# Non-Ferrous Metals (Copper)

## Category Shift and Expanding Business Fields are the Keys to Growth

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# Summary


- Looking ahead, amid the drive for carbon neutrality (CN) by 2050, it is anticipated that demand for non-fossil fuel energy sources and products which contribute to energy saving (such as solar panels, electric vehicles, and superconducting cables) will grow. Copper is an essential material in the manufacturing of these CN-related products, and global copper demand is projected to grow
- However, in the future production of electrolytic copper in Japan's main export markets - Asian countries such as China - will increase, leading to an anticipated decrease in exports from Japan. Production levels of electrolytic copper in Japan are therefore projected to fall
- It is possible for Japanese copper refiners to create a competitive advantage for sustained future growth by demonstrating their strengths both in upstream (copper smelting) businesses - such as resource procurement and recycling technology - as well as downstream (processed copper products) businesses - such as adaptability to customer needs, and at the same time by furthering their strengths through implementing CPS (for example, this would include predicting changes in furnace internal temperature due to loading recycled feedstock as well as maximizing the usable volume of recycled feedstock via the implementation of process informatics to copper smelting)
- Conceivable competitive advantages for Japanese copper smelting businesses based on their existing strengths and implementing CPS include, in their upstream businesses, 1. transitioning to comprehensive recycling companies and 2. promoting secondary smelting and recycling businesses in their overseas operations. This will in turn create downstream competitive advantages of 3. expanding the fields of high-performance materials businesses and 4. strengthening overseas production of general-purpose components
  - In their upstream businesses, refiners should 1. not be limited by existing copper smelting, but extend their operations into waste processing. By doing so, they can procure and sell a wide range of recycled feedstock containing copper, and therefore promote the establishment of recycling in copper smelting businesses and develop new sources of profit. It will also be important to 2. capture demand for copper overseas and - based on the ease of securing recycled feedstock - enter the secondary smelting sector overseas and work on category shift
  - In downstream businesses, it will be important to expand fields of business by 3. selling a wide range of high-performance components oriented toward new essential industries etc. and 4. expanding on-the-ground presence overseas where growing demand is anticipated for general-purpose but still high-quality components
- A variety of issues and hurdles are anticipated when implementing strategies based on competitive advantages 1. to 4. Increasing the probability of growth through the likes of measures so that recycling is suitably appreciated by society, joint ventures between companies, collaboration with customers, and accurately ascertaining the market environment will be required of copper smelting businesses

# Category shift in upstream businesses and expanding fields of operation in downstream businesses are the keys to growth

## Changes in External Environment

- Expanding demand for CN
- Growing necessity of using recycled feedstock

## Changes in Industry Structure

**Decreasing production of electrolytic copper in Japan**
- ✓ Lower exports lead to decreasing production
- ✓ Background: Maturation of the Japanese economy and decreasing population

**Increasing production of electrolytic copper overseas**
- ✓ Decreasing exports of electrolytic copper from Japan

## Strengths

**Copper smelting**
- ✓ Ability to build resource procurement networks
- ✓ Recycling arrangements

**Processed copper products**
- ✓ Adaptability to customer needs
- ✓ Quality control ability
- ✓ Mass-production technology

## Implementation of CPS (real x virtual)

- Copper smelting: Forecasting in-furnace status (maximizing the amount of recycled feedstock loaded)
- Processed copper products: Developing alloys using advanced simulations

## Winning Strategies

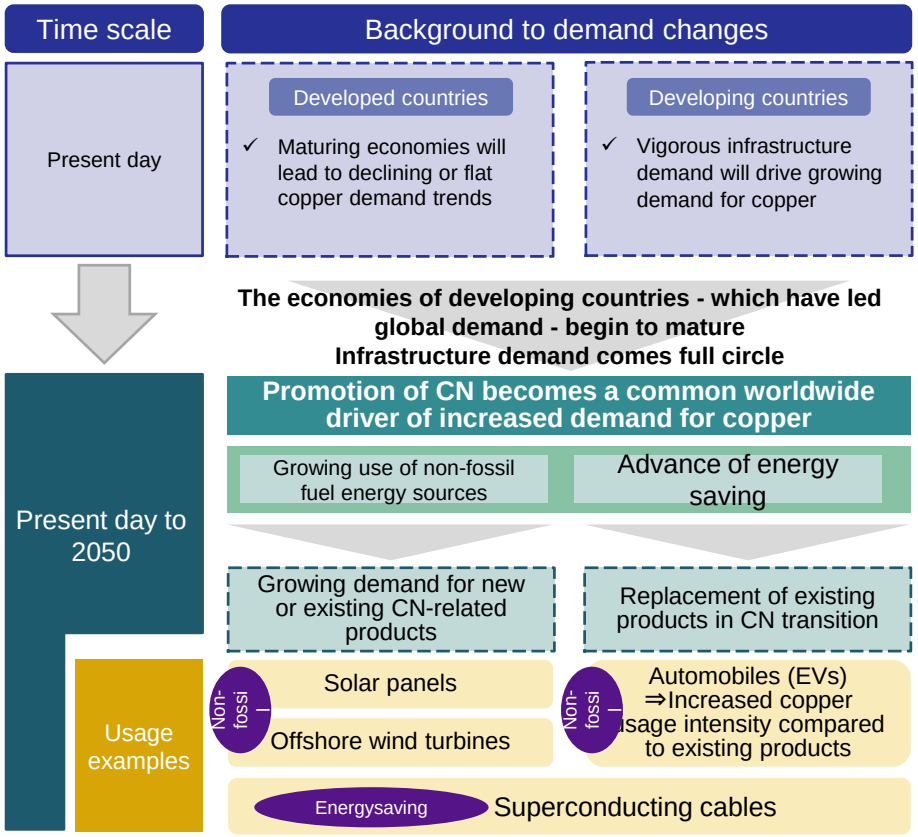
| | Upstream businesses | | Downstream businesses | |
|---|---|---|---|---|
| Domestic | (1) | Transitioning to comprehensive recycling companies | (3) | Expanding the fields of high-performance materials businesses |
| Overseas | (2) | Promoting secondary smelting and recycling businesses in overseas operations | (4) | Strengthening overseas production of general-purpose components |

Source: Compiled by Mizuho Bank Industry Research Department

# Growing demand for copper from a medium- to long-term perspective thanks to CN-related demand growth

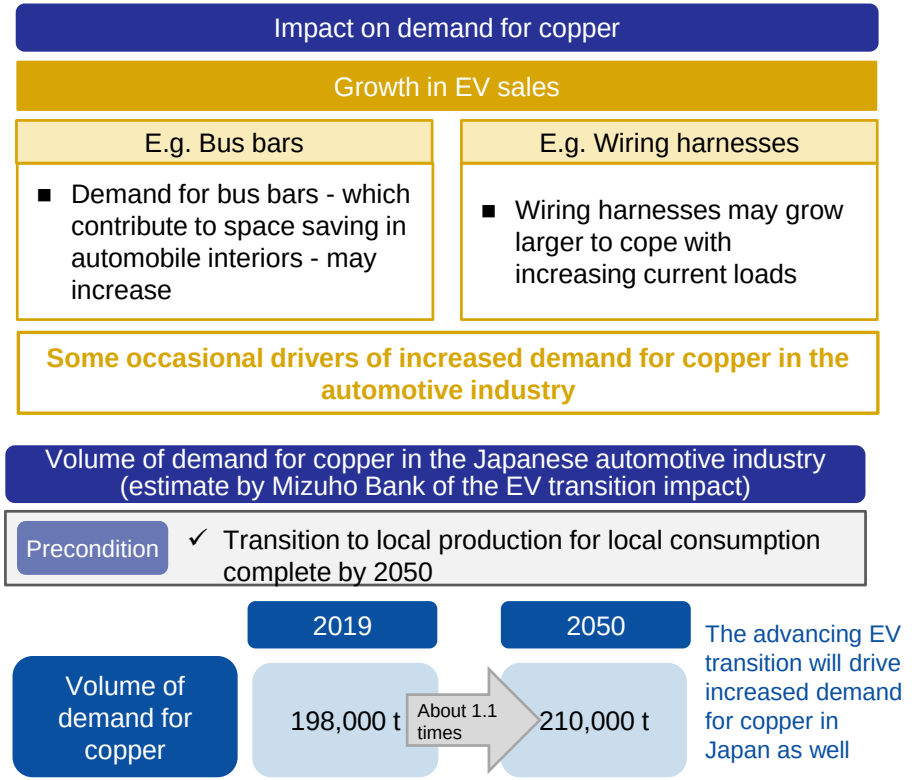
- Looking ahead, global demand for copper is anticipated to grow from a medium- to long-term perspective thanks to CN-related demand growth
- Focusing on trends in the automotive industry, it is envisaged that future growth in EV sales will drive increased demand for copper. Demand for copper in the automotive industry is also anticipated to grow in Japan out to 2050

## Direction of demand for copper




Source: Compiled by Mizuho Bank Industry Research Department

## Drivers of increased demand for copper: Analysis of automotive industry trends




Note: Copper demand volume values are estimates by Mizuho Bank
Sources: Compiled by Mizuho Bank Industry Research Department based on data from the United Nations, the International Organization of Motor Vehicle Manufacturers, and publicly-available information

# The necessity of utilizing recycled feedstock will increase from the perspectives of resource procurement and $CO_2$ emissions reduction

- As demand for copper grows, competition to procure resources is projected to intensify. This trend is anticipated to further increase the necessity of recycling
- The utilization of copper ore in smelting will still be important in order to satisfy growing demand for copper, but the reduction of $CO_2$ emissions via utilizing recycled feedstock and improving the profitability of smelting operations will also become important

## Direction of copper resource procurement

| Time scale | Primary feedstock (copper ore) | Secondary feedstock (recycled feedstock) |
|---|---|---|
| Present day | ✓ Mining capacity will increase along with growing demand for copper<br>✓ Accelerated investment in copper mines | ✓ Increased attention paid to recycling globally |
| | ✓ Intensifying resource nationalism (growing trend to hold onto resources) | |

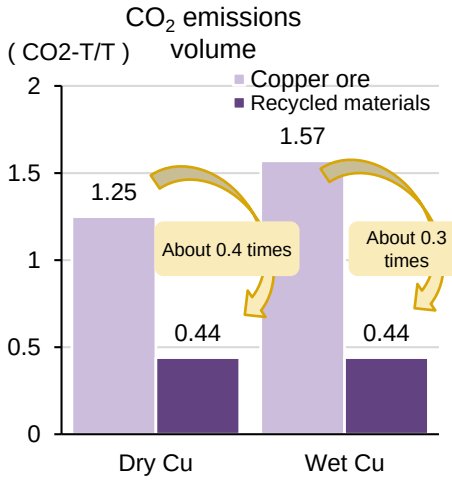
**Intensifying competition to procure resources**
**Growing uncertainty in resource procurement**

| Present day to 2050 | Existing mines' lifespans reached | Advancing utilization of recycled feedstock |
|---|---|---|
| | Advancing development of new mines | $CO_2$ emissions reduction<br>Improving profitability of copper smelting<br>Decreased resource procurement risk |
| | ✓ Covering growing demand for copper by utilization of recycled feedstock alone is problematic<br>✓ Resource development will still be important | ✓ Advancing utilization of e-scrap containing valuable metals as well as scrap copper |

Source: Compiled by Mizuho Bank Industry Research Department

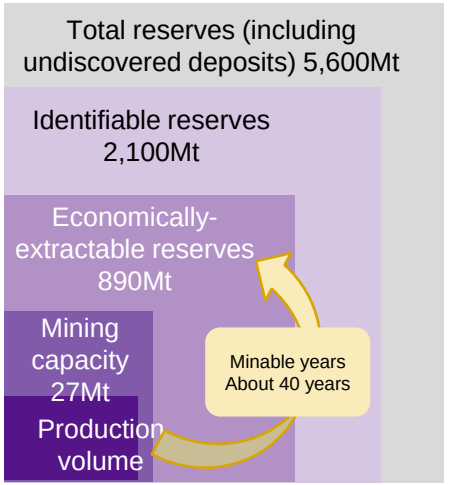
## Analysis of the necessity of copper recycling

### $CO_2$ emissions reduction




✓ By using recycled feedstock in copper smelting, it is possible to reduce $CO_2$ emissions by about 0.3 to 0.4 times compared to when using copper ore

### Copper ore reserves (2022)




✓ Looking ahead, the probability that copper ore will be depleted by 2050 is considered low. However, it is forecast that the remaining deposits being at higher altitude or of lower grade could easily cause the economic efficiency of copper ore usage to drop

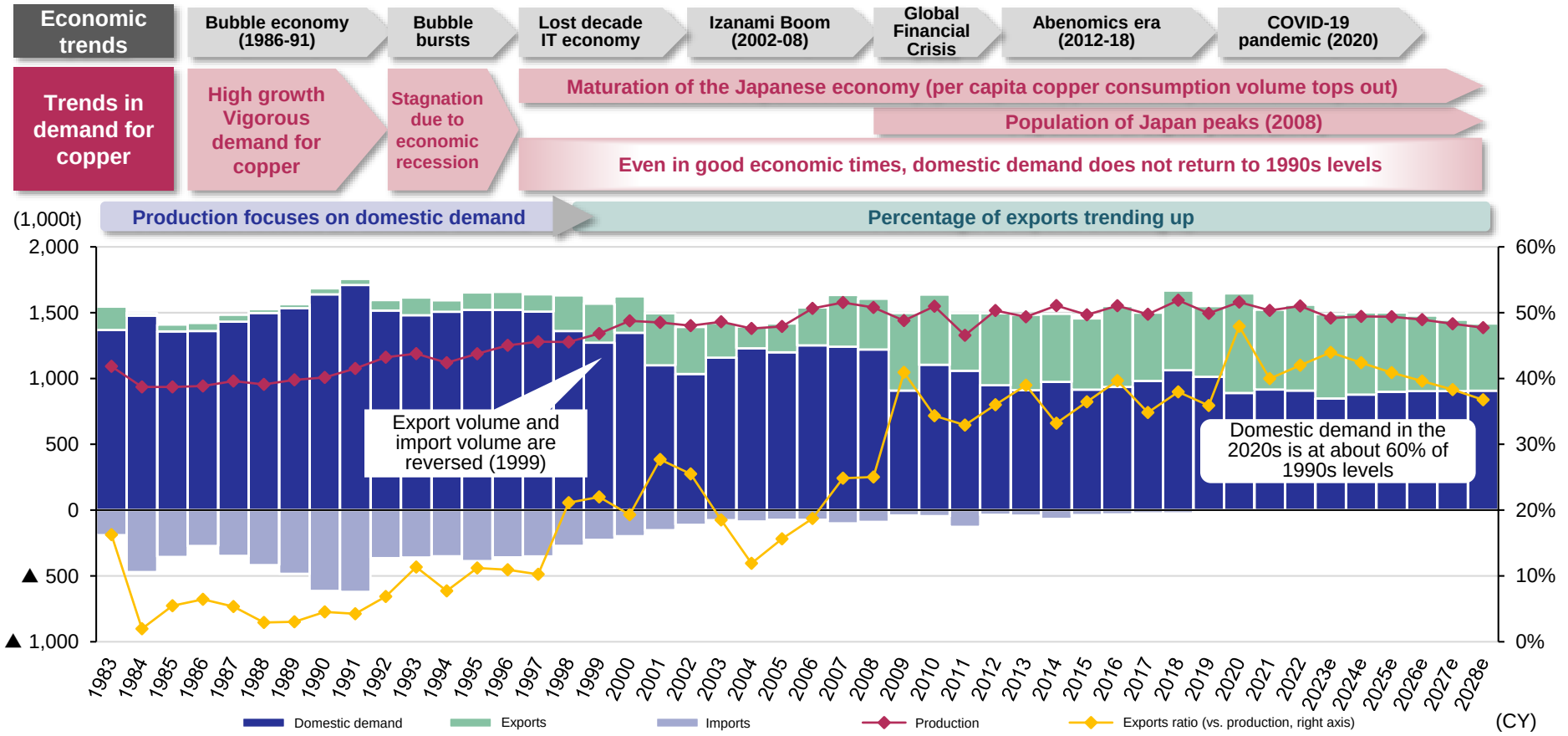
**Reduction of $CO_2$ emissions via utilizing recycled feedstock and improving the profitability of smelting operations will become necessary**

Sources: Compiled by Mizuho Bank Industry Research Department based on ICSG and Metal Economics Research Institute, Japan materials

# Even though domestic demand for electrolytic copper is on a decreasing trend, exports are helping to underpin production levels

- Until around the mid 1990s, domestic demand for electrolytic copper was following an increasing trend, reflecting the strong economic conditions. Since then, the trend has reversed toward contraction, in line with the maturation of the Japanese economy and decreasing population However, growing exports have served to maintain production levels

## Movements in copper industry and economic trends



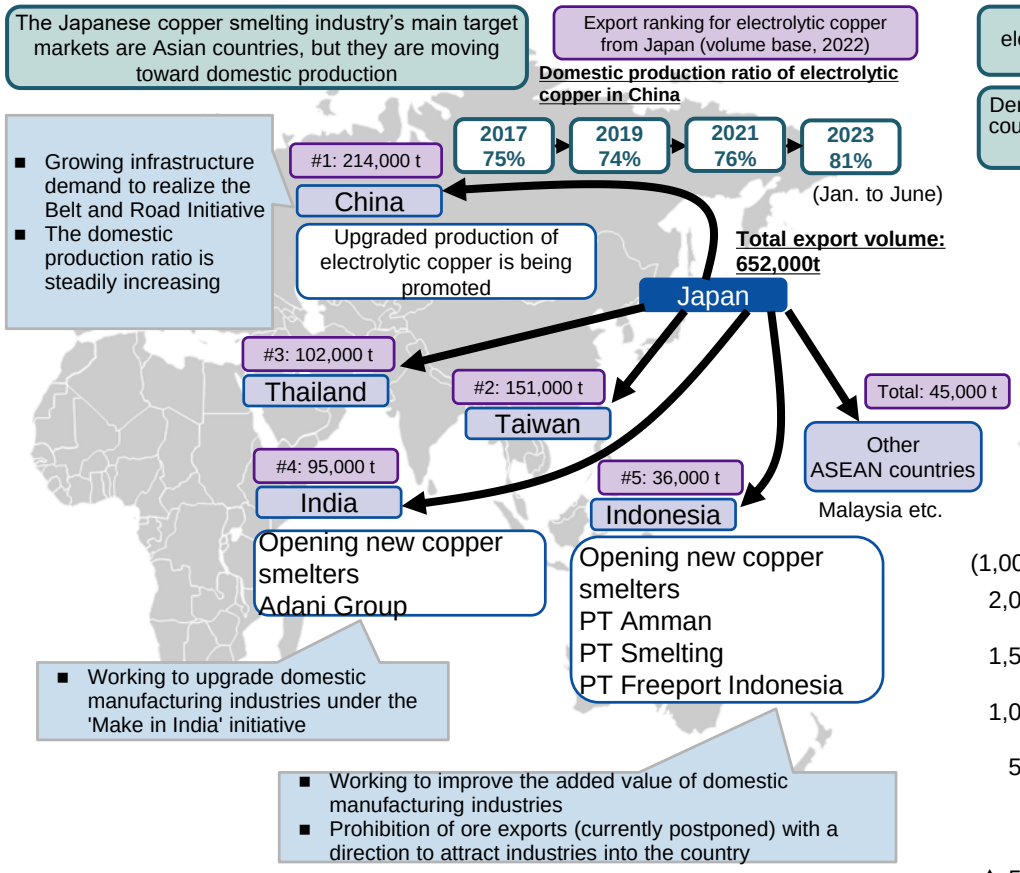

Note: 2023 values onwards are predictions by the Mizuho Bank Industry Research Department

Sources: Compiled by Mizuho Bank Industry Research Department based on "Current Production Statistics," Ministry of Economy, Trade and Industry, and "Demand and Supply Schedule," Japan Mining Industry Association

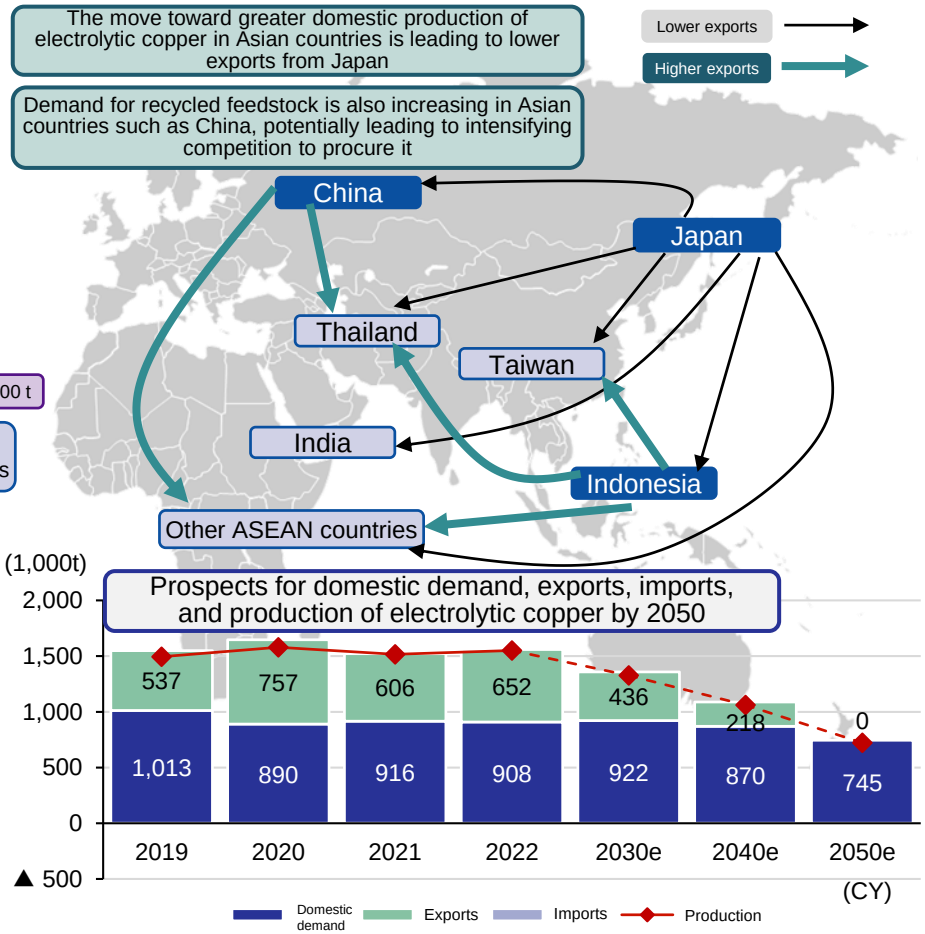
# Increasing production of electrolytic copper in Asian countries such as China is causing decreased exports from Japan

- Looking ahead, the major export markets for Japanese electrolytic copper - Asian countries such as China - are heading towards increased production, meaning that downward pressure on exports from Japan is forecast. As a result, production levels of electrolytic copper in Japan are anticipated to fall

## Trends in exports of electrolytic copper from Japan (current)




## Direction of exports of electrolytic copper from Japan (Mizuho Bank projections)



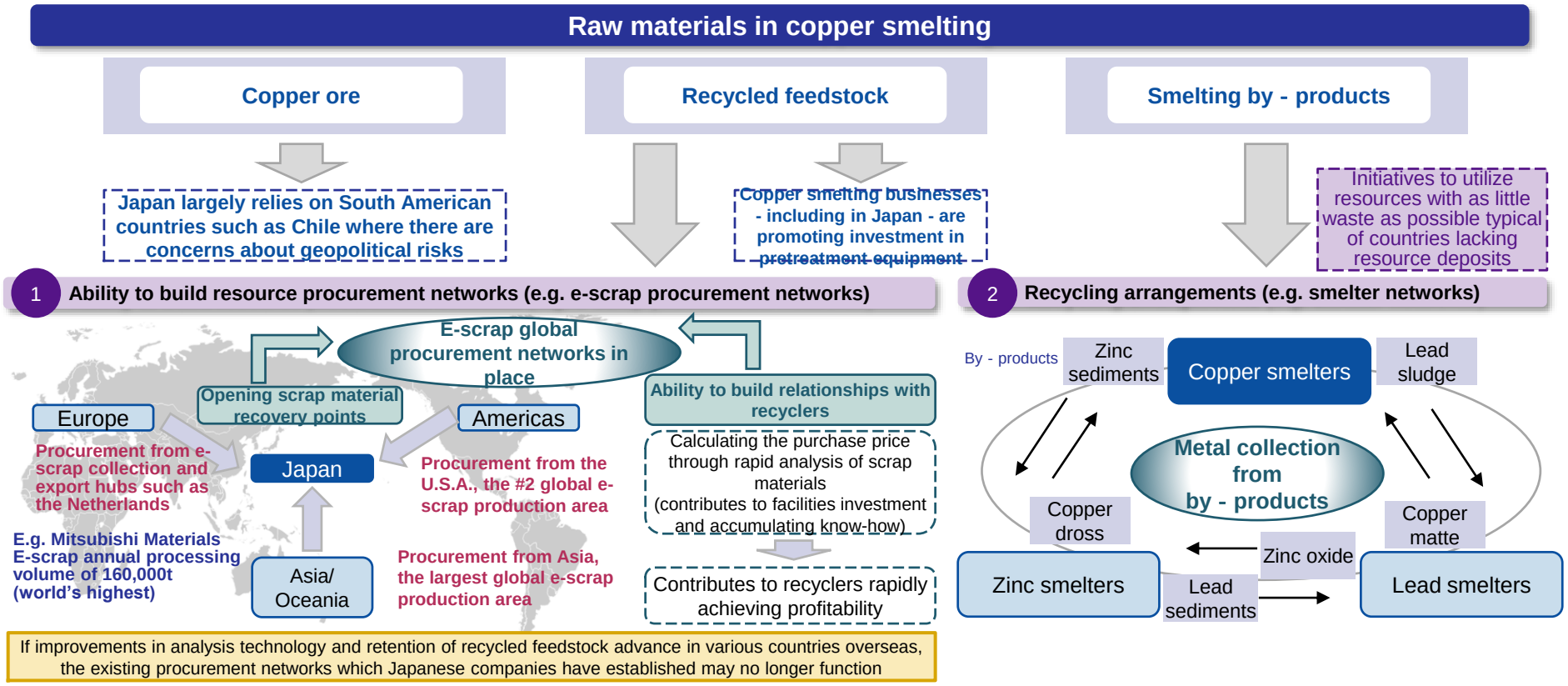

Note: Prospects for production and exports of electrolytic copper by 2050 were calculated assuming zero exports in 2050

Sources: Both figures compiled by Mizuho Bank Industry Research Department based on Global Trade Atlas, WBMS, and publicly-available information

# Upstream businesses: Copper smelting has strengths in building resource procurement networks and recycling technology

- As Japan lacks resource deposits, the need for recycling is higher than other countries. As well as driving development of the capability to build robust resource procurement networks, this situation has also led to refined recycling technology
- However, as attention paid to recycling increases globally and competitors close the technology gap, there is now the risk that these strengths may not be sustainable

## Strengths in copper smelting




Sources: Compiled by Mizuho Bank Industry Research Department based on Global Trade Atlas, Japan Mining Industry Association, and Metal Economics Research Institute, Japan materials

# Downstream businesses: Strengths in processed copper products are adaptability to customer needs, quality control ability, and mass-production technology

- Japanese companies' main target market in the processed copper business is the high-performance materials field. By continually rolling out high-quality products, Japanese companies have captured and maintained the leading global market share in all product fields. The foundations of that success are considered to be the three strengths of (1) adaptability to customer needs, (2) quality control ability, and (3) mass-production technology.

## Strengths in processed copper products

**Product categories**

**High-performance materials** | **General-purpose components**

**Fields Japanese companies are proficient in**

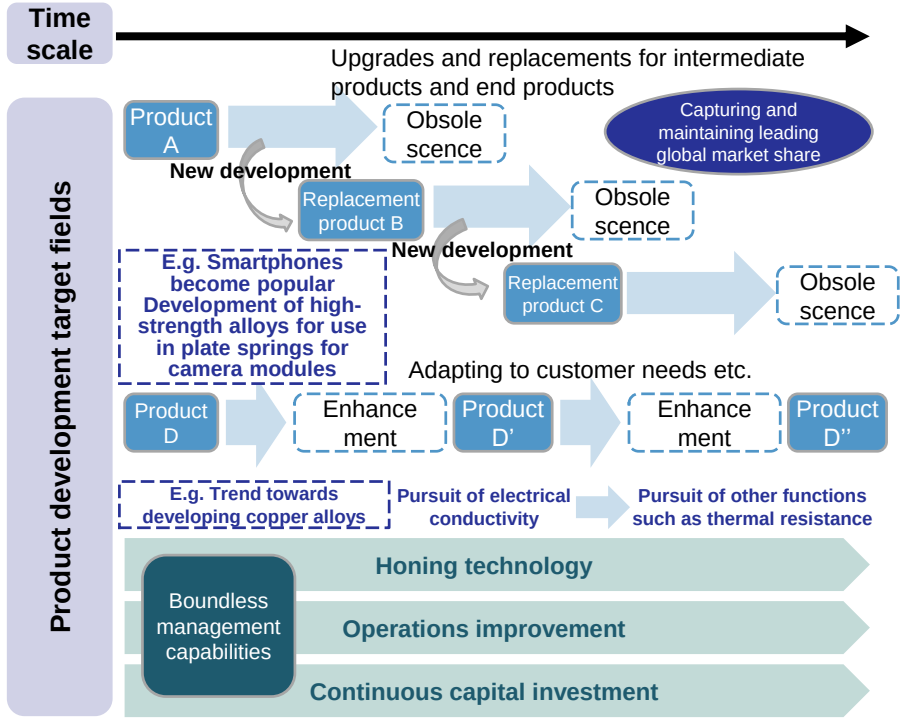
| Examples | | |
|---|---|---|
| JX Metals | Target materials for semiconductors | Rolled copper foil |
| Mitsubishi Materials | High-performance copper alloys (copper alloys including Mg etc.) | |
| Mitsui Kinzoku | Electrolytic copper foil | Functional powders |

**Three strengths**

1. **Adaptability to customer needs**
2. **Quality control ability**
3. **Mass-production technology**

- The leads that Japanese companies have opened up will not be eliminated by overseas competitors overnight
- However, there is some scope for them to close the gap - there is risk of being caught through capital investment and R&D

**Three strengths underpinning high-performance materials structure**

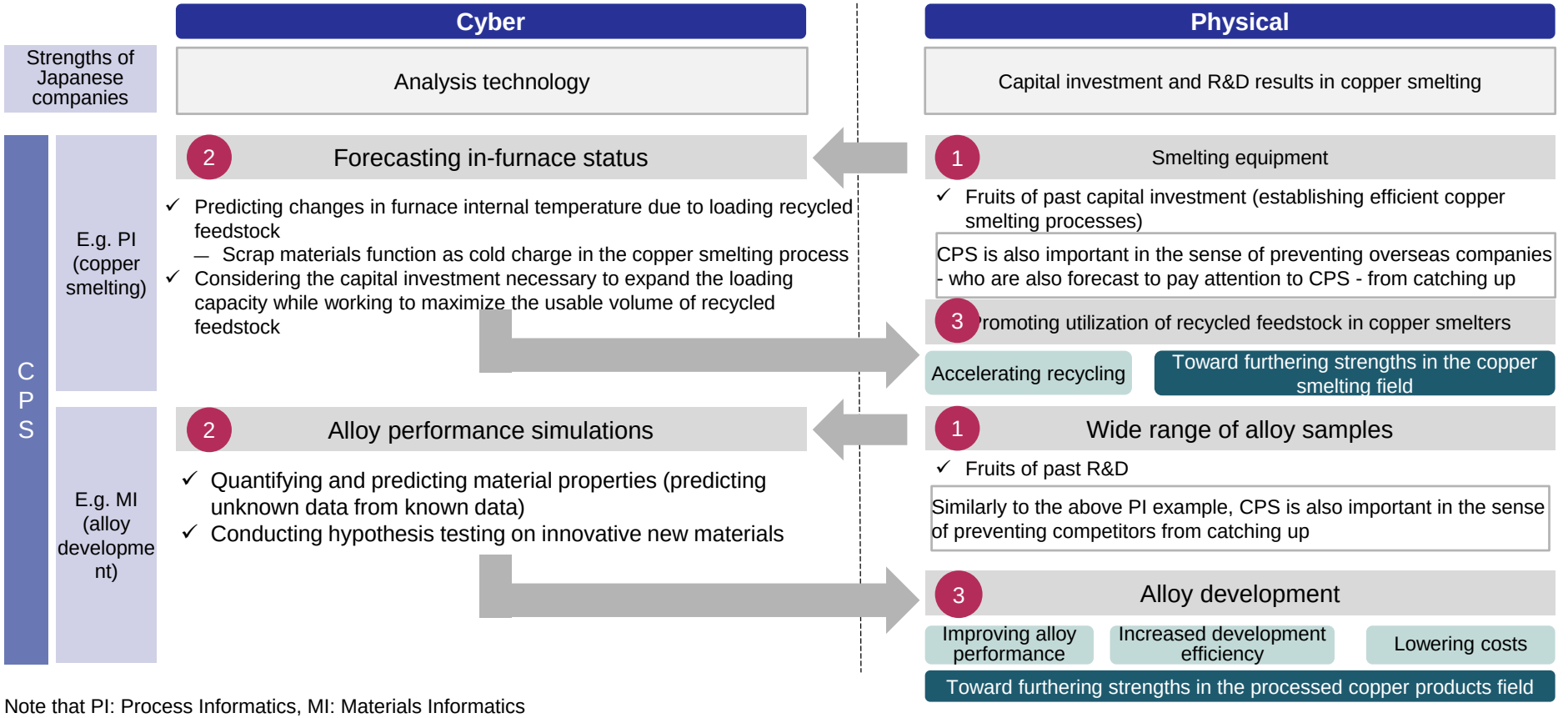



Source: Compiled by Mizuho Bank Industry Research Department based on publicly-available information

# Furthering the strengths of Japanese companies through implementing CPS

- Utilization of CPS is anticipated to progress as a technology contributing to promoting recycling in copper smelters and to producing future new high-functionality materials (e.g. high-performance alloys)
- Japanese companies have strengths in holding a wide range of alloy samples and efficient production processes, the fruits of past capital investment and R&D. Based on this, it is considered that implementing CPS could also deliver competitive advantages

## CPS in the non-ferrous metal industry (examples of copper smelting and alloy development)




Note that PI: Process Informatics, MI: Materials Informatics

Source: Compiled by Mizuho Bank Industry Research Department based on publicly-available information

# Category shift in upstream businesses and expanding fields of operation in downstream businesses are the keys to growth

- Competitive advantages for Japanese copper smelting businesses can be sorted into four types by business location (domestic or overseas) and supply chain (upstream or downstream)

## Future vision of the domestic non-ferrous industry

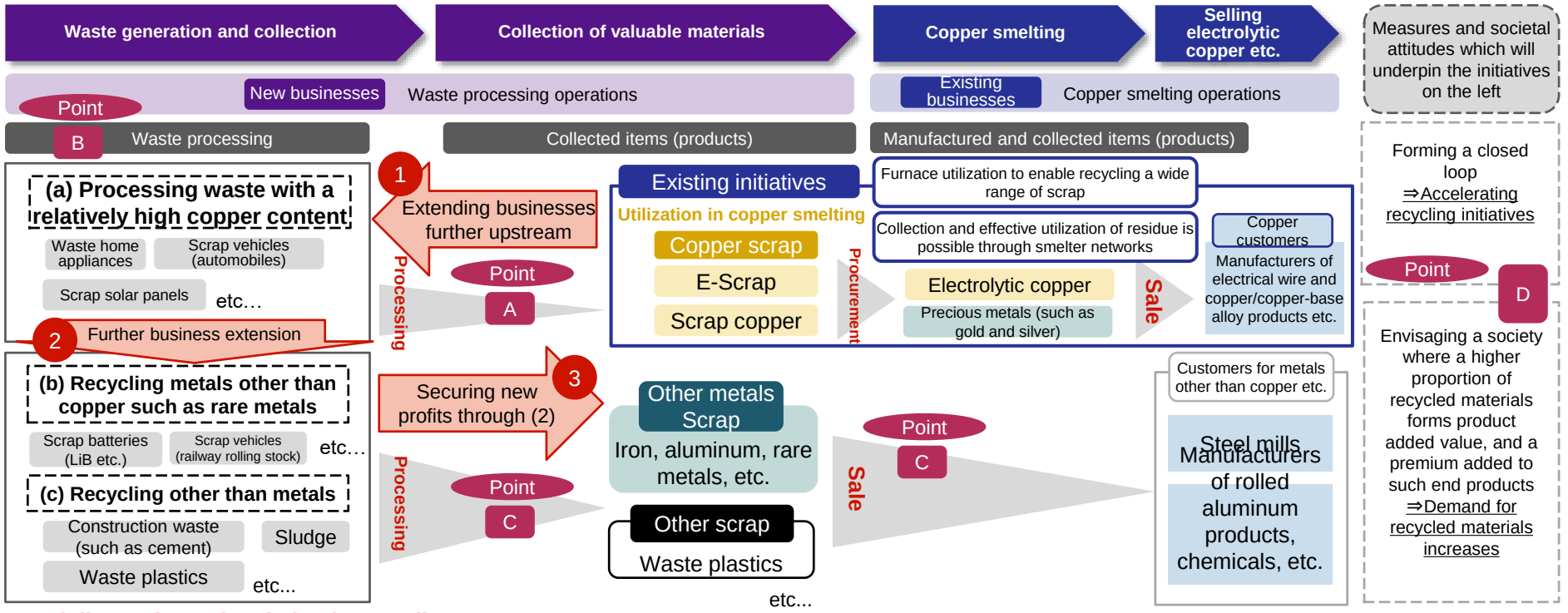
| | Upstream (copper smelting) operations | Downstream (processed copper products) operations |
|---|---|---|
| **Domestic** | **(1) Transitioning to comprehensive recycling companies**<br>Existing strengths to leverage: Recycling arrangements<br>Strengths to hone in future: Ability to procure a wide range of recycled feedstock<br>■ Securing new sources of profit through expanding into the waste processing industry<br>■ Strengthening the ability to procure recycled feedstock through linking the value chains of the waste processing and copper smelting industries<br>■ Maximizing utilization of recycled feedstock through implementing CPS in copper smelting | **(3) Expanding the fields of high-performance materials businesses**<br>Existing strengths to leverage: Adaptability to customer needs, quality control ability, and mass-production technology<br>Strengths to hone in future: Ability to assess growth fields<br>■ Expanding a domestic production/export oriented business similar to now in order to prevent technology outflow<br>■ Strengthening high-performance materials in which Japanese companies have world-class market share |
| **Overseas** | **(2) Promoting secondary smelting and recycling businesses in overseas operations**<br>Existing strengths to leverage: Ability to build scrap material recovery networks<br>Strengths to hone in future: Ability to build sales networks for local customers<br>■ Growing overseas businesses which take into account greater difficulty in procuring copper resources from overseas (including recycled feedstock) and well as expanding global copper demand<br>■ Linking the value chain with overseas copper smelting businesses and expanding recycling businesses overseas utilizing the strengths in recycling technology that Japanese companies have<br>■ Displaying overseas as well the strengths developed through CPS | **(4) Strengthening overseas production of general-purpose components**<br>Existing strengths to leverage: Adaptability to customer needs, quality control ability, and mass-production technology<br>Strengths to hone in future: Ability to expand overseas sales networks<br>■ Local production overseas geared not only towards customers in Japan but also to expanding sales to local customers and entering markets<br>■ Rather than concerns about technology outflow and catchup, prioritizing how to quickly enter markets which will in the future shift to local production for local consumption |
| | **Upstream businesses ⇒ category shift** | **Downstream businesses ⇒ expanding fields of operation** |

Source: Compiled by Mizuho Bank Industry Research Department

# (1) Transitioning to comprehensive recycling companies

- In the short term, focusing on processing waste with a high copper content and collection of copper scrap to secure raw materials for copper smelting businesses and collect/sell precious metals. In the long term, achieve transformation into comprehensive recycling companies by initiatives to process and recycle metals other than copper and a wide range of waste - not limited to metals - to create greater diversity in sources of income

## Initiatives concept diagram




### Focal discussion points in business rollout

| | | | |
|---|---|---|---|
| A | Strengthening procurement of copper scrap for utilization in copper smelting through entry into the waste processing business (utilization of CPS also increases the usable volume of copper scrap) | B | Beginning with operations processing waste with a relatively high copper content (order is a→b→c) (it is anticipated that sector entry for processing waste other than metals will take time) |
| C | Securing new sources of profit (waste processing income, scrap sales income) | D | Promoting the transition to comprehensive recycling companies |

Sources: Compiled by Mizuho Bank Industry Research Department based on various materials

# (2) Promoting secondary smelting and recycling businesses in overseas operations

- Looking ahead, it is considered that - based on the growing trend to local production for local consumption - it will be increasingly necessary to produce electrolytic copper overseas to capture overseas demand. In addition, there are concerns that procurement of e-scrap from overseas may become problematic as competition to salvage e-scrap is expected to intensify overseas. The sustainability of businesses utilizing e-scrap could be increased by expanding secondary copper smelting overseas

## Initiatives flow (concept)

**Time scale**

**2020s** → **Until 2050**

**Capturing and accumulating know-how relating to overseas operations** → **Full-scale rollout of overseas operations**

**Notable developments (including expectations)**

### Participating in secondary smelting businesses overseas

- E.g. Mitsubishi Materials
  - Participating in U.S. plant operations utilizing copper scrap materials through a partnership with U.K. firm Exurban

### Full-scale rollout of secondary smelting businesses overseas

- Rolling out secondary smelting businesses while working to build and strengthen e-scrap collection networks
- Rolling out secondary smelting businesses overseas (exploring options such as rollout through joint ventures with local secondary smelting companies)

### Rollout of recycling businesses overseas

- As comprehensive recycling companies, collecting and selling valuable materials from a wide range of recycled feedstock in the copper smelting rollout areas
  - Processing the likes of waste home appliances, scrap vehicles, and construction waste to collect a wide range of valuable metals not limited to copper

### External environment

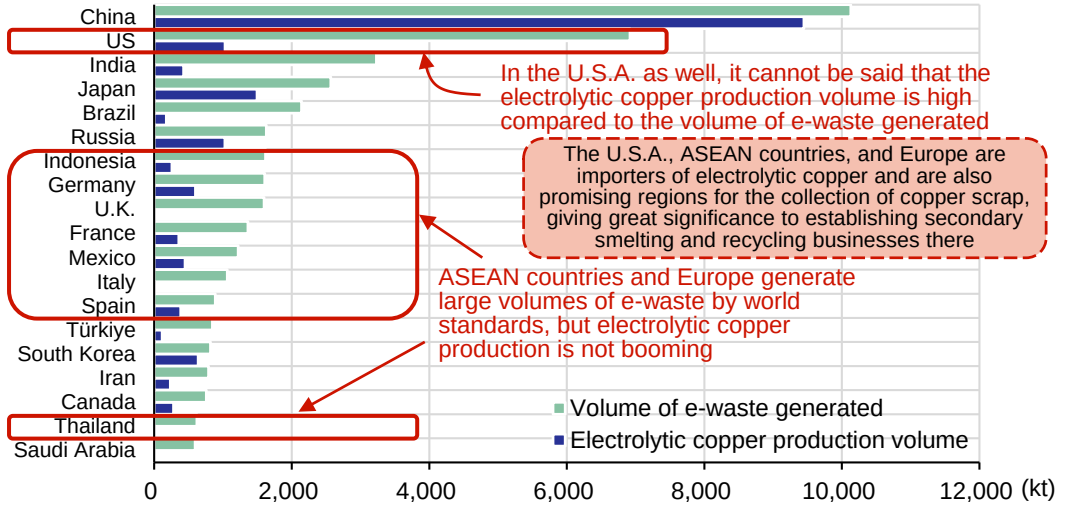
**Growing e-scrap processing capabilities in Europe and North America**

| | |
|---|---|
| **Wieland (Germany)** | In May 2021, announced plans to invest in copper products recycling businesses in the U.S.A. |
| **Aurubis (Germany)** | In November 2021, announced plans to strengthen e-scrap processing facilities in North America |
| **Atlantic Copper (Spain)** | In June 2023, announced plans to invest in e-scrap processing facilities in Spain |

**Amendments to the Basel Convention**

- Amendments to the Basel Convention are planned for January 1, 2025
- Trade in e-waste will become regulated by the Convention, meaning that shipment will not be possible without the agreement of both the exporting and importing countries (the trade procedures to confirm agreement will become more complex)

**Volume of e-waste generated by country (top 20 countries globally) and electrolytic copper production volume (2019)**

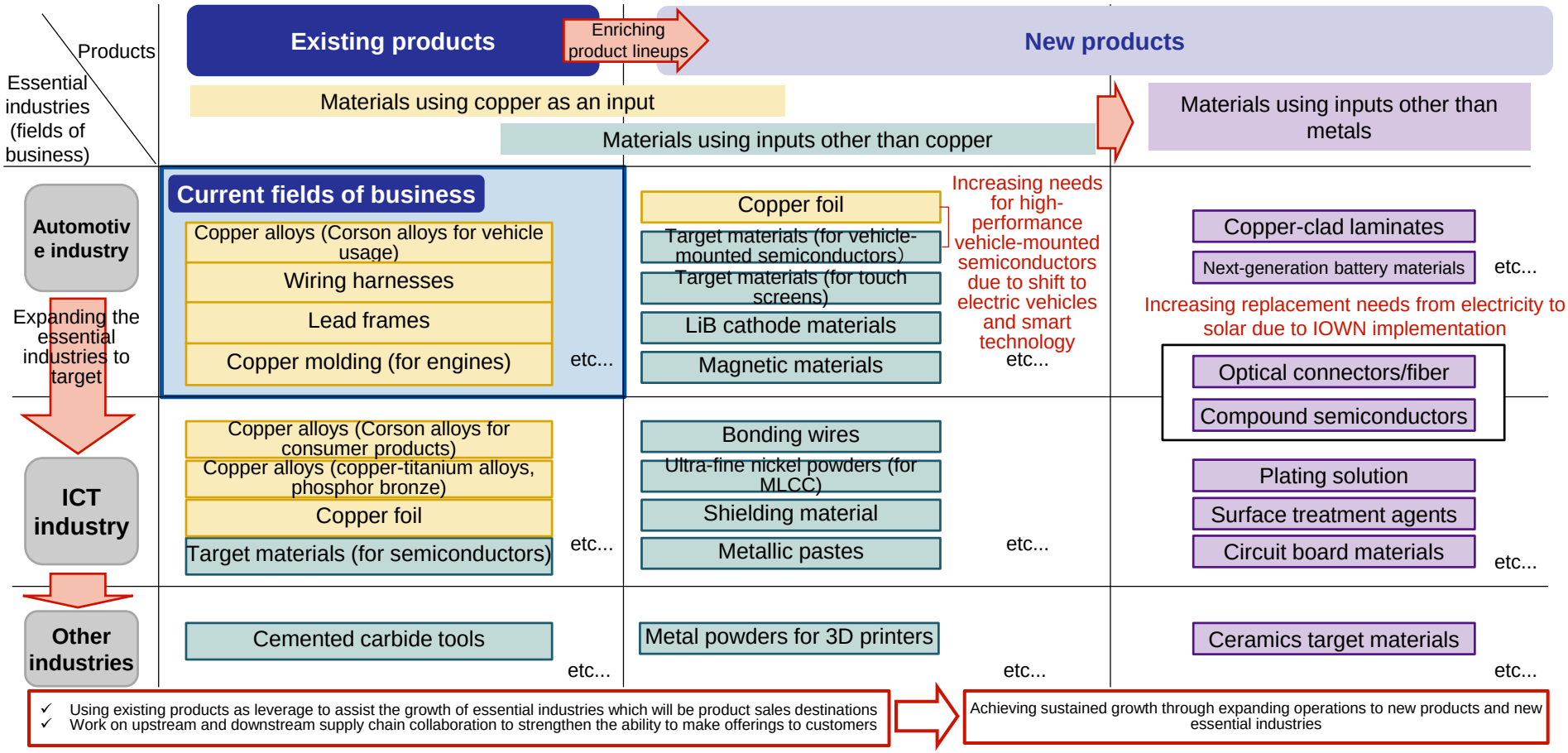



Sources: Compiled by Mizuho Bank Industry Research Department based on UNITAR "*The Global E-waste Monitor 2020*" and Refinitiv WBMS publicly-available information

## (3) Expanding the fields of high-performance materials businesses

- Trend: Towards aiming to further strengthen high-performance materials. Metal processing technology (such as surface treatment) is essential in expanding the scope of applications of metallic materials and producing high-performance metallic materials. It is envisaged that Japanese companies will leverage these and other strengths into expanding their businesses into new product fields as well as enriching their product offering to existing customers spanning different types of materials, such as chemicals and composites

**Sample concept initiatives towards expanding the scope of applications of existing metallic materials and broadening the product lineup spanning different types of materials**

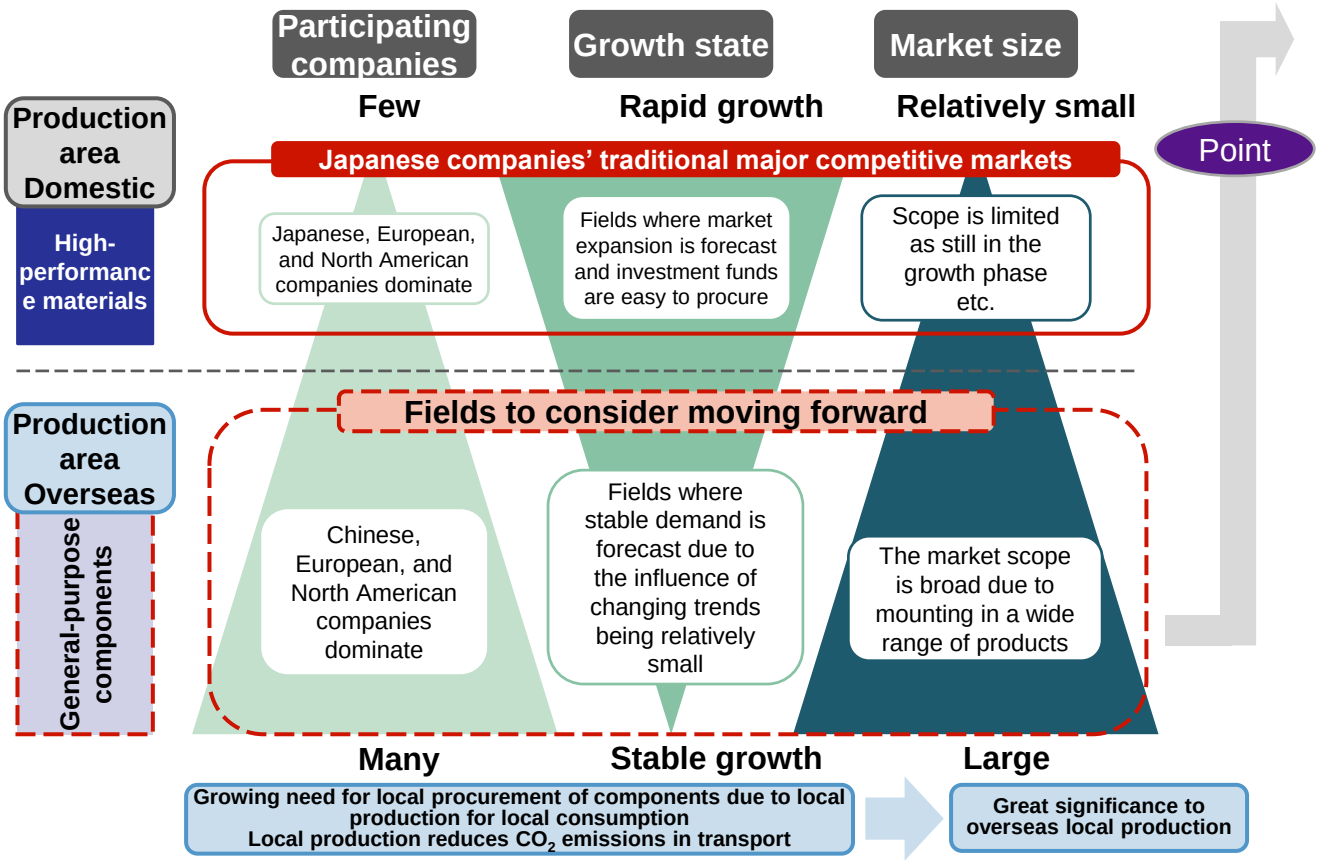



Source: Compiled by Mizuho Bank Industry Research Department

# (4) Strengthening overseas production of general-purpose components

- The market size of the general-purpose components field is enormous compared to high-performance materials. Furthermore, while stable growth is forecast, notably, a large number of companies (such as Chinese companies) are in this field
- Maximizing the capture of the enormous overseas markets with exports alone is problematic, and therefore progressing local production is critical

## Approach to strengthening the general-purpose products business




Source: Compiled by Mizuho Bank Industry Research Department

# Measures will be necessary to increase the probability of growth even after implementing strategies based on competitive advantages

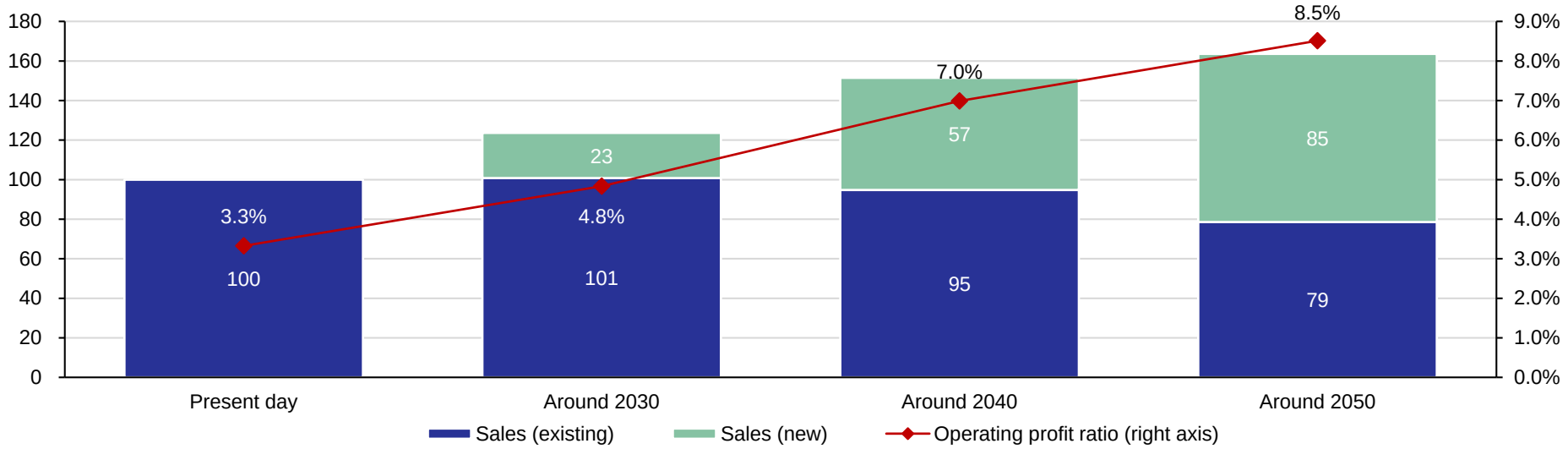
- A variety of issues and hurdles are anticipated when rolling out strategies based on competitive advantages 1. to 4. Increasing the probability of growth through the likes of initiatives so that recycling is suitably appreciated by society, joint ventures between companies, collaboration with customers, and accurately ascertaining the market environment will also be required of copper smelting businesses

## Actions, issues, and hurdles anticipated in the non-ferrous metals industry

| | Upstream businesses | Downstream businesses |
|---|---|---|
| **Domestic** | **(1) Transitioning to comprehensive recycling companies**<br>**Issues and hurdles**<br>✓ Is the value of recycling suitably appreciated by society?<br>✓ Difficulties in obtaining the permits for establishing recycling facilities<br>**Actions:** Clarifying the value of recycling such as through stating its benefits (e.g. amount of $CO_2$ emissions reduction); Active discussion relating to obtaining permits | **(3) Expanding the fields of high-performance materials businesses**<br>**Issues and hurdles**<br>✓ Accurately ascertaining the needs of customers in new essential industries which emerge<br>✓ Newly-developed products may not gain popularity as replacements for existing products<br>✓ Appearance of strong competitors overseas<br>**Actions:** Promoting research and development in partnership with customers (clarifying customer needs and promoting engagement to achieve better results); Considering dynamic revisions to strategies in competitive advantages from 3. to 4. |
| **Overseas** | **(2) Promoting secondary smelting and recycling businesses in overseas operations**<br>**Issues and hurdles**<br>✓ High investment costs incurred<br>✓ Increasing difficulty in building factories overseas<br>— There are cases where buy-in from residents neighboring planned factory sites could not be obtained, making new copper smelter construction more difficult (for example, delays in work on the Mitsubishi Materials and Exurban of the U.K.'s secondary smelter in the U.S.)<br>**Actions:** Mitigating investment costs and business risks through steps such as joint ventures with local companies | **(4) Strengthening overseas production of general-purpose components**<br>**Issues and hurdles**<br>✓ Specifying countries and regions to focus expansion planning in<br>✓ Risk of being dragged into price competition as it is a field with many market participants and fierce competition<br>**Actions:** Accurately ascertaining the market environment through existing overseas bases; Promoting quality differentiation with products manufactured overseas to strengthen position in price negotiations |

Source: Compiled by Mizuho Bank Industry Research Department

# Both sales and operating profit ratio are anticipated to follow an upward path




| | | | | |
|---|---|---|---|---|
| Comments | • Upstream: Utilization of e-scrap is a topic to address now. Focus is on capital investment in pretreatment equipment and M&As with recyclers<br>• Downstream: Begin consideration of newly-emerging high-performance materials fields and also promote M&A | • Upstream: Impact of expanded production of electrolytic copper in Asian countries may begin to become markedly apparent. Envisaged as the time to begin promoting competitive advantages<br>• Downstream: New business growth through M&A etc.<br>• Profit ratio rises thanks to the increasing weight of new businesses projected to be highly profitable (similarly after this) | • Upstream: Anticipated continued focus on collection and processing of e-scrap in Japan, while recycling other than e-scrap such as home appliances as well as overseas businesses also begin contributing to profits<br>• Downstream: Expanded fields of business through promotion of additional M&As leads improved business results | • Upstream: Business collecting metals from a wide range of recycled feedstock not limited to e-scrap anticipated to be reaching full-scale operation<br>• Downstream: Consider ongoing M&A implementation |
| Technological preconditions | • Upstream: Having e-scrap pretreatment equipment (within scope of existing technology levels)<br>• Downstream: Rolling out businesses based on existing technology<br>• Upstream/downstream: Promoting research aimed at effective utilization of CPS | • Upstream: Accumulating copper secondary smelting technology<br>• Downstream: Accumulating technology related to new fields<br>• Upstream/downstream: Accumulating know-how for utilization of CPS | • Upstream: Technology innovations contributing to increased e-scrap processing volume at existing smelters makes progress (including initiatives using CPS)<br>• Downstream: New product development utilizing CPS reaches full-scale operation | • Upstream: Exploring new recycling technology toward further expansion of the scope of recycling<br>• Downstream: Exploring further expansion of business fields |

Note: Data from around 2030 onwards are predictions by the Mizuho Bank Industry Research Department
Source: Compiled by Mizuho Bank Industry Research Department based on publicly-available information

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