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Understanding and Addressing the Barriers for Aluminum Companies to Set Science-Based Targets

Summary of Findings and Recommendations

January 2020

This project aimed to establish a foundation for the development of tools and guidance to enable aluminum companies to set science-based targets (SBTs). In this project, WRI engaged aluminum sector experts to identify challenges to setting SBTs using existing methods and recommend options for pursuing revised methods, as well as new guidance and other resources.

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Context

In December 2015, nearly 200 countries adopted the Paris Agreement, the first-ever universal climate agreement that seeks to "strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5° Celsius." In 2018, the Intergovernmental Panel on Climate Change (IPCC) released the special report Global Warming of 1.5°C (SR1.5), which provides strong evidence that limiting warming below 1.5°C will significantly lower climate impacts and humanitarian crises linked to drought, sea level rise, flooding, extreme heat, and ecosystem collapse. To limit warming to 1.5°C, the IPCC asserts that global greenhouse gas (GHG) emissions must be cut by 45% from 2010 levels by 2030 and reach net-zero emissions around 2050 (IPCC 2018).

To support corporate efforts to move to more sustainable growth patterns and to stay within the scientific temperature guardrails set by the IPCC, the Science Based Targets initiative (SBTi) was launched in June 2015. The SBTi defines and promotes best practice in SBT setting, offers resources and guidance to reduce barriers to adoption, and independently assesses and approves companies' targets. For example, it has created the Sectoral Decarbonization Approach (SDA), a method for developing SBTs in the aluminum and other GHG-intensive industries. The SBTi's overall aim is that by the end of 2020, setting SBTs will be standard business practice and corporations will play a major role in driving down global GHG emissions.

According to the International Aluminium Institute (IAI), the aluminum sector contributes more than 1 gigatonne of carbon dioxide equivalent (Gt CO_2e) to annual global GHG emissions, roughly 2% of total anthropogenic emissions globally. The International Energy Agency (IEA) ranks the aluminum subsector as the fourth-largest industrial energy consumer and CO_2 emitter, representing 4% (6.2 exajoules) of final industrial energy demand and 3% of total direct CO_2 emissions from industrial sources in 2014[1] (261 million metric tonnes of carbon dioxide equivalent, or $MtCO_2e$/year).

Aluminum production is particularly associated with high electricity demand, which is responsible for approximately 70% of total GHG emissions from the sector. In fact, the sector accounts for 4.7% of global electricity consumption (IEA 2017) while total energy use, on average, accounts for more than 40% of aluminum production costs.[2] The GHG predominantly emitted in the production of primary aluminum is CO_2, although other GHGs with high global warming potentials (GWP) are also emitted.

Project Scope

Although the aluminum industry is a large producer and end-user of energy, the material properties of aluminum—lightweight, durable and highly recyclable—mean the aluminum industry has an important role to play in the transition to a low-carbon economy. However, of the 789 companies that have either approved SBTs or have committed to set SBTs (as of January 2020), only three are part of the aluminum industry: Ball Corporation (a downstream consumer of rolled products), EN+ Group (an energy producer

[1] Energy Technology Perspectives 2017, IEA
[2] IPCC AR5 TWG3

with predominantly hydro-powered primary aluminum assets in its portfolio), and Hulamin (a producer of rolled products).[3]

To respond to this reality, this project was conceived to identify existing and perceived barriers for the aluminum sector, leading to greater understanding of options for setting SBTs by aluminum companies. The key expected outcomes for the project include:

1. Greater awareness of the practical challenges faced by the global aluminum industry in limiting GHG emissions from the sector;
2. Greater understanding of the feasibility of sectoral SBT pathways that include (and don't include) the emissions reduction potential from along the value chain;
3. Recommended options for factoring these challenges into revised methods or new tools and guidance for setting SBTs in the industry.

Project Activities

To build support for the project's findings and build momentum for the development of future tools, WRI engaged numerous industry stakeholders drawn from companies, industry associations, NGOs, research organizations, and inter-governmental organizations (including the IEA).[4] WRI collaborated closely with the IAI in particular, as one of the organization's core activities is to collect, analyze, disseminate and maintain the best available data for the global aluminum sector. In fact, the IEA uses the IAI's data to model and produce the aluminum sector outputs for its Energy Technology Perspectives (ETP) publication (an important detail to note for the purposes and outcomes of this project).

WRI held three stakeholder engagement events during this project. The first was a kickoff webinar held on January 9, 2019 to introduce the project. An initial list of 288 potential stakeholders was identified and provided by IAI, and the kickoff webinar recorded 228 registered participants. Following the webinar WRI convened a three-hour, in-person workshop on March 13, 2019 in San Antonio, Texas. Over ten representatives from the aluminum sector attended and provided critical input on the project. Appendix A summarizes key themes from the workshop discussion, which were guided by the following objectives:

1. Align on aluminum sector-specific inputs and assumptions for refreshing the sectoral decarbonization (SDA) pathway;
2. Share opportunities and challenges for setting SBTs and reducing emissions;
3. Discuss what tools, guidance and support aluminum companies need to set SBTs.

WRI convened a third stakeholder event on September 27, 2019 in Cambridge, UK in collaboration with the Aluminium Stewardship Initiative's (ASI) annual Standards Committee meeting. Nearly two dozen participants attended the workshop, where WRI shared preliminary research results including a revised well-below 2°C (WB2C)[5] climate stabilization pathway for the aluminum sector. Participants at both

[3] https://sciencebasedtargets.org/companies-taking-action/
[4] Add Appendix with Stakeholder list
[5] Although "well-below 2˚C" is not strictly defined in the Paris Agreement, it is commonly understood to be analogous to the IPCC's 'likely chance' terminology, which is equivalent to a 66% probability of keeping temperature rise below a certain limit (in this case 2˚C).

workshops provided useful input that ultimately helped inform this document. In general, the meeting covered brainstorming and discussion of SBT options, as well as targeted Q&A from WRI to help expand on previously discussed ideas and to solicit feedback on new ideas. Minutes from the meeting with ASI are provided in Appendix B.

Existing SBT Options for the Aluminum Sector

As defined in the GHG Protocol Corporate Accounting and Reporting Standard, scope 1 emissions are direct emissions from owned or controlled sources, whereas scope 2 emissions are indirect emissions from the generation of purchased energy (WRI and WBCSD 2004).

The current SBTi criteria and recommendations (Version 4.0, published in April 2019) requires corporate scope 1 and 2 targets to be consistent with at least a WB2C pathway, with greater efforts encouraged toward limiting warming to 1.5°C. Companies from the aluminum sector currently have three methods for setting scope 1 and 2 targets within the SBTi:

- **Absolute contraction:** Reduce absolute emissions by a minimum of 2.5% annually to keep global temperature increase within well-below 2°C, or by a minimum of 4.2% annually for a 1.5°C global temperature limit;
- **Activity-based intensity:** Reduce emissions intensity per physical production output with a unit that's representative of a company's portfolio (e.g., per aluminum can shipped), which, when translated to absolute emissions reduction terms, is in line with the minimum absolute contraction approach;
- **Sector-based:** The global carbon budget is divided by sector and emission reductions are allocated to individual companies based on the sector's budget. To facilitate this approach, the SBTi developed the Sectoral Decarbonization Approach (SDA).

For scope 3 targets, there are four methods available for companies.[6]

- **Absolute contraction:** Reduce absolute emissions by a minimum of 2.5% annually to keep global temperature increase within well-below 2°C, or by a minimum of 4.2% annually for a 1.5°C global temperature limit;
- **Economic intensity:** Reduce emissions intensity per value added by at least an average of 7% year on year;
- **Physical intensity:** Intensity reductions aligned with the aluminum sector SDA; or targets that do not result in absolute emissions growth and lead to linear annual intensity improvements equivalent to 2%, at a minimum;
- **Supplier engagement:** Commit to having a specific percentage of suppliers (as a percentage of spend or GHG emissions) with their own SBTs within five years from the date the company's target is submitted to the SBTi for validation.

[6] 2°C is the minimum level of ambition for scope 3 targets; however, companies are encouraged to pursue greater effort toward a well-below 2°C (minimum 2.5% annual linear reduction) or a 1.5°C trajectory (minimum 4.2% annual linear reduction).

Scope 3 Emissions

Value chain (scope 3) emissions can be significant for both upstream and downstream aluminum companies. For "pure play" aluminum producers, for example, downstream scope 3 emissions from *Category 10 – Processing of Sold Products*[7] (e.g. transformation of one tonne of aluminum into components for the aviation sector) are often a significant source of emissions. For all fabricators of aluminum end-use products, the upstream scope 3 emissions from *Category 1 – Purchased Goods and Services*[8] (transformation of mined bauxite into one tonne of aluminum) are oftentimes more significant than the combined scope 1 and 2 emissions from their own operations. Figure 1 describes the 15 scope 3 categories as defined by the GHG Protocol [Corporate Value Chain (Scope 3) Accounting and Reporting Standard](https://ghgprotocol.org/standards/scope-3-standard).

Figure 1: GHG Protocol Scope 3 Emissions Categories

Upstream or Downstream	Scope 3 category
Upstream Scope 3 Emissions	1. Purchased goods and services 2. Capital goods 3. Fuel-and-energy-related activities (not included in scope 1 or scope 2) 4. Upstream transportation and distribution 5. Waste generated in operations 6. Business travel 7. Employee commuting 8. Upstream leased assets
Downstream Scope 3 Emissions	9. Downstream transportation and distribution 10. Processing of sold products 11. Use of sold products 12. End-of-life treatment of sold products 13. Downstream leased assets 14. Franchises 15. Investments

While companies of all stripes face numerous barriers to accounting for and addressing scope 3 emissions (e.g. collecting data from suppliers), these emissions also present companies with potential mitigation opportunities when setting SBTs (e.g. increased purchasing from carbon-friendly suppliers).

For all companies, the current SBTi criteria and recommendations (Version 4.0, published in April 2019) require the submission of a scope 3 target when a company's relevant scope 3 emissions are 40% or more of total scope 1, 2 and 3 emissions. Once this 40% threshold has been reached, companies must set one or more emission reduction targets and/or supplier or customer engagement targets that collectively cover at least two-thirds of total scope 3 emissions in conformance with the GHG Protocol Scope 3 Standard.

[7] https://ghgprotocol.org/standards/scope-3-standard
[8] Ibid

The Sectoral Decarbonization Approach (SDA)

The SDA is a scientifically-informed method for companies to set GHG reduction targets. The methodology is intended to help companies in homogenous, energy-intensive sectors with well-defined activity and physical intensity data to align their emissions reduction targets with a global WB2C pathway.[9]

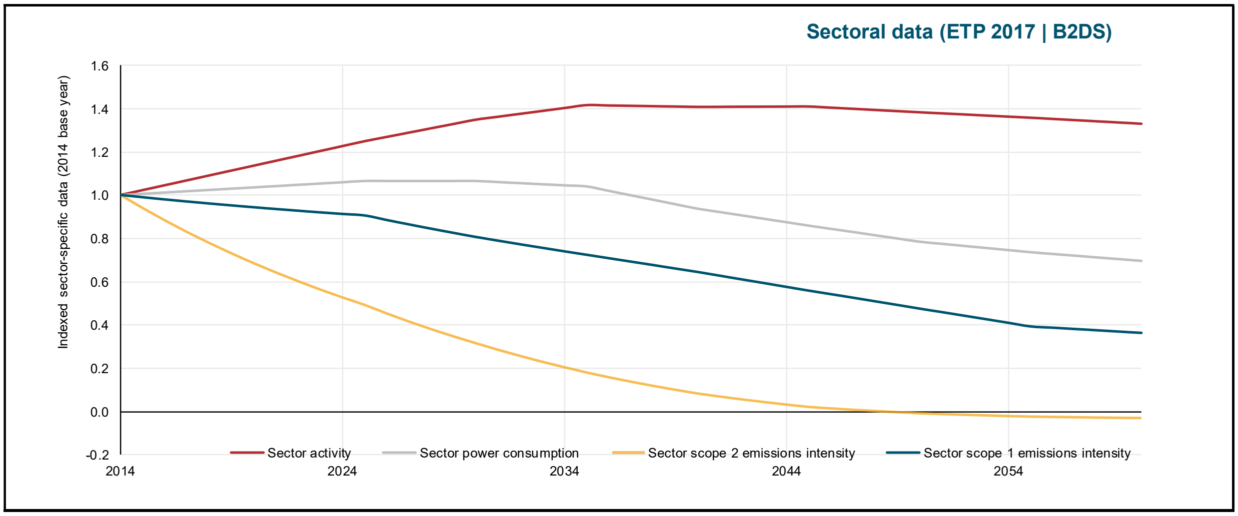
The current SDA method provides the basis for the only existing, sector-specific method for setting SBTs in the aluminum sector. The SDA's WB2C scenario is based on a modeled "Beyond 2°C" (B2DS) scenario from the 2017 ETP,[10] where technology improvements and deployment are pushed to their maximum practicable limits across the energy system in order to achieve net-zero emissions by 2060 and to stay net zero or below thereafter, without requiring unforeseen technology breakthroughs or limiting economic growth. This "technology push" approach results in cumulative emissions from the energy sector of around 750 $GtCO_2$ between 2015 and 2100, which is consistent with a 50% chance of limiting average future temperature increases to 1.75°C.[11][12] The aluminum sector's cumulative carbon budget over this same timeframe has been estimated to be approximately 11 GtCO2 (scope 1 only), or roughly 1% of the global carbon budget.

The IEA's B2DS scenario lays out an energy system pathway and a CO_2 emissions trajectory consistent with at least a 66% probability of keeping temperature rise below 2˚C by 2100. Under this pathway, the energy intensity of aluminum production (assuming a 2010 grid mix) must fall by 7% between 2010 and 2025,[13] and steeper reductions are required over the long term. Ultimately, the pathway implies the need for large reductions in emissions intensity between 2010 and 2050, specifically: direct (scope 1) emissions intensity must fall 88%, while scope 2 emissions intensity must fall 96%.[14]

Figure 2 shows the sector's SDA pathway outputs (2014 – 2060) for primary aluminum (secondary excluded) based on IEA's B2DC scenario and indexed to production.

[9] The SBTi currently is in the early phases of developing a 1.5°C aligned pathway for incorporation into the SDA.
[10] https://www.iea.org/reports/energy-technology-perspectives-2017
[11] In contrast, the IEA's 2017 2°C scenario estimates an overall carbon budget of 1,170 GtCO2 from 2015 - 2100.
[12] https://sciencebasedtargets.org/wp-content/uploads/2019/04/foundations-of-SBT-setting.pdf
[13] http://www.iea.org/etp/etp2016/
[14] http://sciencebasedtargets.org/wp-content/uploads/2015/05/Sectoral-Decarbonization-Approach-Report.pdf

Figure 2: Indexed SDA pathway outputs for primary aluminum (2014-2060)



The SDA method takes sectoral differences and abatement potentials into account, which are considered in the making of the different sector scope 1 scenarios. The SDA model also includes scope 2 scenarios based on a shared power generation pathway for each scenario outcome (e.g. 1.5˚C). These scenarios can also be used to set valid scope 3 targets, to the extent that certain activity pathways correspond to scope 3 categories or the emissions sources of a company's scope 3 inventory. For example, where certain scope 3 categories consist mainly of purchased electricity emissions, the relevant SDA power generation pathway can be used to model reduction targets. For homogeneous sectors, the SDA method also accommodates differentiated levels of historical action, as it requires GHG emissions-intensive companies to reduce their emissions faster than the sectoral average; conversely, companies with relatively low initial emissions intensities may reduce their emissions more slowly.[15]

Limitations of the current SDA for the aluminum sector

Companies from the aluminum sector have expressed increasing interest in using the SDA or another sector-specific intensity-based approach to set SBTs and demonstrate their commitment to transition to a low-carbon future. However, companies have also identified and expressed concerns about the modeling assumptions used to produce the SDA's benchmark pathway.

A homogenous sector?

In general, a physical indicator that represents a sector's primary output (e.g. one tonne of aluminum) is a helpful way to compare the emissions intensity of similar companies within the same homogenous sector, and thus the individual level of effort needed to converge to an optimal level of emissions per unit of product. To produce a useful metric, however, the underlying data used to measure a company's emissions impact ideally should be aligned with the data used to model the sector's emissions impact (e.g. total consumption of electricity).

One clear takeaway from stakeholders involved during this project is that whilst the sector is generally defined as homogenous, many companies in the aluminum industry produce a wide array of products that oftentimes cannot be captured in a single physical indicator. Similarly—but not unique to the

[15] https://sciencebasedtargets.org/wp-content/uploads/2019/04/foundations-of-SBT-setting.pdf

aluminum sector per se—the organizational boundaries that define a company's GHG emissions profile can often differ, further complicating perceptions of an unlevel playing field by some. Although this is not the case for every stakeholder, the diversity that exists across the aluminum sector's value chain has nonetheless presented complications for both upstream and downstream actors interested in using the SDA to help define their SBT.

The weight of electricity

Electricity is a significant input to the aluminum production process, and variations in the electricity mix of global aluminum producers is the primary (but not only) distinction among the GHG emissions intensity (tCO_2e/t Al) of an aluminum producer's final sold products. According to a 2011 study by the Carbon Trust this metric can vary considerably, from as little as 1 tCO_2e/t Al of recycled aluminum, to 3 tCO_2e/t Al for best available technology (BAT) smelters powered by renewable electricity, and up to 20 tCO_2e/t Al for less modern technology powered by coal-based electricity.[16]

Furthermore, due to the aluminum sector's considerable utilization of captive or directly delivered power supplies, the source of electricity actually used (and the corresponding emission factors) can significantly differ from the national or regional grid mixes used in the IEA's ETP modelling.[17] And because many producers of aluminum generate their own electricity, the profile of their scope 1 and 2 emissions may differ considerably from those of their peers, potentially limiting the usefulness of the aluminum pathway results from the SDA model.

Cradle to gate

The upstream segment of the aluminum market consists of the production of primary aluminum (and alloys), including the entire raw material supply chain and processes that precede its production. The downstream sector is made up of thousands of producers of semi-finished and finished aluminum products, as well as producers of recycled aluminum from processed material. Of concern for many downstream aluminum stakeholders is the SDA's coverage of sector emissions and activities, which is currently limited to the "cradle-to-gate" upstream energy emissions from transforming bauxite into alumina, anode production, aluminum smelting (electrolysis) and ingot casting. The current IEA model includes both production of primary aluminum from alumina and secondary aluminum production (from recycled materials) and of aluminum alloys. Admittedly these activities represent the lion's share of emissions from the sector, but the absence of a relevant pathway for the downstream segment—beyond their upstream scope 3 emissions—ostensibly closes the door for a significant number of potential SBT setters from the industry.[18]

On a related note, the scope 2 emissions pathway results for different actors along the value chain is not accounted for in the current SDA. For example, the scope 2 emissions of a downstream fabricator of aluminum products are likely to be vastly different than those of a pure-play producer of aluminum, and

[16] https://www.carbontrust.com/media/38366/ctc790-international-carbon-flows_-aluminium.pdf
[17] http://www.world-aluminium.org/media/filer_public/2018/02/19/lca_report_2015_final_26_june_2017.pdf
[18] On average 72% of GHG emissions from primary production of aluminum are from electricity with the remainder from thermal combustion of fossil fuels and process emissions. https://www.carbontrust.com/media/38366/ctc790-international-carbon-flows_-aluminium.pdf

thus the SDA's assumption of intensity convergence would be particularly inappropriate for the fabricator.

Key Challenges Identified for the Aluminum Sector's Adoption of SBTs

Based on discussions with stakeholders during the webinars, workshops and individual conversations, there are a range of challenges as to why the aluminum sector has been slow to commit to setting SBTs. Some of these challenges are not unique to the aluminum sector and its companies (e.g. organic growth), but several challenges do demonstrate a need to move beyond a one-size-fits-all approach for the sector.

Mirroring the operational diversity that characterizes the aluminum industry, there is a wide range of perceived obstacles for participation among individual stakeholders, including:

Emissions-intensive growth

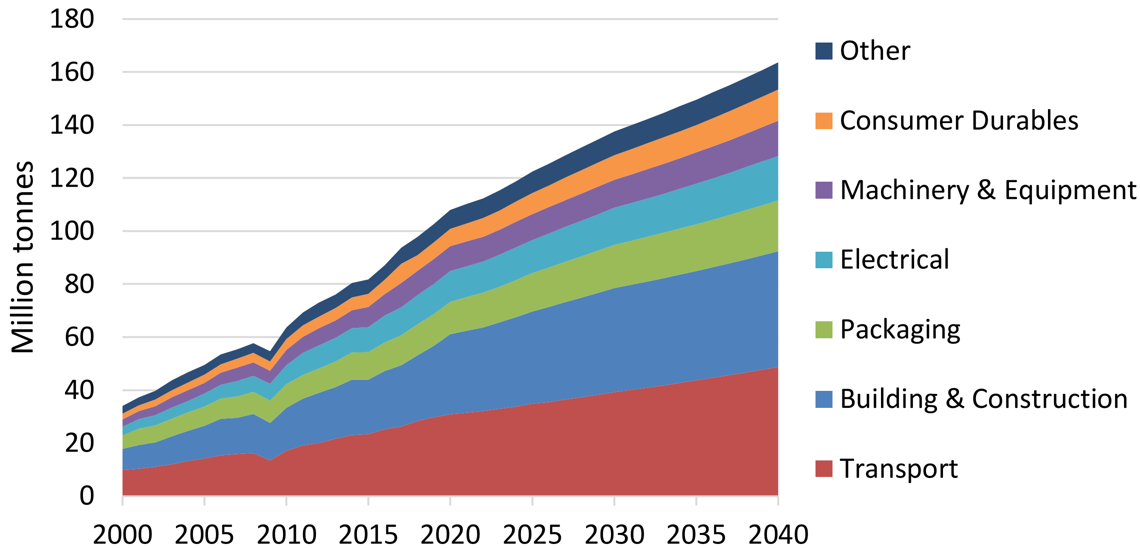
Led by the economic growth of emerging economies, the sector estimates that by 2030 it will produce 90 million tonnes of primary aluminum (MT Al), compared to 60 MT Al today.[19] Given a business-as-usual scenario based on current macroeconomic trends, the sector projects the production of the additional 30 MT Al to be supplied mostly by China and South East Asia (both powered mostly by coal-based electricity) and the Middle East (powered by natural gas), with the result that fossil fuels could power an even higher percentage of global smelter production (currently about 60%).[20] In the absence of support for low-carbon aluminum from the public and private sectors, this reality is a particularly vexing problem with respect to the sector's contribution to climate change.

Recycling uncertainty

Greater recycling by the industry to produce more secondary aluminum is often cited as one of the primary ways to reduce GHG emissions from the aluminum sector. Indeed this is true, but sector experts (e.g. IAI, *et al*) have indicated there is limited availability of end-of-life scrap metal for collection (a function of long product lifetimes, growing demand, and a shift from cast to wrought applications, particularly in the automotive sector) and increasing competition for high quality, well-sorted and valuable new scrap (again, particularly from the auto sector).[21] Figure 3 illustrates the annual demand among different sectors for semi-fabricated aluminum products (e.g. extruded aluminum). In 2018, for example, 54% of total demand for aluminum was dominated by two sectors that produce products with long lifetimes: Transport (28.4 Mt Al) and Building & Construction (24.8 Mt Al).

[19] International Aluminum Institute, http://www.world-aluminium.org/
[20] International Aluminum Institute, http://www.world-aluminium.org/
[21] Energy Technology Perspectives 2017, IEA

Figure 3: Sector demand for semi-fabricated products



Source: IAI

IEA modelling outputs versus reported industry data

The IEA's ETP scenarios are produced using models that account for industrial energy consumption separately from the production of electricity. However, because aluminum smelters are often co-located with aluminum industry-operated power generation facilities, electricity production and consumption are intertwined for a substantial portion of the sector. Despite a considerable amount of desktop research and collaboration with industry experts (most notably IAI), the discrepancy between the IEA's electricity consumption figures for the sector and those of the IAI's remains unclear. Predictably, the corresponding differences in scope 2 emissions estimates from IEA and IAI for electricity use by the sector are considerable (35%). Table 1 shows the discrepancies in scope 1 emissions estimates between the IEA and the IAI (47%) and the total percentage difference for all GHG emissions (39%). Of equal concern is the difference between IEA's total reported production of primary and secondary aluminum (126 MT Al in 2014) versus those of the IAI (80 MT in 2014). The difference between these numbers is not fully accounted for by the IEA, sowing confusion about the results of its analysis for the sector and its appropriateness for modelling corporate targets using the SDA.

Table 1: Modelling Implications of Differing Data Estimates

SOURCE	SCOPE 1 EMISSIONS (2018)	SCOPE 2 EMISSIONS (2018)	TOTAL 2018 EMISSIONS (SCOPE 1 AND 2)
IEA ETP 2017	273 $MTCO_2e$	500 $MTCO_2e$	773 $MTCO_2e$
IAI 2018	401 $MTCO_2e$	676 $MTCO_2e$	1,077 $MTCO_2e$
Difference between estimations (%)	47%	35%	39%

Regional differences

The current version of the SDA method intrinsically accounts for regional differences regarding level of activity and carbon intensity, but not explicitly in relation to regional resources. Strong regional variations exist for the power sector globally, however, under both the B2DS and 1.5C scenarios the global carbon intensity of electricity production must converge to 0 $MtCO_2e$/KWh. There is no way to sugarcoat the implication for aluminum companies that purchased power in regions reliant on fossil-based electricity: the higher a company's carbon intensity, the steeper the reduction pathway.

Process emissions

For all sectors, IEA's scenario modelling is solely focused on energy production and consumption and does not account for direct process emissions such as PFC emissions during the electrolysis process (while SDA pathways account for all Kyoto GHGs).[22] Global PFC emissions have been reduced considerably by the industry and are now relatively small in comparison to the overall CO_2 emissions from energy generation and consumption from the sector (approximately 5%); however, they are a potent greenhouse gas with a GWP of between 9,200 – 11,100 for C2F6 (SAR and AR5, respectively) and 6,500-6,630 for CF4 (SAR and AR5, respectively) and remain a source of mitigation potential for the industry.

Organizational boundaries

Another challenge communicated by aluminum stakeholders has been the recognition that not every company in the sector is accounting for the same things in their GHG inventory, creating the perception of an uneven playing field.[23] Some companies from the aluminum sector may be hesitant to set SBTs due to the prospect of outside stakeholders making apples-to-apples comparisons between the targets

[22] The IEA's ETP 2017 estimates 37% of direct CO_2 emissions from aluminum were process-related emissions.
[23] "Aluminium and GHG emissions: Are all top producers playing the same game?", AluWatch (Cyclope), 2015.

of companies with different organizational boundaries. This is another challenge that is not unique to the aluminum sector but is understandably problematic from an external communications perspective.

2020 edition of IEA's Energy Technologies Perspectives (ETP) publication

Since the SBTi's inception in 2015, the International Energy Agency's (IEA) Energy Technology Perspectives (ETP) report has underpinned the SBTi's Sectoral Decarbonization Approach (SDA) method for companies setting SBTs. The ETP outlines sector-specific pathways for GHG-intensive sectors, including aluminum, iron and steel, power and cement. IEA's scenarios are based on least-cost reduction measures within and across sectors. The current version of the ETP (2017) provides several temperature-aligned climate scenarios, two of which are utilized by the latest version of the SBTi's SDA (V8.1) to assess corporate SBTs: a 2°C scenario (2DS) (only applicable for scope 3 targets) and a "below" 2°C decarbonization scenario (B2DS).

Over the past decade the IEA has updated its ETP publication on a bi-annual basis and has recently announced plans to revamp the publication and release a new edition in June 2020. According to preliminary plans, the IEA will be moving away from temperature-aligned scenarios and focus instead on two scenarios: a reference/BAU scenario and a 'net zero by 2070' scenario, which tracks closely to the current B2DS scenario. However, in April 2019 the SBTi integrated the latest climate science findings from the IPCC to pursue greater efforts towards a 1.5°C trajectory—with an eventual goal to reach net zero by 2050—into existing tools and resources. Given the recent announcement of IEA's focus on a net zero by 2070 scenario it is unclear if any future ETP will reflect a 1.5°C scenario.

Meanwhile, the SBTi has committed to updating the SDA to include a 1.5°C pathway and is currently in the early stages of developing a power sector scenario for incorporation into the SDA—this is an essential piece to a revised SDA and is particularly relevant for setting SBTs in the aluminum sector. The SBTi expects to release a 1.5°C-aligned tool and accompanying technical guidance in Spring 2020, thereby enabling companies to use the SDA to submit 1.5°C-aligned targets for assessment by the SBTi. It is important to note, however, that an enhanced SDA tool is not a requirement for setting 1.5°C aligned targets; in fact many SBTi companies have already set such targets by using an absolute emissions linear reduction threshold of 4.2% to receive approval for their SBTi targets.

Key Recommendations and Priorities

In keeping with a metaphor that has long been used in discussions about climate change mitigation, there is no silver bullet solution to the problem, we instead need to be using silver buckshot. Companies from the aluminum sector must deploy as many technologically and financially feasible mitigation options as possible over the next 30 years if they are to do their part in combating climate change. Setting credible SBTs can help guide this process. As Holly Emerson from Ingersoll Rand explained, "We don't know what technology will exist in ten years to help us meet our target. But now we have the incentive to find out."

As this document is intended to provide a foundation for the development of additional tools and guidance to enable aluminum sector companies to SBTs, this section provides recommended options for pursuing revised methods and guidance.

Revise the current SDA to include missing scope 1 and 2 emissions

Many stakeholders have expressed concerns about using the SDA as a one-size-fits-all benchmark for the industry for a variety of reasons. Table 1 captures in stark terms the considerable difference in GHG emission data estimates for the sector and the need to resolve these in future SBT models. Fortunately, data availability for the sector is very good when compared to many other sectors. This presents several opportunities, including the industry's potential to create its own science-based benchmarking approach. Indeed, the IEA's ETP may compel stakeholders in the sector to forge an aluminum SBT pathway that is more representative and granular given the sector's operational diversity.

Using the existing SDA B2DC pathway, Figure 3 demonstrates the significant differences between using the IEA's ETP assumptions and reported data from IAI. For example, the scope 1 and 2 emissions for the sector reported by IEA for 2014 measure approximately 766 $MtCO_2e$, whereas IAI's 2014 scope 1 and 2 sector emissions are nearer 897 MtCO2e—a 15% difference. In the SDA pathway using IAI data, GHG emissions for the sector peak in 2025 (1,129.8 $MtCO_2e$) and by 2060 reach 136.1 $MtCO_2e$, while IEA's B2DC scenario suggest the sector's emissions peaked in 2014.

Figure 4: Different data will produce different results. Which is the correct pathway?

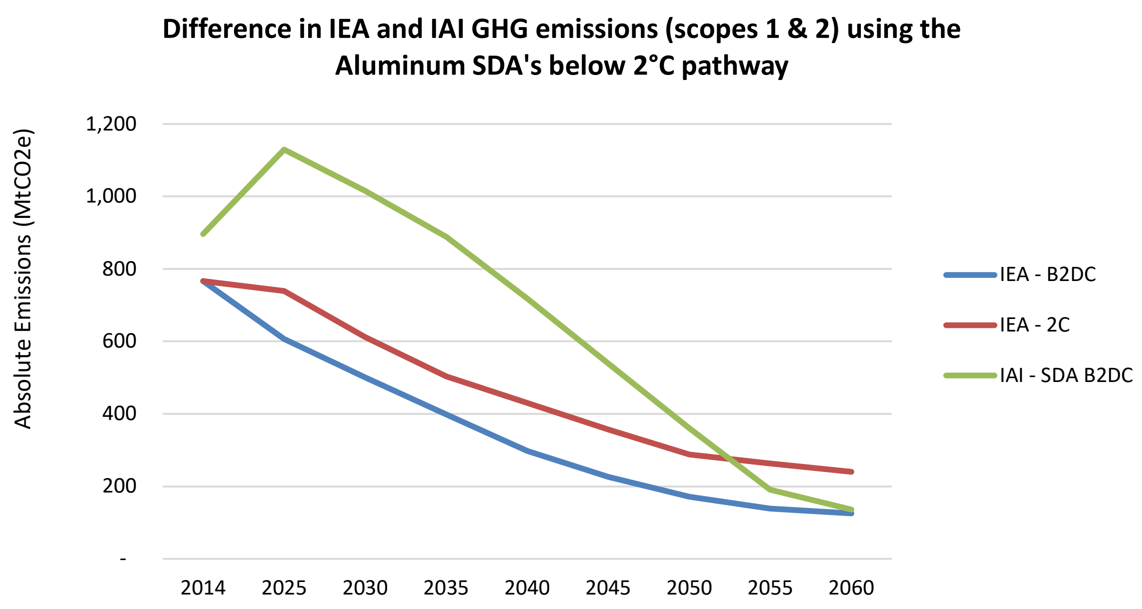
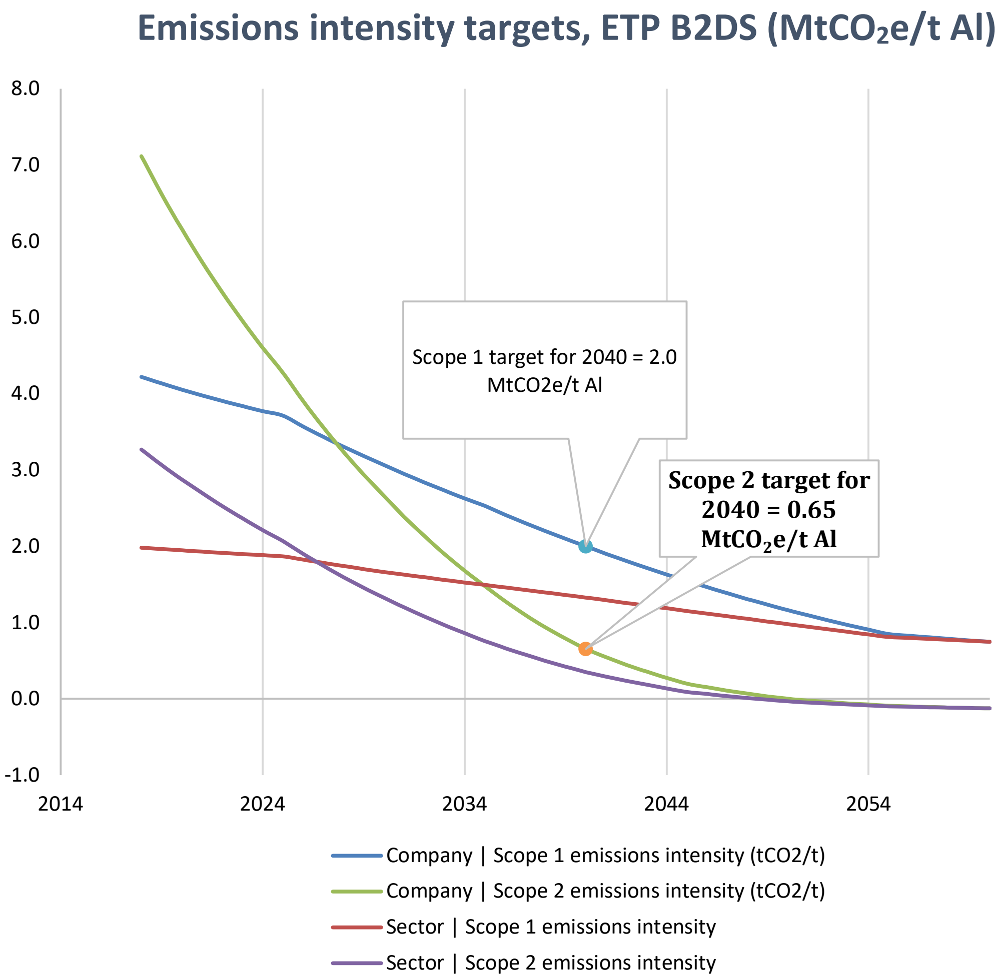


Figure 5 shows SDA outputs using the same GHG estimation data and production estimates for the sector from IAI to derive GHG emission intensity targets for the entire sector (scopes 1 and 2) by 2040.

Figure 5: Emissions intensity benchmarks to 2040



Utilize alternative SDA sector approaches

All SBTi companies may use relevant SDA pathways for energy-intensive activities across scopes to inform the underlying target ambition of absolute or intensity targets. For example, if the majority of a downstream aluminum company's emissions are from purchased electricity, a company may use the SDA pathway for power generation to model targets for its scope 2 emissions.[24] This particular option was not discussed at great length during the stakeholder meetings and thus it is likely many companies are unaware of this as a potential SBT approach.

In addition, the current SDA tool includes an option for "Other Industry" which could potentially be used by aluminum sector companies that are not well represented by the aluminum SDA approach. This is yet another alternative that was not included during discussions with stakeholders but should receive more attention for future research. Further sector-specific guidance and/or adjustment of the existing SDA

[24] Note: IEA scenarios for both the well below 2 and 1.5 pathways require the power sector to reach net zero levels by 2050.

tool for aluminum companies could make the process more user-friendly while also providing more clarity about available target-setting options.

Develop strategic SBT 'roadmaps'

The establishment of a handful of strategic 'roadmaps' for certain segments of the value chain might provide a useful accelerator for aluminum companies setting SBTs. For all sectors, the mitigation options available to upstream versus downstream companies across scopes can be quite different. For a downstream fabricator of aluminum products, for example, targeting scope 2 reductions (perhaps through long-term power purchase agreements (PPAs) with local or co-located renewable energy generators, or virtual PPAs in favorable markets) presents mid-to-long term opportunities to commit to 100% production or consumption of renewable energy. For an upstream aluminum producer that generates its own captive power using renewable energy, however, it will be necessary to look towards investments in fossil-free assets that transition the company to lower-carbon production.

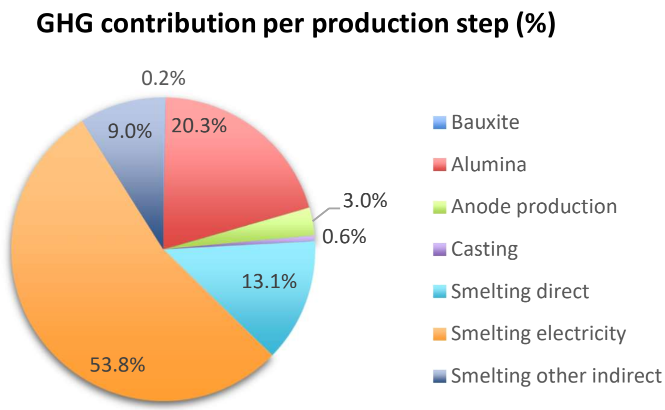
Furthermore, these strategic roadmaps should also include specialized guidance for scope 3 emissions. There is a considerable amount of work to be done with respect to the sector's treatment of scope 3 emissions. Building strategic roadmaps that entwine the various options for setting and meeting SBTs across all scopes, together with targeted consideration of current and emerging mitigation options could perhaps help to remove a sizeable portion of doubt for companies looking to set SBTs.

Create multipliers and discount factors to the SDA

To help create a clearer measure of equity among targets established using the current SDA, the idea of incorporating transparent multipliers or discount factors to account for major operational differences among companies has been discussed. For example, for companies that do not refine alumina themselves and purchase it instead, a multiplier could be applied to normalize the outputs of the SDA to help account for the absence of this activity for scope 1. Figure 6 provides an approximation of the GHG contribution of each process step, by percentage, in the production of one tonne Al.[25]

[25] These figures are based on IAI estimates and could be further refined for SBT application via industry engagement.

Figure 6: Percentage of GHG emissions by each process step



There was considerable interest among stakeholders during the project to break down the aluminum production process by each step's GHG contribution, which is what each of the percentage figures in Figure 5 represent.

Like many of the recommendations made in this document, this idea would require additional expert stakeholder input and consensus and, consequently, more detailed GHG inventory disclosure from companies during the SBT-setting process. Although this approach is useful in providing more granularity about which processes contribute to companies' GHG impact, it should avoid being used for 'cherry picking' which sources to include or exclude in a company's GHG reporting boundary. The SBTi is technology neutral with respect to the mitigation options companies choose to meet their SBT commitments, but explicitly discourages (and disallows) companies from setting SBTs that do not account for a company's entire scope 1 and scope 2 GHG inventory.[26]

Summary and Prioritization of Recommendations

Close the data gaps for each segment of the value chain, including downstream: WRI recommends the industry deliberate and reach consensus for each step of the value chain where large discrepancies exist between data produced by IAI and IEA. The stakeholder process revealed that any existing or new target-setting methods need to have the confidence of companies, which is likely unattainable without accurate and complete data. These new data could also help to inform a revised and enhanced version of IAI's 2018 *Aluminium Carbon Footprint Technical Support Document*.

Continued collaboration with both the IEA and SBTi to help improve the SDA: We have identified various ways the current SDA tool for the aluminum sector can be altered or improved to develop more meaningful and consistent SBTs for the industry. WRI recommends the industry commit to helping both IEA and the SBTi to develop more nuanced SBT scenario pathways that are based on the most up-to-date activity data, market trends, geographical peculiarities and technological innovations.

[26] SBTi companies do have the option to exclude certain de minimus sources from their GHG inventory up to 5%.

Develop relevant sector-specific SBT 'roadmaps': WRI recommends the development of industry-informed roadmaps that help lay out the options for specific company groupings for setting and achieving SBTs in order to help demystify the process and spur science-based commitments. These roadmaps should include technological and economic analyses of mitigation and material efficiency options that are included in the models used to produce relevant SBT pathways, especially options that companies can realistically deploy during the timeframe of their SBT.

Initiate a comprehensive value chain assessment of the potential scope 3 emissions represented by companies within the sector: The more options aluminum sector companies have to reduce their GHG emissions impact, the more likely they will set SBTs. Although the sector has carried out useful LCA analyses of their primary product (1 Mt Al), corporate GHG inventories are fundamentally different in their approach with respect to their allocation of "ownership" of emissions. A comprehensive assessment of the scope 3 emissions that companies should consider—and the potential hotspots and opportunities for low-carbon investments—could have a profound, positive effect on companies' interest and ability to set SBTs.

Appendix A: Key Themes from San Antonio Workshop

Overview

On March 13 in San Antonio, WRI convened a three-hour workshop with representatives of the aluminum sector to solicit input on the aluminum sector project of the Science Based Targets initiative. The session objectives were three-fold:

1. Align on aluminum sector-specific inputs and assumptions for refreshing the sectoral decarbonization pathway
2. Share opportunities and challenges for setting science-based climate change targets (SBTs) and reducing emissions
3. Discuss tools, guidance, and support that aluminum companies need to set SBTs

This document includes a summary of the key themes from the discussion, with references to slides that WRI shared during the session. Also, it should be noted that the discussion focused primarily on mid-stream activities (i.e. alumina refining, aluminum smelting), though there is a role for downstream actors to play.

Summary of feedback

The following themes emerged from the workshop:

- It would be helpful for the SBTi (or another organization such as the International Energy Agency) to clearly articulate the required global reductions of greenhouse gas emissions globally under different scenarios (i.e. 1.5ºC, 2ºC), and how these reductions translate for the aluminum sector (i.e. what is the sector's share?). Thus, aluminum companies would understand the scientific basis for the required reductions and the contribution they must make to it. Several participants opined that the slide on the decarbonization of the power sector (#23) was helpful in showing the required ambition level for a sector that, like aluminum, faces considerable challenges to decarbonize.
- The group suggested a number of revisions to the aluminum sector pathway that is included in the IEA's Energy Technology Perspectives 2017 report. For reference, the report indicates 261 million tonnes of CO_2 emissions in 2014, dropping to 125 million tonnes in 2060 under the below 2ºC scenario. The suggestions:
    - Include direct (scope 1) and electricity-related indirect (scope 2 – scope 1 for self-generated power) emissions in the baseline and projections. This would take the baseline a fair amount higher – to over 1 billion tonnes in 2017.
    - Further explain how the IEA arrived at the slope of the emissions curve out to 2060 (see slide 24), and the various assumptions inherent to this curve (e.g. adoption of inert anode technology, percentage of recycled vs. primary aluminum, grid and on-site electricity emissions intensity).

- Clarify how the IEA is treating internal (run-around) scrap (i.e. scrap collected from the smelting process and put back in at the front end).
- In discussing the breakdown of sector emissions by unit process (alumina refining, smelting, casting, etc. – see slide 30), participants suggested that WRI consider creating pathways for each phase to acknowledge different processes and inputs. This could make it easier for a companies in that they could then focus specifically on their piece of the value chain. For example, if a company is involved only in aluminum smelting (and not alumina refining), it could focus its target setting and reductions there. Related, the group suggested that we also consider different pathways for primary vs. recycled production.

ACTION: IAI to develop illustrative curves representing unit process pathways (Q2 2019)

Several participants raised questions about whether companies that have already achieved notable GHG emissions face a disadvantage in setting SBTs (as they have fewer reduction opportunities ahead of them). In such cases, the intensity reduction approach in the SDA may be helpful because companies with low GHG intensities (relative to the sector average) have to reduce their emission intensity less than more emission intensive companies.

ACTION: IAI to develop illustrative curves representing company reduction pathways (Q2 2019)

A participant suggested that it would be helpful to identify key customers (or users) of aluminum across sectors – automotive, aviation, buildings, electronics, etc. – to understand how they are approaching aluminum from an SBT perspective (e.g. is aluminum being addressed in scope 3 targets?). This would also help aluminum companies ascertain current and future interest in low carbon aluminum, which would help make the case for aluminum companies to set and work towards SBTs.

While WRI has been clear that avoided emissions (e.g. reductions downstream via light weighting with aluminum) are not a focus of this project, the topic came up a number of times and we expect it will continue to do so. It is thus worth considering how to address avoided emissions in this project or elsewhere. The inclusion of electricity related emissions in the aluminum sector baseline and pathway opens the door to this multi-sectoral approach.

Lastly, while the focus of this project is helping aluminum companies set SBTs, aluminum companies need solutions to certain GHG hotspots (see slides 27 and 30):

- Alumina refining: currently coal, oil or gas based for process heat & steam) – this is not easily changed (see link).
- Electrolysis electricity: While hydro will continue to play a role, nearly 60% of aluminum is produced by China, 90% of which is with coal-based electricity (see link).
- Directs for electrolysis (anode consumption, PFCs): Technologies such as inert anodes will take time to develop and scale and do not address the energy-intensity of the process.

Next steps

WRI will share this note and the slides with workshop participants and other stakeholders that have expressed interest in this work. We are also discussing how to refine the project scope and approach based on the feedback.

Appendix B: Greenhouse Gas Working Group In-Person Meeting Minutes

Date/Time: Friday, September 27, 2019, 8:45 a.m. – 12:30 p.m.
Location: The David Attenborough Building, Pembroke St, Cambridge CB2 3QZ

Antitrust Statement

Attendees are kindly reminded that ASI is committed to complying with all relevant antitrust and competition laws and regulations and, to that end, has adopted an Antitrust Policy, compliance with which is a condition of continued ASI participation. Failure to abide by these laws can have extremely serious consequences for ASI and its participants, including heavy fines and, in some jurisdictions, imprisonment for individuals. You are therefore asked to have due regard to this Policy today and in respect of all other ASI activities.

Participants

- **ASI Standards Committee Members:** Catherine Athenes (Constellium), Steven Bater (EGA), Christophe Boussemart (Nespresso), Annemarie Goedmakers (Chimbo Foundation), Jostein Soreide (Norsk Hydro), Alexey Spirin (UC Rusal)
- **Other ASI Members:** Andy Doran (Novelis), Miles Prosser (Australian Aluminium Council), Olivier Neel (Constellium)
- **Non-Members:** Chris Bayliss (IAI), Pernelle Nunez (IAI), Shaun Walden (DNV GL).
- **ASI Secretariat:** Krista West, Marieke van der Mijn
- **Apologies:** Mohammad Al Jawi (EGA), Nicholas Barla (Odisha Indigenous Peoples Forum, India), Sam Brumale (ASI), Giulia Carbone (IUCN), Mark Cooksey (CSIRO), Taylor Dimsdale (E3G), Alexander Farsan (WWF), Lawrence Hambling (Heineken), Wieke Hofsteenge (Ecofys), Justus Kammueller (WWF), Tobias Kind (WWF), Alexander Liedke (WWF), Jérôme Lucaes (Rusal), Marcus Moreno (ABAL), Ewoud Nieuwenhuis (Heineken), Frederic Picard (RTA), Hugo Rainey (WCS), Jessica Sanderson (Novelis), Jeroen Scheepmaker (Ecofys), Fiona Solomon (ASI), Sandro Starita (European Aluminium), Linda Wright (Energia Potior Limited)
- **Alternates:** Theresia Ott for Catherine Munger (Rio Tinto), Anthony Tufour for Marcel van der Velden (Arconic), Carlos Gago Rodríguez for Rosa Garcia Piñeiro (Alcoa).
- **Invited:** Michael Sadowski (World Resources Institute), Jon Sottong (World Resources Institute)

Documents circulated

1. Meeting agenda
2. Previous minutes (11 February 2018)
3. SBTi project revised GHG reduction pathway for the aluminium sector (WRI)

Meeting objectives

Review and discuss the SBTi project revised GHG reduction pathway for the aluminium sector, prepared by World Resources Institute (WRI).

Items discussed

Preliminaries

1. Welcome and roundtable introductions
2. Meeting objections and approach
3. Previous minutes and actions (none open)
    - No comments were received about the previous meeting minutes.

Key WG discussion points: None

GHG reduction pathway

4. Review and discuss revised potential GHG reduction pathway for the aluminium sector with Science Based Targets (SBT):
    - Inclusive of scopes 1 and 2 (and 3, where these emissions make up more than 40% of corporate combined scope 1, 2 and 3), as per SBTi
    - Potential to provide a breakdown by unit process (i.e. for primary aluminium: bauxite mining, alumina refining, anode production, electrolysis)
    - It was noted that one aim of the SBT initiative project was to develop a revised sector pathway for the industry, based on the best available data from associations like IAI and from industry, and with a scope that includes direct emissions, indirect emissions and non-CO2 greenhouse gases. This would complement the International Energy Agency (IEA) sector pathway, including those for power generation, and would develop a conversation about the underlying data (e.g. using sector specific power mixes vs national/regional grid mix). Stakeholders engagement and the underlying data integrity is important.

Key WG discussion points:

- There was discussion that the 8 t CO2e per metric tonne Aluminium as currently required in the ASI Performance Standard today excludes 90% of aluminium sector emissions (and well over half of primary metal volume).
- There was discussion at the Standards Committee meeting over the last two days that the Performance Standard needs to be aligned with a below 1.5°C target. There was discussion that WRI could indicate what the emissions / tonne threshold would look like over time for it to be aligned with well-below 2°C and 1.5°C targets. Such a threshold would sit below the performance of any primary producer today across all unit processes.
- The GHG working group commented that the IEA aluminium sector data for a well-below 2°C pathway shown during the presentation were misleading and the baseline should be at least twice as high.

- The challenge for the aluminium industry to meet production emission targets needs to be articulated to prevent a credibility gap.
- The Committee recommend that targets by unit process would be helpful, as would regionalised Sectoral Decarbonisation Approaches (SDA).
- There was a comment that SBT may not be readily applicable for downstream companies (recycling, rolling and extrusion) in the aluminium value chain and that different approaches should be explored for setting time bund GHG reduction targets. Scope 3 emissions are not currently part of the SDA and companies using more scrap in the future may find their scope 1 and 2 emissions increasing, even as their total falls (which is not allowed under SBTi) so additional considerations for the downstream aluminium supply chain are needed.

Application of the GHG reduction pathway

5. Discuss how to apply this revised pathway to the ASI carbon standard (8 kg CO2e / kg Al for electrolysis process) and other benchmarks (e.g. company low carbon standards, LME)
6. Explore how the sector can collaborate to drive emissions reductions in line with the SBTi pathway (below 1.5°C)

Key WG discussion points:

- IAI presented on the aluminium market, production and GHG emissions scenarios to 2040. The presentation noted that decarbonisation of the global aluminium sector requires significant changes to the existing (and relatively young) Chinese industrial capacity. Of the 1.1 billion tonnes of emissions from the aluminium sector globally today, 750 million tonnes are evolved in China, 500 Mt of which are from coal-fired power stations. Links to IAI data below:
  - http://www.world-aluminium.org/statistics/massflow/
  - http://www.world-aluminium.org/statistics/primary-aluminium-smelting-power-consumption/
  - http://www.world-aluminium.org/media/filer_public/2018/02/19/lca_report_2015_final_26_june_2017.pdf
  - http://www.world-aluminium.org/media/filer_public/2017/07/04/appendix_a_-_life_cycle_inventory.xlsx
- There was a discussion about what impact ASI can have on climate change and reducing GHG emissions if those (smelters) which are certified are already below 8 tonnes CO2e per tonne of Aluminium. There is also a question of what the pathway may be for other (non-electrolysis) processes, which will also require reduction to achieve a below 1.5°C target.
- There was a discussion about differential access to power from electricity grids, the share of captive power in different regions, and the role that the aluminum industry has played and will play in the future. Coal and hydro have been the suppliers of base load power (driven by local resources), and smelters have played an enabling role in these grids as baseload consumers, but the future will require other technologies to back up supply without destabilizing the grid; options are limited. There was discussion on the costs of these other power sources such as hydro, wind, or solar.

- There was discussion that setting a sector target is complex and the goal should always be incentivizing companies to reduce GHG emissions, but also that emissions across the anthropogenic system should be reduced, which is not necessarily delivered at the magnitude required by individual corporate target setting.

Recap and close

1. Agree any final post-meeting actions and timeframes by Working Group
2. Agree actions by Secretariat
3. Final reflections
4. Close