ITU/MIC Kyoto Symposium on ICTs and Climate Change
15-16 April 2008
Meeting Summary

The issue of global warming needs to be tackled from a global perspective, because its impact affects the entire planet and it is growing more serious every year. Estimates from the Intergovernmental Panel on Climate Change (IPCC) show that global greenhouse gas (GHG) emissions, the primary cause of global warming, have risen by 70 per cent since 1970. In Kyoto, in December 1997, the world took concrete steps to combat global warming with an international agreement to limit and reduce GHG emissions. The first commitment period set out in the Kyoto Protocol began in 2008. In the intervening decade, the number of users of information and communication technologies (ICTs) worldwide has tripled. Kyoto is therefore the best place to launch a new work programme aimed at investigating the role that ICTs play in causing global warming, but also in monitoring, mitigating and adapting to climate change. The timing of this symposium is also highly appropriate because global measures under discussion at the symposium can be forwarded for appropriate action at the G8 Summit, to be held at Lake Toya, Hokkaido Prefecture, in July 2008 and at other relevant fora.

It is in this context that the International Telecommunication Union (ITU) and the Ministry of Internal Affairs and Communications (MIC) of the government of Japan co-organized the Kyoto Symposium on *ICTs and Climate Change*, at the Kyoto International Conference Centre, on 15-16 April 2008. The symposium was chaired by Mr. Hanazawa, Senior Vice President, Director, R&D Planning Dept, NTT, Approximately [240] participants drawn from a wide range of organizations including, *inter alia*, the private sector, research institutes, international organizations and governments.

The Symposium had six substantive sessions: "Climate change: ICTs to the rescue?", "Corporate responsibility: Towards a climate-neutral ICT Sector", "ICTs for monitoring climate change", "ICTs as a clean technology", "Towards a high-bandwidth, low carbon future" and "Adapting to climate change". Copies of all presentations, plus archived versions of the audio and visual clickstreams (using *GoToWebinar*) of the presentations can be found online at the event website at www.itu.int/ITU-T/climatechange.

Opening Ceremony

The welcome address was given by **H.E. Mr. Satoshi NINOYU**, Vice-Minister for Internal Affairs and Communications and Member of the Upper House. He explained the background to the symposium, which has been jointly organized by ITU and MIC Japan. He explained the broader context of the global process of the third meeting of the Conference of the parties of the UN Framework Convention on Climate Change (UNFCCC), held in December 1997, which had led to the signing of the Kyoto Protocol. This meeting, just over a decade later, focuses on how Information and Communication Technologies (ICTs) can assist in mitigating and adapting to climate change.

The keynote address was given by **Mr Malcolm JOHNSON**, Director, ITU-T. He set out the background to the symposium, which had been proposed at a meeting of the ITU-T Telecommunication Standardization Advisory Group (TSAG) in December 2007. The title of the first session of this symposium – ICTs to the rescue? – encapsulates this view that technology can solve the very same problems it has caused. ICTs have certainly contribute to global warming, but much more important is their role in monitoring, mitigating and adapting to climate change. He outlined the fourfold strategy of ITU in developing a coherent programme on ICTs and Climate Change. The first role is to create a knowledge base and repository on the relations between ICTs and Climate Change. These two symposia – here in Kyoto and in London on 17-18 June – are a first step towards fulfilling this mission. The second role is to position ITU as a strategic leader on this topic. The third role is to promote a global understanding of the relations between ICTs and climate change through international fora and agreements. Finally, ITU is committed to achieving climate-neutral status within three years.

Mr Johnson invited **Mr Takashi HANAZAWA**, Senior VP, Director, R&D Planning Dept, NTT (Japan) to chair the symposium. In his opening remarks he highlighted the dual role of ICTs, both in reducing its own contribution to global warming but also in reducing the environmental impact of other sectors. He highlighted the growing role of ICTs by showing the phenomenal growth of the sector in Japan. He identified three environmental roles that ICTs can play in terms of energy efficiency, more efficient manufacturing and substitution of movement of people and things. For instance, the conversion of newspapers and magazines to a digital formal would reduce paper and printing requirements. Similarly, downloading of music reduces the requirement for production of CDs and the costs of their distribution. He invited all participants to contribute towards a successful meeting.

Session 1: Climate Change: ICTs to the rescue?

The Kyoto Protocol came into force in 2005 and has been ratified by more than 175 countries. However, the agreed limitations on greenhouse gas emissions may not be achieved by all parties and, in any case, they may be insufficient to reverse the effects of global warming without an additional technological contribution. This session will provide an overview of the role of ICTs in the wider context of the efforts by the international community to implement the Kyoto Protocol and to commit to more ambitious reductions as part of the Bali plan of action.

The first session was moderated by Mr. **Art LEVIN**, Head, Corporate Governance and Membership Division (ITU). He outlined the emerging global framework on climate change, which began in 1992 with the adoption of the UN Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol was adopted in 1997, at the third conference of the parties (COP), which sets out binding commitments on reductions and limitations of emissions of greenhouse gases (GHGs). The Protocol came into force in 2005 and the first commitment period is in operation from 2008-2012. The 4th assessment report of the Intergovernmental Panel on Climate Change (IPCC) highlights that the problem of global warming is getting much worse than had previously been thought. This was adopted as the scientific basis for future work at the 13th COP in Bali, in December 2007 and negotiations on a successor to the first commitment period will be negotiated at Poznan, Poland, in December 2008, and in Copenhagen, Denmark, in 2009, at the 15th COP.

The first speaker was **Dr Luis NEVES**, GeSI chairperson and Head of Sustainable Development and Environment, Deutsche Telekom (Germany), who spoke on "The Global e-Sustainability Initiative (GeSI)". He explained the background to the organization and its membership. One of the early initiatives was the ETNO/WWF study entitled "Saving the climate at the speed of light". He showed that, in the period up to 2010, the potential savings that can be achieved by ETNO members exceed by tenfold their current CO_2 emissions (see Figure 1). GeSI is currently undertaking a wider study, together with McKinsey and the Climate Group, the results of which will be published on 5 June 2008. The study is likely to show that the impact of ICTs on the environment has actually been underestimated, and is certainly growing, driven in particular by emerging markets, especially China and India. The study focuses on the two areas of dematerialization and energy efficiency. Four "deep dives" have been identified that offer the best opportunities, both for energy savings and of monetization. These are smart buildings, industrial motor optimization, smart grid and efficient logistics and supply chain.

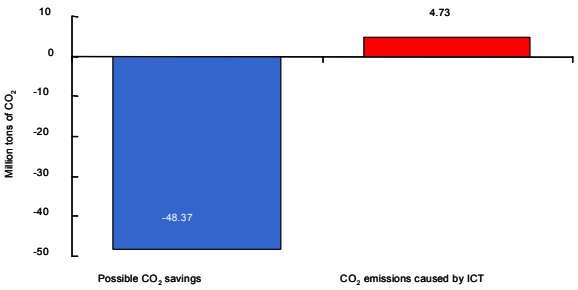

Figure 1: The potential influence of ICTs on CO_2 emissions
Source: Presentation by Luis Neves, GeSI

Mr Tetsuo YAMAKAWA, Director-General, International Affairs Department, Telecommunications Bureau, Ministry of Internal Affairs and Communications, spoke on the "Aiming to reach a low carbon society, via ICTs**"**. He began by echoing the forecasts in the IPCC report that global average temperatures could rise by around 4° C by the end of the current century. MIC has established a study group which has recently reported its findings. He differentiated between the direct potential for CO_2 emissions of the ICT industry and the reductions that could be achieved through application of ICTs. The former (estimated by number of subscribers) shows forecast net energy consumption in Japan of 57 billion kWh by 2012. With energy saving, this could be reduced to 44 billion. However, the broadcasting sector will emit a further 15 billion kWh, making a combined total of 72 billion kWh. Some 19 areas have been identified for reductions of CO_2. The net savings by the use of ICTs greatly exceed the likely emissions, as summarized in Figure 2. The nine main Recommendations of the study include some areas in which ITU work could be important, including in standardization and in establishing evaluation methodologies for ICTs and assisting developing countries in establishing projects under the Clean Development Mechanism (CDM).

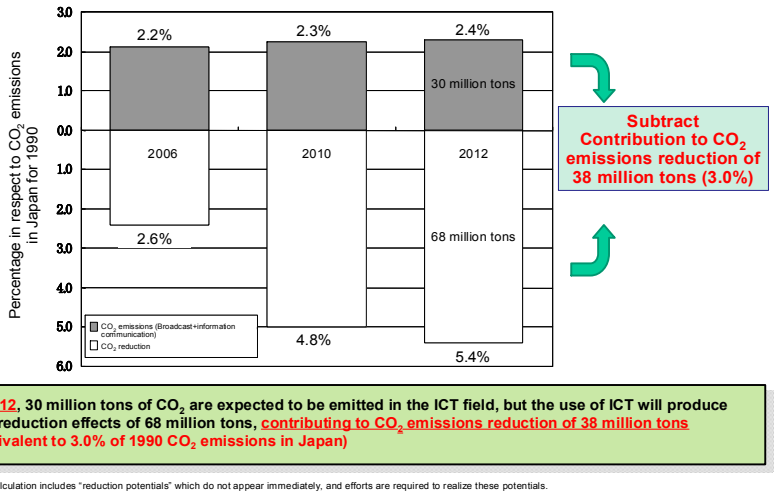

Figure 2: Estimated net emissions of CO_2 in Japan, by 2012 (excluding broadcasting)
Source: Presentation by Mr Tetsuo Yamakawa, MIC, Japan.

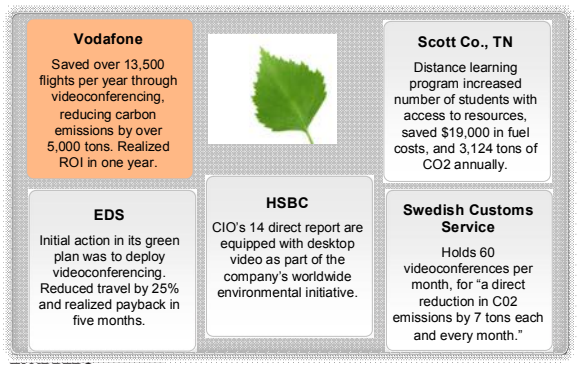

Figure 3: Videoconferencing case studies
Source: Presentation by Mr Jeff Hurmuses, Tandberg.

Mr Jeff HURMUSES, President, China and Japan, Tandberg (Norway/US) spoke on "The potential of video-conferencing to reduce travel". He highlighted the concept of the Green adoption curve. In the past, this had been a niche market concern. It is now entering the mainstream and will soon be part of the competitive advantage that companies can accrue. For instance, a recent survey conducted by Tandberg shows that 50 per cent of customers would like to buy goods and services from a company with a good environmental reputation and 80 per cent of employees would like to work with such an organization. He gave five customer case studies of the savings that could be achieved through the use of videoconferencing (see Figure 3). For instance, the Swedish Customs Service holds 60 videoconferences per month achieving a direct reduction of 7 tonnes per month in carbon dioxide reductions.

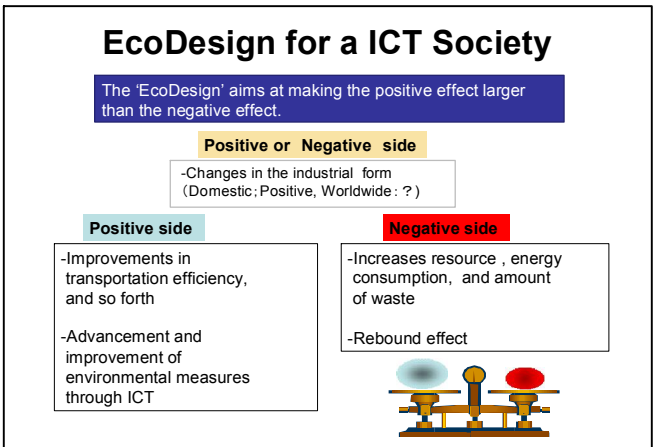

Figure 4: Design of a low carbon society using ICTs
Source: Presentation by Prof. Jun Fujimoto, Univ of Tokyo

Prof. Jun FUJIMOTO, Research Centre for Advanced Science and Technology, University of Tokyo spoke on

"Ecodesign of an ICT society". He talked about a possible "rebound effect" from the development of a society based on ICTs. He presented the results of a study carried out on the likely effects of ICTs by 2020. The overall effect is a reduction in CO_2 emissions of 2-3 per cent, rising to 10 per cent by 2050. However, the effects will not be uniform. A model of social images for 2050 was developed for a future sustainable society (see Figure 4). If one takes social change into account, it is possible to increase the saving from 10 to 40 per cent by 2050. He concluded that the ICT revolution can have a big impact on assisting the environment.

Dr Tim KELLY, Head, Standardization Policy Division, ITU-T presented the "ITU background report on ICTs and climate change", which had been especially prepared for this symposium. The report follows the structure of the symposium, beginning with an overview of how the ICT sector is actually contributing to global warming, but going on to look at the role of ICTs in monitoring climate change, and helping to mitigate and adapt to it. He showed estimates from the Gartner Group which show that ICTs (excluding broadcasting and consumer electronics) are already contributing 2-2.5 per cent of global GHG (Figure 5), but that it is likely that this will increase, both as ICT use grows worldwide and becomes more prevalent. He outlined the ITU' strategy on climate change. The background paper includes an inventory of around 50 actions already underway in the three ITU Sectors and the General Secretariat which are relevant to the themes of this symposium.

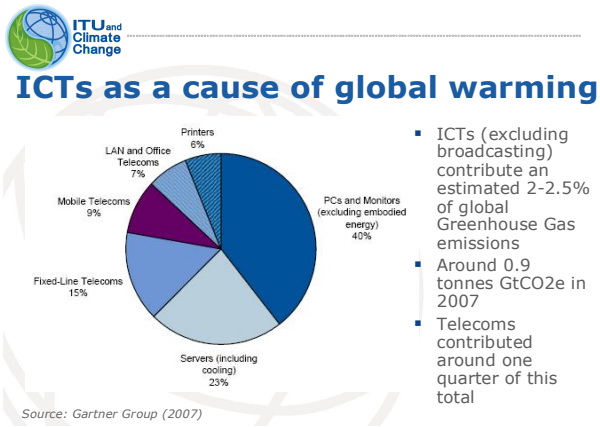

Figure 5: Estimated ICT contribution to global GHG emissions
Source: Presentation by Dr Tim Kelly, ITU-T

In discussion, Mr Levin noted that the title for this session, "ICT to the Rescue" was phrased as a question mark, as there is some debate as to whether ICTs can come to the rescue with regard to climate change.

In the overall view of the panel, the issue should not be framed as a question, but as an affirmative statement. Their view is that ICTs can be part of the solution but it is important to act now. The key is to make the positive effect of ICTs use significantly larger than the negative effects. The use of ICTs is growing and will continue to grow, particularly in developing countries. In the area of ICTs there are two key positive roles: emission reductions in the sector and emission reduction achieved through the use of ICTs. With regard to the latter, the sector can also serve as an enabling technology by developing products and services that promote the use of ICTs to reduce emissions in other sectors.

The extent, to which ICTs can play a key role in reducing GHG emissions in other sectors, as well as in controlling energy use in the sector itself, outweigh by a significant magnitude the energy consumption of the sector. The role of the ICT sector will depend in large part on the following key factors, in which the ITU has a vital role, in partnership with other relevant entities:

- Active involvement of the private sector, which is increasingly realizing the positive economic benefits to taking a green approach to business;
- Establishment of new policy structures at national, regional and global levels with incentives to promote the use of ICTs;
- Development of the necessary standards to facilitate the use of ICTs in emission reduction strategies, such as the use of tele/videoconferencing and tele-working;
- Establishment of common approaches to evaluation methods for CO_2 emission reduction by ICT use at the international level;

- Taking account of the evolution in the relationship between ICTs and consumer behaviour and the changes that ICT use can bring about in lifestyle modification;

Given the urgency of climate change, sort and medium term strategies to incrementally reduce GHG emissions in existing technology are needed, but emphasis should also be given to longer-term strategies designed to develop and introduce new, more efficient technologies, such as Next Generation Networks (NGNs). Efforts also must be made to help developing countries to avoid the trap of being locked-in to carbon intensive technologies.

Session 2: **Corporate responsibility: Towards a climate-neutral ICT sector**

It is estimated that the ICT Sector produces directly some 2-2.5 per cent of total emissions of greenhouse gases, and that this share will increase as ICTs make a larger contribution to the global economy. What can ICT companies – manufacturers, service providers, and users – do to reduce their own carbon footprint? Which companies are showing leadership and exercising best practice?

This session was moderated by **Mr Kenn CUKIER**, Journalist, *The Economist*. He related an anecdote that the concerning Theodore Roosevelt and his great-grandson. The first Theodore Roosevelt, who served as President of the United States from 1901-1909, created America's first national parks while Theodore Roosevelt IV is now working at Lehman Brothers, leading their activities related to climate change, notably in carbon trading. This shows how, in the course of a few generations, environmentalism has changed from something addressed primarily by governments to an issue addressed by the private sector.

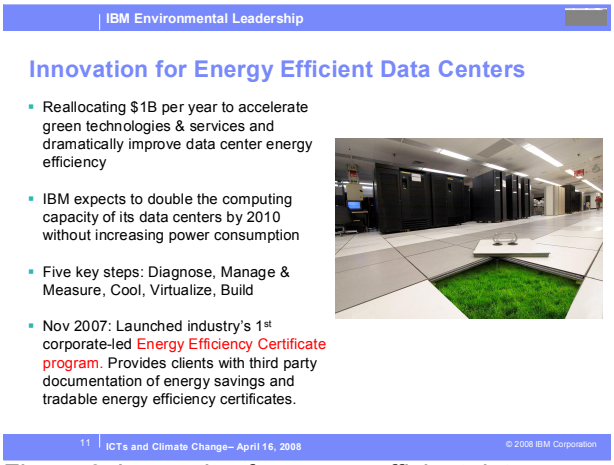

Figure 6: Innovation for energy efficient data centres
Source: Presentation by Mr Mitsuo Kobayashi, IBM

Mr Mitsuo KOBAYASHI, Manager, Corporate Environment Affairs, Asia-Pacific, IBM (Japan), who was a member of the team contributing to the original Kyoto Protocol conference in 1997, while working for MIC. He addressed the topic "Energy efficiency and climate protection at IBM". He began by outlining IBM's own corporate policy, first formulated in 1971. Between 1990 and 2006, IBM avoided approximately 3 million tonnes of CO_2 emissions as well as other savings in the areas of reduced PFC emissions, use of renewable energy and flexible working patterns. In terms of the application of IBM's work, a number of examples were given in the presentation , including improved energy efficiency in data centres (Figure 6), innovation in utility networks and intelligent transport systems (such as a congestion tax in Stockholm). IBM environmental has established a "Big Green Innovations Unit" for applying ICTs in areas like advanced water management, alternative energy, carbon management and computational modeling.

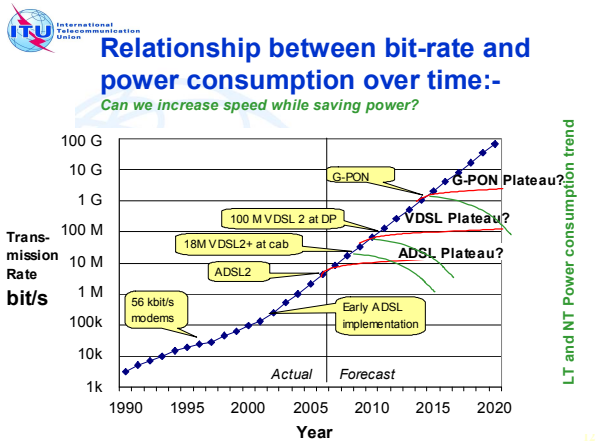

Figure 7: Relationship between bit-rate and power consumption over time
Source: Presentation by Mr Dave Faulkner, BT

Mr Dave FAULKNER, ITU-T Study Group 15 Q2/15 rapporteur, BT (UK), presented the "Energy Efficiency Checklist" which has been developed as part of the work of ITU-T Study Group 15, Working Party 1. The scope for energy saving in SG-15's

work lies in areas like broadband access technologies as well as in transport technologies. The focus is on transmission interfaces at both the user end (network termination) and the operator end (line termination). On average the transmission capacity available to users is tending to double every year or so. In addition, the actual number of users continues to grow, with DSL broadband users growing almost threefold and FTTH users growing seven-fold between 2005 and 2011 (forecasts from Ovum). All other things being equal, this would mean that power requirements also double. The challenge therefore is to develop standards that break that linear relationship and allow transmission capacity to rise while power consumption falls (see Figure 7). He gave a few examples of the checklist which has been developed to provide a systematic review of existing and new ITU-T Recommendations.

Mr Tetsuo TAKEMURA, Corporate Officer, Global Business, Information & Telecommunication Systems, Hitachi, Ltd（Japan, addressed the topic "Corporate responsibility towards an environmentally-conscious manufacturer". He began by outlining Hitachi's vision for the future and its environmental credo, which is to contribute to the development of society through the development of superior, original technology and products. One of Hitachi's main areas of business is in data centres. Through the "CoolCentre 50" programme, Hitachi plans to use a combination of measures to reduce power requirements, including power saving design and reform in working practices. By application of an evaluation methodology based on system integration and life cycle assessment (LCA), it should be possible to reduce energy consumption by around 22 per cent, in the entire life cycle, with a reduction of almost one-third in the usage stage (see Figure 8). The speaker noted that there is also a role for ITU standardization in this area.

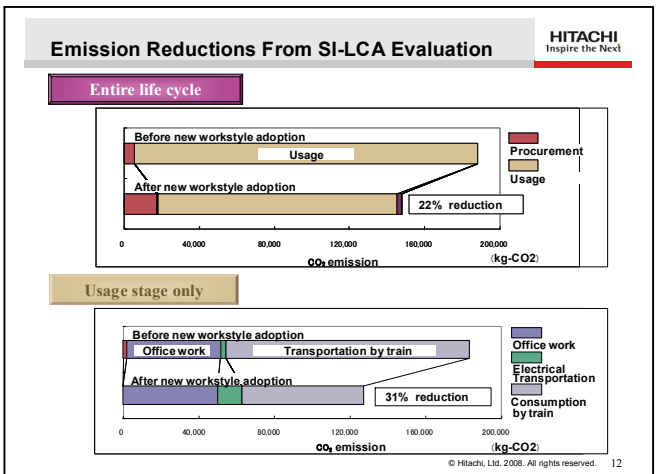

Figure 8: Scope for emission reductions through evaluation of System Integration – life cycle assessment
Source: Presentation by Mr Tetsuo Takemura. Hitachi

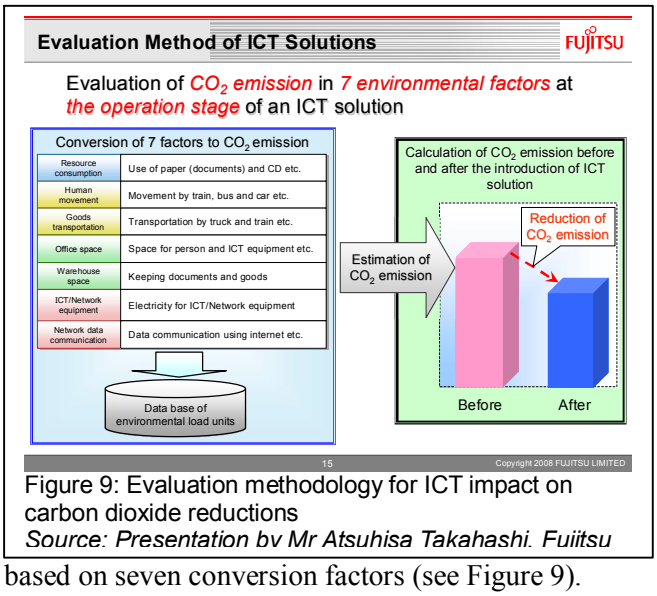

Figure 9: Evaluation methodology for ICT impact on carbon dioxide reductions
Source: Presentation by Mr Atsuhisa Takahashi. Fujitsu

Mr Atsuhisa TAKAHASHI, President, Corporate Environmental Affairs Unit, Fujitsu Ltd Japan) addressed "An ICT company's efforts to create corporate social value". The major strengths of ICTs lie in their potential for labour saving and efficiency improvements, downsizing, reduction of paper use, dematerialization and the transcendence of space and time. He demonstrated a methodology for calculating the corporate social value of the ICT sector by subtracting the increased power consumption due to the use of ICTs from the savings that arise from the use of ICTs which, in Japan, is around 30 million tonnes of CO_2. He outlined a methodology for evaluating the ICT impact on reductions of carbon dioxide emissions, based on seven conversion factors (see Figure 9).

Ms Joanna GORDON, WEF (Switzerland), outlined the "World Economic Forum's work on ICTs and Climate Change". She argued that the ICT sector had embraced the challenge of climate change with typical enthusiasm, but that different companies are currently pulling in different directions. She argued that the ICT sector is spending "98 per cent of its time discussing 2 per cent of the problem" (i.e., its own emissions),

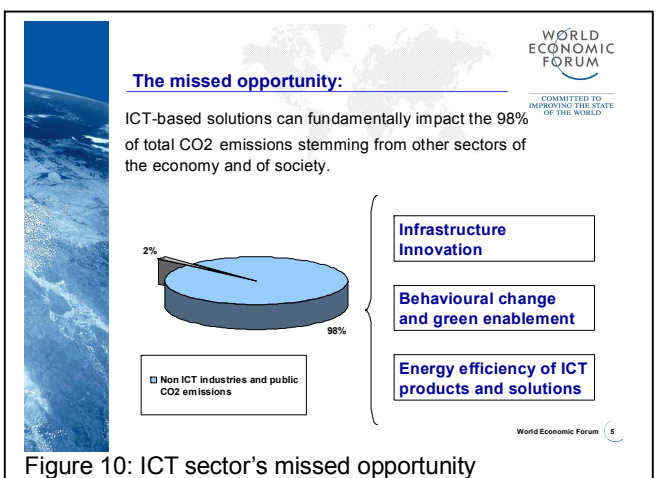

Figure 10: ICT sector's missed opportunity
Source: Presentation by Ms. Joanna Gordon, WEF

while missing the opportunity offered by the use of ICTs to reduce carbon dioxide emissions in other sectors (see Figure 10). She indicated that this is likely to be driven by infrastructure innovation, behavioural change and energy efficiency. The drive of change has to be financial incentives rather that philanthropy. In 2008, WEF issued a challenge to establish a list of economically viable approaches, to develop a clear message and to create incentives for change.

During the ensuing discussion, the panel focused on how to mainstream the green message within corporations. In BT, the motivation was simple in that the company was the largest electricity user in the UK and therefore it is a business imperative to reduce costs. In other companies, like Hitachi and IBM, the key factor was to get buy-in from senior management. Another approach is bottom-up, to get the support of ordinary employees and to get them commit to changed behaviour. It is important, however, to get companies to work together and to share best practices, even though companies working in the same sector are often unwilling to share trade secrets. Mr Kobayashi mentioned his company's plans for creating an eco-pool of patents in this area and shared intellectual property rights. For corporations, it is also important to work with suppliers, and implementing standards, such as ISO 14001, can be especially helpful. But cooperation should not reduce the positive elements of competition, which will also play a role in improving efficiency.

Mr Cukier concluded by noting how the topic of climate change has shifted to a general concern rather than one limited to a closed community of scientists. The fact that ITU is getting involved is a sign of this and the new spirit of cooperation, which is also embracing civil society. Corporations are changing behaviour, which involves innovation, design of ecological products (as well as their eventual disassembly), setting standards that are eco-friendly, and above all, not missing opportunities that are created. It is important that the industry not just try to defend its carbon footprint, but also attempt to reduce it. That involves making both the business and social case for saving energy. The key to success lies in the successful melding of environmental action with financial incentives.

Session 3: ICTs for monitoring climate change

The science of climate change is made possible by the use of ICTs, for instance in remote sensing, telemetry, supercomputers for climate modelling, etc. Large scale efforts to reduce emissions – for instance through reforestation, combatting desertification, protection of wetlands, etc. – will require new investment, from both the public and private sectors, in ICT-based monitoring systems. What are the tools available and what further standardization effort may be required?

This session was moderated by **Dr Hiroshi KUMAGAI**, National Institute of Information and Communication Technologies – NICT (Japan), who set the scene in terms of the importance of basic science in climate change and the important role that ICTs play in this area.

Mr Hiroyuki ICHIJO, Japan Meteorological Organization (JMO) and Chairperson of the WMO Expert Team on the WMO Information System (WIS) and Global Telecommunication System (GTS) Communication Techniques and Structure, presented on "The WMO Information System (WIS) and Global Telecommunication System (GTS), Managing & Moving Weather, Water and Climate Information in the 21st Century". The GTS is an operational systems, with some 2'765 ship reports and over 4'000 land stations report daily. The WIS however is still at the conceptual stage (see Figure 11). It incorporates GTS but also the Integrated Global Data Dissemination Service (IGDDS) and Data Discovery Access and Retrieval Service (DAR). GTS comprises six regional networks and a core main telecommunications network, using Multi-protocol label switching

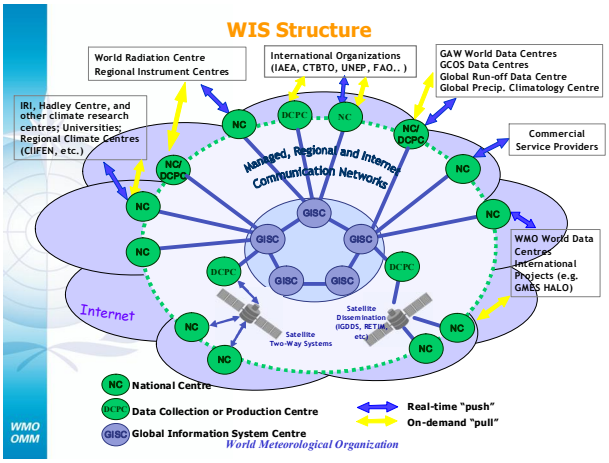

Figure 11: The WMO Information System
Source: Presentation by Mr Hiroyuki Ichijo, WMO

(MPLS). There are currently 77 circuits within the Asia region of which 80 per cent are TCP/IP based. The JMO serves as the world data centre for GHG, which is available at: http://ds.data.jma.go.jp/tcc/tcc/index.html.

Dr Hiroshi KUMAGAI presented on "ICTs for innovative sensing and networking toward sustainable society". NICT research focuses on three areas:

- Next-Generation Network (NGN) technology;
- Universal Communication technology;
- ICTs for safety and security.

New technologies are transforming remote sensing, for instance through the use of laser sensing of CO_2 and global monitoring of cloud using millimetre radio. Although the global warming effect of CO_2 is well understood and measured, the negative (cooling) effect of cloud albedo is less easy to measure. One approach is to use a laser sensor with a 2 micrometer wavelength. Another approach, being pioneered jointly between Japan and EU, is to use cloud radar (see Figure 12). This research shows the significant role that cloud, aerosol and water vapour can play in climate change. The EarthCare satellite mission is due to be launched in 2013. Another area of research is on optimizing the energy efficiency of Japan's Internet traffic, which will reach 1 Terabit/s (1000 Gbit/s) in 2008, with no signs of slowing down. One solution could be the use of optical packet switching (OPS). Finally, NICT is developing a more proactive approach to home energy management systems (HEMS) and Building and Energy Management System (BEMS).

Figure 12: Global monitoring of cloud
Source: Presentation by Mr Hiroshi Kumagai, NICT

Mr Muhammad HELMI ABDULLAH, Director, Corporate Communications Division, Malaysian Meteorological Service, discussed "ICTs and Weather Forecasting". Extreme weather events are increasing in Malaysia, with two major floods in 2007. Malaysia also suffers from haze, which is caused by a combination of fires and adverse climatic conditions. A wide range of sources are used to obtain weather data (see Figure 13) and all of them use ICTs to a lesser or greater degree. In terms of the flow of data, it begins with monitoring/observation, passes on to computer processing, modeling and assessment, then dissemination and finally reaches the clients, which includes the navy and military, air traffic controllers, airlines, transport sector, fishing, shipping, oil and gas sector, mass media etc.

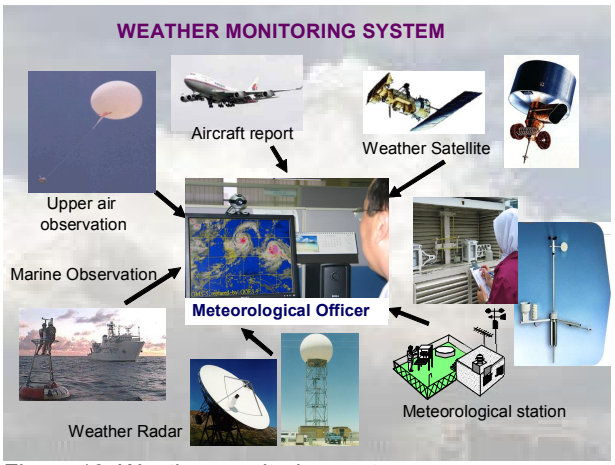

Figure 13: Weather monitoring system
Source: Presentation by Mr Mohammed Helmi Abdullah, Malaysian Meteorological Organisation

Mr Alexandre VASSILIEV, Study Group Counsellor, ITU-R, presented on "Remote sensing radio applications/systems for environmental monitoring". Before starting his presentation, he commented that information about contribution of radiocommunications in greenhouse gas emissions is generally absent in reports related to the overall ICT carbon footprint to date. He indicated that if broadcasting and other radiocommunication systems and applications are taken into account the impact of ICTs on climate change may actually be much higher than the generally quoted 2-2.5 per cent figures. Mr. Vassiliev specially thanked Mr. Tetsuo Yamakawa (MIC Japan) for providing information for Japan on power consumption by broadcasting equipment including TV sets, which indicates a very high level of consumption by broadcasting equipment including TV sets.

Climate Change has become a major focus of concern in ITU meetings, most notably at WRC-07, which attracted some 2'800 delegates. The conference extended spectrum allocation and adopted protection criteria for the services involved in climate monitoring. Recognizing that remote sensing provides a global systematic observation of the world's terrestrial carbon budget as well as other environmental parameters WRC-07 and Radiocommunication Assembly 2007 adopted several Resolutions on studies related to further development of these systems. Article 1 of the ITU Radio Regulations (RR) distinguishes between active and passive sensors. Other RR provisions and WRC-07 decisions provide relevant protection from interference to remote sensing radio applications with special attention to passive sensors. The presentation contained examples of data derived from remote sensing including:

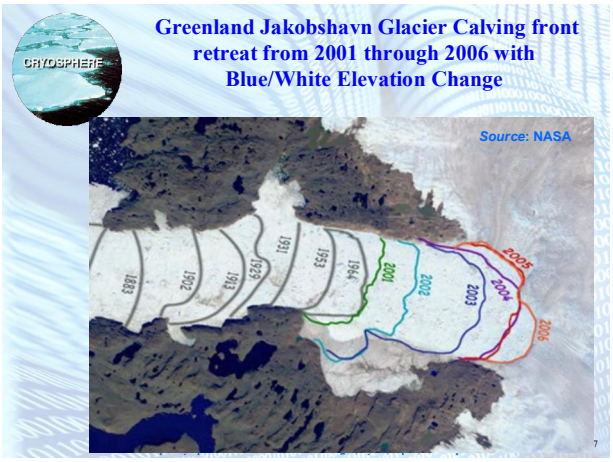

Figure 14: Remote sensing of the retreat of glaciers
Source: Presentation by Mr Alexandre Vassiliev, ITU

- Atmospheric composition (including GHG);
- Measurements of methane, which is second only to carbon dioxide in its importance as a GHG;
- Monitoring of extreme weather events, such as hurricanes;
- Ocean topography, including detecting very small variations in sea temperature and variations in sea-level with a precision of 2-3 cm.
- Progress of oil slicks;
- Land-use change;
- Change in ice coverage (see Figure 14);
- Variations in gravitational pull;
- Volcanic activity;
- Etc.

In discussion, participants discussed the relative merits of different forms of alert in advance of natural hazards. SMS is widely used, in both Malaysia and Japan. However, it suffers from problems with network congestion (for instance, during the reality TV show *Malaysian Idol*) and may itself suffer from natural disasters (for instance, SMS service was suspended during the Kobe earthquake). It was indicated that ITU-T Sector has recently developed special signaling protocols included in ITU-T Recommendation E.106, implementation of which would help to deliver warning message with high priority.

Day 2: Wednesday 16 April 2008

Session 4: ICTs as a Clean Technology

Although ICTs contribute to global warming, they can also help in reducing the greenhouse gas emissions of other sectors. By replacing the need for travel, or by improving transport efficiency, ICTs help to reduce the carbon footprint of individuals and companies. With oil prices around USD 100 per barrel and rising awareness of climate change, what opportunities does this create for using ICTs, especially telecommunications, for the abatement of carbon emissions in other sectors of the economy?

This session was moderated by **Mr Yoichi MAEDA**, Chair, ITU-T Study Group 15 (Optical and other transport network infrastructure), who outlined the context of the session in the general flow of the

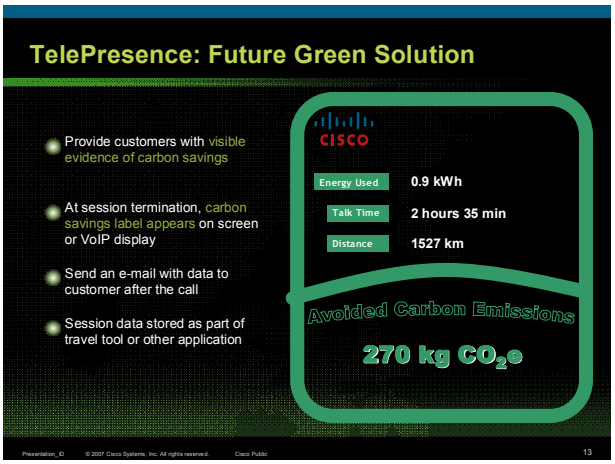

Figure 15: Auto-calculation of avoided carbon emissions at the end of a telepresence meeting
Source: Presentation by Mr Yoshiki Kawakami, CISCO Japan

symposium programme.

Mr Yoshiki KAWAKAMI, Director of Enterprise Operations, CISCO Japan, presented on "Making every connection a green connection". Under the aegis of the Clinton Global Initiative, CISCO has committed to reduce business travel by 10 per cent and to earmark some US$20 million for development of remote collaboration tools. Other Green projects in which CISCO is involved include product energy efficiency, intelligent transport systems (in San Francisco, Seoul and Amsterdam), energy efficient data centres and connected real estate (smart buildings). CISCO is also using its own telepresence (high-performance video-conferencing) technology to promote the connected workforce. To date, at CISCO, the connected workforce has enabled a 40 per cent increase in office utilization and a 40 per cent reduction in electrical demand. Telepresence has already clocked up more than 76'000 hours of use, of which approximately one fifth avoided travel. One particularly neat feature is the display that appears at the end of the session which summarizes the avoided carbon emissions, based on the geography of the call. This can be used by corporate clients for calculating their carbon offsets (see Figure 15).

Mr Hiromichi SHINOHARA, Associate Senior Vice President Executive Director, Information Sharing Laboratory Group, NTT Japan, presented on "Environmental impact reduction via broadband service". NTT is Japan's largest telecommunication services provider with sales in excess of US$100 billion but declining revenues from voice (62 per cent, fixed and mobile combined, in 2007). NTT's Corporate Social Responsibility (CSR) charter includes a commitment to reducing its own environmental impact, both in terms of its inputs (e.g., electricity, water, pulp, fuel, gas etc) and outputs (carbon dioxide and other GHG emissions, equipment for recycling and disposal etc). It has set environmental targets for 2010. NTT has also conducted research on the reduction in CO2 emissions that can be achieved by sharing a fibre optic cable, which amounts to around 57 per cent. NTT calculates its own environmental impact by subtracting the emissions generated by providing ICT services from the savings achieved by using them. It has set a target of 10 million tonnes of CO2 to be achieved by 2010. It calculates the savings by a survey of consumer lifestyles with and without ICTs, based on an analysis of 16 broadband-based services common to both fixed and mobile networks and 3 other broadband-fixed applications. The major potential saving (up to 82 per cent) is made on NTT's IMT-2000 (3G) mobile service, FOMA (see Figure 16). He concluded his presentation with an appeal to ITU to carry out a standardization exercise for the methodology for calculating the reductions in CO2 emissions that can be achieved through the use of ICTs.

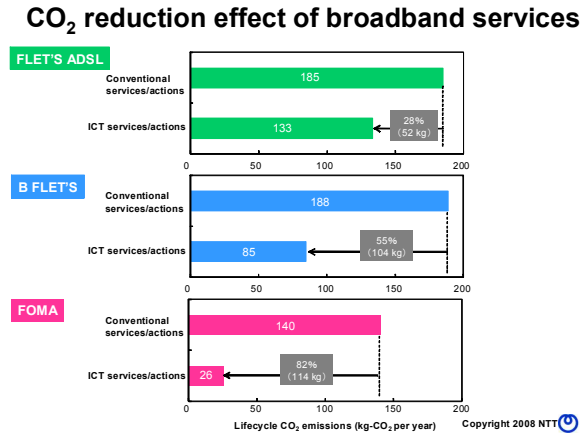

Figure 16: Methodology for calculating carbon dioxide reductions arising from use of broadband ICTs
Source: Presentation by Mr Horomichi Shinohara, NTT
Note: FLET's ADSL = Flat-rate asynchronous subscriber line; B FLET's = fibre-based broadband service; FOMA = NTT's IMT-2000 (3G) mobile service

Mr Robert SHAW, Head, ICT Applications and Cybersecurity Division, ITU-D presented the results of a recent scoping study on "e-Environment opportunities in ITU" (the draft report is available at: http://www.itu.int/ITU-D/cyb/app/docs/itu-icts-for-e-environment.pdf). The report was commissioned in mid 2007 from the Aylmer Group (Canada) to look at ways of implementing ITU's commitments under Resolution 35 (Kyoto, 1994) on e-Environment applications, as well as responding to ITU's role as a co-facilitator of WSIS action line C7 (e-environment). A simple view of the ICT role distinguishes between:

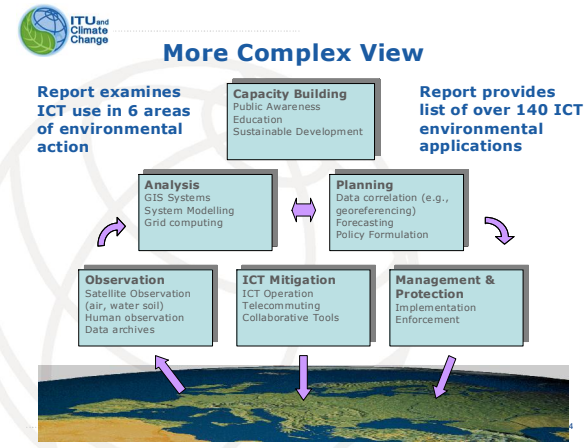

Figure 17: A methodology for structuring analysis of e-Environment opportunities
Source: Presentation by Mr Robert Shaw, ITU-D

- first order effects (e.g. negative impact on use of resources and carbon emissions if the ICT sector itself);
- second order effects (e.g. efficiency gains from ICT use and structural benefits);
- third order effects (e.g. behavioural adaptation).

But a more complex view would distinguish among as many as six different roles (see Figure 17). The report lists over 140 ICT environmental applications. The report identifies some 900 different multilateral and 1'500 bilateral agreements in the environmental area. It also looks at the implications for developing countries. Opportunities identified for ITU include awareness-raising, capacity-building, strengthening activities related to disaster communications and assisting developing countries in elaborating e-Environment strategies.

Dr Yutaka YASUDA, Vice President, General Manager of Core Technology Sector, KDDI (Japan) looked at "The Contribution of Fixed Mobile Broadcast Convergence (FMBC) to reducing carbon emission**s".** He began by examining the growth trends of broadband service in Japan, which is heading towards a convergence of fixed and mobile networks. The number of fixed broadband subscribers reached 28.3 million at the end of 2007 while, in the mobile market, there has been a surge in sales of "one seg" mobile phones (so-called because they are able to receive mobile TV by using just one out of 13 frequency segments available to broadcasters) to reach 20.5 million by the same date. He went on to describe KDDI's energy conservation efforts which include introduction of high-efficiency mobile base stations, and the use of solar power generation (see Figure 18). KDDI is also conducting R&D into battery fuel technology for handsets and next-generation battery technology for base stations (Lithium ion in place of lead). KDDI is targeting a 16 per cent reduction in energy usage by 2011 and a limit of 1.5 million tons of GHG emissions. KDDI further expects that fixed-mobile broadcast convergence will also bring savings in the areas of paper substitution, flexible work arrangements and traffic leveling for a stable power supply.

Figure 18: Examples of solar power, for a mobile base station and a network centre
Source: Presentation by Mr Yutaka Yasuda, KDDI

Discussion at the conclusion of the session focused on the need to develop a common methodology for assessing the reductions in the emission of greenhouse gases that could be achieved through the application of ICTs and the prospects for adapting the methodology used in the MIC study for international use.

Session 5: Towards a high-bandwidth, low-carbon future

This session was intended to follow on from session 4 and examine what level of carbon abatement might be achievable with greater use of ICTs. In particular, this session should examine what kind of targets might be established for the reduction in greenhouse gas emissions through the use of ICTs and what contribution to this could be made by the implementation of relevant ITU Treaties and ITU Recommendations.

The session was moderated by **Mr Charles DESPINS**, President PROMPT Next Generation Internet Initiative (Canada). He set the stage for the session by pointing out the large disparities in the different methodologies used for estimating the carbon abatement and displacement opportunities arising from the use of ICTs. Like other speakers, he recognized the need for a common standardized methodology for such calculations.

Mr. Gareth JOHNSTON, Director of Corporate and Government Risk, Climate Risk Pty Ltd (Australia) presented on "Telecom-based opportunities to reduce greenhouse gas emissions". This work originated in a study commissioned by Telstra, the incumbent public telecommunication operator in Australia. That study addresses some seven main opportunities for carbon abatement:

- Increased renewable energy;
- Real-time freight management;
- Personalized public transport;
- Decentralized central business district;

- Presence-based power;
- Remote appliance power management;
- High-performance video-conferencing.

The aggregate level of potential savings in CO2 emissions in Australia calculated by the study is some 27 million tonnes of CO2 equivalent. In the context of Australia's overall emissions, this would amount to around 5 per cent of the national total, which would be a major contributor to helping the country meet its commitments under the Kyoto Protocol (see Figure 19). The overall conclusion of the study is the need for a clear message that ICT can be a major player in carbon abatement, and the overall impact could be around 2-4 times greater in reductions.

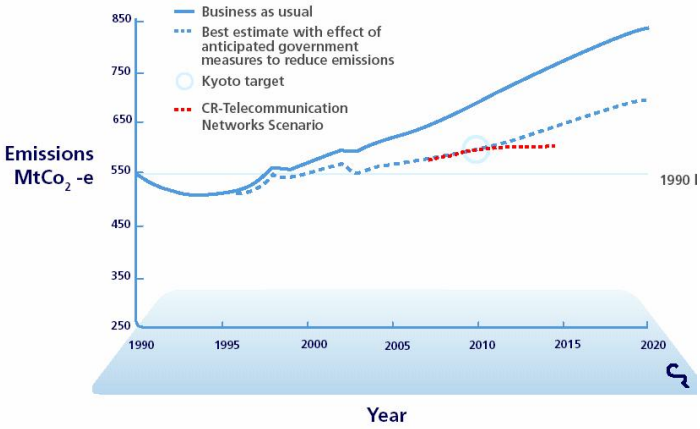

Figure 19: Possible effect of carbon abatement opportunities offered by telecommunications in Australia
Source: Presentation by Mr Gareth Johnston, Climate Risk pty

Figure 20: Breakdown of power consumption in wireless (left) and broadband access (right) networks
Source: Presentation by Mr Hans-Otto Scheck

Mr Hans-Otto SCHECK, Senior Specialist, Nokia Siemens Networks (Finland), addressed "Power consumption and energy efficiency of fixed and mobile telecom networks". He showed data from the ETNO/WWF study which highlights the potential savings that can be made through energy efficiency in the ICT sector. Within 15 of the EU member states, the savings are estimated at 50 Million tonnes of CO2 by 2010. This is equivalent to 100 TeraWatt hours of electricity worth some €7 billion Euros. The study also demonstrates, in more detail the savings that can be made, for instance, through online billing as opposed to paper billing by telcos (around 0.5 million tons of CO2); through centralized rather than decentralized answering machines (1 millions tons); through online rather than paper-based taxation (0.3 million tons etc). He demonstrated Nokia's estimates of the distribution of the carbon footprint between the service provider and its customers. For the wireless network, this is around 9:1 and for broadband around 1:2.3 (see Figure 20).

Dr Yuji INOUE, President and CEO, Telecommunication Technology Committee of Japan, addressed "Climate change and ICT standardization". He echoed many of the same statistics already presented by Mr Yamakawa, because they are drawn from the report of the study group established by MIC under which Japanese companies have been developing a harmonized methodology. This has

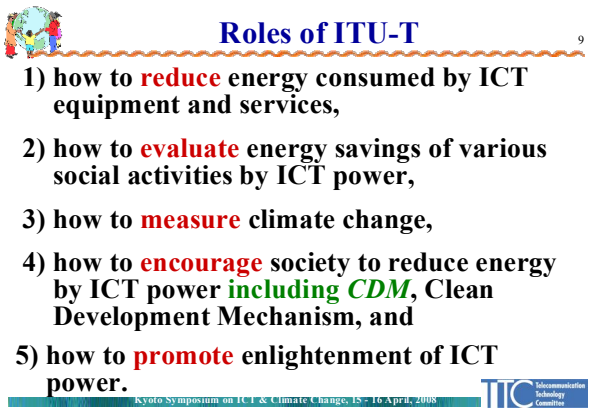

Figure 21: Possible roles for ITU-T on ICTs and Climate Change
Source: Presentation by Mr Yuji Inoue, TTC

allowed Japan to come up with a nationwide set of estimates. However, there is a need to globalize this methodology at the international level. For this purpose, he proposed a series of roles that ITU-T could play in this area (see Figure 21) focusing on developing a common methodology for evaluation of opportunities for carbon abatement. He proposed that the best way of achieving this would be to establish a Focus Group, under the procedures set out in ITU-T Recommendation A.7. This would provide a flexible mechanism for bring together expertise from the standardization world and the climate change community, including non-members of ITU. He also noted that a new work item on this topic is proposed at the level of the Global Standards Collaboration for consideration at its next meeting (Boston, in July 2008).

Mr Nigel HICKSON, Deputy-Director, EU ICT Policy, Dept for Business Enterprise and Regulatory Reform (UK) addressed the topic of the session: "Towards a high-bandwidth, low-carbon future". He began by tracing the history of this work, which dates back to Resolution 35 from Kyoto. He emphasised the need to go beyond mere talk and take action. There is a need for international cooperation and action at the global level. He also outlined the work that is currently being undertaken in the European Union (Figure 22). It has already developed codes of conduct for areas such as consumer electronics and broadband and will shortly introduce a Communication on ICT and energy efficiency. However, it would be a mistake for the ITU, or anyone else, to impose regulation in this area. It is also important that this message feed through to the G8. To quote Al Gore: "We can make it possible; but others must decide".

Figure 22: EU activities on energy-efficiency
Source: Presentation by Mr Nigel Hickson, BERR (UK)

Discussion at the conclusion of the session focused on carbon abatement opportunities for the ICT industry. These include:

- Reducing travel
- Flexible working arrangements
- Intelligent transport systems
- Dematerialization
- Next-generation networks.

On this last topic, we have seen the migration over the past decade from the PSTN to IP networks. But next generation networks are still under definition and it is conceivable that at some point in the future, they may not use the Internet protocol. Can we design future networks with a green conscience so that the new technology is not only greener but also so that the applications that reduce CO_2 emissions can run smoothly and securely over such networks? The former will help greatly to stimulate the positive impact of ICTs themselves while the latter will do so through the application of ICTs in other sectors.

The panelists presented CO_2 reduction levels for these various opportunities that impact different sectors of the economy and quantified the impact on CO_2 emissions reduction. MIC's study group report shows that the reduction in the emissions of CO_2 that could be achieved through the pervasive use of ICTs in different sectors of the economy could reach 38 million tons, equivalent to some 3 per cent of 1990 CO_2 emission levels, in Japan. Promoting the use of ICTs in other sectors of the economy is thus a key element in getting ICTs to fulfill their full potential in carbon abatement.

The issue of validating these quantifiable results is also of prime importance. Standardization of a methodology to evaluate carbon abatement levels through the use of ICTs should be a top priority for ITU-T.

As such, three main recommendations come out of this session:

1) ICT evolution and specifically, next-generation networks, both wireline and wireless, should be designed with an energy-saving imperative and for both terminals and network infrastructure.
2) A methodology to measure carbon abatement levels for ICTs should be standardized.

3) The positive benefits of ICTs with respect to climate change should be actively promoted to other sectors of the economy. As such, a new Focus Group should thus be created within ITU-T to fulfill this role. Expertise on both climate change and standardization should be included in this group. Climate change experts from non-ITU member organizations should also be welcomed.

Session 6: Adapting to climate change

Even if the Kyoto protocol commitments to limit emissions of greenhouse gases are met in full, there may still be a rise in global average temperature of up to 2° by 2020 with a consequent rise in sea levels and in the occurrence of extreme weather events. Developing countries, especially small island developing states, are literally in the eye of the storm. How can ICTs help in adapting to the new environmental challenges? How can ICT-based projects for sustainable development, which generate carbon credits, be registered under the Clean Development Mechanism of the Kyoto Protocol?

This session was moderated by **Dr Tim KELLY**, Head, Standardization Policy Division, ITU-T, who argued that although less glamorous than other topics, like mitigation or monitoring of climate change, adaptation is nevertheless essential. Indeed, the first speaker reminded us of the words of Mahatma Gandhi that "*A technological society has two choices: First it can wait until catastrophic failures expose systemic deficiencies, distortion and self-deceptions. Secondly, a culture can provide social checks and balances to correct for systemic distortion prior to catastrophic failures"*

Ms Sangeeta GUPTA, Director IT, The Energy and Resources Institute (TERI) addressed "Rural communities adapting to change: Opportunities for ICTs". She argued that climate change is a reality and that adaptation measures will be required to reduce the adverse effects of climate change whatever the scale of mitigation in the next 20-30 years. She showed the five main phases of adaptation (Figure 23) and highlighted three climate-sensitive areas in particular – agriculture, water and health. A country like India, which has some 700 million people living in rural areas, faces particular challenges. In each of these three areas, she looked at the impacts of climate change and the range of adaptation measures that can be offered with the assistance of ICTs. Opportunities for ICTs include integrated natural resource management, early warning systems, surveillance systems and disaster response and relief systems, as well as decision support, capacity-building and awareness raising. She highlighted a pilot project in which TERI is involved for developing an information sharing system to enhance the coping capacities of farming communities in dealing with climate variability in drought prone areas of Northern India. He concluded by saying that there is still a long way to go to reach the "bottom of the pyramid".

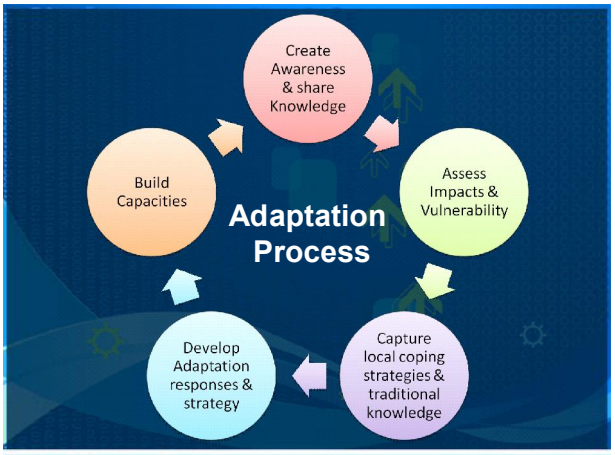

Figure 23: Five phases of the adaptation process
Source: Presentation by Ms Sangeeta Gupta, TERI

Mr Mahabir PUN (Nepal), Chairman of the Institute for Himalayan Conservation and Winner of the 2007 Ramon Magsaysay award for community leadership, presented on "Disaster prevention monitoring in a vulnerable environment". Like Ms Gupta, he also looked at rural communities, but with a focus on the high altitude villages of the Himalayas. In particular, he presented a project to develop a wireless sensor network at the Imja-Tse glacial lake at 5'100 metres altitude. There are more than 20 such glacial lakes in Nepal which, if they burst, could endanger the lives of

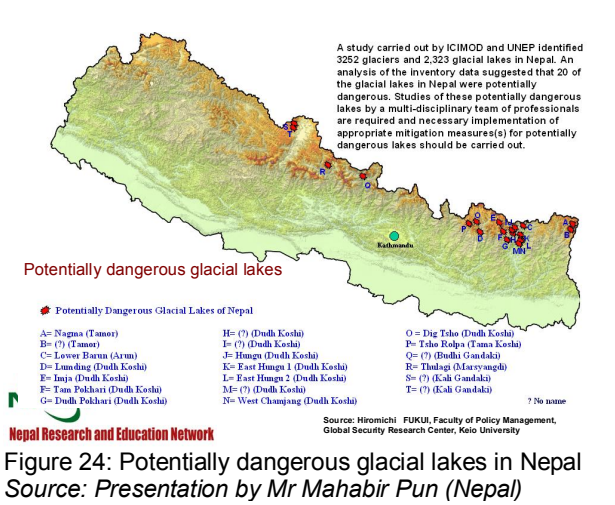

Figure 24: Potentially dangerous glacial lakes in Nepal
Source: Presentation by Mr Mahabir Pun (Nepal)

hundreds of people. The project, which is being conducted in cooperation with Keio University in Japan, uses wireless sensors to give advance warning of a possible Glacial Lake Outburst Flood (GLOF) (see Figure 24). The objective of the study is to provide real-time monitoring of the lake, to provide early-warning to mountain communities and to build a Wi-Fi based local area wireless network in several villages with a VSAT (very small aperture terminal) satellite connection to provide Internet connectivity. The project has demonstrated that wireless networks can work even in the remotest areas, using low-power self-sufficient devices with minimal impact on the local environment, but that power storage technology still needs some more work in the frozen conditions of the Himalayas.

Mr Makoto KAJII, Associate Executive Director, the Japan Aerospace Exploration Agency (JAXA) addressed "Contribution to global Earth observations from satellites". He highlighted the role that remote earth observation can play in assisting with the adaptation process. He provided information on the current and future programme which JAXA is pursuing in conjunction with other partners within GEOSS. During the 2008 Financial Year, JAXA will be launching the Greenhouse Gases Observing Satellite (GOSAT) which will be used for global monitoring of carbon dioxide and methane in particular (see Figure 25). This will extend the number of sampling points from the current 256 to some 56'000 worldwide. JAXA also plans the launch of the Global Change Observation Mission (GCOM) in 2011 and Global Precipitation Measurement in 2103. The application areas of remote sensing which bring benefits to society include disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity.

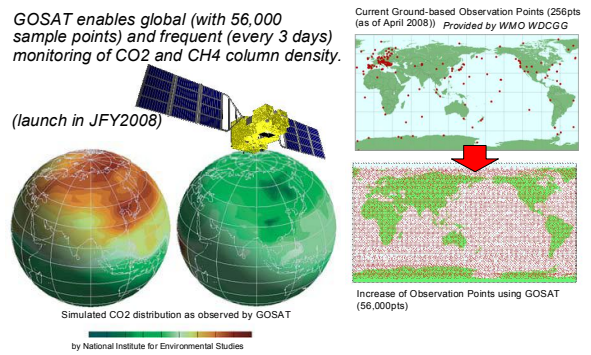

Figure 25: Greenhouse Gases Observing Satellite
Source: Presentation by Mr Makoto Kajii (JAXA)

Mr Akira ARUTAKI, Associate Senior Vice President, NEC Communication Systems, Ltd. Japan presented on "ICT strategy and solutions to overcome climate change". He described the ICT sector as being like a "white knight" riding to the rescue of our embattled planet. Using data from JAXA, in particular on natural disasters and incidence of heat stroke, he demonstrated that climate change is not science fiction but is already a harsh reality for many people and communities around the world. Public opinion in Japan is very favourable to ICTs and there is a general feeling that ICTs will contribute towards a safer and more secure society. One possible model is shown in Figure 26, which shows the enhanced application of ICTs in a number of different domains. The Internet is increasingly expected to be a lifeline infrastructure. He also described the use of NEC supercomputers for earth simulation and forecasting the effects of climate change.

Figure 26: System model for a safer and more secure society, using ICTs
Source: Presentation by Mr Akira Arutaki, NEC
Note: SAR = Synthetic Aperture Radio; PSTN = Public Switched Telephone Network; MSTN = Mobile Switched Telephone Network; FireSTN = Fire station; NW = Network.

Finally, Professor Dimitar Totev (University of Botswana), in a wide-ranging and philosophical presentation that touched briefly on "ICT electronic waste and exhaust emissions", made the case for an approach to climate change based on central planning. He gave a number of examples, in particular in the areas of software and engine design, and argued that the ICT revolution has turned into a fashion show and this is endangering our planet.

To conclude, this session more than any of the others in this symposium focused on the problems of developing countries and brought home the reality that it is the world's poor who will bear the main brunt of climate change unless efforts on adaptation to climate change are stepped up in a manner which is appropriate to the scale of the problem. Discussion at the end focused on the world's current food insecurity, with rising prices for basic foodstuffs, especially rice, leading to riots in some countries. It was noted that, although climate change is just one of many causes of rising food prices, it is also clear that misguided reactions to other perceived environmental crises (such as the conversion of food crops to biofuels) has also contributed.

Session 7: Review and wrap-up

This final session, chaired by **Mr. Takashi HANAZAWA**, Senior VP, Director, R&D Planning Dept, NTT (Japan) discussed the draft chairman's report of the meeting (which was distributed before the coffee break). The draft was adopted and has been posted online at: www.itu.int/ITU-T/climatechange for further comment by Wednesday 23 April. The revised chairman's summary will be forwarded for review by the second ITU symposium on ICTs and climate change, to be held 17-18 June 2008 in London, hosted by BT. The revised chairman's summary will also be forwarded to upcoming meetings of the World Economic Forum, the Organisation for Economic Cooperation and Development (in Republic of Korea), the G8 (in Japan) and the UN Framework Convention on Climate Change (UNFCCC).

The moderators of the six sessions were invited to provide brief summaries of the discussion in their respective sessions, which have been used as the basis for this extended summary.

Meeting close

At the close of the meeting, Mr Malcolm Johnson, Director ITU-T, took the floor to thank all the meeting organizers and participants. He said ITU will study seriously the Chairman's excellent summary of this symposium to adapt its future strategy. As Director of Telecommunication Standardization Bureau in ITU, he had taken particular note of the need for action in the standardization Sector, and would pass on the results also to the other two Bureaux. One message is very clear, and that is that there is not, as yet, any internationally agreed common methodology for measuring the impact of ICTs on climate change, either in terms of the direct emission of greenhouse gases or the savings that can be generated in other sectors of industry through the application of ICTs.

He expressed his belief that this is important and urgent work that needs to be carried out in an open, rigorous and multi-disciplinary way. It needs to involve not only the whole ITU membership, but also the work of non-members, especially those who have so kindly contributed to this event. He fully supported the meeting's recommendation that an ITU-T Focus Group is an appropriate vehicle to take forward this work and said he would make this proposal to ITU's Telecommunication Standardization Advisory Group (TSAG) at its next meeting in July. However, to move quickly, he encouraged all participants to submit their proposals on the terms of reference for this group, as well as initial proposals on methodologies to be adopted, to: tsbtechwatch@itu.int. He especially welcomed contributions from the speakers at this event.

He concluded with an open invitation to all participants to join, either in person or remotely, the second ITU symposium on ICTs and climate change, to be held in London, 17-18 June 2008.