

ECO-PRODUCTS DIRECTORY 2005

*For Sustainable
Production & Consumption*



ASIAN PRODUCTIVITY ORGANIZATION

Published by the Asian Productivity Organization
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ASIAN PRODUCTIVITY ORGANIZATION
Hirakawa-cho Dai-ichi Seimei Bldg. 2F
1-2-10 Hirakawacho, Chiyoda-ku, Tokyo 102-0093, Japan

ISBN: 92-833-7042-02

Contents

Foreword

Introduction

Background of the Eco-products Database 1

Eco-materials, Eco-components, Eco-products, and Eco-services - What are they ? - 7

Categories 9

Development of Eco-materials, Eco-products, and Eco-services in Japan

1. History of Eco-design 11

2. Eco-materials..... 11

3. Eco-components and Eco-products 13

4. Eco-services 16

5. Eco-product exhibitions in Japan..... 17

Related Organizations List 19

Database

1. Eco-materials

i Metals 23

ii Polymers 42

iii Natural Materials..... 46

iv Foams 49

v Ceramics and Glass..... 50

vi Composites 56

vii Others 59

2. Eco-components

i Construction Components 65

ii Electrical and Electronic Components 67

iii Semiconductor Manufacturing Devices..... 67

iv Machine Parts 74

v Automobile Parts..... 77

vi Others 80

3. Eco-products	
i Home electric appliances / Lightings	87
ii Carriers / Automobiles	140
iii OA / IT Equipments.....	168
iv OA / Furniture	190
v Apparel / Fabric Product	196
vi Commodity / Outdoor Goods / Housing Kit.....	199
vii Building and Civil Engineering	226
viii Machines and Equipments.....	242
ix Others	280
4. Eco-services	
i Product-related services	305
ii Reuse and recycling-related services.....	305
iii Management-related services	307
iv Others	311
Company List	315

Foreword

The APO is continuously devoting itself to the improvement of productivity and accelerating the economic development in the Asia and Pacific region through the sharing of experiences and expertise. After the Rio Summit, from the viewpoint of sustainable economic growth, the APO has been emphasizing Green Productivity (GP), so that the region can remain competitive in a business environment that is globalizing at an ever faster rate.

Japan has accumulated vast experience in environmental management and the APO, recognizing this, established in 2003 the GP Advisory Committee (GPAC), comprising more than 40 Japanese companies for advice and support on GP-related activities. The committee, chaired by Mr. Yoichi Morishita, Chairman of Matsushita Electric Industrial Co., Ltd., recommended that the APO focus on promoting environmentally friendly products and services, establishing green supply chains, organizing eco-product exhibitions in Asia, and publishing eco-products databases for wider dissemination of environmentally friendly products and services.

This Eco-products Directory 2005 is an updated version of the Eco-products Directory 2004, which was published in conjunction with the Eco-products International Fair 2004, held in Malaysia. It is our great pleasure to publish this updated version on the occasion of Eco-products International Fair 2005 in Bangkok, Thailand.

As the Asian region takes up the position of a production hub in the global market, we can look forward to expanding green markets in Asia. I hope that this publication will contribute to an appreciation and expansion of the eco-product markets in the region.

Finally, our sincere thanks go to Professor Ryoichi Yamamoto, Chairman of the Subcommittee on the Eco-products Database of the GPAC, and all members of the committee and working group, and the Society of Non-Traditional Technology for their dedicated efforts and leadership in bringing this publication to fruition.

Shigeo Takenaka
Secretary-General

Tokyo
October 2005

Introduction

Achieving a Sustainable Economy through Eco-innovation

It is now clear that if the current world economy continues its present course, environmental destruction and social collapse will be inevitable. The following facts should provide sufficient empirical evidence to support this assertion. Overall, 760 tons of CO₂ are emitted globally every second; about 50% of this accumulates in our atmosphere and has become the major cause of global warming. Other signs and reasons include the reduction of oxygen at a rate of 710 tons per second due to excessive consumption, an increase in the world population by 2.4 persons per second, and the exponential increase in the production of materials such as metal, cement, and plastic. In the industrial civilization of the 20th century, economic development inevitably increased the consumption of resources and energy, as well as the discharge of substances that place a burden on the environment. The increased input and output of such substances has made clear the extent of resource depletion and limited ability of earth's ecosystems to absorb and purify substances causing environmental burdens. In the 21st century, giant nations such as China and India are starting to show rapid economic growth with massive consumption of resources and energy accompanied by massive discharges of environmentally burdening substances, following in the footsteps of the OECD nations. On the other hand, as summarized in a recent report by the Swedish government, attempts to decouple massive consumption of resources and energy and massive discharges of environmentally unfriendly substances from economic growth have failed even in OECD members. This implies that while the world economy grows at a rate of 3% every year, we are heading directly toward the depletion of resources, environmental destruction, and social collapse.

To resolve this problem, we need to promote eco-innovation at every level, including technical, policy, management, and individual lifestyle levels, and disseminate such innovation swiftly into society. The goals are clear: reducing materialism, substituting for hazardous substances, and decarbonization of energy use.

In eco-innovation efforts, it is vital to increase two indicators. One is improving performance per resource input or increasing resource productivity, which expresses the economic added value. The other is eco-efficiency, which indicates improved performance per environmental impact or increased added economic value during the product life cycle. Worldwide, active efforts are being made for eco-innovation. In 2000, the EU issued the End-of-Life Vehicles Directive to ban the use of lead, mercury, hexavalent chromium, and cadmium. In 2001, the EU published a Green Paper on Integrated Product Policy. Since 2003, based on the Restriction of Hazardous Substances Directive or Energy Using Product Directive Proposal, businesses have been required to prepare ecological profiles of their products. In addition, the Registration, Evaluation, and Authorization of Chemicals Regulation Proposal is further reinforcing chemical substance management. In 2001, Japan enacted the Law on Promoting Green Purchasing to mandate eco-friendly procurement by national and local governments. Meanwhile, the United Nations Environment Programme is

striving to spread the cleaner production concept and the Asian Productivity Organization its Green Productivity concept worldwide. All these activities will promote eco-innovation, along with the development of eco-materials, eco-products, and eco-services. Still, no methods for the rapid and explosive spread of eco-innovation to communities have been developed. This document is the second attempt after the *Eco-products Directory 2004* to remedy this lack in Asia. Just as a small ripple can set off a tidal wave, I am convinced that Asia will soon see markedly accelerating trends in Green Productivity, eco-design, and ecoproducts. Human beings are currently facing an environmental struggle of life-or-death proportions: Which will be achieved first, environmental destruction and social collapse or the development and dissemination of eco-innovation? In 2005, the International Green-Purchasing Network (IGPN) was established to promote sustainable production and consumption worldwide. The IGPN should contribute to eco-innovation and its dissemination.

Ryoichi Yamamoto

Professor

Institute of Industrial Science, University of Tokyo

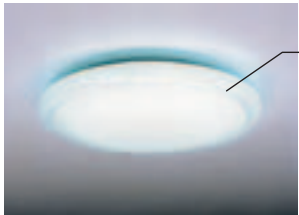
Background of the Eco-products Database

As mentioned in the Foreword, the first eco-products exhibit in Southeast Asia, the Eco-products International Fair 2004, was held in Malaysia from 2 to 4 September 2004. On that occasion, the Green Productivity Advisory Committee (GPAC) (List 1) of the Asian Productivity Organization (APO) compiled a database of major eco-materials, eco-components, and eco-products produced in Japan to introduce environment-friendly products to other Asian countries. To launch the database project, the Subcommittee on the Eco-Products Database (chaired by Professor Ryoichi Yamamoto, see List 2) was set up within the GPAC. The subcommittee discussed the methodology for database development, standards to be applied, companies to be included, division of labor, maintenance of the database after publication, etc. The Society of Non-Traditional Technology organized the Database Working Group (List 3) with the collaboration of the University of Tokyo, National Institute for Materials Science, and Green Purchasing Network. The Database Working Group oversaw the details of the format and publication.

This *Eco-products Directory 2005* is a revised edition following the 2004 format but including newly incorporated information on eco-services and more product information from companies known for their concern for the global environment.

Databook Format

Based on the databook format determined in 2004, the Database Working Group invited both foreign and domestic companies to register their product information. The contents and format of the information listed in the *Eco-products Directory 2005* are as illustrated below.

Eco-products No.053	
Home electric appliances/ Lightings	Circular fluorescent lamp fixtures
High-efficiency flickerless inverter ceiling lamp	
Matsushita Electric Works, (Ayuthaya)Ltd.	
13 Moo 5 Rojana Industrial Park, T.Kanham, A.Uthai, 13210 Thailand	
Tel; 66-3533-0846 Fax; 66-3522-6660	
E-mail;	
URL; http://www.mew.co.jp	
Category: ● A1. Global Warming ● A5. Resource Consumption ● B4. Higher Quality ● B5. Energy Saving ● C5. Product Use, Maintenance and Repair	
[Power-saving] The inverter circuit converts 50Hz alternating current to approx. 50,000Hz high frequency current, which increases the number of collisions (light emissions) between mercury atoms and electrons in the fluorescent lamp, efficiently converting electricity into light. The power consumption has been reduced by approx. 25% from that of the conventional glow-starter magnetic ballast type without changing the brightness. (32W glow-starter type: Approx. 41W, Inverter type: Approx. 30W) [Need no glow starter] Since the inverter type turns on the lamp by electronic control, it does not need a glow starter, which has been required for the conventional type. Replacement work and waste are eliminated. [Quick lighting] This lamp is lit quickly when the switch is turned on. Stress applied on the lamp is less than the conventional type, which starts lighting after flickering, making the lamp life longer. [Flickerless] The lighting frequency is as high as approx. 50,000Hz. This lamp is easier on the eyes than the conventional type, which flickers 100 times per second.	
Products/Model : HAT9502E (32W type)	

(1) Product type

One of the four product types below was selected.

- I. Eco-materials and technical usage
- II. Eco-components and technical usage
- III. Eco-products and technical usage
- IV. Eco-services

(2) Product field

One of the product fields below was selected.

- (I. Eco-materials and technical usage)
 - 1 Metals
 - 2 Polymers
 - 3 Natural materials

- 4 Foam
- 5 Ceramics and glass
- 6 Composites
- 7 Others
- (II. Eco-components and technical usage)
 - 1 Construction components
 - 2 Electrical and electronic components
 - 3 Semiconductor manufacturing devices
 - 4 Machine parts
 - 5 Automobile parts
 - 6 Packaging
 - 7 Others
- (III. Eco-products and technical usage)
 - 1 Home electric appliances/lighting
 - 2 Carriers/automobiles
 - 3 OA/IT equipment
 - 4 OA furniture
 - 5 Apparel/fabric products
 - 6 Commodities, outdoor goods, housing kits
 - 7 Building and civil engineering
 - 8 Machines and equipment
 - 9 Others
- (IV. Eco-services)
 - 1 Product-related services (maintenance, upgrading, repair/renovation, etc.)
 - 2 Reuse and recycling-related services (collection, reuse, etc.)
 - 3 Lease, rental, sharing
 - 4 Outsourcing services (waste disposal, control of hazardous substances, treatment of chemicals, facility management, etc.)
 - 5 Management-related services (consulting, accreditation, analysis, evaluation, etc.)
 - 6 Others (insurance, e-commerce, eco-tourism, hotels, information transfer, etc.)

(3) Product name with product code

Using the Standard Commodity Classification of Japan, the product code is given, and products are listed based on the order of the code. When the corresponding code was not found in the Standard Commodity Classification, the most appropriate code was selected by the Database Working Group, regardless of whether the company included the product trade name. The product category code consists of a numeral and a name, but only the name element of the product code or the product trade name given by the company or the Database Working Group appears in space (6).

(4) Product/service name with features

The heading is in boldface type (65 characters maximum).

(5) Company contact details

The company name and address (required), telephone number, facsimile number, e-mail address, or homepage address (optional).

(6) Category

Five items were selected from the following 18 (A1 to C6).

A: Items related to environmental impact

- A1 Global warming
- A2 Air pollution
- A3 Hazardous substances
- A4 Waste
- A5 Resource consumption

B: Items related to environmental performance indicators

- B1 Recyclability
- B2 Longevity
- B3 Resource saving

- B4 Higher quality
- B5 Energy saving
- B6 Environmental purification
- B7 Use of recycled materials
- C: Items related to life-cycle stage
 - C1 Material extraction
 - C2 Material and component production
 - C3 Design and material selection
 - C4 Product manufacture
 - C5 Product use, maintenance, and repair
 - C6 End-of-life disposal

(7) Product details

The features of the product/service and how it reduces environmental impact are described (1200 characters maximum).

(8) Photograph

One photograph per product is shown.

(9) Explanation of photograph

A brief explanation of the product photograph with the model number is given (45 characters maximum).

The number of environment-friendly products/services contained in the *Eco-products Directory 2005* totals 568.

[List 1]

Green Productivity Advisory Committee

(As of end of June 2005)

Members List

Chairperson

Mr. Yoichi Morishita
Chairman of the Board
Matsushita Electric Industrial Co., Ltd.

Vice-Chairpersons

Mr. Toshio Yonezawa
Representative Director and President
Nippon Steel & Sumikin Stainless Steel Corporation

Mr. Masatoshi Yoda
Corporate Adviser (Former President)
Ebara Corporation

Prof. Ryoichi Yamamoto
Professor, Institute of Industrial Science & International Research
Center for Sustainable Materials
University of Tokyo

Members

Mr. Seiichi Ueyama
General Manager, Corporate Citizenship Department
Aeon Co., Ltd.

Mr. Masayuki Hirata
Corporate Councilor, Environment Department
Ajinomoto Co. Inc.

Mr. Eisuke Kumano
President
Amita Corporation

Mr. Shigeto Yamashita
Producer, Department of Environment Management
Asahi Breweries, Ltd.

Mr. Masaaki Hikida
Director, Corporate Planning Division
Biznet Corporation

Mr. Kiyoto Furuta
Deputy Senior General Manager, Environment Management and
Engineering Center
Canon Inc.

Mr. Kenzo Shibutani
Senior Manager, Global Environmental Department
Daikin Industries Ltd.

Mr. Tsutomu Ishibashi
General Manager, Corporate Environmental Management Office
Ebara Corporation

Mr. Hiroyuki Akiyama
Group Manager, Corporate Social Responsibility Dept
Fuji Xerox Co., Ltd.

Dr. Nobuo Kamehara
President
Fujitsu Analysis Laboratory Ltd.

Mr. Yoichi Takahashi
Divisional Manager, Corporate Environmental Policy Division
Hitachi, Ltd.

Mr. Masami Shinohara
Vice President, Global Environment Division
Japan Tobacco Inc.

Mr. Takuya Kadowaki
Manager, Business Project Planning and Marketing Department
JFE Engineering Co., Ltd.

Mr. Toru Nakagawa
General Manager, Environmental Protection & Safety Department
Kaneka Corporation

Mr. Tadashi Matsui
Vice President, Headquarter of Environment and Safety
Kao Corporation

To be designated
Mr. Kazuya Kojitani
Department Manager, Group Management Headquarters
Kokuyo Business Services Co., Ltd.

Dr. Narito Shibaike
Councilor, Environmental Planning Group, Corporate Environmental
Affairs Division
Matsushita Electric Industrial Co., Ltd.

Mr. Shinji Hirano
Senior Engineer, Environmental Preservation Division
Meidensha Corporation

Mr. Yoshitaka Moriide	Manager, Marketing Department Ministop Co., Ltd.
Mr. Takashi Yoshida	General Manager, Corporate Environmental Sustainability Group Mitsubishi Electric Corporation
Mr. Chikura Kinoshita	Executive Officer, General Manager, Environment Management Division Mitsubishi Materials Corporation
Mr. Koji Yamaguchi	Vice President Executive Expert (Environmental Affairs) NEC Corporation
Mr. Teruo Furuyama	Senior Manager, Technical Group, Environmental Affairs Division Nippon Steel Corporation
Mr. Tetsuo Hasegawa	General Manager, Environmental and Safety Engineering Nissan Motor Co., Ltd.
Mr. Junji Ohsawa	General Manager, Environmental Department Oji Paper Co., Ltd.
Mr. Susumu Nakamaru	Corporate Councilor, Corporate Environment Division Ricoh Company, Ltd.
Mr. Misao Muraoka	Senior Manager, Environment Team, Corporate Environment Center Corporate Innovation Central Unit Innovation Group Sanyo Electric Co., Ltd.
Mr. Yoshihiro Ono	General Manager, CSR & Global Environment Policy Department, CSR & Environment Affairs Division Seiko Epson Corporation
Dr. Hiroshi Morimoto	Group Deputy General Manager, Environmental Protection Group Sharp Corporation
Mr. Junzo Ohse	Senior Manager, Environment and Occupational Safety Management Department Shimadzu Corporation
Mr. Ryo Sasaki	President Shinagawa Chemical Ind. Co., Ltd.
Ms. Mieko Kuwayama	General Manager, CSR Department Shiseido Co., Ltd.
Mr. Hidemi Tomita	Vice President, Corporate Social & Environmental Affairs/Compliance Office Sony Corporation
Mr. Hiroyuki Tada	General Manager, Management Quality Department Sony EMCS Corporation
Mr. Yoshihisa Mizukami	Executive General Manager, Environmental Affairs Department Suntory Limited
Mr. Naoki Arai	Teijin Group Corporate Officer, Assistant Chief Marketing Officer Teijin Limited
Mr. Kazunari Take	Manager, Society/Environment, Corporate Affairs The Seiyu Ltd.
Mr. Hiroshi Inanaga	Chief Executive Officer Tohatsu Evaluation and Certification Organization Co., Ltd.
Mr. Toshinobu Sato	General Manager, Environment Department Tokyo Electric Power Company
Mr. Yasunori Takakuwa	General Manager Environmental Affairs Department Tokyo Gas Co., Ltd.
Mr. Masataka Iwadate	Section Chief, Environmental Affairs, Environment Department Tokyu Corporation
Mr. Susumu Ota	General Manager, Corporate Planning Department Toray Industries, Inc.
Mr. Kiyoshi Sanehira	Chief Specialist, Corporate Environment Management Division Toshiba Corporation
Mr. Tetsushi Ito	Manager, Environmental Affairs Division Toyota Motor Corporation
Mr. Keiichi Matsushima	General Manager, Environmental Administration Division Victor Company of Japan Limited

[List 2]

Subcommittee on the Eco-products Database

Members List

Prof. Ryoichi Yamamoto	Professor, Institute of Industrial, Science & International Research Center for Sustainable Materials University of Tokyo
Mr. Shigeto Yamashita	Producer, Department of Environment Management Asahi Breweries, Ltd.
Mr. Kiyoto Furuta	Deputy Senior General Manager, Environment Management and Engineering Center Canon Inc.
Mr. Tadashi Matsui	Vice President, Headquater of Environment and Safety Kao Corporation
Mr. Kazuya Kojitani	Department Manager, Group Management Headquarters Kokuyo Business Services Co., Ltd.
Dr. Narito Shibaike	Councilor, Environmental Planning Group Corporate Environmental Affairs Division Matsushita Electric Industrial Co., Ltd.
Mr. Takashi Yoshida	General Manager, Corporate Environmental Sustainability Group Mitsubishi Electric Corporation
Mr. Koji Yamaguchi	Vice President Executive Expert (Environmental Affairs) NEC Corporation
Mr. Teruo Furuyama	Senior Manager, Technical Group Environmental Affairs Division Nippon Steel Corporation
Mr. Tetsuo Hasegawa	General Manager, Environmental and Safety Engineering Department Nissan Motor Co., Ltd.
Mr. Junji Ohsawa	General Manager Environmental Department Oji Paper Co., Ltd.
Mr. Susumu Nakamaru	Corporate Councilor, Corporate Environment Division Ricoh Company, Ltd.
Mr. Hiroshi Morimoto	Deputy Director, Environmental Protection Group Sharp Corporation
Mr. Hiroshi Inanaga	Chief, Executive Officer Tohatsu Evaluation and Certification Organization Co., Ltd.
Mr. Kiyoshi Sanehira	Chief Specialist, Corporate Environment Management Division Toshiba Corporation

[List 3]

Database Working Group

Members List

Hiroyuki Sato	Green Purchasing Network (GPN)
Gakuji Fukatsu	Green Purchasing Network (GPN)
Katsutoshi Yamada	Ecomaterials Center, National Institute for Materials Science
Hong Nguyen Xuan	Institute of Industrial Science, University of Tokyo
Ying Wang	Institute of Industrial Science, University of Tokyo
Kohei Morimoto	Institute of Industrial Science, University of Tokyo
Kenichi Nakajima	Graduate School of Environmental Studies, Tohoku University
Shoko Tsuda	The Society of Non-Traditional Technology
Wakako Suetsugu	The Society of Non-Traditional Technology

Eco-materials, Eco-components, Eco-products, and Eco-services

— What are they ? —

The prefix “eco”, meaning habitat or environment, comes from “ecology”, the branch of science concerned with the interrelationships between organisms and their environments. Eco has long been used in such compound forms as ecosystem and ecocide. More recently, this prefix has been used in combination with “materials”, “products”, or “services” to indicate that they take into account environmental impacts through the entire life cycle.

1. What are eco-materials?

The term “eco-materials” was first introduced in Japan by Professor Ryoichi Yamamoto and colleagues at the University of Tokyo in 1991 as a proactive measure in response to the sustainable development movement. Eco-materials are defined as those that can improve the environment throughout their life cycle, with accountable performance. Eco-materials encompass one or more of the following six factors:

1. avoiding and/or reducing the use of nonrenewable or scarce resources;
2. enhancing the material closed loop by recycling and reusing waste;
3. increasing resource efficiency including that of energy and materials;
4. using more durable materials with fewer maintenance requirements;
5. promoting the use of renewable resources and energy; and
6. minimizing adverse impacts on biodiversity and eco-systems.

In other words, eco-materials form a key concept in material science and technology to minimize environmental impacts, enhance the recyclability of materials, and increase energy and material efficiency. Eco-materials also contribute to the development of eco-products and promote the green procurement movement in Japan and elsewhere.

Eco-materials have relatively better ecological, economic, and efficiency features and are currently classified into groups based on similar properties, similar processing routes, and similar applications. Therefore, this data book classifies them into seven categories: metals, polymers, natural materials, foams, ceramics and glass, composites, and others.

2. What are eco-components?

The term “eco-components” in this publication refers to those used as components or parts of eco-products. Eco-components can be essential, functioning parts of a subsystem or equipment, or a combination of parts, assemblies, attachments, or accessories of an eco-product. They are sometimes called semi-products and used as inputs in eco-product manufacturing.

Similar to eco-materials, eco-components are produced taking into account their environmental impacts through the entire life cycle. As a result, the six factors involved in eco-materials can also be applied to eco-components. Eco-design or life-cycle design concepts, methodologies, and tools are used in the production of eco-components. In addition, eco-components can contribute to the manufacture of eco-products through eco-design for disassembly, design for upgradeability, and design for waste prevention.

While eco-components are defined as components or parts of eco-products, they are naturally related to the industrial sectors making them. Based on the major product categories, eco-components can be classified into seven groups: construction components, electrical and electronic components, semiconductor manufacturing devices, machine parts, automobile parts, packaging, and others.

3. What are eco-products?

Eco-products are designed according to eco-design concepts and principles to have environmentally friendly features. Life cycle concepts and engineering play a very important role during the development phase of eco-products. Eco-products are made from improved raw materials, including recycled or biomass materials. In addition, during the production process, minimal energy and water resources are used with less waste and fewer pollutants. In the consumption phase, the use of eco-products can lead to energy and water savings, minimal emissions, and reduced waste and subsequent need for waste treatment. Eco-products are also designed to ensure the ability to recycle and recover materials and components.

In Japan, eco-products generally bear eco-labels, which are type I, type II, or type III according to ISO14020 standards. In addition, those products listed in the database of the Green Purchasing Network are also considered to be eco-products.

In this data book, eco-products are classified into nine groups following the conventional industrial product categories. Among commercial products on the Japanese market, these are home electric applications/lighting, carriers/automobiles, OA/IT equipment, office furniture, apparel/fabric products, commodity/outdoor goods/housing kits, building and civil engineering equipment, machines and equipment, and some other eco-products not relevant to the above eight groups of eco-products.

4. What are Eco-services?

Eco-services are defined as those designed to shift traditional business from designing and selling products as physical objects into designing and selling product or service functions to meet the needs of customers. This new business is based on the life-cycle concept to ensure consideration of environmental issues. The use of eco-services can enhance the eco-efficiency of customer activities. A number of similar concepts have been proposed, such as Product Service Systems, Sustainable Service Systems, and eco-efficient services in Europe, and “servicizing” in the USA. Although these concepts have their own distinguishing features, the main purpose of shifting traditional business to new, sustainable business in eco-services is common to all.

While the economy is shifting from goods production toward service provision, eco-products can be transformed into services to improve resource productivity and eco-efficiency. Eco-services have great potential to bring about huge changes in production and consumption patterns that will accelerate the shift toward a more sustainable society.

Eco-services are generally classified based on actual business scenarios. The great diversity of eco-services has led to varying classifications, and no single standard yet exists. Based on examples in the Japanese market, eco-services are classified into six categories:

1. product-related services, including maintenance, upgrading, repair, reform, etc.;
2. reuse and recycling-related services;
3. user services, such as consumer leasing, rental, or product sharing;
4. outsourcing services, such as those provided by some professional companies in the form of pay-per-service waste treatment, hazard control, chemical handling, or facility management;
5. management-related services, such as consulting, certification, diagnosis, assessment; and
6. other services outside the above categories.

These six categories may cover most eco-services, from traditional industrial services to new services and businesses.

In this data book, we modified the classification of eco-services into four groups: 1) product-related services, 2) reuse and recycling-related services, 3) management-related services, and 4) others.

Classification of Categories

Recently, many eco-products have been developed in Japan. Eco-labelling (types I to III) has been introduced to standardize or evaluate these products. The classification of available eco-products into categories and the compilation of a databook on such products should aid both consumers and companies in using and developing eco-products easily and appropriately. Based on this objective, information collected on eco-products was categorized from three perspectives: A) environmental load; B) environmental performance index; and C) life cycle stage. These categories are considered useful for investigating the effects that eco-products have on which environmental loads, with what level of eco-performance, and at which stage.

For category A, products were categorized according to the environmental impact reduction with the use of eco-products. Among various environmental problems currently observed, products were grouped according to their impact on the following five: global warming as a global environmental problem; air pollution as a local environmental problem; the issue of hazardous substances; management of waste due to landfill site limitations; and the consumption of resources due to Japan's dependence on other countries for most. Details of the classification are as follows:

- A1. **Global warming** : Products effective for reducing greenhouse gases such as CO₂ which cause global warming. The category includes products with energy-saving effects and those that contribute to decreasing deforestation, in addition to products that directly reduce the discharge of greenhouse gases.
- A2. **Air pollution** : Products that reduce the discharge of air pollutants such as nitrogen oxides, sulfur oxides, and suspended particulate matter, discharge of which is restricted by the Air Pollution Control Law and other governmental regulations. The category also includes products with properties promoting air cleaning.
- A3. **Hazardous substances** : Products with actions to reduce the discharge of substances affecting the human body and ecology such as substances subject to the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law), and material safety data sheet. The category includes products that use hazardous substances in lesser amounts or which use no hazardous substances at all, as well as certain products composed of hazardous substances which can be reused/recycled.
- A4. **Waste** : Products that reduce the final disposal amount. They include those with reduced volume or weight and those supported by reuse/recycling systems.
- A5. **Resource consumption** : Products that reduce the consumption of resources such as minerals, wood, water, etc. They include those using few resources in the product itself or in the manufacturing process and those that can be reused/recycled efficiently.

In category B, products were categorized based on the environmental performance required for resolving the environmental problems in "A" above. The following seven environmental performance indices were selected:

- B1. **Recyclability** : Index of the ease of recycling. The category includes products that are easy to disassemble and classify for reuse and recycling and those designed so that recycling can be carried out efficiently.
- B2. **Longevity** : Index of longer life for conventional products. The category includes products designed for longer-term use and those of which the use can be extended by repair.
- B3. **Resource saving** : Index of resource saving for conventional products. The category includes products designed to save resources by reducing product weight or enhancing product design efficiency.
- B4. **Higher quality** : Index of enhanced quality for conventional products. The category includes those effective for improving the environment due to enhanced quality and services (environmental efficiency) achieved for the same environmental loads.
- B5. **Energy saving** : Index of energy saving for conventional products. The category includes those made

under an efficient process design, those that have been made lightweight, or those designed to reduce energy consumption during use.

B6. Environmental purification : Index of products with the function of cleaning the environment. The use of these products should detoxify hazardous substances or waste in the environment and recycling systems.

B7. Usage of recycled materials : Index of the enhancement of the rate of use of recycled resources for conventional products. The category includes products that use recycled resources in the products themselves or during the manufacturing process.

Furthermore, as it is preferable that measures for environmental problems be implemented in the entire product life cycle, for category C products were distinguished by life cycle stage as measured using the life cycle assessment method. The following six life cycle stages were selected:

C1. Materials extraction : Stage for mining resources used for products in mine sites. The category includes facilities for reducing environmental impact in this stage.

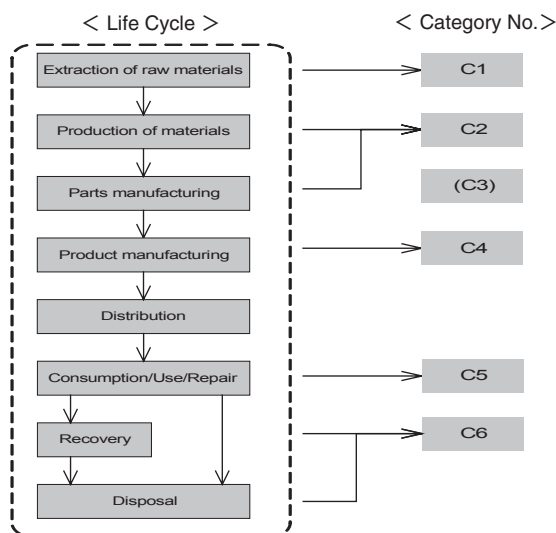
C2. Materials and components production : Manufacturing stage of half-finished products in general, such as primary products and parts serving as the material for products. Products in this category include half-finished products and products designed to reduce the environmental load in the manufacturing process.

C3. Design and materials selection : Stage in which parts and materials are selected and products are designed. The category includes those made of parts and materials that are eco-friendly or designed taking the environment into consideration, and eco-products based on design.

C4. Products manufacture : Stage in which products are manufactured using parts and materials. The category includes products reducing the environmental load during the manufacturing process.

C5. Product use, Maintenance and Repair : Stage in which manufactured products are used by consumers, including prolonged use due to repair. The category includes products with a reduced environmental load during use such as energy-saving products, products cleaning the environment during use, products of which the life can be prolonged by repair, and long-life products.

C6. End-of-life : Stage in which products are disposed of/recycled after use. The category includes products with low final disposal amounts, those easy to break down, those with high reusability/recyclability, and products with recycling systems.



Figuer Conceptual outline of a product's life cycle stages.

Development of Eco-materials, Eco-products, and Eco-services in Japan

1. HISTORY OF ECO-DESIGN

Eco-design has a long history dating from the 1960s. The concept, methodologies, and tools of eco-design can be divided into product-oriented and system-oriented approaches. The publication of *Silent Spring* by Rachel Carson in 1962 initiated a new movement for environmental protection and sustainable development. Since then, various organizations and governments have introduced principles, methodologies, programs, laws, and regulations related to eco-design and sustainable development. The first life cycle assessment (LCA) project was conducted by Coca Cola in the USA in 1969. The declaration of the United Nations Conference on the Human Environment in 1972 also marked a milestone in eco-design history. In the 1970s, Ruedi Mueller-Wenk, a Swiss engineer, introduced the concept of “eco-balance” or “ecological accounting” to address the impact of products, companies, and others on the environment. Later in that decade, the three main concepts of eco-design, Resource Productivity, The Natural Step, and Industrial Ecology were introduced in Europe and North America.

The last decade of the 20th century saw a blossoming in the development of eco-design concepts, methodologies, and tools. In 1991, the eco-material concept was introduced to Japan by Professor Ryoichi Yamamoto and his colleagues as a proactive measure for eco-design and sustainable development in the field of material science and engineering. At the same time, a green chemistry program was started in the USA. The World Business Council for Sustainable Development (WBCSD) introduced the eco-efficiency concept in 1992. One year later, Ernst Ulrich von Weizsacker introduced the factor 4 concept, and then the factor 10 concept was introduced by his colleague Friedrich Schmidt-Bleek in Europe to enhance resource productivity while reducing the impact on the environment by a factor of 4 or 10, respectively, to achieve the goal of sustainable development. These two concepts have been widely used in Japan as indicators of sustainable development or of the benefits of eco-products. Following the introduction of the pollution prevention concept in the USA, several other concepts such as Cleaner Production, Green Productivity, Zero Emissions, and Inverse Manufacturing were initiated in Europe and Asia in 1994. In the period from 1996 to 1999, various system-oriented concepts were proposed, including the ISO14000 series, functional economy, Product-Service System, Servicizing, Integrated Product Policy, Sustainable Service System, and triple bottom line. At the same time, the United Nations Environment Programme (UNEP), in collaboration with scientists in the Netherlands, published the first eco-design manual under a project called PROMISE. Since then, the trend in concept development has moved toward holistic management systems of products and services.

At the beginning of the 21st century, European and OECD countries introduced new systems and tools to cope with the growing demand for the appropriate management of chemicals. The first system was a globally harmonized system (GHS) for the classification and labeling of chemicals introduced in 2001. One year thereafter, the OECD countries organized a workshop in Tokyo, Japan, to develop a plan for a more holistic approach to chemical management, referred to as the Chemical Product Policies (CPP). In 2003, European scientists proposed the establishment of a new EU directive setting eco-design requirements for energy-using products (EuP). This proposed directive was enacted by the end of 2004, and it will be mandatory for manufacturers to address the life-cycle environmental performance of electrical and electronic products.

Eco-design development trends are shifting from products to services and from the old industrial economy to the new service economy. The importance of system-oriented approaches and concepts has increasingly been emphasized in the later phases of development.

2. ECO-MATERIALS

2.1 Development of basic concepts

In the beginning, the eco-material concept focused on the development of materials that could contribute to environmental conservation and protection. Environmental issues and functional properties of materials were considered, including structural materials used in construction or automobile manufacture and special functional materials such as semiconductors or solar cells.

Recently, the Eco-materials Forum in Japan has started an eco-materials guidelines project to develop a standardized concept of and criteria for the evaluation of eco-materials. The conceptual definition

of eco-materials in this project is: “Eco-materials are those that can contribute to reduction of environmental burden throughout their life cycles” (Shinohara, 2004). In other words, any material can be an eco-material as long as it satisfies prerequisites (I in Figure 1) and the necessary conditions for eco-materials (II and/or III in Figure 1). The prerequisites for eco-materials include the optimization of physical and/or chemical properties and superior technical performance. The necessary conditions are: significant environmental improvement compared with conventional materials (II); and no tradeoff of the environmental load throughout the whole life cycle, and if there is a tradeoff, all life cycle environmental data must be available to verify the improvement of environmental performance (III).

It should be noted that the entire life cycle impacts of eco-materials must be considered and improved. Condition II includes six vectors: 1) green resource profile; 2) minimal environmental impact during the material manufacturing process; 3) high productivity in use; 4) minimal use of hazardous substances; 5) high recyclability; and 6) high environmental purification efficiency. It is not necessary for an eco-material to include all six vectors, but it must include at least one.

In addition to the development of methodologies and tools, several books on eco-materials have been published in Japanese to help practitioners, students, and other interested persons apply the concept, methodologies, and tools. The latest, an eco-material selection guideline, was published in June 2004. Along with the publications, an eco-material international conference has been held every two years in Japan, China, and the USA. These conferences provide a good opportunity for materials researchers and industrial engineers to exchange ideas related to eco-materials. In 2003, the fourth eco-material conference was held in Yokohama, Japan, which attracted more than 150 presentations, including 26 invited lectures. In July 2005, the fifth international conference on eco-materials was organized in conjunction with the 9th International Conference on Advanced Materials held by the International Union of Materials Research Society (IUMRS) in Singapore. This international conference attracted more than 120 delegates from 16 countries, and about 150 research papers were presented.

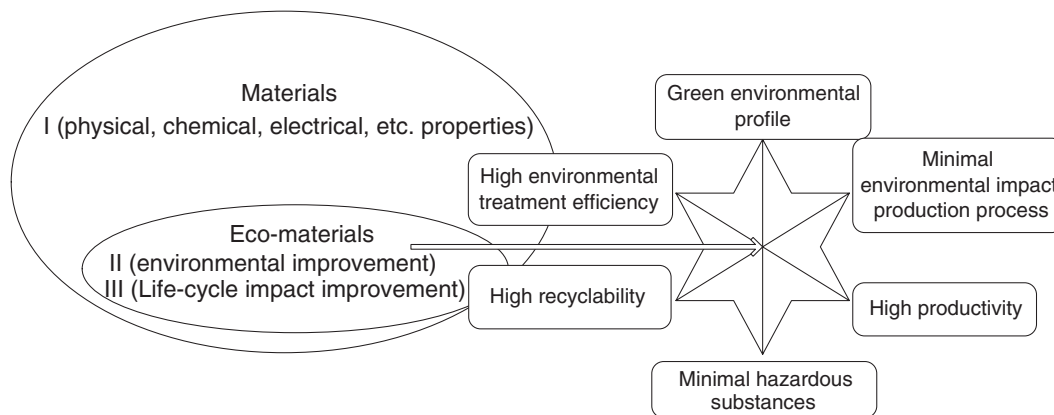


Figure 1. Conceptual model of eco-materials within the context of material sciences

A new concept of eco-material was also proposed during the conference, that of the “material-lease system.” This new concept is meant to promote the development of eco-services focusing on business-to-business activities. The material-lease system is defined as a “system to improve the resource productivity by sound material circulation” (Halada et al., 2005).

2.2 Current industrial practices

A recent study by Nguyen et al. (2004) reported a list of eco-materials based on environmental reports or responsible care reports in 2002 of more than 40 Japanese companies and eco-materials reported by companies in several industrial sectors including metals, cement, chemicals, and others. Altogether, 441 different eco-materials were identified and further investigated to determine their eco-material classification (359 eco-materials from the 2002 study and 82 eco-materials from a 2005 study).

Among industrial sectors, the metals industries (including ferrous and nonferrous metals) were one of the leading industries in Japan in the field of eco-material development. Figure 2 shows that this industry produced more than half (52%) of all eco-materials. The second leading industry was the ceramics and

glass sector, which accounted for 13%. Polymers, composites, and natural material industries followed as the third and fourth (accounting for 10%, 7%, and 7%, respectively).

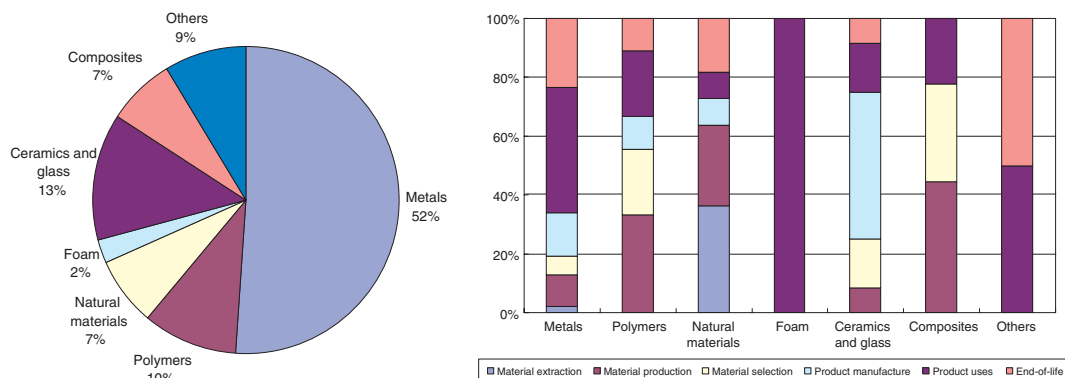


Figure 2. Eco-materials used in Japanese industries

These commercialized eco-materials were then qualitatively classified using the LCA concept in conjunction with the six stages of material extraction, material production, material selection and design, product manufacturing, consumption, and end-of-life disposal. As illustrated in Figure 2, in metals most eco-materials were developed with the emphasis on the consumption and end-of-life stages (42.6% and 23.4%, respectively). In the polymer and composite sectors, production of materials is the main consideration stage for overall environmental improvement (33.3% and 44.4%, respectively). Unlike the metal, polymer, and composite sectors, the ceramic and glass sectors tend to pay more attention to the product manufacture stage (accounting for 50%). The natural material sector focuses on material extraction and production, as well as end-of-life stages (accounting for 36.4%, 27.3%, and 18.2%, respectively). This is because the use of natural materials can reduce, or even eliminate, the use of nonrenewable resources. In addition, at the end-of-life stage, the disposal of natural materials appears easier than that of metallic materials and wastes.

In the metal industry, there have been three main focuses in eco-material development. First of all, hazardous substance-free steel such as lead-free and chromate-free steel during production received the greatest research and manufacturing attention. Second, in addition to the hazardous substance-free issue, new advanced technologies in the steel-making process enabled easier production of steel by eliminating cleaning processes or allowing the use of easily formable processes. Third, the iron and steel industry also focused on the consumption stage by producing high-efficiency steel such as high tensile-strength steel, weather-resistant steel, and higher energy-efficiency steel used in automobiles.

The second notable industry in the field of eco-material development was the polymer industry. Hazardous substance-free materials such as halogen-free flame-retardant or VOC-free plastics were the main eco-materials in the plastics industry. The industry also focused on the development of biomass-based and biodegradable plastics as eco-materials.

In general, the development of eco-materials in Japan has taken advantage of advanced and newly developed technologies. Ultralight steel, formable steel, recyclable plastics (Toyota super olefin plastics), halogen-free flame-retardant polymers, and eco-cement are typical examples of eco-materials based on advanced technology. Furthermore, the results of a study by Yamada et al. (2003) suggested that the development of eco-materials in Japan was still in the early stage. R&D activities on eco-materials should be diversified and better balanced between all sustainable concerns. The introduction of eco-material guidelines is essential for this.

3. ECO-COMPONENTS AND ECO-PRODUCTS

3.1 Development of basic concepts

Similar to eco-materials, the prefix “eco” in eco-components and eco-products originally denoted that they were ecologically sound. It also reflected economic issues in later phases of development. The concept of eco-components and eco-products in Japan began to develop in the 1980s, along with

the development of the eco-design concept, methodologies, and tools. Several definitions have been introduced by various organizations and industries under three different auspices: the Green Purchasing Network (GPN), type I and type II eco-labeling, and eco-product exhibitions. In other words, there are numerous criteria for eco-component and eco-product evaluation. Almost every large Japanese company such as Sony, Canon, Panasonic, NEC, and Toyota has its own criteria. In addition, each product category may also have different criteria. For example, NEC has 24 eco-product standards to evaluate its products (NEC, 2004). However, they all share such common aspects as resource and energy saving, recyclability, use of recycled materials, longevity, and ability to contribute to environmental purification processes. These common aspects have been described in eco-design guidelines or in ISO standards on eco-labeling (ISO14020 to ISO14025).

The first set of eco-products was introduced in 1989 when the Eco-Mark Program was established (Japan Environment Association, 2003). The Eco-Mark Program is classified as type I eco-labeling according to ISO standards. The number of certified products reached more than 5600 in 2003, up from 265 in 1989. In addition, Eco-Mark product categories also increased from 14 in 1989 to 59 in 2003. Two basic requirements for Eco-Mark products are 1) the minimization of environmental impact during the manufacturing, use, and disposal phases compared with similar products; and 2) the reduction of environmental impact by any means. Furthermore, the Eco-Mark criteria for eco-products depend heavily on the life cycle concept. The product life stage covers from resource extraction to manufacturing, distribution, use and consumption, disposal, and recycling.

A few years after the introduction of the Eco-Mark Program, several companies introduced their own criteria for eco-products. These are classified as type II eco-labeling. In the beginning of concept development, most criteria for eco-products focused on one or two environmental aspects including energy saving and/or compliance with laws and regulations. In the later phase, environmental and economic aspects have increasingly been included, especially since the start of the Factor X Program in Japan with the participation of more than 50 companies. The criteria for type II eco-labeling vary by company. Companies participating in the Factor X Program such as Mitsubishi, Matsushita Electric, Hitachi, Toshiba, Canon, and Fujitsu have developed their own calculation methods for type II eco-labels. Other companies such as NEC have also developed standards to evaluate their eco-components and eco-products. The details vary and depend on the focus of the company. However, the three main concerns of global warming, resource efficiency, and energy efficiency are found in most criteria sets.

In addition to eco-labeling programs, the GPN and the enactment of the Green Procurement Law in Japan have played a major role in eco-product development (Green Purchasing Network, 2004). In 1994, the Shiga prefectural government was the first local government in Japan to introduce comprehensive guidelines on green purchasing. Two years later, the GPN was established to promote the green purchasing concept and activities. In 2000, the Japanese government enacted the Green Procurement Law. Under the law, all state institutions must follow its stipulations in the purchase of 14 product categories such as copy and printing paper, stationery and office supplies, office furniture, electronic appliances, and others. The criteria for each product category were mainly based on those of the Eco-Mark Program and GPN criteria or on existing governmental targets.

3.2 Current industrial practices

3.2.1 Eco-components

Another study on the current status of eco-components and eco-products in Japan was conducted during the development of this data book. More than 470 eco-components and eco-products were investigated to determine current trends in their development. This study covered more than 300 companies in Japan including electronics, construction, automobile, and machinery manufacturers. The distribution of eco-components and eco-products in different industrial sectors is shown in Figure 3. Electrical and electronic industries contributed the largest number of eco-components (33% of the total). Packaging components, automobile parts, and construction components were second (18%), third (16%), and fourth (15%), respectively. Machinery parts closely followed in fifth place (13%).

In the electrical and electronics industries, hazardous substance-free components are one of the most crucial concerns as they are closely monitored by the authorities. This concern is related to the three life cycle stages of manufacturing, product use, and end of life (Figure 4). These industries have also focused on global warming because energy consumption during the production and use of eco-components is closely related to their industries.

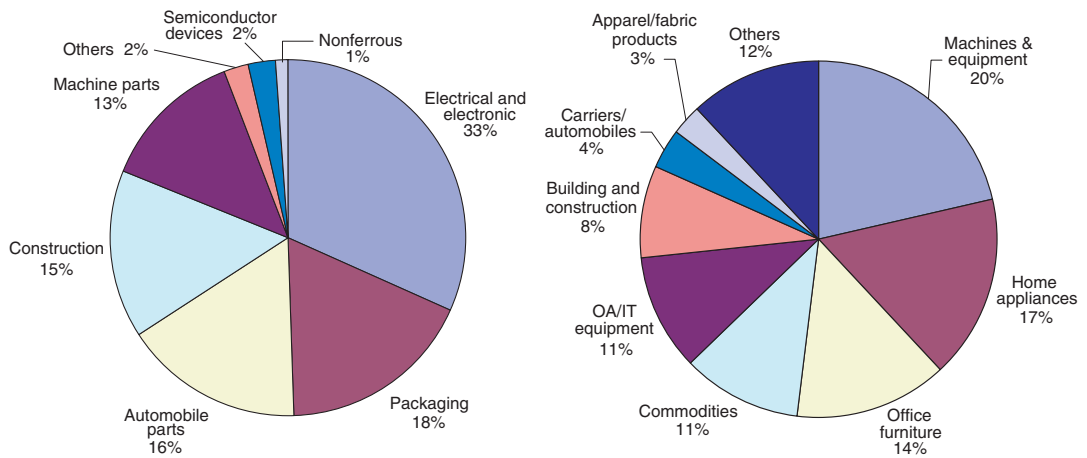


Figure 3. Eco-components and eco-products in different industrial sectors

Similarly, the automobile and machinery industries also conducted R&D on eco-components to reduce energy consumption during the product-use phase. This will help reduce the impact of global warming.

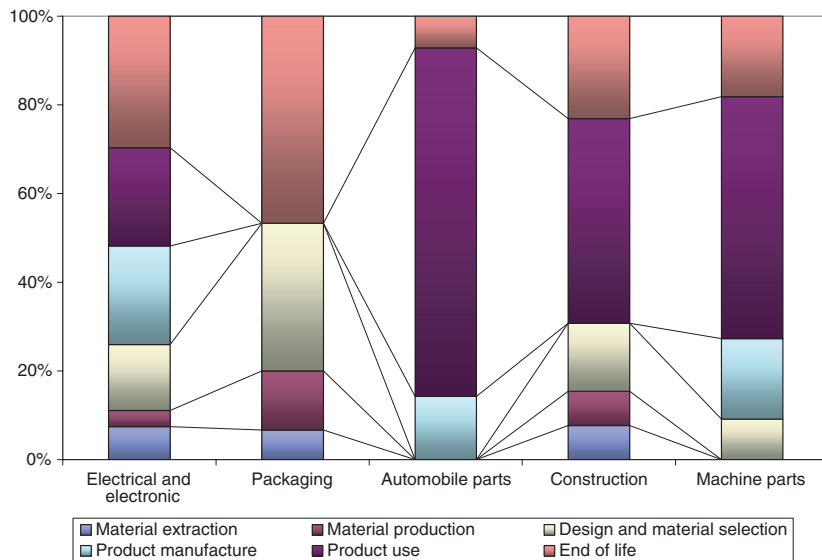


Figure 4. Distribution of eco-components in different industries in the six life cycle stages

Unlike the electrical and electronics industries, the packaging industry has focused on resource conservation and recycling. This is due to the relatively short life of its products (a few months or years). As a result, most packaging materials and components were carefully developed with great attention to the material selection, design, and end-of-life stages (Figure 4).

3.2.2 Eco-products

Studies on the development of eco-products in Japan have been scattered. With more than 500 eco-components and eco-products on the market, the authors tried determine the development status and trends of eco-products in Japan while preparing this data book. As shown in Figure 3, the three leading sectors in the field of eco-product production were machinery, home appliances, and office furniture (20%, 17%, and 14%, respectively). Commodities/outdoor/house kits, and office and information technology (IT)

equipment categories followed (11%). Automobile and carrier industries contributed only 4% of the total number of eco-products. This is due to the scale and complexity of eco-products in each sector. Unlike commodities or outdoor goods, a car consists of hundreds or thousands of different components. The apparel and fabric industries surprisingly contributed only 3% of the total number of eco-products.

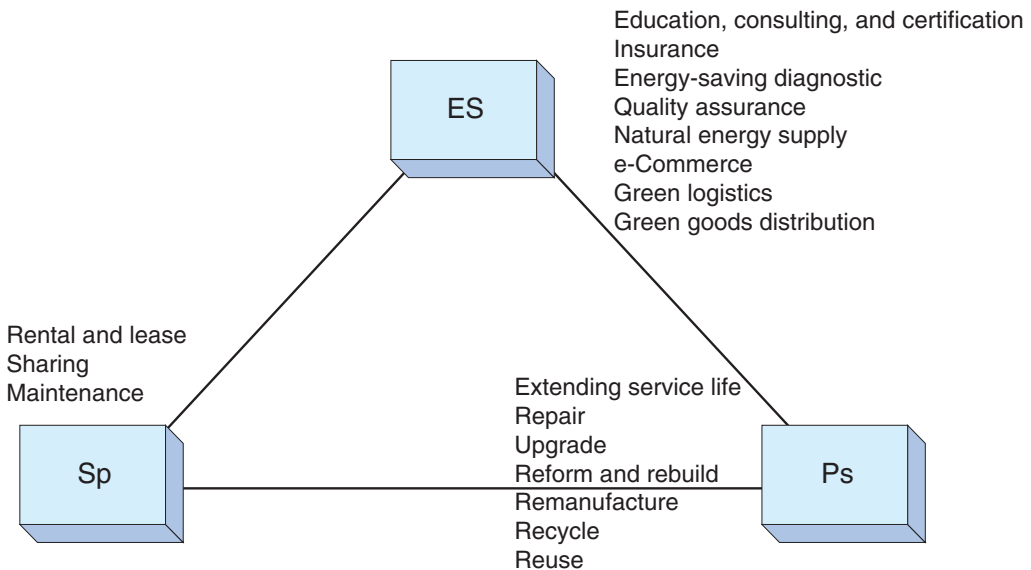
The development and production of eco-materials, eco-components, and eco-products make a great contribution to companies' sales and revenues. According to annual environmental reports, Canon had the highest eco-product sale contribution to its total sales in Japan (92.3%). Other electronics companies such as Fujitsu, Toshiba, and Matsushita Electric had eco-product sales percentages of more than 50% of total sales. For Hitachi and NEC, the figures were less than 50%. These percentages, however, do not indicate which company is better than others in the field of eco-product development and production, since different companies have different evaluation criteria for eco-products. For example, Canon had the highest sales value because its calculation method is based only on energy efficiency (ENERGY STAR®) criteria.

4. ECO-SERVICES

4.1 Development of the basic concept

Eco-services in Japan have developed along with the basic concept of eco-materials and eco-products. This approach is aimed at addressing social consumption patterns to provide function and/or utility to customers through the use of services rather than physical products. The Product-Service System (PSS), Sustainable Service System (3S), and servicizing are similar terms for eco-services used in Europe and the USA.

Classifications of eco-services are mainly based on actual business cases. The great diversity of examples of eco-services lead to a number of classifications. However, no standard classification yet exists. According to a recent study on eco-services in Japan, they can be classified into the three categories of Ps, Sp, and ES based on the relationship between product provider and user (Figure 5) (Tagusari et al., 2001). In the Ps category, a company provides its main product (P) and additional services (s). In the Sp category, a company provides mainly services (S) and additional products (p). Services that cannot be classified into the above categories are classified as ES (general Ecological Service).



Source: Tagusari et al., 2001

Figure 5. Three categories of eco-services

In this directory, eco-services are grouped into the four different categories of product-related services, reuse and recycle-related services, management-related services, and others to reflect the current practice in Japan.

4.2 Current Industrial Practices

A study in 2001 by Tagusari et al. reported a list of 51 Japanese examples of eco-services (Tagusari et al., 2001). These 51 examples were classified into the three main groups shown in Figure 5. By assuming that one example corresponds to one environmental issue among seven (resources, global warming, air emissions, waste reduction, sharing, general purposes, and forestry), the report indicated that resource saving was the main focus of eco-services in Japan (accounting for 36%). Global warming and CO₂ emission issues also received significant attention (accounting for 26% of the total). The third mainstream eco-service is for “general purposes” (15% of the total), which represented consulting and certification services. Solid waste, air emission reduction, and forestry issues were still not the main focus of Japanese industries when setting up eco-service systems (accounting for 11%, 4%, and 1%, respectively).

Another small study reported on 16 eco-services currently offered in Japan. Five main environment-related categories were used to analyze the focus of Japanese eco-services: global warming, air pollution, hazardous substances, solid waste, and resource consumption. Fifty percent of eco-service case studies reported their intention to consider global warming issue when designing eco-service systems. Resource consumption issues received slightly less consideration (37.5% of case studies reported).

5. ECO-PRODUCT EXHIBITIONS IN JAPAN

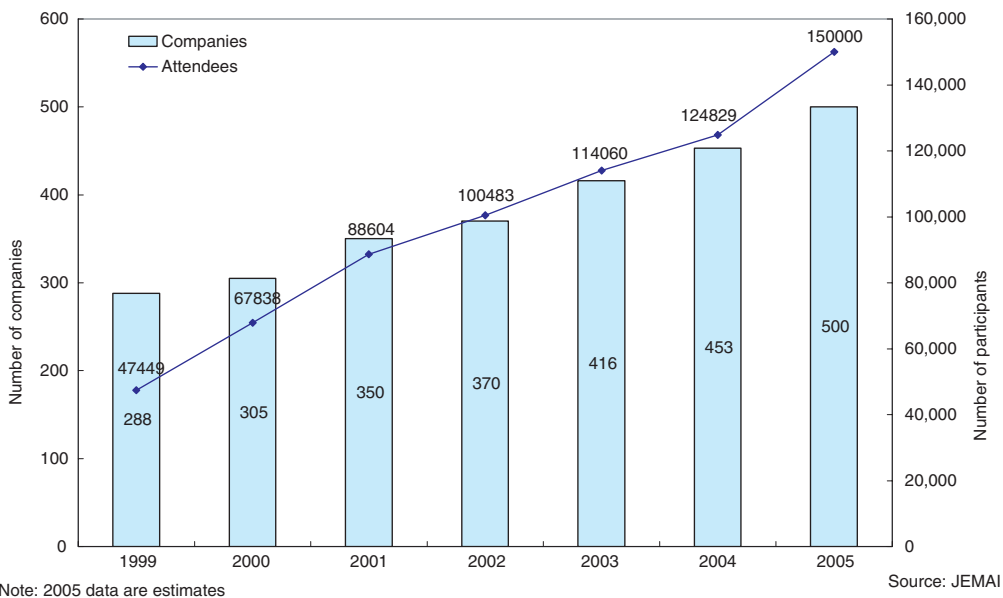


Figure 6. Number of participating companies and participants in eco-product exhibitions in Japan

In addition to the development of eco-design tools and approaches, annual eco-product exhibitions have been organized since 1999 to promote the eco-design movement in Japan. The objectives are to encourage the transition from mass production and consumption to eco-products and revolutionizing consumer awareness of the use of eco-products. A number of interested parties such as local governments, educational institutions, corporations, and NGOs have participated in the annual exhibitions. More than 300 companies and organizations participated each year (Figure 6). In addition, individuals from government authorities to private citizens, from top managers to shopfloor workers, from elementary schoolchildren to college students across the country gathered to exhibit their activities and products, exchange knowledge, and establish networks in workshops on green purchasing, environmental business, and education.

More than 450 corporations and organizations participated in the Eco-products Exhibition 2004. They exhibited a wide range of products and services, from consumer goods to fuel-cell equipment to materials for industry. A record 124,829 visitors, including ordinary consumers, green purchasing buyers, top executives of leading environment-oriented companies, and young students attended the three-day exhibition.

According to a survey conducted at the Eco-products Exhibition 2004, only 6% of participating companies questioned thought that LCA was not necessary in eco-product development, while 34%

believed that it was necessary. Among the survey respondents, 40.2% of companies had implemented LCA for their eco-products either in all or parts of companies and products. In addition, more than 50% of implementing companies had used LCA for eco-product environmental accounting as well as for developing new eco-products (JEMAI, 2005).

Authors

Hong Nguyen,* Ying Wang, Kohei Morimoto, and Ryoichi Yamamoto

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Related Organizations List

Ecomaterials Center, National Institute for Materials Science (NIMS)

1-2-1 Sengen, Tsukuba, Ibaraki 305-0047, JAPAN

Tel: +81-29-859-2668 Fax: +81-29-859-2601

<http://www.nims.go.jp/emc/>

Ecomaterials Forum, The Society of Non-Traditional Technology (SNTT)

Sakura Bldg. 2-5-5, Toranomon, Minato-ku, Tokyo 105-0001, JAPAN

Tel: +81-3-3503-4681 Fax: +81-3-3597-0535

<http://www.sntt.or.jp/>

Green Purchasing Network (GPN)

Cosmos Aoyama B2F, 5-53-67, Jingumae, Shibuya-ku, Tokyo 150-0001, JAPAN

Tel: +81-3-3406-5155 Fax: +81-3-3406-5190

<http://www.gpn.jp/>

SPEEED (Special Project on Eco Efficiency and Eco Design)

Fe-209, 4-6-1, Komaba, Meguro-ku, Tokyo 153-8505, JAPAN

Tel +81- 3-5452-6098 ex.57780 Fax +81- 3-5452-6305

E-mail: speed17@iis.u-tokyo.ac.jp

<http://www.speeed.org/index.htm>

Yamamoto Lab., Institute of Industrial Science, University of Tokyo

Fe-207, 4-6-1, Komaba, Meguro-ku, Tokyo 153-8505, JAPAN

Tel +81- 3-5452-6098 ex. 57781 Fax +81- 3-5452-6305

<http://www.iis.u-tokyo.ac.jp/english/index.html>

Company List

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A

AJINOMOTO CO., INC.	EP388
Alpine Electronics, Inc.	EP110
AMITA CORPORATION	EM077
Andes Electric Co., Ltd.	EP041
Anritsu Corporation	EP372, EP373, EP374, EP375
AOMORI HOME COMPONENT CO., LTD.	EC001
Apple Studio	EP404
Asahi Breweries, Ltd.	EP429, EP430
ASAHI KASEI CONSTRUCTION MATERIALS CORPORATION	EM054

B

BAIO WORTH Co., Ltd.	EM067
BASF INOAC polyurethanes Ltd.	EM055
Bestway Inc.	EP283
Bridgestone Corporation	EC025, EC026, EC027, EP160

C

Canon Inc.	EP163, EP171, EP197, EP198, EP199, EP204, EP407, EP408, EP421
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Cycle Inc.	EP405

D

Daido Steel Co., Ltd.	EM020, EM021, EP333, EP334
DAIKIN INDUSTRIES, LTD.	EP023, EP024, EP029, EP357, EP358, EP359, EP360, EP361, EP362, EP363
Dainippon Ink And Chemicals, Incorporated	EM040
DCT Co., Ltd.	EP054
Dynax Corporation	EM073, EC029, EC030

E

East Japan Railway Company	ES014
Ebara Corporation	EP330, EP337, EP340, EP341, EP342, EP343, EP344, EP350
ENTEC Co., Ltd.	EP242

F

FD Green (Thailand) Co., Ltd.	EP277
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FUJITSU LIMITED	EC009, EC011, EC012, EP185, EP186, EP194, EP195, EP203, EP205
FUJITSU MEDIA DEVICES LIMITED	EC013, EC017, EC018

G

G&F Corporation	EP386
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H

HANITSU TRADE Co., Ltd.	EM080, EP268
Hattori paper co., Ltd.	EP239, EP245, EP273, EP274
HEART CO., LTD.	EP224
Hemp Products Spread Association	EM051
Hiba Development Co., Ltd.	EP225, EP238, EP243
Hitachi Air Conditioning Systems Co., Ltd.	EP347
Hitachi Cable., Ltd.	EC019, EC023, EC024
Hitachi Chemical, Ltd.	EP107
Hitachi Communication technologies, Ltd.	EP192
Hitachi Global Storage Technologies	EP193
Hitachi High-Technologies Corporation	EP365
Hitachi Home & Life Solutions, Inc.	EP006, EP007, EP012, EP016, EP031, EP035, EP040, EP296
Hitachi Industrial Equipment Systems Co., Ltd.	EP331, EP349, EP356
Hitachi Industries Co., Ltd.	EP065, EP338, ES013
Hitachi Koki Co., Ltd.	EP295, EP321, EP322
Hitachi Maxell, Ltd.	EP177
Hitachi Metals Automotive Components Company	EC031
Hitachi Metals Singapore Pte. Ltd.	EM035
Hitachi Plant Engineering & Construction Co., Ltd.	EP028, ES008
HITACHI Recycle Hotline (Service only in Japan)	ES002
Hitachi, Ltd.	EP323, EP355, ES006, ES007
Hitachi, Ltd., Advanced Research Laboratory	EP109
Hitachi, Ltd., Automotive Systems	EP161, EP162
Hitachi, Ltd., Digital Media Division	EP080
Hitachi, Ltd., Disk Array Systems Division	EP182
Hitachi, Ltd., Energy Solution Service Division	ES009
Hitachi, Ltd., Information and Telecommunication Systems	ES012
Hitachi, Ltd., Power System PV Business Project	EP300
Hitachi, Ltd., Ubiquitous Platform Group	EP079, EP106, EP179
Hitachi, Ltd., Urban Planning and Development Systems	EP009

I

INAX Corporation	EP247, EP248, EP249, EP250, EP289, EP290, EP291
Intact, private limited company	EM041, EP227

J

JFE Engineering Corporation	EM037, EP376, EP377, EP378, EP379
JFE Steel Corporation	EM014, EM017, EM018, EM028, EM029, EM030, EM031
JIT Co., Ltd.	EP414

K

Kajima Corporation	EM059, EM064, EP287
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KAWASAKI HEAVY INDUSTRIES, LTD.	EP367
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Kodate Lumber Inc.	EP279
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KUBOTA Corporation	EP402
KURABO INDUSTRIES LTD.	EM048, EM049, EM050
Kyocera Corporation	EP276

L

LHT Holdings Limited	EM074, EM075, EM076
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M

Maezawa Industries, Inc.	EP282
Marujyu Kasei Co., Ltd.	EP217
Materialhouse Co., Ltd.	EP002
Matsushita Ecology Systems Co., Ltd.	EC003, EC004, EP316
Matsushita Electric Industrial Co., Ltd.	EC008, EP020, EP021, EP032, EP037
Matsushita Electric Industrial Co., Ltd., Air-conditioner Division	EP026
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Matsushita Electric Industrial Co., Ltd., Panasonic AVC Networks Company	EP011, EP059, EP060, EP061, EP062, EP063
	EP066, EP067, EP070, EP071, EP072, EP073, EP081, EP082, EP087, EP088
	EP094, EP095, EP096, EP097, EP098, EP099, EP100, EP101, EP102, EP104
	EP187, EP188, EP189, EP190, EP411, EP412
Matsushita Electric Industrial Co., Ltd., Semiconductor Company	EC010
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Matsushita Electric Works, Ltd., Electrical Conduits and Wiring Materials Division	EP428
Matsushita Electric Works, (Ayuthaya)Ltd.	EP053
Matsushita Refrigeration Company	EP018
Matsushita Refrigeration Company Food Solutions Division	EP013
meiwa kosakusho Co., LTD.	EP339, EP345
Mieco Manufacturing Sdn Bhd	EP208, EP209
MITSUBISHI CHEMICAL FUNCTIONAL PRODUCTS, INC.	EP284
Mitsubishi Electric Corporation	EC007, EC022, EP015, EP022, EP030, EP078, EP267, EP269, EP270, EP297
	EP298, EP299, EP335, EP336, EP351, EP352, EP353, EP354, EP431, ES010
MITSUBISHI ELECTRIC OSRAM Ltd.	EP048
Mitsubishi Heavy Industries, Ltd.	EP317, EP346, EP348, EP368
Mitsubishi Materials Corporation	EP306
Mitsubishi Materials Corporation Geothermal & Electric Power Center	ES011
Mitsubishi Materials Polycrystalline Silicon Corporation	EM032
Mitsubishi Rayon Engineering Co., Ltd.	EC021
MO-HOUSE	EP220
MU COMPANY LTD.	EP312, EP313

N

Nagashima Special Paint Co., Ltd.	EP285
Nakayama Steel Works, Ltd.	EM006
NEC Corporation	EM053, EP183, EP201, ES003, ES004
NGK SPARK PLUG CO., LTD.	EM065, EM066
Nihon Servo, Ltd.	EP366
NIKON CORPORATION	EM056, EP409
Nippon Steel Corporation	EM002, EM004, EM005, EM007, EM015, EM016, EM025, EM026, EM027, EM038
	EM039, EM078, EP108, EP311
Nitto Denko Corporation	EM079, EC039
NSK Ltd.	EC020
NTN Corporation	EP387

O

Obayashi Corporation	EP280
OBAYASHI CORPORATION (Technical Research Institute)	EP310
Obayashi Corporation, Technical Research Institute	EC002, EP286
Okamura Corporation	EP210, EP211

OLYMPUS CORPORATION	EP415, EP417, EP418, EP419, EP420
Osaka Gas Co., Ltd.	EP004, EP005, EP262, EP263
Osaka Organic Chemical Ind., Ltd.	EM052

P

Panasonic Communications Co., Ltd.	EP076, EP172, EP174, EP176, EP178, EP196
Panasonic System Solutions Company, Matsushita Electric Industrial Co., Ltd.	EP180, EP410, EP413
PFU LIMITED	EP206
PIONEER CORPORATION	EP058, EP074, EP077, EP091, EP092, EP103, EP159
Platinum Pen Co., Ltd.	EP214
PLUS CORPORATION	EP219

R

Ricoh Company, Ltd.	EP164, EP165, EP166, EP167
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S

Sagawa Express Co., Ltd.	EP156, EP158
SAKURAI CO., LTD.	EP212
Sambo Copper Alloy Co., LTD.	EM033
SARAYA CO., LTD.	EP237
SASAKI PRINTING CO., LTD.	EP391, EP392
SEED CO., LTD.	EP426, EP427
SEIKO EPSON CORPORATION	EP175, EP181, EP200, EP423
Sekisui Chemical Co., Ltd.	EM045, EM069, EP307, EP308, EP309, EP403
Sekisui Chemical Co., Ltd. Housing Company	
URBAN INFRASTRUCTURE & ENVIRONMENTAL PRODUCTS HEADQUAR	EM068
SEKONIC CORPORATION	EP173
SHARP CORPORATION	EP019, EP027, EP034, EP045, EP046, EP047, EP086, EP090, EP169, EP170
	EP384, EP385
Shimadzu Corporation	EP326, EP369
SHIMIZU CORPORATION	EP302, EP303, EP304
Shin Nippon Core Co., Ltd.	EP001
Sony Corporation	EP039, EP064, EP069, EP075, EP084, EP085, EP093, EP105, EP184, EP432
Sumitomo Bakelite Co., Ltd.	EM046, EM047
Sumitomo Electric Fine Polymer, INC.	EM042, EM043
Sumitomo Metal Industries, Ltd.	EM001, EM003, EM008, EM009, EM010, EM011, EM012, EM013, EM019, EM071
	EP293, EP294
Suntory Limited	EP228

T

Taiheiyo Cement Corporation	EM057, EM058
TAIYO NIPPON SANZO Corporation	EP327, EP328, EP329
TANABE SEIYAKU and TERUMO Corporation	EP394
Tanaka Sekkai-Kogyo co.	EP292
Taniguchi Heat Treatment Co., Ltd.	EP332
TEIJIN TECHNO PRODUCTS LIMITED	EM044
TERAO CO., LTD.	EP010
Tex Cycle Sdn. Bhd	ES005
The Seiyu, Ltd.	EP240
Think the Earth Project / SPACEPORT INC.	EP422
Tokin EMC Engineering Co., Ltd.	EP416
Tokio Marine & Nichido Fire Insurance Co., Ltd.	ES015
Tokyo Electric Power Company	EC005, EP272

Tokyo Electric Power Environmental Engineering CO., INC.	EP288
Tokyo Gas Co., Ltd.	EP254, EP255, EP256, EP257, EP258, EP259, EP260, EP261, EP380, EP381
Tombow Pencil Co., Ltd.	EP215, EP216
tomita & co., ltd.	EP390
Toshiba Carrier Corporation	EP025
TOSHIBA CONSUMER MARKETING CORPORATION	EP008, EP017, EP033
TOSHIBA CORPORATION Digital Media Network Company	EP089
TOSHIBA CORPORATION Industrial and Power Systems & Services Company	EP202, ES016
TOSHIBA CORPORATION Personal Computer & Network Company	EP191
TOSHIBA HOMELIGHTING CO., LTD.	EP050
TOSHIBA LIGHTING & TECHNOLOGY CORPORATION	EP049, EP051, EP052
TOSHIBA LIGHTING & TECHNOLOGY CORPORATION Electric Products Equipment Division	EP055, EP056, EP057
TOSHIBA MEDICAL SYSTEMS CORPORATION	EP364, EP370, EP371
TOSHIBA PLANT SYSTEMS & SERVICES CORPORATION	EP382, EP383
TOSHIBA TEC CORPORATION	EP036, EP168, EP207
TOSTEM CORPORATION	EP226, EP241, EP251, EP264, EP265, EP266, EP278, EP305
TOTO Ltd.	EP229, EP246, EP252, EP253, EP271
TOYO INK MFG. CO., LTD.	EC032, EC033, EC034, EC035, EC036, EC037, EC038
Toyo Kohan Company, Limited	EM022, EM023, EM024, EM036
Toyo Machinery & Metal Co., Ltd.	EP324, EP325
Toyota Motor Corporation	EC028, EP111, EP112, EP113, EP114, EP115, EP116, EP117, EP118, EP119 EP120, EP121, EP122, EP123, EP124, EP125, EP126, EP127, EP128, EP129 EP130, EP131, EP132, EP133, EP134, EP135, EP136, EP137, EP138, EP139 EP140, EP141, EP142, EP143, EP144, EP145, EP146, EP147, EP148, EP149 EP150, EP151, EP152, EP153, EP154, EP155, EP301

U

Uenodai htaihiseisan kyoudoukumiai	EP389
Unicharm Corporation	EP230, EP231, EP232, EP233, EP234, EP235, EP236, EP244

V

Victor Company of Japan, Ltd.	EC006, EC014, EP003, EP068, EP083
VIVO Corporation Co., Ltd.	ES001

W

wellwishers inc.	EP281
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Y

Yamaha Corporation	EP424, EP425
YAMAHA MOTOR CO., LTD.	EM034, EP157
Yokogawa Electric Corporation	EP406

1000.10.2005



ASIAN PRODUCTIVITY ORGANIZATION

1-2-10, Hirakawa-cho, Chiyoda-ku, Tokyo 102-0093, Japan
Tel: (81-3)5226-3920 Fax: (81-3)5226-3950
e-Mail: apo@apo-tokyo.org
URL: www.apo-tokyo.org

EGO-PRODUCTS DIRECTORY 2005

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ISBN: 92-833-2361-0