Green ICT Activities in ITU-T

Submitted by: NTT Energy & Environment Systems Laboratories
Green ICT Activities in ITU-T

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NTT Energy and Environment Systems Laboratories

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Outline

1. Global Warming Issues and ICT
2. Environmental Impact Reduction Using ICT
3. Role of ITU-T
4. Methodology of Environmental Impact Assessment of ICT
5. Examples of Calculation Formula
6. Conclusion
Global Warming Issues and ICT

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

- Reduced movement of people and products
  - Online shopping, online trading
  - Telework, TV conferencing
  - Music, video, and software distribution
  - e-applications (tax declarations, online receipts)

- Improved efficiency of production and consumption
  - Supply chain management
  - e-publication and distribution
  - Paperless office

- Environmental measurements and predictions
  - Radar for measuring CO2
  - Sensing network
  - Global simulator

Contribute to tackling global warming issues by promoting wider use of ICT

Environmental load caused by ICT

- Dematerialization (digitization of information)
- Reduction of movement and transportation
- Making industry and lives efficient
- Enhancing environmental awareness and environmental education
- Environmental sensors and environmental monitoring

Environmental load reduction achieved by ICT services

- Minimization towards Sustainable ICT Industry
- Maximization towards Sustainable Society

Negative environmental aspects
- Consumption of energy
- Consumption of natural resources
- Generation of waste

Must quantify both environmental impacts.

Green of ICT

Green by ICT

Relationship between ICT and Environment
Global Emissions by Sector

Telecoms contributed around one quarter of total ICT percentage (0.5%).

The ICT sector accounts for approximately 2% of emissions and contributes to reductions in the other sectors that account for 98% of all emissions.

Total emissions in 2000: 42 GtCO2e.

Energy emissions are mostly CO₂ (some non-CO₂ in industry and other energy related). Non-energy emissions are CO₂ (land use) and non-CO₂ (agriculture and waste).

*The Stern Review Chapter 7
http://www.hm-treasury.gov.uk/stern_review_climate_change.htm


Source:
Gartner Group (2007)
ICT, Contributing to CO₂ Reduction (Globally) NTT

World CO₂ emissions
- Percentage of emissions by country -

2006
27.3 billion tons
Carbon dioxide (CO₂) equivalent

United State 21.1%
China 20.6%

Others 28.8%

From the Japan Center for Climate Change Actions Web site (http://www.jccca.org/)

ICT Reduction potential:
- Smart grids
- Smart construction
- Smart distribution
- Smart motors

Amount that must be reduced
7.8 billion tons*
(15% of the global total)

2006
27.3 billion tons
Energy sources (fossil fuel)

2020
50% Reduction

2050
50% Reduction

*GeSi: from SMART2020. The effect from telecommuting, teleconferencing, electronic paper, electronic transactions eliminating materials, and movement reduction, a 6% reduction is achieved.

From the Japan Center for Climate Change Actions Web site (http://www.jccca.org/)

Created from GeSi SMART2020, IPCC materials

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Information and communication technology is mankind's first technology in which increased benefits are not proportional to the consumption of resources and energy."

(Professor Emeritus Yoshio Tsukio)
To revolutionize lifestyles and move toward a low-carbon society, quantification and visibility of ICT effects on environmental impact reduction are important issues.

Making CO₂ emissions visible across the entire supply chain to service provision

Making effects visible

Make comparison possible and objective

Ex: Video-conference

Standardization allowing international comparison and objectivity

- Determine environmental impact assessment range
- Reduction effect calculation methodology, etc.

Human movement (car, bus, rail, airplane etc.) reduction

Reduction volume = energy reduced per person per kilometer (J)

Reduction volume = Energy consumption unit per sq. meter of office space

Work efficiency (human workload, etc.)

Reduction volume = Energy consumption unit per sq. meter of office space

x sq. meters of space used per person x amount of work made efficient (people/year)
Life Cycle Assessment

Environmental contributions are quantitatively assessed using LCA*.

* LCA (Life Cycle Assessment) is a method of calculating the environmental load across all processes from procurement of raw materials for a product or service to its use and disposal.
ITU Structure

Plenipotentiary Conference

ITU Council

General Secretariat
ITU-T World Telecommunication Standardization Assembly
ITU-R World Radiocommunication Conference Radiocommunication Assembly
ITU-D World Telecommunication Development Conference

- **ITU-T**: Telecommunication standardization on a world-wide basis on technical, operating and tariff Questions
  
  *(The Secretariat of ITU-T (TSB) provides services to ITU-T Participants)*

- **ITU-R**: Radio communications and wireless

- **ITU-D**: Use and deployment of telecom networks and services in developing and least developed countries

- **General Secretariat**: Coordinates the Union's activities and the overall management of the Union


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Roles of ITU

1) How to reduce energy consumed by ICT equipment and services

2) How to evaluate energy savings of various social activities by using ICTs

3) How to measure climate change

4) How to encourage society to reduce energy by using ICTs, including CDM*

5) How to promote enlightenment of ICT potential

* The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries.
There are no standardized methodologies for evaluating and quantifying GHG reduction of other sectors by using ICTs.

- Valid?
- Common to other countries?
- Acceptable for other sectors?

Therefore, we DO need a standard for the methodology.
ITU Activities on ICT and Climate Change

ITU Symposia on ICT and Climate Change
(April 2008 at Kyoto, June 2008 at London)

- Energy consumption of ICT equipment;
- Energy saving contributions by using ICT services
- Need for an internationally agreed common methodology for measuring environmental impact of ICTs on climate change
- Need for a behavioral change – both for businesses and consumers.
- Proposal for establishment of a new FG

TSAG of ITU-T approved to establish new Focus Group on ICT and Climate Change (FG-ICT&CC) and its Terms of Reference (July 2008)

New ITU-T FG on ICTs and Climate Change (September, 2008 ~ March, 2009)

TSAG, in April 2009, received reports from FG-ICT&CC and approved the establishment of a new SG5 on “Environment and Climate Change”.

Establishment of New WP3 in SG5 (May 2009)
<table>
<thead>
<tr>
<th>Study Groups of ITU-T</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SG 2</strong></td>
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<td><strong>SG 3</strong></td>
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<td><strong>SG 4</strong></td>
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<td><strong>SG 17</strong></td>
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Structure of Study Group 5 (SG5)

SG5: Environment and Climate Change

WP1: Damage prevention and safety

WP2: Electromagnetic fields: emission, immunity and human exposure

WP3: ICT and Climate Change
  Chair: Keith Dickerson (UK)
  Vice Chair: Eunsook Kim (Korea) and Takeshi Origuchi (Japan)

- Q17: Coordination and Planning of ICT&CC related standardization
- Q18: Methodology of environmental impact assessment of ICT
- Q19: Power feeding systems
- Q20: Data collection for Energy Efficiency for ICTs over the lifecycle
- Q21: Environmental protection and recycling of ICT equipments/facilities

(Study Period: May 2009 ~ 2012)
The purpose of this Question is to develop Recommendations on methodology for environmental impact assessment of ICT and on collecting and calculating reliable data for the assessment model.

Following work items for series Recommendations are running in SG5 for methodologies:

1. **Methodology general umbrella**
   - Overview and general principles of methodologies

2. **Methodology ICT goods and services**
   - Methodology for environmental impact assessment of ICT goods and services

3. **Methodology ICT projects**
   - Methodology for environmental impact assessment of ICT projects

4. **Methodology ICT in organizations**
   - Methodology for environmental impact assessment of ICT with organizations

5. **Methodology ICT sector in countries**
   - Methodology for environmental impact assessment of ICT with countries
Energy consumption (CO₂ emissions) reduction through the use of ICTs is defined as follows.

\[
\text{Energy consumption (CO₂ emissions)} = \text{Reduction effect of energy consumption by utilizing ICTs} - \text{Energy consumption through the use of ICTs}
\]
## Eight Effects of Reducing Energy Consumption Based on Using ICT

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
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</thead>
<tbody>
<tr>
<td>Consumption of goods</td>
<td>By reducing the consumption of goods (e.g. paper), it is possible to reduce the energy consumption involved with production and disposal and to reduce waste emissions.</td>
</tr>
<tr>
<td>Electric power/energy consumption</td>
<td>By improving the efficiency of electric power and energy use and reducing consumption, it is possible to reduce the energy consumption involved with electricity generation and supply.</td>
</tr>
<tr>
<td>Movement of people</td>
<td>By reducing the movement of people, it is possible to reduce the energy consumption needed for methods of transportation.</td>
</tr>
<tr>
<td>Movement of goods</td>
<td>By reducing the movement of goods, it is possible to reduce the energy consumption needed for transportation methods.</td>
</tr>
<tr>
<td>Office space efficiency</td>
<td>By using office space more efficiently, it is possible to reduce the electricity consumption of lighting and air-conditioning and to reduce energy consumption.</td>
</tr>
<tr>
<td>Storage of goods</td>
<td>By reducing the storage space of goods, it is possible to reduce the electricity consumption involved with lighting and air-conditioning and to reduce energy consumption.</td>
</tr>
<tr>
<td>Business efficiency</td>
<td>By improving business efficiency, it is possible to reduce resource and energy consumption.</td>
</tr>
<tr>
<td>Waste material</td>
<td>By reducing waste emissions, it is possible to conserve the environment and reduce the energy consumption needed to dispose of waste.</td>
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### Example of effective online shopping

- No movement of people through product return/negotiation
- No movement of people through product return/negotiation
- No movement of people through comparing/purchasing products

Direct from manufacturer (e.g., computer, vehicle)

Decrease unnecessary production

Reduce intermediate distribution

Reduce retail sales

Reduce movement of consumers
The energy consumption reduction effect by utilizing ICTs” and “the energy consumption through the use of ICTs.”

The energy consumption (CO₂ emissions) reduction effect by utilizing ICTs can be generally calculated as follows if the consumption of goods/services by utilizing ICTs can be identified.

\[
\text{Energy consumption reduction effect} = \frac{\text{Impact of consumption of goods/services on the environment}}{\text{Unit energy consumption when one unit of goods/services is consumed}}
\]

The energy consumption (CO₂ emissions) through the use of ICTs can be generally calculated as follows if the amount used by the device/network (NW) can be identified.

\[
\text{Energy consumption} = \frac{\text{Amount used by device/NW used}}{\text{Unit energy consumption when one unit of device/NW is used}}
\]
Examples of Calculation Formula for Energy Consumption Reduction Effect by Utilizing ICT

(1) Consumption of goods (Paper, CDs, DVDs, etc.)

Energy reduction = (Energy consumption to produce one unit of the product) \times (Amount reduced)

E.g., Reduction of paper:
(Energy to produce paper (A4 size, 1 sheet) (J)) \times (Quantity reduced (Sheets))

(2) Movement of goods (mail, trucks, rail cargo, cargo ships, etc.)

Energy reduction = (Unit energy consumption for each transportation means (J)) \times (Transportation distance reduced (km))

E.g., Reduction of the number of mails:
(Energy consumption per mail (J)) \times (Number of mails reduced (mail))

Reduction of truck transportation:
(Energy consumption per ton-km (J)) \times (Transportation distance reduced (km)) \times (Cargo weight reduced (t))
Examples of Calculation Formula for Energy Consumption through the Use of ICTs

(1) ICT device

Energy consumption = (Unit energy consumption for each type of device) × (Amount used)

E.g.,

Production of devices for Video conferences:

( Energy consumption to produce one device (J) ) × (Number of units used)

Use of devices for Video conferences:

( Electric power to use one device (kW) ) × (Time of use (h)) × (Number of units used)]

(2) Network use

Energy consumption = (Energy consumption per amount of use) × (Amount used)

E.g.,

Use of networks:

( Apportioned [allocated] energy consumption per line (J) ) × (Number of lines used)]
Case 1

Video conference held between Tokyo and Yokohama, *once a week (48 times / year)*, *one hour each time*, participated in by *two people* from each office

Case 2

Video conference held between Tokyo and Yokohama, *every working day (240 times / year)*, *eight hours each time*, participated in by *two people* from each office

Evaluation Result

- **Case 1**: Reduction of 53% (91%)
  - The figure in ( ) is based on only the "use" stage.

- **Case 2**: Reduction of 52% (59%)
  - The figure in ( ) is based on only the "use" stage.
Reduction Potential Effect

Video conference

Energy consumption through the use of ICTs

Conference on a trip

Reduction effect of energy consumption

Reduction Potential Effect
Conclusion

- International standardization on Environmental technologies for telecommunication, in particular to ICT and climate change is now underway in ITU-T.

- We need to reduce environmental loads of ICT equipment and ICT sector, and we also expect that ICT can reduce environmental loads, particularly GHG emissions, in other relevant sectors.

- For this purpose, prompt standardizations on objective and transparent methodology of ICT environmental impact assessment are required.
Thank you for your kind attention.