Aluminium Supply Chain Pathways to Net Zero GHG Emissions and Fair Global Markets: Priority Action Areas

Context

Aluminium is a strategically critical material; it is the second most widely used metal in the world, is infinitely recyclable, and possesses a broad range of unique properties essential to building a low carbon economy. Beyond its traditional manufacturing base, aluminium is used in lightweight vehicles, renewable energy systems, energy-efficient buildings, and protective consumer and medical packaging. And new applications that contribute to building a more circular global economy continue to emerge, for example using aluminium as a next generation renewable energy carrier. Global demand is expected to increase up to 80% by 2050; as much aluminium will need to be produced in the next decade as in the last one hundred years.

Aluminium is an energy intensive and trade exposed (EITE) industrial sector. Energy consumed in the aluminium smelting process is responsible for 60% of the sector's 1.1 billion metric tons of CO2 emissions per year (roughly 3% of global emissions). But recycled aluminium requires only 5% of the energy required to produce the primary metal. International aluminium markets are highly distorted by non-market policies and practises, most notably in China. Over the past 20 years China's share of global markets grew from 8% to 58%, largely on the basis of state support; at the same time, China's share of the aluminium industry's total CO2 emissions increased from 12% to 71%.

Making the transition to net zero GHG emissions and increasing the supply of responsibly produced aluminium across the US, Europe, Canada, and Japan require massive new investments in alternative clean energy systems, near zero GHG emission production technologies, and near 100% recycling rates for pre-consumer scrap and end-of-life products. Private sector investments in turn are dependant on a global level playing field, open to fair competiton, and free of aggressive state capitalism. These challenges are recognized by our governments and several important international initiatives have been launched in response.[i] More recently, national industrial strategies – whether motivated by interests in economic security, sustainable and resilient supply chains, green transition, or technological leadership – are beginning to re-shape the environment in which businesses operate.

In light of the evolving economic and geopolitical landscape, and drawing on the work of international organisations – in particular the Organisation for Economic Cooperation and Development (OECD), the International Energy Agency (IEA), and the International Aluminium Institute (IAI) – our associations are working collaboratively to build secure, sustainable, and resilient aluminium supply chains.[ii] This note highlights the priority actions needed to get us there.

Priority action areas

Within each of the following action areas the initial focus is on improving the transparency of information on both national and international experiences and best practices. This in turn would enable well-informed decisions with respect to business strategies and government policies.

Electricity decarbonization

Clean energy technologies are an integral component of any scenario for aluminium supply chains to transition to net zero GHG emissions. Public and private investments will need to balance the immediate need to lower emissions from existing (long-life) facilities and the imperative to switch more rapidly to low emission alternatives for aluminium refining and smelting. For industry, this can mean building new facilities in locations with access to renewable power (notably hydro, solar, and wind). It will also require significant public investment in new energy infrastructure in the near-term. Public and private collaboration to develop the potential of alternative sources of clean energy (including hydrogen and nuclear) over the medium-term should also be a priority.

Production technologies

Near zero GHG emission production technologies for aluminium refining and smelting are already emerging. A collaborative initiative across the public and private sectors in Canada has been testing the feasibility of replacing high emission carbon anodes with zero-emission inert anodes in the smelting process. A successful prototype could be commercially available within 1-2 years. Carbon capture, use and storage (CCUS) technologies are also being tested. While commercial application is likely medium-term, given the relatively low concentration of CO2 in aluminium refining and smelting, initiatives in France, Norway, and Iceland show promise.

Dedicated R&D funding underpinned by international science & technology collaboration to scale-up both clean energy and production technologies should be prioritized. In some cases, collaboration across the public and private sectors should be pursued, while in others the pre-competitive nature of R&D and technology commercialization imply a greater role for the private sector.

Material efficiency

Increased demand for finite resources across aluminium supply chains necessitates increased circularity in their use and re-use. An exchange platform of international experiences and best practices should be established to encompass:

- recycling education and incentives for consumer recycling, and public-private support schemes for material recovery facilities to increase the supply of end-of-life products, and
- public-private investment to accelerate R&D for advanced collection and sorting systems for end-of-life products, including technologies to segregate valuable alloys.

The practical insights learned from experiences to date can inform future spending and regulatory decisions to enable a near 100% recycling rate. This would represent an essential contribution to net zero GHG emissions across aluminium supply chains and should be a high priority both for public and private collaboration and for international cooperation.

Market incentives

Robust ***estimates of the carbon content of production and trade flows*** across aluminium supply chains, at the national and regional level, are being developed for the US & Canada, Europe, and Japan. This more granular information, expected to be available later this year, will complement existing global data and should help inform a wide range of national policy decisions and industry strategies towards net zero GHG emissions. [iii]

For example, public procurement preferences for certified low-carbon "green aluminium" should be introduced on an evidence-based and non-discriminatory basis. There may also be benefit in exploring the notion of "carbon contracts for difference", whereby governments would compensate firms, on a clearly time-limited basis, for a part of the exceptional costs of more rapidly adopting net zero GHG emission production systems.

In addition to such direct government support, regulatory measures to incentivize the transition to net zero GHG emsissions are also being elaborated. The EU Carbon Border Adjustment Mechanism (CBAM) aims to impose the same carbon price on imported aluminium as applied on domestic production under the EU Emissions Trading Scheme (ETS). A number of countries are exploring climate clubs as a mechanism to reduce emissions, price carbon, and avoid carbon leakage, while the OECD has launched an Inclusive Framework for Climate Mitigation Approaches to inform and support global emissions reduction efforts. These are important initiatives that should be elaborated in collaboration with relevant stakeholders, including industry, to ensure that they work effectively and avoid negative unintended impacts – the aims are laudable but policy design matters.

Some industry groups, national governments, and international organisations monitor the evolution of ***policy measures that impact aluminium supply, demand, and trade*** in order to inform timely and evidence-based responses nationally (such as trade remedy measures) and internationally (such as multilateral and regional cooperation initiatives). Robust trade defence measures are essential not just to protect domestic producers from unfair competition, but also to motivate increased international cooperation to establish a global level playing field.

Increased priority should be given to using available information on the incidence and impacts of existing (and new) policies to remove (and to avoid) *disincentives* to new private investment. Unfair competition as a result of aggressive state capitalism, discriminatory subsidies, or poorly designed regulations imposes unnecessary costs on un-subsidized firms today, increases the uncertainty of longer-term returns, and discourages much needed private investments. Removing economically and environmentally harmful subsidies should be a core element of comprehensive climate policy to accelerate progress towards net zero GHG emissions.

The high concentration in just a few countries of critical minerals that are essential inputs to aluminium value chains implies major *supply risks*, whether from export restrictions, mine closures, or conflict. Stress testing aluminium supply chains to identify vulnerabilities associated with concentrated or unreliable sources of critical minerals is an urgent priority that should be addressed by greater public-private collaboration. Ensuring aluminium supply chains are secure, sustainable and resilient is essential to maintain the industrial ecosystems that not only supply good jobs in often disadvantaged regions, but that also provide aluminium inputs to strategically important consumer, industrial, and defence markets.

Conclusion

As an energy intensive sector, net zero emission aluminium production will require access to affordable low carbon electricity, as well as near zero GHG emission production technologies and near 100% recycling rates. As a trade exposed sector, responsible aluminium production will require access to fair global markets for both its inputs and its outputs. As aluminium is a critical input to clean energy technologies, a low carbon circular economy will require access to secure and resilient aluminium supply chains.

"Industrial strategies for clean energy technology manufacturing require an all-of-government approach, closely coordinating climate and energy security imperatives with economic opportunities…(and) there remain huge gains to be had from international co-operation.[iv] The same is true of industrial strategies for aluminium supply chains. No country has everything it needs, and within countries no single policy area offers a panacea for making the transition to net zero GHG emissions and fair global markets. International cooperation across like-minded governments, underpinned by strategic public-private collaboration, offers the surest pathway.

This note represents an initial contribution to enabling this cooperation.

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[i] Including the *Joint Statement on Cooperation on Global Supply Chains* (July, 2022), *G7 Leaders Communique* (June, 2022), *Trilateral Partnership* (US-EU-Japan), *Global Arrangement on Sustainable Steel and Aluminium*, *Trade and Technology Council, First Movers Coalition, and Mission Possible Partnership*

[ii] See *International Cooperation on Supply Chains for Critical Materials: Aluminium,* September, 2022

[iii] See IAI, *Aluminium Sector Greenhouse Gas Pathways to 2050*, September 2021

[iv] See IEA *Energy Technology Perspectives 2023,* February 2023