

Environmental Performance

1. Green Design

Our Environmental Assessment Standard for Product Design stipulates how to assess the performance, cost, safety, and use of common parts, and it complements the conventional Design Review Standard. Engineers in the product design departments can freely access by PC the Environment-friendly Product Design Guideline and other engineering standard tools of Yokogawa, thus facilitating environment-friendly design and engineering.

1) Design Support Tools

1-1) Environment-friendly Product Design Guideline

Defines mandatory rules regarding environment-friendly product design. This guideline applies to all product design plans without exception. Design aspects may include:

- Design of long-life products
- Design of energy-efficient products
- Design of resource-efficient products
- Selection of materials and parts
- Recycling and disposal design
- Selection of machining and assembly methods

1-2) Environmental Assessment Standard for Product Design

Defines:

- The who, what and when of environmental assessments
- Detailed assessment items and standards
- Pass/fail standards and handling of failed designs

According to this standard, every product design plan, without exception, is assessed at three stages of the design process (initial, mid, and final design stages) in order to check the degree of reduction of environmental impact for 29 items over all phases of the product's lifecycle from material procurement, manufacturing, distribution, and use, to disposal. The overall target reduction is 25% (from Yokogawa's previous model or a competitor's equivalent).

1-3) Product Design Assessment Record Form

This is used to record the progress of a series of product assessments.

1-4) Standard for Products Containing Toxic Substances

Stipulates the use of toxic substances contained in products including packing materials. This standard categorizes toxic substances into prohibited substances and reduced-usage substances, and controls usage.

2) Database of Standard for Eco-material Selection

Product design departments are now building databases containing standards for eco-material selection. These will be used during each product assessment based on the Product Design Assessment Record Form, to check whether any of the parts for the product contain a prohibited substance that affects the environment.

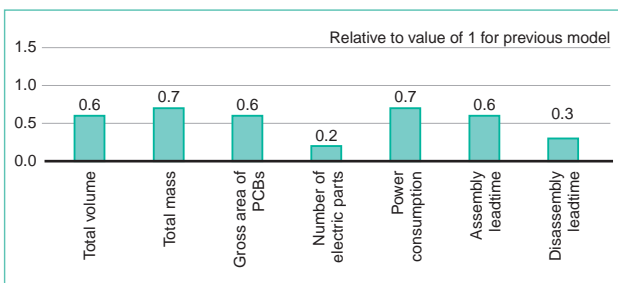
3) Examples of Benefits of Green Design

Example 1: PZ4000 Power Analyzer

The PZ4000 power analyzer, a new design of power meter, accurately captures the transient statuses of an electric power supply. Measurements that have traditionally required various instruments including a high-frequency power meter, waveform monitor/analyzer, current probe, and isolating amplifier, can now be performed by the PZ4000 alone. This has greatly reduced the number of electric parts, disassembly leadtime, gross area of PCBs, assembly leadtime, total volume, total mass, and power consumption in comparison to earlier models. The PZ4000 achieved an improvement rate of 76% in the assessment!



PZ4000 Power Analyzer



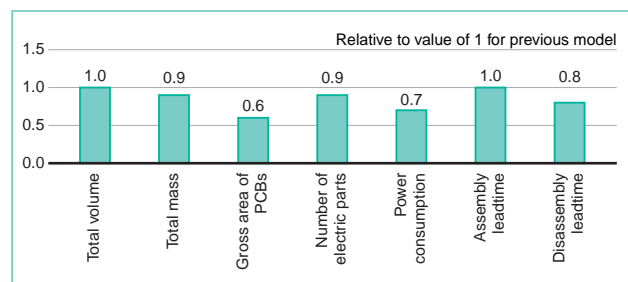
Comparison of New PZ4000 and Combination Set of Wide-band Power Meter and Waveform Monitor/Analyzer

Example 2: Console of CENTUM CS 3000 Production Control System

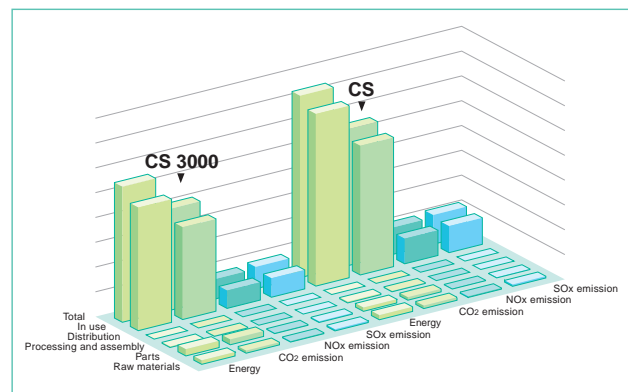
The number of modules, gross area of PCBs, and power consumption were all reduced in a console of the CENTUM CS 3000 production control system, while retaining the same size and shape as the console of the earlier CENTUM CS to allow side-by-side installation. Also, the materials used in parts are clearly named in the instruction manual to allow materials to be easily identified during disassembly, thus facilitating recycling and safe disposal. As a result, the assessment indicated a 48% improvement from the previous console. Most remarkably, the lifetime environmental impact (CO₂ emission equivalent) over 10 years of use from the time of production of materials and parts, was slashed by 25%.



CENTUM CS 3000 Production Control System



Comparison of New CENTUM CS 3000 and CENTUM CS



Comparison of CO₂ Emission for New CENTUM CS 3000 Console and CENTUM CS Console

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2. Green Production

Environment-friendly production is possible only if environment-friendly design is also considered in the production facilities, processes and lines. Yokogawa therefore implements Environment, Quality, Delivery, Cost (E+QDC) activities to minimize the use of energy and resources and thus help protect the environment. These E+QDC activities involve avoiding waste at all stages, from order reception to delivery, in order to deliver high-quality products quickly and at low cost, as well as decrease the impact on the environment.

Based on the concept of E+QDC activities, Yokogawa revised the Production Process Engineering Standard and the Production Facility Engineering and Employment Standard to include environmental considerations. These standards are linked to the Yokogawa production system, NYPS, and extend across all Yokogawa group companies worldwide to achieve environment-friendly production throughout the Yokogawa group.

1) Production Process Engineering Standard

This defines criteria for minimizing the environmental impact when constructing a manufacturing line; in fact, the manufacturing process is designed at the same time as the product itself, from the outset of the product planning phase. This approach helps us to meet quality, delivery, and cost (QDC) targets, as well as save resources and energy.

Also, through the NYPS system that was set up in 1981 to satisfy diversifying customer needs, all factors that prevent QDC targets are eliminated, thus helping to achieve the “E” targets and to conserve resources and energy.

2) Production Facility Engineering and Employment Standard

This standard defines eight categories of environment-friendly activities, including compliance with laws, prevention of environmental impact in case of abnormality, ease of salvaging, energy efficiency, and long-term usage. Its objectives are:

- (1) In the manufacturing phase, select eco-materials and eco-parts.
- (2) During use, the products must consume little energy and there must be no effect on the environment, even in case of abnormality.
- (3) At disposal, products must be easy to recycle.

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Assembly Line

3) Some Examples of Green Production

Example 1: Hot-water-circulating Parts Cleaner

This cleaner was developed by Yokogawa to replace organic chlorine solvents (e.g., trichloroethylene), which is an environmentally harmful substance that is subject to strict controls. Since the cleaner uses only hot water, the running costs are just one fourth, yet the cleaning is just as effective. Also, the closed recycling circulation system, in which machine oil is recovered from the cleaning water and no waste water is discharged, has decreased the impact on the environment. This hugely popular invention is harmless to humans, does not use hazardous materials, and improves the safety and cleanliness of the working environment.



Hot-water-circulating Parts Cleaner

Example 2: Wastewater Treatment Plant

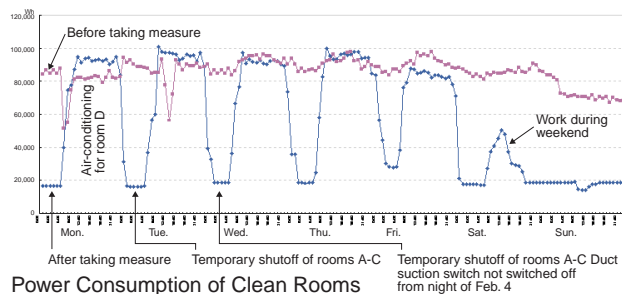
This system renders harmless the wastewater from circuit board printing and soldering processes before discharge, and recycles the separated and precipitated sludge. The merits are many: plant area is reduced to two thirds; dual-redundant underground tanks allow on-line inspection; wastewater discharge is reduced by circulating the recycled cleaning water; and the fractional treatment depends on the intake route. Especially, sludge is filtered by a state-of-the-art micro-flow filter, and then undergoes dehydration compression by a recycling company to produce pellets for copper refineries, which are recycled for ground copper and copper slug (a material for cement), thus achieving zero emission.



Wastewater Treatment Plant

Example 3: Energy-efficient Production Line (by Means of Energy Monitoring Using Power Monitor)

To reduce electric energy consumed, it is necessary to accurately measure power consumption at each place and for each purpose. Using power monitors, we monitored and analyzed the power consumed of 28 air-conditioners used in clean rooms at the Kofu plant. The results showed that air-conditioning is unnecessary except for ventilation during nighttime and weekends and so we stopped running them, thus halving power consumption. Similarly, we cut off the stand-by power to 20 thermostatic chambers in assembly lines and hence greatly reduced the power consumption.



4) Handling of Toxic Substances – Implementation of Pollutant Release and Transfer Registers (PRTRs)

Regarding the environmental impact and safety of chemical substances used in production processes, such as agents and paints, we have been striving to prohibit use of those substances, reduce the amount used, or replace such substances by safe substances.

In response to a request from the Electronic Industries Association of Japan, the Pollutant Release and Transfer Registers (PRTRs) were carried out in June 1998 in Yokogawa. From among 179 substances controlled under the PRTR system (5 industry-specific substances in addition to the 174 substances specified by the Environment Agency), Yokogawa uses only 10 substances (including 2 industry-specific substances marked with asterisks below) that must be reported. Those are:

1. Cyanides
2. Toluene
3. Xylene
4. Trichloroethylene
5. Tetrachloroethylene
6. Dichloromethane
7. Barium compound
8. Formaldehyde
9. *Hydro-chlorofluorocarbons (HCFCs)
10. *Lead solder

Environmental Performance

3. Green Plants

Production processes involve various environmental issues including the global warming effect caused by CO₂ emitted from combustion of fossil fuels, air pollution and acid rain due to emission gases, industrial wastes, and water pollution. Yokogawa is therefore committed to improving production processes and work procedures.

1) Energy Efficiency

Our production plants have been increasing the efficiency of energy usage by using energy-efficient production technologies and facilities, by implementing careful energy control, and so on. Furthermore, energy-efficient building designs and co-generators are now used for office buildings. As a result, since 1991 the Headquarters have decreased the purchased power per unit floor space by 17.1%, and the Kofu plant has decreased the power consumption per unit of retail price-based sales by 33.6%. For the total of the Headquarters, Kofu plant, and Komine plant, the amount of CO₂ emitted from energy consumption has been decreased by 5.4% from that in 1991.

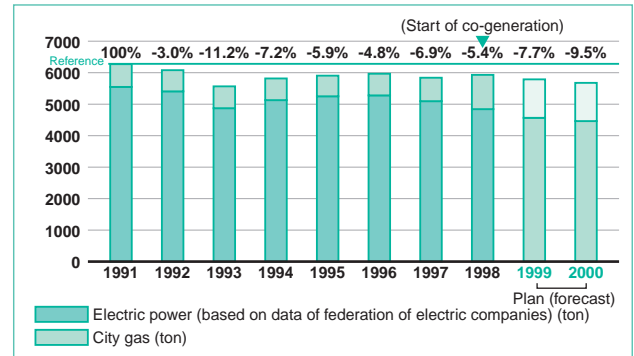


Energy-efficient, New Head Office Building

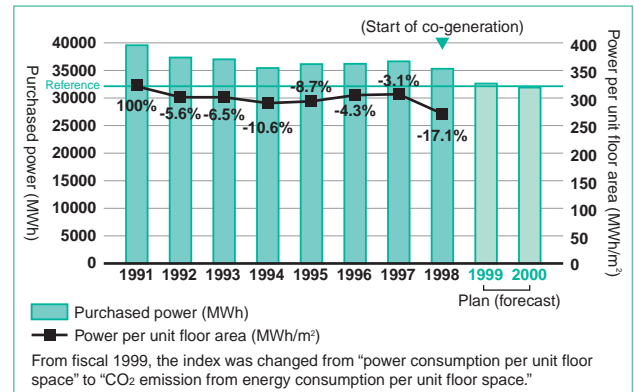


Co-generator

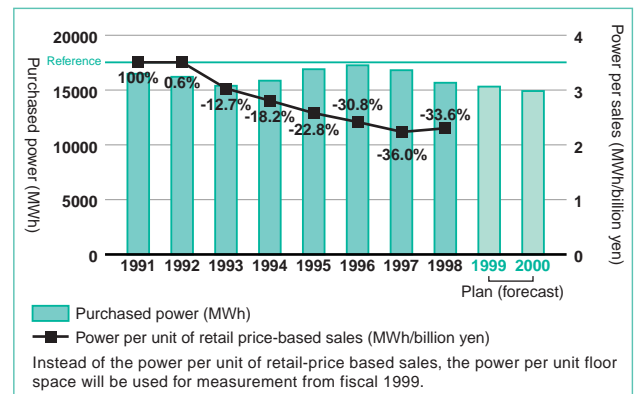
CO₂ Emission from Energy Consumption (equivalent carbon weight) at Headquarters, Kofu Plant, and Komine Plant



Reduction of Purchased Power at Headquarters



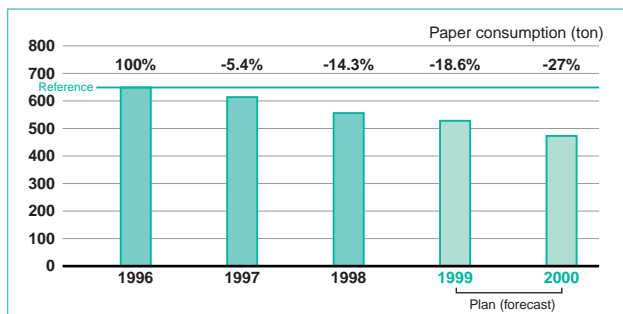
Reduction of Purchased Power at Kofu Plant



2) Reduction of Paper Consumption

Regarding forest resources, we are progressively reducing paper consumption and using recycled paper for office-use, business cards, and publications. This is being done by extensive computerization, such as by CD-ROM documentation and an in-house on-line system. Paper consumption has been reduced by 14.3% since 1996.

Reduction of Paper Consumption at Headquarters and Kofu Plant



3) Reduction of Waste Except Paper and Examples of Measures Taken

To achieve zero waste, we are trying to prevent the generation of waste, and to recycle the waste that is produced. Total waste was reduced to 1,350 tons, a 29% reduction from 1995.

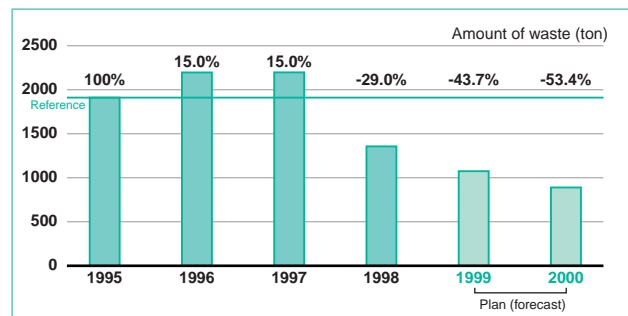
Example 1: Reduction of Waste Alkali Liquid

By developing a waste alkali liquid condensing system utilizing boiler waste heat, the amount of waste alkali liquid has been decreased drastically.

Example 2: Thorough Fractionating of Waste

Plastic and wood pieces with metal attached used to be pulverized and used as ground-fill, or simply burnt, with the metal left attached in either case. However, such waste is now disassembled and the respective components recycled.

Reduction of Waste (Except Recycled Amount) at Headquarters, Kofu Plant, and Komine Plant



The Headquarters are working to achieve “zero earth-filling waste” by July 2000. The same activities will progressively be rolled out at the Kofu plant, the Komine plant, and group companies that have obtained ISO14001 approval.