Aluminum lightens the world
アルミでかなえる、軽やかな世界

Aluminum's Sustainability and UACJ's Capabilities

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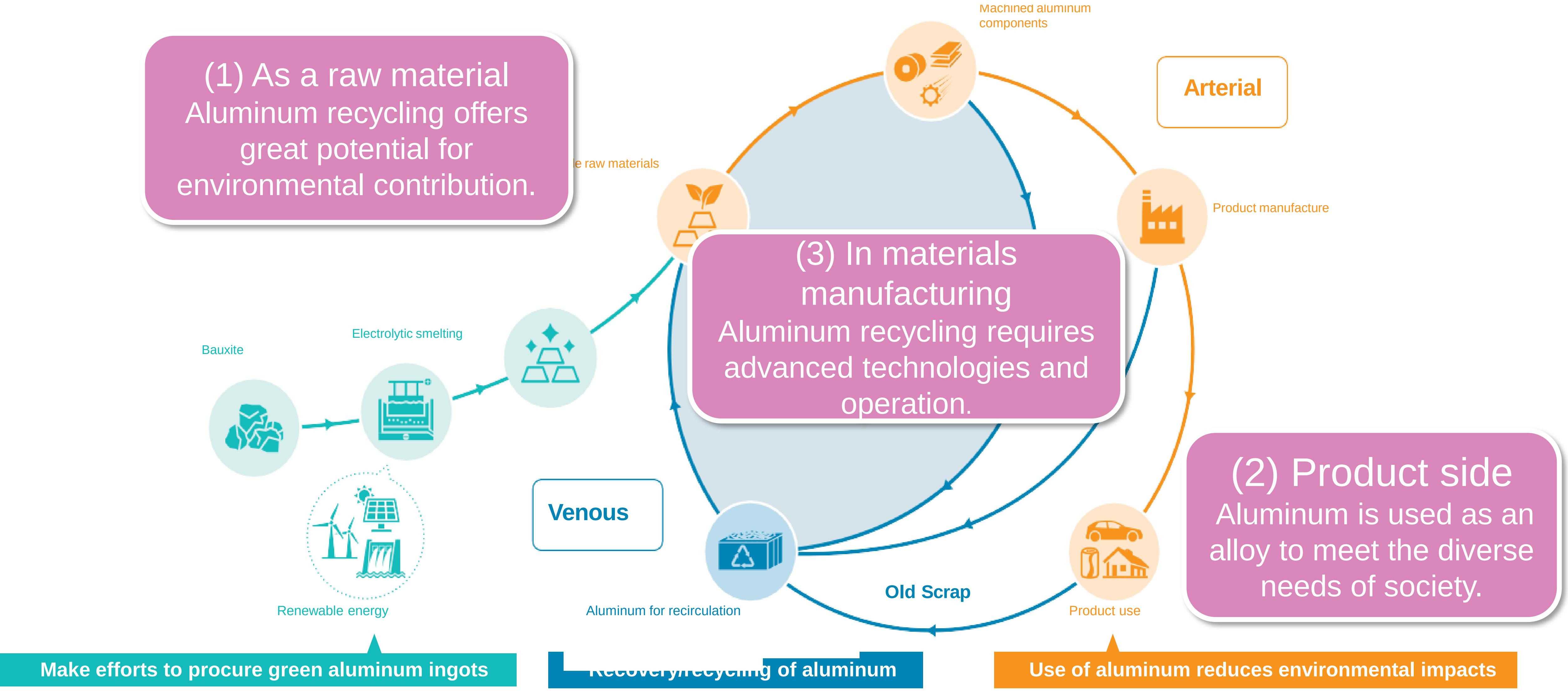
Three Key Points About Aluminum Alloys



Aluminum Properties

- Light
- Does not magnetize
- Cold-resistant
- Easy surface treatment
- Easy welding
- Strong
- Good conductor of electricity
- Non-toxic
- Easy casting
- Good vacuum characteristics
- Good corrosion resistance
- Good heat conductor
- Reflects light and heat
- Easy processing
- Easy recycling

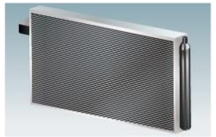
Aluminum Applications: Providing Diverse Properties Required of Aluminum Alloy Materials

Automotive

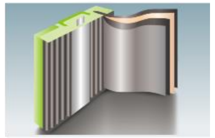
Lightweight, offers improved performance and fuel efficiency, contributes to longer infrastructure service life

Body panel material

Structural components



Heat exchanger materials



Battery module materials

Beverage Cans

Using recycled raw materials reduces society’s environmental burden

Pharmaceuticals and Food

Non-harmful, sealable characteristics contribute to safe/secure living

Aerospace

Utilizing state-of-the-art technology to achieve both safety and improved fuel economy

IT

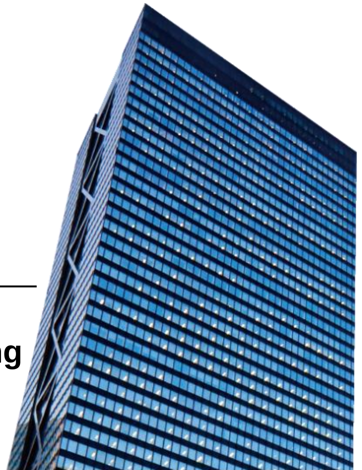
Lightweight, refined design and high usage performance

Shipbuilding

Contributes to higher speed, lighter weight and corrosion resistance

Architecture

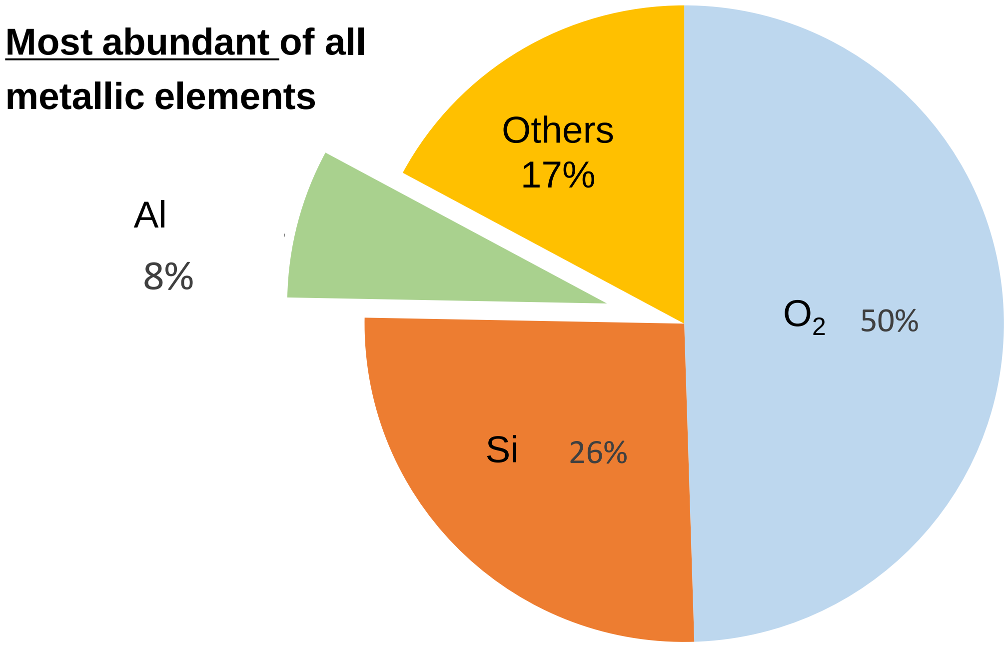
Expands use cases through more appealing visuals and improved workability



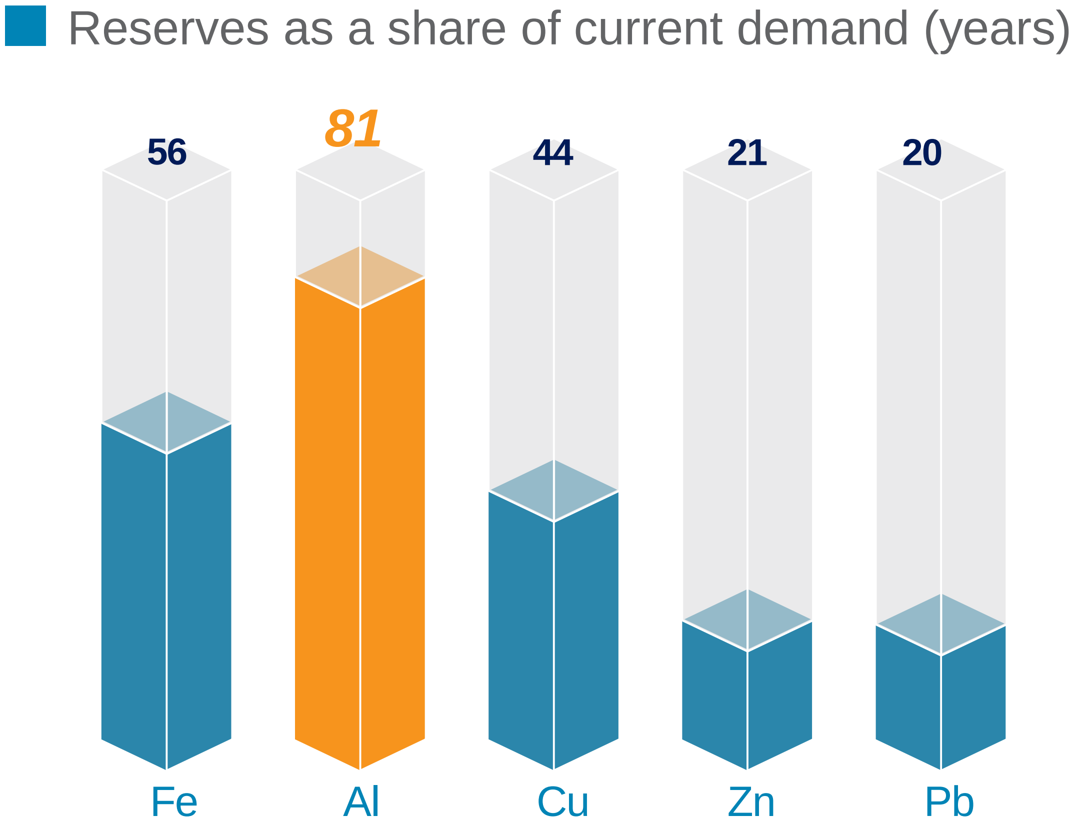
Aluminum as a Metal Resource

Aluminum’s Sustainability as a Resource

Share of Elements in the Earth’s Crust



Base Metal Sustainability



Source: USGS2021

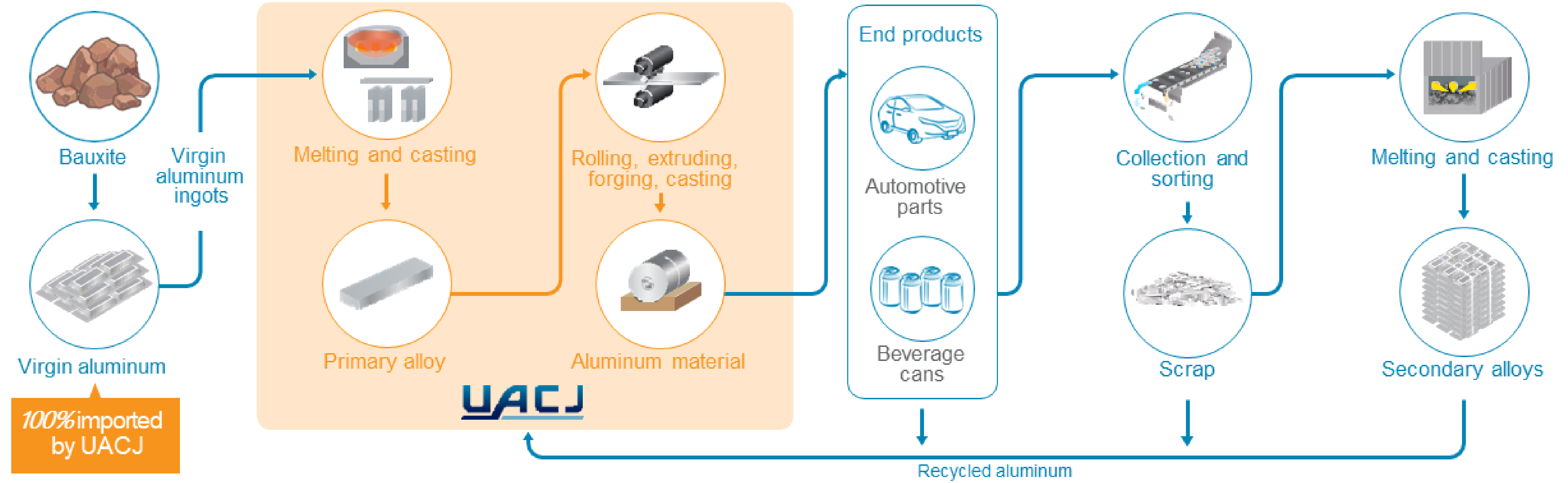
*Ore production volume in 2020

Sufficient time available to establish environmental response and resource recycling

Aluminum’s Life Cycle

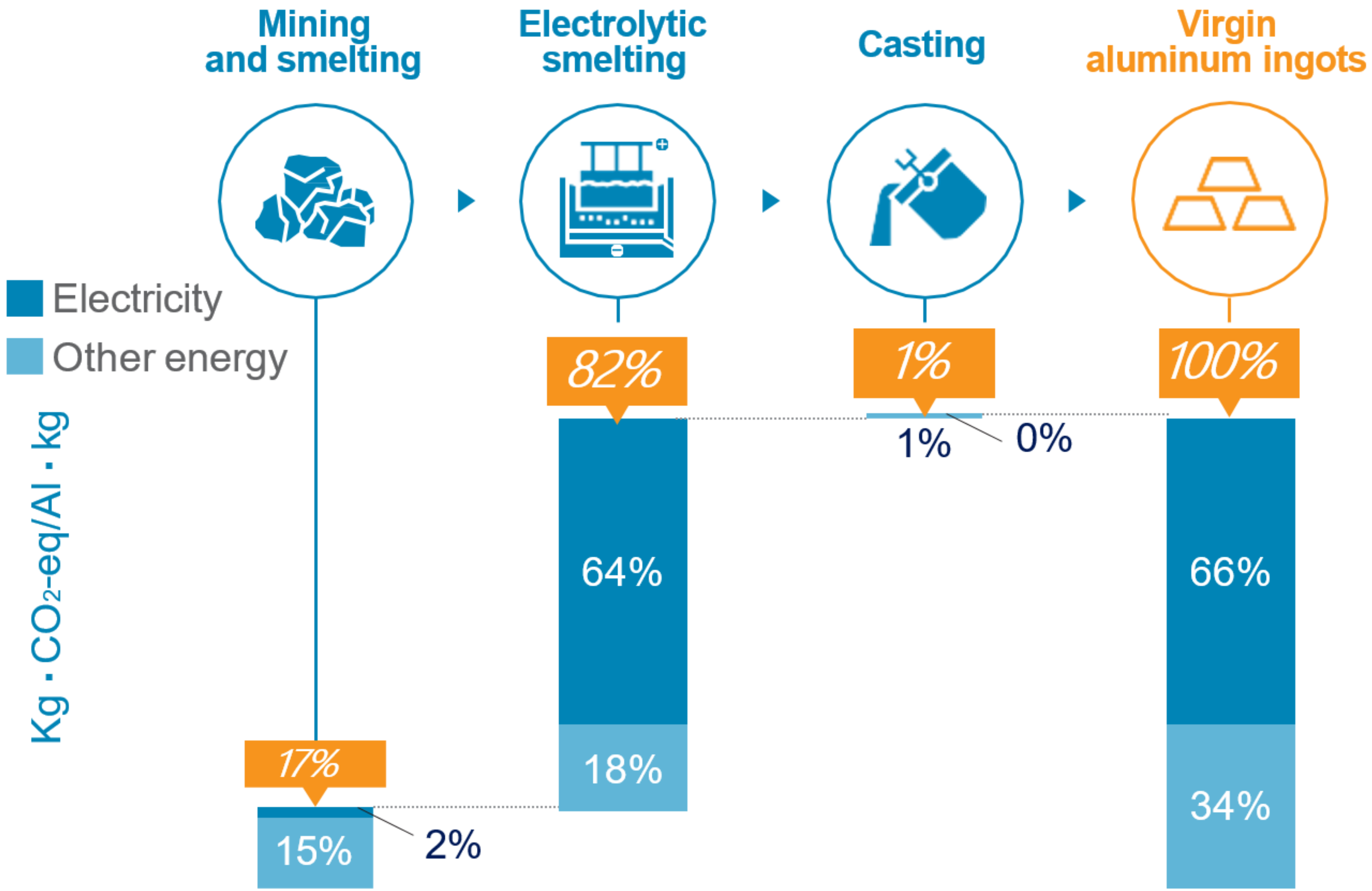
100% of new bullion is imported and used repeatedly in a circulation model

Virgin aluminum production	Melting and casting	Processing	Product manufacturing and use	Collection and sorting	Recycling
Virgin aluminum is produced from bauxite using electricity	Virgin aluminum is melted down and has various elements added to it for casting primary alloys	Rolling, extruding, forging, casting, and other means of processing are used to form materials for products	Machined to end products like beverage cans and automotive parts	Used products are collected and sorted, then recovered as scrap	Scrap is melted down for casting secondary alloys



Aluminum’s Energy Sustainability

Two-thirds of CO_2 emissions from the production of new bullion come from electricity



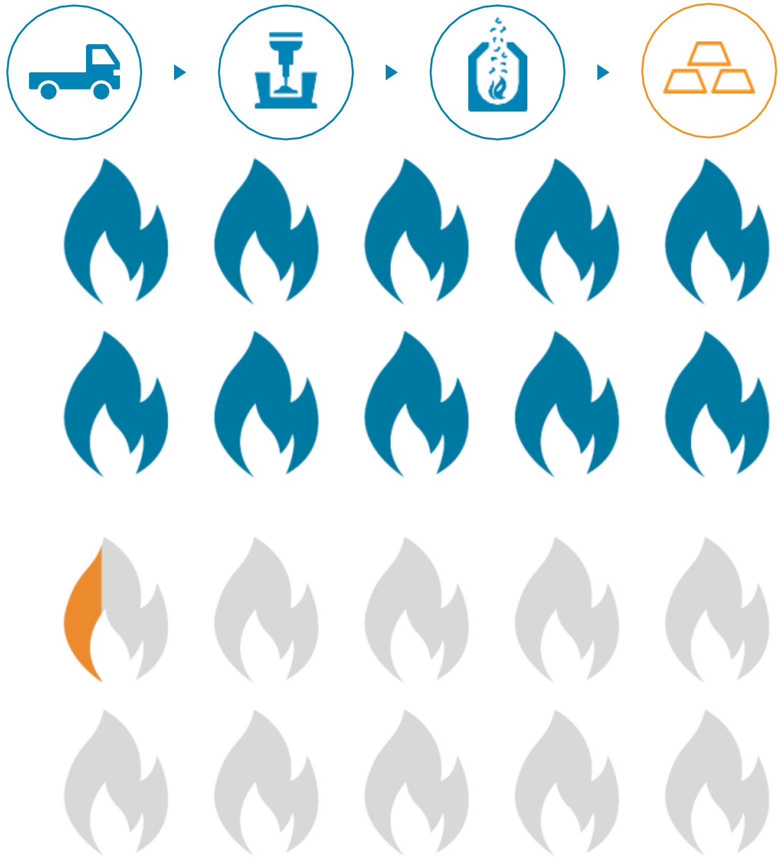
Importance of Aluminum Recycling

Aluminum’s Energy Sustainability

Aluminum (metal) extracted from ore can be re-melted with little energy

Production process and GHG emissions of recycled aluminum ingots

Recovery Crushing Dissolving/Adjustment Recycled aluminum ingots



New aluminum bullion

100%

Recycled aluminum bullion

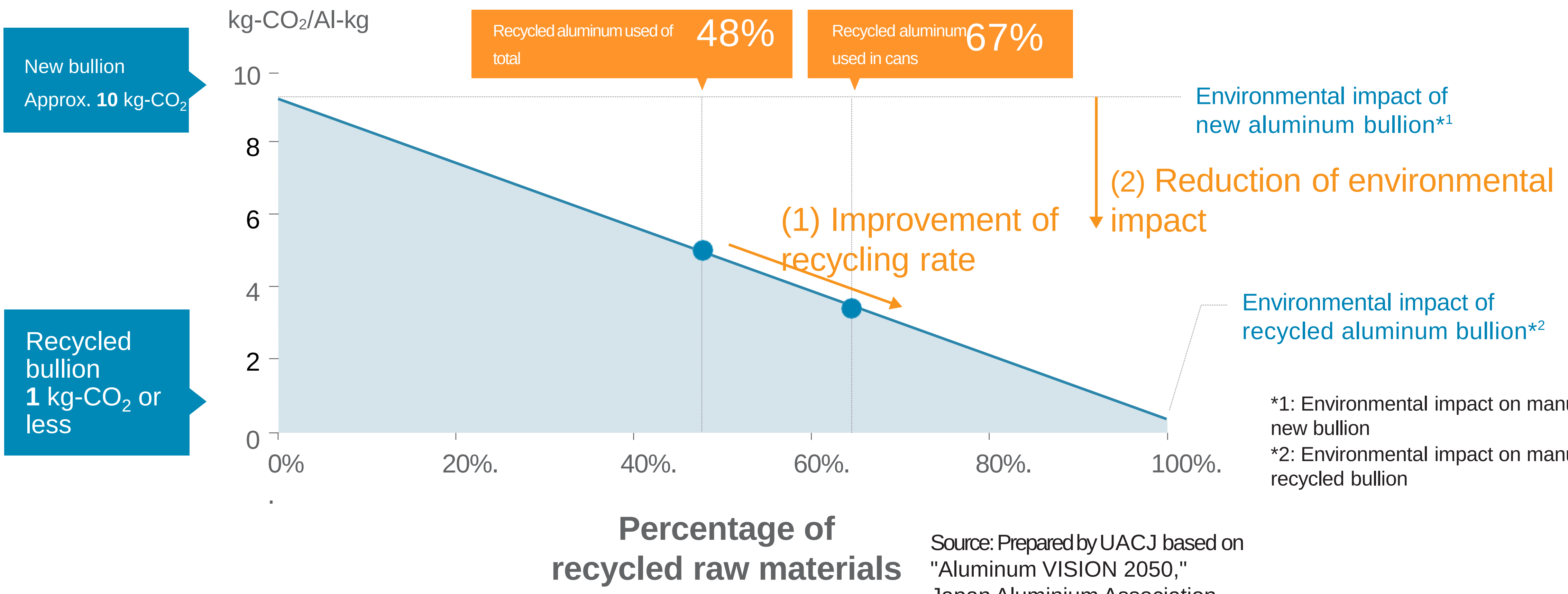
3%

Source: Japan Aluminium Association

Reducing Environmental Impact by Using Recycled Raw Materials

Aluminum's recycling rate and average environmental impact*

* (Environmental impact of new aluminum bullion) x (1− (Recycling rate))+(Environmental impact of recycled aluminum bullion) x (Recycling rate)



*1: Environmental impact on manufacture of new bullion
*2: Environmental impact on manufacture of recycled bullion

Source: Prepared by UACJ based on "Aluminum VISION 2050," Japan Aluminium Association

Effects of Aluminum Recycling

Trial Calculation Example

- Energy-saving effect of aluminum can recycling
- CO_2 emissions per aluminum product

Material Flow for Aluminum Cans

2020 Domestic Aluminum Demand in Japan

Domestic demand for aluminum is
Approx. 3.6 million tons

Of which, food use is
Approx. 10%.

Source: Japan Aluminium Association

2020 Aluminum Can Recycling Flow

Recycled amount: 311,000 t

Consumption is
Approx. 331,000 tons
(21.79 billion cans)[1]

Approx. 311,000 tons
Resource recovery company

Unaccounted for amount: 18,000 tons
Not included for resource recovery companies

Approx.*[1] 225,000 tons
Domestic recycled amount used
(Secondary alloy manufacturers, etc.)

Approx. 160,000 tons (71.0%)
for aluminum cans

Approx. 65,000 tons
for casting and deoxidizing materials

Approx. 86,000 tons in overseas export volume

Approx. 2,000 tons in landfill disposal, incineration, etc.

Notes: 1. Figures other than consumption, domestic recycling, recovery by local governments, and export to overseas are estimates.
2. All figures reflect the composition ratio of 87.5%.

Source: Japan Aluminum Can Recycling Association

More than 90% collected and about 70% reused in Japan

About 70% of this is recycled into aluminum cans

Environmental Effect of Recovering Aluminum Cans

Significant contribution to energy conservation and CO_2 emissions reduction in society as a whole

Recycled aluminum cans*[1]
Approx. 220,000 tons

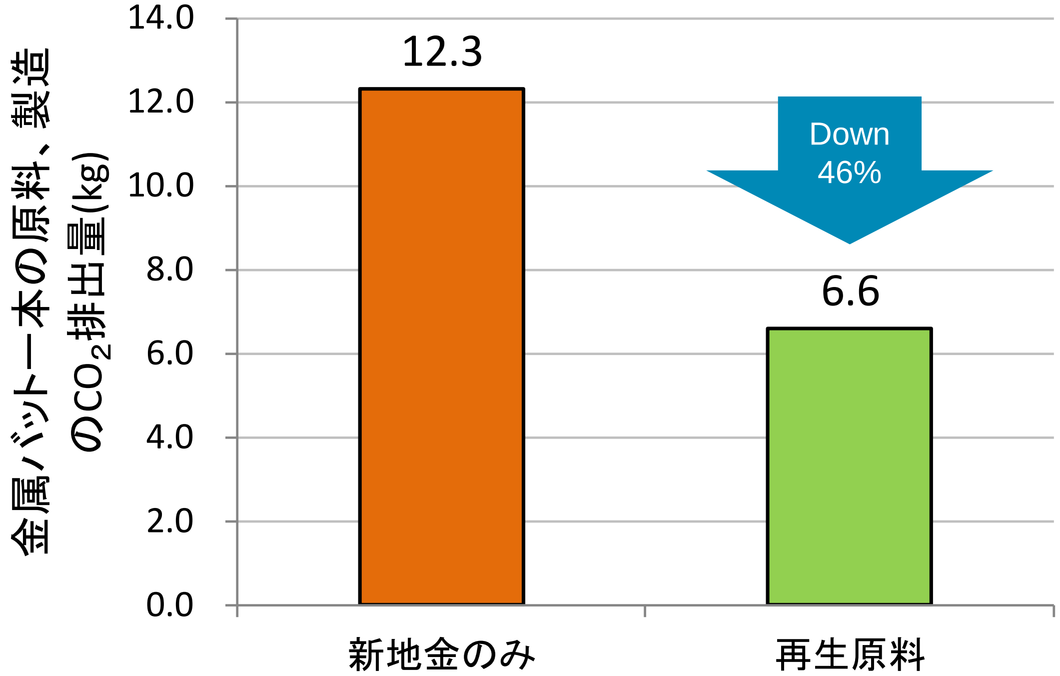
Approx. 30 billion MJ energy conservation

Approx. 15 days' worth of electricity consumption for all of Japan's households (51.78 million)

See: Japan Aluminum Can Recycling Association, "About Recycling."
*1 Weight of aluminum cans recycled in Japan in 2020
*2 Japan Aluminium Association, "Survey Report on Inventory of Scrap Melting for Expansion Materials"

Trial Calculation Example (Single Aluminum Product): Recycling Aluminum Metal Bats

When recycled materials are used in 60% of the manufacture of a single bat



Trial calculation by UACJ using per-unit emissions and absorption data from the Japan Aluminium Association, Forestry Agency, METI, etc.

Manufactured using 60% recycled materials

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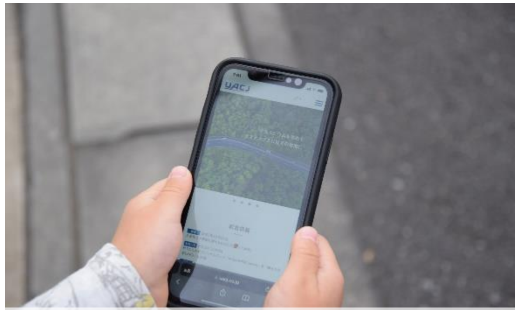


Approx. 1,000 full smartphone charges

or

Approx. 2/3 of the annual amount absorbed by one camphor tree

Message for Material Users

Recently, demands have emerged to reduce supply chain emissions

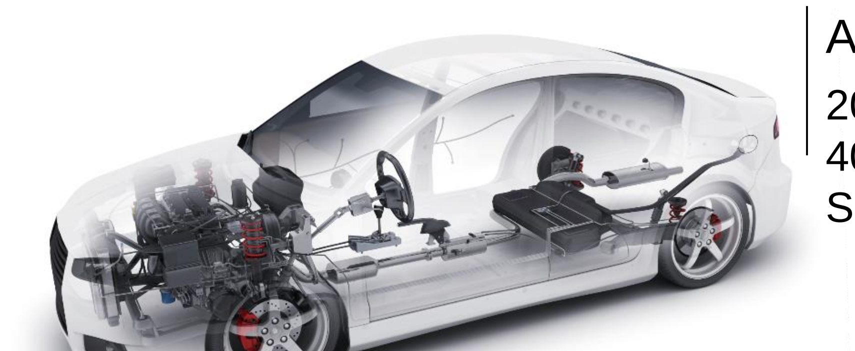
(Scope 3: More companies are disclosing upstream emissions)

For user companies, when comparing emission reduction in factories (Scope 1) and power saving and greening of electricity (Scope 2),

aluminum material offers significant reduction potential

Recycling Aluminum Alloys:
Current State and Future Outlook

Applications/Alloys for Aluminum Expansion Materials:
UACJ Offers Approx. 2,000 Alloys and Over 10,000 Manufacturing Methods

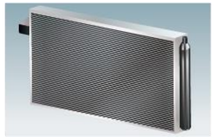


Automotive

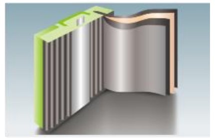
2000 (Cu, Mg), 3000, (Mn, Mg), 4000 (Si), 5000 (Mg), 6000 (Mg, Si)

Body panel materials

Structural components



Heat exchanger materials



Battery module materials

Beverage Cans

3000 (Mn, Mg), 5000 (Mg)

Pharmaceuticals and Food

1000, 3000 (Mn, Mg)

IT

5000 (Mg),6000 (Si)

Aerospace

1000, 2000 (Cu, Mg), 5000 (Mg), 7000 (Zn, Cu, Mg)

Shipbuilding

3000 (Mn, Mg), 5000 (Mg)

Architecture

6000 (Mg, Si)

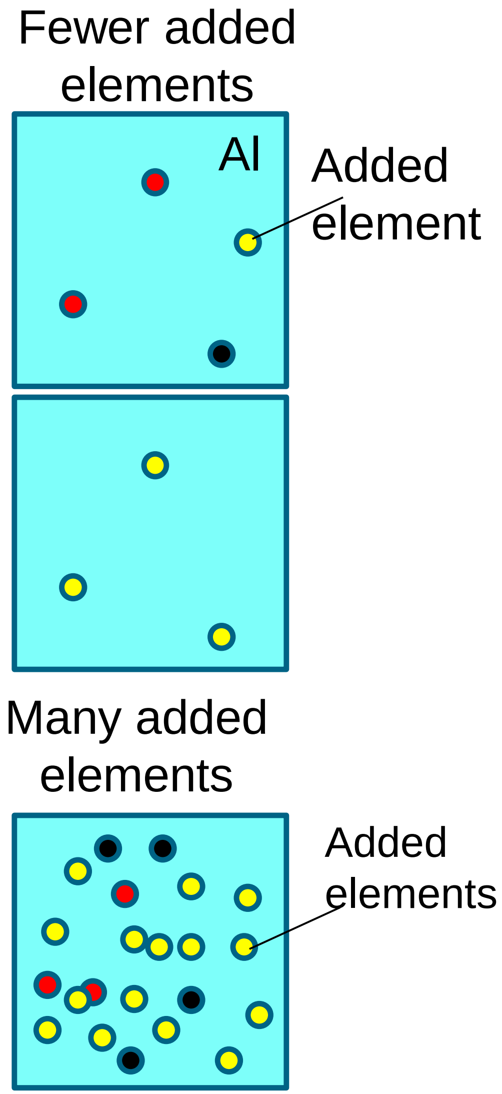
Examples of Aluminum Alloys (Ex: Automotive Field)

Restrictions exist on reuse as different alloys; the casting flow is one-way

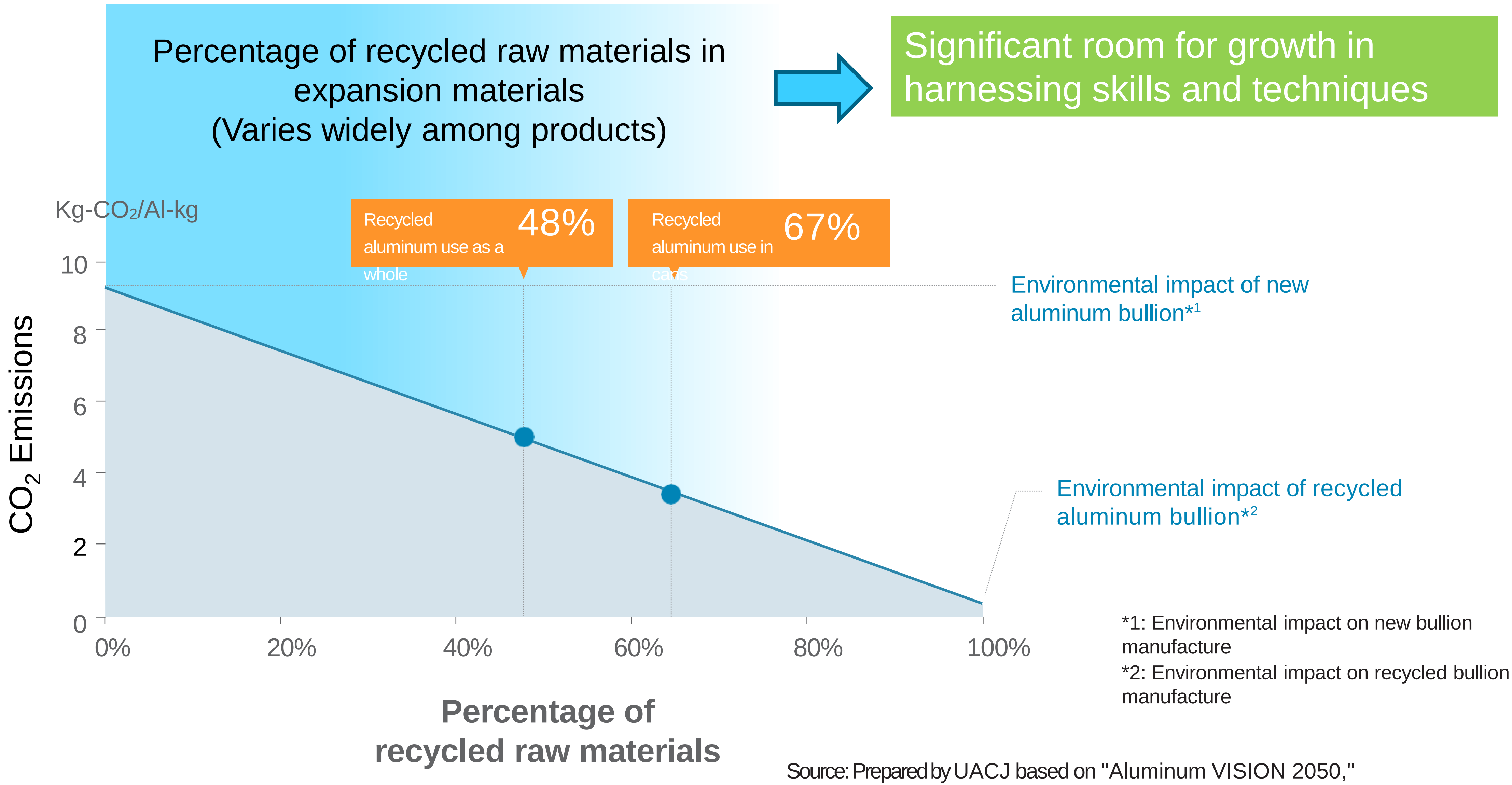
Expansion material

Casting material

	Applications and Products	Required Properties	Aluminum Alloy
Expansion material	Aluminum foil for batteries	Workability, surface properties	1000 series
	Battery cases	Ductility, thermal conductivity	3000 series (Mn, Mg)
	Heat exchanger plates, tubes	Corrosion resistance, brazing process productivity	3000 series (Mn, Mg)/ 4000 series (Si) (Clad material)
	Panels	Rigidity, corrosion resistance	5000 series (Mg) 6000 series (Mg, Si)
Casting material	**Engine blocks**	**High strength, formability in casting**	**AC, ADC series (Si)**



The Future of Using Recycled Raw Materials for Expansion Materials

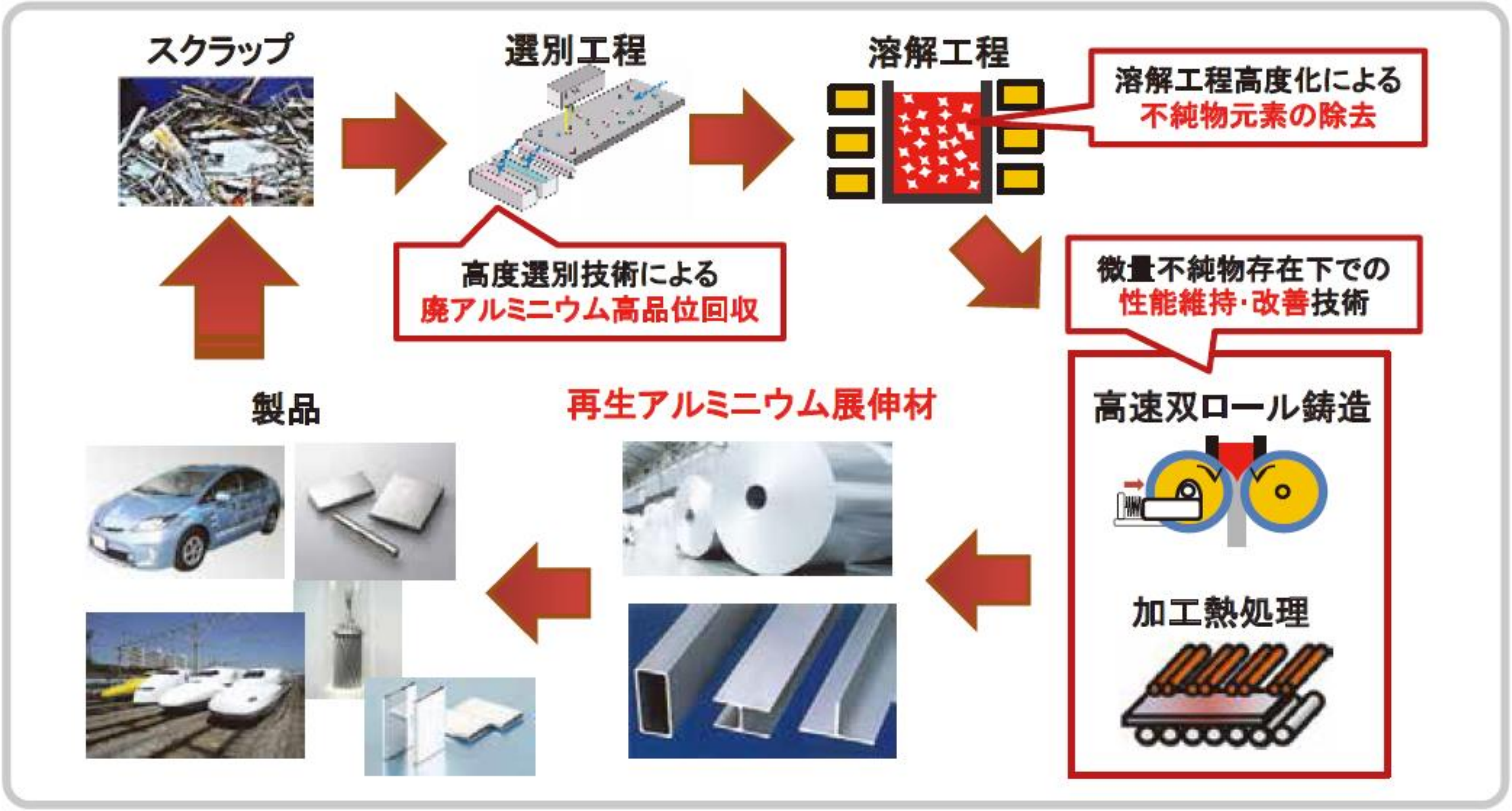


*1: Environmental impact on new bullion manufacture

*2: Environmental impact on recycled bullion manufacture

Source: Prepared by UACJ based on "Aluminum VISION 2050," Japan Aluminium Association

Three-pronged approach: <u>Recovery and selection</u> + <u>Separation and purification</u> + <u>Mastering use</u>



UACJ's Environmental Capability to Become the "Heart of Aluminum Circulation"

Material characteristics/social position

Aluminum expansion material is used as an alloy for various applications

- Accumulation of alloy development capability
  About 2000 alloy products
- Close ties with a wide variety of industries

Characteristics of use in circulation

During circulation use, alloy composition and manufacturing processes are limited

- Process design and mass production capabilities
- Operational capability from raw materials to manufacturing to product certification

The future of aluminum circulation

Skills and techniques harnessing recycling, separation, purification, and recycled raw materials are the key

UACJ's initiatives

- Active use of recycled materials
- Promote near-horizontal recycling, including closed-loop recycling
- Development and branding of materials with reduced environmental impact
  UACJ SMART
- Upgrading/sorting technology

Cautionary note concerning forward-looking statements

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