BCG

GeSI
GLOBAL e-SUSTAINABILITY INITIATIVE

Evaluating the carbon-reducing impacts of ICT

September 2010

Objectives

Recap objectives of study

Provide an overview of the approach

Explain the recommended assessment methodology

Illustrate the assessment methodology

Share path forward

Study context and objectives

GeSI commitments

1. **Develop an agreed ICT industry-wide methodology for the carbon footprinting of ICT products and services**

2. **Put more emphasis on climate change issues in our supply chain work so we influence the end-to-end manufacturing process for electronic equipment**

3. **Ensure that energy and climate change matters are fully considered by the organisations that set the technical standards for our industry**

4. **Work with organisations in the key opportunity areas – travel/transport, buildings, grids and industry systems – to help turn potential CO2 reductions into reality. This will include a strong emphasis on the significant opportunities offered by dematerialisation**

5. **Work with public policy makers to ensure that the right regulatory and fiscal frameworks are in place to move us all in the right direction.**

GeSI's SMART 2020 report series identified ICT as a major low carbon enablement opportunity

2008 SMART 2020 Report

- Globally, ICT solutions have the potential to reduce by 15% (7.8 Gt CO2e) of the remaining 98% CO2e emitted

2008 U.S. Addendum

- ICT enabled solutions could cut annual CO2e emissions in the U.S. by 13–22% from business as-usual projections in 2020
- This translates to a gross energy and fuel savings of $140-240 billion dollars. These savings are equivalent to a reduction in total oil consumption by 11-21% and a reduction of oil imports into the U.S. by 20-36%

The enabling effect covers four primary areas

Industry
- Smart motors
- Industrial process automation
- Dematerialisation* (reduce production of DVDs, paper)

Transport
- Smart logistics
- Private transport optimisation
- Dematerialisation (e-commerce, videoconferencing, teleworking)
- Efficient vehicles (plug-ins and smart cars)
- Traffic flow monitoring, planning and simulation

Buildings
- Smart logistics†
- Smart buildings
- Dematerialisation (teleworking)
- Smart grid‡

Power
- Smart grid
- Efficient generation of power, combined heat and power (CHP)

The reports identified government support needed to accelerate adoption

Over-arching policies

Create policies that build overarching framework for encouraging CO2 reduction and ICT solution adoption

Targeted policies

Use targeted policies to accelerate adoption and address specific technical, economic and behavioral challenges

	Principles for effective government policies
Smart Grid **Road Transport** **Smart Buildings** **Travel Substitution**	**Create an enabling regulatory framework** • Aim for consistent legislation that supports market-based solutions **Enable development of solutions** • Conduct fundamental research benefiting all stakeholders • Encourage innovation, not specific technologies • Encourage investment in required infrastructure **Support the business case when necessary** • Create the right incentives • Ensure that markets create desired environmental and social outcome **Encourage positive behavior change** • Lead by example and support pilot projects • Facilitate and coordinate the sharing of information

Source: GeSI policy expert interviews; BCG analysis; SMART 2020 United States Addendum Report

ICT Enablement Methodology Study context and objectives

Context

Despite the positive reception of these reports, the lack of policy- and commercially-relevant assessments is preventing the full realization of benefits from smart use of ICT

- ICT industry unable to clearly define the specific benefits of different types of ICT investments
- Policy-makers unable to create appropriate incentives for the government, commercial and residential sectors

Project objectives

- Survey and evaluate existing methodologies relevant for assessing enabling impacts of ICT
- Highlight key characteristics of existing methodologies
- Develop an optimal "next step" methodology
- Apply methodology to selected case studies
- Identify issues for application and path forward for the ICT industry

Representatives from 18 international companies sponsored and provided input to the study, orchestrated by BCG

In addition to working team members, many industry and academic experts have provided input

1	Ted Reichelt	Principal Environmental Engineer, Intel
2	Kirsty MacDonald	Senior Manager, Global Public Policy, Intel
3	Marissa Yao	Analyst, Intel
4	Charlie Sheridan	Senior IT Consultant, Intel
5	John Malian	Manager, Global Supply Chain Management, Cisco
6	Jens Malmodin	Senior Research Engineer, Ericsson
7	Craig Donovan	Research Engineer, Ericsson
8	Pernilla Bergmark	Researcher, Ericsson
9	Fredrik Jonsson	Researcher, Ericsson
10	Hans Scheck-Otto	Researcher, Nokia Siemens Network
11	Emma Fryer	Head of Climate Change Programs, Intellect UK
12	Anders Andrae	Senior Expert, Huawei Technologies Sweden
13	Sarah Boyd	Researcher, Sustainability Consortium
14	Mattias Höijer	Head of Centre of Sustainable Communications, Royal Institute of Technology, Stockholm
15	Cristina Bueti	Policy Analyst, ITU
16	Keith Dickerson	Head of Global Standards, BT Innovate & Design
17	Ian Mackenzie, Alex Velkov, Peter Thomond	Think, Play, Do, Imperial College London
18	Skip Laitner	Director of Economic and Social Analysis, American Council for an Energy-Efficient Economy
19	Simon Redding	Sustainable ICT Lead & Technology Innovation Consultant, Environment Agency of England & Wales
20	Fu Zhao	Assistant Professor of Mechanical Engineering, Purdue University

The team reviewed numerous parallel efforts to develop methodology for assessing enabling impacts

	Impact focus		Status of methodology recommendation		Report timing	LCA assessment approach			
	"2%"	"98%"	Published	In development		Process	Hybrid	EIO	Description
ITU International Telecommunication Union	✓	✓	✓	✓	Nov 2009, 2010 / 11		✓		Hybrid LCA with general calculation steps for replaced conventional systems
ETSI	✓	✓		✓	June 2010 *(early draft in 2008*	✓		✓	Process for direct ICT emissions; EIO for macroscopic ICT impact (positive and negative)
ict4ee.eu ICT for Energy Efficiency Forum	✓	✓		✓	2012	✓			2%: Limited LCA for ICT processes only 98%: TBD by ReViSITE/GeSi
iNEMI International Electronics Manufacturing Initiative	✓			✓	2011	✓			Modular process-based LCA and tool focused on 2% but with expected use for 98%
ERICSSON	✓	✓	*Not stand-alone methodology; input provided to ICT industry bodies (e.g. ITU, ETSI)*		Late-2009		✓		Hybrid LCA methodology including infrastructure for ICT systems
IEMAI	✓	✓	✓		2006		✓		Hybrid LCA, outlines target activities, excludes some life cycle phases
REVISITE		✓		✓	Late-2010		✓		Hybrid LCA / Capability Maturity Model (CCM)
WWF CHINA MOBILE	✓	✓	✓		May 2010		✓		LCA methodology for 14 ICT applications

Source: BCG analysis

Developed methodology meets specific needs

Comprehensive	**Captures all major impacts, both positive and negative** (i.e., direct ICT emissions, enabling effects, and rebound effects)
Burden-limiting	**Limits burden of assessment**: Minimizes time and resources required by facilitating exclusion of negligible components of net effect
Communication-friendly	**Supports clear, transparent communication** of methodological approach and findings to broad stakeholder audience
Applicable for varying scope	**Widely applicable for assessing impact of ICT products and services and ICT category levels**
Applicable across geographies	**Effective when applied in both developed and developing world settings**
Flexible	**General and flexible enough for large-scale adoption** – will meet current and future stakeholder needs as sector innovation occurs
Adaptable	**Can adapt as more detailed guidance, industry-wide standards and software assessment tools are developed**
ISO compliant	**Based extensively on ISO 14040-series standard**, but introduces additional guidance specific to assessing enabling effects of ICT

Case studies intended to demonstrate use and applicability of assessment methodology

Case studies utilized to test the relevance and effectiveness of methodology in real-world setting

Diverse set of case studies developed to illustrate applicability across:

- ICT solution areas (dematerialization, SMART logistics, SMART grids, SMART transportation)
- Unique audiences: end-consumers, business customers, policymakers
- Diverse geographies: developed and developing world

Existing case studies and research data used as starting point

- Studies identified and aggregated from GeSI team members as well as external resources
- Key criteria for inclusion: existing robust quantification of key impacts

6 case studies selected from 30 identified and evaluated

Existing case study?	Sufficient data available?	Illustrates unique application?

- Existing studies identified via:
  - GeSI team members
  - Review of existing literature
  - Discussion with external experts

- Majority of studies eliminated due to lack of sufficient existing data on ICT impacts
  - E.g., emission reductions for key forms of impact

- Case studies selected for uniqueness in terms of:
  - SMART ICT category
  - Geographic scope
  - Scope of measurement

Six case studies included in report

	SMART area	Location	Assessor	Description
1 **Home energy monitoring kit**	SMART grids	United Kingdom	AlertMe	Energy savings in household before and after installation of AlertMe home energy monitoring system
2 **HVAC automation system**	SMART buildings	United States	Cypress	Energy savings in building complex after installation of HVAC automation system
3 **Eco driving software solution**	SMART logistics	United Kingdom	Microlise	Fuel efficiency gains across 350+ vehicle fleet after software implementation
4 **Telecommuting**	Dematerialization	United Kingdom	BT	Assessment of whether telecommuting has positive net enabling effect despite rebound effect of increased home energy use
5 **E-health delivery system**	Dematerialization	Croatia	Ericsson	Emission-reducing impact of e-referral and e-prescription services in Croatia
6 **Telepresence system**	Dematerialization	Multinational company	Cisco	Assessment of net enabling effect from company-wide adoption of telepresence

Source: BCG analysis

Recommended assessment methodology

ICT enablement methodology

1 Define goal and scope	2 Limit assessment	3 Assess and interpret
1a Define goal of study	2a Estimate BAU reference value	3a Rigorously assess significant life cycle processes
1b Define scope of study	2b Limit life cycle processes requiring rigorous assessment	3b Interpret net results

Methodology uses a Life Cycle Assessment (LCA) approach to guide the assessment of changes to an existing system resulting from the adoption of an ICT solution

Source: BCG analysis

1a: Define goal of study

Assessment worksheet

Step 1: Define goal and scope

1a Define goal of study

Define the purpose of the study and the intended audience for the study. These attributes will guide decision-making on the set of effects to include in further assessment.

Q: What is the purpose of the study and the intended audience?

Purpose of study _____

Intended audience _____

Scale of adoption _____

Implications for assessment

Illustrative output

1a Define goal of study

Illustrative example used throughout worksheets

Purpose of study *Quantify carbon abatements from use of logistics optimization software*

Intended audience *Business customers*

Scale of adoption *Use to manage operations of a single organization's 500-truck fleet*

Implications for assessment

Relevant effects to include in calculation of net impact are limited to near-term effects such as primary enabling and rebound effects, or secondary effects that occur over a shorter period of time

For further reference–additional examples

Purpose of study *Assessment of emission reductions from home energy monitoring system*

Intended audience *Business-to-business customers (marketing communication)*

Scale of adoption *Single-business in United Kingdom*

Implications for assessment

Relevant effects from adopting home energy monitoring system likely to be limited to activities and operations of individual businesses; broader secondary effects such as reduced energy plant construction and operation not relevant

Purpose of study *Communication of macro-scale benefits of telepresence*

Intended audience *National policy makers*

Scale of adoption *Adoption and use by all businesses in United States*

Implications for assessment

Relevant effects for ICT solution with broad adoption and targeted at policymakers would be more inclusive of enabling and rebound effects which often will only occur with sufficient time or adoption, such as the ability to reduce the need for travel infrastructure

Illustrative scale considerations by audience

Customers
"Low" scale of adoption

- Impact from adopting ICT solution likely to be limited to one's own activities, operations

Business/Industry
Variable scale of adoption

- Impact from adoption will depend on the size and characteristics of organizations

Policy makers
"High" scale of adoption

- Impact from adoption will include cumulative effects of use by many individuals or businesses

Expected primary enabling effects of ICT opportunity levers

SMART opportunity	*Sub-opportunity*	1 Reduced energy consumption	2 Reduced or eliminated travel/shipment	3 Reduced or eliminated materials
SMART Motors	Smart Motor	• Optimization of variable speed motor systems • ICT driven automation in key industrial processes		
SMART logistics	Air transportation	• Reduction in ground fuel consumption • In-flight fuel efficiency	• Reduction in unnecessary flight time	
	Road transportation	• Eco-driving	• Optimization of logistics network • Intermodal shift (to other transports) • Optimization of truck itinerary planning • Optimization of truck route planning • Flexible home delivery methods • Intelligent traffic management	• Minimization of packaging
	Ship / Rail / Other	• Optimization of ship operations	• Optimization of train operations • Maximization of ship load factor	
	Warehouse	• Centralized distribution centres • Reduction in inventory		• Reduction of damaged goods • Recycling and remanufacturing
SMART buildings	Building design	• Improved building design for energy efficiency • Reduced building space through design		
	Building technology	• Building management systems • HVAC automation • Lighting automation • Ventilation on demand • Intelligent commissioning • Benchmarking and building recommissioning • Voltage optimization		
SMART grids	Consumption efficiency	• Reduce consumption through user information • Demand management • Intelligent load dispatch		
	Renewable Energy	• Integration of renewables		
	T&D Loss	• Reduce transmission and distribution losses		
Dematerial-ization	Physical material			• Online media • E-commerce • E-paper
	Travel substitution		• Video-conferencing • Telecommuting	

Path forward

Path forward

Development of additional case studies

- Additional real-world case studies to demonstrate successful application of methodology

Expansion of shared data

- Increased volume of, access to primary data to more accurately capture real-world impacts (especially those driven by adoption rates and behavioral changes)

Development of assessment tools and databases

- Continued development of tools to support application of methodology
- Integration of tools and aggregation of underlying data

Standardization of impacts and life cycle processes included in assessment

- Establishment of agreed-upon approaches for assessing effects of specific ICT product or service categories

The launch website at GeSI.org is the starting point

There, you can:

- Download the Report
- Download methodology worksheets you can use to guide your own assessment and track your data
- Review the latest case studies
- Watch a video explaining the study
- Register your interest in future workshops and published case studies

Thank you!

Questions?
Comments?