

NTT Group Energy Efficiency Guidelines Initiative and Promotion of Green R&D

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Abstract

In April 2010, the NTT Group Energy Efficiency Guidelines were created with the goal of reducing the NTT Group's energy costs as well as its environmental load. The guidelines establish evaluation methods and set target standards for power-consumption efficiency in information and communications technology (ICT) equipment. They were accompanied by revisions to the "Detailed Guidelines for the Green Assessment of R&D Results", which is part of the NTT Group Green R&D Guidelines. This article introduces the background and current state of this series of initiatives.

1. ICT Ecology Guidelines

As services continue to diversify and traffic on the networks of telecommunications service providers increases, the power consumed by information and communications technology (ICT) equipment comprising the networks, air conditioners, power supplies, and other accompanying equipment, as well as the amount of CO₂ emitted as a result, are increasing in proportion. In response, the Ministry of Internal Affairs and Communications released a report in June 2009 entitled "Study Group on Ecological Measures in the ICT Field" [1]. This report stated that if telecommunications service providers would, at their own initiative, procure equipment designed to conserve energy and increase the visibility of their CO₂ emissions reduction initiatives, it would be effective in reducing CO₂ emissions. Accordingly, NTT and other telecommunications service providers created the ICT Ecology Guideline Council (Ecology Council [2]) in June 2009. It produced the ICT Ecology Guidelines (1st ed.) (Ecology Guidelines [3]) in February 2010 to establish procurement standards for

telecommunications services providers for the purpose of evaluating the energy efficiency of ICT equipment and services. These guidelines indicate (1) assessment standards for evaluating applicable equipment, (2) assessment standards for evaluating data-centers, and (3) assessment standards for obtaining the Eco ICT Logo designation.

2. Standards for evaluating energy savings in ICT equipment

The Ecology Guidelines ver. 1.1 (revised on Dec. 27, 2010) stipulate figures of merit, normative references, and approximate dates for achieving the normative references for seven types of ICT equipment such as routers and servers^{*1} (Table 1). The figure of merit for each type of ICT equipment was determined with due consideration for energy-saving methods, assessment standards from standards organizations, and also actual operational conditions. Furthermore, technical trends and other factors were also taken into

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^{*1} Compact routers (without a virtual private network feature), Layer-2 switches (box-type), transport equipment, passive optical network equipment, broadband base stations, external power supplies, and server equipment.

Table 1. Normative references for equipment covered by the ICT Ecology Guidelines (ver. 1.1).

Equipment type	Category	Equipment name	Figure of merit	Normative reference	Approximate date for achieving normative reference	Notes
Broadband router (no VPN function)	A	Wired router	Power consumption (W)	4.0	FY2010 end	×2: 2.4-GHz radio output (mW/MHz) ×5: 5-GHz radio output (mW/MHz) * Figures of merit and normative references (×2, ×5, etc.) conform to assessment standards based on the Top Runner Method
	B	Wired router with VoIP		5.5		
	C	Wireless router (2.4 GHz)		0.10×2+3.9		
	D	Wireless router (5 GHz)		0.15×5+3.9		
	E	Wireless router (2.4 GHz + 5 GHz)		0.10×2+0.15×5+5.1		
	F	ADSL router		7.4		
	G	ADSL router with VoIP		7.4		
	H	Wireless ADSL router		8.8		
Layer-2 switch (box-type)	A	Layer-2 switch (SNMP management function, IP filter function)	Power consumption (W) ÷ max. effective Tx speed (Gbit/s)	$(\alpha_n + P_n)/T$	FY2011 end	α_n : Sum of port and fixed power consumption P_n : PoE additional power component T : Max. effective transmission rate n : Class (A, B, C, D) * Figures of merit and normative references conform to assessment standards based on the Top Runner Method
	B	Layer-2 switch (SNMP management function, no IP filter function)				
	C	Layer-2 switch (web-equiv. management function)				
	D	Layer-2 switch (no management function)				
Transport equipment	WDM	DWDM equipment	Max. throughput (Gbit/s) ÷ avg. power cons. (W)	0.32	FY2012 end	Avg. power consumption: (full wavelength power + 1 wavelength power)/2 * Figure of merit conforms to ATIS references
		CWDM equipment		0.48		
PON equipment	GE-PON	OLT (AC power source)	Average power consumption (W) ÷ total no. of lines	0.46	FY2012 end	Avg. power consumption = $(P_{100} + P_{50} + P_0)/3$ Total no. of lines = total intermediate frequency ports × no. of PON branches
		OLT (DC power source)		0.42		
		ONU (100 Mbit/s)	Avg. power consumption (W)	3.68	FY2012 end	Avg. power consumption = $(P_{100} + P_{50} + P_0)/3$
		ONU (1 Gbit/s)		4.45		
Broadband base station equipment	WiMAX	WiMAX base station (integrated, 10-W device (one system))		12.60	FY2012 end	P_n : Tx power on antenna terminal n (W) P_{idle} : primary input power with no load (W) P_{max} : primary input power at max Tx (W) α : daily average transmit traffic rate
		WiMAX base station (integrated, 10-W device (two systems))		9.63		
		WiMAX base station (integrated, 5-W device (one system))		5.84		
External power supply	AC adapter	AC adapter	Average conversion rate	$62.2+6.26\ln(P_{\text{no}})$	FY2011 end	Avg. conversion rate = $(\eta_{25} + \eta_{50} + \eta_{75} + \eta_{100})/4$ η_n : efficiency when load rate is n% P_{no} : nominal power (W) * Figures of merit conform to international agreements on efficiency
Server equipment	Server equipment	Server equipment	(Operating conditions evaluation index) $0.1 \times \sum_{\text{ssj_ops}} \Sigma P$, where P is power consumption (W)	1000	FY2010 end	ssj_ops: processing capacity * Figure of merit conforms to SPECpower ssj®
			(Idle state evaluation index) (idle state power consumption (W) + low-power mode conversion (W))/2 ÷ combined theoretical performance	Under study	Under study	

ADSL: asynchronous digital subscriber line
 CWDM: coarse wavelength division multiplexing
 DWDM: dense wavelength division multiplexing
 GE-PON: Gigabit Ethernet-passive optical network
 IP: Internet protocol
 OLT: optical line terminal
 PoE: Power over Ethernet

PON: passive optical network
 SNMP: simple network management protocol
 Tx: transmitter
 VOIP: voice over Internet protocol
 VPN: virtual private network
 WDM: wavelength division multiplexing
 WiMAX: worldwide interoperability for microwave access

account when setting each normative reference and the approximate date for its achievement. Threshold

values in five steps were also set to evaluate the degree to which ICT equipment achieves a given

Table 2. Assessment scales established in ICT Ecology Guidelines (ver. 1.1).

Equipment type	Five-step assessment scale threshold				
	★	★★ (normative reference)	★★★	★★★★	★★★★★
Broadband router (no VPN function)	(normative reference not achieved)	Power consumption reduction relative to normative reference: 0–10%	Power consumption reduction relative to normative reference: 10–20%	Power consumption reduction relative to normative reference: 20–30%	Power consumption reduction relative to normative reference: over 30%
Layer-2 switch (box-type)	(normative reference not achieved)	Power consumption reduction relative to normative reference ^{*1} : 0–10%	Power consumption reduction relative to normative reference ^{*1} : 10–20%	Power consumption reduction relative to normative reference ^{*1} : 20–30%	Power consumption reduction relative to normative reference ^{*1} : over 30%
Transport equipment	(normative reference not achieved)	Power consumption reduction relative to normative reference: 0–10%	Power consumption reduction relative to normative reference: 10–20%	Power consumption reduction relative to normative reference: 20–30%	Power consumption reduction relative to normative reference: over 30%
PON equipment					
Broadband base-station equipment					
Server equipment	(normative reference not achieved)	Power consumption reduction relative to normative reference ^{*2} : 0–20%	Power consumption reduction relative to normative reference ^{*2} : 20–40%	Power consumption reduction relative to normative reference ^{*2} : 40–60%	Power consumption reduction relative to normative reference ^{*2} : over 60%

*1 Power consumption reduction relative to normative reference is for comparison with equipment with equivalent maximum effective transmission speed.

*2 Power consumption reduction relative to normative reference is for comparison with equipment with equivalent processing capacity (ssj_ops value).

normative reference. For example, if the relative reduction in energy consumption exceeds the normative reference by 10–20%, it is given three stars, if it exceeds the normative reference by 20–30%, it gets four stars, and if it does not meet the normative reference, it gets only a single star (**Table 2**).

It is assumed that manufacturers will conduct these evaluations themselves and that the product-evaluation results will be published on the council's website. Telecommunications service providers will be able to refer to the results on the website when deciding their procurement standards.

3. NTT Group Energy Efficiency Guidelines

To reduce CO₂ emissions by the NTT Group, we are focusing on communications equipment and offices, which account for 90% of emissions by the group, in order to reduce power consumption. Accordingly, in April 2010, eight NTT-Group companies^{*2} established the NTT Group Energy Effi-

ciency Guidelines (1st ed.) (Energy Efficiency Guidelines [4], [5]), on the basis of the Ecology Guidelines, in order to support development and procurement of equipment with high energy-efficiency for NTT Group companies. The Energy Efficiency Guidelines ver. 1.1 (revised on Dec. 27, 2010) represent the basic approach to developing and procuring ICT equipment for the NTT Group. Some key extracts from them are shown in **Fig. 1**.

To encourage manufacturers to meet target values for equipment types as far as possible when applying these guidelines, manufacturers are required to indicate specific requirement items and show how they were evaluated in their technical specification documents. Moreover, the suitability of energy-saving-performance-guideline target values for each equipment group will be reexamined according to product trends. An overview of the operational flow for the guidelines is shown in **Fig. 2**. In the future, we will promote their application beyond the initial eight group companies.

*2 NTT, NTT EAST, NTT WEST, NTT Communications, NTT DOCOMO, NTT DATA, NTT Facilities, and NTT Comware.

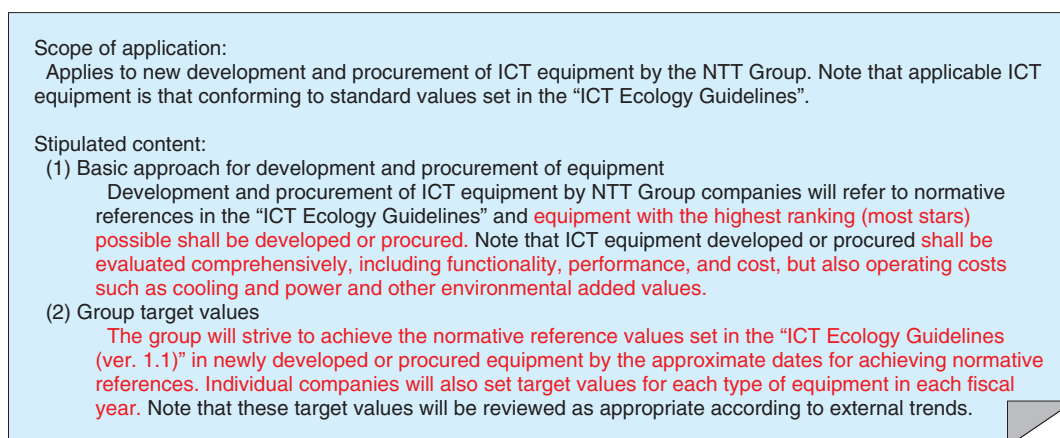


Fig. 1. Extracts from the NTT Group Energy Efficiency Guidelines (ver. 1.1).

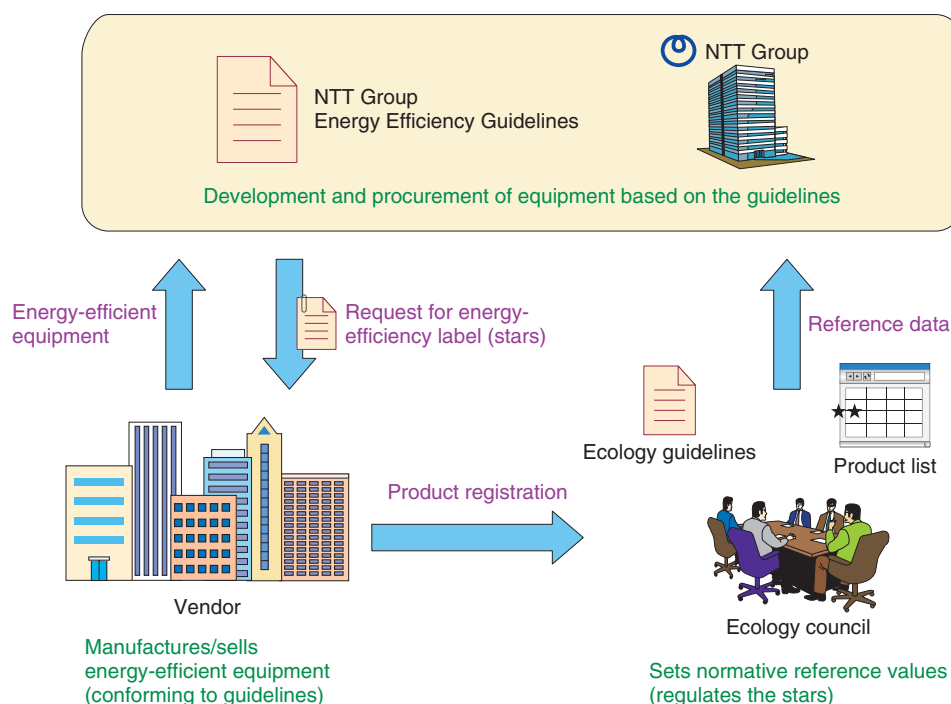


Fig. 2. Operational flow for the guidelines.

4. Eco ICT Logo

The Eco ICT Logo shows that a telecommunications service provider is taking appropriate initiatives to reduce CO₂ emissions. The Ecology Council began accepting applications for the Eco ICT Logo and publishing the names of companies receiving it in July 2010. The eight NTT companies that established

the Energy Efficiency Guidelines have all received the Eco ICT Logo [6], [7].

The process for receiving the Eco ICT Logo is shown in **Fig. 3**. The Ecology Guidelines establish items that companies must check themselves regarding the state of their CO₂ emissions reduction initiatives. These items include mainly whether the company is creating equipment procurement standards,

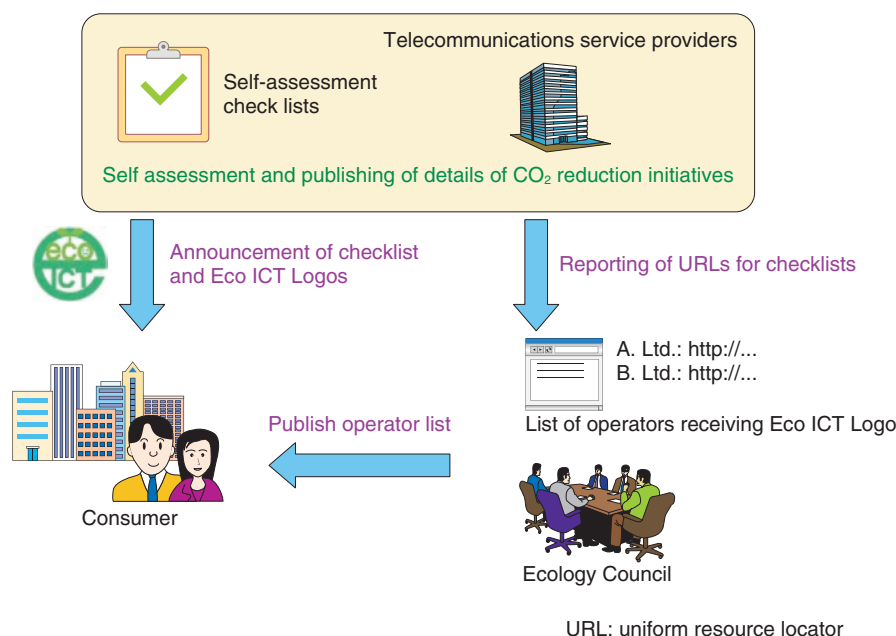


Fig. 3. Operation flow for the Eco ICT logo.

whether it is conducting procurement according to these standards, whether it has a voluntary environmental action plan describing CO₂ emission reduction target values, whether it is operating according to this plan, and whether it has any initiatives, staff announcements, or developments, besides CO₂ reduction ones, toward reducing its environmental load. The Ecology Guidelines include eight mandatory items and two optional items. Telecommunications service providers can obtain the Eco ICT Logo by fulfilling all the mandatory items and publishing the results of their self-assessment on their own websites. In the future, this Eco ICT Logo will be displayed on the websites and in corporate social responsibility reports of companies that have received it, and we will continue to widely promote NTT Group efforts to reduce CO₂ emissions.

5. NTT Group Green R&D Guidelines

In the NTT Group, we established the NTT Global Environmental Charter in 1991 and are promoting environmental protection measures throughout the company. In 2000, the NTT Group Green R&D Guidelines were established as an initiative toward research and development (R&D) taking the environment into consideration. Then, in 2004, the R&D Green Assessment Detailed Guidelines (GA Detailed

Guidelines) were established and assessments based on these guidelines are instituted when R&D is started and when the results are provided to businesses, promoting ongoing efforts for environmental improvement.

In particular, from the outset, R&D must consider compatibility with issues such as the selection and compatibility of materials, restricted use of toxic substances, conservation of resources and energy, ease of disassembly and disposal, and methods for recycling and disposal. The energy efficiency of ICT devices and other R&D products are also evaluated (Green of ICT), as well as the effect of reducing the overall load of society on the environment (Green by ICT) through aspects such as improving distribution efficiency, reducing the movement of people and materials, and dematerialization. With this introduction of Energy Efficiency Guidelines, the GA Detailed Guidelines have also been revised so that in the future, in addition to previously evaluation items, conformance to the target values for each equipment group in the energy-saving guidelines will also be evaluated.

Finally, the NTT Group Green Procurement Guidelines [8] and the (Addendum) Green Procurement Guidelines [9], which establish the idea of reducing environmental load from a procurement perspective, have also been revised. The relationships among these guidelines are shown in Fig. 4.

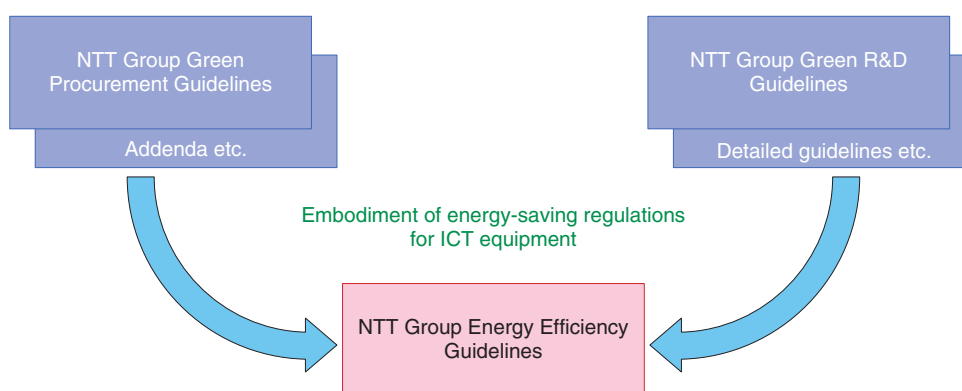


Fig. 4. Position of NTT Group Energy Efficiency Guidelines.

6. Future prospects

In the future, we will continue to revise the Energy Efficiency Guidelines in accordance with the Ecology Guidelines and technical trends for ICT equipment, promote the application of these guidelines in group companies besides the original eight companies, and further expand initiatives within NTT to reduce CO₂. The NTT Group will endeavor to create R&D results that have less environmental load (Green of ICT) and that help reduce the environmental load of society (Green by ICT) and will continue to promote policies at the R&D level that consider the environment.

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