

**Reinforcing development of products featuring superior eco-friendliness throughout their life cycles
Achieving "world's first" results in rapid succession**

We apply the criteria elucidated in our internally developed Green Product Evaluation Standard throughout the Fujitsu Group to achieve the following: develop products that contribute to resources reduction, reuse and recycling; save energy; and reduce chemical emissions throughout the product life cycle, not only in the design and manufacturing stages. This development of Green Products featuring superior eco-friendly characteristics is accompanied by efforts to promote effective recycling. Our exertions to develop technologies that help to reduce the environmental burden have born fruit in terms of world's first results.

A recent development case

Another world's first! Biodegradable plastic parts made from corn employed in notebook computers

Reduction of the environmental burden and oil consumption realized by use of vegetable-derived material.

Fujitsu and Fujitsu Laboratories developed a technology for employing a vegetable-derived biodegradable plastic with a lower environmental burden for the first time ever in the casing of notebook computers. The biodegradable plastic is currently used to make some of the parts in the FMV-BIBLO NB notebook computer, and plans call for extending its use to the entire case in fiscal 2004. The biodegradable plastic, developed by optimizing a polylactic acid composition*1 derived from corn, realizes approximately the same strength and contraction rate as the PC/ABS resin*2 used previously. Even if disposed of or buried in the ground, it will be decomposed into CO₂ and water through the activity of soil bacteria and assimilated back into nature. Even when burned, moreover, the material does not discharge dioxin or other harmful chemical substances. Since the energy required for its manufacture is only approximately 40% as compared with consumption for production of conventional plastics, it contributes to reducing oil consumption for power plant operation as well. We are also promoting wide-ranging use of biodegradable plastics in other products, including LSI embossing tapes, protective bags for cellular phones and a portion of the shock-absorbing packing material for IA servers.

*1 Polylactic acid: A vegetable-based biodegradable plastic employing lactic acid obtained from corn and potato starch, etc., as a material

*2 PC/ABS resin: A polymer alloy consisting of polycarbonate and ABS resin (copolymer of acrylonitrile, butadiene and styrene). It is often used in notebook computer cases.

Examples of biodegradable plastic applications



Prototype for a biodegradable plastic PC

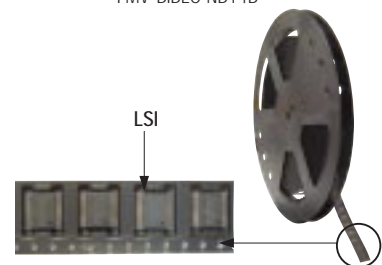


FMV-BIBLO NB14B

pr.fujitsu.com/en/news/2002/06/5-1.html

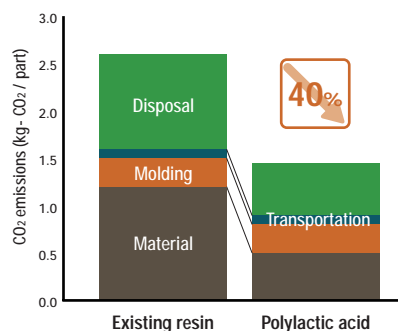


LSI tray (Aug. 1996)



LSI embossing tape (Apr. 2000)

LCA Results (assumptions concerning biodegradable plastic case prototype)



40% reduction of environmental burden

Assumptions for calculation

- Material: Existing resin is PC/ABS alloy
- Environmental burden from resources mining to resin synthesis (Note 1)
- In the case of polylactic acid, CO₂ absorption during corn cultivation is deducted from the environmental burden resulting from agricultural production and resin synthesis. (Note 2)
- Manufacture: Environmental burden derived from electric power required for case manufacturing (including metal mold production)
- Disposal: Complete incineration assumed

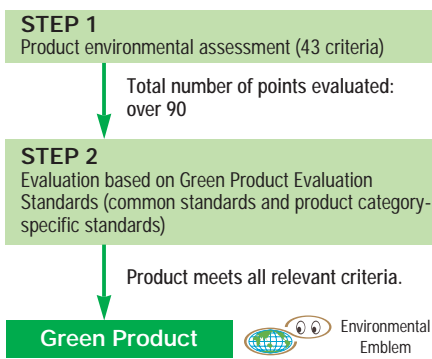
Note 1: Report on Energy Analysis Investigations of Basic Materials, Chemistry and Economic Research Institute (1993)

Note 2: From hearing data by Cargill Dow LLC

Green Product Development

We have conducted original environmental assessments of products since fiscal 1993. Since 1998, we have also carried out strict evaluations based on the Green Product Evaluation Standard comprising common standards and product category-specific standards*1. We strive to develop Green Products throughout, from parts selection to the introduction of LCA (life cycle assessment).

The Green Product Development Process



Criteria System

Common standards (27 items)	Category-specific standards	
		Electronic parts (semiconductors, PCBs)
	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

Revisions of Standards

We are constantly upgrading our environmental awareness standards to take various regulatory measures into account and to encourage development of a cyclical society and the establishment of eco-labeling systems.

Each consolidated subsidiary has established its own standards based on Fujitsu's Green Product Evaluation Standard.

*1 For details concerning the Green Product Evaluation Standard, see Pages 56-57.

Report on Fujitsu Environmental Protection Program (Stage III) Results

Group-wide efforts to achieve our Green Products development targets in the Fujitsu Environmental Protection Program (Stage III) achieved the following results:

Fiscal 2002 Green Product Development Results

Green Products accounted for 66% of newly developed products in fiscal 2002. This represents 100% achievement of Fujitsu's targets.

Fujitsu

(Cumulative total: 161 product categories, 57 product categories in fiscal 2002)

- Notebook computers
- IP switching nodes
- Micro-controllers
- Desktop PCs
- Network servers
- FCRAM
- Cellular phones
- Switching hubs
- ASIC
- Others



IP switching node GeoStream R940



Network server IPCOM150



Media converter system MC71-R



Micro-controller MB9F312

Consolidated subsidiaries

(Cumulative total: 50 product categories, 37 product categories in fiscal 2002)

- Industrial system controllers (PFU)
- VoIP (Voice-over IP networks) Gateway (Fujitsu I-Network Systems)
- Media converter systems (Fujitsu Access)
- Slider attachment devices (Fujitsu Automations)
- LCD units (Fujitsu Display Technologies)
- Automotive audio equipment (Fujitsu Ten)
- Optical magnetic discs (Fujitsu Personals)
- Plasma displays (Fujitsu Hitachi Plasma Display)
- Distribution/financial terminal products (Fujitsu Frontech)
- Capacitors (Fujitsu Media Devices)
- Others

Fiscal 2002 Lead-free Solder Results

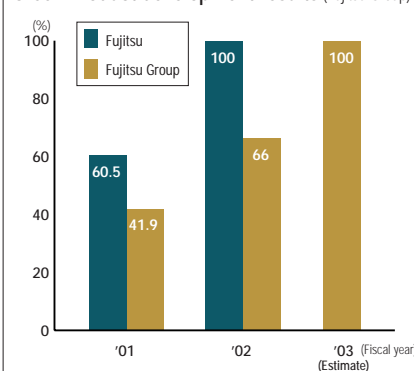
We completed development of lead-free solder joint technology and constructed a manufacturing system.

- Although approximately 4.5% of printed-circuit boards are subject to joint reliability evaluation in mass-production operations, we plan to employ lead-free solder by the end of September 2003.
- Employment of lead-free solder will be introduced sequentially for portions for which it has been postponed due to insufficient heat resistance of parts mounted on the printed circuit boards.

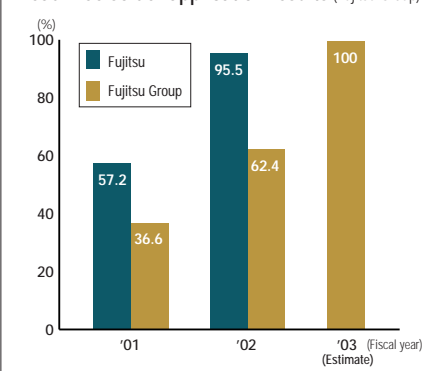
[Joint technology development]

Materials reliability evaluation/joint reliability evaluation/simulation technology/new material [Tin (Sn) - Zinc (Zn) - aluminum (Al)] development

Green Product development results (Fujitsu Group)



Lead-free solder application results (Fujitsu Group)



Examples of 3R (Reduce/Reuse/Recycle) Design

We are applying various technologies with an eye to post-use handling of products through our original product environmental assessments and Green Product evaluations. Consideration of the 3Rs — Reduce waste generation to the maximum; Reuse products, parts and materials; and Recycle whenever possible — is being extended to every aspect of our product manufacturing.

FMV-DESKPOWER CE Series

Conforms to Law Promoting Green Purchasing.

- Paperless computerized manual produced.
- Soy oil-based inks used for the container box.



- Recyclable paint**
Paint made of recyclable plastic material that permits recycling with plastic parts without stripping employed since 1999.
- Chrome-free steel plate**
Chrome-free steel plate containing no hazardous hexavalent chromium employed.
- Recycled plastic**
Used since 1999.

FMV-BIBLO MG Series

Conforms to Law Promoting Green Purchasing.

Soy oil-based inks used for the container box.



Recycled plastic
Employed since 1998.



- Halogen-free resin**
Halogen-free resin that does not generate dioxin during incineration employed.
- Lead-free solder**
Soldering technology eliminating use of health-threatening lead developed and applied.

Magnesium alloy (recycled material)
Recycled PC bodies we collected ourselves employed.
pr.fujitsu.com/en/news/2002/12/4.html



FMV-BIBLO LOOX/S Series

Conforms to Law Promoting Green Purchasing.

Soy oil-based inks used for the container box.



Magnesium alloy
Alloy recycling technology developed and applied.



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

Recycled plastic
Recycled resin from PC bodies we collected ourselves employed.
pr.fujitsu.com/en/news/2002/11/28.html



Promotion of Energy Savings in Products

We promote energy savings in products positively from the development stage in an effort to reduce global warming and make efficient use of Earth's limited resources.

Blade IA server "PRIMERGY BX300" with electricity consumption reduced to 1/5

Employing parts that consume less power — a low-voltage Pentium® III processor (level 2 cache: 512KB) and 2.5-inch HDD — for the server blade*1 enabled us to realize low electric power consumption approximately just 1/5 that of conventional 1U servers.

*1 A blade in the server body comprising the processor memory disc



Electricity consumption cut to 3.3 W in standby mode! Development of image scanner fi series (PFU)

The image scanners in the fi series also achieve superior performance from the standpoint of energy savings. All models in the series, noted for efficient paper use, are registered with the International Energy Star Program.

	Electricity consumption in operation ^{*2} (unit performance reduction rate)	Product recycling rate
fi-4120C	70%	96.5%
fi-4220C	73.8%	97.7%
	Electricity consumption in standby mode ^{*2} (reduction rate)	Product recycling rate
fi-4110EOX2	52%	96.5%
fi-4340C*3	80%	98.8%
fi-4860C	83%	99.5%

*2 Electricity consumption represents comparisons with our previous models.

*3 Front runner among scanner products registered with the International Energy Star Program in fiscal 2001

MOS transistor capable of reducing electricity consumption to 1/100 or less

Fujitsu Laboratories has developed a MOS transistor employing hafnium oxide (HfO₂) gate insulating film with a high dielectric ratio. Use of this transistor reduces electricity leakage by at least 2 or 3 figures as compared with use of conventional silicone oxide film (SiO₂), sharply reducing electricity consumption by the system LSI.

Hazardous Chemical Substance Reduction Activities

We are eliminating hazardous chemical substances from all our products, beginning in the development and design stages, based on Fujitsu restricted chemical substance containment regulations.

Prohibited chemical substance containment

30 substances regulated in domestic and overseas laws and regulations, including polychlorinated biphenyls, asbestos and ozone-depleting substances

Controlled chemical substance containment

155 substances such as heavy metals, greenhouse gas-releasing substances and halogenated compounds

Expanded lead-free solder application

We are expanding the application of lead-free solder in newly developed products in accordance with our lead solder elimination policy.

Products employing lead-free solder in fiscal 2002

Personal computers, cellular phones, hard discs, opto-magnetic disk equipment, engine control units (Transtron, Shinano Fujitsu), DVD navigation devices (Fujitsu Ten), others

A world's first! Sn-Zn-Al lead-free solder developed

We have developed a new Sn-Zn-Al lead-free solder and begun applying it in our products.

[Features]

Can be easily introduced into the existing soldering process due to the successful lowering of its melting point (199°C). U.S. patent # US6,361,626

Products employing Sn-Zn-Al solder

15-inch LC display <VL-15VAW>

* Production initiated December 2002 by Fujitsu Peripherals



Results of joint reliability test for Sn-Zn-Al solder on printed circuit boards

Test item	Test conditions	Results
MIL humidification cycle	MIL-STD-202F	Approved
High-temperature creep	80°C x 500 h	Approved
Temperature cycle	-30 ~ 80°C x 3,000 cyc	Approved
Vibration test	10 ~ 500 Hz, 1.5 mmP-P	Approved
Dropping test	Dropping in packaging	Approved
SO ₂ exposure	20 ppm x 10 days	Approved
Electrolytic corrosion test	40°C/90% RH, 1,000 h	Approved

Example of product chemical reduction activities

(Fujitsu Media Devices)

Wide-ranging measures implemented to eliminate hazardous chemical substances include employing lead-free terminals (Sn-Bi family) and non-halogen family exterior

sleeves and avoiding use of environmental burden substances for products and packing materials in the functional polymer capacitor FPCAP-SE series.



Disclosure of environmental information

We provide informative environmental data concerning products at the point of purchase by means of eco-labels as well as on our homepage.

Law Promoting Green Purchasing*¹ (Law Concerning the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities)
The Green Purchasing Network*² provides online information concerning the conformance of those among our targeted products, such as servers, workstations, personal computers, magnetic disks, displays, printers and scanners, with the Law on Promoting Green Purchasing.

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

*2 Green Purchasing Network: A nationwide network of consumers, corporations and administrative bodies organized in Japan to promote green purchasing

Type I

Environmental details concerning products approved by third-party organization following voluntary application by the manufacturer.



Eco-mark (certified by Japan Environment Association)

After becoming the first desktop PC manufacturer in Japan to receive Eco-mark certification in January 2001, Fujitsu has now acquired certification for displays as well. See the Japan Environment Association homepage for details.

www.jeas.or.jp/ecomark/english/index.html

Type II

Environmental details concerning products conforming to independent criteria determined by the manufacturer.



Environmental Emblem

The Environmental Emblem is employed in the catalogs and packaging for our Green Products. The Ministry of the Environment provides detailed information concerning the emblem in its "Database for Eco-labels, etc."

eco.fujitsu.com/en/info/emblem-e.html

CLEAR 2005 Target standard for energy consumption efficiency
省エネルギー目標達成!

Fujitsu's original environmental label. The target standard is used in our catalogs for products that have cleared the target standard values set for achievement by 2005 by the Law Concerning the Rational Use of Energy.



3R eco-label for PCs

The label is used in product catalogs and packaging for PCs that satisfy the standards set by the Japan Electronics and Information Technology Industries Association.

www.jeita.or.jp/english



The International Energy Star Program

We have registered computers (PCs, workstations), displays, printers and scanners with the program and displayed the logo in the registered products' packaging and catalogs. The Energy Conservation Center, Japan, provides detailed information on its homepage.

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

International eco-labeling standards
ISO14020 Series

Type III

Quantitative environmental burden imposed by the product indicated on the label.

EcoLeaf environmental label (certified by Japan Environmental Management Association for Industry)
In May 2003, Fujitsu became Japan's first notebook PC manufacturer to receive EcoLeaf environmental label certification for its FMV-718NU/B model. The Japan Environmental Management Association for Industry provides detailed information on its homepage.

www.jemai.or.jp/english/ecoleaf-e/default.htm



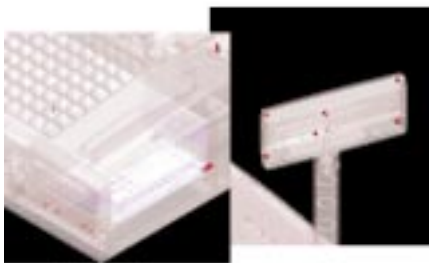
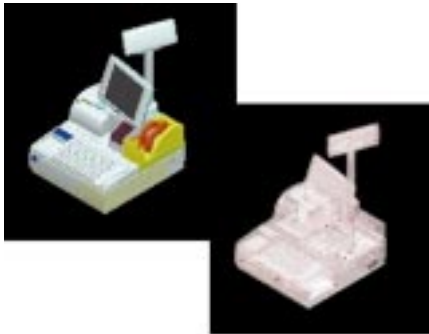
*1 Please refer to page 60 for definition.

LCA (Life Cycle Assessment)*1 utilizing original evaluation tools

We design products with the aim of reducing the overall environmental burden by making full use of LCA measures to assess the environmental effect imposed by the products in the course of their life cycle. We are extending application of LCA to all Green Products by making LCA implementation a requisite part of Green Product evaluation.

Evaluation tools

Our originally developed VPS/ECODESIGN software is an LCA support tool that automatically calculates the environmental burden imposed by such processes as CO₂ generation in the design stage of the product life cycle by means of a materials database and environmental burden databases. It is also used to perform product degradability verification and degradation time calculations in association with 3-D CAD techniques.



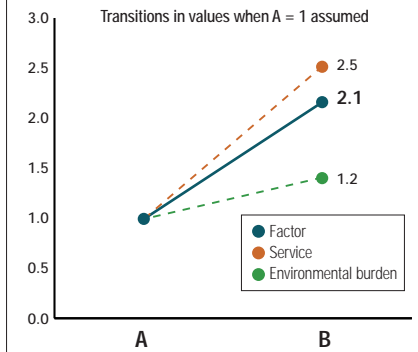
VPS/ECODESIGN evaluation screen

Environmental Indicators

We are currently studying the use of various factors as environmental indicators to assess environmental improvement effects quantitatively. The "factor X" environmental efficiency index, especially, is a breakthrough technique capable of expressing the environmental burden of products (denominator) and improvements in services such as functions and performance (numerator) by means of an old-new ratio. We began developing environmental indicators at an early date and became the first to suggest application of the indicators to PCs in a proposal to the METI-sponsored Resource Productivity Examination Committee. We also proposed use of an environmental efficiency factor calculation method for scanners and cellular phones in fiscal 2002.

Example: Application of environmental efficiency factor to scanners

The environmental efficiency factor of product B, launched in spring 2002, increased 2.1 times compared with that of product A, launched in spring 1999. (Both models are compact A4 two-sided color document scanners weighing under 4 kg.)



Method of environmental efficiency factor calculation

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

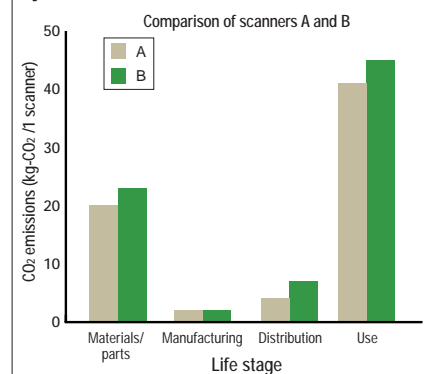
Numerator: Quantification of scanner services

Function/performance		Old/new ratio for function/performance	
Large items	Small items	S= (B) / (A)	=(1/n*ΣS^2)^0.5
Optical performance	Evaluation item 1	2.000	3.808
	Evaluation item 2	5.000	
Media-processing performance	Evaluation item 1	1	1.240
	Evaluation item 2	1.440	
Data-processing performance	Evaluation item 1	1.500	1.500

For calculating services, functions such as optical performance, media-processing performance and data-processing performance were digitalized. The values of the sums of the items were calculated by the square-sum average method.

2.47

Denominator: Environmental burden emissions by scanners



A scanner

$$(B) / (A) = 1.16$$

The volume of CO₂ emitted throughout the product life cycle is treated as the environmental burden. The manufacturing stage covers the period through the final assembly and the distribution stage the period from final assembly to delivery to the user. Calculation of the use stage assumed operation 2 hours/day, 6 hours/day standby, 240 days/year for five years.

Principal Plans for Fiscal 2003

Reinforcement of environmental technology development

We added Materials & Environmental Engineering Laboratories and Environmental Materials Stations to our laboratory system in April 2002 for the purpose of promoting development and improving the quality of Green Products. We are making use of these organizations to strengthen our environmental technology development capabilities further.

*1 Please refer to page 60 for definition.