

# FY2018 1<sup>st</sup> Half Results

(from April 1, 2018 to September 30, 2018)

November 1, 2018



## NGK INSULATORS, LTD.



This is a translation of materials used for the analyst meeting held in Tokyo, Japan on November 1, 2018

This document contains forward-looking statements that are based on management's expectations, estimates, projection and assumptions that were available and reasonable at the time of release. Actual future results and trends may differ materially from those in the forecasts due to a variety of factors.

**President**  
**Taku Oshima**

**Agenda**

**Summary of financial results for FY2018 1<sup>st</sup> Half**

(Ended September 30, 2018)

**Forecast for FY2018**

(Ending March 31, 2019)

**Segment Information**

**Capital Expenditures & Depreciation Costs**

**Medium-term Plan (New products / R&D / Financial / ROIC)**

**Financial Condition**

	(¥Bil.)	FY2017 1 <sup>st</sup> half	FY2018 1 <sup>st</sup> half		FX	Growth ratio
			April announcement			
Net Sales		219.8	240.0	228.2	-0.2	+4%
Operating Income		35.9	35.0	35.7	-0.4	−0%
Ordinary Income		34.2	33.0	34.2		+0%
Profit Attributable to Owners of Parent		19.8	20.0	24.7		+25%
Exchange Rate	USD	¥111	(¥105)	¥110		−¥1
	EUR	¥127	(¥125)	¥130		+¥3

Sales increased but Operating/Ordinary income unchanged from the previous year, while profit increased

- Power Insulators sales worsened both in Japan and abroad as demand continued to be weak.
- Ceramics Sales increased due to higher demand for sensors and GPF (Gasoline Particulate Filter) under tighter emission regulations. Profit was flat due to increased in depreciation and development costs.
- Electronics Results were roughly same as the last year despite the weak demand for package products, thanks to the favorable performance of Wafer products.
- Process Technology Both sales and profits increased for products for semiconductor manufacturing equipment due to the high level of investments in semiconductor manufacturers on the background of strong demand for semiconductor.
- Income taxes Tax was reduced due to the completion of liquidation of an overseas subsidiary resolved in the year ended March 2014.  
(At the beginning of the fiscal year, assumed to take place in the 2<sup>nd</sup> half)

# Forecasts for FY 2018

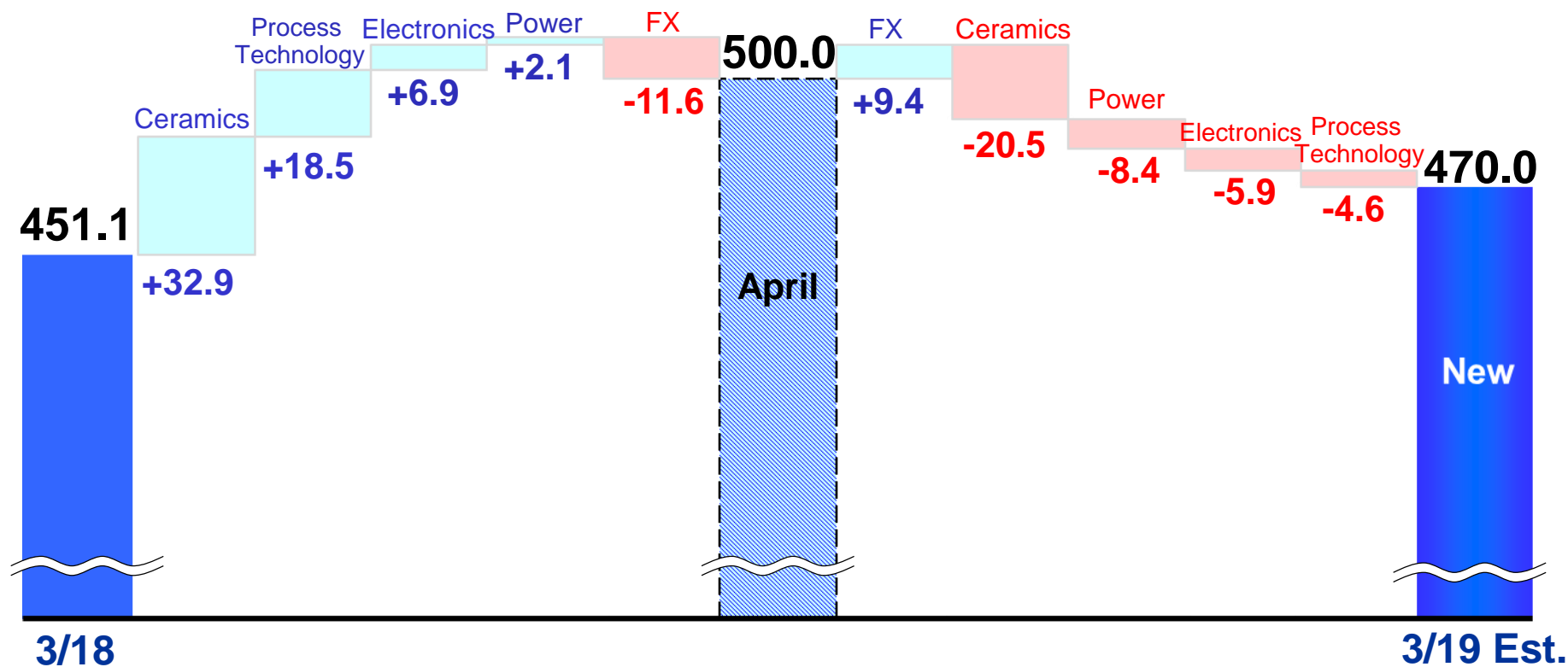
	(¥ Bil.)	FY2017	FY2018		Growth ratio	
			April announcement		FX	
Net Sales		451.1	500.0	470.0	-1.0	+4%
Operating Income		70.0	77.0	70.0	-0.9	−0%
Ordinary Income		70.6	76.5	68.0		−4%
Profit Attributable to Owners of Parent		45.8	52.0	44.0		−4%
Exchange Rate	USD	¥111	(¥105)	¥110	−¥1	
	EUR	¥129	(¥125)	¥130	+¥1	

Operating income is expected to be flat despite higher sales, Ordinary Income and Profit to decline

- Power** Sales of insulators are expected to fall significantly both in Japan and abroad, due to sluggish demand and postponement of large deals, causing deficit to increase.
- Ceramics** Profit is likely to flat, due to depreciation and development costs despite higher sales led by stronger demand for sensors and GPF.
- Electronics** Both sales and profit are expected to flat despite the weak demand for package products, thanks to the favorable performance of piezoelectric elements for HDD and wafer products.
- Process Technology** Higher sales and profits are expected for ceramic components for semiconductor manufacturing equipment despite the risk of some semiconductor manufacturers slowing down the pace of their investment.

# Change Analysis: Sales

(¥ Bil.)



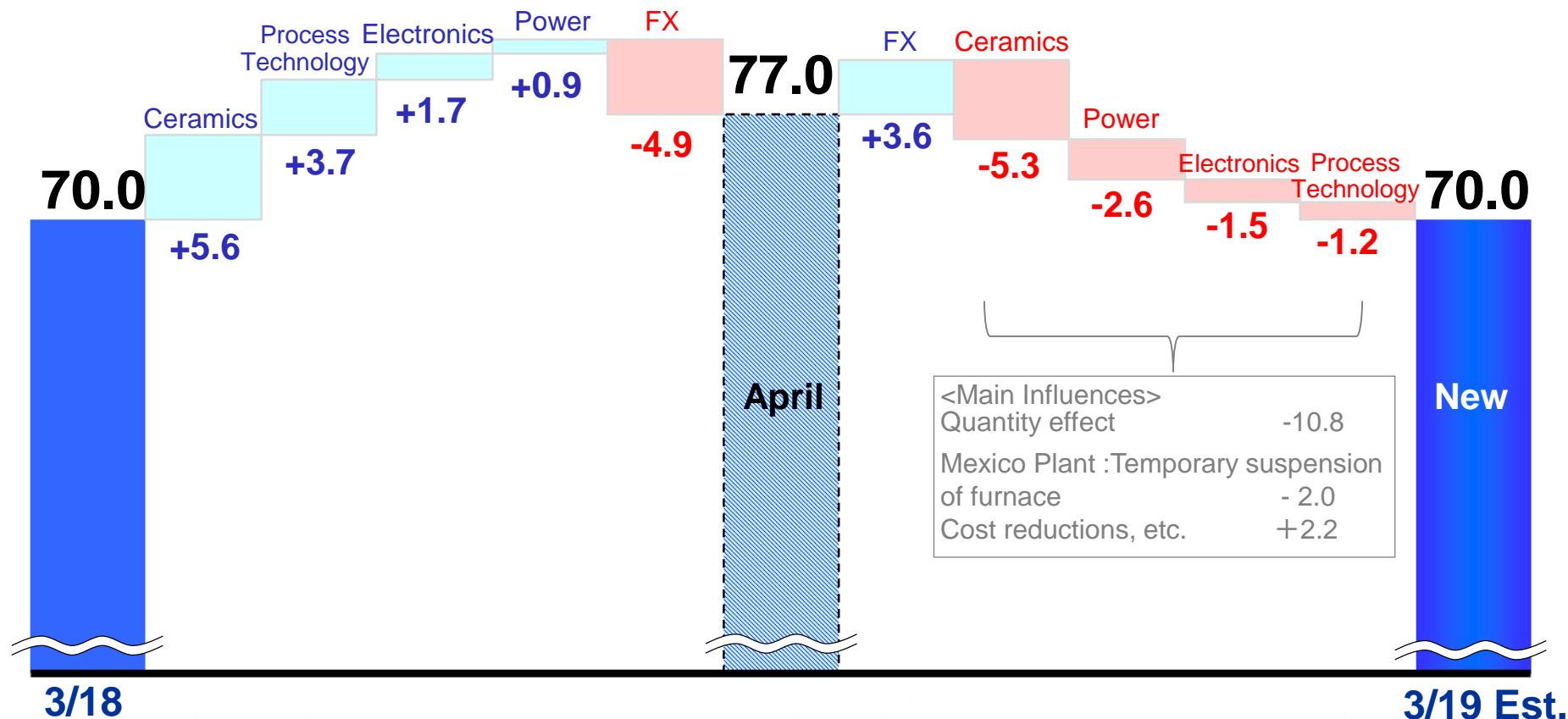
FX Rate 3/18  
¥111/USD  
¥129/EUR

April(3/19 Est.)  
¥105/USD  
¥125/EUR

New(3/19 Est.)  
¥110/USD  
¥130/EUR

# Change Analysis: Operating Income

(¥ Bil.)

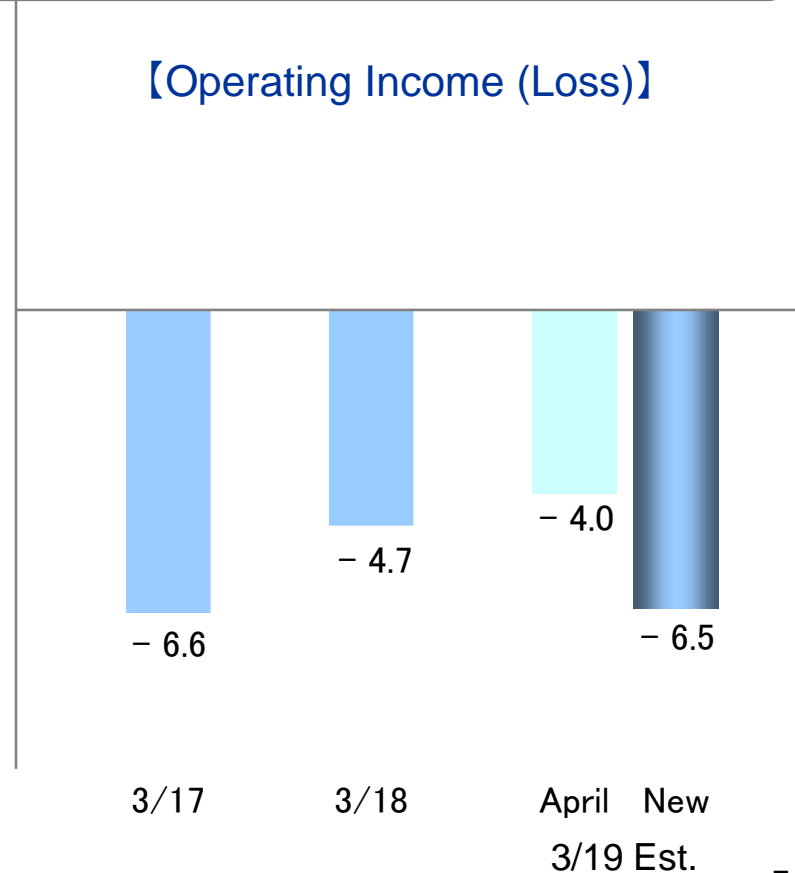
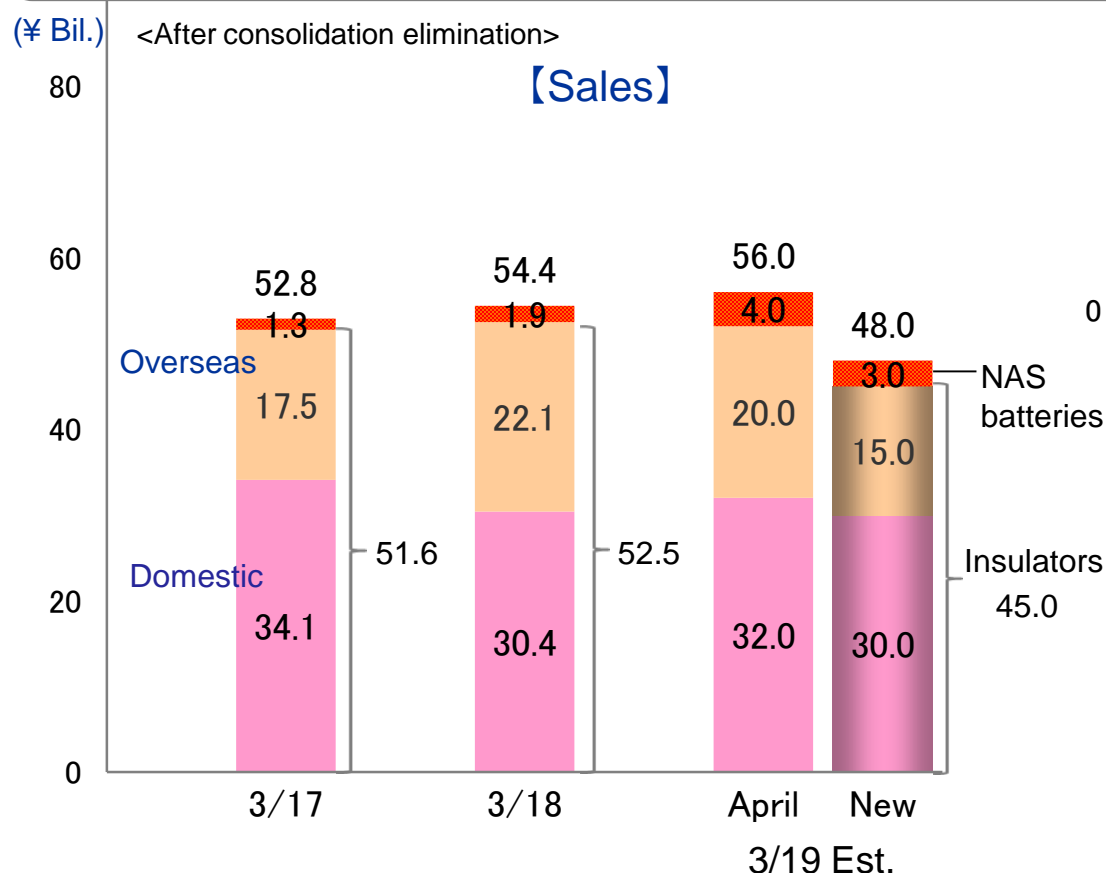


FX Rate 3/18  
¥111/USD  
¥129/EUR

April(3/19 Est.)  
¥105/USD  
¥125/EUR

New(3/19 Est.)  
¥110/USD  
¥130/EUR

- Insulators
  - In Japan, power companies continue to curb their capital investments, and demand remains weak.
  - Overseas, demand remains weak in the Middle East and North America, while a large power transmission project is delayed and competition intensifies in China.
  - Also in other parts of Asia, competitiveness is weakening due to a stronger influence of China against the backdrop of the Chinese One Belt One Road Initiative.
  - Despite measures implemented, including the change from two shifts to one at the Komaki and Chita plants, higher temporary costs associated with the tighter insulator inspection system among other factors cause deficit to increase.
- NAS
  - Both orders received and shipments are weak in Japan and abroad with no change, and deficit continues.

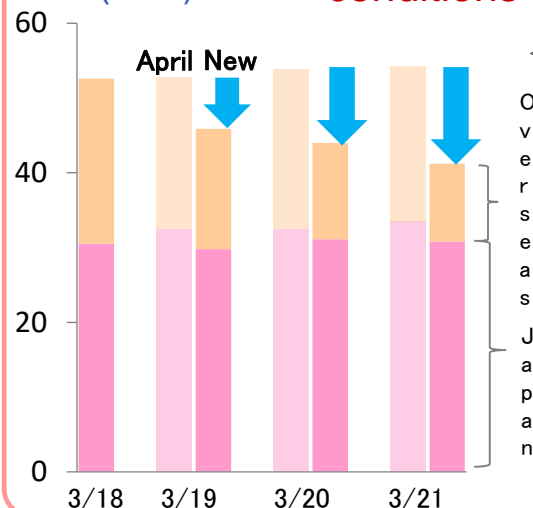


# Forecast of Power business

## ■ Insulators

With demand being weaker than expected in Japan and abroad, tough operating conditions will likely continue.

Sales (¥ Bil.)



< Market environment >

Japan: Power companies will continue to curb their capital investments. It is likely that time will be required before we see replacement demand on full scale.

Overseas...China: In addition to the delay of a large project, competition is intensifying.

Asia: Chinese competitors will remain predominant, due to the influence of China's One Belt One Road Initiative.

North America: Replacement of power transmission insulators is weak as focus is placed on investments in power distribution facilities to accommodate renewable energy.

Middle East: Demand continues to be weak due to tight budget.

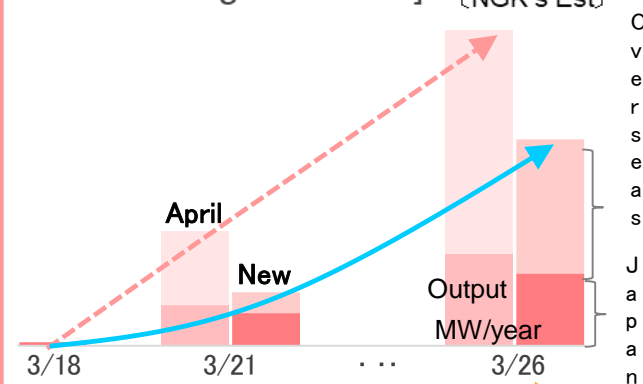
In an increasingly tough environment, formulate a drastic reconstruction plan, including site reorganization, and aim to move into the black.

## ■ NAS® Batteries

While it will take time for the development of full-scale demand, the potential needs are high.

[Global market scale for long-life storage batteries]

(NGK's Est)



< Market environment >

Japan...Under the Fifth Basic Energy Plan (July 2018), storage cells have been considered to offer companies with adjustment capacity for the future.

Hokkaido: Needs remain, including those for systems storage batteries, despite a delay in the plan caused by the establishment of an adjoining wind power generation site. Large-capacity storage cells are attracting attention as an emergency power source following the large-scale blackout caused by a natural disaster.

Kyusyu: Oversupply of electricity resulting from greater solar power generation leads to a restraint on the output of solar power.

Needs to absorb surplus power by means of storage cells will increase.

In addition, VPP (Virtual Power Plant) validation testing using storage cells will advance.

Overseas: Large-scale solar power generation implementation plan is under way (Abu Dhabi 2026 5.7 GW)

There are expected to be greater needs for storage cells for long-hour use, including to avoid reinforcement of systems for storage batteries in power transmission networks, to shift the peak of solar power generation, and to use as an emergency power source and VPP. They will gradually become full-scale needs from 2020 or thereafter.

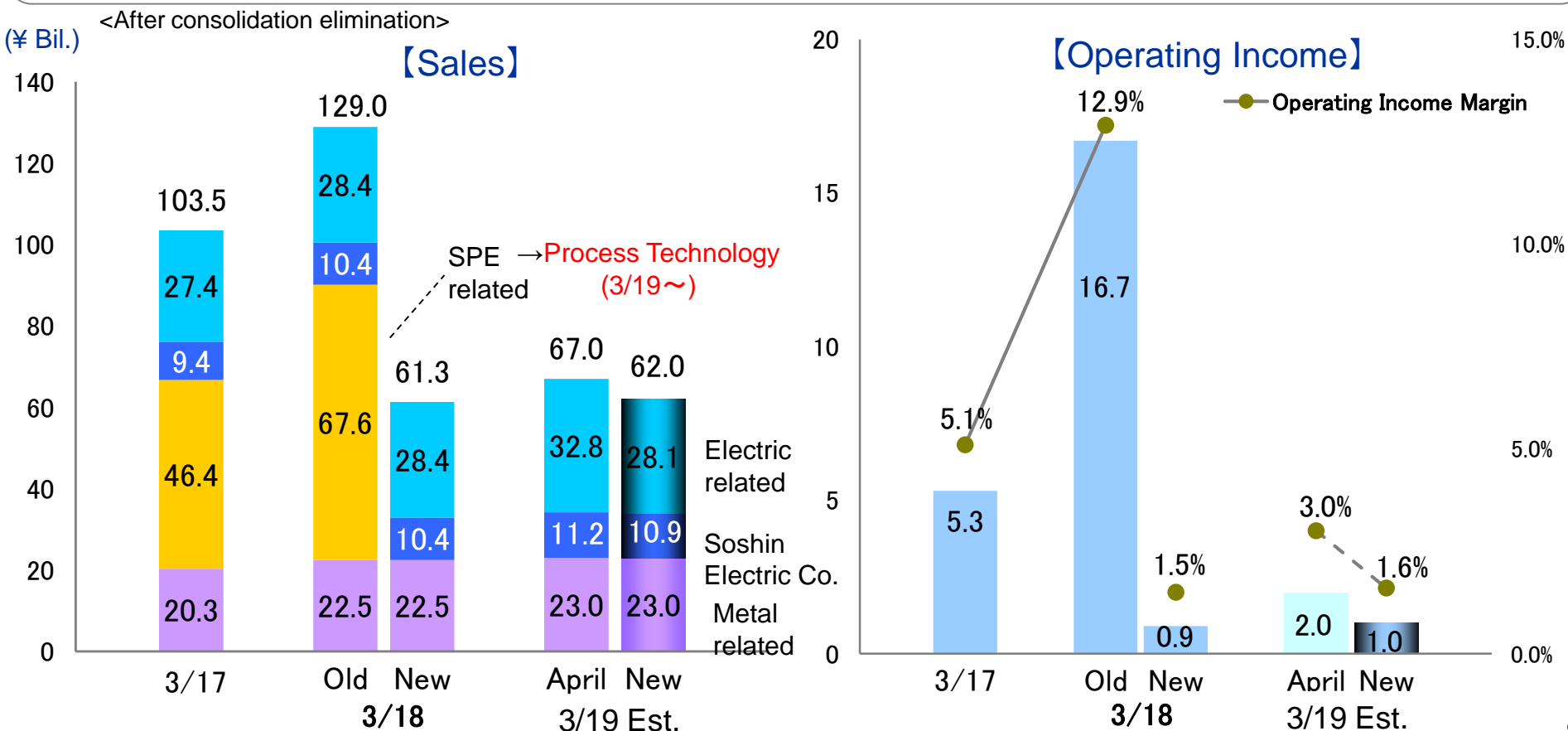


## ● Electronics Components

- Demand for package products for mobile phone base stations in China is weak, due to the impact of sanctions placed on individual Chinese firms by the U.S.  
Although the sanctions were lifted in July, further time will likely be required before demand recovers.
- Demand for piezoelectric elements for HDD is rising, thanks to the greater capacity of HDDs for data centers (nearline).
- Composite wafers show steady performance in general.

## ● Metal Related Products

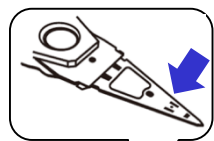
- Current demand is strong primarily for the Chinese market.



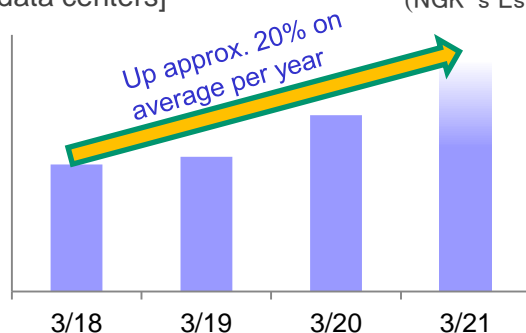
## < Existing product lines >

### ■ Piezoceramic Actuators for HDD (Electronic Components)

While high-speed servers/mobile memory equipment are shifting to SSD, demand for cost-competitive HDDs is expanding for data centers (nearline).



[Forecast for total shipment of HDDs for data centers] (NGK's Est.)



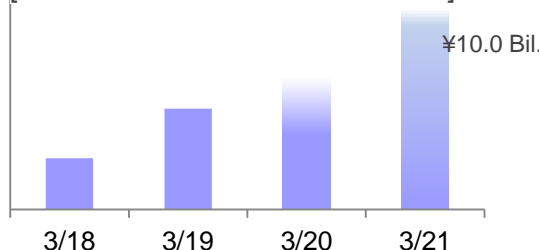
Investment for expanding production is ongoing to meet growing demand.

### ■ Bonded Wafers (Electronic Components)

Given the penetration of high-speed technologies for mobile communication, demand for high-performance filters is rapidly increasing.



[Sales forecast for bonded wafer]



Work to reduce costs while strengthening production capacity in response to the increase in demand.

## < New product lines >

### ■ Gallium Nitride (GaN) Wafer

#### Product



Against the backdrop of mercury regulations under the Minamata Treaty, demand for an ultra-luminant LED using a GaN wafer is increasing as an alternative to an ultra-high pressure mercury lamp source for projectors.

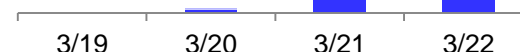
#### Final Use

Business projector



[Sales forecast for gallium nitride (GaN) wafer products]

¥5.0 Bil.



Pursue deployment to headlights for automobiles.

## < New product lines >

### < Existing product lines >



Piezoceramic Actuators for HDD



Bonded Wafers



RF package



Gallium Nitride (GaN) Wafer



Micro-lens for Ultraviolet LED

Aim to increase earnings by achieving growth in existing products and launching new products.

## ● Ceramic for Semiconductor Manufacturing Equipment (SPE-related products)

- While the 1<sup>st</sup> half saw favorable performance, the 2<sup>nd</sup> half faces a phase of demand adjustments caused by postponement of investments by some semiconductor manufacturers due to the fall in memory prices, and other factors. Sales will likely decline while profits stay flat on a full-year basis.

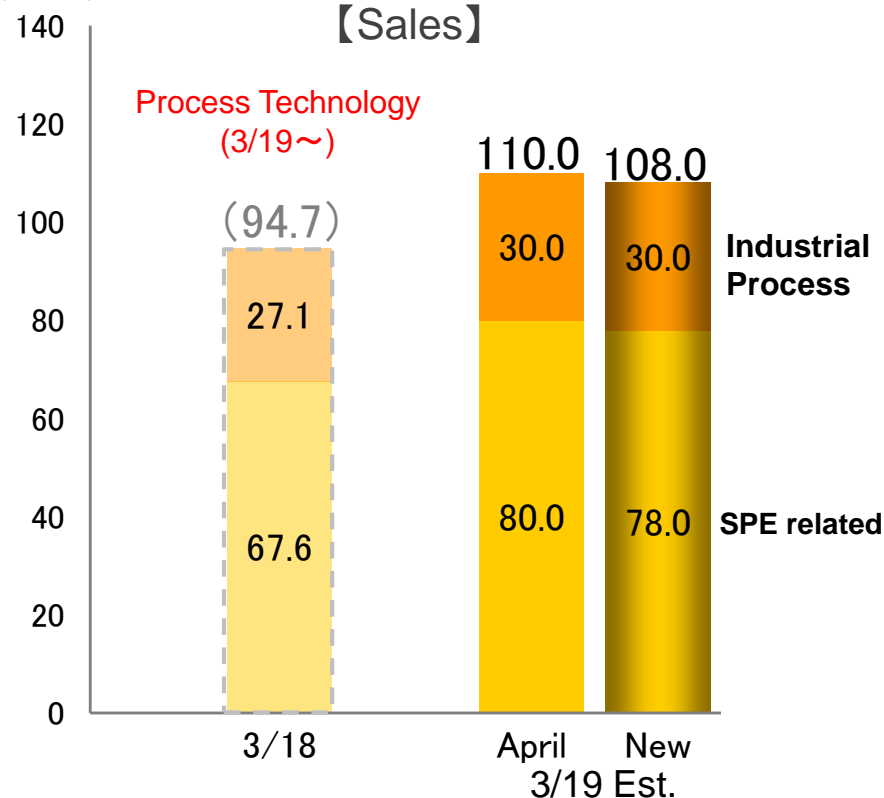
## ● Industrial processes

- Demand for heating equipment is strong, due to continuous investments in lithium-ion batteries for automobiles by Chinese clients.

<After consolidation elimination>

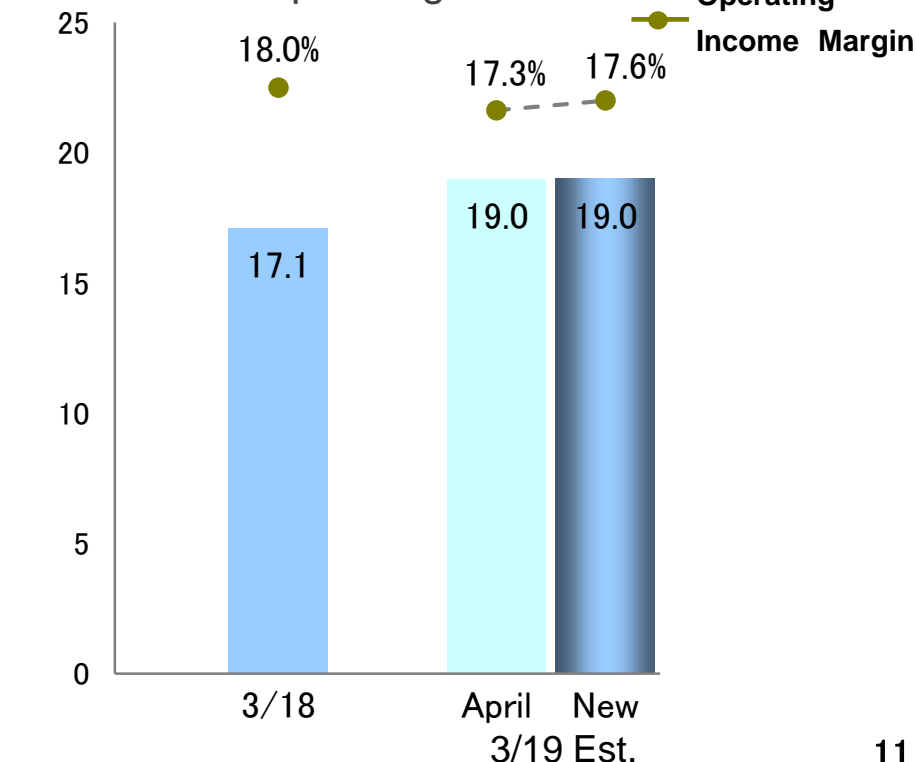
(¥ Bil.)

### 【Sales】



(¥ Bil.)

### 【Operating Income】

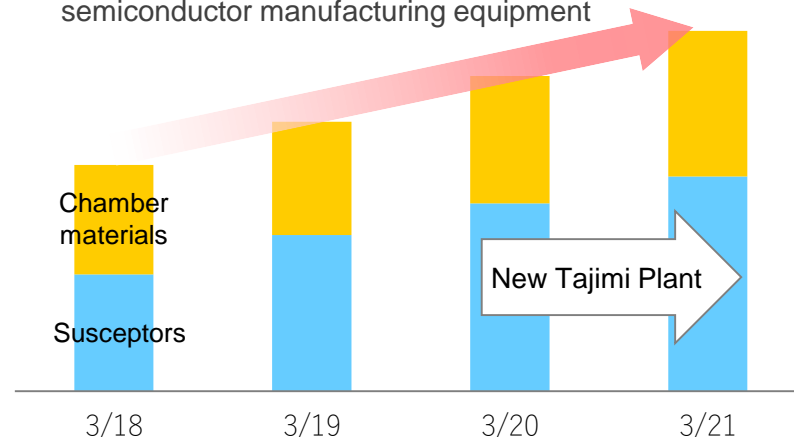


## ■ Ceramic Components for Semiconductor Manufacturing Equipment

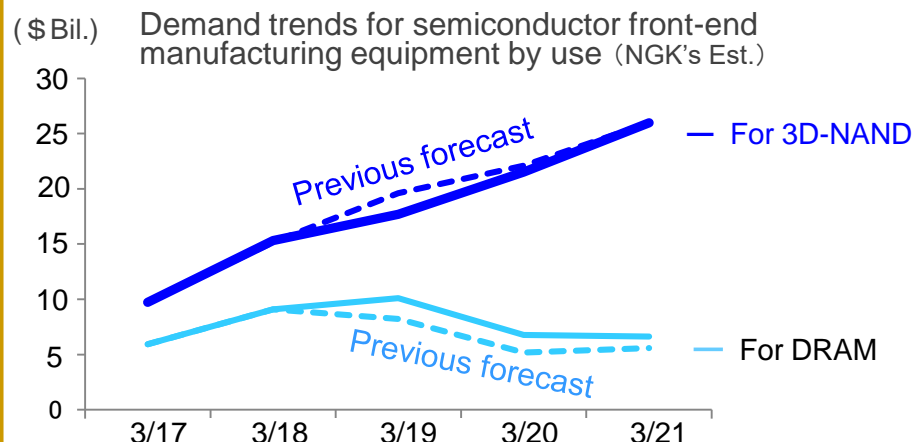


Despite the shift in investments from 3D-NAND to DRAM recently, the investments in 3D-NAND are expected to expand due to an increase of the demand for NAND flash memory devices from a medium- to long-term viewpoint.

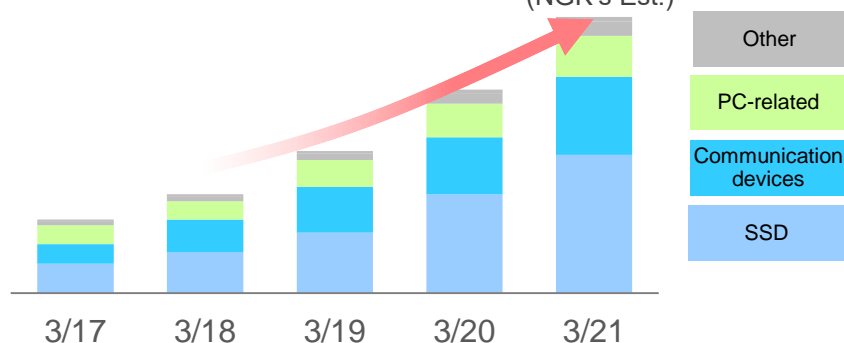
Illustrated trend of NGK sales of components for semiconductor manufacturing equipment



Investments for production expansion in Japan and abroad



Demand for NAND flash memory devices (NGK's Est.)

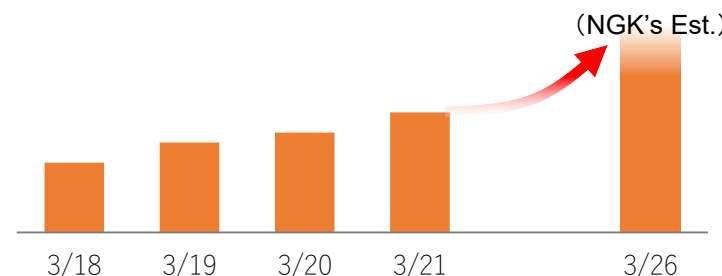


## ■ Heating Equipment (Industrial Process Products)

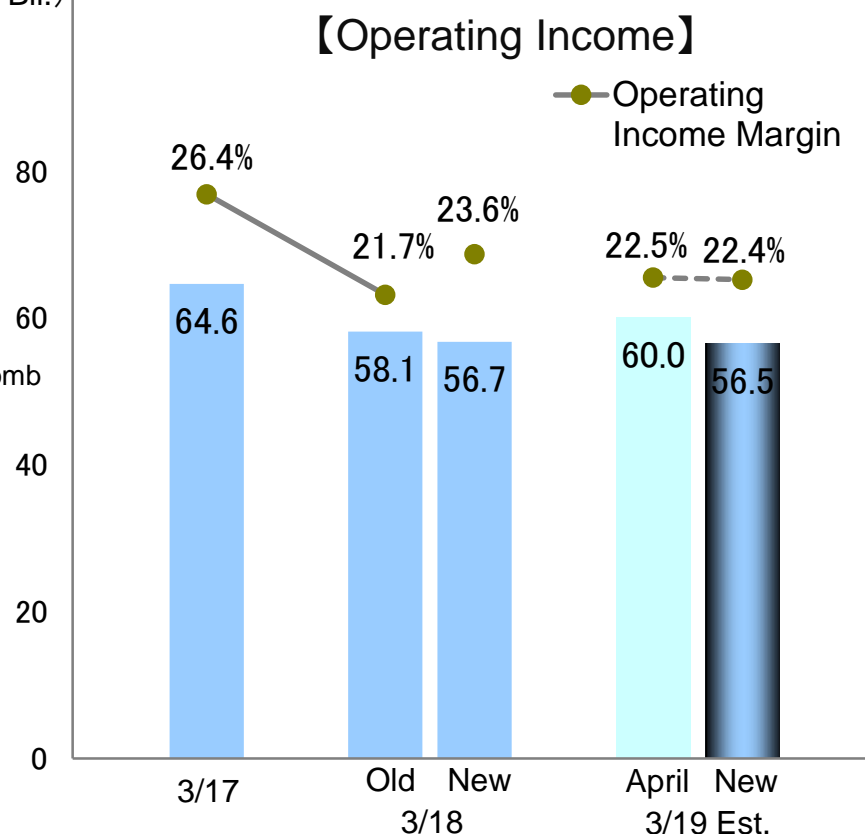
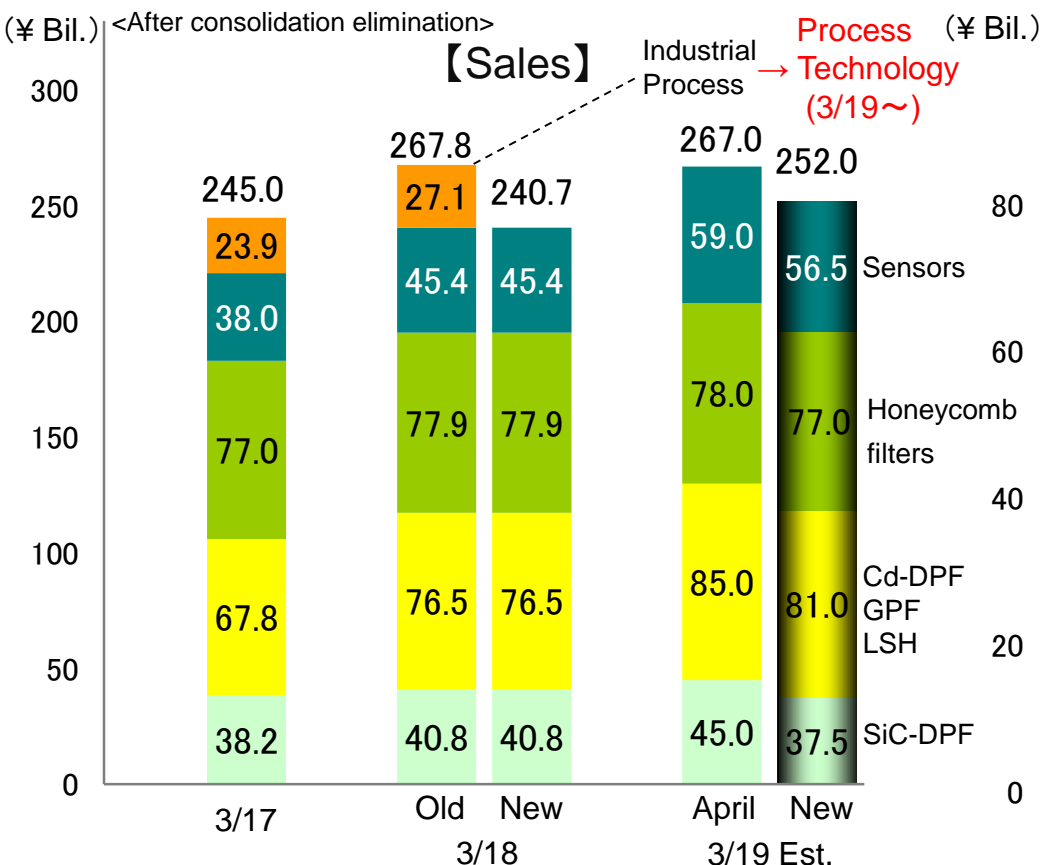


China will introduce the NEV (New Energy Vehicle) Regulations in 2019 as planned by the government. Investments in cathode materials for lithium-ion batteries for EV will be steady, leading to the growth of NGK's shipment of combustion furnaces for cathode materials used in lithium-ion batteries.

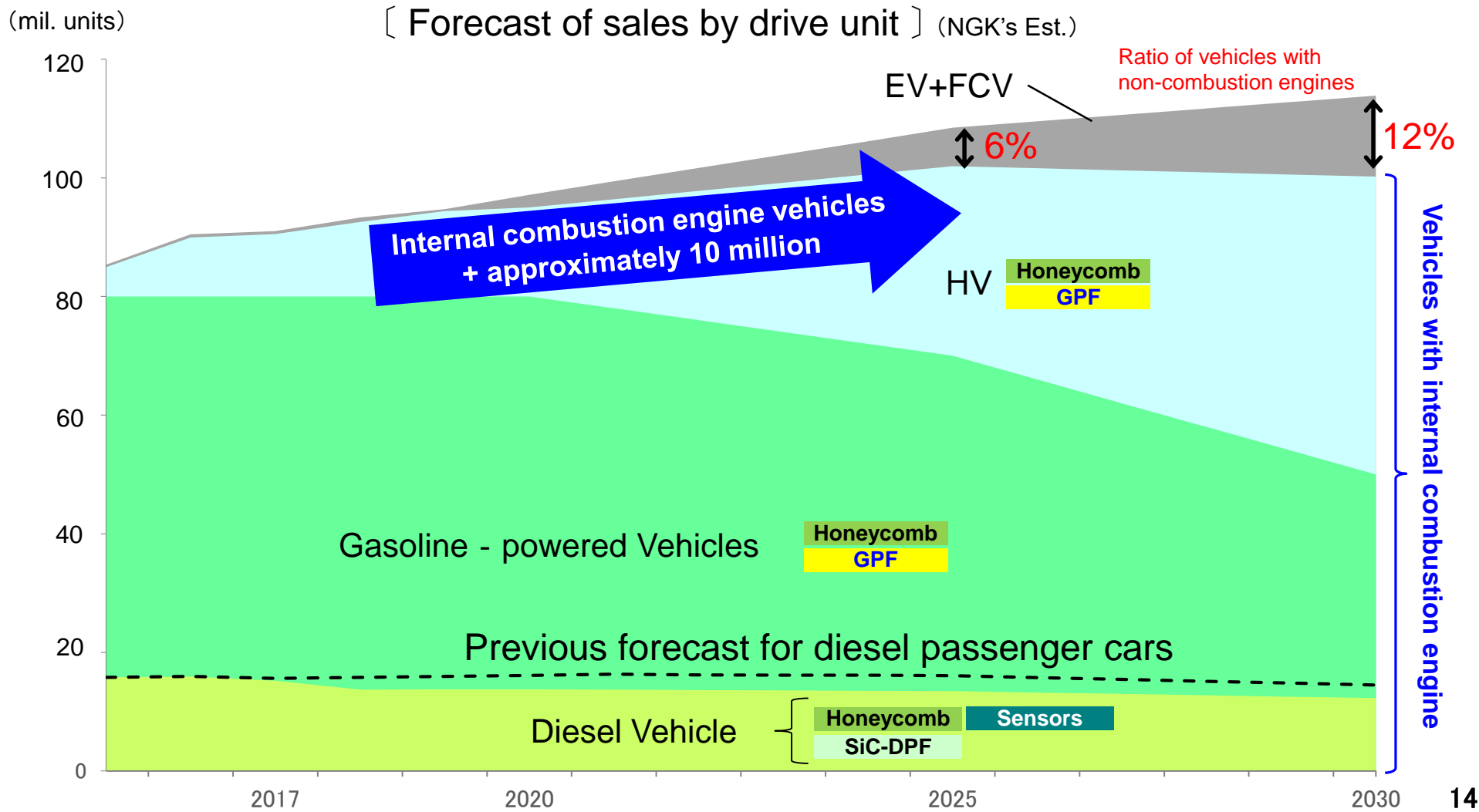
China: Demand for combustion furnaces for cathode materials used in lithium-ion batteries (NGK's Est.)



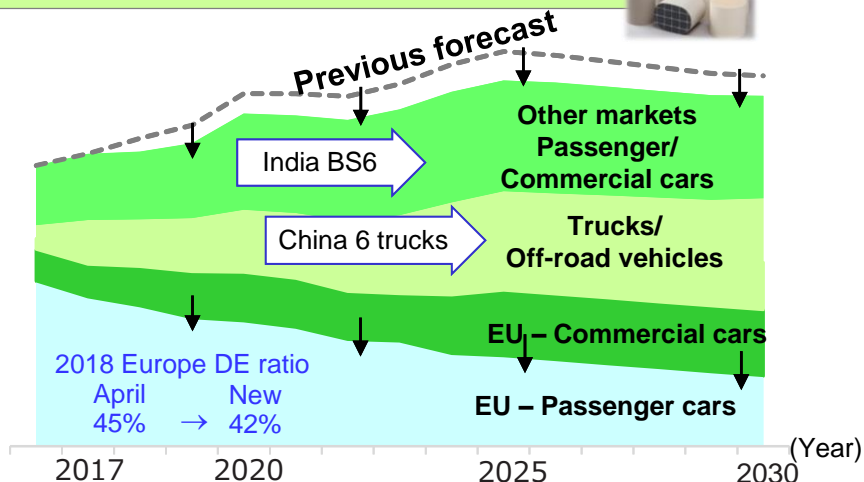
- Automotive-related: Sales and profits are expected to fall short of the initial forecasts, due to the more-than-projected decline in the ratio of diesel passenger cars in Europe.
- Honeycomb :Sales volume will decrease due to a slow down in the sales of passenger cars in China.
- LSH :Although the demand for trucks and off-road vehicles in North America are robust, sales will decrease due to a weak demand for trucks in China and a temporary suspension of furnace in Mexico plant.
- GPF :Demand will increase due to a higher ratio of gasoline passenger cars in Europe.
- SiC-DPF/Sensors :Demand will decrease significantly due to a lower ratio of diesel passenger cars in Europe.  
(Sensors: Number of units installed per vehicle will increase)



- The number of passenger cars sold in the world will surpass the 100 million-level in 2020 or so and is expected to be at the 110 million-level in 2025 to 2030.
- Non-internal combustion engine vehicles (EVs, fuel battery vehicles) will likely account for only 6 to 12% even some time between 2025 and 2030. The market for vehicles with an internal combustion engine is expected to be at the annual 100 million-level, above the present state.

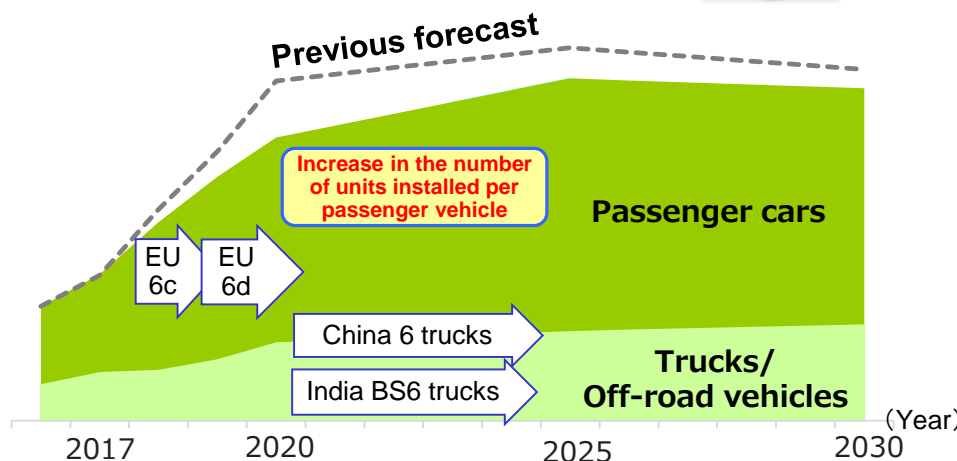


## Total demand forecast of SiC-DPF



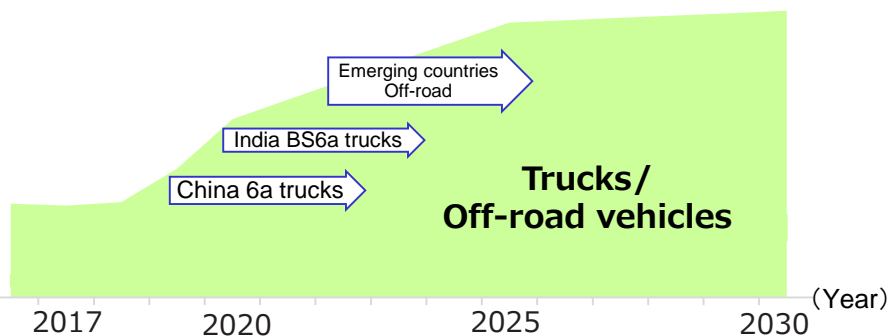
In Europe, demand for products for diesel passenger cars will decrease while that for commercial cars rises. Sales to markets other than the EU will expand, due to strong demand for trucks/off-road vehicles and tightened emission regulations in emerging countries. Demand for SiC-DPF is expected to increase moderately until 2025.

## Total demand forecast of Sensors



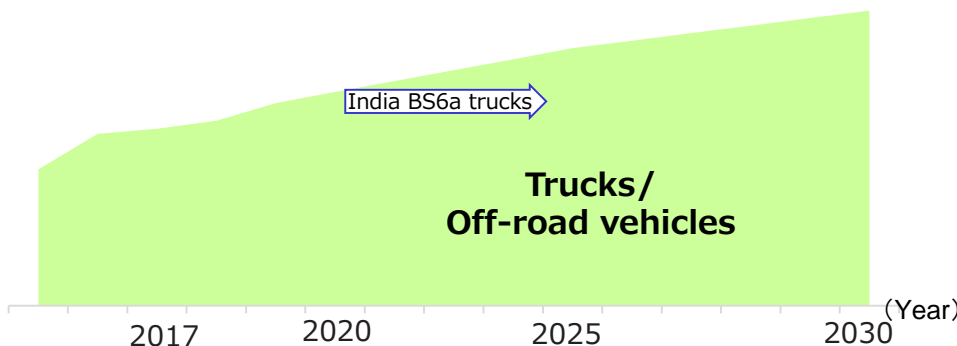
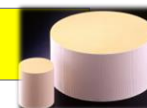
Mid-to-long-term demand is expected to grow since there is no change in the trend for an increasing number of sensors installed per diesel vehicle, although the forecast falls short of the previous forecast due to a lower ratio of diesel passenger cars in Europe.

## Total demand forecast of Cd-DPF



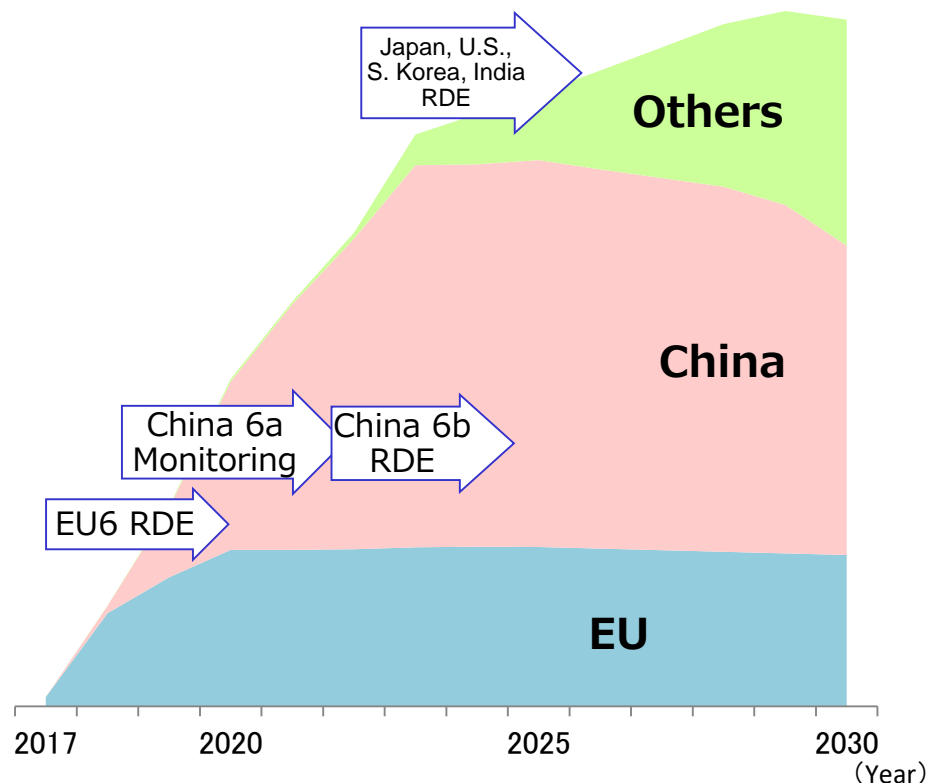
Demand for DPF will increase in FY2019 and thereon, due to the tightening of emission regulations in China, India and other emerging countries.

## Total demand forecast of LSH



Demand for large carriers will increase in conjunction with the growing demand for trucks and construction machines.

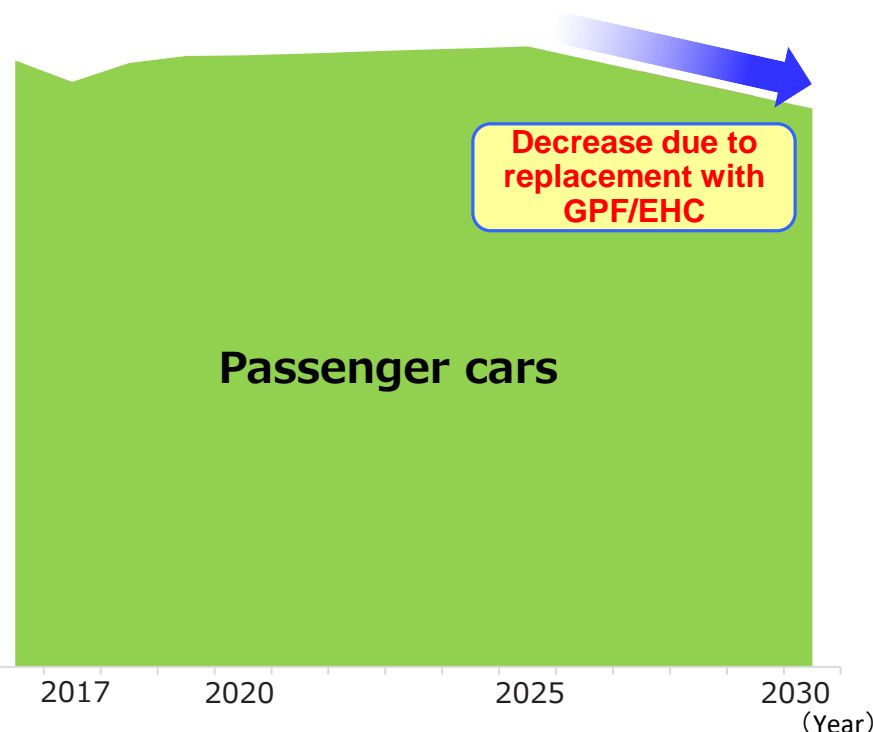
## Total Demand Forecast of GPF



Demand will increase rapidly in conjunction with the start of RDE in the EU and the tightening emission regulations (country 6a, b) in China.

From 2025, demand for GPF in China will gradually decrease due to the promotion of EVs, while demand for other regions is expected to increase primarily in North America.

## Total Demand Forecast of Honeycomb



Although the number of passenger cars sold in the world is likely to increase moderately, demand is expected to decline from 2025 due to replacement with GPF/EHC in part.



## Increase of capacity of Sensors (approx. ¥14.0 Bil.)

### 1st plant in Poland

Facilities for assembling Sensors :  
Production starts **in October 2019.**

### Plant in Ishikawa

Facilities for elements of Sensors :  
Production Starts **in January 2019.**



## Plant in Ishikawa



Increase of capacity of  
**raw material mixing equipment**

Production starts **in June 2020.** (approx. ¥7.0 Bil.)  
(Press release on September 19, 2018)

- Ceramics business base
- Process technology business base

Belgium ● ● Poland

## 2nd plant in Poland



## 2nd plant in China



Mass Production of GPF  
(approx. ¥33.0 Bil.)  
Production starts **in December 2019.**

Ishikawa  
Gifu (Tajimi)  
Aichi  
(Komaki, Chita)

U.S. California)

U.S.  
(Arizona)

Mexico

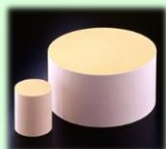
U.S.  
(North Carolina)

Thailand

Indonesia

South Africa

## Plant in Thailand



Mass Production of **LSH** : approx. ¥16.0 Bil.  
Production starts **in April 2019.**

Reinforce ceramic products for  
semiconductor manufacturing equipment



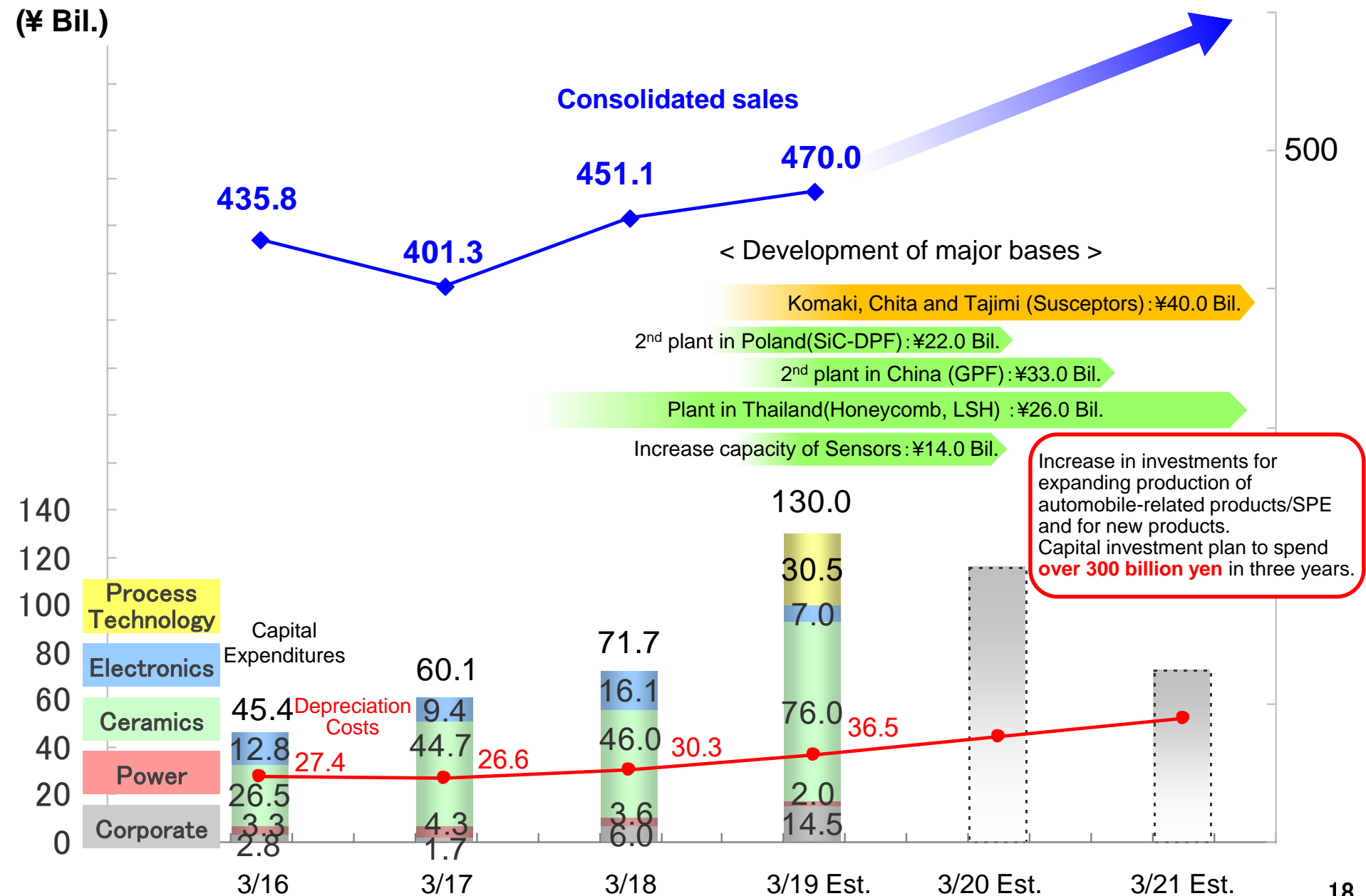
Susceptor

(Tajimi Plant: Image at completion)



Construct a new plant in Tajimi City, Gifu Prefecture  
(Production starts **in October 2019.**) (approx. ¥20.0 Bil.)

Plan to reinforce production capacity with a further investment of ¥20 billion at 3 bases (Tajimi, Komaki, and Chita).



## Chip-type Secondary Battery (EnerCera® Series)

Ultra-compact lithium-ion secondary battery suitable for use as power source of IoT device, etc.

Proprietary crystal-orientation ceramic plate is applied to the electrode to achieve downsizing, thinning, high capacity, low internal resistance, and high heat resistance.

Can output large current of several 10 mA to several 100 mA necessary for ICs, sensors and wireless communication.



### EnerCera Coin

- Coin-shaped battery (thickness of 1 mm or more) that can be mounted on a circuit board using the reflow soldering.
- Constant voltage charging is possible, which eliminates the need for charger IC.

### EnerCera Pouch

- Ultra-thin battery, 0.4 mm thick, with bendability that can be embedded in an IC card, etc.
- Can accommodate hot lamination in card production.
- High-speed charging is possible to accommodate non-contact card readers.

### Applications

IoT device, payment card, ID card, beacon, RFID tag, electronic shelf label, wearable device, solar wristwatch, wireless earphone, SSD backup power source, etc.

### Progress

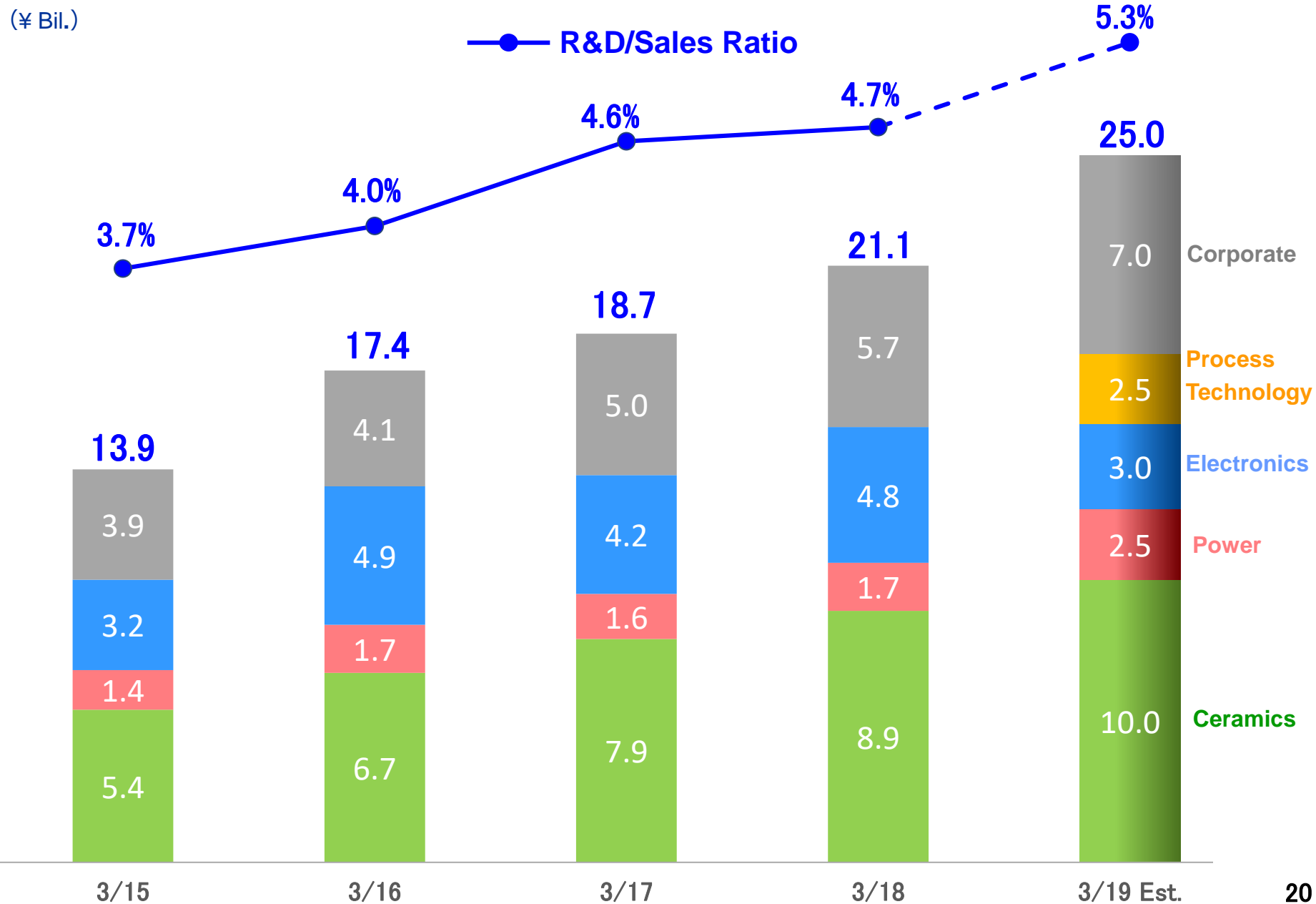
Several tens of clients around the world are considering adopting for IoT devices, etc.

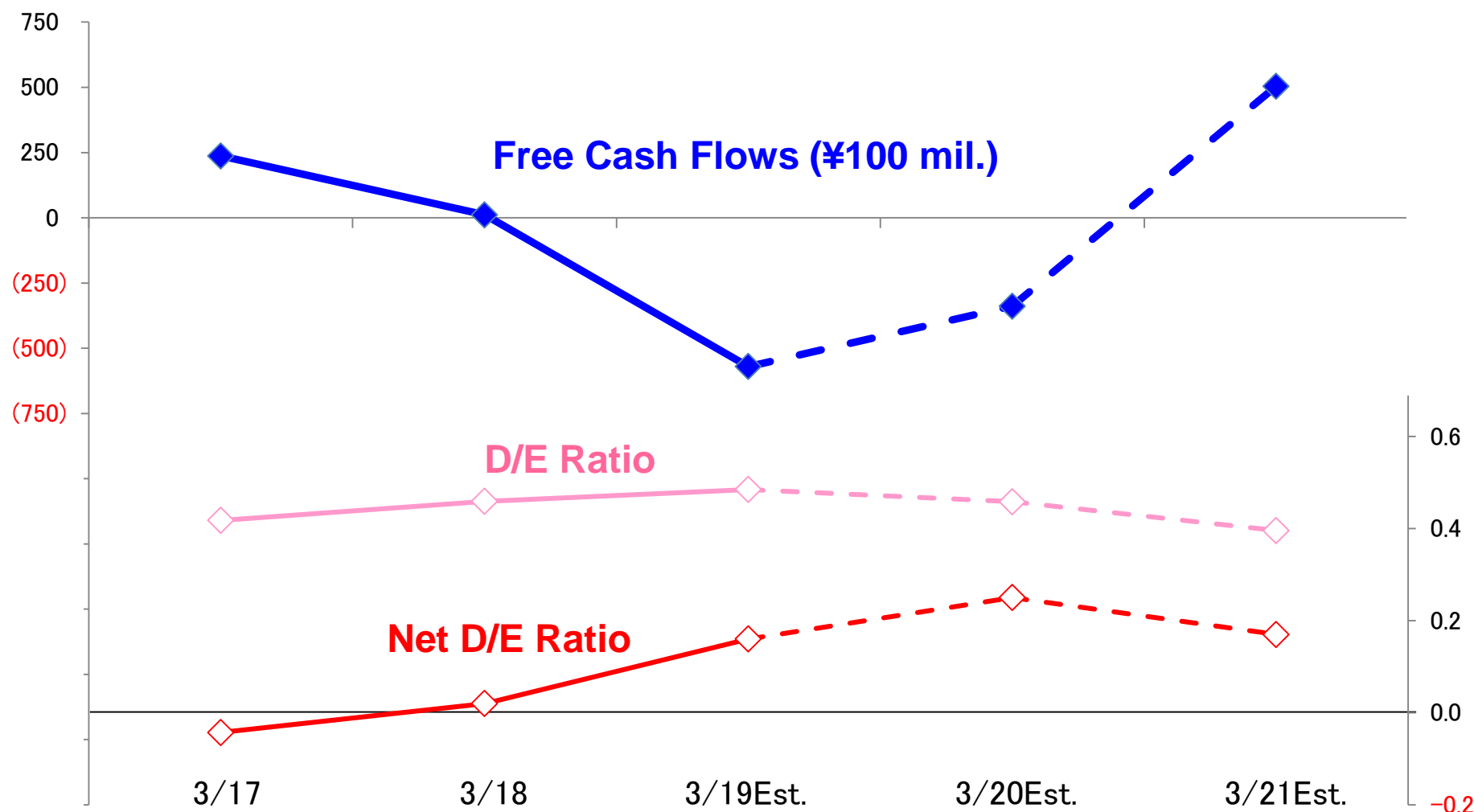
Installed mass-production lines in the Head Office region and the Yamanashi Plant of NGK Ceramic Device Co., Ltd. to produce 2 million units monthly.

Mass production will start in April 2019.

## Stationary Module Batteries

Zinc Rechargeable Batteries and SOFC (Solid-Oxide Fuel Cell) Modules : Field tests and customer evaluation are in progress.





- With capital expenditure preceding, interest-bearing liabilities will exceed outstanding funds for a while.  
Free cash flow is forecast to turn positive in FY ending March 2020.
- Equity ratio of 50% or higher and DE ratio of about 0.4 will be maintained.

# Return on Invested Capital (ROIC)

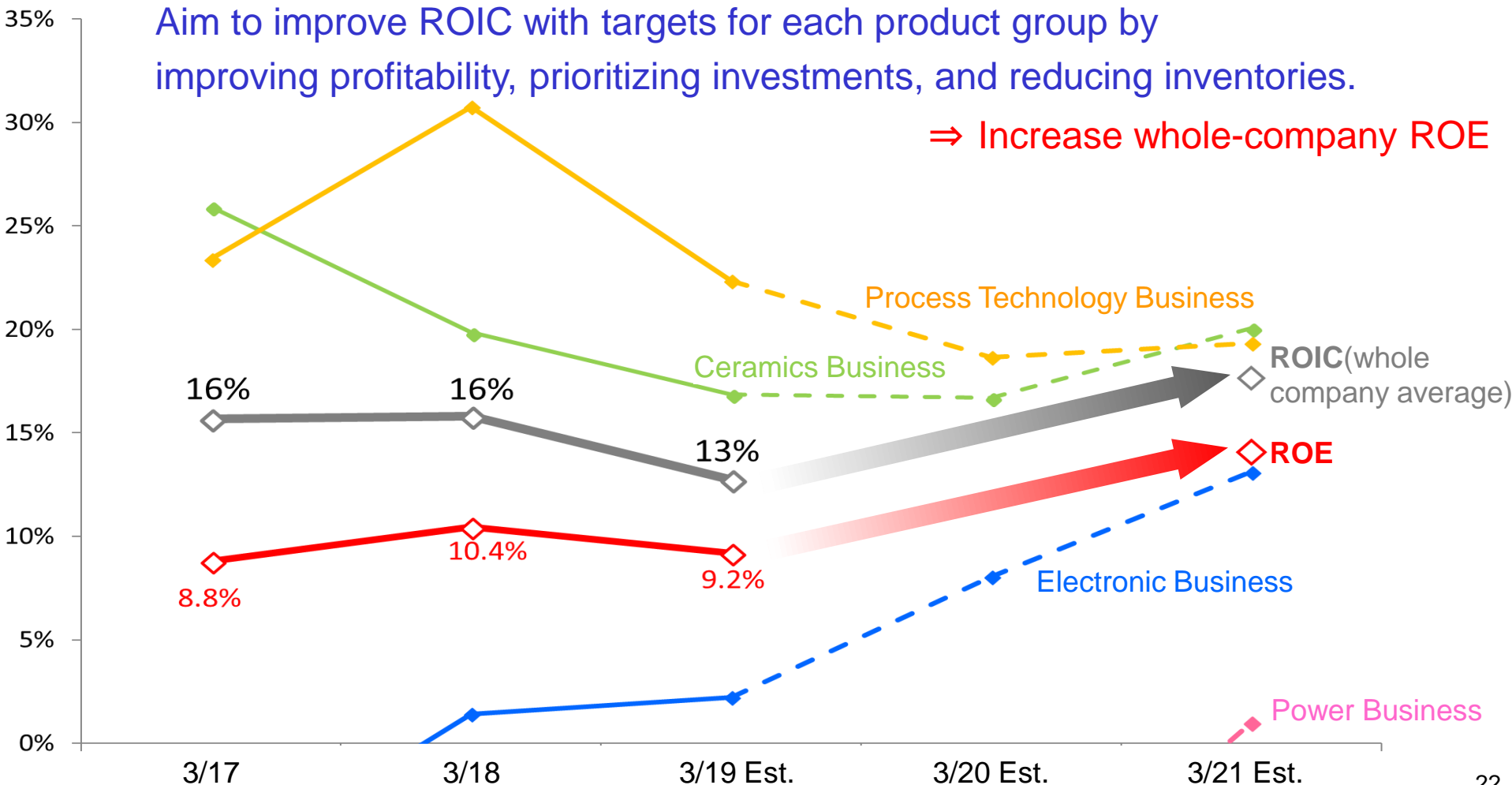
• Return on invested capital (NGK-version ROIC\*) =  $\frac{\text{Operating income}}{\text{Net sales}}$  ×  $\frac{\text{Net sales}}{\text{Business assets (sales receivables + inventories + fixed assets)*}}$

Return on turnover (profitability) × Business assets turnover rate (efficiency)

\* NGK-version ROIC: Calculated based on business assets (sales receivables + inventories + fixed assets) that can be managed by business departments rather than capital and liabilities.

Aim to improve ROIC with targets for each product group by improving profitability, prioritizing investments, and reducing inventories.

⇒ Increase whole-company ROE

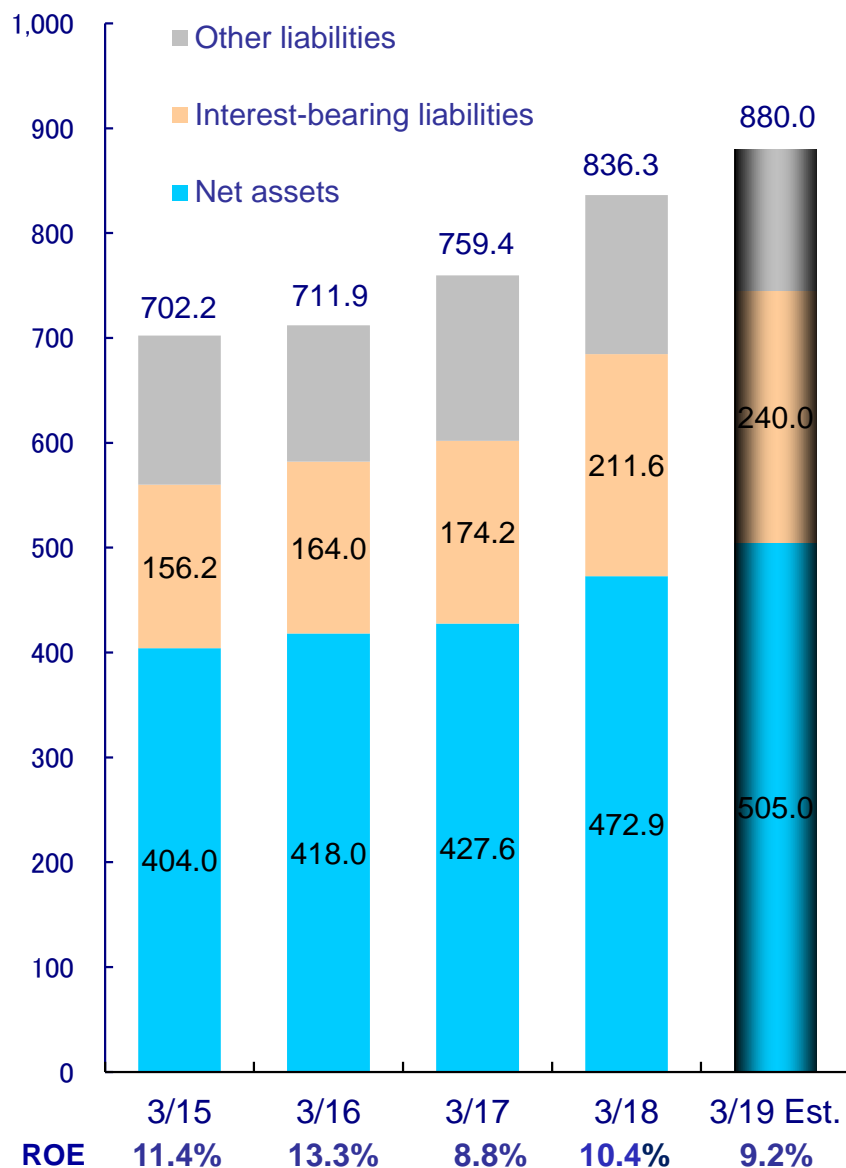


# Summary of Cash Flows

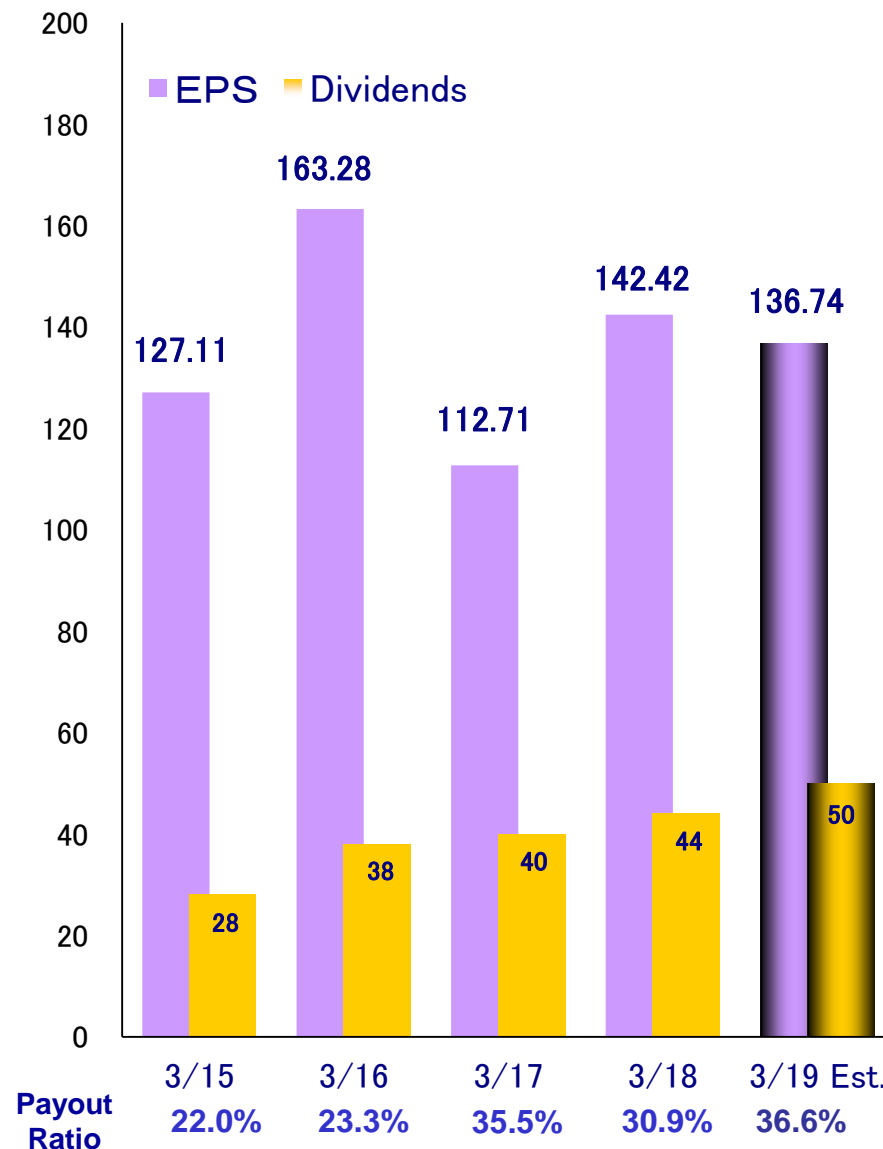
(¥ Bil.)

	3/17	3/18	3/19 Est.
Operating Activities	80.2	50.6	71.0
Investing Activities	-56.5	-49.4	-128.0
Financing Activities	-13.0 New loans +30.1 Repayment -19.2 Treasury stock purchase -11.2	22.5 New loans +42.4 Repayment -6.8	13.0 New loans +38.0 Repayment -10.0
Effect of Exchange Rate Changes on Cash &Cash Equivalents	-2.1	1.5	-1.0
Net Change in Cash & Cash Equivalents	8.6	25.2	-45.0
Cash & Cash Equivalents- at the End of Year	144.7	169.9	124.9

(¥ Bil.)



(¥)





# Sales by Product (Annual)

&lt;After Consolidation Elimination&gt;

(¥ Bil.)

	3/16	3/17	3/18		3/19 Est.
			Old Segment	New Segment	
Insulators	57.3	51.6	52.5	52.5	45.0
NAS	26.2	1.3	1.9	1.9	3.0
Power Business	83.5	52.8	54.4	54.4	48.0
Honeycomb filters	81.0	77.0	77.9	77.9	77.0
SiC-DPF	44.1	38.2	40.8	40.8	37.5
Cd-DPF / LSH	71.6	67.8	76.5	76.5	81.0
Sensors	32.4	38.0	45.4	45.4	56.5
Industrial Process	21.9	23.9	27.1		
Ceramics Business	250.9	245.0	267.8	240.7	252.0
Metal related	19.9	20.3	22.5	22.5	23.0
SPE related	36.8	46.4	67.6		
Electric related	33.9	27.4	28.3	28.3	28.1
Soshin Electric CO.	10.8	9.4	10.5	10.5	10.9
Electronics Business	101.4	103.5	129.0	61.3	62.0
Industrial Process				27.1	30.0
SPE related				67.6	78.0
Process Technology Business				94.7	108.0
Total	435.8	401.3	451.1	451.1	470.0

# Sales by Product (Semi Annual)

<After Consolidation Elimination>	3/18		3/19 Est. (¥ Bil.)	
	1 <sup>st</sup> . Half	2 <sup>nd</sup> . Half	1 <sup>st</sup> . Half	2 <sup>nd</sup> . Half
Insulators	26.9	25.6	23.1	21.9
NAS	0.4	1.5	1.1	1.9
Power Business	27.2	27.2	24.2	23.8
Honeycomb filters	38.5	39.4	38.4	38.6
SiC-DPF	20.4	20.4	18.8	18.7
Cd-DPF / LSH	37.6	38.9	38.1	42.9
Sensors	22.0	23.5	27.3	29.2
Industrial Process	12.5	14.6		
Ceramics Business	131.0	136.8	122.6	129.4
Metal related	11.2	11.3	10.8	12.2
SPE related	31.7	36.0		
Electric related	13.5	14.9	14.3	13.8
Soshin Electric CO.	5.2	5.3	5.1	5.8
Electronics Business	61.5	67.4	30.3	31.7
Industrial Process			13.5	16.5
SPE related			37.6	40.4
Process Technology Business			51.1	56.9
Total	219.8	231.4	228.2	241.8

The purpose of this brief is information disclosure for better understanding of NGK Group's policies, projections and financial condition. This brief does not solicit buying and selling of NGK's shares.

The figures included in this brief, including the business performance targets and figures, are all projected data based on the information currently available to the NGK Group, and are subject to variable factors such as economic conditions, competitive environments and future demands.

Accordingly, please be advised that the actual results of business performance may differ substantially from the projections described here.



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