Sumitomo Heavy Industries Group's Initiatives for Carbon Neutrality

Sumitomo Heavy Industries, Ltd.

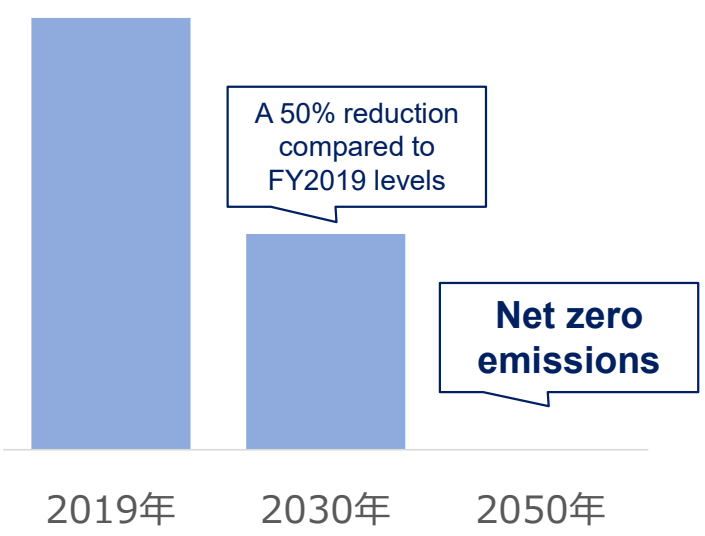
September 2026

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

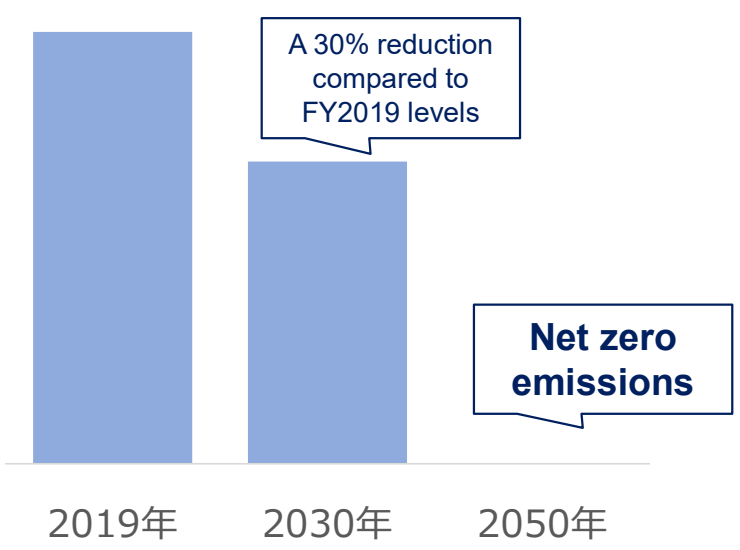
Response to Climate Change Risks

- **The Sumitomo Heavy Industries Group (SHI Group) is working on reducing environmental impacts from the perspectives of "reducing the impact its business activities have on the environment" and "improving the environmental performance of its products." Notably, the SHI Group positions "climate change" as a social issue it should contribute to solving.**
- **The SHI Group aims to become carbon neutral by 2050 and set CO2 emission reduction targets up to 2030 to achieve the ultimate goal.**

Targets for reducing CO_2 emissions from product manufacturing



Targets for reducing CO_2 emissions from product use



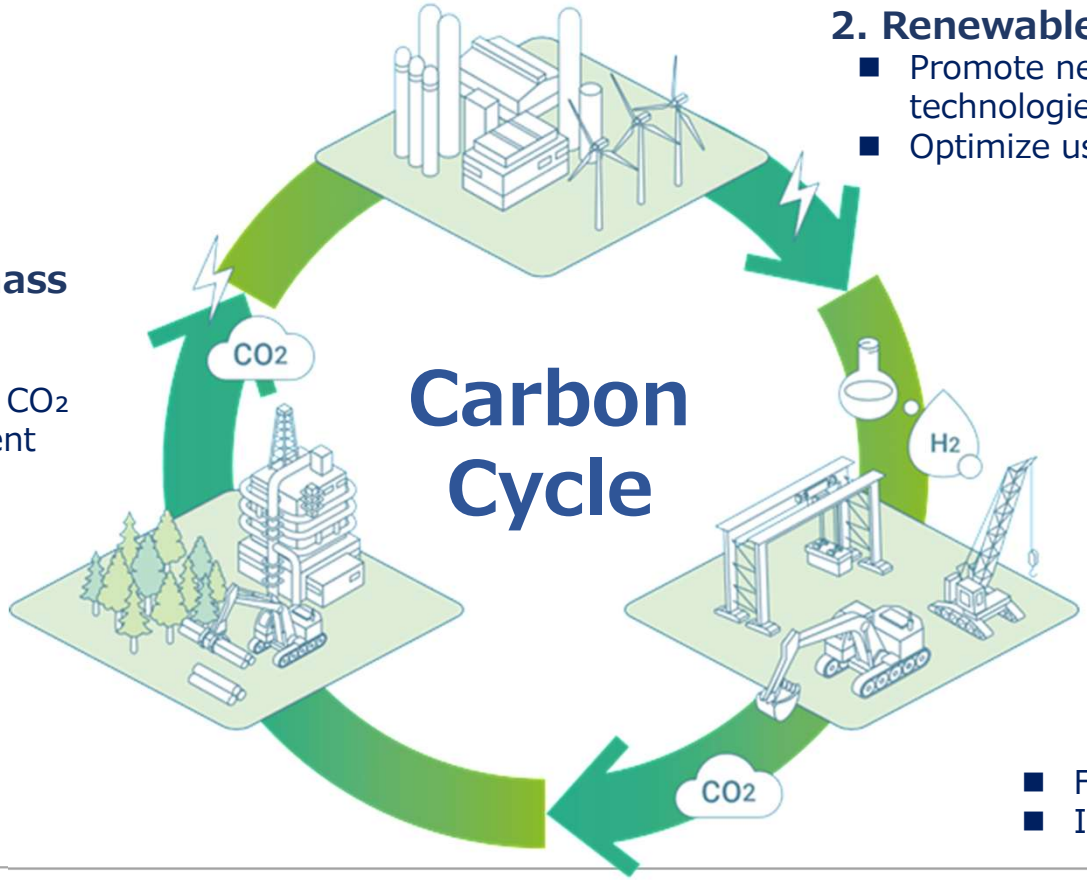
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Carbon Neutrality Strategy

- **SHI aims to achieve practical and sustainable carbon neutrality through Forest circulation & biomass, Renewable energy promotion, and Fuel conversion & energy saving.**

1. Forest Circulation & Biomass

- Resource circulation through biomass and forests
- Promote effective local use of CO_2
- Appropriate forest management and water conservation



2. Renewable Energy Promotion

- Promote next-generation renewable energy technologies
- Optimize use of renewable energy

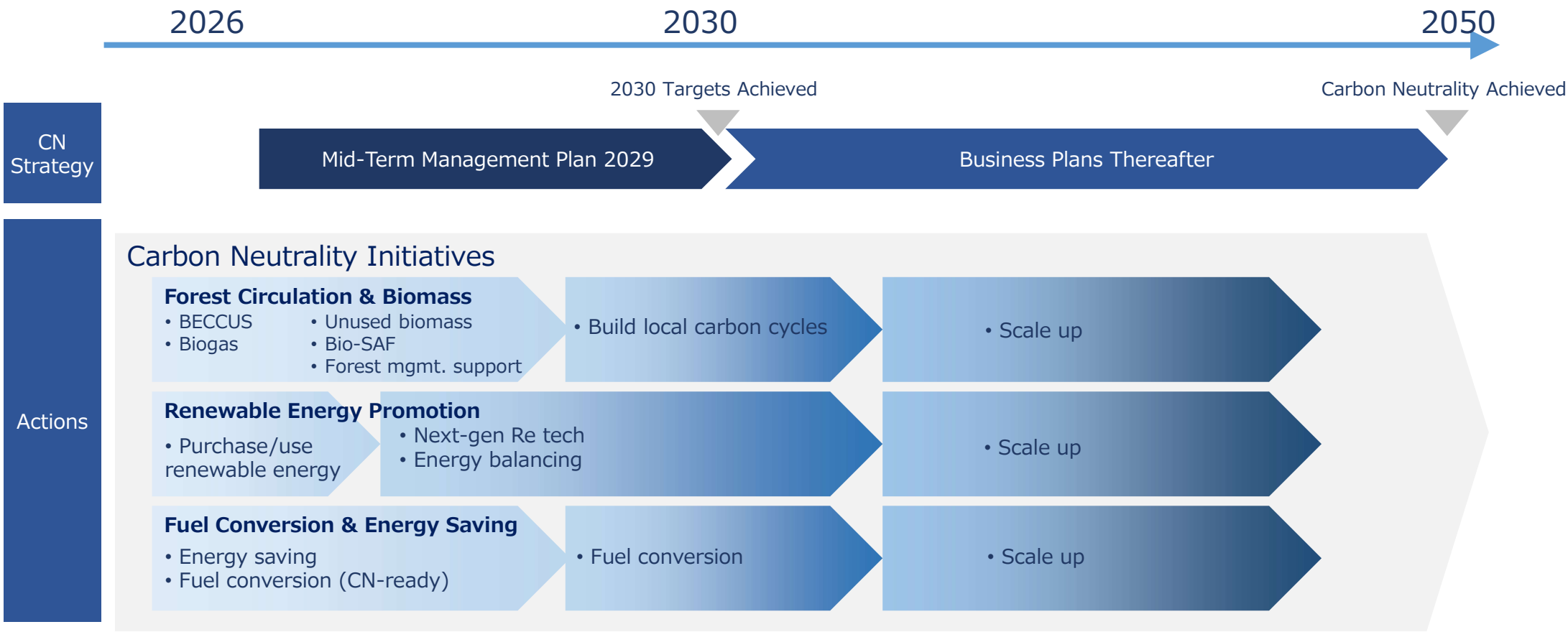
3. Fuel Conversion & Energy Saving

- Fuel conversion and electrification
- Improve product energy efficiency

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Roadmap

SHI aims to achieve carbon neutrality by 2050 through a range of initiatives.



Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

1 Forest Circulation & Biomass

Forests are renewable resources that circulate when properly grown, used, and replanted. They are increasingly important for energy security and water conservation. In Japan, forests cover roughly 70% of the land, but many planted forests are underutilized and CO_2 absorption is declining.

Through high-efficiency forestry machinery, biomass power generation, and technologies that use biomass as fuels and chemical feedstocks, we aim to realize carbon neutrality based on forest circulation and biomass.

Biomass Boiler	p. 6
Syngas Gasifier	p. 7
Biogas from Organic Wastewater	p. 8
Distributed Biochar Unit	p. 9
Waste-to-Energy System	p. 10
FT Fuel Synthesis	p. 11
Electrochemical Reduction	p. 12
Carbonation	p. 13
Biofuel-Compatible Crawler Crane	p. 14
Forestry Machinery	-

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Biomass power boilers

R&D | FS/Demo | **Product/ Service**

Energy & Environment SBU

- Biomass power generation uses carbon-neutral fuels such as wood-derived fuel and agricultural residue and is an environmentally friendly technology that **does not significantly increase atmospheric CO_2 levels on a life-cycle basis.** Carbon negative is possible by capturing CO_2 generated at biomass power plants and combining it with subsequent storage and utilization processes.
- SHI's circulating fluidized bed (CFB) boilers and bubbling fluidized bed (BFB) boilers can stably burn a wide range of fuels, from biomass to recycled fuels. These boilers are widely used for feed-in tariff (FIT) and private power generation.
- CO_2 can be easily captured by utilizing oxyfuel combustion technology (such as Flexi-Burn™ technology), which supplies oxygen into a conventional CFB boiler and burns biomass fuel.

Carbon Neutral Contribution points

- ✓ Supplying adjustable power for stable grid operation
- ✓ **Contributing to post-fossil-fuel and the reduction of CO_2 emissions while utilizing locally available biomass and recycled fuels**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

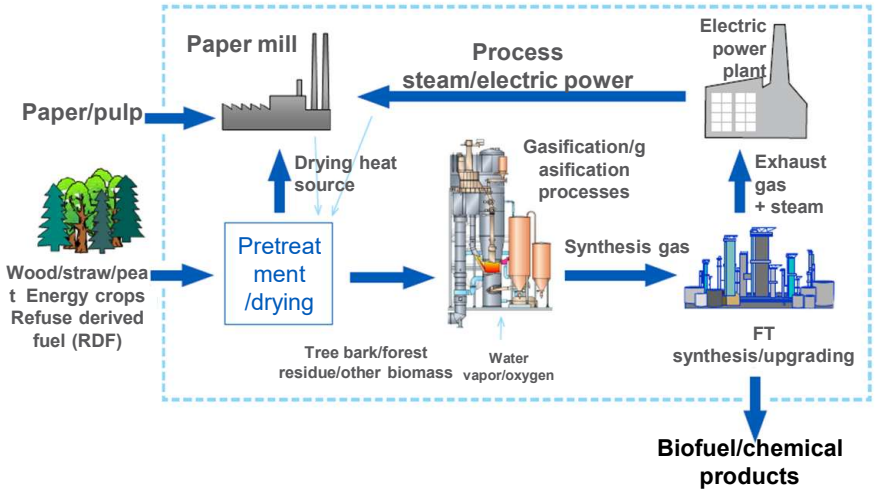
Gasification Furnaces to Generate Synthesis Gas

R&D | FS/Demo | Product/ Service

Energy & Environment SBU

- **Gasification is the process of transforming solid fuel into synthesis gas (hydrogen and carbon monoxide).** The synthesis gas generated can also be used **as a raw material for chemicals such as methanol and for aviation fuel,** making it an alternative to fossil resources for use in multiple applications.
- SHI's fluidized bed gasification furnaces can utilize a wide variety of resources, such as waste plastics, construction waste, forest residue, and agricultural residue. These gasification furnaces will contribute to decarbonization by using synthetic gases derived from biomass and recycled materials, for chemicals and aviation fuel as carbon resources to replace fossil resources.

  * SHI has delivered this technology as biomass gasification equipment since the 1980s.



Carbon Neutral Contribution points

- ✓ Production of green fuels with reduced CO_2 emissions compared to conventional fossil-based processes
- ✓ **Reducing the use of fossil resources**

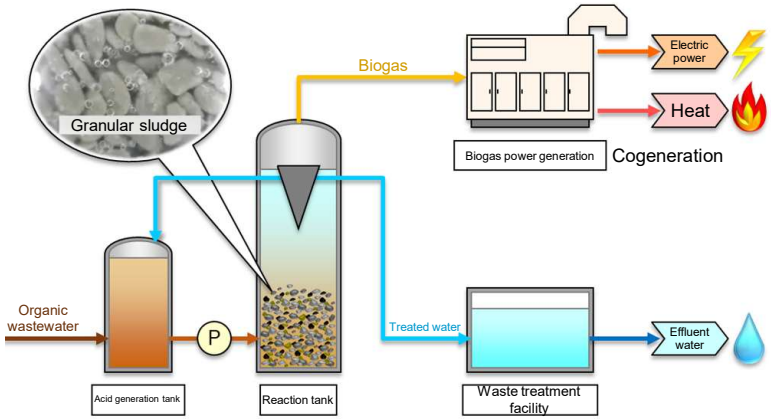
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Biogas Gas Generation from Organic Wastewater and the Utilization

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Environment Co., Ltd.

- This system captures biogas from organic wastewater generated in the production process of food-processing factories and the like. The biogas captured will be used as a fuel for power generation, and the electric energy will be recovered for utilization. **This system offers opportunities for energy creation, reduced environmental impacts, and reduced waste disposal costs.**
- The anaerobic wastewater treatment (methane fermentation) system that does not require oxygen treats organic substances in wastewater. Unlike aerobic treatment, this treatment does not require power for aeration, **contributing to energy saving and CO_2 emission reduction**.
- **This system significantly reduces the amount of sludge generated and decreases the volume of waste materials to be treated.**
- **This system will contribute to a sustainable society by preserving the water environment through water purification and using biogas as a fuel.**



Carbon Neutral Contribution points

✓ Generating biogas from organic wastewater. **The consumption of fossil fuel at a factory can be reduced by using biogas as a fuel.**

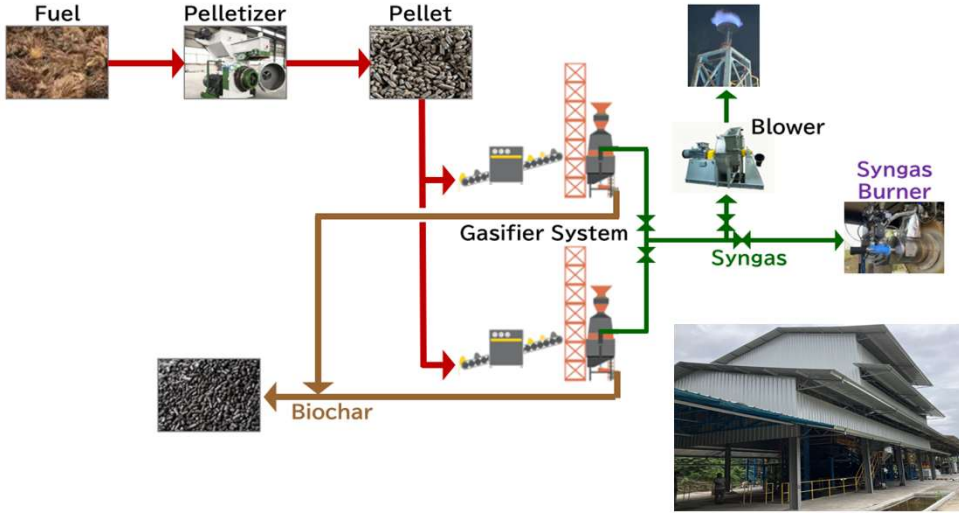
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Biochar Production Systems

R&D | FS/Demo | **Product/ Service**

Energy & Lifeline Segment SBU

- Producing biochar from low-grade biomass for use as an alternative to coal and other fossil fuels.
- Generated syngas can be utilized as fuel for boilers, hot air furnaces, or power generation.
- Demonstration testing conducted in Malaysia successfully produced high-quality biochar.
- Toward 2030, aiming for aiming to **achieve carbon-negative performance** through long-term carbon sequestration using biochar.



Biochar Production Demonstration Facility
2 ton/day, equipped 135kW power generation

Carbon Neutral Contribution points

- ✓ Long-term carbon sequestration as a **carbon-negative technology**
- ✓ CO_2 reduction effect for **10 t/day biochar production**:
  - I. Coal substitution: 13,600 t-CO_2/year
  - II. Long-term carbon fixation: 13,200 t-CO_2/year

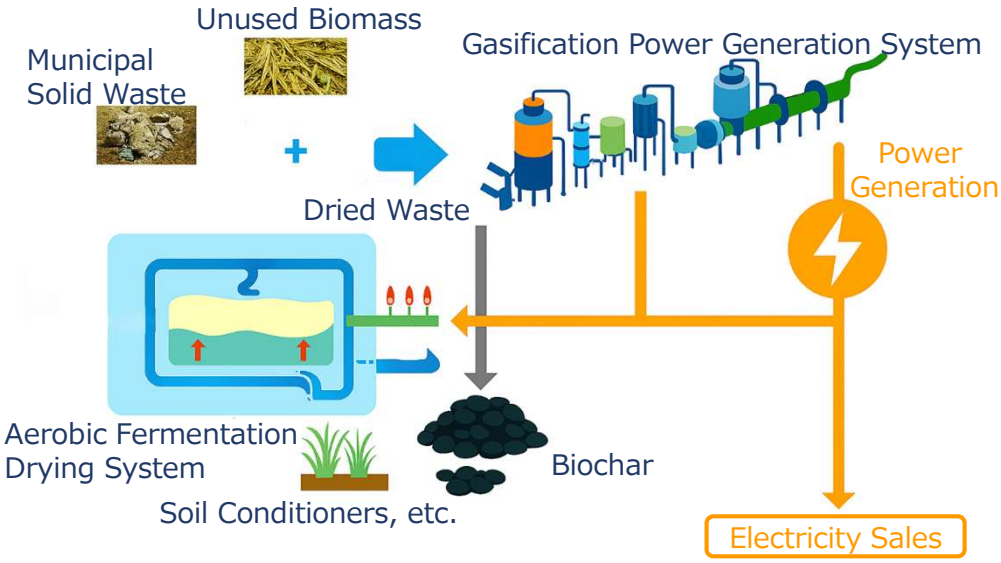
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Distributed Waste Treatment System with Power Generation

R&D | **FS/Demo** | Product/ Service

Energy & Lifeline Segment SBU

- Waste is treated and dried using an aerobic fermentation drying process, and the dried waste is utilized as fuel for gasification power generation.
- Power generation is often not included in waste treatment facilities handling **less than 100 t/day;** this system enables power generation even at small-scale facilities.
- Biomass that is otherwise difficult to process can also be treated simultaneously.



Carbon Neutral Contribution points

✓ **For a facility handling 30 t/day of waste:**

- Power generation: **7,000 kWh/day**
- CO_2 reduction: **10,000 t-CO_2/year**

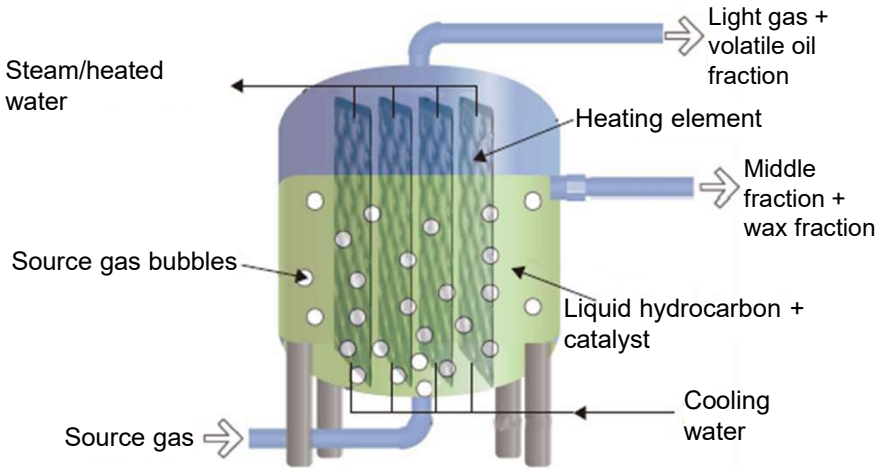
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Fuel Generation by FT Synthesis

R&D | FS/Demo | Product/ Service

Technology Research Center

- SHI is conducting R&D on **Fischer-Tropsch (FT) synthesis,** designed to synthesize liquid high-cetane fuels with zero sulfur content from **synthesis gas (CO and H_2) containing CO_2** using own catalyst. The crude oil synthesized will be distilled and separated into **light oil and jet fuel.**
- While conventional FT synthesis requires decarboxylation, SHI has a technology to produce **liquid fuel without separating CO_2** SHI is also considering **the conversion of the synthesis gas from its gasification system into fuel.**
- Synthetic fuels have the advantage of **utilizing the existing internal combustion engines and fuel infrastructure,** which means the users can **minimize the cost needed to respond to decarbonization**.



Carbon Neutral Contribution points

- ✓ This synthesis approach can **manufacture the potential to produce carbon-neutral fuels** from biomass-derived synthesis gases.
- ✓ This synthesis approach can **minimize the cost needed to respond to decarbonization.**

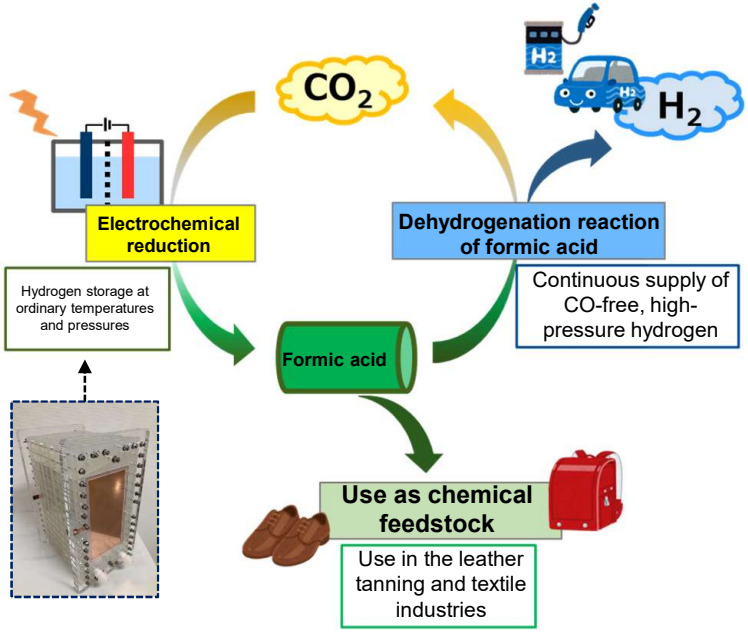
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Electrochemical Reduction

R&D | FS/Demo | Product/ Service

Technology Research Center

- SHI is developing a technology to convert CO_2 emitted from power plants and machinery into valuable resources through **electrochemical reduction.**
- **With the generation of formic acid and synthesis gas targeted,** the technology is characterized by using boron-doped diamond electrodes (hereinafter, "BDD electrodes") for the electrochemical reduction of CO_2. BDD electrodes have a characteristically wide potential window, making it possible to initiate electrolytic reactions that conventional electrodes could hardly accomplish. Furthermore, these electrodes are physicochemically stable, promising stability and durability during system operation.
- Formic acid is expected to be used as feedstock for chemical products and as a hydrogen carrier. On the other hand, synthesis gas is expected to be used as feedstock for chemical products and fuel.



Carbon Neutral Contribution points

- ✓ **CO_2 recycling**
- ✓ It is possible to synthesize feedstock for chemical products that require a shift to post-fossil fuels and materials that support a hydrogen society.

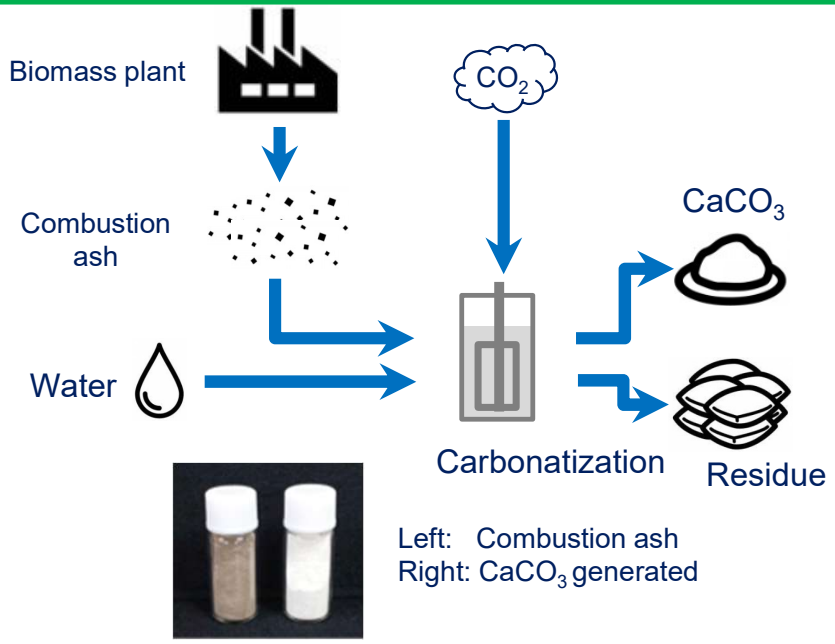
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Carbonation using biomass ash

R&D | FS/Demo | Product/ Service

Technology Research Center

- Biomass boilers utilize carbon-neutral biomass fuels, but they generate a large amount of combustion ash.
- The treatment of this ash has become a major challenge, and both volume reduction and effective utilization are required.
- Biomass ash is known to contain a high amount of calcium (Ca), and our technology aims to reduce the volume of boiler ash by reacting the Ca in the ash with CO_2 contained in power-plant exhaust gas and recovering it in the form of calcium carbonate ($CaCO_3$).
- The calcium carbonate obtained through this process has high purity and fine particle size, making it suitable for application to high-value-added products.
- By effectively utilizing biomass ash, which was previously treated as waste, this technology contributes to resource circulation.



Left: Combustion ash
Right: $CaCO_3$ generated

Carbon Neutral Contribution points

✓ Utilizing combustion ash derived from carbon-neutral biomass fuels and CO_2 contained in exhaust gas, this technology aims to achieve resource circulation.

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Cranes and foundation machines

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Construction Cranes Co., Ltd.

- Our **crawler cranes** and foundation machines are contributing to realizing a decarbonized society **by using renewable diesel (hereinafter, "RD"),** a next-generation biofuel that can significantly reduce CO_2 emissions.
- RD, made from materials such as used cooking oil and animal and vegetable oils, is an HVO*1 with improved vulnerability to oxidation of conventional biodiesel fuels. Using RD as a fuel would **reduce** greenhouse gas emissions by **about 90% based on fuel life cycle assessment (hereinafter, "LCA").**
- RD is a "drop-in" fuel that does not require engine refurbishment or additional capital investment, making it possible **to minimize the introduction cost needed for decarbonization.**

*1 : Hydrotreated Vegetable Oil

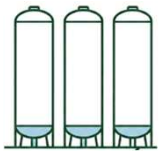
Carbon Neutral Contribution points

- ✓ **Contributing to reducing greenhouse gas emissions at construction sites (by about 90% based on fuel LCA)**
- ✓ **Minimizing the introduction cost** needed for decarbonization is possible

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

2 Renewable Energy Promotion

Renewable energy adoption is advancing as an alternative to fossil energy. It offers low CO_2 emissions, but output can fluctuate with weather and natural conditions. In some regions, surplus generation can cause output curtailment.



We are expanding energy storage equipment and developing infrastructure such as offshore wind and geothermal power to support stable supply and social implementation.

Liquid Air Energy Storage (LAES)	p. 16
Chemical Heat Storage	p. 17
Mid-Scale Geothermal Power Equipment	p. 18
Offshore Wind Power Business	-

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Liquid Air Energy Storage (LAES)

R&D | FS/Demo | **Product/ Service**

Energy & Environment SBU

- **LAES** is composed of **the charging process**, in which air is compressed, cooled, and liquified using excess renewable energy-derived and other electric power, **the storage process**, in which liquified air, compressed heat, and evaporated heat are stored, and **the discharging process**, in which liquified air is evaporated, heated, and expanded to drive a turbine generator for power generation.
- This system can **absorb solar and wind power output fluctuations** by storing and supplying electric power at the right time, **contributing to the widespread use of renewable energy**. Additionally, **it enables long-duration energy storage and provides the inertial force to stabilize the power system's frequencies.**
- In partnership with Hiroshima Gas Co., Ltd., the LAES commercial demonstration plant at Hatsukaichi LNG Terminal commenced commercial operation in December 2025. The facility enhances charging efficiency by utilizing LNG cold energy during the liquefied air production process.

Carbon Neutral Contribution points

- ✓ **Contributing to stabilizing the power system**
- ✓ Contributing to **making renewables a main power source**
- ✓ Utilization of external waste heat and waste cold heat is possible

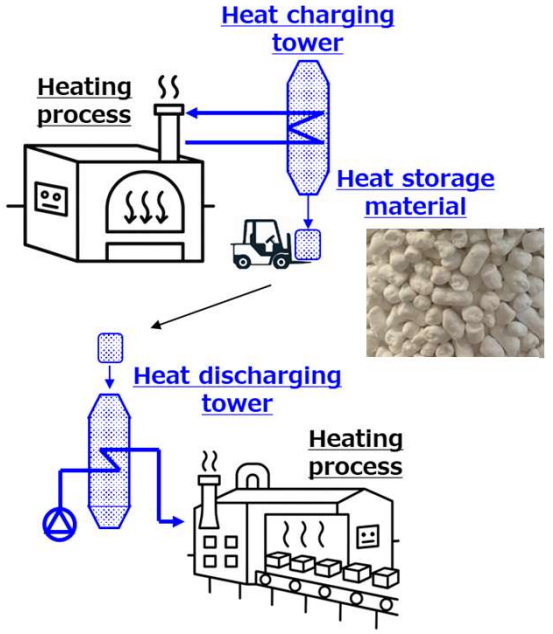
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Thermochemical Heat Storage

R&D | **FS/Demo** | Product/ Service

Technology Research Center

- SHI is developing **the thermochemical heat storage system, which has a high energy density and offers advantages in terms of size reduction and cost.** This system can play a critical role in promoting waste heat utilization and enabling the storage and leveling of renewable energy.
- Cost-effective and widely available CaO/Ca(OH)2 is used as the heat storage material, allowing for efficient heat storage at around 500°C. During the heat releasing process, it can produce heat energy at even higher temperature around 600°C by controlling the steam pressure for reaction, providing additional benefits through the effective use as a heat pump.
- **Waste heat from factories or plants can be stored in this system and then released when needed or transported to other locations for alternative heat use**. This technology can also provide low-cost renewable energy storage for flexible heat or energy supplying.



10kW reactor

Carbon Neutral Contribution points

- ✓ **This technology contributes to a reduction in overall energy consumption** by using heat that would otherwise be wasted.
- ✓ **This system can offer a cost-effective solution for renewable energy storage.**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

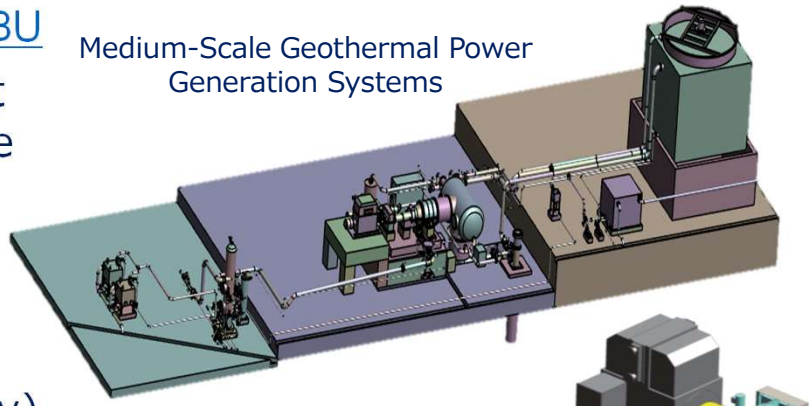
Medium-Scale Geothermal Power Generation Systems

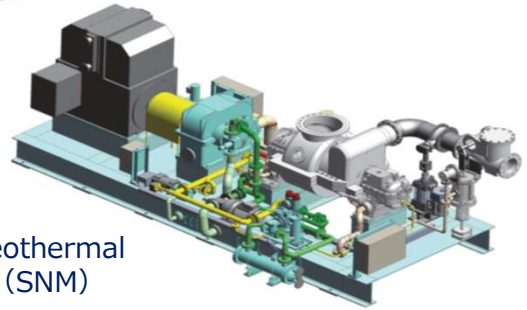
R&D | FS/Demo | **Product/ Service**

Energy & Lifeline Segment SBU

- Entering the geothermal power generation market for systems of **20 MW class or smaller,** which are expected to become the core scale for future site development, primarily in Japan and Indonesia.
- Providing equipment that contributes to **CAPEX reduction**, a key challenge in geothermal power projects (low cost, short delivery time, high quality).
- Aiming to secure **2–3 orders per year by 2030.**

Medium-Scale Geothermal Power Generation Systems





Medium-Capacity Geothermal Turbine Generator（SNM）

Carbon Neutral Contribution points

- ✓ Utilization of **stable renewable energy**
- ✓ Reduction of **CO_2 emissions to approximately one-twentieth** of coal-fired power generation(Approx. 80,000 t-CO_2/year reduction for a 10 MW-class facility)

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

3 Fuel Conversion & Energy Saving 1/3 Fuel Conversion

Construction and industrial machines have relied on diesel fuel. Fuel conversion is key to reducing CO_2 during equipment use; switching powertrains and energy sources directly reduces environmental impact.

SHI is considering product-specific fuel conversion using technologies such as hybridization, electrification, and hydrogen.

Electric Excavator	p. 20
Battery-Powered Forklift	p. 21
Hybrid RTG	p. 22
Fuel Cell Hybrid RTG	p. 23

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Electric Excavator 135E-8

R&D | **FS/Demo** | Product/ Service

Sumitomo Construction Machinery

- Following the exhibition of a 7.5-ton compact electric excavator in 2023, a 13.5-ton medium-sized electric excavator was unveiled at *the International Construction & Survey Exhibition (CSPI-EXPO)* held at Makuhari Messe from June 18 to 21, 2025.
- While inheriting the work performance, operator comfort, and safety of conventional engine-powered models, this electric excavator further advances the pursuit of **carbon neutrality, low noise, and low vibration.**
- Development is progressing as an important first step toward the future of electrified construction machinery.

Carbon Neutral Contribution points

- ✓ **Contributing to zero emissions (no exhaust gas) at construction sites**
- ✓ **Targeting approximately 8 hours of continuous operation**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Electric Forklifts

R&D | FS/Demo | **Product/ Service**

Sumitomo Nacco Forklift Co., Ltd.

- The company has developed a new battery-powered forklift that is more environmentally friendly than ICE *1 forklifts. This battery-powered forklift is **equipped with a high-efficiency IPM motor** and can **reduce energy consumption and extend its operating hours**.
- Furthermore, **optional lithium-ion batteries enable rapid charging**, allowing a **longer continuous operation with a shorter charging time**.
- Lithium-ion batteries have a high charging efficiency, **saving about 20% of the electricity cost** compared to lead-acid storage batteries.
- By tactically utilizing the high-efficiency and rapid charging characteristics, this battery-powered forklift could achieve an operating hours close to those of ICE forklifts, expanding the possibility of this electric forklift **replacing conventional ICE forklifts**.

*1) ICE = Internal Combustion Engine

Carbon Neutral Contribution points

- ✓ **Contributing to zero emissions (zero exhaust gas)**
- ✓ Switching an ICE forklift to a battery-powered forklift could **reduce CO_2 emissions by about 60%** during product use.

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Hybrid RTGs

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Material Handling Systems Co., Ltd.

- Rubber Tired Gantry cranes (RTG) are widely used in container terminals to stack containers. RTGs are equipped with diesel engine generators to freely travel within the container terminal.
- The company's hybrid power pack is designed to combine storage batteries with a diesel engine generator to supply power for the RTG motion. By applying this design, **the hybrid RTG requires a reduced engine size while maintaining the necessary power with the help of the company's proprietary regenerative power control technology, reducing CO_2 emissions and improving fuel efficiency (a 60% reduction).**
- This hybrid power pack can enable future replacement of the diesel engine generator **with a fuel cell (FC), achieving zero CO_2 emissions.** This will contribute to carbon neutrality at ports moving forward to hydrogenation.

Carbon Neutral Contribution points

- ✓ **Reducing CO_2 emissions by about 60% while maintaining the necessary power**
- ✓ **Achieving zero CO_2 emissions is possible by converting the diesel engine to a fuel cell (FC)**

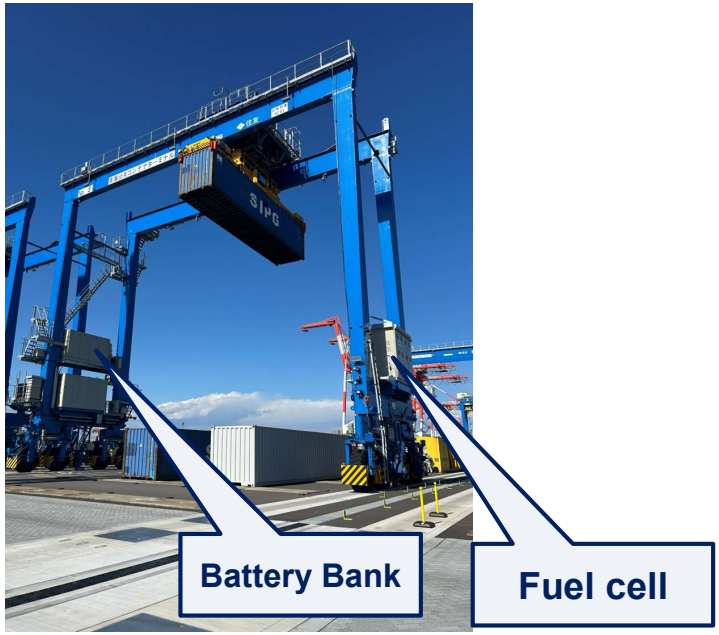
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Fuel-Cell Hybrid RTGs

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Material Handling Systems Co., Ltd.

- Fuel-cell hybrid RTGs will use **a fuel cell (FC)** as the main power supply device, **thus eliminating the conventional diesel engine generator.**
- Using a fuel cell would enable **zero CO_2 emissions**.
- By adapting a battery bank hybrid type, the company's proprietary "Simultaneous Optimization Control technology of Power and Efficiency" will minimize the fuel cell size, realizing a higher level of energy saving.
- Fuel-cell hybrid RTGs will contribute to carbon neutrality at ports moving forward to hydrogenation.



Carbon Neutral Contribution points

- ✓ **Zero CO_2 emissions due to eliminated the diesel engine generator**
- ✓ The hybrid RTG **can be operated with a minimum-capacity fuel cell**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

3 Fuel Conversion & Energy Saving 2/3 Energy Saving

Carbon neutrality requires not only switching energy sources but also using limited energy efficiently. Higher drive and control efficiency directly reduces CO_2 emissions.

We reduce energy losses through high-efficiency motors and inverters, optimized machine configurations and controls, and reviews of production and operating processes—cutting energy use and environmental impact while maintaining productivity.

Bevel Buddybox® Reducer H	p. 25
PM Motor + Inverter HPI	p. 26
OPTIDRIVE E3	p. 27
Magnet Motor Design System	p. 28
Nitriding vs. Carburizing	p. 29
Inverter Compressor E-77A	p. 30
Superconducting Cyclotron SC230	p. 31
Cyclotron System HM-18HC	p. 32
Injection Molder SE-EV-S	p. 33
Smart Flipper	p. 34
FINEMAG UK Type	p. 35
MAXBLEND® Agitator	p. 36
Energy-Saving Distillation	p. 37
Multifunction Extractor	p. 38

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

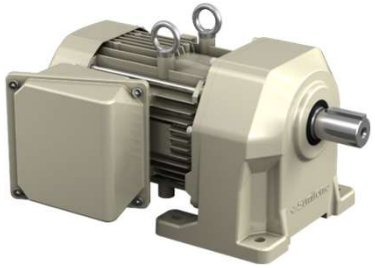
Motor capacity: 0.55~7.5kW
Ultra Premium Efficiency IE5 Gear Motor

R&D | FS/Demo | **Product/ Service**

Drive Technologies SBU

- The Ultra Premium Efficiency IE5 is the highest level defined in the international motor standard(IEC60034-30-2),which specifies efficiency classes from IE1 to IE5.
- Permanent Magnet Synchronous Motors use permanent magnets in the rotor, eliminating secondary current losses and achieving IE5 efficiency.
- By directly coupling this high-efficiency motor with four types of gear reducers, we developed an energy-saving, environmentally friendly gear motor.

CYCLO® Drive



PREST® NEO Gearmotor

Bevel BUDDYBOX® 4 Series

HYPONIC Gearmotor®

Carbon Neutral Contribution points

✓ 4 different types of Gear motor with the most efficient IE5 motors.

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For Fans, Pumps, Compressors and Conveyors; Compliant with IE5 PM Motors

HPI: A PM Motor with a Built-in Control Inverter

R&D | FS/Demo | **Product/ Service**

Lafert S.p.A

- HPI (High Performance Integral) is a product that combines a control inverter with a PM motor (permanent magnet motor).
- HPI has achieved **the highest efficiency class, IE5 (ultra-premium efficiency), as specified by the international standard**, and **contributes to reducing electricity consumption**.
- Since it is a one-piece product, the motor characteristics are pre-configured in the inverter before shipment.
- HPI is available in three package types: "Smart," "Flow," and "Plus," and supports both variable torque and constant torque applications.

Carbon Neutral Contribution points

- ✓ The highest efficiency class, **IE5, as specified in the international standard has been achieved**
- ✓ Contributing to the **reduction of electricity consumption**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Inverters for Fans, Pumps, Mixers, and Conveyors

OPTIDRIVE E3

R&D | FS/Demo | **Product/ Service**

Invertek Drives

- Optidrive E3 is an inverter that features reliability and usability based on innovative technologies. It can perform sensorless vector control of **all types of motors**, including IE5 motors.
- Initial parameter settings are already configured for various applications, such as fans and pumps.
- **Can achieve up to 60% energy savings** compared to an IE1 three-phase motor, depending on the application.
  Application example

Carbon Neutral Contribution points

- ✓ **Controls IE2, IE3, IE4 and IE5 motors in an accurate and highly reliable manner**
- ✓ **Can achieve up to 60% energy savings** compared to an IE1 three-phase motor, depending on the application

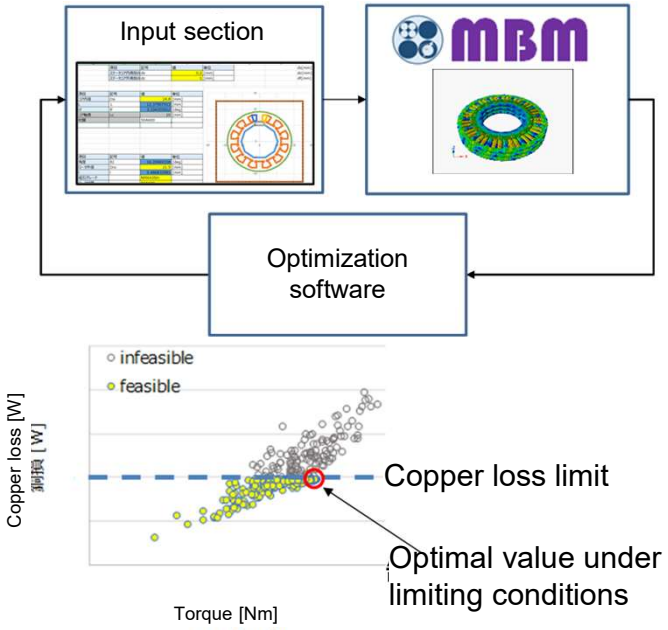
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Design Support
Optimum Design System for Magnetic Motors

R&D | FS/Demo | Product/ Service

Technology Research Center

- This automatic design system for motor magnetic circuits uses our unique magnetic field analysis software, "MBM: Magnetic Beads Method," along with optimization software.
- To **design a highly efficient motor**, it is necessary to use high-precision magnetic field analysis technology that enables accurate evaluation of losses and to identify optimal specifications under specified limiting conditions.
- The Magnetic Beads Method allows for magnetic field analysis of 3D actual unit shapes and is suitable for analyzing small and flat motors.
- Coordinating with optimization software **enables the optimal design of magnetic circuits** under various constraints.



Carbon Neutral Contribution points

- ✓ By conducting numerical experiments using **high-precision magnetic field analysis technology**, we can **eliminate the need for creating prototypes**
- ✓ **Designing an optimal magnetic circuit under various limiting conditions allows for the reduction of electricity consumption**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Treatment Technology Development

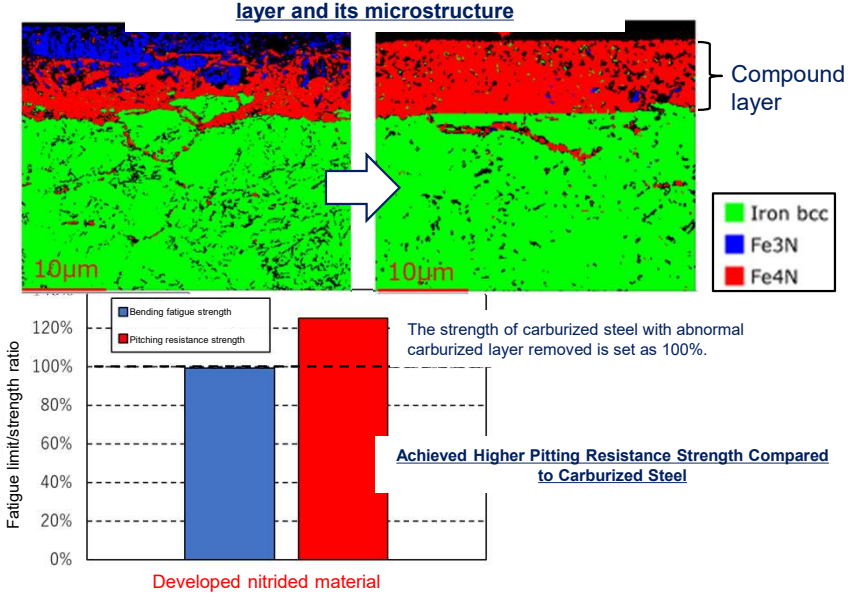
Nitriding as an Alternative Heat-Treatment Process to Carburizing

R&D | FS/Demo | **Product/ Service**

Technology Research Center

- Carburizing with hydrocarbon gas for surface hardening is commonly used for gears, gear reducers, and other components that require both high strength and good machinability. However, this process produces significant CO2 emissions, contributing to environmental concerns. As a result, there is increasing interest in shifting to processes like nitriding and induction hardening, which have lower CO2 emissions.
- Conventional nitrided parts have lower strength compared to carburized parts, making conventional nitriding unsuitable as an alternative process.
- With our next-generation nitriding process and controlled microstructure, we have achieved strength levels that match or exceed those of carburized components.
- Applying the nitriding process can also reduce heat treatment deformation, thereby minimizing the burden on the finishing process
- We are optimizing heat treatment conditions to enhance strength and utilize nitriding technology into our products.

Optimizing the thickness of the compound layer and its microstructure



Carbon Neutral Contribution points

- ✓ **Reducing CO2 emissions during the heat treatment process.**
- ✓ **Minimizing heat treatment deformation, thereby reducing the burden on subsequent finishing processes**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For Energy Saving Operation of 4KGM Cryocoolers Inverter-mounted

Compressor E-77A

R&D | FS/Demo | **Product/ Service**

Advanced Technologies SBU

- The E-77A compressor is equipped with a **dual inverter, enabling energy-saving operation** of the 4KGM cryocooler RDE-412 while maintaining its high cooling capacity.
- In cryostats (low-temperature vacuum vessels) with liquid helium tanks, such as those used for MRI superconducting magnets, 4KGM cryocoolers are operated steadily. To prevent the internal pressure of the liquid helium tank from becoming negative due to excessive helium gas re-condensation, a heater was conventionally used to control and maintain a positive internal pressure.
  (*If the helium tank's pressure becomes negative, the tank may inhale external air, causing the safety valve to freeze and clog. This could lead to a severe accident.)
- Using the E-77A compressor enables the operation of cryocoolers and compressors at reduced speeds, allowing for control and maintenance of a positive internal pressure without using a heater. As a result, it **becomes possible to save energy compared to steady operation**.

Carbon Neutral Contribution points

- ✓ Can save more energy than conventional compressors. **(Electricity consumption can be reduced by more than 40-50%)**
- ✓ Downtime for various equipment can be reduced with the boosted cooling function

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For Proton Therapy Systems

Superconducting Cyclotron SC230

R&D | FS/Demo | **Product/ Service**

Technology Research Center and Medical & Quantum Solutions SBU

- In proton therapy, to irradiate protons at cancer located deep within the body, an accelerator is needed to accelerate the protons to approximately 70% of the speed of light.
- Our superconducting cyclotron accelerator **uses a superconducting coil as the main coil that generates the main magnetic field. This allows for a reduction in electricity consumption by approximately 40% compared to a cyclotron accelerator with conventional normal-conducting coils**.
- For technologies that cool coils to maintain the superconducting state, **the conduction cooling method using a cryocooler has been adopted. This eliminates the need for liquid helium,** and replenishment is unnecessary if liquid helium is lost due to evaporation or other reasons.

Carbon Neutral Contribution points

- ✓ **Reducing electricity consumption by approximately 40%**
- ✓ **Adopting the conduction cooling method using a cryocooler eliminates the need for liquid helium**
- ✓ **Space efficiency has been achieved**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For PET scans

Cyclotron System HM-18HC

R&D | FS/Demo | **Product/ Service**

Medical & Quantum Solutions SBU

- PET scans, which are highly effective in imaging diagnosis of tumors, cerebral infarctions, cardiac diseases, and more, require labeled RIs like 18F-FDG, which accumulate in cancerous lesions and help pinpoint their location.
- Our cyclotrons for PET assure a safe and reliable supply of the radioactive isotopes necessary for producing these labeled RIs.
- Our new cyclotron systems have achieved **approximately a 12% reduction of electricity consumption compared to conventional systems***, by combining the following two newly developed products.

  (i) Cyclotron with an external ion source: HM-18HC
  (High beam current output is achievable)
  (ii) 18F high yield target with enhanced cooling
  (High beam current irradiation is achievable)

  * Comparison was made by producing an equivalent amount of radioactive isotopes

Carbon Neutral Contribution points

✓ **Reducing electricity consumption by approximately 12%**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

SE-EV-S Series
Injection Molding Machines

R&D | FS/Demo | **Product/ Service**

Plastics Solutions SBU

- This product pursues energy-saving performance and exerts a significant electricity conservation effect even when it replaces a general electric motor.
- A direct drive (*1), which enables accurate screw control by a servo motor, and a highly rigid and low-vibration frame are used to **allow for molding with low injection pressure and low clamping force, achieving defect reduction and energy conservation**.
- A guidance function, which improves the usability of the feature supporting low injection pressure and low clamping force, has been enhanced along with **the function contributing to energy conservation, thereby enhancing the carbon neutrality performance of the molding environment**.

*1 Mounted on SE-EV-S and SE-EV-S-HD-CT-6spec

Carbon Neutral Contribution points

✓ **The SE-EV-S Series has achieved a 65% reduction in electricity consumption compared to our first electric motors.**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

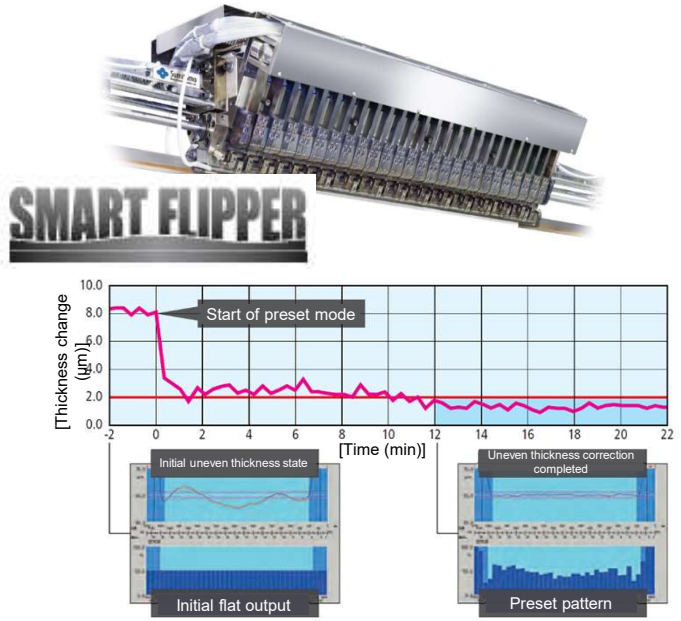
For the Food Packaging and High-Performance Film Industries

Smart Flipper

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Modern, Ltd.

- We offer a range of T dies (metallic molds) for laminating and casting, designed to **reduce the amount of raw materials used in producing plastic films**, such as those for food packaging.
- **Pneumatic-driven automatic control** has achieved high responsiveness and **precise film thickness accuracy**. Moreover, we have **shortened the film thickness adjustment time**, resulting in a **significant reduction in resin consumption**.
- Using the preset mode, which offers **high reproducibility**, can **reduce production startup and switchover times**. As a result, **resin consumption can be further minimized**.



Carbon Neutral Contribution points

✓ Compared to the conventional method*1, **resin consumption has been significantly reduced, resulting in a potential decrease of approximately 160 t/year/unit*2 in CO_2 emissions.**

Trial calculation based on the case of manufacturing food packages
*1 Conventional method: Heat bolt (thermal expansion) method
*2 Amount of resin reduction converted to CO_2 + Reduced electricity

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

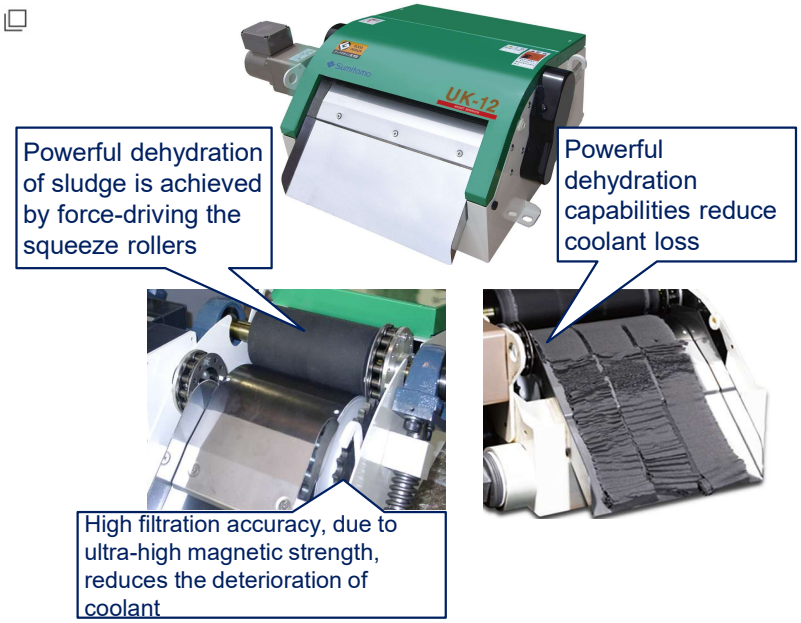
Strength Magnet Separators for the Automobile and Steel Industries

FINEMAG UK Model

R&D | FS/Demo | **Product/ Service**

Metal Processing Solutions SBU

- This filtration device recovers micron-sized fine metal chip (sludge) from coolant used primarily in grinding machines that process metals with grinding wheels. The device then dehydrates the collected sludge with a squeeze roller, minimizing coolant loss.
- Our FINE MAG UK has achieved the industry's highest magnetic field strength of 9,000 gauss on the magnetic drum surface, enabling the recovery of single-digit micron-sized fine sludge and weakly magnetic materials that were previously difficult to collect with conventional magnets. In the recycling of carbide, which is weakly magnetic, **the drying process can be omitted** because of high recovery capabilities and dehydration performance.
- This product **saves electricity** because it uses only a 25W motor to rotate a magnetic drum.
- It does not use filters or other waste materials, resulting in no CO_2 emissions from waste incineration.



Carbon Neutral Contribution points

- ✓ **Extending the service life of machining fluid** reduces **CO_2 emissions** during industrial waste processing
- ✓ **No CO_2 is generated when disposing of the filtration material**
- ✓ **Electricity conservation product** driven with one 25W motor

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

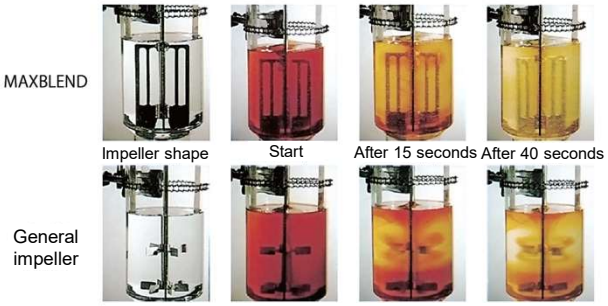
For the Chemical Industry

Mixing Vessels: MAXBLEND

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Process Equipment Co., Ltd.

- In the chemical and other industries, mixing processes are performed for various purposes, such as dissolution, dispersion, separation, absorption, and heat transfer. Even for mixing processes that seem simple at first glance, productivity can be greatly enhanced by using more effective methods. Our “**MAXBLEND**” features a unique impeller shape that allows for **reduced energy consumption during operation**.
- Compared to general impellers, MAXBLEND **achieves complete mixing in a shorter time when using the same mixing power. To reach the mixing status of the same level as general impeller, it can operate with less power**.
- MAXBLEND achieves energy-saving operation by generating an ideal entire circulation flow within a vessel.



Comparison of mixing times using the iodine decolorization reaction (where the liquid becomes transparent as mixing progresses)

Carbon Neutral Contribution points

✓ Generating an ideal flow within a vessel **reduces energy consumption during operation by up to 80%*** compared to general impellers(*Under solid-liquid condition)

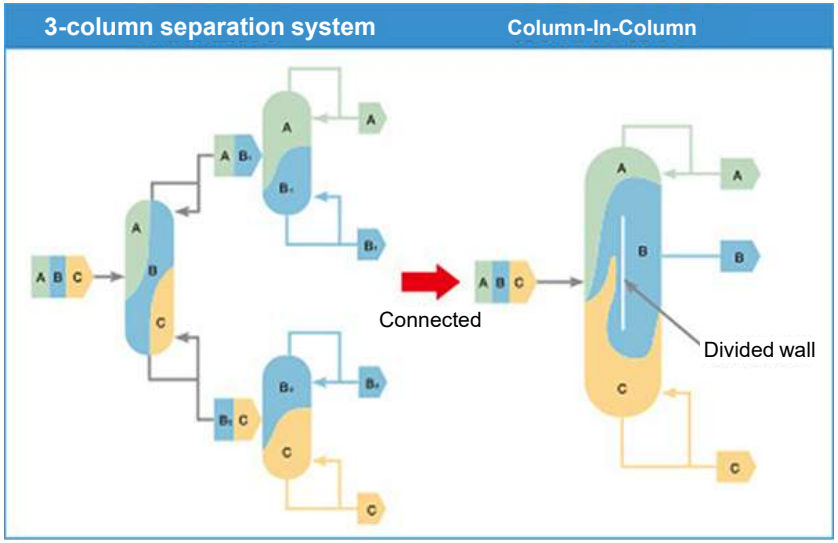
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For the Chemical Industry
Integrated-Flow Energy-Saving Distillation System

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Process Equipment Co., Ltd.

- Our "**Column-In-Column**" **integrates the functions of three distillation columns into one**, achieving **approximately a 40% reduction in CO_2** emissions during operation.
- Distillation is a process that separates desired components based on their different boiling points. It involves repeated heating and cooling, which accounts for 40 to 50% of energy consumption in the chemical industry, making it energy-intensive. In particular, separating three or more components requires multiple distillation columns, which increases the need for energy conservation. Column-In-Column has a divided wall inside a distillation column, effectively simulating the operation of three distillation columns. Therefore, **multiple components can be separated with one column, reducing the number of heating and cooling processes and achieving energy conservation.**



Carbon Neutral Contribution points

✓ Reducing CO_2 emissions by 40% during multi-component separation process

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For the Beverage and Seasoning Industries

Multi-Purpose Extractor

R&D | FS/Demo | **Product/ Service**

Izumi Food Machinery Co., Ltd.

- Traditionally, tea, coffee, and similar products were produced on dedicated lines. However, there is now a shift towards producing them on multi-purpose lines.
- Our Multi-Purpose extractor offers various extraction methods, including conventional dip extraction, drip, semi-dip, pressurized extraction, deoxygenation, aroma recovery, circulation, and more. This versatility allows for multi-product production with just a single unit, tailored to customer needs.
- Furthermore, adopting a closed-type tank reduces **thermal dissipation (and consequently steam consumption) more effectively than a conventional open-type tank, thereby achieving a reduction in CO_2 emissions.**
- Previously, it was necessary to disassemble part of the product for manual washing. However, **with CIP (Cleaning-In-Place) now possible, washing water usage and the workload on operators can be reduced**.

Carbon Neutral Contribution points

- ✓ **Reducing thermal dissipation and lowers CO_2 emissions by up to approximately 30% compared to conventional products**
- ✓ Multi-item extraction is possible with just a single unit, reducing the number of **CO_2-emitting products**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

3 Fuel Conversion & Energy Saving 3/3 Reducing Emissions in Society

Carbon neutrality requires not only energy saving in individual facilities but also new mechanisms and processes that reduce CO_2 emissions across society.

We support CO_2 reductions in manufacturing by providing equipment for low-carbon materials and next-generation energy products, and by proposing processes that rethink conventional manufacturing methods.

Jib Cranes, Goliath Cranes	p. 40
Rolling Mill Rolls for Hot Rolling	p. 41
Hot Rolling Rolls	p. 42
STAF System	p. 43
Lifting Magnet	p. 44
Laser Annealing Equipment	p. 45
High-Temp Dust Collector ALTEMPULSER	p. 46
Energy-Saving Dry Thermal	p. 47

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Jib Crane, Goliath Crane

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Material Handling Systems Co., Ltd.

- Sumitomo, the foremost Material Handling Machinery manufacture for many years, has built an excellent reputation throughout the region and has become the industry leader. Sumitomo had earned special recognition as the premier manufacturer of highly reliable, economical, easy to operate, quality Shipyard Jib Cranes and Goliath Cranes (Portal Cranes). Our cranes have been widely accepted throughout the heavy industry, including shipbuilding, engine, offshore wind foundations, and component manufacturers, etc.
- In today's world where attention is focused on decarbonizing society, the introduction of Jib Crane and Portal Cranes are gaining traction for increasing the construction capacity of Zero-Emission Ship and Offshore Wind Power Installations.

Carbon Neutral Contribution points

Essential for:

- ✓ **Construction of Zero-Emission Ship**
- ✓ **Offshore wind power foundations manufacturing**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

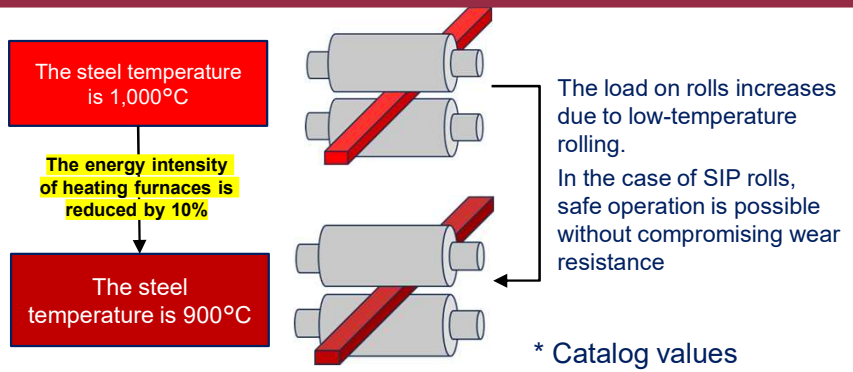
For the Steel Industry
Cast Iron & Steel Rolls “Special heat treatment”

R&D | FS/Demo | **Product/ Service**

Metal Processing Solutions SBU

- At iron works, cast iron & steel rolls are used in the rolling process where steel materials are stretched by applying pressure. Our SIP (**S**umitomo **I**mproved **P**enetration of hardness) rolls are distinguished by our proprietary heat treatment process. This allows them to **withstand higher loads more effectively while maintaining excellent wear resistance**, outperforming conventional products.
- In recent years, as part of energy-saving and carbon neutrality measures, steelmakers have been performing low-temperature rolling by reducing the temperature of heat applied to steel materials so that the energy intensity of heating furnaces can be enhanced. This results in higher loads on rolls.
- Using our SIP rolls allows for **safe operation and maintains productivity** even during low-temperature rolling. **Customers** can improve the energy efficiency of their heating furnaces* **by approximately 10%** with our SIP rolls.

* When the temperature of steel discharged from the furnace is reduced from 1,000°C to 900°C



* Catalog values

Mechanical properties	Conventional product	SIP roll
Hardness (Hs)	45±3	**45/50**
Fatigue strength (N/mm^2)	186	**235**
Fracture toughness (Kic)	185	**203**

Carbon Neutral Contribution points

- ✓ Capable of **withstanding high loads** while **maintaining wear resistance**
- ✓ **Improving the energy intensity of customers’ heating furnaces by approximately 10%**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

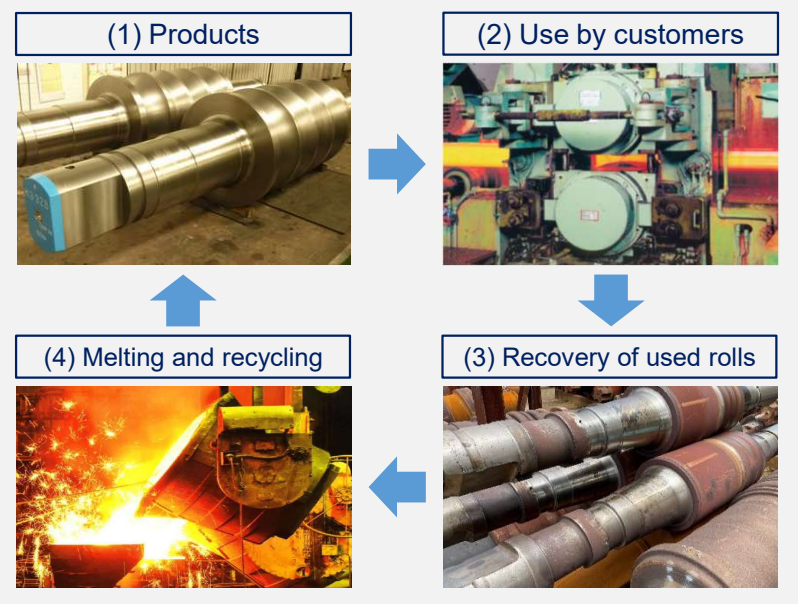
For the Steel Industry

Cast Iron & Steel Rolls “Recycled”

R&D | FS/Demo | **Product/ Service**

Metal Processing Solutions SBU

- We manufacture "cast iron and steel rolls for hot rolling" primarily using iron, a highly recyclable material, through casting and forging production methods. These rolls are mainly used in steel mills.
- By **effectively utilizing recycled materials and reducing the use of virgin materials (such as pig iron and iron alloy)** that generate **CO_2** in the production process, we aim to contribute to the reduction of CO_2 emissions in Scope 3 (procurement of consumables) measures implemented by our customers.
- We have achieved a high ratio of recycled materials in all the cast iron & steel rolls we manufacture.



Carbon Neutral Contribution points

- ✓ Contributing to the reduction of **CO_2** emissions in Scope 3 measures implemented by customers
- ✓ **Helping to establish a recycling society by using recycled materials, such as used rolls**

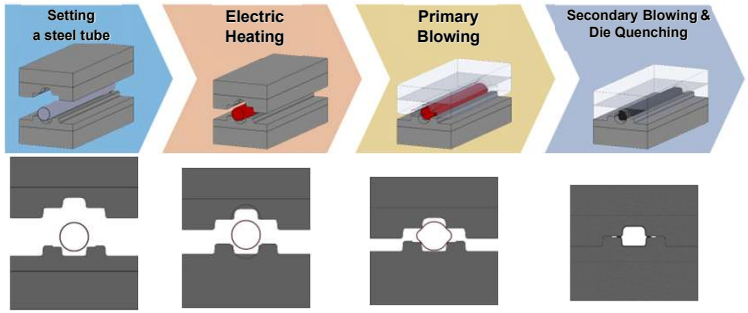
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For the Automotive Frame Manufacturing
STAF system

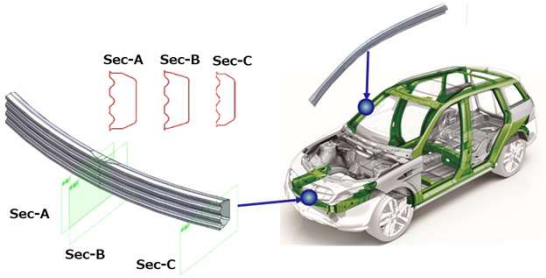
R&D | FS/Demo | **Product/ Service**

Metal Processing Solutions SBU

- The STAF system is the world's first forming technology that electrically heats a steel tube inside a press die, injects high-pressure air into the tube, and forms continuous closed-section components with integrated flanges and varying cross-sectional shapes.
- By adopting direct resistance heating, which heats the material directly, the heating process **achieves higher energy efficiency than furnace heating and significantly reduces environmental impact**.
- Components with a continuous closed-section structure and integrated flanges can be produced from tube materials and strengthened through die quenching. Therefore, it is possible to reduce the thickness, **contributing to vehicle lightweighting and reduced CO_2** emissions.



STAF process flow



Carbon Neutral Contribution Points

- ✓ **Improved energy efficiency through direct electric heating**
- ✓ **Lightweighting automotive frame components**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

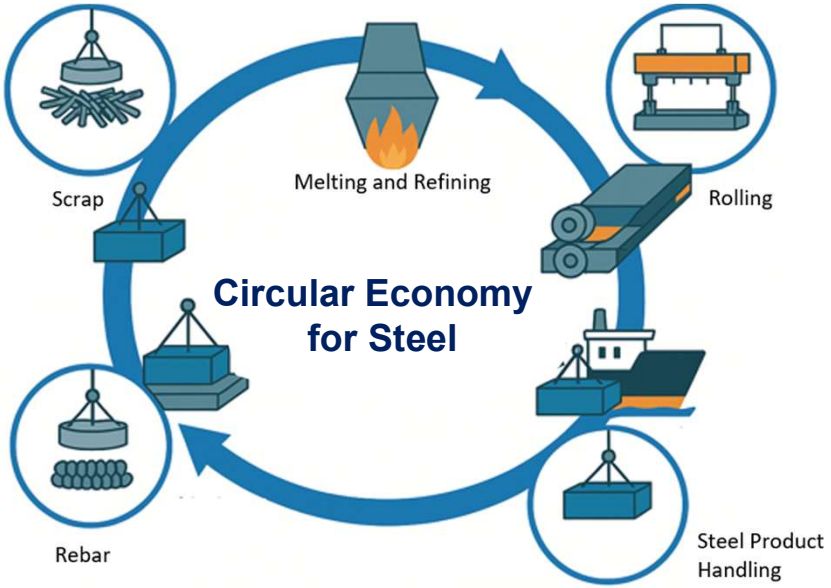
Lifting Magnet

R&D | FS/Demo | **Product/ Service**

Metal Processing Solutions SBU

"Lifting Magnet Contributes to Sustainable Steel Recycling."

- Lifting magnet compress irregular steel scrap with its powerful magnetic force, preventing dropping or scattering and thereby reducing material loss. It also enables quick and safe handling, significantly shortening work time and greatly improving processing efficiency.
- Their strong magnetic force facilitates the separation of ferrous and non-ferrous materials, enhancing sorting accuracy. This contributes to high-quality steel recycling and improved energy efficiency in the steelmaking process.
- Leveraging its unique and advanced engineering capabilities, Sumitomo Heavy Industries optimizes the design of lifting magnets. Through a high magnetic field, high current, and high efficiency—our "Three High Technologies", we provide essential infrastructure that supports sustainable steel recycling.



Carbon Neutral Contribution points

- ✓ **Providing essential infrastructure for steel recycling**
- ✓ **Driving the circular economy through efficient steel scrap handling**
- ✓ **Enhancing resource efficiency through improved sorting accuracy and reduced material loss**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For the Power Semiconductor Industry

Laser Annealing Equipment

R&D | FS/Demo | **Product/ Service**

Sumitomo Heavy Industries Material Solutions Co., Ltd

- Our laser annealing equipment is used as a key component in the power semiconductor production process.
- Heat treatment using a laser beam is performed on thin (approximately 100 μm) silicon and SiC wafers to enhance the performance of power semiconductors.
- Power semiconductors are crucial components used in equipment that controls motors “efficiently” and “without loss”.
- They are widely used as key devices in BEVs, PHVs, HEVs, and other electric vehicles, and they contribute to **energy conservation and electricity savings around the world**.
- Through our customers’ products (power semiconductors) manufactured using our products, we are contributing to a reduction in electricity consumption and global **CO_2 emissions, as well as global warming mitigation initiatives**.

Laser annealing equipment:
SWA-20US/ SWA-22USH

Carbon Neutral Contribution points

- ✓ **Global energy conservation and electricity savings**
- ✓ **Contributing to a reduction in CO_2 emissions and global warming mitigation initiatives**

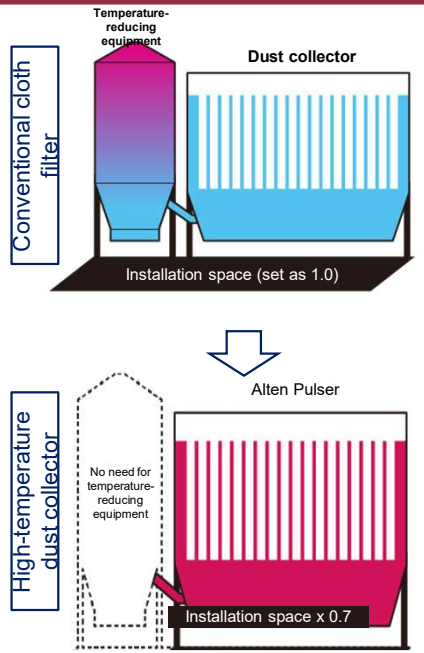
Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

High-Temperature Dust Collector : Alten Pulser

R&D | FS/Demo | **Product/ Service**

Nihon Spindle Manufacturing Co., Ltd.

- Alten Pulser is an **energy-saving high-temperature dust collector (350°C) that eliminates the need for temperature-reducing equipment**. This product is expected to find applications in various industries, including production plants, biomass power generation, wastewater sludge incineration, gasification plants, and industrial waste incineration.
- Traditionally, dust collection from high-temperature exhaust gases required lowering the temperature due to limitations of filter cloths. However, as awareness of decarbonization grows, the need for high-temperature dust collection is increasing.
- Supports powder recovery and dust collection at high temperatures. Additionally, it can handle a wide range of applications, from environmental dust collection to corrosive gases.
- Recovering heat from clean, high-temperature gas after dust collection improves energy recovery efficiency and contributes to a reduction in CO_2 emissions.



Can collect dust from gases at 250°C or higher, which conventional cloth filters cannot handle!
Alten Pulser does not require temperature-reducing equipment!

Carbon Neutral Contribution points

- ✓ **No need for preparing for temperature-reducing equipment (leading to energy conservation)**
- ✓ **Improved energy recovery rate**

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

For R&D of Lithium-ion batteries
Energy-Saving Dry Thermal System

R&D | FS/Demo | **Product/ Service**

Nihon Spindle Manufacturing Co., Ltd.

- Next-generation technologies such as all-solid-state batteries, lithium-ion batteries, perovskite solar cells, capacitors, and organic EL devices require strict low-dew-point* environments in R&D and manufacturing.
  *Low-dew-point environments are extremely dry conditions necessary to prevent material degradation or ignition caused by moisture.
- Nihon Spindle has developed a **curtain-booth-type** system that provides low-dew-point environments suitable for these applications.
- Compared with conventional dry rooms, the system offers energy savings, space efficiency, and flexibility for relocation and expansion.
- Efficient operation using a weekly timer reduces energy consumption.
- The latest model achieves an **approximately 28% reduction in power consumption**, lowering both operating costs and environmental impact.

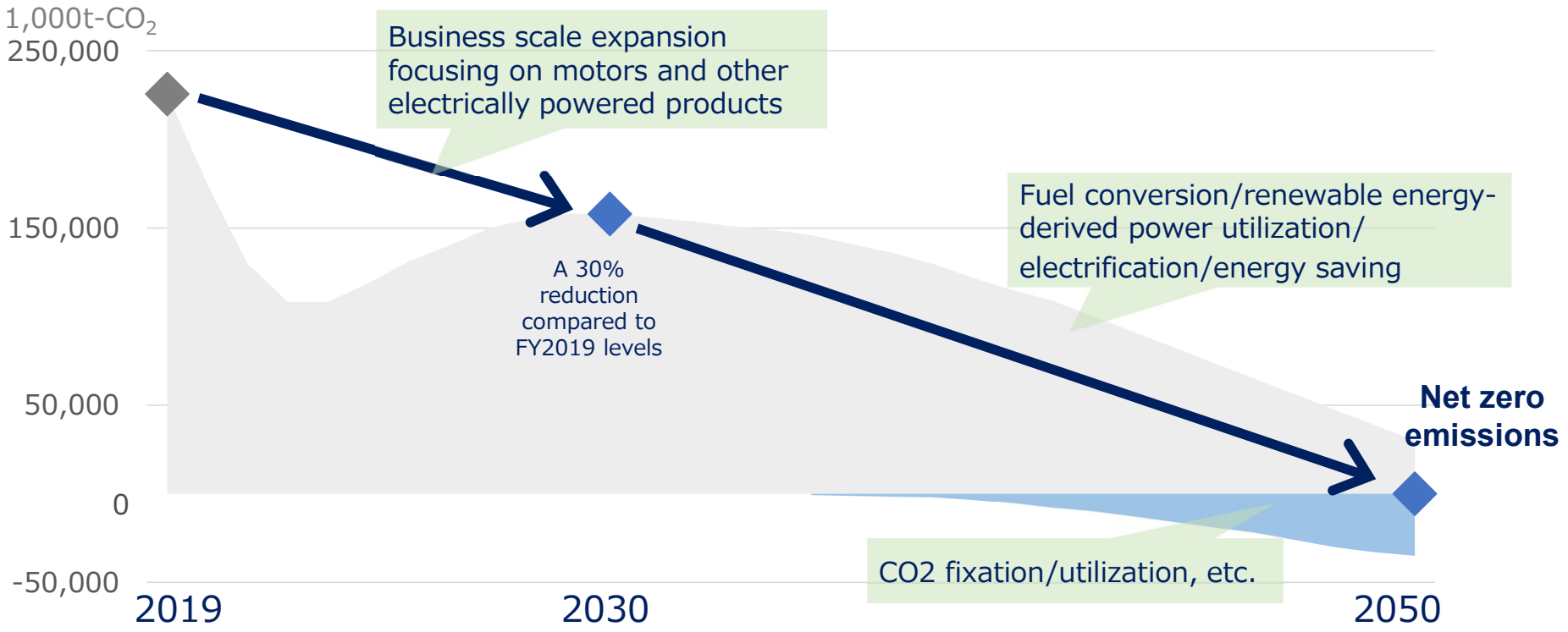
Carbon Neutral Contribution points

✓ **Approximately 28% reduction in power consumption compared with conventional systems,** enabling simultaneous reduction of operating costs and environmental impact.

Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Image of Reducing CO2 Emissions from Product Use Up to 2050

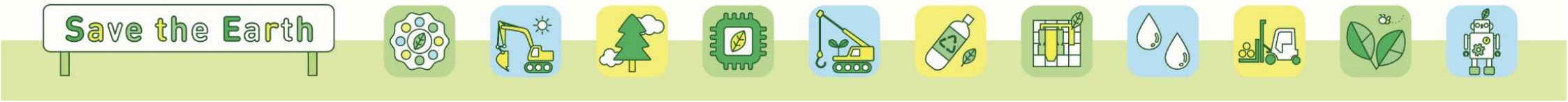
- **SHI aims to achieve the goal of zero CO2 emissions in 2050 by developing various decarbonization technologies.**



Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.

Sumitomo Heavy Industries, Ltd.

Note: CO_2 reduction effects and environmental performance described in this document are based on our estimates under individual conditions or on publicly available information. Actual effects may vary depending on usage conditions, region, energy mix, and other factors.



Copyright © Sumitomo Heavy Industries, Ltd. All Rights Reserved.