Evolving unique chemical company

SHOWA DENKO K.K.

2016 Financial Forecast

- Consolidated -

(Announced on February 14, 2017)

Toshiharu Kato, CFO
Corporate Officer

Performance forecast and other statements pertaining to the future as contained in this presentation are based on the information available as of today and assumptions as of today regarding risk factors that could affect our future performance. Actual results may differ materially from the forecast due to a variety of risk factors, including, but not limited to, the economic conditions, costs of naphtha and other raw materials, demand for our products, market conditions, and foreign exchange rates. We undertake no obligation to update the forward-looking statements unless required by law. Performance forecast does not include the effect of planned integration of graphite electrode businesses of SDK and SGL GE, which we announced in October 2016, because the date of business integration has not been specified yet as of today.

Consolidated Companies

- Consolidated subsidiaries: 48
  - 2 companies newly consolidated
    - Shoko Highpolymer Co., Ltd.
    - SunAllomer Ltd.
  - 2 companies excluded
    - Japan Ethyl Acetate Co., Ltd. (Completion of liquidation)
    - SDK Sunrise Investment Ltd. (Merged with SunAllomer Ltd.)
- Equity method applied: 12
  - 1 company excluded
    - SunAllomer Ltd.

Selected Data

(Average)

	2015		2016		Increase/decrease	
		Oct.-Dec.		Oct.-Dec.		Oct.-Dec.
■Exchange rate: ¥/US$	121.1	121.5	108.8	109.3	Yen appreciated by ¥12.2/$	Yen appreciated by ¥12.2/$
■Domestic naphtha price: ¥/KL	46,000	40,900	32,800	34,000	-13,200	-6,900
■Aluminum						
LME price: US$/T	1,682	1,508	1,610	1,709	-73	201
Domestic market*: K¥/T	273	237	227	238	-46	1

Exchange rate at the end of December, 2015 ¥120.6/US$, at the end of December, 2016 ¥116.5/US$
⇒Yen appreciated by ¥4.1/US$

*Domestic market: data from Nikkei

Summary

(Unit: Billions of Yen)

	2015	2016 Forecast*	Increase/ decrease
Net Sales	781.0	671.2	-109.8
Operating Income	33.7	41.8	8.2
Non-operating income and expenses, net	-1.4	-3.3	-1.8
Interest/Dividends income and expenses	-2.2	-1.6	0.6
Equity in earnings of affiliates	1.9	4.3	2.4
Foreign exchange gains or losses	-0.4	-1.7	-1.2
Other	-0.8	-4.3	-3.5
Ordinary Income	32.2	38.6	6.4
Extraordinary Profit	8.4	1.7	-6.7
Extraordinary Loss	-34.4	-23.9	10.5
Income before income taxes	6.2	16.3	10.1
Income taxes	-13.9	-3.7	10.2
Profit	-7.7	12.6	20.3
Profit attributable to non-controlling interests	8.7	-1.6	-10.2
Profit attributable to owners of parent	1.0	11.0	10.1
Net Income per share**	¥6.78	¥77.12	¥70.34
Cash dividends per share**	¥3.00	¥30.00	—

(*) 2016 Forecast was announced on Feb. 14, 2017.

(**) SDK consolidated every ten shares of its common stock into one share on July 1, 2016. The above-mentioned "Net Income per share" for 2015 and 2016 are calculated on the basis of the number of outstanding shares after this consolidation and "Cash dividends per share" for 2015 is calculated on the basis of the number of outstanding shares before this consolidation, while that for 2016 is calculated on the basis of the number of outstanding shares after this consolidation.

Extraordinary Profit/Loss

(Unit: Billions of Yen)

	2015	2016 Forecast*	Increase/decrease
■Extraordinary Profit	8.4	1.7	-6.7
●Gain on sales of fixed assets	0.2	0.8	0.6
●Gain on bargain purchase	—	0.7	0.7
●Other	8.2	0.1	-8.0
■Extraordinary Loss	-34.4	-23.9	10.5
●Loss on sales and retirement of noncurrent assets	-4.1	-4.0	0.0
●Impairment loss	-10.7	** -17.0	-6.3
●Provision for business structure improvement	0.0	-0.7	-0.7
●Provision of allowance for doubtful accounts	-13.4	—	13.4
●Other	-6.2	-2.1	4.1
■Extraordinary Profit/Loss, Net	-26.0	-22.3	3.7

●Impairment loss (2016 Forecast*)

(Unit: Billions of Yen)

Segment	Business	Place	Amount
Electronics	Electronics materials	Chichibu City, Saitama	-4.5
Aluminum	Aluminum specialty components	Oyama City, Tochigi	-8.0
		Other	-4.5
		Total	** -17.0

(*) 2016 Forecast was announced on Feb. 14, 2017.
(**) Total impairment loss posted for 4Q 2016 was 15.2 billion yen.

Consolidated Sales by Segment

(Unit: Billions of Yen)

	2015	2016 Forecast*	Increase/ decrease	
Petrochemicals	231.3	185.8	-45.5	【Olefins】sales decreased (naphtha price down, shipment volumes slightly down due to shutdown maintenance of derivative plants) 【Organic chemicals】sales decreased (vinyl acetate, ethyl acetate: price down)
Chemicals	142.3	134.5	-7.8	【Basic chemicals】sales decreased (AN: market price down) 【Electronic chemicals】sales slightly increased 【Functional chemicals】sales decreased (transferred phenolic resin business) 【Industrial gases】sales slightly increased
Electronics	131.5	103.3	-28.2	【HDs】sales decreased (shipment volumes down, yen appreciated) 【Compound semiconductors】【Rare earths】sales decreased
Inorganics	63.5	50.9	-12.6	【Ceramics】sales decreased (shipment volumes of alumina down) 【Graphite electrodes】sales decreased (shipment volumes up but market price down)
Aluminum	100.8	98.6	-2.2	【High-purity foil for capacitors】sales increased (shipment volumes up) 【Aluminum specialty components】sales decreased (metal price down, shipment volumes for automotive applications down) 【Aluminum cans】sales increased (Hanacans Joint Stock Company: shipment volumes up)
Others	152.5	142.4	-10.1	【LIB materials】sales slightly increased (shipment volumes up for smartphone and automotive applications) 【SHOKO Co., Ltd.】sales decreased
Adjustments	-40.8	-44.3	-3.5	
Total	781.0	671.2	-109.8	

(*) 2016 Forecast was announced on Feb. 14, 2017.

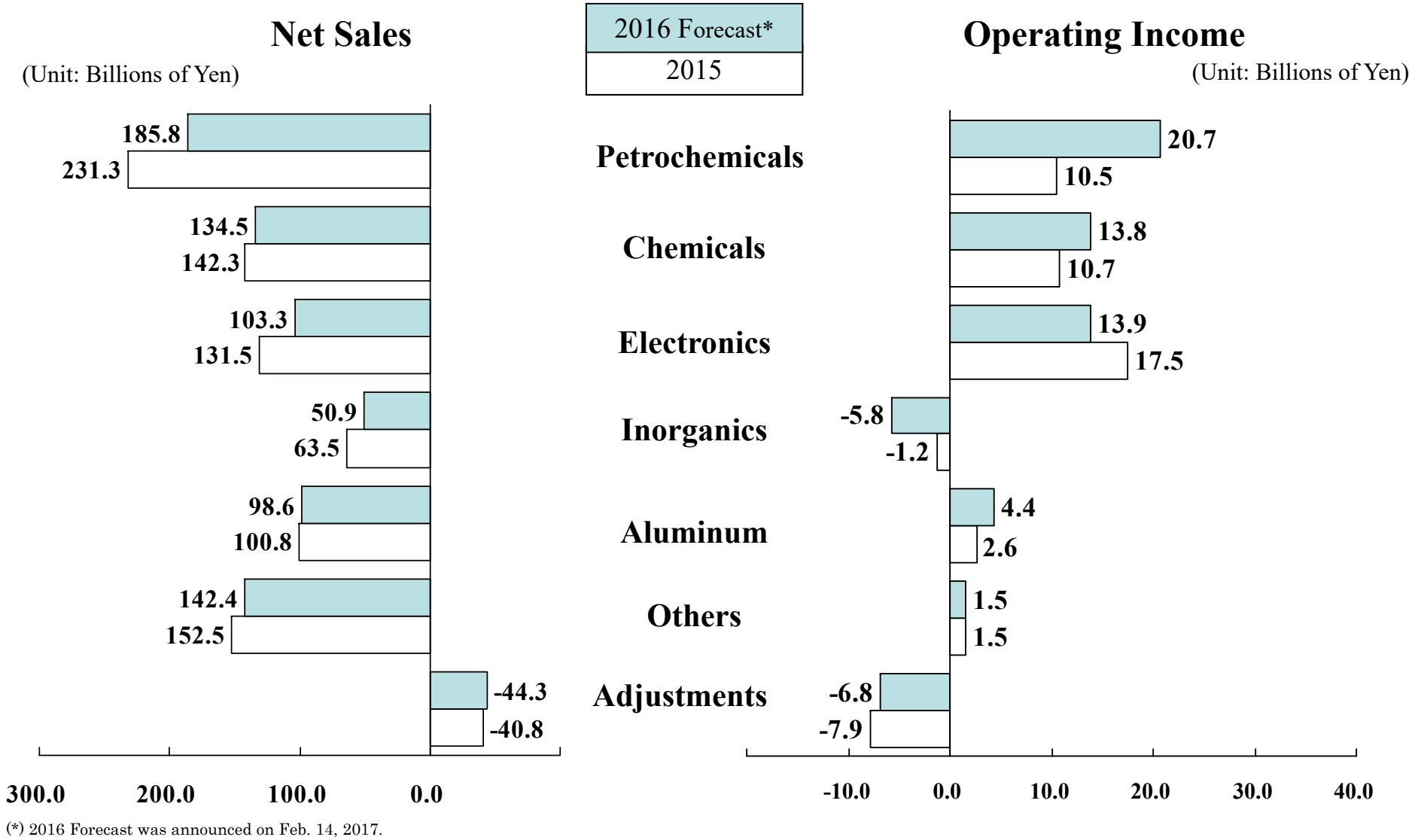
Consolidated Operating Income by Segment

(Unit: Billions of Yen)

	2015	2016 Forecast*	Increase/ decrease	
Petrochemicals	10.5	20.7	10.1	【Olefins】profit increased (continued high operation rate, raw naphtha price down) 【Organic chemicals】profit increased (vinyl acetate, ethyl acetate: high operation rate, prices of raw materials down)
Chemicals	10.7	13.8	3.1	【Basic chemicals】profit increased (ammonia: shipment volumes up, raw materials prices down, the ratio of recycled plastics among raw materials increased) 【Electronic chemicals】profit decreased (high operation rate but yen appreciated) 【Functional chemicals】profit increased 【Industrial gases】profit increased (liquefied carbon dioxide, dry ice shipments steady) 【Power generating business】profit increased
Electronics	17.5	13.9	-3.6	【HDs】profit decreased (shipment volumes down, yen appreciated) 【Compound semiconductors】profit decreased (shipment volumes down) 【Rare earths】profit increased
Inorganics	-1.2	-5.8	-4.5	【Ceramics】profit decreased (shipment volumes of alumina down) 【Graphite electrodes】profit decreased (market price down)
Aluminum	2.6	4.4	1.9	【High-purity foil for capacitors】profit increased (shipment volumes up) 【Aluminum specialty components】profit decreased (shipment volumes for automotive applications down) 【Aluminum cans】profit increased (Hanacans Joint Stock Company: shipment volumes up)
Others	1.5	1.5	0.1	【LIB materials】profit increased (shipment volumes up)
Adjustments	-7.9	-6.8	1.1	
Total	33.7	41.8	8.2	

(*) 2016 Forecast was announced on Feb. 14, 2017.

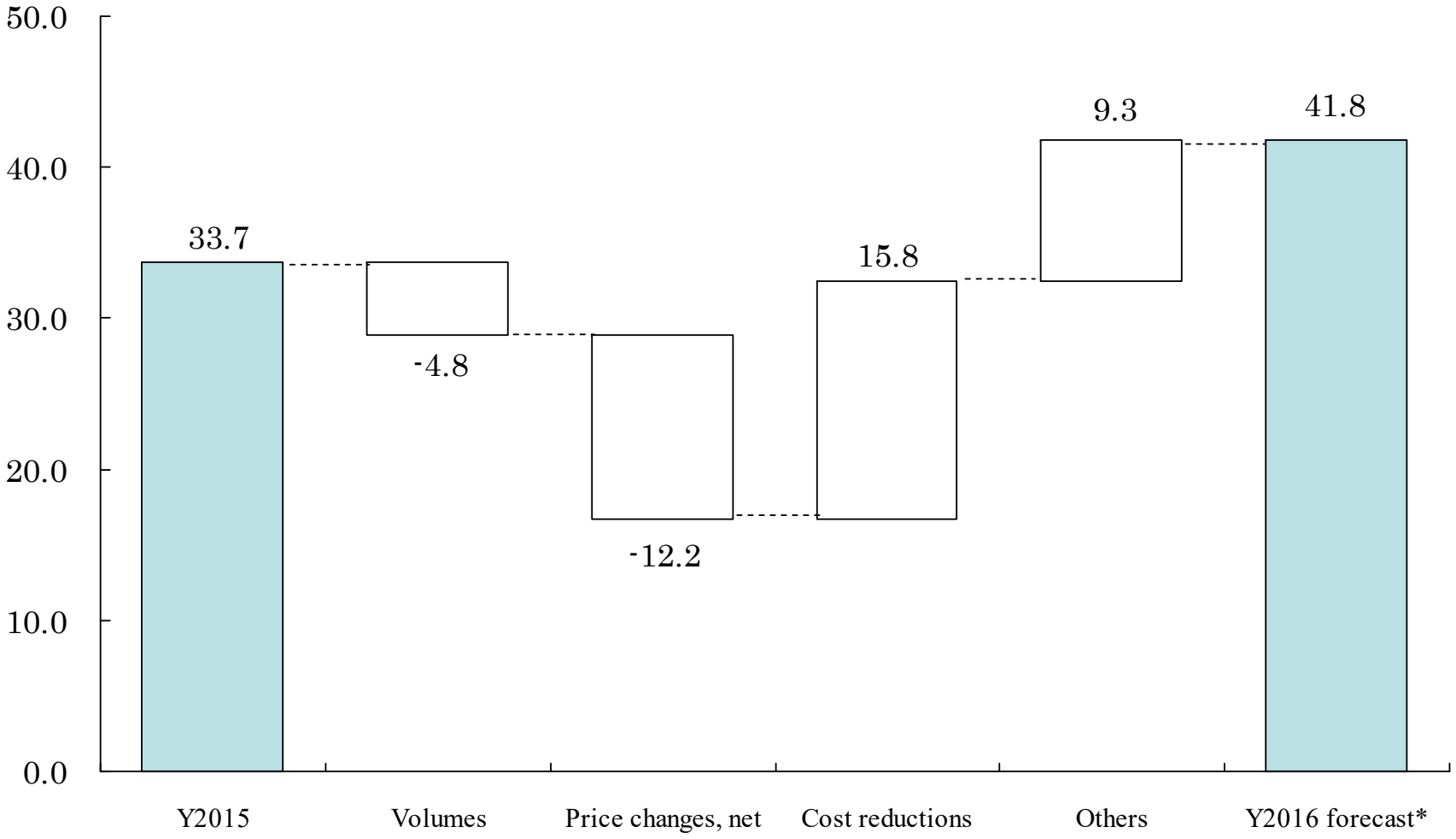
Sales and Operating Income by Segment



(*) 2016 Forecast was announced on Feb. 14, 2017.

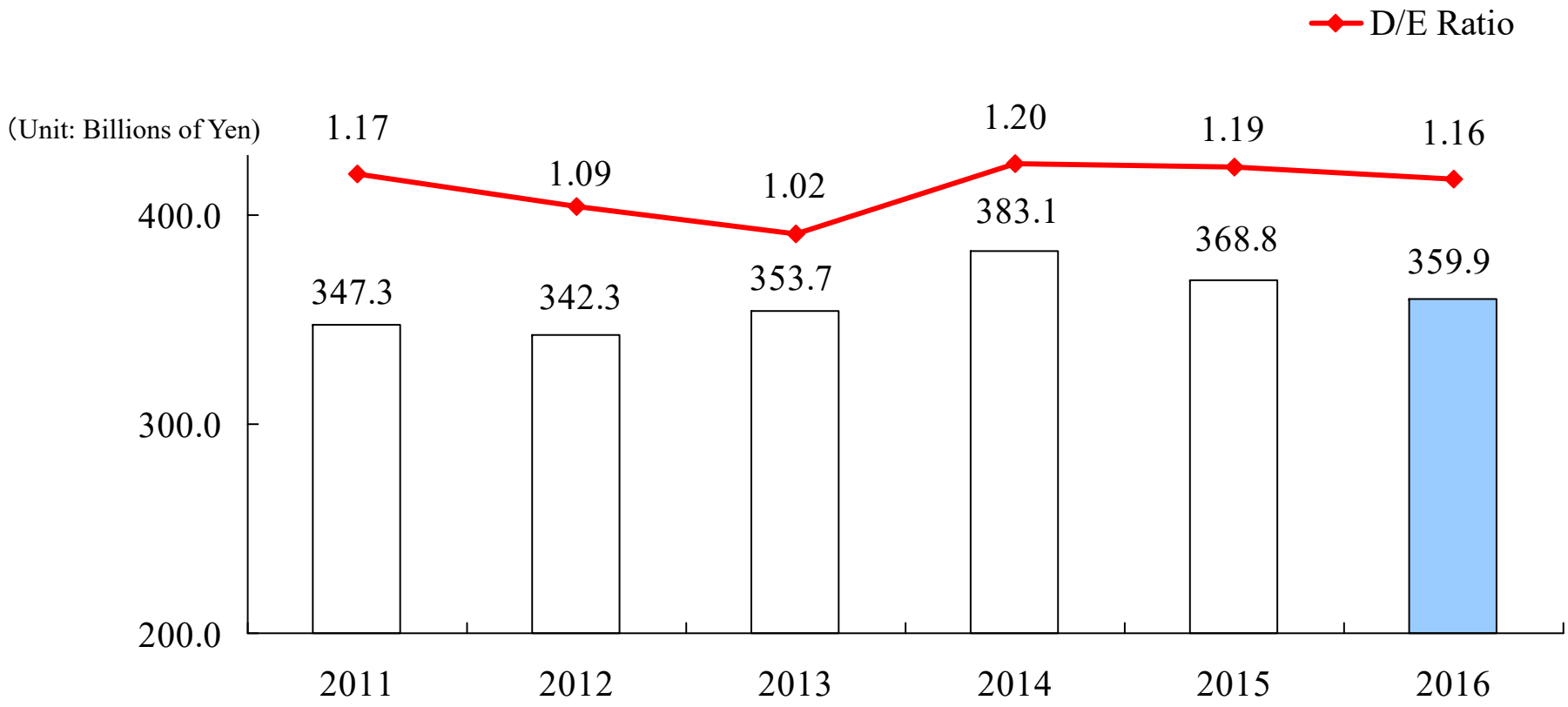
Operating Income Breakdown by Factor

(Unit: Billions of Yen)

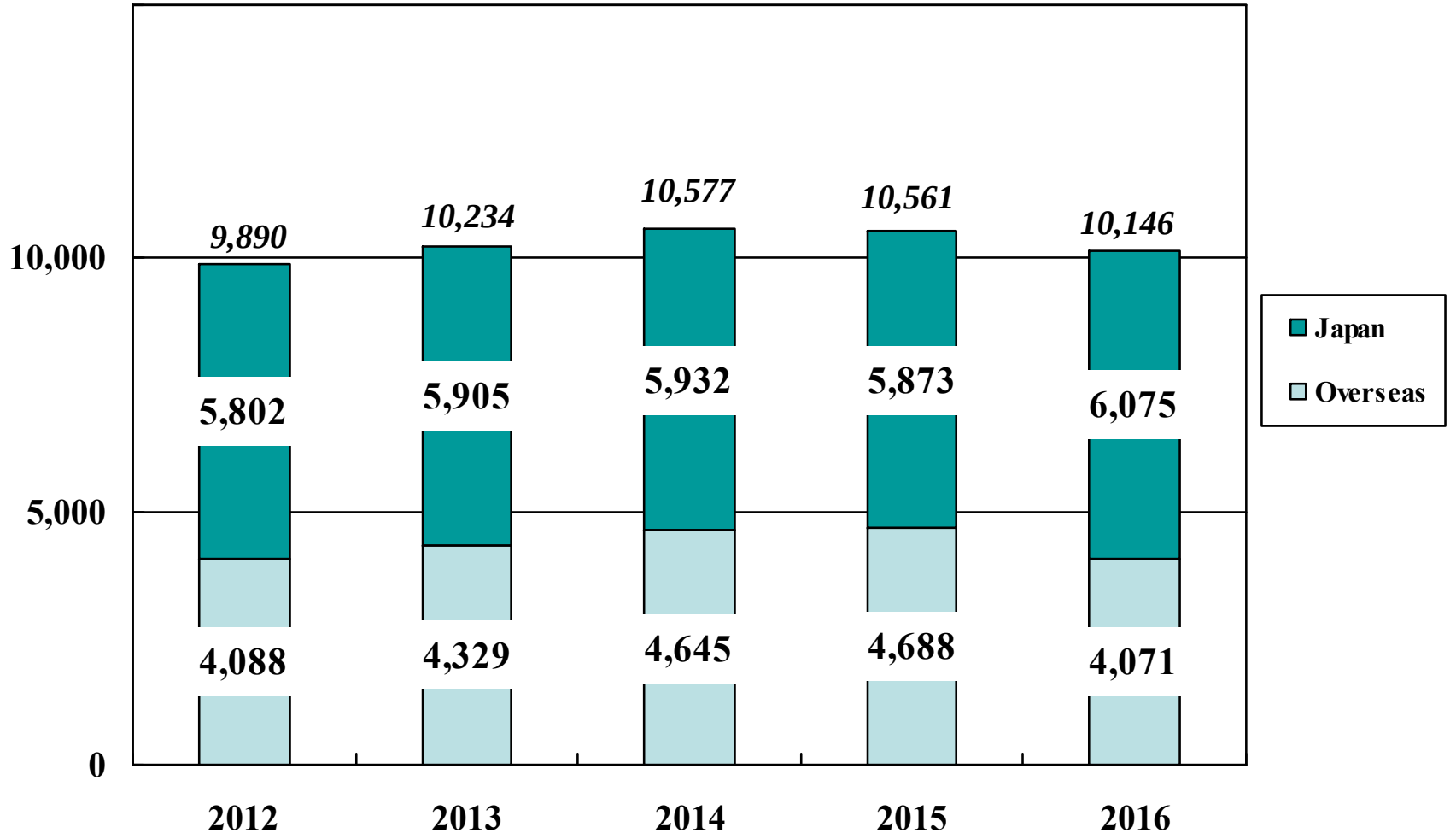


(*) 2016 forecast was announced on Feb. 14, 2017.

Interest-bearing Debt



Total number of employees and breakdown by location



Japan	58.7%	57.7%	56.1%	55.6%	59.9%
Overseas	41.3%	42.3%	43.9%	44.4%	40.1%

Capital expenditures/ Depreciation by Segment

(Unit: Billions of Yen)

	2015		2016 Forecast*		Increase/decrease	
	Capital expenditures	Depreciation	Capital expenditures	Depreciation	Capital expenditures	Depreciation
Petrochemicals	2.0	5.8	3.4	5.7	1.4	0.0
Chemicals	10.3	7.6	12.9	7.4	2.6	-0.2
Electronics	11.1	14.0	6.4	11.7	-4.7	-2.3
Inorganics	10.2	4.1	8.2	4.1	-2.0	0.0
Aluminum	6.1	6.0	5.2	5.7	-0.9	-0.4
Others	4.3	4.7	3.1	4.2	-1.1	-0.5
Total	44.1	42.1	39.3	38.8	-4.8	-3.4

(*) 2016 forecast was announced on Feb. 14, 2017.

Selected Data for 2016/2017 Forecasts (Consolidated)

(** Unit: Billions of Yen)

	2015	for 2016 Forecast	2016-2015 Increase/ decrease	for 2017 Forecast	2017-2016 Increase/ decrease
●Exchange rate: ¥/US$	121.1	108.8	-12.2	105.0	Yen will appreciate by 3.8
●Domestic naphtha price: ¥/KL	46,000	32,800	-13,200	36,900	4,100
●Aluminum LME price: US$/T	1,682	1,610	-7.3	1,650	40
●R&D expenditures**	20.3	17.3	-3.0	18.5	1.2
●Number of employees: people	10,561	10,146	-415	10,327	181
●Total employment cost**	71.9	70.2	-1.7	73.4	3.2

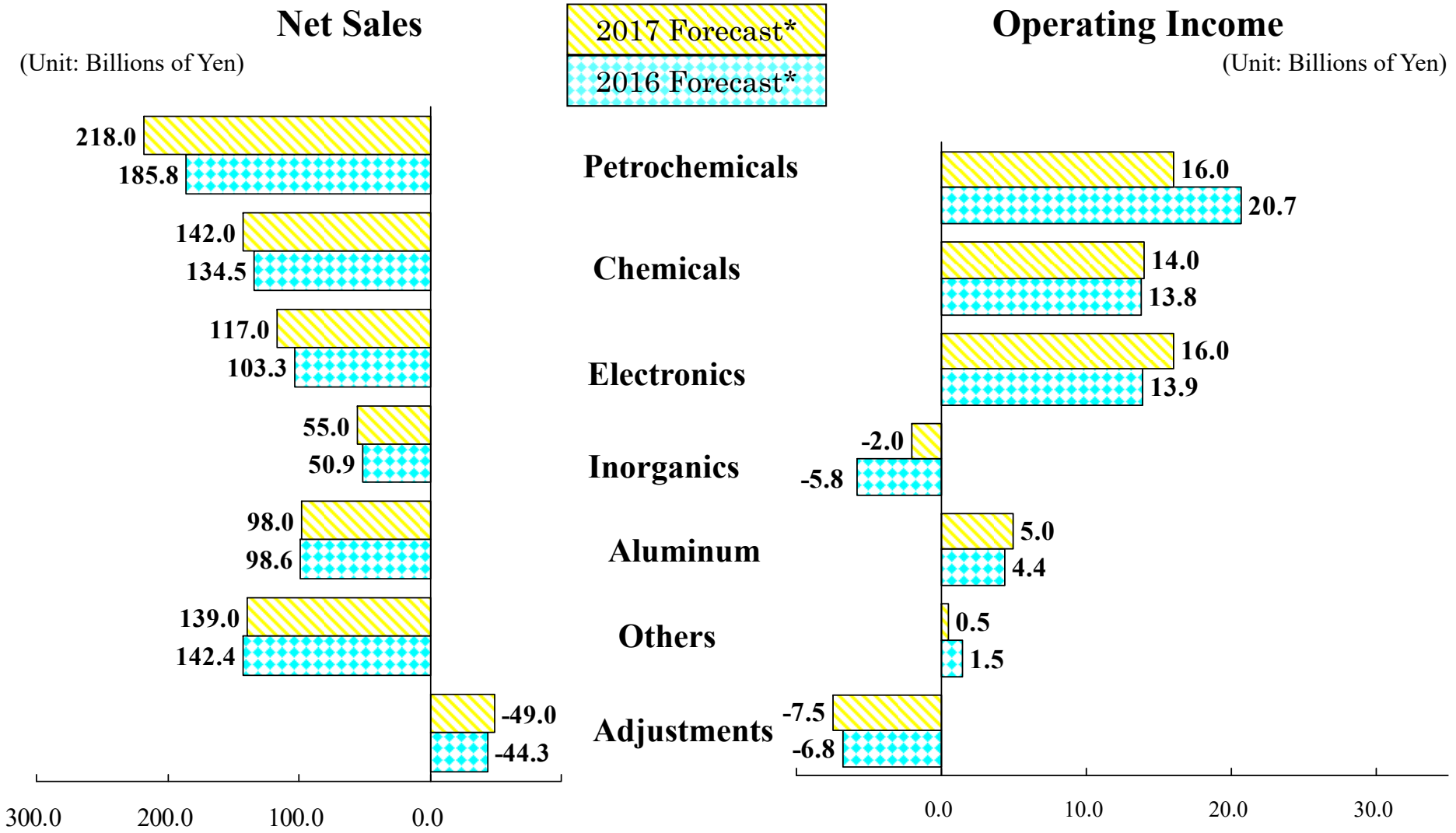
2017 Forecast (Consolidated)

(Unit: Billions of Yen except Cash dividends per Share and Net income per Share)

	2016 Forecast*	2017 Forecast*	Increase/ decrease	2017 Forecast*	
				1st Half	2nd Half
Net Sales	671.2	720.0	48.8	348.0	372.0
Operating Income	41.8	42.0	0.2	16.5	25.5
Non-operating income and expenses	-3.3	-5.5	-2.2	-3.0	-2.5
Ordinary Income	38.6	36.5	-2.1	13.5	23.0
Extraordinary Profit	-22.3	-12.0	10.2	-6.0	-6.0
Extraordinary Loss					
Profit attributable to owners of parent	11.0	20.0	9.0	6.0	14.0
Profit attributable to owners of parent per share	¥77.12	¥140.33	¥63.21		
Cash dividends per Share	¥30.00	¥30.00	—		

(*) 2016/2017 Forecasts were announced on Feb. 14, 2017.

Sales and Operating Income Forecast for 2017



(*) 2016/2017 Forecasts were announced on Feb. 14, 2017.

(note) From 2017 SDK changes the segmentation (LIB materials is transferred from "Others" to "Electronics") .
Figures of 2016 are based on the previous segmentation.

Net Sales by Segment, 2017 Forecast (Consolidated)

(Unit: Billions of Yen)

	2016 Forecast*	2017 Forecast*	Increase/ decrease	Comments	2017 Forecast*	
					1st Half	2nd Half
Petrochemicals	185.8	218.0	32.2	Olefins: slight sales increase expected Organic chemicals: sales will be maintained at the previous year's level The effect of consolidation of SunAllomer Ltd. expected for full year	106.0	112.0
Chemicals	134.5	142.0	7.5	Electronic chemicals: sales increase expected (shipment volumes up) Functional chemicals: sales increase expected (shipment volumes up)	67.0	75.0
Electronics	103.3	117.0	13.7	HDs: shipment volumes decrease expected (stronger yen) LIB materials: Transferred from the Others segment	57.0	60.0
Inorganics	50.9	55.0	4.1	Ceramics: sales increase expected (shipment volumes up) Graphite electrodes: sales will be maintained at the previous year's level	26.0	29.0
Aluminum	98.6	98.0	-0.6	Rolled products: sales decrease expected (stronger yen, metal price down) Aluminum cans: sales increase expected (shipment volumes up)	47.0	51.0
Others	142.4	139.0	-3.4	LIB materials: Transferred to the Electronics segment	69.0	70.0
Adjustments	-44.3	-49.0	-4.7		-24.0	-25.0
Total	671.2	720.0	48.8		348.0	372.0

(*) 2016/2017 Forecasts were announced on Feb. 14, 2017.

(note) From 2017 SDK changes the segmentation (LIB materials is transferred from "Others" to "Electronics") .
Figures of 2016 are based on the previous segmentation.

Operating Income, 2017 Forecast (Consolidated)

(Unit: Billions of Yen)

	2016 Forecast*	2017 Forecast*	Increase/ decrease	Comments	2017 Forecast 1st Half	2017 Forecast 2nd Half
Petrochemicals	20.7	16.0	-4.7	Olefins, Organic chemicals: profit decrease expected (narrower spread) The effect of consolidation of SunAllomer Ltd. expected for full year	7.0	9.0
Chemicals	13.8	14.0	0.2	Electronic chemicals: profit increase expected (shipment volumes up) Industrial gases, Basic chemicals: profit decrease expected (costs of raw materials and fuel up)	5.0	9.0
Electronics	13.9	16.0	2.1	HDs: profit will be maintained at the previous year's level LED, Rare earth: profit increase expected LIB materials: Transferred from the Others segment	7.5	8.5
Inorganics	-5.8	-2.0	3.8	Ceramics: slight profit increase expected Graphite electrodes: profit increase expected (cost reduction)	-2.0	0.0
Aluminum	4.4	5.0	0.6	Aluminum cans: profit increase expected (shipment volumes up)	2.0	3.0
Others	1.5	0.5	-1.0	LIB materials: Transferred to the Electronics segment	0.5	0.0
Adjustments	-6.8	-7.5	-0.7		-3.5	-4.0
Total	41.8	42.0	0.2		16.5	25.5

(*) 2016/2017 Forecasts were announced on Feb. 14, 2017.

(note) From 2017 SDK changes the segmentation (LIB materials is transferred from "Others" to "Electronics") .
Figures of 2016 are based on the previous segmentation.

Capital expenditures/Depreciation by Segment
2017 Forecast

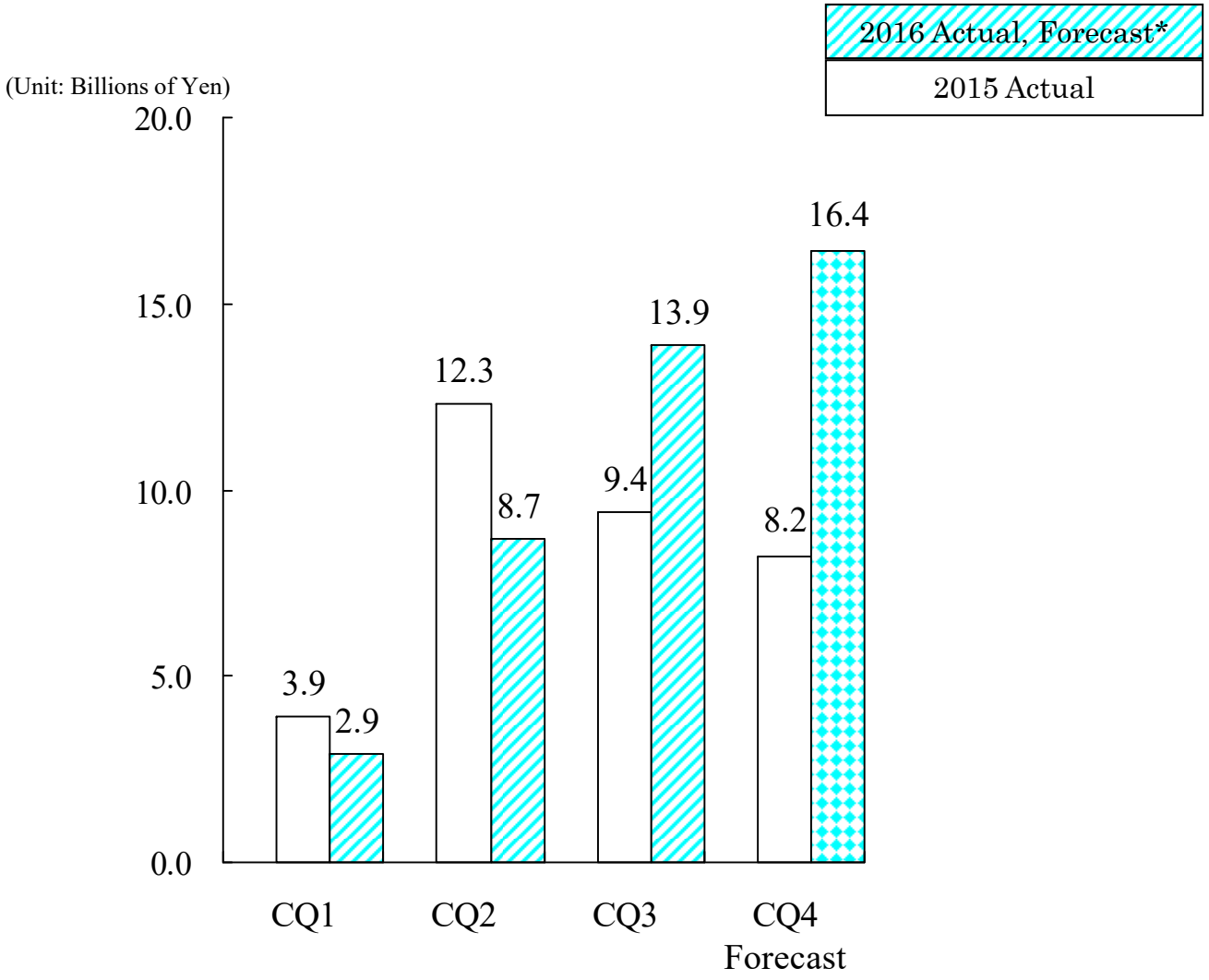
(Unit: Billions of Yen)

	2016 Forecast*		2017 Forecast*		Increase/decrease	
	Capital expenditures	Depreciation	Capital expenditures	Depreciation	Capital expenditures	Depreciation
Petrochemicals	3.4	5.7	2.8	7.0	-0.5	1.3
Chemicals	12.9	7.4	12.1	7.9	-0.9	0.5
Electronics	6.4	11.7	13.9	9.7	7.5	-2.0
Inorganics	8.2	4.1	9.3	5.4	1.1	1.3
Aluminum	5.2	5.7	10.4	5.6	5.2	-0.1
Others	3.1	4.2	3.5	3.2	0.3	-1.1
Total	39.3	38.8	51.9	38.7	12.6	-0.1

(*) 2016/2017 Forecasts were announced on Feb. 14, 2017.

(note) From 2017 SDK changes the segmentation (LIB materials is transferred from “Others” to “Electronics”) .
Figures of 2016 are based on the previous segmentation.

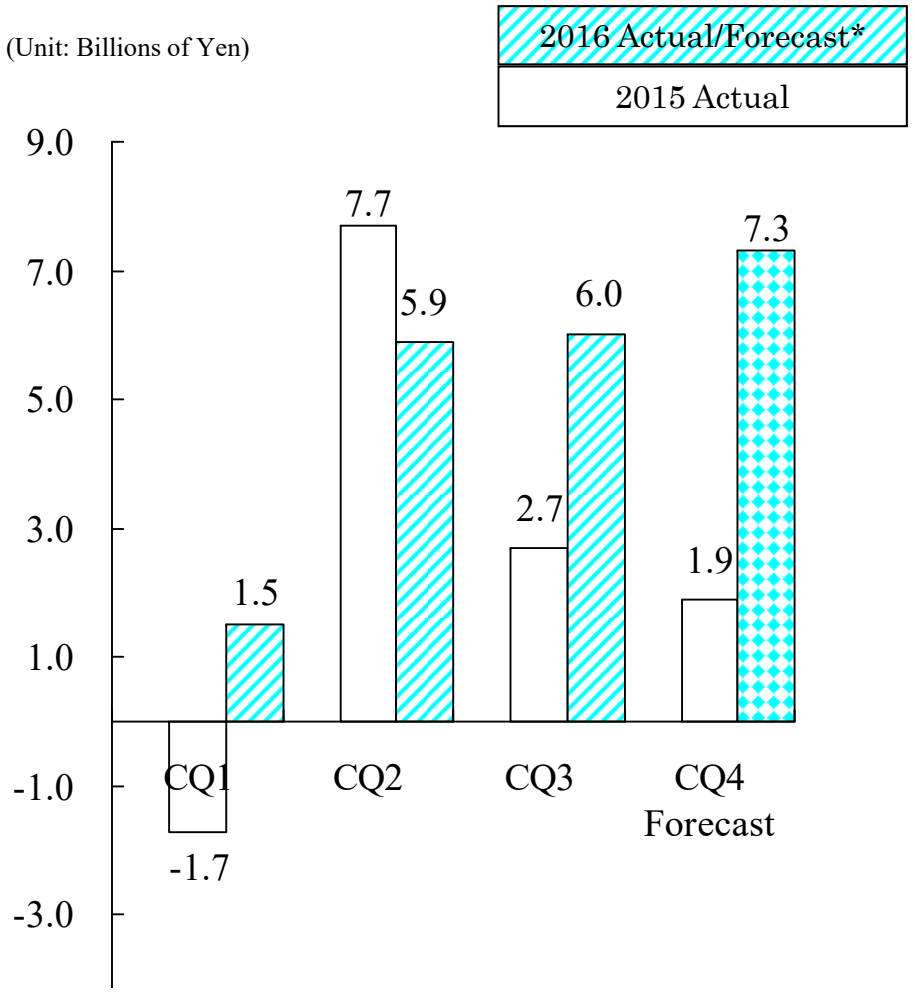
(Reference)　Quarterly Operating Income



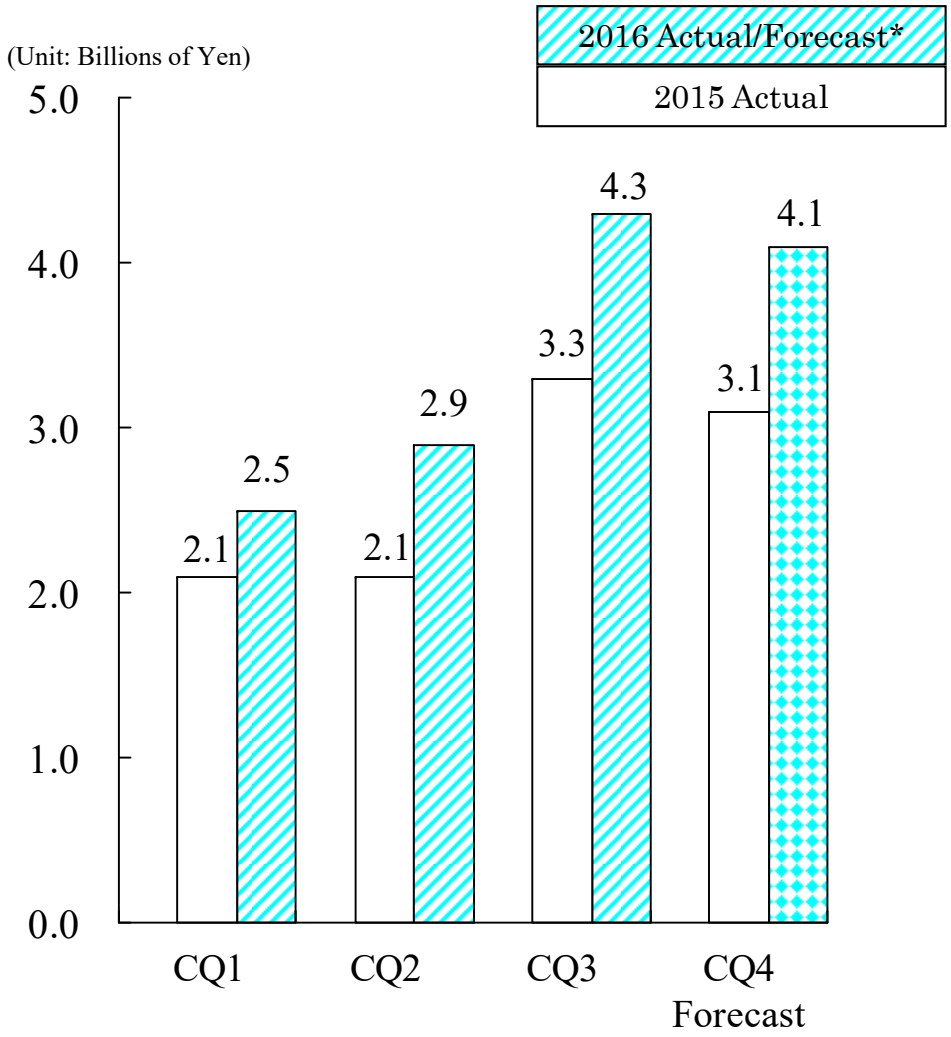
(*) 2016 Forecast was announced on Feb. 14, 2017.

(Reference) Quarterly Operating Income by Segment

《Petrochemicals》



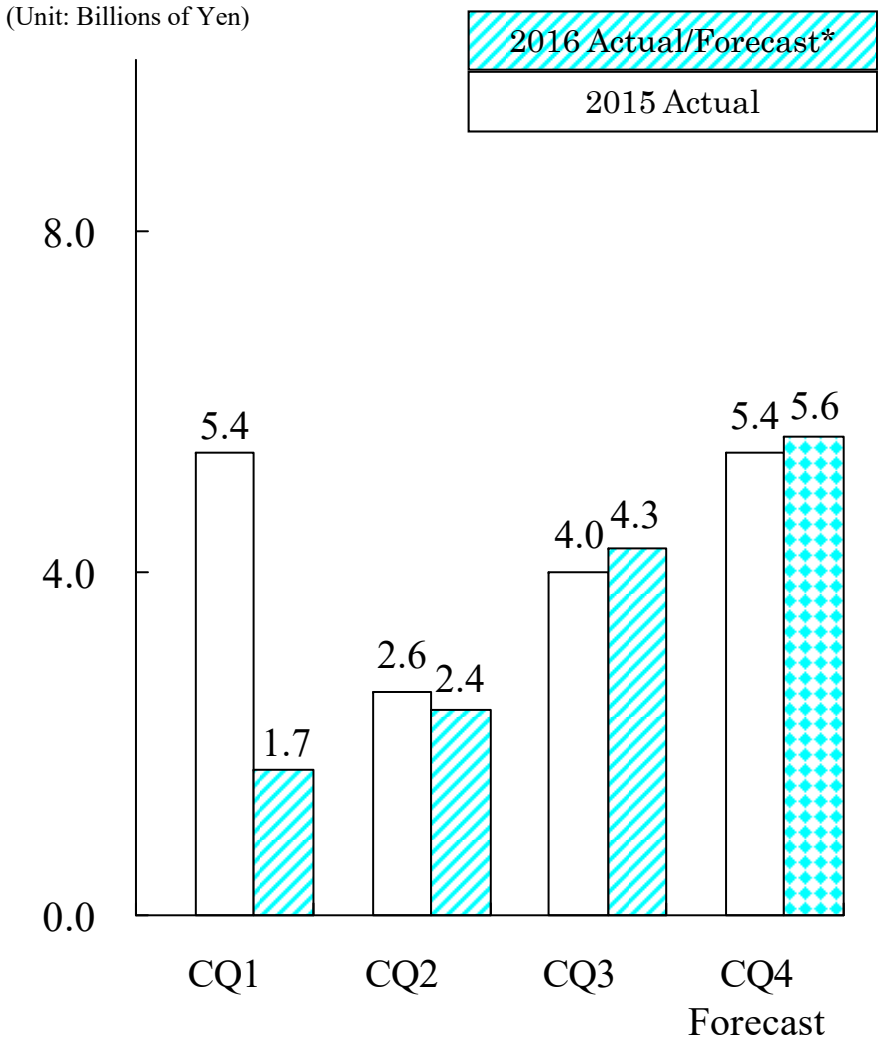
《Chemicals》



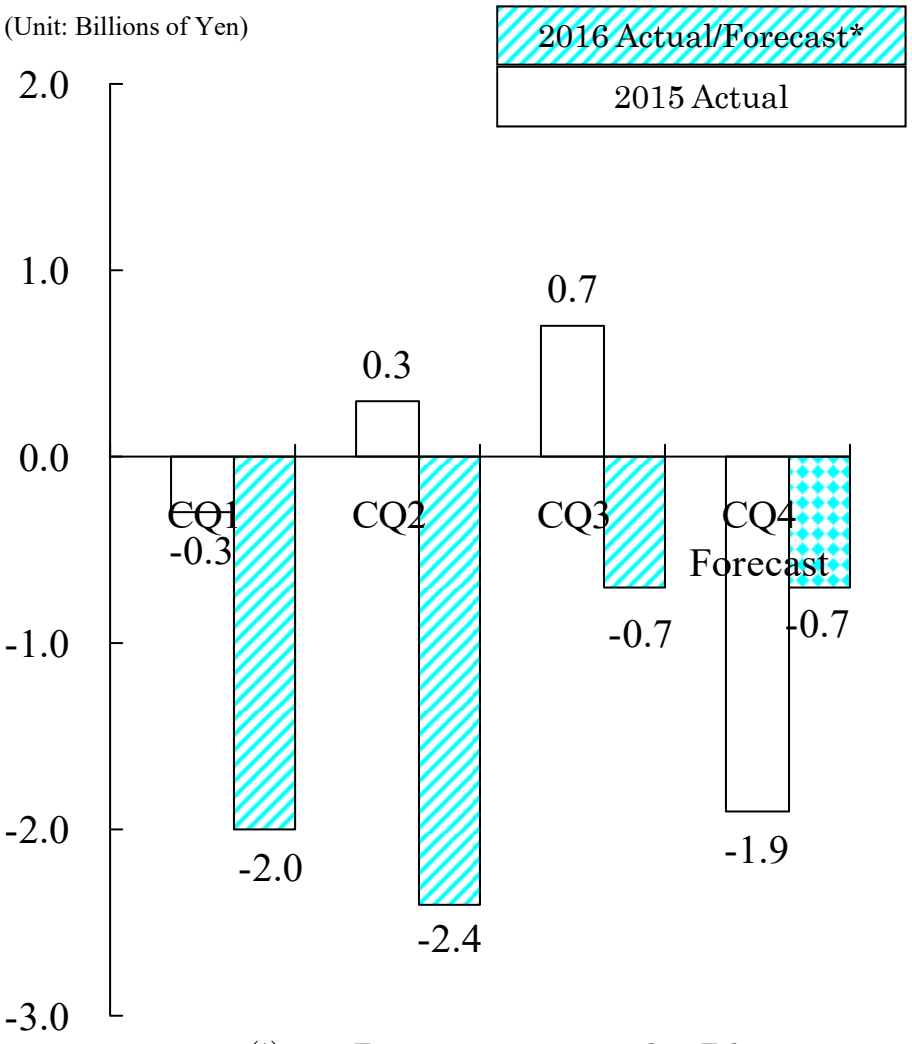
(*) 2016 Forecast was announced on Feb. 14, 2017

(Reference) Quarterly Operating Income by Segment

《Electronics》



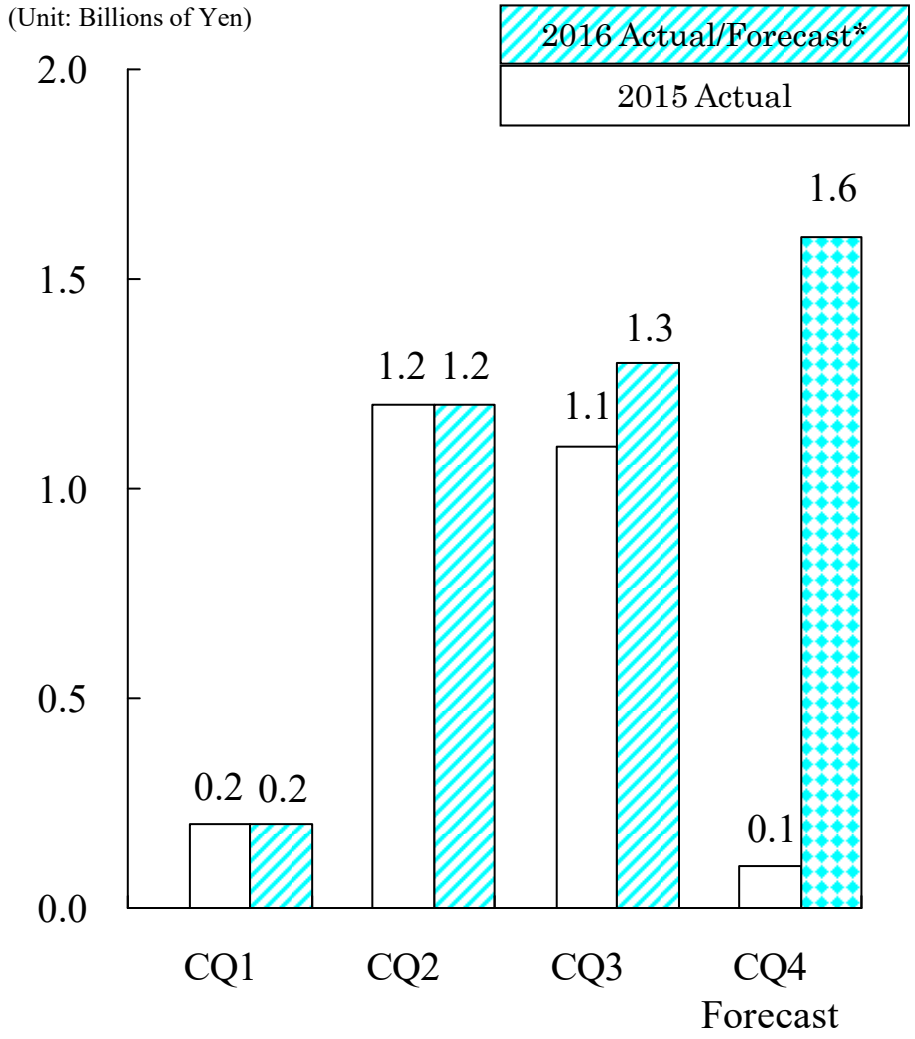
《Inorganics》



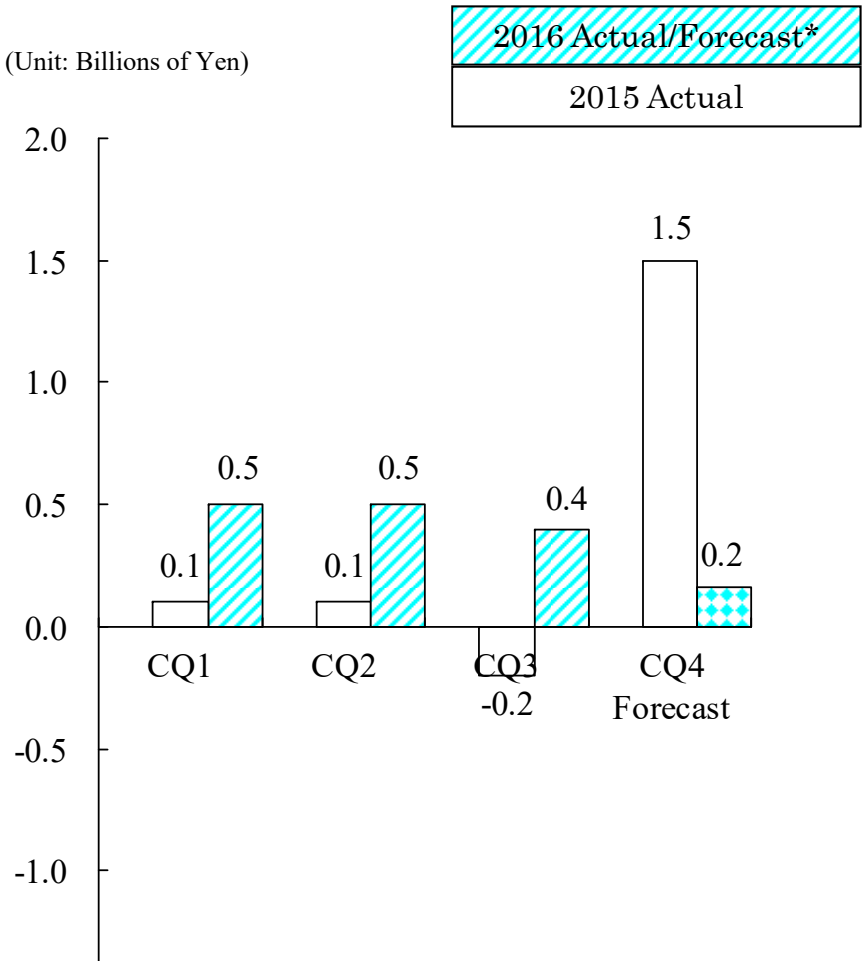
(*) 2016 Forecast was announced on Feb. 14, 2017.

(Reference) Quarterly Operating Income by Segment

《Aluminum》



《Others》



(*) 2016 Forecast was announced on Feb. 14, 2017.

Topics

[General]

- **Consolidation of shares and change in the number of shares per share unit**

  SDK resolved at its 107th ordinary general meeting of shareholders held on March 30, 2016 that it would consolidate its shares and change number of shares per trading unit (share unit). On July 1, 2016, based on this resolution, SDK changed number of shares per share unit from 1,000 shares to 100 shares. Along with the change in the share unit, SDK also consolidated its shares (ten shares into one share).

- **Introduction of performance-linked stock compensation scheme**

  SDK resolved at its 107th ordinary general meeting of shareholders held on March 30, 2016 that it would revise its compensation scheme for Directors and Corporate Officers, and introduce a performance-linked stock compensation scheme utilizing a trust service ("the Scheme"). The Scheme became effective in May 2016. The purpose of the introduction of the Scheme is to further clarify the linkage between compensation for non-Outside Directors and Corporate Officers and the share value of SDK, thereby enhancing their awareness of the need to contribute to the efforts to achieve improved business performance and greater enterprise value in the medium to long term.

- **Acquisition of highest-level environmental rating from Development Bank of Japan**

  In March 2016, SDK received a loan from Development Bank of Japan (DBJ) under the scheme of DBJ Environmentally Rated Loan Program, after acquiring the highest-level rating from DBJ for its environmental management. This Program is a loan program utilizing a rating system developed by DBJ that evaluates enterprises on the level of their environmental management and then sets preferential loan conditions when an enterprise is rated high. This time, SDK has acquired the highest-level environmental rating from DBJ because of its identification of important issues related to its own medium to long term management themes, continuous activities to improve its CSR-conscious procurement, its introduction of an integrated comprehensive chemicals management system, and promotion of Diversity Management, which is a management policy to enhance the value of diversity among its employees.

Topics

[Petrochemicals segment]

- **Acquisition of additional shares in polypropylene JV SunAllomer**

  In September 2016, SDK and JX Nippon Oil & Energy Corporation (JX) jointly purchased LyondellBasell Group's 50% stake in SunAllomer Ltd., which had been a joint venture company among the three parties for production and sale of polypropylene. The polypropylene business constitutes a key element in SDK's olefin chain. Taking this opportunity of acquiring additional shares, SDK will further strengthen cooperation with SunAllomer, thereby enhancing the competitive power of its polypropylene business.

[Chemicals segment]

- **Decision to establish a Monofluoromethane gas JV in South Korea**

  In December 2016, SDK and SK Materials Co., Ltd., which is headquartered in Yeongjyu-si, South Korea, has concluded an agreement to establish a joint corporation which is to produce and sell High-purity Monofluoromethane gas (CH_3F) to be used in the manufacturing process of semiconductor chips. The two parties plan to establish the new company in February 2017, and finish construction of the new plant in August 2017. CH_3F is a specialty gas used in the manufacturing process of semiconductor chips for micromachining nitride film by etching. Since CH_3F's etching selectivity is higher than those of other industrial gases, the demand for CH_3F is increasing especially in the field of micromachining of multi-layer structure of 3D NAND flash. SDK will continue expanding its business to produce and sell high-purity gases for production of semiconductor memory chips.

Topics

[Chemicals segment]

- **Increasing capacity to produce high-purity boron trichloride**

  In March 2016, SDK increased the capacity of the facilities in its Kawasaki Plant to produce high-purity boron trichloride (BCl_3), which is a kind of high-purity gas for electronics, to 1.5 times of the previous level and started operation of the expanded facilities. High-purity BCI_3 is a specialty gas mainly used for fine-etching of aluminum circuits in the manufacturing process of LCD panels and silicon semiconductors. In recent years, electronic material manufacturers have been making capital investment in the fields of organic light emitting diode (OLED) display panels and low temperature poly-silicon (LTPS) LCD panels, both of which are equipped with aluminum circuits. Therefore, the demand for high-purity BCl_3 gas is expected to be stable in the future.

- **Installation of a plant to produce a new grade of super-high-purity solvent, "*Solfine*™"**

  In December 2016, SDK developed new-grade products with enhanced high-purity to be added to the lineup of its high-purity solvents, "*Solfine*™" series, and decided to install a new production plant to produce the new-grade products at its Tokuyama Plant. The new plant will start its commercial operation in June 2017. SDK will offer the new-grade super-high-purity solvents mainly as solvents for photoresist for the manufacture of semiconductor integrated circuits.

Topics

[Chemicals segment]

- **Starting commercial operation of a new bulk molding compound plant in China**

  SDK finished the work to construct a new plant of Showa Denko New Material (Zhuhai) Co., Ltd. to produce thermosetting bulk molding compound* (BMC), which is located in Guangdong Province, China, and started commercial production of BMC there in January 2017. Before this construction, SDK Group's BMC business had production bases at three locations: in Japan, Shanghai, and Thailand, and the production base in Shanghai has been operating at full capacity. By producing BMC at two production bases in China, located in Shanghai and Zhuhai, SDK Group will strengthen and expand its BMC supply system in the Chinese market.

  *BMC (Bulk Molding Compound): BMC is a thermosetting bulk molding compound made from unsaturated polyester resin as main component, kneaded together with glass fiber and other additives. BMC is put to various uses including headlamp reflectors and engine covers for car applications, and sealant for home appliances and precision parts.

- **Developing normal-temperature-curing non-styrene vinylester resin aqueous emulsion**

  SDK developed vinylester resin aqueous emulsion that does not use styrene as reactive monomer, and cures after drying of water at normal temperature. SDK started shipment of its samples in October 2016. Making the most of SDK's original resin-design and emulsification technologies, this new resin has high corrosion resistance and curability at normal temperature equivalent to conventional vinylester resins. Moreover, when applied to a repair work of underground cesspits, this new resin does not require measures to prevent fire and poisoning and is good for the safety of workers because it does not contain styrene. Making the most of this new product, SDK proposes a method of lining with superior work environment, less odor, and easy handling of resins.

Topics

[Chemicals segment]

- Ammonia production process utilizing used plastic containers received Silver Prize in the Eco-Mark Awards 2015

In January 2016, SDK's ammonia production process that recycles plastic containers received a "Silver Prize in the Eco-Mark Awards 2015" hosted by Japan Environment Association (JEA). The award-winning ammonia production process utilizes hydrogen gas extracted from gasified used plastics through chemical recycling method as a part of raw materials, and synthesizes ammonia. SDK will continue developing environment friendly products and production processes, thereby contributing to the sustainability of society.

[Electronics segment]

- Streamlining of HD media production capacity

In its HD media business, SDK Group completed integration of processes to develop and produce substrates and media for HDDs, as a part of its effort to promote "Best in Class Strategy." In the second quarter of 2016, the Group also streamlined its capacity to produce HD media in order to make it in line with the movement in the HDD manufacturing industry to reduce its production capacity. Specifically, the Group concentrated production of HD media into production lines of high productivity, reduced its monthly production capacity from 30 million plateaus to 20 million plateaus, and significantly strengthened the Group's cost competitiveness. Through promotion of development and mass production of leading-edge HD media, SDK Group will secure its technical advantages in the HD media market, and make the foundation of its HD media business more solid.

Topics

[Inorganics segment]

- Agreement on acquisition of SGL GE, a graphite electrode manufacturer

In October 2016, SDK agreed with SGL Carbon SE, a global carbon and graphite product manufacturer headquartered in Germany, that SDK will acquire the whole shares of SGL GE Holding GmbH (SGL GE), which engages in the graphite electrode business, from SGL Carbon GmbH, a wholly owned subsidiary of SGL Carbon SE, and make SGL GE a subsidiary of SDK. Graphite electrodes are used in the processes to manufacture electric furnace steel, and is expected to maintain a certain market size. SDK has been supplying graphite electrodes primarily from production bases in two regions, Asia and the U.S. With the acquisition of SGL GE, SDK can cover all areas around the world, including Europe, and gain the position of the global leading supplier of graphite electrodes. Based on the new platform, SDK will revitalize its graphite electrode business as the Company's major profit source and pursue further expansion of it. SDK's acquisition of the shares of SGL GE is subject to the approval of the relevant authorities under the applicable competition laws of the relevant countries including the U.S. and Germany, and other preconditions.

[Aluminum segment]

- Expanding aluminum can business at home and abroad

Showa Aluminum Can Corporation (SAC), a subsidiary of SDK, has been operating aluminum can manufacturing business in the domestic market, where stable demand is expected, and in the Vietnamese market, which has been growing about 10% a year. In the Vietnamese market, through operation of its wholly-owned subsidiary "Hanacans Joint Stock Company," SAC has been expanding sales of cans for beer, the demand for which has been rapidly increasing. Aiming to further accelerate its aluminum can business in Vietnam, in December 2016, SAC made Hanacans to install a new production line to produce sleek cans for beverages, which have smaller diameters and taller heights than those of regular cans. For the domestic market, SAC has developed an ink-jet printing technology for beverage cans suitable for production of cans with multiple designs in smaller lots, and installed a new production line equipped with this new printing method in December 2016. SDK Group will further expand its aluminum can business by rapidly introducing new products that meet to the needs of the market.

Topics

[Aluminum segment]

- **Integrating two aluminum automotive parts production bases in Southeast Asia**

In November 2016, SDK decided to integrate the aluminum forging plant of SHOTIC Singapore Pte. Ltd. (STS), located in Singapore, into the aluminum casting plant of SHOTIC Malaysia Sdn. Bhd. (STM), located in Johor, Malaysia, aiming to strengthen competitiveness of its *SHOTIC*™ business. Thus STM will start to produce forged aluminum products in the first half of 2017, thereby establishing an integrated system to produce both casted and forged products of aluminum. Through our *SHOTIC*™ business, SDK Group offers *SHOTIC*™ continuously-cast aluminum rods manufactured with the Group's proprietary continuous-casting technology which gives *SHOTIC*™ products the properties of high-temperature strength, wear and corrosion resistance. SDK Group also offers forged aluminum products made from *SHOTIC*™ continuously-cast aluminum rods. The Group promotes these continuously-cast aluminum rods and forged aluminum products under the unified trade name of *SHOTIC*™, and offers various products including parts for compressors for cars, pistons for engines, and parts for suspensions.

[Others segment]

- **Expanding production capacities for lithium ion battery (LIB) materials**

SDK offers various LIB materials including *SCMG*™ carbon-based anode material, *VGCF*™ carbon nanofiber, which is used as an additive for cathodes and anodes to improve electrical conductivity, and *SPALF*™ aluminum laminated film for packaging. SDK's LIB materials are acclaimed highly by LIB manufacturers because our products add their LIBs such values as "high capacity, low resistance, and long life." Orders for *SCMG*™ have been increasing because it has advantages of low resistance and long life, and demonstrates high performance when used in LIBs for EVs. SDK completed expansion of production capacity for *SCMG*™ at Omachi Plant by 50%, to 1,500t per year. SDK also started to outsource a part of its *SCMG*™ production to a manufacturer in China in June 2016. On the other hand, in August 2016, SDK decided to expand the capacity of facilities in Kawasaki Plant to produce *VGCF*™ conductivity enhancer from 200t/y to 300t/y by the end of 2017. *VGCF*™ is used as electrically-conductive additive for cathodes and anodes of LIBs, and retards deterioration of LIBs. SDK will continue offering high quality LIB materials in a timely manner, focusing on the market for LIB materials for automotive use, which is surely expected to expand.

*In January 2017, SDK reorganized its Advanced Battery Materials Department, which was the section responsible for its LIB materials business, and created "Advanced Battery Materials Division." At the same time, SDK changed the segment to which that business belongs to from "the Others segment" to "the Electronics segment."

Topics

[Others segment]

- **Expansion of capacity for producing high-grade SiC epitaxial wafers**

SDK expanded its capacity for producing high-quality-grade silicon carbide (SiC) epitaxial wafers for power devices, which had already been marketed under the trade name of "High-Grade Epi" (HGE), and started mass production of HGE wafers in June 2016. The expanded production facility has a capacity to produce 3,000 wafers per month*1. In HGE developed by SDK, the number of surface defects and basal plane dislocation*2, which is the typical crystal defect, is controlled to be 0.1/cm^2 or less. Since the launch in October 2015, HGE has been successfully getting good reputation among device manufacturers at home and abroad. Moreover, the establishment of technology to lower the number of defects enabled us to mass-produce thick-film epitaxial wafers*3 and p-type epitaxial wafers*4, both for potential use in bipolar power devices. We expect that thick-film HGE we market will significantly contribute to the development of SiC-IGBT*5 which can be used as ultra-high-voltage devices for power generation/transmission systems. The size of the market for SiC epitaxial wafers for power devices is expected to reach ¥100 billion in 2025 as the early use of SiC power devices in vehicles is under consideration. SDK will continue meeting the need of the market for high-quality SiC epitaxial wafers, aiming to contribute to the improvement in energy efficiency of power devices.

*1 This number is based on a conversion into SiC epitaxial wafers for power devices having withstanding voltage of 1200 V.

*2 Dislocation that occurs on a basal plane of a single crystal SiC.

*3 These thick-film epitaxial wafers have thickness of about 100μm or more. (1μm=1/1000mm)

*4 A type of electrical conduction in semiconductors

In p-type semiconductors, positively charged holes are the majority carriers of electric energy.

*5 IGBT: insulated gate bipolar transistor

SiC-IGBT has both high-speed-switching capabilities equal to MOSFET and controls on high voltage and high current equal to bipolar transistor.

PROJECT 2020+

