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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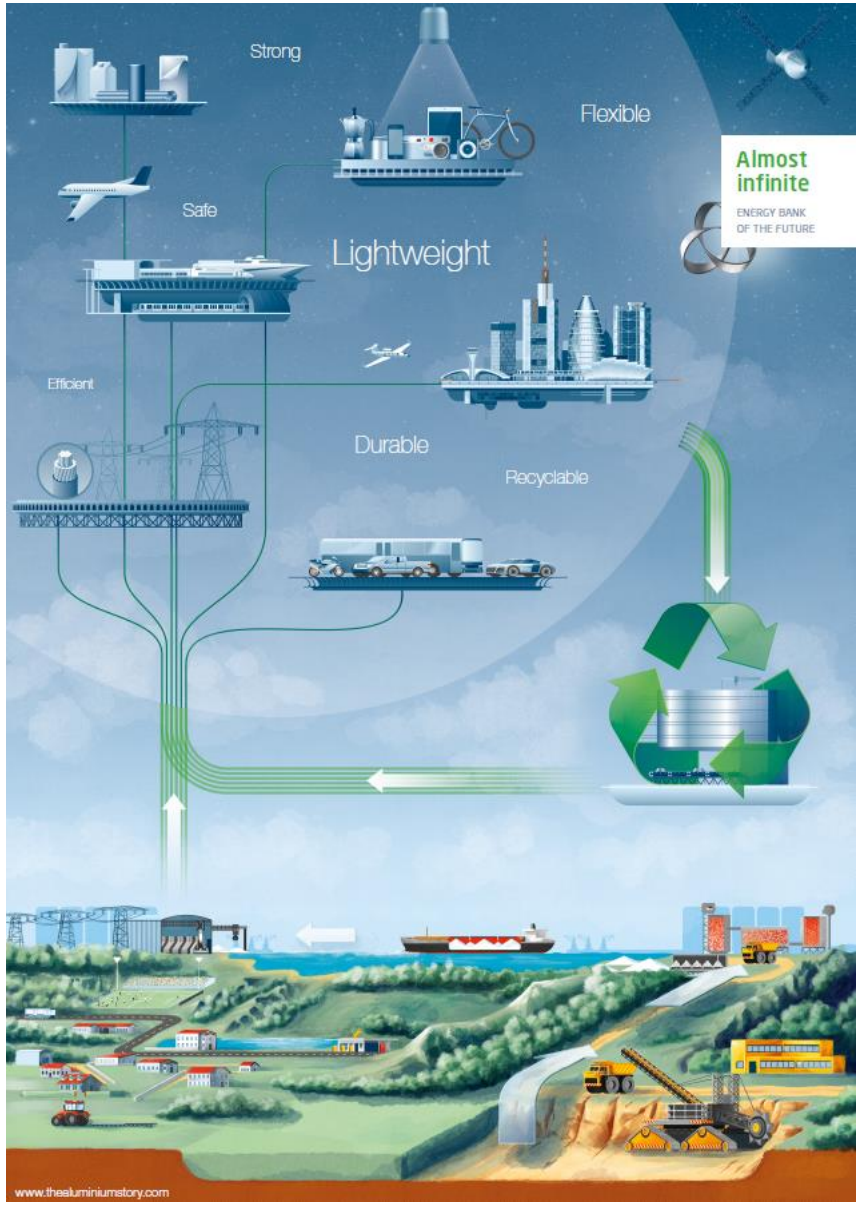


International Aluminium Institute

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

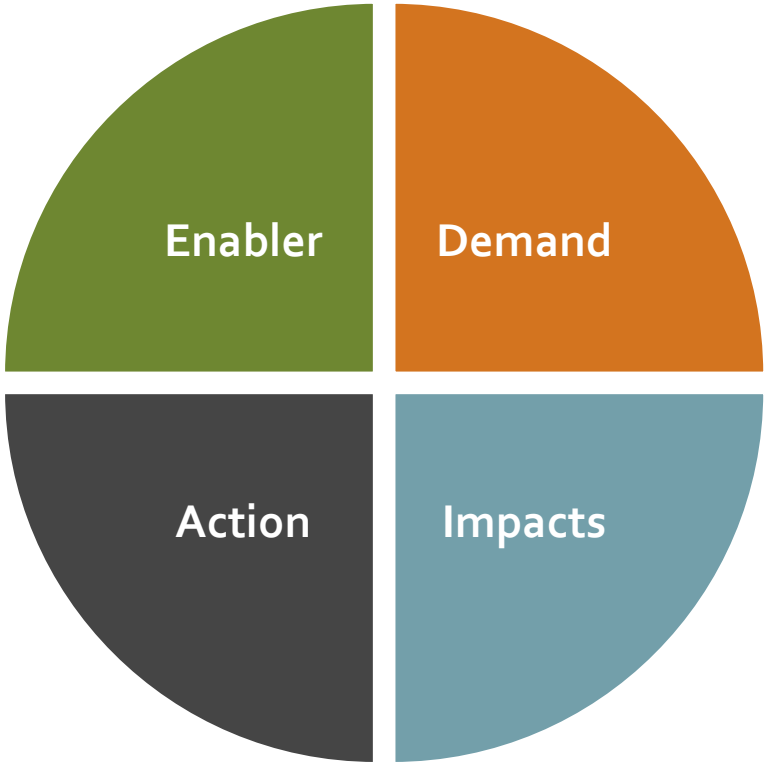
>40 Years of industry data collection

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

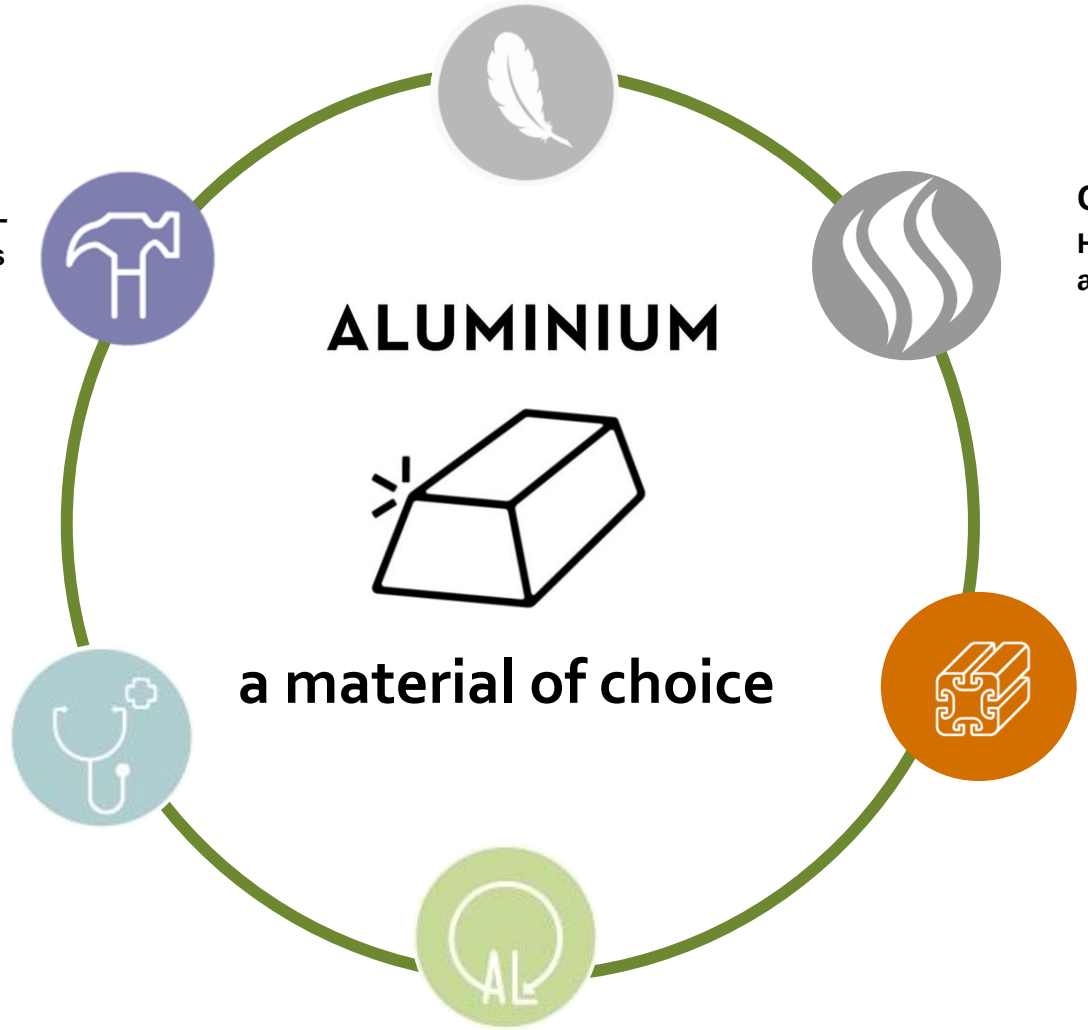
ENABLER

LIGHTWEIGHT

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

DURABLE

Alloys are weather-proof and corrosion-resistant resulting in very long lifetimes



CONDUCTIVE

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

FORMABLE

Flexibility and formability enable unlimited design potential

PROTECTIVE

Barrier properties preserve food, drink and medicines, reducing wastage

RECYCLABLE

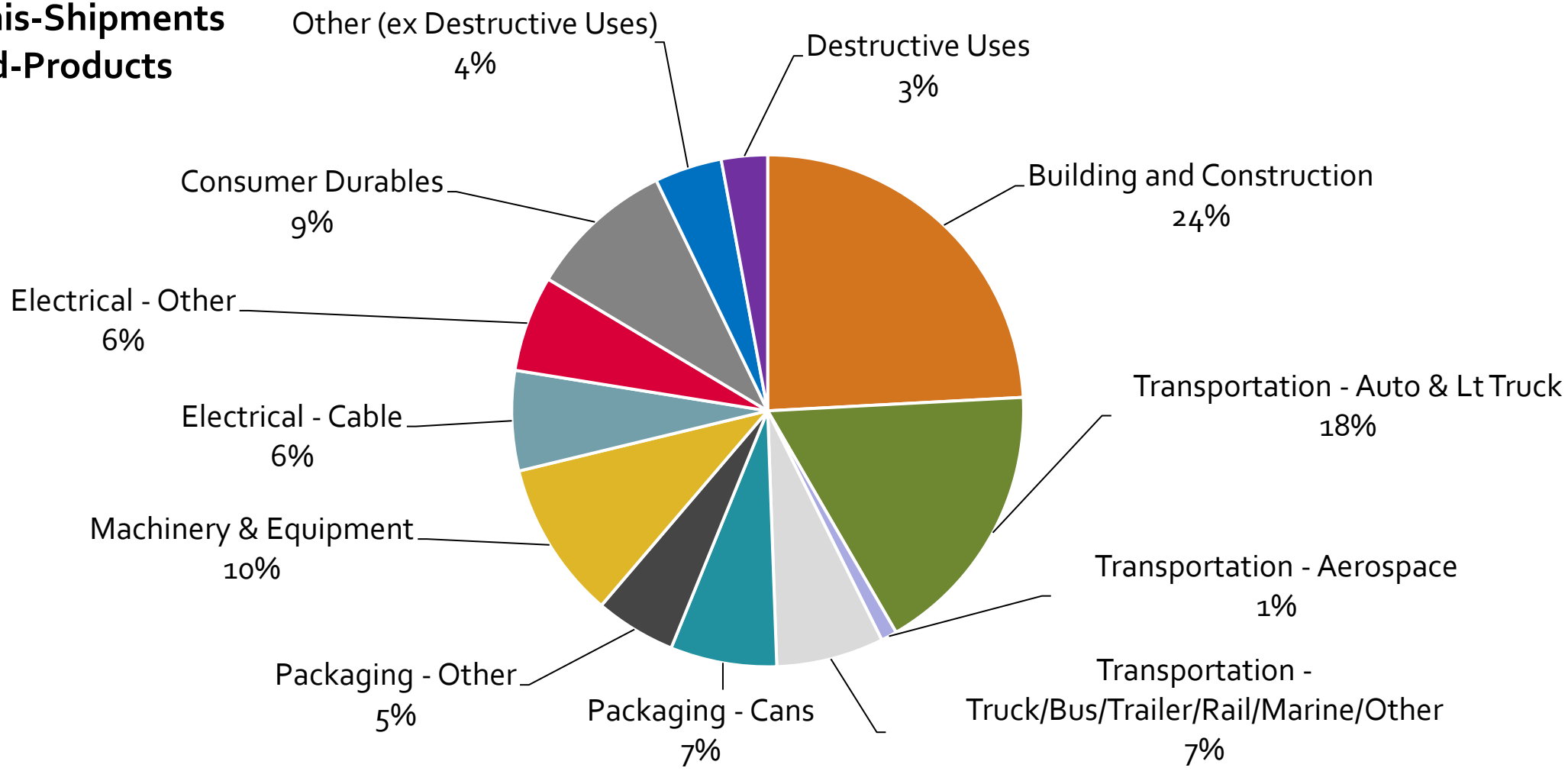
Recycling saves 95% of the energy required for primary production.

WORLD ALUMINIUM

Source: IAI

Unique properties valued across many end use markets

2019 Semis-Shipments by End-Products



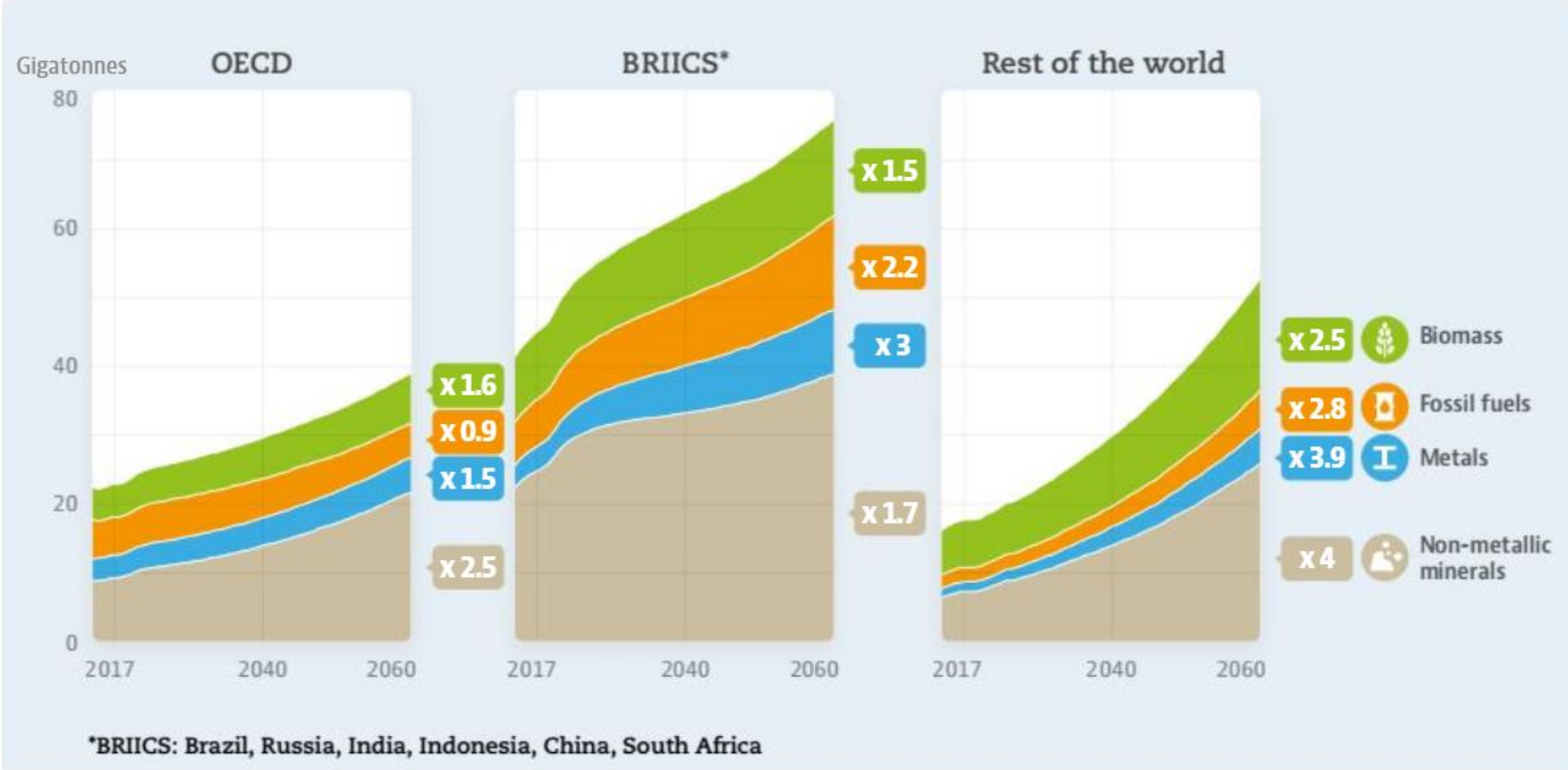
Source: IAI

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**



Source: OECD

Aluminium can enable the transition to low carbon energy systems

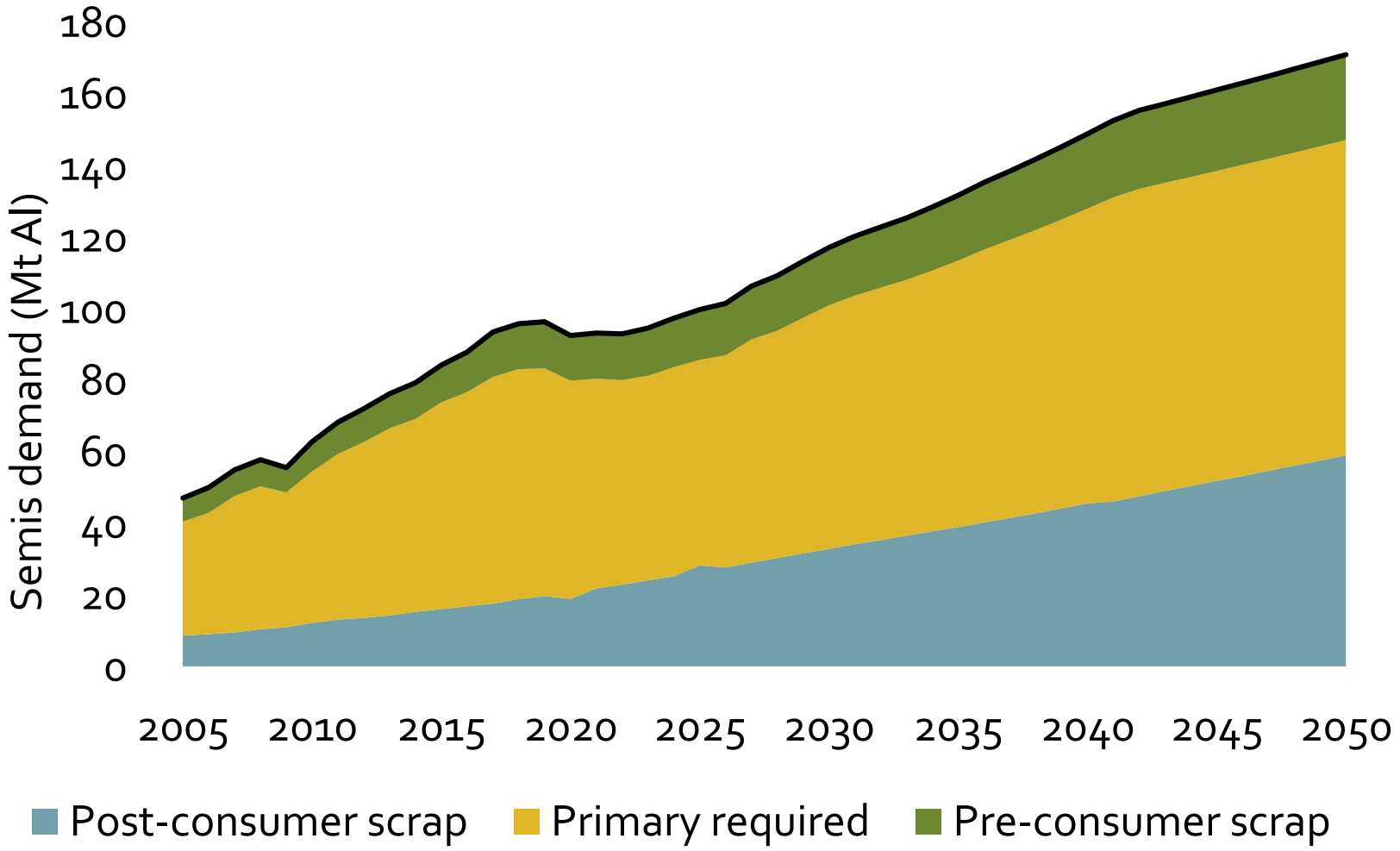
	Wind	Solar photovoltaic	Concentrating solar power	Carbon capture and storage	Nuclear power	Light-emitting diodes	Electric vehicles	Energy storage	Electric motors
Aluminum	X	X	X	X		X		X	X
Chromium	X			X	X	X			
Cobalt				X	X		X	X	
Copper	X	X		X	X	X	X		X
Indium		X			X	X	X		
Iron (cast)	X		X			X		X	
Iron (magnet)	X								X

"…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%

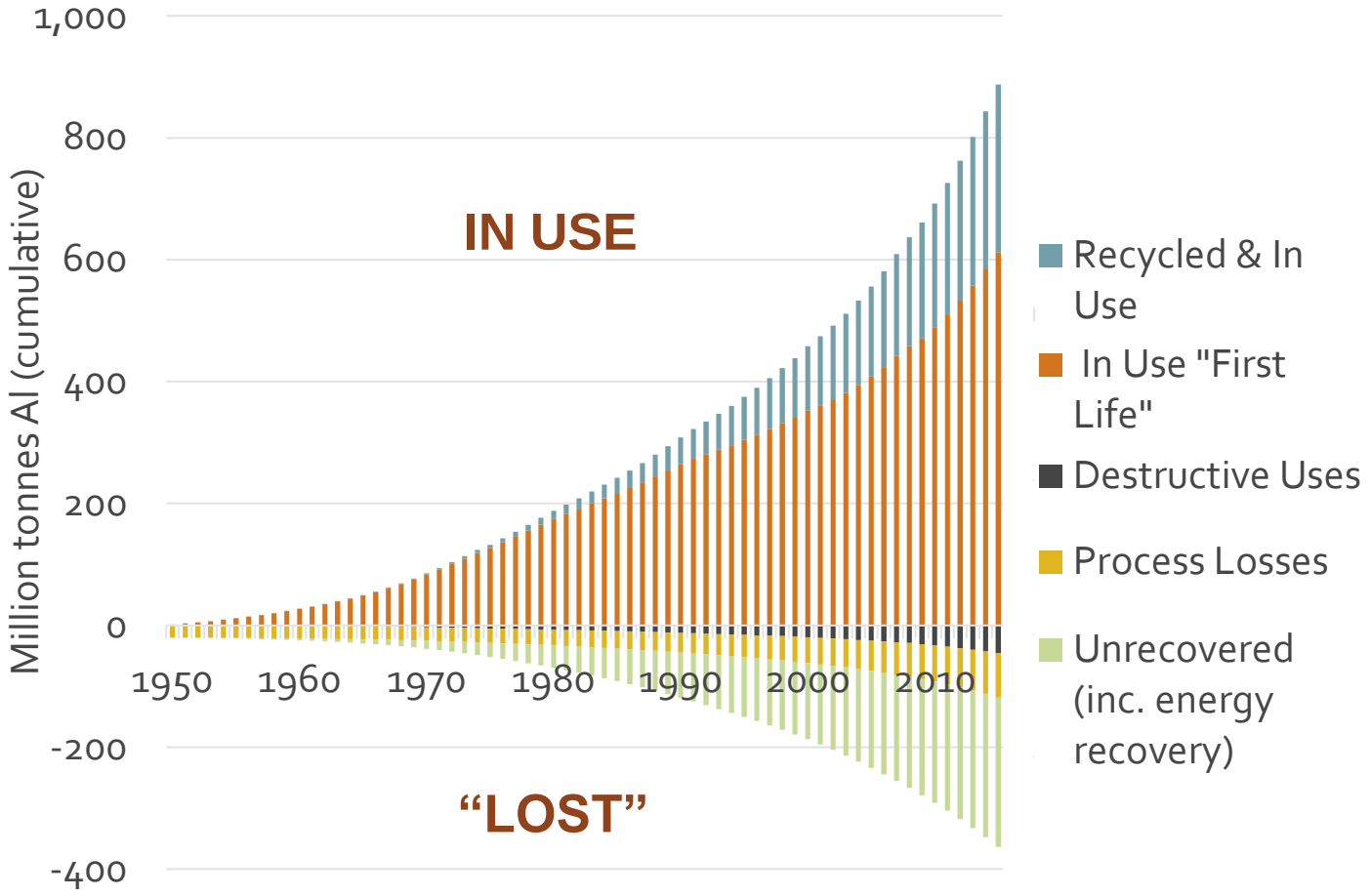
Building &
Construction
+ 80%

Packaging
+ 70%

Consumer durables
+110%

Source: IAI

Demand cannot be fulfilled by increased recycling alone



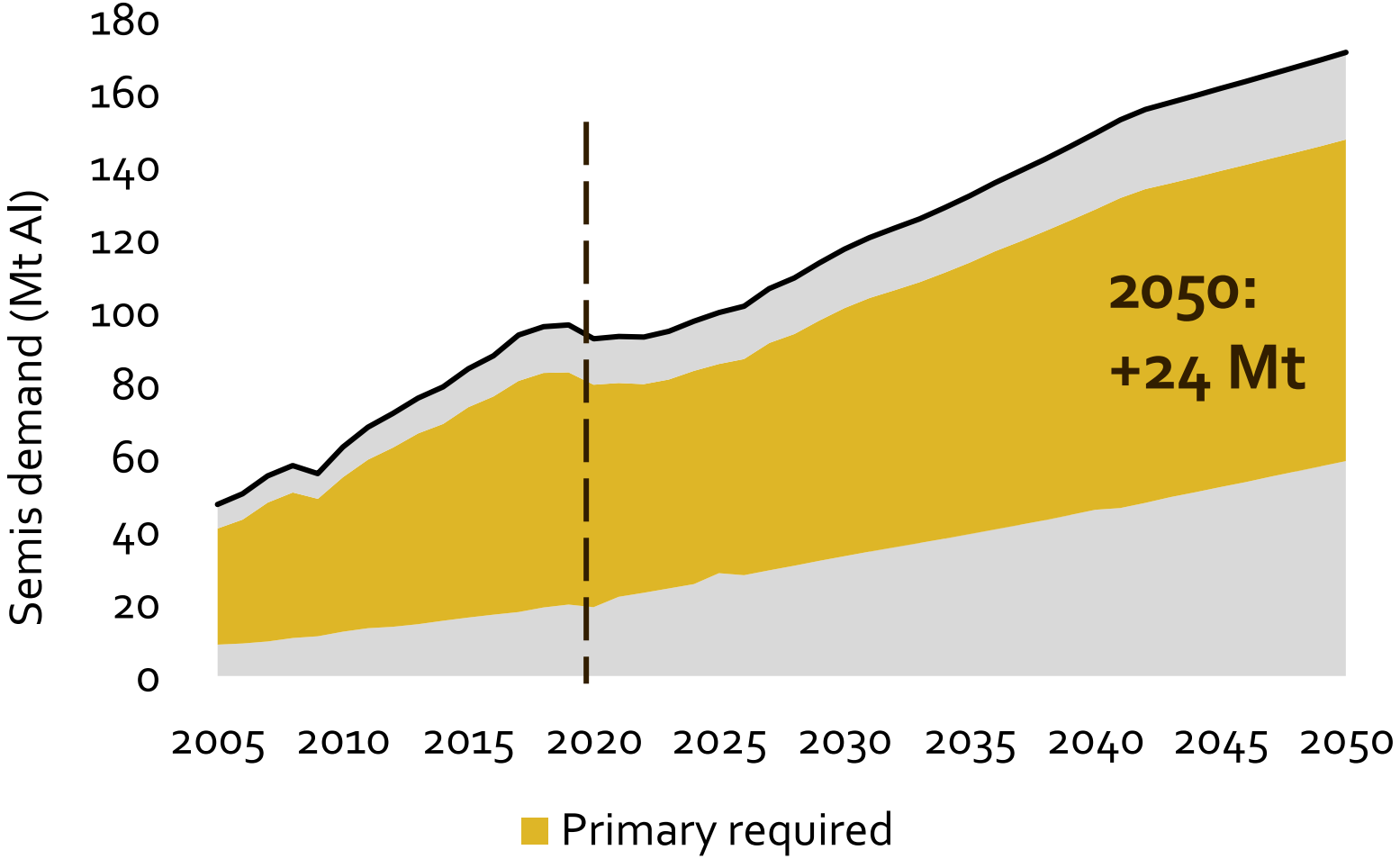
1.5 billion tonnes produced since 1888

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

+ 125Mt

ALUMINA

+ 50Mt

Source: IAI

To enable sustainability, the industry must also be sustainable

RESPONSIBLE PRODUCTION

BENEFITS IN USE

END OF LIFE RECOVERY & RECYCLING

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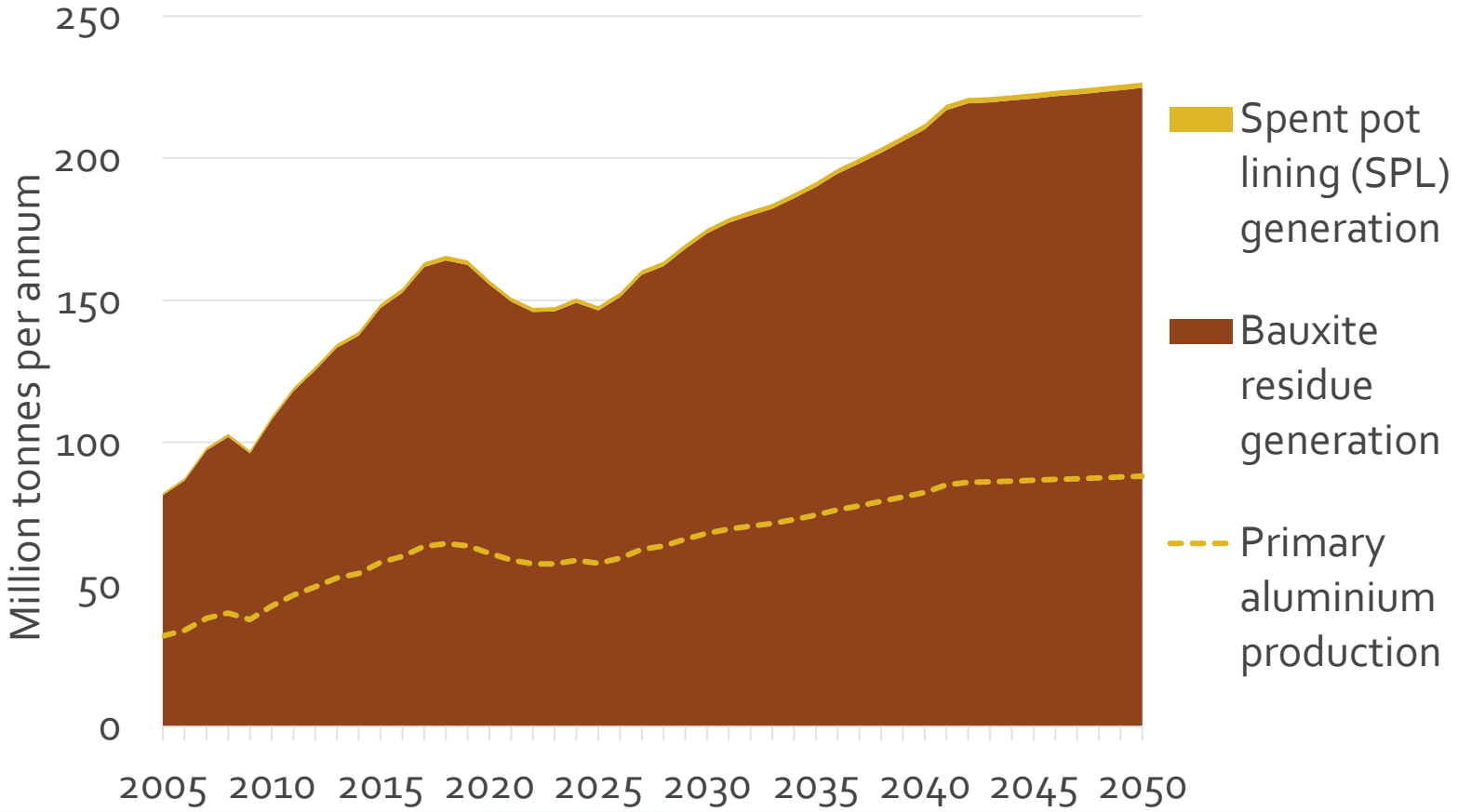
Bauxite residue and SPL generation will increase

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



SPENT POT LINING

2050: up to 30Mt stored

BAUXITE RESIDUE

2050: up to 10 bn t stored

Source: IAI

Collaboration across multiple opportunities is essential

Bauxite Residue

Process improvements

Storage area construction

Construction

Cement

Bio-remediation

Neutralisation

Agronomics

Rehabilitation

Stability

Monitoring

Dust

Spent Pot Lining

Process improvements

Maximising lining life

Refractory liner reuse

Cement

Steel

Mineral Wool

Dust

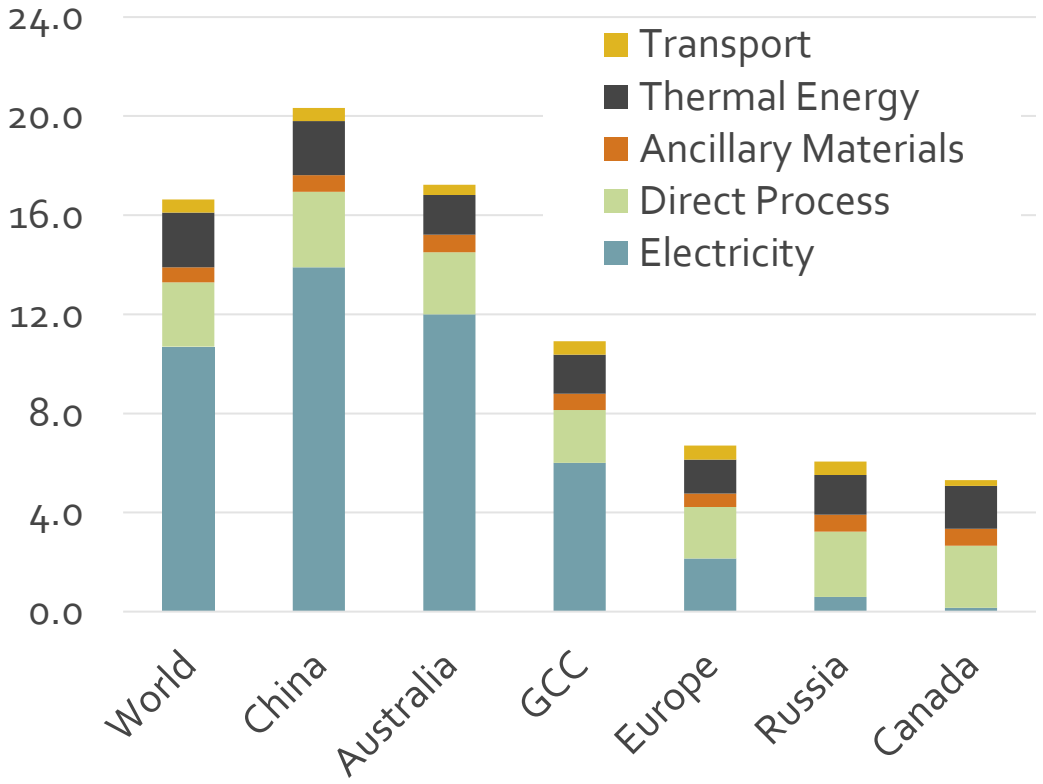
Stability

Monitoring

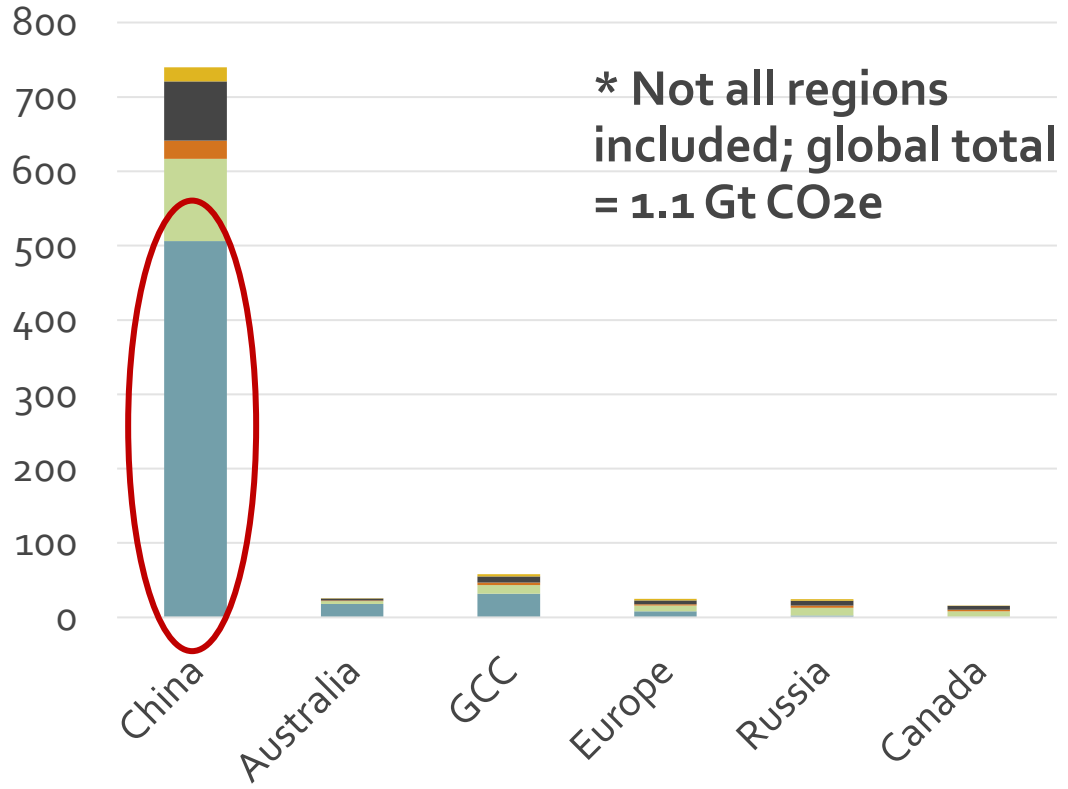
Primary Al GHG Emissions accounts for 1.1 bn t CO_2e.

WORLD ALUMINIUM

Average carbon footprint (t CO_2/t Al)



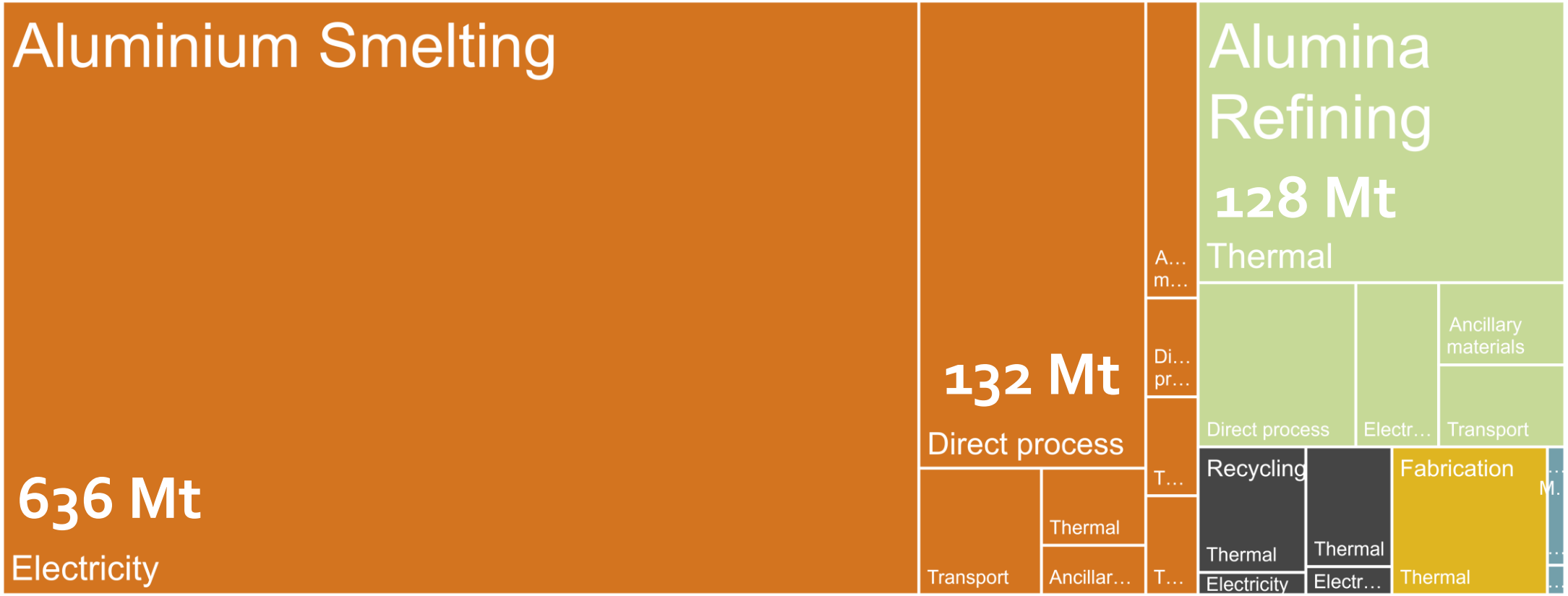
Total emissions*
(million tonnes CO_2)



*** Not all regions included; global total = 1.1 Gt CO2e**

Source: IAI

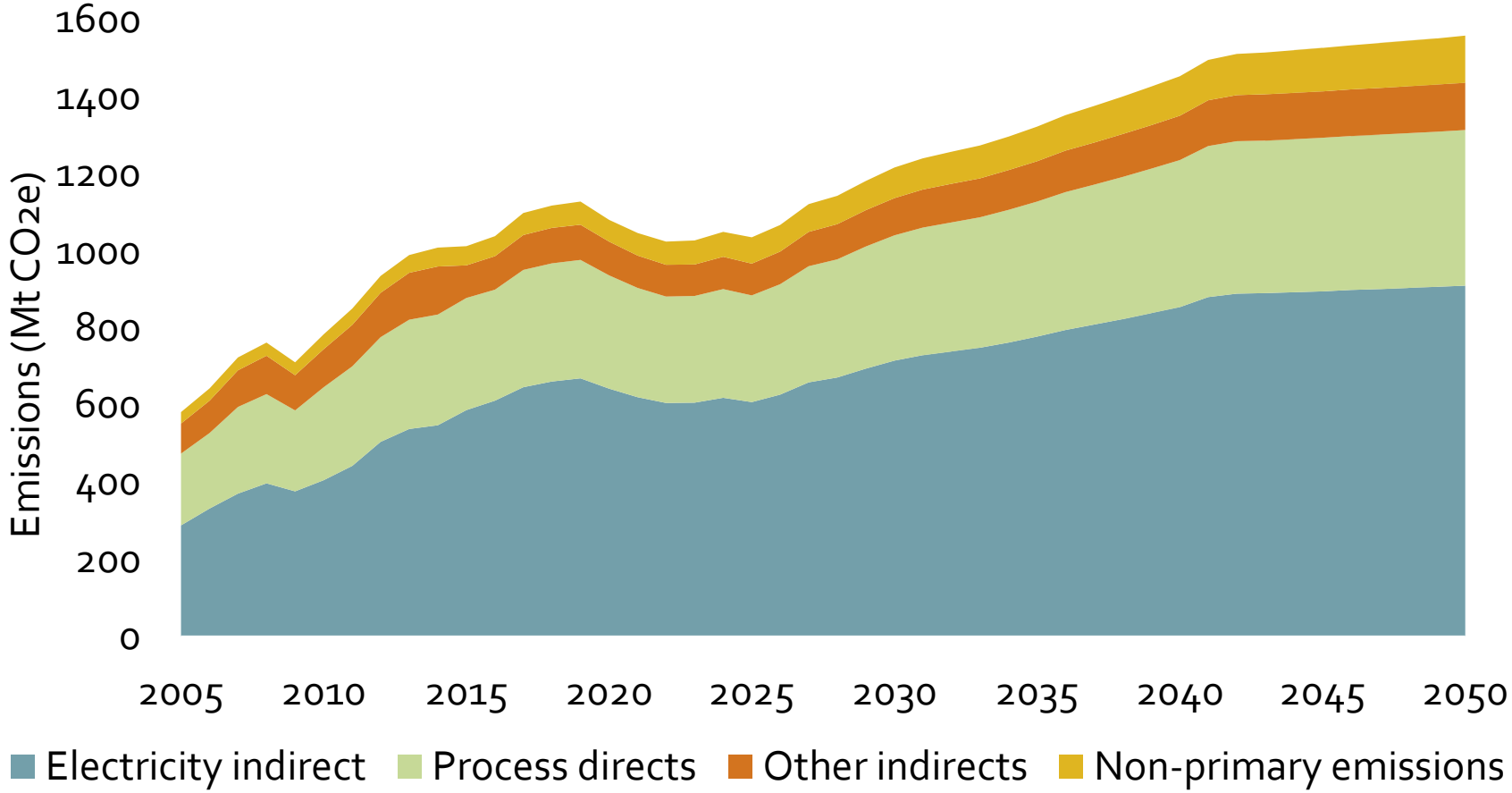
Electricity is the biggest contributor to the industry's carbon emissions



Source: IAI

Under BAU GHG emissions would increase to 1.6 Gt by 2050

1.5Gt will be from primary production by 2050



Business as usual (BAU) 2050, post-covid

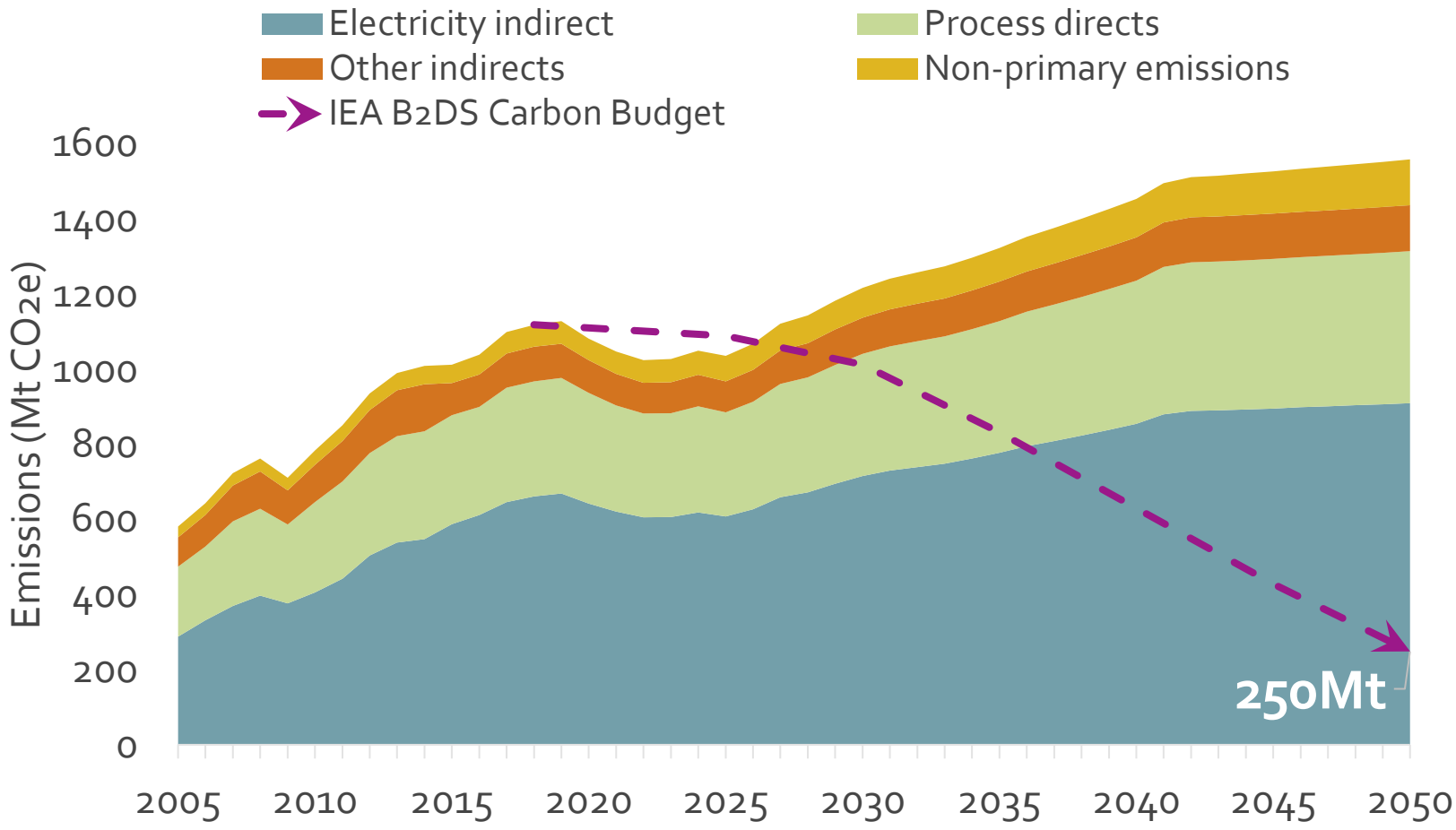
Material Flow Analysis Scenario:
Baseline, moderate

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

Recycling, internal scrap, fabrication:
No change to current

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

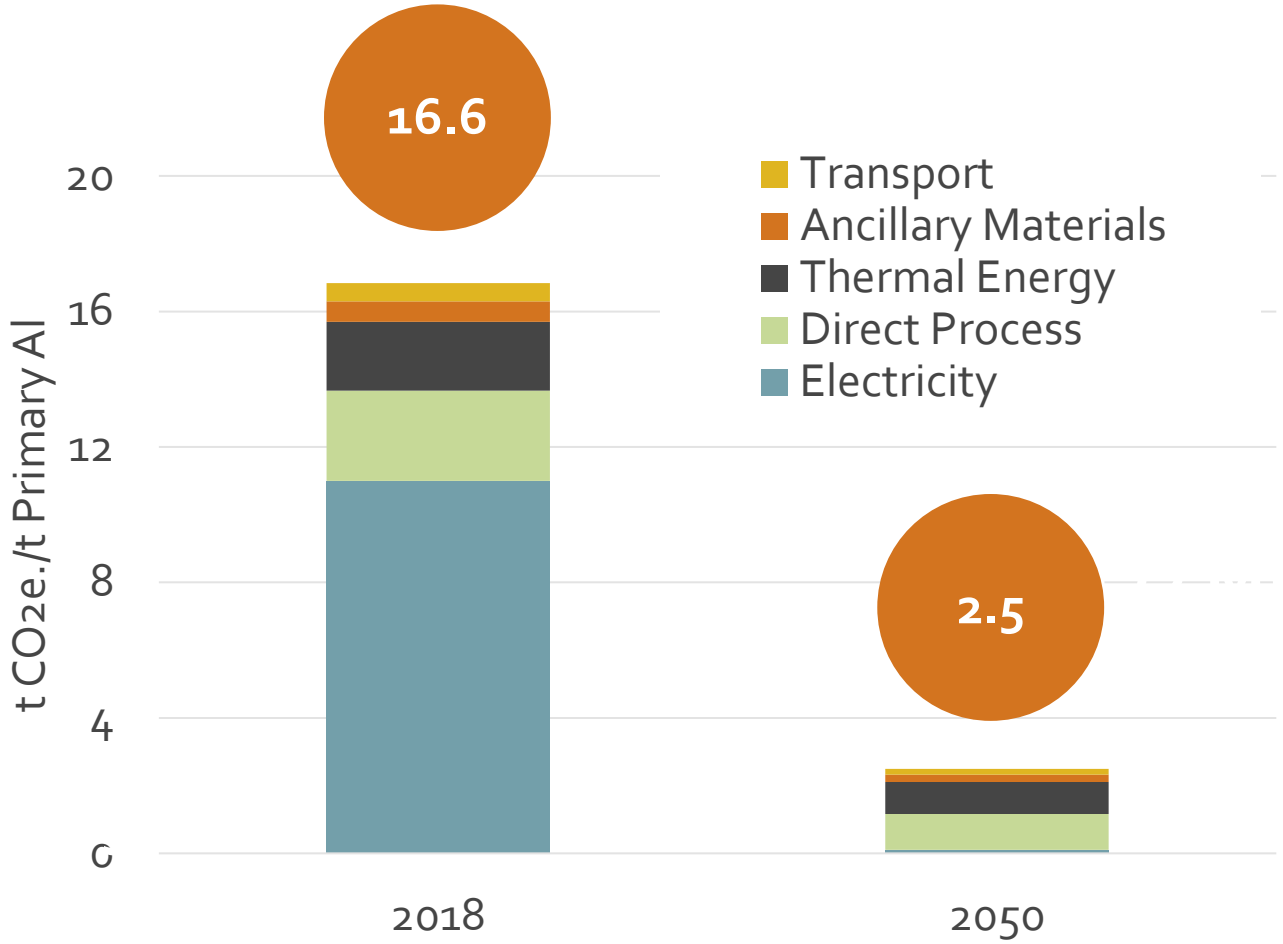
2.5 t CO2e./t Primary Al

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

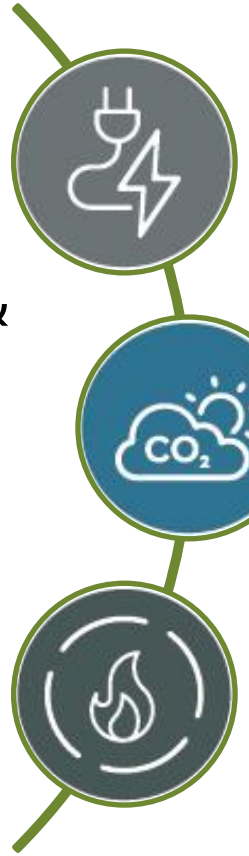
Transport, Thermal energy, Ancillary, Direct
~60% reduction

WORLD ALUMINIUM

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

300 Mt of CO_2e. is avoided today by recycling post-consumer scrap

7 Mt of aluminium is not recycled at end of life today

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.

RECYCLING

Collaboration is critical to addressing today's impacts and to defining technological pathways for the future

RISK MANAGEMENT

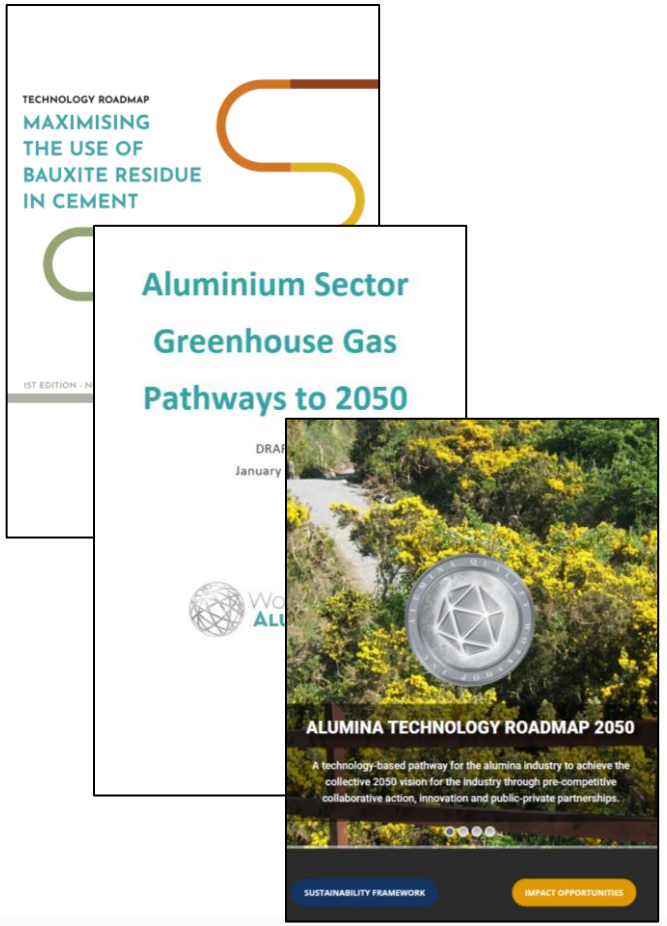
ENVIRONMENT, HEALTH & SAFETY

HANDLING, STORAGE & TRANSPORT

TREATMENT OPTIONS

ADDRESSING IMPACTS

LOOKING TO THE FUTURE



INNOVATION

RESEARCH & DEVELOPMENT

COLLABORATION

INVESTMENT & DEPLOYMENT

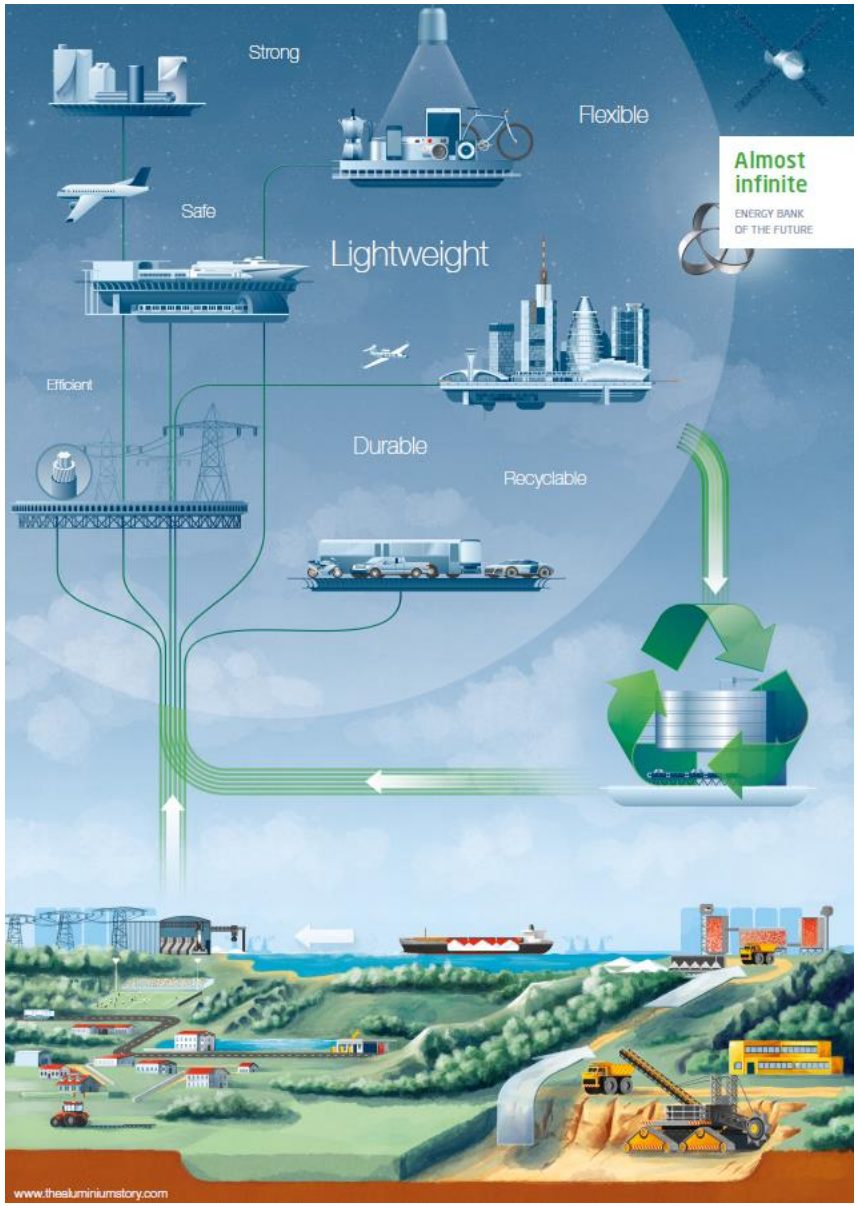
Conclusions

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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