Can the Aluminium Industry Meet Global Climate Change Targets?

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Abstract

There is increasing expectation and scrutiny from the public, customers and stakeholders on the aluminium industry's progress in meeting global climate change targets. The International Aluminium Institute (IAI) has previously outlined the trajectories and technology pathways that the industry would need to follow to be consistent with global *Beyond 2 Degrees (B2DS)* or *1.5 Degree (1.5DS)* scenarios. These trajectories took 2018 as the base year and the most recent comprehensive global data – for 2022 – shows that the aluminium industry has reduced emissions below *Business-as-Usual (BAU)* but is not yet aligned with either the B2DS or 1.5DS scenarios. However, the data also reveals that, for the first time, global aluminium industry greenhouse gas emissions did not increase in 2021 and 2022, despite production increasing. This can be attributed to the significant number of projects in the industry that are developing and implementing the decarbonisation technologies needed. To meet global climate change targets, the challenge for the industry is to speed up and scale up this technology development and investment.

Keywords: Sustainability, Climate Change, Decarbonisation, Aluminium Industry.

1. Introduction

1.1 Sustainability

Over recent decades, sustainability of production is of increasing importance in procurement decisions within supply chains and purchasing choices by final customers. The same issues are also becoming prominent in regulation (particularly in Europe) and investment decisions.

Sustainability issues are usually interpreted to include environmental (including emissions to air, land and water, wastes, consumption of resources, and biodiversity), social (including workforce, communities and the public) and governance components.

While the broad scope of sustainability issues and the integrated nature of sustainability remain important, public, consumer and user attitudes clearly prioritise climate change as the most important sustainability issue for most industries – including the aluminium industry.

1.2 Greenhouse Gas Emissions and the Aluminium Industry

The aluminium industry – considered here as the value chain from bauxite mining to semi-finished products and including recycling – is a significant contributor to global greenhouse gas (GHG) emissions; usually estimated to contribute approximately 2 % of global emissions. This warrants specific attention to reduce emissions. However, for context, it is less than sectors such as steel, cement and plastics and chemicals.

The aluminium industry is also commonly classified alongside these industries as "hard to abate" on the basis of the long-life of assets, significant energy use and need to develop new technologies to decarbonise some aspects of production.

At a global level, the majority of greenhouse gas emissions in the aluminium sector are from the generation of the significant quantities of electricity required for electrolysis (Table 1). However, the importance of this specific source varies at plant level depending on the type of electricity – near zero for hydro power, highest for coal-fired power.

The next most significant sources of emissions are from burning fuels for the thermal energy required in alumina refining (and elsewhere in the production process) and direct process emissions from the consumption of the carbon anode in electrolysis. The emissions of perfluorocarbons in the smelting process have been greatly reduced in the industry since the 1990s. but still remain a noticeable source of emissions.

Table 1. Greenhouse Gas Emissions Intensity - Primary Aluminium, 2022 [1].
(tonnes CO_2e/tonne aluminium)

	Electricity -Indirect	**Perfluorocarbon (PFC) - Direct**	**Process (CO2) -Direct**	**Ancillary Materials -Indirect**	**Thermal Energy -Direct/Indirect**	**Transport -Indirect**	**Total -Cradle to Gate**
Mining	<0.0			<0.0	0.04		**0.04**
Refining	0.3			0.4	1.7	0.2	**2.6**
Anode Production	<0.0		0.1	0.6	0.1		**0.9**
Electrolysis	8.9	0.8	1.5	0.1		0.2	**11.4**
Casting	<0.0			<0.0	0.1		**0.1**
Primary Aluminium	**9.3**	**0.8**	**1.6**	**1.2**	**1.8**	**0.4**	**15.1**

2. Climate Change Targets

2.1 General

The development of climate change targets – at a national, industry sector or corporate level – is usually focussed on alignment with one of the global temperature change objectives of the Paris Agreement (well below 2 degrees, or limited to 1.5 degrees, above pre-industrial levels) or to net zero emissions by a deadline year (often 2050).

Structurally, climate change strategies usually involve targets that align with one or more of these objectives, some level of plan or strategy developed on how it could be met – or at least the initial steps, given the need to develop new technology – and then progress toward the target tracked and reported.

In recent years there has been significant activity, at many levels, in setting climate change objectives and developing strategies. Given the short timeframe available to meet the objectives, external attention necessarily shifts to assessment of early progress toward meeting the targets.

Together these companies are currently responsible for 250 million tonnes of Greenhouse Gas emissions.

5. Conclusions

Early indications on the aluminium's industry decarbonisation journey show that significant investments are occurring. This has reduced emissions below previously estimated business-as-usual levels but have not yet brought the industry on to either of the decarbonisation trajectories that would contribute to achieving the objectives of the Paris Agreement.

The projects appear to be de-linking the trends in aluminium production (still growing) and greenhouse gas emissions (stabilising and slight decline). However, to meet global objectives, significant additional investment is required and the successful technology improvements need to be extrapolated from the early adopters of each technology to broader uptake in the global industry.

6. Acknowledgements

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7. References

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