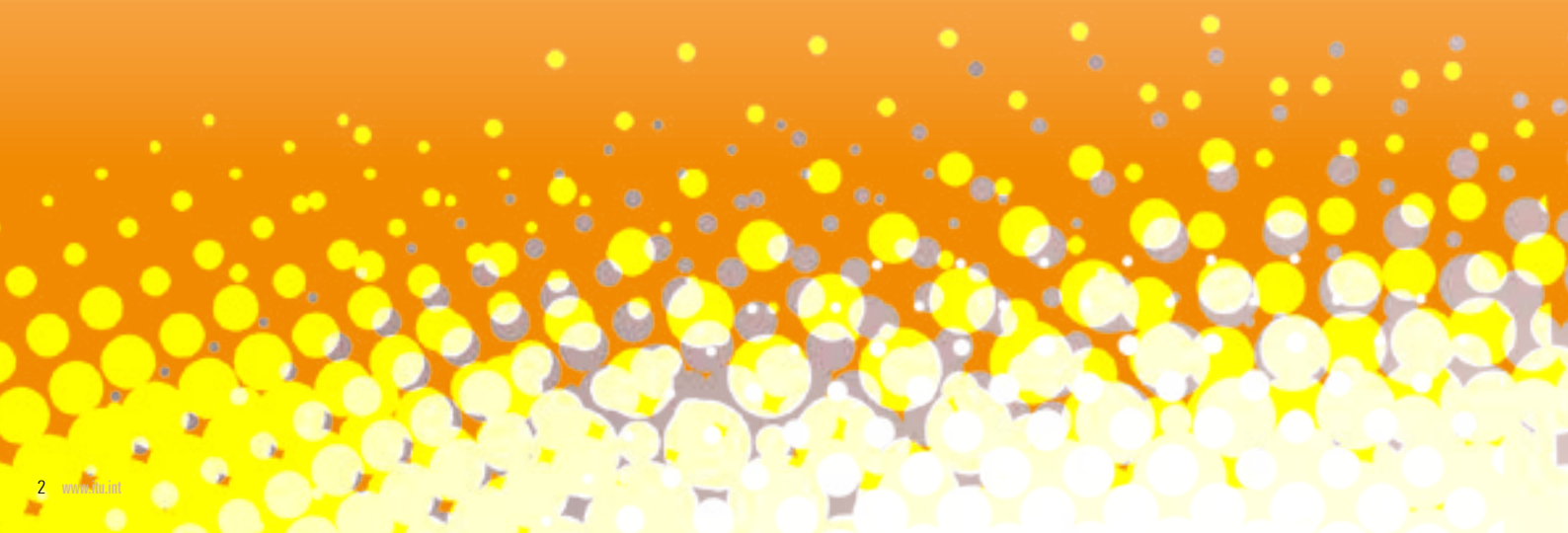




Green ICT Standards

A path to environmental sustainability





ITU-T, climate change and protection of the environment

Information and Communication Technologies (ICTs), such as satellites, mobile phones or the Internet, are capable of playing a key role in addressing the global challenges of climate change and sustainable development.

At the World Telecommunication Standardization Assembly (WTSA-12) held in Dubai, November 2012, ITU's 193 Member States adopted Resolution 73 on "ICTs, the Environment and Climate Change".

By raising awareness of ICT's role in tackling environmental challenges including climate change, ITU-T is promoting innovative ICT solutions to environmental questions and is developing green ICT standards to support a sustainable future.

- More information on ITU-T's ICTs, Environment and Climate Change activities can be found at: www.itu.int/ITU-T/climatechange/

ITU-T STUDY GROUP 5

ITU-T Study Group 5 is ITU's lead study group on environment and climate change.

- Climate Questions (work areas) under study:
 - Q 13/5** – Environmental impact reduction including e-waste
 - Q 14/5** – Setting up a low cost sustainable telecommunication infrastructure for rural communications in developing countries
 - Q 15/5** – ICTs and adaptation to the effects of climate change
 - Q 16/5** – Leveraging and enhancing the ICT environmental sustainability
 - Q 17/5** – Energy efficiency for the ICT sector and harmonization of environmental standards
 - Q 18/5** – Methodologies for the assessment of environmental impact of ICT
 - Q 19/5** – Power feeding systems
- More information can be found at:
 - <http://www.itu.int/en/ITU-T/studygroups/2013-2016/05/Pages/default.aspx>



Methodologies to assess the environmental impact of ICTs

ITU-T is developing a set of standardized methodologies to assess the environmental impacts of ICTs, both in terms of ICT greenhouse gas (GHG) emissions and the emissions savings created through green ICT applications in other industry sectors. The methodologies are being developed in cooperation with over 60 organizations including major ICT private sector organizations, the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Environmental Programme (UNEP).

Recommendation ITU-T L.1400 (Overview and general principles of methodologies for assessing the environmental impact of information and communication technologies) presents the general principles on how to assess and report the environmental impact of ICT, and outlines the different methodologies being developed to assess and report the environmental impact of:

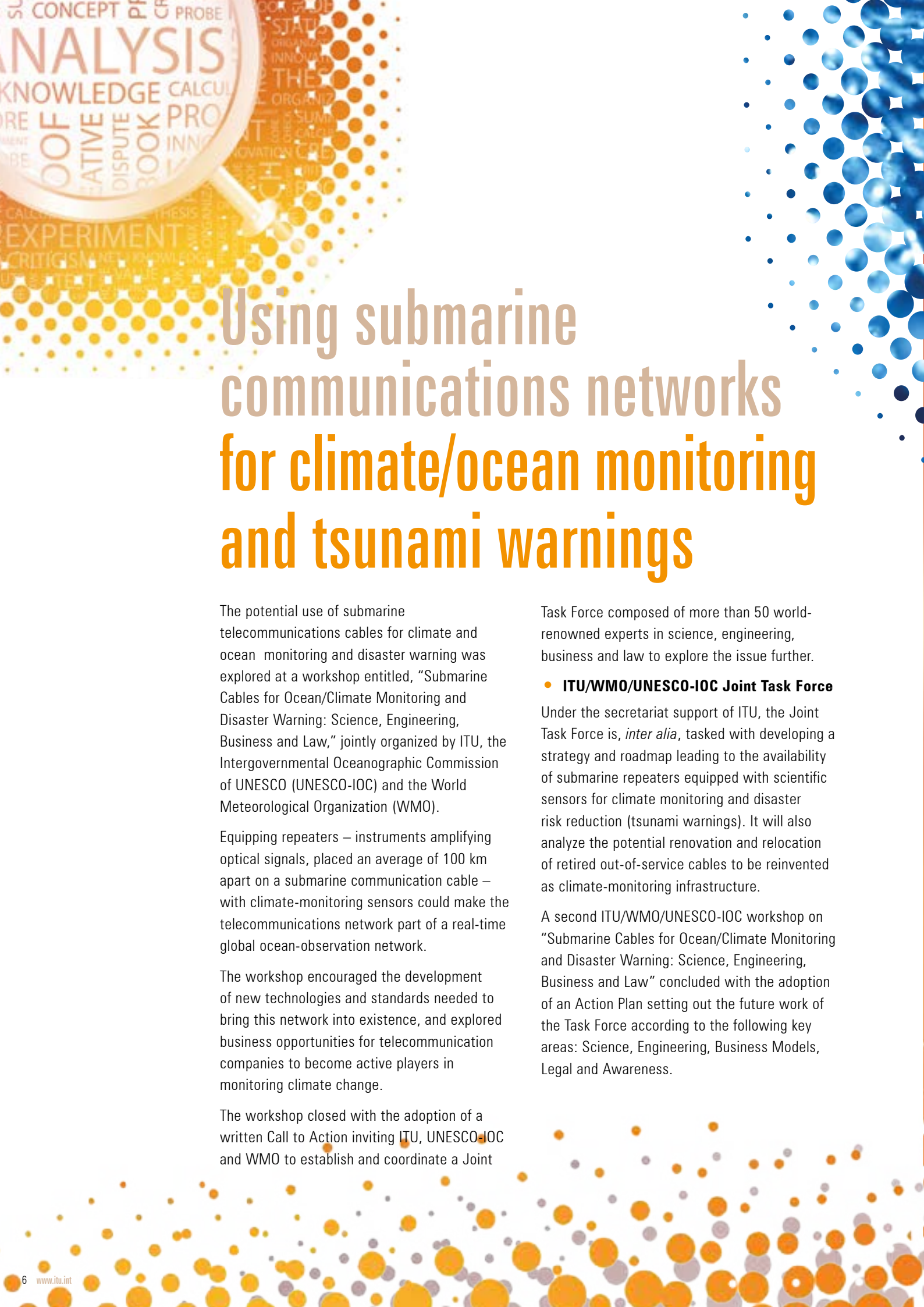
- a.** ICT goods, networks and services;
- b.** ICT projects;
- c.** ICT in organizations;
- d.** ICT in cities*;
- e.** ICT in countries or groups of countries*.

**Under development at time of writing*



Recommendation ITU-T L.1410
(Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services) provides a standardized way to assess the direct environmental impact of ICT goods, networks and services, as well as their indirect impact on the GHG emissions of non-ICT industry sectors. It is based on the Life Cycle Assessment (LCA) methodology standardized in ISO 14040 and ISO 14044.

Recommendation ITU-T L.1420
(Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies in organizations) standardizes the requirements with which an organization should comply when assessing energy consumption and GHG emissions.



Using submarine communications networks for climate/ocean monitoring and tsunami warnings

The potential use of submarine telecommunications cables for climate and ocean monitoring and disaster warning was explored at a workshop entitled, “Submarine Cables for Ocean/Climate Monitoring and Disaster Warning: Science, Engineering, Business and Law,” jointly organized by ITU, the Intergovernmental Oceanographic Commission of UNESCO (UNESCO-IOC) and the World Meteorological Organization (WMO).

Equipping repeaters – instruments amplifying optical signals, placed an average of 100 km apart on a submarine communication cable – with climate-monitoring sensors could make the telecommunications network part of a real-time global ocean-observation network.

The workshop encouraged the development of new technologies and standards needed to bring this network into existence, and explored business opportunities for telecommunication companies to become active players in monitoring climate change.

The workshop closed with the adoption of a written Call to Action inviting ITU, UNESCO-IOC and WMO to establish and coordinate a Joint

Task Force composed of more than 50 world-renowned experts in science, engineering, business and law to explore the issue further.

- **ITU/WMO/UNESCO-IOC Joint Task Force**

Under the secretariat support of ITU, the Joint Task Force is, *inter alia*, tasked with developing a strategy and roadmap leading to the availability of submarine repeaters equipped with scientific sensors for climate monitoring and disaster risk reduction (tsunami warnings). It will also analyze the potential renovation and relocation of retired out-of-service cables to be reinvented as climate-monitoring infrastructure.

A second ITU/WMO/UNESCO-IOC workshop on “Submarine Cables for Ocean/Climate Monitoring and Disaster Warning: Science, Engineering, Business and Law” concluded with the adoption of an Action Plan setting out the future work of the Task Force according to the following key areas: Science, Engineering, Business Models, Legal and Awareness.



- **ITU-T Technology Watch Report: Using submarine communications networks to monitor the climate**

An overview of how both retired and in-service submarine communications cables could be used for decades to come as a real-time global network to monitor climate change and provide tsunami warnings.

- **Using submarine cables for climate monitoring and disaster warning: Strategy and roadmap**

This report presents a strategy and roadmap to progress the vision of incorporating climate-monitoring sensors in submarine cables. The submarine telecommunications cables that traverse our oceans are the data highways of the global Internet, but are deaf, dumb and blind to the ocean environment around them. It is envisioned that telecommunications companies could in the future include ocean-observing sensors within their submarine cable systems, a move which would produce data of critical value in monitoring global climate change and tsunamis in the deep ocean.

- **Using submarine cables for climate monitoring and disaster warning: Opportunities and legal challenges**

Recognizing the novelty of such uses of undersea telecommunications cables and the complexity of national and international legal-regulatory regimes, this report examines opportunities and legal challenges arising from dual-purpose telecom-marine data cables for ocean and climate monitoring and disaster warning.

- **Using submarine cables for climate monitoring and disaster warning: Engineering feasibility study**

This report investigates the technical feasibility of modifying repeaters of commercial telecom cables in such a way that they incorporate scientific instruments. A “green repeater” would improve long-term measurement and data collection, contributing to a better understanding of our oceans and changing climate.



Toolkit on environmental sustainability for the ICT sector

Companies in the ICT sector are increasingly being asked by customers, investors, governments and other stakeholders to report on sustainability performance. However, as yet, there is no globally agreed or standardized method to simplify, guide and streamline this type of reporting. Such reporting is essential in that measuring and reporting on environmental performance frames a company's environmental costs in metrics that enable it to gauge the exact extent of their improvement as they work to reduce their environmental impact.

The Toolkit on environmental sustainability for the ICT sector is an ITU-T initiative providing detailed support to ICT companies seeking to build sustainability into the operations and management of their organizations through the application of international standards and guidelines.

The Toolkit provides ICT companies with a set of internationally agreed sustainability requirements which allow for more objective reporting on sustainability practices in the ICT sector, in terms of the following key areas of focus:

i. Areas of focus:

- Sustainable buildings
- Sustainable ICT in corporate organizations
- Sustainable products
- End-of-life management for ICT equipment
- General specifications and KPIs
- Assessment framework for environmental impact of the ICT

The Toolkit draws together contributions from over 50 ICT companies and universities around the world which have partnered in this effort.

ii. Partners listed in alphabetical order:

- | | | |
|-------------------------------|---|--|
| • Alcatel Lucent | • GHG Management Institute (GHGI) | • PE International AG |
| • BBC | • HP | • Research In Motion |
| • BIO Intelligence Service | • Hitachi | • Scuola Superiore Sant'Anna of Pisa |
| • BT | • Huawei | • Step Initiative |
| • CEDARE | • IBI Group | • Telecom Italia |
| • Climate Associates | • Imperial College | • Telecommunication Networks and Telematics Laboratory |
| • ClimateCHECK | • Infosys | • Telecommunication Technology Committee |
| • Cogeco Cable | • International Telecommunication Union (ITU) | • Telefónica |
| • Datec Technology | • Mandat International | • Thomson Reuters |
| • Dell | • MicroPro Computers | • Toshiba |
| • Ernst & Young | • Microsoft | • United Nations Environmental Programme |
| • ETNO | • MJRD Assessment Inc. | • Basel Convention |
| • ETRI | • National Inter-University Consortium for Telecommunications | • United Nations University |
| • ETSI | • Nokia Siemens Networks | • University of Genova |
| • European Broadcasting Union | • NEC | • University of Zagreb |
| • France Telecom | • NTT | • Verizon |
| • Fronesys | • Panasonic | • Vodafone Ghana |
| • Fujitsu | | • 3p Institute for Sustainable Management |



- **Green data centers**

Data centers are among the fastest growing parts of the ICT industry, making it crucial to minimize their energy consumption and GHG emissions.

Recommendation ITU-T L.1300 (Best practices for green data centers) states that reducing energy consumption and GHG emissions should be considered at the design and construction stages, and that constant monitoring will be required for the consistent management and improvement of energy consumption while the data center is in operation.

ITU-T L.1300 allows for considerable energy savings and applying its best practices on, for example, cooling procedures could reduce the energy consumption of a typical data center by over 50 per cent. The best practices include guidelines on management and planning of data centers; optimum design of data center buildings; selection of ICT equipment; cooling and power equipment; and data center utilization and the monitoring of data centers after construction.



ICT equipment and energy efficiency

Recommendation ITU-T L.1310 (Energy efficiency metrics and measurement methods for telecommunication equipment)

defines energy efficiency metrics and the related test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment (Phase 1).

These metrics evaluate ICT equipment's energy efficiency through a comparison between its technical performance (useful work) and its

energy consumption. The use of such metrics and related measurement methods allows for comparisons between different equipment with the same functionalities, and also enables the construction of specific reference values.

The outcome of ITU-T L.1310 will also be used to develop a new recommendation on metrics at the network level (Phase 2), which could be used to evaluate the energy efficiency of an entire telecommunications network.



Greener ICT power feeding

A new power interface for DC voltage up to 400 V is detailed in **Recommendation ITU-T L.1200 (Direct current power feeding interface up to 400 V at the input to telecommunication and ICT equipment)**. This interface would save roughly 10% of the energy consumed by data centers, using a more simple and reliable power chain with less conversion stages as compared to AC back-up solutions. Compared to 48 V, it can reduce the quantity of copper in big telecommunications centers by a factor of 10.

ITU-T L.1200 also applies to a wide range of the ICT equipment found in office buildings and some consumers' homes. The DC architecture is optimized for smart grid and renewable energy. Considering only data centers and telecommunications networks: energy savings would be from 10 to 50 TWh per year, copper quantities would halve, batteries would require 10% less lead due to gains in efficiency – translating into thousands of tons of raw material and GHG savings, and decreasing e-waste by more than 50% through the simplification of high-power electronic conversion.



Tackling e-waste

The new Resolution 79 on “The role of telecommunications/ICT in handling and controlling e-waste from telecommunications/ICT equipment and methods of treating it” was approved at the World Telecommunication Standardization Assembly (WTSA-12) in Dubai, November 2012.

The Resolution calls upon ITU to strengthen its activities in this arena and to assist ITU Member States in instituting policy frameworks that limit e-waste’s negative environmental effects.

The Resolution arrives against a backdrop of a rapidly progressing ICT industry, increasing consumption of electrical and electronic equipment (EEE) and a marked increase in e-waste, which, as a result of global mismanagement, has led to negative environmental and health effects, particularly in developing countries.

Urgent global action to address this issue is essential if the industry is to fulfill its commitment to a sustainable future.

- **ITU-T Universal Charger**

Recommendation ITU-T L.1000 (Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices) details a universal charger compatible with a variety of consumer electronic devices, reducing waste and improving convenience to users. ITU-T L.1000 will eliminate an estimated

82,000 tons of redundant chargers and at least 13.6 million tons of CO₂ emissions annually.

Recommendation ITU-T L.1001 (External universal power adapter solutions for stationary information and communication technology devices)

builds on the success of ITU-T L.1000. It provides requirements for a universal power adapter (UPA) solution for stationary ICT devices that will reduce the number of power adapters produced by widening their application to more devices, enabling their reuse, and increasing their lifetime. The solution also aims to reduce energy consumption, demand on raw materials, and e-waste.

ITU-T L.1001 will save an estimated 300,000 tons of e-waste annually and will reduce CO₂ emissions by between 25% and 50%.

The next step in the UPA standardization project will be to address the large-scale development of portable ICT equipment expected to reach 2 billion units in 2015, mainly in developing countries. The task here is to optimize energy consumption as it relates to the use of renewable energy.

- **Global Survey on e-waste**

The International Telecommunication Union (ITU), the United Nations Environmental Programme (UNEP)/ Secretariat of the Basel Convention, the United Nations University (UNU), Solving the E-waste Problem (StEP) Initiative and the Center



for Environment and Development for the Arab Region and Europe (CEDARE) are conducting a joint survey on e-waste. This survey is collecting detailed data on e-waste management, policies and standards; constructing a comprehensive overview of the current e-waste landscape and identifying future challenges in this realm. The results of this survey represent a base upon which the exchange of e-waste information and best practices can occur, and will form a valuable tool in promoting collaborative work in the future.

- **Recycling Rare Metals in ICT Products**

Rare metals are essential to the high-end functionality of ICT products, and the ICT industry has reached a point where it is impossible to omit these metals from product design. A mobile phone contains no less than 20 rare metals, and the need to recycle these metals is clear – a ton of gold ore yields just 5 g of gold, whereas a ton of used mobile phones yields a staggering 400 g.

Recommendation ITU-T L.1100 (Procedure for recycling rare metals in information and communication technology goods)

details the necessity of rare-metal recycling and the procedures to be employed when recycling these metals. ITU-T L.1100 outlines key considerations in all phases of the recycling process, and provides guidelines as to how organizations may fairly and transparently report on rare-metal recycling.



Smart solutions

- **Smart Grid**

Electricity grids must be modernized to reflect the energy demands of the 21st century. A smart grid adds communications and thus monitoring, analysis and control capabilities to the electricity grid; increasing its efficiency and reliability, reducing its energy consumption, and minimizing its GHG emissions.

ITU's family of narrowband powerline communications (NB-PLC) recommendations provide low-complexity OFDM (orthogonal frequency-division multiplexing)-based NB-PLC technology optimized for smart grid and home automation, addressing both access (low/medium voltage distribution lines) and in-home applications at frequencies below 500 kHz.

Currently, the family consists of **Recommendations ITU-T G.9901 (Power spectral density (PSD) specification), ITU-T G.9902 (G.hnem), ITU-T G.9903 (G3-PLC) and ITU-T G.9904 (PRIME).**

The standardized next-generation NB-PLC transceivers will provide a 'smart' link between electricity and communications networks through their support of the use of power lines as a communications medium. PLC exploits electricity networks' existing wired infrastructure, greatly reducing the cost of deploying a dedicated communications channel.

The family of standards will enable cost-effective smart grid applications such as distribution automation, diagnostic and fault location, smart metering, demand response, energy management, smart appliances, grid-to-home communications, and advanced recharging systems for electric vehicles.

- **Intelligent Transport Systems (ITS)**

Transportation accounts for a large proportion of global GHG emissions and ICT is to play a central role in improving the industry's energy efficiency. Today's communications capabilities give vehicles the potential to navigate the quickest route to their destination, make use of up-to-the-minute traffic reports, identify the nearest

available parking slot and consequently minimize their GHG emissions.

Considerable resources have been invested in R&D, but the lack of global standards is widely regarded as a major impediment to large-scale deployment of ITS services and applications. To progress standardization work on ITS, an ITU Focus Group on Car Communications (FG CarCom) has been established and ITU-T Study Group 16 (Multimedia) has an ITS question under study: Q27/16, "Vehicle gateway platform for telecommunication/ITS services/ applications."

An ITU, ISO partnership has created a Joint Task Force for ITS Communications, which invites national and regional standards bodies to pool their resources, link their existing work and collaboratively create the standards needed for ITS to become a definitive feature of the modern automotive industry.

In addition, the IEC/ISO/ITU Fully Networked Car event at the Geneva International Motor Show gathers experts from the ICT and automobile industries, forming new collaborative relationships and uncovering industry insight into the future of ITS.





Future networks

Environmental awareness is one of the fundamental objectives of Future Networks (FNs) with network architects embracing the challenge to reduce FN's environmental impact.

Recommendation ITU-T Y.3021 (Framework of energy saving for future networks)

focuses on "Green Future Networks", tackling energy saving within networks to account for rapidly increasing energy consumption brought about by rising numbers of network applications. Energy saving within networks entails network capabilities and operations that systematically and efficiently manage the total energy consumed by network equipment.

ITU-T Y.3021 provides a framework to minimize the energy consumption of network facilities such as routers, switches and equipment at the terminating point by means of technologies such as clock gating, sleep mode control, filtering, shaping, smart antenna technologies, lightweight protocol, transmission scheduling and traffic peak shifting.



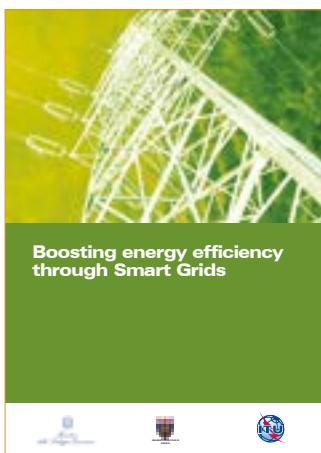


ITU-T environment and climate change reports



- **An energy-aware survey on ICT device power supplies**

This report presents the results of an energy efficiency analysis performed on a large set of commercially-available external power supplies (more than 300 devices verified, and more than 200 electrically measured). The survey was carried out in order to assist the standardization activities of ITU-T Study Group 5, specifically in relation to Recommendation ITU-T L.1001. The survey evaluates mechanical, electrical and environmental characteristics of external power supplies (EPAs), quantifying its results with a comprehensive collection of statistics.



- **Boosting energy efficiency through Smart Grids**

This report discusses the role of ICT in the Smart Grid as it relates to energy efficiency and reducing climate change.



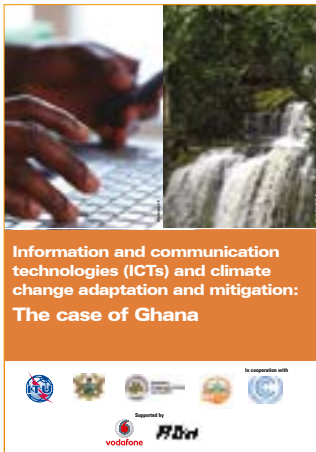
- **Review of mobile handset eco-rating schemes**

This report provides an overview of eco-rating schemes developed by the mobile handset industry to communicate products' sustainability performance to consumers.



- **Guidance on green ICT procurement**

This guide is an essential aid to ICT companies engaged in building environmentally responsible supply chains.



- **Information and communications technologies (ICTs) and climate change adaptation and mitigation: The case of Ghana**

This report explores an important question: "How can developing countries effectively integrate ICT tools within climate change adaptation and mitigation strategies?"

The report presents the potential of ICTs as adaptation and mitigation tools through the concrete case of Ghana, at the same time illustrating more general challenges and opportunities faced by developing countries in this field.



- **Greening ICT supply chains – Survey on conflict minerals due diligence initiatives**

This survey details and assesses existing due diligence initiatives targeting conflict minerals in ICT firms' supply chains (incorporating national and international legislation, as well as industry-, government- and multi-stakeholder-led schemes). The due diligence initiatives analyzed are ones that address the management of the broader spectrum of sustainability issues present in minerals supply chains, with a particular focus on the management of environmental impacts.



Green ICT application challenges - Share your ideas with us!

ITU and Telefónica co-host the **ITU green ICT application challenge** and the **Green ICT hackathon**.

The *ITU green ICT application challenge* is an initiative to attract innovative Concept Papers for climate-related ICT applications. The Concept Papers received yield novel solutions to environmental challenges and cover such topics as climate change monitoring, GHG emissions measurement and community engagement with mitigation and adaptation to climate change.

The *Green ICT hackathon* is an application-development marathon where developers compete to create climate-related ICT apps within a defined timeframe. ITU and Telefónica have teamed up to host a series of these events, harnessing the energy of young innovators and encouraging them to extend ICT's connection with environmental protection.





Raising awareness on ICTs, the environment and climate change

- **ITU Symposia on ICTs, the environment and climate change**

ITU Symposia bring together key specialists in the ICT and environmental-protection fields; from top decision makers to engineers, designers, planners, government officials, regulators and standards experts. Topics presented and discussed include climate change mitigation and adaptation methods in the ICT and other industry sectors, green ICT policy frameworks, green ICT standards, green ICT applications, and the use of ICTs in climate change science and emergency situations.

- **ITU Green Standards Week**

ITU Green Standards Week hosts a cluster of workshops focused on raising awareness of the importance of ICT standards in building green economies and combating climate change. Government, industry and academic participants, from both the ICT and environmental-protection communities, discuss means to extend the use of green ICT standards and highlight areas able to benefit from future standardization.

- **Remote participation in ITU events**

ITU offers interactive remote participation in its major symposia, seminars and workshops. Remote participation is an accurate simulation of on-site participation, and ITU encourages meeting participants to make use of this valuable service. It is an opportunity to enlarge the audience of an event, hosting participants from all corners of the globe, without enlarging the event's carbon footprint.

- **Joint Coordination Activity on ICTs and Climate Change (JCA-ICT&CC)**

The purpose of the JCA-ICT&CC is to provide a visible contact point for ICT and Climate Change activities in ITU-T, seeking cooperation from external bodies working in the field of ICT and CC and enabling effective two-way communication with these bodies. External bodies include representatives from relevant standards development organizations such as IEC, ISO or relevant academia, consortia or fora.



- **Dynamic Coalition on Internet and Climate Change (DCICC)**

ITU launched the Dynamic Coalition on Internet and Climate Change (DCICC) in 2007 as an open body within the Internet Governance Forum (IGF). DCICC is committed to moderating the environmental impact of ICTs, to seeking new ways of embracing the power of ICTs to reduce greenhouse gas emissions worldwide, and to enabling transformation in line with the objectives set out by the United Nations Framework Convention on Climate Change (UNFCCC).

Current DCICC members include United Nations agencies, standards development organizations, researchers, vendors, network operators and other bodies.

- **Global portal on ICTs, the environment and climate change**

The ITU-T website provides references to external resources: background papers, in-depth reports, case studies, and statistics on ICTs and the environment. Topics covered include adaptation and mitigation to climate change, e-waste, and a host of other environmental sustainability issues.

Related website addresses

Homepage: itu.int/ITU-T/
About ITU-T, Environment
and Climate Change: itu.int/ITU-T/climatechange/
Membership: itu.int/ITU-T/membership/
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Photo credits: Shutterstock

ISBN 978-92-61-15161-4



Price: 4 CHF