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via email to: Decarb-Institute@ee.doe.gov

Advanced Manufacturing Office
Office of Energy Efficiency and Renewable Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

The Aluminum Association (the 'Association') and its members appreciate that the Department of Energy (DOE) is focused on supporting US industrial decarbonization and that it is considering a new Manufacturing Institute to further that mission. In particular, the opportunity for additional support in the decarbonization of metals production is welcomed and the Association therefore supports formation of the proposed new Manufacturing Institute (MI).

The Association is the voice of the aluminum industry in the United States, representing aluminum producing companies and their workers that span the entire aluminum value chain from primary production to value-added products to recycling, as well as suppliers to the industry. Association member companies make 70 percent of the aluminum and aluminum products shipped in North America, and the U.S. aluminum industry across the value chain directly employs more than 166,000 workers and indirectly supports an additional 494,000 workers.

Aluminum is foundational to modern societies and to the U.S. economy, and its unique physical properties – light weight, corrosion resistance, and infinite recyclability paired with the innovative application of alloys and manufacturing processes – make use of the metal an ideal solution for a wide range of decarbonization challenges in the 21st century. And beneficially, decarbonization of a material substrate like aluminum that is used in such a variety of manufactured goods across the economy can have a significant 'flywheel effect' that flows through the value chain in reducing the carbon footprint of downstream products as well. The Association therefore recommends that the DOE focus on materials like aluminum that have a proven record of enabling reduced carbon footprint in their application and use.

The North American aluminum industry is highly integrated between the US and Canada, and it has made tremendous progress to date in reducing its carbon emissions. A Life Cycle Assessment report to be released later this month documents that the North American aluminum industry has decreased the carbon intensity of primary aluminum by 49% since 1991 and the carbon intensity of secondary aluminum by 60% since 1991. Incredible progress, to be sure, but the continuous improvement ethic of the aluminum industry is already focused on additional opportunities for the future.

More broadly, a report released in April 2021 by the Association demonstrates positive environmental impact trendlines for the U.S. aluminum industry on virtually every measure over the past 25 years. The *U.S. Aluminum Industry Sector Snapshot* report focuses on seven key environmental issue areas: air, energy, greenhouse gas emissions, land management,

water, waste and aluminum scrap usage. Positive environmental trends are attributable to both performance improvements by the U.S. aluminum industry in the primary sector and the addition of significantly more recycled material.

Importantly, aluminum producers have reduced environmental impact while increasing output – meeting growing domestic demand for the material while demonstrating a commitment to sustainability. Despite the impact of the COVID-19 pandemic, the Aluminum Association estimates that in 2020, the North American demand for aluminum was 24.5 billion pounds. This represents a 30.8 percent increase in demand from 2009, when North American demand was 18.7 billion pounds. With demand increasing, the aluminum industry continues to invest in technologies that decrease operational environmental impact and to embrace operational practices and corporate policies that drive energy efficiency, reliable and sustainable sourcing for raw materials, development of a next-generation workforce, and innovation for material applications.

Recognizing the industry’s significant progress to date, the opportunity now exists to build on it to further enhance the sustainability and production carbon profile of the US aluminum industry in a number of areas to support aggressive decarbonization and a new MI can help provide that support. To help the DOE understand how it can best support the aluminum industry’s decarbonization, below are Association comments responsive to the Request for Information (RFI) published on July 27, 2021 regarding key opportunities to decarbonize energy intensive industries like aluminum.

In April 2021, the International Aluminium Institute (IAI) released its [GHG Pathways to 2050](#) report documenting the type and scale of changes needed across the global aluminum industry to reach IEA 2050 B2DS goals and this report provides a foundation and perspective in considering aluminum industry decarbonization policies and technologies. It recognizes three key areas of focus –

- Electricity decarbonization in the primary aluminum sector
- Reduction of process emissions across all aluminum sectors
- Increase in aluminum recycling and resource use efficiency

Focus on each of these areas is important and the Association recommends that the DOE use the information contained in the report to shape its broad efforts to support industrial decarbonization of the US aluminum industry, including the new industrial decarbonization MI.

DOE Support for Aluminum Industry Decarbonization

The Association encourages DOE to consider broad and strong support for the US aluminum industry well beyond scope and scale of the catalyzing technology development proposed for the new MI. Simply put, the US aluminum industry competes globally with market-based and non-market based countries whose aluminum industry’s efforts are supported by their governments across all levels of research, development, piloting, implementation, and commercial scale deployment. Competing on this uneven playing field risks the future of the US aluminum industry in a sustainable world.

Therefore, the Association believes that the United States government must develop a comprehensive policy with long-term federal investment to enable innovations not just in early technology development, but through all aspects of bringing the technology to market, through

commercialization and deployment. We encourage the DOE to invest in developing recycling technologies and support building the next generation primary aluminum smelter. This can be achieved by: 1) ensuring a reliable and affordable supply of renewable energy; 2) facilitating access to supporting infrastructure such as ports and railways; 3) providing grants or forgivable loans for capital investment in next generation smelting and recycling technologies and 4) supporting R&D development and capital for implementation of successful projects.

Other countries have provided such support that is helping ensure the future of their domestic aluminum industries. Several recent examples are instructive here:

- Canada - At its technical center outside Pittsburgh, PA, Alcoa developed and piloted an inert anode technology for primary aluminum production called Elysis that can eliminate direct carbon emissions from the production of primary aluminum, and instead produces oxygen. To bring the technology to commercial scale, it formed a joint venture with Rio Tinto and solicited government support. Given the significant environmental benefits, the Canadian and Quebec governments have contributed over \$120 million in funding to support proving the technology at commercial scale. That testing is now occurring in a Canadian smelter. Should the Elysis technology be proven out at an industrial scale, it will be a game changer for the primary aluminum industry.
- Norway – It has a multi-stage support structure for decarbonization projects that runs from the R&D level to capital investment with percentage-based support throughout the life of a project. The final support level, during the capital phase, is designed to help offset the financial burden of the changes needed to support decarbonization. The government will contribute up to 40% of the project capital with the intent to bring the financial performance of the new project in line with traditional methods – lowering the risk of investing in new, decarbonizing, technologies.

A model in another metals industry for the DOE to consider that is relevant here is the Steel Upgrading and Emissions Reduction (SUPER) Act that has been introduced in Congress (HR 4599). This bill would direct the DOE to provide significant financial and technical support for the US steel industry to shift towards GHG emission-free production and allow it to take the lead on developing breakthrough technologies in order to stay competitive, create more high-paying jobs, and continue growing the US economy. A similar opportunity exists in aluminum and even without the enactment of formal legislation, the DOE can provide broad support for the industry's decarbonization solutions well beyond that contemplated by the new MI.

Further, given the potential for Elysis and other decarbonization technologies in the aluminum industry to significantly reduce GHG emissions, the Association requests that the DOE consider opportunities for the existing Loan Program Office to financially support deployment of these technologies at scale.

Broadly, the DOE should also consider a renewable electricity TVA/BPA-type program that provides long-term renewable electricity to large industrial consumers at a competitive cost in order to provide the certainty needed for US primary aluminum production to invest and grow in a decarbonizing world.

In sum, the Association is committed to growing US domestic primary and secondary aluminum production inside the framework of decarbonization and asks that DOE and the larger US government consider ways that it can support and enhance that effort.

Manufacturing Institute Proposal

In order to enable rapid development and deployment in the most relevant areas of decarbonization, the MI program direction should come from the private sector, with aligned funding from the public sector. Further, the DOE will only be able to achieve its decarbonization goals for the institute if it prioritizes practical application of technology to the industry rather than solely on academic research.

Charge Question: Category 8 Productivity and Competitiveness

In primary aluminum production, the commercialization of inert anode technology discussed above presents a significant opportunity for decarbonization and the Association encourages the DOE to support those efforts at the investment level required to truly enable the technology to be deployed at an industrial scale. In the near-term, while new technologies are being deployed, support of existing smelters for incremental decarbonization improvements should be provided to enable continued production.

In secondary aluminum production, natural gas continues to be utilized almost exclusively for remelting. At this time, the use of this fossil fuel resource is by far the most cost-effective for that purpose. In order to meet decarbonization objectives in this area, the following breakthrough technology development opportunities should be prioritized:

- Large scale electrical melting coupled with renewable electricity inputs
- Combustion of hydrogen or other non-GHG emitting fuel as a replacement for existing natural gas use
- Carbon capture and use applications for existing natural gas combustion

A valuable intersection of the last two points above recommended for consideration is the opportunity for the MI to provide expertise in developing combined hydrogen/CCUS hubs in areas where energy intensive industry facilities are concentrated.

Incremental improvement in secondary aluminum production and fabrication that continues to use natural gas can also be realized through technology development in:

- Improved systems for utilization of waste heat (advanced regenerative heating systems)
- Better refractories for improved thermal efficiency
- Higher efficiency burner systems
- Smart burner control and management systems
- Alternatives for non-natural gas use in non-melting applications such as homogenizing, heat treating, and annealing

A final recommendation in these areas is for the MI to focus on technology to enhance workforce development in support of all aspects of the aluminum value chain, including aluminum recycling. Investments in enhancing the existing and next generation workforce will reap dividends in the productivity and competitiveness of the US aluminum industry.

Charge Question: Category 9 Energy Efficiency and Energy Intensity

Aluminum recycling and resource use efficiency can play a significant role in decarbonization of the overall industry. For example, a recent Association study showed that each percentage

increase in the end-of-life recycling rate of aluminum cans will reduce the can's cradle-to-grave carbon footprint by 1.02 kg CO₂e per 1,000 cans.

There exists significant opportunity for a new MI to help develop and advance technologies in this area, including:

- Increased collection of post-consumer aluminum through enhancements in the US recycling infrastructure
- Better and faster aluminum sorting and segregation technology to allow highest value recycled use of alloys and alloy families
- Enhanced sorting and segregation of aluminum for recycling at building demolition
- Maximizing recovery of aluminum in co-mingled environments such as shredder outputs and incinerator bottom ash
- Support for aluminum customer enhancements to allow increased use of aluminum alloys such as in product design, re-tooling, stamping, and other further fabrication processes
- Elimination/minimization of metal losses during remelting and recovery
- Minimization of pre-consumer scrap generated during aluminum fabrication activities

Charge Question: Category 10 Material Performance and Alloy Development

In addition to the significant company-specific work being done in this area, there is already existing pre-competitive work on it being done through parallel DOE institutes such as REMADE and the Association believes this should not be a key area of focus for the proposed MI on industrial decarbonization. One area that is relevant is the development of new alloys more suitable for recycled content applications supportive of the decarbonization benefits noted above and the Association recommends consideration of this for the new MI if it is not sufficiently covered by existing Institutes.

In conclusion, the Association and its member companies look forward to participating with DOE in the implementation and operation of the new MI, and simultaneously encourage DOE to take look well beyond just the scope of the MI programs to determine how best to broadly support decarbonization and growth of the US aluminum industry overall.

On behalf of the Association and its member companies, we appreciate the opportunity to provide these comments to the DOE. For further dialogue and/or questions regarding them, please contact me at cwells@aluminum.org, 703-358-2976, or 804-385-6351.

Sincerely,



Curt Wells
Senior Director of Regulatory Affairs
The Aluminum Association