

Oil Refineries

Oil refineries refine crude oil to produce petroleum products such as gasoline, kerosene and diesel fuel.

Large amounts of heat energy are required during the refining process, so the refineries are equipped with heaters, boilers and other facilities. These facilities burn petroleum gas, a byproduct of fuel oil refining, releasing CO₂, SO_x, NO_x and other gases. Cosmo Oil is working to use energy efficiently to reduce CO₂ emissions, while also working in many ways to reduce SO_x and NO_x emissions.

We are also working to reduce the amount of water used in the refining process, and to make the appropriate treatment of wastewater to prevent water pollution outside the refineries.

Petroleum Refining Process

- Crude oil is heated to the boiling point of the various desired materials and divided into fractions
 - ⇒ Distillation (atmospheric distillation, vacuum distillation, etc.)
- Fractions are purified by eliminating sulfur, nitrogen and metals
 - ⇒ Desulfurization (hydrodesulfurization unit)
- The purified fractions are processed to provide added value
 - ⇒ Conversion (catalytic reforming)
 - ⇒ Cracking (catalytic cracking)
- The fractions (base materials) are mixed according to market needs
 - ⇒ Blending (gasoline mixing unit, fuel oil blending unit, lubricating oil mixing unit)

Promotion of Efficient Energy Use to Prevent Global Warming

The introduction of cogeneration facilities is one measure being taken to use energy efficiently at oil refineries. Cogeneration equipment makes possible the supply of both heat and electrical power at the same time. By using waste heat occurring from electrical generation to generate steam, oil refineries can efficiently use this energy—the process is more efficient than using electrical generation equipment alone.

Operations at Cosmo Oil provided 39,500kW at the Chiba Oil Refinery, 17,500kW at the Yokkaichi Oil Refinery, and 17,000kW at the Sakai Oil Refinery.

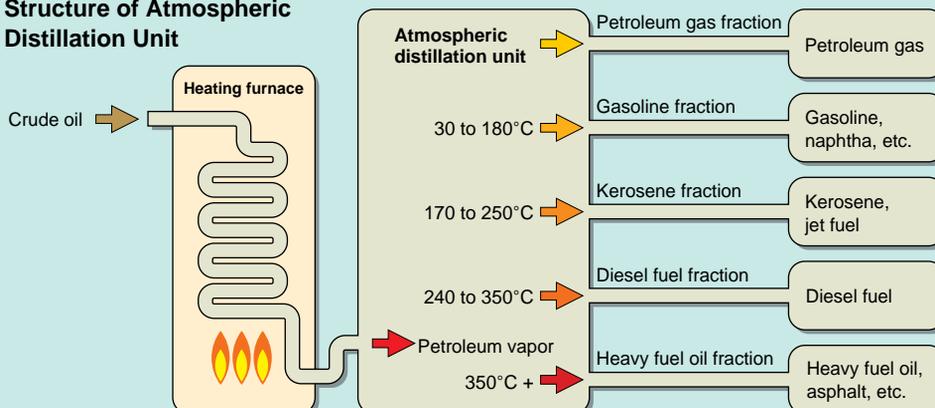
By improving existing infrastructure and by precisely controlling operations, a major reduction in CO₂ emissions is possible. For example, through the introduction of inverters, the recovery of heat from heater exhaust gas, and the careful checking and balancing of heat input and waste heat energy, conservation can be promoted.

At the Sakaide Oil Refinery, existing energy conservation programs were strengthened, resulting in major results in a very short time. As a result, the refinery was awarded the 2000 Agency of Natural Resources and Energy General-Director's Award.



Cogeneration facility at the Chiba Oil Refinery

Structure of Atmospheric Distillation Unit



Preventing Air Pollution with Flue Gas Desulfurization and Vapor Recovery

We work to reduce emissions of SOx and NOx gases by using fuels which are low in sulfur and nitrogen in our oil refineries' heaters and boilers. In addition, low-NOx burners are used to reduce the thermal NOx formed when atmospheric nitrogen and oxygen react during combustion, and flue gas desulfurization and denitration units¹ have been introduced to remove SOx and NOx from flue gases. Electric precipitators are also used to eliminate fine particulates from exhaust gases. Through these actions, Cosmo Oil's four oil refineries have all cleared regulations in the emission of SOx and NOx, and are helping in the prevention of air pollution.*



Fuel Gas Denitration unit which removes NOx from exhaust gases

For gasoline tanker trucks, the release of hydrocarbon vapors² into the atmosphere during loading is prevented through the fitting of vapor recovery units.

* Please refer to data by site on page 41.

¹ Flue gas denitration unit

A unit which removes NOx from exhaust gases. Ammonia and a catalyst are used to reduce the gas, or adsorption using an adsorption solution can be used.

² Hydrocarbon vapor

The gasified form of light hydrocarbons

³ Process wastewater

Wastewater containing oil discharged from refining facilities. At the oil refinery, water contained in the process wastewater is eliminated with an oil-water separation unit, treated by secondary processes such as active sludge treatment, and discharged.

⁴ Biotope

"Biotope" is a German term combining *bio*, the Greek word for "life" and *tope*, from the Greek *topos* or place. It is a place where plants, insects, fish and birds can exist in symbiosis. They are created by organizations, schools and companies in their local area for the purpose of environmental protection.

For the Effective Use of Water Resources and the Prevention of Water Pollution

Seawater and industrial-use water are used in oil refinery processes. Cosmo Oil strives to use as little water as possible by applying the recirculation of industrial water for cooling.

After being used for washing and other refining processes, the resulting process wastewater³ is processed in the oil-water separation unit to remove oil, then undergoes active sludge treatment and other processes to assist in water pollution prevention.

Promotion of Waste Reduction Through Volume Reduction and Recycling

The major industrial waste products generated by oil refineries are the sludge which occurs during wastewater processing, and the spent catalysts from the refining process.

Sludge is first dehydrated, then incinerated to reduce the quantity in incinerators which have been carefully checked for accordance with dioxin emission regulations.

Spent catalysts are reused through reactivation treatments, the metals in spent catalysts are recovered, or recycled as a raw material in cement. Through this the amount of waste and the cost of new catalyst purchases are both reduced.

Cosmo Oil Yokkaichi Kasumi Electric Power Plant Biotope⁴

To find a suitable application for the surplus heavy oil from the Yokkaichi Oil Refinery, the Yokkaichi Kasumi Power Plant is being constructed, with the aim of selling the electricity generated at the facility. During the environmental impact evaluation conducted prior to construction, however, it was discovered that two rare plant species—*kawatsurumo* or Wigeongrass (*Ruppia maritima* Linnaeus) and *tsutsuitomo* or Small Pondweed (*Potamogeton pusillus*)—were on the construction site. Both are aquatic plants which grow in marshes and ponds. The Yokkaichi Kasumi Power Plant is a biotope where the safeguarding of endangered species is promoted.



Protection of rare plants in the biotope