LONG TERM SUSTAINABILITY OF THE ALUMINIUM SECTOR

Bayliss, Bertram, Nunez, Prosser, Tsesmelis & Wu
International Aluminium Institute (IAI)

Presented by: Pernelle Nunez (IAI)
About the Presenter

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International Aluminium Institute

The leading association of the global aluminium industry, with a diverse membership involved in the production, fabrication and recycling of aluminium.

- >40 Years of industry data collection
- 60% Bauxite, alumina and aluminium production
- 25 Member companies
- 9 Secretariat staff members
Long term sustainability

- Aluminium as an enabling material
- Demand for aluminium
- Impacts of production
- Action to address challenges
Alloys are weather-proof and corrosion-resistant resulting in very long lifetimes.

Recycling saves 95% of the energy required for primary production.

High thermal conductivity minimises the time and energy to process, chill and heat food.

Barrier properties preserve food, drink and medicines, reducing wastage.

Recycling saves 95% of the energy required for primary production.

High strength-to-weight ratio makes it possible to design light, strong & stable structures.

Flexibility and formability enable unlimited design potential.

Source: IAI
Unique properties valued across many end use markets

2019 Semis-Shipments by End-Products

- Building and Construction: 24%
- Transportation - Auto & Lt Truck: 18%
- Transportation - Aerospace: 1%
- Transportation - Truck/Bus/Trailer/Rail/Marine/Other: 7%
- Machinery & Equipment: 10%
- Electrical - Cable: 6%
- Electrical - Other: 6%
- Packaging - Other: 5%
- Packaging - Cans: 7%
- Consumer Durables: 9%
- Other (ex Destructive Uses): 4%
- Destructive Uses: 3%

Source: IAI
Materials use is expected to increase significantly

“...consumption of raw materials is set to nearly double by 2060...placing twice the pressure on the environment...”

OECD Global Material Resources Outlook to 2060

Figure 7. Materials use rises for all material groups

*BRIICS: Brazil, Russia, India, Indonesia, China, South Africa

Source: OECD
Aluminium can enable the transition to low carbon energy systems

<table>
<thead>
<tr>
<th>ENABLER</th>
<th>Wind</th>
<th>Solar photovoltaic</th>
<th>Concentrating solar power</th>
<th>Carbon capture and storage</th>
<th>Nuclear power</th>
<th>Light-emitting diodes</th>
<th>Electric vehicles</th>
<th>Energy storage</th>
<th>Electric motors</th>
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<tr>
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</table>

“...low carbon energy systems are more likely than not to be more metal intensive...”

The World Bank: The Growing Role of Minerals and Metals for a Low Carbon Future

Source: World Bank
IAI expects demand for semis to reach 170Mt by 2050

Key sectors will drive growth 2018-2050

- **Transport**: +90%
- **Electrical**: +85%
- **Building & Construction**: +80%
- **Packaging**: +70%
- **Consumer durables**: +110%

Source: IAI
Demand cannot be fulfilled by increased recycling alone

1.5 billion tonnes produced since 1888

1.1 billion tonnes still in use

900 million tonnes primary produced since 2000

Source: IAI
The industry will have to increase primary production while minimising impacts.

Demand for raw materials will also increase significantly:

- **BAUXITE**: +125 Mt
- **ALUMINA**: +50 Mt

Source: IAI
To enable sustainability, the industry must also be sustainable.

- Responsible Production
- Benefits in Use
- End of Life Recovery & Recycling

IMPACTS

- Occupational Health
- Safety
- Biodiversity
- Spent Pot Lining
- Bauxite Residue
- Communities
- Environmental Health
- Water
- Lifecycle
- Recycling
- Material Flow Analysis
- Greenhouse Gases
To enable sustainability, the industry must also be sustainable.
Bauxite residue and SPL generation will increase

BR and SPL account for >90% of solid waste from the production of primary Al

Source: IAI
Collaboration across multiple opportunities is essential

**Bauxite Residue**
- Process improvements
- Storage area construction
- Construction
- Cement
- Bio-remediation
- Neutralisation
- Agronomics
- Rehabilitation
- Stability
- Dust

**Spent Pot Lining**
- Process improvements
  - Maximising lining life
- Refractory liner reuse
- Cement
- Steel
- Mineral Wool
- Dust
- Stability
- Monitoring

**ACTIONS**
- Reduce
- Reuse
- Recycle
- Recover energy
- Responsible storage or disposal
Primary Al GHG Emissions accounts for 1.1 bn t CO$_2$e.

**Average carbon footprint (t CO$_2$/t Al)**

- **World**
- **China**
- **Australia**
- **GCC**
- **Europe**
- **Russia**
- **Canada**

**Total emissions***

- **(million tonnes CO$_2$)**
  - **China**: 700
  - **Australia**: 100
  - **GCC**: 600
  - **Europe**: 400
  - **Russia**: 300
  - **Canada**: 200

*Not all regions included; global total = 1.1 Gt CO$_2$e

Source: IAI
Electricity is the biggest contributor to the industry’s carbon emissions

Aluminium Smelting

636 Mt
Electricity

Alumina Refining

132 Mt
Direct process

128 Mt
Thermal

Source: IAI
Under BAU GHG emissions would increase to 1.6 Gt by 2050

1.5 Gt will be from primary production by 2050

**Material Flow Analysis Scenario:**
- **Baseline, moderate**

**Primary Production:**
- 64 Mt existing, 24 Mt new mixed energy
- Lowest reported energy efficiency

**Recycling, internal scrap, fabrication:**
- No change to current

**Business as usual (BAU)**
- 2050, post-covid

Source: IAI
80% reduction in GHG emissions required to align with Paris commitment

IAI Beyond 2 Degrees Aligned Scenario (B2DS) 2050

Electricity:
Zero emissions

All other emissions:
250Mt

- 2.5 t CO2e./t Primary Al
- 1.5 t CO2e./t semi fabricated

Source: IAI
GHG pathways for the Al sector

Addressing the most substantial emissions can drive improvements across the sector

2050 IAI Aligned B2DS

Electricity:
99% reduction

Transport, Thermal energy, Ancillary, Direct
~60% reduction
Tackling material emissions

Collaboration, innovation & investment will be needed across all sectors

Electricity, direct & combustion emissions account for > 80%

**Electricity**
- Decarbonised power
- Carbon capture utilisation and storage (CCUS)
- Smelters as stabilisers in power grids
- Decarbonisation-enabling aluminium products

**Direct**
- Technological step change
- Inert anode
- CCUS of cell off-gases

**Combustion**
- Heat & steam decarbonisation
- Electrification of refining & casthouse
- Combustion of hydrogen
Increased recycling of post-consumer scrap could further reduce emissions

- >95% of energy can be saved from recycling aluminium
- 7 Mt of aluminium is not recycled at end of life today
- 300 Mt of CO2e. is avoided today by recycling post-consumer scrap
- 17 Mt of aluminium not recycled if no change in current recycling rates

Investment in technologies to sort, process and recycle scrap will be needed.
Collaboration is critical to addressing today’s impacts and to defining technological pathways for the future.

ADDRESSING IMPACTS
- Bauxite Residue Management: Best Practice
- Sustainable Bauxite Mining Guidelines
- Sustainable Spent Pot Lining Management Guidance

LOOKING TO THE FUTURE
- Aluminium Sector Greenhouse Gas Pathways to 2050
- Technology Roadmap: Maximising the Use of Bauxite Residue in Cement

ACTION
- Research & Development
- Innovation
- Collaboration
- Investment & Deployment

RISK MANAGEMENT
ENVIRONMENT, HEALTH & SAFETY
HANDLING, STORAGE & TRANSPORT
TREATMENT OPTIONS

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Conclusions

ALUMINIUM HAS A KEY ROLE TO PLAY IN A SUSTAINABLE FUTURE

DEMAND FOR ALUMINIUM PRODUCTS WILL INCREASE

THE INDUSTRY MUST ADDRESS ITS SUSTAINABILITY CHALLENGES

COLLABORATION, INNOVATION & INVESTMENT TO DEPLOY TECHNOLOGY IS ESSENTIAL
Thank you
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