

A system that helps customers implement environmental management

Econo-Pilot:

An energy-saving control system for water pumps

Awarded the 2002 Energy Conservation Award by the Energy Conservation Center



Energy Conservation Award ceremony

Air conditioners consume tremendous amounts of energy

The world has countless office buildings and other types of structures. According to a study conducted by the Building-Energy Manager's Association of Japan, half of the energy consumed by office buildings is related to air conditioning. While the exact percentage may vary according to differences among buildings (commercial buildings, general hospitals, factories, and the like), the total amount of electricity consumed in providing air conditioning for buildings in Japan is very large. Reducing this type of energy consumption is a key to preventing global warming, and has been the focus of extensive efforts in the Group.

Air conditioning systems for commercial buildings pump water through pipes. The pipes supply cold or hot water to air conditioning units located on each building floor. The amount of pumped water varies according to changes in demand for cooling and heating. For example, to maintain the indoor temperature at a target setting during the daytime in the middle of summer, it is necessary to pump a large amount of cold water. However, it is not necessary to pump as much water at night, and in spring, fall, and winter, when cooling demand is lower.

The pumps of conventional air conditioning systems are

Helping Customers on the Environmental Front

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At the age of 32, I transferred to Yokogawa's Corporate Marketing Department in the hope of starting up new lines of business for the Company. At the time, I was exploring the possibility of helping customers on the environmental front, utilizing Yokogawa's technical resources. Environmental problems were starting to gain attention and there was interest in approaching energy conservation as a business opportunity. Since then, I have had many valuable experiences and have had the good fortune to meet many people in the course of activities such as starting up new energy conservation ventures. The development of the Econo-Pilot energy conservation system and the receipt of the Energy Conservation Award are the fruit of the intensive efforts of many people who recognized the importance of environmental problems, especially energy conservation issues.

operated at high pressures, so that they always satisfy the high pumping pressure required for peak cooling demand in the middle of summer. As a result, these systems waste enormous amounts of energy over the course of a year. Econo-Pilot is designed to minimize the use of very high pumping pressure so as to eliminate wasteful energy use.

Developed to be simple, inexpensive, and low-risk

It is important to realize that only a few customers have the budgetary flexibility to be able to replace an existing air conditioning system with a new, high-efficiency energy saving system. Therefore, we developed Econo-Pilot so that it could be installed easily, inexpensively, and with low risk, while allowing the customer to anticipate a significant reduction in electricity consumption.

Econo-Pilot optimally controls the pumping pressure according to changes in the flow rate by means of a STARDOM controller. This controller has data processing capability on par with a personal computer. Optimal pressure control eliminates the unneeded energy consumption incurred when high pressure is maintained at all times, thereby significantly reducing the pump's electricity consumption. The actual reduction in percentage terms varies depending on factors such as the type of air conditioning system in place and the type of pump control system used before Econo-Pilot is installed. One customer reported an astounding reduction of 89% over the course of a year. In some buildings, the cooling system and heating system are separated. To address this market, in February 2004 we introduced a model which allows a single controller to simultaneously control two pump systems. This reduces installation costs and installation space requirements.

The benefits of collaboration

In February 2003, Econo-Pilot was awarded the 2002 Energy Conservation Award by the Energy Conservation Center. It is not an exaggeration to say that we were able to receive this award thanks to collaboration among many people, both inside and outside of Yokogawa. Econo-Pilot was based on technology jointly devised by Yokogawa together with Asahi Industries Co., Ltd. and the First Energy Service Company, Ltd. It was developed and demonstrated through a joint research project with NEDO (New Energy and Industrial Technology Development Organization), after which various functions (e.g., function for viewing the effectiveness of energy conservation) were incorporated to complete the final product. Within Yokogawa as well, the Econo-Pilot product development effort represented the joint work of the System Products Division, Corporate Marketing Division, General Affairs Department, Legal Department, Industrial Solutions Business Headquarters, YMF Kofu Plant, and other business units. The Group will continue working to make energy conservation solutions and a variety of environmental solutions widely available, in order to build on the success of Econo-Pilot while supporting the environmental management initiatives of customers, and for the benefit of the global environment.

INTERVIEW A customer's perspective

“First we only half-believed it, but now we are simply amazed”

Toshiaki Yoshikawa

Manager, Safety Management Center
Management Department, Tokyo Dome Hotel



Ever since opening in June of 2000, the Tokyo Dome Hotel has strived to improve its energy conservation through the use of various systems, including cogeneration systems, ice heat storage systems, and district heating and cooling. We decided to try the Econo-Pilot system because we had heard that by itself it could cut pump power consumption by some 80% without a large capital investment. We have been running three Econo-Pilot units since April, and the reduction in electricity consumption is better than we expected. In addition to cutting our electricity bill, Econo-Pilot also helps reduce CO₂ emissions, so I am very glad we decided to install it.



Assessing and Managing “Eco-Balances” to Improve Resource/Energy Efficiency

The Yokogawa Group assesses various “eco-balances” quantitatively and implements environmental impact reduction activities for building a sustainable society.

Understanding Environmental Impact as a Whole

In order to build a sustainable society, it is important to reduce environmental impact over the course of resource extraction, raw materials production, product development and production, distribution, consumption, and disposal. In order to do this, it is necessary to assess how the environment is impacted and at what stages over the entire course of business activities. Environmental impact must then be minimized based on this assessment.

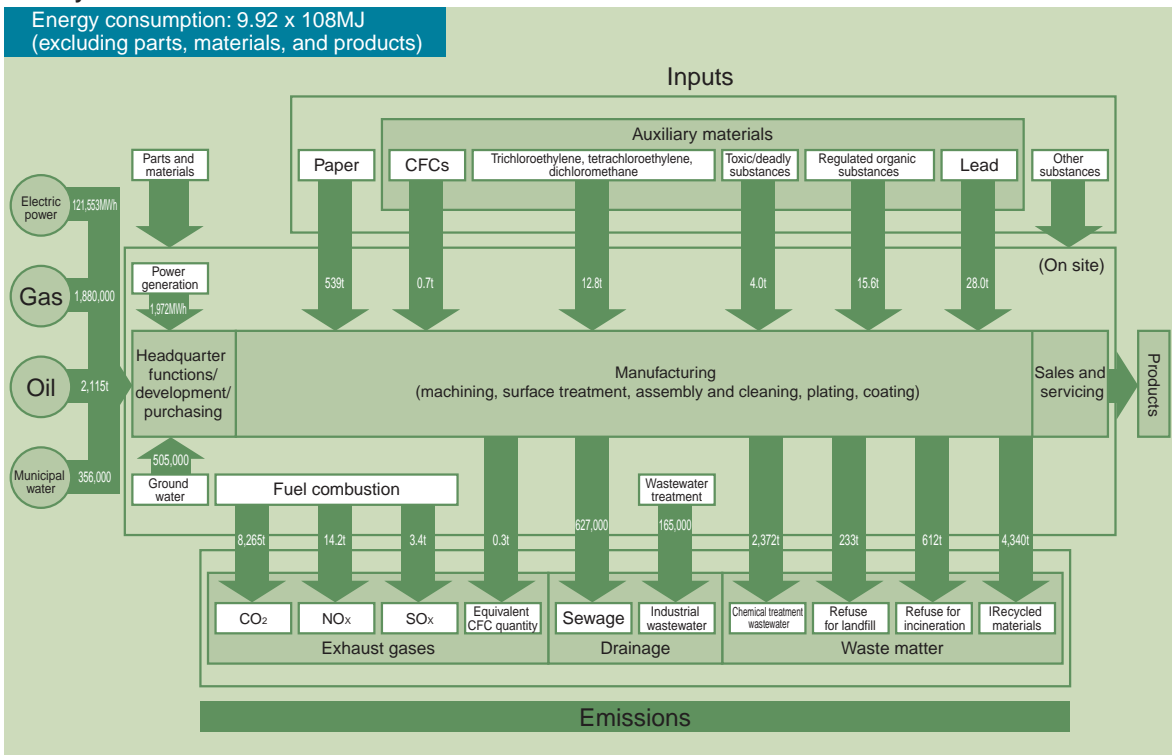
The Group is expanding its business operations in the areas of manufacturing and selling process measuring equipment and control systems, electric meters, measuring instruments, and other products. These activities require parts and materials, energy, and other resources on the input side, and generate exhaust gases and waste products in product manufacturing processes. We believe that assessing and managing the “eco-balances”^{*1} of the inputs and outputs in our business activities are the first step in enabling improvements in resource/energy efficiency and preventing global warming, so as to build a sustainable society.

Fiscal Year 2003 Overview

The graph below illustrates the eco-balances in fiscal year 2003. In fiscal year 2002, the data sources used were 19 sites with ISO14001 certification. For fiscal year 2003, this list was expanded to 46 Yokogawa Group companies and 53 sites, reflecting the Group’s global expansion.

^{*1} **Eco-balance:** Annual balance between inputs (consumption) and emissions of energies and resources excluding parts, materials, and products.

Fiscal year 2003 Eco-Balances



Using Environmental Burden Indicators to Assess Overall Environmental Activities

The Yokogawa Group continuously collects information on the types and amounts of substances that have an environmental impact. Collected and assessed data are converted to an environmental burden indicator for use in developing environmental burden reduction plans.

Yokogawa's Eco Point Environmental Burden Indicator

One of the objectives of environmental management is to reduce the environmental impact of business activities and to create new value through collaboration with employees and society. In order to assess the success of these measures, it is important to quantitatively understand the environmental impact (environmental burdens) of business activities and to quantitatively analyze how much economic value has been generated relative to that environmental burden.

For example, a factory uses electricity, raw materials, and other resources as inputs to manufacture products. In addition, it emits exhaust gas, waste, and the like into the surrounding environment. In order to assess the environmental impact of the factory, the individual environmental burdens of the inputs and outputs are measured. Next, these data are inserted into a formula to quantitatively determine the overall environmental impact of the factory.

The Group has established an environmental burden indicator called eco point (EP). This indicator allows a variety of environmental burdens to be assessed using a common numerical indicator. EP is calculated by the following formula.

$$EP = \sum \{ (*1 \text{ LCA} *2 \text{ LCA inventory analysis result}) \times (*3 \text{ Eco factor}) \}$$

The greater the EP value, the greater the environmental impact.

The eco point score for fiscal year 2003, based on the energy consumption as well as input and emission amounts at 18 certified sites, was 36,976EP. This score represented an environmental burden reduction of 1,732EP compared to the previous fiscal year. Starting in fiscal year 2003, we began collecting data for the entire Group. The eco point score for the entire group was 41,289EP.

Environmental Management Indicator

Currently, a variety of environmental management indicators are being explored. Under these conditions, the Group has selected environmental burden efficiency as an environmental management indicator that expresses the reduction in the environmental burden and progress in environmental management.

Environmental burden efficiency is calculated using the following equation as an indicator to measure how efficiently environmental management generates economic value for a specific environmental burden.

$$\text{Environmental burden} = \frac{\text{Gross profit on sales}}{\text{EP}}$$

Environmental burden efficiency for fiscal year 2003 was 1.95, based on data from 18 certified sites. This figure represents an improvement over the previous year. Factors leading to this improvement include the effects of environmental burden reduction activities at the individual sites, combined with an increase in gross profit on sales and other factors. The environmental burden efficiency for the Group's 46 companies and 53 sites was 3.16.

Terminology

*1 Life-cycle assessment (LCA):

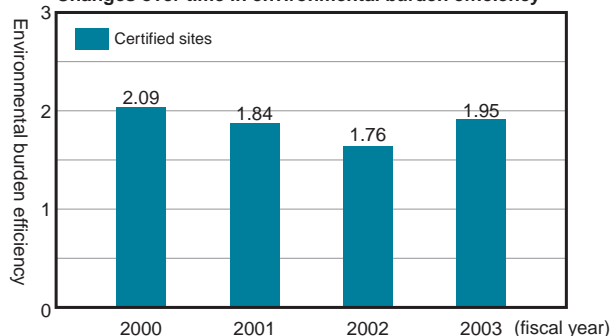
LCA is an assessment which comprehensively evaluates the environmental impact of a specific product throughout its lifecycle, from material purchase, manufacture, and distribution to its use and disposal.

*2 Inventory analysis:

A technique which uses LCA data to analyze levels of emissions into the atmosphere and hydrosphere (ground water) from supplied power, natural gas, and chemicals as well as emitted substances; and which also calculates emission amounts (inventory) by category (global-warming gases, ozone-depleting potential substances, etc.).

***3 Eco factors:** Weighing factors established to evaluate the environmental impact of the individual emitted substances determined through inventory analysis.

Changes over time in environmental burden efficiency



Applying Environmental Accounting to Realize Optimal Environmental Management

In fiscal year 2003 Yokogawa applied environmental accounting to 18 sites, including some sites outside Japan. The results showed a continued improvement over the preceding year, as the environmental activities implemented earlier began to take effect.

Environmental Accounting for Fiscal Year 2003

The table below shows the environmental accounting of the Group for fiscal year 2003.

Environmental Protection Investments

Environmental protection investments totaled 56 million yen. The main investments were for the new YMF Komine plant and the YMF Kofu plant.

Environmental Protection Costs

Expenditures on environmental protection totaled 1,008 million yen, a year-over-year increase of 30%. The main expenditures were soil cleaning expenditures for the site of the demolished YMF Moroyama plant and the Yokogawa Electric Hachioji plant, and soil survey expenditures for the YMF Koriyama plant, YMF Haramachi plant, YMF Daian plant, and YMF Ashikaga plant, which were closed as part of a rationalization of our Japan production system.

Through the last fiscal year, expenditures with long-term effects (soil survey expenditures and the like) were counted as investments. Starting this fiscal year, however, they are expensed in keeping with our financial accounting.

Economic Effects of Environmental Protection Measures

Economic effects totaled 1,541 million yen, including 796 million yen for “reduced materials costs due to the development of environmentally friendly products.” Going forward, we will develop even more environmentally conscious products.

Environmental Management Indicator

The Group has established the following indicator in order to integrate economic and environmental protection activities:

●Eco-efficiency = Economic effects / environmental protection costs

Fiscal year 2003: $1.5 = 1,541 \text{ million yen} / 1,008 \text{ million yen}$ The historical changes in this indicator are shown below.

Environmental Protection Costs (in millions of yen)

Category	Main initiatives	Investment	Expenditure
(1) Environmental protection costs for reducing environmental burden occurring within areas of operations due to production and service activities			
(1)-1 Pollution prevention costs	Using alternative cleansers in place of toxic substances Preventing pollution of air, water, and soil	10	414
(1)-2 Global environmental protection costs	Efficient use of energy (energy-efficient buildings and equipment, co-generation, solar power generation), using alternative cleansers in place of HCFC	41	74
(1)-3 Resource environmental protection costs	Reduction of paper use (digitization of documents), expansion of recycling, reduction of waste disposal and waste treatment	5	174
	Subtotal	56	662
(2) Costs for limiting environmental impact occurring downstream or upstream from areas of operations due to production and service activities	Green purchasing	0	7
(3) Environmental protection costs in management activities	Development and deployment of EMS, environmental education	0	273
(4) Environmental protection costs in R&D activities	Development of environmentally friendly products, lead-free soldering processes, and cleaning methods using safe alternatives for toxic substances	0	18
(5) Environmental protection costs in community activities	Promotion of nature preserves and greening, local community activities, and transparency of environmental information	0	48
(6) Costs of addressing damage to the environment	-	0	0
	Total	56	1,008

Capital Expenditures and R&D Costs (in millions of yen)

Item	Description	Amount
Total capex for period	All capex including environmental expenditures	19,544
Total R&D costs for period	All R&D costs including environmental expenditures	26,865

* Data were taken from eighteen ISO14001-certified sites (see page 13).

Fiscal year	2001	2002	2003
Sites	18	19	18
Eco-efficiency	1.07	2.1	1.5

Note: Higher efficiencies indicate improved environmental management.

Environmental Accounting Standards

The Group's environmental accounting standards comply with the Environmental Reporting Guidelines (Fiscal Year 2002 Version) published by the Ministry of the Environment of Japan, and are supplemented by the following.

(1) Environmental Protection Costs

The straight-line method is used to calculate capex-related depreciation in each term. The maximum depreciation period is five years counting from the fiscal year in which an investment is made.

(2) Environmental Protection Effects

a. Environmental protection effects are analyzed by looking at how much an environmental burden is reduced or avoided, in terms of physical amounts. The effects are calculated by totaling these amounts and comparing them to the amounts that would have occurred if the

environmental protection measures had not been implemented.

- b. The overall environmental protection effects of capex are totaled over a maximum of five years, counting from the fiscal year in which an investment is made.
- c. The overall environmental protection effects of environmentally friendly products are totaled based on factors such as the reduction in CO₂ emissions during the service life of the product.

(3) Economic Results from Environmental Protection Activities

- a. The results to be totaled should be the actual income and outflows, as well as the assessed monetary value for environmental risks that were avoided.
- b. The outflow reductions resulting from capex benefits are to be applied over a period of five years, starting from the fiscal year in which an investment is made.
- c. The outflow reductions resulting from the benefits of environmental protection measures other than capex are to be the actual reductions, as compared to what the outflows would have been if the environmental protection measures had not been implemented. These reductions are to be applied over the one-year period in which the measures are implemented.

Environmental Protection Effects

Description of Effect	
(1) Environmental protection effects occurring within areas of operations	
Item	
•Reduction in amounts of toxic substances used	Trichloroethylene, tetrachloroethylene, etc.
•Reduction in environment-polluting substances	reduced by 13.1 tons
•Reduction in CO ₂ emissions due to efficient energy use	CO ₂ reduced by 1,152 tons (power consumption 2,721 MWh, etc.)
•Reduction in HCFC use	HCFC, etc. reduced by 6.0 tons
•Reduction in paper use	Paper reduced by 58 tons
•Reduction in waste	Waste reduced by 96 tons (recycling, etc.)
•Increase in recycling	
(2) Upstream and downstream environmental protection effects	
•Reduction in CO ₂ emissions resulting from energy conservation using environmentally friendly products	29,072 tons (based on emissions over the service life of environmentally friendly products)
•Packaging improvements	Packaging reduced by 10 tons
(3) Other environmental protection effects	
•Reduction in CO ₂ emissions resulting from resource conservation using environmentally friendly products	519 tons (materials saved during the manufacture of environmentally friendly products)
•Community activities	
•Local community activities	

Economic Effects of Environmental Protection Measures (in millions of yen)

Description of Effect	Monetary Value
Reduction in expenditures due to reduced use of toxic substances and risk avoidance	432
Reduction in expenditures due to energy conservation, reduced use of HCFC, etc.	118
Reduction in expenditures due to reduced use of paper and water, and reduced waste	88
Income from asset sales	
Subtotal	638
Reduction in expenditures due to packaging reuse, etc.	9
Reduction in materials expenditures due to development of environmentally friendly products and R&D effects	¹ 796
Education effects and reduction in education expenditures	² 98
Subtotal	903
Total	1,541

Sales of Environmental Business Products and Total Sales (in millions of yen)

Item	Description	Amount
Sales of environmental business products	Sale of products and systems (for the term) that exclusively contribute to reduction of social and environmental burdens, including environmental business products (water purification, atmosphere protection, waste treatment, etc.)	17,864(6.9%)
Total sales for period	Grand total	257,499

¹ The economic value of resource savings due to the use of environmentally friendly products is calculated as follows: (reduction in materials costs in new product compared to old product) x (annual sales volume). In addition, the corresponding development costs are applied as the added value of the R&D investment.

² The corresponding education costs as well as reductions in outside training and consultant fees are applied as the added value of the environmental education investments.