PROJECT 2020+

Evolving unique chemical company

Second Quarter, 2016 Financial Results
- Consolidated -

SHOWA DENKO K.K.

August 9, 2016

Saburo Muto, CFO
Director & Managing 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.

Consolidated Companies

- Consolidated subsidiaries: 48
  1 company newly consolidated
  Shoko Highpolymer Co., Ltd.
  1 company excluded
  Japan Ethyl Acetate Co., Ltd. (Completion of liquidation)

- Equity method applied: 13
  Newly applied or excluded: none

Selected Data

(Average figure)

	Jan.- Jun. 2015	Jan.- Jun. 2016	Increase/ decrease
■Exchange rate:¥/US$	120.2	111.8	Yen appreciated by 8.4
■Domestic naphtha price: ¥/KL	47,900	33,000	-14,900
■Aluminum			
LME price: US$/T	1,802	1,548	-254
Domestic market*: K¥/T	303	227	-76

Exchange rate at December 31, 2015 ¥120.6/US$, at June 30, 2016 ¥102.9/US$
⇒Yen appreciated by ¥17.7/US$

*Domestic market: data from Nikkei

Summary

2015 (Jan.1 – Jun.30) vs. 2016 (Jan.1 – Jun.30)

(Unit: Billions of Yen)

	Jan.-Jun. 2015	Jan.-Jun. 2016	Increase/ decrease
Net Sales	397.0	321.6	-75.4
Operating Income	16.1	11.5	-4.6
Non-operating income and expenses, net	-0.6	-4.5	-3.9
Interest/Dividends income and expenses	-0.8	-0.9	-0.2
Equity in earnings of affiliates	1.1	1.9	0.8
Foreign exchange gains or losses	-1.0	-3.9	-3.0
Other	0.1	-1.5	-1.6
Ordinary Income	15.5	7.0	-8.5
Extraordinary Profit	1.9	0.5	-1.5
Extraordinary Loss	-17.5	-6.1	11.5
Income before income taxes	-0.1	1.4	1.5
Income taxes	-5.3	0.8	6.0
Profit	-5.4	2.2	7.5
Profit attributable to non-controlling interests	6.6	-0.6	-7.2
Profit attributable to owners of parent	1.3	1.6	0.3

Extraordinary Profit/Loss

(Unit: Billions of Yen)

	Jan.-Jun. 2015	Jan.-Jun. 2016	Increase/ decrease
■Extraordinary Profit	1.9	0.5	-1.5
●Gain from sales of fixed assets	0.1	0.3	0.2
●Gain on sales of investment securities	1.7	0.1	-1.6
●Other	0.1	0.1	-0.1
■Extraordinary Loss	-17.5	-6.1	11.5
●Loss on sales and retirement of noncurrent assets	-1.4	-2.0	-0.6
●Impairment Loss	-0.4	-1.6	-1.1
●Provision of allowance for doubtful accounts	-12.9	—	12.9
●Other	-2.8	-2.5	0.3
■Extraordinary Profit/Loss, Net	-15.6	-5.6	10.0

Consolidated Sales by Segment

(Unit: Billions of Yen)

	Jan.-Jun. 2015	Jan.-Jun. 2016	Increase/ Decrease	
Petrochemicals	121.2	86.0	-35.2	【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	70.2	64.9	-5.3	【Basic chemicals】sales decreased (AN: market price down) 【Functional chemicals】sales decreased (transferred phenolic resin business) 【Electronic chemicals】【Industrial gases】sales slightly increased (shipment volumes up)
Electronics	65.0	46.9	-18.1	【HDs】sales decreased (shipment volumes down) 【Rare earths】【Compound semiconductors】sales decreased
Inorganics	33.1	24.9	-8.2	【Ceramics】sales decreased (shipment volumes down) 【Graphite electrodes】sales decreased (market price down)
Aluminum	50.0	47.8	-2.2	【High-purity foil for capacitors】sales increased (shipment volumes up) 【Aluminum specialty components】sales decreased (shipment volumes for automotive applications down) 【Aluminum cans】sales increased (Hanacans Joint Stock Company: shipment volumes up)
Others	79.4	72.9	-6.6	【LIB materials】sales increased (shipment volumes up for smartphones and automotive applications) 【SHOKO Co., Ltd.】sales decreased
Adjustments	-22.0	-21.8	0.2	
Total	397.0	321.6	-75.4	

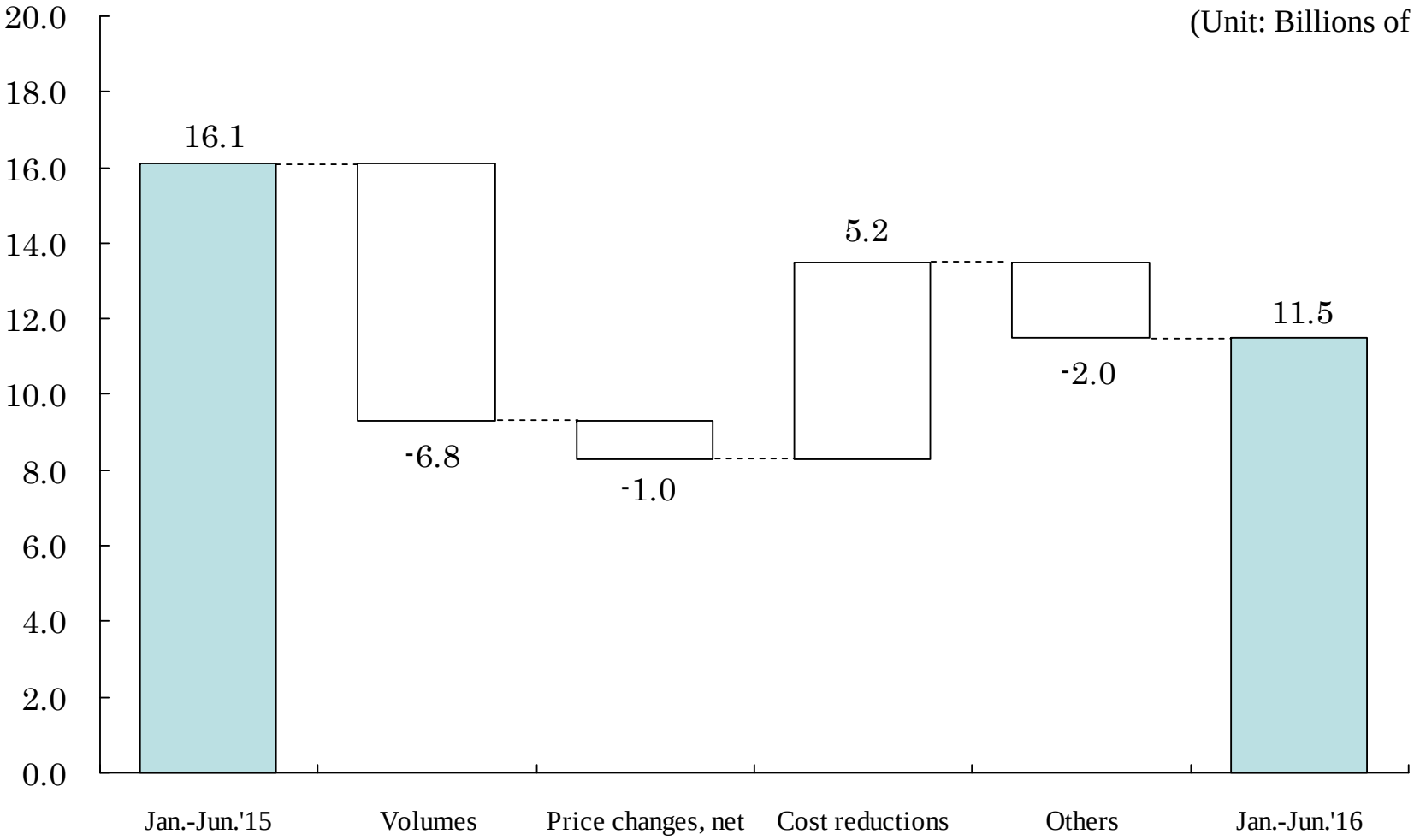
Consolidated Operating Income by Segment

(Unit: Billions of Yen)

	Jan.-Jun. 2015	Jan.-Jun. 2016	Increase/ Decrease	
Petrochemicals	6.0	7.4	1.4	【Olefins】profit increased (improvement in the difference between procurement and consumption prices of raw materials) 【Organic chemicals】profit increased (ethyl acetate: lower prices of raw materials)
Chemicals	4.3	5.5	1.2	【Basic chemicals】profit increased (ammonia: shipment volumes up, lower price of raw materials) 【Electronic chemicals】profit decreased 【Functional chemicals】profit increased 【Industrial gases】profit increased (shipment volumes up) 【Power generating business】profit increased
Electronics	8.0	4.1	-4.0	【HDs】profit decreased (shipment volumes down) 【Compound semiconductors】profit decreased (shipment volumes down) 【Rare earths】profit increased (improvement in the loss on reduction in the book value of inventories)
Inorganics	0.0	-4.4	-4.3	【Ceramics】profit decreased (shipment volumes down) 【Graphite electrodes】profit decreased (market price down, renovation of the hydropower facilities)
Aluminum	1.4	1.5	0.1	【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	0.2	1.0	0.8	【LIB materials】profit increased (shipment volumes up)
Adjustments	-3.7	-3.5	0.2	
Total	16.1	11.5	-4.6	

Operating Income Breakdown by Factor

(Unit: Billions of Yen)



Consolidated Balance Sheet

(Unit: Billions of Yen)

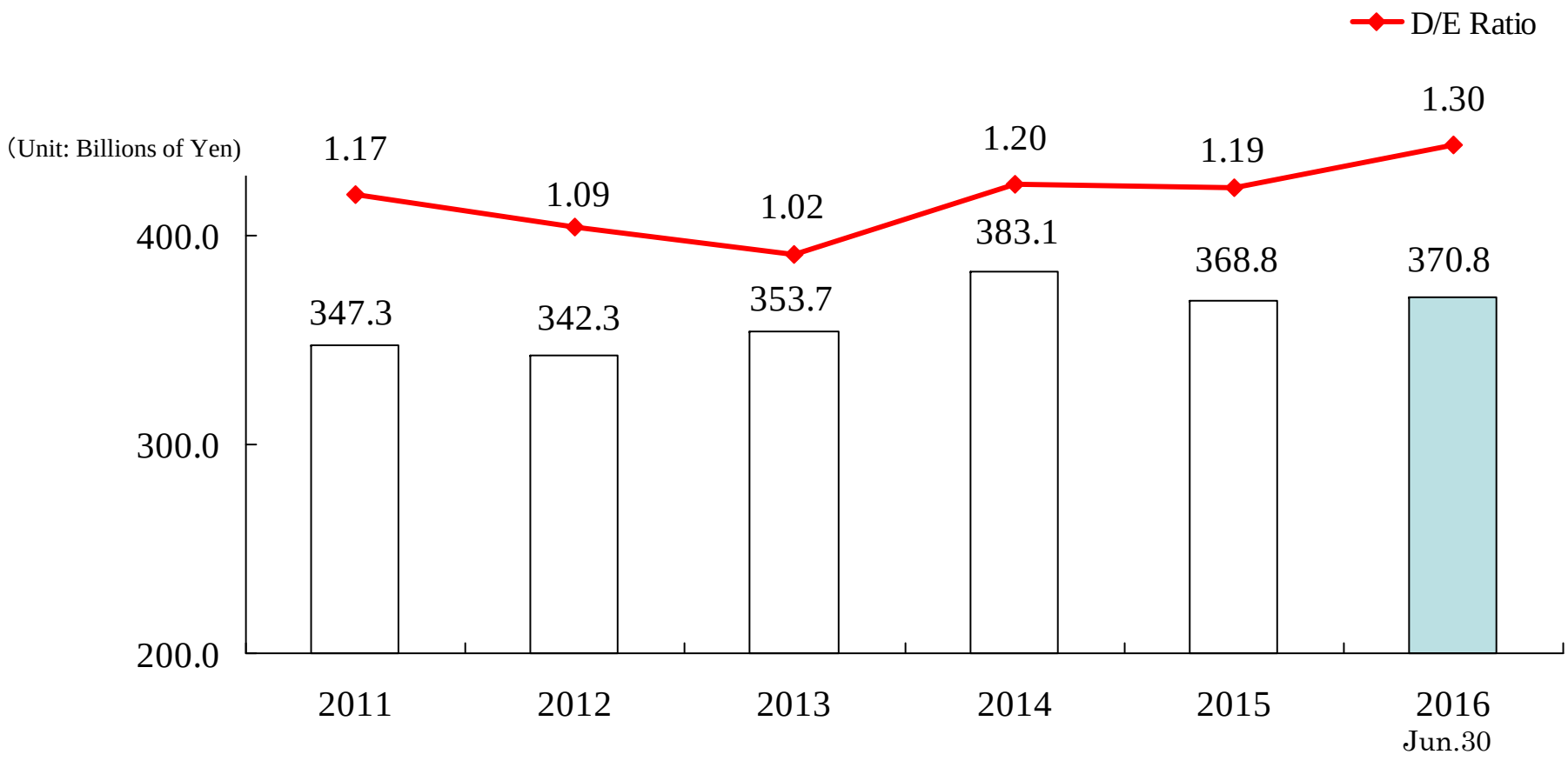
Assets	Dec.31, 2015	Jun. 30, 2016	Increase/ decrease	Liabilities and Net Assets	Dec.31, 2015	Jun. 30, 2016	Increase/ decrease
Cash and deposits	64.1	54.8	-9.3	Notes and accounts payable	103.9	88.6	-15.3
Notes and accounts receivable	136.6	113.3	-23.3	Interest-bearing debt	368.8	370.8	2.0
Inventories	105.9	96.5	-9.4	Net defined benefit liability	15.2	13.0	-2.2
Other current assets	26.5	34.1	7.6	Other liabilities	143.6	130.5	-13.1
Total Current Assets	333.1	298.8	-34.3	Total Liabilities	631.5	602.9	-28.7
Buildings and structures	81.5	77.1	-4.4	Capital stock	140.6	140.6	0.0
Machinery and equipment	112.9	108.7	-4.3	Capital surplus	62.2	62.2	0.0
Land	251.9	251.6	-0.3	Retained earnings	55.8	53.3	-2.5
Other tangible fixed assets	55.0	49.2	-5.8	Treasury stock	-10.2	-10.5	-0.3
Total Tangible Fixed Assets	501.3	486.5	-14.8	Total Shareholders' equity	248.4	245.6	-2.8
Intangible Fixed Assets	12.5	11.5	-1.1	Valuation difference on available-for-sale securities	3.9	-1.2	-5.2
Investments and other assets	94.4	91.0	-3.4	Deferred gains or losses on hedges	-0.3	-1.4	-1.0
incl. investment securities	76.6	68.7	-7.9	Foreign currency translation adjustment	18.6	0.1	-18.5
				Revaluation reserve for land	31.3	32.9	1.6
				Remeasurements of defined benefit plans	-4.8	-4.0	0.8
				Total accumulated other comprehensive income	48.7	26.4	-22.3
				Non-controlling interests	12.6	12.8	0.2
Total fixed assets	608.2	588.9	-19.3	Total net assets	309.8	284.8	-25.0
Total Assets	**941.3**	**887.7**	**-53.6**	**Total Liabilities and Net Assets**	**941.3**	**887.7**	**-53.6**

Total Assets
Interest-bearing Debt and D/E ratio

(Unit: Billions of Yen)

	Dec. 31, 2015	Jun.30, 2016	Increase/ decrease
● **Total assets**	941.3	887.7	-53.6
● **Interest-bearing debt**	368.8	370.8	2.0
● **Debt/Equity ratio**	1.19times	1.30times	0.11p
● **Stockholders' Equity ratio**	31.6%	30.6%	-1.0p

Interest-bearing Debt



Equity ratio	26.8%	29.2%	30.6%	29.7%	31.6%	30.6%

Consolidated Cash Flows

(Unit: Billions of Yen)

	2015 Jan.-Jun.	2016 Jan.-Jun.	Increase/ decrease
●CF from Operating Activities	21.3	20.6	-0.7
●CF from Investing Activities	-18.3	-24.6	-6.4
●Free CF	3.1	-4.0	-7.1
●CF from Financing Activities	-7.6	0.1	7.6
●Others	2.1	-5.4	-7.5
Increase/decrease in cash and cash equivalents	-2.5	-9.3	-6.9

Selected Data (Consolidated)

(Unit: Billions of Yen)

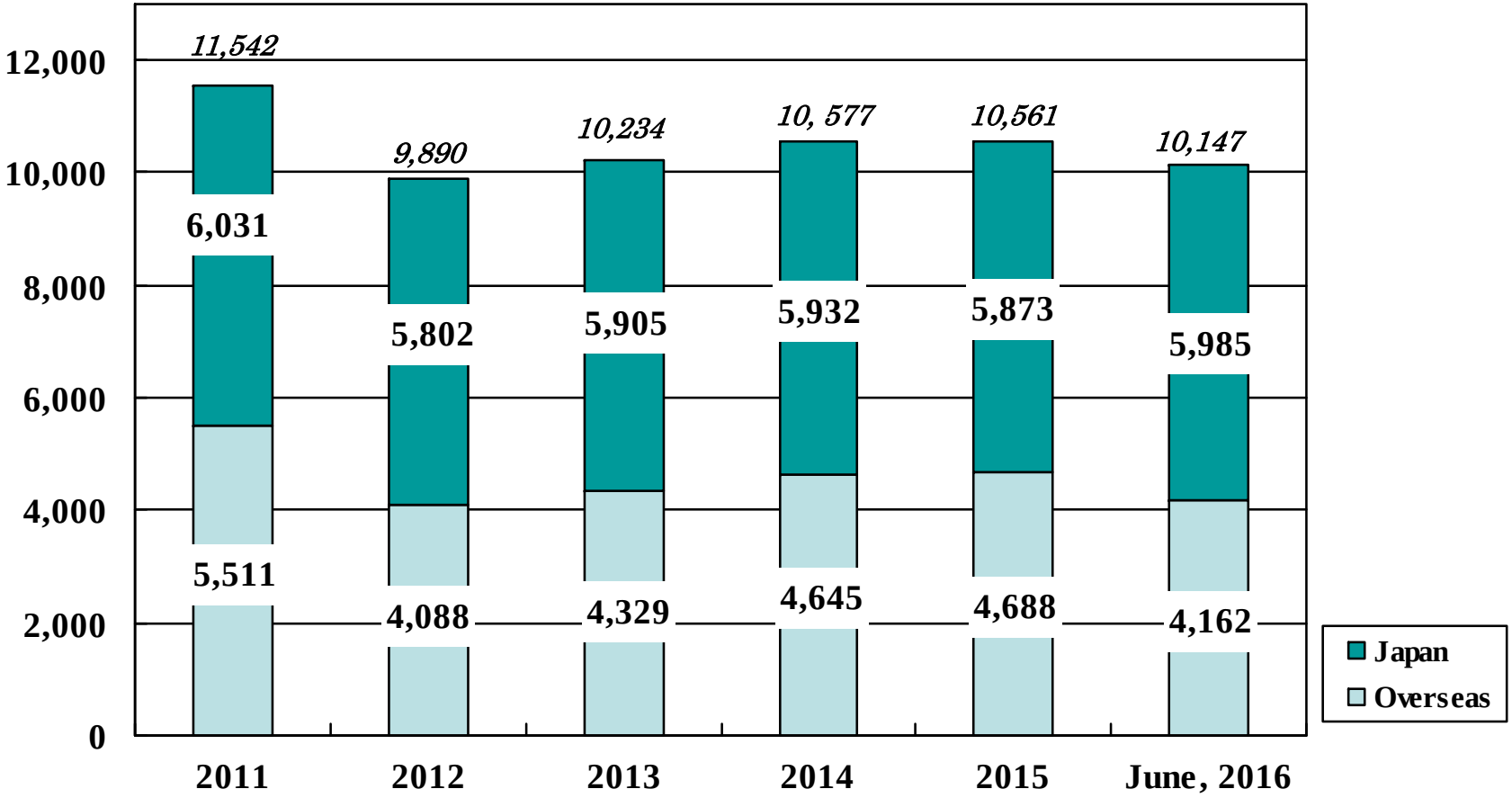
	Jan.-Jun. 2015	Jan.-Jun. 2016	Increase/ decrease
● Interest/dividend income less interest expenses	-0.8	-0.9	-0.2
● Capital expenditures	20.3	16.9	-3.4
● Depreciation and amortization	21.0	19.6	-1.4
● R&D expenditures	10.3	8.7	-1.6
● Number of employees	10,746	10,147	-599
● Total employment cost	36.2	35.1	-1.1

Capital expenditures/ Depreciation by Segment

(Unit: Billions of Yen)

	Jan.-Jun. 2015		Jan.-Jun. 2016		Increase/decrease	
	Capital expenditures	Depreciation	Capital expenditures	Depreciation	Capital expenditures	Depreciation
Petrochemicals	1.2	3.0	1.5	2.7	0.3	-0.3
Chemicals	5.3	3.8	3.8	3.7	-1.5	-0.1
Electronics	4.2	6.9	3.5	6.2	-0.7	-0.6
Inorganics	4.5	2.0	4.8	2.0	0.3	0.0
Aluminum	2.4	3.0	2.0	2.8	-0.3	-0.2
Others	2.7	2.3	1.2	2.1	-1.5	-0.2
Total	20.3	21.0	16.9	19.6	-3.4	-1.4

Total number of employees and breakdown by location



Japan	52.3%	58.7%	57.7%	56.1%	55.6%	59.0%
Overseas	47.7%	41.3%	42.3%	43.9%	44.4%	41.0%

Selected Data, Forecast

(Unit: Billions of Yen)

	2015 Actual	2016 Revised Forecast*	Increase/ decrease
● Exchange rate: ¥/US$		2016 Initial forecast** 119.0	
	1H 120.2	1H actual 111.8	1H -8.4
	2H 121.9	2H revised 100.0	2H -21.9
● Domestic naphtha price: ¥/KL		2016 Initial forecast** 42,200	
	1H 47,900	1H actual 33,000	1H -14,900
	2H 44,050	2H revised 32,200	2H -11,850
● Aluminum LME price: US$/T		2016 Initial forecast** 1,650	
	1H 1,802	1H actual 1,548	1H -254
	2H 1,563	2H revised 1,550	2H -13
● Interest-bearing debt at year end	368.8	370.0	1.2
● Interest/dividend income less interest expenses	-2.2	-1.9	0.3
● R&D expenditures	20.3	18.8	-1.5
● Number of employees	10,561	10,033	-528
● Total employment cost	71.9	70.2	-1.7

* 2016 revised forecast was announced on August 9, 2016.
**2016 initial forecast was announced on February 10, 2016.

2016 Forecast

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

	2015 Actual	2016 Revised Forecast*	Increase/ decrease	2016 Initial Forecast**	Increase/ decrease (against initial)
Net Sales	781.0	670.0	-111.0	765.0	-95.0
Operating Income	33.7	30.0	-3.7	36.0	-6.0
Non-operating income and expense	-1.4	-7.0	-5.6	-5.0	-2.0
Ordinary Income	32.2	23.0	-9.2	31.0	-8.0
Extraordinary Profit / Extraordinary Loss	-26.0	-12.0	14.0	-8.0	-4.0
Profit attributable to owners of parent	1.0	9.0	8.0	20.0	-11.0
Profit attributable to owners of parent per share ***	¥6.78	¥63.10	¥56.31	¥140.03	¥-76.93
Cash dividends per share***	¥3	¥30 (planned)	—	¥30 (planned)	—

* 2016 revised forecast was announced on Aug. 9, 2016. **2016 Initial forecast was announced on Feb. 10, 2016.
***SDK consolidated every ten shares of its common stock into one share on July 1, 2016. The above-mentioned “Profit attributable to owners of parent per share” for 2015 and 2016 revised forecast are calculated on the basis of the number of outstanding shares after this consolidation. The above-mentioned “Cash dividends per share” for 2015 is calculated on the basis of the number of outstanding shares before this consolidation, while that for 2016 revised forecast is calculated on the basis of the number of outstanding shares after this consolidation.

Consolidated Net Sales by Segment, 2016 Forecast

(Unit: Billions of Yen)

	2015 Actual	2016 Revised Forecast*	Increase/ decrease	2016 Initial Forecast**	Increase/ decrease (against initial)
Petrochemicals	231.3	180.0	-51.3	211.0	-31.0
Chemicals	142.3	135.0	-7.3	144.0	-9.0
Electronics	131.5	93.0	-38.5	121.0	-28.0
Inorganics	63.5	52.0	-11.5	67.0	-15.0
Aluminum	100.8	98.0	-2.8	102.0	-4.0
Others	152.5	157.0	4.5	162.0	-5.0
Adjustments	-40.8	-45.0	-4.2	-42.0	-3.0
Total	781.0	670.0	-111.0	765.0	-95.0

* 2016 revised forecast was announced on Aug. 9, 2016.
**2016 initial forecast was announced on Feb. 10, 2016.

Consolidated Operating Income by Segment, 2016 Forecast

(Unit: Billions of Yen)

	2015 Actual	2016 Revised Forecast*	Increase/ decrease	2016 Initial Forecast**	Increase/ decrease (against initial)
Petrochemicals	10.5	15.0	4.5	12.0	3.0
Chemicals	10.7	13.0	2.3	13.0	0.0
Electronics	17.5	9.5	-8.0	15.5	-6.0
Inorganics	-1.2	-5.5	-4.3	-2.0	-3.5
Aluminum	2.6	4.0	1.4	3.5	0.5
Others	1.5	2.0	0.5	2.0	0.0
Adjustments	-7.9	-8.0	-0.1	-8.0	0.0
Total	33.7	30.0	-3.7	36.0	-6.0

* 2016 revised forecast was announced on Aug. 9, 2016.
**2016 initial forecast was announced on Feb. 10, 2016.

Capital expenditures/Depreciation Forecast by Segment for 2016

(Unit: Billions of Yen)

	2015 Actual		2016 Revised forecast*		Increase/decrease		2016 Initial forecast**	
	Capital expenditures	Depreciation	Capital expenditures	Depreciation	Capital expenditures	Depreciation	Capital expenditures	Depreciation
Petrochemicals	2.0	5.8	3.7	5.3	1.7	-0.4	3.7	5.4
Chemicals	10.3	7.6	17.9	7.2	7.5	-0.4	16.4	7.1
Electronics	11.1	14.0	10.4	11.8	-0.7	-2.2	11.1	12.9
Inorganics	10.2	4.1	9.5	4.5	-0.8	0.3	9.7	4.3
Aluminum	6.1	6.0	5.6	5.7	-0.5	-0.3	5.8	5.9
Others	4.3	4.7	3.7	4.6	-0.6	-0.1	3.7	4.8
Total	44.1	42.1	50.7	39.1	6.7	-3.1	50.3	40.4

* 2016 Revised forecast was announced on August 9, 2016.
**2016 Initial forecast was announced on Feb. 10 2016.

Summary (Reference)

CQ1 (Jan.1 – Mar.31), 2016 v s. CQ2 (Apr.1 – Jun.30), 2016

(Unit: Billions of Yen)

	CQ1, 2016	CQ2, 2016	Increase/ decrease
Net Sales	157.4	164.1	6.7
Operating Income	2.9	8.7	5.8
Non-operating income and expenses, net	-1.4	-3.1	-1.7
Interest/Dividends income and expenses	-0.5	-0.4	0.1
Equity in earnings of affiliates	1.3	0.6	-0.8
Foreign exchange gains or losses	-1.8	-2.2	-0.4
Other	-0.4	-1.1	-0.6
Ordinary Income	1.4	5.6	4.2
Extraordinary Profit	0.0	0.5	0.4
Extraordinary Loss	-1.6	-4.5	-2.9
Income before income taxes	-0.1	1.6	1.7
Income taxes	1.1	-0.4	-1.5
Profit	1.0	1.2	0.2
Profit attributable to non-controlling interests	-0.3	-0.2	0.1
Profit attributable to owners of parent	0.7	0.9	0.3

(Reference) Consolidated Sales by Segment

(Unit: Billions of Yen)

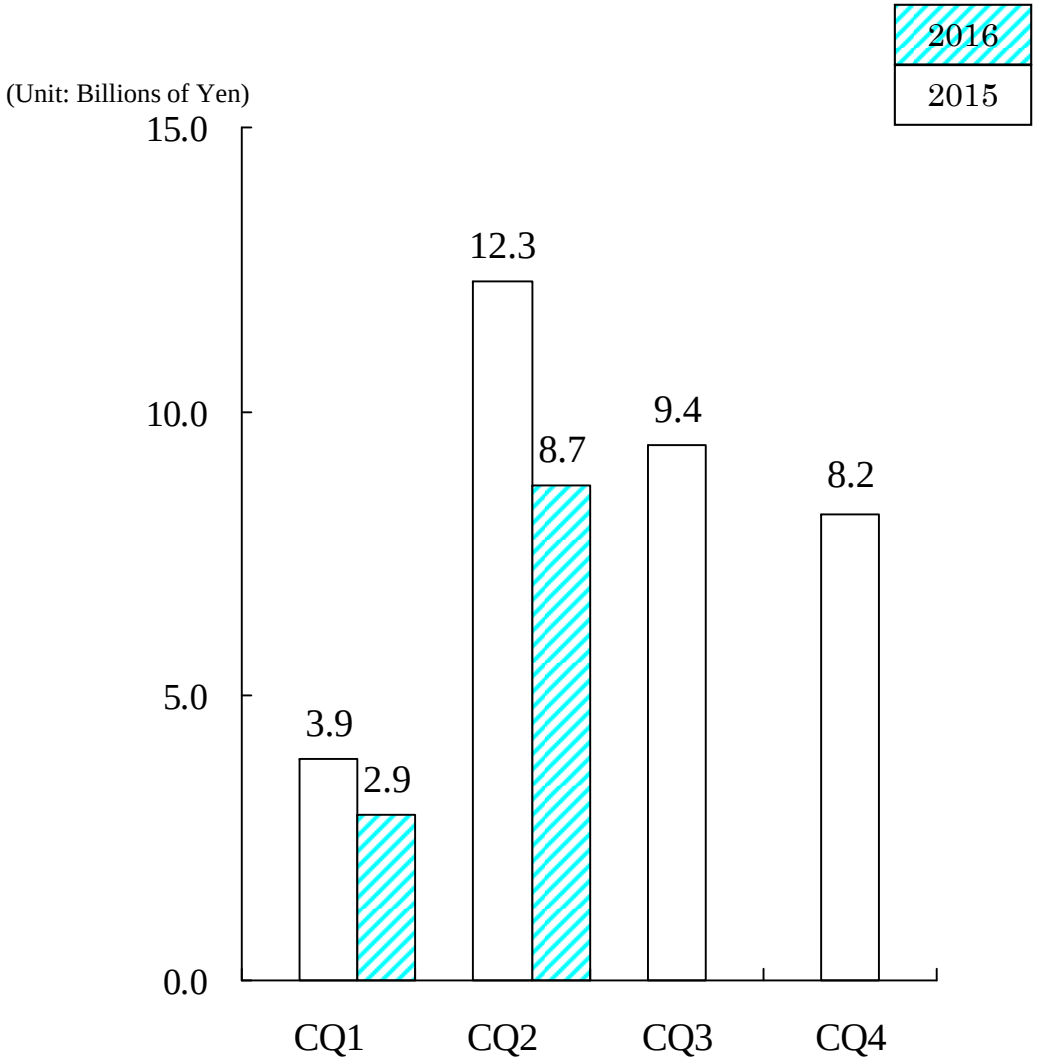
	CQ1, 2016	CQ2, 2016	Increase/ decrease	
Petrochemicals	42.9	43.1	0.2	【Olefins】sales maintained at the CQ1 level 【Organic chemicals】sales increased (conducted shutdown maintenance in CQ1)
Chemicals	32.1	32.8	0.6	【Basic chemicals】sales increased (shipment volumes of ammonia and chloroprene rubber up) 【Industrial gases】sales increased (seasonal) 【Electronic chemicals】sales increased 【Functional chemicals】sales decreased 【Power generating business】sales decreased (conducted shutdown maintenance in CQ2)
Electronics	22.3	24.7	2.4	【HDs】sales increased (shipment volumes up) 【Compound semiconductors】sales maintained at the CQ1 level 【Rare earths】sales increased (shipment volumes up)
Inorganics	12.4	12.5	0.2	【Ceramics】sales slightly increased 【Graphite electrodes】sales maintained at the CQ1 level
Aluminum	22.0	25.8	3.8	【High-purity foil for capacitors】sales increased (shipment volumes up) 【Aluminum specialty components】sales decreased 【Aluminum cans】sales increased (shipment volumes up: seasonal)
Others	36.2	36.7	0.5	【LIB materials】sales increased (shipment volumes up) 【SHOKO Co., Ltd. 】sales slightly increased
Adjustments	-10.5	-11.4	-0.9	
Total	157.4	164.1	6.7	

(Reference) Consolidated Operating Income by Segment

(Unit: Billions of Yen)

	CQ1, 2016	CQ2, 2016	Increase/ decrease	
Petrochemicals	1.5	5.9	4.3	【Olefins】profit substantially increased (improvement in market price and the difference between procurement and consumption prices of raw materials and market price) 【Organic chemicals】profit increased
Chemicals	2.5	2.9	0.4	【Basic chemicals】profit increased (shipment volumes of ammonia and chloroprene rubber up) 【Electronic chemicals】profit increased (shipment volumes up) 【Functional chemicals】profit decreased 【Industrial gases】profit increased (shipment volumes up: seasonal) 【Power generating business】profit decreased (conducted shutdown maintenance in CQ2)
Electronics	1.7	2.4	0.7	【HDs】profit maintained at the CQ1 level 【Compound semiconductors】profit maintained at the CQ1 level 【Rare earths】profit increased (shipment volumes up, improvement in the loss on reduction in the book value of inventories in CQ1)
Inorganics	-2.0	-2.4	-0.4	【Ceramics】profit maintained at the CQ1 level 【Graphite electrodes】profit decreased (market price down)
Aluminum	0.2	1.2	1.0	【High-purity foil for capacitors】profit increased (shipment volumes up) 【Aluminum specialty components】profit maintained at the CQ1 level 【Aluminum cans】profit increased (shipment volumes up: seasonal)
Others	0.5	0.5	0.0	【LIB materials】profit maintained at the CQ1 level 【SHOKO Co., Ltd.】profit maintained at the CQ1 level
Adjustments	-1.7	-1.8	-0.2	
Total	2.9	8.7	5.8	

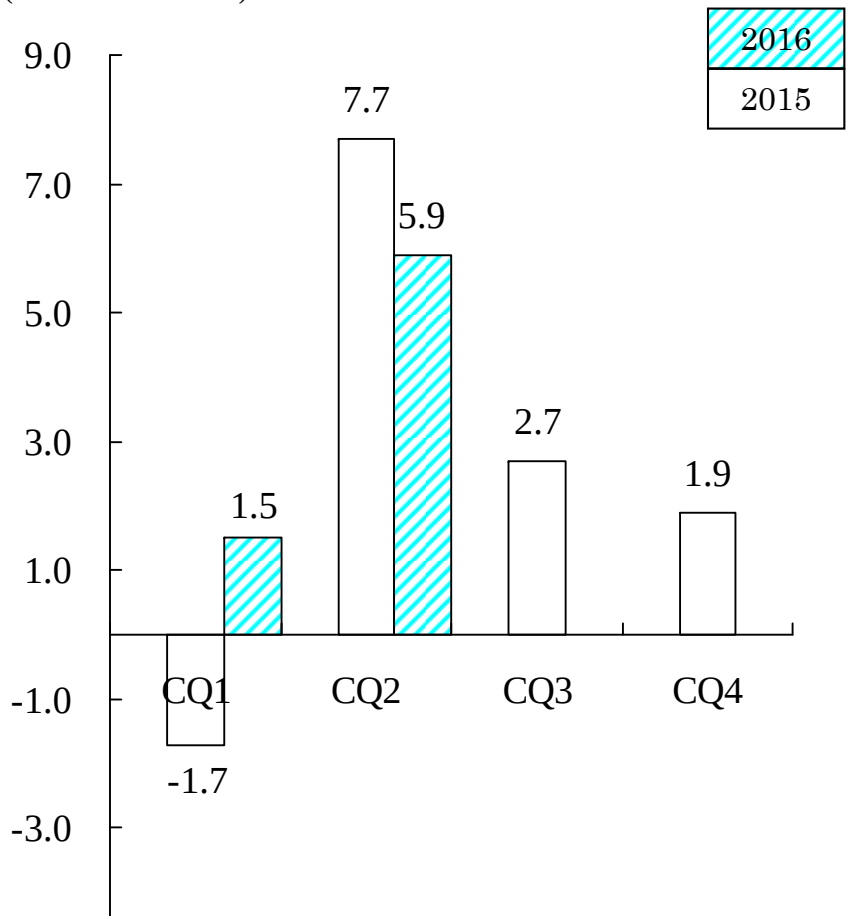
(Reference)　Quarterly Operating Income



(Reference) Quarterly Operating Income by Segment

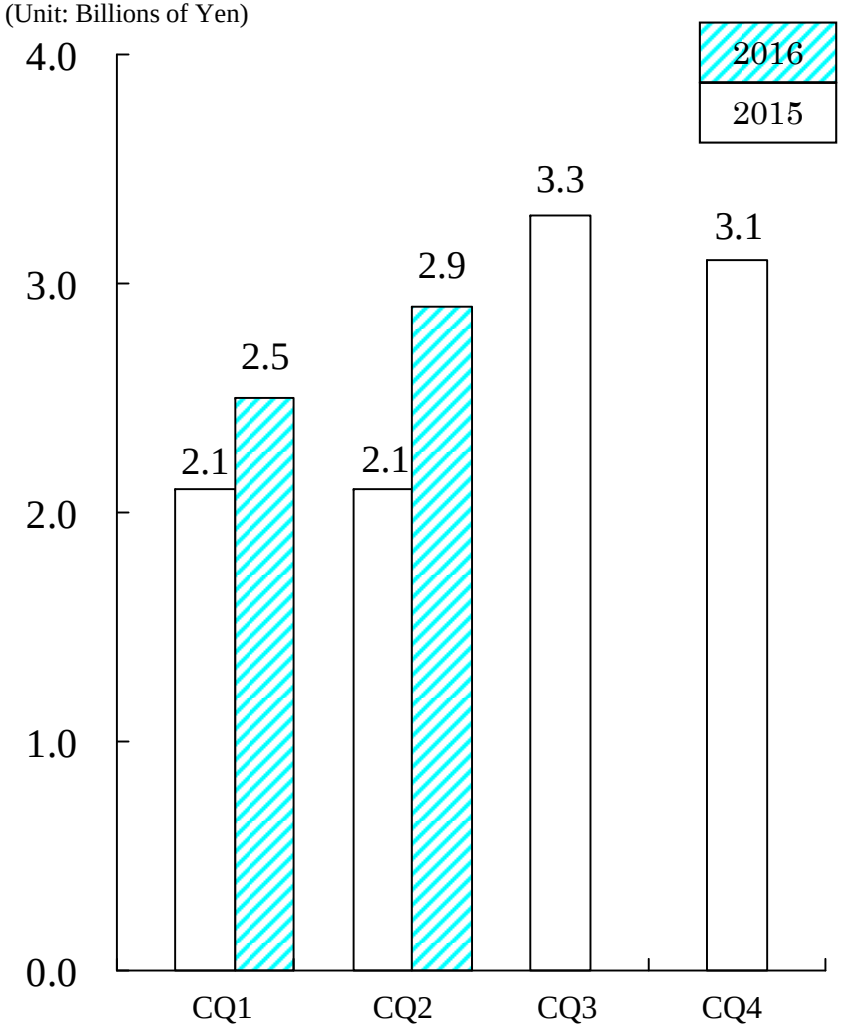
《Petrochemicals》

(Unit: Billions of Yen)



《Chemicals》

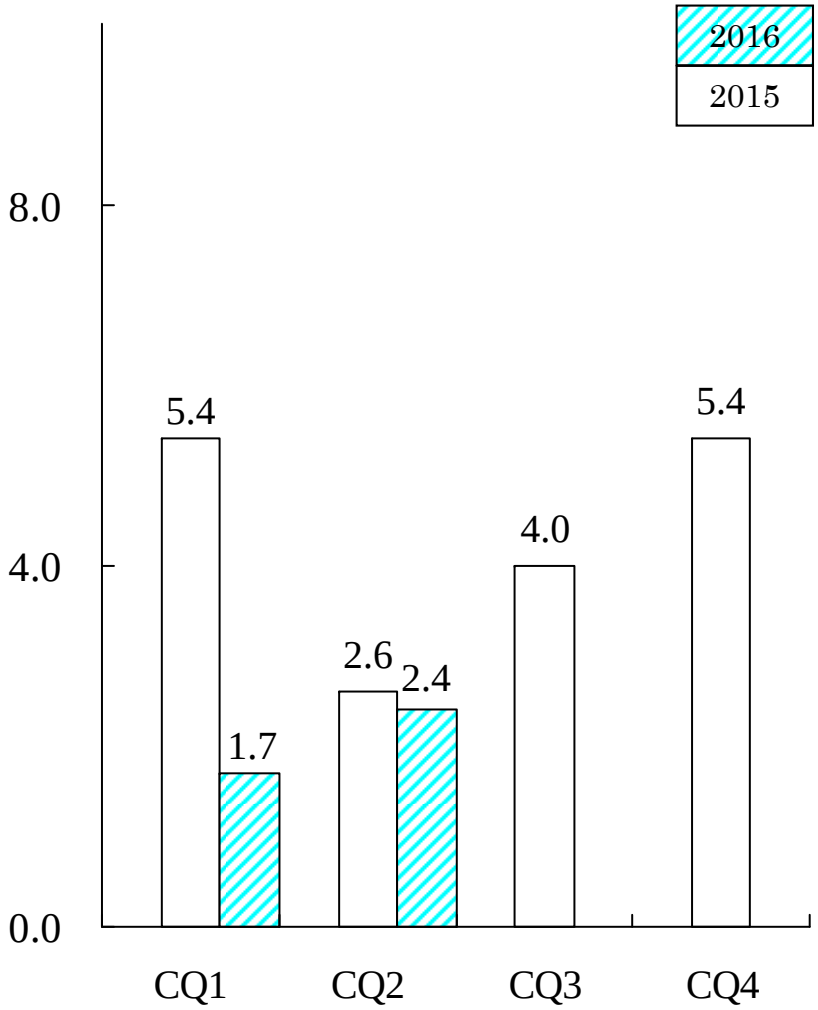
(Unit: Billions of Yen)



(Reference) Quarterly Operating Income by Segment

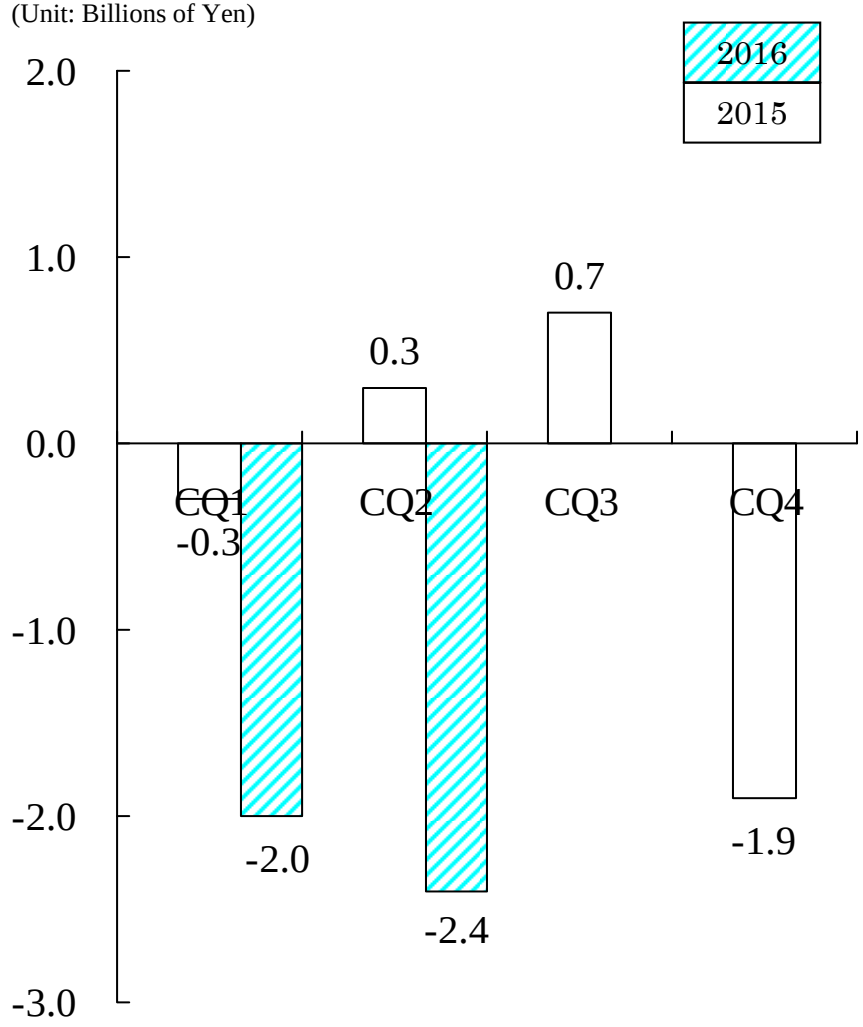
《Electronics》

(Unit: Billions of Yen)



《Inorganics》

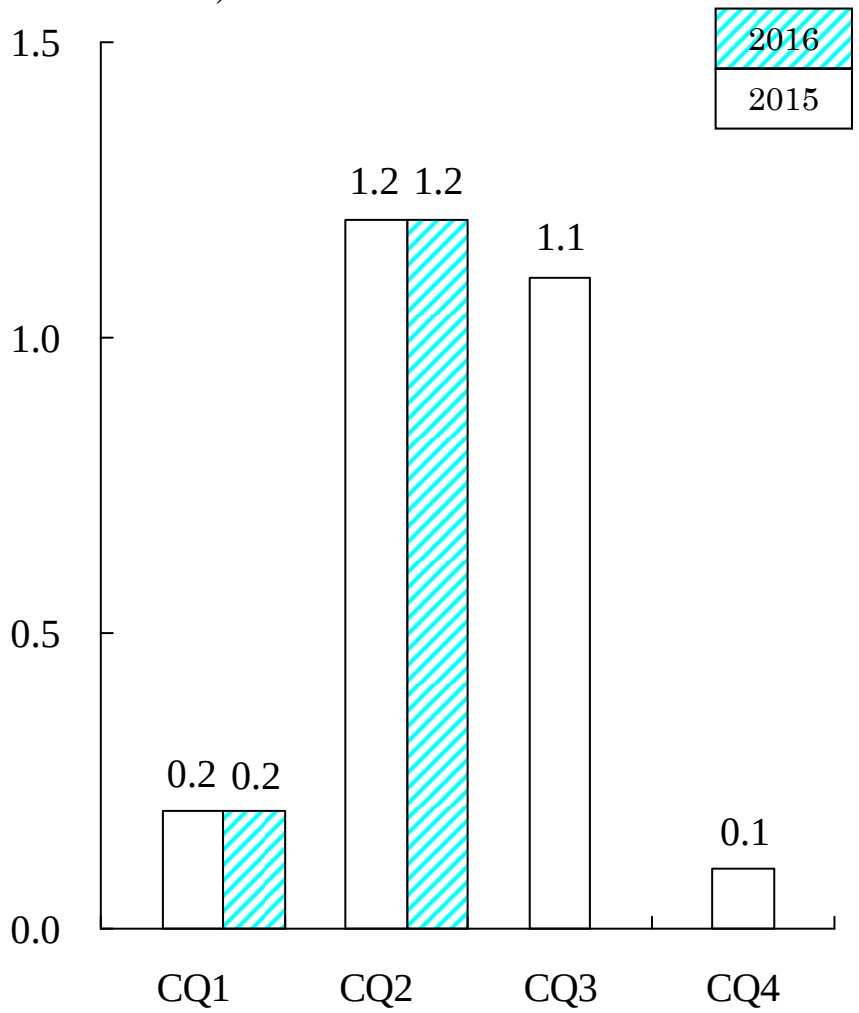
(Unit: Billions of Yen)



(Reference) Quarterly Operating Income by Segment

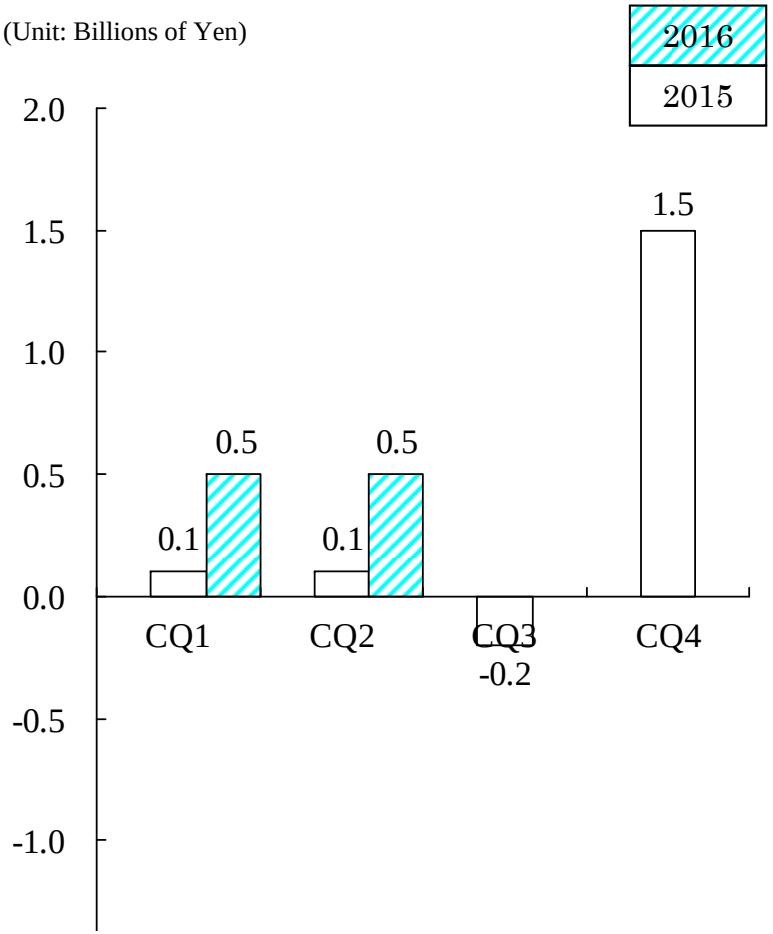
《Aluminum》

(Unit: Billions of Yen)



《Others》

(Unit: Billions of Yen)



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) in order to maintain the level of investment unit considered desirable for SDK's shares by Japan's stock exchanges (50,000 yen or more and less than 500,000 yen). Number of authorized shares was decreased from 3.3 billion shares to 330 million shares according to the ratio of the consolidation of shares.

- **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. SDK has in place a Compensation Advisory Committee, a majority of which comprises Outside Directors and Outside Audit and Supervisory Board Members, which serves as an advisory body to the Board of Directors. Prior to the board meeting resolution to introduce the Scheme that decides compensation for Directors and Corporate Officers, this committee deliberated on the proposal.

Topics

[General]

- **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.

[Chemicals segment]

- **Alliance with Azelis in cosmetic materials**

  In April 2016, SDK agreed with Azelis that the two parties form a business alliance to market SDK's cosmetic raw materials in Europe. Azelis, of Luxembourg, is a leading global specialty chemicals distributor with business bases in 40 countries. SDK and Azelis concluded an exclusive distributorship agreement to enable Azelis to market SDK's vitamin derivatives, a slimming agent and hair care products in Europe. Azelis started its marketing activities for SDK's products in this April. Whether a cosmetic material can demonstrate enough effectiveness depends on development of formulas. Moreover, the needs of customers to cosmetics greatly vary by region. SDK expects that the sales of its cosmetic raw materials in Europe will significantly increase, taking advantage of Azelis' sales network in European countries and expertise and know-how about development of formulas that meet European Customers' needs.

Topics

[Chemicals segment]

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

  In March 2016, SDK increased its capacity 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. Under its ongoing medium-term consolidated business plan “Project 2020+,” SDK classifies its business in high-purity gases for electronics into the category of “Growth-accelerating” business. SDK will continue aiming to further strengthen and expand its business in high-purity gases for electronics, responding rapidly to the expansion of the global electronic materials market.

- **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.

Topics

[Aluminum segment]

- **Development of high-strength version of ST60 aluminum plate**

  SDK developed “ST60-HSM” aluminum plate, a new grade product of ST60-series aluminum plates which boast high thermal conductivity and high strength. SDK started to manufacture samples of ST60-HSM in April 2016. ST60-series aluminum plates have thermal conductivity and heat radiation capacity equal to pure aluminum, and also have strength equal to A5052 aluminum alloy which is widely used as material for frames. In recent years, manufacturers of mobile devices including smartphones and tablets tend to apply metal enclosures to products in order to give them enhanced rigidity and better designs. Moreover, these manufacturers expressly prefer to apply aluminum enclosures in order to take advantage of attractiveness of anodized surfaces. ST60-HSM is as bendable as ST60-T3, which has been used as heat sink in electronic devices, and is stronger than ST60-T8, which features high-strength and has been used mainly as metallic base panels. By putting ST60-HSM on the market, SDK aims to expand adoption of its aluminum plates by manufacturers as enclosures for mobile devices.

Topics

[Others segment]

- Expansion of production capacities for LIB materials in response to increasing LIB use in vehicles

SDK has decided to expand its production capacity for *SCMG*™ carbon-based anode material, and implemented expansion of production capacity for *SDX*™ carbon-coated aluminum foil which is used as collector for cathode, both for LIBs. The rage of LIBs' use is rapidly increasing. These days, more and more LIBs are used not only in small devices such as smartphones but also to in large equipment, especially in electric vehicles (EVs). In China, the demand for large LIBs for use in EVs and electric buses has been significantly increasing in recent years due to stricter emission control and subsidies to EVs by governments. 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. In June 2016, SDK decided to expand the production capacity for *SCMG*™ at Omachi Plant by 50%, to 1500t per year by the end of 2016. SDK also started to outsource a part of its *SCMG*™ production to a manufacturer in China in June 2016. In January 2016, SDK started to outsource a part of its production of *SDX*™ carbon-coated aluminum foil for cathodes in LIBs. *SDX*™ has the advantages of low resistance and close adhesion to cathode materials in LIBs, thereby improving charge/discharge performance of LIBs and contributing to a reduction in the amount of conduction supportive agents and binders added to cathode materials in LIBs. SDK positions its LIB materials business as an advantage-establishing business in its medium-term business plan "Project 2020+," and will maintain stable supply of high-quality LIB materials to the continuously expanding market.

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 HE 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 1,200 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=1/1,000mm)

*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.

Topics

[Others segment]

- Promotion of SDK's plant factory systems in overseas markets

  A plant factory system developed by SDK as a package of *SHIGYO*™ Method fast-track plant cultivation technology, LED light, aluminum racks for plant cultivation and other equipment has been adopted by Isetan Cool Japan SDN. BHD. (ICJ) in order to be installed and displayed as an example of "Cool Japan" (Japanese esprit) at "ISETAN The Japan Store Kuala Lumpur" which is scheduled to open in October 2016 at Kuala Lumpur, Malaysia. This store is expected to be a new model that disseminates and shares "excellent Japanese products and services," expresses Japanese esprit, and creates new demands in the local market as well as spinoff impact to the Japanese market.

  Moreover, SDK, Marubeni Corporation, and Chiyoda Corporation will jointly develop an overseas artificially-lit plant factory business. SDK will provide plant factory system including *SHIGYO*™ Method; Marubeni will promote and conduct market development of plant factories in overseas countries; and Chiyoda will conduct design, procurement and management of the factory by utilizing the know-how it has gained through the experimental study of crop cultivation in the International Space Station. As the first stage in this business, the three companies have reached an agreement with Al Ghurair Group, one of the largest conglomerates in the United Arab Emirates, to introduce a demonstration plant of their plant factory in Dubai in January 2017. The three companies will use this demonstration plant as a showroom for customers who are considering introducing their own plant factory and proceed with overseas market promotion with a primary focus on the Middle East.