Carbon Measurement Standards and Decarbonisation in the Aluminium Sector

World Trade Organization

20 September 2023
Marlen Bertram

Director – Scenarios and Forecasts

**Responsibilities at IAI:** I’m responsible for IAI’s material flow analysis, including the Alucycle visualisation and developing scenarios and forecasts for the industry. I also manage work related to aluminium recycling and greenhouse gas modelling.

**Education:** Environmental Science and Process Engineer from Brandenburg University of Technology (Germany)

**Email:** bertram@international-aluminium.org
Agenda

• About the International Aluminium Institute (IAI)
• Industry Guidelines for Carbon Footprint Calculations
• Data Collection & Publication
• IAI Greenhouse Gas Pathways
International Aluminium Institute

Global association for aluminium metal producers
- Bauxite, alumina and aluminium
- Producers from all regions
- 50+ years

Data, Joint Projects, Guidelines, etc
- Industry material flow model
- Sustainability
- Promotion

GHG Emissions Reductions
- GHG Pathways
- Carbon Footprint Guidance – Primary metal and upstream
- Transparency Guidelines – Secondary metal

Don’t do:
- Thresholds
- Criteria
- Green Al definition
- Low-carbon Al definition
- Audit
- Verification
- Commercially competitive issue between producers, including trade
IAI Product Carbon Footprint Guideline

- A **single method** for primary aluminium, alumina and bauxite – Al producers can report consistent, comparable, and transparent.
- Cradle-to-gate – scope 1, 2 and 3 (upstream)
- Referenced by Aluminium Stewardship Initiative (ASI) and London Metal Exchange (LME), Rocky Mountain Institute (RMI)
Applicable to a given mass of primary aluminium and precursor products (Bauxite, Alumina, Anodes, Electrolytic Aluminium):

- Direct emissions from process, inclusive of emissions from fuel combustion
  - **Scope 1**
- Emissions related to energy production
  - **Scope 1** for self-generated energy
  - **Scope 2** for purchased energy
  - Plus, **Scope 3 Category 3** fuel and energy-related activities (not included in Scope 1 and 2)
- Others
  - Scope 3, Category 1 (purchased goods), 4 (upstream transportation and distribution) and (5 – waste generated in operation)

*Scope terminology – GHG Protocol Corporate Standard*
## IAI Product Carbon Footprint Guideline - Checklist

### Product Carbon Footprint - Cradle-to-Gate

<table>
<thead>
<tr>
<th>Product</th>
<th>Emission Category</th>
<th>Emission Source</th>
<th>Primary aluminium smelter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct Process</td>
<td>Anode/Paste Production - self produced</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anode/Paste Production - purchased</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emissions from Anode/Paste consumption</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perfluorocarbon emissions</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stationary combustion in casthouse</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stationary combustion in auxiliary, emergency or pollution control equipment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>combustion of fossil fuels for stationary and mobile equipment,</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Energy Production</td>
<td>Fuel</td>
<td>3 (cat 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electricity, steam, heat - purchased</td>
<td>2 &amp; 3 (cat 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electricity, steam, heat - self generated</td>
<td>1 &amp; 3 (cat 3)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>Purchased goods and services</td>
<td>3 (cat 1)</td>
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<tr>
<td></td>
<td></td>
<td>Capital goods</td>
<td>3 (cat 2)</td>
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<tr>
<td></td>
<td></td>
<td>Upstream transportation and distribution of aluminium oxide</td>
<td>3 (cat 4)</td>
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<td></td>
<td></td>
<td>Waste Generated in operations</td>
<td>3 (cat 5)</td>
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<tr>
<td></td>
<td></td>
<td>Employee commuting</td>
<td>3 (cat 7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upstream leased assets</td>
<td>3 (cat 8)</td>
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</tbody>
</table>

### Broadly equivalent corporate

- 1
- 1
- 3 (cat 1)
- 1 & 3 (cat 3)
- 3 (cat 2)
- 3 (cat 4)
- 3 (cat 5)
- 3 (cat 7)
- 3 (cat 8)
## IAI GHG Data Collection and Publishing

<table>
<thead>
<tr>
<th>Period</th>
<th>Electricity – Indirect</th>
<th>Perfluorocarbon (PFC) – Direct</th>
<th>Process (CO2) – Direct</th>
<th>Ancillary Materials – Indirect</th>
<th>Thermal Energy – Direct/Indirect</th>
<th>Transport – Indirect</th>
<th>Total – Cradle to Gate</th>
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<tbody>
<tr>
<td><strong>2021</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td><strong>10.7</strong></td>
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<tr>
<td>Mining</td>
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<td>&lt;&lt;0.01</td>
<td>0.04</td>
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<td>0.4</td>
<td>0.04</td>
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<td>Refining</td>
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<td>0.4</td>
<td>1.6</td>
<td>0.2</td>
<td>2.7</td>
<td><strong>2.7</strong></td>
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<tr>
<td>Anode Production</td>
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<td>0.1</td>
<td>0.7</td>
<td>0.1</td>
<td></td>
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<td>Electrolysis</td>
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<td>0.8</td>
<td>1.5</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td><strong>12.9</strong></td>
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<tr>
<td>Casting</td>
<td>0.04</td>
<td></td>
<td>&lt;&lt;0.01</td>
<td>0.1</td>
<td></td>
<td></td>
<td><strong>0.1</strong></td>
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<td>Primary Aluminium</td>
<td><strong>10.7</strong></td>
<td><strong>0.8</strong></td>
<td><strong>1.7</strong></td>
<td><strong>1.2</strong></td>
<td><strong>1.8</strong></td>
<td><strong>0.4</strong></td>
<td><strong>16.6</strong></td>
</tr>
</tbody>
</table>

**Data Collection**
- **Annual**
- **Every 2 years**
- **Every 5 years**

**Annual**
- All processes except Transport

**Every 2 years**
- Transport

**Every 5 years**
- All processes

**2021**
- Annual
- Transport

**2022**
- Annual
- Transport

**Total – Cradle to Gate**
- All processes

**Annual**
- All processes except Transport

**Every 2 years**
- Transport

**Every 5 years**
- All processes
2019 Regional Cradle-to-Gate Scenarios

IAI LCI Report (IAI, 2022)
China: Mining (M) China / Refining (R) China / Anode (A), Electrolysis (E), Casing (C) China
GCC: M Oceania / R Oceania / A, E, C GCC
Europe: M Africa / R Europe / A, E, C Europe
Canada: M South America / R South America / A, E, C Canada
**IAI Greenhouse Gas Pathways to 2050**

- **Data driven approach**
- **Industry data & input**
- **Establish the sector baseline**
- **Top-down scenario analysis – IEA**
- **Consider the different positions**
- **Identify variety of pathways**

- **2018: 1.1 billion tonnes of CO₂e**
- **700 million**
  - Electricity
- **300 million**
  - Process & Thermal
- **<100 million**
  - Ancillary & Transport
IAI Emissions Scenarios

Aluminium Sector (million tonnes CO2e)

IAI GHG Pathways to 2050 (IAI, 2021)
Building On IAI Scenarios & Pathways

**Pathway 1**  
**Electricity decarbonization potential**

- Inform company GHG/climate change plans

**Pathway 2**  
**Direct emissions potential**

- Basis for emerging initiatives & methodologies
- Collective understanding & action

**Pathway 3**  
**Recycling & resource efficiency potential**

- Demonstrate the industry has a credible sector pathway
- Shift to implementation – policy, finance, partnerships
- Building on industry fact-base & engaging with key stakeholders
IAI Membership Decarbonisation Plans

- Decarbonisation Plan: 84%
- 2050 Net-Zero Pathway: 72%
- Endorsement of MPP Aluminium Transition Strategy: 36%
GHG Reduction Projects

2020 -> 16 Projects

1. Virtual battery (e.g., Germany)
2. Wind (e.g., Norway)
3. Hydropower (e.g., China)
4. Solar (e.g., UAE)
5. Inert anode cells (e.g., North America and Russia)
6. Fuel switch (e.g., Brazil)
7. Hydrogen (e.g., Norway and Australia)
8. Mechanical vapour recompression (e.g., Australia)
9. Lightweighting/supply chain (e.g., India)
10. Closed-loop recycling (e.g., USA, Europe, Japan)
11. Scrap sorting (e.g., Germany)
12. Recycling optimisation (e.g., Europe)

2022/2023 -> 50 Projects

1. Virtual battery (e.g., Germany)
2. Renewable electricity (e.g., Norway, Spain, Australia)
3. Hydrogen (e.g., China)
4. Renewable electricity (India, UAE, Mr. Al Masih, Chian)
5. IoT-
6. Carbon Capture, utilisation, and storage (e.g., UAE, Mr. Al Masih, China, India)
7. Inert anode (e.g., Russia, China)
8. Increased post-consumer scrap recycling (e.g., Japan, China)
9. Lightweighting/supply chain (e.g., India)
10. Hydrogen (e.g., Norway, Australia, South Korea)
11. Mechanical vapour recompression (e.g., Europe)
12. Closed-loop recycling (e.g., Brazil, South Korea, Japan)
13. Recycling optimisation (e.g., Brazil, Europe)
14. Scrap quality improvements (e.g., Germany, Brazil)
15. Solar power plant (e.g., Saudi Arabia)
16. Electrification of vehicles (e.g., South Korea, India)
17. Electrification of vehicles (e.g., Saudi Arabia, India)
18. Electrification of vehicles (e.g., South Korea, India)
19. Electrification of vehicles (e.g., Saudi Arabia, India)
20. Electrification of vehicles (e.g., South Korea, India)
21. Electrification of vehicles (e.g., Saudi Arabia, India)
22. Electrification of vehicles (e.g., South Korea, India)

Go to page 3 for more details on each of the technological innovations.

IAI GHG Technology Map (IAI, 2023)
Thank you