

# Business Briefing

## Functional Products business

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**FURUKAWA ELECTRIC CO., LTD.**

## Forward-Looking Statements

Projections of future sales and earnings in these materials are “forward-looking statements.”

Management offers these projections in good faith and on the basis of information presently available.

Information in these statements reflects assumptions about such variables as economic trends and currency exchange rates.

Forward-looking statements incorporate known and unknown risks as well as other uncertainties that include, but are not limited to, the following items.

- Economic trends in the U.S., Europe, Japan and elsewhere in Asia, particularly with regard to consumer spending and corporate expenditures.
- Changes in exchange rates of the U.S. dollar, euro, and Asian currencies.
- Furukawa Electric Group’s ability to respond to rapid advances in technology.
- Changes in assumptions involving financial and managerial matters and the operating environment.
- Current and future trade restrictions and related matters in foreign countries.
- Changes in the market value of securities held by the Furukawa Electric Group.

Due to the above factors, actual sales, earnings, and other operating results may differ significantly from Looking Statements in these materials. In addition, following the release of these materials, Furukawa Electric Group assumes no obligation to announce any revisions to forward-looking statement in these materials

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**FURUKAWA ELECTRIC CO., LTD.**

- 【 I 】 Overview of the Functional Products business**
- 【 II 】 AT & Functional Plastics**
- 【 III 】 Thermal Management Solution & Products**
- 【 IV 】 Memory Disk**
- 【 V 】 Copper Foil**

- 1. Organization**
- 2. Functional product lineup that will support 5G and the sustainable society**
- 3. FY2018 results and FY2019 forecast**

# I - 1 ) Organization

## Functional Products Div.

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graph TD; A[Functional Products Div.] --- B[AT & Functional Plastics Div.]; A --- C[Thermal Management Solution & Products Div.]; A --- D[Memory Disk Div.]; A --- E[Copper Foil Div.]; A --- F[Planning & Administration Div.];
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**AT & Functional  
Plastics Div.**

**Thermal Management  
Solution & Products Div.**

**Memory Disk Div.**

**Copper Foil Div.**

**Planning &  
Administration Div.**

# I - 2) Functional product lineup that will support 5G and the sustainable society

Increase the speed and capacity of telecommunications



## Infrastructure



Data centers



Base stations



## Terminals

Smartphones, tablets, wearable devices



In-vehicle AI unit, millimeter wave radar



## Functional product lineup that will support 5G and the sustainable society



Aluminum blanks



Heat sinks



Tape for semiconductor process



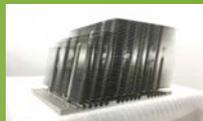
Electrolytic copper foil



Vapor chamber



Heat sinks for railroads



Heat sinks for solar power



Green trough



Plastic recycling (Polyal)



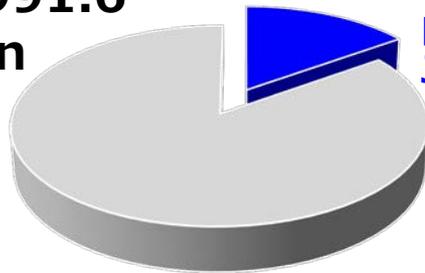
Cable protective pipes & accessories

# I - 3 ) FY2018 results and FY2019 forecast

The business lost speed from the end of the 3<sup>rd</sup> quarter in FY2018 triggered by the trade friction between the US and China, as well as reduced investments and inventory adjustments

## FY2018 Net sales

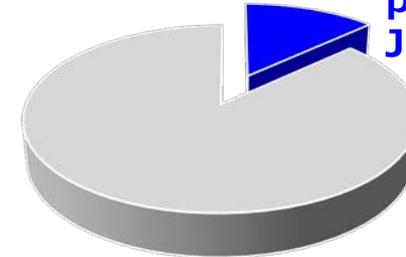
**Companywide:**  
JPY 991.6  
billion



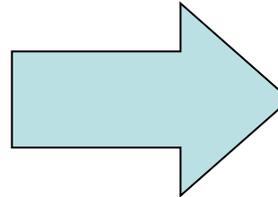
**Functional products**  
JPY 149.3 billion

## FY2019 Net sales

**Companywide:**  
JPY 960 billion

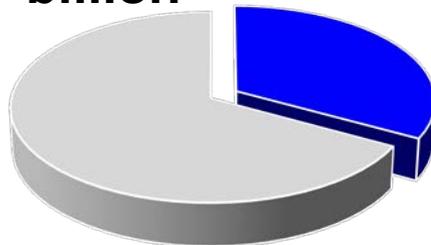


**Functional products**  
JPY 125.0 billion



## FY2018 Operating income

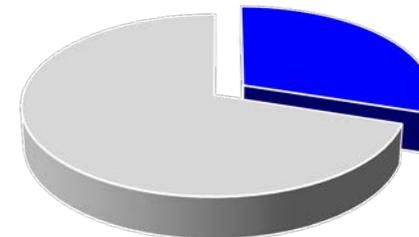
**Companywide:**  
JPY 40.8  
billion



**Functional products:**  
JPY 13.5 billion

## FY2019 Operating income

**Companywide:**  
JPY 40.0  
billion

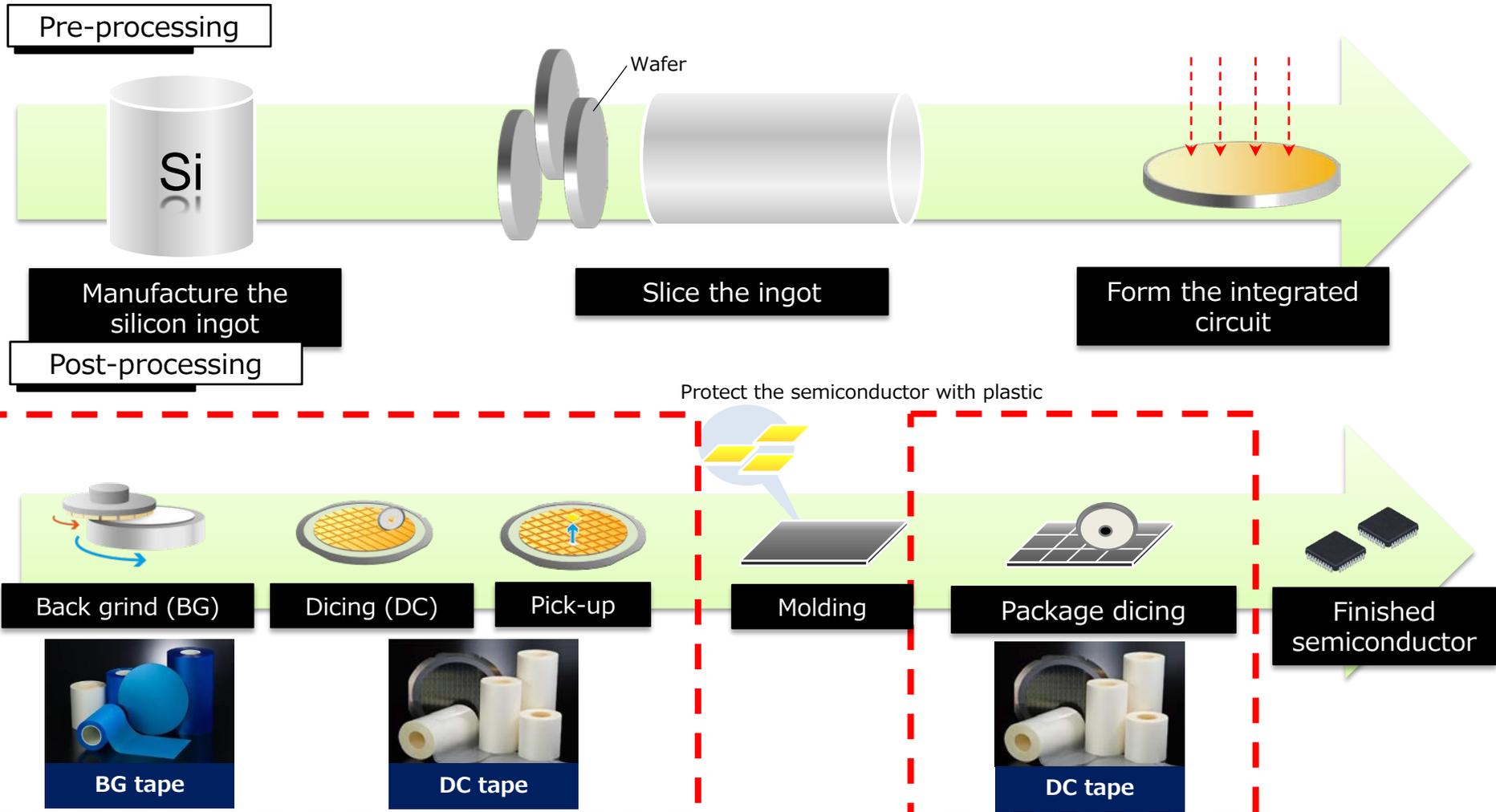


**Functional products:**  
JPY 12.0 billion

- 1. Introduction of the functional products**
- 2. AT products – Future business developments**
- 3. AT & Functional Plastics – Sales forecast**
- 4. Create new businesses (recycling of disposable plastic)**

# II - 1 ) Introduction of AT products

Used to temporarily immobilize the wafer during the post-processing of semiconductors (back grind / dicing)



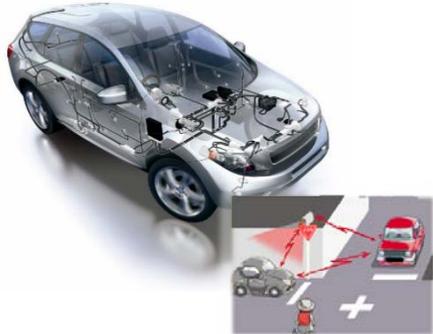
# II - 2 ) AT products

## – Future business developments

In accordance with market trends, the performance and manufacturing process required for semiconductors continues to evolve



Expansion of data centers: Directed at increased data storage capacity, density is increasing through 3D implementation  
→ When implementing a chip with high density, it is necessary to take measures to address the **thermal problems**  
→ In order to **reduce film thickness** on the chips, it is necessary to introduce a process for applying a thinner film



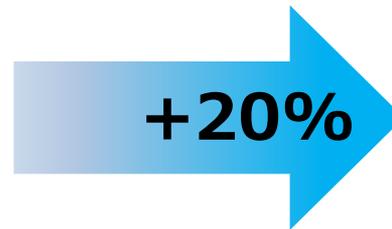
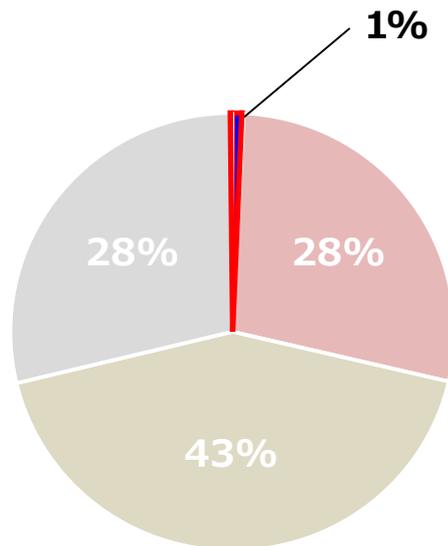
Directed at the practical implementation of autonomous driving, the camera modules are becoming higher performance  
→ CMOS image sensor must have a **fast response time**

# II-3) AT & Functional Plastics

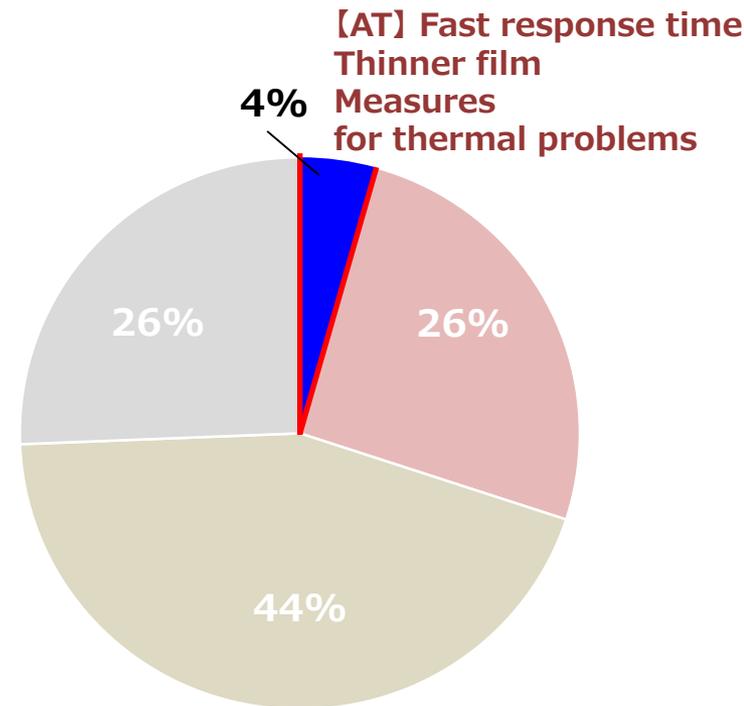
## - Sales forecast

Quickly grasp the changes in the semiconductor processing process, and actively introduce new products as they become ready

FY2018



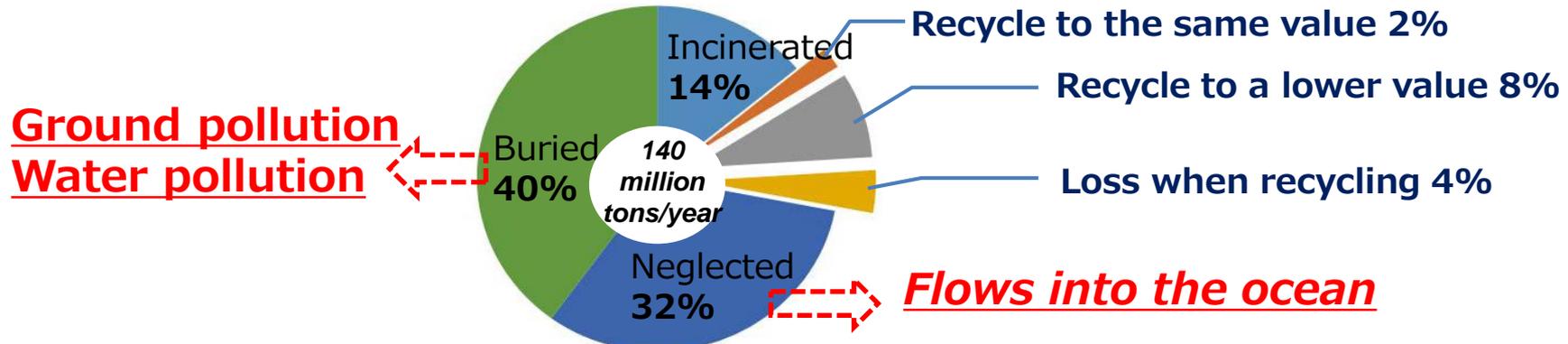
FY2020



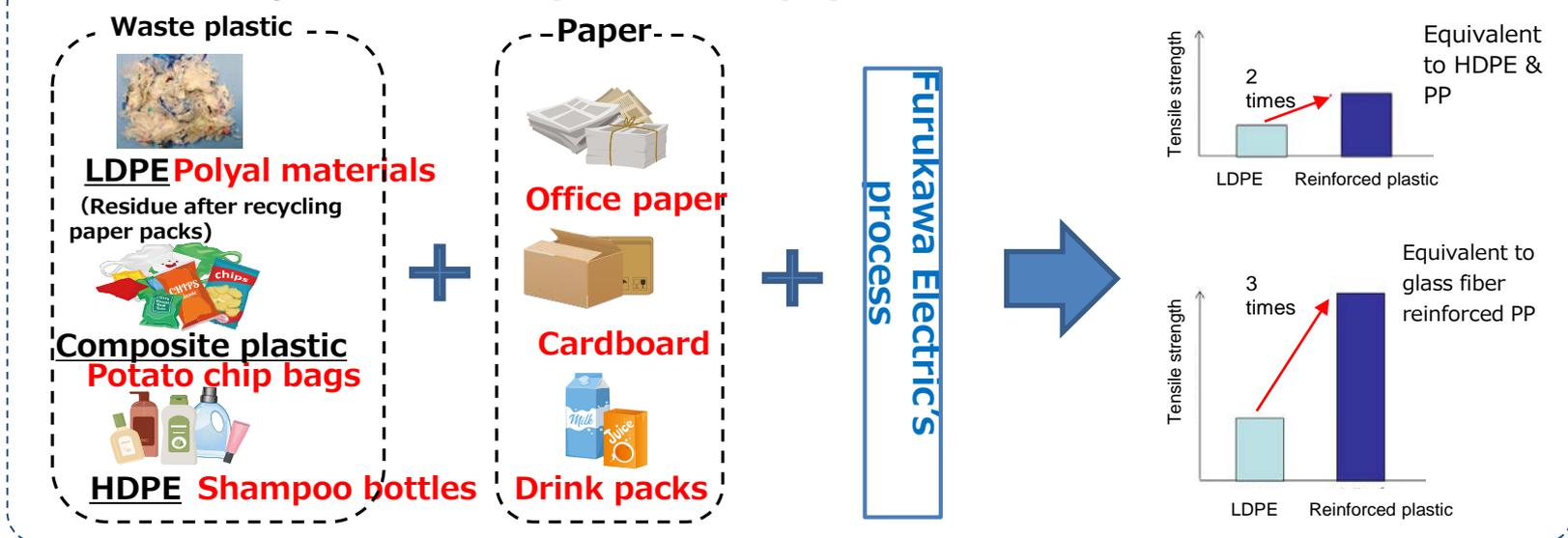
- AT (Measures for thermal problems/Thinner film/Fast response time)
- AT (for 5G terminals/ 5G infrastructure)
- Functional plastics (Japan)
- Functional plastics (Overseas)

# II - 4) Create new businesses (Recycling of disposable plastic)①

Recycle disposable plastic into high strength plastic  
Contribute to increasing the recycling ratio by increasing the value



## Recyclable waste plastic and paper



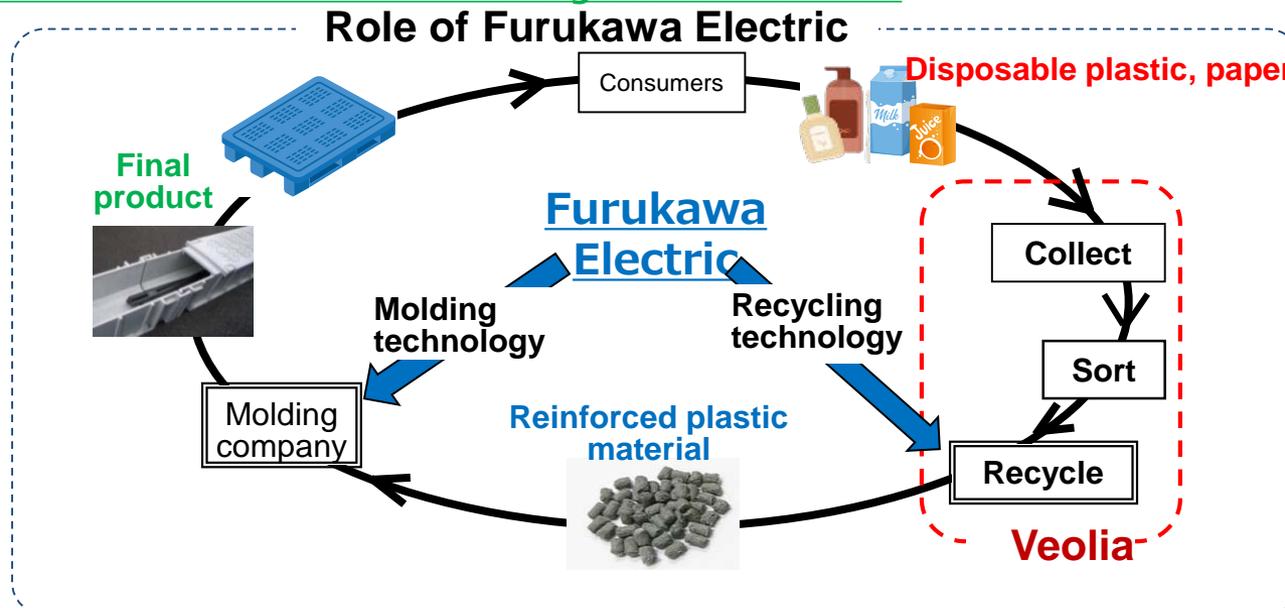
# II - 4 ) Create new businesses (Recycling of disposable plastic)②

Recycle disposable plastic into high strength plastic  
Contribute to increasing the recycling ratio by increasing the value

- ◆ Succeeded in recycling **polyal (residue from the recycling of paper packs)** into **reinforced plastic material**



- ◆ **Low strength** disposable plastic → **High strength** plastic material (can be used in a wide range of applications, such as buildings and automobiles)
- ◆ In collaboration with **Veolia** and **Tetra Pak** → Expand from Europe to the world – **contribute to improving the global environment**



- 1. Products and markets**
- 2. Future business developments (initiatives for the priority markets)**
- 3. Sales forecast**

# III- 1 ) Products and markets



Personal computers, smartphones and wearable devices, etc.



Data centers and autonomous driving, etc.



For various thermal dissipation fields

Renewable energy and base stations, etc.



Railroads and transportation systems, etc.

Medical and lighting devices



# III-2) Future business developments (initiatives for the priority markets)

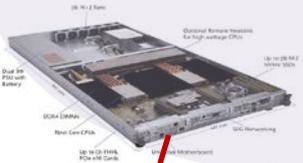
In fields that are expected to grow along with the changes in the current times, aim to differentiate the products from those of competitors in terms of performance, dimensions, weight, etc.



✓ Increased heat generation and heat generating locations in the CPU



Strengths in terms of weight and strength  
⇒ **Stainless steel vapor chamber**



**5G infrastructure market**

✓ Downsizing needs at base stations

✓ Increased heat generation from the processor



Heat pipe type heat sink ⇒ **New cooling method**

**5G terminal market**



✓ Lower environmental load, smaller, lightweight



**Cooling device with solderless structure**

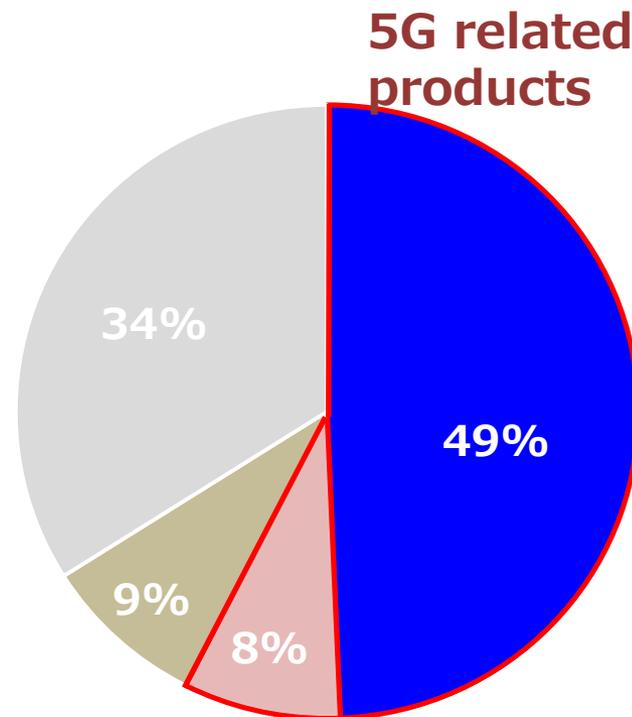
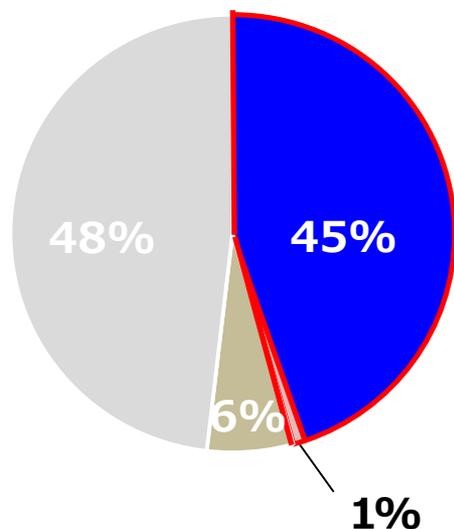
**Railroad and renewable energy market**

# III-3) Sales forecast

Expect sales and profits to increase mainly in the **5G related markets**

FY2018

FY2020



- 5G infrastructure (data centers and base stations)
- 5G terminals (smartphones, tablets, VR/AR)
- Railroads and solar power
- Other (LED and electronics components)

# **【IV】 Memory Disk**

- 1. Products and markets**
- 2. Future business developments**
- 3. Sales forecast**

# IV- 1 ) Products and markets

Niche product with 40% global share, contributing to “increased HDD capacity” with thin blanks

## Product

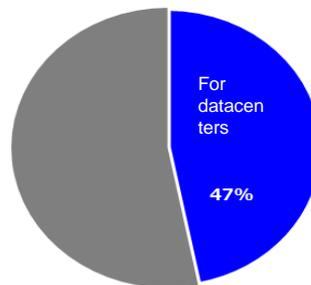
Punch round circles out of an aluminum coil and provide them to substrate processing manufacturers as **aluminum blanks**



■ What type of product is memory disks?  
→ **Aluminum substrate material used in HDD**

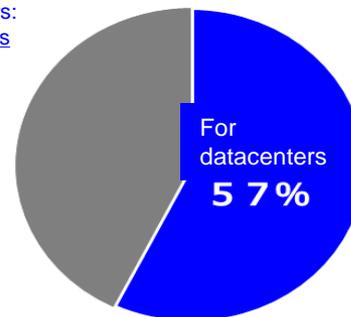
## Market

2018  
total HDD data capacity  
【873 exabytes】



Total data capacity: about 1.2 times  
For data centers: about 1.5 times

2020 total HDD data capacity (forecast)  
【1056 exabytes】



■ What kind of markets are they used in?  
→ **Mainly HDD for the growing data center segment**

As the big data society advances towards 5G, cloud computing and IoT, continue contributing to **establishing safe, secure, convenient storage social infrastructure** through aluminum blanks in the data storage business domain

# IV-2) Future business developments

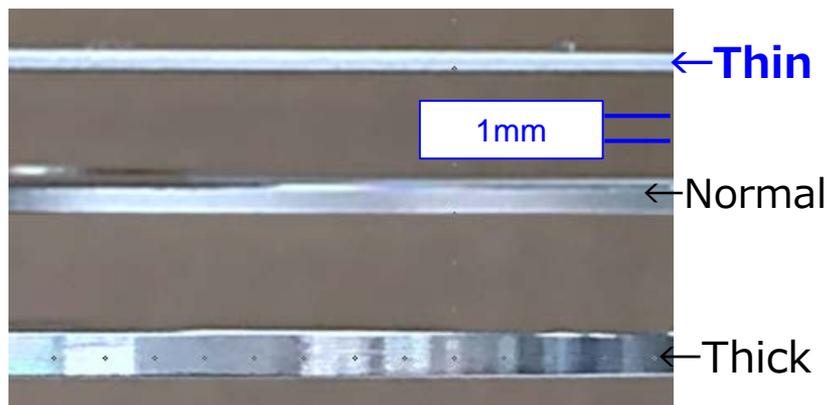
In response to the trend towards **thinner** substrates, respond to customer needs through the **development of new materials**

【Cross section of new HDD※】



The number of disks in each unit continues to increase, and some products now have **8 or 9 disks** (Left: 8 disks, Right: 7 disks)

【Comparison of blank thicknesses (current products)】



(Thin blanks are less than about 1mm thick, pictures show Furukawa Electric materials)

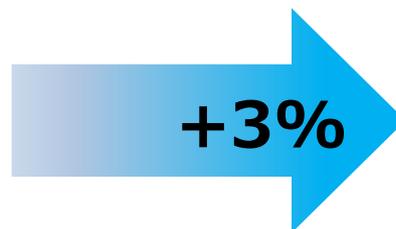
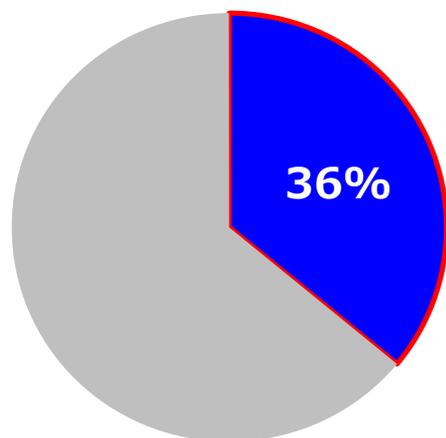
- ✓ Increases in the number of disks installed in each HDD unit is supporting the growth of aluminum blanks
- ✓ In order to increase number installed, further reduce thickness
- ✓ In response to the customer need, **Currently developing new materials suitable for “even thinner blanks”**

※Pictures were sourced from Western Digital Blog <https://blog.westerndigital.com/rise-helium-drives/>

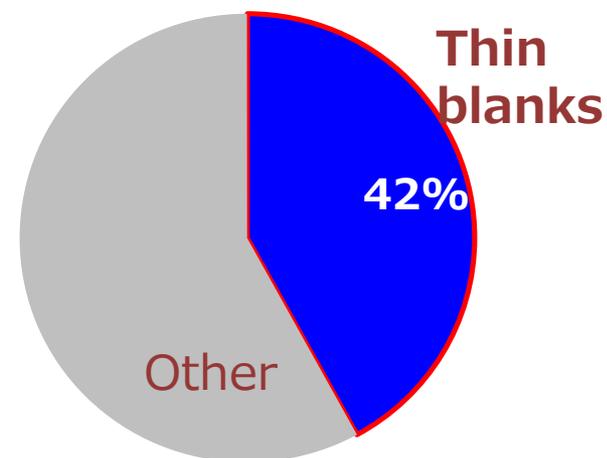
# IV-3) Sales forecast

In response to the trend towards **thinner** substrates, respond to customer needs through the **development of new materials**

FY2018



FY2020

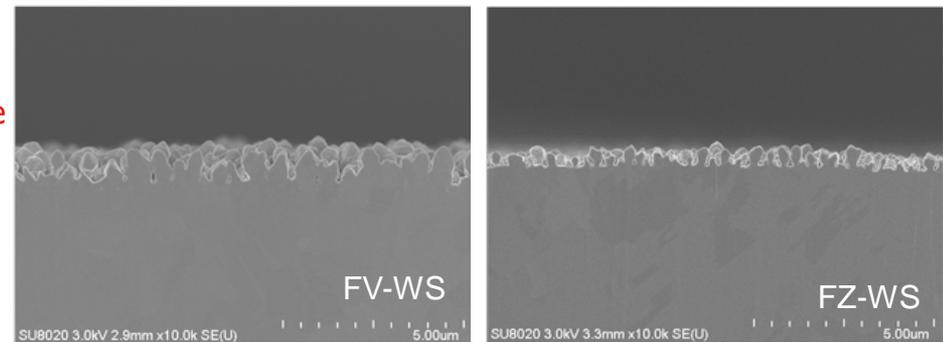
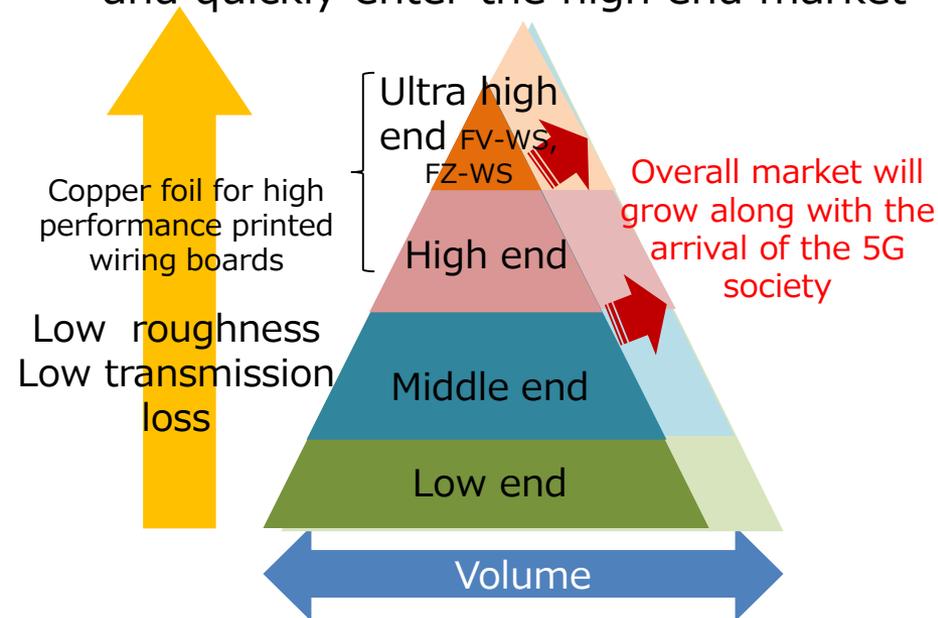


- 1. Future business developments**
- 2. Sales forecast**

# V-1) Future business developments

In copper foil for printed wiring boards, shift from general use products to products for high performance printed wiring boards

→ Develop copper foil for high performance printed wiring boards that will “contribute to faster, higher capacity” telecommunications in 5G and the next era, and quickly enter the high end market



Cross sectional image of copper foil for high performance printed wiring boards

- The dedicated high frequency technology organization within Furukawa Electric<sup>※</sup> conducted a surface simulation and evaluation of the transmission characteristics and reflected the results in product development

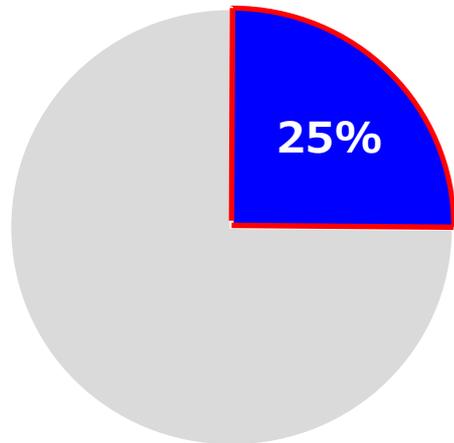
※Research & Development Division, Laboratories for Fusion of Core Technologies, High Frequency Electronics Technology Center

In copper foil for batteries, without expanding the scale of the business, provide a **stable supply** to partners who properly evaluate the company's copper foil

# V-2) Sales forecast

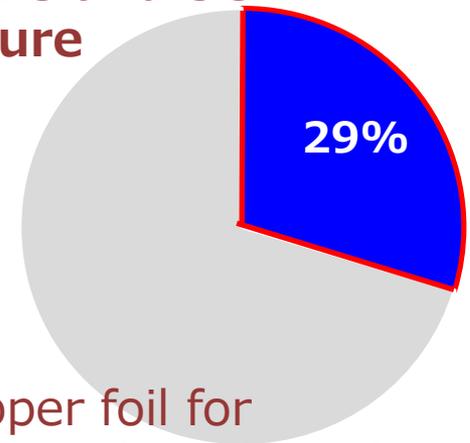
Through the company's unique surface processing technology, minimize surface roughness, and focus on the development of **copper foil for high performance printed wiring boards** that reduces transmission losses in the high frequency range

FY2018



FY2020

**Copper foil for high performance printed wiring boards directed at 5G terminals and 5G infrastructure**

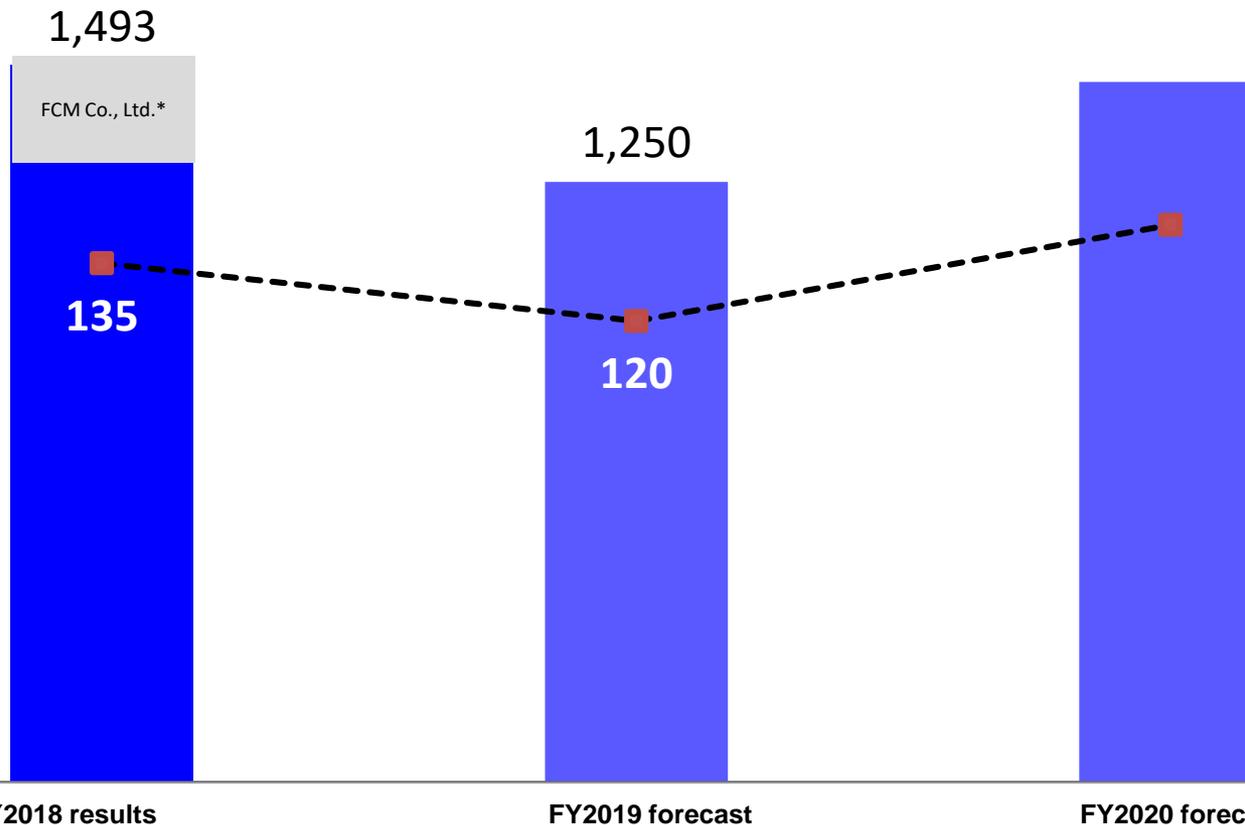


**±0%**

Other copper foil for printed wiring boards and batteries

# Functional Products: Net sales and operating income forecast

Net sales: Bar graph, Operating income: Line graph  
(Units: 100 million yen)



\* The net sales and operating income of FCM Co., Ltd., which was included in the functional products segment, was deconsolidated in 18/Q4 following the sale of the shareholdings in FCM

Thank you very much  
for your attention.

***Bound to***  ***Innovate***

# Main products in Functional Products

## Appendix

Business	Main products	Applications	Current main customer segments
AT & Functional Plastics	<ul style="list-style-type: none"> <li>•Tape for semiconductor process</li> </ul>  <p>AT : Advanced Technology Tape</p>	<ul style="list-style-type: none"> <li>•Surface protection, immobilizing, etc. during semiconductor wafer processing</li> <li>•Semiconductor chip stacking in flash memory</li> </ul>	Semiconductor manufacturers; foundry manufacturers
	<ul style="list-style-type: none"> <li>•Cable protective pipes</li> <li>•Troughs made from recycled materials</li> <li>•Insulation materials</li> </ul> 	<ul style="list-style-type: none"> <li>•Protective pipes for underground cable</li> <li>•Troughs for holding cables</li> <li>•Insulation for air conditioning ducts</li> </ul>	General construction companies and subcontractors; railroads; highway public corporations and road subcontractors; air conditioning duct manufacturers
Copper Foil	<ul style="list-style-type: none"> <li>•Electrolytic copper foil for printed wiring boards</li> </ul> 	<ul style="list-style-type: none"> <li>•Rigid printed wiring boards</li> <li>•FPC</li> </ul>	FCCL manufacturers; CCL manufacturers; Battery manufacturers
	<ul style="list-style-type: none"> <li>•Electrolytic copper foil for batteries</li> </ul>	<ul style="list-style-type: none"> <li>•Cathode material in lithium ion batteries for vehicles</li> <li>•Cathode material in lithium ion batteries for consumer products such as smartphones and power tools</li> </ul>	
Thermal Management Solution & Products	<ul style="list-style-type: none"> <li>•Copper, etc. including heat sinks and heat pipes</li> </ul> 	<ul style="list-style-type: none"> <li>•Heat dissipation and cooling of CPUs and power semiconductors, electronics components, high output LED lighting, etc.</li> </ul>	Data center operators; telecommunications base station operators; smartphone, PC and tablet manufacturers; manufacturers of power conditioners for railroads and solar power; lighting equipment manufacturers, etc.
Memory Disk	<ul style="list-style-type: none"> <li>•Aluminum blanks for HDD</li> </ul> 	<ul style="list-style-type: none"> <li>•HDD for PCs and data centers</li> </ul>	HDD substrate manufacturers