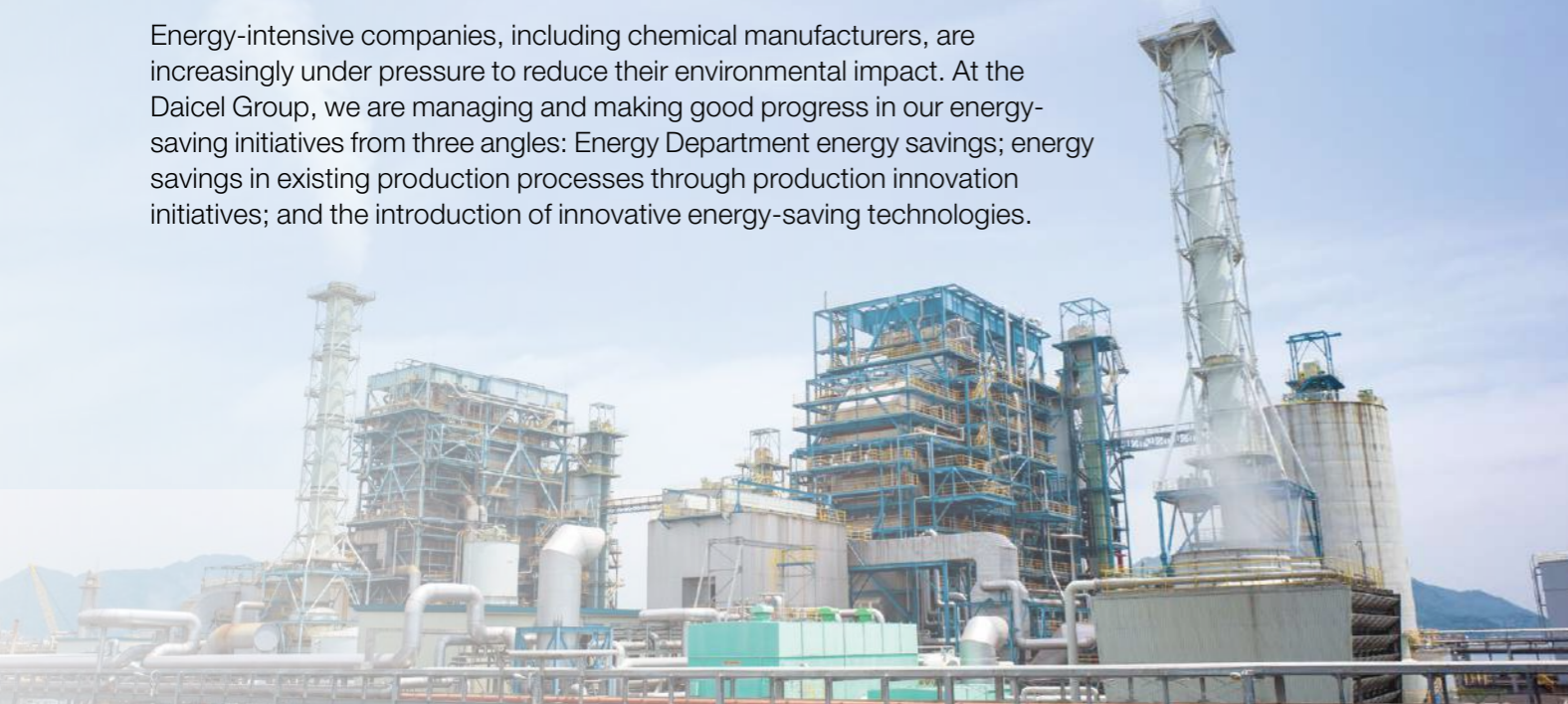


Special Feature

Promoting Multifaceted Energy Savings

Energy-intensive companies, including chemical manufacturers, are increasingly under pressure to reduce their environmental impact. At the Daicel Group, we are managing and making good progress in our energy-saving initiatives from three angles: Energy Department energy savings; energy savings in existing production processes through production innovation initiatives; and the introduction of innovative energy-saving technologies.



1 Saving Energy at the Energy Department

Each of our plants generates its own steam and electricity for its manufacturing processes while also upgrading their facilities and switching to better fuels for greater energy conservation.

Aboshi Plant

In September 2012, the plant installed a cogeneration system with gas turbines. In June 2019, it started selling its excess electricity.

Ohtake Plant

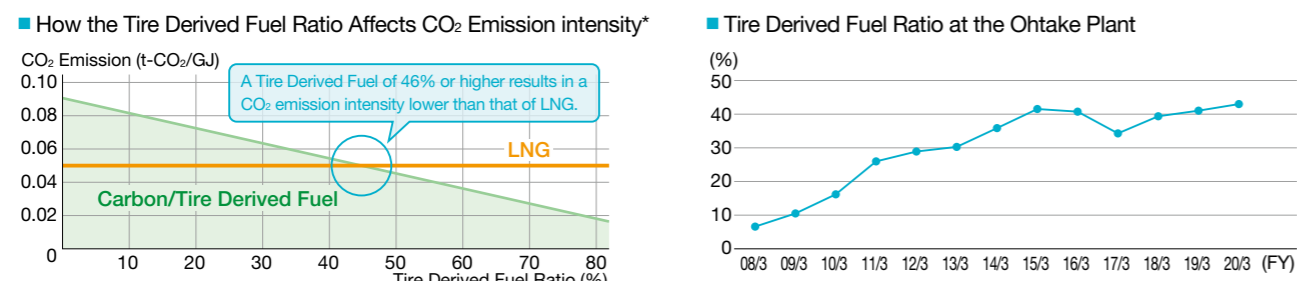
In August 2007, the plant started selling its excess electricity. In July 2016, it installed an additional boiler. Two dual-fuel boilers are run in parallel using a mix of coal and scrap tires as fuel.

Arai Plant

In January 2017, the plant switched from a coal boiler to a cogeneration system with gas turbines.

Using Tire Derived Fuel to Reduce Fossil Fuel Use

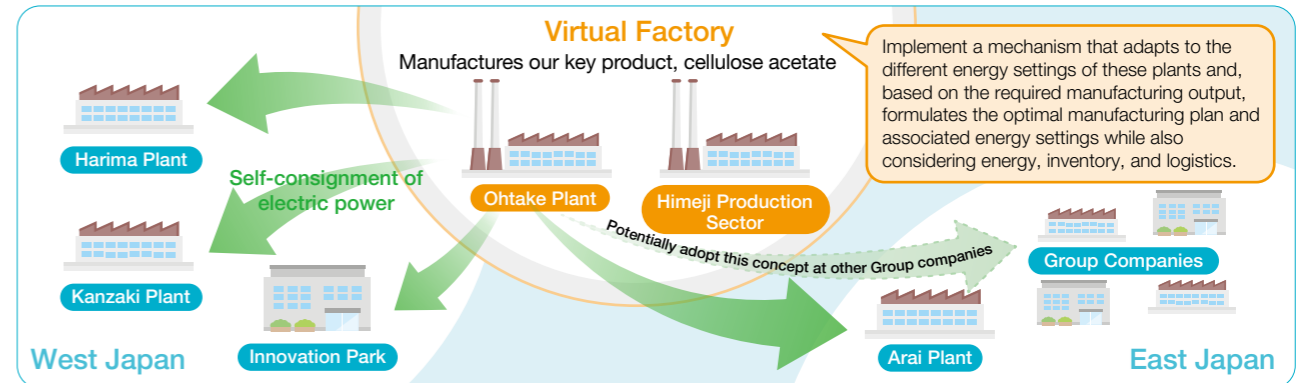
At the Ohtake Plant, a mix of coal and scrap tires is used as fuel for its boilers. Using a mixture that contains at least 46% of scrap tires enables the generation of steam and electricity that emits less CO₂ than LNG, a lower carbon fuel. Excess electricity is sent to our other business sites using a self-consignment system and also sold externally to start-up energy companies. We are improving this process continuously by procuring higher quality scrap tires, ensuring stable boiler operation, and using a fuel mix with a higher scrap tire ratio. We have recently been working toward a ratio of over 50%.



*Volume of energy-derived CO₂ emissions as defined in the Energy Conservation Act.

2 Optimizing Energy Savings in Production Processes

Energy consumption by the Himeji Production Sector and Ohtake Plant account for 80% of the Group's overall consumption. We treat these as one virtual factory and centrally manage information related to their manufacturing processes. This enables us to formulate optimal manufacturing plans and achieve overall optimization and energy savings.



Energy Operation Optimization System

In order to manage our energy consumption in accordance with the optimal manufacturing plan, we have introduced the Energy Operation Optimization System. This provides online monitoring and controls over the actual operational settings based on the optimal settings as calculated by simulation, and it is used by the Himeji Production Sector and Ohtake Plant.

Leveraging the Self-Consignment System*

As part of optimizing energy supply and demand, in June 2018 the Ohtake Plant started sending excess generated electricity to other worksites in West Japan using the self-consignment system. In May 2020, the system was extended to the Arai Plant in East Japan. Looking ahead, we expect to further extend the system to other Group companies toward achieving zero purchased electricity at the Group level.

*The system to supply of electricity to our facilities in other locations with energy generated by our own facilities using the electric company's distribution network.

3 Developing Innovative Energy Saving Technologies

We are aggressively identifying energy-intensive processes and taking action to reduce energy consumption by either improving our technologies or developing completely new ones.

Enhancing Our Current Technologies

Vapor Recompression (VRC) Technology ▶ P. 38

We have established a technology for recovering low-temperature exhaust heat from the organic solvent distillation process, which previously was not possible. In January 2015, we implemented an acetic acid recovery plant with a proof-of-concept capability in the cellulose acetate manufacturing area of the Aboshi Plant and started a test run the following month. We have so far achieved our goal of reducing energy consumption by 30% and will continue to analyze the new technology toward establishing a stable, long-term application.

Modified Petlyuk distillation process ▶ P. 38

Daicel has modified the Petlyuk distillation process so that our facilities can use the technology. After lab-scale experiments and simulations, our acetic anhydride manufacturing facilities were identified as candidates for application. Demonstration tests conducted in January 2014 achieved the targeted energy savings of 30%, and we are currently in the process of commercializing the technology at these facilities. In future, we plan to extend its use to other similar processes at the Ohtake Plant and lower our CO₂ emissions even more.

New Technologies that Adapt to Environmental Change

Membrane Separation Technology

The evaporation process in distillation consumes massive amounts of energy. Dramatic energy savings, however, are possible if a membrane separation technology is used instead. And we have been evaluating the operating life of various candidate membranes since April 2016.

New Reaction Technology

We developed an innovative process, which leverages a proprietary reaction technology with a new catalyst. This is installed at the Aboshi Plant's 1,3-BG facility, which will be completed in September 2020. We expect that energy consumption will be reduced by approximately 20% compared to that of conventional technologies.

New Wastewater Treatment Technology (Anaerobic Wastewater Treatment Technology)

Anaerobic wastewater treatment does not require oxygen and therefore requires less energy. In addition, the methane gas generated can be used for heating. Since April 2016, we have been experimenting and validating this new technology for use in production.

