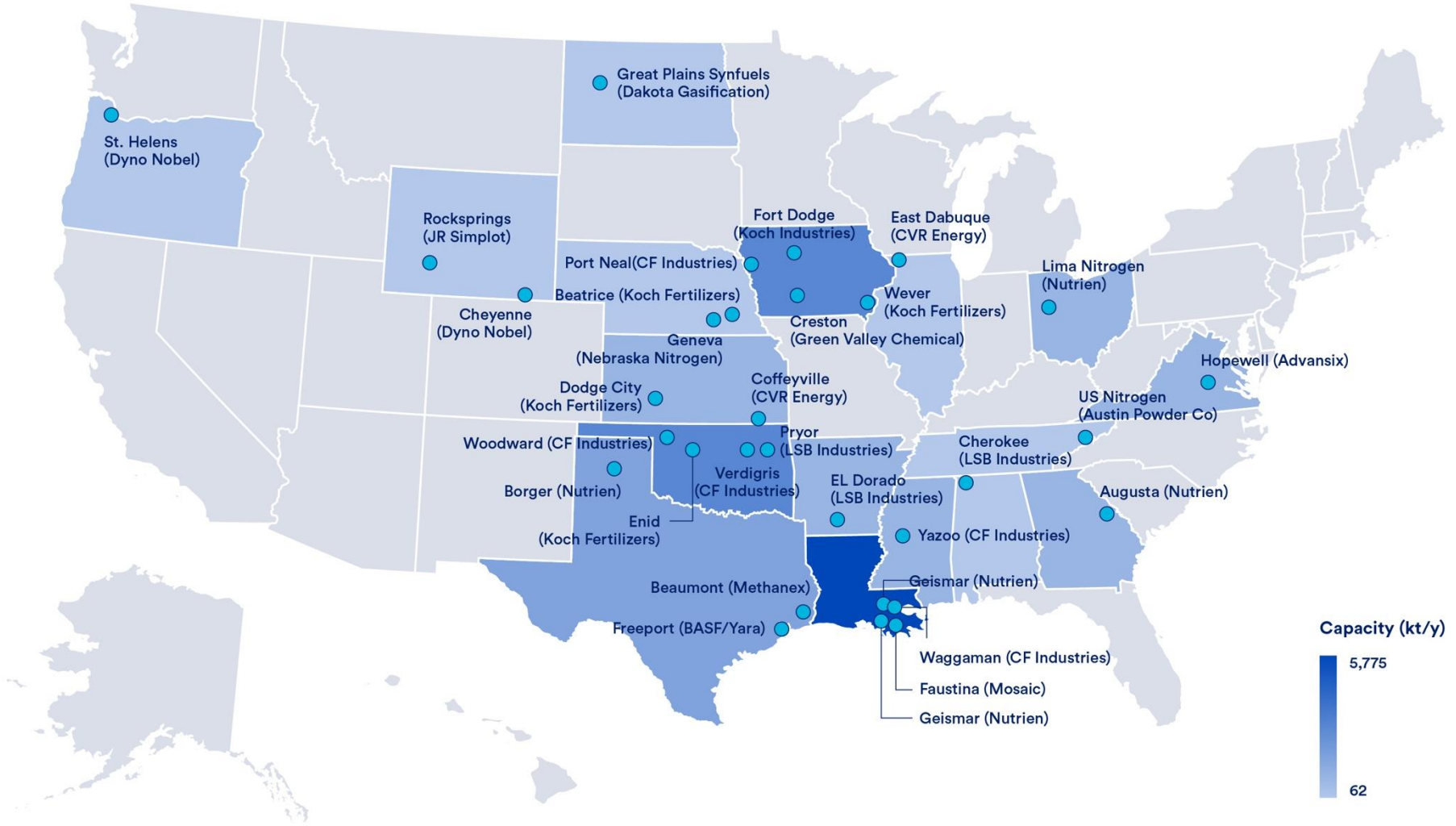
Ammonia Production in the U.S.

Current efforts to decarbonize include:

- An operational ammonia plant in Beulah, ND, that uses hydrogen derived from natural gas with carbon capture to produce ammonia.
- The CapturePoint Carbon Hub in Oklahoma, which captures CO_2 from ammonia production at CVR Partners' Coffeyville plant with plans to expand sequestration capacity to 2-4 MMT/yr.
- Newly proposed ammonia facilities in Donaldsonville, LA by CF Industries, one of which is projected to sequester up to 2 MMT/yr of CO_2 through a new carbon capture & storage (CCS) project and another powered by electrolytic hydrogen.
- Wabash Valley Resources' project in West Terre Haute, IN, recently secured a nearly $1.6 billion loan from the DOE to restart a former coal-gasification plant and produce anhydrous ammonia using coal/petcoke feedstock, combined with carbon capture and the underground storage of roughly 1.6 to 1.7 MMT CO_2 per year.



Ammonia Production in the U.S.

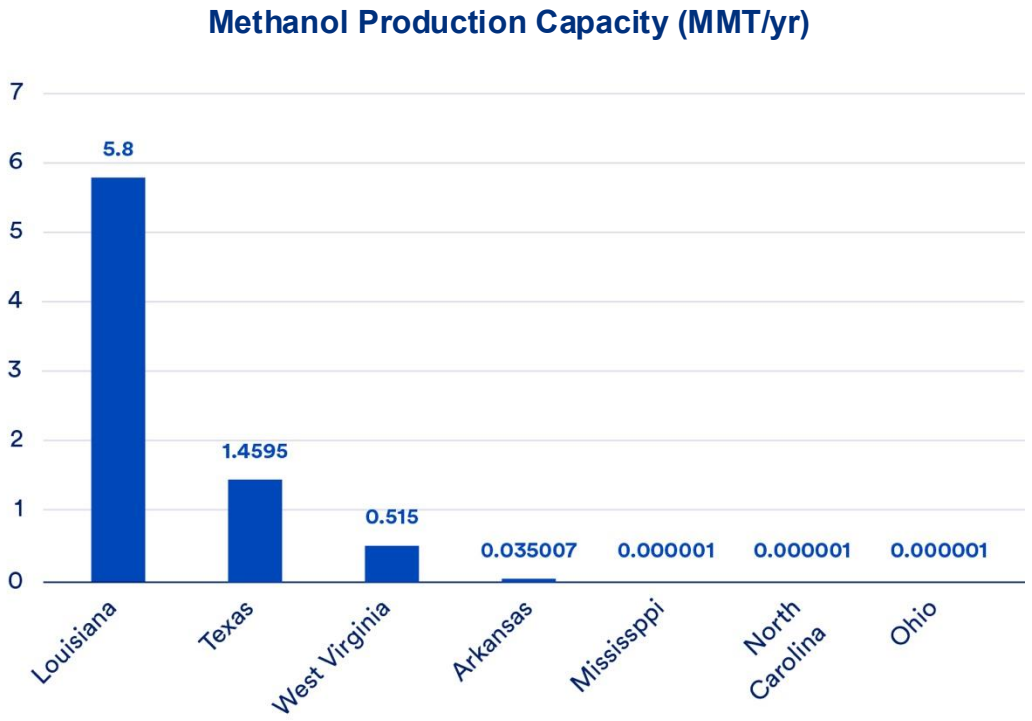


Powered by Bing

Methanol Production in the U.S.

The U.S. consumed an estimated **7 MMT/yr** of methanol in 2023, while domestic production capacity now exceeds **10 MMT/yr**, positioning the country as a net exporter.

Methanol in the U.S. is almost entirely produced from natural gas–derived syngas, via SMR or partial oxidation methods, often co-located with refining and petrochemical facilities. The U.S. methanol production capacity is mostly concentrated in the Gulf Coast, with Louisiana and Texas accounting for over 90%.



Source: Various company annual reports & websites

Note: Production capacity data for certain methanol plants was not found online. The graph provides only a partial image of methanol production in the U.S., given the limited available information, and might not capture all methanol production capacity in the U.S.

Section IV
Hydrogen Uptake from Emerging & Industrial Sectors

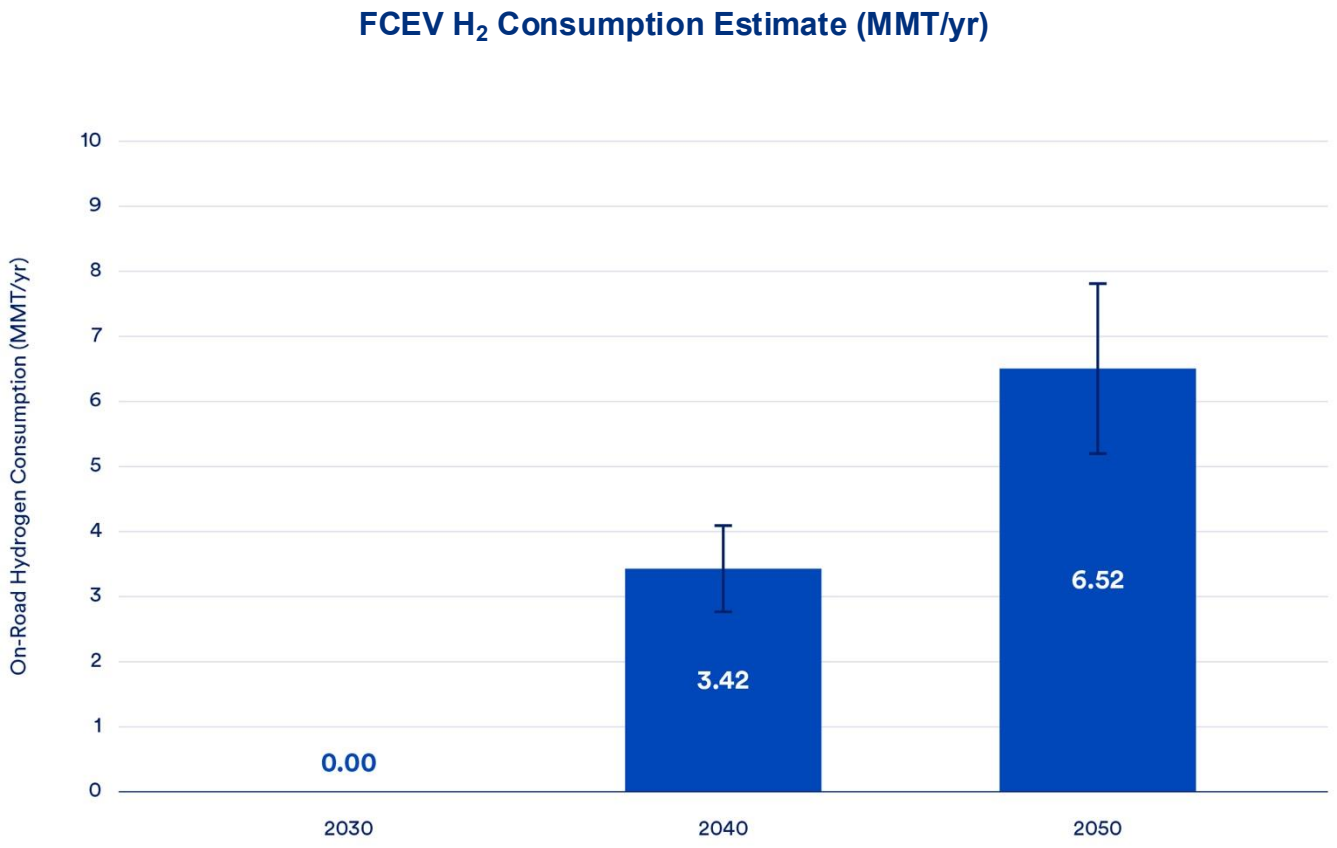
Transportation

By 2050, aviation, on-road, and marine transportation together could account for **40-50 MMT/yr** of hydrogen demand in the U.S., or roughly four to five times the total volume of hydrogen consumed and produced today. Ramping up hydrogen production and deployment will be critical to decarbonizing transportation modes that are difficult or impossible to electrify.

Nevertheless, uncertainties remain around cost trajectories and technology readiness, particularly with shifting policy momentum under the current administration.

Transportation: On-road

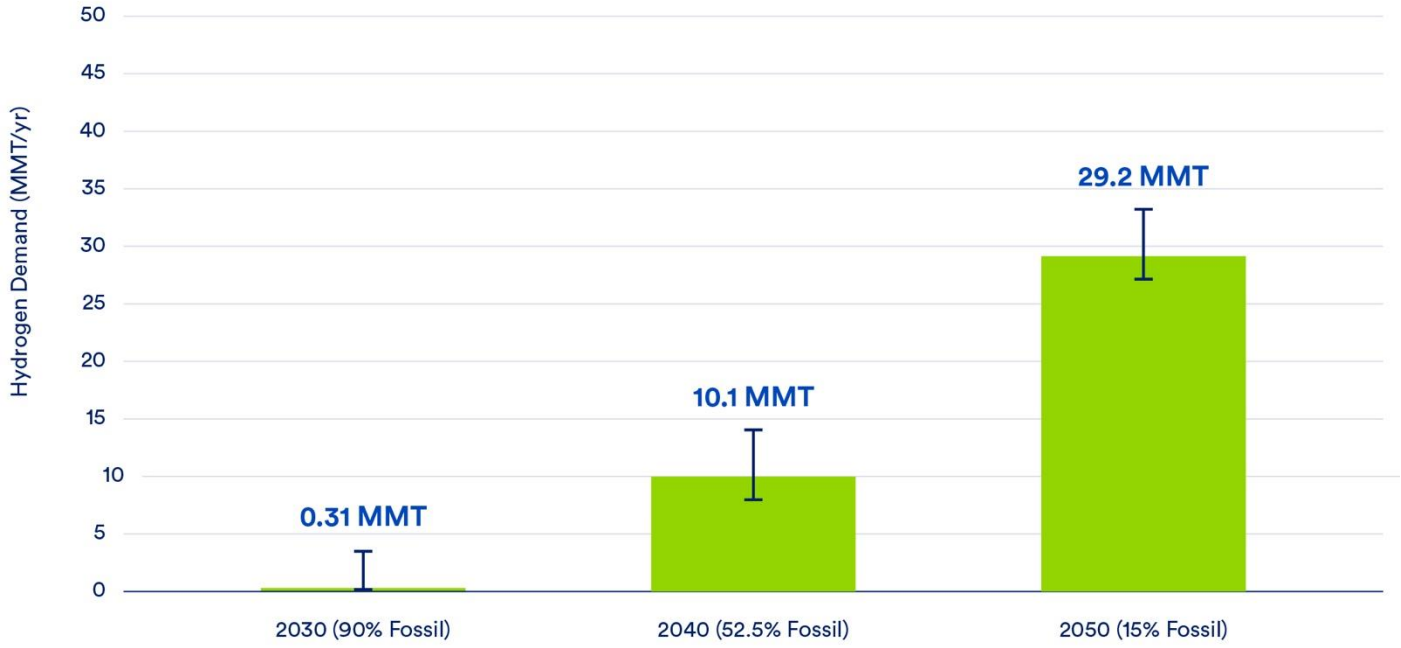
The amount of hydrogen consumed by the transportation sector in the U.S. today is minimal, but projections indicate steady growth as fuel-cell adoption expands and the cost of hydrogen fuel drops in the next few decades. At the baseline price of $4/kg H_2, demand is expected to reach roughly **3.4 MMT/yr by 2040** and about **6.5 MMT/yr by 2050**. If the price drops to $3/kg H_2, hydrogen demand is projected to reach **11.6 MMT/yr and 23.41 MMT/yr by 2040 and 2050**, respectively.



Source: Per author's calculations, see Appendix.

Transportation: Aviation

Hydrogen used for aviation sector[1] in the U.S. is negligible today and will likely remain so until at least 2030 as fossil-based fuel will dominate until then. Hydrogen demand in aviation is projected to grow to **10.1 MMT/yr by 2040 and 29.2 MMT/yr by 2050**, where 52.5% and 15% of aviation fuel in the U.S. will be fossil-based, respectively.



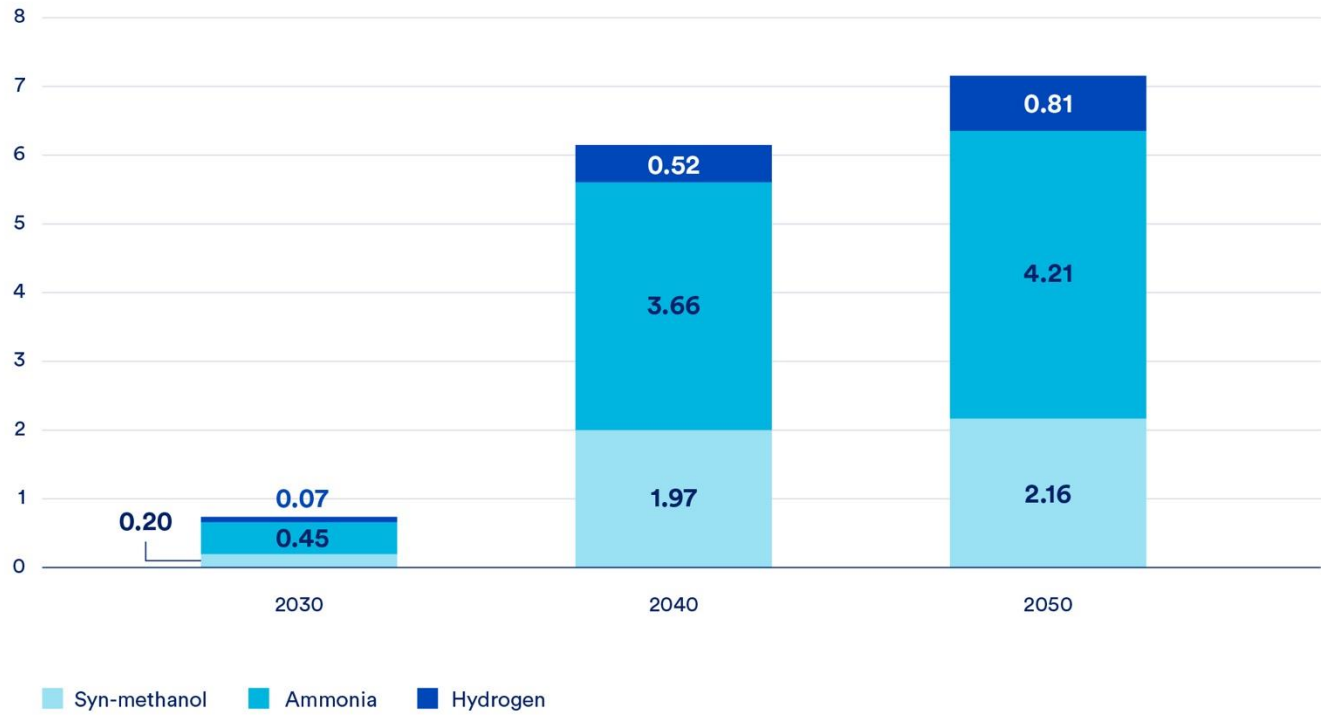
[1]Refers to hydrogen (or hydrogen-derived fuel) loaded onto aircraft for flights departing from U.S. airports, supplied by domestic U.S. refineries and pipelines.

Source: Per author's calculations, see Appendix.

Transportation: Marine

Under business-as-usual assumptions, U.S. marine fuel is projected to drive steadily increasing hydrogen demand, reaching **~6 MMT/yr by 2040 and just over 7 MMT/yr** by midcentury.

H_2 Consumption (MMT) by Marine Fuel Type



Note: There are other marine fuels, including bio-methanol, hybrid BE, and fossil, that are likely to be part of the fuel mix but do not consume hydrogen.

Source: Per author's calculations, see Appendix.

Transportation: Marine

In addition to the baseline forecast, the U.S. could see significant upside if it becomes a competitive bunkering hub for international shipping. Depending on the share of the global bunkering market it captures, this could generate an additional **0.75 to nearly 5 MMT/yr** of hydrogen demand — pushing total U.S. marine hydrogen demand to roughly **8 to 11+ MMT/yr** by 2050.

2050 U.S. Marine Bunkering Demand Scenarios

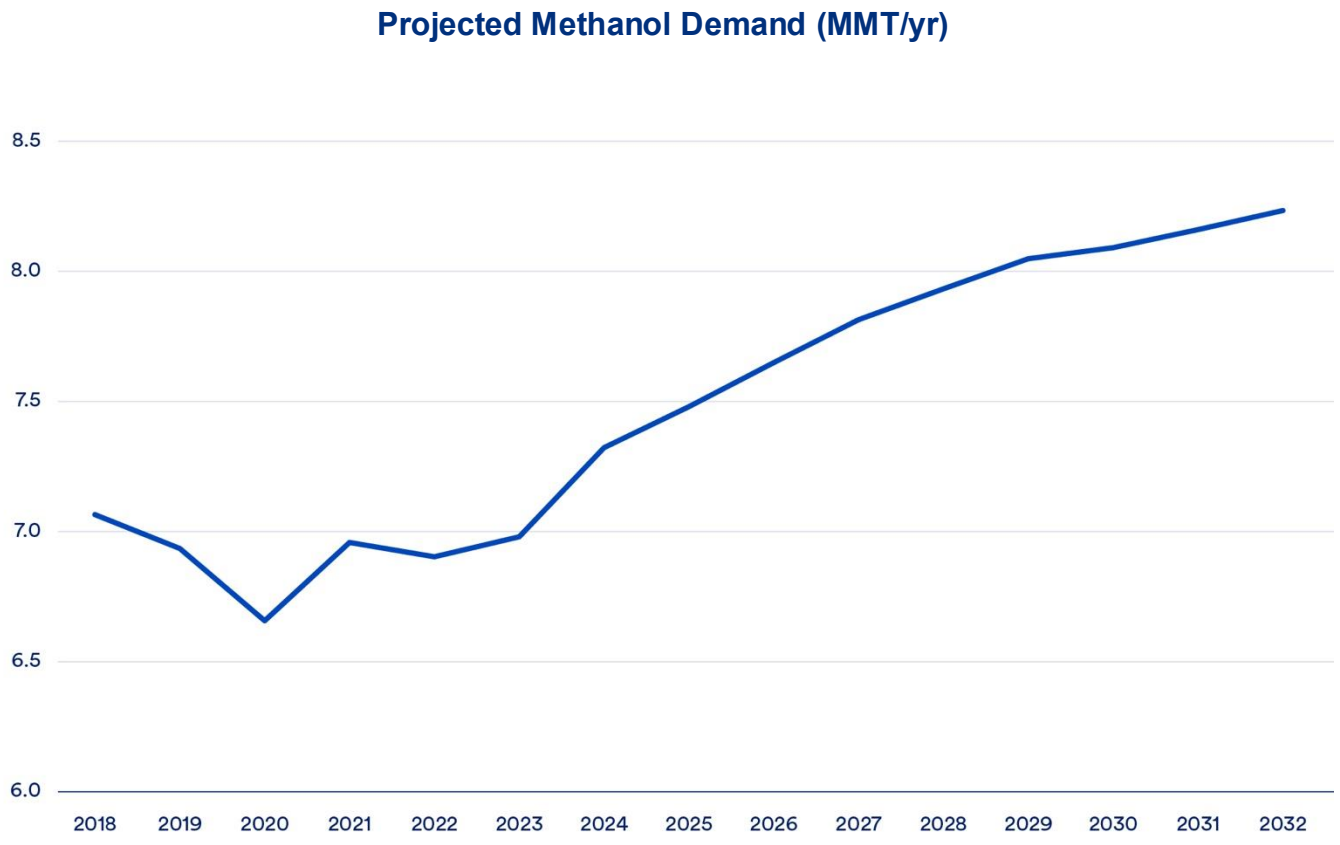
Scenario	Market share to U.S.	Additional MMT of H_2	Total H_2 demand (2050 U.S. consumption plus bunkering scenarios)
Low	5%	0.75	7.92
Medium	15%	2.24	9.42
High	30%	4.49	11.66

Heavy Industry: Iron & Steel

Demand of Ore-based metallics (OBMs), such as pig iron and direct reduced iron (DRI) is expected to remain around 30 MMT/yr. Depending on steel production configuration (replacement of blast furnaces with hydrogen direct-reduced iron facilities), the theoretical amount of hydrogen to meet 30 MMT/yr of DRI is **1.95MMT/yr** of hydrogen.

Heavy Industry: Methanol

U.S. methanol demand remained relatively flat from 2018 to 2023, averaging just under 7 MMT/yr, but is projected to grow steadily through 2032, reaching over **8.2 MMT/yr** with an annual growth rate of over 10%. This upward trajectory is driven by expanding use in industrial and petrochemical applications, as well as rising demand in the clean energy sector, like marine fuel blending and hydrogen carrier systems.

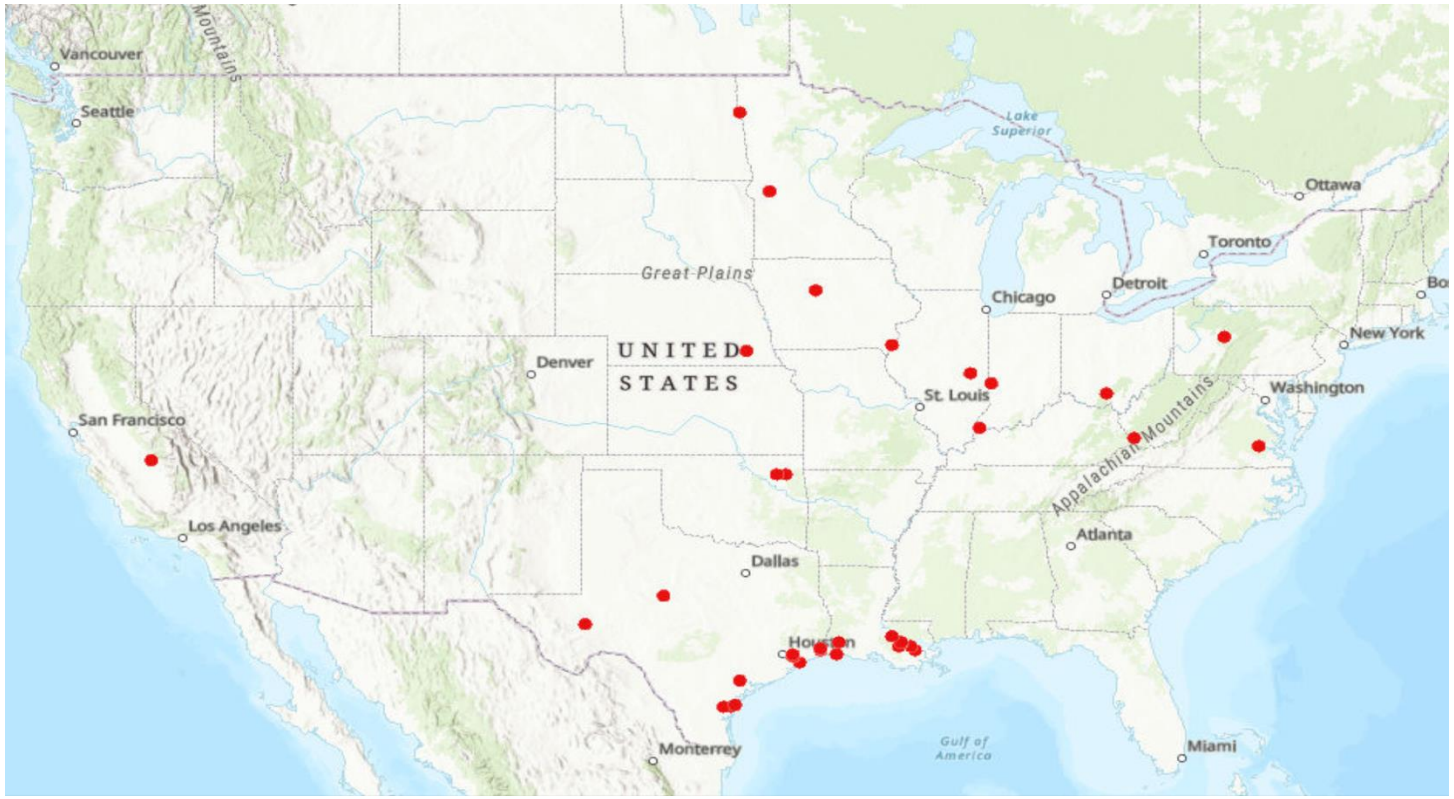


Source: Argus Media & Consulting

Heavy Industry: Ammonia

As of 2025, there are 56 new ammonia projects proposed or under construction, including planned facility expansions, across the U.S. If all are completed, U.S. annual ammonia production would grow by more than **60 MMT** over the next five years. This increase alone would drive an additional hydrogen demand of over **11 MMT/yr**.

New Ammonia Projects in the U.S.



Map made with ArcGIS
Source: Oil & Gas Watch

Section V
Conclusion

Conclusion

Hydrogen already plays a central role in the U.S. industrial economy. Today, hydrogen production alone accounts for over 100 MMT/yr of CO_2 – comparable to the total emissions of a smaller mid-sized industrialized nation.

The majority of US hydrogen consumption is driven by heavy industry sectors, like refining, ammonia, and methanol production. These sectors operate in large, concentrated industrial corridors, particularly along the Gulf Coast, making them the anchor points for clean hydrogen and Carbon Capture, Utilization, and Storage (CCUS) deployment.

Looking forward, our demand projections show that hydrogen's role in the U.S. economy is poised to expand. Heavy-duty transport, aviation, marine fuels, and steelmaking all represent potential sources of significant future demand uptake, sectors where hydrogen or hydrogen-derived fuels may play an essential role in long-term decarbonization.

Together, these findings point to a clear strategy:

- Decarbonize sectors with existing use of hydrogen
- Prepare for growth in sectors where hydrogen is an indispensable solution
- Prioritize deployment in industrial regions where production, infrastructure, and offtake can scale efficiently

Grounding U.S. hydrogen policy in these priorities will deliver immediate climate benefits while positioning the sector to meet high-value, strategic demand in the decades ahead.

Appendix: Methodology

H_2 conversion factors

- The report assumes a conversion factor of 0.178 to translate ammonia production capacity into hydrogen capacity. This figure reflects the hydrogen content of ammonia by mass: each ammonia (NH_3) molecule contains three hydrogen atoms, and hydrogen accounts for approximately 17.75% of ammonia's molecular weight. Therefore, one metric ton of ammonia stores roughly 0.178 metric tons of hydrogen. This mass-based conversion is a standard approach for estimating the hydrogen yield potential from ammonia facilities.
- The report uses a conversion factor of 0.125 to estimate hydrogen capacity from methanol production capacity. Methanol (CH_3OH) contains four hydrogen atoms per molecule, which make up about 12.5% of its total weight. As a result, one metric ton of methanol contains about 0.125 metric tons of hydrogen.

Capacity factors/utilization rate

- Ammonia plants are running at around 80% utilization rate globally. Well-optimized methanol plants are presumed to operate at ~90% capacity factor on average. U.S. refineries run at ~85 to 90% utilization rate in most of the recent decade. In 2024, U.S. refineries operated at 90.6% of their operable capacity on average.
- The report thus adopts a 90% capacity factor (assuming facilities operate at 90% production capacity) to convert installed capacity to expected production volume.

Appendix: Methodology

Hydrogen Demand Projection for the Transportation Sector

- Hydrogen demand for aviation: Projections are drawn from Chapter 6 of Clean Air Task Force (CATF) 2024 Paper on Decarbonizing Aviation: Enabling Technologies for a Net-Zero Future, which details hydrogen and e-fuel demand trajectories for domestic and international aviation under decarbonization scenarios.
- Hydrogen demand for on-road segment: Estimates use hydrogen modeling results for light-, medium-, and heavy-duty vehicle segments in CATF 2023 paper.
- Hydrogen demand for marine: Demand estimates are derived from the DOE EERE Marine Action Plan, which provides fuel-mix assumptions, total marine energy consumption, and vessel-type breakdowns used to calculate hydrogen and ammonia uptake in maritime shipping.

About Clean Air Task Force

Clean Air Task Force (CATF) is a global nonprofit organization working to safeguard against the worst impacts of climate change by catalyzing the rapid development and deployment of low- carbon energy and other climate-protecting technologies. With more than 25 years of internationally recognized expertise on climate policy and a fierce commitment to exploring all potential solutions, CATF is a pragmatic, non-ideological advocacy group with the bold ideas needed to address climate change.

Report Authors

Amy Ouyang
Hydrogen Associate
aouyang@catf.us

Thomas Walker
Senior Manager,
Transportation Technology
twalker@catf.us

Sam Bailey
Industrial Decarbonization
Manager
sbailey@catf.us

Rachel Starr
Senior U.S. Policy Manager,
Hydrogen & Transportation
rstarr@catf.us

Thank you