December 20, 2023

TO: U.S. ENVIRONMENTAL PROTECTION AGENCY
FR: THE INSTITUTE OF CLEAN AIR COMPANIES
RE: DOCKET ID NO. EPA-HQ-OAR-2023-0072

The Institute of Clean Air Companies (ICAC) appreciates the opportunity to offer comments in response to EPA's Initial Regulatory Flexibility Analysis (IRFA) for the proposed New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units.

ICAC is a national trade association of companies that supply greenhouse gas management solutions, air pollution control and monitoring systems, and equipment and services for stationary sources. For 60 years, ICAC member companies have helped to clean the air by developing and installing reliable, cost-effective control and monitoring systems. We support technology-neutral and flexible policies that enable cost-competitiveness and a diverse set of technologies to compete in the market. Many ICAC members are focused on addressing greenhouse gas emissions in support of both hydrogen production and carbon capture systems.

Our comments will focus on EPA's assumptions behind the compliance costs for conversion to hydrogen.

Again, ICAC appreciates the opportunity to offer comments on this IRFA and we look forward to answering any further questions should EPA seek additional information.

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Introduction

ICAC members support a healthy power generation market that is enabled, and responsibility grown, by an efficient approach to carbon management, coupled with an effective long-term strategy that promotes affordable clean energy to small entities and small communities throughout the country. Avoiding negative environmental, societal, health, and economic impacts on small entities and small or overburdened communities is equally important to ICAC members.

ICAC members represent a significant market segment of the capable technologies needed to decarbonize the U.S. energy market. Armed with experience and a long history of cleaning up waste gas streams, ICAC members are prepared, today, to rapidly scale up the production of technologies in existing manufacturing facilities. We stand ready to enable hydrogen production through a vast suite of proven and established technologies. Many of our member companies are focused on rapid low-carbon intensity hydrogen production.

In EPA's Initial Regulatory Flexibility Analysis (IRFA), the agency states that "for NGCT additions, we find that average compliance costs are expected to be negative." This critical assumption is the basis for the remainder of the analysis. We believe that if the market fails to achieve this ambitious goal for compliance costs, it could have a catastrophic impact on small entities and small communities due to significantly higher electric costs and the potential for future abandonment of billions of dollars of investment into industrial and power generation facilities targeted for improving quality of life in the same communities.

Impact on Small Entities and Small Communities

The boom and bust of the ethanol industry in small American towns is a great example of significant unintended negative impacts of changes in government funding. The shift in government policy support for the industry in the early 1990s led to the bankruptcy of most of the ethanol companies that had sprung up in rural small-town America, along with sharp reductions in the employment they once provided. Many facilities remained abandoned for 20 years and limited local investment in these communities until scrap metal demand from China finally drove up prices enough to justify removing structures for their scrap value. Most of those sites remain as brownfields today. Small entities and small communities were unfairly burdened by the lack of core economic support from industry and government incentives.

If there is a future shift in policy or expiration of the IRA tax credits, hydrogen for power generation could be similarly impacted.

As another example, small entities and small communities in central and northern Alaskan communities are significantly impacted by fuel costs that drive very high electrical pricing. The economic hardship associated with such high fuel costs of trucked diesel greatly impacts the quality of life, especially in remote and tribal regions. To avoid utilizing high-cost electricity for heat, community members may burn firewood as an alternative, which has negative health

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consequences associated with particulate emissions and is much less efficient from an overall lifecycle carbon avoidance aspect. A similar substitution of fuels to a more carbon-intense approach would occur readily in regions of the continental U.S. with high access to firewood.

Mandating a Switch to Hydrogen through EPA Regulation is Problematic

ICAC member companies support the creation of a highly functional hydrogen ecosystem, helping to produce the technologies to accomplish this.[1] However, the hydrogen ecosystem needs to be supported by clear, consistent, and long-term public policy. Leveraging EPA mandates to force the power generation industry into making compliance decisions that are likely only temporarily supported by tax or incentive policy is highly problematic.

The 12-year applicability of the Inflation Reduction Act (IRA) of 2022's hydrogen production tax credit is a relatively short period to incentivize producers and ensure there is adequate supply for obligated parties. Statements from Congress say that the legislation is only designed to jump-start the industry and traditional economic forces would need to support its continuation following the tax incentive period. ICAC cautions EPA not to make assumptions about the long-term continuation of these credits. Judging by the Department of Energy's $7 billion announcement for the Regional Hydrogen Hub program, DOE similarly views the need for core economics to support the industry as the agency will be requiring $40 billion in co-investment. The IRFA should not make assumptions that hydrogen will be less costly than natural gas.

Economic Analysis of Hydrogen Costs

The IRFA identifies the cost of delivered hydrogen at $1/kg reducing to $0.50 for the 2nd phase of the New Source Performance Standards (NSPS). ICAC questions whether the costs for hydrogen production will be one-half to one-third of the cost of hydrogen production using current SMR technology without carbon capture. Industry has optimized this production technology for over 50 years, and we believe it is unrealistic to assume relying on a breakthrough technology to change the economics of production, especially for utilization in an EPA regulatory analysis. This leads ICAC to believe that EPA is assuming the full $3.00/kg production tax credit against delivered hydrogen costs of $4.00/kg reducing to $3.50/kg. Our comments below are based on that EPA assumption.

The $0.50/kg delivered hydrogen cost would be comparable in heat content to $4.35/MMBtu of delivered natural gas. If that occurred, ICAC members agree that the industry would be incentivized to fuel switch assuming the H_2 fuel is readily available and natural gas pricing is high. ICAC remains concerned about the potential for a future administration to simply change the Treasury rules on qualification for the production tax credit and the $3.00/kg tax credit is impacted or eliminated. Loss of the credit, along with mandated use of hydrogen, would be equivalent to a 7x increase in fuel costs. The equivalent pricing for natural gas based on the

[1] For more information about ICAC's involvement in establishing a thriving hydrogen ecosystem, please see a recently released whitepaper (October 2023) with several key recommendations on this topic.

same heat content would be $30.45/MMBtu (7 times higher price). This price is more than 50% higher than typical LNG pricing realized in Southeast Asia.

Fuel supply cost is most of the operational cost of combustion turbines and a significant increase would result in very high electricity prices that would be catastrophic to small entities and small communities in the U.S. Substantial gaps of generation are still required to be filled by combustion turbines in a grid consisting predominantly of solar, wind and batteries. This is broadly recognized based on recent statements by the North American Electric Reliability Corporation (NERC) and the Federal Energy Regulatory Commission (FERC). The power generation costs associated with simply filling these gaps will push the cost of electricity substantially higher for residential use and force the remaining manufacturing capacity from these small entities and small communities to overseas production in a less costly energy environment.

The use of $4.00/kg reducing to $3.50/kg is also highly problematic and inconsistent with financial analyses of current planned hydrogen production projects. The DOE hydrogen production cost goal of $1.00 per kg is an aspirational moon-shot goal, it is significantly less than current hydrogen production costs using SMR technology without carbon capture. In fact, a December 2023 report by DOE finds clean hydrogen production through thermal conversion of fossil and/or waste feedstocks, with carbon capture and sequestration, will not meet the goal of clean hydrogen costs of $1 per kilogram by 2031. Recent inflationary pressures further push that goal out of reach. The delivered cost of hydrogen is only a partial cost of utilizing hydrogen in a combustion turbine; storage is required too, which we've discussed below.

Delivered Hydrogen Fuel Cost Does Not Include Storage Costs

Hydrogen for peaking or intermediate generation would require massive storage facilities as production from electrolyzers using renewables does not occur at the same time peaking demand would be required on the system. Establishing local hydrogen fuel storage is very expensive, especially in most regions of the country without ready access to local salt domes. The Advanced Clean Energy Storage (ACES) project in Delta, Utah utilizes a local salt dome formation, but that is a unique example of resource availability. Remaining sites without this unique geology will require liquefaction and above-ground liquid storage at -253°C. The massive capital investment and power for the operation of such a facility are significant and the design is more demanding than even Liquified Natural Gas (LNG) terminal storage. For a peaking facility, this cost is much more than the entire $3.00/kg tax credit.

ICAC member companies believe clean hydrogen infrastructure will need to be almost entirely built based on continuous-use applications. We believe that at that point it will become viable to utilize hydrogen from a nationwide network like natural gas. Even so, Winter Storm Uri clearly demonstrated that a localized electric grid cannot rely solely on a fuel requiring real-time transport to a power generation facility, so dual fuel permitting will remain needed to ensure the reliability to protect small entities and small communities.

Reliability of fuel supply through the availability of multiple fuels (stored hydrogen being one of them) is a key element of the Los Angeles Department of Water and Power (LADWP) and ACES Delta project strategy. Utilizing hydrogen for power generation should be targeted as one of the later applications as the costs of localized hydrogen fuel storage are prohibitive in most all locations in the U.S. Localized storage costs following delivery and prior to utilization are not accounted for in the IRFA.

Most Cost-Effective Hydrogen Production Methods

ICAC believes the two credible production methods that can achieve the lowest cost of hydrogen are:

1) Electrolysis utilizing carbon-free power (commonly referred to as “green” hydrogen); and
2) Steam Methane Reforming (SMR)/Autothermal Reforming (ATR) technology coupled with carbon capture and storage (commonly referred to as “blue” hydrogen).

Electrolyzer Hydrogen Production Utilizing Carbon-Free Power

The cost of the power is by far the most influential financial aspect of utilizing this production method. Many of the initially announced projects in the U.S. made assumptions in their pro forma models of significantly reduced costs for contracting their power. Others used the assumption that renewable or nuclear power was entirely stranded having no real value or even negative. These assumptions have proven unachievable in most of the market, especially because of inflation and costs now significantly increasing for these same carbon-free power generation resources. Some projects with unique electrical supply cost structures will likely be constructed, but only on a very limited scale and not on a scale that supports the intermittent hydrogen demand for peaking or intermediate power generation. Baseload generation will also result in a variable hydrogen demand as those facilities inversely load follow the availability of renewable generation resources on the grid.

Solar as a renewable is currently attracting a lot of investment, but not without challenges. Some solar components like panels and inverters will likely continue to be on a long-term curve with reducing costs. Unfortunately, the greatly reduced component costs now mean that a much higher percentage of projects are influenced by costs other than the solar components alone. Significantly increased labor costs, increased land prices, and significantly increased system upgrade costs required for transmission interconnection (an order of magnitude in some cases) have significantly impacted overall project costs and the net pricing is up dramatically. This directly impacts the pricing the solar developer is willing to contract with an off-taker. This situation is also further constrained by ongoing supply chain issues and much higher costs associated with electrical hardware including switchgear. This supply chain issue is unlikely to be resolved for at least 5+ years as demand has greatly increased and lead times for equipment, such as transformers, now exceed 2 years.

Wind energy has even more challenges with an uncertain future going forward. The increased costs resulting in the cancellation of a significant portion of announced U.S. offshore wind projects are causing big ripples. Wind manufacturers and developers have within the past 18 months written down over USD 13 billion of market value. The impact of supply chain and warranty claims on equipment manufacturers has truly devastated several of the few key manufacturers. Costs are now being quoted significantly higher along with shifting much of the risk from the manufacturer to the project developer. This has led to a rapidly declining wind market size amidst the establishment of significantly increased production tax credits provided by the IRA of 2022 that should have instead rapidly expanded the industry. This industry has also been hit by the inflationary effects of increased labor costs, increased land pricing, and significantly increased transmission interconnection costs. The majority of the least-costly site interconnection locations are already utilized, therefore increasing transmission interconnection costs.

Linear programming modeling by 1898 & Co (part of Burns & McDonnell and an ICAC member company) of a representative hydrogen hub in the Midwest shows break-even production costs for electrolyzer-produced hydrogen significantly more than the $4.00/kg and $3.50/kg that would have been utilized in the IRFA. The exact number depends on any further production methodology restrictions of upcoming Treasury guidance, but no identified scenario has wide-scale hydrogen production achieving this range. Other hydrogen hubs have been similarly modeled with results consistent. This includes consideration of evolving solid oxide electrolysis technologies.

SMR/ATR Hydrogen Production Coupled with Carbon Capture and Storage

This production approach for hydrogen does have the potential to reach the $0.50/kg identified target if coupled with the entire $3.00/kg tax credit. Transitioning the production from the anticipated $0.60/kg tax credit (assuming the higher carbon intensity threshold) would require the integration of a very low-carbon or negative-carbon feedstock.

SMR/ATR with CCS production is often paired with renewable natural gas (RNG), which can be produced from multiple sources of emissions, such as landfill gas, dairy gas, organic waste, and more. These production pathways are utilized today, but their potential to provide RNG as a significant, sustainable resource for decarbonization is limited due to various factors, including insufficient feedstocks.

For example, dairy production linked to digesters producing RNG leverages the reduced carbon feedstock benefits as identified by the Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model. However, utilization of RNG produced in this manner might come with associated environmental impacts that could harm small entities and small communities. Dairy operations produce fugitive methane emissions and are commonly challenged with odor management. Additional incentives for dairy RNG projects established or expanded by the Inflation Reduction Act could incentivize increased dairy production, therefore increasing fugitive methane emissions and the potential for odor. Alternative feedstocks for RNG face other challenges as well that currently may inhibit its widespread adoption.

The carbon intensity of alternative RNG production methods to support achieving the tax credit is not readily achievable under the current methodology of the GREET model, which should be what core assumptions are based on for any EPA analysis. This also carries the societal and environmental impacts of the expansion of pipelines and carbon sequestration projects, which small communities have commonly challenged as a negative impact on their quality of life.

Impact on Small Communities of Short-term Investment Focus

The most widely held concept of the cleanest approach to hydrogen production is utilizing electrolyzers coupled with carbon-free power. Wind and solar investments in small communities and other entities can play a vital role in clean hydrogen production. If renewables are built supporting hydrogen production in a future reduced-cost environment for electricity, there still may be a significant impact risk for small entities and small communities if these assets are decommissioned or abandoned and the significant environmental cleanup costs become the burden of already cash-strapped localities. To achieve anticipated operational life for these renewables, maintenance (especially inverters for inverters and gearboxes for wind) needs to be performed to achieve design output. When the hydrogen production tax credits expire, the economics for ongoing site production would require the realization that the associated renewable projects are entirely stranded. The revenue from electricity sold at these "stranded" prices would be inadequate to perform ongoing maintenance to achieve rated capacity. Thus, small entities and small communities would be burdened with abandoned wind and solar investments and significant environmental clean-up. It's important to note that most of the solar and wind facilities have been allowed to be built without a funded decommissioning bond. Repowering with new wind and solar assets is unlikely if the hydrogen tax credit no longer supports the market off-take demand.

Abandonment after 12 years of hydrogen production and associated renewable resources at the end of the tax credit has a significant impact on the lifecycle carbon emissions. Scope 1, scope 2, and scope 3 emissions all need to be accounted for in these lifecycle carbon emissions. Operating a 20-year hydrogen production or renewable asset designed asset for only 12 years carries a 40% burden of wasted scope 3 carbon emissions.

Conclusions

ICAC members are proud of their role in helping to deliver innovative clean energy solutions for the power generation industry and remain committed to leveraging our technologies to help overcome challenges. Our members support a healthy power generation market that promotes an affordable clean energy supply to small entities and small communities throughout the country.

ICAC would like to thank EPA for the opportunity to respond to this IRFA. We welcome an opportunity to further discuss these thoughts with you and are happy to answer additional questions or clarify any points made.