

Business Briefing Communications Solutions business

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June 11/12, 2019
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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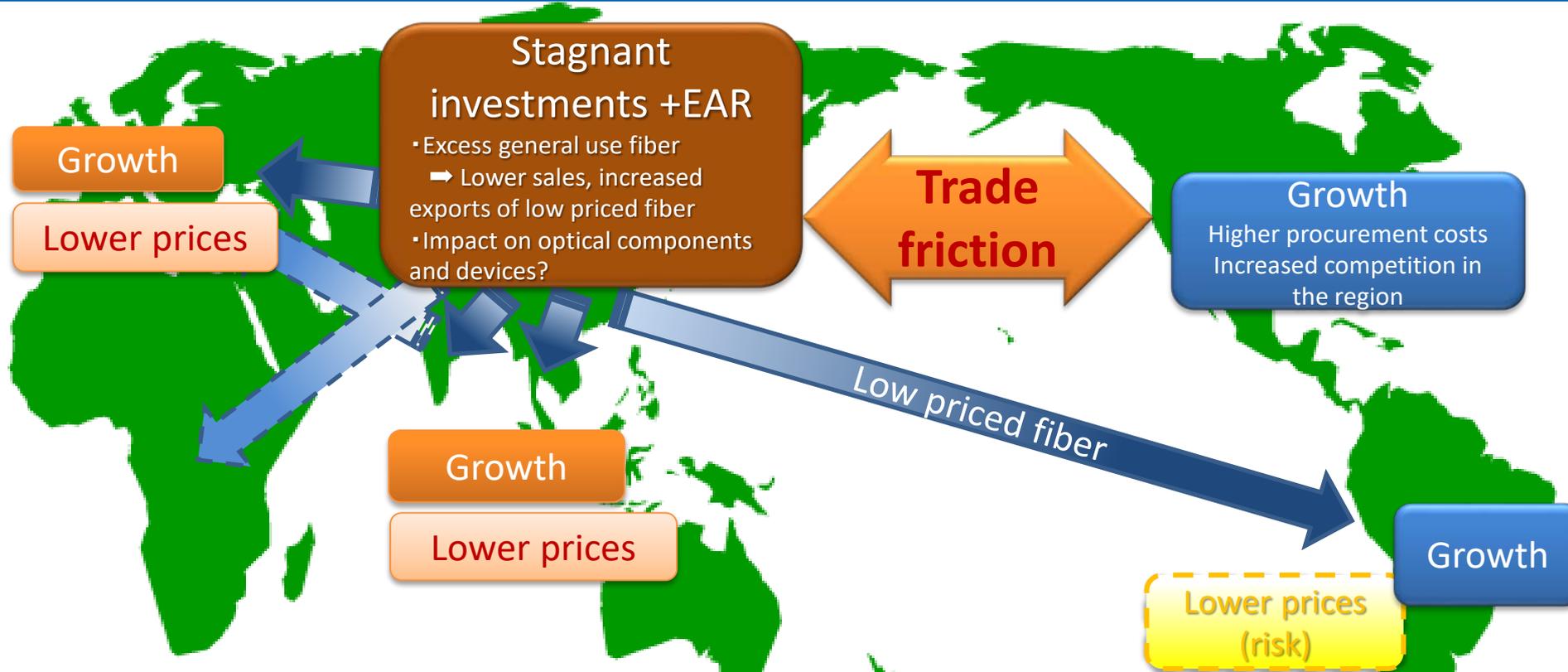
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FURUKAWA ELECTRIC CO., LTD.

- 【 I 】 Recent changes in the business environment and response policy**
- 【 II 】 Optical fiber and cable business**
- 【 III 】 Optical components business**
- 【 IV 】 Broadband business**
- 【 V 】 New co-creation initiatives**
- 【 VI 】 Initiatives for 5G**
- 【 VII 】 Future earnings growth and FY2019 forecast**

【 I 】 Recent changes in the business environment and response policy

I. Recent changes in the business environment and response policy



- For fiber, a major impact in Asia and EMEA → Accelerate the shift to high added value (Low loss, resistance against bending loss, lower cost)
- For optical cable, improve productivity and accelerate and shift to thin ultra-high count multi-core cable and higher densities (increase rollable ribbon production)
- No major impact on optical components for now → EAR compliance / carefully observe the trends (mass production of next generation ITLA)
- Accelerate the evolution from “selling tangible items” to “selling intangible items” (broadband solutions, industrial lasers, 5G response, etc.)

【Ⅱ】 Optical fiber and cable business

A) Market trends and global activities

B) Rollable ribbon cable

~Expand the optical cable lineup and
increase sales~

C) izzi telecom's large FTTH project

D) Optical cable demand in Japan

II. A) Market trends and global activities

Strengthen the ability to deliver well differentiated cable related products on schedule

- Optical fiber
- Optical cable

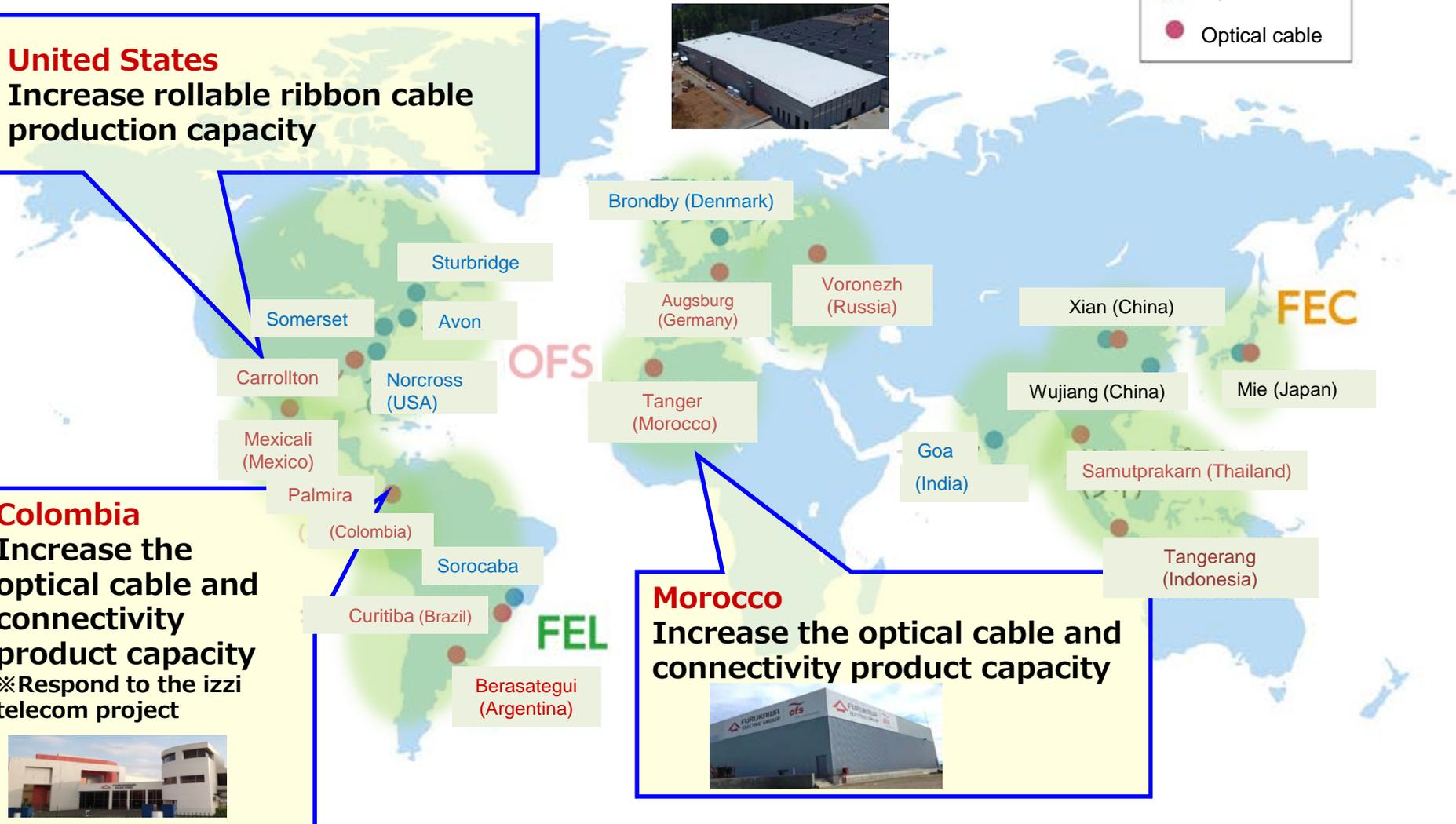
United States
 Increase rollable ribbon cable production capacity



Colombia
 Increase the optical cable and connectivity product capacity
 ※ Respond to the izzi telecom project



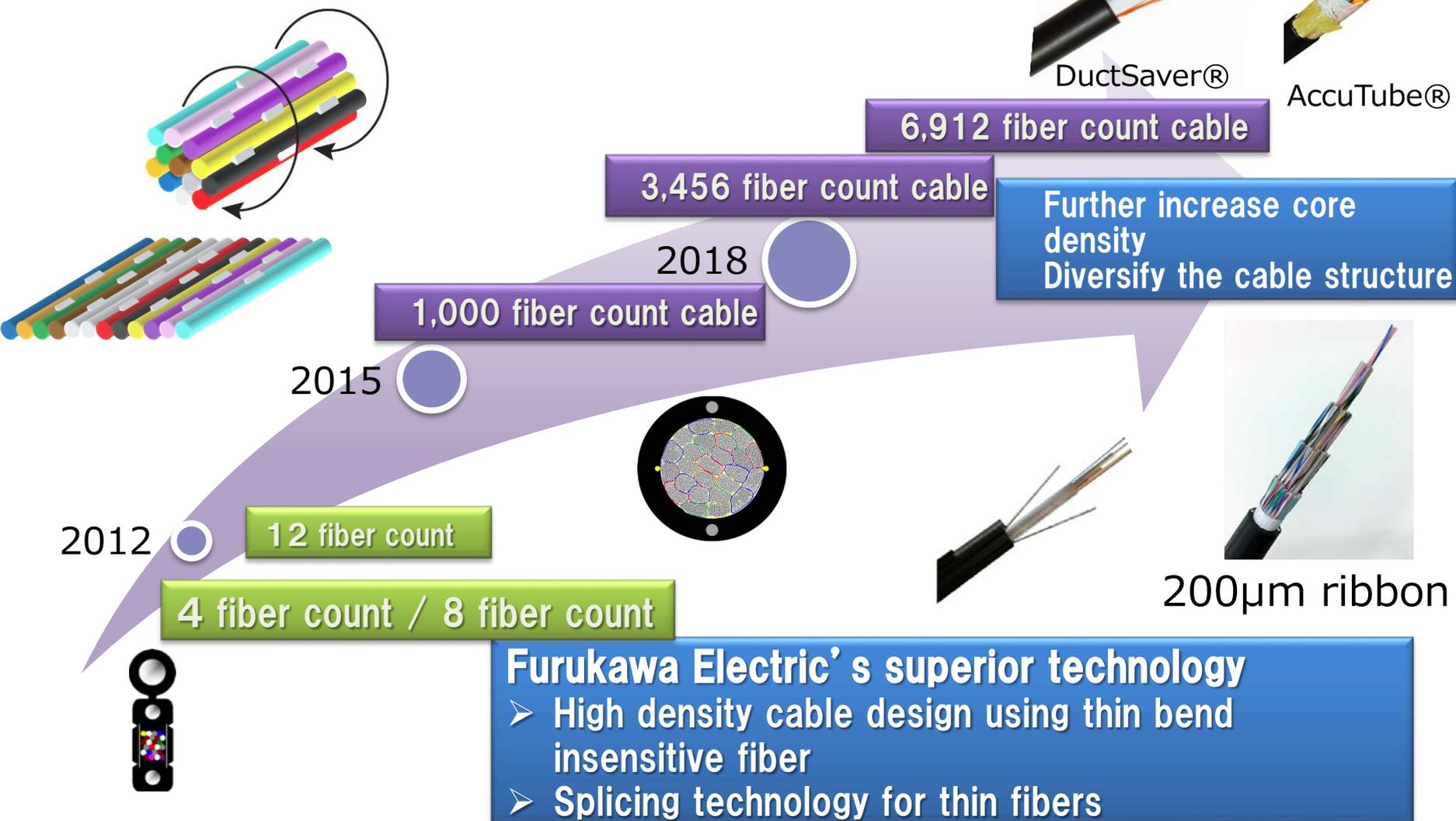
Morocco
 Increase the optical cable and connectivity product capacity



II. B) Rollable ribbon cable

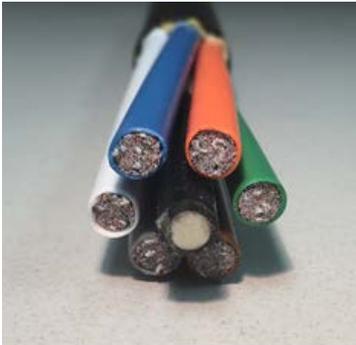
(Ultra-high count Optical Fiber cable)

Expansion of the global product line

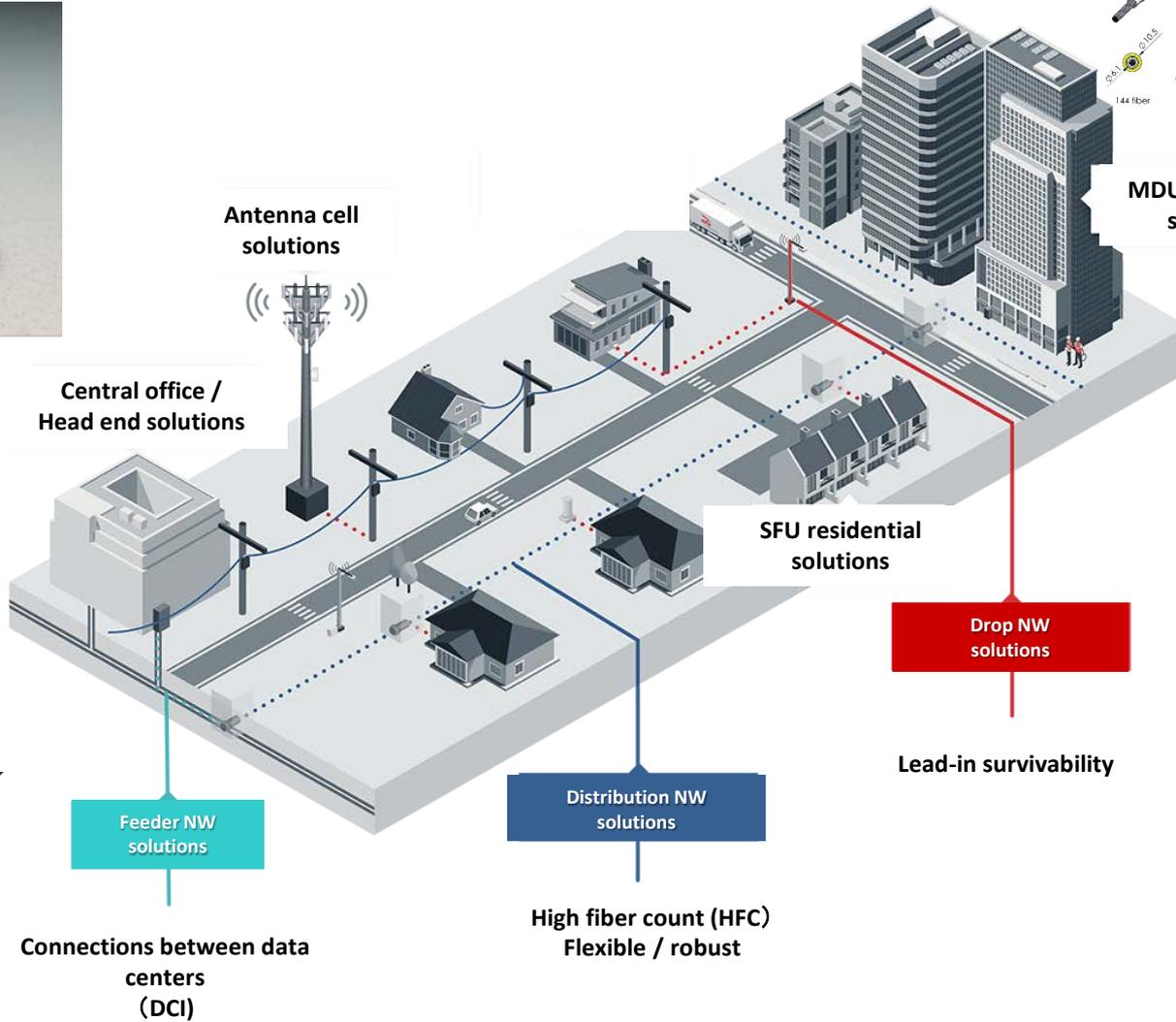


II. B) Rollable ribbon cable

~Expand the range of applications~



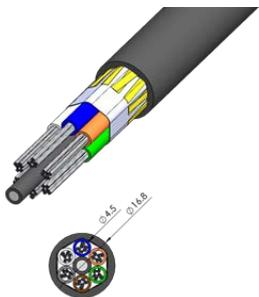
1,728 fiber count cable



MDU & business solutions

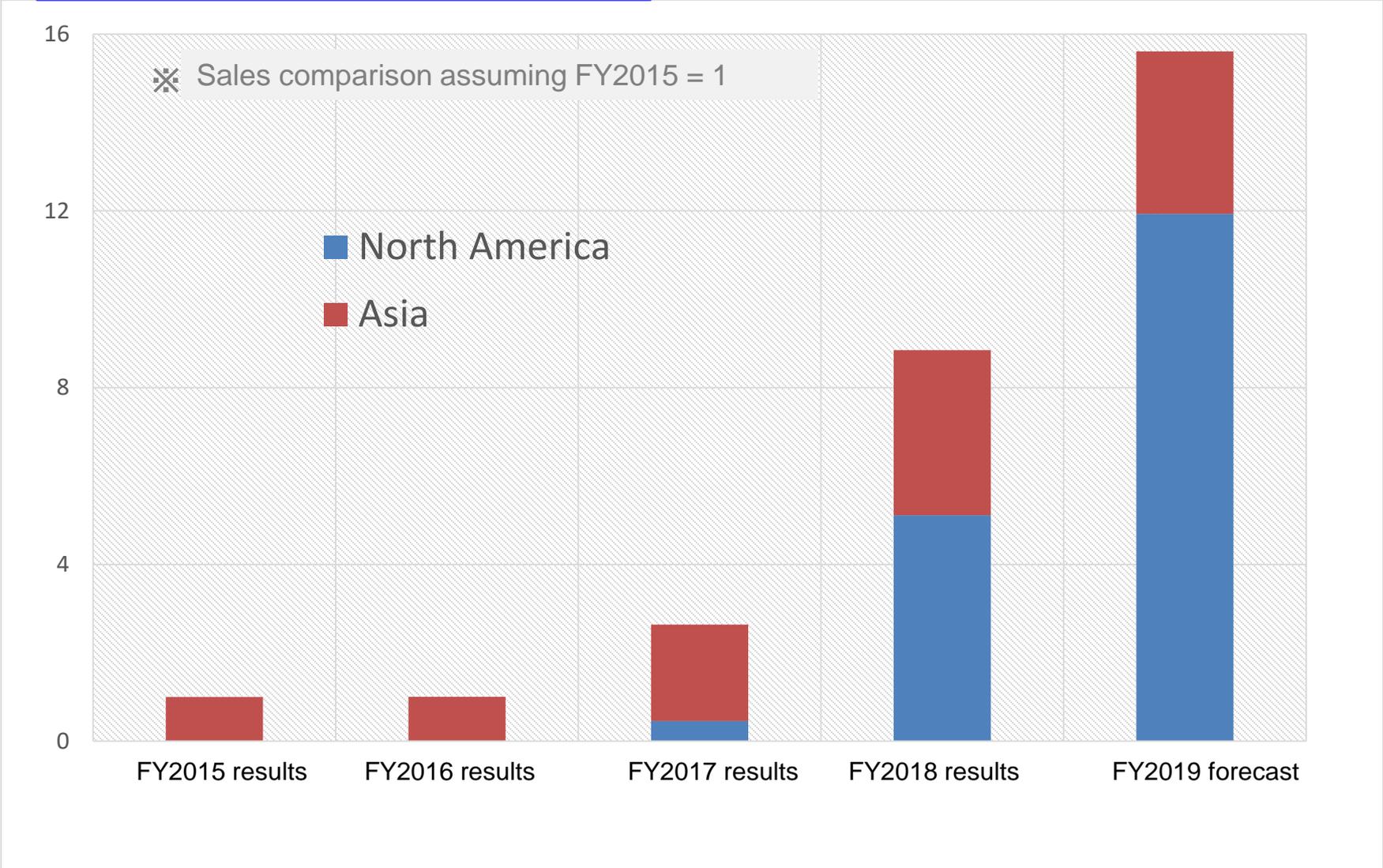
Drop NW solutions

Lead-in survivability



II. B) Rollable ribbon cable

~Sales growth~

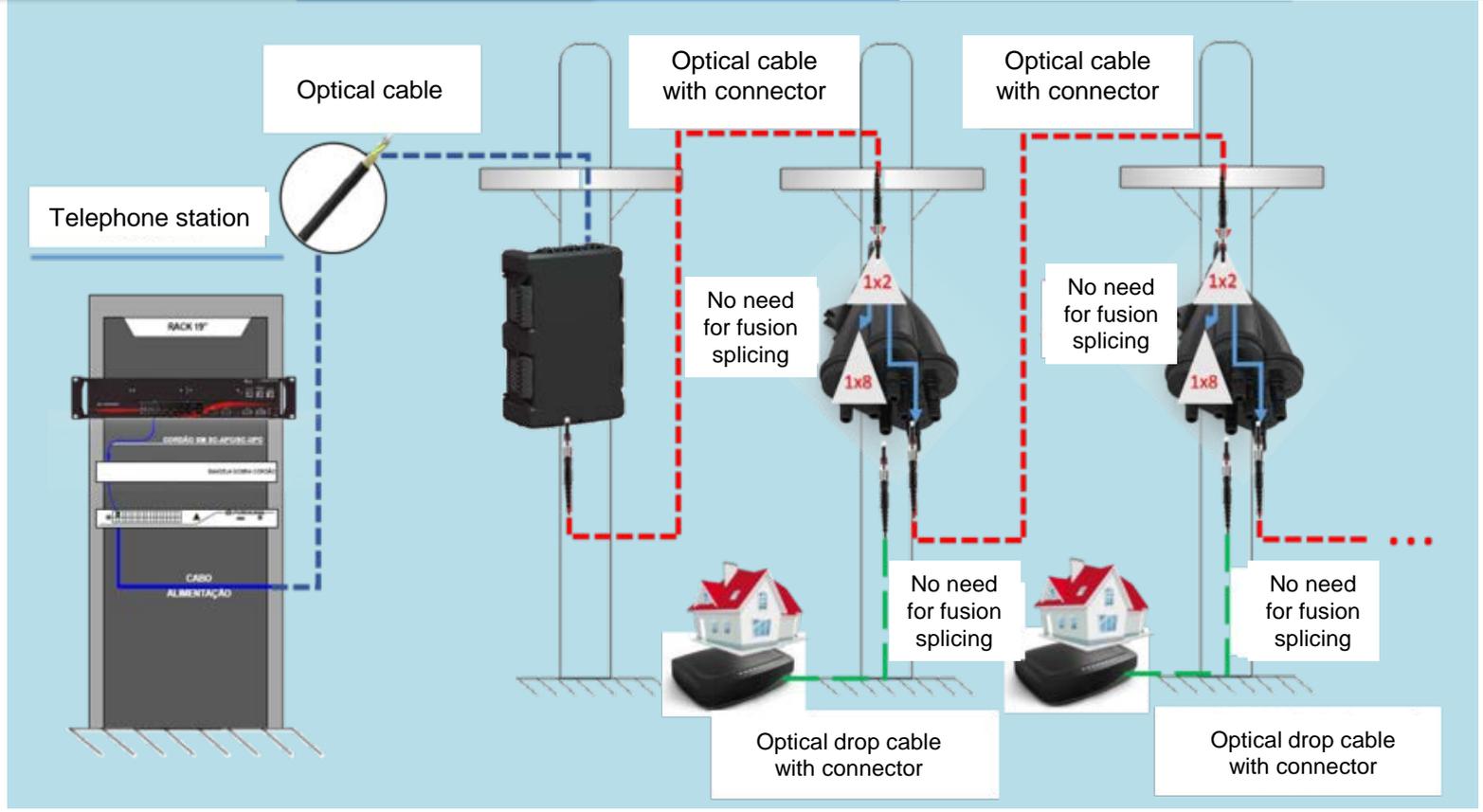


II. C) izzi telecom's large FTTH project

- Convert the existing HFC (Hybrid Fiber Coax) network to a FTTH network
- Total optical cable length is 8,000km (Support a maximum of 1.6 million users)

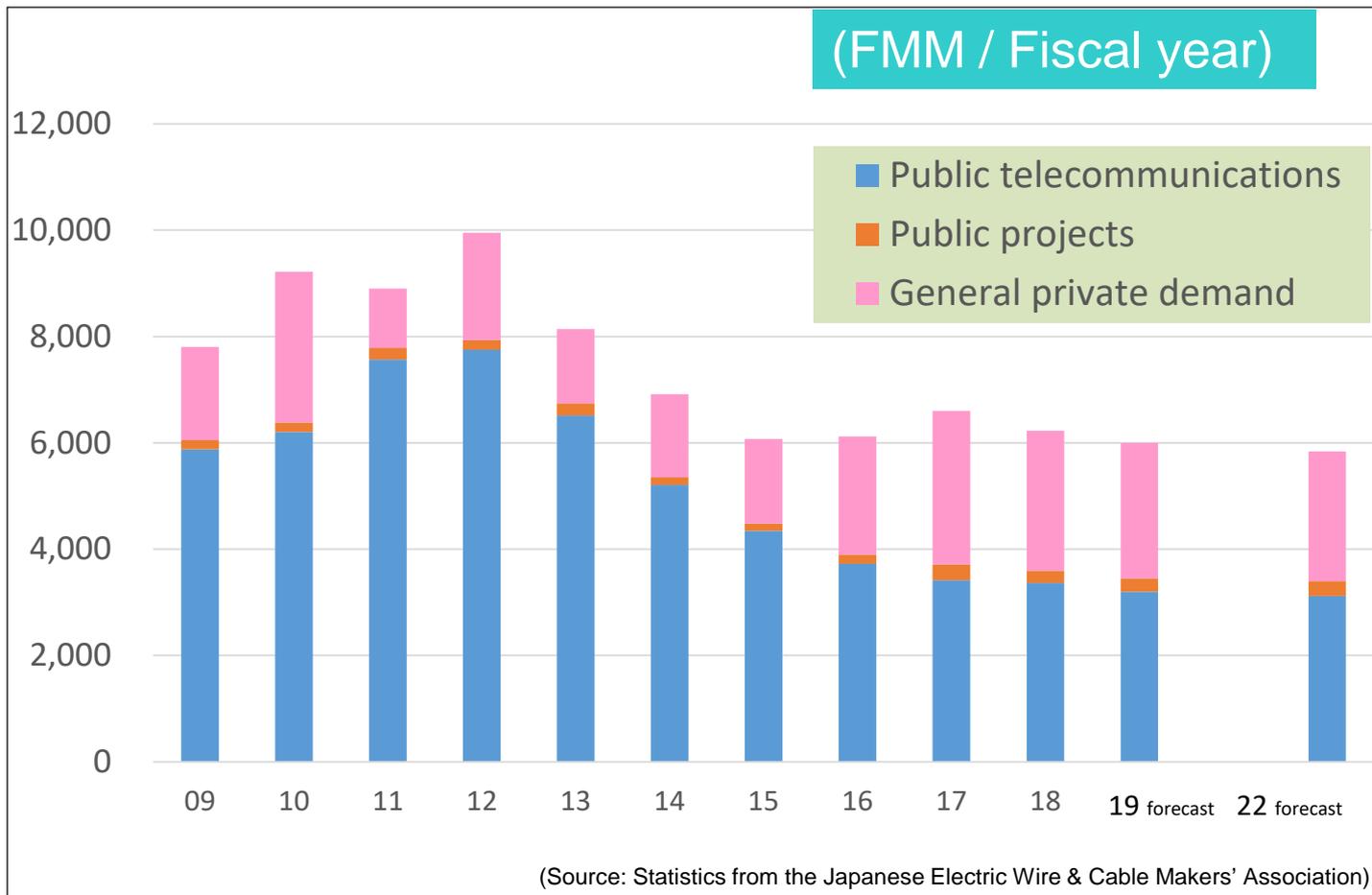
"Cascade" solution

Sales will be about USD 50 million over 2 years



*1 izzi telecom: Major telecommunications carrier that provides service in over 60 cities and 29 states in Mexico
*2 Cascade: Cable connection method that increases the number of terminals by linking the devices (hubs) that relay the connections in series

II. D) Optical cable demand in Japan



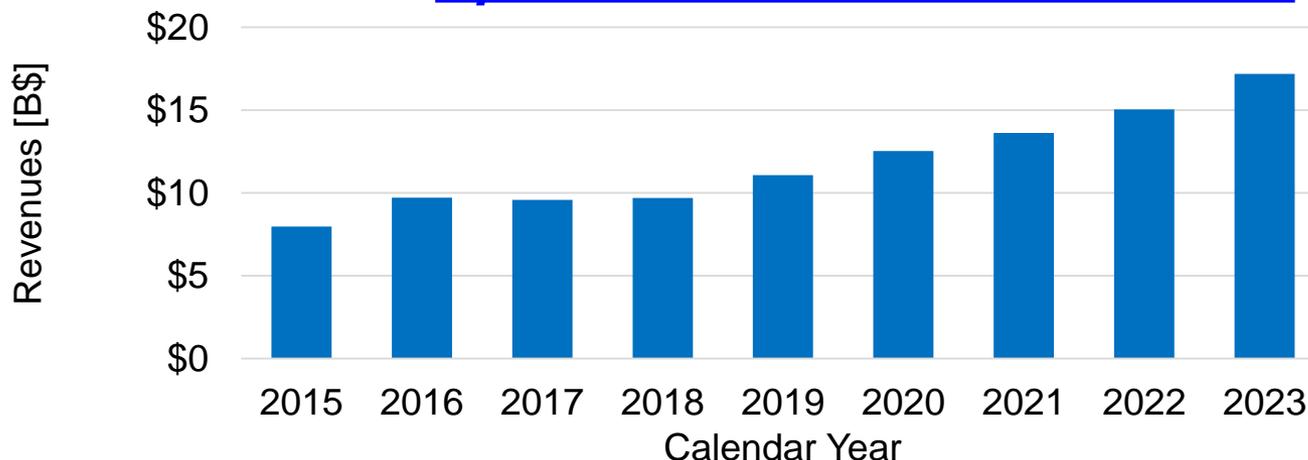
- Demand in Japan centered on FTTH related investments for public telecommunications has fallen by 2/3 since its peak in the early 2000s
- Recently, demand for shifting CATV to optical (support 4K/8K) and Olympics related demand were firm, but this demand peaked in FY2018
- Going forward, there is expected to be increased investments in strengthening the backbone networks following the advancements in 5G, data centers and IoT

【Ⅲ】 Optical components business

- A) Evolution of optical communications networks and business opportunities**
- B) Furukawa Electric's optical devices and changes to the product mix**
- C) Industrial lasers**

III. A) Evolution of optical communications networks and business opportunities

Optical device market forecast



Source: Ovum
Total_Optical_Components_Forecast
Spreadsheet_2017_23

■ Market requests

Long haul: ~1000km

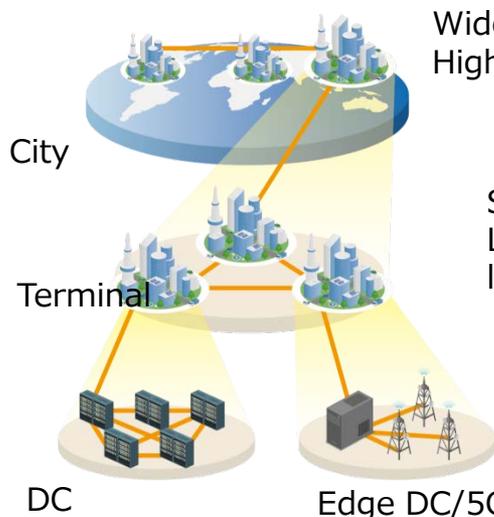
Wide bandwidth (C→C+L band)
High output, Low power consumption

Metro: >80km

Small/high density,
Low power consumption, Narrow
linewidth

Client: 0.5~80km

Small, low price,
Low power consumption,
Expanded range of applicable
environments



■ Furukawa initiatives

Long haul / Metro

- ✓ Respond to increased demand for excitation light sources for broadband amplification
- ✓ Respond to increased demand for excitation light sources for EDFA
- ✓ Respond to increased demand for L-band products
- ✓ Respond to increased demand for small, high performance μ ITLA

Client

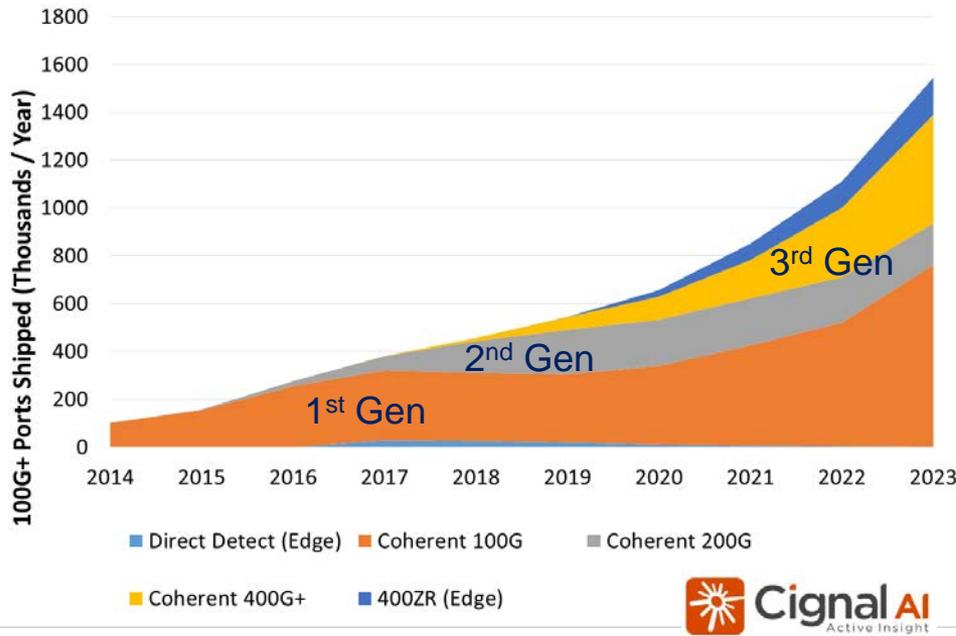
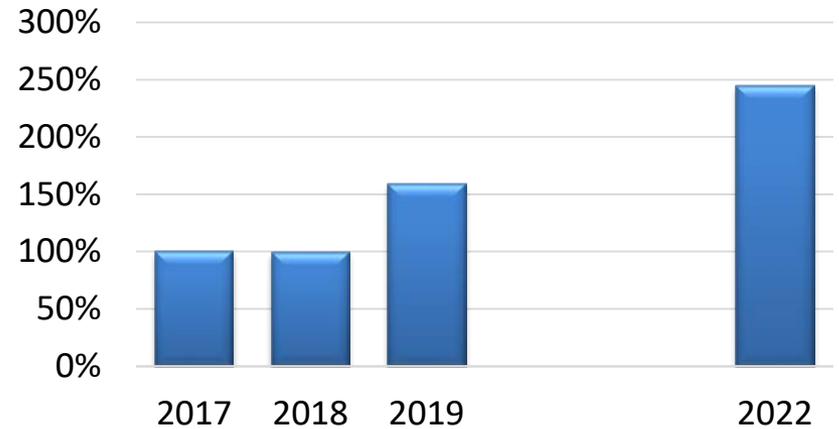
- ✓ Respond to increased demand for products suited to high load environments

III. B) Optical device market and sales of Furukawa Electric products

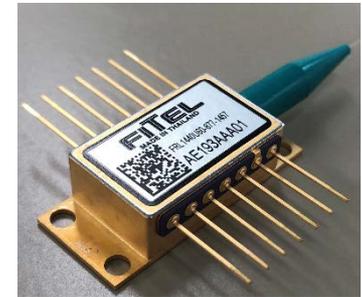
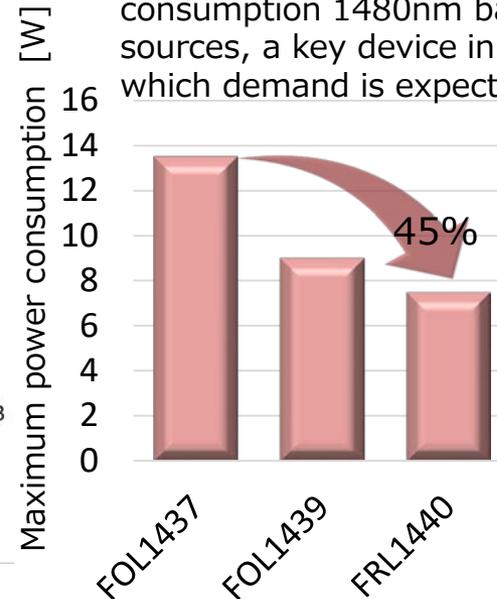
Signal light source trends toward small, low power consumption and narrow linewidth remain ongoing

Following the expansion of 5G, through the expansion of digital coherent to the DC and short haul metro segments, the needs for models that are small and have low power consumption will increase

Optical device sales compared to FY2017



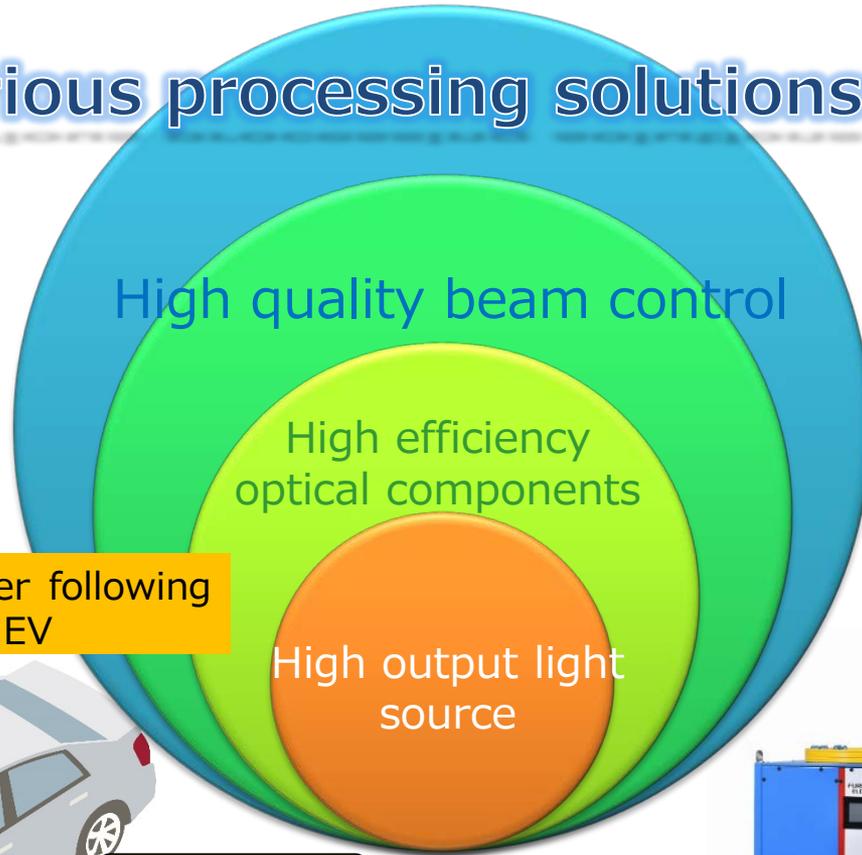
In the area of ultra high speed optical communications, develop high output, low power consumption 1480nm band excitation light sources, a key device in the Raman amplifiers for which demand is expected increase



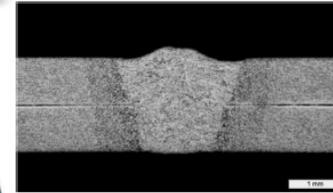
FRL1440 series

III. C) Industrial lasers

Various processing solutions



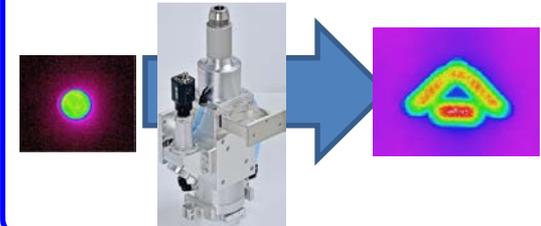
Welding galvanized steel plates



Welding copper foil



Beam mode control technology



Demand for copper following the trend towards EV

LIB

Motor

Harness

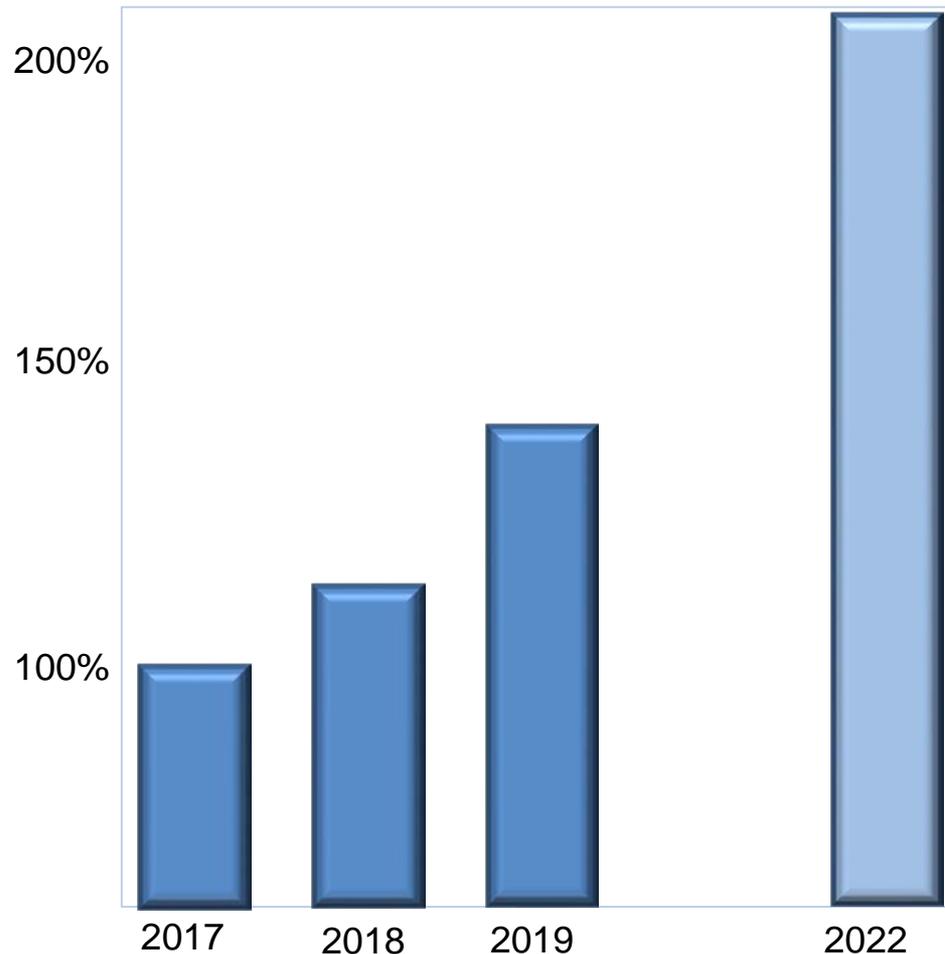
Inverter



Based on high output lasers and high quality beam control, propose solutions in line with customer needs

III. C) Industrial lasers

**Net Sales in the industrial laser business
(2017=100%)**



Exhibitions participated in during
FY2018

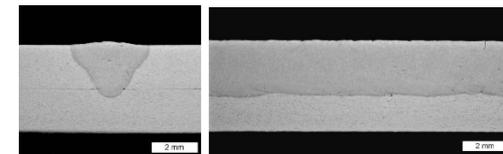
April International Welding Show

December Photonix2018

Over 250 people attended the welding
demonstration



Lap welding of
aluminum alloy



By optimizing the output, welding
speed and beam mode shape, good
weld quality was achieved

【IV】 Broadband business

**A) Developments in the
broadband business**

B) Initiatives for 8K

Sapporo Snow Festival

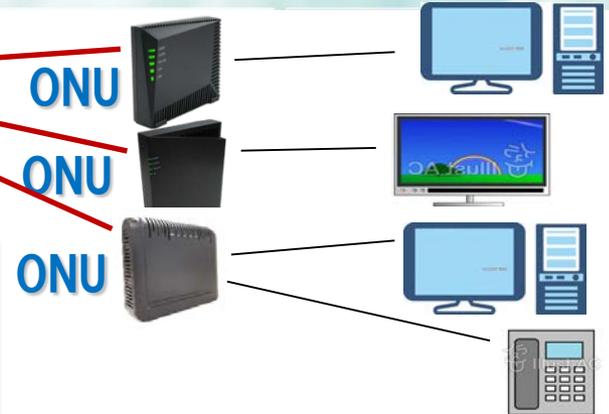
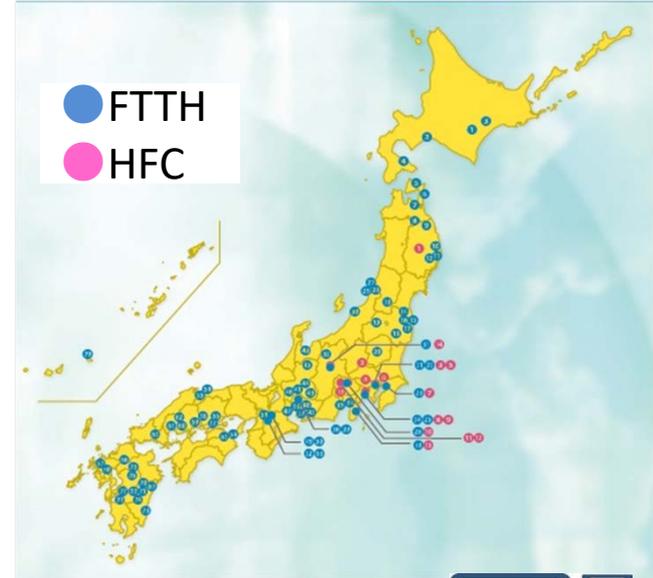
– Successful transmission test of 8K video

IV. A) Developments in the broadband business

No. 1 company in Japan for FTTH systems for CATV

- 50 years of engineering experience for CATV providers
- Provide one-stop systems to the customer from proposing a solution and design through installation
- Currently conducting business in various segments, including broadcasters, telecommunications providers, railroads and public facilities

No. 1 company for FTTH system installations!



Future business developments

- Establish high speed / high reliability telecommunications networks directed at IP broadcasts
- Enhance the support services to businesses utilizing the established telecommunications network
- Diversify the applications of the high definition image technology

IV. B) Initiatives for 8K

Sapporo Snow Festival Successful transmission of 8K video



ISDB-S3
modulator



■ Overview

February 4-7, 2019

8K video transmission test by the National Institute of Information and Communications Technology (NICT)

Products of the Furukawa Electric Group were used and the efficacy was validated in a multi-location broadcast test during which several locations including Sapporo, Osaka, Tokyo and Okinawa were linked together and 8K live video was transmitted at various resolutions from the Sapporo Snow Festival.

Furukawa Electric products used in the test

“8K HEVC encoder” “ISDB-S3 modulator”

Can be used for the introduction of 8K video in segments such as medical, security and entertainment

“Virtual router” “VPN router”

Applies security to compressed video data transmissions and provides effective solutions for preventing data alteration and theft

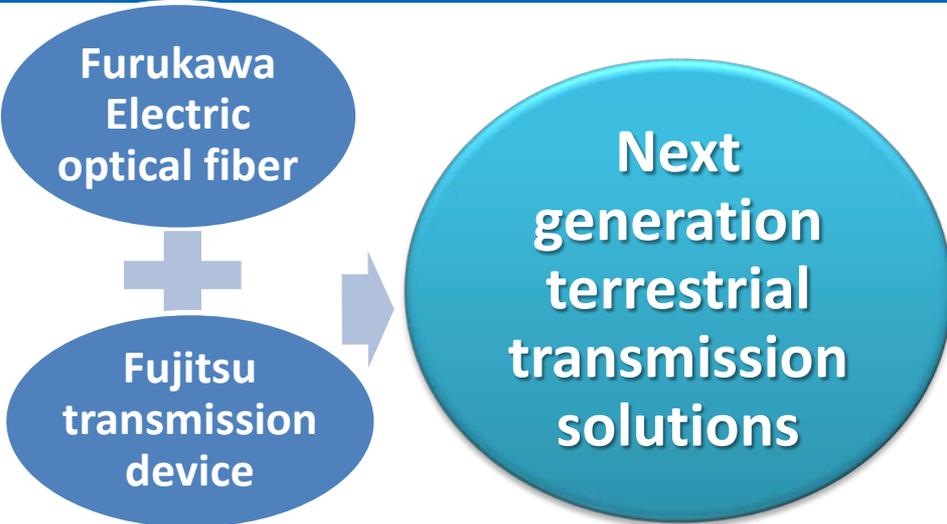
<Overall image of the 2019 demonstration test>

Overall image of the demonstration test (excerpt from NICT documents)

【V】 New co-creation initiatives

- A) Co-creation with another company directed at improving long-distance transmission characteristics 1**
- B) Co-creation with another company directed at improving long-distance transmission characteristics 2**
- C) Example of co-creation with another company in the industrial laser business**
- D) Example of co-creation with another company in the broadband business**

V. A) Co-creation with another company directed at improving long-distance transmission characteristics 1



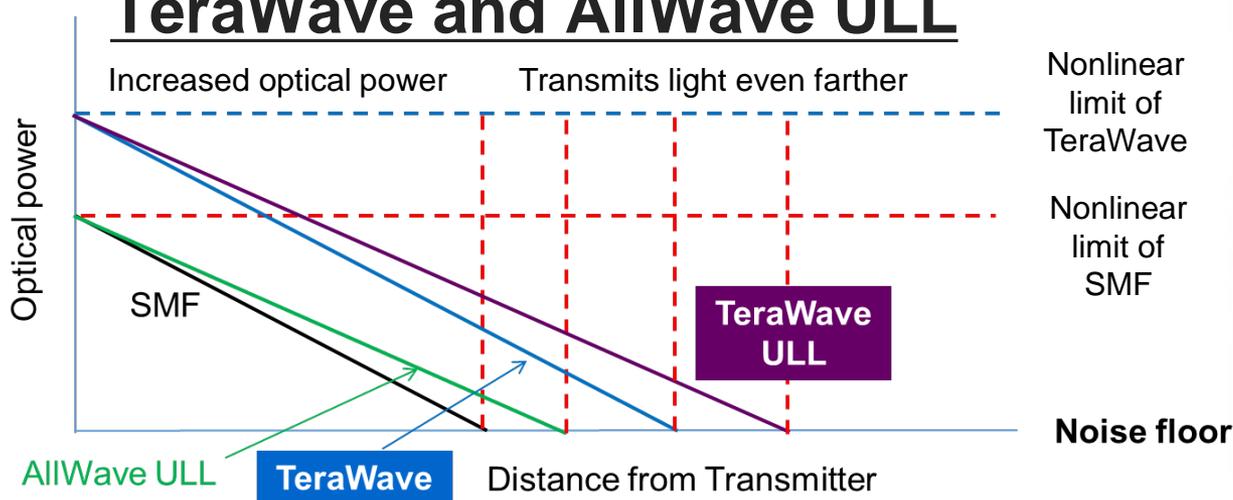
As a result of a demonstration test using Furukawa Electric's next generation optical fiber (TeraWave ULL) and Fujitsu's transmission device, at 600G speeds, compared to the existing single mode fiber (SMF), **total transmission distance increased about 25% and power consumption was reduced by about 14,000 kWh per year** (※Compared to Furukawa Electric's existing SM fiber)

	Optical fiber name	ITU-T recommendation		Fiber loss (typical value) (dB/km@ 1.55μm)	Effective area (μm ²)	Designation
		Category	Transmission loss requirement (dB/km@ 1.55μm)			
General use SMF	AllWave	G.652.D	0.30 or less	0.190	83	General use optical fiber most widely used around the world
Expanded core Ultra low loss SMF	TeraWave ULL	G.654.E	0.23 or less	0.168	125	Fiber with the best performance for terrestrial use. With higher maximum input power and ultra low loss, locations in which light amplification devices were used will likely no longer be necessary

TeraWave™ ULL Single-Mode Optical Fiber

Fiber for the Long Haul

Optical fiber that possesses the characteristics of both TeraWave and AllWave ULL



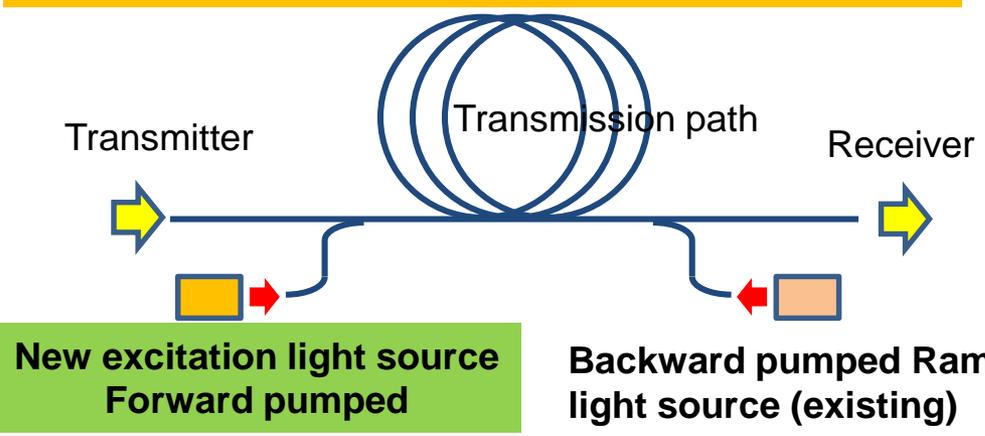
- **Large effective area** ($125 \mu\text{m}^2$) and **ultra low transmission loss** ($0.168 \text{ dB/km @ } 1550 \text{ nm}$)
- Realizes **longer regenerative relay distance** than any other fiber products
- Contributes to reducing the cost of introducing digital coherent systems
- Can be used with the major light amplification devices such as **EDFA, Raman and hybrid amplification**
- Improved nonlinear limit level
- Conforms to the ITU-T **G.654.E international standard**

V. B) Co-creation with another company directed at improving long-distance transmission characteristics

(1) Ultra long distance transmission demonstration test (cooperative venture with NTT Electronics)



(2) New excitation light source (joint research with NTT)



The new excitation light source exhibited the potential to improve the characteristics of long distance coherent communications systems through the use of forward pumped Raman amplification, which was difficult with existing light sources

※Announced by NTT at the Optical Fiber Communication Conference (OFC2019) held in San Diego in the United States in March 2019
T. Kobayashi et al, "PDM-16QAM WDM Transmission with 2nd-order Forwardpumped Distributed Raman Amplification Using Incoherent Pumping" the Optical Fiber Communication Conference (OFC) 2019, paper Tu3F.6

V. C) Example of co-creation with another company in the industrial laser business



Developed monitoring equipment for detecting and quantifying with high precision and in-process the level of dirt buildup on the protective glass for the scanner laser processing head



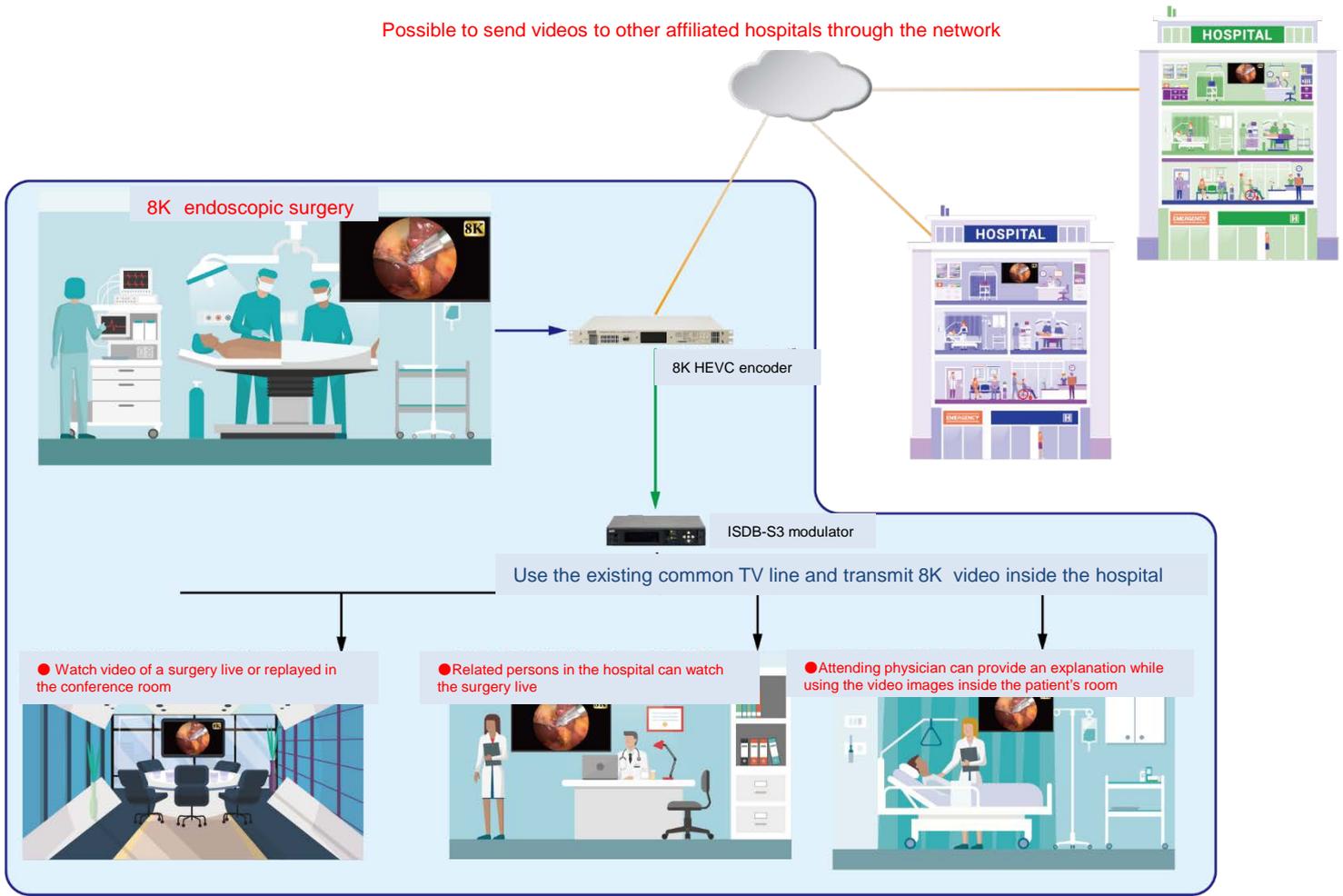
Through Daihen's arc welding technology and Furukawa Electric's fiber laser technology, successfully welded aluminum and automotive steel sheets

V. D) Example of co-creation with another company in the broadband business

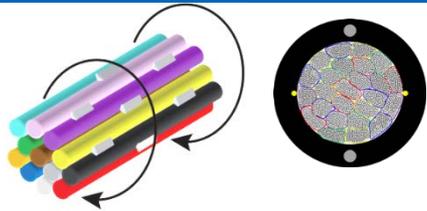
System for transmitting, recording, playing back and sharing endoscopic surgery video using an 8K HEVC encoder

Possible to send videos to other affiliated hospitals through the network

かまくらNOW!
MIHARU



【VI】 Initiatives for 5G

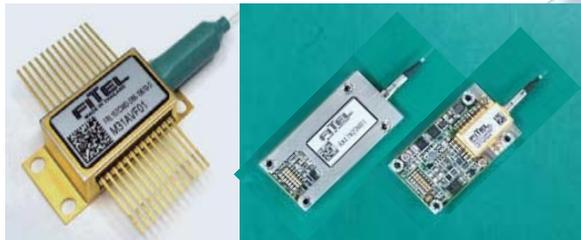


- High-Density Multi-fiber connectors
- High-Density small diameter fiber cable
- Micro ITLA

Ultra-High Speed / Large Capacity

Red: Product / Elemental Technology that supports 5G
Blue: Use realized through 5G

- SDN/NFV technology
- NG-PON2
- Microwave transmission



- High speed in-vehicle communications
- Peripheral monitoring radar (First Japanese manufacturer)

VR 4K/8K streaming
5 G
 Autonomous driving Smart city

- Thermal management technology
- High frequency substrate technology (copper foil)



Low Latency

- Virtual router
- MEC (Mobile Edge Computing)
- IoT system

Simultaneous Connection of Multiple Terminals

- Local optical/wireless hybrid system



Multi-Mode Radar



“Leading to safety”

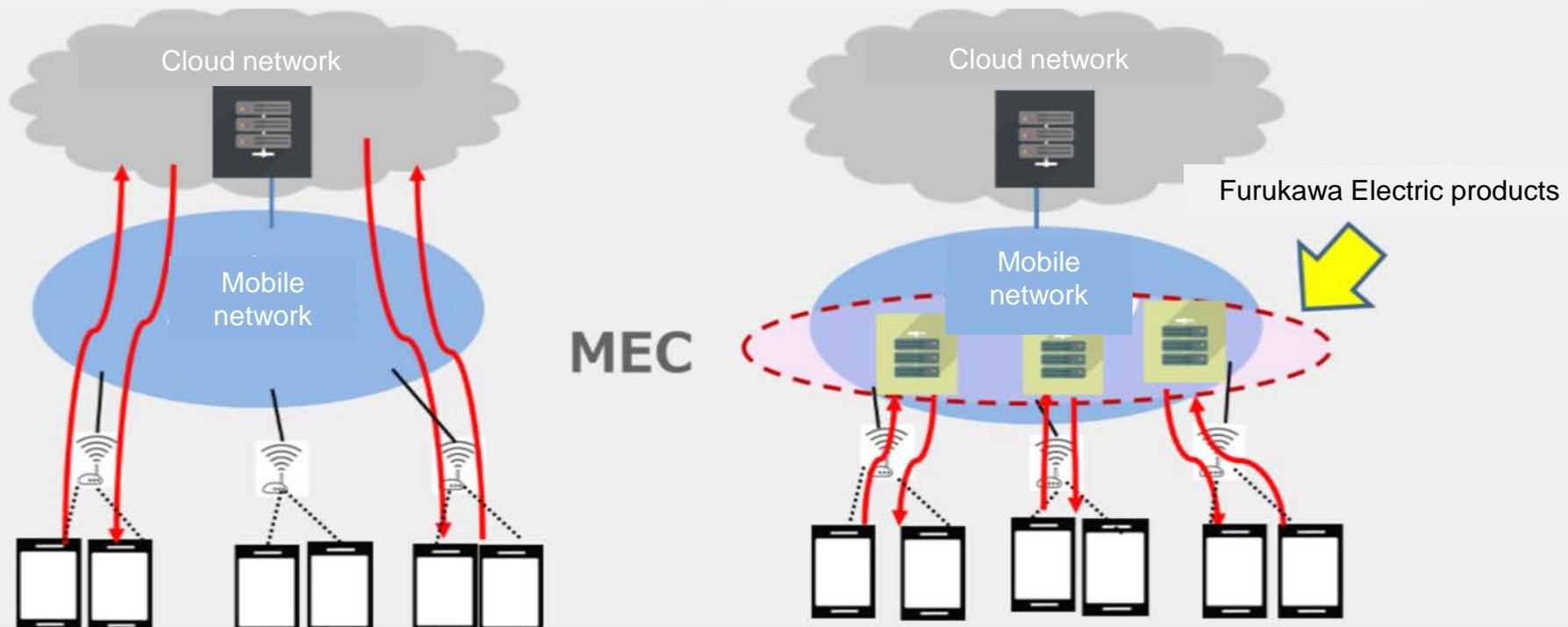
Shift to mobile edge computing (MEC) where the servers used to provide cloud services are located close to the user. Further develop the virtualization technology (VPN) accumulated through many years in the router business and play a role in MEC.

【Now】

All of the data is processed in the cloud network = High latency

【5G】

Some of the data is processed near the user = low latency



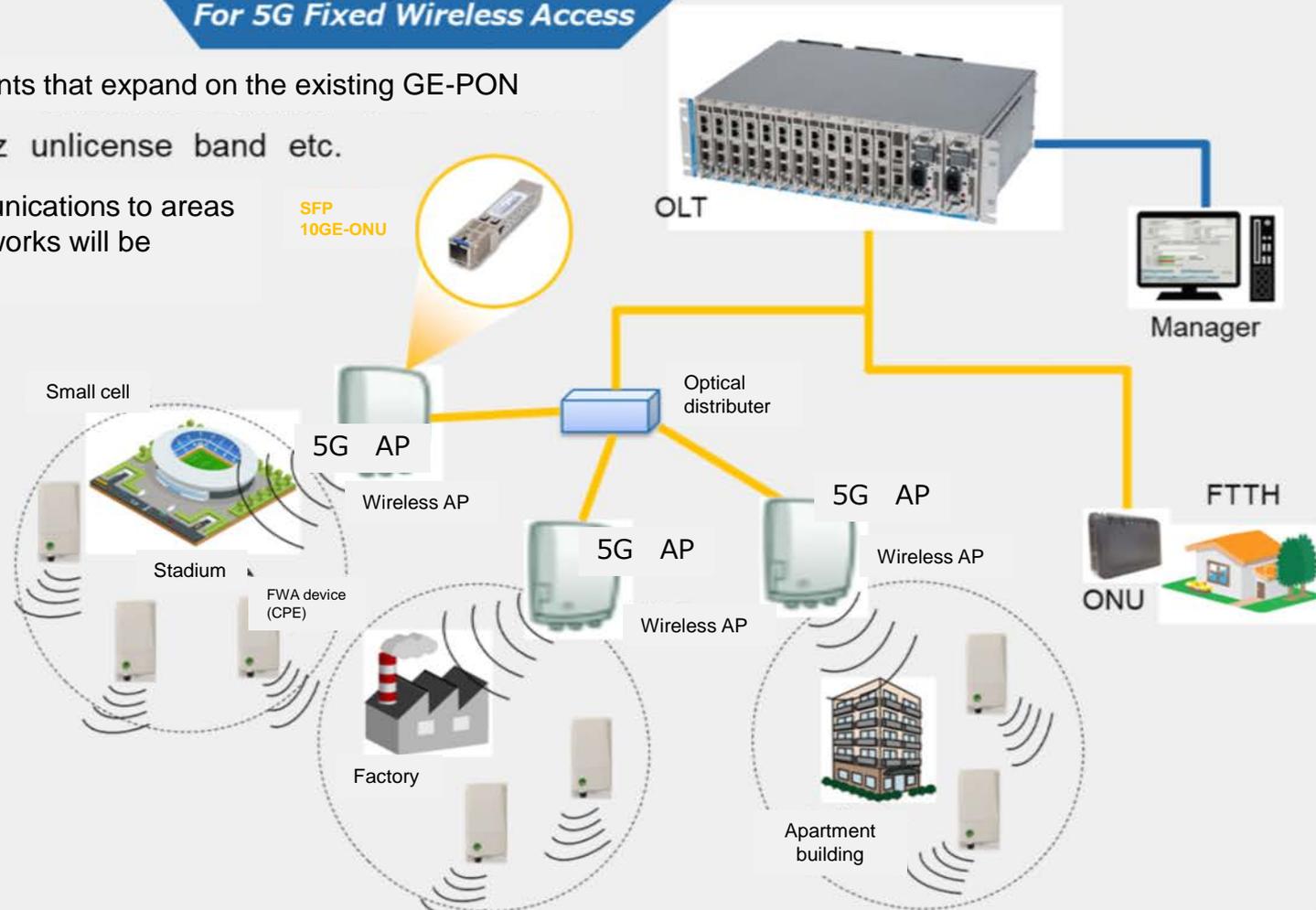
Information solutions and 5G

“Realizing diverse connections”

Technology For Enabling Connections with Optical Fiber and Wireless

For 5G Fixed Wireless Access

- Wireless access points that expand on the existing GE-PON
Local 5G, 60GHz unlicense band etc.
- Provide 10G communications to areas in which optical networks will be difficult to establish

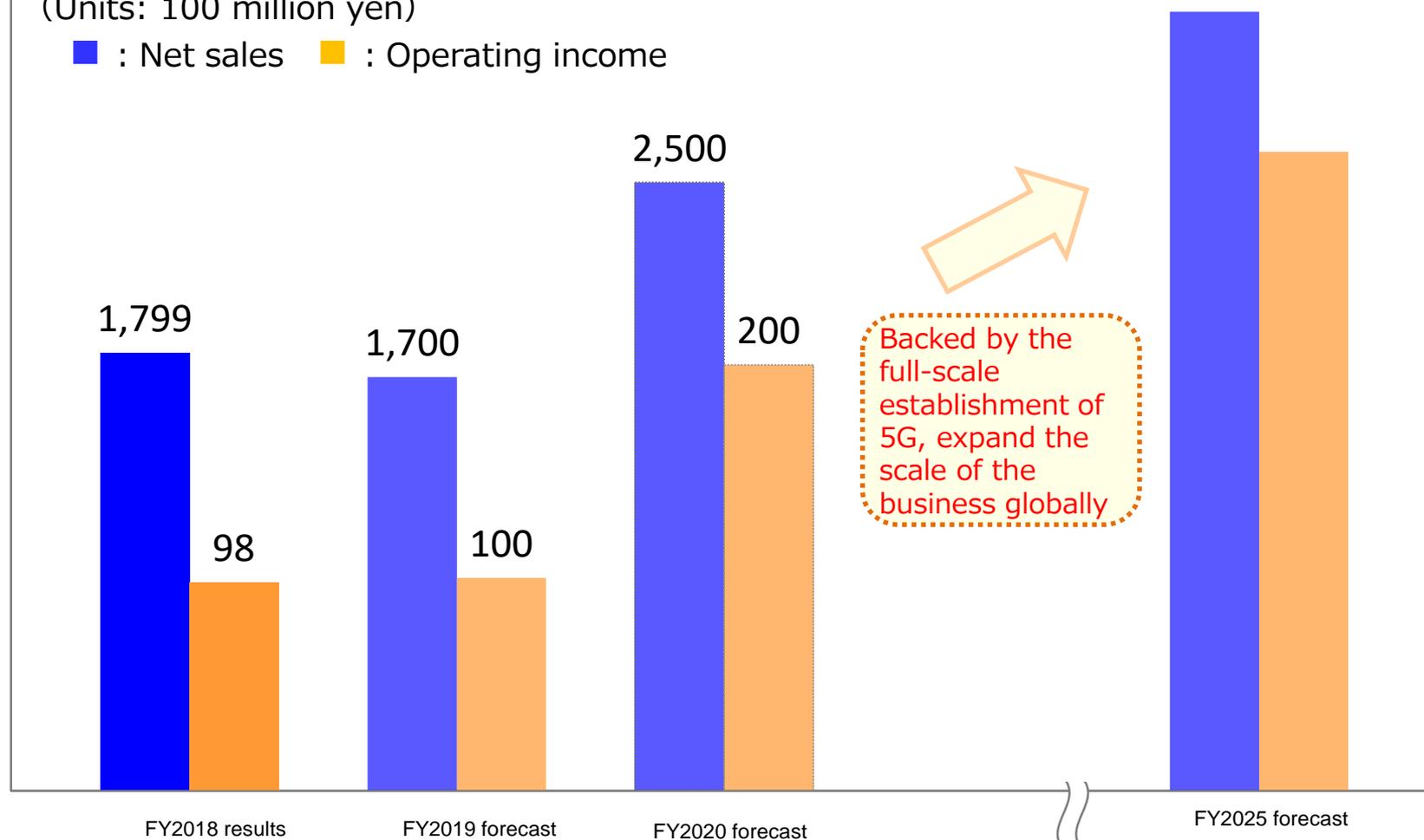


【Ⅵ】 Future earnings growth and FY2019 forecast

Net Sales and operating income forecast

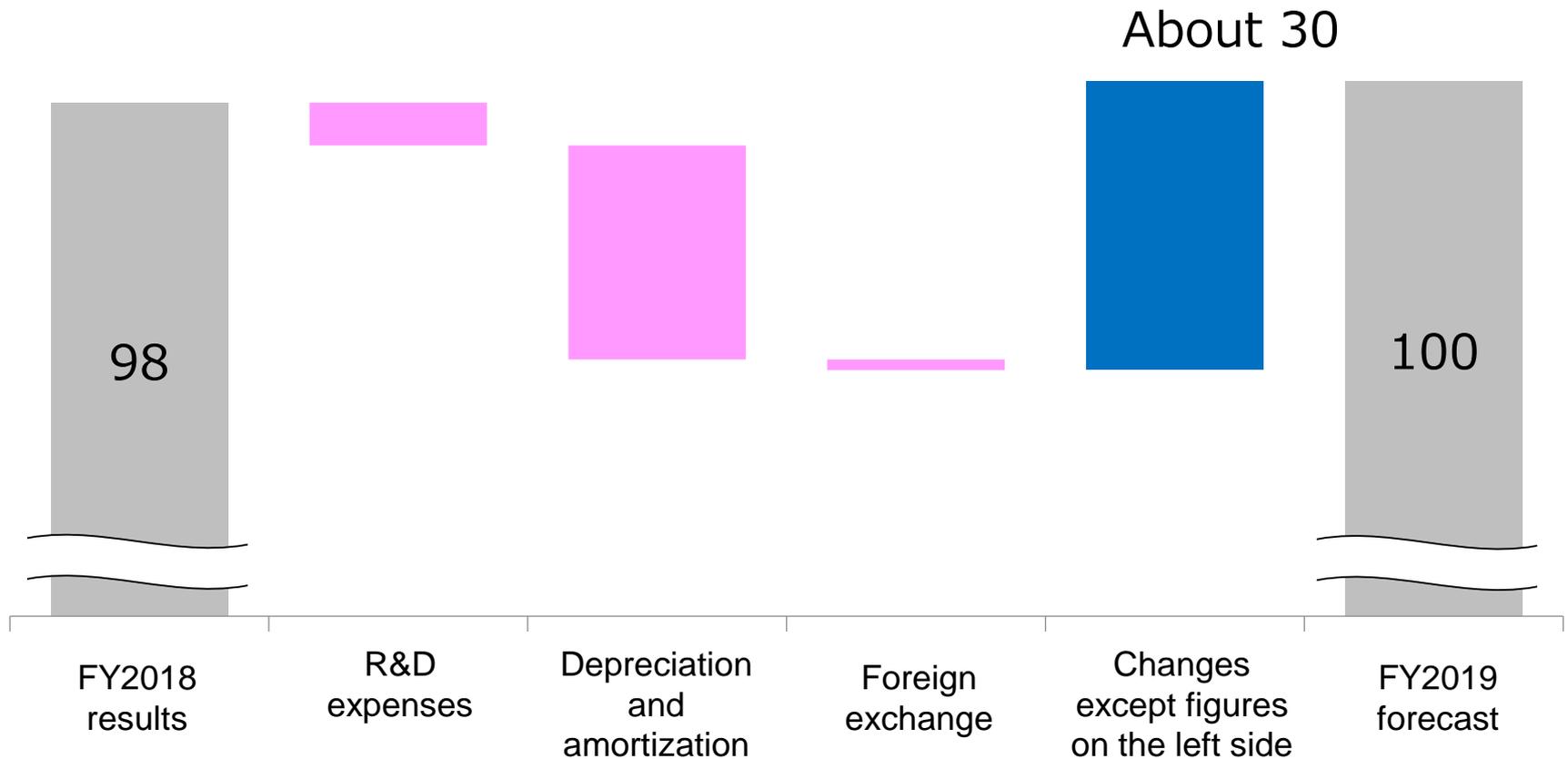
(Units: 100 million yen)

■ : Net sales ■ : Operating income



FY2019 operating income forecast **FURUKAWA ELECTRIC**

(Units: 100 million yen) **Depreciation cost, R&D expenses and exchange rate effects**



Thank you very much
for your attention.

Bound to  ***Innovate***

Main products in the Communications Solutions business

Business	Main products	Main applications	Main customers	Main areas
Optical Fiber and Cable Products	<ul style="list-style-type: none"> •Low loss fibers for submarine power cable and long distance •Low bending loss fiber for building/residential applications 	<ul style="list-style-type: none"> •Telecommunications •Video broadcasts •Data centers 	<ul style="list-style-type: none"> •Telecommunications carriers •CATV providers •OTT 	Europe, North America, South America, Southeast Asia
	<ul style="list-style-type: none"> •Rollable ribbon cable 	<ul style="list-style-type: none"> •Telecommunications •Video broadcasts •Data centers 	<ul style="list-style-type: none"> •Telecommunications carriers •CATV providers •OTT 	Japan, North America
FITEL Products	<ul style="list-style-type: none"> •Variable wavelength laser modules (ITLA) 	<ul style="list-style-type: none"> •Digital coherent signal light source 	<ul style="list-style-type: none"> •System vendors •Transmission device manufacturers 	North America, China
Broadband solutions Business	<ul style="list-style-type: none"> •FTTH system devices 	<ul style="list-style-type: none"> •Telecommunications service •Broadcast service •Design, installation 	<ul style="list-style-type: none"> •CATV providers •Municipalities •Telecommunications providers 	Japan
	<ul style="list-style-type: none"> •Network routers 	<ul style="list-style-type: none"> •High speed, high capacity telecommunications service •Establish VPN 	<ul style="list-style-type: none"> •Telecommunications providers •General companies 	Japan