

Feature 2 Initiatives for Reducing CO₂ Emissions

Reduction of CO₂ Emissions as a Management Issue

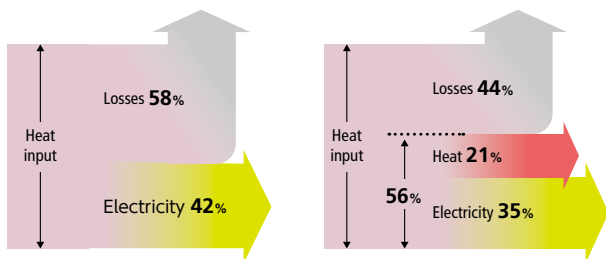
Tokuyama has a coal-fired power plant at the Tokuyama Factory and reducing CO₂ emissions has been a management issue for many years.

The Company has promoted energy consumption rate management, the reduction of greenhouse gas (GHG) emissions and emission intensity management. In 2019, the Company identified material issues for promoting CSR activities and made contributing to the mitigation of global warming its top priority. In addition to the energy-saving activities that the Company has conducted using the energy consumption rate as an indicator, Tokuyama has set a new target of a 15% reduction in energy-originated CO₂ emissions from BAU (base year: fiscal 2013) by fiscal 2030 based on the Paris Agreement. In this way, the Company is accelerating its efforts to mitigate global warming. The Company has already reduced CO₂ emissions by 10% and is undertaking a range of initiatives to achieve the final target.

Features of In-House Power Generation at the Tokuyama Factory

General thermal power plants supply only electricity, and energy efficiency is said to be around 42%. The thermal power plant within the Tokuyama Factory supplies steam in addition to electricity, and the total thermal efficiency is 56%. Efficiency is approximately 1.3 times higher than general thermal power plants and is about equal to leading-edge thermal power plants.

In its in-house power generation, Tokuyama is taking steps to begin carbon recycling, in which the Company considers CO₂ as a resource and reuses it as a fuel or raw material.



From the 200,000kW pulverized coal-fired power plant design thermal efficiency BAT reference table of the Ministry of Economy, Trade and Industry (as of January 2020), generating end, LHV

Energy flow for the Company's power plant, generating end, LHV

CO₂ Project Group Established

To achieve the goal of a 15% reduction from BAU, the Company established the CO₂ Project Group within the Tokuyama Factory in January 2020. The project group is undertaking the following initiatives.

■ New Technology Development

CO₂ Capture and Reuse

In cooperation with outside research institutions, including universities, and other companies, Tokuyama is developing technologies, including a technology to capture CO₂ generated from the Tokuyama Factory as well as a technology for using captured CO₂.

■ Hydrogen Production Using Electric Power Derived from Renewable Energy

The Company is developing and demonstrating a commercial-scale electrolytic cell and process for developing hydrogen production equipment that can use large, variable amounts of power from renewable energy. The Company aims to procure power from renewable energy, which involves variable factors, stably at low cost by producing hydrogen, which is a storable energy source.

■ Renewable Energy Introduction

Biomass Combustion

The Company will use more biomass at its thermal power generation facility and will reduce the consumption of fossil fuels. The Company will use wood pellets made mainly from waste materials as forest friendly sources of energy.

Energy Mix

Tokuyama will examine an energy mix (power source mix) at the Tokuyama Factory in fiscal 2030, devising a scenario about environmental administration and the energy situation by leveraging the knowledge about the environment and energy of Yamaguchi University, with which Tokuyama has concluded a comprehensive collaborative agreement*, and the chemical technologies that Tokuyama has developed over many years (see following page).

* Comprehensive collaborative agreement between Yamaguchi University and Tokuyama Corporation: In 2004, Tokuyama concluded a comprehensive collaborative agreement with Yamaguchi University for joint research, the exchange of personnel and cooperation in human resources development. Since November 2019, Tokuyama and Yamaguchi University have been jointly conducting a study examining a future power source mix (energy source) to reduce CO₂ emissions at the Tokuyama Factory.

■ Optimization of Energy Efficiency at the Tokuyama Factory

In addition to energy saving at each plant within the Tokuyama Factory, Tokuyama will promote energy circulation between plants and the supply of heat and energy to users outside the facility to optimize energy efficiency throughout the Tokuyama Factory. Tokuyama is examining joint energy use at plants and energy

circulation outside the Company's facilities and within the Shunan Industrial Complex for energy saving in respective manufacturing departments.

In fiscal 2020, Tokuyama will work out a roadmap for the above initiatives up to fiscal 2030 based on key performance indicators (KPIs). The Company will make a Company-wide effort to steadily achieve the plan.

Column

Kazuhiro Fukuyo

Director and Professor at Yamaguchi University's Graduate School of Innovation and Technology Management

Background of Academic Guidance

I conduct research on technology management in the industrial sector where large amounts of energy are generated and consumed at industrial complexes. One of the research themes is energy circulation systems connecting multiple companies (plants), for example, systems where companies (plants) provide emitted steam to each other or where waste heat from electric furnaces is reused in different plants.

I have executed a variety of projects with Tokuyama, forming comprehensive alliances. I proposed the development of a future energy mix using scenario planning, and Tokuyama has agreed to it.

At the Tokuyama Factory, multiple plants are connected to each other for the reuse and effective use of energy, and this is closely related to my research.

Concept of Technology Management

In the technological world, engineers play a central role. In technology management, the perspective of management is incorporated and profitability through the effective use of technology is taken into consideration. How will the company use the technologies that it has? What services will the company provide using the technologies that it has? Who will it provide the services to? In addition to increasing efficiency and profitability, technology management identifies future growth areas for development. Creating a vision for the company is one of the roles of technology management.

Evaluation of CO₂ Reduction by Tokuyama

The chemical industry plays an important role in people's lives. However, due to large volumes of CO₂ emissions, the chemical industry tends to have a negative feeling. Amid this environment, Tokuyama aims to reuse CO₂, and I appreciate Tokuyama's stance. Reusing emitted CO₂ for products in addition to reducing CO₂ emissions by

efficiently reusing thermal energy is a bold initiative that only a chemical manufacturer can take.

ICT companies can contribute to reducing CO₂ emissions by replacing power from fossil fuels with power from renewable energy and through carbon offsets. However, inherently, chemical manufacturers cannot avoid CO₂ emissions. It can be said that reducing CO₂ emissions and reusing CO₂ are the missions of the chemical industry. I appreciate Tokuyama's stance of taking the initiative before global warming becomes more serious.

Expectations for Tokuyama Going Forward

Global environmental conservation is a long-term issue that needs to be addressed. Reducing CO₂ emissions is a particularly significant issue. It is the mission of the chemical industry to tackle this problem from a long-term perspective. I believe Tokuyama, a leading global company in Yamaguchi Prefecture, has this same mission. I would like to conduct research with Tokuyama while taking into consideration Tokuyama's long-term growth.



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In 1998, completed the doctoral program at the Division of Environmental Engineering of the Osaka University Graduate School of Engineering. Joined Hitachi, Ltd. Engaged in the development of air-conditioning equipment. In 2001, won the Award of The Society of Heating, Air-Conditioning, and Sanitary Engineers of Japan. In 2002, became a lecturer at the Faculty of Engineering of Yamaguchi University. From 2002 to 2004, served as manager of the Environmental Engineering Committee of The Architectural Institute of Japan. From 2003, engaged in MOT education. In 2004, received the Education Award from Yamaguchi University's Faculty of Engineering for his engagement in MOT education. In 2005, became an Associate Professor at Yamaguchi University's Graduate School of Innovation and Technology Management. In 2010, assumed current position.