Environment-Friendly ICT Use

ICT use to limit negative impacts and enhance positive impacts

Ministry of Internal Affairs and Communications, Japan

Introduction

Information and Communications Technology (ICT) is an indispensable infrastructure that can dramatically improve the efficiency of economic activities such as production, distribution and consumption, and government administration. It also helps us to create a society in which information is accessible to all people, at all times, everywhere and, having such an integral part in our daily lives, is expected to play a significant role in reducing our environmental burden, or the negative impacts our activities have on the environment.

On the other hand it has been pointed out that the increasing sophistication and use of ICT devices will increase power consumption, meaning potentially more emissions of greenhouse gases, including carbon dioxide, (collectively referred to in this handbook as "CO_2") and a greater environmental burden.

Under the Kyoto Protocol, which came into effect in 2005, Japan is committed to reducing CO_2 emissions by 6% below the 1990 level during the first period from 2008 to 2012 and is working hard to achieve this target. Regrettably, due to increasing economic activity, CO_2 emissions have actually increased by 8.1% above the 1990 level, according to a flash report in fiscal 2005.

The Ministry of Internal Affairs and Communications (MIC) has thus developed this handbook for corporations and organizations that use ICT systems with the aim of providing guidelines and advice to help limit the negative impacts and enhance the positive impacts on the environment when ICT systems are introduced, operated, and disposed of. We hope this book will be used to improve environmental sustainability while simultaneously streamlining business operations and improving convenience.

For more information on the environmental impacts of ICT, its potential for future use and energy-efficient technologies, please refer to the report compiled by the Study Group on ICT System and Network for Reducing Environmental Impacts.

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- The full title of the "MIC Report" referred to in this handbook is:
  Report of the Study Group on ICT System and Network for Reducing Environmental Impacts (March 2007).
- URLs quoted in this handbook are correct as of March 2007.

1. Environmental Impacts of ICT Systems

★ While ICT systems can have negative impacts on the environment, such as CO_2 emissions, when used to streamline business operations they can also help to reduce CO_2 emissions.

★ To achieve both environmental sustainability and economic development, the use of ICT systems in a way which minimizes the negative impacts and enhances the positive impacts on the environment is crucial.

The production process for ICT systems and devices consumes resources and energy, placing a burden on the environment. ICT systems also consume electricity when used, which produces CO_2. On the other hand, if used effectively—for example, to reduce the movement of people and goods and reduce the consumption of paper in economic activities such as production, distribution and consumption as well as government administration—they can have a positive environmental impact, improving efficiency in the use of resources and energy and reducing CO_2 emissions. (See Figure 1.)

This chapter describes the environmental impacts of ICT systems over their life cycle, from production and use, to disposal and recycling.

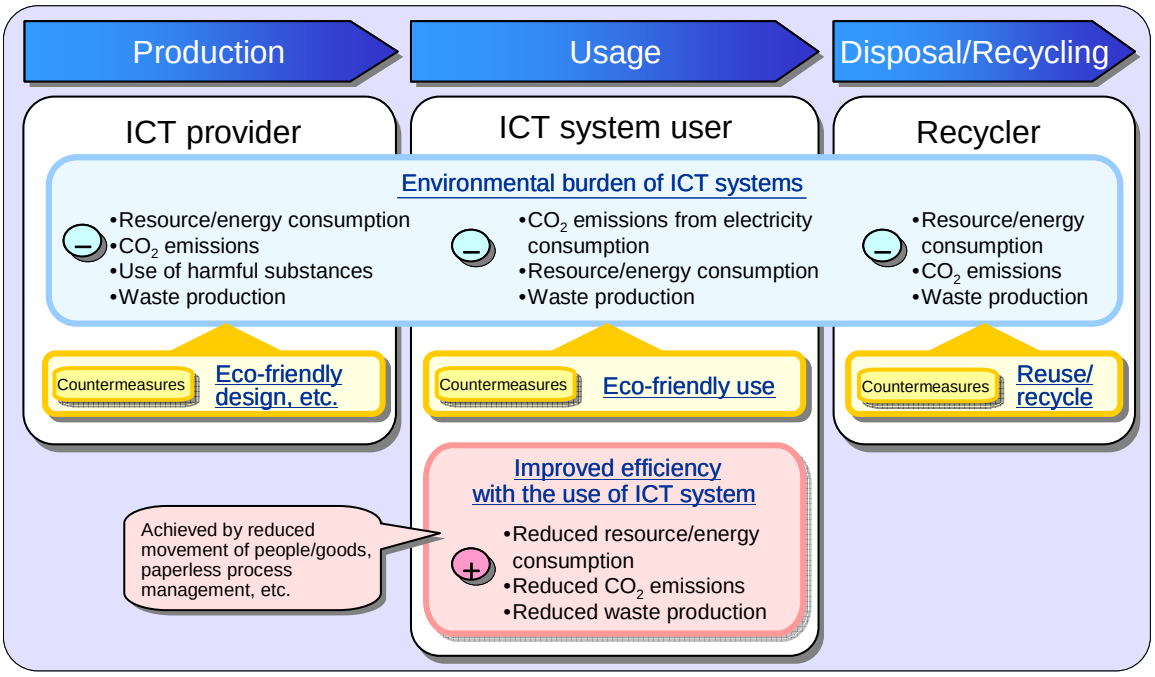

Figure 1 Environmental impacts of ICT systems

1.1. Impacts from the Production of ICT Systems

<Negative impacts>

- Resource and energy consumption during the design, production, shipment and distribution of ICT devices, as well as the resulting CO_2 emissions, use of hazardous substances and waste production.
- Resource and energy consumption through development of communications facilities, the resulting CO_2 emissions and waste production.
- Environmental burden imposed by businesses involved in the provision of ICT systems, including ICT device manufacturers, software manufacturers, system integrators and telecommunications carriers.

<Measures to curb negative impacts>

- Environmentally friendly ICT providers are committed not only to reducing the environmental burden of their business activities, but also to designing eco-friendly ICT devices and services that have less of an environmental impact when they are used, disposed of or recycled. Design and production that take into account the use and disposal or recycling of ICT systems contribute to reducing the environmental burden of the overall life cycle of the systems.
- Telecommunication carriers are also making efforts to reduce the environmental burden of information and communications services by designing efficient communications facilities and using communications devices that have less negative environmental impacts.

1.2. Impacts from the Use of ICT Systems

<Negative impacts>

- Electricity and paper consumption from printing documents.
- Electricity consumption of communications facilities.
- The consumption of electricity by ICT devices is the biggest environmental burden over the life span of the systems.

<Measures to curb negative impacts>

- You can reduce your environmental burden by periodically assessing the amount of power and paper consumed by ICT systems and taking appropriate measures based on the assessment results.

<Positive impacts>

- The use of ICT systems in production, distribution, consumption and government administration to reduce the movement of people and goods and the amount of paper used will contribute to efficient resource and energy use and, ultimately, to the reduction of CO_2 emissions.
- Possible benefits of the use of ICT systems are described in 2. ICT to Balance Environmental Sustainability
  with Economic Development and Improved Convenience.

1.3. Impacts from the Disposal and Recycling of ICT Systems

<Negative Impacts>

- Environmental impacts from the disposal or recycling of ICT devices by waste management companies.
- Environmental burden of the demolition of aging communications facilities of telecommunications carriers.
- Environmental burden of business activities of companies that dispose of or recycle ICT devices.

<Measures to curb negative impacts>

- You can use resources efficiently and reduce waste production by re-using and recycling ICT devices and their components and recovering rare metals used in ICT devices.
- You can prevent environmental pollution by properly processing waste.

2. ICT to Balance Environmental Sustainability with Economic Development and Improved Convenience

In a ubiquitous network society in which all people, at all times, everywhere have access to networks we will be able to balance economic development and environmental sustainability by optimizing ICT systems to improve energy efficiency, streamline production and distribution of goods and reduce the movement of people and goods, which consequently reduces CO_2 emissions.

ICT systems are generally expected to have positive impacts in a wide range of areas, from the industrial sector, including manufacturing and distribution, to households, as illustrated in Figure 2 below.

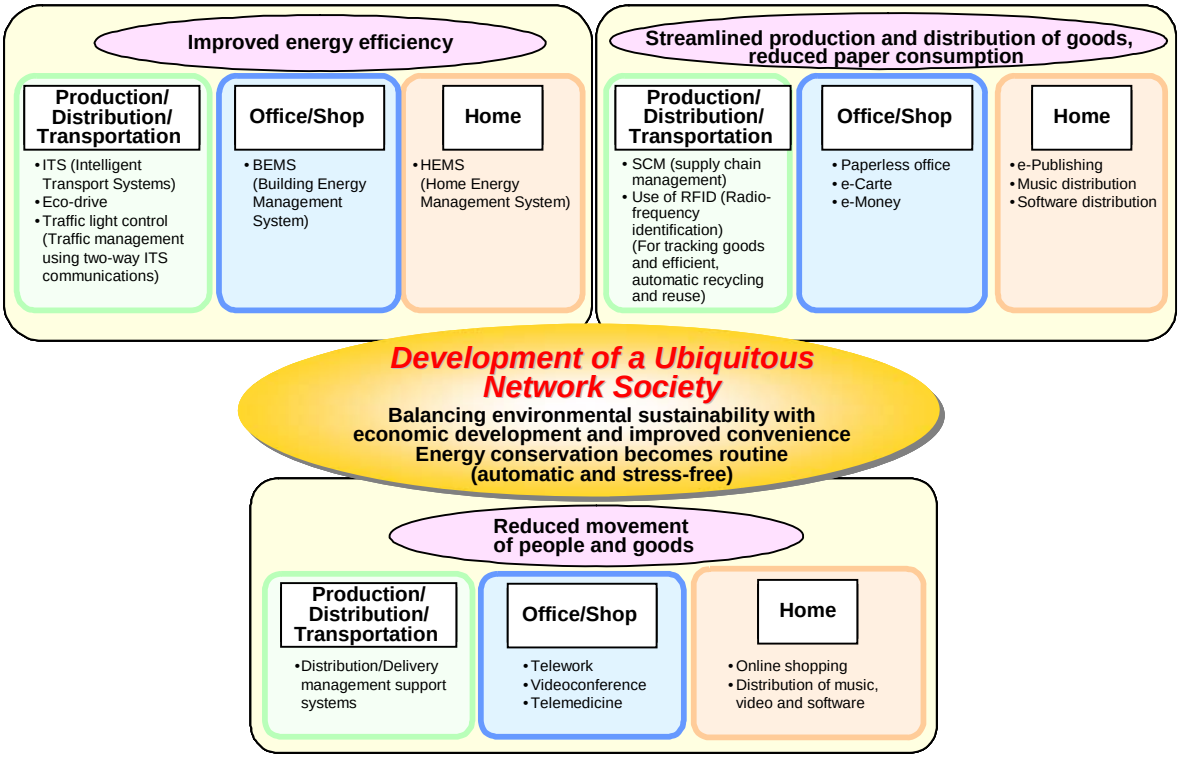

Figure 2 Environmental benefits of a ubiquitous network society

Source: Report from the Study Group on the Development and Environment of a Ubiquitous Network Society, March 2005 (MIC) (modified)

<Potential positive environmental impacts from the effective use of ICT systems>

(1) Improved energy efficiency
- Improved efficiency of resource and energy use during production and distribution processes reduces resource and energy consumption, CO2 emissions, and waste production.

(2) Reduced consumption of resources by streamlining production and distribution of goods
- Streamlined business operations reduces the amount of resources, including paper, and energy used by offices, such as for lighting and air-conditioning.
- Effective use of storage space also reduces the amount of resources and energy required for lighting and air-conditioning.

(3) Reduced transportation requirements
- Streamlined and reduced movement of people and goods reduces the resources and energy consumption required for transportation.

As shown above, ICT systems can bring about a variety of positive environmental impacts. It must be noted, however, that unless ICT systems are used properly potential benefits may not be realized, or negative impacts may even increase after the introduction of the system.

The following chapter provides some hints to help ICT system users to minimize the potential negative environmental impacts of ICT systems and enhance the potential positive impacts.

3. Using ICT Systems in an Eco-friendly Way

★ Environmental sustainability and economic development can both be achieved using ICT systems by (1) limiting negative and enhancing positive environmental impacts of ICT, and (2) using consumer purchasing power to raise the environmental awareness of companies involved in the manufacturing, disposal or recycling of ICT systems.

This section lists actions that ICT system users can take to the limit negative environmental impacts and enhance positive impacts of ICT systems over their life cycle.

ICT system users can contribute to environmental sustainability while ensuring economic development by taking the following actions:

<Key points of environmentally friendly ICT use>

(1) Use ICT systems in a way which reduces the negative environmental impacts and enhances the positive ones.

(2) Use your purchasing power to raise the environmental awareness of companies that may have a direct impact on the environment during the manufacturing, disposal or recycling of ICT systems.

You can achieve the first point by adopting an eco-friendly ICT framework and choosing eco-friendly ICT devices and systems.

You can achieve the second point by choosing a device or service which places a smaller burden on the environment and is produced or offered by a provider with a demonstrated track record of commitment to environmental sustainability. Similarly, when disposing of ICT devices it is also important to choose a recycling or disposal company that has proven its commitment to the environment.

3.1. Adopting Eco-Friendly ICT Framework

In order to limit the negative and enhance the positive environmental impacts of an ICT system at all stages throughout its life cycle, it is crucial to consider both the initial and subsequent potential environmental impacts of the system—for example, the amount of electricity and paper used—before its introduction, and then adopt an appropriate eco-friendly framework for its use. To maximize the benefits of introducing a new ICT system, the system's potential environmental impacts, both good and bad, should be considered, along with the usual considerations of functionality and information security.

Negative environmental impacts may be reduced simply by replacing existing ICT devices with energy-saving models. (See 3.2 Choosing Eco-Friendly ICT Devices.) Additionally, by reviewing the entire business operations conducted using ICT systems and building a framework to improve productivity and streamline operations, efficient use of resources and energy can be achieved and positive environmental impacts can be enhanced. Furthermore, business operations can be completely overhauled, increasing productivity and reducing negative environmental impacts by the creation of a new framework which fully exploits the potential of the ICT system, rather than just using it to carry out routine business procedures.

You can assess the environmental impacts, negative and positive, of your proposed ICT system by using Table 1 to check the performance of each item before introduction of the system against its estimated value after introduction[1], as shown in Figure 3. This helps to determine the most effective framework in terms of environmental sustainability.

Additionally, after implementing a new ICT system, the actual performance in terms of impacts on the environment can be compared to those of the previous system, which helps in the development of effective measures for the ongoing use of ICT systems in an environmentally sustainable manner. (See 3.4 Using ICT Systems in an Eco-Friendly Way.)

[1] For assessing the environmental impacts of ICT systems and devices, the Japan Forum on Eco-Efficiency (JFEE) developed the *Guideline for Information and Communication Technology (ICT) Eco-Efficiency Evaluation*, a unified industry standard, in March 2006. For details see chapter 4 of the MIC Report, 4.1 Guideline for Information and Communication Technology (IOCT) Eco-Efficiency Evaluation. http://www.jemai.or.jp/japanese/eco-efficiency/ict.cfm

Table 1 Environmental checklist for introducing a new ICT framework

Objective	Check item	Description
Adopting an eco-friendly ICT framework	Will introduction of the ICT system reduce use of office consumables (e.g., paper)? **Use of consumables**	Reduced use of consumables leads to reduced CO_2 emissions and waste production from production or disposal of office consumables.
	Will introduction of the ICT system improve power and energy efficiency? **Electricity and energy consumption**	Improved efficiency and reduced consumption of power and/or energy leads to a reduction in CO_2 emissions from power generation and transmission.
	Will introduction of the ICT system reduce the movement of people? **Movement of people**	When the movement of people is reduced, energy consumption from commuting and the attendant CO_2 emissions can be reduced.
	Will introduction of the ICT system reduce the movement of goods? **Movement of goods**	When the movement of goods is reduced, energy consumption for transport and the attendant CO_2 emissions can be reduced.
	Will introduction of the ICT system make the use of office space more efficient? **Effective use of office space**	Effective use of office space leads to a reduction in electricity consumption for lighting and air-conditioning and the attendant CO_2 emissions.
	Will introduction of the ICT system reduce the space needed to store goods? **Storage of goods**	When storage space is reduced, power consumption for lighting and air-conditioning and the attendant CO_2 emissions can be reduced.
	Will introduction of the ICT system improve the operational efficiency? **Streamlined operations**	Streamlined operations leads to a reduction in resource and energy consumption and the attendant CO_2 emissions.
	Will introduction of the ICT system reduce waste production? **Waste production**	Reduction in waste production contributes to environmental conservation and reduces the energy consumption required for waste disposal as well as the attendant CO_2 emissions.

Environmental burden	Before system introduction	After system introduction (forecast)
Paper consumption	_ sheets/year	_ sheets/year
Electricity consumption of ICT devices	_ kWh/year	_ kWh/year
Movement of people	_-seater private car, _km/year	_-seater private car, _ km/year
Movement of goods	_-ton truck, _km/year	_-ton truck, _km/year
Storage space	_ m^2	_ m^2

Figure 3 Example of how to check environmental burden

Hints for curbing negative impacts and enhancing positive impacts

Following are some of the ICT frameworks to limit negative impacts and enhance positive impacts on the environment, and their benefits in terms of the factors described in the checklist.

● Telework **Movement of people** **Effective use of office space** **Streamlined operations**

- Changing community attitudes towards employment, easy accessibility of information and communications devices, such as personal computers and mobile phones, and the rapid diffusion of broadband Internet networks for high-speed, large-capacity communications have transformed the way we work. Teleworking is becoming more popular as a new work style that is unconstrained by time or place. Additionally, it is attracting attention in terms of environmental sustainability: it reduces CO_2 emissions not only from commuting but also from the entire office as business operations are streamlined.

● Free address office **Effective use of office space**

- In a free address office, rather than having their own desks, employees use whichever desk is available when they need one. This scheme is particularly advantageous in sales sections, where employees are mostly out of the office, or in companies that have adopted teleworking, as they can eliminate desks and use the office space more effectively. Having a free address office allows businesses to reduce costs, improve productivity and reduce their environmental burden.
- The free address office system can be more easily implemented if combined with ICT systems such as teleworking, paperless process management and thin client systems.

● Paperless process management **Consumption of goods** **Movement of goods** **Storage of goods** **Streamlined operations**

- A set of two acts, together known as the e-Document Act[1], permits the use of electronic means for archiving legal documents, such as accounting statements, financial statements, receipts and invoices, which are otherwise required to be retained on paper pursuant to the Commercial Code or the Tax Law.

[1] The e-Document Act refers to a set of two acts, the Act Concerning the Use of ICT in Document Preservation by Private Companies, and the Act Concerning Development of Related Acts for Enforcement of the Act Concerning the Use of ICT in Document Preservation by Private Companies. These acts went into effect on April 1, 2005.

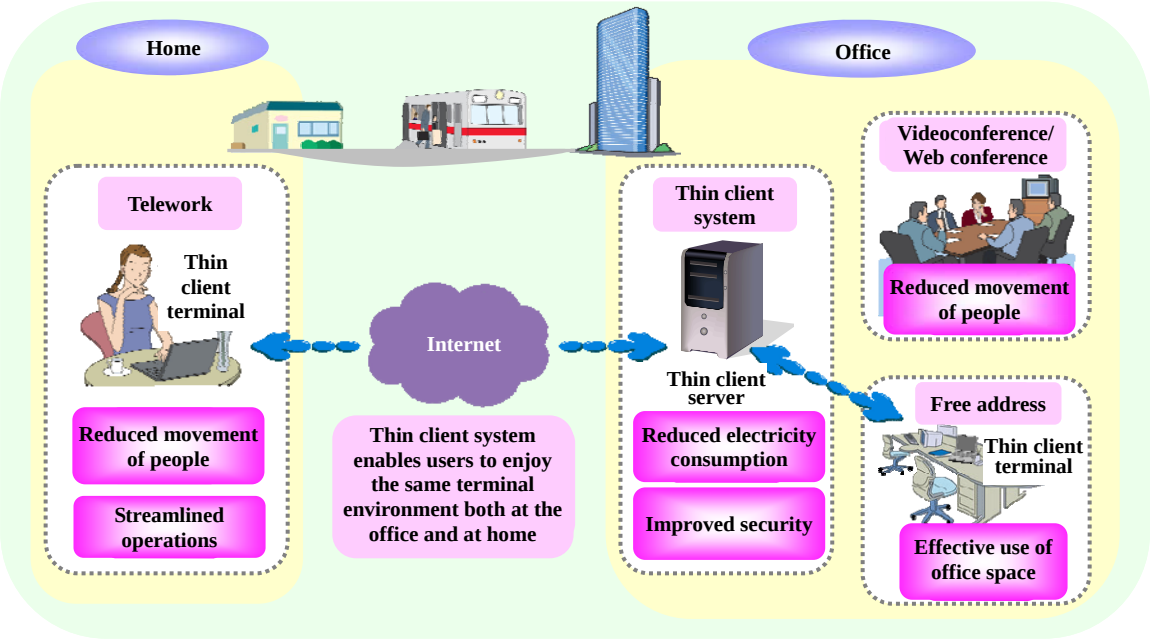

Figure 4 Example of combining telework, thin client system and free address office system

The act allows not only the electronic archiving of documents that were originally produced in electronic form, but also the scanning of documents that were originally produced on paper.

- Electronic documentation and archiving reduces paper consumption, storage space, such as libraries, and the amount of energy required to maintain the storage space in terms of, for example, air-conditioning and lighting. Additionally, by retaining information as computerized data, the maintenance and management of information, such as document retrieval, can be more efficient.
- The key to successfully implementing paperless process management is to ensure that the details of electronically archived documents can be easily viewed on a computer screen. If a document is not legible on the screen it will need to be printed out, which will increase paper consumption. It is helpful to ensure that ICT systems are able to display documents in PDF form, or are equipped with some other function that enables users to easily read documents on-screen.
- A “sticky-note” function, which allows users to put a memo on an e-document, in a similar manner to writing a memo on a piece of paper, also facilitates paperless process management.

● Network software delivery **Consumption of goods** **Movement of goods**

- When installing or upgrading software, distributing the software over the network, rather than by using CD-ROMs or other physical media, is more environmentally friendly. This also eliminates the movement of goods and reduces resource and energy consumption for the transportation of goods.

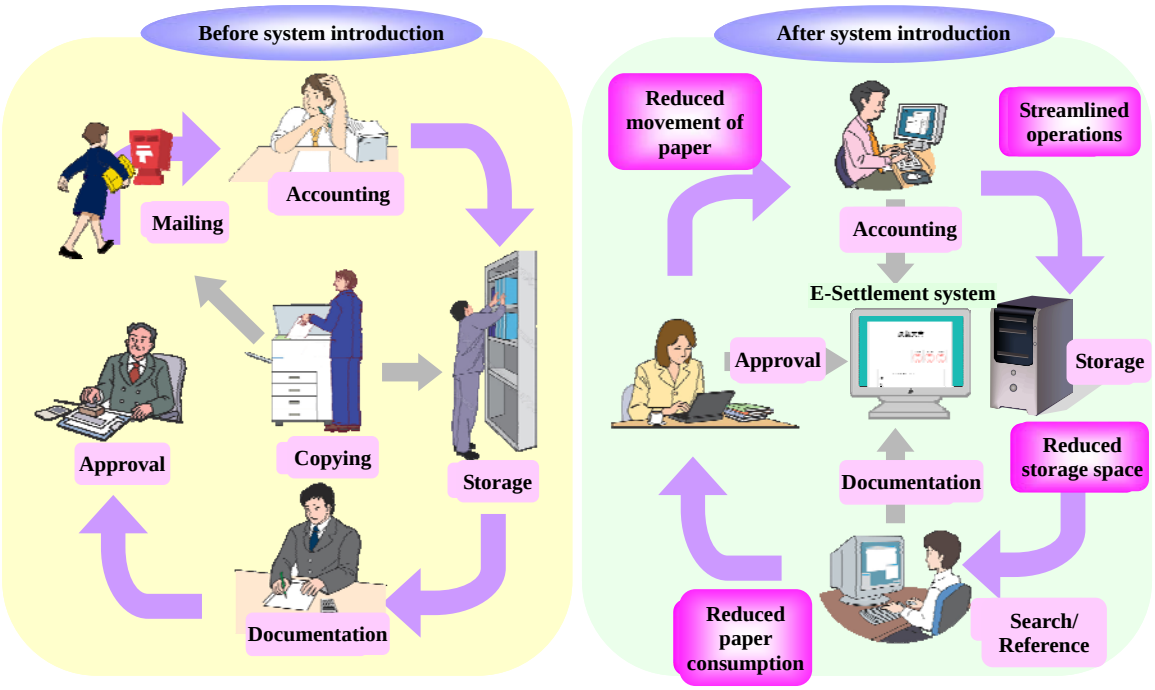

Figure 5 Example of paperless process management with an e-Settlement system

● Integration of multiple functions Electricity consumption Effective use of office space Waste production

- Use of a hybrid machine, such as a copier that also serves as printer, image scanner and fax, reduces the amount of electricity consumed and optimizes office space. It also reduces the volume of waste at the end of the product's life. It must be noted, however, that machines equipped with functions that are rarely used may rather increase electricity consumption. When choosing a machine the specific functions needed should be carefully considered.

● Thin client systems Electricity consumption Effective use of office space Waste production

- Under a thin client system, client terminals perform only the minimum necessary processes, such as connection with servers and screen operation, while servers manage the execution of applications and files. Since data is not retained on the client terminals, more and more corporations are introducing this system as an information security measure for compliance with the Personal Information Protection Act or to address issues surrounding file-sharing programs, such as Winny.
- Under a thin client system, each user's environment settings are created and retained on the server. Unlike individual computers that require environment settings for each terminal, users can work in the same environment using any terminal. Therefore, the introduction of a thin client system also facilitates the free address office system.
- Terminals dedicated to thin client systems do not require memory or hard disks, reducing the number of components needed and eliminating the need for sophisticated performance. Consequently, they lead to a reduction in electricity consumption, longer product life and a smaller environmental burden.

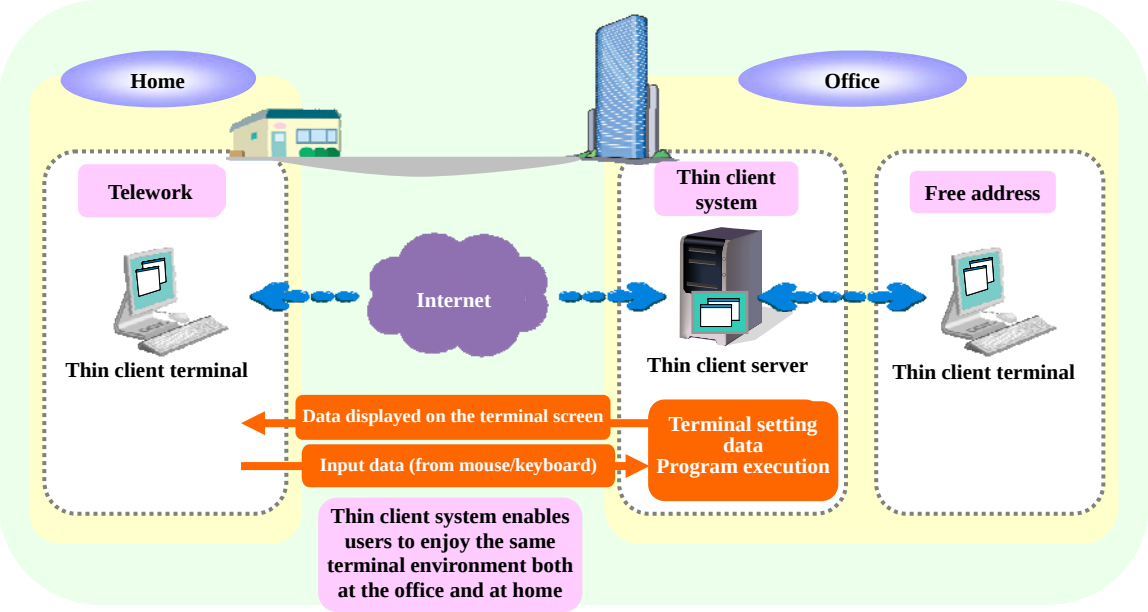

Figure 6 Example of a framework for a thin client system

- However, when servers or terminals need to be added or replaced for the introduction of a thin client system, the environmental burden may become greater, depending on how the system is used.
- Thin client systems can be effectively combined with teleworking. Implementation of a thin client system together with teleworking enables employees to work at home, reducing the use of public or private transportation, or allows for mobile working, which reduces office space. These will also potentially reduce the environmental burden.

● Server integration **Electricity consumption** **Effective use of office space** **Streamlined operations**

- Server integration refers to the technology to integrate multiple server devices of ICT systems. Since this technology eliminates some of the server devices that have been introduced in great numbers, it will reduce the electricity consumption of servers, as well as their heat generation and the attendant electricity consumption for air-conditioning in the server room. It also reduces the server storage space, and the environmental burden from lighting and air-conditioning.
- Server integration may lead to streamlined server management, which reduces server management costs as well as the environmental burden from the management of the server administrators' office.
- Some of the major systems for server integration are large-scale servers, blade servers and virtual servers.
- A large-scale server is a high-end server equipped with a number of CPUs and extension interfaces. Server models that allow logical partitioning for multi-server configuration can be used for server integration.
- A blade server is a server that can house multiple "blades," or modular electronic circuits, each including CPU, memory, hard disk and other components, in an enclosure. The enclosure provides power supply

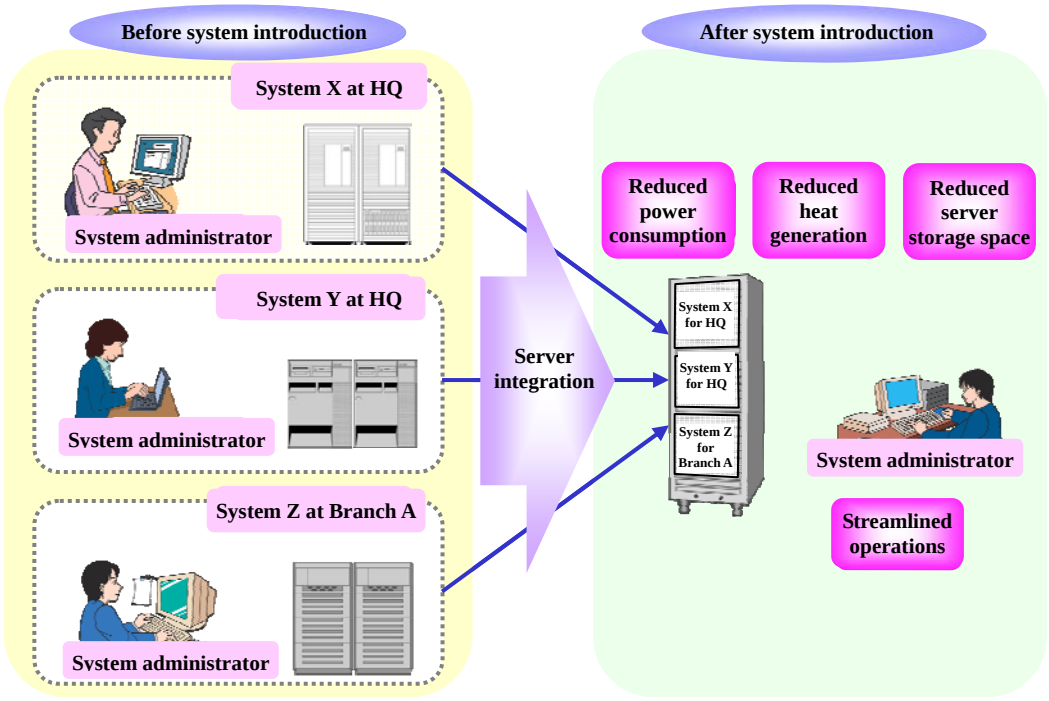

Figure 7 Example of integration of branch servers

and sockets for connection to networks and peripheral devices, all of which are connected to the blades via the enclosure's backplane. Blade servers limit the environmental burden as high-density packaging saves space and sharing components saves energy.

- A virtual server is a method of integrating servers by using software that operates multiple virtual servers simultaneously on the operational system of one computer. This method can be adopted for server integration on a relatively small scale.

● Data center **Electricity consumption** **Effective use of office space** **Streamlined operations**

- Sharing servers at an Internet Data Center (IDC) with multiple corporations and organizations, rather than operating in-house servers, is sometimes effective in reducing electricity consumption and server storage space, and streamlining server management.

● Optical connection service **Electricity consumption** **Streamlined operations**

- Optical connection services have less environmental impact compared to other connection services, such as ADSL. As large amounts of data can be transmitted in a relatively short time, electricity consumption is reduced and operations are streamlined.

3.2. Choosing Eco-Friendly ICT Devices

The consumption of electricity by ICT devices is the biggest environmental burden in the overall life cycle of ICT systems. Electricity consumption can be effectively reduced by using ICT devices that consume less power; therefore, it is advisable to choose an energy-saving model when purchasing an ICT device.

Other critical factors in making purchasing decisions are whether the device contains substances that have adverse effects on human health, and whether it is designed to have a smaller environmental impact at all stages of its life cycle, from raw material extraction through to disposal.

When choosing an ICT device it is also crucial to consider whether the ICT provider who manufactures or sells the device is committed to environmental sustainability, in addition to whether negative environmental impacts of the device itself are low. By using your purchasing power, you can help raise the environmental awareness of ICT providers, which leads to increased efforts by them to reduce the environmental burden from production or sales of ICT devices. Means of assessing environmentally friendly activities of ICT providers are described in chapter 3.3 Choosing Eco-Friendly ICT Providers.

Table 2 below lists key factors to consider when choosing an eco-friendly ICT device. Purchasers may find some of the items hard to check. It is therefore advisable to take advantage of the eco-labels, as described later, and web sites that provide purchasers with environmental information about products. The eco-labels referred to in this handbook are listed inTable 3.

Table 2 Environmental checklist for choosing an ICT device

Objective	Check item	Description
Choosing an eco-friendly ICT device	Is the ICT device designed not to use or emit substances that have an adverse effect on the environment or human health?	Reduction in the use or emission of substances harmful to the human body or the environment contributes to the protection of human health and the environment.
	Does the ICT device consume less resources and energy during the production and distribution processes and during its use?	Reduction in resource and energy consumption over the entire life cycle of the product contributes to a reduction in CO_2 emissions.
	Does the ICT device use renewable natural resources?	When natural resources are used in a sustainable manner (e.g., forest resources), the environmental burden is reduced.
	Can the ICT device be used for a long period of time?	Use of the ICT device over a long period of time reduces the environmental burden of production and disposal.
	Is the ICT device, including its components, designed for reuse? Is there a framework in place for collection after final use?	Reuse of the ICT device reduces the environmental burden of production and disposal.
	Is the ICT device made from materials that can be easily recycled? Is it designed for easy disassembly and separation per material type? Is there a framework in place for collection after final use?	If components that are not reusable can be separated and recycled, the environmental burden of production and disposal can be reduced.
	Is the ICT device made from recycled materials or components?	Use of recycled materials or components generally saves resources, reduces waste, and promotes more recycling.
	Is the ICT device designed for easy separation and collection of materials, and separation and removal of harmful substances upon its disposal?	If an ICT device is designed to have less environmental impact when it is disposed of or recycled, it has less environmental impact over its life cycle.
	Have the designer, manufacturer and distributor of the ICT device been committed to environmental sustainability?	If you choose ICT providers who are committed to environmental sustainability, you can reduce the environmental burden over the life cycle of the device. For ideas for assessing companies, see 3.3 Choosing Eco-Friendly ICT Providers.

Hints to curb negative impacts and enhance positive impacts

Following are some guidelines for choosing eco-friendly ICT devices.

● Eco-labels and environmental standards

- Eco-labels are designed to help purchasers choose products and services with a smaller environmental burden. Information related to environmental performance of products and services is conveyed using symbol marks and logos. Eco-labels are categorized into three types: third-party certification marks that are granted to products that satisfy certain environmental standards (Type I); labels that certify the providers have conducted self-evaluation of the products (Type II); and labels that disclose the environmental impacts over the life cycle of the products (Type III).
- Web sites and catalogs also provide purchasers with environmental information. Some manufacturers list the particular products out of their lineup that meet specific environmental standards. Others give side-by-side comparisons of various manufacturers' products. When referring to such information, it is important to check the basis for these products being listed on the web sites or in the catalog.

Following are some eco-labels and web sites that you may find helpful to refer to when choosing an ICT device.

● Energy Conservation Label (Energy Conservation Labeling Program)

- The energy conservation label is the Japan Industrial Standards (JIS) label, and it allows consumers to easily see the energy consumption efficiency and other information that must be indicated on consumer appliances pursuant to the Act Concerning the Rational Use of Energy. As of March 2007, the program covered 16 categories of consumer appliances.
- An energy conservation label consists of the energy-saving logo and information about the product's energy conservation standards achievement rate, energy consumption efficiency and target year.
- The energy-saving logo (see below) comes in two colors. A green logo indicates that the energy conservation rate of the product is 100%, while an orange logo indicates that the product has not yet achieved the standards (under 100%). The energy conservation standards achievement rate shows the degree to which the product satisfies the target (Top Runner Standards) designated for the product category. The energy consumption efficiency is calculated for each product category and shows how much energy the product consumes. The target year refers to the year when the product is expected to satisfy the energy conservation standards.

Energy Conservation Performance Catalog

- The Energy Conservation Performance Catalog web site[1] provided by the Energy Conservation Center, Japan lists the energy conservation standards achievement rate mandated by the Act Concerning the Rational Use of Energy as well as the functions and performance of a variety of manufacturers' products, including personal computers, for comparison purposes .

Energy Star Program

- Energy Star Program[2] is an international labeling program for office automation equipment, and is recognized by both the Japanese Ministry of Economy, Trade and Industry and the U.S. Environmental Protection Agency. A manufacturer or distributor who wishes to participate in the program first registers as a partner and then conducts internal or third party assessments to determine whether the target product satisfies the standards, and reports the results. If the product does meet the standards the manufacturer or distributor can affix the logo shown below to the product.

J-Moss Content Mark

- The Act on the Promotion of Effective Utilization of Resources mandates indication of the following orange logo on products falling into seven categories, including computers and consumer appliances, if they contain six specific chemical substances above the standard level. If under the standard level, the same logo in green can be attached on a voluntary basis. You are advised to check if J-Moss Content Mark is indicated, when purchasing a computer.

PC Green Label

- Standards for design, production and disclosure of information related to personal computers are specified as the PC Green Label Standards. Personal computers that satisfy the standards can carry the logo below. This labeling system is organized by the PC3R Promotion Center, a personal computer manufacturers' association, to promote the three Rs for personal computer manufacturing: reduce (the amount of waste generated), reuse (the product after final use) and recycle (the renewable materials).

[1] http://www.eccj.or.jp/catalog/
[2] http://www.eccj.or.jp/ene-star/

Eco Mark

- The Eco Mark Program certifies products that have an overall life cycle which is eco-friendly and identifies them with the logo below[1]. This program is organized by the Japan Environment Association, and encompasses a wide variety of product categories, including ICT devices such as personal computers, printers and copiers.

GPN Data Base

- The Green Purchasing Network (GPN) develops guidelines for green purchasing and promotes green purchasing through the GPN Data Base[2].
- The GPN Data Base provides environmental information on products which can be used to make green purchasing decisions. ICT-related product categories covered in the database include personal computers and paper for printers and copiers.

EcoLeaf

- EcoLeaf[3] is an environmental labeling program developed by the Japan Environmental Management Association for Industry. The label shows the environmental burden over the life cycle of the product or service, based on data quantitatively calculated using Life Cycle Assessment (LCA) methodology. Products are assessed according to unified assessment standards designated for each product type, for example, at the process level or at the product level.
- The system covers not only hardware such as personal computers and fax machines, but also ICT systems such as Internet Data Center systems.
- The EcoLeaf program certifies the reliability of disclosed environmental information, rather than whether the product or service satisfies environmental standards[4]. Therefore, in order to determine if a product or service is eco-friendly, the environmental data disclosed under the EcoLeaf program should be further examined.

1 International Organization for Standardization (ISO) Type III environmental labeling program
2 http://gpn-db.mediapress-net.com/gpn-db/
3 http://www.jemai.or.jp/ecoleaf/
4 ISO Type III environmental labeling program (disclosing products' environmental impacts)

Table 3 Choosing an ICT device

ICT device	Labels and other guidelines for choosing ICT devices							
	Energy conservation			Harmful substances	3R	Comprehensive assessment		
	Energy Conservation Label	Energy Conservation Performance Catalog	Energy Star	J-Moss Content Mark	PC Green Label	Eco Mark	GPN Data Base	EcoLeaf
Personal computer	◎	◎	◎	●	◎	◎	◎	◎
Monitor			◎	●	◎	◎	◎	◎
Telephone								◎
Facsimile			◎				◎	◎
Printer			◎			◎	◎	◎
Photocopier	◎	◎	◎			◎	◎	◎
Scanner			◎					◎
Hybrid copier		◎	◎			◎	◎	◎
Server	◎							
Magnetic disk storage device	◎						◎	
Network device (e.g. router, switch)	△							

Legend: ● Statutory, ◎ Voluntary registration, △ Considering adoption of Top Runner Standards

3.3. Choosing Eco-Friendly ICT Providers

In order to limit the negative environmental impacts and enhance the positive impacts of ICT systems at all stages of the life cycle, it is important to take into account the environmental burden imposed by the business activities of providers of ICT devices and services. By choosing products and services based on environmental concerns, you can raise the environmental awareness of ICT providers and encourage them to take initiatives to reduce the environmental impacts of the processes of production of ICT devices or provision of ICT services.

In choosing an ICT provider, you should consider the factors listed in Table 4. For your reference, when evaluating providers you can also check the environmental commitment of ICT providers disclosed at their web sites or in their environmental reports. It is also advisable that when asking an ICT provider to submit a proposal you request the company to attach a specific plan or a list of past achievements in regard to the check items.

Table 4 Environmental checklist for choosing an ICT provider

Objective	Check item	Description
Choosing an eco-friendly ICT provider	Does the ICT provider have an internal framework in place for environmental activities (e.g., an environmental management system)?	If a framework for environmental activities is in place, the provider can continue to carry out eco-friendly business activities.
	Has the ICT provider been carrying out environmental activities, such as conservation of resources and energy, management and reduction of harmful substances, green purchasing and waste reduction?	It is crucial to assess specific environmental activities or achievements of the ICT provider.
	Is the ICT provider proactively disclosing plans and achievements in regard to its environmental initiatives, or environmental information about its products or services?	It is important to evaluate the provider as to whether it has actively disclosed environmental information through a variety of media, including product catalogs, web sites and environmental reports, and whether it has been making efforts to provide this information to purchasers.

Hints to curb negative impacts and enhance positive impacts

Following are some further hints for choosing eco-friendly ICT providers.

● Evaluating environmental activities of ICT providers

- Programs to certify environmental commitment, such as ISO 14001 and Eco Action 21, examine the attitude, system and environmental management system of organizations carrying out environmental activities. When choosing an ICT provider, it is important to check not only if the provider is certified under such a program but also its specific activities and performance. For specific activities and achievements of ICT providers, you can also refer to their environmental reports or voluntary environmental action plans on their company web sites.

3.4. Using ICT Systems in an Eco-Friendly Way

In order to limit the negative impacts and enhance the positive impacts on the environment caused by your ICT system, you should periodically monitor these impacts. By keeping track of specific impacts that you assessed before introducing the system (see Table 1 in 3.1 Adopting Eco-Friendly ICT Framework) as you operate the system (see Table 5), you may be able to develop effective improvement measures.

For example, in terms of electricity or paper consumption, which depend largely on the way you use the ICT system, you can regularly monitor the consumption by monitoring the power charges or expenditure on paper, and compare the figures with the forecasts made before the system was introduced to see if the results are as favorable as expected, or, alternatively, if the consumption has instead increased. (See Figure 8.)

Table 5 Environmental checklist for using an ICT system

Objective	Check item	Description
Using an ICT system in an eco-friendly way	Has the ICT system contributed to reducing use of office consumables (e.g., paper)? **Use of consumables**	It is helpful to compare the current consumption against the forecasts made before the introduction of the ICT system.
	Has the ICT system actually contributed to a reduction in electricity or energy consumption? **Electricity and energy consumption**	It is helpful to compare the current electricity and energy consumption against the values before the introduction of the ICT system.
	Has the ICT system actually contributed to a reduction in the movement of people? **Movement of people**	It is helpful to compare the current movement of people against the value before the introduction of the ICT system.
	Has the ICT system actually contributed to a reduction in the movement of goods? **Movement of goods**	It is helpful to compare the current movement of goods against the value before the introduction of the ICT system.
	Has the ICT system actually contributed to effective use of your office space? **Effective use of office space**	It is helpful to compare the current use of office space against the use of space before the introduction of the ICT system.
	Has the ICT system actually contributed to a reduction in storage space for goods? **Storage of goods**	It is helpful to compare the current storage space against the space used before the introduction of the ICT system.

	Has the ICT system actually contributed to an improvement in operational efficiency? **Streamlined operations**	It is helpful to compare the current operational efficiency (e.g., productivity) against the value before the introduction of the ICT system.
	Has the ICT system actually contributed to a reduction in waste production? **Waste production**	It is helpful to compare the current waste production against the value before the introduction of the ICT system.

Environmental burden	Before system introduction	After system introduction (forecast)	After system introduction (actual results)
Paper consumption	_ sheets/year	_ sheets/year	_ sheets/year
Power consumption of ICT devices	_ kWh/year	_ kWh/year	_ kWh/year
Movement of people	_-seater private car, _ km/year	_-seater private car, _ km/year	_-seater private car, _ km/year
Movement of goods	_-ton truck, km/year	_-ton truck, _ km/year	_-ton truck, _ km/year
Storage space	_ m^2	_ m^2	_ m^2

Figure 8 Example of monitoring the environmental burden of the ICT system

Hints to curb negative impacts and enhance positive impacts

Following are some further hints for using ICT systems in an eco-friendly way.

● Keeping track of electricity consumption of ICT systems

- One of the easiest ways to keep track of electricity consumption of ICT systems is by making estimates based on either the power charge or the electricity consumption of individual ICT devices and the amount of time these devices are used.
- To get a more accurate reading of the power consumption of your ICT system, you can measure the value with a commercially available electricity consumption monitoring device. These devices can either be a device connected to a power distribution board which indicates both the current power consumption as charges and when the consumption exceeds a predetermined energy-saving target, or a measuring device connected to an outlet which indicates CO_2 emissions in real time[1].

[1] For more details, see the MIC Report, Chapter 5.5 Electricity Consumption Monitoring Technology.

Devices to reduce standby power consumption **Electricity consumption**

- Devices that can be connected to both an electric appliance and the power outlet to control the power supply to the appliance and consequently reduce the amount of standby power consumed are available on the market. Such devices include devices which can be connected to a fax machine, to supply power depending on the communications status; or power strips that allow control of the power supply for each outlet[1].

Paperless process management **Consumption of goods** **Storage of goods** **Streamlined operations**

- By taking advantage of the paperless process management that you may have adopted upon the introduction of the ICT system (see 3.1 Adopting Eco-Friendly ICT Framework), you can reduce paper consumption. Use of e-document display or sticky note functions are also be helpful.
- By retaining information in an electronic media you can reduce paper consumption and the energy consumed by air-conditioning and lighting systems required for the maintenance of document storage space or libraries. You can also effectively reduce document storage space by reviewing the necessity of retaining the documents on paper, and by retaining them only as electronic data, if possible. The electronic data must still be appropriately managed from the perspective of information security.
- When distributing information you can reduce paper consumption by distributing the information electronically.
- When printing a document you can effectively reduce paper consumption with some printer functions, such as printing two pages on one sheet of paper, side-by-side or on both sides, rather than printing one page per sheet.

Reducing power consumption of ICT devices **Electricity consumption**

- You can save power used by your personal computer or terminal by either turning off the power or putting it in the energy-saving mode when not in use. Some file exchange software automatically starts up to transmit data even when the computer is in standby mode. Turning the computer off can avoid unnecessary data transmission and thus reduce the environmental impact of the equipment.

[1] For more details, see the MIC Report, Chapter 5.6 Technology to Reduce Standby Power.

3.5. Disposing and Recycling of ICT Systems in an Eco-Friendly Way

It is crucial to reduce the environmental burden of the process of disposing of or recycling ICT devices that are no longer needed. First of all, please consider if the ICT devices that you will no longer use can be reused as secondhand devices.

When you have decided to dispose of or recycle the devices, you can reduce the environmental burden by choosing a company that is committed to environmental sustainability.

Table 6 Environmental checklist for disposing of and recycling ICT systems

Objective	Check item	Description
Disposing of or recycling an ICT device in an eco-friendly way	Have you considered re-using the ICT device?	Using devices for a long period of time reduces their environmental impact, such as CO_2 emissions, of production and disposal of the devices.
	Are you using an eco-friendly company to dispose of or recycle ICT devices?	Choosing an eco-friendly company may reduce the environmental impact of the process of disposal or recycling.

Hints to curb negative impacts and enhance positive impacts

Following are some further guidelines for eco-friendly disposal or recycling of ICT devices.

● Reuse of ICT devices

- If you use products for a long period of time, you can reduce the environmental burden of mass production and mass disposal. You should consider whether the device which is no longer needed can be used for other purposes. When re-using personal computers, you should take proper information security measures, such as deleting the data on the hard disk.
- In light of the ongoing advancement in energy-saving technology for ICT devices, you may actually increase negative environmental impacts if you continue to use old models that require relatively large amounts of power. It is advisable to compare your devices with new models to determine whether you should continue to use them.

● Personal computer collection or recycling

- Used personal computers and monitors must be collected and recycled in accordance with the framework stipulated in the Act on the Promotion of Effective Utilization of Resources. The collection procedure for personal computers owned by legal bodies, such as corporations and public organizations, is different from that for privately owned personal computers. Corporations must directly request the manufacturers of the computers to collect them.

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