

2nd Quarter of FY2014

Progress of Business Strategy

November 2014

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

Contents

- I** 2012 3-Year Business Plan Strategy:
Progress & Management Issues
- II** Trends in Business Performance
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and Information Materials

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



Opening ceremony for the Sierra Gorda Mine

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 ○ Launch of 220 kt production structure
	Cu	Expansion of Morenci Mine	Transition to full production structure	○ 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 (Rise of a New Resource Nationalism)

Active movement toward resource nationalism

Past movements

Assertion of sovereignty over own resources

Content	Implementing country
Nationalization, foreign capital restrictions	South Africa, Bolivia...
Export volume restrictions	China (rare earth), India (iron ore) ...
Mandatory equity stake in resource-owning country	South Africa, Mongolia...

Recent movements

Reallocation of wealth to own country

Content	Implementing country
High value added requirement	Indonesia...
Increased mining-related tax, increased royalties	Australia, Chile, Peru... About 30 countries

Other

- Strengthening of laws and regulations in resource sector
- Strengthening of emission and other environmental regulations...

Our company's response

Strengthening of cooperative structures with government of Japan
Evolution of mutual understanding with resource-owning countries

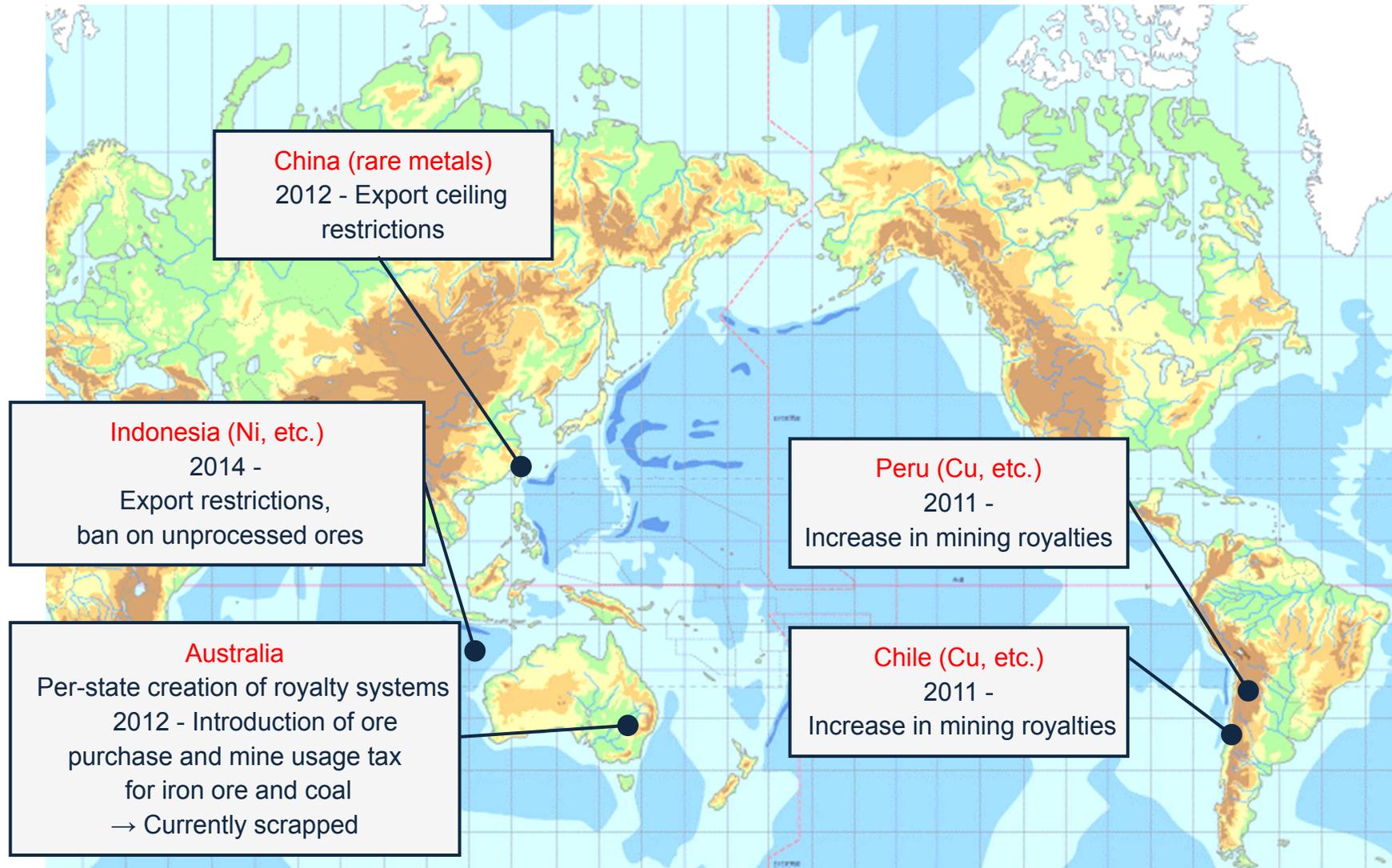
Cases involving our company:

- Mining rights issue on Solomon Islands
- Movement toward high value added requirement for ore in Philippines

2) Management Issues

② (Rise of a New Resource Nationalism)

Recent cases (representative)



2) Management Issues ③ Consideration Toward the Environment and Society

Resource development and consideration toward the environment and society

Case (1) Chile

Strengthening of freshwater usage restrictions in mines



Requirement for usage of seawater or desalinization of seawater
 Seawater transported about 140 km by pipeline at Sierra Gorda Mine
 ⇒ Factor behind cost increases at mines

Example (2) Pebble Mine Project, Alaska

Anglo American and Rio Tinto have partial equity interests
 Opposition by local residents over destruction of salmon spawning grounds
 ⇒ Difficulty of acquiring environmental permit from state



Relations with community increasingly important

Issues accompanying resource development (examples)

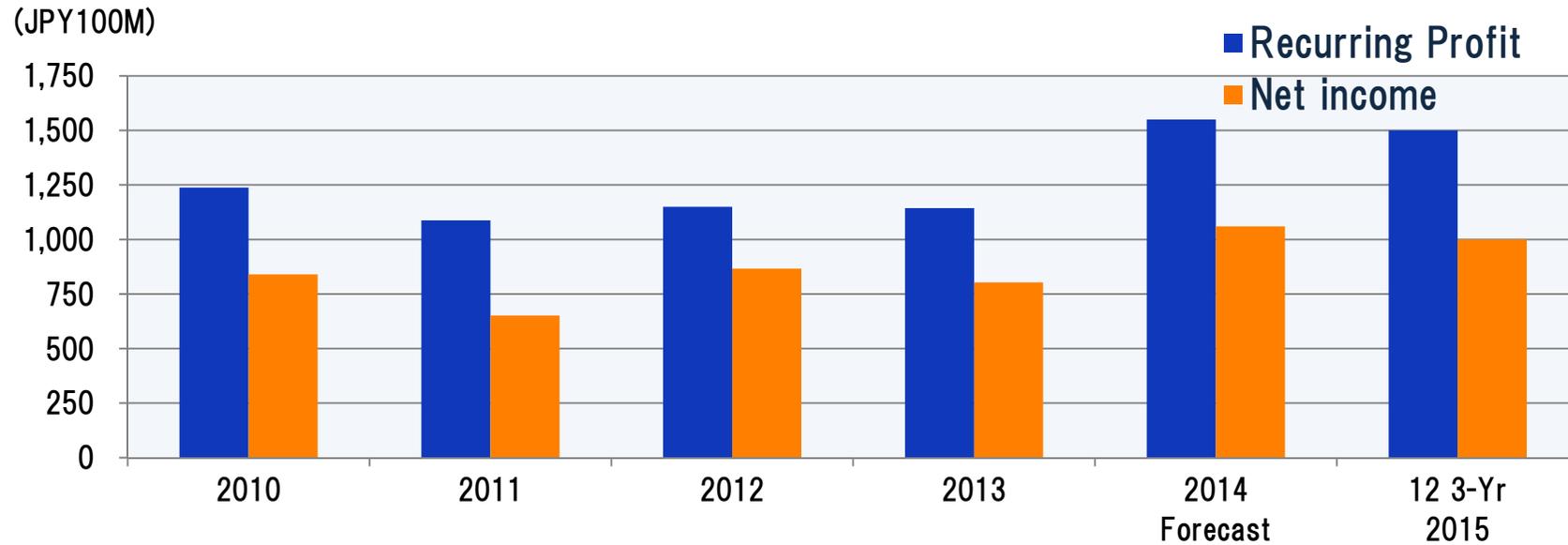
Human rights	Migration of indigenous peoples Eminent domain
Environment	Natural destruction Environmental pollution Destruction of biodiversity
Labor	Child labor Occupational safety
Politics	Political corruption
Conflicts	Riots, regional conflicts

II. Trend in Business Performance



Opening ceremony for the Sierra Gorda Mine

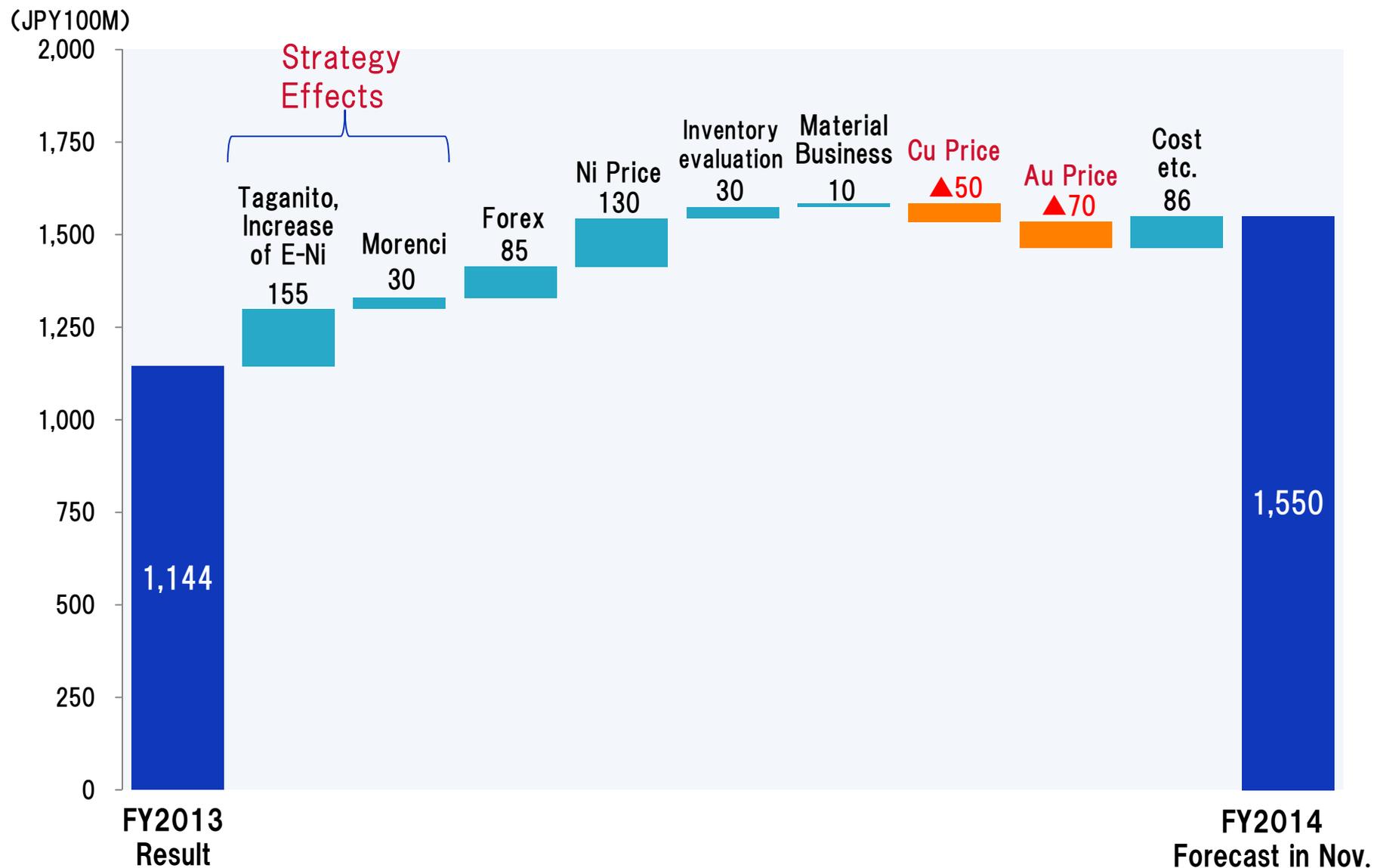
1) Profit Trends



	2010	2011	2012	2013	2014 Forecast	12 3-Yr 2015
Recurring profit (JPY100M)	1,238	1,088	1,150	1,144	1,550	1,500
Net income (JPY100M)	841	653	866	803	1,060	1,000
Cu Price (\$/T)	8,140	8,485	7,855	7,104	6,845	7,500
Ni Price (\$/lb)	10.7	9.6	7.7	6.5	8.0	9.0
Au Price (\$/Toz)	1,294	1,646	1,654	1,327	1,243	1,550
Forex (¥/\$)	85.7	79.1	83.1	100.2	105.5	80.0

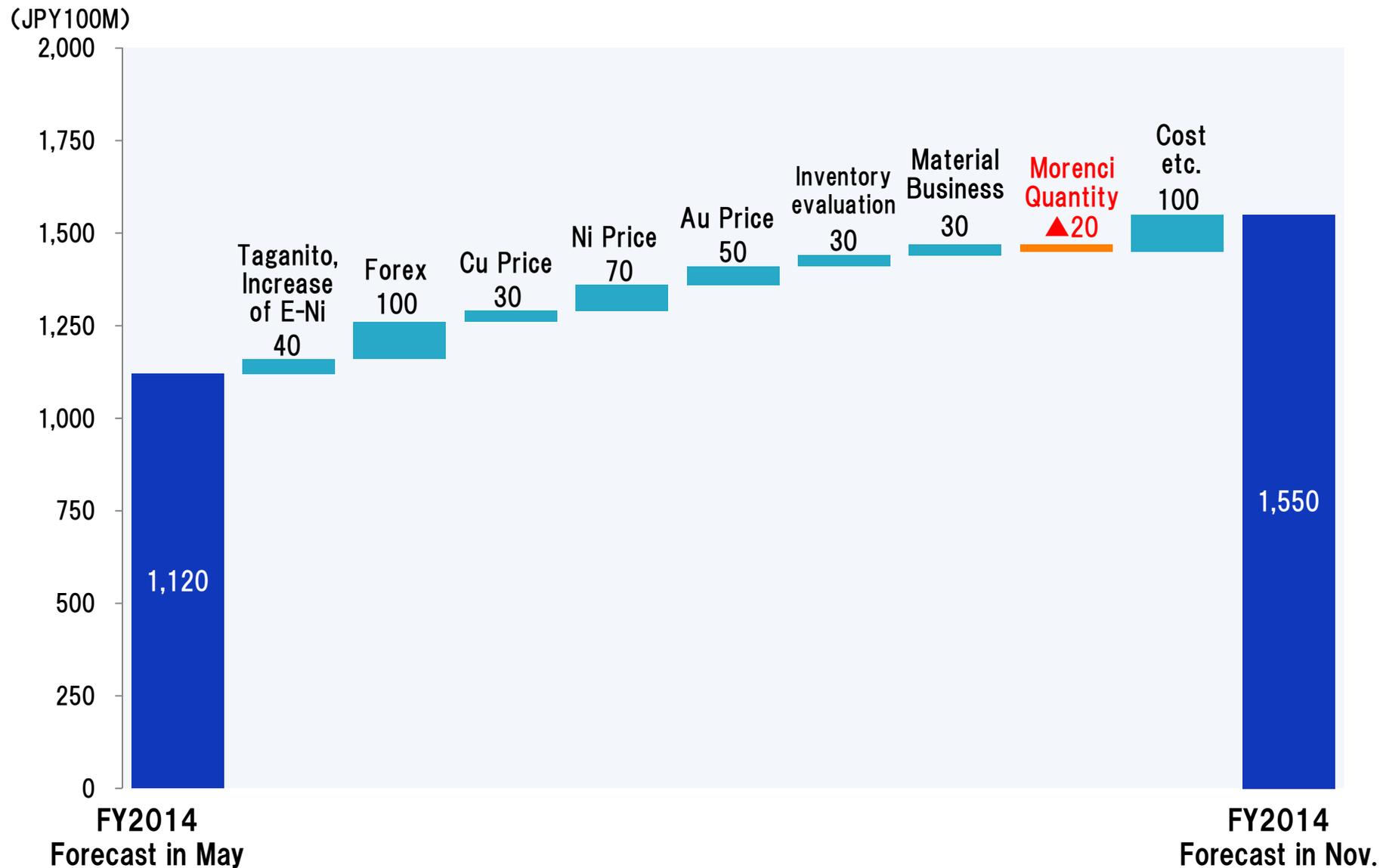
2) Recurring Profit Analysis

① FY2013 Result vs. FY2014 Forecast in November

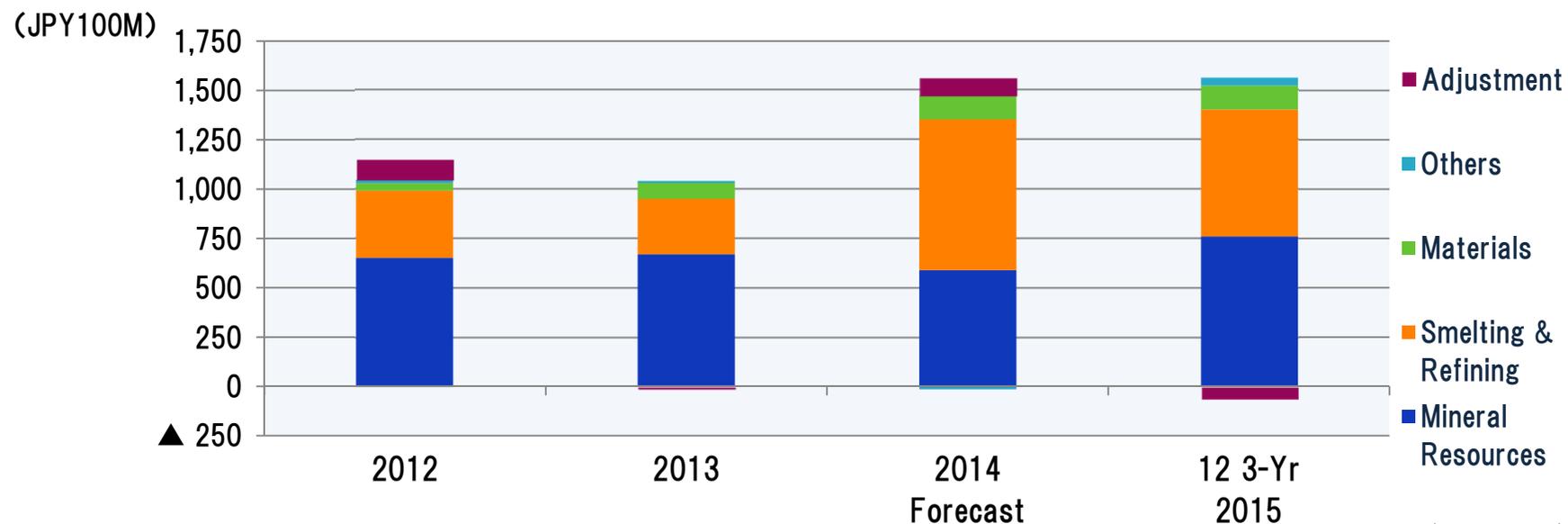


2) Recurring Profit Analysis

②FY2014 Forecast in May vs Forecast in November



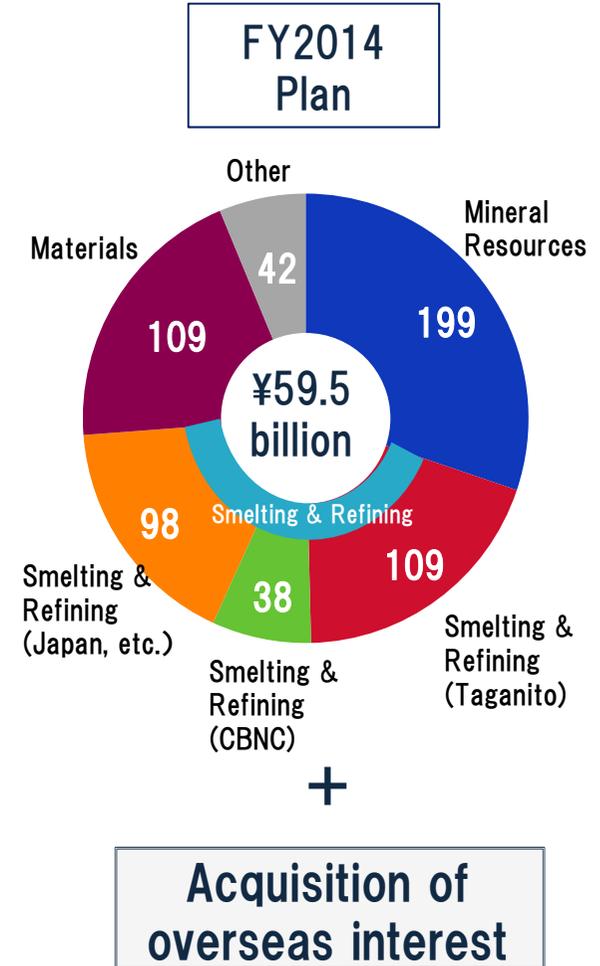
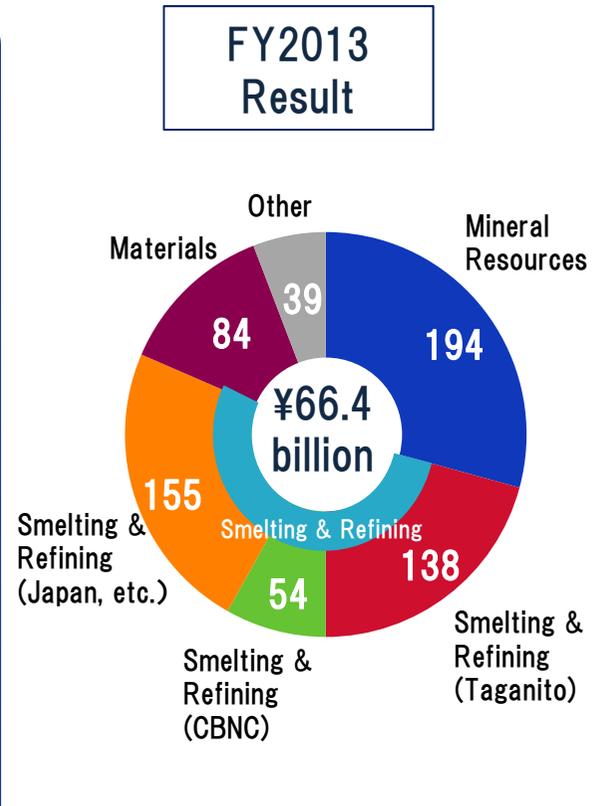
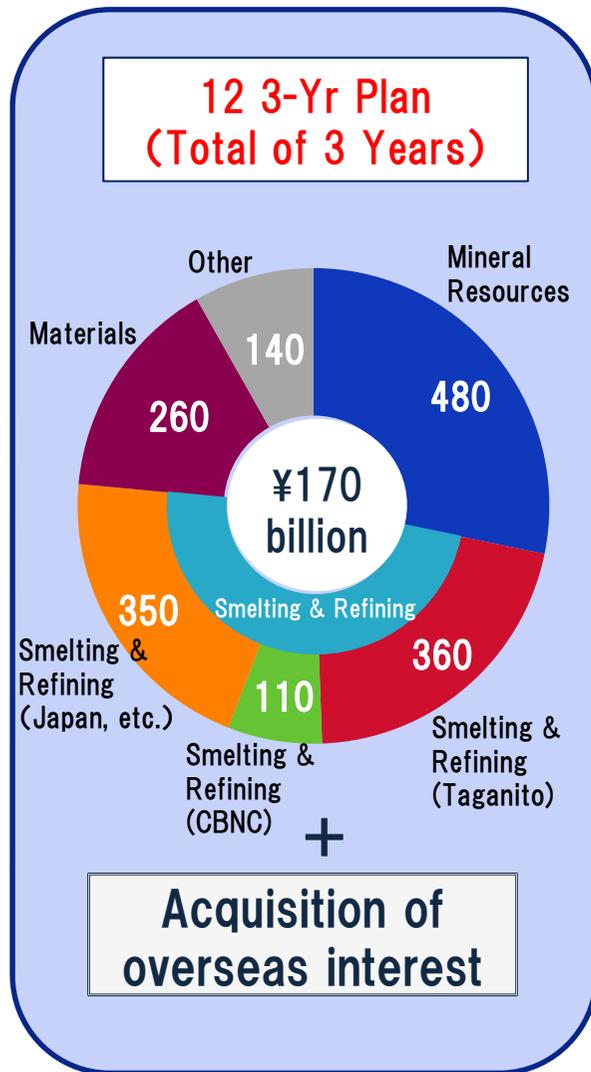
3) Profit Trends by Segment



(JPY100M)

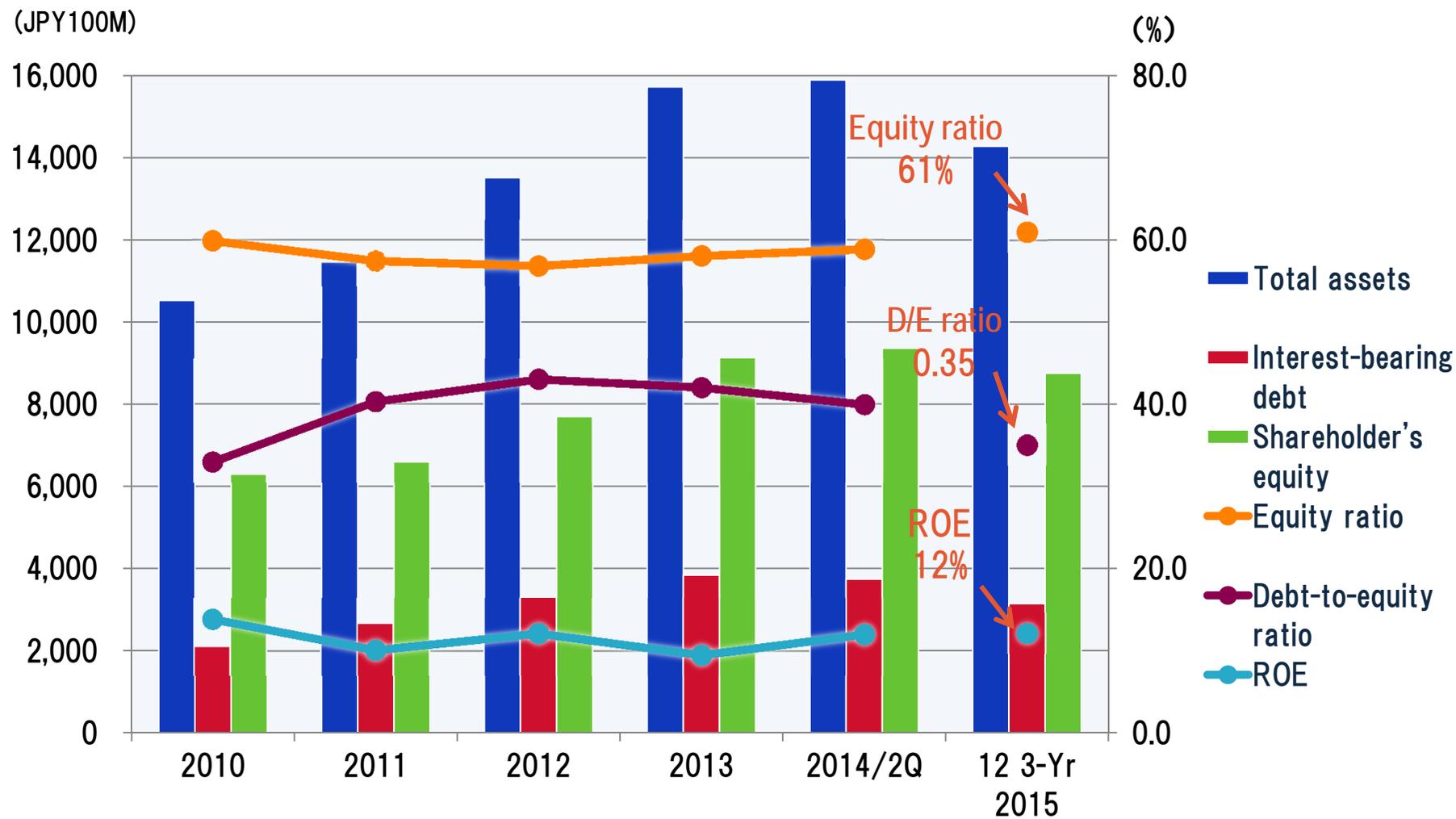
		2012	2013	2014 Forecast	12 3-Yr 2015
Segment profit	Mineral Resources	652	691	590	760
	Smelting & Refining	339	291	760	640
	Materials	38	111	120	120
	Others	16	16	0	40
Adjustment		105	35	80	▲60
Recurring Profit		1,150	1,144	1,550	1,500

4) Capital Expenditure

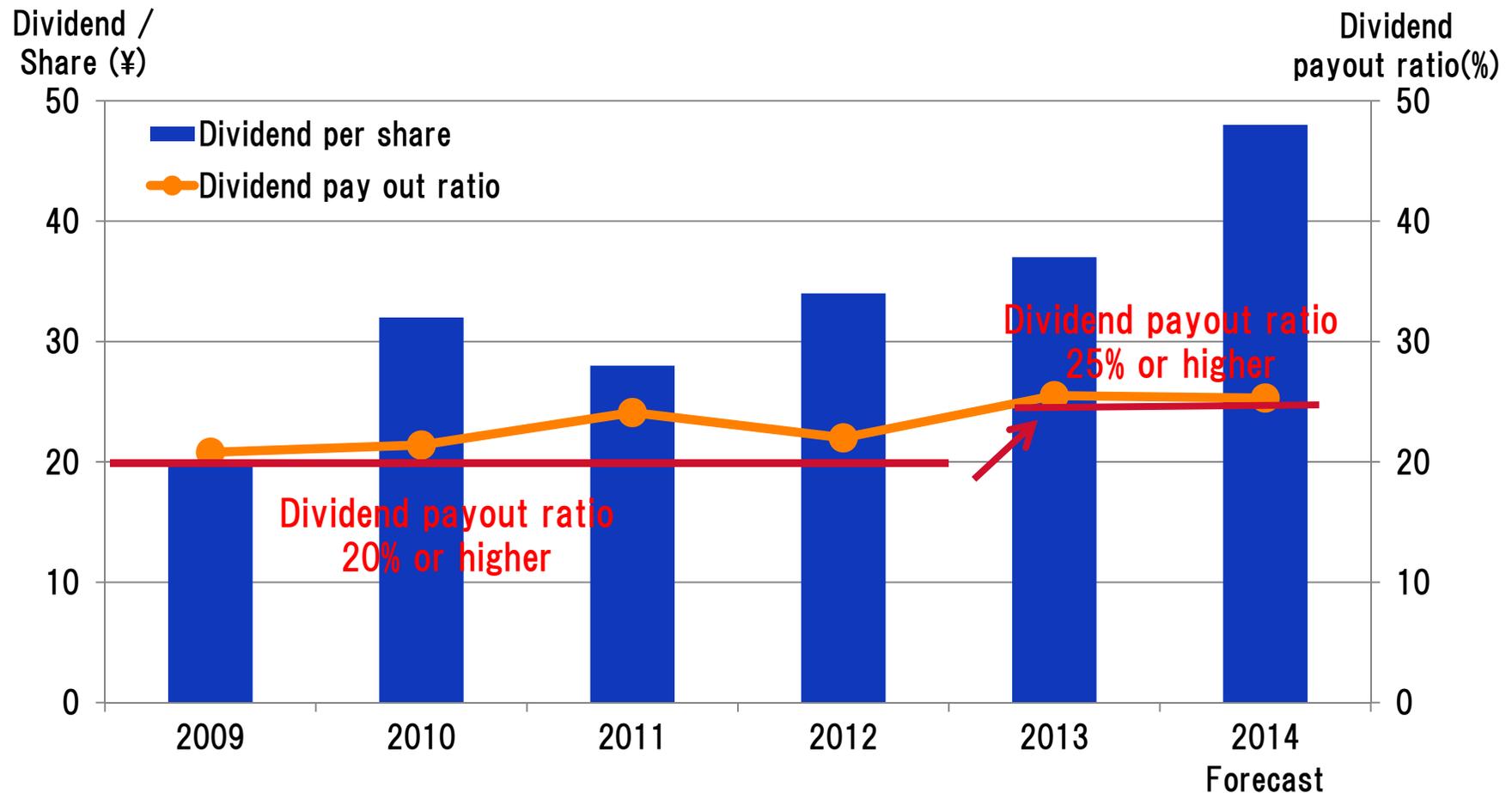


5) Financial Strategies

Maintenance of a Sound Financial Structure



6) Trend of Dividend



- **FY2014 Dividend Forecast : ¥48 (+¥11 from Previous Year)**
- 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



Opening ceremony for the Sierra Gorda Mine

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	\$4.2 B
	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
Late November – December - Scheduled to arrive at Toyo Smelter

Current Progress

- End of copper concentrate-related commissioning
- Ramp-up is progressing steadily, with completion scheduled for the second half of 2015
- Start of commercial production from end of 2014 to start of 2015

Through review of mining plan, minable ore amount extended from 1.3 billion t ⇒ 1.5 billion t;
mine life extended from 20 years ⇒ 23 years

1) Mineral Resources

② Increasing Production at Existing Mines Morenci - Cu

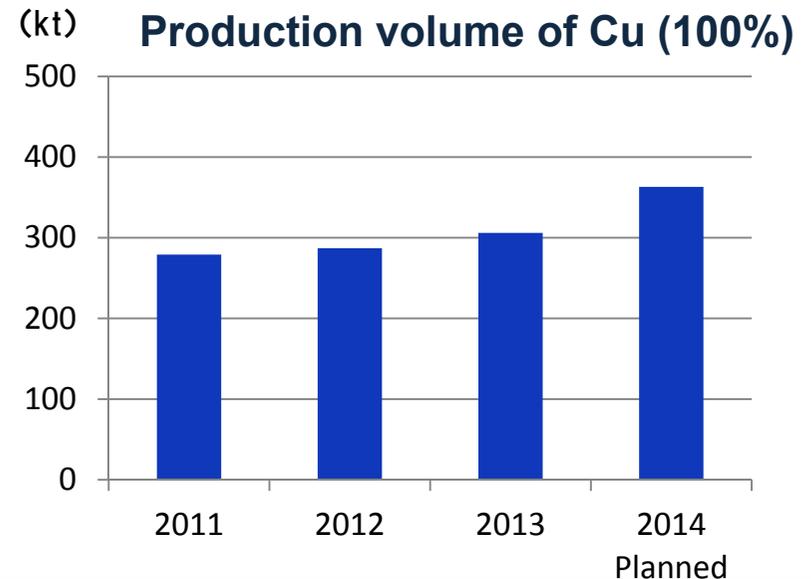


Morenci Mine (USA) Expansion Project

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

Upgrade Plan

	Current status	2014
Mining output	635 kt/day	815 kt/day
Concentration capacity	50 kt/day	115 kt/day
Production volume of copper	280 kt/year	400 kt/year



Schedule

- January 2013 - Decided on participation in project for increasing production
- May 2014 - Start of new mill plant operation
- Currently in ramp-up, increase in production volume from 3Q
Full production in 4Q

1) Mineral Resources

② Increasing Production at Existing Mines Cerro Verde - Cu



Cerro Verde Mine (Peru) Expansion Project

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

Upgrade Plan

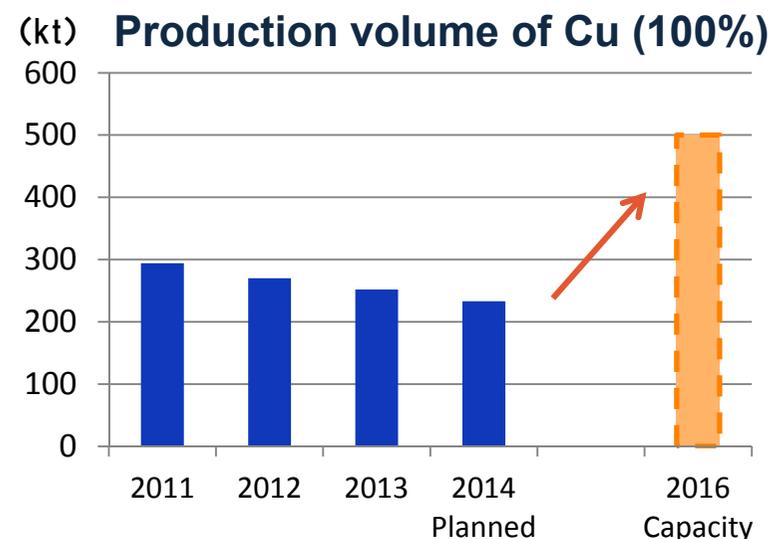
	Current status	2016
Mining output	320 kt/day	850 kt/day
Concentration capacity	120 kt/day	360 kt/day
Production volume of copper	300 kt/year	500 kt/year

Schedule

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

Present - Construction work proceeding steadily

- * 2016 - Full production



1) Mineral Resources

③ Maintenance and Expansion of Existing Au Mine Volume



Hishikari Mine

Production volume and gold content

FY2014 Production plan: 6.5 t

1H performance: 3.4 t

**Lowering of ore grade expected at
planned mining face**

Recovery expected in FY2015

Gold content as of December 31, 2013: 170 t

Development plan for lower ore body

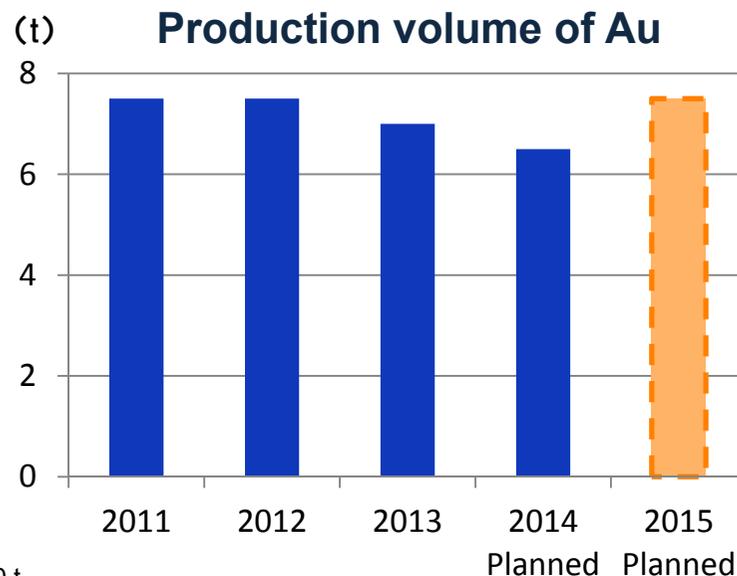
**Confirmed quality mineral vein in the lower part
of ore body being mined**

*** 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

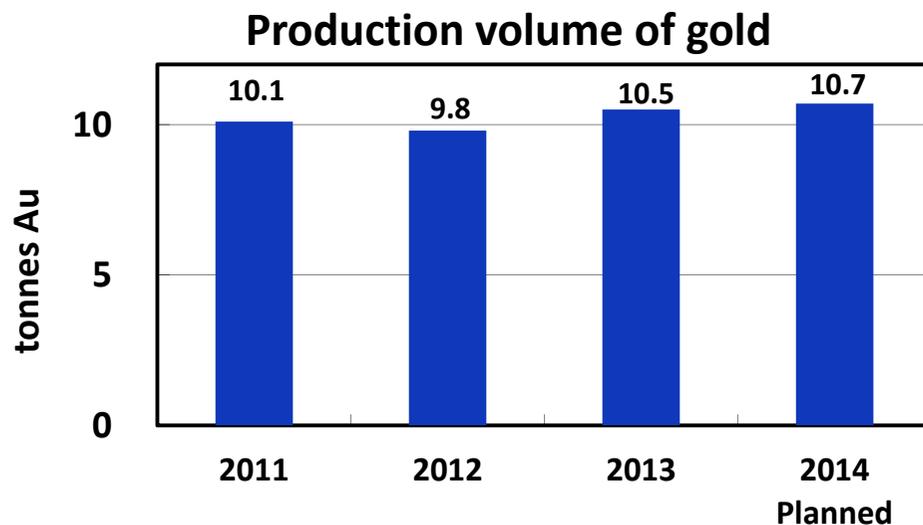
2009 - Acquisition of additional mining interest (51% → 85%)

2014 - Production plan: 10.7 t

1H performance: 5.1 t

Gold content as of December 31, 2013: 144 t

* Actively continue exploration of the surrounding area



East Deep Section Development Plan

* 2014 1Q – Start mining
Construction is progressing steadily

(Note) Gold content of Pogo Gold Mine : Gold contained in reserves plus resources under Canadian standards (Gold content in reserves: 59 t, in resources: 85 t)

1) Mineral Resources

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

Stone Boy Project

- Conduct gold exploration in Alaska
Continue exploration

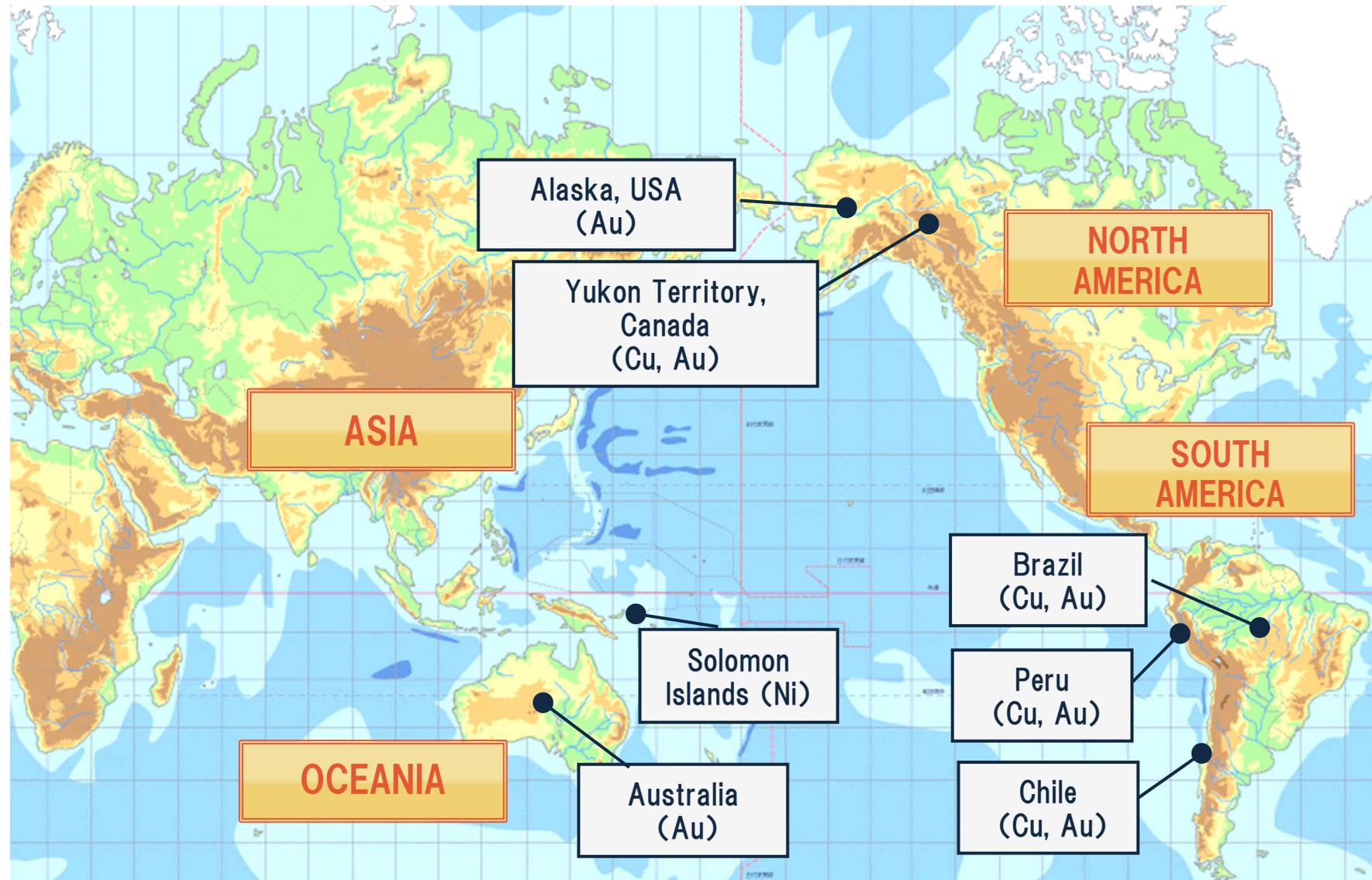
Solomon Project

- 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



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
- Production starts with 30kt per year capacity
→ 36kt capacity in 2016
(20% increase in production)



Schedule

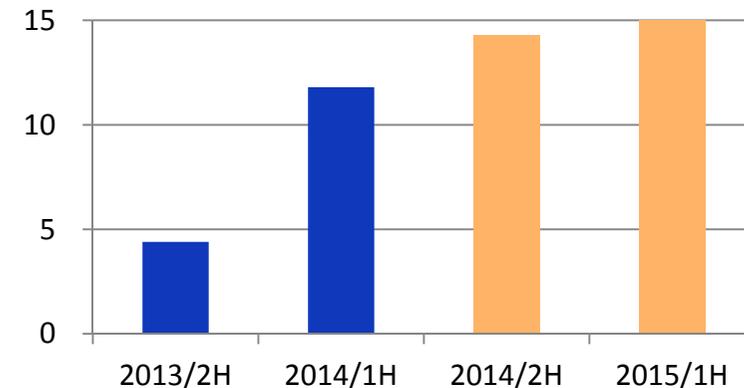
June 2013 – Construction work Completion
Sep – Inauguration Ceremony

June 2014 – Completion of work reached
August – Achievement of 3 kt / month production for the month
14.3 kt production scheduled for 2H

FY 2015: 30 kt production scheduled

**+¥15.0 B project effect forecast
for FY 2014 profits**

Production plan of MS (Ni-kt)

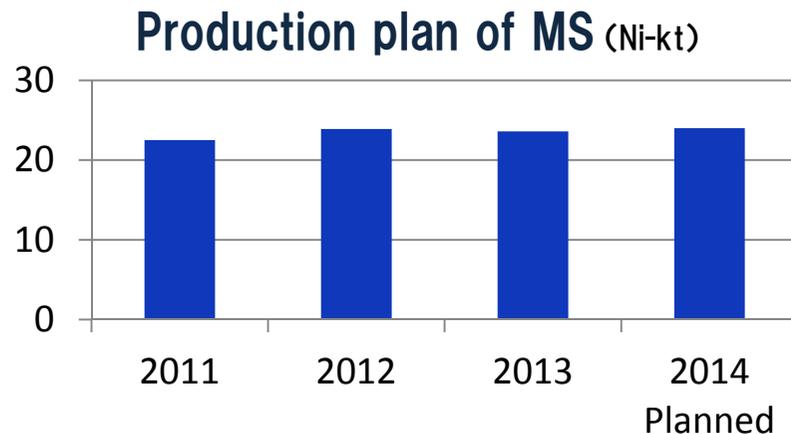


2) Smelting & Refining

② Establish a 100kt Capacity for Ni – Coral Bay Nickel

Coral Bay Nickel (Palawan, Philippines)

Continued 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 Ni 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

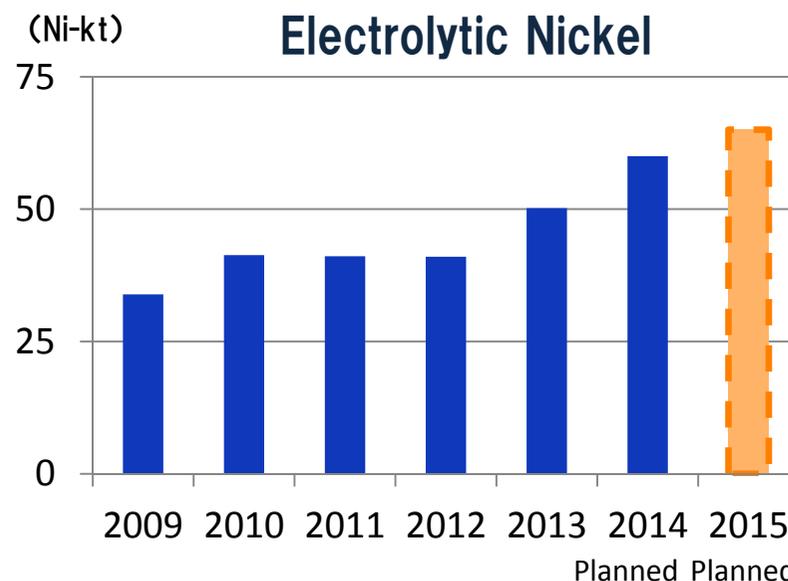
Production Volume

FY2013 – 50 kt

FY2014 – 60 kt (increase in external materials compared to plans)

FY2015 – 65 kt planned, through increased raw material 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
impacts resulted from differences in characteristics, but
operation stabilized from 2Q due to operational improvements

FY2014: Planned production is almost unchanged from previous year

Impacts on business

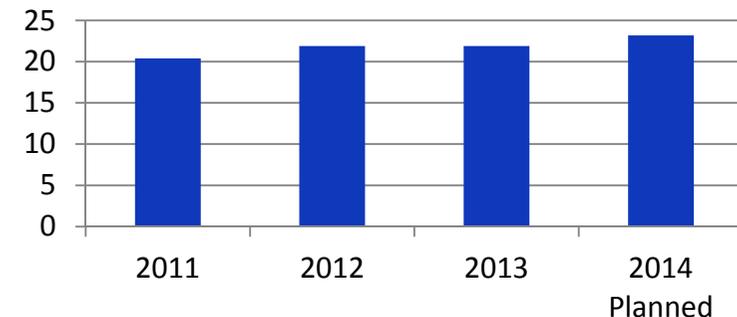
- Considerable rise in ore spot prices
- Increase in processing volume through reduction in ore grade



Make efforts to reduce costs; secure profits



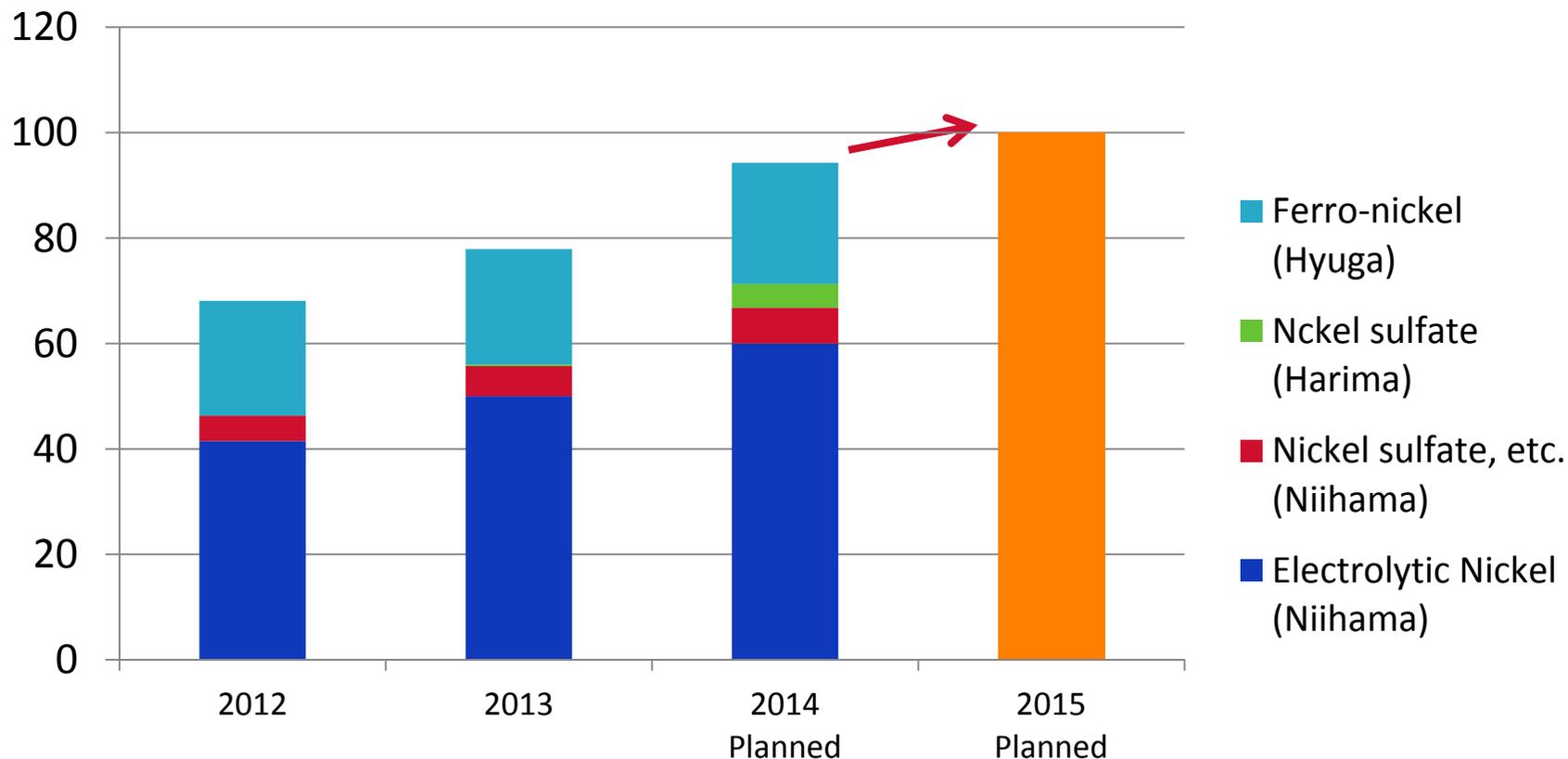
Production volume of
Ferro-nickel (kt)



2) Smelting & Refining

⑤ 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: 95 kt

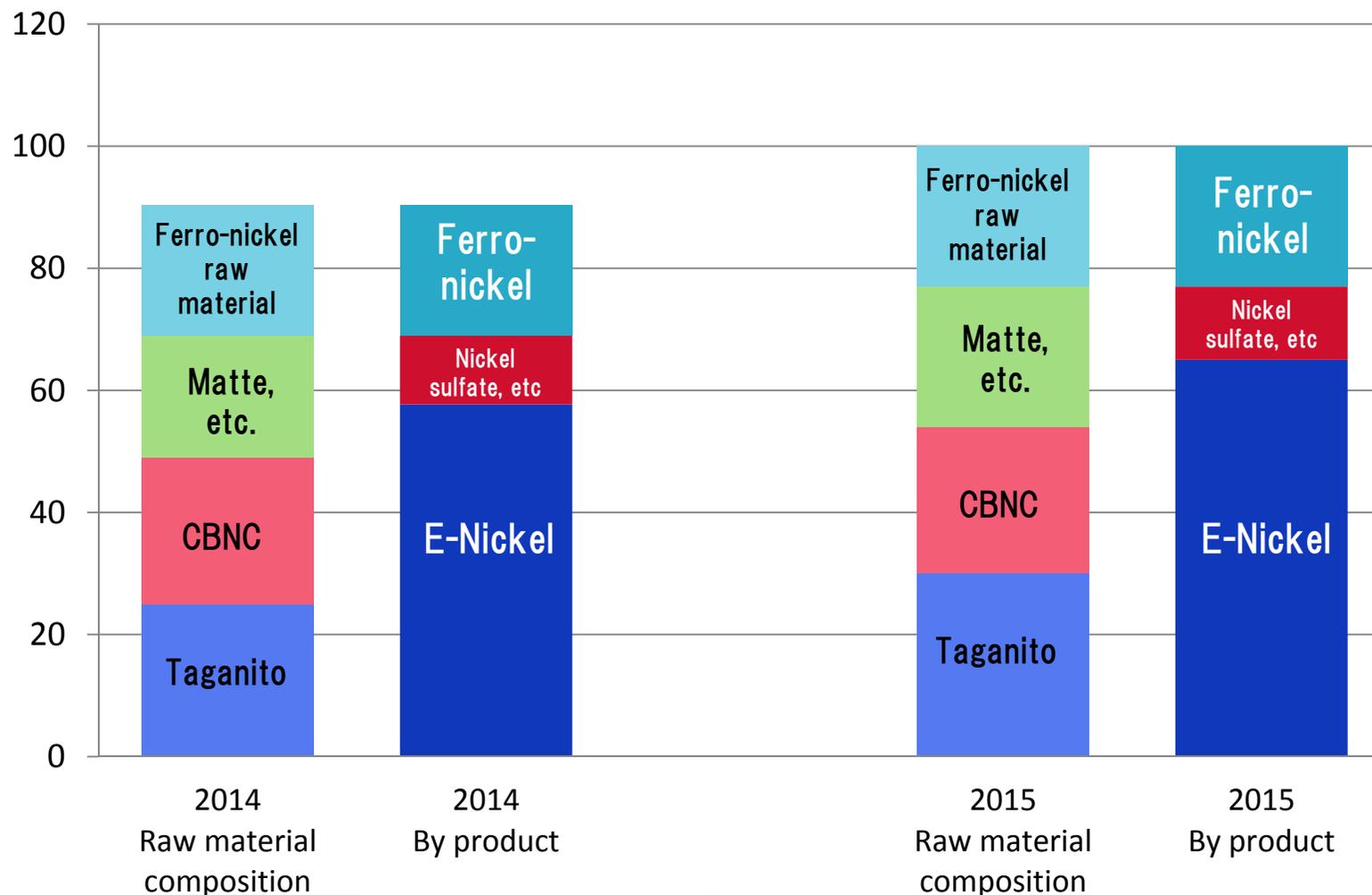
FY2015 - Toward 100 kt production through increase in intermediate products from Taganito

2) Smelting & Refining

⑤ 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

⑥ 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



2) Smelting & Refining

⑧ Cu – Enhance Competitiveness of Toyo Smelter



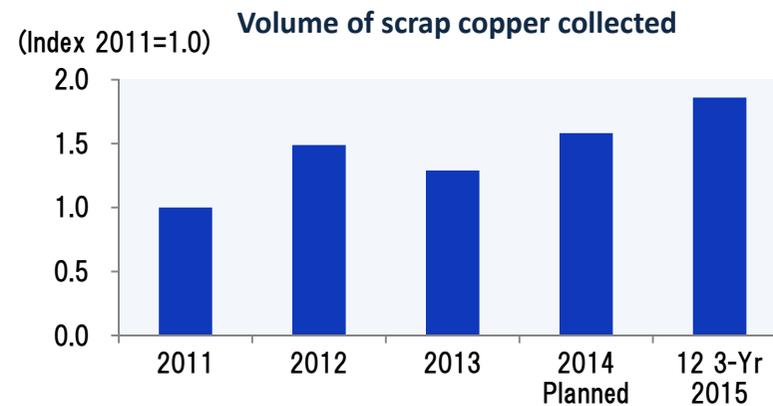
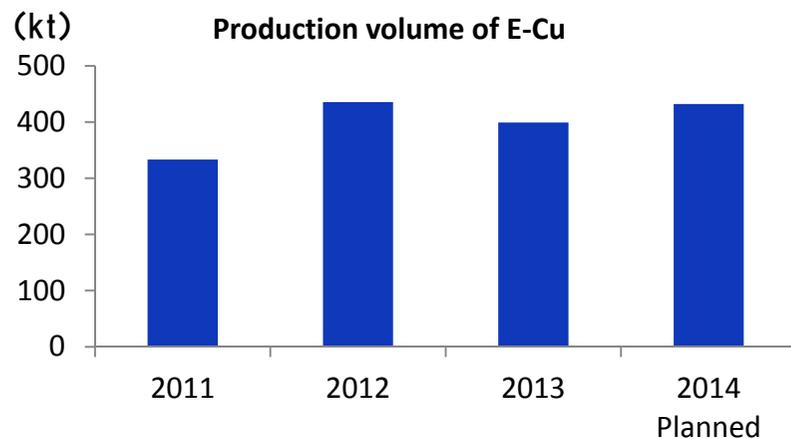
Toyo Smelter & Refinery (Ehime, Japan)

FY2013 Electrolytic copper production volume: 401 kt

FY2014 Production plan: 436 kt

Stable high-load operation at the flash furnace
Progressively increased volume of recycled raw materials
Next large-scale shutdown scheduled for FY 2015

Promote further cost reduction measures



3) Materials

① Pursue Selection and Consolidation, Complete Business Structure Changes

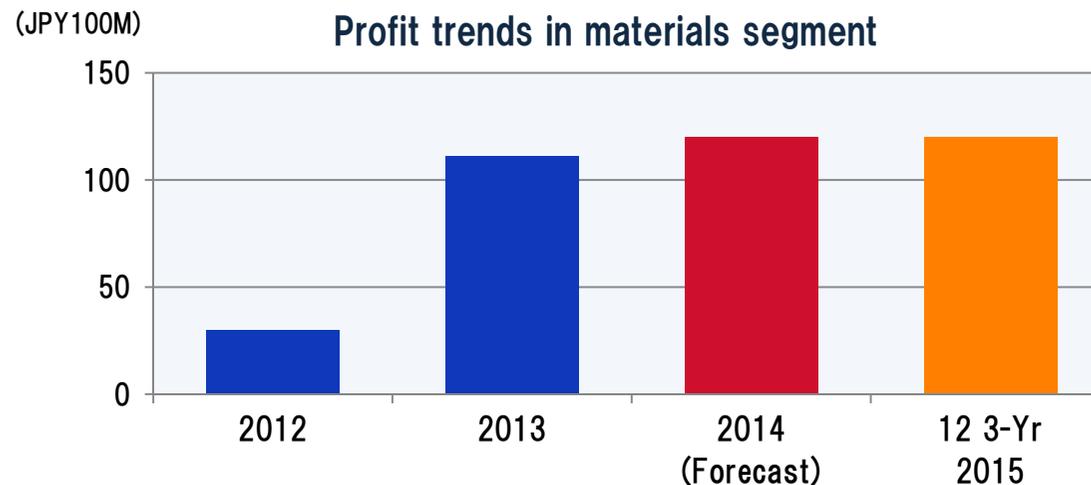
Promotion of the 12 3-Yr Plan Strategy

Implement measures toward realigning of business structure

- Withdrawal from and transfer of COF business
- Withdrawal from and operational transfer of MIM (metal powder injection molding product) Business
- Withdrawal from GaP (gallium phosphide) crystal business

Promote growth strategies

- Increased production of battery materials
- Launch of lead frame integration company
- Improvement of technological and product development capabilities through cooperation with favored customers
- Further speed-up of technological development



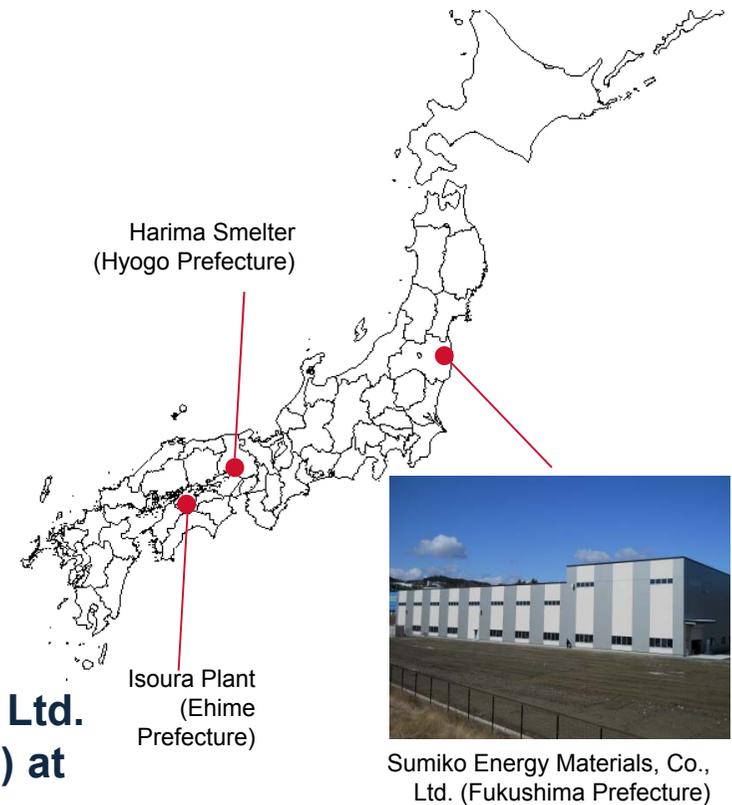
3) Materials - Expansion of Battery Materials Business ①

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 - Expansion of Battery Materials Business ②

Business structure change at Harima Smelter

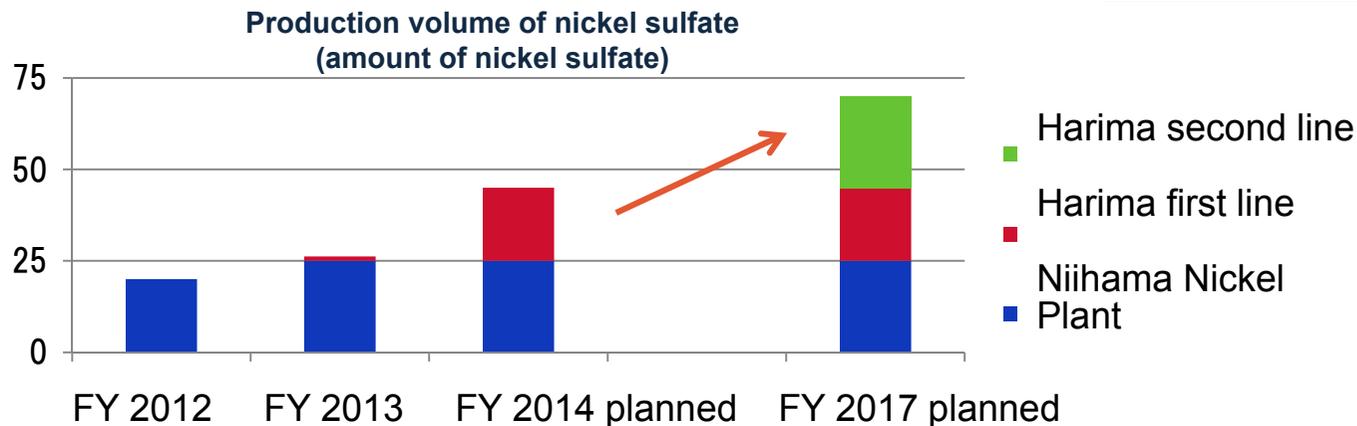
- 1966 - Start of manufacture of distilled zinc
- 2012 - Halt of manufacture of distilled zinc from zinc concentrate : Shift to recycled zinc raw material on all smelting volume
- January 2014 - **Start of nickel sulfate production** (First line) production capacity 20 kt / year
- Autumn 2015 (scheduled)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



Second series total investment

About ¥5.0 B

year1



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

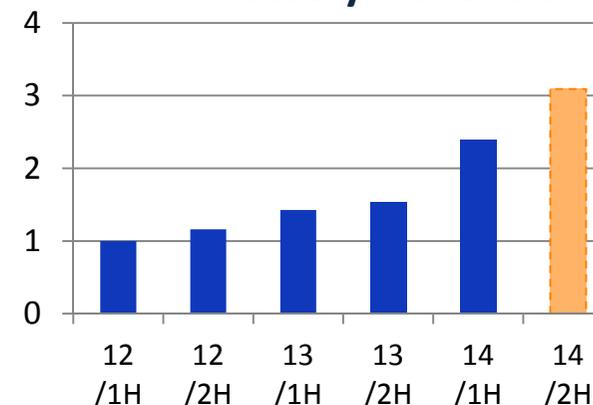
Lithium Nickel Oxide



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

(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.

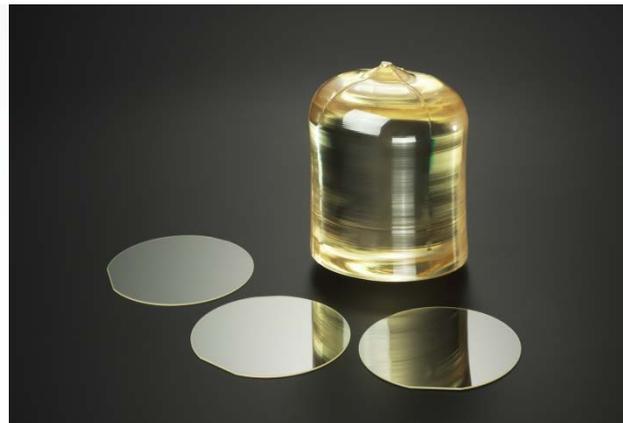
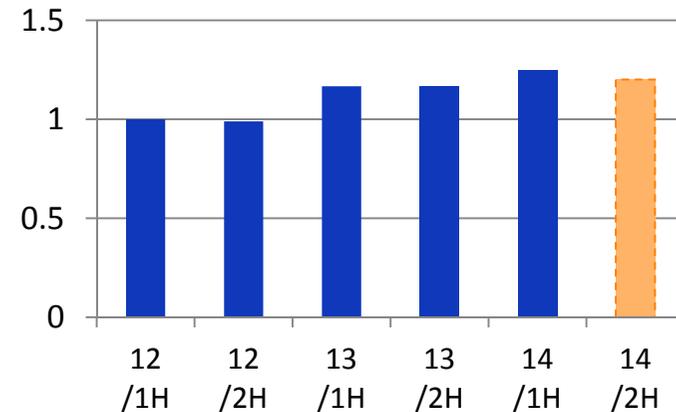
3) Materials ④ Thick Film / Crystal / Thin Film Materials / Leadframes

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)
- ITO targets for touch panels
- Lead frames for IC packages

(Net sales 12/1H=1)
Thick film materials



3) Materials ⑤ Integrate Lead Frame Business

Launch of Integrated Business

July 1, 2013 - Launch

- **Lead frames**

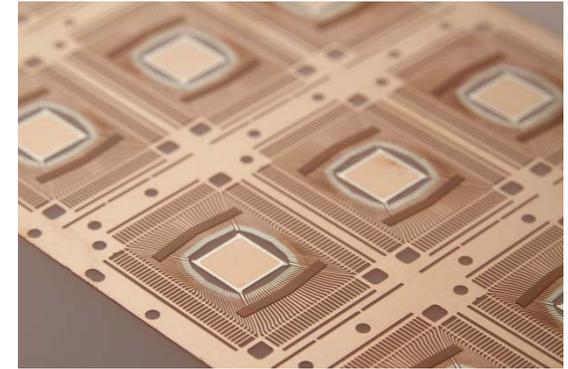
SH Materials Co., Ltd.

Investment ratio: SMM 51%, Hitachi Metals, Ltd. 49%

- **Brass and copper**

SH Copper Products Co., Ltd. (SHCP)

Investment ratio: SMM 50%, Hitachi Metals, Ltd. 50%



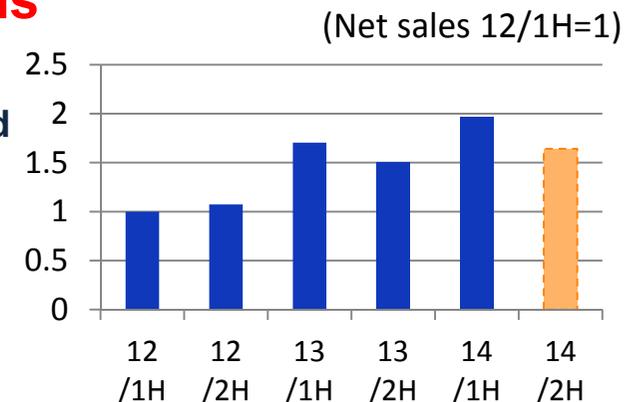
Vertical Integration

Improve competitiveness in materials development and procurement through capital investment in copper products business

Structural Reforms

Make effective use of production equipment and facilities
Construct efficient production systems

Maintain No. 1 competitiveness in the market as a global top manufacturer



4) Promotion of Research & Development

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 23 - Completion ceremony**



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

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

FY 2013 - Target value: ¥5.0 B / Performance: About ¥6.0 B

Progress in FY2014

Target amount: ¥9 billion

1H performance – Target: ¥4.0 B;

Performance: About ¥4.0 B

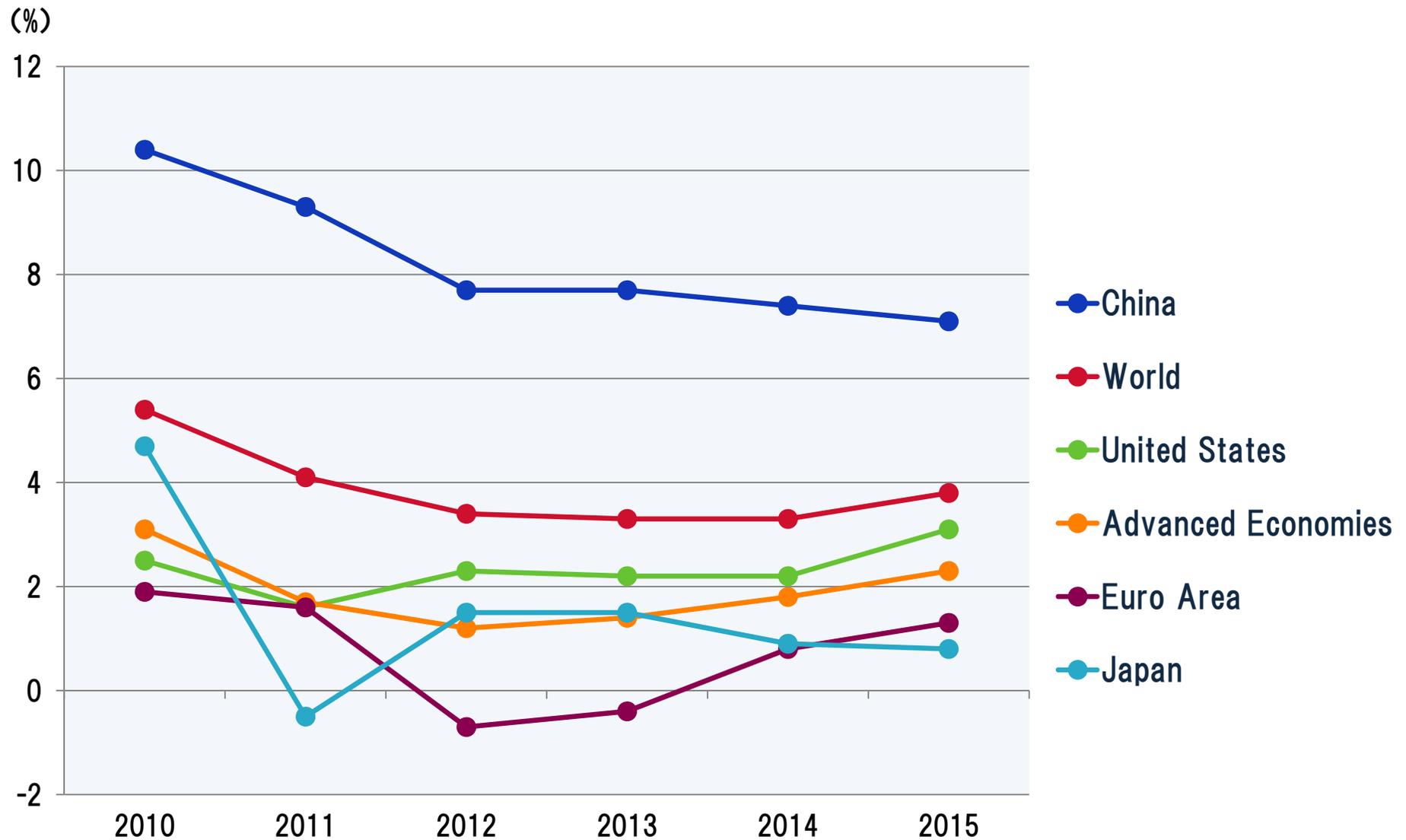
Continuing cost reduction initiatives in all departments

IV. External Environment



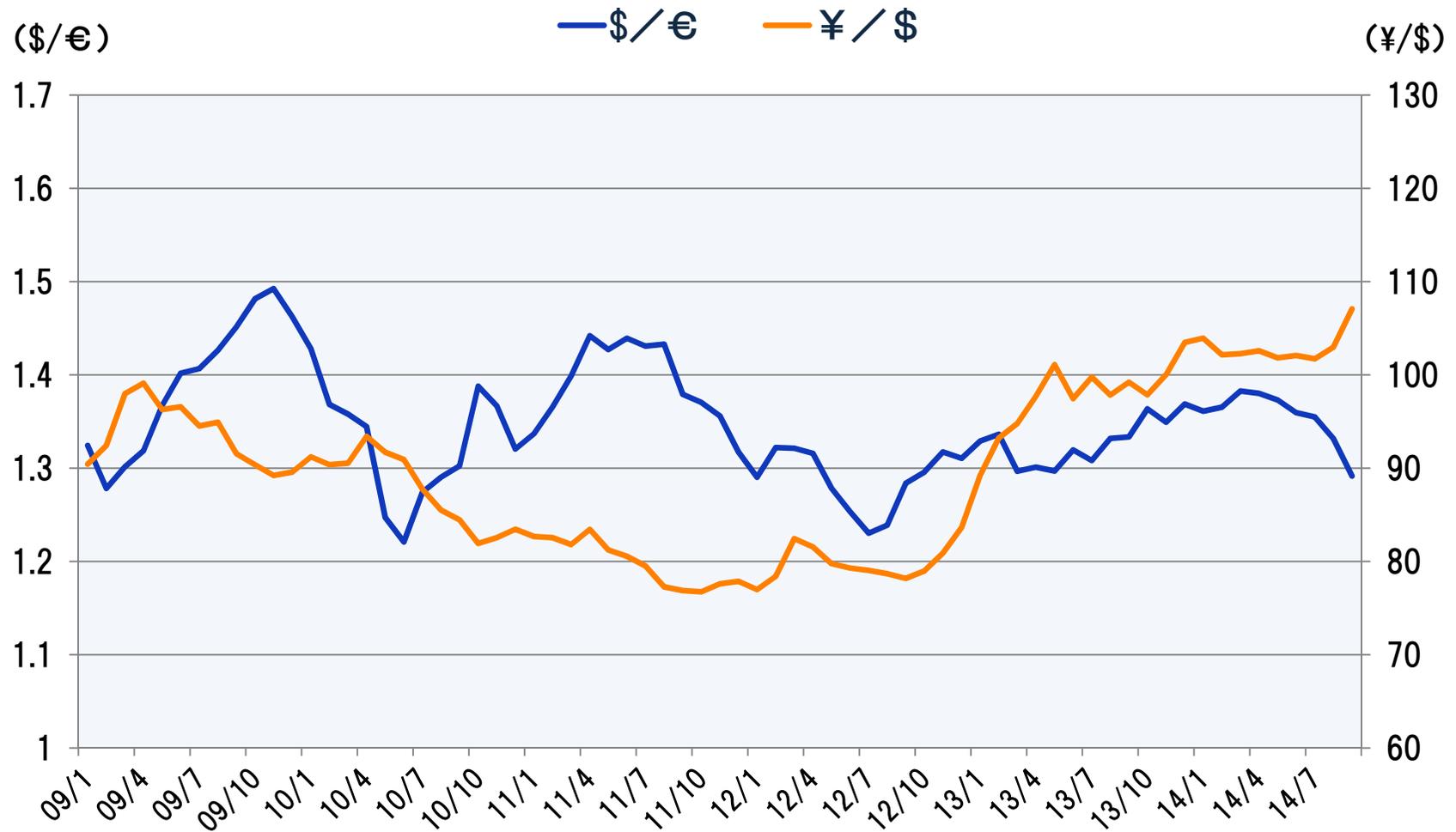
Sierra Gorda

1) General Conditions – Global GDP Growth

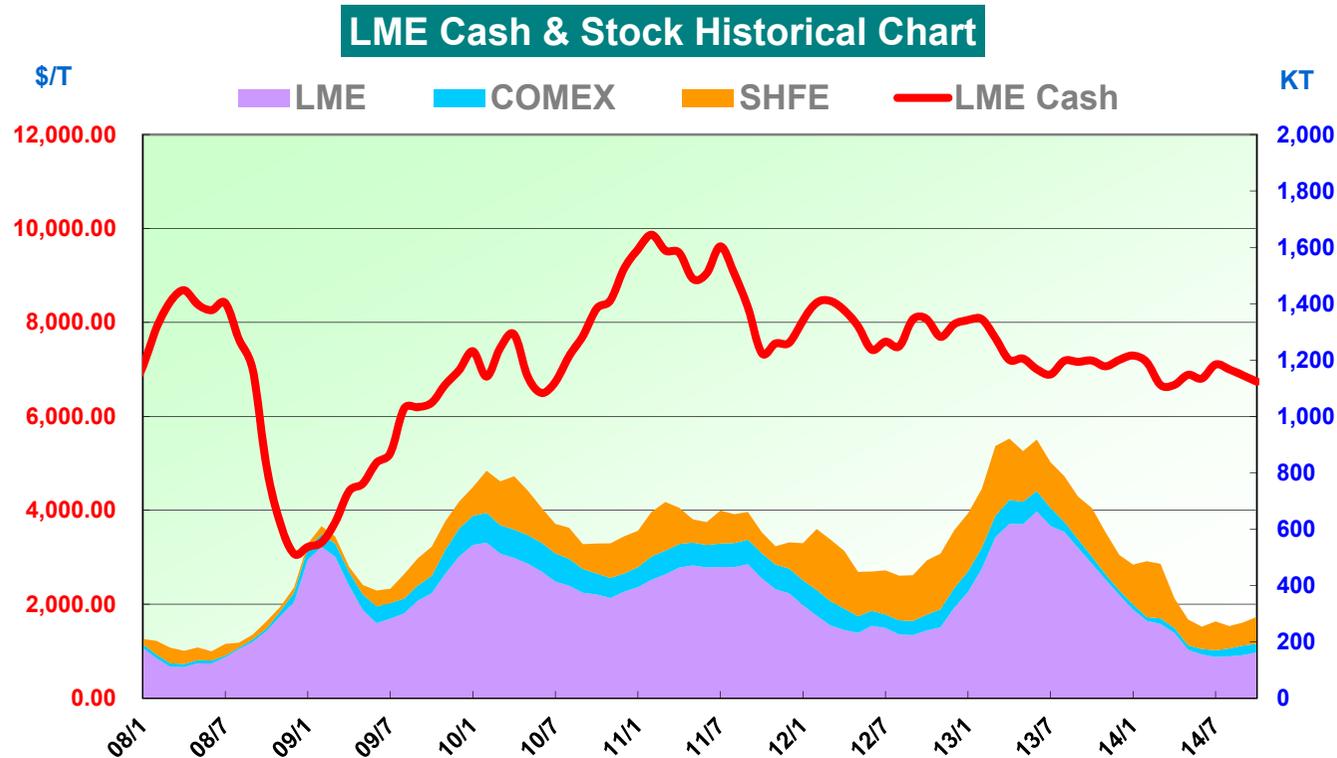


(IMF Oct. 2014)

2) Forex Trends



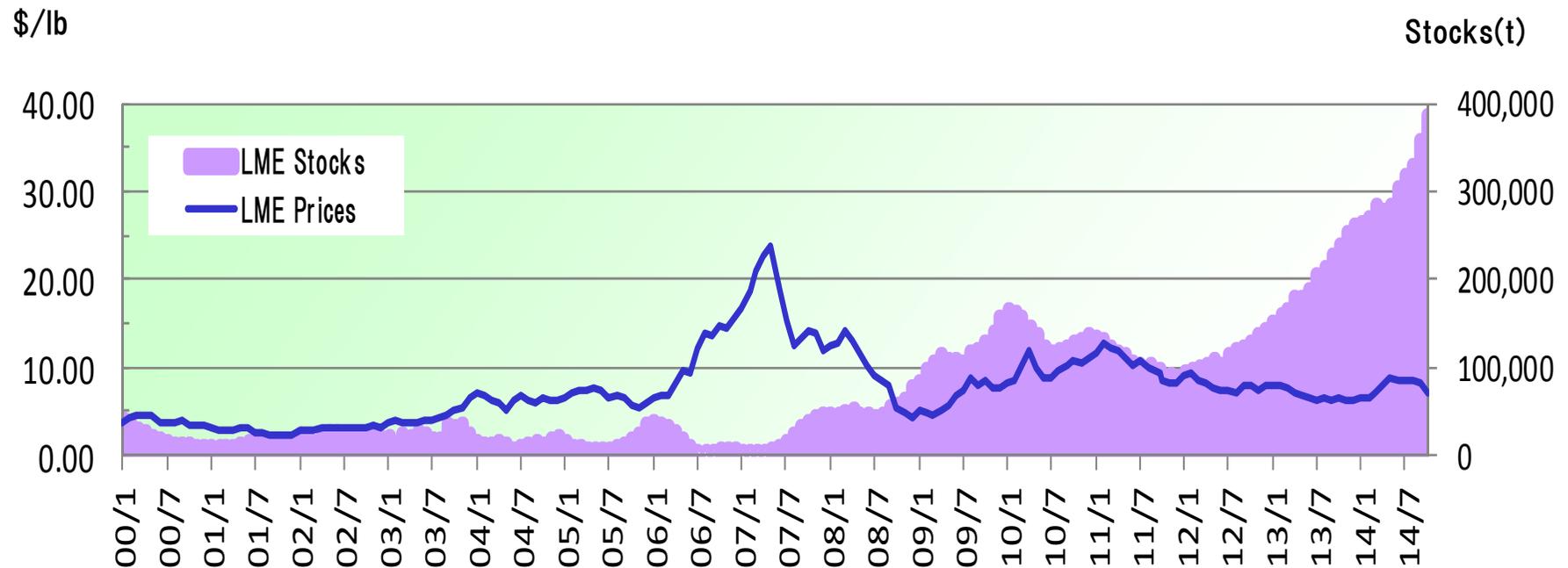
3) Cu – Price / Supply & Demand Balance



[ICSG Estimation Oct.2014]

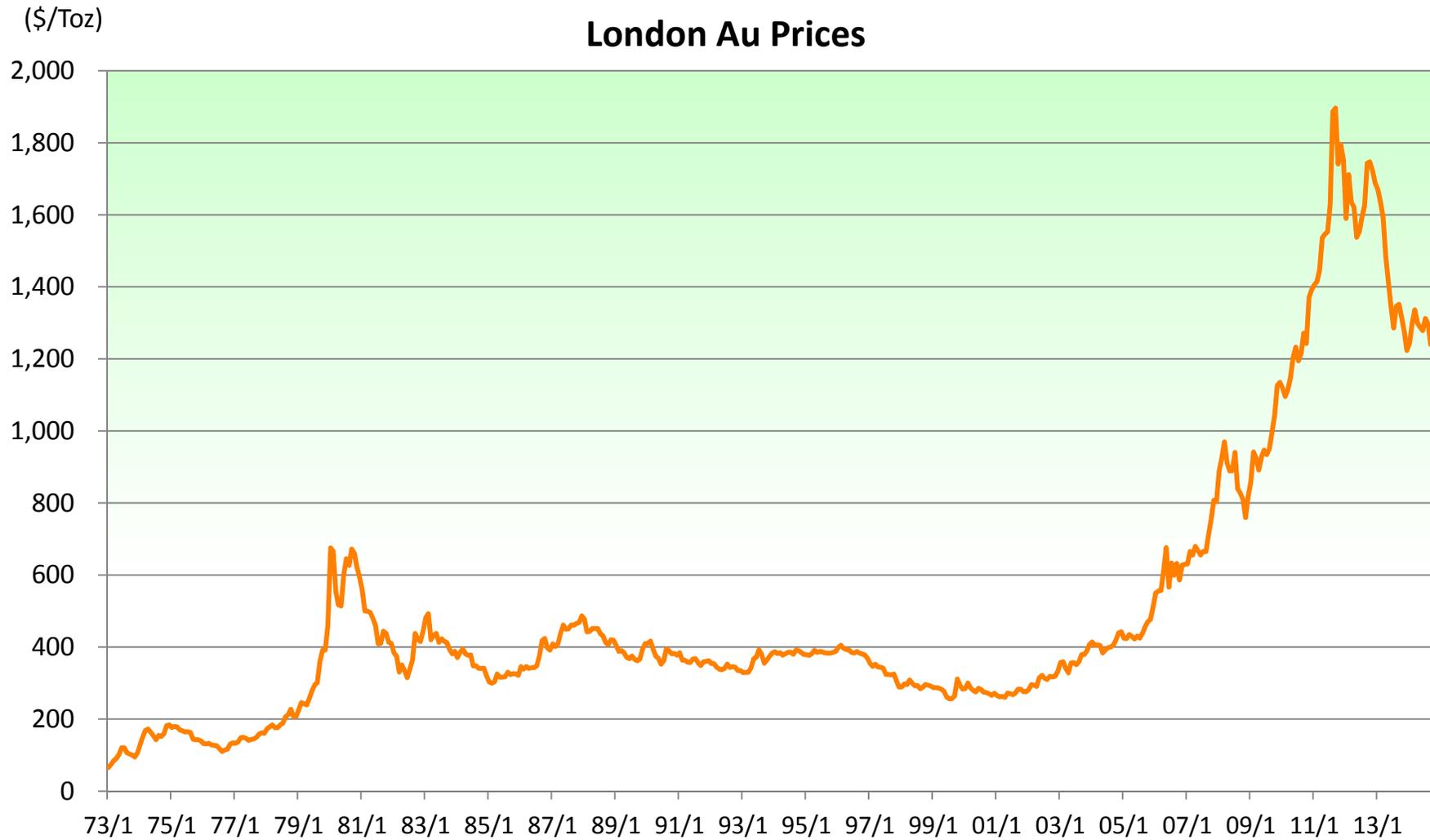
	2013	2014	2015
Production	21,058	22,136	23,086
Usage	21,331	22,443	22,692
Balance	▲272	▲307	393

4) Ni – Price / Supply & Demand Balance



	INSG Est. Oct 2014 (kt)			SMM Est. Oct 2014 (kt)		
	2013	2014	2015	2013	2014	2015
Production	1,944	1,929	1,948	1,906	1,947	1,984
Usage	1,773	1,918	1,974	1,793	1,932	2,016
Balance	171	11	▲26	113	15	▲32

5) Au - Price



V. Financial Highlights and Information Materials



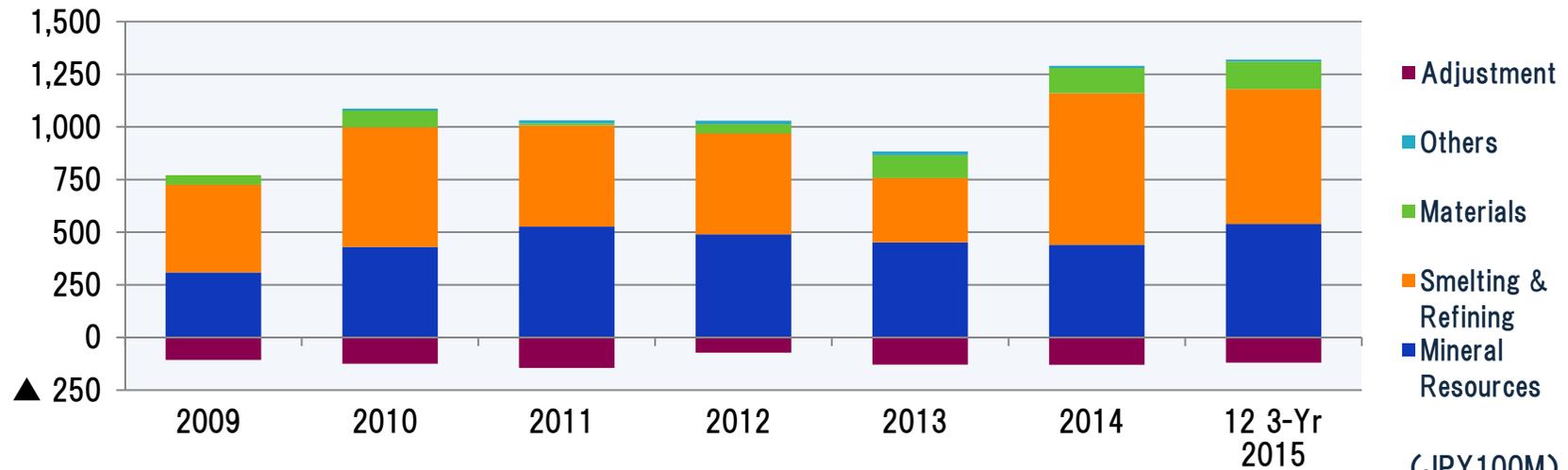
First Shipment of Copper Concentrate from Sierra Gorda Mine
(Port of Antofagasta)

1) Performance Trends

	2009	2010	2011	2012	2013	2014 Forecast	12 3-Yr 2015
Net Sales	7,258	8,641	8,479	8,085	8,305	9,220	9,100
Operating Income	663	962	886	958	754	1,160	1,200
Recurring Profit	879	1,238	1,088	1,150	1,144	1,550	1,500
Equity Method profit	261	348	232	171	307	300	360
Net Income	540	841	653	866	803	1,060	1,000
ROA(%)	5.8	8.3	5.9	6.9	5.5	-	7
ROE(%)	9.9	13.8	10.1	12.1	9.5	-	12
Dividend Per Share(¥)	20.0	32.0	28.0	34.0	37.0	48.0	N/A
Copper (\$/t)	6,101	8,140	8,485	7,855	7,104	6,845	7,500
Nickel (\$/lb)	7.7	10.7	9.6	7.7	6.5	8.0	9.0
Gold (\$/Toz)	1,023	1,294	1,646	1,654	1,327	1,243	1,550
Zinc (\$/T)	1,934	2,187	2,101	1,950	1,909	2,196	1,800
Exchange(¥/\$)	92.9	85.7	79.1	83.1	100.2	105.5	80.0

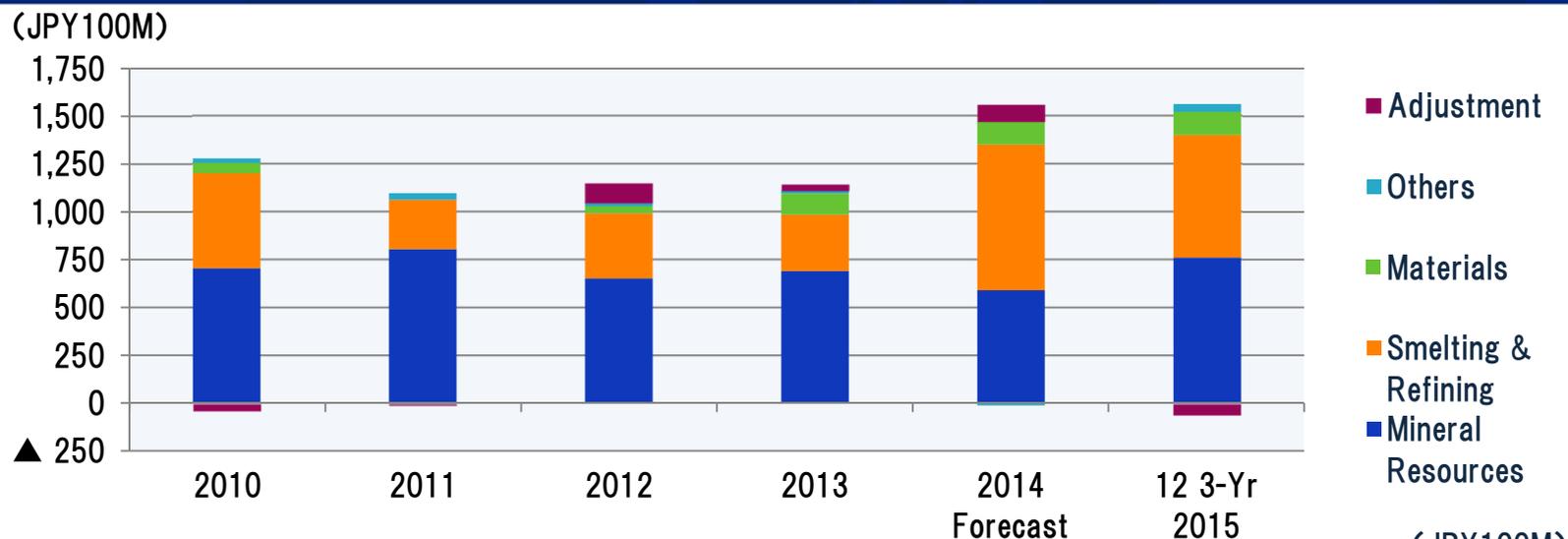
2) Operating Income by Segment

(JPY100M)



	2009	2010	2011	2012	2013	2014 Forecast	12 3-Yr 2015
Mineral Resources	309	432	528	490	452	440	540
Smelting & Refining	417	569	480	479	306	720	640
Materials	45	78	8	45	108	120	130
Others	▲ 1	10	16	16	17	10	10
Adjustment	▲ 107	▲ 127	▲ 146	▲ 72	▲ 129	▲ 130	▲ 120
Total	663	962	886	958	754	1,160	1,200

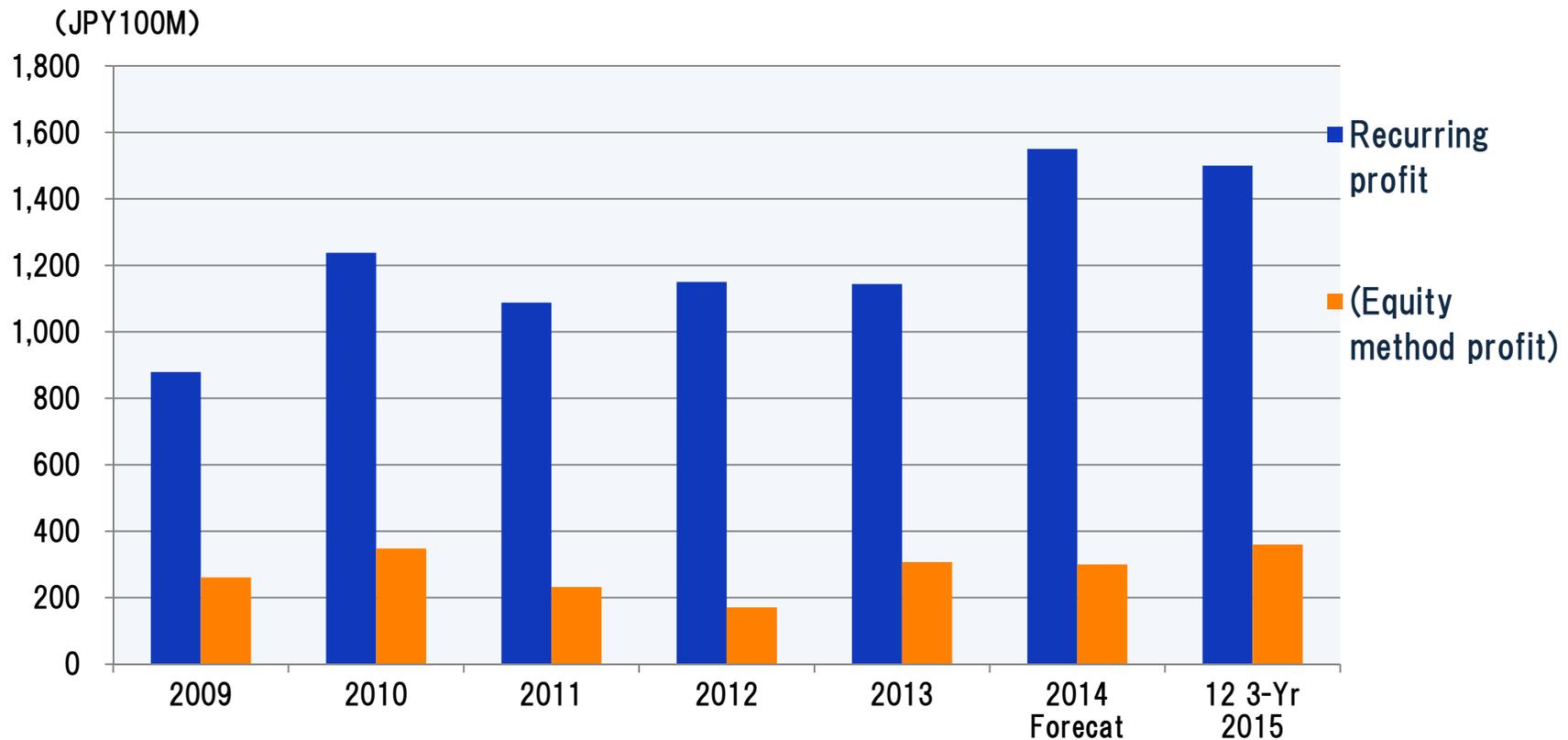
3) Profit Trends by Segment



		2010	2011	2012	2013	2014 Forecast	12 3-Yr 2015
✘ Segment profit	Mineral Resources	705	806	652	691	590	760
	Smelting & Refining	495	256	339	291	760	640
	Materials	54	14	38	111	120	120
	Others	23	19	16	16	0	40
Adjustment		▲39	▲7	105	35	80	▲60
Recurring Profit		1,238	1,088	1,150	1,144	1,550	1,500

✘ FY2010-FY2012 : Contribution Margin (Earlier Bases) / FY2013, FY2014 Forecast, 12 3-Yr 2015 : New Segment Profit

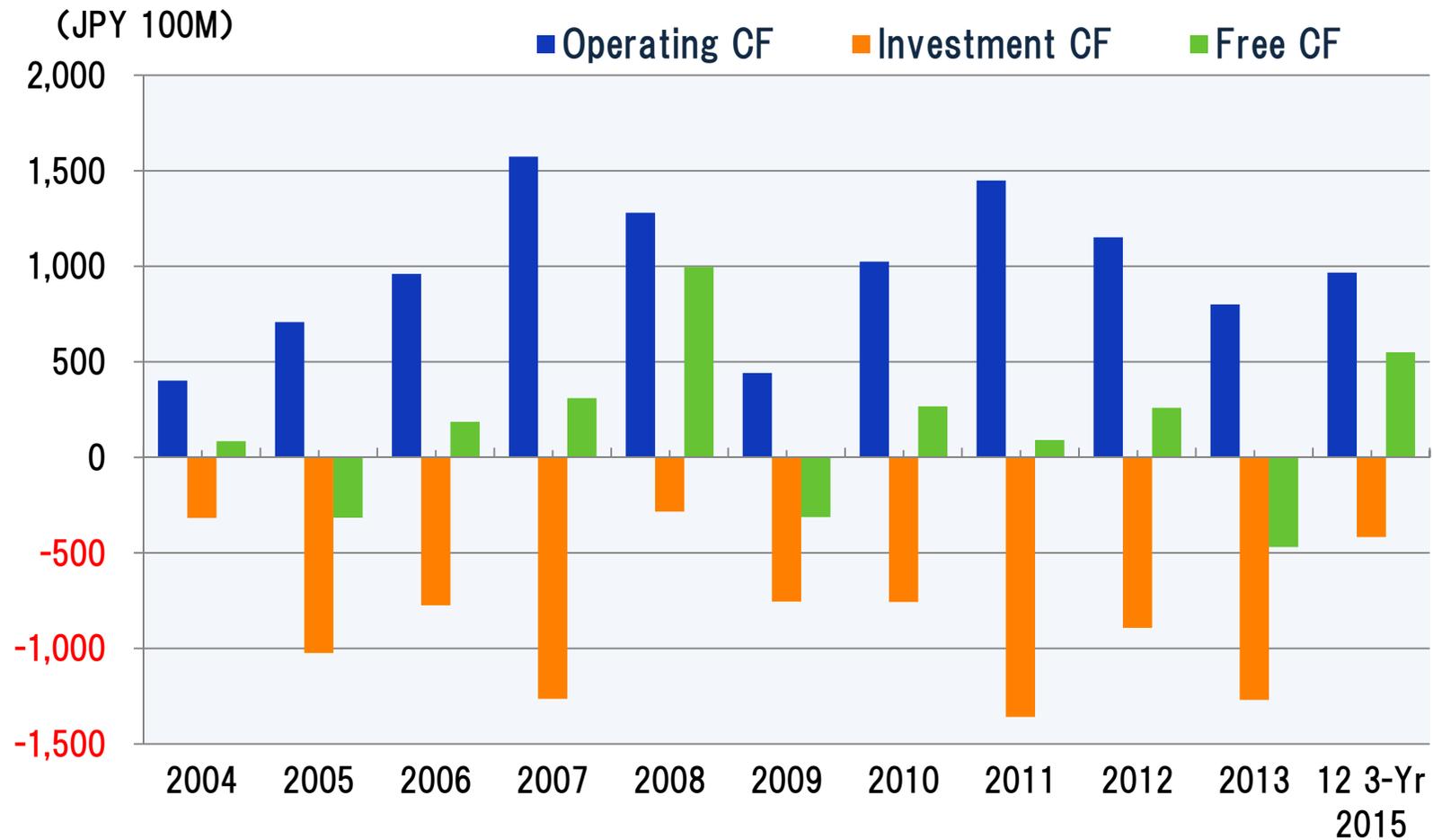
4) Recurring Profit / Equity Method Profit



(JPY100M)

	2009	2010	2011	2012	2013	2014 Forecast	12 3-Yr 2015
Recurring profit	879	1,238	1,088	1,150	1,144	1,550	1,500
(Equity method profit)	261	348	232	171	298	300	360

5) Cash Flow Trends



6) Sensitivity

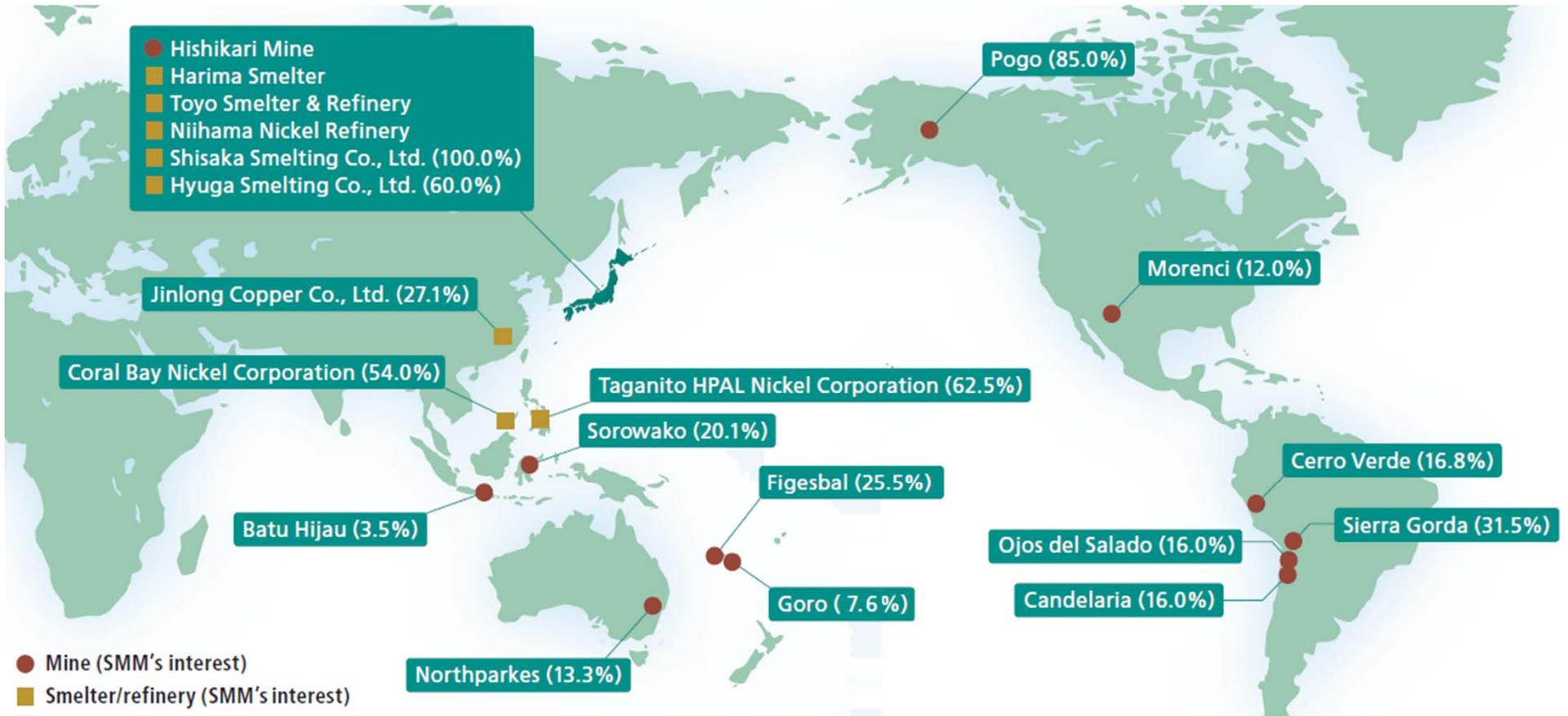
(JPY100M)

Element	Degree of variation	Operating income/ Recurring profit
Cu	$\pm 100\$/t$	8/13
Ni	$\pm 10 \text{ ¢ } /lb$	14/16
Au	$\pm 10\$/TOZ$	5/5
JPY/USD	$\pm \text{¥}1/\text{\$}$	13/14

(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) 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.

8) 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.

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