Key Roles of Green Technology for Access Network Systems

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Abstract: ICTs are expected to reduce their own equipment and service energy consumption and mitigate GHG emissions through use of ICTs in other relevant sectors. Standardization activities of green ICTs in ITU-T will be outlined.

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1. Introduction

The United Nations Intergovernmental Panel on Climate Change (IPCC) foresees a further rise of between 1.4 and 5.8°C in average global temperatures by the end of the century. Climate change is a concern for everyone and requires efforts on the part of all sectors of society, including the information and communications technology (ICT) sector. Although ICTs contribute only an estimated 2.5% of total greenhouse gases, this is expected to grow as ICT usage expands globally, growing at a faster rate than the general economy. ICTs are thus part of the cause of global warming; however, they can also be part of the solution, e.g., through the promotion of carbon displacement technologies. Namely, ICTs are expected to reduce their own emissions over their entire lifecycles and mitigate global warming through their adoption in other relevant sectors to enhance the efficiency of energy use, reduce the movement of people and goods, and so on (Fig. 1).

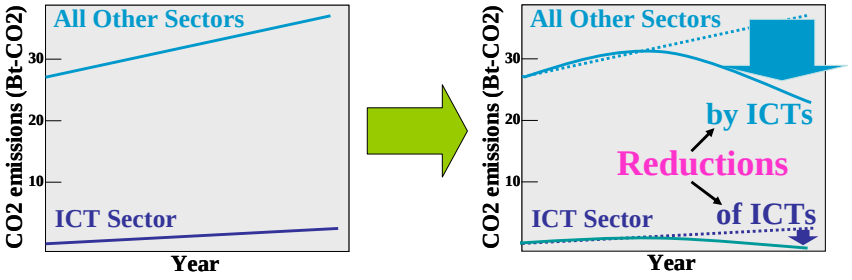

Fig. 1. CO_2 reduction of all sectors by using ICTs

This article reviews standardization activities at the International Telecommunication Union, Telecommunication Standardization Sector (ITU-T) related to ICTs and climate change. It also outlines discussions to date, describes recent progress, and introduces the future structure of such standardization activities in ITU-T. Furthermore, as key roles of green technology for access network systems, case studies for energy saving by using the passive optical network (PON) system and fiber to the home (FTTH) are introduced.

2. Positive and negative impacts of ICTs on environment

ICTs have both positive and negative impacts on the environment, as shown in Fig. 2. In general, the negative impact is the environmental load caused by ICT devices and equipment themselves, such as energy and natural resource consumption and e-waste. On the positive impact side, ICT services can make lifestyle and business operations efficient. They do so by, for example, enabling dematerialization, which means transporting information instead of physical objects, and reducing production and transportation. This efficiency of lifestyle and business activities indirectly reduces the environmental load. To construct a sustainable society from an environmental viewpoint, it is important to minimize the negative impacts of ICT (“Green of ICT”) and maximize the positive ones (“Green by ICT”). Because the quantification of both ICT environmental impacts is essential, it is necessary to standardize a methodology for evaluating the environmental impact of ICT objectively and transparently. Such a methodology is based on the life cycle assessment (LCA).

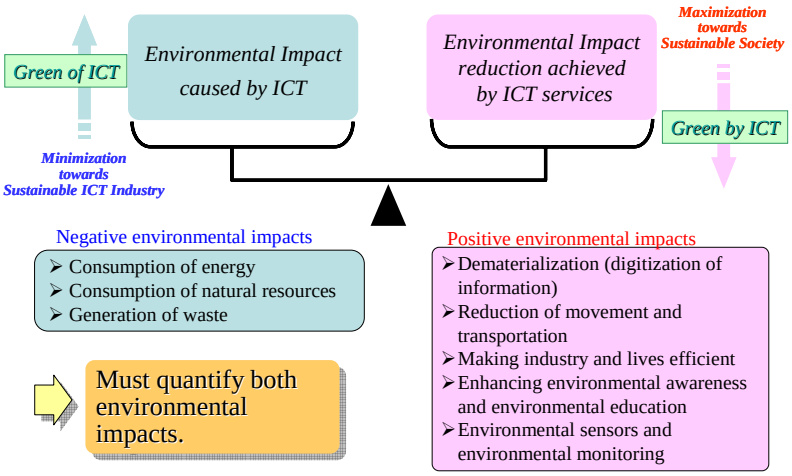

Fig. 2. Relationship between ICT and environment

3. Focus Group on ICTs and Climate Change

The ITU-T held two symposia in the first half of 2008 on ICTs and climate change (ICT&CC). These two symposia recognized the importance of energy-saving contributions by ICT services, the need for an internationally agreed common methodology for measuring the environmental impact of ICTs on climate change, and the need for a new Focus Group (FG). At the Telecommunication Standard Advisory Group (TSAG) meeting of ITU-T held in July 2008, a new FG on ICT&CC was established [1,2]. The scope of the FG was to identify from the standardization viewpoint, within the competences of ITU-T, the impact of ICTs on climate change, in particular the reduction of their own equipment and service energy consumption over their entire lifecycles, the mitigation due to the adoption of ICTs in other relevant sectors, and the monitoring of relevant climate parameters. The results of FG-ICT&CC were reported at the TSAG meeting in April 2009, the mandate of Study Group (SG) 5 was expanded to “Environment and Climate Change”, and a new Working Party (WP) 3 concerning “ICT and climate change” was created in SG5.

4. Activities and objectives of SG5

SG5 aims to standardize an internationally agreed method of calculating two elements: (1) the energy usage and carbon impact arising from the lifecycles of ICTs and (2) the mitigation that can be achieved through dematerialization and by substituting ICT services and devices for intensive fossil-fuelled activities such as travel and transport. This work has an important bearing on current and future global agreements under which countries make commitments to reduce their overall greenhouse gas emissions. The work on methodologies under SG5 is central, as it aims to provide a standard method of calculating the potential benefits of mitigation due to ICTs.

Japan is actively contributing to standardization work in WP3/SG5 to provide an objective and transparent method. This method enables ICT users to quantitatively show their contribution when they use ICTs so that they can include the contribution in their energy reduction activities. Standardizing the calculation method can clarify the contribution of the ICT sector in other sectors. This will make it possible to study specific measures using ICTs to combat global warming.

In addition, SG5 also aims to standardize the specifications and architecture of power feeding systems, environmental protection and recycling of ICT equipment and facilities, etc.

5. Case study of “Green of ICT” and “Green by ICT”

As an example of “Green of ICT”, a major focus of ITU’s work in recent years has been on next generation networks (NGNs), which are expected to reduce energy consumption by 40% compared to the current public switched telephone networks (PSTN) [3]. This energy saving is due to a significant decrease in the number of switching centers required and to more tolerant climatic range specifications for NGN switching locations.

Furthermore, the introduction of Very high bit-rate Digital Subscriber Line (VDSL) 2 is expected to reduce energy consumption because it specifies three power modes (full, low-power, and sleep), whereas VDSL has only a single power mode (full power).

As a case study of "Green of ICT" by utilizing a method for calculating environmental impact, a PON system has an advantage over a single star (SS) system in energy saving, as shown in Fig. 3, because PON can decrease the environmental load (CO_2 emission) by sharing optical fibers among users.

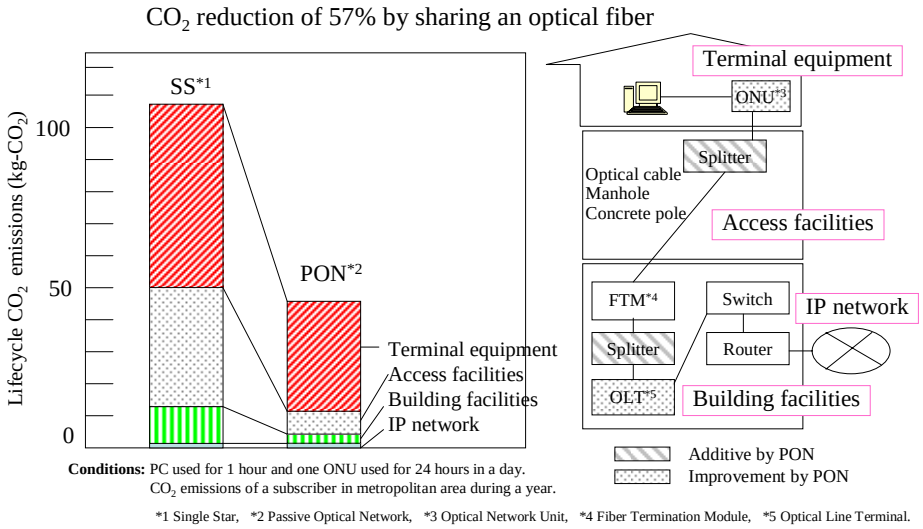

Fig. 3. Green of ICT by using PON system

As a case study for "Green by ICT", the effect of NTT Group's FTTH service, in reducing environmental impact has been quantitatively evaluated, taking the lifecycles of FTTH equipment and networks into consideration. By investigating the use of FTTH using statistical data, we determined that there are 19 types of ICT services/actions using FTTH and conventional ones that can achieve the same objectives without using FTTH, such as sending e-mail instead of conventional mail, downloading movies instead of purchasing DVDs at a store, purchasing e-tickets instead of tickets from a store, etc [4]. FTTH has been found to reduce environmental impact by 70% compared with the use of conventional alternative means as shown in Fig. 4.

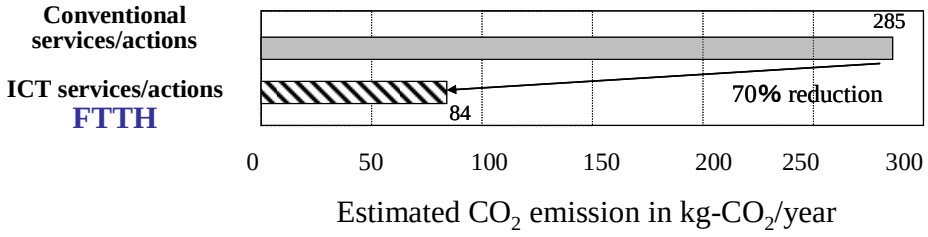

Fig. 4. Energy saving by using FTTH

6. References

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