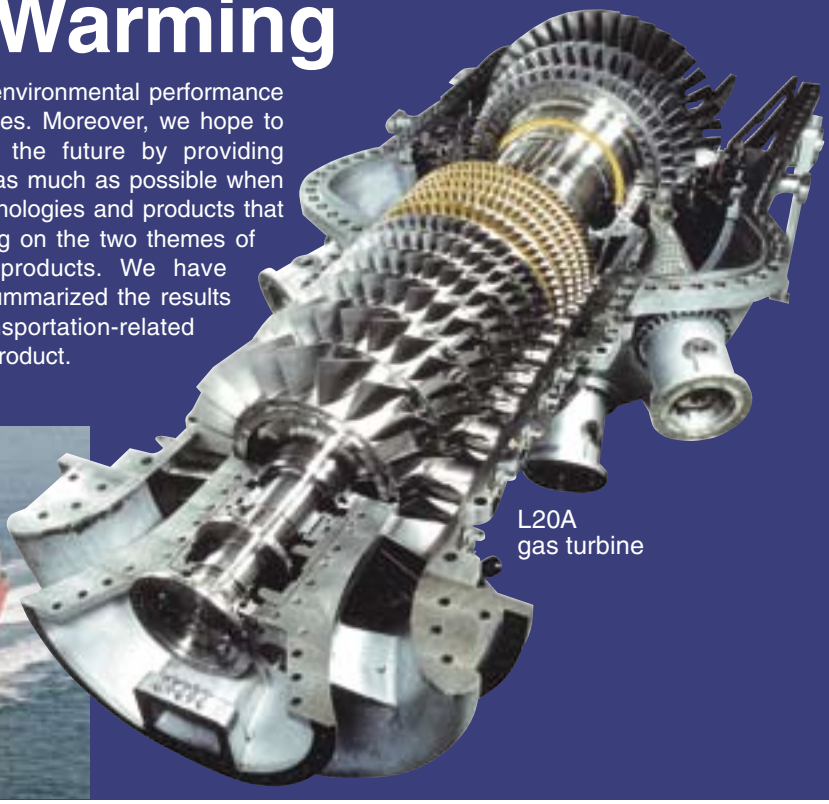
Kawasaki Products That Help Prevent Global Warming

At Kawasaki, we are providing products with superior environmental performance using technologies that we have cultivated over decades. Moreover, we hope to contribute to preserving the global environment in the future by providing technologies and products that control CO_2 emissions as much as possible when they are used. In this feature report, we introduce technologies and products that contribute to the prevention of global warming, focusing on the two themes of energy-related products and transportation-related products. We have quantified their CO_2 emissions reduction effects and summarized the results for energy-related products on page 10. For transportation-related products, we have also provided specific data for each product.


LNG carrier


L20A gas turbine

Energy Products

Energy-Related Products That Contribute to Reducing CO_2 Emissions

To realize CO_2 emissions reduction in energy-related products, we are incorporating various technologies including those for high-efficiency energy use, renewable energy use, and using energy from waste heat and waste matter. Moreover, by developing new technologies to strengthen our product and technology lineup, we are seeking to contribute even more to the global environment and society.

High-Efficiency Energy Use Technologies

- **Gas Turbine Cogeneration System**
- **Combined Cycle Power Generation System**

We provide gas turbine cogeneration systems and combined cycle power generation systems.

We have developed our own gas turbines to run small and medium facilities. Since our first gas turbine in 1974, we have succeeded in building more than 8,000 units, and we have received high evaluations from society for them.

These facilities use natural gas that generates small amounts of CO_2. Since the heat that they produce can also be used effectively, they are receiving attention as one valuable system for responding to global warming and energy problems.

Gas turbine cogeneration system

In addition to generating power from natural gas burned in gas turbines, this system effectively uses the waste heat as steam and warm water.

Large-scale combined cycle power generation system

In addition to generating power from natural gas burned in gas turbines, this system also uses the waste heat to generate more power using steam turbines.

Renewable Energy Use Technologies

● Woody Biomass Fixed-Bed Gasification, Combined Heat and Power System
● Woody Biomass Fluidized-Bed Gasification Power Generation System

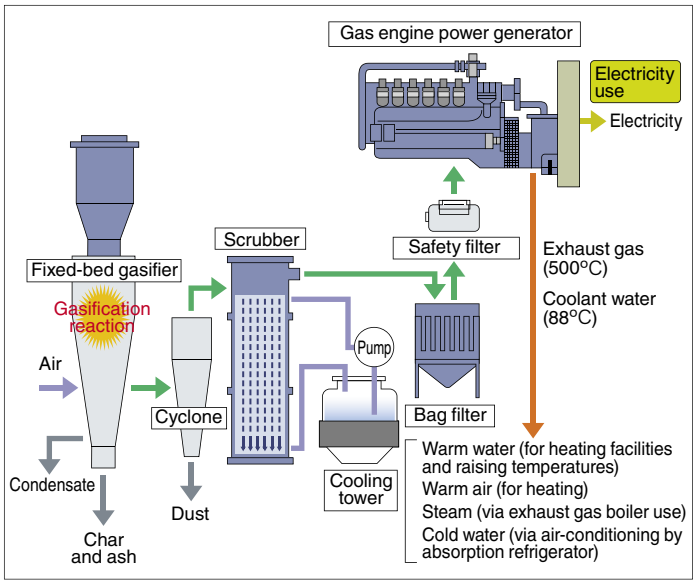
Test plant in Niyodogawa, Kochi Prefecture

Research on the use of woody biomass as a means of preventing global warming is being conducted in many places. The CO_2 generated during the combustion of woody biomass is offset by the same amount that the trees absorbed during their growth. As a result, the cycle from growth through use as a fuel is carbon neutral, meaning that there is no overall increase in CO_2 in the atmosphere. However, due to problems of facility efficiency and fuel collection costs, it has still not become very popular in Japan. High-efficiency, compact power generation facilities are necessary to make effective use of the woody biomass that is abundant in the mountainous regions of the country.

In consideration of these conditions, we have developed Woody Biomass Fixed-Bed Gasification, Combined Heat and Power System and Woody Biomass Fluidized-Bed Gasification Power Generation System that can be used for small-scale distributed power generation. Considering factors that include the type and quantity of biomass handled, as well as the application, building systems for the effective use of energy that are suited to each region is possible.

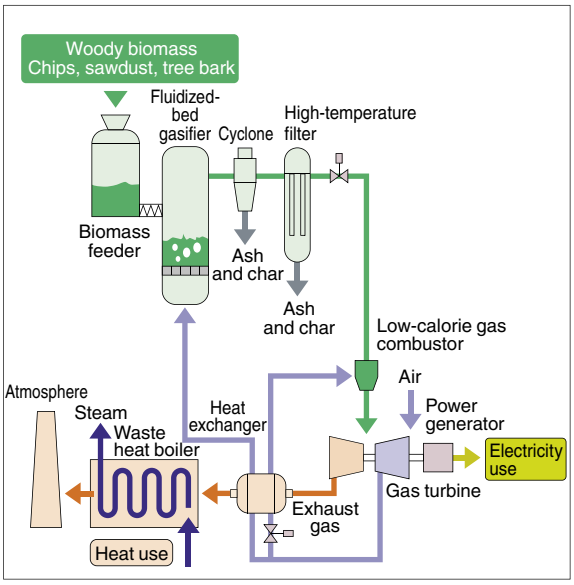
Our Woody Biomass Fluidized-Bed Gasification Power Generation System was selected by NEDO* for Tests for Locally Systemized Biomass Energy. We are conducting demonstration tests for this system in the town of Niyodogawa in Kochi Prefecture from FY2007 through FY2009.

* New Energy and Industrial Technology Development Organization



Woody Biomass Fixed-Bed Gasification, Combined Heat and Power System

Lumber scraps, wood from forest thinning and pruned branches, for example, are gasified in a fixed-bed gasifier to generate power in a gas engine. The heat generated in this process is also available. (Standard output scale: 50–200 kW)



Woody Biomass Fluidized-Bed Gasification Power Generation System

Chipped timber scraps from forested regions, for example, are gasified in a fluidized-bed gasifier to generate power in a gas turbine. The heat generated in this process is also available. (Standard output scale: 150 kW)

● Methane Fermentation System for Biomass Resources

We have provided a methane fermentation system for biomass resources to the Suzu City Sewage Treatment Plant in Ishikawa Prefecture. This is the first biomass utilization project jointly promoted by two related government ministries. This facility mixes and treats sewage sludge, human waste, kitchen waste and other biomass, and uses the methane gas generated in the treatment process to, for example, heat the facility and dry sludge. Moreover, the dry sludge that is produced is utilized for the community as organic fertilizer.

Methane fermentation system for biomass resources

Technologies for Using Energy from Waste Heat and Waste Matter

● Waste Heat Recovery Power Generation (WHRPG) in Cement Plant

We have a record of numerous achievements in the cement plant field. Combining this experience with our waste heat recovery boiler technologies, we have developed and delivered WHRPG in cement plant that effectively uses the heat emitted by cement plants. This system recovers heat from exhaust gas in cement plants by waste heat recovery boilers and generates electric power using steam turbines. Since delivering our first WHRPG in Japan in 1980, we have built about half of all such facilities installed in the country. Moreover, since delivering our first one to China in 1998, working with a joint venture, we have delivered and received orders for 97 systems. By doing this, we are contributing to reducing CO_2 emissions in China as that country experiences remarkable economic growth.

WHRPG in cement plant

The main components of WHRPG are two waste heat recovery boilers and one steam turbine and generator. One boiler is installed at the exit of the preheater that heats raw materials and the other is installed at the exit of the cooler that cools clinker. Since especially the exhaust gas from preheater contains much dust, a forced circulation, horizontal waste heat recovery boiler is used. By removing dust continuously, stable operation for long periods can be possible with reduced adhesion of dust.

● Coke Oven Gas Heat Recovery Power Generation System

The coke that is used in the blast furnace of ironworks, for example, is generated in coke ovens. The exhaust gas emitted by coke ovens has a high temperature of 1000°C or more, giving it a great amount of heat energy. In a coke oven gas heat recovery power generation system, the heat of the gas is captured as heat energy by a waste heat recovery boiler and power is generated by a steam turbine. We delivered the third in the world, and also the largest facility so far, to an ironworks in Brazil. In addition to using the electricity generated in the ironworks, extra energy is sold, which helps respond to sudden growth in the local electricity demand.

Coke oven gas heat recovery power generation system

Our waste heat recovery boilers are available in a variety of types with structures and forms that can handle every type of gas and are suitable for nonferrous smelting, petrochemical and iron-manufacturing plants, for example. They can operate stably and continuously even with coke oven gas, which is very hot at 1000°C or more and contains dust.

● Waste Power Generation System

We were early to begin working on the theme of transitioning from just treating waste to using it effectively. For this purpose, we have developed and provided waste power generation systems that use waste as fuel. Among systems that we use to seek increased efficiency, the Kawasaki Advanced Stoker System realizes complete high-temperature combustion with a low air ratio by using an advanced stoker (fire grate) type waste incinerator, while gasification and melting systems gasify waste and use its energy.

Fluidized-bed gasification and melting waste treatment plant

Waste is gasified (partially combusted) in a fluidized-bed partial combustion furnace. That gas (unburned gas and solids) is fed to a rotating melting furnace and the unburned gas is combusted. Energy is also saved by using the heat generated from the waste itself to melt ash at a high temperature of about 1300°C and to turn it into slag.

● Top Pressure Recovery Turbine (TRT) System

Top pressure recovery turbine (TRT) systems recover electricity by using a turbine to capture the pressure energy of blast furnace gas generated by an ironworks blast furnace. By controlling the blast furnace top pressure using variable stator vanes of turbine, we have made a product that generates power with little energy loss.

With our long record with TRT systems, including delivery of 42 units in Japan and abroad, we are contributing to the reduction of CO_2 emissions around the world, even in Brazil, for example, where economic growth is remarkable.

Top Pressure Recovery Turbine (TRT) System

Green Gas Engine

Newly Developed Technologies

Gas Engine Cogeneration System

Kawasaki Green Gas Engine with the Highest Power Generation Efficiency (48.5%) in the World

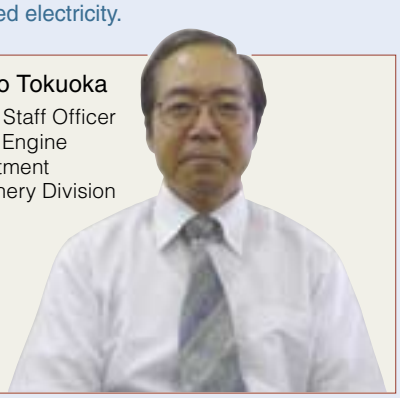
In response to the expansion of the market for gas engines that use clean natural gas as fuel, we developed a gas engine with an 8-MW power output. We have achieved 48.5% power generation efficiency, the highest in the world, and a NOx emissions value of 160 ppm (O_2 = 0% conversion), which is also the best environmental performance in the world. Based on our long years of experience with diesel engine manufacturing, we began the development of a gas engine in 2003 and realized this new model in 2006.

Thus far, we have built a record with numerous cogeneration systems that have high overall thermal efficiency and have earned high confidence for our products. By strengthening our lineup with this newly developed gas engine, we are now able to provide gas turbines to users that need both heat and electricity, and gas engines to users that mainly need electricity.

Project Member Interview

We are seeking further efficiency improvements while looking at prospects overseas.

A major issue in the development of this product was controlling the abnormal combustion known as knocking. As measures to resolve this, we optimized the forms of the main- and pre-combustion chambers and developed a control system to raise anti-knocking performance. These efforts allowed us to complete this product. In addition to further improving efficiency, we will seek to promote its high environmental performance, which is exemplified by low NOx emissions, and work actively to increase sales in Japan and abroad.



Tetsuo Tokuoka
Senior Staff Officer
Diesel Engine Department
Machinery Division

CO_2 Emissions Reduction Effect of Energy-Related Products

CO_2 emissions reduction effect by products delivered in FY2007
(selection of main products)

Product	Total number of deliveries (FY2007)	Output totals		CO_2 emissions reduction effect [t-CO_2/Y]	Number of units until FY2006 (approx.)	Notes and calculation criteria
		Electricity [kW]	Heat quantity [MJ*/h]			
Gas turbine cogeneration system	21	124,000	1,050,000	284,000	480	(1)
Methane fermentation system for biomass resources	1	735 GJ in 8 months (biogas)		31	0	(1), (3)
Waste heat recovery power generation in cement plant	8	155,000	—	462,000	22	(1), (3)
Coke oven gas heat recovery power generation system	1	150,000	—	492,000	0	(1), (3)
Waste power generation system	1	12,000	—	22,000	26	(1), (3)
Total	—	441,000	1,050,000	1,260,031	—	—

CO_2 emissions reduction effect that can be expected from the adoption of our products
(selection of main products)

Product	Calculation unit	Standard output		CO_2 emissions reduction effect [t-CO_2/Y]	Number of units until FY2006 (approx.)	Notes and calculation criteria
		Electricity [kW]	Heat quantity [MJ*/h]			
Combined cycle power generation system	1	311,000	—	650,000	13	(2)
Biomass Fixed-Bed Gasification, Combined Heat and Power System	1	157	630	790	1	(1), (3)
Biomass Fluidized-Bed Gasification Power Generation System	1	80	7,890	800	0	(1), (3), under demonstration
Top pressure recovery turbine (TRT) system	1	15,000	—	49,200	42	(1), (3)
Gas engine cogeneration system	1	7,800	20,000	11,000	0	(1) under demonstration

Criteria for calculating CO_2 emissions reduction effect

(1) The amounts of CO_2 emissions reduction from the generated electricity and heat were calculated in comparison with the amounts of CO_2 produced from equivalent amounts of electricity purchased from electric utilities companies (emission factor: 0.410 kg-CO_2/kWh) or generated by boilers (heavy oil A burning, efficiency 90%).

(2) For large-scale power generation systems, the CO_2 emissions if the electricity was from an average thermal power generation plant (emission factor: 0.690 kg-CO_2/kWh) was used for comparison and calculation.

(3) For the use of wasted energy, as well as energy from waste and biomass, the derived energy was all calculated as a CO_2 emissions reduction effect.

* MJ (mega joule) = 0.239 Mcal (mega calorie)

Transportation Products

Transportation-Related Products That Contribute to Reducing CO_2 Emissions

Kawasaki is making great efforts to reduce CO_2 emissions from our transportation-related products, which is one of our core business areas. Utilizing our accumulated experience of success in this field, we will further refine our technologies for rolling stock and ships, which are known as transportation means that have low amounts of CO_2 emissions, and reduce the environmental impact as much as possible.

Energy Saving Technologies for Rolling Stock

● N700-Series Shinkansen

On receiving the order from Japan Railways (JR), we participated in the development, design and manufacture of most models of a new shinkansen train (bullet train). The new N700-Series shinkansen began operating on the Tokaido-Sanyo Shinkansen line in 2007. This shinkansen has realized energy saving of about 19% compared to the previous model 700 Series when traveling at the same speed of 270 km/h. One roundtrip of the new train between Tokyo and Shin Osaka produces about 2.4 tons less CO_2 emissions than the previous model.*

The N700 Series also incorporates our technologies. For example, we worked on the development of the front end of the train for optimal aerodynamic characteristics that are desirable at high speeds. For that purpose, employing technologies that are also used in the development of aircraft, we conducted 5,000 simulation patterns to realize reduced air resistance and suppression of aerodynamic noise. Moreover, our tilting system makes it possible to maintain comfort for the passengers while reducing the frequency of acceleration and deceleration on curves and realizing energy saving.

These technologies were combined with other improvements, including a new type of hood that covers the entire space between cars, smooth vehicle bodies and the use of more electric regenerative brakes, in the N700 Series to greatly improve its energy efficiency.

We will continue to further develop our technologies and promote the reduction of CO_2 emissions through our products.

N700-series shinkansen

CO_2 emissions reduction effect
2.4 tons
(Tokyo–Shin Osaka roundtrip)

* We calculated this while referring to the Central Japan Railway Company Environmental Report 2007.
Calculation suppositions
- Amount of CO_2 emissions for a one way trip from Tokyo to Shin Osaka on a 700 Series: 4.8 kg-CO_2/seat
- Number of seats: 1,323 seats/train (same for both the 700 Series and the N700 Series)
- Amounts of electricity consumption and CO_2 emissions are assumed to have a proportional relationship

LNG carrier
CO_2 emissions reduction effect
31 tons per day

LPG carrier
CO_2 emissions reduction effect
9 tons per day

LPG carrier

Energy Saving Technologies for Ships

● LNG Carrier ● LPG Carrier

In recent years, the demand for natural gas, which is one type of clean energy, has expanded greatly, and the construction of liquefied natural gas (LNG) carriers has increased. In addition, increasing the capacity of LNG carriers and improving their propulsive performance have become issues for reducing fuel costs, which keep rising.

In response, we have developed a 147,000 m^3 LNG carrier that is compatible with existing LNG terminals around the world and provided it to many customers. We increased the LNG carrying capacity by 10,000 m^3 while keeping the same fuel consumption as the conventional 137,000 m^3 LNG carrier by optimizing the hull form and improving propulsive performance. Thus, we have realized streamlined and more efficient transportation for this energy source. As a result, we have achieved a 7% improvement in energy efficiency and a reduction in CO_2 emissions of about 31 tons per day.

Moreover, we have realized energy saving for 80,000 m^3 liquefied petroleum gas (LPG) carriers, which are typical mid-speed ships, by adopting our newly developed bow shape named “SEA-Arrow (Sharp Entrance Angle bow as an Arrow)” and our “Rudder Bulb System with Fins (RBS-F),” an energy saving device which efficiently converts the rotation energy of the propeller slipstream into propulsive force. Compared to a conventional ship (79,000 m^3 LPG carrier), we have achieved a 7% improvement in energy efficiency and a CO_2 emissions reduction of about 9 tons per day.

Illustration of LNG carrier

177,000 m³ LNG carrier

Newly Developed Technologies

Kawasaki URA Reheat Turbine Plant

Great Fuel Efficiency Improvement for 177,000 m³ LNG Carriers, Which Are the Standard of the New Generation

As LNG carriers continue to become even larger, improvement of energy efficiency for the steam turbine plants that are the propulsion plants for the LNG carriers is sought.

In order to respond to this demand, we have developed the Kawasaki URA (Ultra Reheat Advanced) Turbine Plant as an LNG carrier propulsion plant based on the Kawasaki UR Turbine Plant and the great experience that we have gained with it. This product is a reheat turbine plant that takes steam from the turbine at a middle stage and heats with boilers to raise the temperature and then leads it back to the turbine. Moreover, we have further improved the efficiency of the entire heat cycle by increasing the steam pressure and temperature of the turbine and adopting improvements to the nozzles and blades of the turbine, for example. Compared to a conventional turbine plant, energy efficiency has been improved by about 15%, reducing CO_2 emissions by about 60 t/day.

Reheat turbine plant

The 177,000 m³ LNG carriers equipped with the URA turbine plant, which are the standard ships of the new generation, have reduced fuel consumption by about 20% per unit of cargo compared to current 147,000 m³ LNG carriers. This is due to adoption of the URA turbine plant, increased scale and other improvements to propulsion performance. These 177,000 m³ LNG carriers, which are subject to high expectations, will contribute to global LNG transportation.

CO_2 emissions reduction effect

60 tons per day

Project Member Interview

We are aiming to increase orders of LNG carriers that have Kawasaki URA Reheat Turbine Plants with the highest level of energy efficiency in the world.

Since steam turbine plants can effectively use boil-off gas* as fuel, they have come to be used in the propulsion engines of most LNG carriers. However, in recent years, the use of diesel engines and other propulsion engines has increased, and responding to strong demands from customers by improving the energy efficiency of steam turbine plants has become an urgent issue for us. The Kawasaki URA Reheat Turbine Plants for ships provide a solution to this issue while maintaining the advantages of steam turbine plants, including less maintenance, high reliability and a wide variety of fuel selections. With the highest steam pressure and temperature, as well as a reheat cycle, energy efficiency has been improved by about 15%. This performance has been highly evaluated, and we received the Japan Institute of Marine Engineering of the Year 2007 award for outstanding ship equipment. Its use on two 177,000 m³ LNG carriers has already been determined. In the future, we will aim to have it adopted in as many LNG carriers as possible, and we hope to actively advance solutions for customers as we make further improvements and enhancements.

* Boil-off gas: LNG that vaporizes and comes out of the tank

Yoshihiko Toma
Staff Officer, Machinery Planning Section
Initial Design Department, Engineering Division
Kawasaki Shipbuilding Corporation

Battery-Driven Low-Floor Light Rail Vehicle SWIMO and Battery Power System (BPS) for Railways

Make the Most of the Features of Gigacell®

The Gigacell® is a large-scale, nickel-metal hydride battery that is developed by Kawasaki. We have expanded the application of this high-capacity power storage battery, which is capable of charging and discharging rapidly. Taking advantage of its features, it has contributed to the creation of the next-generation light rail vehicle SWIMO and BPS for Railways enabling excellent energy saving.

SWIMO

The LRV was named SWIMO (Smooth WIn MOver) because the goal was to realize (WIN) a vehicle (MOVER) with smooth (SMOOTH) boarding and exiting, and smooth entry into non-electrified segments.

BPS for Railways

Gigacell

Development of a Large-Scale Nickel-Metal Hydride Battery Gigacell with Diverse Potential Applications

The Gigacell has numerous outstanding features which conventional power storage batteries could not offer.

In addition to its high capacity and high-speed charging and discharging characteristics, this battery also has excellent endurance for repeated charging and discharging, allowing long-term usage. It can be used for numerous applications, including stabilization of the output of wind turbine generation systems and photovoltaic systems, which have great output fluctuation, and the regulation of the supply and demand of electricity on microgrids.*

By making the Gigacell compact and fully closed, we are advancing its practical application in battery-driven low-floor light rail vehicle SWIMO and Battery Power System (BPS) for Railways, which provides power directly to overhead lines.

* Microgrid: a system that networks diverse distributed power generation facilities and stabilizes supply and demand using power storage equipment

Gigacell Specifications

Battery specifications	Gigacell for mobile applications
Model	Fully closed
Structure	Non-welded layers
Number of layers	30-cell layers
Nominal voltage (V)	36
Rated capacity (Ah)	200
Energy capacity (kWh)	10
External dimensions (mm) L × W × H	1188 × 213 × 305
Capacity (l)	77
Weight (kg)	200
Volumetric energy density (Wh/l)	130
Gravimetric energy density (Wh/kg)	50
Cooling method	Forced air-cooling
Main applications	Driving vehicles, Battery Power Systems, emergency power source, etc.

SWIMO

Battery-Driven Low-Floor Light Rail Vehicle SWIMO: Friendly to Both People and the Global Environment

Urban transportation, currently centered in automobiles usage, now faces various issues, including increased exhaust gas and greenhouse gas emissions. SWIMO offers transportation methods friendly to both people and the global environment and can solve these issues.

Gigacell Allows SWIMO to Enable Various Advantages

SWIMO uses its driving motor to generate power when braking. This regenerated electricity is stored in the Gigacell and reused. In addition to greatly improving energy saving characteristics, this battery also helps realize various advantages. (Please see the next page for details of how the electricity is regenerated.)

Using electricity stored in the Gigacell, SWIMO has succeeded in test runs of 30 km and more without the electricity supply from overhead lines. In consideration of traffic congestion and other issues, the current plan is to run distances of up to about 10 km without overhead lines in revenue service operation. By establishing recharging facilities about every 10 km, overhead lines can be eliminated in sections, including new routes from the start as well as upon extension of existing routes and where routes intersect, contributing to reduction in construction costs and preservation of the urban landscape.

Test run without power supply from overhead lines in Sapporo

In addition, the Gigacell can provide power in places where the voltage drop occurs due to distance from substations. This allows the distance between substations to be increased and their overall number to be reduced. SWIMO makes use of these advantages and offers various new possibilities for urban transportation.

Entrances and exits close to the ground

Pursuing Human-Friendliness—the Realization of a Barrier-Free Design with Super-Low Floors

The SWIMO is a barrier-free Light Rail Vehicle (LRV), developed to minimize the height difference between platforms and vehicle cabin floors. Additionally, both lead cars have a carbody structure to provide fully flat cabin floor. In order to enable this design, SWIMO has electrical and other components mounted on its rooftop, and also utilizes an extremely compact truck, which was newly developed for this purpose.

Wide, flat passenger compartment

Project Member Interview

We strive to provide solutions for the needs of different communities.

I was in charge of test operations conducted in Sapporo. Sapporo is a city with snowfall and cold temperature. Numerous types of tests conducted in this region helped contribute to implementation and development of SWIMO. SWIMO, which helps protect the urban environment and its appearance and is also easy for riders to use, is a means of transportation that is expected to contribute much to society. We are seeking to expand the use of SWIMO, and want to provide solutions to meet the needs of societies, including the development of rolling stock with different track widths.

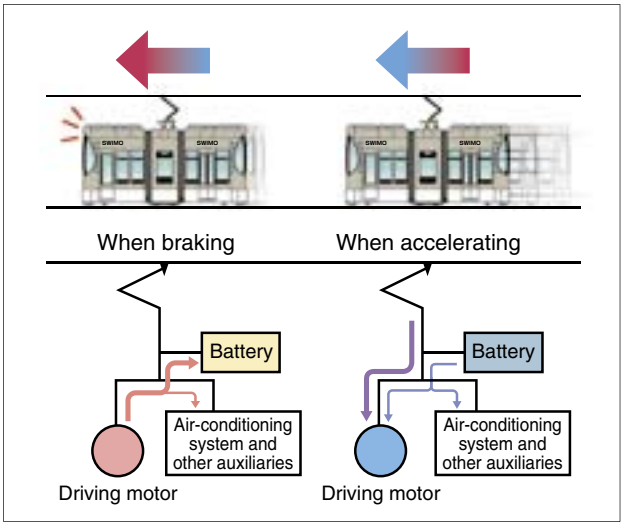
Takahiro Maeda
Assistant Manager
Development Engineering Section 2
Development Engineering Department
Engineering Center
Rolling Stock Division

Gigacell® Allows Regenerated Electricity to Be Used Without Waste

When a motor that is the driving force for a train is used to generate power upon braking, the generated electricity is returned to the overhead lines. This system is called "regenerative braking," and the electricity it generates is called "regenerated electricity." However, if no other trains that use electricity are nearby, power generation cannot occur (regeneration fails), and the train's kinetic energy is lost as heat through mechanical braking.

In SWIMO, electricity regenerated upon braking is stored as power in the Gigacell®. In sections with overhead lines, electricity is received through the pantographs and stored along with the regenerated electricity in Gigacell. The stored electricity is used as backup power when the vehicle starts moving and accelerates depending on the voltage of the overhead lines and the amount of charge in the Gigacell. In addition, trains can operate completely on the electricity stored in the Gigacell in sections without overhead lines.

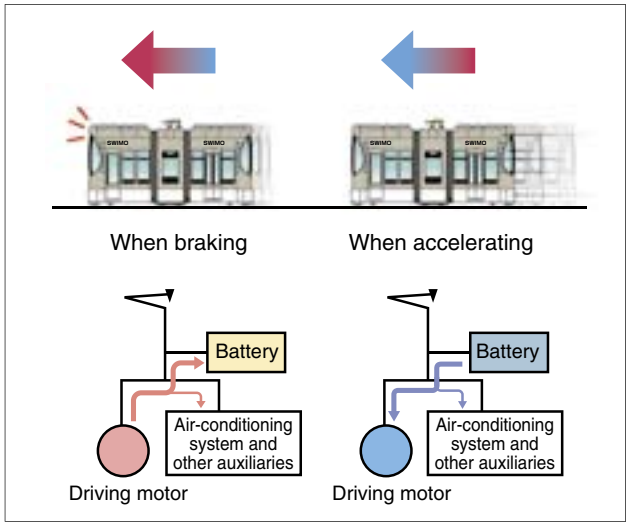
Operation when overhead lines are present



●**When braking (when regenerating):**
Regenerated electricity is used to charge the Gigacell.

●**When accelerating:**
Train power is provided by overhead lines with the Gigacell providing back-up power.

Operation when overhead lines are not present



●**When braking (when regenerating):**
Regenerated electricity is used to charge the Gigacell.

●**When accelerating:**
All train power is provided by the Gigacell.

Seeking to Create Transportation System Friendly to Both People and the Global Environment

SWIMO incorporates various considerations for the environment. For example, the amount of volatile organic compounds (VOCs) in the paint used on the train exterior has been greatly reduced. Moreover, this paint also has high ability to reflect solar heat (insulation from heat), helping reduce the consumption of electricity for air-conditioning. As a next-generation vehicle friendly to both people and the global environment, SWIMO is a means of transportation expected to contribute to the benefit of society in numerous countries and different climates around the globe.

Illustration of SWIMO

Battery Power System (BPS) for Railways

Maximizing the Use of Regenerated Electricity with Battery Power System (BPS) for Railways

In November 2007, we conducted verification tests of Battery Power System (BPS) for Railways that uses the Gigacell in the Osaka Subway System, and investigated its performance, including energy saving and as a countermeasure for regeneration failure and voltage drops. We are currently advancing development with the goal of putting this equipment into use in FY2008.

Battery Power System (BPS) for Railways

Verification of Outstanding Energy Saving and Safety Characteristics

In recent years, the majority of trains in service have a function called "regenerative braking." With this function, motors which are the driving force for trains generate power upon braking, and the electricity generated (regenerated electricity) is returned to the overhead lines so that other trains can use it effectively. However, if no other trains are nearby, the driving motors cannot function as power generators (regeneration fails) and the kinetic energy of the train is released as heat by mechanical braking.

By connecting high capacity Gigacell capable of charging and discharging at high speed to overhead lines and storing the regenerated electricity to control overhead line voltage, Battery Power System (BPS) for Railways prevents regeneration failure and increases the amount of electricity regenerated from trains, enabling great improvements in energy efficiency.

Six Advantages of Battery Power System (BPS) for Railways

Regeneration Failure Countermeasure

Greatly increases energy efficiency by storing regenerated electricity and preventing regeneration failure.

Energy Saving

Regenerated electricity is stored without waste, and discharged for use when necessary. Energy consumption from substations can also be reduced.

On-Peak Cutting

Reduces on-peak electricity demand during rush hours by receiving electricity from power storage batteries. This helps suppress the power demand on substations.

Safety and Peace-of-Mind

Upon power failure, power is provided by the power storage batteries, making continued operation between stations possible and assuring passenger safety and peace-of-mind.

Voltage Drop Countermeasure

BPS can provide power when the overhead line voltage is low because of the distance from substations, suppressing drops in voltage.

Alternative to Substations

By using BPS instead of substations, costs associated with the construction of new substations can be reduced.

Battery Power System (BPS) for Railways

The size is compact because it can connect directly to overhead lines without the use of control equipment (one unit is about 5.4 m^3). In addition, high-speed direct-current circuit breakers also provide a thorough safety measure by preventing short-circuits in emergencies.

Battery Power System (BPS) for Railways