Environment

Message on Environment

Since its inception, Toyo has been exerting advanced comprehensive engineering capabilities to reduce burdens on the global environment through project execution in the energy and material industries.

We are confident that it is Toyo's mission to contribute to "sustainable development" that can balance competing goals for economic development and conservation of the global environment.

In the execution of projects, Toyo focuses on reducing environmental loads of plants by actively employing such measures as energy-saving technology, appropriate wastewater treatment processes, and technologies for removing hazardous substances from emission gases.

As a global corporation, Toyo will strive to develop, acquire, and retain global environment conservation technologies; to promote technology exchanges with clients throughout the world; to make proposals on environmental issues; and to contribute actively to solving environmental issues such as global warming through international cooperation frameworks.

Efforts for Environment

Office Activities*

Reduction of CO_2 emissions

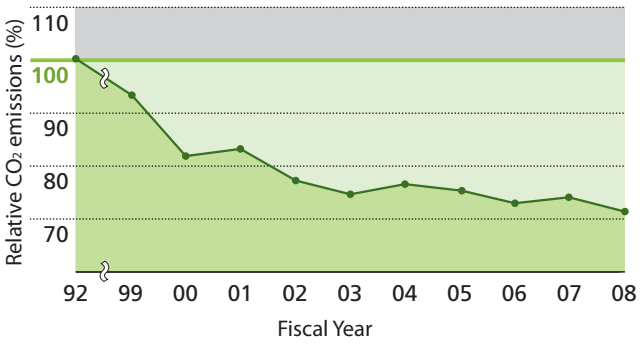
CO_2 emissions from offices are calculated from electricity consumption, urban gas consumption, and consumption of fuel oil A used for emergency power supplies.

Toyo launched energy-saving activities in fiscal 2000, with office lights being turned off during lunch breaks and unnecessary lights removed. In fiscal 2001, in addition to these efforts, we made energy-saving investments, such as installing lighting inverter stabilizers, which produced positive results in fiscal 2002 and after.

CO_2 emissions in fiscal 2008 were reduced by 29% from the 1992 level.

* Office activities are defined as those of the Head Office and Engineering Center (Narashino City).

Relative CO_2 emissions (1992 emissions = 100)

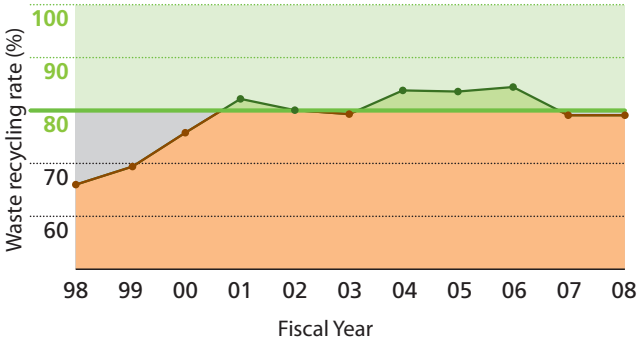


Improvement of general waste recycling rate

Since fiscal 2001, when separation of general waste and double-sided printing were encouraged for the first time, the general waste recycling rate has been more than 80%, as is required by guidelines.

However, the general waste recycling rate in fiscal 2008 decreased to 78.9%. We will analyze the cause of this decrease and make efforts to improve the rate.

General waste recycling rate (%)



Construction Waste Gross Discharge

Domestic project sites

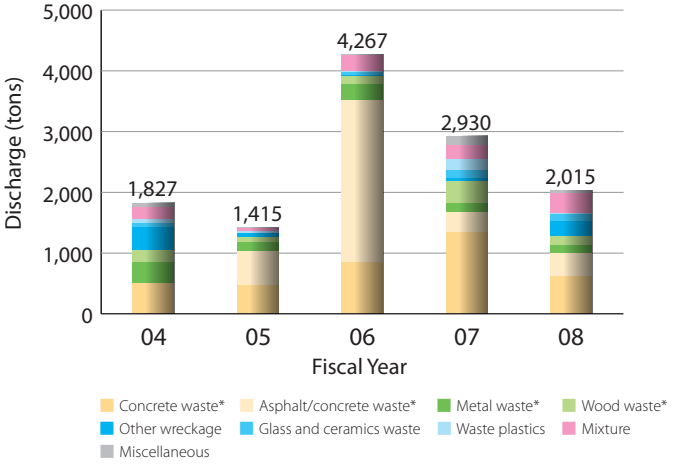
(1) Volume of construction waste discharge

The figure to the right shows the volume of construction waste and its categories in proportion.

The volume of construction waste discharge from domestic project sites in fiscal 2008 was 2,015 tons, about 915 tons less than the 2,930 tons discharged in fiscal 2007.

The four categories of waste marked with an asterisk (*) are recyclable.

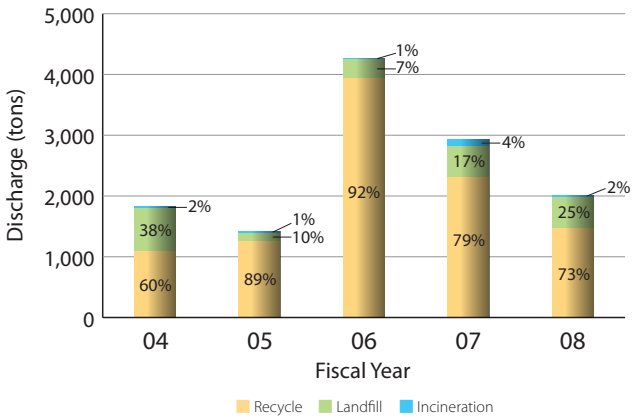
Percentage of construction waste by category (domestic)



(2) Percentage of construction waste by disposal method

Percentage of construction waste by disposal method (recycle, landfill, and incineration) is shown in the figure to the right: 73% recycled, 25% landfilled, and 2% incinerated in fiscal 2008. As the "mix" of construction waste increased, the recycling rate decreased to 73% from 79% in fiscal 2007.

Percentage of construction waste by disposal method



(3) Recycling rates for four items specified by the Construction Material Recycling Act

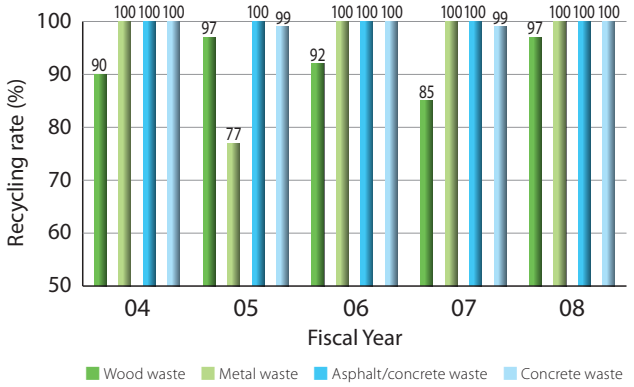
The recycling rates for four items specified by the Construction Material Recycling Act are illustrated to the right.

The recycling rates for concrete waste and asphalt/concrete waste have been kept to almost 100%.

The recycling rate for metal waste was as high as 100%, with the exception of fiscal 2005.

The recycling rate for wood waste was largely improved in fiscal 2008.

Recycling rates for four items specified by the Construction Material Recycling Act



● Overseas project sites

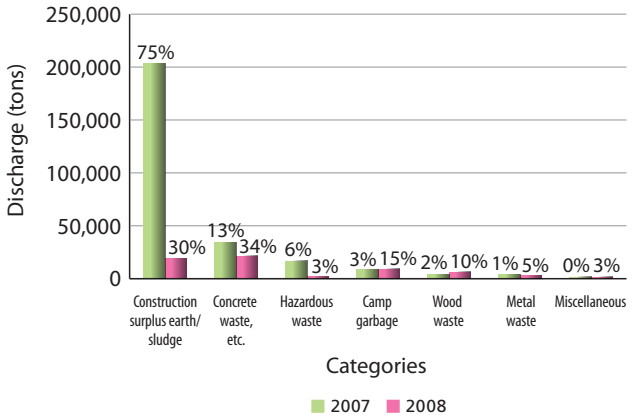
Volume of construction waste discharge and percentage by category

The total discharge volume in 2008 was 63.3 thousand tons, about a quarter of that in 2007. This is because some large-scale projects were completed in 2007, reducing the volume of construction surplus earth/sludge to about 10 percent of that in 2007.

Concrete waste, etc., was the largest in volume, and construction surplus earth/sludge was the second largest in fiscal 2008.

Toyo will continue to summarize the construction waste discharge volumes at overseas project sites to utilize the data for reducing environmental load.

Volume of construction waste discharge and percentage by category
(Proportions of individual waste categories to the total discharge volume for each year shown in percentage)



■ Engineering, Procurement, and Construction Activities

● Engineering

Toyo makes efforts to reduce the environmental load in plant operation. These efforts start in the engineering stage. Based on ISO 14001 and ISO 9001, Toyo reduces the environmental load that occurs in plant operation through the following work processes:

(1) Clarification and confirmation of client requirements (environmental specifications)
(2) Design review
(3) Design verification
(4) Design validation

Toyo makes efforts to reduce environmental load in design work through its activities for "eliminating *muri* (overdoing), *muda* (waste), and *mura* (irregularity)," while striving for efficient design work and methodology as an environmental target.

Moreover, Toyo contributes to client satisfaction with energy and resource conservation at the product plants by actively proposing Toyo's energy- and resource-saving technologies to the clients.

● Procurement

As one of its environmental targets, Toyo has set up "promotion of green procurement." Toyo actively promotes the procurement of equipment and materials from environmentally conscious green enterprises.*

In fiscal 2006, Toyo issued an in-house guideline titled "Guideline for Green Procurement." In line with this, we continue green procurement, aiming to achieve a green procurement rate of more than 90%.

In fiscal 2008, the amount of procurement from green corporations reached 88% of the total procurement amount. Toyo regards this percentage as the green procurement rate. We will make efforts to increase this rate, although it has decreased by 3% since fiscal 2007.

Toyo promotes paperless work to contribute to resource saving by computerizing inquiries from clients, quotation requests to vendors, quotations from vendors, and inspection reports.

*** Environmentally conscious green enterprises are vendors that have acquired ISO 14001 or that are carrying out environmental conservation activities, selected from the 100 largest vendors to Toyo.**

● Construction

Among Toyo's business activities, site construction work causes the largest environmental load. At construction sites, the following environmental targets are set up and efforts are made to reduce the environmental load:

(1) Appropriate treatment of construction waste
(2) Appropriate treatment of chemicals (paint, etc.)
(3) Environmentally conscious construction method
(4) Environmentally conscious material transportation
(5) Turbid water treatment and oily water separation

Safety and environmental meeting at construction site
Meetings are held regularly at construction sites to familiarize workers with knowledge regarding safety and environmental management.

■ In-House Environmental Education

Toyo started in-house environmental education to familiarize all employees with the necessity of Environmental Management System (EMS) activities and their contents.

EMS is associated with the reduction of paper, waste, electricity, and water consumption in offices as well as environmental conservation activities at construction sites. However, attention is also paid to the fact that *muri* (overdoing), *muda* (wasting), and *mura* (irregularity) in overall engineering work are significant environmental aspects. Toyo provides education focusing on these environmental aspects.

In-house environmental education

Environmental Conservation Activities at Overseas Sites

Sakhalin LNG Plant and Oil Export Terminal Project

In September 2008, we successfully completed the Sakhalin LNG plant and oil export terminal (OET) project, which was carried out jointly with Chiyoda Corporation, and we handed over the facilities to the client, Sakhalin Energy Investment Company Ltd. (SEIC). SEIC is an operating oil and gas company and its shareholders are Royal Dutch Shell plc (Netherlands), OAO Gazprom (Russia), Mitsui & Co., Ltd. (Japan), and Mitsubishi Corporation (Japan). The company is the investor and operator of the Sakhalin Ⅱ project, which is the largest integrated oil and gas project in the world. The project entailed the construction of a large-scale LNG plant with an annual capacity of 9.6 million tons and an OET. The LNG and OET facilities of the Sakhalin Ⅱ project were developed by SEIC in the southern part of Sakhalin Island.

Because the construction in Sakhalin occurred in the midst of a vast tract of nature, environmental protection based on RF and local requirements was a major issue. The period from May to August is the spawning period for pink salmon in Aniva Bay, which is part of the construction site. The project restricted dredging and other operations that would disturb the sea bed in the bay during this period. The project teams incorporated these environmental protection constraints into the construction plan at the planning stage.

Environmental survey

Prior to the start of construction at the site, we conducted environmental surveys of animals, plants, water, and other nature at the entire site and in the surrounding areas to obtain baseline data. During the construction period, we continuously monitored environmental impacts by regularly checking over 100 observation points covering the site, including the sea.

Fauna: Bird tagging

Vegetation

Air quality inspection by gas analysis

Soil investigation

Installment of monitoring well for underground water inspection

River monitoring

● Rainwater measures

We surrounded the entire construction site with silt fences* and ditches to lead muddy rainwater to settlement ponds. There, the mud was deposited and clean rainwater was discharged into rivers and the sea.

In addition, we designated a protection zone ranging 50m from both sides of streams running through the plant site in order to conserve nature.

As one of the synergetic effects of these measures, the profuse number of pink salmon that swim up the stream to spawn in autumn is a rare sight at any other plant site in the world.

* A silt fence is a temporary sediment control used on construction sites to protect water quality in nearby streams, rivers, and bays. Silt fences are perimeter controls, typically used in combination with settlement ponds, as well as erosion controls, which are designed to retain sediment in place where soil is being disturbed by construction processes.

Pink salmon swimming up the stream

Settlement pond

● Hydroseeding*

The ground surface that was upturned by civil works was covered with sod or pasture grass via hydroseeding within about 2 months. This protected soil erosion by rainwater and contributed to beautification inside and outside of the plant site.

* Hydroseeding is a planting process which utilizes a slurry of seed and mulch. The slurry is transported in a tank and sprayed over prepared ground in a uniform layer. Hydroseeding promotes quick germination and inhibits soil erosion.

Vegetation

Directly following implementation

50 days later

■ Oil Refinery Modernization Project in Brazil

This is one of the refinery modernization projects awarded by PETROBRAS, the largest oil company in Brazil. The equipment to be constructed consists of a Natural Gas Separation Unit and a Treatment Unit.

The joint venture "TS GAS CONSTRUCOES," composed of Toyo and Setal Óleo e Gás S.A., has been awarded the contract for engineering, procurement, and construction. The project is being implemented at two sites of PETROBRAS: Cabiúnas Terminal near the city of Macaé and Reduc Refinery in the city of Duque de Caxias.

● Environmental education for local residents

As a part of environmental education for local residents, Toyo's staff members teach the importance of biodiversity conservation to schoolchildren near the construction sites, and also plant young trees.

Environmental education for local residents

● Waste management

Construction waste and general waste are stored separately in color-coded containers. Construction waste is sorted into 14 categories and recycled.

Construction waste

General waste

● Preliminary emergency drill

A preliminary emergency oil leakage drill has been implemented.

Leakage preventing apparatus container

Briefing session before preliminary drill

Preliminary emergency oil leakage drill

■ GTL Project for Qatar Shell

This project, awarded by Qatar Shell GTL Ltd., is for construction of a Gas to Liquid (GTL) plant. Construction is now at its peak activity in Qatar.

For this project, Toyo worked out the project's environmental policy, objectives, and targets to meet the strict environmental criteria and regulations of the Ministry of Defense and the Ministry of Environment of Qatar, in addition to the client's environmental policy. Efforts toward achieving the environmental targets are made under the environmental program. These efforts include environmental education, which is obligatory for all workers to improve their environmental awareness and knowledge.

● Noise control and monitoring

Noise is monitored and recorded day by day with noise level meters. Where noise levels exceed 85 dB, an ear protection sign is put in place, obliging workers to wear ear protectors.

● Oil contamination control

Various oil leakage preventing device boxes are arranged in project sites to allow countermeasures to be taken immediately when oil leakage occurs. An oil leakage preventing device box contains oil absorbent, disposable work clothes, rubber gloves, boots, shovels, protective masks, and other items.

A temporary fuel tank is provided with an oil protection bank to prevent oil contamination.

Oil contamination control applies to hydrocarbon storage areas, all fuel-driven machines on the site, and temporary fuel storage areas.

Ear protection sign

Oil leakage preventing device box

Oil protection bank for preventing contamination

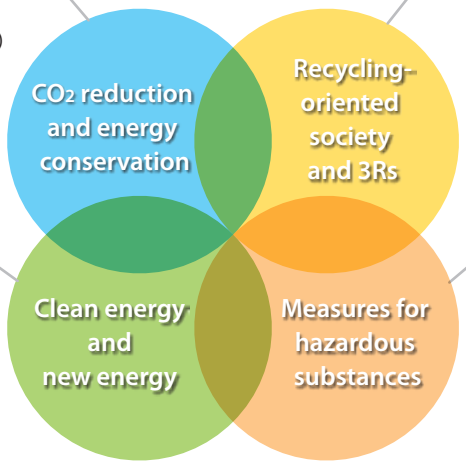
Toyo's Environmental Technology

Toyo actively promotes the development, introduction, and improvement of technologies that contribute to the environment. Through utilizing these technologies, Toyo provides a variety of solutions to environmental conservation and contributes to sustainable economic development with unique engineering services in view of the global environment.

On the basis of accumulated knowledge and experience, Toyo aggressively applies R&D engineering* to the field of environmental conservation, making various approaches to CO_2 reduction and energy conservation, a recycling-oriented society, the Reduce, Reuse, Recycle (3Rs) campaign, clean energy and new energy, and measures for hazardous substances.

* R&D engineering is a technical service to facilitate the quick commercialization of laboratory scale technologies that clients have developed.

(1) Energy-saving urea process (ACES21™)
(2) Energy-saving propylene production boosting process (OCT)
(3) High-activity steam reforming catalyst (ISOP)
(4) New autothermal steam reforming process (ATR)
(5) CO_2 capture and storage (CCS)



(1) Reuse of wastewater
(2) Reduced-product-loss and low-drainage-load type automated line changeover device (XY router™)
(3) Waste biomass recycling technology
(4) Sludge volume reducing technology (using low-temperature hydrothermal reaction)
(5) Incinerator residue recycling technology

(1) Dimethyl ether (DME)
(2) Gas to Liquid (GTL)
(3) Hydrogen
(4) Methanol
(5) Liquefied Natural Gas (LNG)
(6) Biomass energy
(7) Ethyl tertiary butyl ether (ETBE)
(8) Fuel cell

(1) Electric precipitator
(2) Exhaust gas desulfurizer using magnesium hydroxide process
(3) High-performance wastewater treatment unit (BioPOP)
(4) Dioxin decomposing device using catalyst
(5) Hazardous waste treatment (PCB, etc.)

TOYO's Solutions to CO_2 Reduction and Energy Conservation

Energy-saving urea process (ACES21™)

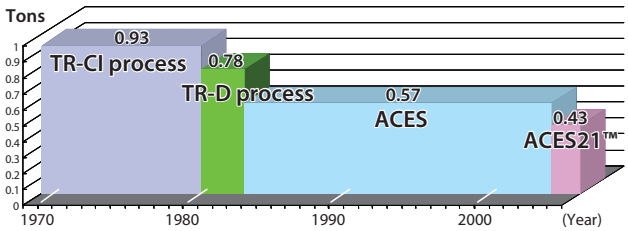
Since its establishment in 1961, Toyo has been a leader in urea technologies worldwide, designing, engineering, constructing, and commissioning almost 100 urea plants based on its own processes. The history of urea plants is the history of energy conservation. While producing one ton of urea required 0.93 tons of steam and 140 kWh of electric power in the past, the newest process, ACES21™, requires only 0.43 tons of steam (54% less) and 118 kWh of electric power (16% less) to produce one ton of urea, which greatly contributes to energy conservation and CO_2 reduction.


ACES21™ urea plant

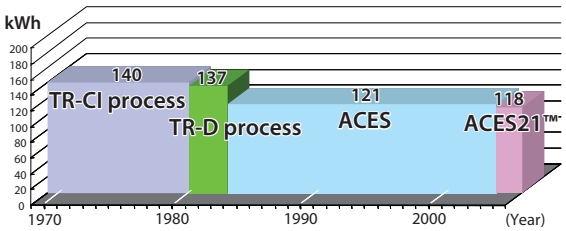

Urea product

Energy consumption per ton of urea

Steam



Electric energy



● High-activity steam reforming catalyst (ISOP)

Toyo has developed the "ISOP catalyst," which is three to four times more active than commercially available conventional steam reforming catalysts. The high activity of the ISOP catalyst promotes endothermic reaction and significantly improves the characteristics of reaction and heat transfer in steam reformers. Because of its superiority, the ISOP catalyst received two awards independently in 2000, from the Catalyst Society of Japan and from the Japan Petroleum Institute.

Replacing a conventional steam reforming catalyst with the ISOP catalyst should yield a savings of 2% in reformer fuel (about ¥50 million per year for a 1,000 tons/day-class ammonia plant). Other benefits to the steam reformer include an extension of the life of the steam reformer tubes by two to three times, and a 20–30% increase in the throughput of the steam reformer.

The commercial track record of the ISOP catalyst has been growing in the field of large-scale syngas and hydrogen production plants. For its superiority, the ISOP has been authorized by Kellogg Brown & Root (KBR), the largest licensor of ammonia processes. In recent years, the ISOP catalyst has been increasingly applied to the field of fuel cells, achieving a high share in the market in Japan.

For fuel cells

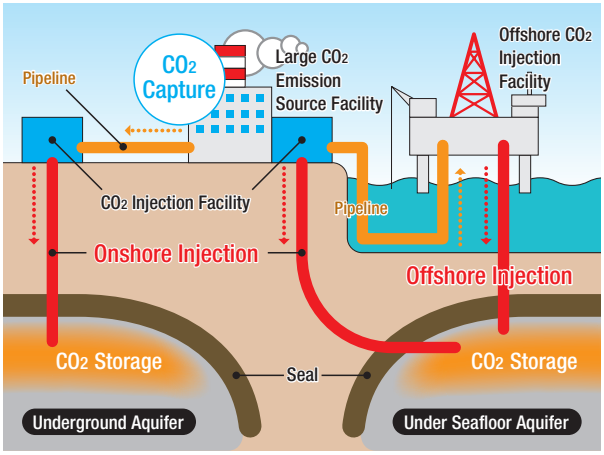
For a large-scale plant

● CO_2 capture and storage (CCS)

Carbon dioxide capture and storage (CCS) is one prospective measure for CO_2 emission reduction on a large scale.

The Intergovernmental Panel on Climate Change (IPCC) estimates in its special report, "Carbon dioxide Capture and Storage" (2005), that CCS could contribute to greenhouse gas emission reduction at a rate between 15% and 55% until the year 2100.

Toyo has participated in the activities of Japan CCS Co., Ltd., which was established in 2008 for the early realization of large-scale CCS demonstration testing in Japan.



CCS image

■ TOYO's Solutions Contributing to Recycling-Oriented Society

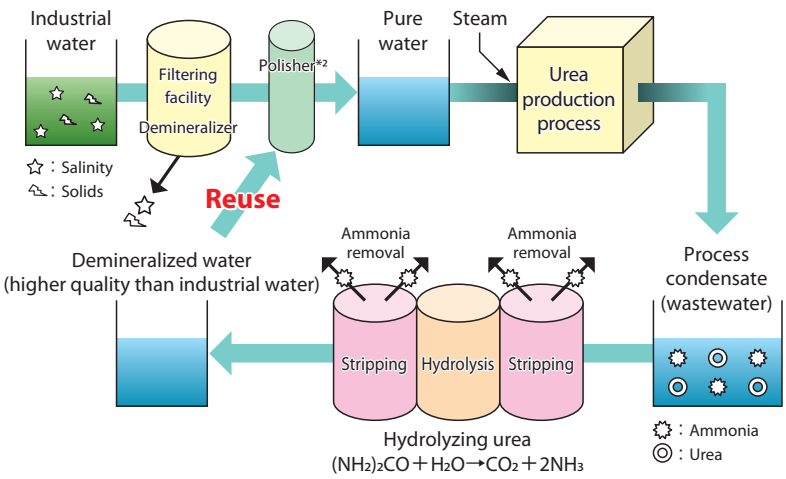
● Reuse of wastewater

The issue of water resource conservation has become more serious than ever in the 21st century.

Where serious water shortages have become obvious in the Middle East and other regions, wastewater is required to be not only treated, but also reused effectively.

Toyo's urea production process hydrolyzes urea contained in process condensate (wastewater), removes ammonia by stripping,*1 and reuses wastewater as boiler feed water, which requires a high water quality level.

*1: Stripping means to separate gas or low-boiling components dissolved in liquid into vapor phase.
*2: A polisher is a piece of equipment used to further improve the purity of demineralized water by ion-exchange resins.



■ TOYO's Solutions Contributing to Clean Energy and New Energy

● Gas to Liquid (GTL)

Gas to Liquid (GTL) is a process that converts natural gas into liquid fuels, mainly diesel fuel. The liquid fuels provide clean energy because they do not contain impurities such as sulfur.

Toyo has concluded an agreement for the joint development and commercialization of floating GTL plants with Mitsui Ocean Development & Engineering Co., Ltd. (MODEC), and Velocys Inc. of the United States.

Toyo and Velocys Inc. are jointly developing a new GTL process using "micro-channel technology," a technology to let exothermic reaction and endothermic reaction take place simultaneously in two adjacent micro-channels.

This will allow the GTL production plot area to be downsized into one-sixth of that of a conventional system, contributing greatly to the commercialization of floating GTL.

Floating GTL effectively utilizes natural gas that was difficult to exploit and oil-associated gas that was discharged into the atmosphere and flared. Therefore, floating GTL contributes to environmental improvement by reducing global greenhouse gas emissions.

Velocys Reactor using micro-channel technology

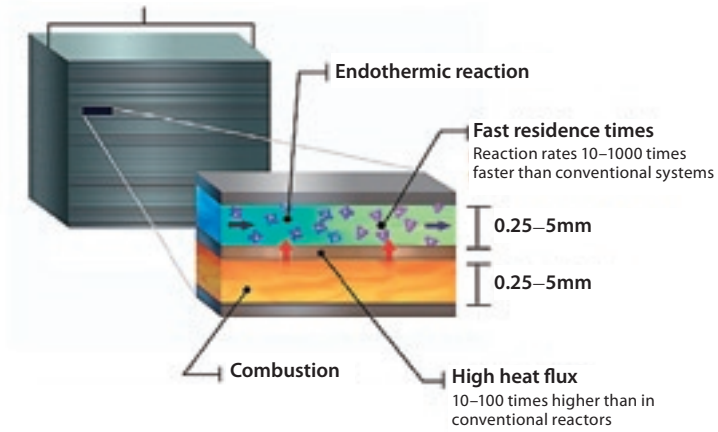
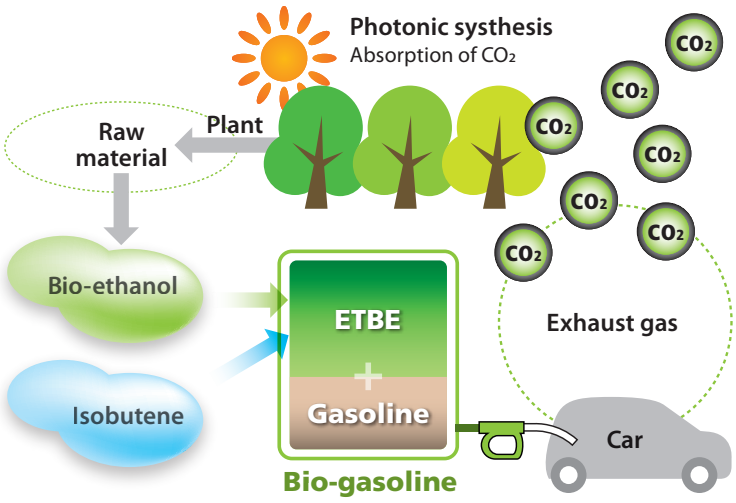


Illustration of the floating GTL (provided by MODEC)

● Ethyl tertiary butyl ether (ETBE)

Bio-ETBE is produced by synthesizing plant-derived bio-ethanol and petroleum-derived isobutene. Bio-gasoline containing bio-ETBE is supplied to ordinary automobiles at gas stations in the same manner as ordinary refilling.

When an automobile runs with bio-gasoline, a reduction of greenhouse gas emissions (mainly CO_2) from the automobile can be expected from the viewpoint of the carbon neutral concept.* The number of gas stations supplying bio-gasoline will gradually increase as permanent introduction of bio-gasoline is scheduled for 2010.



Toyo is implementing an engineering, procurement, and construction project to convert an existing MTBE (synthesized from natural gas-derived methanol and isobutene) facility to an ETBE facility for Nippon Oil Corporation Negishi Refinery. This facility will be the first ETBE commercial plant in Japan.

* According to the Kyoto Protocol, CO_2 discharged from biofuel while it is burnt is not calculated as greenhouse gas emissions, because plants, from which biofuel is produced, absorb CO_2 through photonic synthesis while they grow, and therefore CO_2 discharged as the biofuel burns does not increase the total amount of CO_2.