

### **Renewable Energy Use Technologies**

Test plant in Niyodogawa, Kochi Prefecture

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

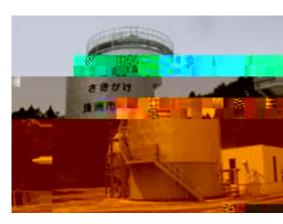
Lumber scraps, wood from forest thinning and pruned branches, for example, are gasified in a fixed-bed gasifier to generate power in a gas engine. The heat generated in this process is also available. (Standard output scale: 50–200 kW)

# 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





## Gas Engine Cogeneration System

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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.

### **CO2 Emissions Reduction Effect of Energy-Related Products**

CO<sub>2</sub> emissions reduction effect by products delivered in FY2007 (selection of main products)

### Reducing CO<sub>2</sub> Emissions Through Our Products

Transportation Products

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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.

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### **Energy Saving Technologies for Rolling Stock**

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#### 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<sub>2</sub> 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.



\* We calculated this while referring to the Certatoro () 1565702eਜ መርተር በአንድርጉ ዓ. Τው 071/01.317 0 Td (the

LNG carrier

CO2 emissions reduction effect 31 tons per day

LPG carrier CO2 emissions reduction effect 9 tons per day



Energy Saving Technologies for Ships

### LNG Carrier LPG Carrier

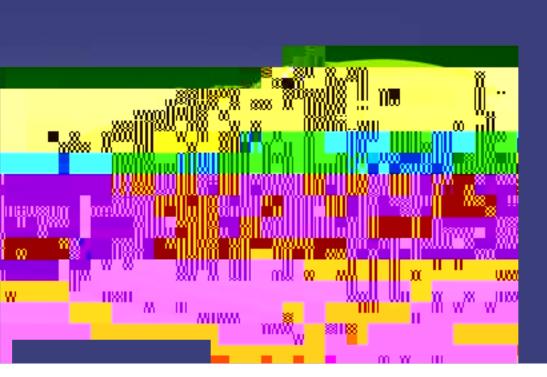
In recent years, the demand for natural gas, which is one type of clean energy, has expanded greatly, and the construction of liquefied natural gas (LNG) carriers has increased. In addition, increasing the capacity of LNG carriers and improving their propulsive performance have become issues for reducing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

In response, we have developed a 147,000 m<sup>3</sup> 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<sup>3</sup> while keeping the same fuel consumption as the conventional 137,000 m<sup>3</sup> 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<sub>2</sub> emissions of about 31 tons per day.

Moreover, we have realized energy saving for 80,000 m<sup>3</sup> 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<sup>3</sup> LPG carrier), we have achieved a 7% improvement in energy efficiency and a CO<sub>2</sub> emissions reduction of about 9 tons per day.

LPG carrier





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.

