



**We are striving to contribute to the efficient use of energy resources by combining material technologies.**

International society is facing a number of issues in the energy sector. With the balance between natural resource supply and demand growing tighter, demand for energy continues to grow. Environmental risks due to fuel consumption are increasing. Furukawa Electric is making a proactive effort to address international environmental issues by pursuing the efficient use of energy resources.

In April 2013, we announced Furukawa G Plan 2015, the medium-term management plan for the Furukawa Electric Group. This plan calls for the promotion of businesses that use energy efficiently and in an environmentally friendly manner in the three essential consumer categories of energy, telecommunications and automobiles. We have set “create a smart electric power infrastructure, “build high-capacity telecommunication infrastructure” and “make cars greener” as shared goals for the Group going forward, and our R&D, production and sales functions will work together to achieve these goals.

Furukawa Electric has developed a host of products processed from diverse materials, including copper, aluminum and plastic. By deepening, broadening and combining material technologies at Furukawa Electric, we aim to pursue the groupwide development of innovative new products and technologies on global scale. We have identified three sectors that are closely related to everyday life; by making use of products in these areas, we aim to promote the efficient use of energy resources and contribute to ongoing environmental improvements.



Hisaharu Yanagawa  
General Manager of  
Research and  
Development Division  
Corporate Senior Vice  
President



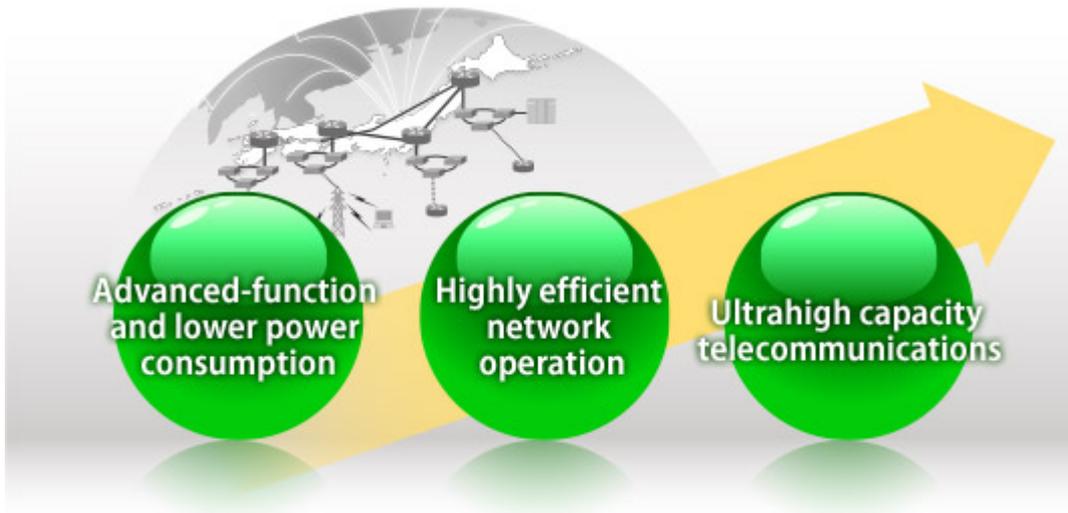


## Using Leading-Edge Photonics Technology to Achieve High-Capacity Optical Telecommunications

The volume of global data traffic is projected to increase at an annual rate of 40%, highlighting the need for high-capacity telecommunication networks that take advantage of advances in optical communication technology. The Furukawa Electric Group contributes to bringing high-capacity telecommunication infrastructure into practical use by using advanced functional optical components developed through its leading-edge photonics technology.

In addition to some of the world's most advanced optical fiber cables, Furukawa Electric supplies such optical components as semiconductor lasers, optical waveguides and optical switches, as well as optical fiber amplifiers, routers and other optical transmission equipment. In recent years, attention has focused on the development of lasers and related devices that are used in digital coherent communication systems to realize higher volumes of data transmission than conventional systems. As devices become compact in size and advanced in functionality, a huge volume of information can be communicated with lower power consumption.

We will utilize the expertise we have built up in optical communications to increase data center capacity while reducing their power consumption and pursuing space savings. At the same time, we are undertaking R&D initiatives toward more efficient network operation and ultrahigh-capacity communications.



- Digital coherent communication
- Integrated signal light source
- High-density optical wiring
- Optical engine
- Optical communication with high spectral efficiency
- Spatial multiplexing
- Ultrahigh-speed wireless communication

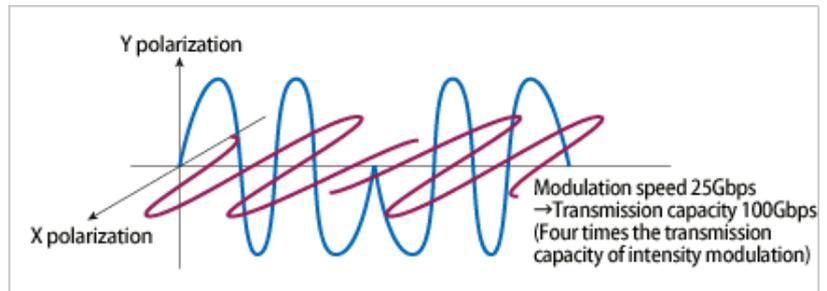
**Pick up**

## High Speed and Quality

### Digital Coherent Communication

Given the demand to communicate increasing volumes of data at high speed, digital coherent communication is garnering attention for its ability to handle higher capacity by utilizing optical phase and polarization.

The Furukawa Electric Group has developed some of the elemental technologies needed for digital coherent communication, such as sophisticated optical waveguide technology for controlling phases and polarization, contributing to its practical realization.



**Pick up**

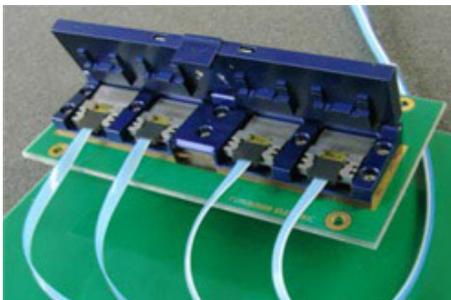
## Using Optical Wiring to Achieve Ultrahigh-Speed Transmission and Reduce Power Consumption

### Optical Interconnection

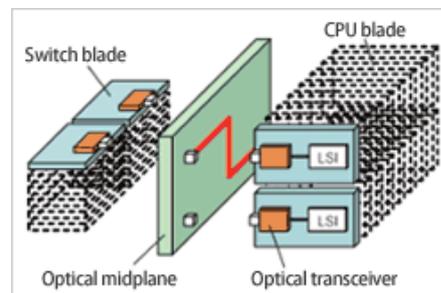
In recent years, dramatic increases in the volume of information handled by networks and data centers has highlighted the limitations inherent in using electrical wiring to connect massive computers. Optical interconnection, using optical connectors and wiring, is heralded as an alternative approach.

This new technology overcomes the distance and speed limitations of electrical wiring transmission capacity. The technology is also environmentally friendly, as it consumes less electric power.

The Furukawa Electric Group is developing elemental technologies for optical interconnection, such as optical modules, optical connectors and optical fibers.



Ultrahigh-speed optical interconnection



**Pick up**

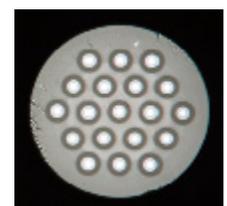
## Optical Fiber That Enables Spatial Multiplexed Optical Transmission

### Multicore Fiber:

Current optical fibers have a single “core” where optical signals propagate. Multicore fiber, as its name suggests, has more than one core.

As the transmission capacity of existing optical fiber transmission lines is predicted to become insufficient in the near future, expectations for the introduction of innovative technologies are growing. For example, spatial multiplexed optical transmission technology can be used to substantially increase the volume of data handled by transmission networks made of existing optical fiber.

In addition to multicore fiber, the Furukawa Electric Group is promoting R&D on incidental technology, such as multicore amplifiers and connectors, aiming for commercial production in 2020 or later.



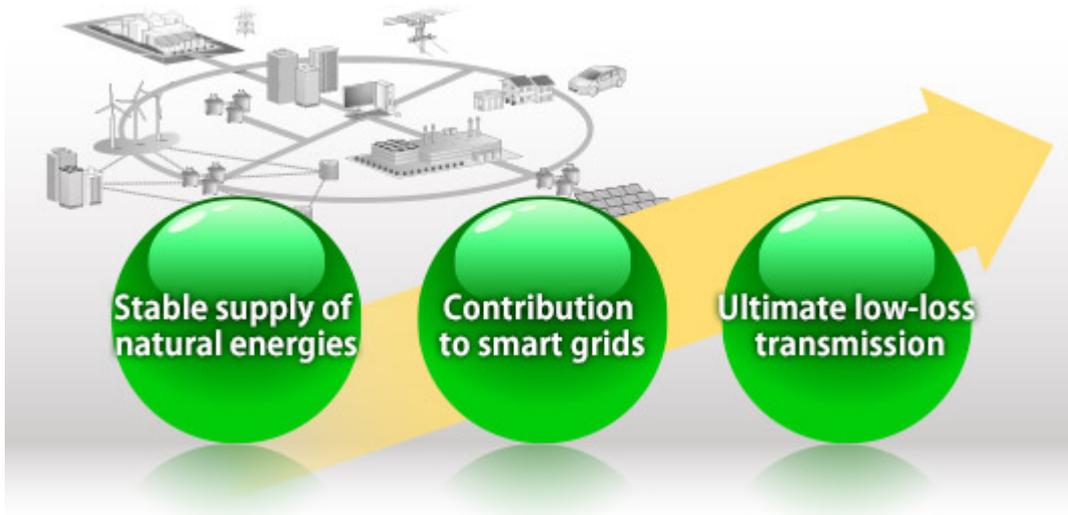
Multicore fiber:



## Leveraging the Expertise We Have Cultivated over Many Years to Realize a Society with Smart Grids

The Furukawa Electric Group boasts a long history in the development of power transmission technologies that provide the basic infrastructure for today's society. We are leveraging the technologies we have cultivated in the power infrastructure business to contribute to the realization of a society that employs smart grids to use energy efficiently.

We already contribute the efficient supply of electricity by providing low-, medium- and ultrahigh-voltage cables and components. In addition, we are developing high-temperature superconducting power cables that are expected to transmit electricity efficiently and greatly reduce power loss during transmission. Furthermore, we are targeting the natural supply of stable energies by participating in an offshore floating wind farm project and developing an energy storage system to improve the efficiency of energy use.



- Energy storage system
- Automatic control systems for power distribution
- Power cables
- Terminations
- EV charger connectors and devices
- V2H/V2G system
- High-temperature superconducting cables
- High-temperature superconducting devices

**Pick up**

## Reducing Peak Power Consumption and Making Efficient Use of Nighttime Power

### Package-Type Energy Storage System

The importance of storage batteries has attracted more widespread recognition in the aftermath of the Great East Japan Earthquake.

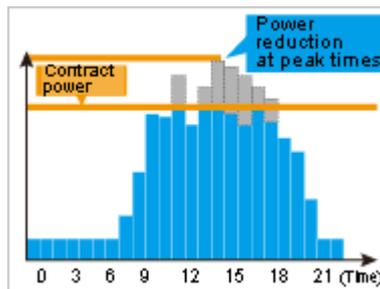
Furukawa Electric’s package-type energy storage system serves as an emergency power source to sustain operations of a limited amount of essential electrical equipment in the event of a power outage. This system uses electricity efficiently by reducing consumption during times of peak power demand and making use of nighttime power generation.

For customers, reduced peak electricity consumption translates to lower base rates and allows for the installation of equipment to ensure safe and stable operation, enabling a partial recovery of capital investment.



Package-type energy storage system

### Peak power reduction



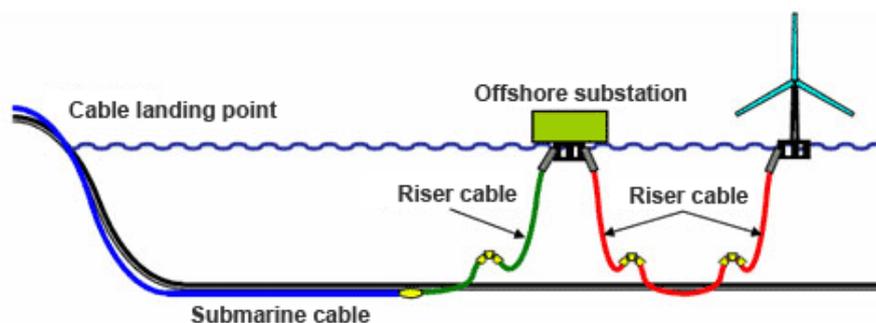
**Pick up**

## Participating in the Experimental Offshore Floating Wind Farm Project

### Riser Cables, Terminations

Furukawa Electric is in charge of the power supply for the experimental project. We are building and testing a power supply system capable of securely delivering control signals and power generated at the offshore floating wind farm to the shore through submarine cables. Since the force of waves and tides cause floating wind farms to constantly pitch, the submarine cables are also required to track dynamic movement under severe conditions. We are helping to realize the world’s largest offshore floating wind farm by developing an ultrahigh-voltage riser cable system that mobilizes the dynamic cable technology cultivated at Furukawa Electric.

### Schematic diagram of the power supply system at offshore floating wind farms



**Pick up****The World's Most Advanced 275kV–3kA High-Temperature Superconducting Cables****High-Temperature Superconducting Cables**

Technology is needed to ensure the stable supply of power, which underpins economic society, as is highly efficient transmission technology to send this power without waste from its source of generation.

In the past, 66kV was mainstream in the development of superconductive transmission cable technologies, but in recent years demand for transmission cables with even higher voltage has emerged, particularly overseas. As this technology takes hold, it is likely to be introduced into new infrastructure in Japan, as well as in other parts of Asia.



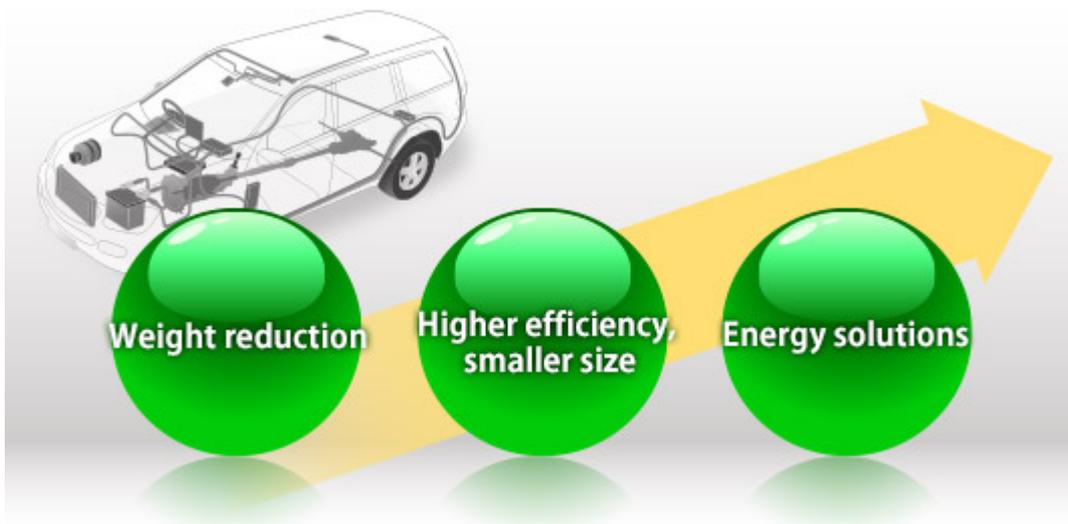
30m 275kV superconducting cable verification test (Shenyang)



## Leveraging Our Proprietary Material Technologies to Accelerate the Creation of Green-Energy Cars

To resolve issues in the field of transportation equipment, including energy problems and rising CO<sub>2</sub> emissions, the Furukawa Electric Group is utilizing its proprietary materials capabilities to make cars greener, such as by making automotive parts more lightweight to improve energy efficiency.

For example, we use our metal structure control technology and property modification and processing technologies for plastics to make automotive parts (aluminum body materials that are highly rigid and conduct heat well, highly conductive and rigid aluminum wire harnesses, and high-strength foamed materials used in electronic components) more lightweight, improving fuel efficiency and leading to CO<sub>2</sub> reductions. We also employ our technologies for designing plastics and making wiring thinner to make highly compact and reliable windings for alternators, which contributes to higher energy efficiency on electric and hybrid vehicles (EVs/HVs). Going forward, in addition to making parts more compact and light weight, we aim to become involved in overall energy management efficiency for automobiles.



- High-strength foam components
- High-strength aluminum alloys
- Thin insulation film enameled wire
- Thick insulation film rectangular wire
- Energy management system
- Thermal energy control

**Pick up****Achieving Lighter Weight by Changing the Conductor Material from Copper to Aluminum****Aluminum Wire, Wire Harnesses**

Wire harnesses are the tied bunches of automobile electric cables, or wires, that provide electrical connections to a vehicle's electronic components.

The weight of wire harnesses has grown in recent years, as vehicles include more electronics and automakers pursue higher levels of functionality to make automobiles safer and more comfortable. Wiring accounts for around 60% of the weight of wire harnesses. We are taking a variety of approaches to reduce their weight, such as by making insulative coatings thinner and employing smaller-diameter wires.

As another method for making wiring lighter weight, we have developed alloy-based aluminum wire for conducting electricity in place of copper. Using this aluminum wire in some locations makes the harness more lightweight.

By making wires thinner and using improved anticorrosion technology, we plan to increase the scope of application for aluminum wires and help to make automobiles even more lightweight.



Wire harness

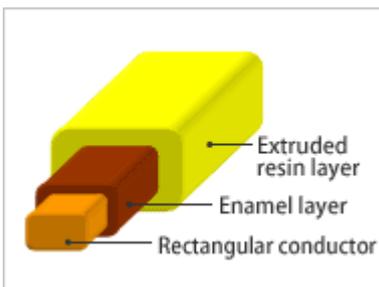


Aluminum wire

**Pick up****Making EV/HV Drive Motors More Highly Efficient and Compact****High-Withstand Voltage Rectangular Wires**

Making EV/HV drive motors more compact requires highly insulative and reliable windings.

High-withstand voltage rectangular wires comprise a rectangular conductor, an enamel layer and an extruded resin layer. In addition to being highly insulative, the rectangular shape of these wires gives them a high space factor, and their enamel layer enables them to withstand heat and contributes to reliability. As a result, these wires help to make EV/HV drive motors more compact.



Rectangular wire for EV/HV drive motors

**Pick up**

## Monitoring the Degradation in Lead Battery Discharge Performance

### On-Board Lead Battery Status Detection Sensors

A battery's internal resistance <sup>(note 1)</sup> is an extremely important factor for determining its discharging performance and degree of depletion. However, using conventional methods does not allow the internal resistance of lead batteries could to be measured when the engine is turned off or on EVs/HVs not equipped with starter motors.

Furukawa Electric has developed the technologies to install a discharging circuit in the sensor and calculate the internal resistance based on current and voltage response. For the first time in the world, using this sensor allows continuous monitoring of a lead battery's status, even when the engine is turned off and on EVs/HVs without starter motors. This addition helps to improve automotive fuel performance and reduce CO<sub>2</sub>.

<sup>(note 1)</sup> Internal resistance refers to the electrical resistance within a battery. The higher the internal resistance, the lower the voltage will be when discharging takes place. In general, internal resistance goes up as a battery deteriorates.



Lead battery status detection sensor installed in a vehicle