Position on the European Commission's Policy Roadmaps

16 June 2020

EUROPEAN ALUMINIUM

European Aluminium represents the entire value chain of the aluminium industry in Europe. We welcome the opportunity to share our views on the European Commission's upcoming Energy Sector Integration and Hydrogen Strategies[1]. These are important policy milestones and an opportunity to accelerate the low carbon transition of the overall energy system, and consequentially enhance the decarbonisation potential across our value chain.

However, protecting the competitiveness of European aluminium producers and industrial energy consumers will have to be a guiding principle across all envisaged actions under the upcoming strategies.

Furthermore, the immediate economic and social impact of the COVID-19 crisis on global material value chains and the EU's internal market should also be thoroughly considered, particularly in the context of the re-adjusted EU policy priorities that are part of the Recovery Plan[2]**. Europe should urgently reflect on how to reinforce its strategic autonomy in global value chains, preserve existing industrial assets and reshore the production in Europe instead of relying on carbon-intensive imports.** Reduced European production will only increase our dependency on primary imports with a significantly higher carbon footprint. The aluminium value chain should thus be at the forefront of envisaged actions under the EU Recovery Plan and in the transition to a climate-neutral and circular economy. **Industries in Europe need today more than ever an enabling framework to be more energy-efficient, competitive, circular, and sustainable to deliver and invest in climate neutrality while operating in a free and fair-trade environment.**

In the following sections, we explain **the specificities of aluminium production** with regards to energy use, circularity, carbon costs and subsequently **outline the enabling tools we believe the Strategies will have to incorporate to achieve the following three EU policy objectives: deliver decarbonisation, energy system efficiency and industrial competitiveness of European industry vis-à-vis our global competitors.**

Aluminium: a front-runner in electrification, circularity & energy system efficiency

When compared to other energy intensive manufacturing industries, **aluminium's primary production is already electrified, thus supporting the EU's Green Deal objectives and the 2050 Long-Term Strategy.** The challenge, however, is that the smelting process is electro-intensive (about 14 - 15 MWh/t) and Europe has the highest electricity prices vis-à-vis its main competitors (Russia, UAE and China). This is mainly because of increased costs under the EU's Emissions Trading Scheme (ETS) and the greening of power generation systems (ETS indirect costs and other climate related costs). No aluminium smelter outside Europe is exposed to carbon costs in their electricity prices and since aluminium is priced on global markets such as the London Metal Exchange (LME), European producers cannot pass on these extra carbon costs and are price takers on the market[3].

As a result, electricity costs were on average 37% of the total production costs of primary aluminium smelters between 2008 and 2017[4]. This, combined with the global financial crisis, has led to a reduction of more **than 30% of Europe's primary capacity since 2008, in the face of growing global and significant investments in other parts of**

[1] See DG ENER's Policy Roadmap Consultations here and here
[2] See here European Aluminium Policy Recommendations for an EU sustainable industrial recovery plan (May 2020)
[3] The ongoing review of the State Aid ETS Guidelines and on Energy and Environment (EEAG) are thus crucial for protecting the European producers' competitiveness against carbon leakage. See here our position paper on the draft ETS Guidelines, March 2020
[4] Source: CEPS, Jan 2019: Composition and drivers of energy prices and costs in Energy Intensive industries

the world. To date, there are only 15 smelters that remain in operation in the EU 27, despite the fact that European smelters are some of the least carbon-intensive in the world.[5]

At the same time, while Europe has lost significant primary production capacity, global aluminium demand has been rising steadily and is bound to continue to grow towards 2050[6]. This is because **aluminium's unique properties make it a key enabler to decarbonise the global economy and it is also a raw material used in many industrial ecosystems and consumer applications, ranging from low carbon mobility, defense, infrastructure, and buildings to packaging and renewable energy technologies**. However, these increases in global demand are being covered almost exclusively by carbon-intensive semi-manufactured products from China. Chinese subsidised excess capacity[7] is severely undermining the resilience of European producers and generating market distortions in our industry.

Aluminium is thus a material which is **crucial for Europe's long-term strategic autonomy and decarbonisation goals.** In order to prevent further carbon and investment leakage in our value chain, the upcoming strategies will have to **improve the energy efficiency of the EU's overall energy system while ensuring aluminium producers affordable and long-term access to low carbon energy. This is crucial with regards to electricity, given the high electro-intensity of the primary production process, but also of aluminium's secondary production, which requires gas and fuel for the remelting process.**

The aluminium value chain's contribution to energy sector integration

Aluminium primary production **is already electrified** and Europe's carbon footprint is one of the lowest in the world. It requires a **highly electro-intensive process**, with 14-15 MWh electricity use per tonne of primary aluminium produced. This process requires a stable and uninterrupted supply of electricity, although this supply can be cut off for short periods of time in order to offer valuable load shedding services (demand response) to the Transmission System Operator (TSO).

For recycling aluminium, the energy needs are significantly smaller, **saving 95% of the energy used in primary production and allowing to achieve an equivalent reduction in CO2 emissions**. More specifically, for aluminium rolled sheet, for example, about only one-third of the energy used is originating from electric power. The other two-thirds of the energy demand stems from the use of gas for different steps (e.g. refining, re-melting, temperature treatment) during the recycling process. Here, switching from gas to renewable electricity cannot be easily achieved given the significant investment costs and high temperatures needed. **Furthermore, the global amount of recycled aluminium available to cover the present and future demand is limited to approximately 40% due to continuous market growth linked to long life spans of major use cycles** (e.g. automotive / buildings) ranging between 20 and 50 years.

For this reason, **the decarbonisation potential relies both on the carbon content of the electricity consumed during the primary production process and the increase of recycling as metal sourcing.** At the same time, **it is equally crucial that for the electrification of recycling activities, that this is incentivised by always taking into account technical feasibility and receives adequate public financial support**: firstly because recycling aluminium already achieves decarbonisation in terms of energy savings compared to primary production and, secondly, because the investment costs to switch to electric furnaces are, to date, still extremely prohibitive.

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[5] The carbon footprint of the primary aluminium production in Europe (EU28 + EFTA) is three times lower compared to China. See also here
[6] Source European Aluminium, Vision 2050
[7] See OECD Report: "Measuring distortions in international markets: the aluminium value chain" (7 January 2019)

Also, several European smelters have started offering ancillary services to the power grid (e.g. grid stabilisation and peak attenuation), by allowing for (temporary) interruption of power supply or other participation in demand response[8]. Such competitive services are already being provided in several EU Member States, including France, Belgium, Netherlands, Greece and Germany. **With higher levels of variable (renewable) energy to be produced in the EU, it is expected that these ancillary markets will become even more important and aluminium producers will be in a position to offer crucial demand response services to the European power market**.

To provide an example, a € 36 million investment by TRIMET into a 'showcase' pilot plant is demonstrating this potential. TRIMET Aluminium is testing one of its pot-rooms in its Essen plant to operate as an energy storage or "virtual battery'. The electricity input can vary by +/- 25 percent, based on a nominal load of 90 MW, providing a virtual storage capacity of approximately 2,100 megawatt-hours (MWh). This is comparable to a medium-sized pumped-storage power plant. By balancing grid fluctuations, this power-storing capability allows variable renewable energy sources, including wind and solar energy, to be fed into the German power grid. To ensure flexible control of its electrolysis cells, TRIMET Aluminium has developed a process technology that maintains the thermal stability within the cell, even with a fluctuating energy supply. Fully implemented, the three TRIMET smelters in Germany (located in North Rhine-Westphalia and Hamburg) should increase the "storage"capability of the grid by nearly 40 percent in comparison to Germany's pumped storage capacity of 40 gigawatt-hours (GWh) today.

Additionally, **aluminium is contributing to sector integration also by facilitating more renewables uptake via corporate sourcing.** For example, in the last years, companies like Hydro and Alcoa have become global leaders in signing long-term Power Purchase Agreements (PPAs) with intermittent renewables. Long-term renewables PPAs represent a win-win situation for both renewables developers and industrial consumers. On the one hand, such agreements enable new large-scale wind projects through a stable revenue stream; on the other hand, they guarantee a long term horizon for investment, as they reduce the industry's risk of volatility by achieving predictable power costs.[9]

Challenges stemming from increased electrification

Aluminium is thus **a front-runner in sector integration, both in terms of electrification, by facilitating the increase of renewables in the energy system** and by **generating energy savings via recycling**. However, it is an industrial sector where **<u>the main challenge is not to switch to an electrified production process but rather to ensure stable and affordable access to clean electricity</u>** in a context where it is estimated that the power system will require approximately 75% more generating capacity by 2050 to achieve the envisaged decarbonisation objectives via sector integration[10]. More specifically:

- Electricity is expected to become the dominant energy carrier for buildings, transport and for industrial heating applications in the industry, including hydrogen production;
- Despite energy efficiency improvements**, power demand will increase significantly and will be covered to a greater extent by intermittent renewables (e.g. wind, solar), thus potentially leading to additional grid and balancing costs due to the increase of volatility in power generation**;

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[8] See Joint statement "Demand Response in industry: when industrial flexibility supports competitiveness and climate neutrality", June 2020
[9] See here DG ENER Study by CEPS "Competitiveness of corporate sourcing of renewable energy", August 2019
[10] See here Bloomberg Report "Sector Coupling in Europe: Powering Decarbonisation", February 2020

- New sectors in the power system will **change the short- and seasonal term variability and high electrification will increase variations in demand:** one example is the seasonal energy demand for heating purposes;
- **The need for demand flexibility and storage will be high**. Furthermore, the increasing need for seasonal storage will represent a barrier for expanding the power sector with a higher share of wind and solar. Periods of limited availability of solar and wind can last for several weeks. **Carbon free technologies to cope with this are currently largely unavailable and immature;**
- Sector coupling **may increase the greenhouse-gas output for the electricity sector itself because more fossil-fuel-fired plants might be potentially needed to provide enough flexibility to the system**. Therefore, despite the increased participation of renewable energy systems (RES), end even though natural gas functioning as a transition fuel is admittedly far cleaner than solid fossil fuels, **it could be expected that indirect ETS carbon costs for Aluminium producers will remain considerable;**
- **Switching to Industrial heat pumps, electric boilers and other electrification technologies generally have higher capital costs and far lower efficiency than fossil-fuel equivalents**.

This is why a report that was recently published by the Institute for European Studies (IES) described aluminium as a "bellwether industry[11]": as a frontrunner in industrial electrification, aluminium will be "*the first in line to face several major regulatory challenges from Europe's climate transition*". Therefore, aluminium is effectively a "test case' for the EU's electrification policy for the EU's climate policy.

Whether our sector is able to overcome these challenges in order to decarbonise our electricity supply will be an early indicator of the adequacy of the EU's climate and industrial strategies. In other words, If primary aluminium smelters are unable to decarbonise their electricity supply, there will be no incentive and no climate benefit for other sectors to electrify their own processes.

Electrification in and of itself only solves half the problem. Once a process is electrified, we also have to ensure that the electricity being consumed is actually carbon-neutral, while not compromising its global competitiveness.

Therefore, **the barriers that are already limiting electro-intensive consumers' ability to decarbonise their electricity supply must be removed now, in order to enable and incentivise other sectors to decarbonise their processes via electrification.** A report published by DG ENER last year detailed the significant challenges that large corporate consumers face in consuming renewable electricity[12].

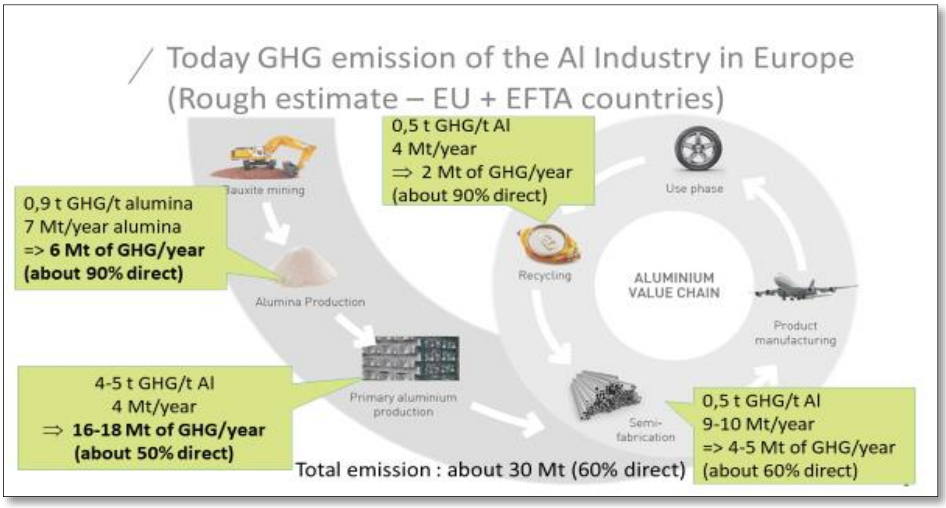
Therefore, **the uptake of, for example, renewable Power Purchase Agreements (PPAs) and self-generation by industrial consumers should be supported and facilitated via public support.** This could be achieved, for example, within **the context of the Important Projects of Common European Interest (IPCEI) framework as well as in the ongoing review of the EU State Aid Guidelines for Environmental protection and Energy (EEAG) post-2020**[13]. Along these lines, the Strategic Forum for Important Projects of Common European Interest that was set up by the European Commission has already identified[14] "*Low CO_2 Emissions Industry*' as a strategic value chain and called for the establishment of IPCEIs in this field.

[11] See here "Metals for a Climate Neutral Europe: A 2050 Blueprint", 2019
[12] See here DG ENER Study by CEPS "Competitiveness of corporate sourcing of renewable energy", August 2019
[13] See here European Aluminium Position Paper on Review EU State Aid Guidelines for Environmental protection and Energy post 2020 (EEAG)
[14] See here "Strengthening Strategic Value Chains for a future-ready EU Industry", 2019

Policy Recommendations:

- Given their high exposure to carbon leakage and electricity costs, **aluminium producers should be protected against all future additional charges related to the grid, balancing costs and storage costs due to increased volatility in power generation.**
- Market mechanisms alone will not bring about emissions reductions on the scale required in the coming decades to transform the energy system. Stronger public-sector interventions are needed, including **supportive industrial policies to avoid losses of EU industrial competitiveness.** For example, **companies should receive support and incentives to invest directly in self-generation of decarbonised electricity or receive fiscal incentives addressing the extra costs from converting to use hydrogen.**
- **Public funding mechanisms, financial support and a long-term predictable framework for competitive power supplies will be necessary in order to allow investments into those transformation technologies needed to make production processes more energy efficient** and **scale up carbon free technologies** to address increased demand flexibility and storage. **The trade-off between demand response and process efficiency should also be acknowledged.**
- **Intelligent energy management systems, market design, new business models and regulatory frameworks have the potential to increase the flexibility for the effective operation of increasingly complex power systems.**

Opportunities and challenges from hydrogen and decarbonised gases



According to the European Commission's Consultation roadmap[15], besides increasing electrification, two crucial components of the Strategy will be to identify policy and regulatory measure *"to gradually replace fossil-based gases and fuels with renewable and decarbonised gases and fuels, especially in hard-to-decarbonise sectors such as air transport or certain industrial processes"* and to boost circularity in energy use, for example by re-using industrial waste heat.

In general, when it comes to aluminium production industrial processes, recovery and use of thermal energy in the form of waste heat (gas/water) from lower temperature (e.g. coating lines, heating furnaces, hot fumes, etc.)

[15] See here Consultation Roadmap on EU Strategy for smart sector integration

especially in plants integrating various parts of the value chain could help to save up to 0.2 tonnes of CO2 per tonne of aluminium produced. For example, we face situations where, despite excess heat available for external users, heat transfer systems are not available for extension outside the plan fence.

More emission reduction potential could instead be achieved via recycling by maximising aluminium post-consumer scrap quality through optimised product design, better collection and preparation phase including sorting per alloy family through digitalisation and robotics. This could save up from 10 to 18 tonnes of CO2 per tonne of aluminium produced[16]. Such savings correspond to the avoided primary production, assuming that any additional tonne of recycled aluminium will save the equivalent of primary aluminium. The idea behind such an approach is to achieve decarbonisation via increasing the material's recycling rate, also carefully taking into account the need to improve the quality of collected scrap. Furthermore, Europe currently exports significant volumes of aluminium scrap to other regions in the world, sometimes to then even re-import it in the form of semi-manufactured products. Boosting circularity and increasing recycling rates would increase the bloc's overall resource efficiency while decreasing its dependence from imports.

However, the process for recycling aluminium is today highly dependent on natural gas, with hydrogen not yet being technically feasible. In general, re-melting furnaces as well as the gas infrastructure network can only handle a limited amount for reasons of both technical feasibility and national regulatory requirements.

Also, more generally, hydrogen is already in use in some industrial processes, but almost 100% is produced from fossil fuels, a small share from electrolysis. There is potential for replacing natural gas and more importantly solid fossil fuels with hydrogen in the industry sector but this is currently not economically viable. The use of hydrogen also presents challenges in terms of system efficiency of technical processes, safety conditions and would require modernizing existing gas grid infrastructure.

Considering the GHG emissions along the aluminium value chain as estimated in the above diagram, several innovative processes could contribute to the decarbonisation of the value chain.

However, **the majority of them are still at low Technological Readiness Level (TRL 3 - 5) and will require significant research efforts or have massive investment costs.** These new solutions rely either on the **use of green fuels and gases (including hydrogen)**, **energy efficiency improvements or breakthrough technologies to increase decarbonisation**:

- **Alumina Production**: In the Bayer-Process, the use of green energy in the digestion and evaporation processes via renewable electricity in high pressure electric boiler (e.g. 30 MW) or using solar energy renewable electricity for generating thermal energy which is stored (e.g via molten salts) could save up to 0.8 tonnes of CO2 per tonne of primary aluminium produced. Secondly, the use of green fuels (e.g. "blue" or "green" hydrogen[17]) and/or electric/solar furnaces for the subsequent calcination process could save up to 0.5 tonnes of CO2 per tonne of primary aluminium produced.
- **Smelting (electrolysis and casting):** The smelter should enable the use of more renewable electricity (i.e. fluctuating energy input) by increasing the thermal stability of the electrolysis cells (including heat recovery). Additionally, smelters could potentially reduce their direct GHG emissions through the use of inert anodes,

[16] See here our Aluminium Circular Aluminium Action Plan, May 2020

[17] Hydrogen can also be produced by the electrolysis of water (using an electric current to break water, H2O, into its component elements of hydrogen and oxygen). If this electric current is produced by a renewable source (e.g. Solar PV or a wind turbine), the clean hydrogen produced is known as green hydrogen. Blue hydrogen is produced from natural gas, usually via steam-reforming, with carbon capture storage. (CCS).

through green carbon sourcing for anodes if there is a technological breakthrough in these technologies, which are still at a very early stage of development. Such anode-related innovation could help to save up to 1.8 tonnes of direct CO_2 emission per tonne of primary aluminium produced, but investment costs are still prohibitive. Other options include optimised and digitalised electrolysis cells for maximising efficiency (reduction of CO_2 emissions and elimination of perfluorocarbon emissions) or the chloride process. The latter is also at very early testing stages.

- The development of Carbon Capture Storage (CCS) and Use (CCU) for aluminium smelters or alumina refineries is also an alternative that should be further investigated. The latter could help save up to 2 tonnes of CO_2 per tonne of primary aluminium produced.

- **Aluminium semi-fabrication and recycling:** Substitution of natural gas by green fuel (e.g. hydrogen) or/and using electric furnace instead of natural gas-based furnaces for remelting/refining furnaces and other downstream furnaces (e.g. annealing). It could help save up to 0.5 tonnes of CO_2 per tonne of aluminium produced. **Here, the challenge is not the low TRL level, but mainly the massive investment costs. Furthermore:**
  - Hydrogen itself can only be introduced to a certain amount into the existing gas distribution system due to existing national legal requirements or technical limits;
  - Higher hydrogen contents need an adaptation of the existing gas infrastructure (e.g. gas distribution system) and the plants' combustion technologies and furnaces. Adapting to these systems would require a massive investment in a context where existing assets have a remaining lifespan between 30 and 50 years.

In sum, most of the technologies listed above **are still at a low Technological Readiness Level (TRL)** and/or **have very prohibitive costs, thus requiring significant financial investments that cannot be bared by individual companies alone**. **The time needed to develop a demonstrator (TRL7-8) and to fully deploy such technology in an industrial context (TRL 9) will depend on many factors, especially in relation to the future cost and characteristics of the renewable energy and energy costs.**

Policy Recommendations

- **The use of waste heat in industrial processes should be encouraged as much as possible**. Such potential depends on the plants' location and regulatory framework. The Commission should identify, in partnership with the EU Member States and industry, the regulatory and practical barriers to further develop such energy efficiency potential. For example, the Commission could **explore ways for industry to enable more waste heat to be captured and transferred to external users.** Support alternatives could be in the form of projects funded by the EU, or national support, or subsidized prices on heat.

- **Investments in technologies aimed to improve the collection and sorting of aluminium post-consumer scrap, including optimised product design and sorting per alloy family through digitalisation and robotics, should be encouraged**. Optimising circularity has the biggest decarbonisation potential given the significantly lower carbon footprint of secondary aluminium processing compared to the primary production process.

- **The Commission must carefully assess, for each initiative under the new Strategies, the impact of new infrastructure on industrial consumers: increasing capacity, congestion, decentralisation adaption and the costs of switching to electric furnaces or decarbonised gases**.

- On **decarbonised gases, measures to promote renewable gases could be based, for instance, on support**

systems for production and demand-side measures. However, in promoting decarbonised gases, **the EU Commission should avoid using systems such as tradable Guarantees of Origin, which allows for trading of the "greenness" of the energy apart from the energy itself**. This allows for the greenwashing of energy consumption and thus does not necessarily imply increased production of decarbonized gases. **Measures adopted should be directed at actually increasing the market for gases itself, and not virtual trading**.

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