

# FY2014 Progress of Business Strategy

May 2015

 **SUMITOMO METAL MINING CO., LTD.**

# Contents

**I**

**2012 3-Year Business Plan Strategy:  
Progress & Management Issues**

**II**

**Trends in Business Performance**

**III**

**Promotion of the 12 3-Yr Plan Strategy**

**IV**

**External Environment**

**V**

**Financial Highlights  
and Information Materials**

# I. 2012 3-Year Business Plan Strategy: Progress & Management Issues



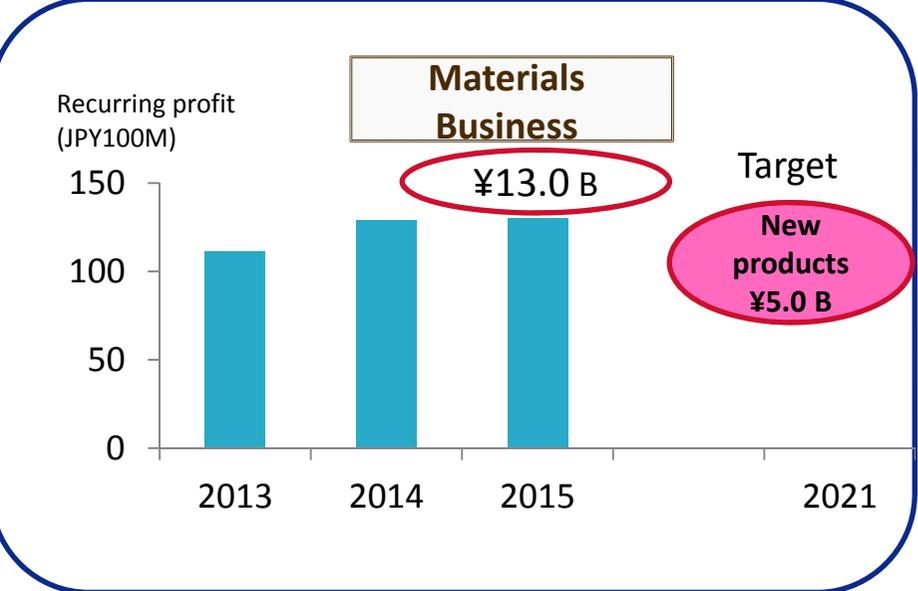
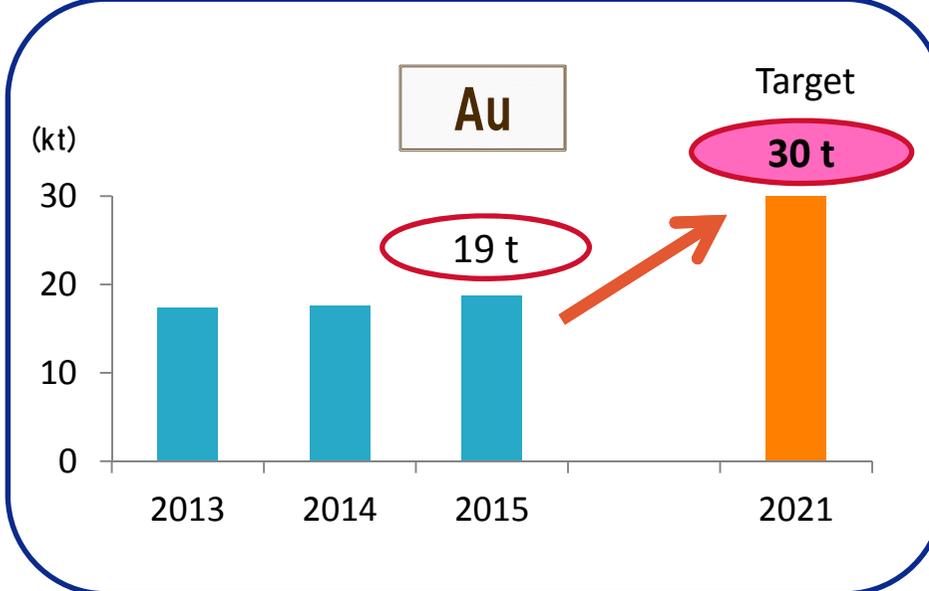
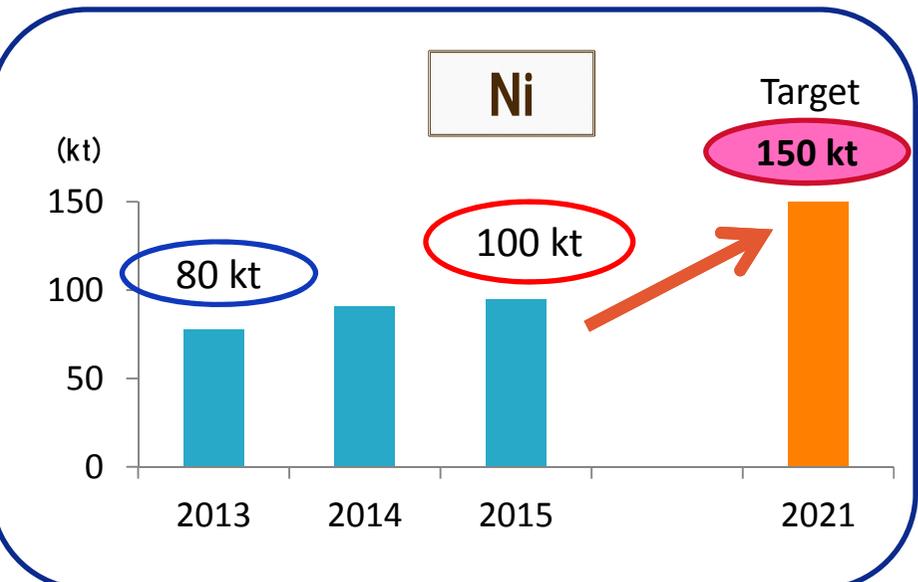
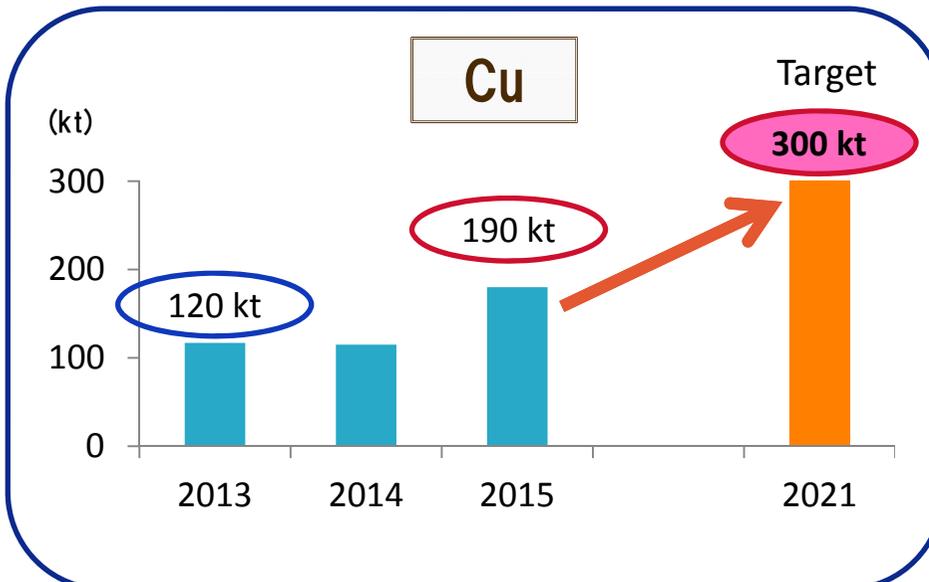
Sierra Gorda

# 1) Management Issues ① Progress of Projects

## FY 2014 Progress of major projects

		Project name	FY 2014 target	FY 2014 progress	Future outlook
Mineral Resources	Cu	Sierra Gorda	Smooth launch of project	○ Mine opening ceremony	○ 2015 110 kt production structure operation ○ Start construction of 220 kt production structure
	Cu	Expansion of Morenci Mine	Transition to full production structure	○ Start of ramp-up	○ Start of full operation
	Cu	Expansion of Cerro Verde Mine	Promotion of project		○ 2016 Full production structure
Smelting & Refining	Ni	Taganito Project	Transition to full production structure	○ Start of full operation	○ Toward 36 kt production structure
	Nickel sulfate	Harima Smelter Nickel sulfate	Smooth launch of first line	○ Start of first line production ○ Decision on second line investment	○ 2016 Second line launch
Materials	Battery materials (Increased production of lithium nickel oxide)	Establishment of 850 t increased production structure		○ Completion of 850 t production structure ○ Decision on production increase 850 t ⇒ 1,850 t	○ 2015 1,850 t production structure

## 2) Management issues ② Progress towards achievement of long-term vision



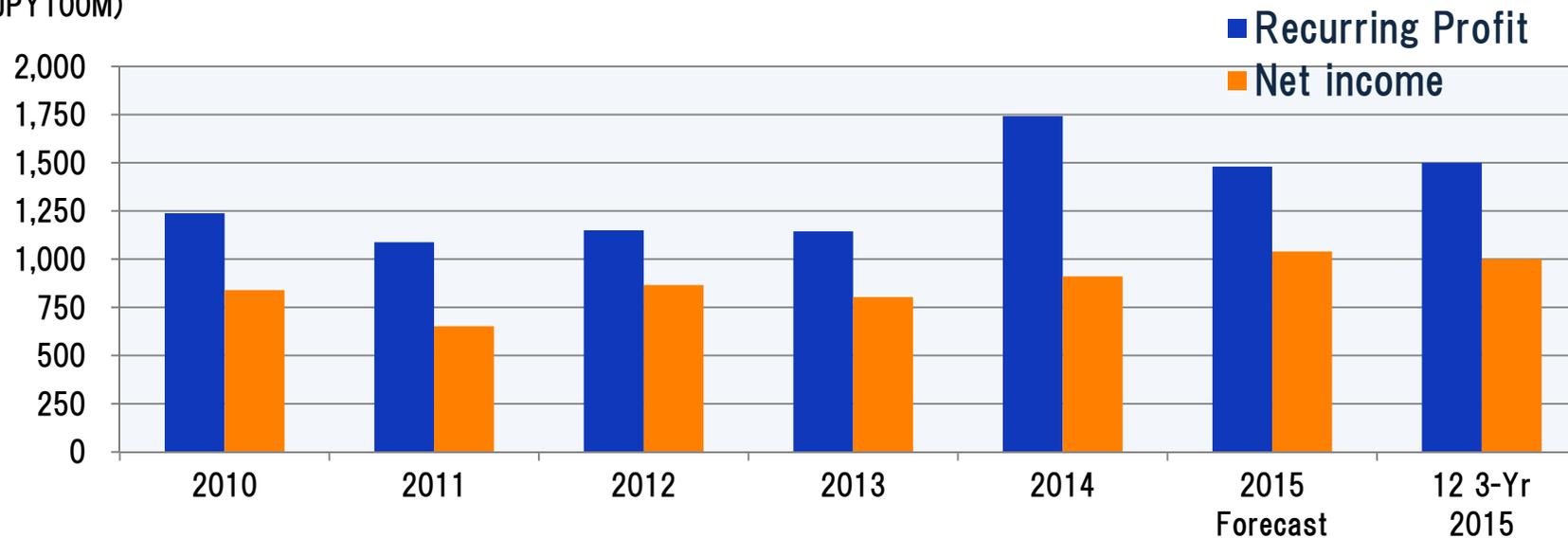
## II . Trends in Business Performance



Sierra Gorda

# 1) Profit Trends

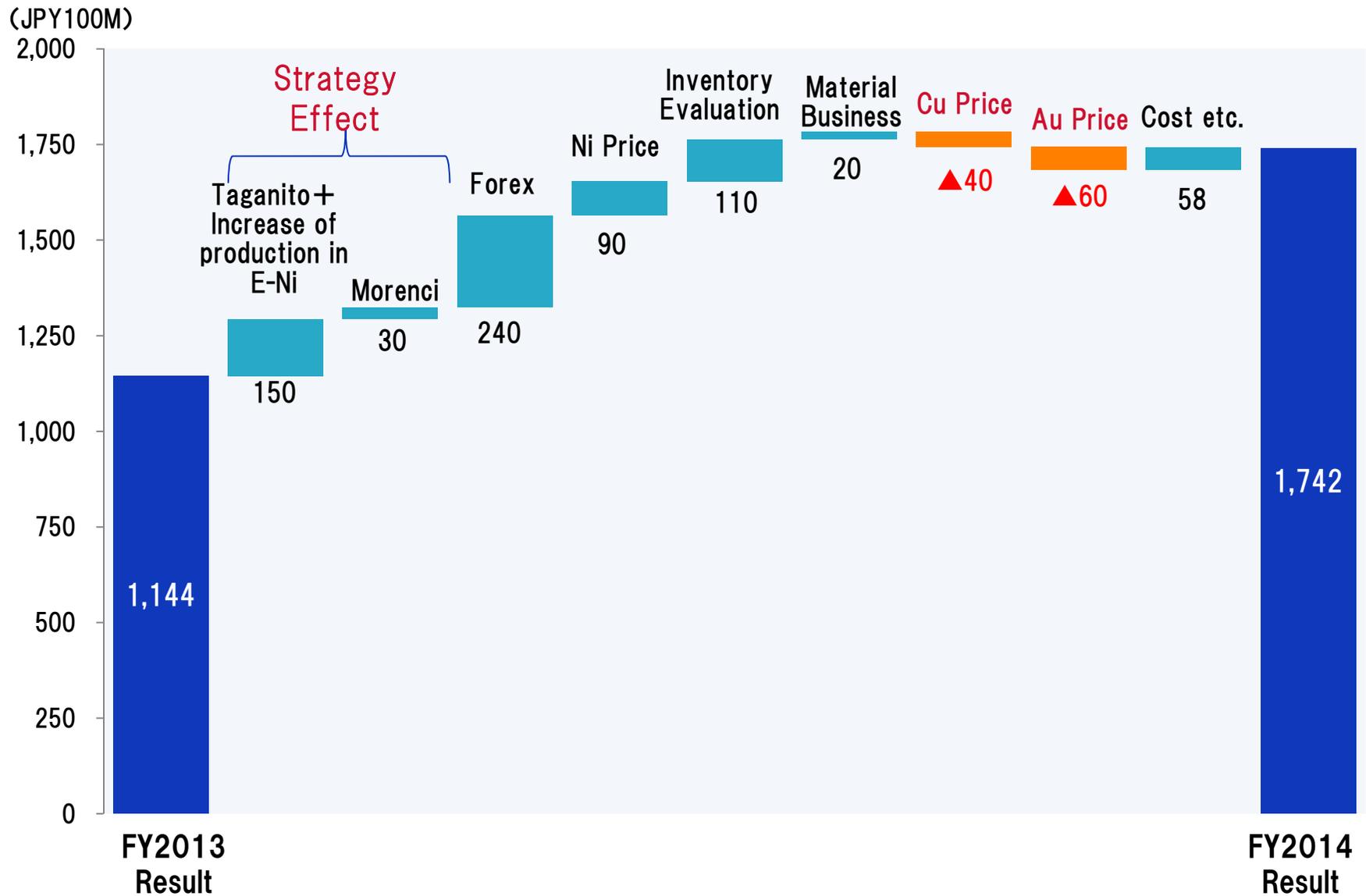
(JPY100M)



	2010	2011	2012	2013	2014	2015 Forecast	12 3-Yr 2015
Recurring profit (JPY100M)	1,238	1,088	1,150	1,144	1,742	1,480	1,500
Net income (JPY100M)	841	653	866	803	911	1,040	1,000
Cu Price (\$/T)	8,140	8,485	7,855	7,104	6,554	6,000	7,500
Ni Price (\$/lb)	10.7	9.6	7.7	6.5	7.6	6.5	9.0
Au Price (\$/Toz)	1,294	1,646	1,654	1,327	1,248	1,150	1,550
Forex (¥/\$)	85.7	79.1	83.1	100.2	109.9	120.0	80.0

## 2) Recurring Profit Analysis

### ① FY2013 Result vs FY2014 Result

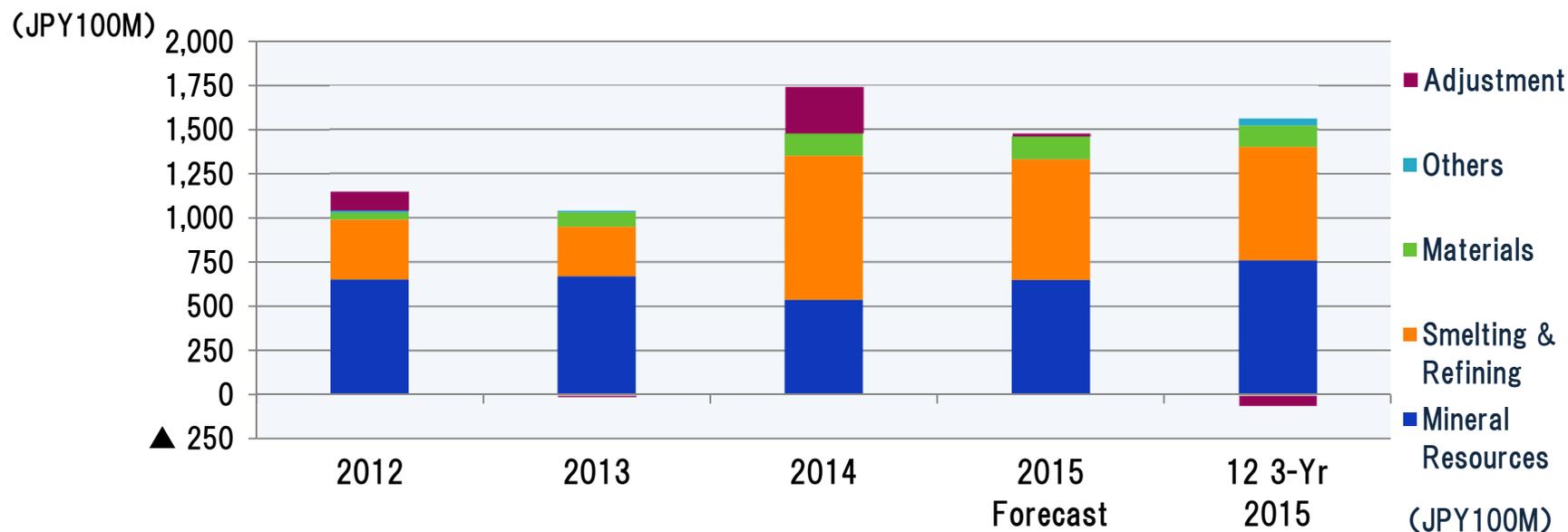


# 2) Recurring Profit Analysis

## ② FY2015 Forecast vs FY2014 Result



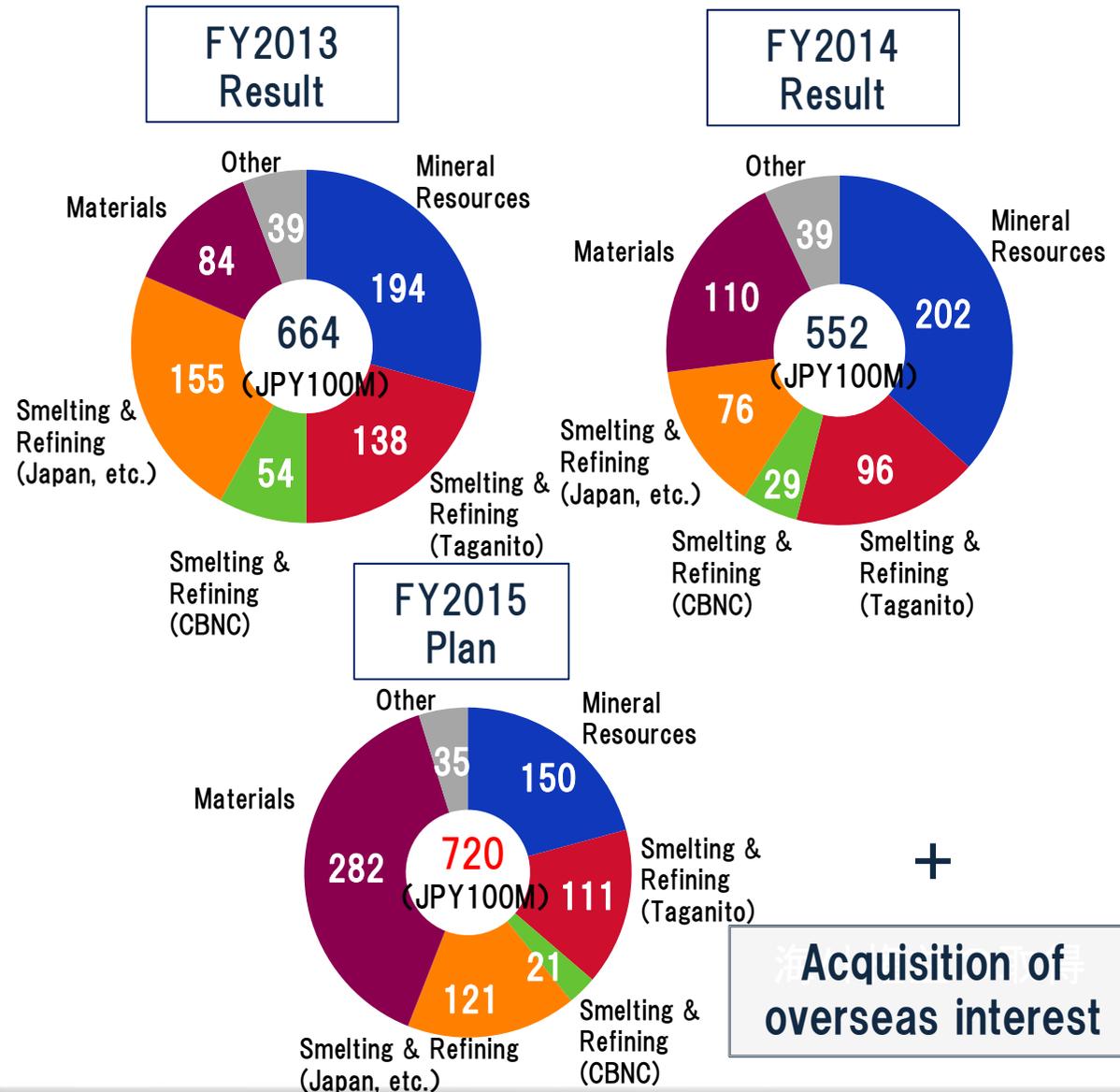
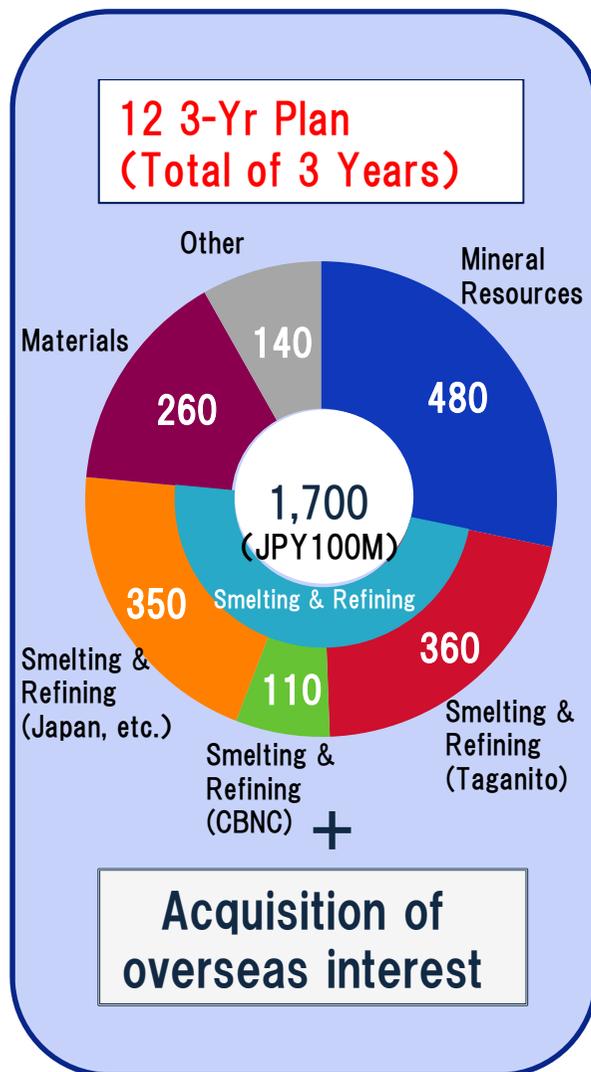
### 3) Profit Trends by Segment



		2012	2013	2014	2015 Forecast	12 3-Yr 2015
Segment profit	Mineral Resources	652	691	538	650	760
	Smelting & Refining	339	291	813	680	640
	Materials	38	111	129	130	120
	Others	16	16	▲1	0	40
Adjustment		105	35	263	20	▲60
Recurring Profit		1,150	1,144	1,742	1,480	1,500

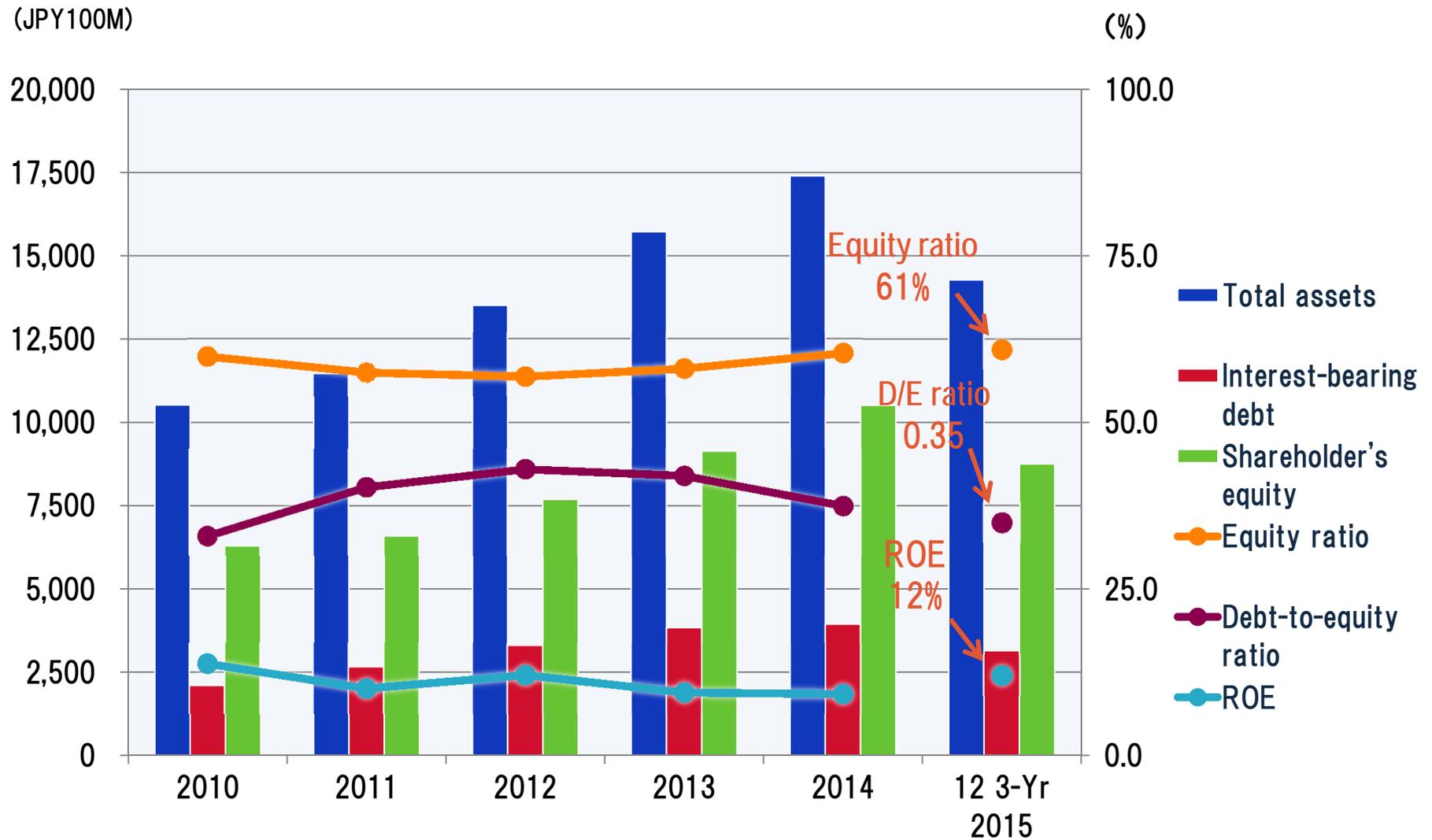
(JPY100M)

# 4) Capital Expenditure

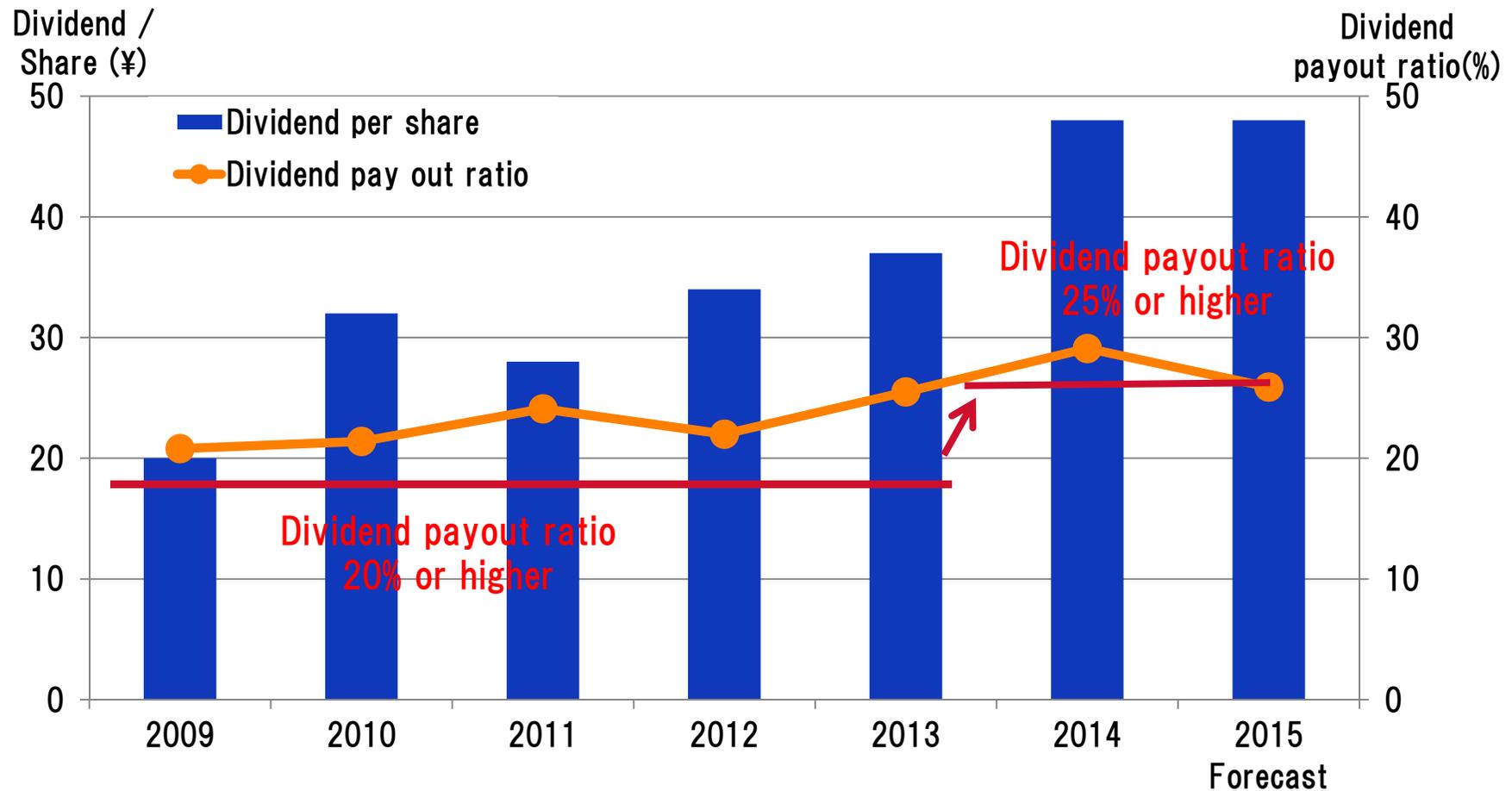


# 5) Financial Strategies

## Maintenance of a Sound Financial Structure



## 6) Trend of Dividend



- FY2014 Dividend : ¥48 (+¥11 from Previous Year)
- FY2015 Dividend Forecast : ¥48
- Continue performance linked dividend
- Dividend payout ratio raised from 20% or higher  
⇒ 25% or higher from FY2013

### Ⅲ. Promotion of the 12 3-Yr Business Plan



Sierra Gorda

# 1) Mineral Resources

## ① Participation in Mine Development Project Sierra Gorda Project - Cu



### Sierra Gorda Project (Chile)

Equity Interest Ratio	KGHM	55%	Total Investment for Phase 1	\$ 4.2B
	SMM	31.5%		
	Sumitomo Corp.	13.5%		

#### Schedule

- 2011 - Decided to participate in the project
- October 1, 2014 - Conducted opening ceremony with President of Chile in attendance
- October 25 - First ship laden with copper concentrates left Port of Antofagasta
- November 29 - First Ship arrive at Toyo Smelter

	2014	→	2015 Planned
Production volume of copper	11kt/year		123kt/year

#### Current Progress

- Extraction and copper refining currently being ramped up
- Start of operations at Mo plant
- Move to full operation in mid-2015

Start of work on extension plan (2<sup>nd</sup> phase) in first half of FY2016

# 1) Mineral Resources

## ② Increasing Production at Existing Mines Morenci - Cu



### Morenci Mine (USA) Expansion Project

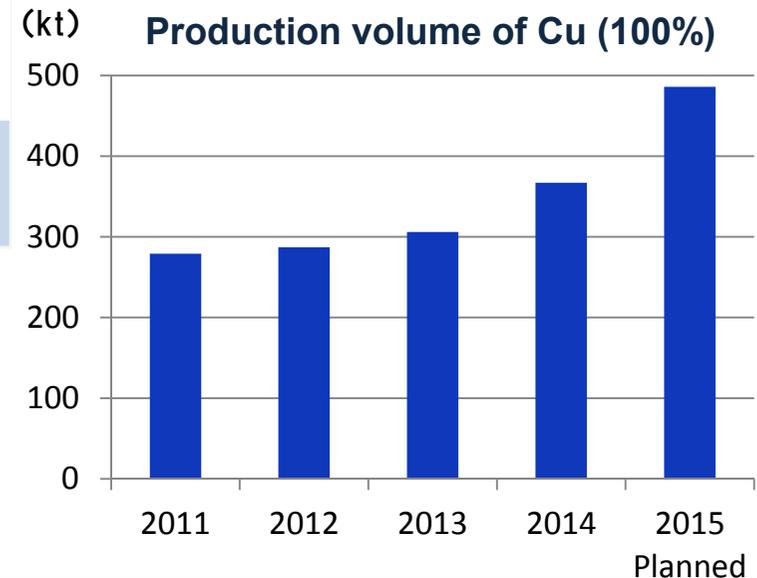
<b>Equity Interest Ratio</b>	<b>FCX</b>	<b>85%</b>	<b>Total investment</b>
	<b>SMM</b>	<b>12%</b>	
	<b>Sumitomo Corp.</b>	<b>3%</b>	
			<b>\$1.9B</b>

### Upgrade Plan

	Current status	After expansion	2015 Planned
Mining output	635kt/day	815kt/day	
Concentration capacity	50kt/day	115kt/day	
Production volume of copper	280kt/year	400kt/year	486kt/year

### Schedule

- January 2013 - Decided on participation in project for increasing production
- May 2014 - Start of new mill plant operation
- **2015 2Q - Move to full operation**



# 1) Mineral Resources

## ② Increasing Production at Existing Mines Cerro Verde - Cu

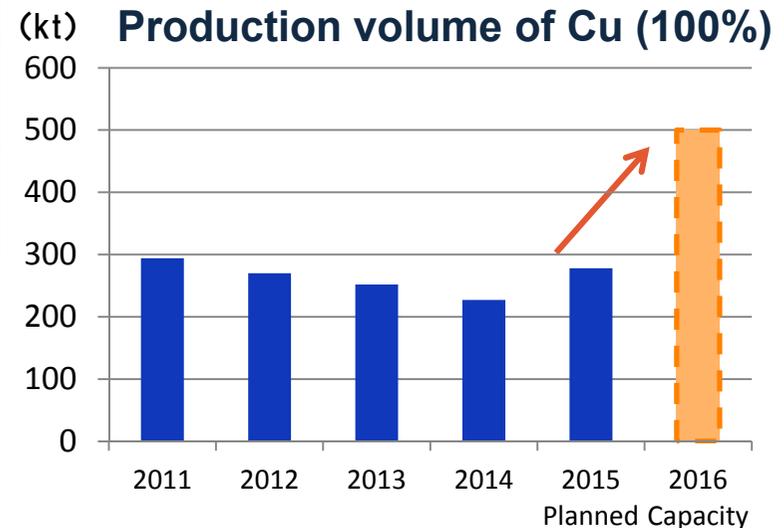


### Cerro Verde Mine (Peru) Expansion Project

<b>Equity Interest Ratio</b>	<b>FCX</b>	<b>53.56%</b>	<b>Total investment</b>  <b>\$4.6B</b>
	<b>SMM</b>	<b>16.80%</b>	
	<b>Sumitomo Corp.</b>	<b>4.20%</b>	
	<b>Other</b>	<b>25.44%</b>	

### Upgrade Plan

	Current status	2016
Mining output	320kt/day	850kt/day
Concentration capacity	120kt/day	360kt/day
Production volume of copper	300kt/year	500kt/year



### Schedule

- 2013 - Completed final planning, began construction
- February 2014 - Decided on participation in project for increasing production

At present - Construction 70% complete

\* mid-2016 - Move to full operation

# 1) Mineral Resources

## ③ Maintenance and Expansion of Existing Au Mine Volume



### Hishikari Mine

#### Production volume and gold content

FY 2014 Performance : 6.9 t

FY 2015 Production plan : 7.5 t

Production will recover in FY2015 due to ore grade at locations planned for mining.

Gold content as of December 31, 2014: 170 t

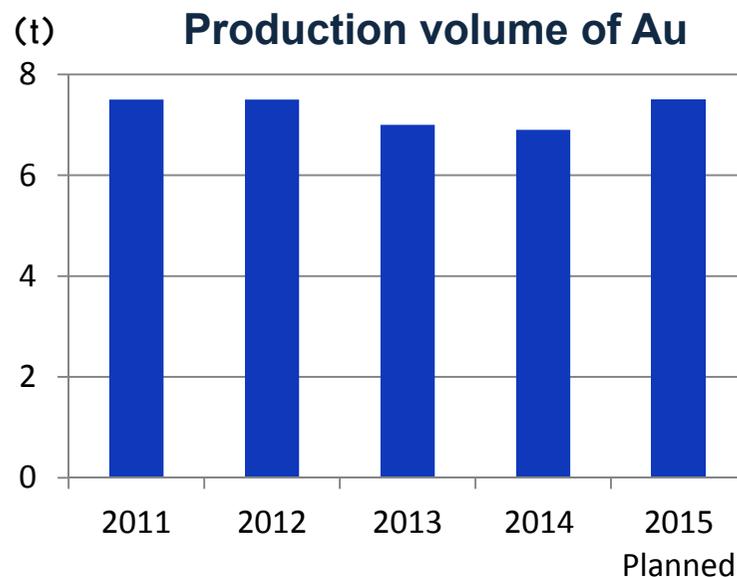
#### Development plan for lower ore body

Confirmed quality mineral vein in the lower part of ore body being mined

- \* Installed hot spring drawdown equipment at 80ML below sea level  
Total investment amount: Approx. ¥3.2 billion
- \* November, 2012 - Start construction
- \* 2018 - Scheduled to start mining

(Note)

Gold content of Hishikari mine: Content of gold in minable ore according to JIS standards: 170 t



# 1) Mineral Resources

## ③ Maintenance and Expansion of Existing Au Mine Volume



### Pogo Gold Mine

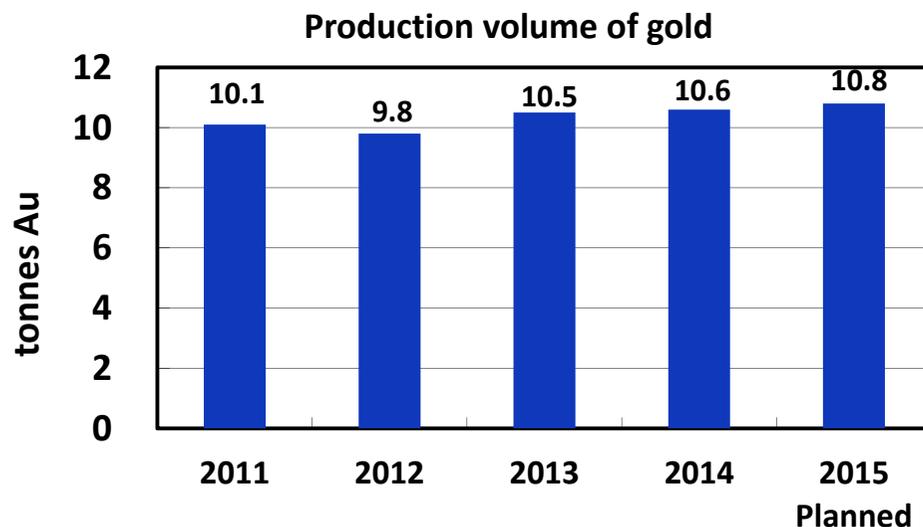
2009 - Acquisition of additional mining interest (51% → 85%)

**2014 Performance : 10.6 t**

**2015 Production plan : 10.8 t**

**Gold content as of December 31, 2014: 140 t**

\* Actively continue exploration of the surrounding area



### East Deep Section Development Plan

2014 1Q – Start mining

**2015 – Main facilities scheduled for completion**

(Note) Gold content of Pogo Gold Mine : Gold contained in reserves plus resources under Canadian standards

# 1) Mineral Resources

## ④ Promotion of Exploration by SMM Stone Boy - Au/ Solomon - Ni

### Stone Boy Project

- Conduct gold exploration in Alaska  
Efforts being made in a wide-area survey to secure new mining blocks

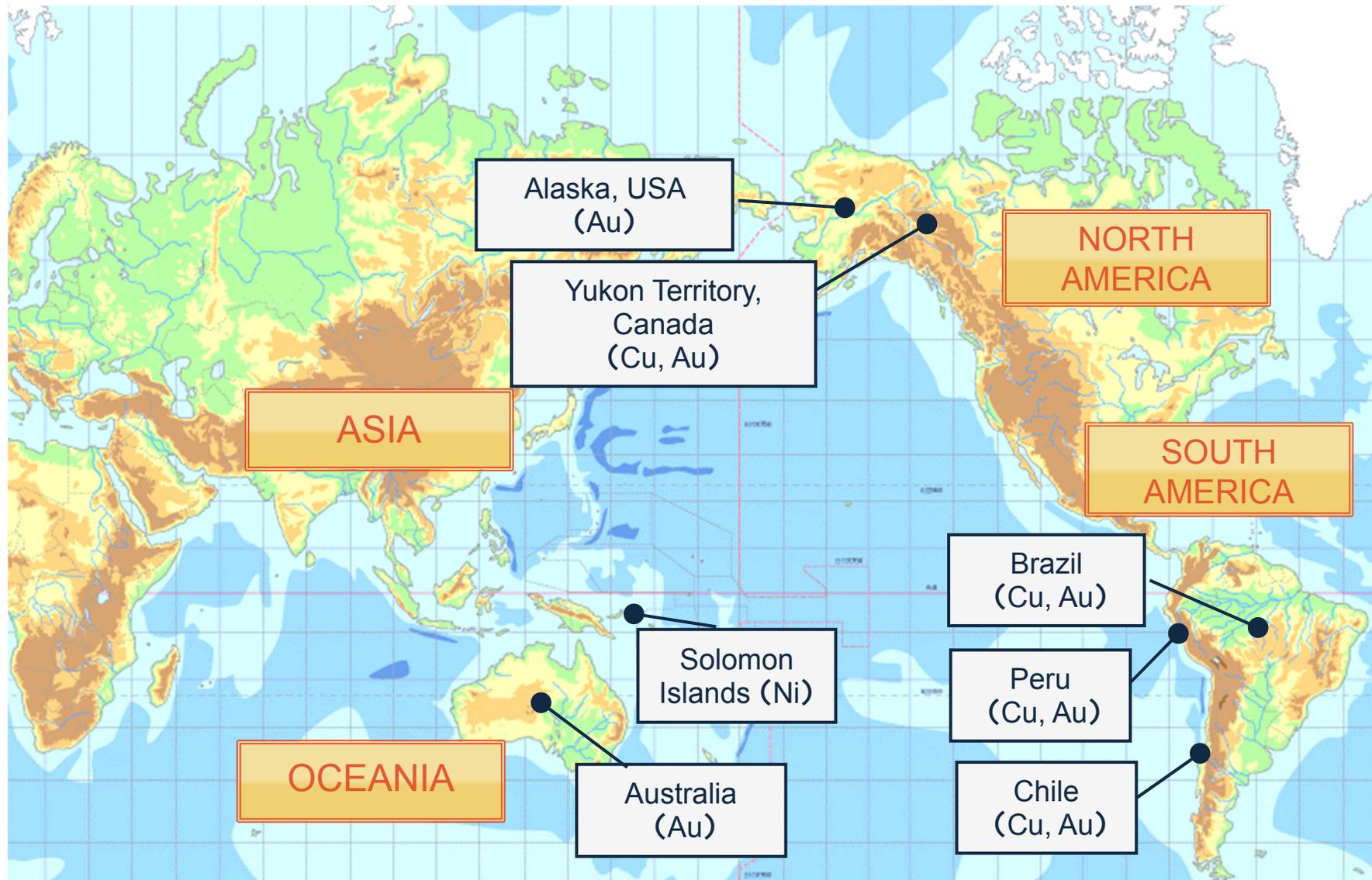
### Solomon Project

- Conduct exploration, environmental research, and Pre/FS in Isabel Area
  - 2010 - Successfully bid for 3 mining blocks in Isabel Area in international bidding
    - 2011 - Government of Solomon unilaterally revoked successful bids and conferred mining blocks to Axiom KB Limited
    - In same year, SMM sued government and Axiom KB Limited
- October 2013 - High court Litigation began  
September 2014 - Claim by our company dismissed by high court  
October 2014 - Appeal to Court of Appeals  
March 2015 – Scheduled to start proceedings at Court of Appeals



# 1) Mineral Resources

## ④ Promotion of Exploration by SMM - Worldwide Exploration



## 2) Smelting & Refining

### ① Establish a 100kt Capacity for Ni - Taganito HPAL

#### Taganito HPAL Nickel (Mindanao, Philippines)

- Investment ratio: SMM 62.5%, NAC 22.5%, MITSUI & CO., LTD. 15%
- Scheduled period for operation: 30 years
- Investment amount: US\$1.6 billion

Move to 36 kt capacity in 2016  
(20% increase)



#### Schedule

June 2013 - Construction work Completion  
Sep - Inauguration Ceremony

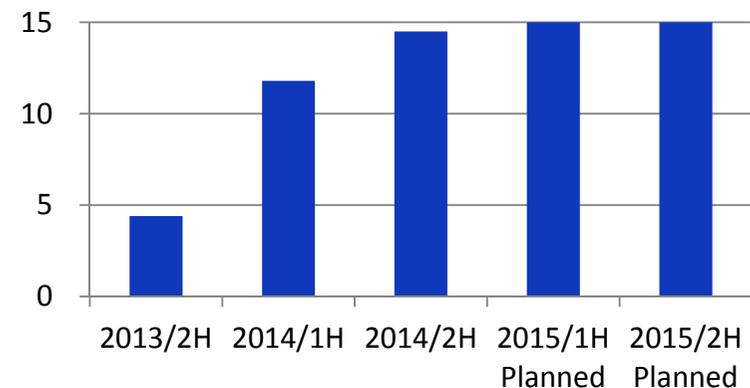
June 2014 - Completion of work reached  
August - Achievement of 3 kt / month production for the month  
2H - 14.5 kt production

2015: 30 kt full production planned

+¥15.0 B project effect for FY 2014

+¥6.0 B project effect for FY 2015

Production plan of MS (Ni-kt)

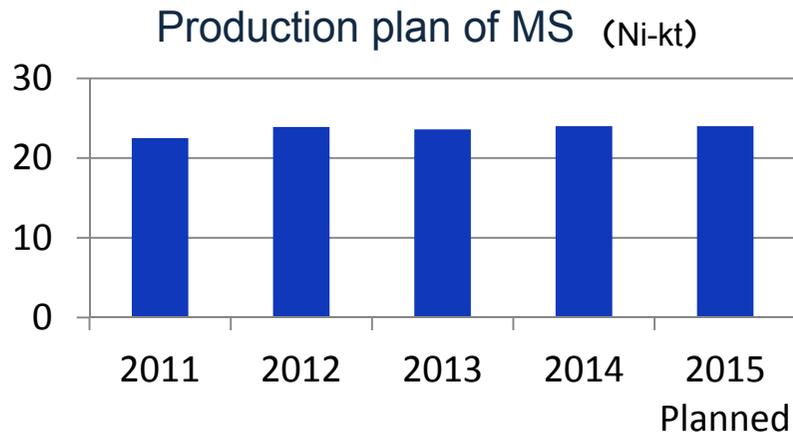


## 2) Smelting & Refining

### ② Establish a 100kt Capacity for Ni - Coral Bay Nickel

#### Coral Bay Nickel (Palawan, Philippines)

Continued 24 kt/year full production



HPAL technology (High Pressure Acid Leach) allows Ni-Co recovery from low-grade Ni oxide ores world-first for SMM on commercial scale  
2005 Phase I: Start of production Current Capa: 24ktpa  
MS Ni intermediate produced at CBNC  
E-Ni produced from MS at Niihama Nickel refinery in Japan



## 2) Smelting & Refining

### ③ Promotion of 65 kt Electrolytic Nickel Production Operation



## Niihama Nickel Refinery

Production  
Capacity

41 kt/year  
→ 65 kt/year

Total  
investment

¥14 B

### Schedule

FY2009 - Completed 41 kt production structure

FY2010 - Decided to invest in 65 kt production operation

End of March 2013 - Refining facility completed

November onward - Receipt of raw materials from Taganito

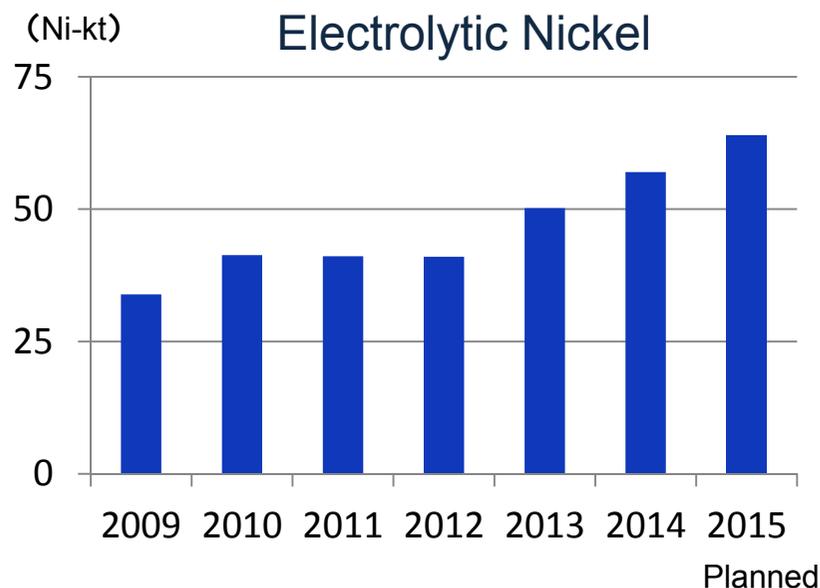
### Production Volume

FY2013 – 50 kt

FY2014 – 57 kt

FY2015 – 64 kt planned, through increased intermediate products processing at Taganito

### Production volume of Electrolytic Nickel



## 2) Smelting & Refining

### ④ Ferro-nickel Production Plan

#### Hyuga Smelting Co., Ltd. Ferro-nickel Production Plan

- 2014, Jan Ban of export of unprocessed ore from Indonesia  
Centered in raw material from New Caledonia, Indonesia, in the past  
→ Shifted to raw materials from New Caledonia/Philippines

Continuous operation at almost full level in 2014  
23 kt production

#### Impacts on business

- Considerable rise in ore spot prices
- Increase in processing volume through reduction in ore grade



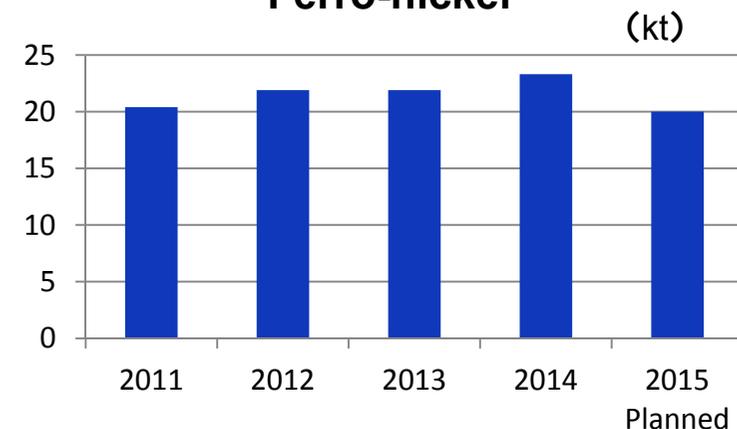
Make efforts to reduce costs and minimize impact on profit

#### FY2015

- Production of 20 kt planned
- Also investigate future optimum operation



Production volume of Ferro-nickel



## 2) Smelting & Refining

### ⑤ Cu – Increasing Production of Nickel Sulfate

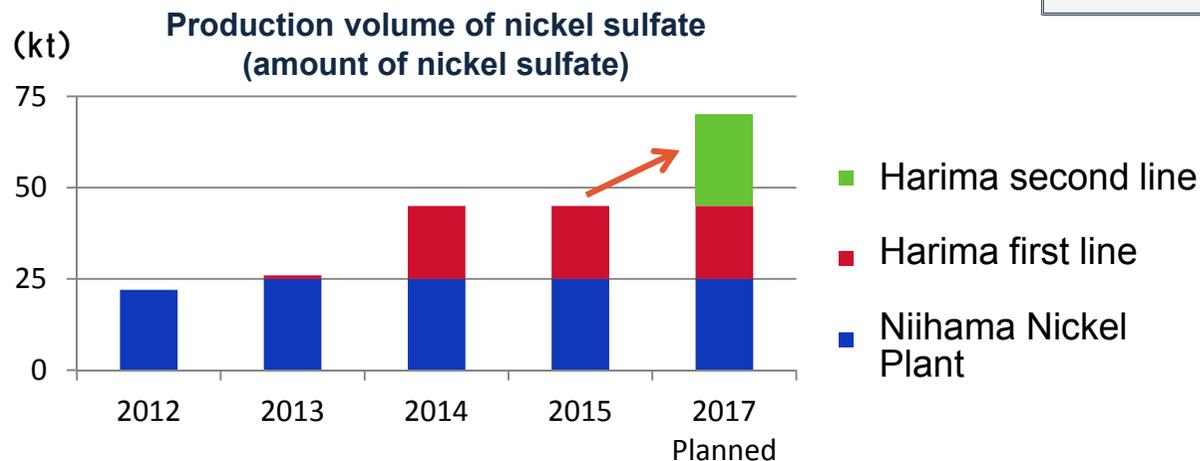
#### Business structure change at Harima Smelter

- 1966 - Start of manufacture of distilled zinc
- 2012 - Halt of manufacture of distilled zinc from zinc concentrate: Shift to recycled zinc raw material on all smelting volume
- January 2014 - Start of nickel sulfate production (First line) production capacity 20 kt / year
- Autumn 2015 (scheduled) - Halt of distilled zinc production
- Autumn 2016 (scheduled) **Completion of nickel sulfate second line**  
Production capacity 25 kt / year



Second line  
total  
investment

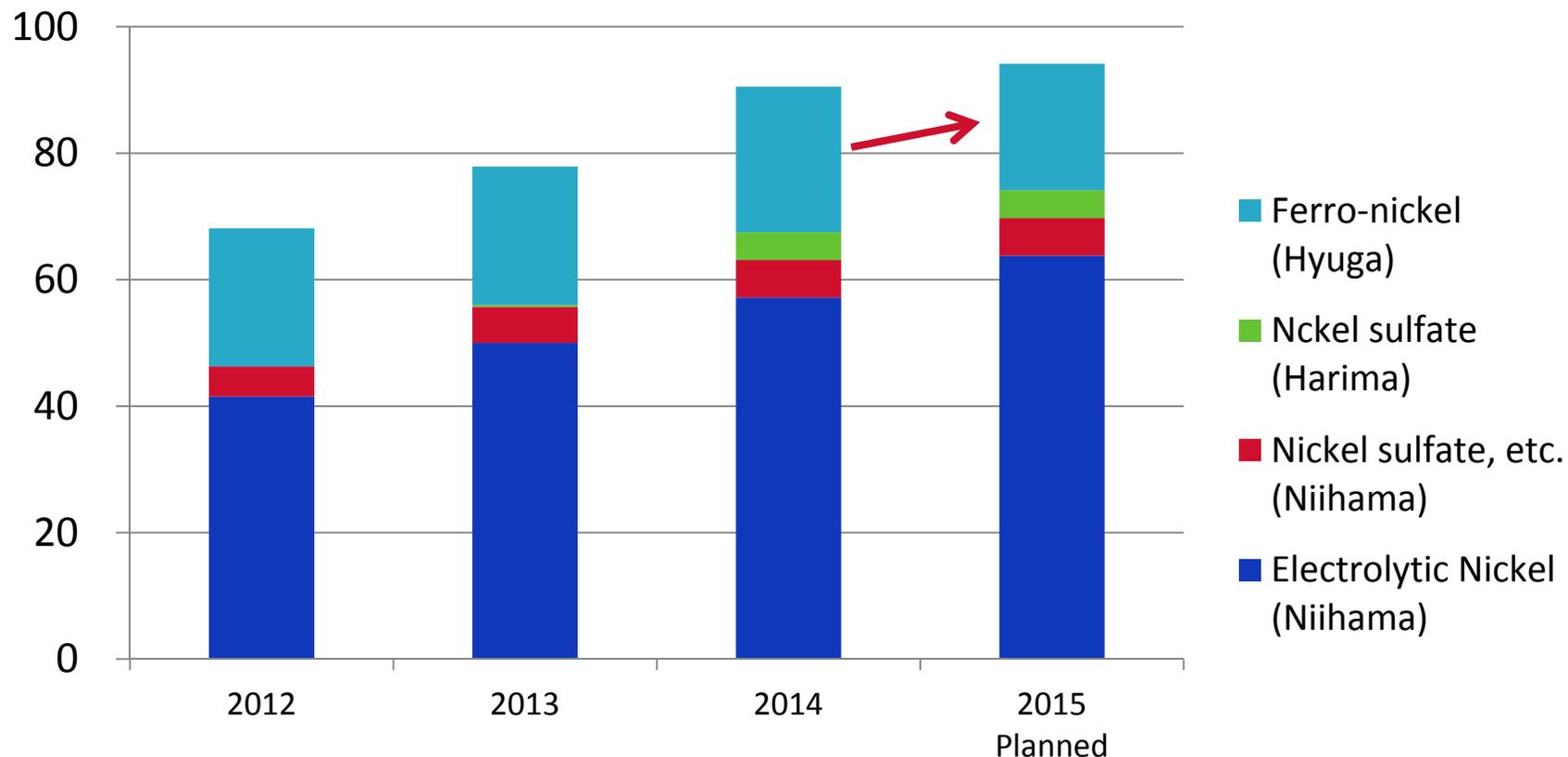
About ¥5.0 B



## 2) Smelting & Refining

### ⑥ Toward a 100 kt Capacity for Nickel

(Ni-kt, nickel sulfate is indicated in terms of pure nickel content)



Toward 100 kt production of nickel

FY2014 - **Production volume: 91 kt**

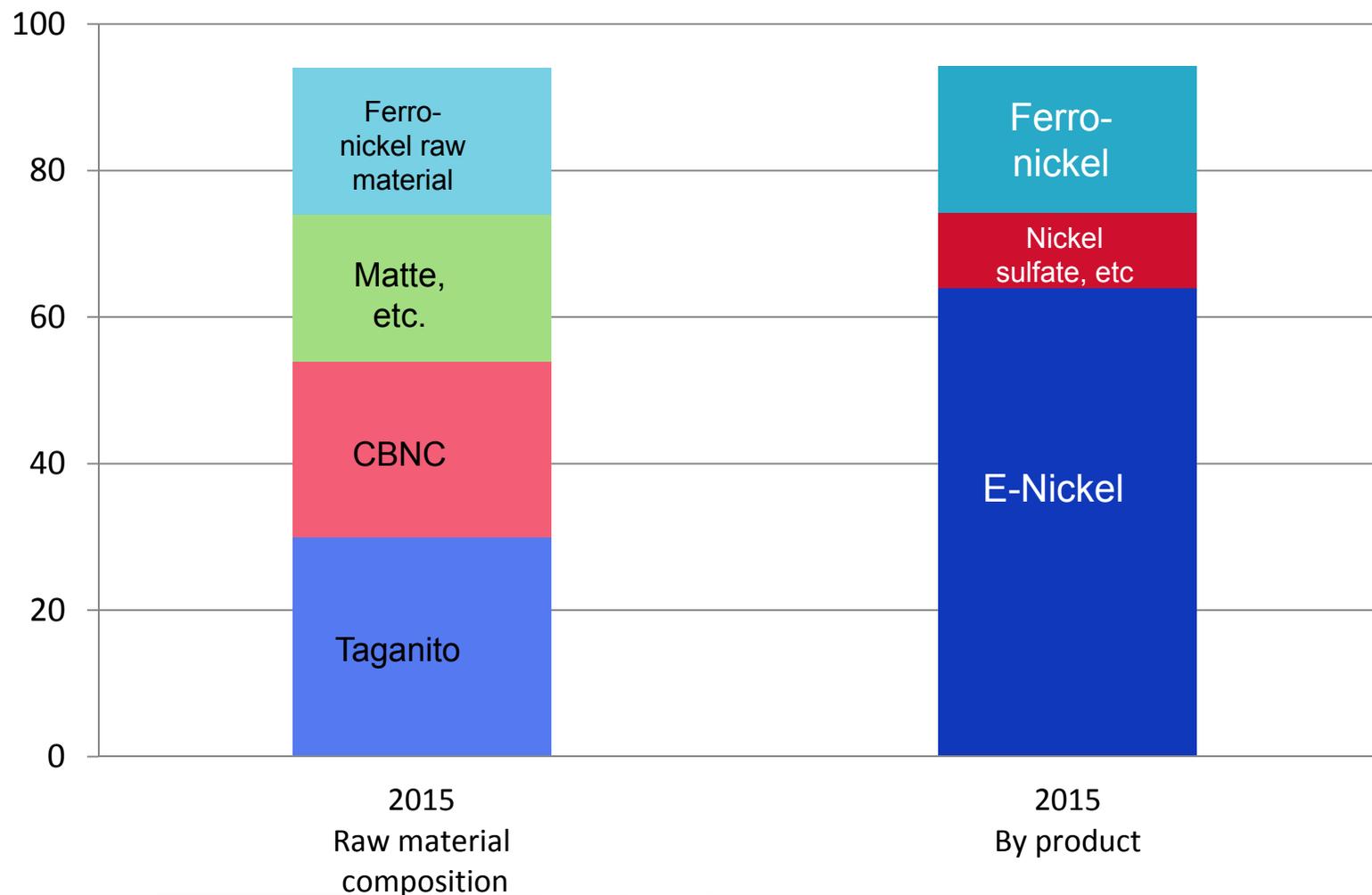
FY2015 - Toward 100 kt production through increase in intermediate products from Taganito

## 2) Smelting & Refining

### ⑥ Toward a 100 kt Capacity for Nickel

#### Composition of nickel products and raw materials

(Ni-kt, nickel sulfate is indicated in terms of pure nickel content)



## 2) Smelting & Refining

### ⑦ Expanded Recycling of Valuable Metals

#### Scandium (Sc)

**Recover small quantities of scandium contained in HPAL raw ore at CBNC**

- 2014 - Build pilot plant  
Start trial production (10 kg/month)
- 2017 (scheduled) - Start of commercial production

**Current scandium production and usage status**

- Global production of approx. 10 t/year
- Supplied by the United States, Ukraine, Russia, China, etc.
- Modest volume of production and high price result in limited demand

Additive to aluminum (increases strength)  
Additive to solid electrolyte for fuel cells



Provide stable supply in order to increase new demand

#### Chrome (Cr)

**Recover chrome contained in HPAL raw ore as chromite at Taganito**

- September 2013 - Build pilot plant at CBNC  
Start test operation
- Based on pilot test results, build chrome recovery plant at Taganito

**Current chrome production and usage status**

- Main suppliers: South Africa, Kazakhstan, and India
- Additive for special steels such as stainless steel

#### Hematite

**Recover hematite contained in HPAL residue at Taganito as steel-making materials**

- 2013 3Q - Build pilot plant at THPAL  
2014 3Q - Scheduled completion
- Examining for the possibility of practical use

## Pomalaa Pre F/S

### Overview

- P.T. Vale Indonesia owns mining rights
- Pre F/S is underway

### Background

- June 2012 - Began Pre F/S
- January 2013 - Began environmental impact analysis survey (mandated)

### Current Progress

- Pre F/S is completed; will conduct evaluation
- Acquisition of logging permit
- PTVI concluded new COW
- **Start of work on F/S planned for FY2015**



## 2) Smelting & Refining

### ⑨ Cu – Enhance Competitiveness of Toyo Smelter



## Toyo Smelter & Refinery (Ehime, Japan)

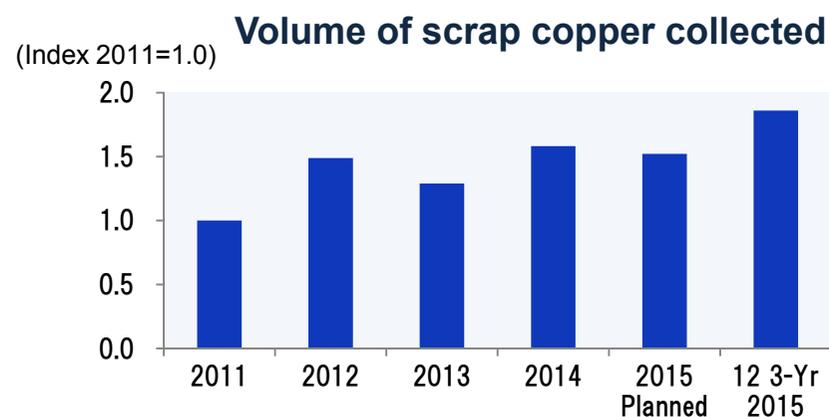
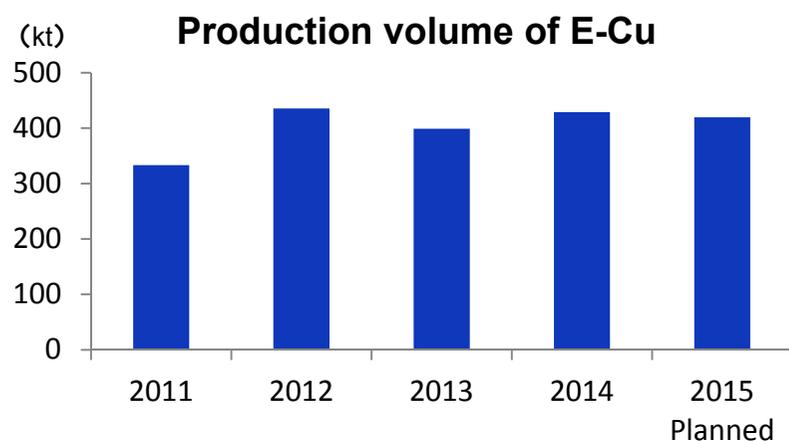
FY2014 Electrolytic copper production volume: 429 kt

FY2015 Production plan: 420 kt

Stable high-load operation at the flash furnace  
Progressively increased volume of recycled raw materials

Large-scale shutdown scheduled for 25 days in October to November

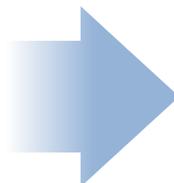
- Promotion of initiatives to achieve further cost reduction inc. energy
- Taking full advantage of TC/RC improvements



### 3) Materials ① Taking on Growth Strategies

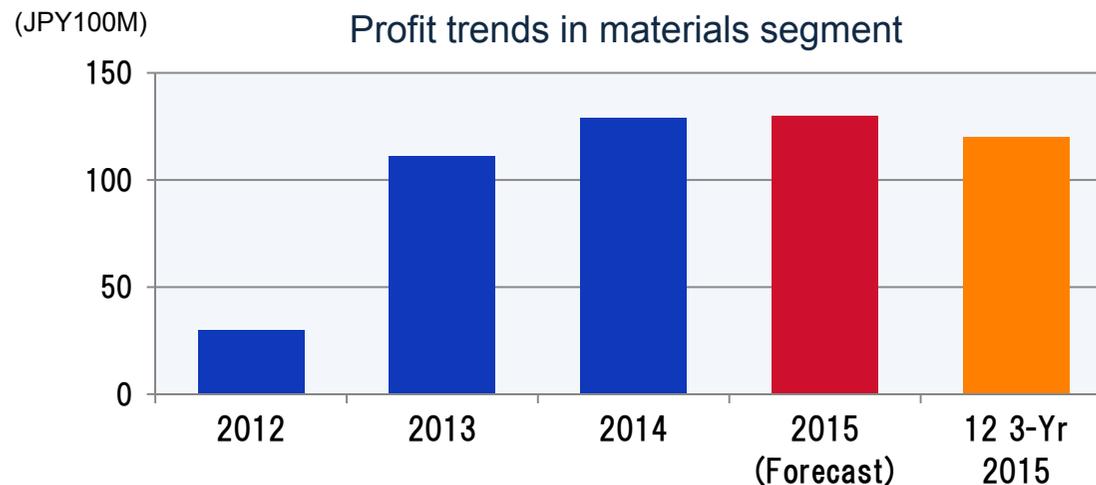
## Promotion of the 12 3-Yr Plan Strategy

Realigning of  
business structure



### Shift to growth strategies

- Increased production of battery cathode materials (NCA 1,850 t/month)
- Increased production of crystal materials (LN/LT) (300 kp/month)
- Acceleration of shift to overseas of thick film materials (Ni-resistor paste) (enhancement of Chinese plant)
- Maximization of integration effect for lead frame operations



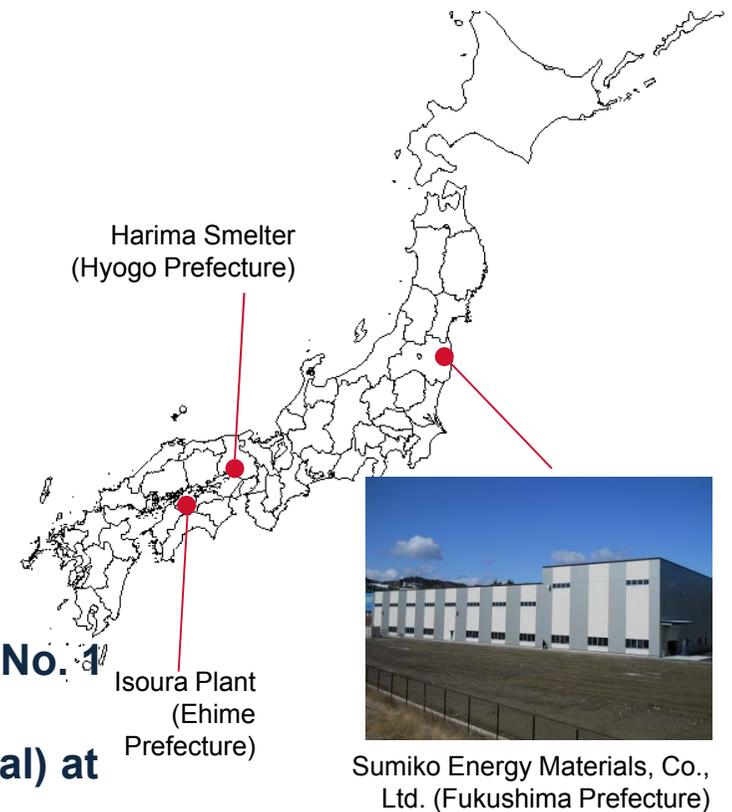
## 3) Materials – ② Expansion of Battery Materials Business

### Increased production of lithium nickel oxide for electric vehicles

- April 2012 - Decision to increase production volume:  
300 t / month ⇒ 850 t / month
- June 2014 - 850 t / month production structure completed
- October 2014 - Decision to increase production volume: 850 t / month ⇒ 1,850 t / month  
Total investment amount: ¥15.0 B  
Completion scheduled for December 2015

#### Increased production structure

- Continued increased production at Isoura Plant
- Established Sumiko Energy Materials, Co., Ltd. in Naraha Town, Fukushima Prefecture  
Migrated a portion of processes
- Outsourced a portion of processes to Fukushima No. 1 Plant, Nihon Kagaku Sangyo Co., Ltd.
- Increased production of nickel sulfate (raw material) at Harima Smelter



## 3) Materials ③ Battery Materials

### Battery Materials (Rechargeable Battery Material)

#### Nickel Hydroxide



- Used as cathode material in automotive nickel metal hydride batteries by PEVE\*
- Final user: TOYOTA Motor Corporation (HEV: hybrid cars)
- SMM has large share in battery materials for HEV

\*PEVE: Primearth EV energy Co., Ltd

#### Lithium Nickel Oxide



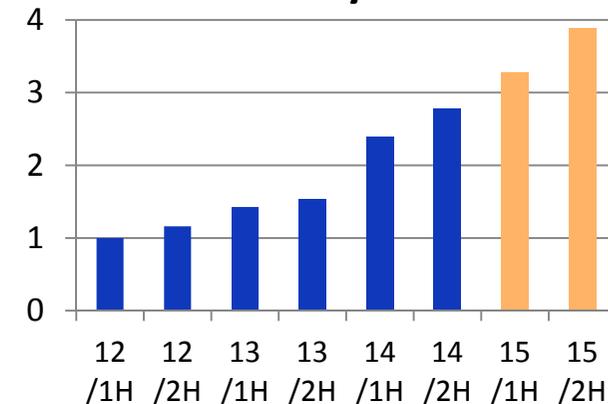
Used in lithium-ion battery cathode material by Panasonic Corporation  
Used in electric vehicles by Tesla Motors Inc. as final user

#### Ternary Material

Being developed for cathode material in automotive lithium-ion batteries

(Net sales 12/1H=1)

#### Battery materials



We aim at the global battery cathode materials producer in the in-vehicle / highly functional consumer market by utilizing the strength of our Ni and Co resources possession and technology of the battery materials development.

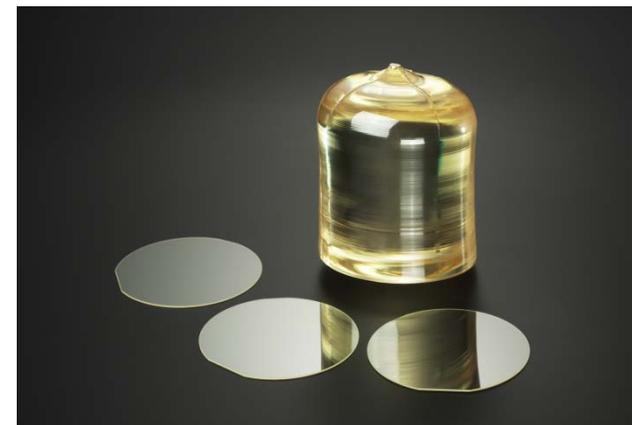
## 3) Materials ④ Thick Film / Crystal Materials

### Materials for smartphones and tablets

Sales of many materials with top-class shares, to favored customers

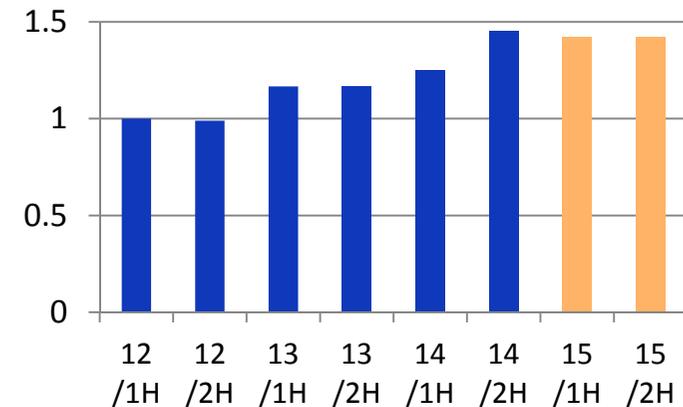
- Nickel paste for MLCC
- Resistor paste for chip resistors
- Crystal wafers for SAW filters

(LN: lithium niobate; LT: lithium tantalate)



(Net sales 12/1H=1)

Thick film materials



## 4) Promotion of Research & Development

### ① Enhancement of Research Institute Functions

#### Technology Development Measures for 12 3-Yr Business Plan

##### Mineral Resources and Smelting & Refining Business

- **November, 2012 - Decided on construction of new Resource & Hydrometallurgy Process Center**  
Develop world's most advanced processes and facility technologies in the area of mineral resources and smelting & refining
- **April 2014 - Completion**



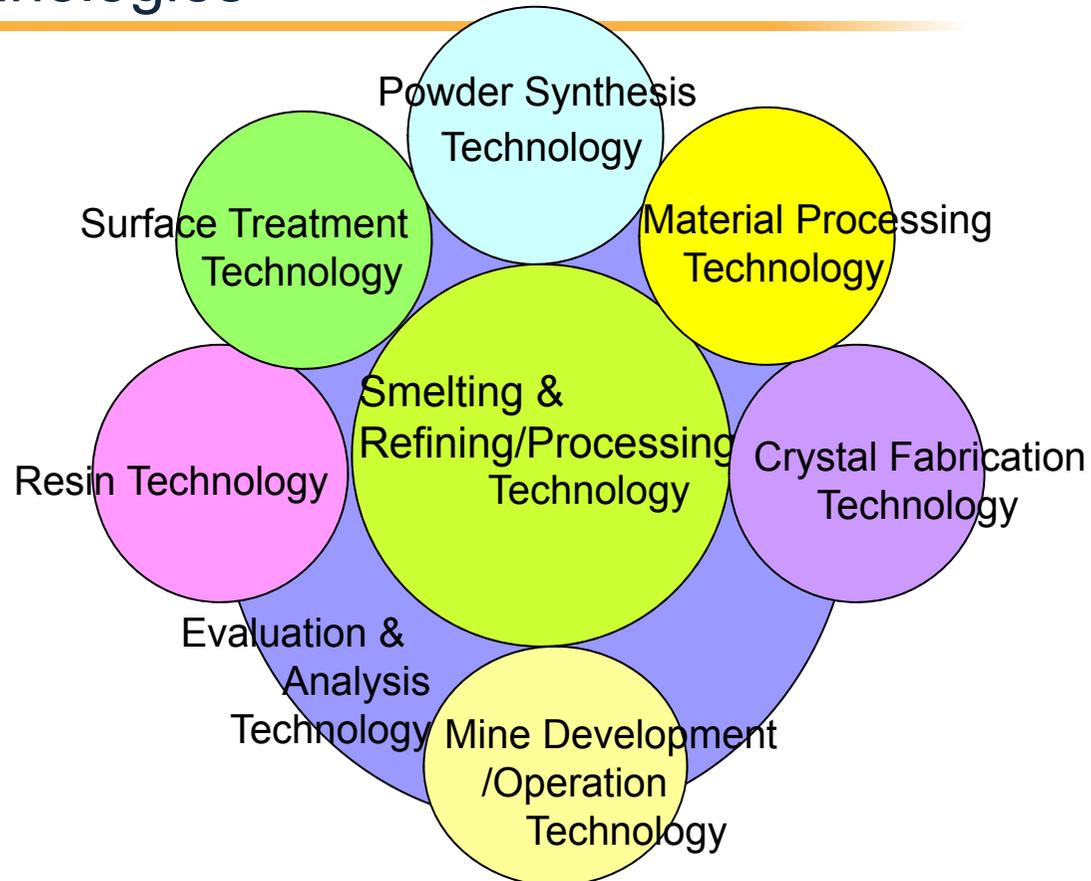
Resource & Hydrometallurgy Process Center

##### Materials Business

- **Battery Research Laboratory (established October 2010)**  
Support start of lithium nickel oxide production increase project  
Develop cathode materials for next-generation batteries
- **Materials Research & Development Center (established October 2012)**  
Development of products in environmental and energy area  
Respond to decreasing size of final products and increasing speed of communications

## 4) R&D Promotion ② SMM core Technologies

### SMM technologies



Base formed by smelting & refining/processing technology, mine development/operation technology, and evaluation & analysis technology

Use of powder synthesis technology, surface treatment technology, resin technology, material processing technology, and crystal fabrication technology



Roll out to products and customers

## 5) Progress in Cost-Cutting

### Cost-Reduction Measures in 2012 3-Yr Business Plan

#### Reduce costs by ¥10 billion/year

**Period of activity: October 2012 - fully achieve in FY2015**  
**Target amount: Reduction of ¥10 billion/year**  
**Base: FY2012**

- Improve productivity
- Switch to low-cost materials
- Carefully select fixed costs

#### Progress in FY2014

Result : ¥9.9 billion

Continuing cost reduction initiatives in all departments

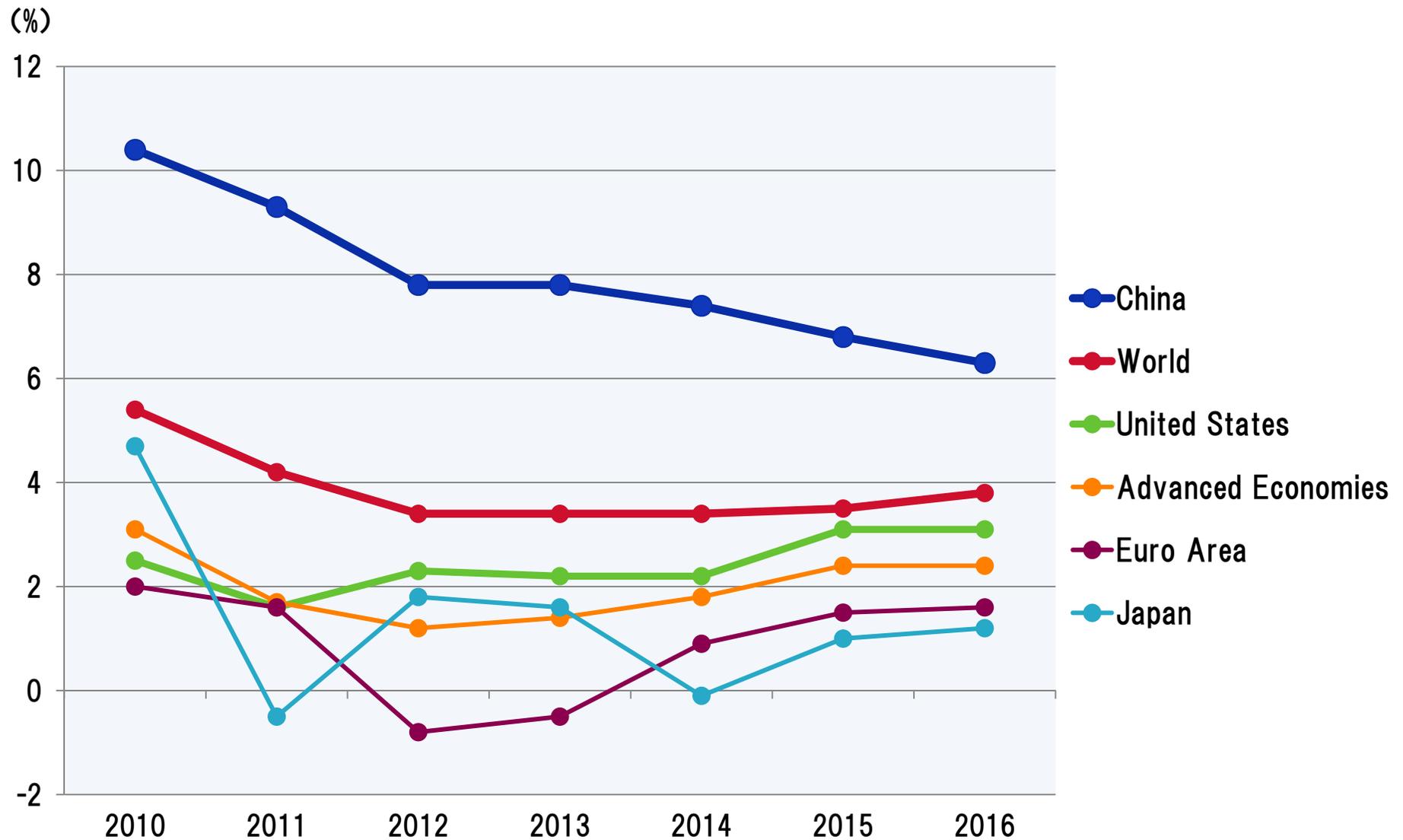
**FY2015 plan: ¥13 billion**

## IV. External Environment



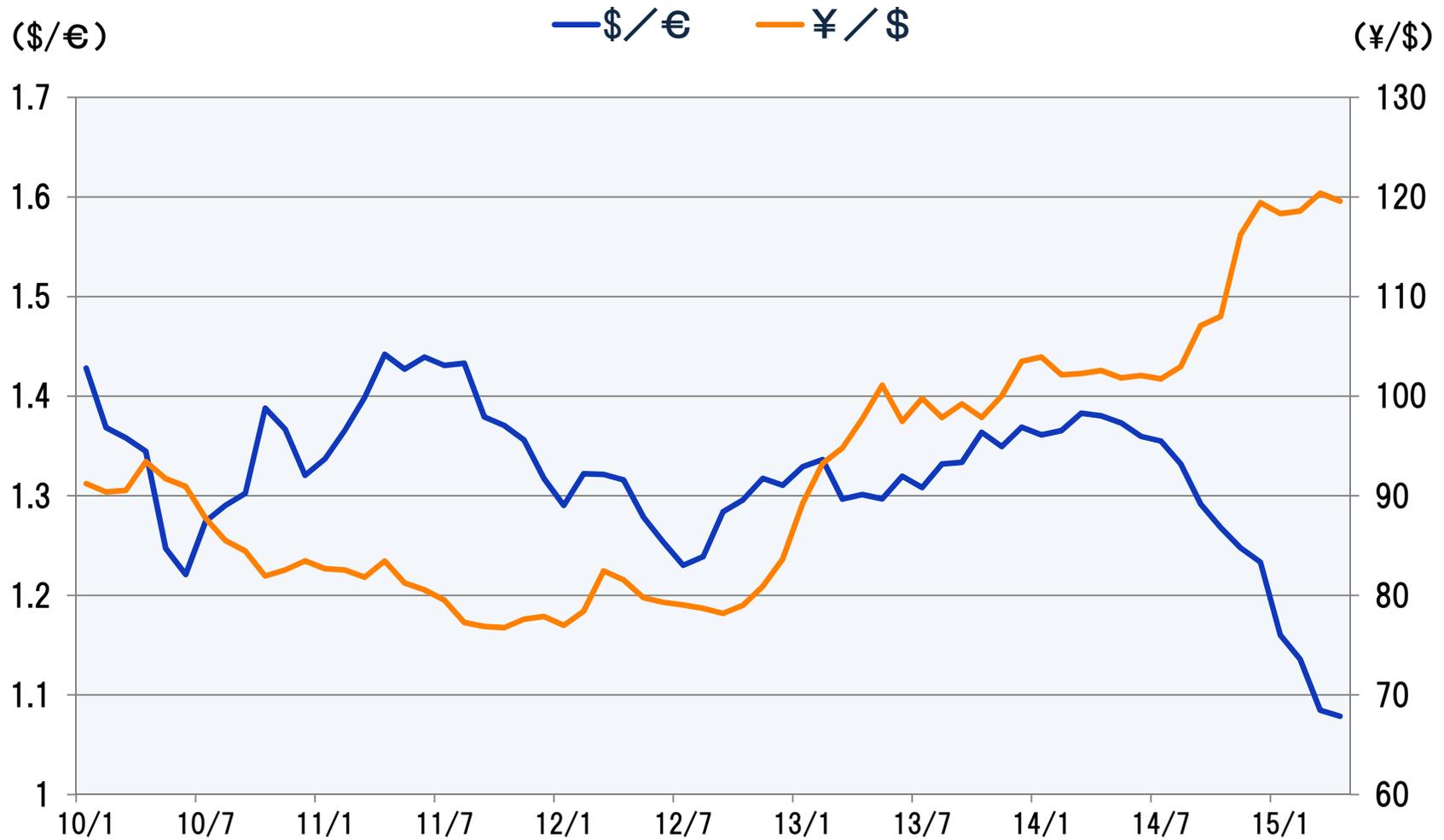
Sierra Gorda

# 1) General Conditions – Global GDP Growth

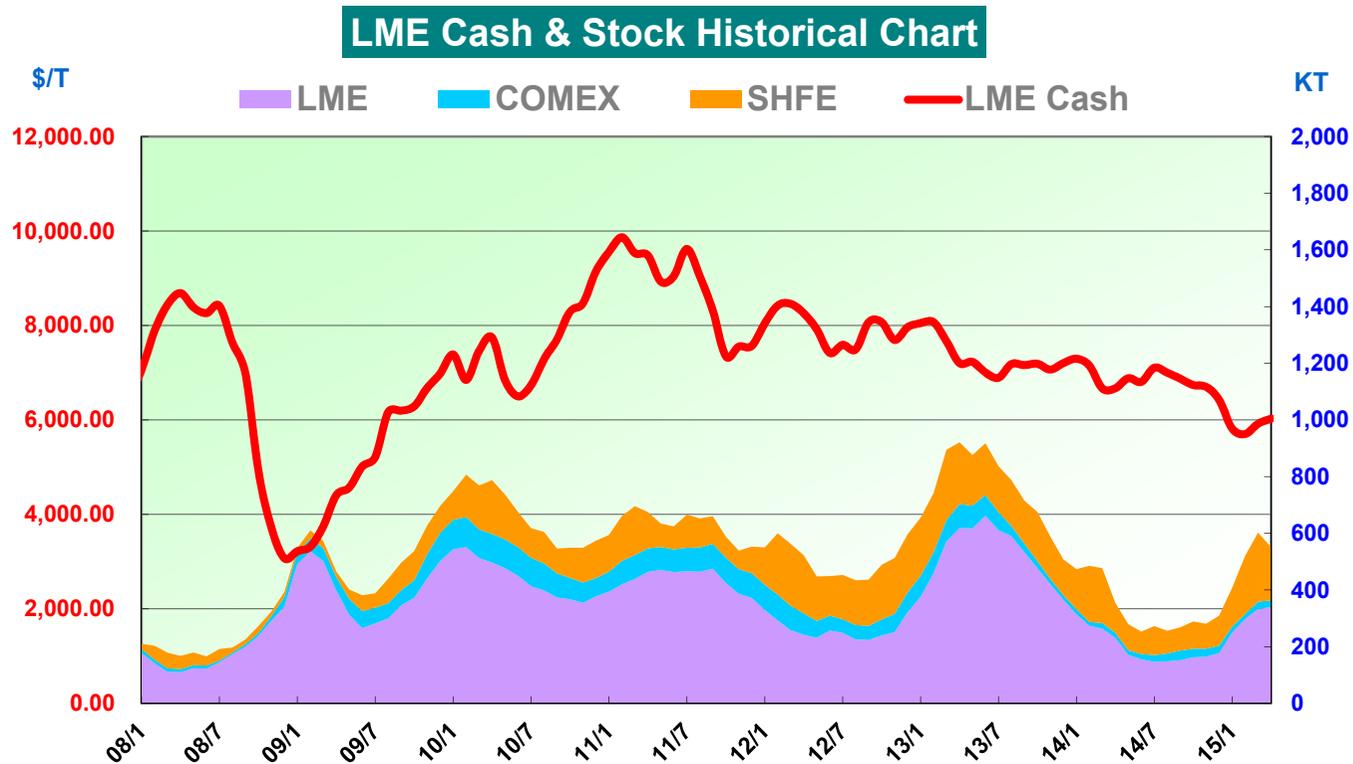


(IMF Apr. 2015)

## 2) Forex Trends



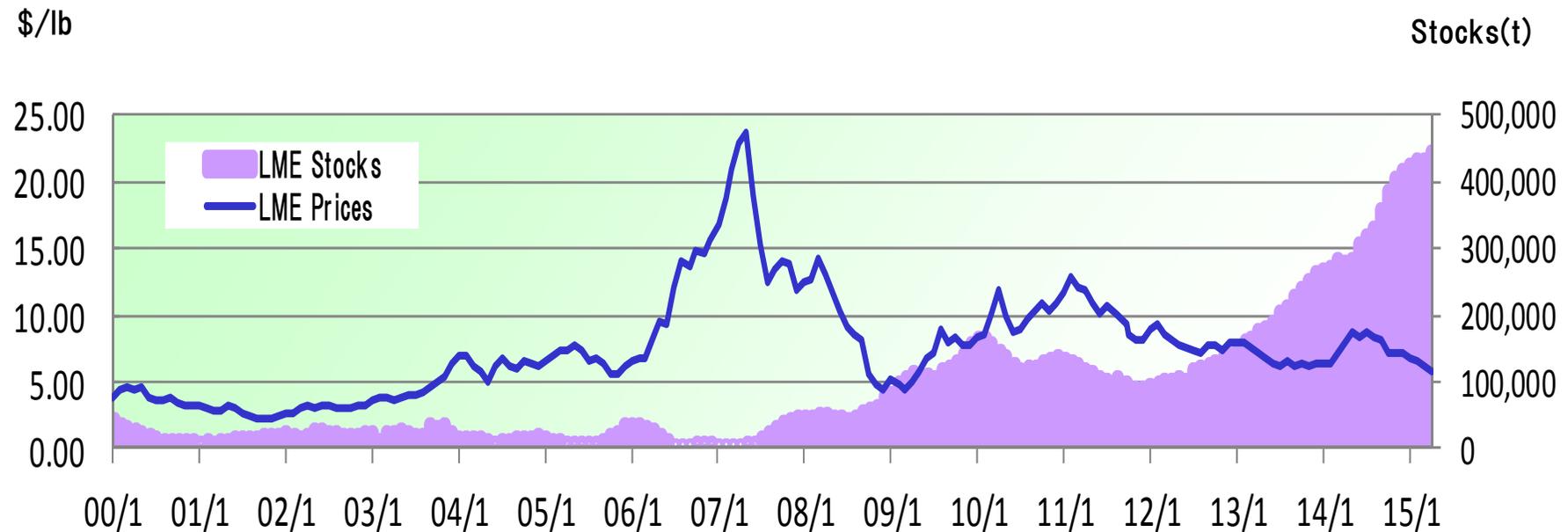
# 3) Cu – Price / Supply & Demand Balance



[ICSG Estimation Apr.2015]

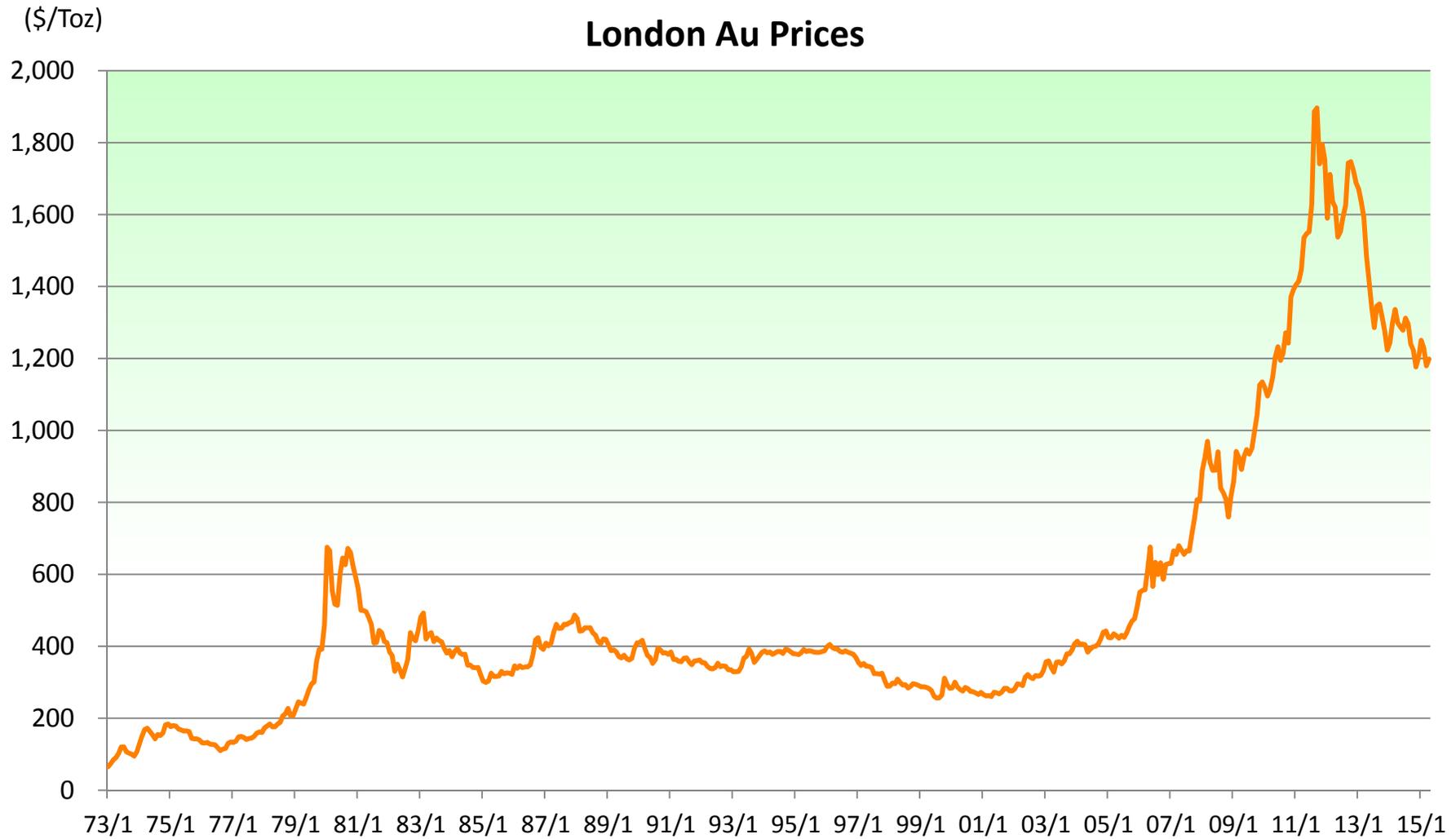
	2014	2015	2016
Production	22,487	23,410	23,985
Usage	22,910	23,046	23,757
Balance	▲423	364	228

## 4) Ni – Price / Supply & Demand Balance



	INSG Estimation 2015/4 (kt)			SMM Estimation 2015/4 (kt)		
	2013	2014	2015	2013	2014	2015
Production	1,962	1,999	1,958	1,902	1,978	1,963
Usage	1,785	1,869	1,939	1,795	1,933	1,968
Balance	177	130	20	107	45	▲5

# 5) Au - Price



## V. Financial Highlights and Information Materials



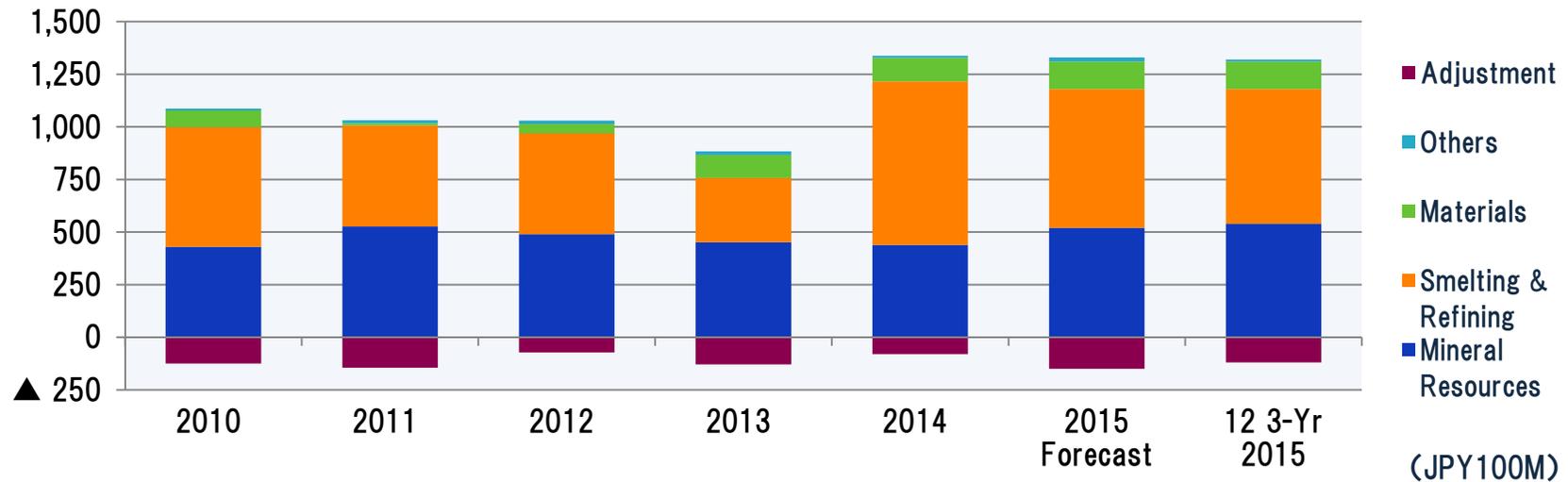
Port of Antofagasta

# 1) Performance Trends

	2010	2011	2012	2013	2014	2015 Forecast	12 3-Yr 2015
Net Sales	8,641	8,479	8,085	8,305	9,213	9,500	9,100
Operating Income	962	886	958	754	1,258	1,180	1,200
Recurring Profit	1,238	1,088	1,150	1,144	1,742	1,480	1,500
Equity Method profit	348	232	171	307	239	270	360
Net Income	841	653	866	803	911	1,040	1,000
ROA(%)	8.3	5.9	6.9	5.5	5.5	-	7
ROE(%)	13.8	10.1	12.1	9.5	9.3	-	12
Dividend Per Share(¥)	32.0	28.0	34.0	37.0	48.0	48.0	N/A
Copper (\$/t)	8,140	8,485	7,855	7,104	6,554	6,000	7,500
Nickel (\$/lb)	10.7	9.6	7.7	6.5	7.6	6.5	9.0
Gold (\$/Toz)	1,294	1,646	1,654	1,327	1,248	1,150	1,550
Zinc (\$/T)	2,187	2,101	1,950	1,909	2,174	2,000	1,800
Exchange(¥/\$)	85.7	79.1	83.1	100.2	109.9	120.0	80.0

## 2) Operating Income by Segment

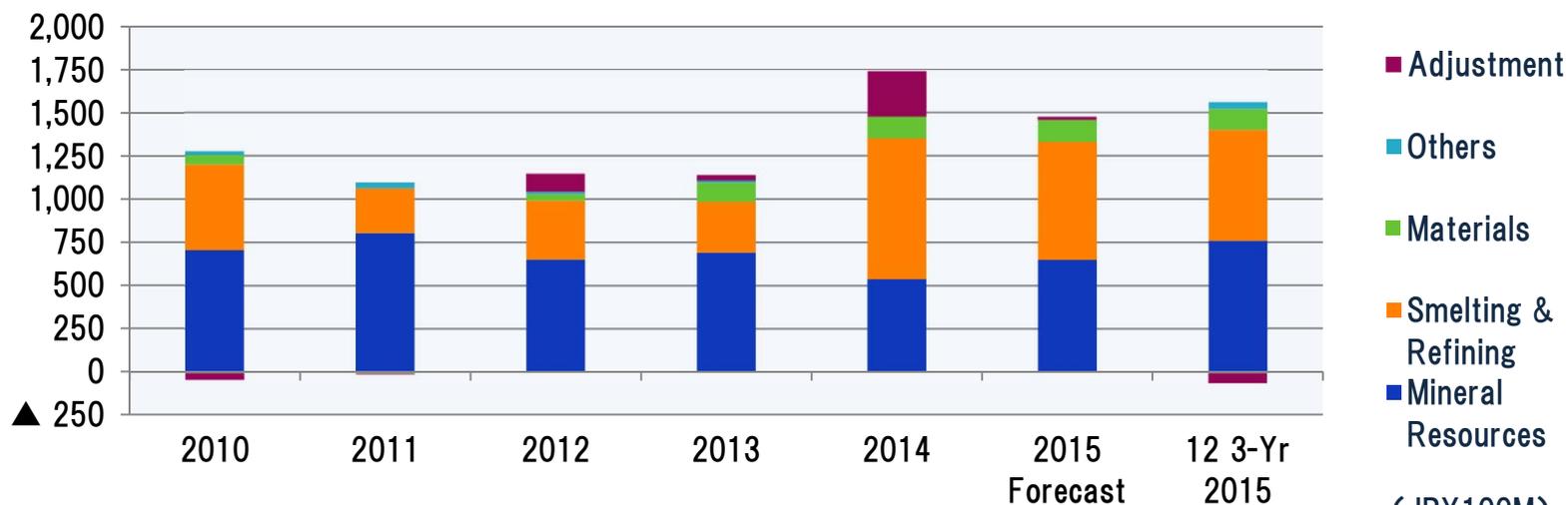
(JPY100M)



	2010	2011	2012	2013	2014	2015 Forecast	12 3-Yr 2015
Mineral Resources	432	528	490	452	439	520	540
Smelting & Refining	569	480	479	306	777	660	640
Materials	78	8	45	108	112	130	130
Others	10	16	16	17	10	20	10
Adjustment	▲127	▲146	▲72	▲129	▲80	▲150	▲120
Total	962	886	958	754	1,258	1,180	1,200

### 3) Profit Trends by Segment

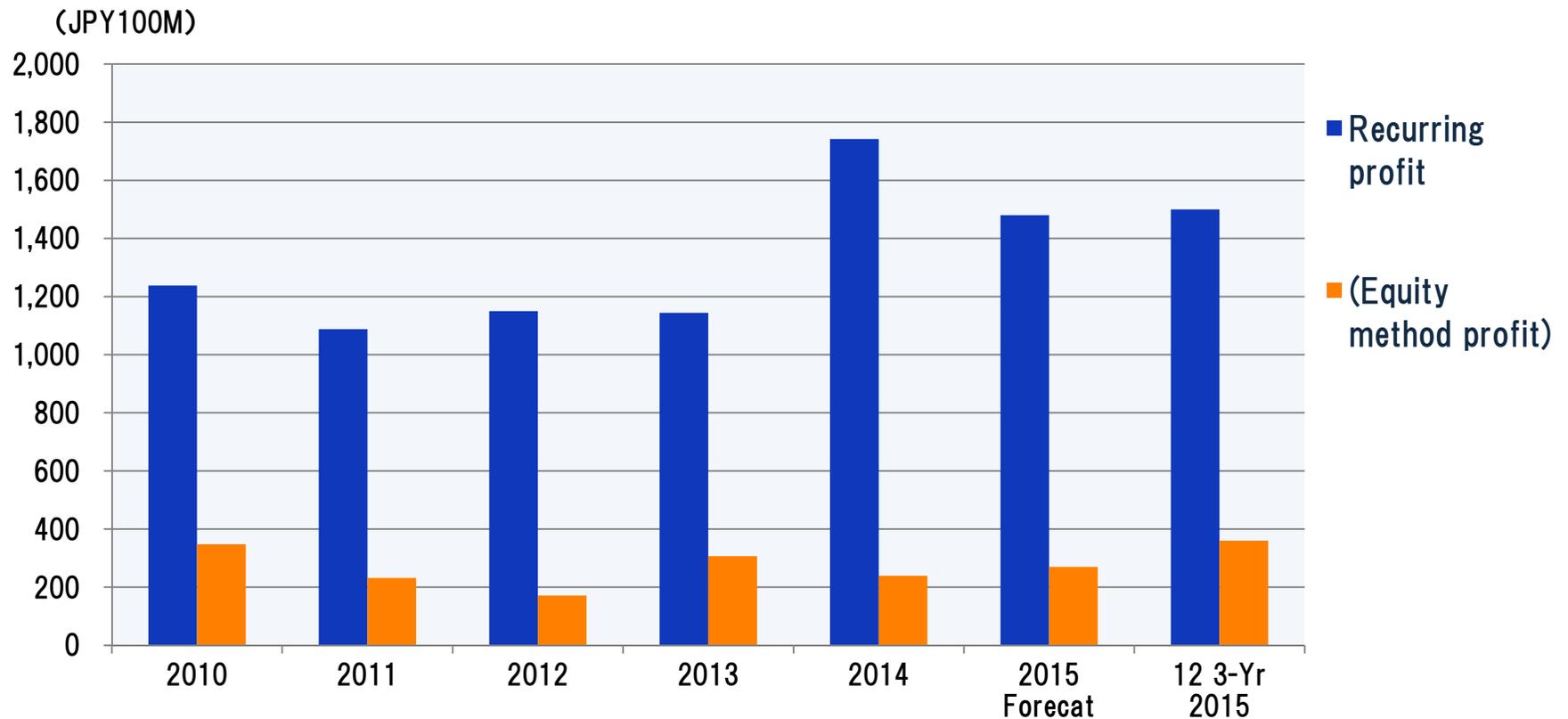
(JPY100M)



		2010	2011	2012	2013	2014	2015 Forecast	12 3-Yr 2015
※ Segment profit	Mineral Resources	705	806	652	691	538	650	760
	Smelting & Refining	495	256	339	291	813	680	640
	Materials	54	14	38	111	129	130	120
	Others	23	19	16	16	▲1	0	40
Adjustment		▲39	▲7	105	35	263	20	▲60
Recurring Profit		1,238	1,088	1,150	1,144	1,742	1,480	1,500

※ FY2010-FY2012 : Contribution Margin (Earlier Bases) / FY2013, FY2015 Forecast, 12 3-Yr 2015 : New Segment Profit

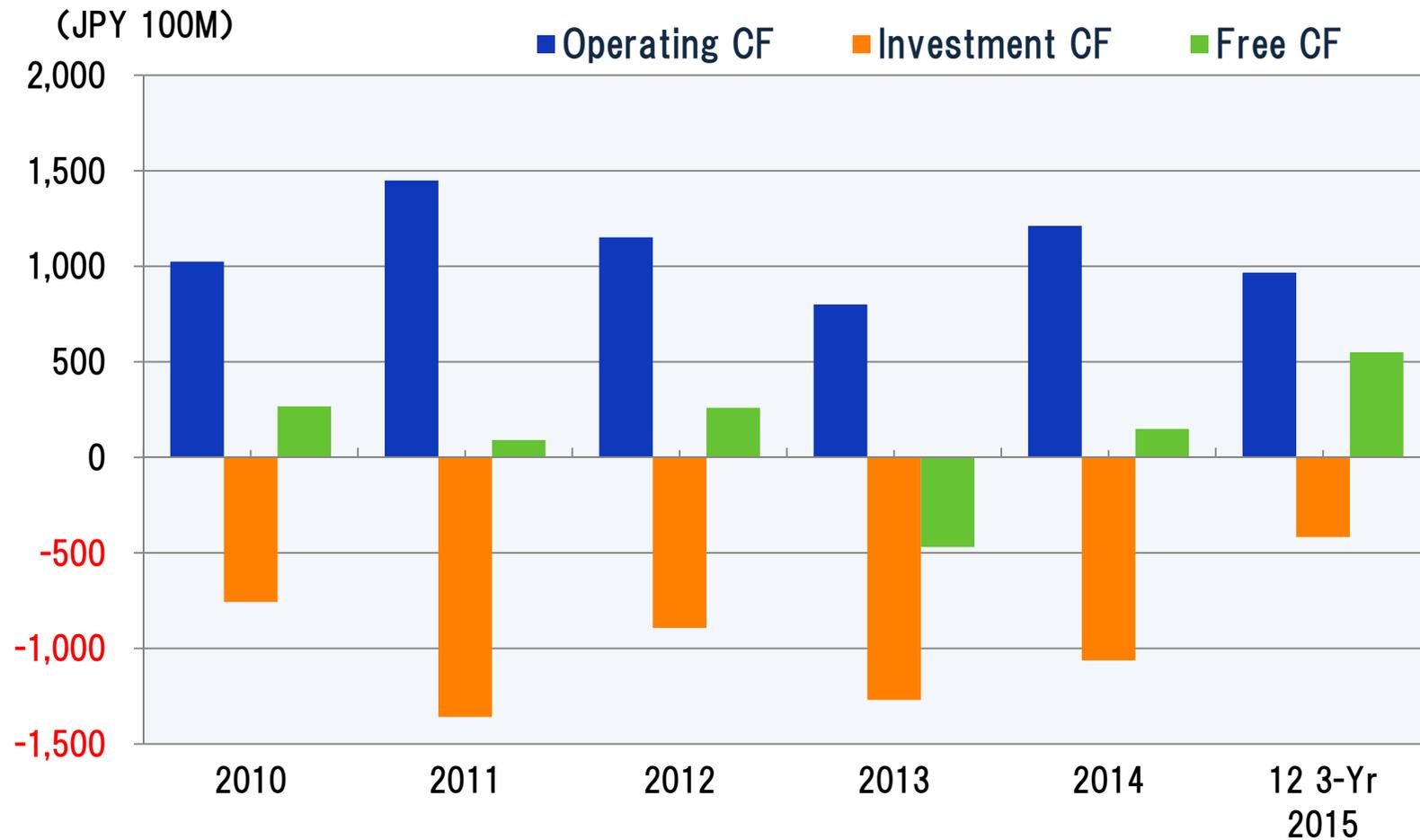
## 4) Recurring Profit / Equity Method Profit



(JPY100M)

	2010	2011	2012	2013	2014	2015 Forecast	12 3-Yr 2015
Recurring profit	1,238	1,088	1,150	1,144	1,742	1,480	1,500
(Equity method profit)	348	232	171	298	239	270	360

## 5) Cash Flow Trends



## 6) Sensitivity

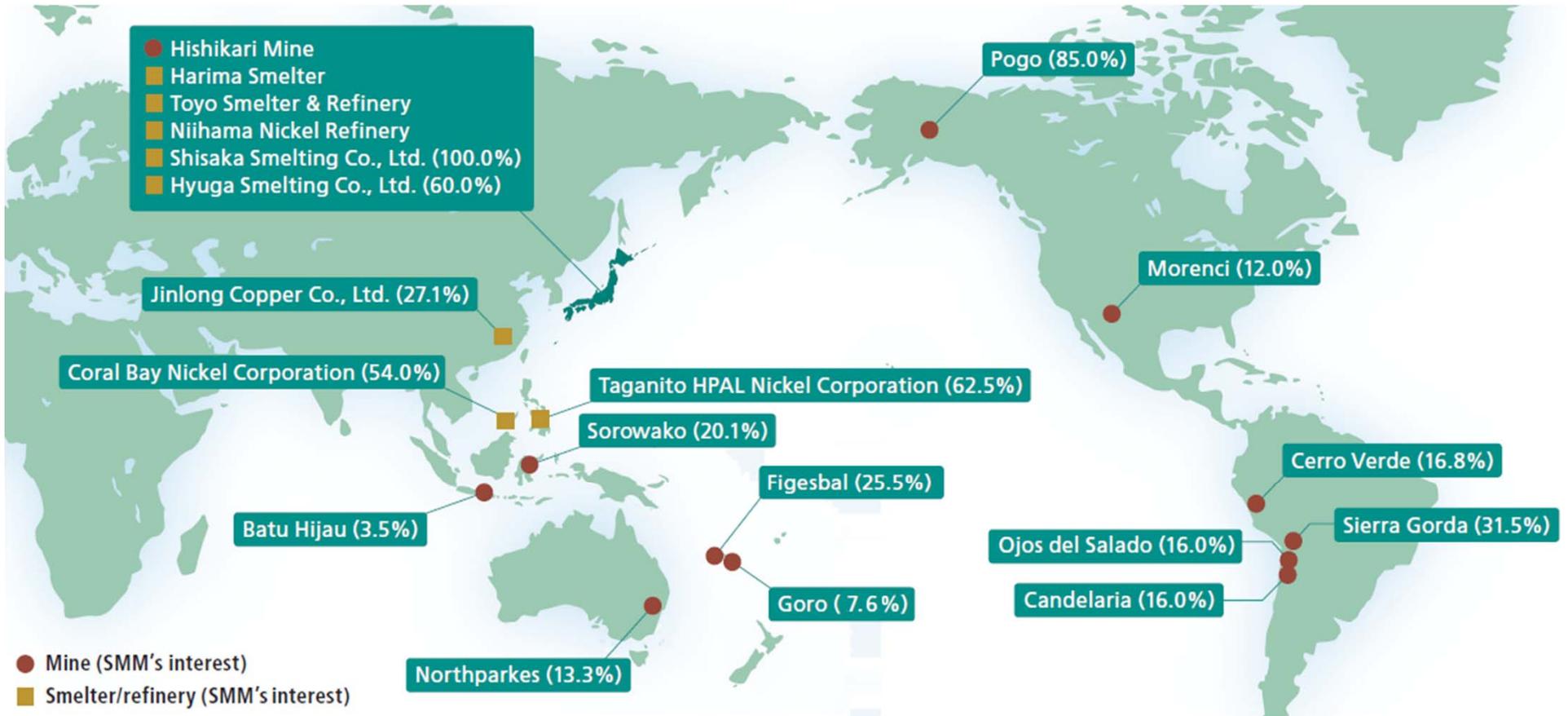
( JPY100M )

Element	Degree of variation	Operating income/ Recurring profit
Cu	±100\$/t	11/21
Ni	±10 ¢ /lb	18/20
Au	±10\$/TOZ	6/6
JPY/USD	±¥1/\$	13/14 (Yen Depreciation= Positive)

(Remark)

USD/JPY translation include RC-related and Conversion rate of overseas consolidated / equity-method affiliate companies' profit.

# 7) SMM's Mines and Smelters / Refineries



## 8) 12 3-Yr plan ① Long-Term Vision Targets

Aiming to be a World Leader in the  
Non-Ferrous Metals Industry  
&  
an Excellent Company of Japan

### Targets

World Leader in the Non-Ferrous Metals Industry

FY 2021

Nickel 150kt

Copper interests 300kt

Gold interests 30 t

New materials  
Recurring profit  
¥5 billion

Excellent Company of Japan

Net Sales ¥1 trillion

Net Income ¥100 billion

# 8) 12 3-Yr plan ② Long-Term Vision Targets

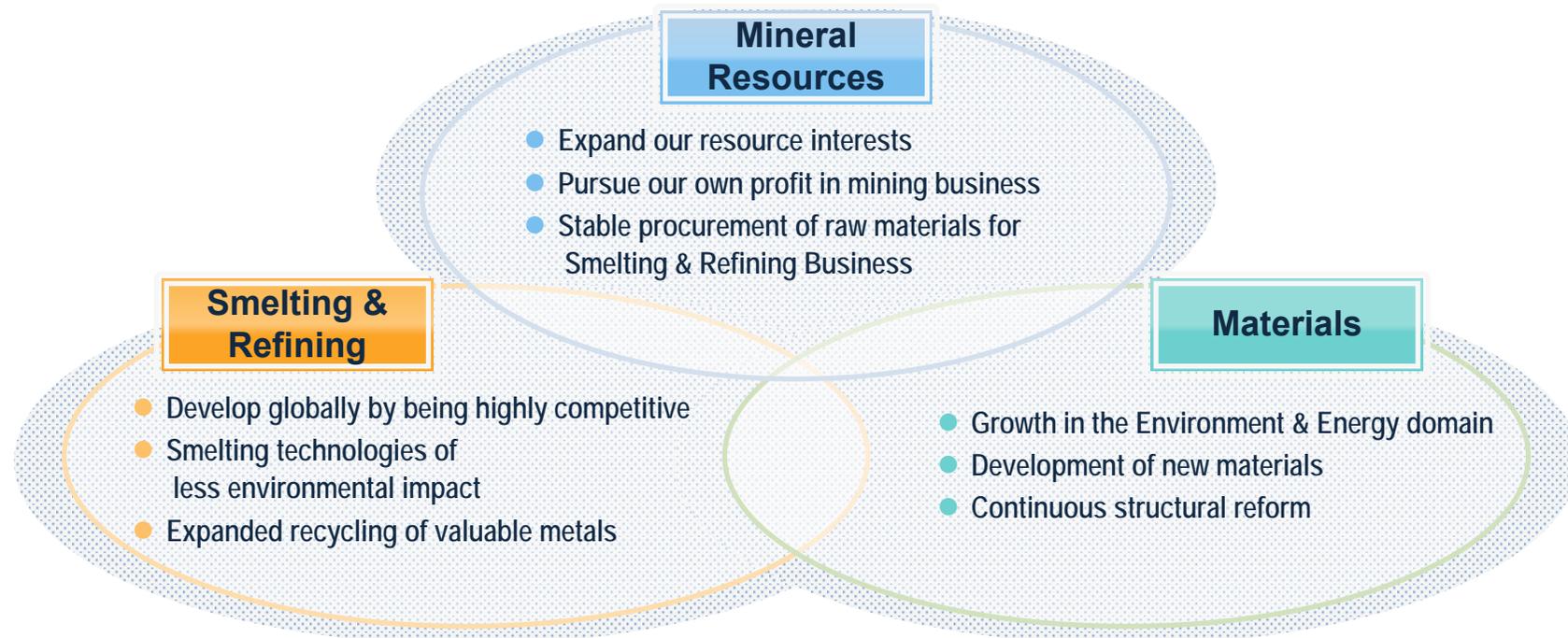
## World Leader in the Non-Ferrous Metals

### World Leader in the Non-Ferrous Metals Industry

We are contributing to society by securing superior mineral resources, smelting and refining those resources into metal, and supplying them to the market. To provide added value in Materials Business that uses non-ferrous metals.

Operates its own  
mines and smelters  
both in Japan and abroad

Among the top 5 companies in  
the world in production volume



## 8) 12 3-Yr plan ③ Long-Term Vision Targets

### Excellent Company of Japan

## Excellent Company of Japan

A solid corporate philosophy  
and management vision

Practicing corporate governance  
and CSR activities as a pillar of  
our business

Net sales: ¥1 trillion  
Net income: ¥100 billion

Lays out continuous  
growth strategy

# 9) Enhancement of Corporate Governance

## Corporate governance system

Multiple outside directors and increased ratio from FY2015

## Engagement

Enhancement by top management with shareholders, etc. (in Japan/overseas) from FY2014

Explanation of business strategy from division managers to investors from FY2014

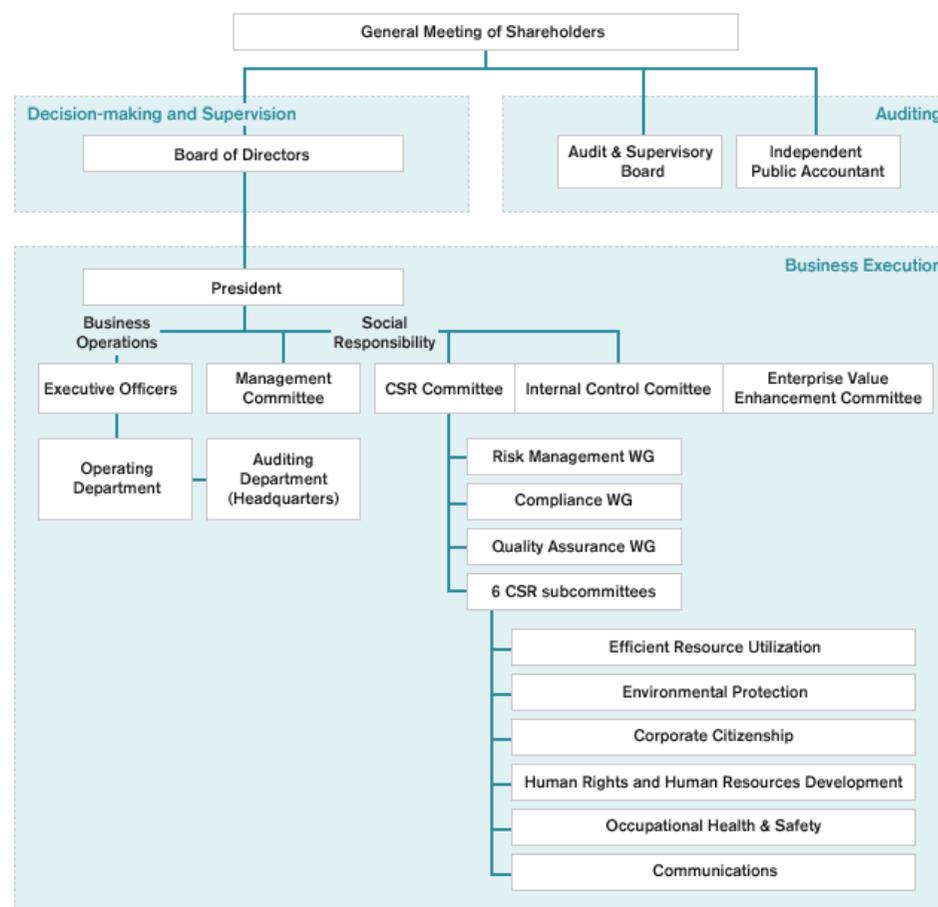
## Non-financial information

Integrated report (Annual report + CSR report) from FY2016

## Accounting standards

Start of preparations to implement IFRS

Corporate Governance System



# 10) Glossary

## Mineral resources and metals

### 1) Metal trading

#### London Metal Exchange (LME)

The LME specializes in trading of non-ferrous metals such as copper, nickel, aluminum, lead and zinc. The LME trading prices for metals are used as the international pricing benchmarks for sales of refined metal and purchases of refining ores.

#### TC/RC

Treatment Charge (TC) and Refining Charge (RC) are commonly used in the terms of purchase for copper concentrate or nickel ore for refining. They are amounts designed to cover refining costs. For example, copper concentrate contracts may define a purchase price based on the LME price at a certain date, minus the TC and RC being used at the time.

#### London fixing

Gold is not traded on the LME. Its price is determined for each transaction between market participants. The financial institutions in the London Bullion Market Association (LBMA) agree a standard price for gold based on these transactions and publish it on the morning and afternoon of each trading day. This “London fixing” price is the benchmark for trading in gold.

#### Pound (lb)

The pound is the standard unit of weight used in measuring and pricing base metals such as copper and nickel, and in TC/RC calculations. One pound is equal to 453.59 grams; an metric ton equals 2,204.62lb.

#### Troy ounce (toz)

The troy ounce is the standard unit of weight for precious metals such as gold and silver. It equals approximately 31.1 grams. It is named after Troyes, a city in the Champagne region of central France that was the site of a major market in Europe in medieval times. Originally used as a unit of exchange for valuing goods in terms of gold or silver weights, the troy ounce is still used today in gold trading.

### 2) Metal refining

#### Smelting and refining

Refining processes extract valuable metals from ores or other raw materials. They fall into two basic types: hydrometallurgical (wet) and pyrometallurgical (dry). At SMM's Toyo facilities in Ehime Prefecture, the copper concentrate pre-processing undertaken at Saijo uses pyrometallurgical processes and the nickel refining at the Niihama site uses hydrometallurgical processes entirely. The term 'smelting' is used for the extraction of metal from ores using melting and heating (pyrometallurgy). The term 'refining' refers to any process that increases the grade or purity of a metal.

#### Pyrometallurgical Smelting

The precursor ore is melted at high temperature in a furnace, and refining techniques are applied to separate the metal in a molten state. Although large amounts of ore can be processed at one time, the equipment needs periodic maintenance for heat proofing.

#### Hydrometallurgical refining

The ore and impurities are dissolved in a solution, and chemical reactions are used to separate out the metal. This approach allows continuous and stable refining, but incurs additional costs due to the refining chemicals consumed.

### 3) Metal ores

#### Sulfide ores

These ores contain copper, nickel or other metals chemically bonded to sulfur. Since the application of heat breaks these bonds, releasing the sulfur, such ores are generally refined using pyrometallurgical techniques.

#### Oxide ores

These ores contain metals in oxidized forms. Unlike sulfide ores, oxides need much more energy to achieve melting. For this reason, the hydrometallurgical approach is generally used to refine these ores.

#### Copper concentrates

Used as raw materials in copper smelting, copper concentrates have a copper content of about 30% by weight. The remainder consists mostly of sulfur and iron. Copper concentrates are made mostly from sulfide ores. Ores extracted from overseas mines have a typical grade of about 1%. The ores are then “dressed” at the mine to increase the purity and produce concentrate. Most of the copper ores imported by SMM for smelting in Japan are concentrates.

#### Nickel oxide ores

Whilst the higher-grade sulfide ores are used predominantly in nickel refining, nickel oxide ores are more prevalent than nickel sulfides. The sulfide-oxide ratio in current nickel reserves is believed to be about 3:7. High refining costs and technical issues have limited use of oxide ores in nickel refining to date, but SMM has succeeded in refining nickel from low-grade oxide ores based on HPAL technology.

#### Mixed sulfide (MS)

CBNC and Taganito produce a mixed nickel-cobalt sulfide intermediate containing about 60% nickel by weight. This is used as a raw material in electrolytic nickel production.

#### Matte

A matte is another term for metal sulfides. For raw material, electrolytic nickel production at SMM also uses a nickel matte (of about 75-80% purity) sourced from PT Inco.

# 10) Glossary

## 4) Metal content in ores

**[Au]**

(Canadian standard)

**Reserve (ore)**

Economically minable part of Measured or Indicated Mineral Resources demonstrated by at least preliminary feasibility study.

**Resource (ore)**

Quantity and of such a grade or quality that it has reasonable prospects for economic extraction.

(Japan Standard (JIS))

**"Prospective Mineable Resource" ("Kasai Kouryo")**

Total weight of the crude ore to be mined within the deposit, which contains the mineable portion of the "Geological Resource" and the waste rocks to be added in the mining process.

**"Geological Resource" ("Maizo Kouryo")**

Total weight of the mineralized material in the crust within the deposit.

**[Cu / Ni]**

"Reserve" or equivalent of the standards in each countries.

## 5) Nickel production process

**Coral Bay Nickel Corporation (CBNC)**

Based in the Philippines, this SMM subsidiary produces mixed nickel-cobalt sulfides using HPAL technology and exports the raw materials to the SMM Group's nickel refining facilities in Niihama, Ehime Prefecture.

**High Pressure Acid Leach (HPAL)**

HPAL technology enables the recovery of nickel from nickel oxide ores that traditionally were difficult to process. SMM was the first company in the world to apply it successfully on a commercial scale. The oxide ores are subjected to high temperature and pressure and reacted under stable conditions with sulfuric acid to produce a nickel-rich refining intermediate.

**Matte Chlorine Leach Electrowinning (MCLE)**

MCLE is the technology used in the manufacturing process at SMM's nickel refinery. The matte and mixed sulfide ores are dissolved in chlorine at high pressure to produce high-grade nickel using electrolysis. MCLE is competitive in cost terms, but poses significant operational challenges. Other than SMM, only two companies are producing nickel based on this kind of technology.

## 6) Main applications for metals

**Copper**

Copper is fabricated into wires, pipes and other forms. Besides power cables, copper is used widely in consumer applications such as wiring in vehicles or houses, and in air conditioning systems.

**Electrolytic nickel**

This form of nickel, which has a purity of at least 99.99%, is used in specialty steels, electronics materials and electroplating, among other applications. SMM is the only producer of electrolytic nickel in Japan.

**Ferronickel**

Ferronickel is an alloy containing nickel (about 20%) and iron. Its main use is in the manufacture of stainless steel, which is about 10% nickel by weight. Based in Hyuga, Miyazaki Prefecture, SMM Group firm Hyuga Smelting produces ferronickel.

**Gold**

Gold is in demand worldwide for investment and decorative purposes. Gold is widely used in Japanese industry within the electronics sector because of its high malleability and ductility.

## Materials

**Copper-clad polyimide film (CCPF)**

CCPF is a polyimide film that is coated using a copper base. It is used as a material for making COF substrates.

**Lead frames (L/F)**

Lead frames are electronic packaging materials used to form connections in semiconductor chips and printed circuit boards. They contain thin strips of a metal alloy containing mostly nickel or copper.

**Secondary batteries**

Secondary batteries are ones that can be recharged and used again. SMM supplies battery materials that are used in the anodes of nickel metal hydride batteries and lithium-ion rechargeable batteries, which supply power for hybrid vehicles or notebook computers, among other consumer applications.

# Note

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