

Evaluation of the Information and Communication Technology for Energy Efficiency (ICT4EE) Forum Roadmap

Joint report of the Independent Panel of Experts

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Introduction

The Commission of the European Communities issued a Recommendation on 9.10.2009 *on mobilising Information and Communications Technologies to facilitate the transition to an energy-efficient, low-carbon economy*¹.

It recommended that the Information and Communication Technologies (ICT) sector participate, through its sector associations, in an exercise that aimed to issue a roadmap within three months of adoption of the Recommendation.

For that purpose, the ICT sector associations DIGITALEUROPE², GeSI³, JBCE⁴ and TechAmerica Europe⁵ agreed in a Memorandum of Understanding (MoU) to establish an Information and Communication Technology for Energy Efficiency (ICT4EE) Forum. The MoU signatories agreed on their Terms of Reference (ToR) and developed an ICT4EE Forum Roadmap 2010-12, that was presented at the High Level Event on ICT for Energy Efficiency on 23rd February 2010 in Brussels⁶.

The Commission set up a panel of independent experts to advise it on the evaluation of the work of the ICT4EE Forum. For the initial evaluation process four people with the relevant expertise were invited to join the panel. The panel of experts were:

- ▶ Mr Lorenz Erdmann (Institute for Futures Studies and Technology Assessment IZT, Berlin),
- ▶ Mr Simon Forge (SCF Associates Ltd., Princes Risborough)
- ▶ Mr Kevin Houston (Carbon Masters, Edinburgh), and
- ▶ Mr Robert Williams (Energy Efficiency Expert, Vienna).

Full profiles of the panel of experts can be found in Appendix 2.

The experts were mandated by the Commission to review all the documentation relating to the Initiative. Our remit was:

- 1) to review all relevant documentation, the Commission's Recommendation and ICT4EE documents (Roadmap, MoU and ToR)⁷,
- 2) to provide an individual perspective of the above,

¹ C(2009) 7604. Available at:

http://ec.europa.eu/information_society/activities/sustainable_growth/index_en.htm.

² DIGITALEUROPE's members include 58 leading corporations and 40 national trade associations from all member states of EU covering information technology, consumer electronics and telecommunications subsectors. See <http://www.digitaleurope.org>.

³ The Global e-Sustainability Initiative (GeSI) is an international strategic partnership of ICT companies industry associations and UNEP and ITU, United Nations organizations to foster sustainable development. See <http://www.gesi.org>.

⁴ The Japan Business Council in Europe (JBCE) is the representative organisation of Japanese companies operating in the European Union. The more than 60 corporations are active in a wide range of sectors, including electronics, automotive, and chemical manufacturing. See <http://www.jbce.org>.

⁵ TechAmerica Europe (formerly AeA Europe) represents European high-tech operations with US parentage. The member companies are active throughout the high-technology spectrum, from software, semiconductors and computers to Internet technology, advanced electronics and telecommunications systems and services. See <http://www.techamerica.org/topics/regional-offices/europe>.

⁶ See http://ec.europa.eu/information_society/events/ict4ee/2009/index_en.htm for details.

⁷ All ICT4EE Forum documents available at: <http://www.digitaleurope.org/index.php?id=1145>.

- 3) to reach a consensus view and to provide a high level summary of that consensus to the ICT4EE Forum at the High Level Event on ICT for Energy Efficiency on 23rd February 2010 in Brussels, and
- 4) to provide this report outlining that view.

Initially, the evaluation was based on an ICT4EE Forum draft Roadmap - as conveyed by the Commission to us on 11th February 2010.

We submitted our individual thoughts to the nascent ICT4EE Forum representatives and discussed key deficiencies and improvement options at a teleconference on 18th February 2010 with MoU signatory representatives from all four parties. Our suggestions have been integrated into the final ICT4EE documents - as conveyed by the Commission on 22nd February 2010 - to varying degrees. Some important points were raised at the presentation of the ICT4EE Forum Roadmap at the High Level Event on ICT for Energy Efficiency on 23rd February 2010 in Brussels.

While this joint report was prepared according to the contract with DG INFSO–H4 it synthesizes our independent consensus view. For that purpose we reflected on the ICT4EE Forum’s documents in the context of the Commission’s Recommendation. As the ICT4EE Forum’s Roadmap is an evolving document, our consensus view represents a snapshot of the status by the end of April 2010. We strongly encourage the ICT4EE Forum to fully encompass the aspects we raise in this joint report in the next release of the roadmap and in the individual workplans of the working groups.

The report begins with an executive summary. Section 2 deals with ICT and its own processes while section 3 deals with ICT and other sectors.

In the report references to “carbon” and “ carbon emissions” are a shorthand to cover all the 6 green house gases referred to in the Kyoto protocol (CO₂, CH₄, N₂O HFC’s, PFC’s SF₆

1 Executive Summary

Having reviewed the EU Recommendation we have concluded that it makes a sound case for the need for *action* on ICT in relation to both energy efficiency and carbon emissions. It reflects the growing consensus that ICT has significant potential to both improve its own processes and be a key enabler in achieving energy efficiency improvements and carbon emissions reductions in other sectors. Thereby it provides the ICT industry with a real opportunity to play a central and critical role in assisting in Europe's transition to a more energy-efficient, low-carbon economy. The scope, intentions and recommendations contained in the EU document are ambitious, driven by the EU's underlying policy commitments for both energy and climate change⁸. To fully comply with the Recommendation and its timelines will require substantial efforts on behalf of the ICT sector.

Energy use by ICT equipment and services represents about 8% of electrical power consumption in the EU, and is estimated at about 2% of global carbon emissions (Gartner 2007). It is however estimated that ICT-enabled improvements in other sectors could save about 15% of global carbon emissions by 2020 (The Climate Group 2008). What is also clear is that emissions from ICT are growing rapidly and are likely to go on doing so unless action is taken.

The recommendation points out that the ICT sectors record on dealing with the first issue shows a mixed picture. While some individual companies have an excellent record on taking steps to reduce the energy consumption of their products and services the overall approach is not coordinated or measured against a commonly accepted set of standards or methodologies and thus has room for improvement. Its progress on the second is muted and well below its potential. Energy saving solutions based on ICT are not yet deployed at scale across many sectors.

Against the background of the growing share of the ICT sector's energy consumption and GHG emissions, it is of the utmost importance for ambitious targets to be set by the ICT sector for improving energy and environmental performance of its own processes (i15). The EU Recommendation specifies a clear requirement for the ICT sector to commit itself to do this and provides a specific timetable for it to do so. It recommends that the ICT sector,

- (1) commits to a progressive decarbonisation process leading to a measurable and verifiable reduction in energy intensity and carbon emissions of all processes involved in the production, transport and sales of ICT equipment and components (r1);
- (2) participates through its sector associations to (r2):
 - (a) develop a framework to measure its energy and environmental performance, contribute the baseline data by 2010 (r2a);
 - (b) adopt and implement common methodologies by 2011 (r2b);
 - (c) identify by 2011 energy efficiency targets that aim to exceed the EU 2020 targets by 2015 (r2c);
 - (d) issue a roadmap, thereafter annual reports (r2d);

⁸ The Recommendation recalls the overarching objectives of the European Council to save 20 % of the EU's energy consumption compared with projections for 2020⁸ and to reduce GHG emissions by 20 % in 2020 (i4).

- (3) works with the European Commission and others to develop an auditing and verification framework assessing whether and how energy intensity and carbon emissions reduction targets will be met by individual companies.

It then proposes that the ICT sector should work closely with the buildings and construction, and transport and logistics sectors to develop and deploy at scale energy savings solutions that improve the energy efficiency of these sectors and reduce their carbon footprint.

It is our considered view that this presents the ICT sector with a significant opportunity to play a central role in Europe's transition to a low carbon economy and to do so by leading by example, i.e. to first improve its own processes and use the learning so gained to reapply to other sectors.

In reviewing the material presented to us by the Commission i.e. the TOR, MOU, & the 3-year Roadmap, our approach was to look at the various documents against three criteria:

- How well are they in line with the EU recommendation?
- What were the gaps?
- How might those gaps be filled in subsequent iterations of the Roadmap?

1.1 How well are the ICT4EE Forum documents in line with the EU Recommendation?

Firstly the four founding Industry associations are to be commended for responding to the EU Commission's recommendation by establishing the ICT4EE Forum. We believe its aims and objectives, organisation and governance procedures are well thought through and reflect the commitment of the ICT sector to respond positively to the Commission's Recommendation.

Secondly we think the organisation of the Roadmap into the three working groups and their current scope is appropriate and that if these groups are properly chartered and staffed with the right practitioners from as wide a representation of the Industry as is possible then it can deliver the objectives of the road map.

We note the objective of the Roadmap to establish quantifiable case studies, to show case and share best practice of the use of ICT in other sectors. We commend this and encourage the Forum to have these executed as early as possible

1.2 What were the Gaps?

Our view is that there are some gaps between the spirit and intent of the EU Recommendation and the response to it, based on our reading of the material. These cover the areas of ICT Industry representation, the emphasis and priority given to energy efficiency and carbon emission reduction and a number of specific concerns relating to the 3 year Roadmap which if not corrected risk the project being unable to meet its objectives. The main gaps were:

(1) Industry representation

As regards Industry representation, while we do recognise that the four Industry Associations do cover a large number of ICT sectors and companies within those sectors, we do want to encourage the Forum to reach out to other ICT organisations and bring them in to this initiative. The ICT sector in Europe is large, diverse and contains a wide variety of sectors and subsectors and companies of different sizes. It

will be important that as wide a mapping of the ICT Industry as is possible is made and that the exercise is as inclusive as it can be.

(2) Energy efficiency vs. carbon emission reduction

In our view the intent of EU recommendation is about encouraging the ICT sector voluntarily to take the initiative in reducing **both** the primary energy consumption and the carbon footprint of its own processes. Despite the challenges that this will pose the Industry, this is the very much in our view the first priority. It's not clear that there is a uniform consensus on this based on the documents that we have reviewed and the announcements made by the Industry Associations in the Brussels meeting.

To meet the intent of the recommendation will require the sector to assess its primary energy consumption *and* the carbon emissions associated with its own processes and to agree to reduce both of those over time. Being able to do this on itself, so to speak, will give the ICT Industry the credibility to assist other sectors to follow this path.

(3) The Three-year Roadmap

We are fully supportive of the Formation of the ICT4EE Forum and its broad aims and objectives. We judge that the proposed working groups if properly chartered and staffed with the right Industry practitioners can deliver the objectives within the Roadmap. We are of the opinion that the proposed steering groups and plenary bodies of the forum are appropriate and underline the Industry's commitment to delivering the ICT4EE Forum's 3 year Roadmap

Now while we do recognize that the Roadmap is high level, strategic and will be an evolving document we do have the following concerns:

- Overall we feel there is a lack of urgency or a real bias for action in the Roadmap. This is evidenced by there being very few key milestones in the current document. For instance we note that the EU Recommendation that the ICT sector contribute baseline data by end 2010 is not currently met.
- As to methodologies, while we recognise that WG 1 will carry out a review of current methodologies, we do not see a mechanism for how the scope and boundary of any proposed methodology will be decided which will make making judgements of existing methodologies problematic.
- There is no process outlined in the Roadmap for how an independent, verifiable, voluntary, auditing and reporting system will be established to report energy efficiency metrics and carbon emission reductions.
- While the remit for both WG 1 & 2 are quite clear, we are less sure that this is the case for WG 3. It will be important to get the balance right in this working group between the policy intervention and coordination areas and the communication to stakeholders, users of the results of the Forum as well as the implications of the Forum's work on long term changes in consumer/customer behaviour.
- Finally we believe it will be important that there is close coordination between the three WGs and we do not see currently a mechanism to ensure this happens.

1.3 How might those gaps be filled in subsequent iterations of the Roadmap?

(1) Ensure all ICT voices are heard.

We believe the Forum should expand the number of members involved via reaching out to associations representing companies of all sizes and subsectors to ensure we have as complete as possible a mapping of the ICT sector in Europe (e.g. ETNO, GMSA, ESA, ESCIA).

(2) Bring a greater sense of urgency to the work by being clearer on the priorities.

We recommend progressing the work on the ICT processes themselves i.e. WG 1 be given the highest priority, followed by ICT in other sectors (WG 2) and to give a lesser priority, at least in the start up phase to policies and technologies for the future (WG 3) which will then need to be revisited.

We urge to WG 1

- to adopt and implement common methodologies, that quickly put in place action plans, to remedy growing ICT energy consumption and carbon emissions, and
- to avoid reinventing the wheel by leveraging the existing work on methodologies already done (e.g. by ITU, JRC, CDP and WRI/WBSCD on the GHG Protocol).

(3) Ensure the right scope and boundary are agreed to at the outset.

- The measurement of ICT processes must cover energy consumption and associated carbon emissions of all production, transport and sales processes of ICT components & equipment sold in the EU.
- ICT subsectors with operational activities (i.e. ICT operators of their own data centres) should be considered.
- Scope 1, scope 2 **AND** scope 3 GHG emissions should be considered regardless of geographic boundaries (e.g. in supply chain management).

(4) Implement a rigorous credible verification, auditing & reporting framework.

We want to encourage the Forum to build upon the existing reporting frameworks for carbon emissions (e.g. CDP, GHG Protocol). To do this the Forum will need to ensure an independent, transparent and reliable verification and auditing framework for reporting both the agreed energy efficiency metrics and carbon emission reductions.

2 ICT's own processes

The Recommendation gives the energy efficiency of ICT processes the highest priority in providing legal mandates with a specified timetable for action. To comply with the requirements, the ICT4EE Forum has set up Working Group 1 'Energy efficiency of ICT processes' for the development of methodologies, targets, reporting, auditing and verification frameworks. Therefore it is of the utmost importance to get Working Group 1 started.

The ICT4EE Forum's Roadmap explains five different approaches to manage the measurement of energy efficiency of ICT processes: the assessment of existing metrics & methodologies, the development of a measurement methodology, an agreed protocol for standardised disclosure, sharing verifiable data and an assessment of how to incorporate renewables into ICT processes.

The Roadmap sections on energy efficiency of ICT processes, which we have reviewed so far are mostly high level and lack concrete information on how the intentions of the Recommendation shall be really met. Most of the open questions on energy efficiency of ICT processes will be dealt with in WG 1. WG 1 should we believe take a pragmatic approach and avoid reinventing the wheel or taking over 1 year to define it. The existing work on the measurement of energy efficiency of ICT processes (e.g. by ITU, JRC) should be leveraged and applied, and it should be complemented and improved via iteration according to the state of the art by cross-sector measurement and reporting activities (ISO 14040ff, CDP⁹, GHG Protocol¹⁰). WG 1 should develop a work plan with clearly defined milestones and dates there is also a critical need for mechanisms for agreeing on scope and boundary issues, metrics and methodologies, targets, and auditing and verification.

2.1 Scope and boundaries

Important scope and boundary issues raised in the Recommendation are the ICT sector definition, the impact dimensions to be studied, and the life cycle stages to be covered.

For the purpose of the Recommendation, **the ICT sector** refers to the ICT manufacturing industries, ICT trade industries and ICT service industries as defined by the Organisation for Economic Co-operation and Development (OECD)¹¹ as given in the recommendation as intention 16 or i16.. In its preceding Communication *on mobilising Information and Communication Technologies to facilitate the transition to an energy-efficient, low-carbon economy*¹², the Commission underscored the untapped potential for the ICT sector to focus on systemic improvements to its own processes, including operations, manufacturing, service delivery and supply chain management. Intention 13 (i13). In a more concrete vein, the Commission "hereby recommends that the Information and Communication Technologies sector commits to a progressive decarbonisation process leading to a measurable and verifiable reduction in energy intensity and carbon emissions of all processes involved in the

⁹ The Carbon Disclosure Project (CDP) is an independent not-for-profit organization holding the largest database of primary corporate climate change information in the world.

¹⁰ The Greenhouse Gas Protocol Initiative (GHG Protocol) is a multi-stakeholder partnership of businesses, NGOs, governments and others convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).

¹¹ OECD Guide to Measuring the Information Society. Rev. July 2009. www.oecd.org/sti/measuring-infoeconomy/guide.

¹² COM(2009) 111 final.

production, transport and sales of ICT equipment and components” Recommendation1 (r1)¹³.

The ICT sector definition according to the OECD is both, all encompassing while being precise. It specifies the scope of activities for all policy intentions and actual recommendations specified in the Commission’s Recommendation. The Communication cited in the Recommendation addresses the potential for the ICT sector to improve its own energy-efficiency and reduce the carbon emissions of its own processes.

The specification of operations, manufacturing, service delivery and supply chain management can only be read as *the intention* to cover all activities which are under operational control and/or which can be influenced by the ICT sector to a significant degree. The recommendation (r1) focuses on the reduction in energy intensity and carbon emissions of all processes involved in the production, transport and sales of ICT equipment and components exclusively¹⁴.

The Recommendation document does not explicitly mention whether the specific recommendations r2 (measurement, baseline data, targets and roadmap) and r3 (auditing and verification) refer to the ICT sector scope of r1 in the narrow sense, that is to the ICT sector scope illustrated by intention i13 or to the broad ICT sector definition, as referred to in the intention i16. It was clarified orally by the Commission, that all activities which are under operational control of the ICT sector (including operations, manufacturing, service delivery and supply chain management) are to be addressed in r2 and r3, with the ICT sector being defined according to the OECD definition.

The ICT4EE Forum’s Roadmap relates to “energy consumption of ICT processes including production, transport and sales of ICT components and equipment. (Initial focus will be electricity consumption with scope to be developed by the Forum).” A common efficiency metric will need to be defined by the Forum as a first step.

The Roadmap only acknowledges the need to cover energy consumption and energy efficiency of ICT processes. According to all documents we have received from the ICT4EE Forum so far, the measurement of **Greenhouse Gas (GHG) emissions** by the ICT sector is not intended to be part of its remit. A scope that is so narrowly interpreted might meet the specific recommendation r2c, by confining the scope to mere energy efficiency metrics and methodologies. However neither does it comply with the Recommendation’s intention to cut down total energy consumption and GHG emissions (i4) nor with the concrete recommendation to commit to a progressive decarbonisation process leading to a measurable and verifiable reduction in energy intensity and carbon emissions (r1, r3).

With that context addressing the GHG emissions of the ICT sector’s own processes. Is mandatory. ICT companies have opportunities to reduce GHG emissions without reducing energy consumption (e.g. carbon neutral energy supply) and energy

¹³ The Recommendation refers to ‘carbon emissions’, which are – scientifically spoken - a part of all GHG emissions. As other GHG emissions are also relevant (e.g. HFCs, PFCs, SF₆ in production) all kinds of GHG emissions should be considered.

¹⁴ Other recitals stress the necessity to consider the entire life cycle of ICT products (i7, i8, i12). The use phase and end-of-life phase of ICT equipment and components are covered by other EU policies such as the EuP-, RoHS- and WEEE-Directives. It is reasonable to focus on production, transport, sales and some other life cycle stages which are not treated with regard to energy efficiency and GHG emissions in other EU policies sufficiently.

efficiency increases do not necessarily translate into energy consumption reductions (e.g. because of rebound effects – please see subsection on targets).

The energy and GHG emission reduction potentials are highly dependent on the contributions of single **life cycle stages**. The Forum is strongly encouraged to consider in the determination of its scope the following key aspects:

Firstly, exclusive focus on just electricity consumption would ignore certain life cycle phases, whose examination is required (for example fossil fuel based transport processes such as air, ship and road transport).

Secondly, we do not see any scientific argument justifying an ex ante exclusion of other types of energy dissipated (for example focusing on electricity consumption while ignoring process heat). Symmetric treatment of all relevant matters is a prerequisite for accuracy in any environmental impact assessment.

Thirdly, the largest portions of total energy consumption and GHG emissions of ICT equipment and services originate from the upstream supply chain processes, which can be influenced by the ICT sector. The Recommendation clearly states the expectation to cover supply chain management (i13); Otherwise there is a danger that outsourcing would become an effective strategy to improve energy efficiency.

We suggest to WG 1 with regard to scope and boundaries that:

- It ensures that all activities under operational control of the ICT sector, as specified by the OECD, are included (including manufacturing, transport and sales of ICT components and equipment, operation of data centres and telecommunication equipment, service delivery and supply chain management), and
- It analysis all the three dimensions energy consumption, energy efficiency and greenhouse gas emissions of ICT processes regardless of geographical boundaries (scope 1, scope 2 and scope 3 GHG emissions)¹⁵.

2.2 Metrics and methodologies

The Recommendation expects the ICT4EE Forum’s Roadmap to pave the way to develop a framework to measure the ICT sector’s energy and environmental performance and to contribute the baseline data by 2010 (r2a), to adopt and implement common methodologies by 2011 (r2b), to identify by 2011 energy efficiency targets that aim to exceed the EU 2020 targets by 2015 (r2c) and to issue a roadmap, thereafter annual reports (r2d).

¹⁵ scope 1 emissions: Direct emissions from GHG sources owned or controlled by the reporting organization. scope 2 emissions: Emissions that do not physically occur from within the organization’s reporting boundary, that are caused by the organization’s consumption of electricity, heat, cooling or steam brought into it’s reporting boundary. scope 3 emissions: An organization’s indirect emissions other than those covered in scope 2. They are from sources that are not owned or directly controlled by an organization, but which occur as a result of its activities and can be influenced indirectly. The CDP Information Request considers (1) business travel emissions, (2) distribution and logistics emissions, (3) emissions from the use and disposal of a company’s products, and (4) supply chain emissions. At least (2) and (4) are unequivocally addressed in the Recommendation.

The Roadmap first provides an approach, which assesses existing metrics and measurement methodologies, and then an approach to develop an own measurement methodology. Both approaches shall be carried out in collaboration with international bodies such as ITU, ISO, IEC and OECD. The ITU-T work is explicitly mentioned as a reference¹⁶. The expected outcomes of the first approach are a gap analysis and priorities for methodology development. The expected outcome of the second approach is an agreed measurement methodology, taking into account analysis and measurement considered in the section on ICT in other sectors.

The ICT4EE Forum's WG 1 has not yet provided any concrete document on measurement methodologies. The first approach, the assessment of existing metrics and measurement methodologies, is reasonable – provided that the issues raised in the scope and boundary section are fully met. The Roadmap lacks a concrete commitment to provide baseline data by 2010 as required in the Recommendation. Also the adoption and implementation of common methodologies is not clearly visible in the Roadmap; an “agreed measurement methodology” is insufficient. Here we are missing a plan of how to ensure widespread adoption and implementation of the common methodologies. We strongly encourage WG 1 to relate more closely to the **existing measurement standards and ongoing activities**.

There are numerous different ways of measuring energy consumption, energy efficiency and GHG emissions of the ICT sector. Finding suitable **metrics** involves particular difficulties, which have not been addressed so far in the Roadmap. First, for some issues there are no suitable metrics for comparison (e.g. data centre energy efficiency for different data centre locations). Second, adequate granularity of the metrics should be taken into account (such as proposed by the Japan Green IT Promotion Council for data centres). Third, the choice of a metric can decide whether an energy efficiency increase can be expected or not (e.g. power usage per Mbps or per user in the case of telecommunication). Taking into account the multiplicity of metrics and methodologies available, a compromise between scientific soundness and pragmatic feasibility has to be found.

Though the Recommendation does not specify an energy efficiency target of the EU explicitly, it asks the ICT sector to achieve energy efficiency targets for its own processes that aim to exceed the EU 2020 targets by 2015. The key EU targets specified in the Recommendation are to save 20 % of the EU's energy consumption compared with projections for 2020 and to reduce GHG emissions by 20 % in 2020. Both **references** for these targets, an energy consumption projection for 2020¹⁷ and GHG emissions of the ICT sector by 1990¹⁸ have difficulties. Here it would appear, that the ICT sector is left open to define a reference against which progress should be made be. WG1 should discuss and document the various pros and cons of different references.

¹⁶ ITU: *ITU and Climate Change: Conclusions of ITU-T Focus Group*. International Telecommunication Union, 2009.

¹⁷ Any future impact of the ICT sector on energy consumption strongly depends on the reference projection chosen (e.g. non-ICT reference, Business as Usual, or trend extrapolation scenario). The Smart 2020 study has not been prepared independently but on behalf of GeSI (The Climate Group 2008). The Business as Usual projections might be too pessimistic and the SMART 2020 projections might be too optimistic. In general, Business as Usual projections are discussed controversially in academia and clearly rejected by important institutions, such as the IPCC (2000).

¹⁸ The 1990 reference year is commonly referred to, but there are no reliable data on GHG emissions of the ICT sector for 1990.

We suggest to WG 1 with regard to measurement end metrics it:

- relates better to existing measurement standards and ongoing activities, clarifying the role of other institutions and their principal documents for WG1 (e.g. ITU-T FG D3, ISO 14040ff, JRC Code of Conducts, CDP, GHG Protocol),
- specifies metrics and measurement methodologies for energy efficiency, energy consumption and GHG emissions, considering the existence of suitable metrics, granularity of metrics, the sensitivity to different metrics, and
- defines a delivery of baseline 2010 data as a first step, taking into account that targets should be set against a robust reference baseline.

2.3 Targets

The Recommendation stresses the necessity to reduce energy consumption and GHG emissions in its intention i4 and in recommendation r1, but in r2c targets shall be defined only for energy efficiency. It is widely accepted in academia that ICT is a technology that enhances efficiencies in use of energy, material, time, cost and other efficiencies in the entire economic system – including its own operations- significantly (Erdmann et al. 2004). An increased demand as a reaction to efficiency increases is commonly denoted as the rebound effect in the narrow sense (Hilty 2008)¹⁹. That means, that an efficiency increase of 20 % by the ICT sector will not reduce energy consumption of the ICT sector by 20 %, but to a significantly lesser extent²⁰. Thus while in the Roadmap energy efficiency targets are addressed in compliance with requirements, it is essential to define energy consumption and GHG emission targets for the progressive decarbonisation process as required in the recommendations r1 and r3, too.

The Recommendation emphasizes the urgency to curtail the ICT sector's emissions by setting ambitious and updated targets, which is not sufficiently reflected in the Roadmap. The energy efficiency targets identified only appear as an expected outcome of one of the approaches of the Roadmap. There are no hints in the documents provided how the targets will be set, or on what granularity is aimed or how a consensus among the different trade associations on targets can be reached.

Targets for various subsectors appear to be completely open. Setting aggressive targets can turn out to be a powerful driver for system innovations, whereas moderate targets might foster incremental innovations only. Harvesting the benefits of incremental energy efficiency increases will be faster; although major system innovations might enable breakthrough energy efficiency increases-but later

We suggest to WG 1 with regard to targets that it:

- ensures ambitious target setting and continuous updating of targets for energy efficiency, energy consumption and GHG emissions, and
- organises a clearly defined target setting process, distinguishing between targets for the entire sector, for subsectors and for individual companies.

¹⁹ Greening et al. (2000) distinguish direct, indirect and economy-wide rebound effects.

²⁰ From an academic point of view, any future projections of total energy consumption of ICT processes should encompass modelling of the rebound effect. The same applies to ICT in other sectors. However, feasibility of such an exercise in a roadmapping process is doubtful.

2.4 Auditing and verification

The Recommendation requires the ICT sector to report annually on the progress achieved towards their targets (r2d). In addition, the ICT sector is recommended to work with the European Commission and other relevant public bodies and international organisations in order to develop an auditing and verification framework assessing whether and how energy intensity and carbon emissions reduction targets will be met by individual companies (r3).

Information on auditing and verification as constituents of a reporting framework is not easy to extract from the Roadmap. Approach three is to “Agree on protocols for standardised disclosure of energy consumption of ICT processes”, accounting for various existing reporting schemes such as the GHG Protocol. Through discussion in the ICT4EE Forum a voluntary industry agreement on reporting framework is to be achieved by 2011²¹. Approach four is to share verifiable data around energy measurement and performance of processes in the ICT industry. Data is to be shared via channels yet to be defined by the ICT4EE Forum This approach is aimed at delivering a voluntary reporting framework on the energy footprint of the ICT industry processes, with an energy performance comparison, identification of areas for improvement and benchmarking of progress, complemented by good practice guidelines and case studies.

We commend especially the concrete outcomes of the approach four on data sharing. In approach three instead of a rather undefined voluntary framework we would prefer a much clearer commitment to annual reporting, and concrete provision of measurable and verifiable data in the reporting. These are the outcomes that the Recommendation is asking for. It is important to note, that the choice of a reporting framework (GHG Protocol, CDP) has important impacts on the metrics and methodologies (see preceding subsection above). In addition, all the scope and boundary issues raised in the subsection above have to be applied with regard to auditing and verification accordingly.

Many ICT companies already report to the CDP, which leaves it open to the reporting organization to involve independent third party verification or not. The GHG Protocol reporting framework requires independent third party verification, which is more in line with the Commission’s Recommendation. The Greenhouse Gas Protocol reporting framework is still under development²². Also by the end of 2010 a standard to account for scope 3 GHG emissions is expected to be issued.

We suggest to WG 1 that with regard to individual company reporting and benchmarking it:

- cooperates with all relevant stakeholders on reporting mechanisms,
- ensures reporting of energy efficiency, energy consumption and GHG emissions data for individual ICT companies in a practical way, building upon the existing reporting frameworks (CDP, GHG Protocol), and
- ensures transparent, rigorous and independent 3rd party verification.

²¹ The outcome of identified targets in this approach is surprising and somewhat misleading here.

²² Two telecommunication companies, British Telecom and Deutsche Telekom, take part in the ongoing road test of the GHG Protocol.

We suggest to WG 1 that with regard to ICT sector compliance it:

- defines a work step with concrete delivery of measurable and verifiable data within the ICT sector reporting framework,
- ensures reporting of energy efficiency, energy consumption and GHG emissions sector data for ICT processes in a disaggregated way, and
- adopts and implement methodologies that quickly put in place action plans to remedy growing ICT energy consumption and GHG emissions and to ensure broad participation and compliance by individual companies.

3 ICT in other sectors

The preamble to the EC Recommendation includes reference (i17) to the conclusions of the SMART 2020 Report “Enabling the Low carbon Economy in the Information Age” prepared by the Climate Group on behalf of the Global eSustainability Initiative (GeSI). SMART 2020 estimates emissions savings attributable to ICT-driven solutions in several other sectors to be 15% of global BAU in 2020. Whereas significant ICT-enabled energy efficiency gains are expected to be achievable in the short term in buildings/construction, transport/logistics and energy end-use, there is a lack of comparable methodologies for measuring ICT’s impacts on energy efficiency and carbon emissions from these other sectors.

The ICT4EE Forum has established Working Group 2 (WG 2) to address the enabling impacts of ICT on energy efficiency and emissions reductions in other sectors. A major task for WG 2 will be quantifying, with greater rigor than has previously been the case, ICT’s impact on reducing energy use in the other sectors, while, at the same time, accounting for its own increasing energy use.

The major drivers for accelerating the application of ICT in other sectors as seen by the ICT industry itself are:

- recognition by governments of resource constraints (both the carrying capacity of the atmosphere for GHGs and potential fossil fuel supply constraints),
- significant Market opportunity for ICT products and services. (Accelerating energy efficiency will require acquisition, communication and processing of huge amounts of data and information),
- energy price volatility,
- new regulatory environment, and
- ICT customers’ (users’) desire to demonstrate reduced carbon footprint – public image.

However, ICT solutions are in competition with other, equally effective measures capable of accelerating the uptake of energy efficiency. Significant energy savings are possible through the capture of systems-level energy efficiency opportunities. In buildings, for example, HVAC systems are often poorly designed and operated and individual HVAC and chiller components such as motors, pumps and fans are frequently over-sized and inappropriately matched resulting in major energy losses. Addressing these inefficiencies requires education, training and behavioral change in addition to the introduction of new ICT hardware.

The introduction of new policies to stimulate the accelerated penetration of ICT products and services into other sectors requires accurate quantification of the potential impacts of such measures on energy savings and carbon emissions reduction. Consumers need to be able to verify and compare energy savings offered by ICT’s with savings from other measures. Policies should not give unfair advantage to ICT at the expense of other energy efficiency opportunities.

A large number of organizations including research entities, companies, business associations, academia, international organizations and several consortia implementing EC-funded programs are all working on the topic of ICT-enabled solutions to energy efficiency in other sectors. Most focus on electricity supply, transport/logistics and building/construction. Many have already generated a

significant body of expert knowledge that can usefully inform and guide the work of WG2. WG2 needs to position itself Vis a Vis these other activities to both avoid duplication of effort and to benefit from the methodological work already underway.

3.1 Compliance and gap analysis.

The Commission's Recommendations specifically identify the following four major activities requested from the ICT sector concerning ICT's impact on energy efficiency in two other sectors – buildings/construction and transport/logistics (r4-r7 of the Recommendation):

- *ICT solutions to improve energy and environmental performance of new and existing buildings, construction and renovation practices. (In cooperation with the Sector and leading to Joint Roadmap for large scale adoption).*
- *Address barriers to the wider use of ICT modeling and simulation tools to facilitate compliance with regulatory regimes governing buildings performance.*
- *ICT solutions to improve energy and environmental performance of transport and logistics services coordinated with ITS Action Plan. (In cooperation with the Sector and leading to Joint Roadmap for large scale adoption).*
- *Systematic Framework to provide comprehensive, comparable and reliable data on energy use and carbon emissions from freight and transport operations. (In cooperation with the Sector).*

The Commission's text also recommends that Member States *engage all relevant stakeholders in large-scale Pilots and Demonstrations of Smart metering and Smart Grids to build consensus on the requirements for the emergence of future ICT-enabled innovation (r13).*

The ICT4EE 3-year Roadmap, on the other hand, addresses ICT's potential enabling effect in three sectors – buildings/construction, power supply and transport/logistics. In view of the obvious overlap between all three (as is the case with electric powered mobility and Smart Metering by power users), this addition of the power supply industry in the roadmap, is logical if not essential. When further developing its work with the power supply industry and refining the ICT4EE roadmap, WG 2 should take into consideration the EU Legislative Proposal for a regulatory framework on smart grids expected to be adopted December 2011.

The EC recommendations address very specific issues ...*Barriers to the wider use of ICT modeling and simulation tools to facilitate compliance with regulatory regimes*" in the case of buildings (r5),...*Systematic Framework to provide comprehensive, comparable and reliable data on energy use and carbon emissions...* in the case of freight and transport (r6). Furthermore the Recommendations require close cooperation with the sectors of concern and the generation of Joint Roadmaps (r4, r6).

The current ICT4EE 3-year Roadmap offers a wide range of expected outcomes. The successful delivery of these outcomes will require a major coordinated effort involving many different stakeholders. In part the outcomes exceed the EC Recommendations but elsewhere they are to a large extent subsumed under more general objectives such as common position papers and scaled up technology applications. The roadmap's outcomes do make provision for improved data collection and analysis through collaboration with ITU, ISO, IEC and OECD on standardized metrics and measurement methodologies.

To reconcile the gaps between the Commission's Recommendations to the ICT industry, as summarized above, and the actions proposed in the current version of the roadmap, WG 2 would need to consider:

- Selection of partner organizations with appropriate expertise in metrics and measurement methodologies. As with W G1, WG 2 need to move towards an agreement on measurement methodologies. This will require close cooperation with all stakeholders including standardization bodies.
- Generation of the requested joint roadmaps with the transport/logistics and buildings/construction industries and identifying the barriers to the wider use of ICT modeling and simulation tools to facilitate compliance with regulatory regimes governing buildings performance need to be given priority.

3.2 Suggestions for Improvement.

We strongly recommend that ICT4EE Forum should implement quantifiable case studies to demonstrate the impact of ICT on other sectors as soon as possible. This needs to be a priority task for WG2. (The roadmap includes the objective of establishing quantifiable case studies, to showcase and share best practice of the use of ICT in other sectors). As in the case of the ICT's own processes, scope and boundary will need definition if the case studies are to yield reliable data (see section 2.1). Coordination with WG1 on standardization and scope of measurement will be essential.

A comprehensive inventory of current research and development programs needs to be undertaken from which suitable candidates for the quantifiable case studies demonstrating the ICT enabling effect could be selected. Information available from the High Level Event of 23/24 February 2010 could be a good starting point. At the same time, the inventory could provide valuable information about parallel efforts also developing standardized metrics, methodologies and roadmaps, for example, Logistics Industry Coalition for long-term ICT-based Freight Transport, Intelligent and Efficient Travel Management for European Cities, European strategic research Roadmap to ICT-enabled energy efficiency in Buildings and Construction, Building Energy Watcher and others that could usefully contribute to implementation of the tasks assigned to WG 2 (see References for some of these programs).

WG2 needs to move quickly to identify suitable partners (companies/associations/research consortia) from the other sectors and, as appropriate, secure their engagement in implementation of the roadmap's tasks. If WG2 is going to base its activities on a snapshot of cities, as is suggested in the draft Terms Of Reference for the ICT4EE Forum, then this needs to be taken into account when selecting partners.

An analysis of the barriers to ICT application in the targeted sectors could usefully serve to prioritize sectors and opportunities suitable for the subsequent quantifiable case studies.

WG2 needs to refine the relevant components of the ICT4EE current roadmap referring to ICT's enabling effect and make it more cohesive addressing the prioritization of tasks, reporting procedures and the management of WG2 deliverables. Appendix 1 provides suggestions as to how WG 2 might begin to shape its tasks. WG2 will need to develop the requested joint roadmaps including time-bound work plans, as well as monitoring and verification plans.

4 Further references

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Appendix 1: ICT in other sectors – Shaping the tasks


The table below is a proposal from the panel of experts as to how WG2 might begin to shape its tasks going forward. We provide this as a hopefully helpful suggestion to assist them in their work .

	Buildings and Construction	Power Supply	Transport and Logistics
1. Identify Goals (up to 2030)	Design and operation of all new buildings optimized for maximum energy efficiency.	Significant reduction in fossil energy consumption attributable to personal automobile transportation through large-scale penetration of electricity-powered mobility from renewables.	
	Integrated smart grids and smart buildings allowing grid intelligence to directly control dwelling appliances. BMS with Central control of energy use (HVAC and lighting systems ...) in multiple commercial buildings. Autonomous sensors available at reasonable cost		Widespread congestion and transnational freight charges systems. Possibility of minimum energy consumption attributable to individual traveler through dynamic multi-modal journey planning.
	Availability of standardized buildings design and planning tools covering all aspects of energy efficiency	Carbon-neutral grid operation. Distributed Generation. Minimized T&D losses. Fully integrated and managed renewables.	
2. Identify the barriers/constraints to the achievement of the above goals.	Fragmented market (many small enterprises). Conflicting interests. Lack of knowledge. Not an industry priority (current inappropriate business models). Commercial value of energy data.	Requires radical, long-term and expensive change in legacy network infrastructure, (which is, in any case, rapidly aging). Resistance to intermittency of renewables on the part of national utilities. Urgent need for harmonization of ever proliferating standards to ensure interoperability.	Public acceptance

<p>3. Agree on the key stakeholders that need to be actively engaged in WG2 representing each of the three sectors. (2010)</p>	<p>To include: Researchers, Construction companies, A&E's. HVAC equipment suppliers, municipal planning authorities. Power distribution companies</p>	<p>To include: Researchers, Utilities. Regional Power Supply organizations. Distribution companies. Dispatch Centers. Government Regulators.</p>	<p>To include: Researchers, Logistics service providers, Logistics users, National, regional and municipal transport authorities.</p>
<p>4. Agree the immediate priorities to be addressed by WG2 (2010)</p>	<p>Inventory of current work by others. In cooperation with the appropriate sector organization (and concerned municipal authority if appropriate), develop roadmap for implementation of first incremental step (one or more demonstration projects resulting in quantifiable case studies)</p>		
<p>5. Design Case Studies and in particular select methodology to assess/quantify impact of ICT enabled intervention in other sector. (2011)</p>	<p>The methodology should take into consideration the calculation of the net effect of increased ICT application in the sector selected for the case study. (Deliverable 3 from the ITU Focus Group exercise offers some methodological considerations for the quantification and reporting of ICT's impact on other sectors). The selected methodology needs to consider:</p> <ul style="list-style-type: none"> - Direct energy consumption of ICT use (e.g. energy attributable to accelerated deployment of smart meters, increased data processing requirements, data centers, networks etc.). <p><i>Note: Comments in the foregoing sections of this report concerning estimation of ICT's own energy use/emissions, consideration of life-cycle carbon emissions of ICT products and the standardization of measurement are applicable here.</i></p> <ul style="list-style-type: none"> - Reduced indirect energy consumption attributable to ITC application (e.g. from buildings with smart metering). - The BAU or baseline case (without the ICT intervention). 		
<p>6. Implementation of quantifiable case study (initial priority intervention) (2011 – 2012)</p>	<p>Likely candidate: Smart metering, Comfort level sensors (possibly in an institutional setting such as social housing, hospitals)</p>	<p>Possible candidates: Time-variable congestion charges. GPS/Galileo-based toll-collection. Accelerated penetration of video conferencing and teleworking incl. telemedicine, e-learning etc.)</p>	

Appendix 2: ICT4EE Forum - Panel of Experts Profiles

<p>Lorentz Erdmann</p>	<p>Institute for Futures Studies and Technology Assessment (Germany)</p>
	<p>Lorentz Erdmann works at the Institute for Futures Studies and Technology Assessment GmbH, Berlin (IZT) as project manager since 1999. He graduated in Environmental Engineering (MSc) at the Technical University of Berlin with a Life Cycle Assessment on electricity supply systems.</p> <p>His main research area is “sustainable economic activities”. Main topics include “Sustainability and Information Society”, “Technology Assessment of ICT”, “Environmental Impact Assessment”, “Sustainable Management of non Renewable Resources”, "Roadmapping" and “Foresight Studies”.</p> <p>He is regularly advising international and national organizations, including the European Commission, the OECD, the German Parliament, the German Ministry of Education and Research and the German Ministry of Economics and Technology; as well as trade associations such as BITKOM and ZVEI.</p>
<p>Dr. Robert Williams</p>	<p>Energy Efficiency Expert</p>
	<p>Bob Williams was with the United Nations Industrial Development Organisation (UNIDO) in Vienna, as Chief of the Energy Efficiency Unit. He retired in October 2009.</p> <p>His unit developed and manages UNIDO’s program of technical and policy support designed to accelerate energy efficiency in developing and transition – economy countries. This involves preparing government authorities and industries for the launch of international energy management standards and promoting industrial energy management.</p> <p>Bob spent 35 years working on both renewable energy and energy efficiency. He joined UNIDO in 1985 and held senior positions as Deputy to the Director of the Industrial Energy and Climate change Branch, Officer-in-Charge of Kyoto Protocol Branch and Officer-in-Charge of Environment Coordination Unit. He holds a PhD from the University of Wales.</p>

Kevin Houston	Carbon Masters
	<p>Kevin Houston is a founding partner of Carbon Masters a carbon management consulting company (www.carbonmasters.co.uk). He recently obtained an MSc in Carbon Management from Edinburgh Universities landmark Carbon management programme. Kevin came to Edinburgh in 2008 following an extensive management career in Consulting with IBM and Price Waterhouse Coopers.</p> <p>Prior to that he had a 25 years career with Procter & Gamble including 6 years of International assignments in Turkey and Germany. As a senior consultant he has led and delivered strategy and performance improvement projects with companies like Unilever, Diageo, Nestle, Cadbury, Heineken...</p> <p>His current research interests focus on the carbon emissions from ICT in general and how ICT can be used to dematerialise transport, reduce business travel costs and carbon emissions</p>

Simon Forge	SCF ASSOCIATES Ltd
	<p>Simon Forge has worked for over 20 years in the information industries, managing a wide range of assignments in strategy, marketing and business planning in telecommunications, software and computer systems in many countries. He works on strategy formulation, marketing and business planning, by assessing the impacts of technology, regulatory policy and commercial issues. He has created tools and used current tools for forecasting and data gathering for strategic and tactical decision taking. He has managed both multiple global and single teams, either implementing specific large-scale projects, or advising on corporate strategy or government policy.</p> <p>Most recently, he authored the report "<i>A Green Knowledge Society - An ICT policy agenda to 2015 for Europe's future knowledge society</i>" for the Swedish Presidency. He has Bachelor's, Master's and PhD degrees in Engineering from the University of Sussex, UK.</p>