

Creating Effective, Environmentally-Harmonious Use of Energy Resources

The business of supplying petroleum-based energy is akin to the flow of a river from its headwaters to the ocean; from crude oil development in the oil-producing nations and its import into Japan, through the production of products such as fuel oil and lubricating oil in domestic refineries and distribution locally within Japan, to wholesale sales to the special agencies managing our service stations and service station consulting. We handle all of this, on an ongoing, consistent basis. The great progress of civilization in the 20th century was made possible by petroleum energy; the old century has now come to an end and a new one has begun. The relationship between people and petroleum has reached an entirely new phase. Due to the progress of technology, petroleum reserve levels have actually been increasing—but the inescapable reality is that petroleum resources are finite. If consumption continues at the current pace, the nearly unanimous prediction is that the crisis of the exhaustion of supplies will be met during the 21st century. With today's increasingly important environmental impact viewpoint, there is greater concern about the CO₂ emissions that accompany petroleum energy use. So rather than simply seeing the situation as the cut off of existing resources, there is an increasing awareness that using these resources in the first place is unacceptable. But nuclear energy and other alternatives to petroleum also have a variety of problems to be overcome, so the widespread use of new energy sources will take some time. Petroleum is indisputably the most beneficial energy resource for society at the current time.

Cosmo Oil provides a stable supply of petroleum energy, and is aware that we must

actively take on these energy challenges to be able to respond to global environmental problems. We are engaged in developing the thinking and methods needed for further development. In our production and distribution processes, as well as the end-use of our products, our major concern has been on the materials that create environmental impacts such as pollution, and in reducing waste to a minimum. These will continue to grow in importance into the future.

Global warming is a central theme for the future. We began our new management plan, Value Creation 21, in 2001, which advances our goal to become an environmentally advanced company. This sets the decrease of CO₂ as the principal objective, so that the objectives of COP*3 (the Kyoto Protocol) can be precisely met, for the realization of a sustainable society and where the harmony of the global environment and corporate activities becomes a basic position.

Our thinking on the problem of CO₂ reduction is to use petroleum in the most effective way possible. In our business activities and in every location related to our products, energy conservation will be fully understood, and a systematic approach will be made to spread the message to society about new ways of using petroleum which reduce energy usage. We will pursue methods which use petroleum energy more efficiently, and put them into practice.

There are many different facets to the business of reducing environmental impact and increasing the efficiency of petroleum, but we have begun a variety of approaches to these many issues.

*COP
(Conference of the Parties to the United Nations Framework Convention on Climate Change)
COP, begun in 1992 and held annually since, is the top-level organization of the United Nations Framework Convention on Climate Change. At COP3, held in Kyoto in December of 1997, the Kyoto Protocol was adopted, setting targets for the reduction of greenhouse gases. Compared to 1990 levels, for the period 2008 to 2012 Japan is to reduce greenhouse gas emissions by six percent, the US by seven percent, and Europe by eight percent. At COP6, held in Bonn, Germany in July, 2001, basic agreement was made on concrete curtailment measures; the details of international rules will next be established.



Effective Recovery and Transport: New Energy Development Technologies

The development of resources means that recovery is the main point—resources such as crude oil must be recovered in the most efficient way possible, leaving the least material behind while making the smallest environmental impact possible on the location where energy resources are being developed. Cosmo Oil has been independently developing the crude oil business of the UAE nation of Abu Dhabi since the 1960s. Today the company is the majority shareholder of Abu Dhabi Oil Co., Ltd.; through the ongoing introduction of new technologies, production today is stable.

In many oil fields around the world, the associated gas which emerges as a byproduct of crude oil drilling is normally burned off at the site. In the Abu Dhabi fields where we carry out our business, associated gas likewise has been burned; however, we succeeded in 2001 in the completion of introducing new technology to pressurize the gas and reinject it into the ground. This Zero-Flare technology, a first for the Japanese petroleum industry, decreases CO₂ emissions and, through the reinjection of the pressurized gas into the ground, increases recovery efficiency. The project won an award from the Abu Dhabi National Oil Company, and gained worldwide attention as the first project of its type in the Middle East.

Another new technology is Gas to Liquid, which involves the conversion of natural gas to a liquid form. Natural gas has a variety of advantages such as low levels of impurities such as sulfur, but transportation costs are expensive. Existing liquefaction technology requires large-scale facilities, and extremely low temperatures must be maintained onboard ships as well. Recently, however, chemical synthesis using catalysts has made it possible for gas to be liquefied at ordinary temperatures. We are also carrying out research and development on the liquefaction of natural gas fuel, and in the near future will begin testing at a pilot plant in Hokkaido.

The clean liquid fuels made possible by Gas to Liquid have great potential, for while there is

the possibility of stricter regulations in the future for aromatics and olefins, these new regulations will not include liquid fuels, making them the most environmentally suitable new energy source. If these facilities are constructed near gas fields, transport by existing tankers is also possible, meaning that large new infrastructure costs can be kept down, adding to energy conservation.

Thorough Energy Management, Catalyst Development, Environmental Protection Technology

Refining is energy intensive, and results in the emission of CO₂ and other environmental impacts.

At Cosmo Oil, we realize the importance of controlling materials with environmental impact, and of the need for careful system checks and detailed control of facility operations, actions which also advance energy conservation. We will be further strengthening these activities in the future. In oil refinery management, our greatest efforts have been placed into the development of catalysts which contribute to the improved quality of our products, such as through desulfurization. Technological development continues in the search for higher performance catalysts.

Regulations for the sulfur content of diesel fuel are scheduled to become stricter, mandating a level of 50 ppm. Responding to this, Cosmo Oil has developed a high-performance desulfurization catalyst which can reduce levels to a super-low 50ppm or less.

Japanese gasoline already has the lowest sulfur levels in the world, but there are discussions on stricter sulfur regulations. To respond to this, we are engaged in research into simultaneous isomerization and desulfurization during the production of isomerized gasoline. Isomerized gasoline not only contains virtually no sulfur, but the substituting of butane or other hydrocarbon materials makes possible the reduction of gasoline vapor pressure. There is also the possibility of further technology to reduce gasoline vapor emission, one of the causes of photochemical smog.

Even in the case of heavy fuel oil, we are proceeding on catalyst technology research for conversion to distillates and the highest possible levels of desulfurization.

The development of catalysts which can comply with new standards for quality is also tied to the effective use of existing facilities as well. We are also grappling with the development and application of new technologies for the reduction of industrial wastes at oil refineries.

Excess sludge¹ is a by-product of process wastewater treatment at oil refineries. Cosmo Oil has made use of our biotechnology knowledge to develop technology which dramatically reduces the amount of sludge generated. Performance evaluation at our refineries is planned. After the examination, we will begin application of this technology within our company, but also see applications for the same effluent treatment facilities not only in the petroleum industry but in other industries as well.

We are also involved in the development of technology for the measurement and remediation of oil in the soil. One major contribution in this area comes from Cosmo Oil's microbiological technology.

¹ **Excess sludge**

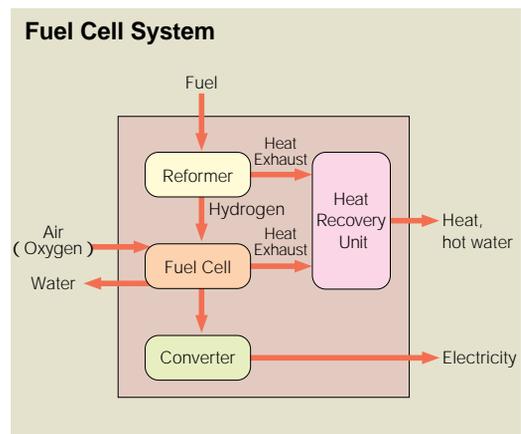
A precipitate resulting from the use of microorganisms in the activated sludge method of process wastewater treatment. Microorganisms adsorb organic materials in the wastewater, decompose them through oxidization, multiply and settle. A portion of the settled sludge can again be used in process wastewater, but the rest is disposed of as excess sludge.

² **Kerosene heat pump air conditioning unit**

Heat pumps are systems which collect heat from low-temperature materials and move it to high-temperature items. In a kerosene heat pump air conditioning unit, kerosene is the fuel to run a compressor; the heat transfer medium is repeatedly vaporized and liquefied, providing both cooling and heat.

Highly-Efficient Distributed Energy Supply

In increasing the efficiency of petroleum-based energy, one important area is the business of developing and popularizing new ways of using petroleum resources. In particular, we are placing special efforts in distributed power generation, in which electricity is generated on the spot at homes and businesses. The supply of electric power from power plants brings with it major waste through energy lost during power



transmission. With distributed power generation, not only is electricity generated directly where it is needed but power transmission loss is almost zero, heat is available in a more effective form for use, and energy savings can be realized.

For Cosmo Oil, a major priority is in distributed power supply activities which are closest to people—fuel cells for home, car and similar uses. While the mainstream approach is to use natural gas as the fuel to be converted to hydrogen, which in turn is used in the generation of electricity, we are focused on the development of fuel cell systems using liquid fuels such as gasoline and diesel fuel. We are applying our hydrogen-production catalyst technology to this system as well. We are now involved in ongoing performance evaluation testing using a test unit which represents the middle stages of our research, a butane fueled fuel cell. Performance evaluation of a micro gas turbine fueled by kerosene and intended for stores and similar locations is now being conducted.



Kerosene heat-pump air-conditioning unit²

In hotels, hospitals, etc., a cogeneration system which effectively recovers heat for use has already been developed and is in use.

Cosmo Oil has been engaged for some time on a

kerosene heat pump air-conditioning unit²; we can increase efficiency through our existing supply network in using this fuel supply in a distributed power system.

We are also proceeding with the preparations for large-scale electrical generation and electric wholesaling³ in lands adjoining the Yokkaichi Oil Refinery. It will use asphalt, which currently has a very low market value, as fuel, an important example of our goal to use petroleum in the most effective way possible.

In a fresh approach to energy diversification, we have begun LNG supply in the Chubu region of central Japan.

CO₂ Reduction at the Global Level

Discussion has been growing worldwide on the greenhouse gas reductions adopted with COP3. The goal set for Japan is a reduction by six percent from the level of 1990 by the years 2008 to 2012. To provide flexibility in achieving the discharge quantity reduction goals, the Kyoto Mechanism has been established, in which nations can use emissions volume trading⁴, CDM⁵ and JI⁶. Cosmo Oil understands the need for energy conservation in its oil refining and distribution business, but also sees the risk management implications for the future, so it has begun CO₂ emissions volume trading. In June 2001, for example, we entered into an emissions volume trading contract with a private Australian firm for the discharge rights of 2.8 million tons of CO₂. This was an exchange for the planting of eucalyptus trees and the amount of CO₂ which can be absorbed. We believe that emissions volume trading, when seen as an indirect support for the maintenance of forests, can be a major contribution to the absorption of CO₂.

In May, 2001, the new company Natsource Japan was founded by 12 major corporations as an emissions trading agency. This company is involved in consulting on CO₂ discharge reductions and the development of the trading

agency business.

Also, through mock testing on emission reduction, it is expected that important know-how on contributions to CO₂ emission reduction can be designed into the Japanese domestic system.

Becoming an Environmentally Advanced Enterprise

Using petroleum as efficiently as possible, engaging in thorough energy conservation, undertaking research and development for new ways to successfully save energy through using petroleum, and making the needed investments in management resources and managing the resulting business all directly support Cosmo Oil's fundamental business of the supply of petroleum-based energy.

In dealing with environmental problems, Cosmo Oil is not simply thinking about the costs involved. We believe that dealing with environmental problems is not a contradiction with the company's activities as a commercial entity pursuing profit, when both are proceeding toward the same goal.

³ Electrical Wholesaling

In 1995, the Electric Utilities Industry Law was revised to allow corporations with electrical generation capabilities to sell electrical power to utilities; in 2000, further revisions allow for the direct sales of electricity to major users. By using reserve electrical generating equipment and our own fuel, relatively inexpensive electricity can be supplied.

⁴ Emissions Volume Trading

Emission limits, or allotment volumes, have been set for the industrial nations; allowance has been made for the exchange of these emission limits.

⁵ CDM

(Clean Development Mechanism) CDM allows industrialized nations, which have green house gas emissions limits, to invest in emission-saving projects in developing countries, which have not had limits established, and gain credit for the savings achieved. This allows both nations to benefit: the industrialized nation can use the credits received to achieve its goals, while the developing nation acquires technical transfer and investment.

⁶ JI

(Joint Implementation) This allows for industrialized nations to exchange reduction units, the amount resulting from the reduction of greenhouse gas discharges or promotion of adsorption business activities, with related countries.