MIC
Ministry of Internal Affairs and Communications

ITU and Climate Change

Aiming to Realize Low–Carbon Society via ICT

~Outline of study group report (draft) on ICT policies
for resolving global warming problems~

April 15, 2008

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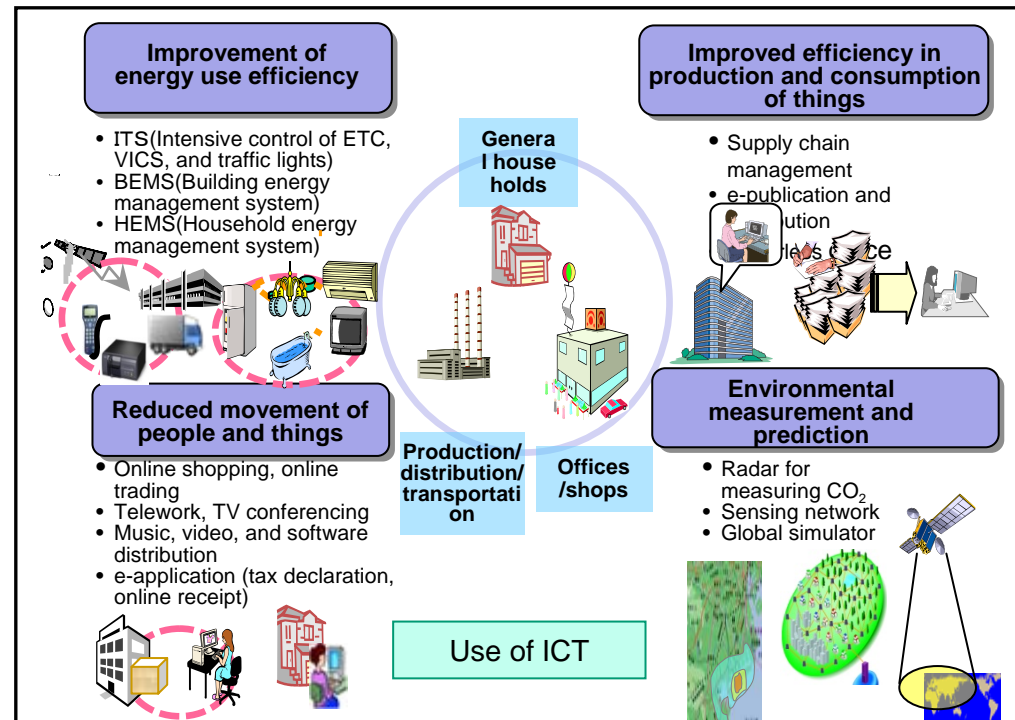Ministry of Internal Affairs and Communications

1. Global Warming Problems and ICT

○ Compared to the end of the 20th century, global average ground temperature in the 21st century is predicted to increase by about 1.8°C(1.1-2.9°C) in societies realizing both environment conservation and economic growth on a global scale, and by about 4.0°C(2.4-6.4°C) in societies realizing high economic growth while placing importance in fossil energy.

○ Efforts to reduce greenhouse gasses are being implemented worldwide to achieve the targets established for the Kyoto Protocol first commitment period (2008 to 2012). (Japan aims to reduce theirs by 6%)

○ Moves to construct a framework for a post-Kyoto Protocol following 2013 are becoming active in recent years (COP, G8 Summit, etc.)

2. Global Warming Problems and ICT

○ CO_2 reduction is required in the ICT field itself to reduce CO_2 emissions.

○ Furthermore, ICT usage can contribute to the reduction of CO_2 emissions through remarkable improvement of efficiency in production, consumption, and business activities, traffic alternatives, and relaxation of traffic.

○ Environment measurement and prediction using ICT is possible.

Improvement of energy use efficiency
- ITS(Intensive control of ETC, VICS, and traffic lights)
- BEMS(Building energy management system)
- HEMS(Household energy management system)

Improved efficiency in production and consumption of things
- Supply chain management
- e-publication and distribution

General house holds

Reduced movement of people and things
- Online shopping, online trading
- Telework, TV conferencing
- Music, video, and software distribution
- e-application (tax declaration, online receipt)

Production/distribution/transportation

Offices/shops

Environmental measurement and prediction
- Radar for measuring CO_2
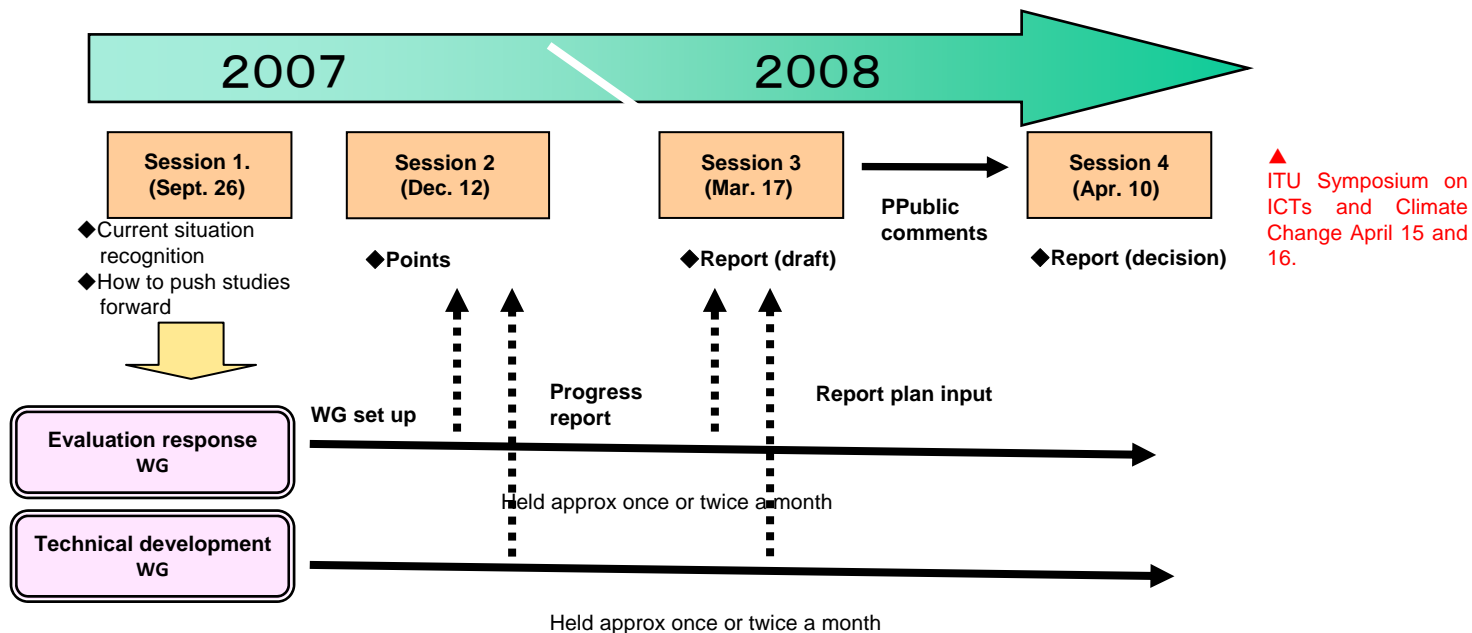- Sensing network
- Global simulator

Use of ICT

1

2. Study group on ICTs in response to global warming

As global warming issues become ever more serious, the Ministry of Internal Affairs and Communications has set up a "study group on ICTs in response to global warming." (Chairperson: Yoshio Tsukio, professor emeritus at University of Tokyo, Ph.D). The group's purpose is to investigate how ICTs can respond to global warming issues.
A report was drawn up on Thurs. April 10, 2008.

1 Details

(1) Possible effects of carbon dioxide emissions reductions and power consumption in the area of ICTs.

(2) Issues on ICT research and development that contribute to carbon dioxide emissions reductions.

(3) Examination into further CO2 emissions reductions through ICTs.

(4) International contributions in the ICT field, as a response to global warming.

2 Schedule

2007		2008	
Session 1. **(Sept. 26)**	**Session 2** **(Dec. 12)**	**Session 3** **(Mar. 17)**	**Session 4** **(Apr. 10)**

◆Current situation recognition
◆How to push studies forward

◆Points

◆Report (draft)

PPublic comments

◆Report (decision)

▲ ITU Symposium on ICTs and Climate Change April 15 and 16.

WG set up

Progress report

Report plan input

Evaluation response WG

Held approx once or twice a month

Technical development WG

Held approx once or twice a month

3. Estimation of CO_2 Emissions Reduction by ICT
（1）Method for Evaluation

CO_2 emissions reduction by ICT	=	CO_2 emissions reduction by use of ICT	－	CO_2 emissions of ICT

CO_2 emissions reduction by use of ICT

By use of ICT system, improvement of energy usage efficiency, improvement of efficiency and reduction of goods production/consumption ,and reduction of movement of people and goods are achieved, resulting in CO2 emissions reduction effects. Generally, the following eight effects can be given.

CO_2 emissions of ICT

Examples include CO_2 emissions by the consumption of resources and energy during the process of manufacturing and installing ICT equipment and networks, and that occurring in the process of power consumption, disposal, and recycling during the stage of use.
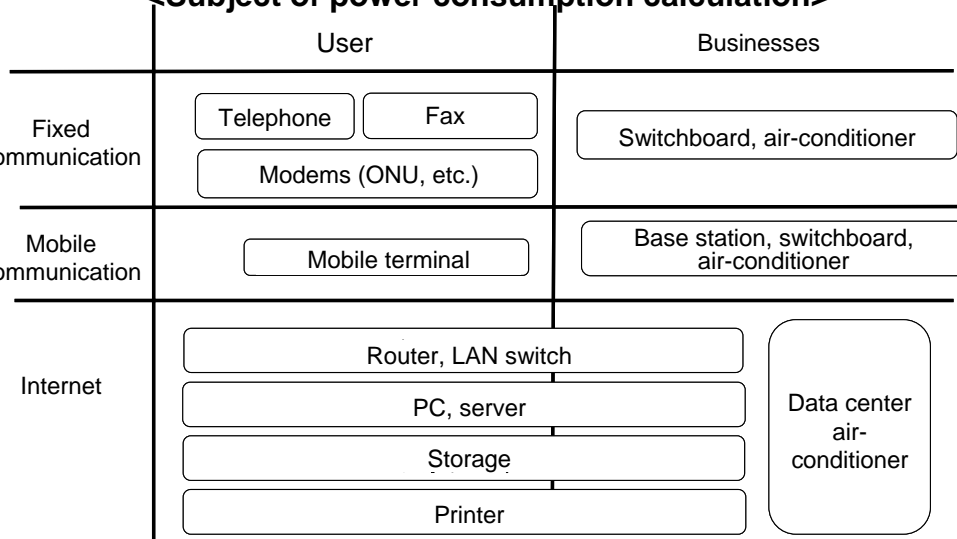
<CO_2 emissions reduction effects from the use of ICT>

Effect	Details
(1)Consumption of goods	By reducing goods consumption (consumption of paper, etc.), CO_2 emissions related to goods production and waste and waste generation can be reduced.
(2)Power consumption/energy consumption	By enhancing the efficiency of power and energy use to reduce consumption, CO_2 emission related to power generation and power transmission can be reduced.
(3)Movement of people	By reducing the movement of people, CO_2 emission and consumption of energy required for transportation means can be reduced.
(4)Movement of goods	By reducing movement of goods, CO_2 emission and consumption of energy required for transportation means can be reduced.
(5)Improved efficiency of office space	By using office space efficiently, CO_2 emission and consumption of power for lighting and air-conditioner, etc. can be reduced.
(6)Storage of goods	By reducing storage space of goods, CO_2 emission and consumption of power for lighting and air-conditioner, etc. and can be reduced.
(7)Improved work efficiency	By enhancing work efficiency, resource and energy consumption can be reduced, thus reducing CO_2 emission.
(8)Wastes	By reducing waste emission, consumption of energy required for environment preservation and waste disposal, etc. can be reduced, thus reducing CO_2 emission.

<Subject of power consumption calculation>

	User	Businesses
Fixed communication	Telephone / Fax / Modems (ONU, etc.)	Switchboard, air-conditioner
Mobile communication	Mobile terminal	Base station, switchboard, air-conditioner
Internet	Router, LAN switch / PC, server / Storage / Printer	Data center air-conditioner

<Number of subscribers (contract)>
(2012)

Unit: 10000 subscriptions

Subscribed phones	3,000
ISDN	400
FTTH	3,000
ADSL	750
CATV	500
Mobile 3G	12,000
Mobile 2G	0
Mobile PHS	550
Mobile WiMAX	400

* Estimate based on current trends. The number of subscribers for broadband service and mobile phones is based on the 2007 communication equipment mid-term demand forecast (Communications and Information Network Association of Japan (CIAJ))

<Numbers of user-side communication related equipment running>
(2012)

|		
Fixed communication user- side device	Monolithic phone, FAX, TA, modem, etc.	104 million units
Mobile communication user- side device	Mobile phones, PHS, WiMAX	130 million units
PC (for household)	PC for home use	33 million units
PC (for business)	PC for commercial use	34 million units
Printer	Inkjet printer, page printer	45 million units
Server	Server	4 million units
Storage	Network storage	3,400,000TB
Mainframe	Mainframe	5,800 units
Router	Router (including wireless LAN function)	31 million units
LAN switch	LAN switch	9 million units
Financial terminals, etc.	CD, ATM, digital kiosk terminal	230,000 units
Home multimedia terminals	PDA, game machine, on-vehicle terminal	80 million units
RFID reader/Writer	RFID reader/Writer	15 million units

* Calculated considering account models remaining in shipment statistics

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3. Estimation of Net CO_2 Emissions Reduction by ICT (2)Power Consumption of ICT Field (Telecommunication②)

<Power consumption of telecommunication field>

<Breakdown of power consumption of telecommunication field in 2012 (Non-countermeasured cases)>
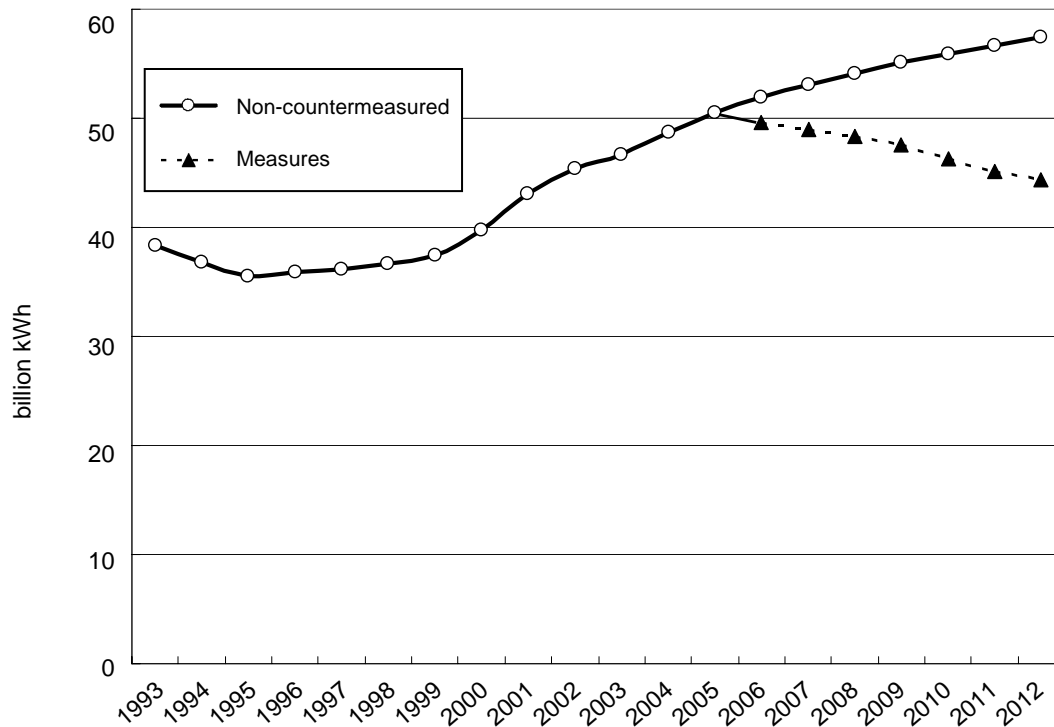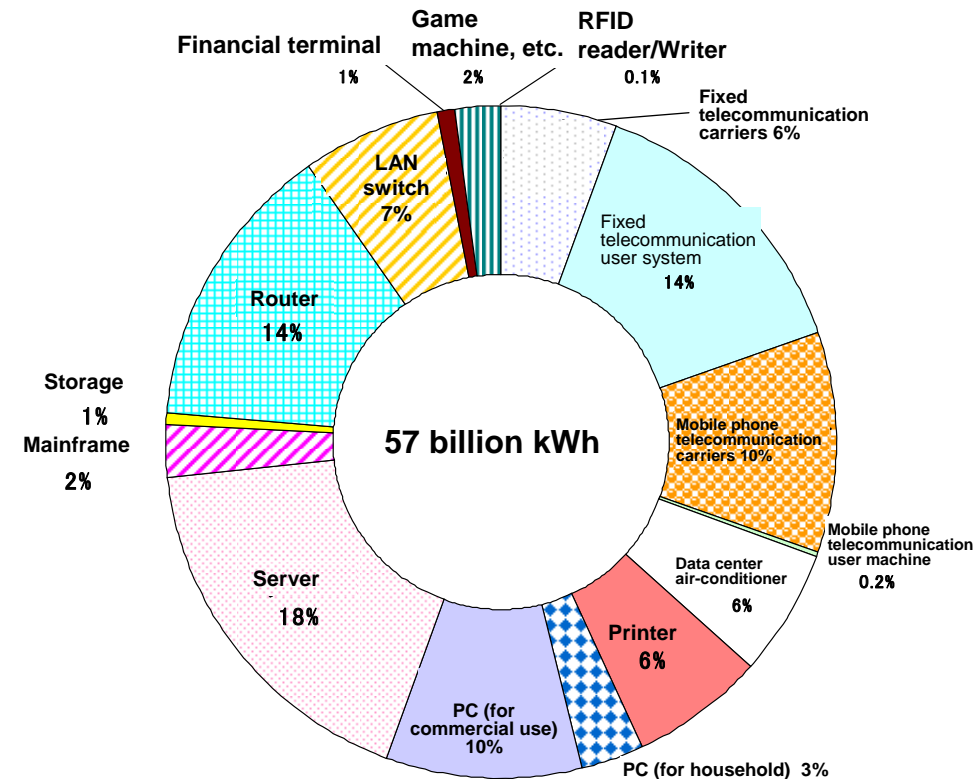
Power consumption of the telecommunications field in 2012 is estimated to be 57 billion kWh (However, estimated at 44 billion kWh when energy saving measures are implemented)

* Presumed energy-saving measures：application of energy-saving of air conditioner/ power supply in data center and top runner system

3. Estimation of Net CO_2 Emissions Reduction by ICT (3)Power Consumption of ICT Field (Broadcasting)
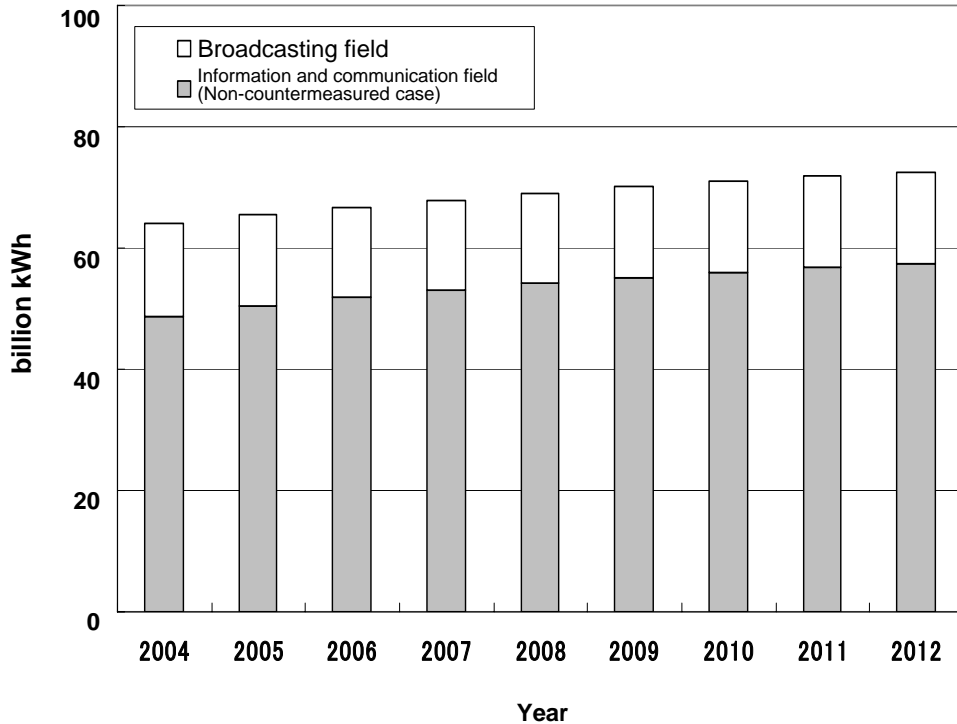
<Power consumption of broadcasting field>
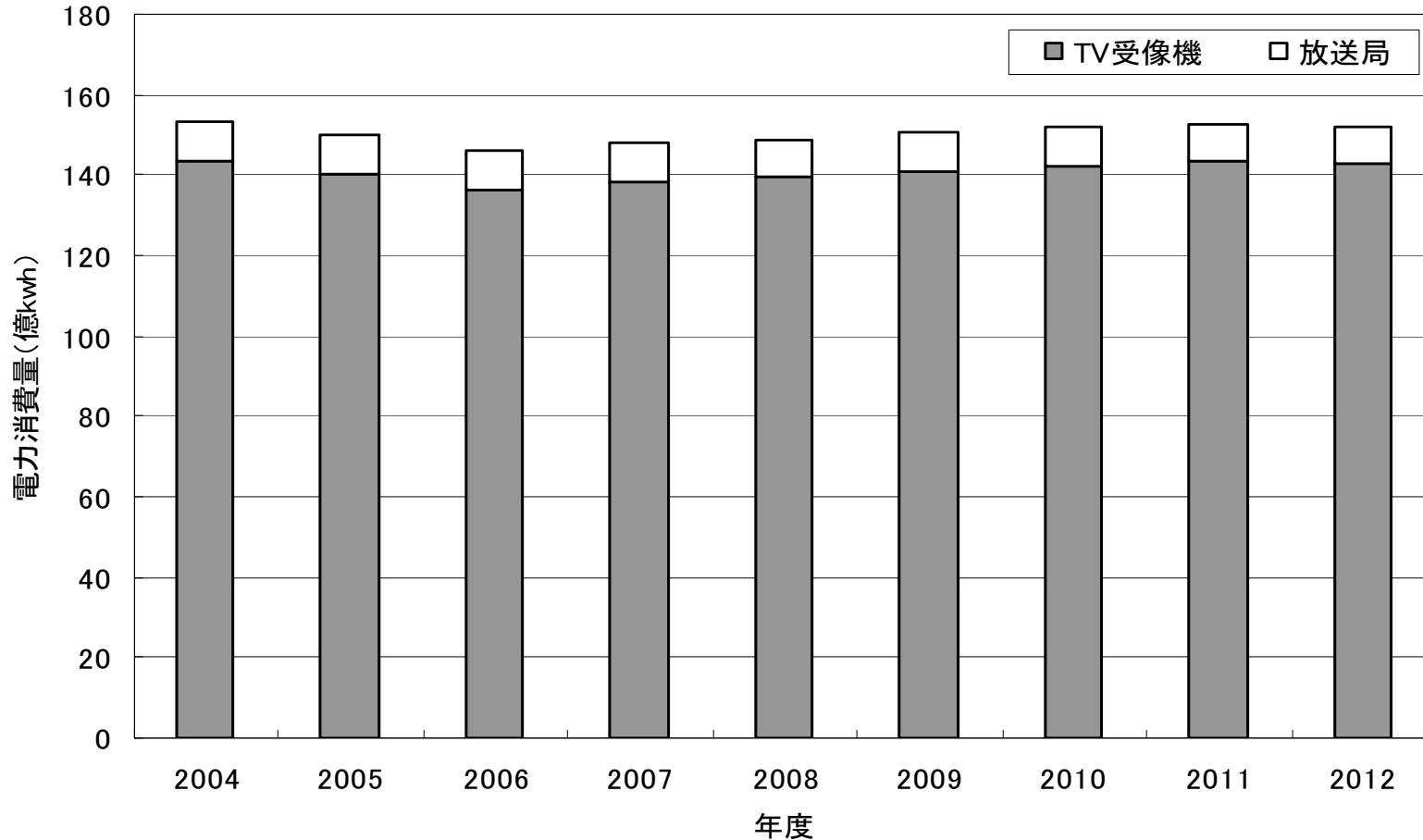
Power consumption of broadcasting field in 2012 is estimated at a combined total of 15.2 billion kWh for power consumed by broadcast stations and TVs.

* Power consumption of broadcasting stations is based on voluntary action plans of broadcasters and results of the hearings.
  Power consumption of TVs is based on Japan Electronics and Information Technology Industries Association (JEITA) estimate.
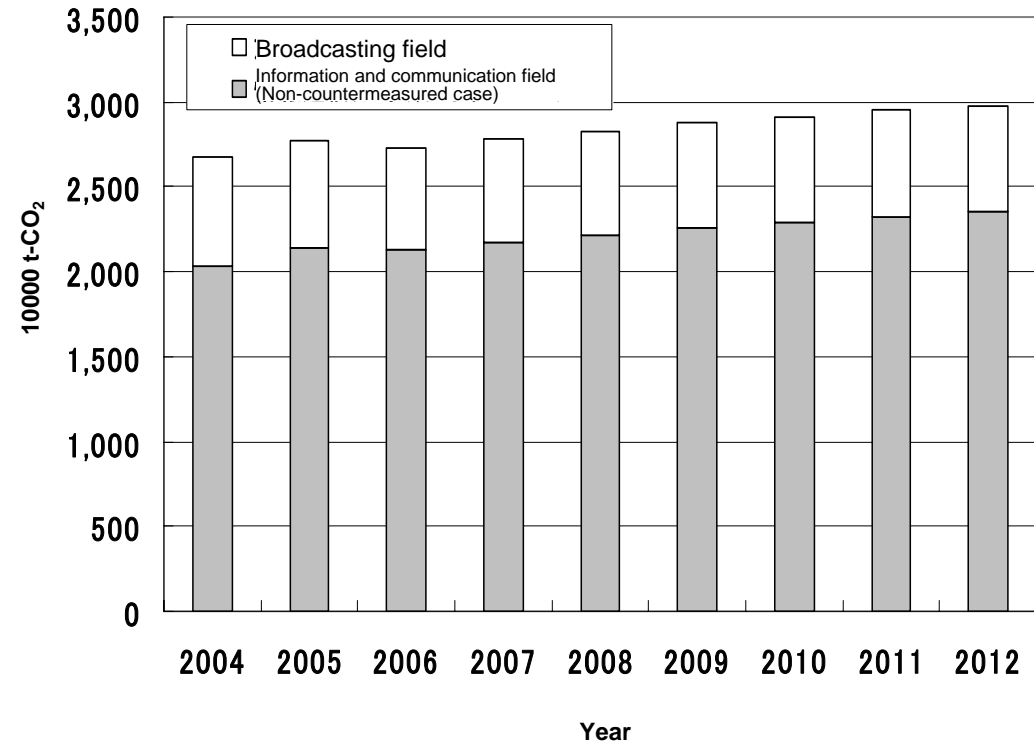
3. Estimation of Net CO_2 Emissions Reduction by ICT (4)Power Consumption and CO_2 Emissions of ICT Field

\<Power consumption of overall ICT field\>

\<CO2 emissions of overall ICT field\>

It is estimated that in <u>2012</u>, <u>73 billion kWh power will be consumed</u> and <u>300 million tons of CO_2 will be emitted</u> in the whole ICT field combining telecommunication field as well as broadcasting field. <u>(Equivalent to 2.4% of CO_2 emissions in Japan in 1995)</u>

* For the conversion from power consumed to CO_2 emitted, the CO_2 emissions basic unit values announced by the Federation of Electric Power Companies of Japan each year are used. Between 2007 and 2012, the 2006 value of 0.410 kg–CO_2/kWh is used.

CO_2 emissions reduction effects in scenes of use and main penetration rate used for calculation, etc.

Evaluated areas	Scenes of use	CO_2 reduction effects	penetration rate, etc.	
			2006	2012
e-trade for individuals	Online shopping	Reduction of shopping traffic, delivery transportation, packaging paper	2% of retail	7% of retail
	Online air ticket issuing	Reduction of traffic energy to purchase at counter	33% of network reservations	83% of network reservations
	Purchase of ticket at convenience store	Reduction of traffic energy to purchase at counter	9% of network service use rate	15% of network service use rate
	Installation of cash automatic payment machine	Reduction of traffic energy to bank counter	Number of installed CD, ATM 66600 units Number of shops reduced 950 shops	Number of installed CD, ATM 81100 units Number of shops reduced 2000 shops
e-trade for corporate business	Online transaction	Reduction of energy accompanying business relocation for business meetings, etc.	B to b rate 20%	B to b rate 40%
	Supply chain management	Reduction of Energy by reducing unnecessary production, etc. through production distribution management	Production distribution management progress rate 50%	Production distribution management progress rate 80%
	Reuse market	Substitution of machine parts production with reused products	Reuse percentage 0.83%	Reuse percentage 1.87%
e-digitization of substances	Music content	Reduction of energy for media transportation of records and CDs	Record e-distribution rate 7%	e-distribution rate 27%
	Visual content	Reduction of energy for media transportation of video and DVDs	Video e-distribution rate 10%	Video e-distribution rate 26%
	PC software	Reduction of energy for media transportation of PC software	ASP progress rate 7% (2005)	ASP progress rate 30%
	Newspaper and books	Reduction of print paper	e-book rate 0.4%	e-book rate 1.5%
Movement of people	Telework	Reduction of traveling for work and business	Telework population 7,800,000 people	Telework population 16,300,000 people
	TV conferences	Reduction of traveling for work and business	TV conference market 23 billion yen	TV conference market 66 billion yen
	Remote control	Reduction of traveling for work and business	Automatic vending machine 2.64 million	Automatic vending machine 2.67 million
Advanced road traffic system	ITS	Improvement of running speed, non-stopping, and elimination of traffic	ETC use rate 68%, VICS penetration rate 18% Intensive control of traffic lights is about 28,800	ETC use rate 85%, VICS saturation rate 21% Intensive control of traffic lights is about 47,000
e-government and e-municipality	e-tender	Improvement of work efficiency and decrease in travel of bidder	Number of e-biddings that can be implemented per municipality (Hearing)	Number of e-biddings that can be implemented per municipality (Hearing)
	e-application (tax filing)	Paperless, reduction of storage space, improvement of work efficiency, and reduction of travel by applicant	Use rate 2.89%(e-TAX), 0.8% (eLTAX)	Use rate 50%
	e-application (online receipt)	Paperless, reduction of storage space, reduction of travel by applicant	Use rate 26.4% (Receipt computer system)	Use rate 100%
Energy control	BEMS, HEMS	Energy-saving effects in buildings and of air-conditioners and home appliances	BEMS delivery amount 53 billion yen	BEMS delivery amount 104.7 billion yen

Note) Regarding telework, ITS and BEMS/HEMS, CO_2 reduction described in the Kyoto Protocol Achievement Plan of Japan was taken as the effect. If no 2012 reduction amount, set equal to 2010.

Note) Regarding e-government, targets are set at the penetration rate from January 19, 2006 (IT Strategy Headquter).

CO$_2$ emissions reduction effects by use of ICT

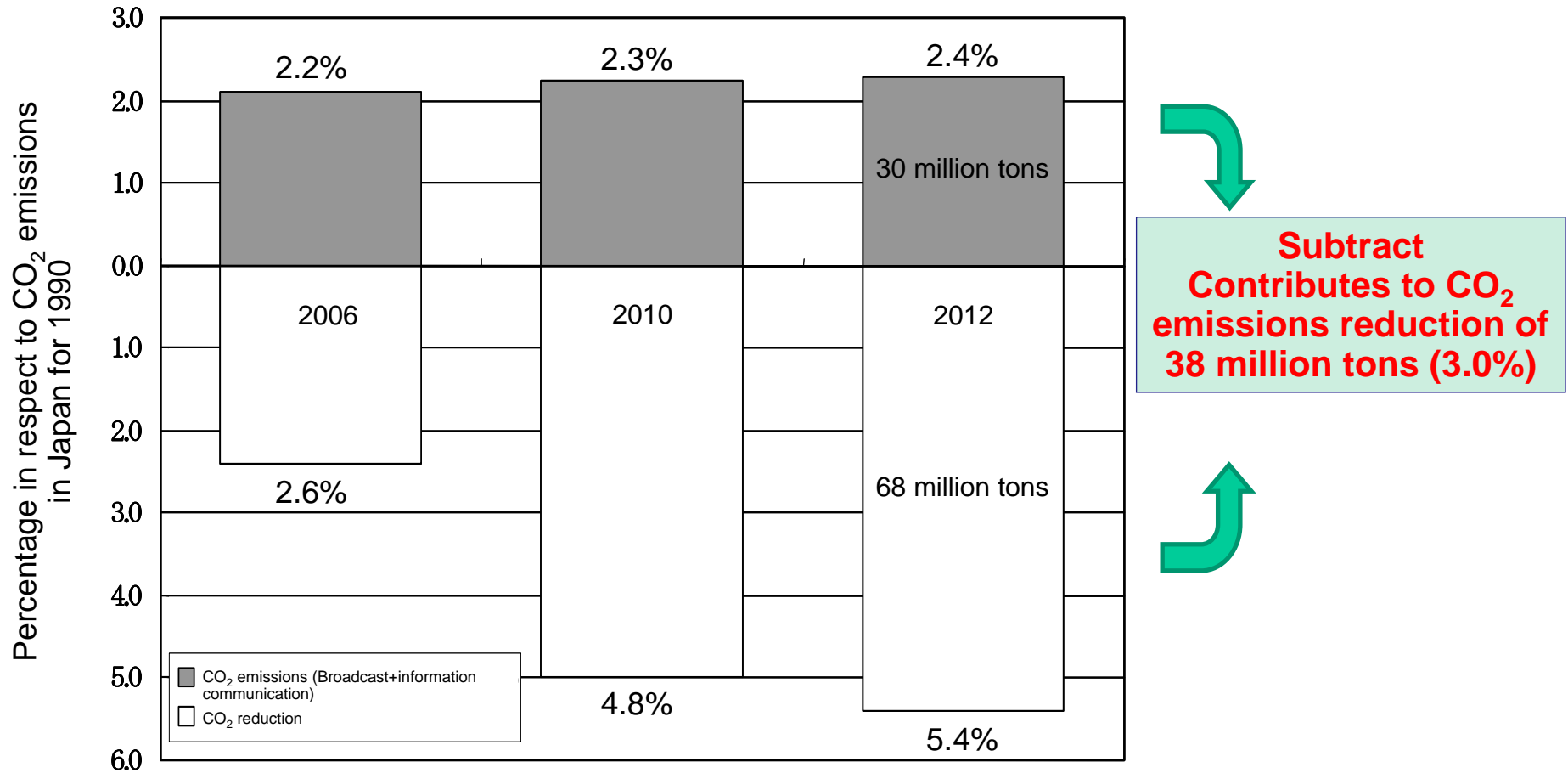| Evaluated field	Scenes of use	2006		2010		2012	
		10000t-CO$_2$	Percentage (%)	10000t-CO$_2$	Percentage (%)	10000t-CO$_2$	Percentage (%)
e-trade for individuals	Online shopping	198	0.1%	542	0.4%	712	0.5%
	Online air ticket issuing	2	0.0%	5	0.0%	6	0.0%
	Purchase of ticket at convenience store	31	0.0%	60	0.0%	64	0.0%
	Installation of cash automatic payment machine	261	0.2%	291	0.2%	319	0.2%
e-trade for corporate business	Online transaction	527	0.4%	767	0.6%	836	0.6%
	Supply chain management	532	0.4%	1,839	1.4%	1,839	1.4%
	Reuse market	577	0.4%	1,154	0.8%	1,197	0.9%
e-digitization of substances	Music content	35	0.0%	114	0.1%	133	0.1%
	Visual content	15	0.0%	21	0.0%	25	0.0%
	PC software	11	0.0%	53	0.0%	61	0.0%
	Newspapers and books	4	0.0%	91	0.1%	95	0.1%
Movement of people	Telework	30	0.0%	50	0.0%	63	0.0%
	TV conferences	105	0.1%	194	0.1%	305	0.2%
	Remote control	5	0.0%	5	0.0%	5	0.0%
Advanced road traffic system	ITS	308	0.2%	370	0.3%	401	0.3%
e-government and e-municipality	e-tender	0	0.0%	2	0.0%	2	0.0%
	e-application (tax filing)	0	0.0%	8	0.0%	8	0.0%
	e-application (online receipt)	0	0.0%	1	0.0%	1	0.0%
Energy control	BEMS, HEMS	468	0.3%	730	0.5%	730	0.5%
Total		3,110	2.3%	6,297	4.6%	6,802	5.0%

Note) Percentage shows the percentage in respect to total greenhouse gas emissions in Japan for 2005

3. Estimation of Net CO_2 Emissions Reduction by ICT
(7) Result of the Estimation

Percentage in respect to CO_2 emissions in Japan for 1990

3.0
2.0
1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0

2.2% 2.3% 2.4%

2006 2010 2012

30 million tons

2.6%

68 million tons

4.8%

5.4%

■ CO_2 emissions (Broadcast+information communication)
□ CO_2 reduction

Subtract
**Contributes to CO_2 emissions reduction of 38 million tons (3.0%)**

In **2012**, 30 million tons of CO_2 are expected to be emitted in the ICT field, but the use of ICT will produce CO_2 reduction effects of 68 million tons, <u>contributing to CO_2 emissions reduction of 38 million tons</u> (Equivalent to 3.0% of 1990 CO_2 emissions in Japan)

* This calculation includes "reduction potentials" which do not appear immediately, and efforts are required to realize these potentials.
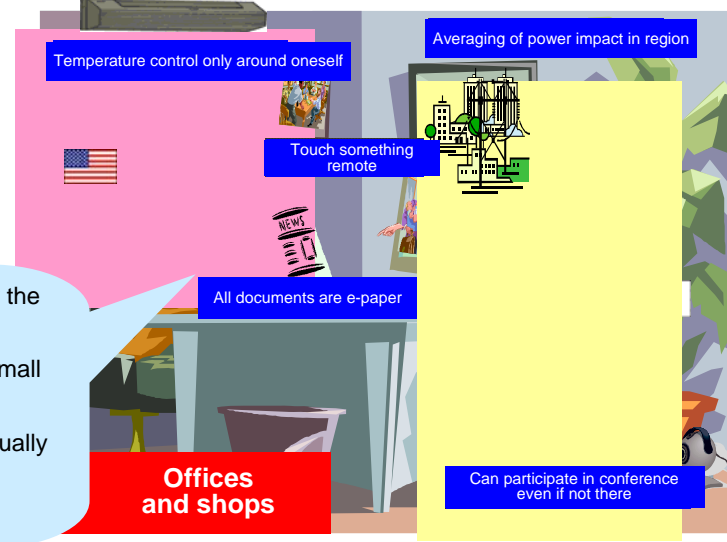
Transportation without waste by rack transportation
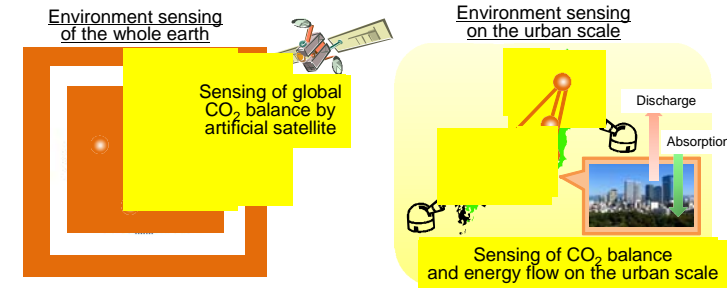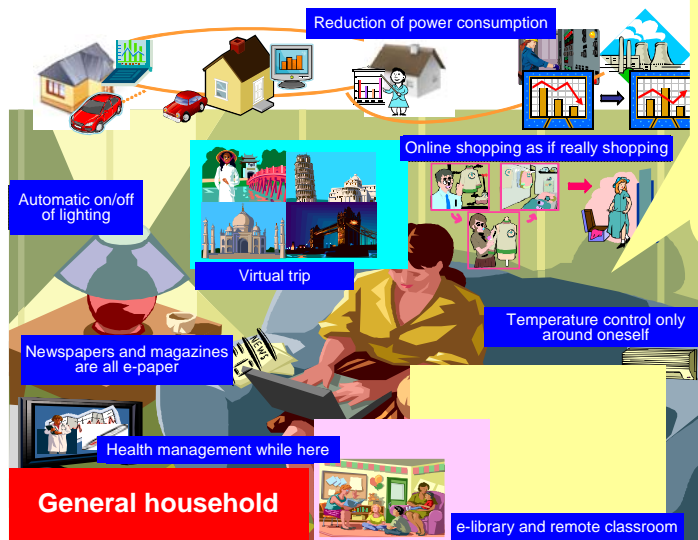
Purchase freely according to preference
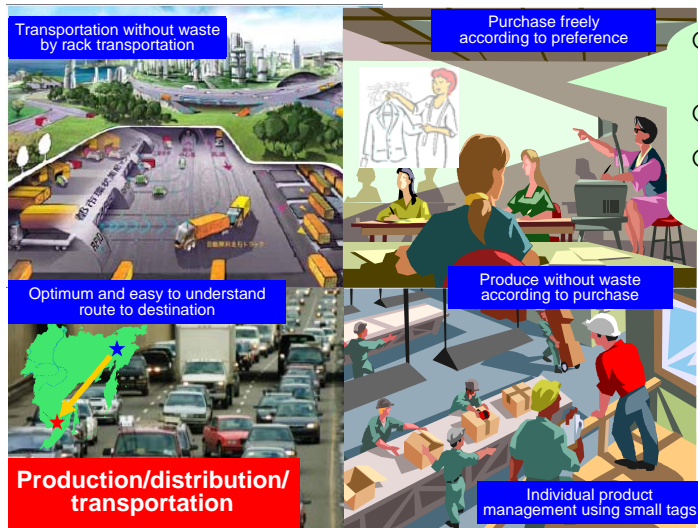
○ Economical production of products according to purchase information

○ Joint transportation with other products

○ Zero-accident and zero-traffic jam efficient transportation

Optimum and easy to understand route to destination

Produce without waste according to purchase

Production/distribution/ transportation

Individual product management using small tags

○ Air-conditioning and heating comfort in only the vicinity of individuals

○ Management of power consumption using small electrical storage devices

○ Participation in overseas meetings while actually being in Japan
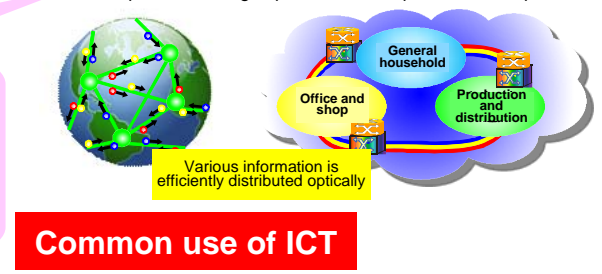
○ Paper used in office is e-paper

Temperature control only around oneself

Averaging of power impact in region

Touch something remote

All documents are e-paper

Offices and shops

Can participate in conference even if not there

Reduction of power consumption

Online shopping as if really shopping

Automatic on/off of lighting

Virtual trip

Newspapers and magazines are all e-paper

Temperature control only around oneself

Health management while here

General household

e-library and remote classroom

○ Air-conditioning and heating comfort in only the vicinity of individuals

○ Management of power consumption using small electrical storage devices

○ Online shopping and virtual tourism that feels like the real thing

○ Daily distribution of newspaper using e-paper

○ Automatic on/off of lighting

Environment sensing of the whole earth

Environment sensing on the urban scale

Sensing of global CO_2 balance by artificial satellite

Discharge

Absorption

Sensing of CO_2 balance and energy flow on the urban scale

All-optical, ultra-high speed, ultra-low power consumption network

○ Networks which can send all data using optical signals are expanding in various parts of the world

○ Implement CO_2 measurement at various scales, ranging from global to urban

General household

Office and shop

Production and distribution

Various information is efficiently distributed optically

Common use of ICT

4. R&D of ICT for contributing the CO_2 Emissions Reduction
(2) ICT Systems Sought for Realizing Image of Society in 2030

I. "Production, distribution, and transportation" scene

Eco-distribution and safe transportation system

By eliminating accidents and traffic jams by ITS and eco-drive, and by minimizing fuel consumption, optimize movement of people and things and improve efficiency of energy use.

Advanced production, purchase, distribution support system

Realize minimization of stock by use of RFID, etc., to enhance efficiency of goods production, inspection and storage; use positional information to enhance efficiency of distribution.

II. "Office/Shop" scene

III. "General household" scene

Eco, energy, and management system

By using information on people's actions and position, and controlling air-conditioning, lighting, hot water supply, etc. to optimum beforehand (proactive function), reduce energy consumption actively without exceeding the power set individually beforehand.

Proactive BEMS

Implement building energy management using proactive function.

Proactive HEMS

Implement household energy management using proactive function.

Tele and reality system

Using systems which enable information transfer via visual sensation and auditory sensation as well as touch, taste, and smell, realize remote conferencing, telework, remote medical care, online shopping, virtual travel experience system, etc., substitute movement of people and goods, and reduce energy consumption.

Resource-saving system

Reduce the volume of paper used for such as catalogues, meeting documents, etc. with e-paper. Also, promote effective use by sharing the use of assets such as office space and bicycles, etc. with many. Furthermore, reduce the volume of food waste.

IV. Use of common ICT, etc.

Measurement of environment information

Measure and digitize environment information such as CO_2 emissions on different scales, from global to urban space.

Environment information

Distribution, analysis, evaluation, control of environment information

By analyzing and evaluating environment information distributed through the network, sustain social convenience and production, and manage CO_2 emissions.

Energy-saving of ICT equipment and network

Promote energy-saving of ICT equipment and networks by using all-optical networks and new network architectures.

5. Recommendations

(1) Actively appeal the concept of "ICT which can contribute actively to global warming issues while pursing economic growth and improved convenience" inside and outside Japan enthusiastically, and aim at enhancement of recognition.

(2) Considering the realization of low-carbon society, encourage the more introduction of ICT for various social systems, and encourage the more penetration in the social systems where ICT has already been introduced such as e-government and e-municipality. In addition, construct low-carbon city models easy to make fully use of ICT.

(3) Establish evaluation methods for CO_2 emissions reduction effects by use of ICT at the international level and promote standardization.

(4) Establish mechanisms which can include CO_2 emissions reduction in efforts of voluntary action plans, etc. of companies. Furthermore, review efforts for use in the CDM of developing countries.

(5) Promote environment-conscious measures in data centers, ASP, SaaS. For archive data, promote CO_2 emissions reduction measures in information management by such as changing storage methods to those that consume little power, such as optical disks, etc.

(6) Review environment-conscious corporate efforts that use ICT, support measures for promoting "visibility" etc, in the household.

(7) Promote dissemination to all of society by providing information on environment impact reduction cases using ICT as best practices, starting an award-giving system, etc.

(8) Promote research and development of an "eco-energy management system" for managing power consumption and supply by digitization of energy flow, "resource saving system" for realizing a paperless society, "energy saving ICT equipment and networks", and "measurement of environment information", etc.

(9) Promote research and development of technical elements common to all of the above systems and technical elements to undergo R&D in the ICT field.

○ Cases of reduced environment impact by ICT were gathered and CO_2 emissions reduction effects were quantitatively evaluated.
- No. of cases gathered: 44 cases (Of which, quantitative evaluation was implemented on 39)
- Companies/organizations from which cases were gathered: Mitsukoshi, House Foods, Kagawa Prefectural Government, Kuriyama Agriculture Promotion Public Corporation, Nakano Ward Office, Sapporo Medical University, Naganuma Agriculture Union, etc.
- CO_2 emission which can be reduced in all participants: 270,000t–CO_2/year (Reduction rate: 92%)

Specific examples

Introduction of agricultural land satellite analysis service using remote sensing technology (Naganuma Agriculture Union)

Before introduction

*Surveyor goes to local site (irrigated rice) and surveys growth and development.

Improvement of agricultural land information gathering efficiency

On-site survey by traveling in car and mapping of analysis information by hand

Reduced relocation of people and improved work efficiency

+

Improvement of environment

After introduction

*Use of remote sensing technology reduced relocation of people.

Use of satellite images and mapping of analysis information

Reduction of 2t–CO_2 emission (99% reduction effects)

Introduction of "administrative information system" at prefectural government (Kagawa Prefecture)

Before introduction

*Gathering of the views of prefectural residents by post
* Launch and renewal of homepage by hand

Improvement of convenience to prefectural residents, improvement of efficiency of office work for prefectural officers, cost reduction
*Based on situation before introduction, assuming that current prefectural services are maintained

Hand-written and submission by postal mail
Homepage written by employee with specific HTML skills

Improvement of work efficiency

+

Improvement of environment

After introduction

By introducing administrative information system,
*make good use of e-mail and Internet
*Systemize homepage registration

Each employee in charge can register on the web

E-mail magazine, e-mail
Use of e-mail and Internet
Use of "WebLinks-Neo" eliminates need for HTML knowledge.

*Reduction of 18t–CO_2 emission (90% reduction effects)*

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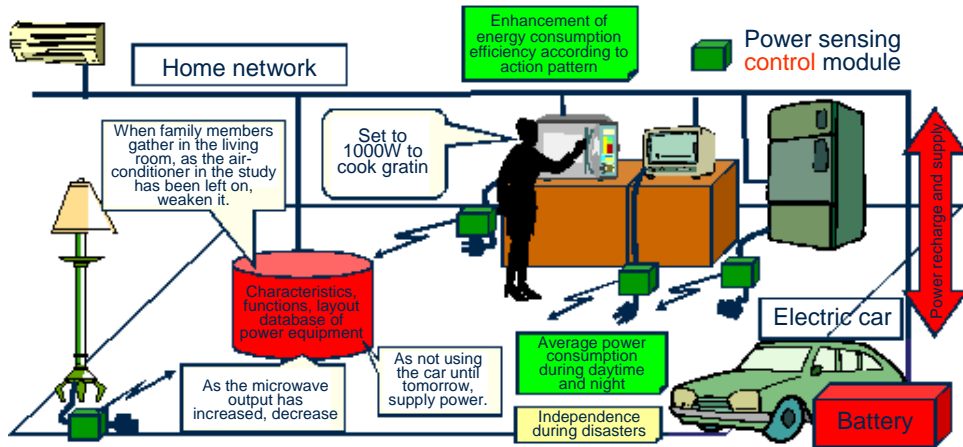
Proactive HEMS

- Use information on people's actions and positions, control air-conditioning, lighting, hot water supply, etc., to optimum in advance (proactive function)
- Realize management by using an energy buffer function
- By controlling power consumption to less than the set power, reduce CO_2 emissions without sacrificing convenience

Measurement of CO_2 concentration by using laser light
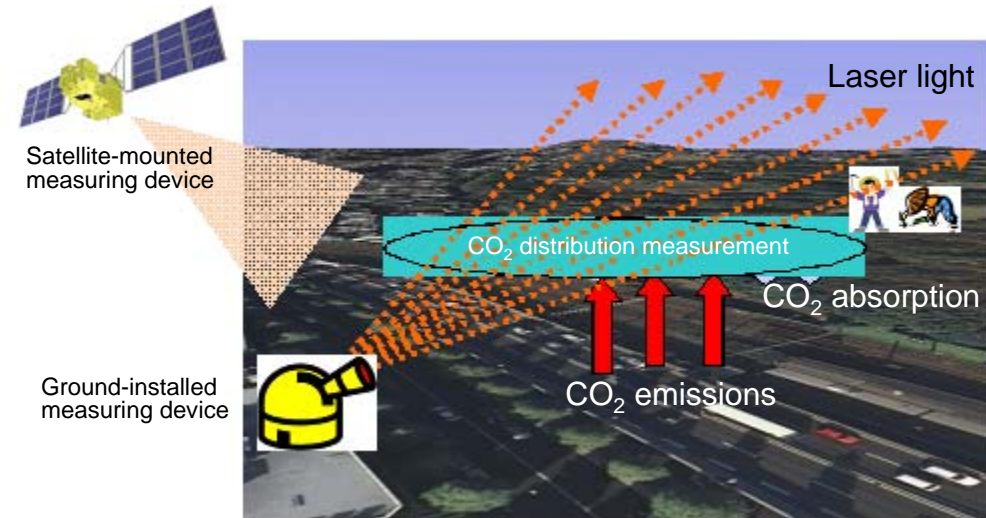
- Irradiate atmosphere with laser light and calculate CO_2 concentration in it
- Succeed in measuring CO_2 concentration using laser sensor (NICT)
- In the future, promote development of high precision, etc., and realize CO_2 concentration measurement on a global scale

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