Greening Throughout Product Life Cycle

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The Fujitsu Group is working to mitigate the environmental impact of its products over the entire product life cycle. We have been conducting environmental impact assessments on our products since FY1993 in an effort to promote environmentally conscious product designs. These efforts have led to a reduction in power consumption, economization of resources, improvement in recyclability, and elimination of hazardous materials through chemical substance management. Moreover, Fujitsu is also promoting the development of "Super Green Products" that achieve the highest level of environmental performance. Since FY2013, we have been particularly proactive in improving product energy and resource efficiency, making them important themes in offering customers products that have lower environmental impact and higher performance in one package. This was set as one of the goals in the Fujitsu Group Environmental Action Plan. This paper presents an overview of previous initiatives of the Fujitsu Group in developing environmentally conscious product designs and describes how we are working to enhance the energy and resource efficiency of our products in the Fujitsu Group Environmental Action Plan [Stage VII (FY2013-FY2015) and Stage VIII (FY2016–FY2018)]. It also introduces some of the technologies we have developed for achieving environmentally conscious product designs.

1. Introduction

The Paris Agreement went into effect in November 2016 with a mandate that all participating countries including developing countries undertake a reduction in greenhouse gases (GHGs). It requires each country to make ongoing efforts to reduce GHGs with the aim of achieving a balance between the emission and absorption of GHGs in the second half of the 21st century. As can be seen from greatly fluctuating resource prices, tight supply-and-demand conditions, and drops in the quality of mineral resources, limitations in resources are expected to intensify on a global basis in the years to come.

The International Resource Panel (IRP) established by the United Nations Environment Programme (UNEP) promotes sustainable resource management. It pointed out that the worldwide consumption of natural resources is still increasing at a dramatic rate, which underscores the need for decoupling[note 1)] in the dual sense of reducing the use of natural resources in economic activities and reducing the environmental load accompanying the use of natural resources.[1)] At the 2015 G7 Summit held in Schloss Elmau, Germany, it was decided that each of the G7 countries would take ambitious action to improve resource efficiency as part of broader strategies to promote sustainable resource management and material-cycle societies.[2)]

In international society, the preservation and efficient use of natural resources has become an increasingly important issue together with global warming. Additionally, in the corporate world, society is asking companies to improve the energy efficiency of

note 1) The word decoupling means to "separate," which in the environmental field refers to a desirable situation in which the environmental load decreases while the economy grows (absolute decoupling) or the environment load increases but with a rate of increase less than the rate of economic growth (relative decoupling).

their products and to contribute to a reduction in energy usage on the customer's side while providing products that excel in resource savings and recyclability.

Against this background, the Fujitsu Group drew up new targets for improving energy efficiency and resource efficiency in the Fujitsu Group Environmental Action Plan (Stage VII) for the period FY2013–FY2015 and is continuing on this path in the Environmental Action Plan (Stage VIII) for the period FY2016–FY2018.

In this paper, we outline the development of environmentally conscious products in the Fujitsu Group, describe the management of chemical substances in products, and introduce efforts toward improving energy efficiency and resource efficiency. We also describe in detail environmentally conscious design throughout the product life cycle including the development of technologies for reducing environmental load.

2. Environmentally conscious design in Fujitsu Group

The Fujitsu Group takes a unified approach to promoting environmentally conscious design in new products and strives to reduce environmental load and enhance value throughout the product life cycle.

As shown in **Figure 1**, Fujitsu has been promoting the development of environmentally conscious products since 1993 through proprietary product-oriented environmental assessment with an eye to laws and regulations, environmental preservation, resource savings, resource reuse, energy savings, and information disclosure. It introduced a "Green Products" evaluation system in 1998 to fortify the development of environmentally conscious products and established the "Procedure for Product Environmental Green Assessment" in 2004 to integrate all of the above. Fujitsu has also been promoting the development of "Super Green Products" having superior environmental performance.

Then, in 2011, to promote environmentally conscious product design on a global basis, Fujitsu established its Eco Design Standard based on the International Electrotechnical Commission (IEC) 62075 standard, "Audio/video, information and communication technology equipment – Environmentally conscious design."

The following provides an overview of these activities.

2.1 Mechanism for evaluating environmentally conscious products

1) Execution of product environmental assessment

Product environmental assessment is performed to promote reduction in environmental load and environmental pollution throughout the entire life cycle

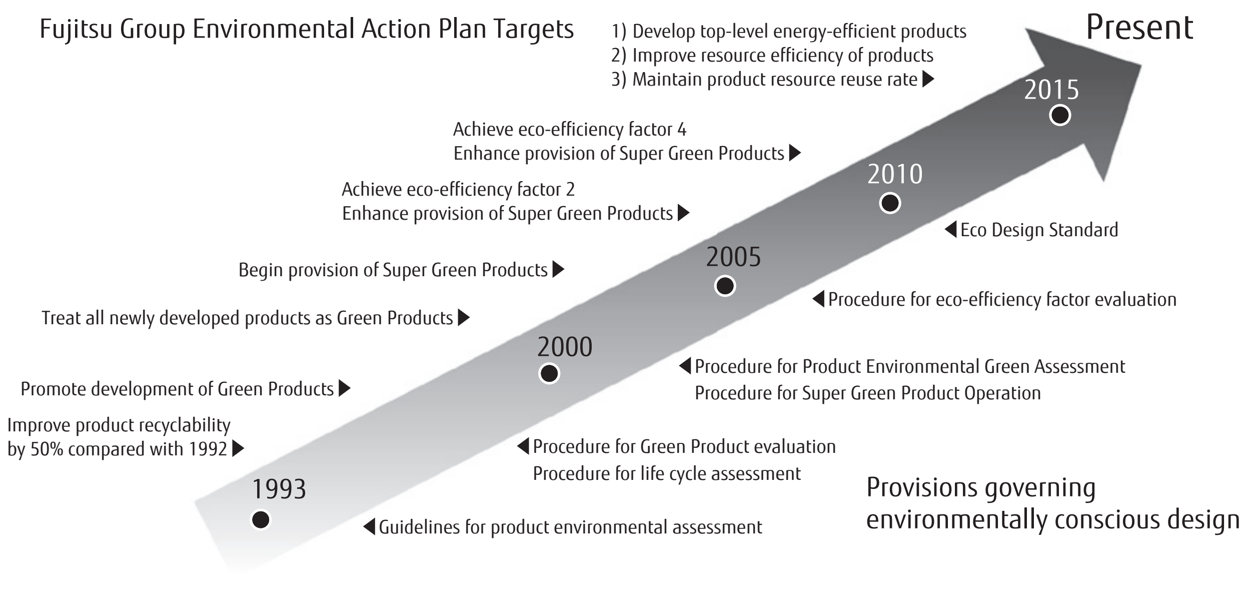

Figure 1
Progress in environmentally conscious design in Fujitsu Group.

of a product and its packaging (from the design and development stages to use, disposal, and recycling). A product that achieves an overall assessment score of 70 or greater for a total of 45 items in 10 categories is certified as an environmentally conscious product.

2) Development of Green Products

A product achieves Green Product certification by having an assessment score of 90 or greater and satisfying all Green Product evaluation criteria including energy savings, reduce, reuse, and recycle (3R) design and technology, and management of chemical substances (**Figure 2**). The Fujitsu Group Green Policy Innovation logo (**Figure 3**) is displayed in its catalogs and on packing boxes for any product certified as a Green Product.

3) Development of Super Green Products

A Super Green Product satisfies all Fujitsu Group Green Product evaluation criteria and is a product or system having superior environmental performance. Fujitsu established the Procedure for Super Green Product Operation to clarify the definition and conformance criteria of Super Green Products. As in the case of Green Products, any product registered as a Super Green Product carries the Green Policy Innovation logo.

2.2 Promotion of 3R design

The Fujitsu Group has been giving designers tours of its recycling centers since 2010 to enable them to experience for themselves the dismantling of post-use products so that they better understand the factors that make dismantling difficult. These tours also enable designers to interact with on-site recycling personnel and then apply what they learn to the design process. Examples of products that are difficult to dismantle are compiled into a collection of case studies.

2.3 Management of chemical substances in products

The Fujitsu Group designates substances that are harmful to people or the environment and that are either prohibited to use or regulated by law as “Fujitsu Group Specified Banned Substances.” Fujitsu complies with both Japanese and global regulations governing chemical substances in products.

In addition, substances that have not been scientifically shown to be harmful but generate concern about that possibility are designated as either “Fujitsu Group Specified Controlled Substances” or “Fujitsu Group Specified Reportable Substances.” As a matter of precaution, Fujitsu manages the constituent amount of such substances in such a way that they can be switched to a banned status once they have been shown to pose a risk.

This system uniformly manages information on chemical substances, including the above specified substances, contained in parts or components purchased from suppliers from the initial request for information to the actual collection of that information. This system is used to compile and tabulate data for each product so that the constituent amounts of

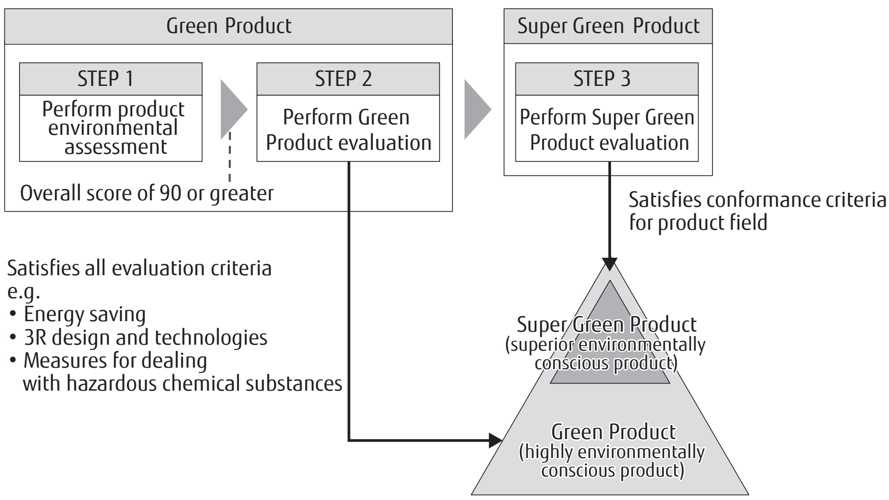

Figure 2
Mechanism for evaluating Green and Super Green Products.

Figure 3
Green Policy Innovation logo.

specified chemical substances can be understood and managed at the product level.

Through activities such as these, the Fujitsu Group aims to provide safe and worry-free products that have no harmful effects on the health of its customers and to reduce the risk of environmental pollution at the time of disposal.

Solutions provided by Fujitsu for managing chemical substances contained in products such as FUJITSU Manufacturing Industry Solution PLEMIA M3 ECODUCE and PLEMIA EcoLink incorporate this in-house know-how.

3. Environmental Action Plan activities

Since formulating its first Environmental Action Plan in 1993, the Fujitsu Group has been implementing measures and conducting activities toward meeting established targets that include those for products. The Environmental Action Plan (Stages I–VI) aimed to improve the resource reuse rate of Fujitsu products to promote product recycling and to achieve Green Product ranking for all its products in support of the environment. It also targeted the development of Super Green Products having even higher environmental performance and the visualization of environmental load in the form of an eco-efficiency factor, and it promoted the development of products with a reduced environmental load and the adoption and thorough application of environmentally conscious design (ECD) in each business division of the Fujitsu Group.

Next, to expand upon the contributions made to customers and society in Stage VI, the Environmental Action Plan (Stage VII) clarified the association between environmental action and social issues in formulating targets. Additionally, as activities had previously been based on original criteria of the Fujitsu Group, the level of environmental consciousness in products was sometimes difficult to understand, so Stage VII also strived to establish targets with high transparency by incorporating outside criteria as much as possible.

As described in the Introduction, the corporate world has been asked by society to use energy and resources in a more efficient manner. For this reason, the Fujitsu Group decided to rank improvement in energy efficiency and resource efficiency in products as an important theme using past activities as a basis from which to work.

3.1 Targets and results of Environmental Action Plan (Stage VII)

1) Development of top-level energy-efficient products

Amid projections of an escalating demand for energy due to the spread of information and communications technology (ICT) and the development of high-performance and high-integration products, energy regulations governing ICT products have been expanding worldwide. As a result, energy efficiency in energy-label conformance criteria, green procurement requirements, etc. is taking on increasing importance.

Taking this worldwide movement into account and seeking to accelerate its contribution to a reduction in GHG emissions, the Fujitsu Group decided to "achieve top-level energy efficiency of more than 50% of newly developed product" as a target to be achieved by the end of FY2015 and emphasized the importance of product development aimed at improving energy efficiency.

Fujitsu based its standards for measuring improvement in energy efficiency on the characteristics of each product group while adopting industry standards as much as possible (**Table 1**). When making comparisons with the market or existing products, Fujitsu established target criteria corresponding to top-level energy efficiency in each product field. Additionally, a rate-of-achievement target was set for each business division defined by the number of product series having top-level energy efficiency with respect to the number of product series slated for development from FY2013 to FY2015.

During this period, each business division made an effort to apply energy-saving techniques. These techniques included the adoption of advanced microprocessors having high energy-savings performance and the use of high-efficiency power supplies and low-power displays, plus the optimization of low-power

Table 1
Main standards for achieving top-level energy-efficient products.

Product Group	Main Standard[1]
Personal computers, imaging devices, etc.	Compliance with Energy Star program (latest version)
Servers, storage systems, etc.	Top-level achievement rate in Top Runner program (FY2011) under Energy Conservation Act
LSIs, products for specific fields, etc.	Top-level energy efficiency in industry
Smartphones	Top-level battery life in industry
Network equipment,[2] electronic components, etc.	Reduced power consumption compared with existing products/performance

1: Criteria values may differ within same product group depending on product configuration.
2: Products evaluated under Ecology Guideline For the ICT Industry[3)] achieve top-level status by five-grade evaluation (passing a multi-stage evaluation).

control, enhancement of power-management functions, consolidation of LSIs and reduction in number of components, and adoption of low-power devices. As a result of these efforts, the Fujitsu Group made 52.8% of its new products top-level performers in energy efficiency, surpassing its target of 50%.

2) Improvement in product resource efficiency

The Fujitsu Group has been promoting 3R design in product development and the efficient use of resources. So far, it has achieved resource savings by reducing the size and weight of products, using recycled plastic, reducing the number of components, and applying diverse resource-saving technologies to products. However, there has been no metric that could be used for comprehensively and quantitatively evaluating such individual measures and that could be applied in common to a wide range of products. It has consequently been difficult for the Fujitsu Group on the whole to undertake resource savings using common numerical targets.

We have therefore defined "resource efficiency" as an original metric and constructed a mechanism for quantitatively evaluating improvement in resource efficiency. The definition and method of calculating resource efficiency is shown in **Figure 4**. This metric is used to evaluate the degree of improvement in resource efficiency of newly developed, Fujitsu-designed products (excluding customized products) compared with past products. Using this metric, we established numerical targets that should be achieved by the entire Fujitsu Group and targets for each business division involved in product development.

The Environmental Action Plan (Stage VII) established the target "Increase resource efficiency of newly developed products by 35% or more compared to 2011 by the end of FY2015." To achieve this target, a variety of actions were taken such as reducing the number of components in products, making components smaller and lighter, and making products smaller by high-density packaging. As a result of these efforts, the Fujitsu Group surpassed this target of 35%, achieving an improvement in resource efficiency of 44.8%.

3) Recycling of products

On the basis of the concepts of "extended producer responsibility," which holds that producers bear responsibility for products not only at the design and manufacturing stages, but also at the disposal and recycle stages, and "individual producer responsibility," which holds that a producer bears responsibility for its own products, the Fujitsu Group has been active in waste processing and recycling in line with laws and regulations while interfacing with industry groups and national governments. In this way, Fujitsu hopes to contribute to the creation of a recycling-minded society that meets the requirements and demands of all stakeholders.

As an authorized operator under the Industrial Waste Wide-Area Recycling Designation System based on the Act on the Promotion of Effective Utilization of Resources in Japan, Fujitsu is entrusted with the appropriate processing of industrial waste at Fujitsu Group recycling centers located throughout Japan. With the aim of achieving a high resource reuse rate while constructing a nationwide recycling system featuring extensive traceability and security, the Fujitsu Group promotes the recycling of ICT products through the provision of safe and secure services.

As mentioned above, the Environmental Action

Resource efficiency: Ratio with "product value" as numerator and "environmental load caused by use and disposal" of individual materials (resources) making up product as denominator

$$\text{Resource efficiency} = \frac{\text{Product value}}{\text{Environmental load due to resource use} = \sum(\text{resource load coefficient} \times \text{amount of resource used}) + \text{Environmental load due to resource disposal} = \sum(\text{resource load coefficient} \times \text{amount of resource disposed of})}$$

Definition of each item

Product value	To place importance on evaluating reduction in environmental load due to resource use and disposal, product value is limited to value related to resource use and is established for each product. (Example of value not targeted here: improvement in CPU performance)
Resource load coefficient	Environmental-load weighting coefficient unique to each resource, takes into account depletion potential, scarcity, environmental impact at time of mining or disposal, etc. Activities begin with load coefficient for each resource set to 1.
Amount of resource used	Mass of each resource used in product (excluding amount of recycled plastic used)
Amount of resource disposed of	Mass of each resource (design value) to be disposed of after product use without reuse. Activities begin with disposal amount set to 0.

Figure 4
Definition and calculation of resource efficiency.

Plan (Stage VII) set a target of "increase resource efficiency of newly developed products by 35% or more compared to 2011." As a result of its efforts to meet this target, Fujitsu succeeded in achieving a resource reuse rate greater than 90% for over 5,000 tons of ICT products collected from corporate customers in Japan.

3.2 Targets of Environmental Action Plan (Stage VIII)

The Environmental Action Plan (Stage VIII) calls for continued efforts in improving energy efficiency and resource efficiency. It defines top-level products in energy efficiency as "products that satisfy higher standards based on external metrics and other criteria" and calls for ongoing development to achieve the target of "making at least 50% of new products top-level performers in energy efficiency" on the basis of those new standards. Additionally, for resource efficiency, Stage VIII establishes as a target "promoting eco design for resource saving and circulation and increasing resource efficiency of newly developed products by more than 15% (over FY2014)" while continuing existing activities. It also calls for the development of new lightweight and highly rigid materials and expanded use of recycled materials. Furthermore, in product recycling, Stage VIII calls for ongoing efforts to "maintain over 90% resource reuse rate of business ICT equipment at Fujitsu recycling centers."

4. Activities toward evaluating environmental impact of resource use in products

Reducing environmental load from the viewpoints of controlling global warming and managing the use of resources is an important issue in achieving a sustainable society throughout the world. To date, the Fujitsu Group has implemented product life cycle assessment (LCA)[note 2)] with the aim of reducing CO_2 emissions and has developed means of visualizing the amount of CO_2 emissions as measures for controlling global warming.[4] Up to now, however, it had not established any evaluation techniques from the viewpoint of resource use nor evaluated the environmental impact of resource use.

note 2) A technique for measuring the resources invested and substances discharged across all product stages from the mining of the raw materials needed for the product to its manufacturing, transport, and disposal.

Evaluating the environmental impact of resource use requires an evaluation not only of the materials used in a product but also of the amount of substances involved in obtaining those materials. Additionally, to apply such an evaluation at the design stage that includes the selection of materials, we need a metric that can be easily calculated. We therefore decided to use total material requirement (TMR)[5] as a simple metric that applies a weight to each type of metal on the basis of the total mass of stripped soil, gangue, etc. created by the mining of each metal. The TMR indicates the amount of movement of the hidden material when manufacturing materials or products and shows promise as a metric for evaluating the latent environmental impact of that material flow.[6] Although TMR has been used for evaluating energy resources and materials, there are few examples of using it to systematically evaluate ICT products, which use a variety of metals.

We therefore applied TMR to ICT products to see whether it could be quantified from the viewpoint of resource use. In the following, we present the results of carrying out an evaluation using TMR as part of environmental strategizing for products.

4.1 Calculation of TMR in products

The TMR metric expresses how many kilograms of earth resources (most of which is material generated during mining) are used in obtaining 1 kg of a certain substance. Its value differs for each type of metal.[5] For example, The TMR coefficient for gold (Au) and copper (Cu) is 1,100,000 kg/kg and 360 kg/kg, respectively, so it can be said that the total amount of material involved in obtaining the same amount of resource is approximately 3,000 times greater for Au than for Cu. Taking as a example a product containing 10 mg of Au and 10 g of Cu, the total TMR value is calculated as follows.

Total TMR value of product

$$= (10 \text{ mg} \times 1{,}100{,}000 \text{ kg/kg}) + (10 \text{ g} \times 360 \text{ kg/kg})$$
$$= 11 \text{ kg} + 3.6 \text{ kg}$$
$$= 14.6 \text{ kg}$$

4.2 Evaluation of TMR in ICT products

We used one type of notebook PC and four types of smartphones sold at different times to test whether the application of TMR to ICT products would enable us to visualize the magnitude of the impact of resource use. Specifically, we identified the constituent amounts of 16 metals (Au, Cu, Rh, Pd, Ge, Ga, Gd, Dy, Ta, Ag, La, Nd, Y, Sn, V, and Ni)[note 3)] in each smartphone through inductively coupled plasma-mass spectrometry (ICP-MS) and calculated the TMR for each smartphone (**Figure 5**).

Examination of the results of this test showed that Au and Cu made up more than 75% of TMR in both the notebook PC and four types of smartphones. It also showed that TMR was lower for more recent products in the case of smartphones, which is attributed to the smaller amounts of Au used to make them. Since 92% of the Au used was contained in the IC components, and the number of IC components in the smartphone products did not decrease from year to year, we conclude that the downward trend in the amount of Au used in the smartphones was due to a decrease in the amount of Au used within each IC component.

We investigated the relationship between trends in packaging technology and the constituent amount of Au to clarify why the amount of Au decreased over time. We found that the decrease can be explained by two main factors. First, the main material used in the bonding shifted from Au to other metals (Cu, Pd, and Ag). Second, the downsizing of the bumps in the flip chip packaging, which directly connects to the wiring board via the backside of the IC chip, was accompanied by a shift to Cu pillar bumps from Au plating.

Moreover, a comparison of TMR between the notebook PC and the smartphone products showed that the amount of Au in the PC had the same order of an amount of Au as that of the smartphone while the amount of Cu in the PC was larger. This is attributed to the large amount of copper used in the wiring boards and heat pipes in notebook PCs.

4.3 Summary

Application of the TMR metric to ICT products showed that the types of metals used and the components, units, etc. with a large TMR could be identified and that changes in TMR over time can be understood. Going forward, we plan to study the application of this metric to strategic planning with an eye to evaluating

note 3) Rh: rhodium, Pd: palladium, Ge: germanium, Ga: gallium, Gd: gadolinium, Dy: dysprosium, Ta: tantalum, Ag: silver, La: lanthanum, Nd: neodymium, Y: yttrium, Sn: tin, V: vanadium, Ni: nickel

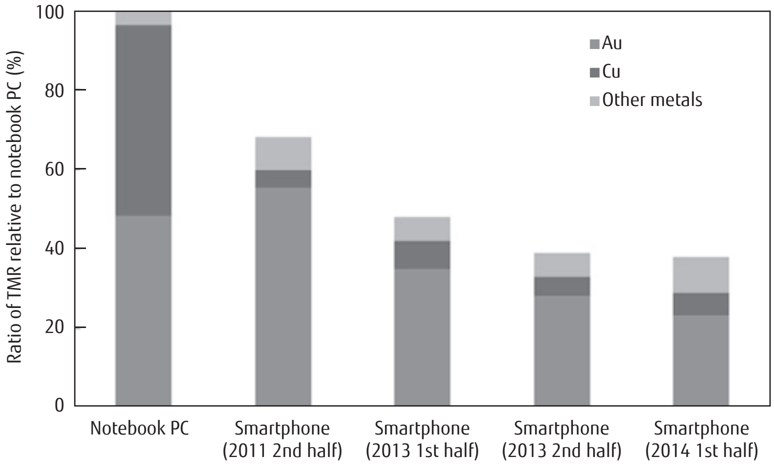

Figure 5
Comparison of total material requirement (TMR) for ICT products.

and reducing the environmental impact of the various resources used in products.

5. Development of environment-contributing materials

Fujitsu and Fujitsu Laboratories have strived to reduce environmental load in ICT products such as notebook PCs through the development of bioplastics based on polylactide made from corn[7] etc. and the development of recycling technology for magnesium alloy housings[8] among other technologies. They have also developed water-based paint technology[9] that can reduce the amount of volatile organic compounds (VOCs), which are known to give rise to photochemical smog. This technology was applied to UNIX servers for the first time in the industry in 2013.

As examples of recent R&D achievements in this area, we here introduce the development of bio-derived, water-based paint technology using environmentally conscious technologies that can reduce not only VOCs but also CO_2 emissions and the development of closed recycling materials using the notebook PCs collected at Fujitsu Group recycling centers as raw material.

5.1 Development of bio-derived, water-based paint

Compared with conventional solvent-based paint, water-based paint contains only a small amount of solvent, resulting in an 80% reduction in VOC content. Building upon this feature, Fujitsu Laboratories has developed bio-derived, water-based paint by combining previously developed and enhanced bioplastics technology and water-based paint technology (**Figure 6**). It can reduce CO_2 emissions in addition to decreasing VOCs.

1) Problems

Applying bio-derived, water-based paint to ICT products such as servers and personal computers means that the coating performance required for the housing of such products be satisfied in terms of hardness, adhesion, chemical resistance, weather resistance, and appearance. In addition, using polylactic acid, a bioplastic, in paints presents the following problems.

- Paints using polylactic acid emulsion adhere poorly to the base material, resulting in a brittle coated film.
- Polylactic acid is susceptible to hydrolysis, and it whitens when water contacts the coating.
- When using a coating film with water-based paint, the coating must be heated after application so that the water evaporates and the coating dries. This enables the suspended resin particles to thermally bond together. This requires a temperature of 100°C or higher, but plastic housings used in ICT products cannot withstand such temperatures and will deform as a result.

2) Developed technology

The bio-derived, water-based paint developed by

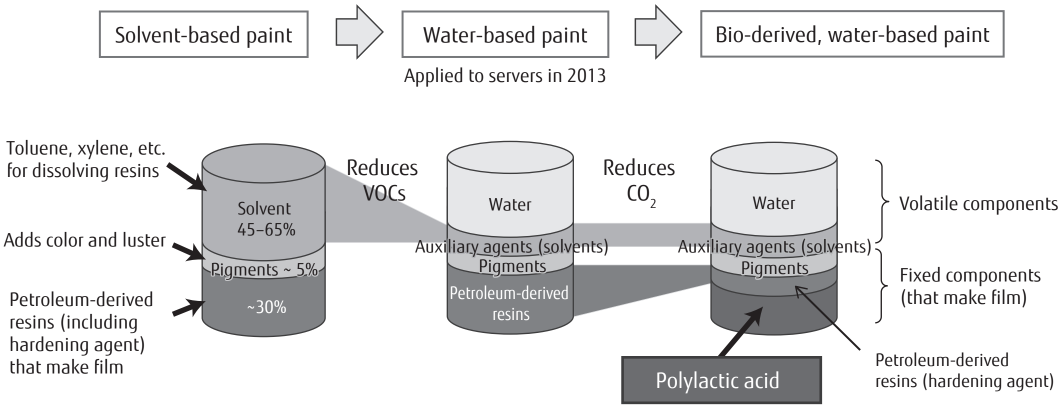

Figure 6
Development of paint for reducing environmental load.

Fujitsu uses an emulsion of polylactic acid and utilizes the effects of both a resin hardening reaction and thermal bonding between resin particles to form a coating.

- Hydroxyls, which normally promote hydrolysis in polylactic acid emulsion, bond with isocyanates, resulting in urethane. The urethane suppresses hydrolysis, enabling formation of a tough, water-resistant coating that does not whiten when contacted by water.
- As mentioned above, when using a coating film with water-based paint, the water must be allowed to evaporate so that the resin particles can bond together. However, viscosity increases as evaporation progresses, making it difficult for the hydroxyls to form urethane. A small amount of a solvent is thus added as auxiliary agents to control the speed of evaporation and optimize resin hardening by urethane bonding and thermal bonding between resin particles. In addition, optimization of the types of solvents used as auxiliary agents enables drying at temperatures low enough to prevent deformation of the plastic housing.

This bio-derived, water-based paint thus achieves the level of coating performance required for ICT products. Compared with base resins of conventional solvent-based paint such as petroleum-derived acryl, the use of polylactic acid, a bioplastic, generally results in low CO_2 emissions. In short, Fujitsu's development of bio-derived, water-based paint incorporating polylactic acid has enabled a 60% reduction in CO_2 emissions and contributed to a reduction in environmental load.

5.2 Closed recycling material

Fujitsu has constructed a "closed recycling system" that can use plastic materials from post-use Fujitsu products collected at Fujitsu Group recycling centers in new Fujitsu products as recycled plastic (**Figure 7**).

1) Problems

In constructing a closed recycling system, there are a variety of problems to be addressed in applying collected products to new products as recycled materials on an ongoing basis. For example, it is important to selectively collect products from which individual materials can be collectively obtained and to manage controlled substances in accordance with RoHS, REACH, and other regulations. Additionally, to manage the chemical substances contained in recycled materials and maintain the properties of that material, the recycling process must be able to remove unneeded components and prevent the target material from being contaminated by other materials. It is also necessary that material properties such as rigidity and flame retardancy required of ICT products such as notebook PCs and tablets be achieved in the recycled material.

2) Developed technology

Fujitsu has constructed a system having the following features to achieve closed recycling.

- It determines the composition/properties of the plastics used in the targeted notebook PC housings.
- It enables thorough management of the recycling

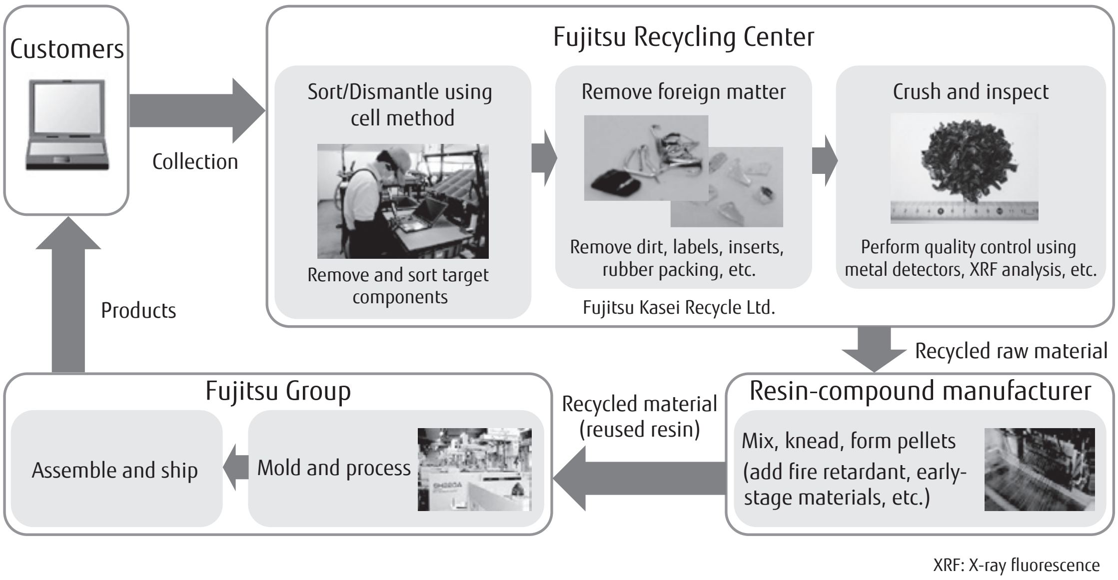

Figure 7
Closed recycling system constructed by Fujitsu.

process and the provision of high-quality recycled materials. It introduces the cell method[note 4)] to the sorting and dismantling of notebook PCs. This means that a particular type of product is always dismantled in the same cell, thereby preventing contamination by other types of products. It also facilitates sorting and dismantling even when changing the model of the product to be dismantled.

- It enables the originally collected plastic material to be upgraded to a high-function, high-value recycled material to achieve the material properties (performance) required of new notebook PCs and tablets at low cost.
- Manufacturing high-quality recycled material using this closed recycling system enables the use of new materials to be reduced and the new use of energy to be decreased, thereby controlling environmental load. Replacing new materials with recycled material in this way reduces CO_2 emissions by approximately 14% in material manufacturing (calculated for tablets with a recycled-material ratio of 20%).

note 4) A production method in which one person or a small number of people constitutes a work team that performs product assembly and processing until completion (or inspection). Compared with traditional production methods such as the line production system, the cell method features a wider range of work and responsibilities for a single worker.

6. Conclusion

In this paper, we outlined the development of environmentally conscious products in the Fujitsu Group, described activities to date based on Fujitsu Group Environmental Action Plans, and introduced efforts toward improving energy efficiency and resource efficiency and enhancing recycling. We also described new efforts at visualizing the environmental load caused by the use of resources and the development of technologies for reducing environmental load such as the development of bio-derived, water-based paint and the construction of a closed recycling system.

Going forward, the Fujitsu Group is committed to applying green technologies to its products, contributing to greater energy efficiency, promoting improvements in resource savings and recycling, and solving social and environmental issues through Fujitsu products.

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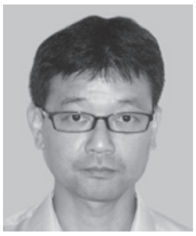

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