European M Aluminium

ALUMINIUM: A KEY ENABLER TO THE GREEN TRANSITION

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1 - THE ENERGY TRANSITION CHALLENGE – SOME KEY DATA



Aluminium, anything but basic!

Total GHG emissions from fuel combustion per product, World



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Aluminium

Aluminium is both an important input to a number of technologies critical to the energy transition, and a significant source of CO2, responsible for about 3% of the world's 9.4 Gt of direct industrial CO2 emissions in 2021.

Read more G





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Year **2020**

About 80% of the used energy in 2020 was produced from CO2-intensive fuels, only 20% of the energy was issued from low-carbon sources ! => Low Carbon energy sources will be the bottle neck of the transition



*Other renewables, e.g. hydro, geothermal, solar and wind

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EUROPEAN ALUMINIUM AND THE INNOVATION HUB

Members Modus operandi Current projects



Key facts & figures

€40 Billion annual turnover

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(A	J)

90% of aluminium is recycled in construction and automotive in Europe



Europe produces **6%** of worldwide primary aluminium



51% of European production comes from recycled sources

Founded in **1981** European Aluminium represents the entire value chain of the aluminium industry in Europe

Approx. **600 plants** in 30 European countries (EU, EFTA, UK, Turkey, BiH)

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100+

members



1 million + Direct and indirect jobs across Europe's value chain



Transport
Building
Packaging
Engineering
Consumer durables

An innovative value chain serving EU key markets (end uses)



*Status: April 2023

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speira

OSTENA

ALUMINIUM

STEP/G

Svenskt Aluminium

TALSAD

trímet

Our **members**







OCOIL

🍰 Constellium

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CORÍALÍS

Al Aluminium Association

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BRIDGNORTH

EURA

Europa

GRÄNGES CHA



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Intels KAWNEER

لموسن



🔿 Norsk Industri

PMS

POLINE ALEXANDA

Gruppen.

PURSO

RAFFMETAL









NORÐURÁL







scнüco

SLOVALCO

RioTinto

ROBA

RVA

Saca









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Aluminium, anything but basic!

A thriving and complete **European value chain**



More than **600** aluminium plants providing over 1 million high-value jobs & €40 billion to the European economy

Alumina

Primary Extrusion Rolling Recycling





* Source: European Aluminium Statistics, 2022 Job figure accounts for direct & in-direct jobs

The role of the Innovation Hub

Mapping R&D challenges	Trigger research
Focusing on pre-competitive topics tackling the main technological challenges to advance a sustainable future in the Al industry	In close collaboration with members, by initiating and facilitating the development of EU funded R&D projects addressing the Aluminium value chain
Engage with the EU Agenda	Stimulating the connection between R&D and the Al industry
By highlighting to the members the Innovation Agenda and the most relevant funding opportunities and by contributing to the EU's research agenda by acting as key stakeholder in the most relevant European Public Partnerships (PPPs) [Process4Planet, Made in Europe, Built4People]	Through the organization of thematic workshops, by targeting calls and topics of key EU funding programs, by connecting relevant research groups/technological providers with members



Innovation Hub members: 18 companies and 3 MG





THE INNOVATION HUB: secretariat



Christian Leroy Director Innovation Chiara Deffendi Coordinator Innovation

Communication & finances Projects: <u>aluSELECT</u> – <u>SAIS</u> - FORMALUB Francesca Cavezza Innovation Project Manager

Manufacturing & recycling Projects : <u>SALEMA</u> & <u>Coralis</u>, <u>HyInHeat</u> Konstantinos Kollias Innovation Project Manager

> Raw materials & Industrial Symbiosis Projects : <u>RemovAL</u>, <u>ReActiv</u>, <u>AlSiCal & Coralis, H2GLASS</u>



ALUMINIUM USE

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Transport
 Building
 Packaging
 Engineering
 Consumer durables

An innovative value chain serving EU key markets (end uses)

The base metal for the twin transition

Aluminium is the world's most used non-ferrous base metal. But with its attractive properties, aluminium is **anything but basic**.

Our sustainable, **versatile material** allows key sectors to decarbonise and achieve otherwise impossible outcomes through its unique combination of properties and effects.

Our metal can be found everywhere and serves 7 of the 14 critical ecosystems identified in the

EU's Industrial Strategy.





Aluminium demand is driven by the green transition

Extra aluminium required globally by 2050 compared to 2020 (2DS, Base Scenario)



Eurometaux "Metals for Clear Energy" (2022) & Eurometaux "Agenda for a resilient European metals supply for the green and digital transitions (2020) European aluminium demand for the energy transition by 2040

Europe's energy transition alone will require an increase of

30% compared to today's consumption (2022).

Main Drivers:







Aluminium, anything but basic!

Aluminium in mobility



Aluminium's low density, high strength-to-weight ratio, dimensional stability, corrosionresistance, formability, recyclability and crash resistance is a key driver of lightweight, safe vehicles that contribute significantly to fuel savings and safety in transport. Regardless of vehicle production growth, the average aluminum Content Per Vehicle (CPV) has steadily been increasing in passenger cars since 2006 (time when Ducker started monitoring the CPV in the EU). With further lightweighting needs, electrification as well as a rising share of larger and premium vehicles, the CPV increase is expected to accelerate by 2026



Sources: Ducker; *CPV of 179 kg in EA study 2019 as second set of OE wheels was included

Historic

Evolution of

Aluminum

CPV

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Aluminum Content by Product Form & Evolution Castings are by far the largest aluminum product form with 123 kg per vehicle, expected to reach 145 kg per vehicle in 2030. Strongest growth is expected from extrusions due to increasing penetration in EV Specific, BIW and Brakes

Average Aluminum Content per Vehicle in 2022

DUCKER

205 kg Alu/car in 2022

Sheet (+14 kg by 2030)

Aluminum sheet demand continues its growth, driven by electrification and weight reduction targets, as well as product mix leaning towards larger vehicles. Growth mainly comes from:

- EV Specific primarily ballistic protection and battery cooling plates
- Closures especially front and rear doors

Extrusions (+15 kg by 2030)

The fastest growing aluminum product form due to increasing penetration in:

- EV Specific battery pack housing
- BIW mainly sills and CMS
- Brakes electric brake booster one-box-system



Castings (+22 kg by 2030)

Remain the leading product form for aluminum components. Decreasing powertrain, transmission and driveline components are overcompensated by:

- new EV components (e-drive housings, battery pack housings, high voltage device housings, etc.)
- large and mega castings for body-in-white, and shock towers
- rising share of cast aluminum subframes

Forgings (+0.5 kg by 2030)

Least growing product form. Only applicable for chassis, wheels and steering components

- · stable in wheels and steering
- slightly increasing in chassis (for knuckles and 2-point links)

Aluminium in construction



Aluminium offers dimensional stability, high strength-to-weight ratio, corrosion resistance, durability and recyclability. These key assets stimulate the development of products that directly contribute to sustainable buildings, through natural lighting, energy savings, air tightness and energy production through solar heating and photovoltaics.

An enabler of solar power

Aluminium is <u>the most used metal in solar panels</u>. It can be found in the frame that holds the panel together, the support structure that keeps it in place, and the electrical wiring that **connects the cells.** It's also used in the mounting systems that attach the panels to rooftops or other surfaces.



To reach the ambition of the EU's Solar Strategy and increase solar PV capacity by over 185% from 2022 to 2030 will require 10 million tonnes of aluminium.



Aluminium in packaging



The unique intrinsic properties of aluminium – high formability, lightweight yet strong, attractive metallic appearance, providing a total barrier to light, gases and moisture and recyclability - make it a preferred packaging material for food and drink.

Aluminium in Consumer durables and electronics



Aluminium's dimensional stability, light weight, durability, conductivity and recyclability are key assets in making aluminium an ideal material in electronics and consumer durables, particularly in premium products.

DESCRIPTION OF MAIN PROCESSES & PRODUCTION FIGURES



The aluminium value chain







Electrolysis



Alumina, Al_2O_3 , dissolved in molten synthetic cryolite, Na_3AlF_6 , to lower its melting point for easier electrolysis Cathode:

4 Al³⁺ + 12 e−
$$\rightarrow$$
 4Al

Anode:

 $6 \text{ O}^{2-} + 3 \text{ C} \rightarrow 3\text{CO}_2 + 12 \text{ e}^{-}$

Overall:

 $2AI_2O_3 + 3 C \rightarrow 4 AI + 3 CO_2$

Electric energy consumption : 14-15 MWh /tonne of aluminium

Aluminium Electrolysis : Inert Anodes conversion

and Greenhouse gases reduction (Elysis project)



Source: Rio Tinto

Indirect CO₂ emissions due to energy consumption are equivalent with both technologies. They depends principally on electricity production source: from 0 for hydroelectricity up to $12.5 \pm CO_2/tAl$ for coal-fired power stations





Source: Rio Tinto

Aluminium Electrolysis : Inert Anodes in permanent

operation and 02 production



Source: Rio Tinto

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Aluminium Electrolysis : Inert Anodes conversion

and Greenhouse gases reduction



Source: Rio Tinto

Direct-Chill Casting





Semi-production



Figure 5-2 Main process steps in aluminium sheet production



Figure 7-2 Extrusion process principle and some aluminium extruded products

Recycling- remelting & Refining



Reverbatory furnace

Rotating furnace





Aluminium Sector in Europe*, 2019



Chinese overcapacity: a looming threat to global markets



In 20 years, China's primary production increased from around 10% to 60% of worldwide production.

This growth is driven by massive state subsidies, which enable Chinese firms to compete aggressively with cheap, high-carbon products.

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4. GHG EMISSIONS ALONG THE VALUE CHAIN

Members Modus operandi Current projects



*EU+EFTA countries

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Mapping GHG emissions of the Al industry in Europe*



**Source: Environmental profile report for the European Aluminium industry, 2018

GHG emission of aluminium Industry vs. other industries in Europe



GHG emission of European vs. global Aluminium industry



IAI Greenhouse Gas Pathways to 2050





5. 2050 SCENARIOS & KEY TECHNOLOGIES

IAI Emissions Scenarios



Aluminium Sector (million tonnes CO2e) – 2018

IAI GHG Pathways to 2050 (IAI, 2021)



GREENHOUSE GAS EMISSIONS REDUCTION PATHWAYS

Pathway 1

Electricity decarbonisation potential



Pathway 2 Direct emissions potential							
E	3AU = 0.65 Gt 32DS = 0.25 Gt	CO 22 CO 20	e** e	Γ			
-0.2							
-0.4							
-0.6							
-1.0	-35%	- 1					
-1.2	(-0.5 Gt)	-1	-15%				
-1.4		- ((-0.2 Gt)		(-		
-16	Carbon capture, utilisation & storage (CCUS)		Inert anodes	el f	R		
	§\$\$		§ \$	(D		



BAU = 0.9 Gt CO₂e avoided B2DS = 1.1 Gt CO2e avoided 0.1 Gt 0.04 Gt Elimination Elimination of all metal of prelosses consumer during scrap casting and recycling

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Aluminium, anything but basic!

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Key decarbonisation technologies along the Al value chain





HyInHeat- Decarbonization of heat processes by Hydrogen



HyInHeat

Title : Hydrogen technologies for decarbonization of industrial heating processes - <u>HyInHeat</u>

Main objective: demonstrating how to adjust reheating and melting furnaces and heating equipment to H_2 as sole fuel in combination with air, oxygen enriched air (OEC) and O2 (oxyfuel) combustion in existing (retrofitting) or new greenfield installations, focus on an increase in energy and resource efficiency, safety, environmental and economic aspects.

Coordination: RWTH (28 partners) Sectors involved: Aluminium, Steel Al industry: Befesa, Speira, Mytilineos, Constellium Total budget: ≈ 24M €, 18 M€ funding Role of European Alulinium:

- Dissemination/Communication within the Al sector (including fostering cross-fertilization and organization of thematic workshops)
- Analysis of policy and regulatory frameworks
- Supporting LCA studies (providing data and revising Alrelated processes)

HyInHeat was kicked-off on 31 Jan-01 Feb 2023 in Aachen (RWTH)





H2GLASS - advancing Hydrogen (H₂) technologies and smart production systems TO decarbonise the GLass and Aluminium SectorS

<u>EU H2GLASS project</u> aims to: i) create the technology stack that glass manufacturers need to realise 100% H₂ combustion in their production facilities and ii) a demonstrator for the aluminium industry to prove the transferability of the technological solutions and underlying models to energy-intensive industries (23 partners/8 countries, 23 M \in EU Contribution).

Unique features:

- 5 on-site industrial use-cases (representing 98 % of EU glass production)
 + 1 replicability demonstrator in cast house (Hydro Havrand)
- 100% green H₂ supply through **a portable electrolyser**
- Application of digital twin technologies/development of smart production processes for predictive maintenance and easier monitoring of the system



European Aluminium is actively involved in Dissemination & Communication, regulatory framework analysis/formulation of harmonised industry recommendations and Life Cycle Assessment aspects



Conclusions

- Aluminium is a key enabler for the energy transition and decarbonisation
- But its primary production is energy and GHG intensive.
- To satisfy the 2050 GHG targets, drastic reductions of GHG intensity are needed
- Three main routes are used :
 - Decarbonisation of the (consumed) electricity
 - Decarbonisation of the processes, i.e. inert anodes, electric furnaces or low carbon fuels
 - Maximising circularity potentials via better/smarter post-consumer recycling routes
- The Innovation Hub of European Aluminium is a collaborative platform promoting/developing projects addressing those challenges.



THANK YOU!

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