Green Product Development

Promoting Eco Design of products that are eco-friendly throughout their life cycle.
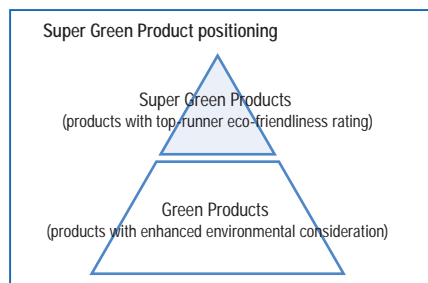**Preparing to offer Super Green Products with top-level environmental characteristics by fiscal 2006 year-end.**

Policy

We will work with our business partners to promote Group-wide Eco Design of all products aimed at developing products that reduce the environmental burden throughout their life cycle. We will accelerate our activities toward clearly defined goals.

Fujitsu Group Environmental Protection Program (Stage IV) targets

All the departments to produce their own super green products furnished with top environmental elements by the end of fiscal 2006.

Super Green Product positioning

Super Green Products
(products with top-runner eco-friendliness rating)

Green Products
(products with enhanced environmental consideration)

Super Green Product development

Our development efforts target hardware, electronic components and semiconductors for information and telecommunications devices to commence development in fiscal 2004.
• A Super Green Product is a product or system with an eco-friendliness rating of "top-runner"* or better in any of three areas: energy saving, 3R design/technology or chemical substance content. Official commendation by an independent organization and third-party certification is requisite in the areas of "measures to reduce environmental burden" and "Eco labeling,"

* Meets one of six eco-friendliness standards: World's 1st, nation's 1st, industry's 1st, world's smallest, nation's smallest or industry's smallest

All Fujitsu-brand products to be made free of specified hazardous substances by the Group by the end of fiscal 2005.

Fujitsu Group-specified hazardous substances

Prohibited substances	Use in products prohibited	27 substance groups
Phase-out substances	Use in products prohibited after prescribed time limit	4 substance groups

Elimination of hazardous chemical substances

As exemplified by the European WEEE/RoHS Directive, nations worldwide are moving to regulate the use of hazardous chemical substances in electric/electronic devices. We have responded quickly to this movement by designating Fujitsu Group-specified hazardous substances

Prohibited substances: 27 substance groups controlled by international and national laws and regulations, including polychlorinated biphenyls (PCBs), asbestos and ozone-depleting substances

Phase-out substances: 4 substance groups controlled by the RoHS Directive, i.e. cadmium and related compounds, hexavalent chromium compounds, lead and related compounds, mercury and related compounds

Structure

1. Green Product evaluation mechanism

Step 1	Evaluation based on Product Environmental Assessment Regulations (43 criteria)
	Total evaluation points: over 90

Step 2	Evaluation based on Green Product Evaluation Regulations (common standards and product category-specific standards)
	Product meets all relevant criteria.

Green Product — Environmental emblem

Criteria system

Common standards (27 items)

Category-specific standards

Electronic parts	(semiconductors, PCBs)	5 items
Portable/small products	(cellular phones, hard disks)	6 items
Medium-sized/large products	(servers, finance-related terminals)	6 items
Personal computers		14 items
Printers	(all sizes)	23 items

We have conducted environmental assessment of products since fiscal 1993 with a view to promoting eco-friendly product design. In 1998 we established the Green Product Evaluation Standards (see pages 65-66), which we revise continuously, to enhance our products' eco-friendliness further. Products scoring 90 points or above in the environmental assessment and receiving passing marks in all Green Product Evaluation assessment items are designated Fujitsu Green Products. These products display Fujitsu's original Eco Mark on their packages and in product catalogs.

* Each consolidated subsidiary has set its own standards pursuant to Fujitsu's Green Product Evaluation Standards to promote development of Green Products.

2. "VPS (virtual product simulator)/Eco Design" design support tool

We have linked a 3D CAD design system with a variety of environmental burden-related databases to develop a system capable of simulating a product's environmental burden any number of times for any stage of its life cycle. The system both enables us to select materials with a lower environmental burden and provides the engineers responsible for product development with a calculated reclamation rate at the time of recycling, validation of product degradability, a calculated degradation time, and extensive additional data to support eco-friendly design development. We employ this system as an LCA support tool in developing Green Products (application examples on pages 28–29).

3. Eco Design promotion organization

The Environment Committee's Green Products Committee (page 14) plays a key role in Eco Design promotion. Its members, comprising management personnel from every Fujitsu and Group company division, meet regularly to engage in deliberations and decision-making concerning Group-wide measures to make products eco-friendly. The Committee also cooperates with the Green Procurement Committee, which promotes procurement of green components for use in products, as well as with the Hazardous Substance Phase-Out Committee, which works to reduce the chemical substance content of our products.

Fujitsu Environmental Protection Program (Stage III) targets

- Product Development: All newly developed products to be "Green Products" by the end of fiscal 2003
- Lead-free Solder: Abolishment of lead solder from products manufactured by Fujitsu Group must be achieved by the end of fiscal 2003.

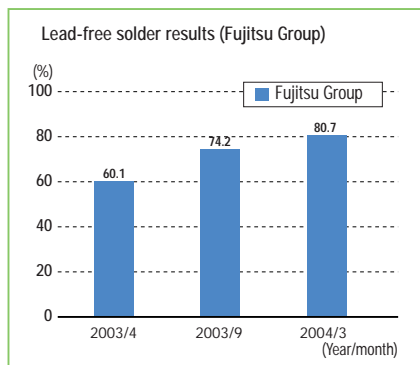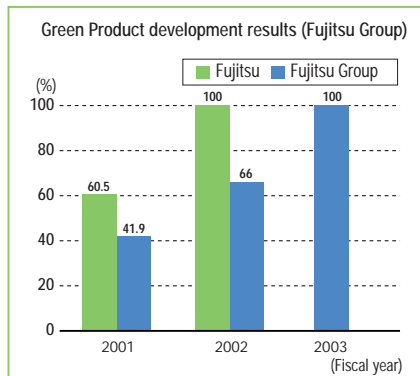## Results of fiscal 2003 Green Product development

Targets fully achieved.

Fujitsu

(Cumulative total: 230 product categories, 69 product categories in fiscal 2003)

- Personal computers
- Media drives
- Family network stations
- Global servers
- Virtual tapes
- Cellular phones
- Access-type optical LAN systems
- Micro-controllers
- Semi-customization (ASIC)
- Others

Consolidated subsidiaries

(Cumulative total: 72 product categories, 21 product categories in fiscal 2003)

- DC/DC converters (FDK)
- Compact controllers (PFU)
- Serial impact printers (Fujitsu Isotec)
- VoIP (voice-over IP network): gateway (Fujitsu I-Network Systems)
- Communication power supply (Fujitsu Access)
- LCD units (Fujitsu Display Technologies)
- Optical magnetic discs (Fujitsu Personals)
- Plasma displays (Fujitsu Hitachi Plasma Display)
- Distribution/financial terminal products (Fujitsu Frontech)
- SAW duplexer (Fujitsu Media Devices)
- Others

FLASHWAVE 2730, access optical LAN system

FMFNS-104, family network station

SAW duplexer

Green Product development results (Fujitsu Group)

(%)

| Fujitsu | Fujitsu Group |

- 2001: Fujitsu 60.5, Fujitsu Group 41.9
- 2002: Fujitsu 100, Fujitsu Group 66
- 2003: Fujitsu Group 100

(Fiscal year)

Lead-free solder results (Fujitsu Group)

(%)

Fujitsu Group

- 2003/4: 60.1
- 2003/9: 74.2
- 2004/3: 80.7

(Year/month)

World's 1st commercialized flame-retardant vegetable-derived resin casing

We developed the world's first technology permitting use of vegetable-derived materials with a low environmental impact in the casings of notebook computers. In June 2002, Fujitsu developed a technology for use of materials derived from vegetables such as corn in notebook computer components. The commercialized technology includes a flame-retardant characteristic requisite for notebook computers casings, while achieving a strength and heat-resistance comparable to those of ABS resin. We plan to expand application of this technology beginning in fiscal 2004. Because casing production employing this technology requires 40% less energy than conventional casing production, it helps to reduce the environmental burden.

Prototype notebook PC employing vegetable-derived resin for LCD front cover

3R (Reduce/Reuse/Recycle) design promotion

We employ original product environmental assessments and Green Product evaluations to support the application of technologies considering post-use situations such as resources saving and recyclability.

Personal computers

(We are conducting efforts like those described below in various series.)

FMV-DESKPOWER CE Series

Conforms to Law Promoting Green Purchasing

CLEAR 2005   3R

Soy oil-based ink used for container box PRINTED WITH SOY INK
Soy-based ink reduces volatile organic compounds (VOCs) and contributes to preventing air pollution, conserving petroleum resources and improving biodegradability at disposal.

Recyclable paint
Plastic-based paint that is recyclable with plastic parts without stripping employed since 1999.

Chrome-free steel plate
Plate containing no hazardous hexavalent chromium employed. Currently promoting application in other parts.

Recycled plastic
Used since 1999.

FMV-BIBLO NB50 Series

Conforms to Law Promoting Green Purchasing

CLEAR 2005   3R

Soy oil-based inks used for container box PRINTED WITH SOY INK
Magnesium alloy (recycled material)
Recycled bodies of notebook PCs we collect applied since 2002. Currently promoting application in other products.

Recycled plastic
Used since 1998.

Halogen-free resin
Halogen-free resin that does not generate dioxins during incineration employed.

Vegetable-derived plastic
Employed for FMV-BIBLO RS Series and FMV-LIFEBOOK MG Series.

## Fiscal 2003 lead-free solder application results

We introduced new equipment and reexamined the soldering conditions at each manufacturing base and improved the annual application rate of lead-free solder by 20%. We postponed use of lead-free solder in 19.3% of the printed circuit boards manufactured, however, pending resolution of the issue of heat-resistant mounting parts. We are committed to employing lead-free solder for these products as well under the Fujitsu Group Environmental Protection Program (Stage IV)

Development of technology employing photocatalyst apatite

Fujitsu Laboratories has developed a method of using photocatalyst apatite to create a resin with a photocatalystic capability. By eliminating the need for conventional coating, this technology has facilitated production of casings made with photocatalystic resin.

"ETERNUS" storage system

Adoption of VPS/Eco Design (see page 26) for product development has drastically reduced the number of components employed. It uses half the number of screws employed in conventional models, for example, with a substantial reduction in dismantling time as well as superior recyclability and metal resources saving. Easier assembly has contributed to reduced energy consumption during production.


VPS display

ETERNUS
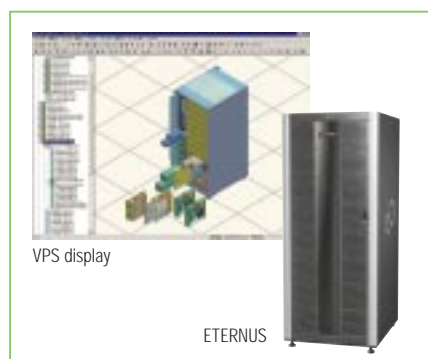
Industry's Smallest!
RF module for RFID reader/writer
(Shinko Electric Industries Co., Ltd.)

We have applied our proprietary high-density packing technologies such as Sip to develop the industry's smallest RF module. Incorporated into an RFID reader/writer employing radio waves to read and write the information and data stored in an IC tag, the technology is accelerating miniaturization of cell phones and other devices.
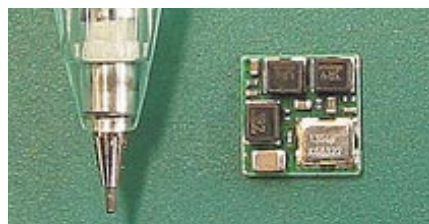
RF Module

Making our products more energy efficient

We are helping to prevent global warming by efficient utilization of limited resources through positive efforts, beginning in the development stage, to produce energy-efficient products.
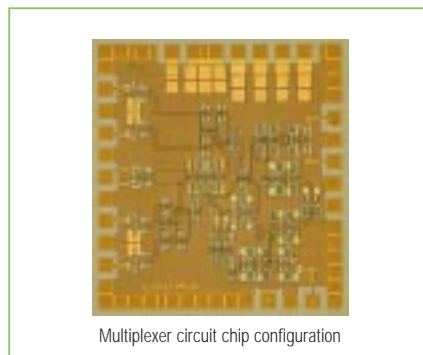
World's First!
Super energy-efficient transmission IC for next-generation optical communications systems

Fujitsu Laboratories employed indium phosphide-based high-electron mobility transistor (InP-HEMT) technology to develop a chip set operating at 50 gigabits/second and comprising a 4:1 multiplex circuit (multiplexer)[1] and 1:4 split circuit (demultiplexer)[2]. The chip not only achieves outstanding signal quality and operating margin through use of the full-rate method[3], but it is also the world's first to feature power consumption of 1 W or lower, 30% the consumption with conventional technology.

[1] A circuit employing time-division multiplexing of two or more low-speed signals to generate a single high-speed signal. It calls for output of high-quality signals.

[2] A circuit that separates two or more original slow-speed signals from a single high-speed signal. It calls for a wide operating margin.

[3] A circuit format employing a clock signal traveling at the same speed as the data speed. It enables signal processing of excellent quality.

Multiplexer circuit chip configuration

http://www.fujitsu.com/news/pr/archives/month/2004/20040217-01.html

World's First!
Paper LCD for contact-free IC cards
(Fujitsu Frontech)

Equipped with a cholesteric LCD capable of continuous display without a power supply, this ultra-thin display panel features ultra-low power consumption of 6 μW or less (except for the drive circuit), a semi-permanent memory capability and a color display. An enhanced write speed makes it suitable for application in the contact-free IC cards employed by transportation companies.

Paper LCD

"Eco Board" energy-efficient scoreboard
(Fujitsu Frontech)

Solar cells mounted on this baseball stadium scoreboard supply all the power necessary to show/revise team names and points scored as well as to display umpires' decisions and the current time. The display unit for team names employs magnetic reverse display components featuring easy readability, even during daylight, and low power consumption. This scoreboard is certified as an Eco-mark product.

Environmental considerations in the sales stage

We implement environmental considerations in the sales stage aimed at reducing the environmental burden throughout the product life cycle.

Switch to eco-friendly display stands and PC sticker materials

We have adopted easily disposable paper display stands for use in retail stores. The stickers displayed on our products are also now made from a 100% non-PVC material featuring a low environmental burden.

Eco-friendly display stands

Sticker

Environmental information disclosure

We promote disclosure of information for use in product purchasing decisions by acquiring various environmental labels and making use of the Internet.

Law Promoting Green Purchasing

(Law Concerning the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities)
The Green Purchasing Network* provides online information on conformance with the Law on Promoting Green Purchasing by or targeting products such as servers, workstations, personal computers, magnetic disks, displays, printers and scanners.

http://eco.goo.ne.jp/gpn/files/gpne

* A nationwide network of Japanese consumers, corporations and administrative bodies organized to promote green purchasing.

Type I

(Classification based on the ISO14020 Series international standards)
Environmental details concerning products approved by a third-party organization upon voluntary application by the manufacturer

Eco-mark

(Certified by the Japan Environmental Association)
Since becoming Japan's first desktop PC manufacturer to receive Eco-mark certification in 2001, Fujitsu has acquired certification for printers as well. (See the Japan Environment Association homepage for details.)

http://www.ecomark.jp/english/

Laser printer
Color Printia LASER
XL-C7400

Laser printer
Printia LASER
XL-5770

Type II

Environmental details concerning products meeting independent criteria set by the manufacturer

Environmental Emblem

The Environmental Emblem is employed in our Green Product catalogs and packaging. The Ministry of the Environment's "Database for Eco-labels, etc." provides details concerning the emblem.

We care for the Earth.

http://www.fujitsu.com/about/environment/policy/emblem_1994.html

Target standard for energy consumption efficiency

This Fujitsu original environmental label is used in catalogs for products that meet target standards set for achievement by 2005 by the Law Concerning the Rational Use of Energy.

CLEAR 2005
省エネ法目標達成!

3R eco-label for PCs

This label is used in catalogs and packaging for PCs that meet Japan Electronics and Information Technology Industries Association standards.

http://www.jeita.or.jp/english

The International Energy Star Program

This logo is displayed in packaging and catalogs for computers (PCs, workstations), displays, printers and scanners registered with the program. The Energy Conservation Center, Japan, provides details on its homepage.

http://www.eccj.or.jp/ene-star/index_esu.html

Type III

Product's quantitative environmental burden indicated on the label

EcoLeaf environmental label

(Certified by Japan Environmental Management Association for Industry)
In 2003, Fujitsu became Japan's first PC manufacturer to receive EcoLeaf environmental label certification. We are promoting expansion of certified products. (Label acquired for 10 notebook PC models as of March 2004.)

ECO LEAF
製品環境情報
No. XX-02-001

http://www.jemai.or.jp/english/ecoleaf/index.cfm

Environmental burden quantification

EcoLeaf environmental label receipt

The EcoLeaf environmental label is given to products that display their CO_2 emission volume and other effects on the environment quantified throughout their life cycle, from resources extraction and manufacture to distribution, use, disposal and recycling.

Features of our activities

(1) System certification acquisition

A business system for label creation, evaluation and disclosure has been completed following external certification, and the stability and reliability of the system has been approved. This has enabled products to be EcoLeaf certified speedily based on internal examination.
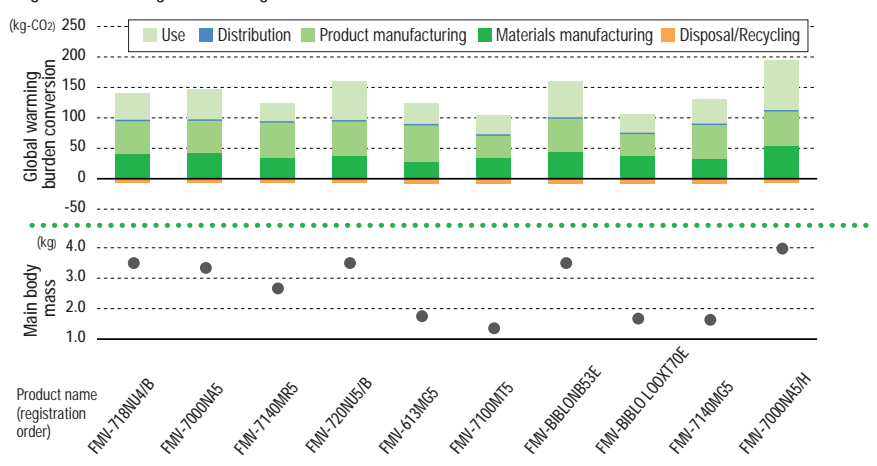
(2) Application of VPS/Eco Design (see page 26)

Extracting the volume from parts and materials data created in 3D and automatically calculating the mass by combining the parts and materials database with the specific gravity. This has drastically reduced the processes involved in LCA calculation, which were formerly conducted manually.
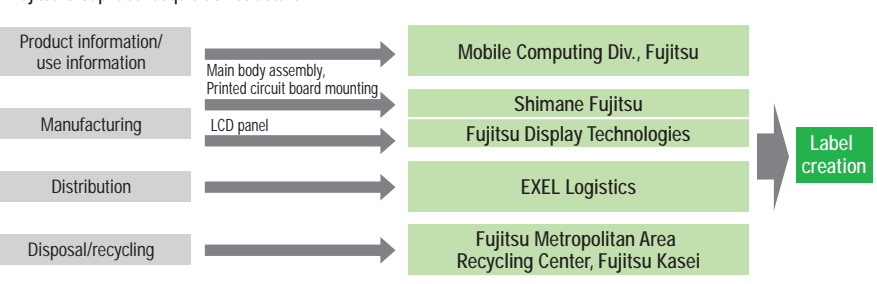
(3) Integrated Group activities

We cooperate with various business groups and affiliated companies in collecting product life cycle information.

Registered models' global warming burdens

(kg-CO_2)

Legend: Use | Distribution | Product manufacturing | Materials manufacturing | Disposal/Recycling

Global warming burden conversion: 250, 200, 150, 100, 50, 0, -50

Main body mass (kg): 4.0, 3.0, 2.0, 1.0

Product name (registration order):
FMV-718NU4/B, FMV-7000NA5, FMV-7140MR5, FMV-720NU5/B, FMV-613MG5, FMV-7100MT5, FMV-BIBLONB53E, FMV-BIBLO LOOXT70E, FMV-7140MG5, FMV-7000NA5/H

Fujitsu Group label acquisition structure

| Product information/ use information | Main body assembly, Printed circuit board mounting | Mobile Computing Div., Fujitsu |
Manufacturing	LCD panel	Shimane Fujitsu / Fujitsu Display Technologies
Distribution		EXEL Logistics
Disposal/recycling		Fujitsu Metropolitan Area Recycling Center, Fujitsu Kasei

Label creation

Environmental burden integration and monetary conversion

Rather than viewing the environmental burden in terms of individual indicators such as CO2 as before, we conducted comprehensive evaluations by converting the environmental effects of every substance into easily understandable monetary amounts based on multiple inventory data (IN/OUT substances throughout the product life cycle). Besides analyzing the influences of environmental burden factors, such as the effect of CO2 on global warming and ozone layer depletion, we employed LIME* to calculate damage to every object of protection, including human health and the ecosystem, and to perform single indexing after weighting.

* LIME (Life cycle impact assessment method based on endpoint modeling): A technique developed by the Research Center for Life Cycle Assessment of the National Institute of Advanced Industrial Science and Technology (AIST) in cooperation with the LCA Project (Ministry of Economy, Trade and Industry, NEDO, Japan Environmental Management Association for Industry).
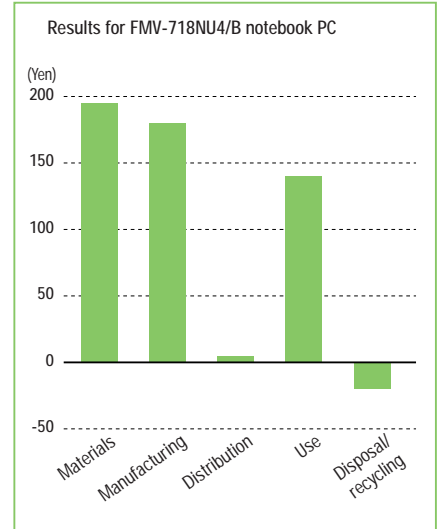
[Monetary conversion of environmental burden]
Evaluation in each stage reveals a large environmental burden in the materials manufacturing stage. The total burden of 511 yen means that this notebook PC causes 511 yen in damage to society during its life cycle.

Results for FMV-718NU4/B notebook PC

"Factor X" Eco-efficiency indicators

This technique for simultaneously indicating product environmental burden reductions and service improvements can be called an indicator for sustainable development in harmony with the environment. Our original "Eco-efficiency factor" calculation method employs the CO2 emission volume throughout the product life cycle, with the environmental burden represented as the denominator and improvements in product functions and specifications representing service as the numerator.

Eco-efficiency factor calculation method

$$\text{Eco-efficiency factor} = \frac{\text{Service (ratio of new to old products)}}{\text{Environmental burden (ratio of new to old products)}}$$

[Service quantification]
The calculation method for quantifying service is shown below. The square sum average is employed for calculations when various CPU, memory and HDD service items are collected.

$$\text{Sum of Square root} \quad \sqrt{\frac{1}{n} \cdot \sum_{i=1}^{n} s_i^{\,2}}$$

Function/ performance	Unit	FMV-5120NA/X (a)	FMV-718NU4/B (b)	S (b)/(a)
CPU	GHz	0.12	1.8	15.0 times
Memory	MB	8	128	16.0 times
HDD	GB	0.81	20	24.7 times

19.1 times

[Environmental burden calculation]
The environmental burden calculation is based on the notebook PC product classification standards (PSC) in the "EcoLeaf environmental label" program.
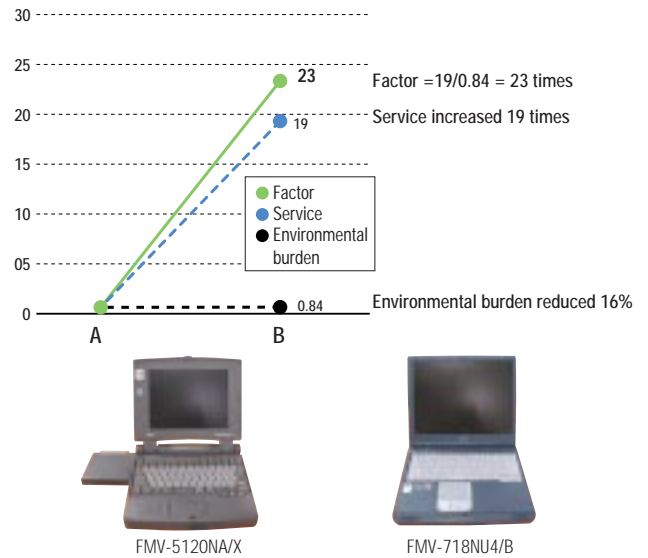
Model name	Old product	New product
Global warming burden (CO2-kg conversion)	164	138
Acidification burden (SO2-kg conversion)	0.286	0.217
Energy resources (crude oil kg conversion)	61.7	52.2
Mineral resources (ironstone kg conversion)	136	89.8

The assumptions below are employed when applying a former product (FMV5120NA/X) to the EcoLeaf environmental label program.

• For manufacturing sites, assuming manufacture of the 10.4-inch panel by Fujitsu Display Technologies and main board mounting and assembly by Shimane Fujitsu
• For distribution, assuming the loading means and ratio are the same as the current situation
• For time in use, assuming a suspended situation and low electric power
• For disposal and recycling, assuming inclusion in the current recycling system

PC Eco-efficiency indicator "Factor X" calculation

Factor 23 (global warming burden conversion) achieved in 7 years.

Factor =19/0.84 = 23 times
Service increased 19 times
Environmental burden reduced 16%

FMV-5120NA/X   FMV-718NU4/B

Comparative Eco-efficiency and factor value calculations for two notebook PCs, model FMV-5120NA/X (1996) and EcoLeaf environmental label acquisition target model FMV-718NU4/B (2003).

Example of cellular phones

2.1 x Eco-efficiency factor achieved in 1.5 years!

Transitions in values assuming A=1
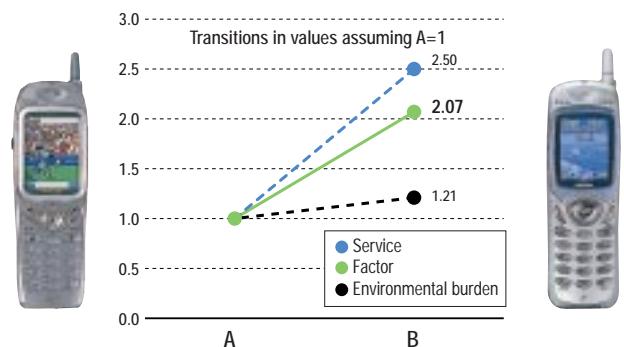
Comparison of models A and B cellular phones without built-in cameras, launched Feb. 2001 and Oct. 2002, respectively.