INSTITUTE OF CLEAN AIR COMPANIES

October 15, 2021

TO: International Trade Administration, U.S. Department of Commerce
FR: The Institute of Clean Air Companies (ICAC)
RE: **International Trade Administration Clean Technologies Export Competitiveness Request for Information** (ITA-2021-0005)

The Institute of Clean Air Companies (ICAC) appreciates the opportunity to offer comments in response to International Trade Administration's Request for Information.

ICAC is the national trade association of companies that supply greenhouse gas management and air pollution control and monitoring systems, equipment and, services for stationary sources. For over 60 years, ICAC member companies have helped to clean the air by developing and installing reliable and cost-effective control and monitoring systems.

ICAC's response will provide an overview of our perspective on ready-to-deploy and emerging technologies and solutions that can help develop pathways for these markets. We support technology-neutral and flexible policies that enable cost-competitiveness and a diverse set of technologies to compete in the market.

Again, ICAC appreciates the opportunity to offer input to International Trade Administration and we look forward to answering any further questions or provide additional information.

Sincerely,

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I. Introduction

The Institute of Clean Air Companies (ICAC) appreciates the opportunity to respond to the International Trade Administration, Department of Commerce's clean technologies export competitiveness Request for Information (ITA-2021-0005).

ICAC is a trade association headquartered in Arlington, VA, and represents more than 30 companies in the air pollution control, greenhouse gas management, and emissions measurement industry. ICAC members have successfully developed and deployed solutions to address emissions challenges for more than 60 years and are uniquely positioned to provide their expertise on emerging clean technologies and advancing clean technology markets. ICAC members have successfully commercialized solutions for the industrial, power, oil and gas, and maritime sectors, and have worked to address challenges that emerge at the nexus of air and water pollution management. Pollutants managed by member technologies include mercury, acid gases, PM, NOx, SOx, VOCs, HAPs, GHGs, HCl, and coal ash. Our members have operations in all 50 states and range from multi-national corporations with thousands of employees to small businesses focused on local emission challenges.

ICAC is recognized as a trusted, unbiased technical resource for government and other stakeholders by providing information on what is technologically achievable and the relevant costs associated with technologies. ICAC members' experience in meeting emissions challenges equips our organization with valuable insights that can help inform the development of successful policies, regulations, and other mechanisms to support the advancement of clean technologies ready to deploy now and those needing further development. ICAC believes policies should be technology-agnostic and flexible to enable cost-competitiveness. Many solutions will be needed to meet the anticipated clean energy demand and to reach our mid-century decarbonization goals.

ICAC members stand ready to provide information to help inform ITA's U.S. Clean Technologies Export Competitiveness Strategy and would welcome the opportunity to further discuss our industry's perspective on the international deployment of clean energy solutions.

II. Scope

Near and Long-Term Technology Neutral Solutions

To successfully secure American leadership in supporting the advancement of clean air technologies, a technology-neutral approach that includes both near and long-term solutions is essential. A variety of factors, such as geography, will help determine which clean technologies should be deployed. For example, regions with ample renewable feedstocks and energy sources may be better suited for green hydrogen deployment. Alternatively, regions with existing infrastructure and production facilities may be better suited for blue hydrogen, where developers can retrofit a facility and utilize the existing assets in the region. Likewise, in the near term, retrofitting an existing production facility could allow for larger volumes of low-carbon hydrogen to be produced. If end-users require a more limited volume of hydrogen, then green hydrogen produced by electrolysis could be a better option. There is no one "best" solution and there needs to be support for a diverse set of clean technologies to meet both current and future climate goals.

Technologies vary in their Technology Readiness Level (TRL) and commercialization stage. While some technologies are available at-scale today, others are in the scaling process and require additional demonstration and refinement to advance the technology itself or to improve costs. Likewise, some markets for clean technologies are mature, while other markets are emerging.

In our comments, we identify technologies that are available at scale today and differentiate between those technologies that currently benefit from a mature market and those that we see as having emerging market opportunities. We also identify technologies that are in the scaling process.

A. Technology Available At-Scale

Several technology options that are ready to deploy today offer significant and immediate opportunities for U.S. exports to advance global decarbonization efforts. These include conventional pollutant controls for fossil-fired power and industrial facilities, emissions measurement and monitoring technologies, carbon capture and storage technologies, and technologies that enable blue and green hydrogen production.

i. Market-Mature Technologies

Conventional pollutant controls for fossil-fired power and industrial facilities are developed, manufactured, and exported by U.S. companies today. Their technological solutions have helped solve emissions challenges around the world for decades. These solutions continue to advance to improve their associated costs and efficiencies. Although many developed countries are shifting much of their power production away from fossil-fired plants, their industrial facilities will continue to rely upon fossil fuels and will need conventional pollutant controls. Developing countries, with fewer regulatory restrictions, will continue to utilize fossil-fired power due to cost and could benefit from conventional pollutant controls. Additionally, where carbon capture equipment is utilized, a clean CO_2 stream is required for the capture process and effective conventional pollutant controls are needed. These controls help enable purer CO_2 streams for capture by cleaning the flue gas or process emissions from the plant. Without this pre-treatment of the gas, capturing the CO_2 would not be possible or efficient.

Other conventional pollutant controls recover valuable Volatile Organic Compounds (VOCs). These add-on control technologies remove VOCs from exhaust gas streams, either collecting the VOCs for recovery and reuse or destroying the VOCs. If the cost of recovery is less than the cost of purchasing new material, or if the recovery value of the

VOC is high enough, then recovery is the appropriate system choice. Carbon or zeolite adsorption, scrubbing, and condensation are typical recovery techniques.

Recovery systems reduce greenhouse gas emissions by providing reusable VOCs that can be used as fuels or other products, thereby avoiding the fossil fuel that would have been used in destruction. Greenhouse gases are also reduced for products where the reused carbon is sequestered. Recovery pollution control systems can also reduce energy usage, specifically natural gas, and Scope 1 and Scope 2 emissions. For Scope 1 emissions (direct GHG emissions), thermal oxidizers burn VOCs by heating them in enclosed combustion chambers in the presence of excess oxygen. Since auxiliary fuel is necessary to maintain combustion temperatures, most thermal oxidizers incorporate some form of heat recovery to lower auxiliary fuel (typically natural gas) costs. In contrast, the air going through a recovery system is not heated, thus eliminating the natural gas needed.[1] For Scope 2 emissions (indirect GHG emissions), the recovery systems that utilize fluidized media, rather than packed (non-moving) media or condensation systems with no media, the electrical power required to move the air through the system may be reduced.

Emissions measurement and monitoring technologies are used for both point sources and ambient air. These technologies identify where emissions are coming from so adequate control strategies can be employed. They also ensure that equipment is working both safely and efficiently. Measurement and monitoring technologies are essential for climate mitigating strategies, including methane management, and other important climate issues such as environmental justice.

Conventional CEMS Technologies such as UV, IR, Chemiluminescence and Electrochemical based sensors continue to be cost effective for the measurement of criteria pollutants (SO_2, NO_X, CO, CO_2, etc). Additionally, FTIR technologies offer a wide array of possibilities for low-level detection. Some compounds can be accurately measured down to single-digit ppb (formaldehyde, ethylene oxide) and other constituents can be measured accurately down to 50 – 200 ppb of detection (HCl, NOx, CO, methanol, etc.) These instruments, particularly useful in several industries, are especially important in power generation, semi-conductors, and chemical manufacturers. They can provide real-time results on-site when properly used and maintained by chemists and engineers. These technologies can also be used with Continuous Emissions Monitoring Systems (CEMS), in laboratory settings and can be modified to suit any process or industry. Currently, FTIR and FTIR-related technologies are used on thousands of compliance and engineering tests throughout the U.S. and in the EU, Canada, South Korea, and Malaysia.

The International Energy Agency recently released a report, “Curtailing Methane Emissions from Fossil Fuel Operations,”[2] offering a pathway to reducing emissions by 75 percent by 2030. The research estimates that over 70 percent of methane emissions

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[1] ICAC Guidance Method for Estimation of Gas Consumption in an RTO. Institute of Clean Air Companies. https://cdn.ymaws.com/www.icac.com/resource/resmgr/RTO-F1.pdf

[2] International Energy Agency. Curtailing Methane Emissions from Fossil Fuel Operations. October 2021.

from oil and gas operations could be eliminated using existing technology. Leak detection and repair (LDAR) technologies and management programs can help reduce fugitive methane emissions significantly by identifying leaks and emissions sources that facilities and other sources can then work to promptly mitigate. The report states that "well-established policy tools have already been deployed in multiple jurisdictions to drive down emissions," and LDAR requirements and programs are highly effective solutions.

ii. Emerging Market Technologies

CO_2 capture and storage (CCS) can be deployed through a variety of different capture techniques, including post-combustion capture, pre-combustion capture, oxy-fuel combustion, and direct air capture. Post-combustion carbon capture technologies are commercialized and have been demonstrated at-scale at industrial facilities and at large-scale power projects. Today, 26 commercial CCS facilities are operating globally. These post-combustion capture technologies are proven and continue to advance to bring down costs. While other CCS technologies are used and being further developed, post-combustion capture is currently more widely used and it can be retrofitted onto existing plants, unlike other CCS solutions. U.S. companies offer products and services in this space, largely due to the rapidly growing market in the U.S. that is complemented by favorable policies for CCS like the Section 45(q) tax credit or California's Low Carbon Fuel Standard.

Gasification technologies are commercialized and a number of large-scale gasification units are now operating reliably around the world. The benefit of gasification technologies involves the integration of carbon capture efficiently into the actual gasification process. This approach greatly reduces auxiliary loads associated with the post-combustion capture process.

Blue hydrogen production technologies are currently available and commercially proven. Blue hydrogen is derived from natural gas through the process of steam methane reformation (SMR). The carbon dioxide produced in this process is captured using CCS technology to create a low-carbon hydrogen production option. Although this technology is available today, the market demand for blue hydrogen is still emerging. Blue hydrogen production facilities operate on existing world-scale refinery hydrogen and syngas production plants for ammonia and methanol production, equivalent to 300 to 900 MW energy capacity. These are mature technologies ready for scale-up and have the resultant cost-effectiveness that comes from widespread use at this scale. Regions with existing infrastructure and production facilities are well-suited for near-term blue hydrogen deployment, where developers can retrofit a facility and utilize the existing assets and end-users in the region. Additionally, retrofitting an existing production facility will allow for larger volumes of low-carbon hydrogen to be produced.

Hydrogen produced via electrolysis powered by renewable energy – commonly known as green hydrogen – is earlier in its development compared to technologies for blue hydrogen. In addition to the further research and development needed to advance this technology, there are manufacturing challenges for electrolysis components. Plans to greatly increase production capacity by several electrolyzer suppliers will need to be supported by governments driving utilization demand. This represents a "chicken and egg" challenge for the market. Furthermore, the reliance on rare earth metals, for almost all proposed low-carbon technologies, is proving to be problematic. The production capacity of these materials will have to improve, but this issue could persist and act as a limitation to net-zero climate goals. However, it is vital to develop both sets of solutions in parallel to meet future demand. As referenced by the International Energy Agency[3], the significance of the scale-up of production capacity is tremendous.

B. Technologies in the Scaling Process

Technologies that are in the scaling process will offer significant opportunities for U.S. exports to advance global decarbonization efforts in the next decade. These include advanced low-cost sensors, direct air capture, and other CCUS technologies.

Advanced low-cost sensors are increasingly in demand for more localized measurement and monitoring. Some example applications include wearables for a person to measure and monitor pollutants and even small sensors on ships that measure leaks from ammonia transportation. Other uses include air monitoring networks at the community level to help identify emissions spikes and sources. There are many technologies in this space that are commercially available with varying degrees of sensitivity and accuracy for different applications. Certification and regulatory bodies are still working on establishing certifications and standards for these technologies. Solutions continue to advance in this area and new sensors are emerging rapidly to meet the increasing demand.

There are currently 16 **direct air capture (DAC)** plants operating worldwide. Although this technology is available today, the market demand for DAC is still developing. Capturing emissions from ambient air, rather than directly at the source point, means the concentration of CO_2 is much lower, thus making the process of separating the CO_2 out more energy intensive. Estimates of capture costs range widely, from USD 100/ton to USD 1000/ton.[4] However, cost estimates are declining, and with continued deployment and cost-sharing measures, DAC can become a cost-competitive clean energy solution. In order to be adopted at-scale in the market, the costs of these proven technologies must continue to improve.

Other **carbon capture, utilization, and sequestration technologies** are continuing to advance rapidly. As noted above, other capture technologies include pre-combustion capture and oxy-fuel combustion. Pre-combustion capture is tailored toward new industrial projects (not retrofits). Oxy-fuel combustion is a solution for power plants where it can produce less flue gas, with the flue gas that it does emit consisting of primarily CO_2 and H_2O. There are ongoing projects to demonstrate these technologies.

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[3] International Energy Agency. "Global electrolysis capacity becoming operational annually, 2014-2023, historical and announced." IEA, Paris.

[4] Budinis, S. (2020). Direct air capture. IEA.

Similarly, innovators are developing novel uses of the captured CO_2 beyond geologic sequestration and enhanced oil recovery. These uses may include synthetic fuel and chemical production or using the CO_2 to enrich or cure products like concrete.

III. Challenges

Several challenges will hinder the United States' competitive position at the global level, despite competitive domestic industries. The U.S. is far behind other countries in terms of clean hydrogen investments and collaborations, which will pose a significant technical risk to the industry's competitive position. There are fewer policy drivers in the U.S. compared to some jurisdictions, such as the European Union, United Kingdom, and Canada. Therefore, in the U.S. these clean energy technologies are currently not incentivized or sought after as they are in other countries.

Other challenges include the ongoing intellectual property issues in China and varying certification processes between the European Union and the United States. European technologies are getting certified faster and less expensively than U.S. technologies sold in Europe. These problems are persistent roadblocks to the deployment of U.S. technologies overseas.

IV. Solutions

The challenges we have listed can be overcome through various tools, resources, and support measures. Supporting domestic markets through government regulation and implementation of these clean energy technologies will help to create market demand, which will be critical to incentivizing deployment and competing internationally. The U.S. government could also help U.S. companies navigate the regulations and standards in other countries to help uncover market opportunities and to ensure compliance under foreign regulatory frameworks.

U.S. companies will need additional support and funding through grants, tax credits, and other mechanisms to de-risk project development. Identifying potential partners and investors will be very helpful to connect U.S. companies with non-U.S. companies that have similar ESG, sustainability, and climate goals. Additionally, resolving any tariff issues that are not favorable to U.S. companies will help ensure international market stability and accelerate progress.

As previously stated, ICAC supports policies that are technology-agnostic and flexible to enable cost-competitiveness. All solutions will be needed to meet the anticipated clean energy demand and solutions to our deployment challenges should not favor some technologies over others. ICAC also encourages measures that provide sufficient support to cover the cost delta between traditional technologies and practices and emerging clean technologies. Cost-sharing will be needed to allow project owners to bear some of the technology, schedule, and performance cost risks until the technology is proven enough for U.S. companies to take on the risks themselves.

V. Conclusion

Again, ICAC would like to thank the International Trade Administration for the opportunity to respond to the U.S. clean technologies export competitiveness Request for Information. ICAC members have a strong history in tackling emissions challenges, and we hope to provide you with valuable insights on deployment strategies. ICAC supports technology-neutral and flexible policies that enable cost-competitiveness and a diverse set of solutions to compete in the market. We welcome any opportunity to further discuss these thoughts with you or answer additional questions.