

December 1, 2022

Via email to hydrogenfuelcells@ee.doe.gov

Dr. Sunita Satyapal
Hydrogen and Fuel Cell Technologies Office
U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
Re: Public Comment on Draft DOE National Clean Hydrogen Strategy and Roadmap

Dear Dr. Satyapal:

The American Petroleum Institute (API) appreciates the opportunity to comment on the Department of Energy's (DOE's) draft National Clean Hydrogen Strategy and Roadmap (hereafter referred to as the "draft roadmap"), originally published September 22, 2022. API recognizes this effort as DOE's first attempt to incorporate input from industry and other stakeholders in the development of a draft Roadmap, as required by the Bipartisan Infrastructure Law (BIL), also known as the Infrastructure Investment and Jobs Act (IIJA).¹

The oil and natural gas industry has a significant role to play and interest in the growth of a clean hydrogen economy.

As an established supplier of feedstock for hydrogen production, consumer of hydrogen, and leader in CO₂ management, and expected producer, transporter, and consumer of low-carbon hydrogen, the oil and natural gas industry has a significant role to play and interest in the establishment of a well-developed national clean hydrogen Roadmap. In addition to being both a producer and consumer of hydrogen, the oil and gas industry is an essential component in the ability to safely and reliably move hydrogen within and across regions of the US. Already, the industry is engaged in efforts to assess maximum hydrogen and natural gas blend limits, the best potential approaches to address leakage and corrosion issues, and efforts to enable combustion of hydrogen and hydrogen-natural gas blends. Additionally, API's Global Industry Services group is evaluating existing standards for the potential to be updated to account for the different properties of hydrogen in materials and equipment. As the industry looks to engage in the development of a low-carbon hydrogen economy, it is in the industry's best interest to ensure that it is built on a solid foundation and plan that can help to ensure smooth deployment of cost-competitive technologies.

¹ Public Law 117-58 (November 15, 2021) 135 Stat. 1010

DOE should continue to engage with stakeholders through listening sessions and workshops and additional comment periods as updated roadmaps are produced.

API was disappointed by the short comment period offered by DOE on the draft roadmap. Looking forward, DOE can offer additional opportunities for engagement through listening sessions and workshops, as indicated in the draft roadmap and should not backslide on this commitment.² Additionally, DOE should hold additional comment opportunities on draft iterations of future roadmaps (to be updated not less than every 3 years), with longer comment periods.

API is supportive of DOE's efforts to advance a clean hydrogen economy and recognizes the essential role that hydrogen can play in meeting emission goals.

As noted within the draft roadmap, hydrogen has a key role to play in meeting the greenhouse gas emission goals of the nation and of the private sector. Hydrogen's potential for emissions reductions will be critical in meeting the current administration's goal to reduce emissions by 50 - 52% by 2030, and to reach net-zero by 2050. An ICF study commissioned by API found that hydrogen produced from natural gas with carbon capture and storage (CCS) and produced from electricity and other energy sources could eliminate up to an additional 180 million metric tons of GHG emissions on average per year through 2050 and save over \$450 billion cumulatively through 2050 when hydrogen incentives are uniformly provided based on a per ton of GHG emissions reduced.³ API analysis of the study's finding shows that uniform incentives for producing hydrogen from natural gas, electricity and other energy sources are critical to meeting the U.S. Department of Energy's goal of 50 MMT of clean hydrogen produced by 2050, as laid out in the recently published National Clean Hydrogen Strategy and Roadmap. As highlighted in the draft roadmap, by enabling significant emissions reductions in the industrial, transportation, and power sectors, the deployment of clean hydrogen will be essential in meeting the nation's climate-related goals.

Clean hydrogen presents decarbonization opportunities for sectors in which GHG emissions are generally more difficult to abate, such as heavy industry and transportation, allowing these sectors to progress towards their respective emissions-reduction goals. For instance, the International Fertilizer Association is committed to playing its part in curbing global GHG emissions below 1.5C, the goal of the 2015 Paris Agreement, recognizing that "an efficient transition to economy-wide, net-zero emissions is the only way to limit global warming."⁴ As stated in the draft roadmap, ammonia and methanol manufacturing can be decarbonized by over 90% by using clean hydrogen as a feedstock. By enabling the production of low-carbon ammonia, clean hydrogen supports the fertilizer industry in contributing to the ambitions of the Paris Agreement.

² DOE, "National Clean Hydrogen Strategy and Roadmap (Draft)" September 2022. At page 2, "DOE will elicit stakeholder feedback through opportunities, such as workshops and listening sessions, and use this feedback to finalize the report and then develop updates as required by the BIL." This stands in contrast to language on the DOE website, "DOE *may* elicit stakeholder feedback through additional opportunities such as workshops and listening sessions." (Emphasis added). <https://hydrogen.energy.gov/clean-hydrogen-strategy-roadmap.html> Accessed 11/18/2022.

³ ICF, "The Potential Role of Blue Hydrogen in Low-Carbon Energy Markets in the US." October 12, 2022.

⁴ [Climate Change \(fertilizer.org\)](https://www.fertilizer.org/newsroom/2022/04/20/clean-hydrogen-fertilizer)

Additionally, the Global Cement and Concrete Association (GCCA) has published a 2050 Industry Roadmap for Net-Zero.⁵ GCCA's Roadmap includes savings in clinker production as a key action for a net-zero future, with utilizing hydrogen as a fuel included as a component of the action. GCCA's Roadmap also highlights the availability of sufficient hydrogen for use by the industry as a key component to meeting this ambition.

In the steel industry, companies are incorporating hydrogen as part of their strategy to reach GHG emissions reduction goals. For example, US Steel has an ambition to reach net zero by 2050, including through the use of hydrogen-based direct reduced iron (DRI). US Steel expects that if their natural gas-based DRI were converted to green hydrogen, company emissions would decrease an additional 20-40%.⁶ They also include expansion of electrification and hydrogen use as fuel to further reduce emissions.

By enabling GHG emissions reductions in hard-to-abate sectors, the deployment of clean hydrogen supports both the public and private sector in reaching their respective emissions reduction goals.

DOE's draft roadmap does not address key elements of the BIL requirements and suggests a failure to fully consider the advantage that thermal production pathways can provide to advance a low-carbon hydrogen economy in the near-term.

As noted by DOE, this draft roadmap is intended to respond to the requirements of section 40314 of the BIL.⁷ However, there are key elements of the BIL requirements that the draft roadmap does not address, or appears to address only in passing. The BIL directs DOE to identify "economic opportunities for the production, transport, storage, and use of clean hydrogen that exist in the major shale natural gas-producing regions of the United States."⁸ While there is some discussion of the ability for low-carbon hydrogen to proliferate along the Gulf Coast based on the prevalence of oil and gas development, existing consumers of hydrogen, and suitable geography for CCS, and there is some discussion of advancement in the Midwest, there is no clear discussion of opportunities that exist in major shale natural gas-producing regions of the US. DOE's discussion of regional networks and a regional focus instead focuses on the deployment of hydrogen hubs. While API recognizes the value and importance of the H₂Hubs program, this does not satisfy the requirement of the BIL as noted above. In fact, when discussing the regional production potential, DOE has included two figures (27 and 28) that only reference renewable and biomass energy resources.⁹ There is no discussion of natural gas resources to be found.

Throughout the draft roadmap, there is significant attention on electrolytic production pathways and the challenges facing those approaches in contrast to little discussion of thermal pathways. While passages often reference the use of fossil fuels with CCS along with other production pathways, there are some notable omissions regarding thermal pathways and other areas where issues are assigned to thermal pathways that are not unique to those approaches. For instance, DOE frequently references the

⁵ [GCCA-Concrete-Future-Roadmap-Document-AW-2022.pdf \(gccassociation.org\)](#)

⁶ [Roadmap to 2050 - www.ussteel.com](#)

⁷ DOE Draft Roadmap, p5

⁸ Public Law 117-58 (November 15, 2021) 135 Stat. 1010

⁹ DOE Draft Roadmap, p67-68

Hydrogen Shot program and its goal of reducing the cost of clean hydrogen production from a range of sources (or unspecified production approaches¹⁰) to "by 80 percent to \$1 per 1 kilogram in 1 decade."¹¹ Reading further however, the draft roadmap makes virtually no additional mention of lowering the costs of thermal pathways such as auto-thermal reformation (ATR) or methane pyrolysis. In fact, when discussing the higher cost associated with clean hydrogen in the context of "Barriers to Achieving the Benefits of Clean Hydrogen" the draft roadmap only references the need to lower the cost of electrolytic production pathways. Moreover, the text reveals that the "80 percent" reduction referenced by the Hydrogen Shot program is specific to "low-volume PEM electrolysis."¹² This is reinforced by Figure 15, which seeks to provide "The status of production, delivery and dispensing, and onboard storage costs relative to the cost projection for high-volumes and the ultimate cost target for market competitiveness," but only includes production cost information for "electrolytic hydrogen."¹³

While the draft roadmap includes the strategic goal of dramatically lowering the cost of clean hydrogen by developing sustainable and supply-resilient pathways, including electrolysis, thermal conversion with CCS, and advanced or hybrid production pathways,¹⁴ it is clear that DOE's focus is overwhelmingly on electrolytic pathways at the expense of other pathways that may already provide cost benefits. Notably, Figure 10 indicates that the current cost of steam methane reforming with CCS ranges between roughly \$1.25 and \$2.25/kg - much closer to DOE's Hydrogen Shot production cost goal. Less costly hurdles may remain that are preventing thermal pathways from reaching DOE's goal, yet they may not be receiving the attention needed to accomplish that goal. Additionally, as DOE notes, other pathways such as ATR and methane pyrolysis may offer advantages like lower costs or lower emissions, yet these approaches are not receiving the same attention as electrolytic pathways. While DOE has two specific projects oriented toward advancing electrolytic technologies noted in the draft roadmap (H₂NEW and HydroGEN) there are no similar programs to advance cutting edge thermal approaches. In a review of recent funding opportunity announcements from DOE, API found that just 13% of the total announced funding opportunities associated with production of clean hydrogen were allocated to ATR or pyrolysis projects. Most of funding associated with any natural gas-based production pathways has been oriented toward CCS.¹⁵ DOE's workshop on the subject of "Enabling an Accelerated and Affordable Clean Hydrogen Future - Fossil Energy Sector's Role" found that while costs of fossil produced clean hydrogen can decrease as production scales up, support will be needed to "'leapfrog' some traditional steps in the technology/technology readiness curve," to accomplish both cost and emission reduction goals.¹⁶

Finally, DOE has assigned specific emission concerns to the fossil fuel-based production with CCS discussion that are universal to all hydrogen production. API recognizes and agrees with DOE on the importance of reducing fossil fuel value chain greenhouse gas emissions, is supporting industry efforts to reduce emissions through programs like The Environmental Partnership, and supports the direct regulation of methane. However, it is not clear why DOE has included a brief discussion of the risk of

¹⁰ DOE Draft Roadmap, p12

¹¹ DOE Draft Roadmap, p12

¹² DOE Draft Roadmap, p36

¹³ DOE Draft Roadmap, p37

¹⁴ DOE Draft Roadmap, p40

¹⁵ API calculation, excluding the \$8 billion announced for the H₂Hubs program.

¹⁶ DOE, "Enabling an Accelerated and Affordable Clean Hydrogen Future - Fossil Energy Sector's Role - Workshop Final Report." September 2021.

hydrogen leaks only in the section regarding fossil fuel-based production with CCS. The brief note on hydrogen leakage risks from hydrogen transport infrastructure, "regardless of primary resource,"¹⁷ should be placed in the following section, "Other System Costs," not alongside fossil fuel-based production with CCS. Despite the clear language that hydrogen leakage risks exist for all production pathways (because these potential emissions are not relevant to production), including this information in the fossil fuel-based production section gives the false impression that this issue is only related to the production of hydrogen from fossil fuels.

DOE's draft roadmap appears to give little attention to significant market opportunities that could be developed with DOE support in the near-term.

Throughout the draft roadmap, DOE orients the discussion of end-use adoption and targeting strategic, high-impact uses to the industrial sector (for high-heat or ammonia production), heavy duty transportation, and long-duration energy storage. The general approach presented in the draft roadmap is that hydrogen should be used as a tool to transition the US away from the use of fossil fuels, and that the application of hydrogen would be most impactful in sectors that cannot electrify and need other approaches to move off of fossil fuels - as driven by a need for high heat, energy density, or long-term storage capability. However, as briefly noted by the draft roadmap, in the near-term, "initial deployments using clean hydrogen are expected to... target industries that currently rely on conventional natural gas to hydrogen technologies (without carbon capture and storage (CCS))."¹⁸ As noted in Figure 6, the refining sector represents the largest of these industries in the US - accounting for 55% of hydrogen consumption in 2021.¹⁹ Nonetheless, the draft roadmap dedicates significant conversation and posturing toward the development of fuel cells, distribution infrastructure networks, long-term storage, and penetration into sectors that will require investment to leverage a new energy source. As a roadmap that will be updated not less than every three years by statute,²⁰ this iteration of the roadmap should focus more on the consequential near-term growth of the clean hydrogen market by capitalizing on shifting existing users of hydrogen to clean supplies.

Advancing near-term adoption of clean hydrogen, by leveraging existing users of traditional hydrogen has the potential to improve the economics of clean hydrogen production by generating at-scale investment in the near-term. Further, these applications are already connected to and utilizing existing infrastructure, eliminating a significant hurdle to further deployment. An added benefit of encouraging existing producers and consumers of traditional hydrogen to move to clean hydrogen production is reflected in potential local environmental benefits. As a significant portion of hydrogen used in the refining sector is produced on-site, efforts to enable these sources to shift to clean approaches can help to improve local emission profiles and assist in addressing environmental justice issues. As noted in DOE's workshop, "decarbonization of legacy facilities is an Environmental Justice opportunity."²¹ Reducing local emissions by encouraging the adoption of clean hydrogen production methods at existing

¹⁷ DOE Draft Roadmap, p61

¹⁸ DOE Draft Roadmap, p19-20

¹⁹ DOE Draft Roadmap, p22

²⁰ Public Law 117-58 (November 21, 2015) 135 Stat 1011

²¹ DOE, "Enabling an Accelerated and Affordable Clean Hydrogen Future - Fossil Energy Sector's Role - Workshop Final Report." September 2021.

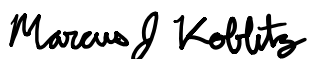
production sites, rather than developing new facilities, should be seen as a near-term goal for DOE that can help address environmental justice concerns. Additionally, encouraging adoption of clean hydrogen at refineries can lower the carbon intensity of existing fuel supplies, enabling emission reductions across the economy without requiring additional infrastructure. Marginal reductions in the near-term should not be precluded by reductions that may materialize in the longer-term.

As noted in the ICF study referenced above, early deployment of clean hydrogen is key to the overall growth of a robust clean hydrogen economy. DOE should be orienting their near-term efforts and strategy toward advancing the adoption of clean hydrogen in these key industries. In the next roadmap, building on the success of near-term applications, DOE can begin to shift their focus toward new applications and more challenging deployment.

The development of a robust low-carbon or clean hydrogen economy has significant potential impacts for the US, for US industries, and specifically for the US oil and natural gas industry.

As noted above, the oil and natural gas industry has significant interest in the development of a robust clean hydrogen economy. API agrees with the need and appreciates DOE's efforts to advance clean hydrogen from a variety of sources. This draft roadmap, however, reveals that DOE's efforts may not be as effectively directed in the near-term, and may reflect an unwillingness to recognize the potential value of thermal production pathways with CCS, to advancing the development of clean hydrogen across the US. DOE's near-term efforts should be oriented toward gaining cost parity between traditional and clean hydrogen production methods and increasing the adoption of clean hydrogen without needing new infrastructure buildout. As cost and infrastructure have been identified as the most significant barriers in the near-term,²² DOE should be analyzing pathways to advance adoption of clean hydrogen that mitigate these barriers to the greatest extent possible.

Sincerely,



Marcus Koblitz

Senior Policy Advisor, Climate & ESG

CC: Alejandro Moreno, Assistant Secretary for the Office of Energy Efficiency & Renewable Energy (EERE), DOE

Brad Crabtree, Assistant Secretary for the Office of Fossil Energy and Carbon Management (FECM), DOE

Sam Thomas, Director for Hydrogen and Carbon Management, FECM, DOE

²² DOE Draft Roadmap, p35