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COMMISSION STAFF WORKING DOCUMENT

Accompanying the

COMMISSION RECOMMENDATION

on mobilising Information and Communications Technologies (ICT) to facilitate the transition to an energy-efficient, low-carbon economy

IMPACT ASSESSMENT

{C(2009) 7604 final}
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1. SUMMARY OF CHANGES SINCE ORIGINAL SUBMISSION

1) In their opinion of 27 October the Impact Assessment Board (IAB) requested a re-submission of the Impact Assessment on "ICT and energy efficiency" for the following main reasons:

- The report should incorporate ongoing developments in the baseline and clarify in which respects current policy instruments are inadequate

- The report should specify the concrete actions that will be taken in the various options

- The report should present not only benefits but also costs

- A final criticism, given orally at the hearing, was that the document should be written in a more clear and non-technical language.

- The present draft addresses the comments of the Board in the following manner:

- With respect to the first point, the new draft of the Impact Assessment clarifies that the proposed initiative intends to be complementary to the existing and proposed policy initiatives in the area of energy efficiency. The problem definition section (2.2) explains that the current progress towards the 2020 energy efficiency target is so far slow and that the potential of ICT in enabling more significant improvements in energy efficiency is still largely unexploited on a mass scale. Also, while the current regulation in the area focuses on individual products or components, ICT can provide a systemic view of energy use and provide tools for better visibility, measurement, control and management of energy consumption. Section 2.3 provides references to the existing policy initiatives and clarifies in what ways the present initiative can complement those.

- The existing and proposed policy initiatives under the reviewed Energy Efficiency Package[1] form part of the baseline Option 1 (see Section 4.1) together with the existing voluntary commitments, agreements and initiatives undertaken by industry, cities and regions. Assessment of Option 1 addresses the question why these initiatives, while they are very valuable and go in the right direction, are unlikely to provide a systemic solution to the problem.

- With respect to the specification of concrete actions that will be undertaken in the various options, the current draft contains a more clear description of options 1, 2 and 3 and a more detailed assessment of possible sub-options under the Option 3. This approach has allowed a more rigorous appraisal of the concrete measures that could be recommended. Some sub-options that were previously envisaged have been discarded because they were found either potentially quite costly or difficult to implement in the short term.

- The assessment of costs has improved as it is now included in the assessment of all options and sub-options. It remains mainly qualitative and for most measures it is considered not very significant. Nevertheless, a new Annex IV provides examples of costs of smart meters and carbon accounting and foot-printing.

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[1] COM (2008) 772 Communication Energy Efficiency: delivering the 20% target

- With respect to the clarity of the report, some background information and evidence has been moved to the Annexes and effort has been made to provide a more clear structure of the main report summarizing the key points in graphs and tables.

- 2) Following the resubmission of the revised IA on 28/01/2008, the IAB delivered a second opinion in which it considered that, though the revised document addressed most of the recommendations previously made by the Board, the following points needed to be covered:

- The report should compare the chances of reaching the 20% target of energy saving under the baseline scenario and under the preferred option

- The report should specify the main actions that the Commission will take to support the implementation of the Recommendation

- In terms of procedure and presentation, Section 4, Section 5 and Section 6 of the report could be reduced in length and avoid duplication

- The present redrafted version addresses the comments of the Board in the following manner:

  As regards the first point, the risk of not achieving the 20% target in energy saving has been clarified by making explicit reference to the 13% attainable saving that is mentioned in the Commission Communication on energy efficiency. In fact, the Commission has acknowledged in November 2008 that "These measures should achieve energy savings of about 13% by 2020 if properly implemented by Member States. Even if this represents a major achievement, **this falls far short of what is needed".** Annex 1 to this Communication contains the list of the measures, with the respective contribution in percentage points. It is clear that the mentioned 13% is not a static number and the situation is constantly evolving - as new measures are implemented, these will translate in further efficiency and savings. Nevertheless, the opportunity to complement the existing measures and to speed up possible efficiency gains is beyond questioning.

In terms of the other side of this question - to know what will be the probable contribution of the proposed measures to achieving this target, "Assess the magnitude of the contribution", this point was addressed by referring whenever relevant to the studies that include the potential saving of ICT in certain domains and areas of activity. It is worth noting that the Recommendation aims precisely to have a decisive contribution towards making energy efficiency gains more accurately measurable. Nevertheless, according to the studies available, ICT-enabled improvements would represent a saving of up to 15% of total energy use by 2020. These savings have been identified mainly in the heating and lighting of homes and buildings; in more efficient electrical power grids; in better supply-chain management and transport logistics, and in manufacturing. All but the latter sector are addressed in the Recommendation.

> With respect to the second item, Option 3 now contains a brief description of the actions that the Commission intends to develop in order to create the best conditions for the full acceptance of and compliance with the Recommendations (see Point 4.3).

Finally, the last point was not considered as it would imply a major redrafting of the text and this did not seem useful at this stage.

2. BACKGROUND, CONTEXT AND CONSULTATION

2.1. Background and context

This Impact Assessment accompanies a proposal for measures to realise energy-efficiency improvements across the EU economy by unlocking the potential for faster development, deployment and take up of relevant innovations in information and communication technology systems and services.

On 13 May 2008, the Commission adopted a first Communication on ICT for energy efficiency[2] and drew attention to the potential for additional energy-efficiency improvements in ICT use, and through ICT-enabled innovations. This Communication initiated a consultation and partnership-building process with a view to identifying opportunities for EU measures, quantifying their potential cost and energy-efficiency benefits, and stimulating business-led and partnership initiatives which could be developed at EU-level.

2.2. Consultation and expertise

This impact assessment builds on an extensive contribution of an ad-hoc Advisory Group convened by DG Information Society and Media; on the results of an open on-line public consultation and the support and advice from Member States in the i2010 High Level Group.

Within the Commission, an InterService Group was set up in May 2008. It included representatives from ten DGs: RTD, TREN, ENTR, ENV, REGIO, MARKT, the SecGen, DIGIT, SANCO and the JRC. It met four times[3] and served to exchange information about the various policy initiatives already in place and in preparation; to co-ordinate the analysis of opportunities and to review this impact assessment in its earlier versions. The work of this InterService group and the necessary contacts that have been taken at the working level with the different DGs concerned has been an effective tool for ensuring that this initiative is in coherence with the overall energy efficiency policy framework.

The Impact Assessment also references the results of a number of studies, notably a study by BioIntelligence[4] commissioned by DG Information Society and Media, and the Smart2020 report[5], commissioned by the Global eSustainability Initiative (GeSI) of companies in the ICT sector and The Climate Group. Input has also been used from the parallel series of seminars organised by the International Telecommunications Union[6] and the OECD expert workshop

2 COM (2008) 241 of 13th May 2008: Addressing the challenge of energy efficiency through Information and Communication Technologies

3 28th May, 7th July, 3rd and 26th September

4 Impacts of information and communication technologies on energy efficiency: BioIntelligence service, in collaboration with the European Council for sustainable energy and the Fraunhofer Instiute, July 2008.

5 SMART2020: Enabling the low-carbon economy in the information age: McKinsey &co, for The Climate group and the Global eSustainability Initiative: www.smart2020.org

6 www.itu.int/ITU-T/climatechange.

on ICTs and environmental challenges[7]. Reference is made to the relevant external sources when their input is used in this Impact Assessment.

An on-line public consultation was launched on 20 May 2008 using the Commission's Interactive Policy-making tool (IPM). It closed on 21 July. Wide visibility was given to the consultation through the i2010 High-level group and the Advisory Group, and at a workshop hosted by the Committee of the Regions on 26 May. Over 400 responses were received. Around half of the respondents represented professional organisations and more than two thirds work directly with ICTs for energy efficiency. The conclusions in detail are included in the relevant chapters of the present Impact Assessment. In general, the results of the public consultation confirmed and supported the direction taken in the Commission's Communication of 13 May and provided input that is convergent with that provided by the ad-hoc advisory group.

The Advisory Group met 4 times; on 25 June, 24 July, 25 September 2008 and jointly with the i2010 High Level Group (Directors General responsible for Information Society policies in the Member States and EEA countries) on 18 November.

It included representatives of the main ICT-sector associations[8], of major ICT-user sectors, regional associations and leading academics. The Advisory Group was assisted by 6 thematic consultation groups addressing specific opportunity areas: Buildings, Lighting and Photonics, Manufacturing, Smart Grids, Road Transport and Structural Change. The input from these groups and from Members of the Advisory Group has been compiled into a report by an independent *rapporteur* and endorsed by the all group members.

The European Parliament responded to the invitation in the previous Communication and adopted an own initiative resolution which has been taken into account in the proposal. There has been ongoing consultation with the Committee of the Regions and the Economic and Social Committee, which adopted opinions respectively on 27 November and 4 December.

3. PROBLEM DEFINITION AND RATIONALE FOR INTERVENTION

3.1. What is the problem and what are the causes?

- ***Need to accelerate energy efficiency improvements – ICT can help***

- According to the latest Commission Communication on energy efficiency[9], most Member States are so far not on the right track to achieve the 20% energy efficiency target by 2020 and acceleration of efforts is needed. **The speed of energy efficiency improvements is absolutely crucial in the light of the global energy and climate targets.**

The Commission has put in place both regulatory and non-regulatory measures in the area of energy efficiency and continues to strengthen those measures. The renewed Energy Efficiency Package announced in the Commission Communication on energy efficiency will undoubtedly contribute to energy efficiency improvements but does not give a guarantee that the proposed measures alone will be sufficient to meet the targets. In its Annex 1, this

[7] May 2008, Denmark
[8] The European ICT Association (EICTA) and the American electronics Association (AeA)) and the Global eSustainability Initiative (GeSI)
[9] COM (2008) 772 Communication Energy Efficiency: delivering the 20% target

Communication gives a quantitative evaluation of the expected impact of some specific energy efficiency legislation and measures when fully implemented. It is also stated in this Communication that the Member States are implementing the legislation and it is therefore too early to assess the full impacts of such legislation. Nevertheless, it is clearly stated that "The energy saving potential is not being realised fast enough. These measures should achieve energy savings of about 13% by 2020 if properly implemented by Member States. Even if this represents a major achievement, **this falls far short of what is needed".**

- Moreover, the Package does not explicitly address the enabling potential of ICT in contributing to a more energy efficient economy. There is therefore an opportunity to **complement** the existing measures, extend the potential for energy efficiency improvements and accelerate the change.

In addition, it has been noted that the quantitative information relating to energy-efficiency gains achieved and achievable through ICT is often inconsistent, relying on incomplete baseline data and varying methodologies. It is a major barrier to understanding energy end-use and a serious hurdle for policies aiming to deliver energy-efficiency. While the Commission is taking steps to address this challenge, ICT can nevertheless make an invaluable contribution to improving the reliability and comparability of data, beginning with its own processes. The data and information acquired can, in turn, be used to assess, in a transparent and verifiable way, its application to increasing energy efficiency across all economic and civic sectors.

- ICT-based innovations represent this untapped potential. Recent studies have identified many opportunities for the ICT-sector and ICT-based innovations to make a significant contribution to improving energy efficiency. These opportunities are however not being realised in the whole economy fast enough and on a mass scale. The problem that needs to be addressed is twofold:

- How can the change to a more energy efficient, low-carbon economy be accelerated through ICT in the view of the global 20% energy efficiency target by 2020?

- Why are we not seeing faster deployment of ICTs that could achieve these additional efficiency gains?

- The answer to the first question can be provided by the ICT sector itself: there is certainly a necessity for continued innovation based on research and development but many of the available and cost-effective technologies are (or can be made) commercially viable in the near future. There are many examples of ICT tools and technologies that can render whole systems and complex processes more energy efficient. The key point is that ICT can provide a **systemic solution** and therefore it is a powerful enabler of change. The EU has legislation in place improves energy efficiency of individual products (light bulbs, electric equipment in stand-by mode, televisions, etc.) but the overall energy savings depend also on how the equipment is used, how energy consumption in a system (a building, logistics chain, manufacturing process, a household, a city) can be effectively managed, monitored and controlled.

- The second question needs to be analysed in more detail in order to determine whether some kind of additional public intervention would be necessary or not. First and foremost, mass deployment of any new technology or tool takes time. Big technological revolutions happen in several stages and, from historical experience, that can take up to several decades. The importance of energy savings and climate change policies has risen only in recent years, the demand for tools managing and reducing energy consumption is still relatively low, although increasing. If the diffusion of ICT solutions for energy efficiency economy is left only to the market forces, there is a certain probability that it could happen anyway as energy prices increase and traditional sources of energy become scarcer. However, there is a high probability that these developments may not happen on a mass scale in the time-frame of the 2020 targets.

- It is therefore pertinent to ask what the obstacles are that hinder faster deployment of ICT-based innovations for energy efficiency in the short to medium term, how these obstacles could be removed and whether some form of public intervention can play a catalyzing role in this process.

- The initiating Communication, the subsequent consultations, external studies and this Impact Assessment focus on three distinct areas of opportunity and related challenges:

- Energy efficiency in the ICT sector itself

- ICT-enabled energy efficiency in major energy-using sectors

- Energy efficiency in the economy at large (consumers, businesses, communities, public administrations)

Energy efficiency in the ICT sector itself

ICT equipment and infrastructures use electricity as their primary form of energy, and represent some 8% of the total electricity consumption in EU 27[10]. The legislative environment, technological innovation and best practices are contributing to significant improvements in energy-efficiency and reductions in carbon emissions. However, as the range and penetration of ICT devices and services increases, its overall energy use is growing at a faster rate than such improvements can offset. 10.9% of EU 27 electricity consumption in 2020 is projected to be consumed by ICT. At the global-level, ICT energy consumption is expected to triple to over 3000 TWh/a by 2020, representing about 3% of total greenhouse gas (GHG) emissions in 2020[11]. Compensating for this rebound effect is critical to the success of ICT-based strategies to achieve energy savings and reduce carbon emissions. The potential for ICT to become *part of the solution rather than part of the problem* will depend on its capacity to minimise its own footprint; this includes its supply chain.

The following main obstacles to reducing energy use in the ICT sector can be identified:

Absence of commonly agreed measurement, quantification and management methodologies and tools, particularly for complex systems; risk of greenwashing: Annex V outlines a range of individual companies' commitments to making improvements. Nevertheless and as the annex highlights, the problem of making common, easily understood and measurable commitments remains. Some companies have chosen to commit to efficiency improvements; others to energy end-use reductions; others still to carbon emissions reductions. Baseline years do not always concur. There are different profiles within the sub-sectors of the industry itself. Chip manufacturers face much different challenges in controlling energy costs than do

[10] BioIntelligence study
[11] SMART2020

software companies, for example. In the absence of commonly agreed measurement methodologies and tools, there is a real risk of greenwashing - taking market share from solutions that offer legitimate benefits and thus slowing the penetration of real energy-efficient innovation in the marketplace. The establishment of a level playing field in therefore urgently required to promote legitimacy, transparency and real progress in energy efficient ICT and ICT for energy efficiency.

Investment problem: It has been shown that the real energy savings from ICT investments materialise not only by replacing or installing equipment, but in rethinking processes and systems and redesigning them on more energy efficient and sustainable patterns. This requires up-front investments for which the business case is not always clear - especially at a time of economic and financial uncertainty.

Interoperability and standardisation issues, slow innovation adoption: As noted earlier, demand for ICT tools for energy efficiency applications is still rather low and clearly at the "early adopter" stage. Reasons for this include insufficient awareness of these technologies; uncertainty about the effectiveness and durability of the new technology until it becomes mainstream; skills gaps and the fear of becoming dependent on a single supplier[12] until proper markets with multiple players develop. Interoperability has emerged as a major issue - especially in the case of buildings and smart metering[13]: without these issues being addressed it is possible that deployment in certain cases would result in encouraging supplier "lock-in" and a reduction of consumer choice. Some Member States have already moved forward and set their own timeframe for the rollout and even technical requirements of smart meters but, without a common functional specification, such measures may create technical barriers to interoperability.

ICT-enabled energy efficiency in major energy-using sectors

Recent analyses indicate that ICT-enabled improvements could reduce energy use and carbon emissions across all sectors of the economy by five- to ten-times[14] the footprint of the ICT sector itself which is currently estimated at around 2%. This would represent a saving of up to 15% of total energy use by 2020. These savings have been identified mainly in the heating and lighting of homes and buildings; in more efficient electrical power grids; in better supply-chain management and transport logistics, and in manufacturing. A fuller analysis, sector by sector, is to be found in Annex II.

The main obstacles to reducing energy use in these sectors through ICT tools and services are the following:

Absence of commonly agreed measurement, quantification and management methodologies and tools, particularly for complex systems: Similarly to the ICT sector, this obstacle impedes widespread take-up of ICT tools in many sectors. Many ICT monitoring, auditing and design

[12] A "lock in" situation can result for ICT users if substitute or alternative solutions are not interoperable. Similarly, the cost of migration can be high if an ICT solution is tied to one provider only. Both situations impede competition unfolding to maximise its beneficial effect.

[13] Smart meters are integral to the power delivery system, allow for bi-directional communication, audible warnings of peak load (and charging) times and feed-in enabling for "consumers" who also generate

[14] The Smart 2020 report estimates a potential of 5-times the ICT-footprint, globally; The BioIntelligence study also estimates potential saving of about 5-times the ICT-footprint under the eco-scenario to 2020, and the Report by the American Council for an energy-efficient economy for the AeA estimates up to a 10-times saving: http://www.aeanet.org/EUenergy

tools already exist but common approaches adapted to the specificities of each sector have not emerged yet.

Absence of cross-sectoral partnerships: As with previous "IT" and "computerisation" revolutions, to develop its full potential, the process of deploying ICT solutions in other sectors requires wide stakeholder involvement and the development of new partnerships between the ICT solutions providers and the client sectors. These partnerships remain rather fragmentary and under-developed.

Lack of awareness and visibility of information: Precise information about energy use is the condition for managing energy costs. The lack of common monitoring and measurement systems (ICT-enabled) and information aggregation and reporting systems (software-based) inhibits the taking of better informed business decisions which fully take into account the growing importance of energy costs. Where clarity and visibility of actually energy usage is absent, it become very difficult to deploy ICT (and other) solutions to exploit energy savings potential to the maximum – either by isolating particular energy inefficient processes or by more fully re-engineering business practices.

Investment problem: The problem of up-front investment has been already explained above. This problem is further exacerbated by principal-agent problems in some sectors (e.g. buildings), where investment is not made by the ultimate beneficiary, which reduces or removes the incentive for investment. The principal-agent problem refers to the situation where those who might invest in particular energy efficiency measures are not those who would be the direct beneficiary of any resultant savings.

Interoperability and standardisation issues, slow innovation adoption

Other obstacles: For example, lack of skilled technicians and IT specialists in some sectors who would be able to integrate energy efficient tools and technologies in the specific and often very complex systems in those sectors.

Energy efficiency in the economy at large

ICTs have demonstrated in the course of the past 20 years their capability to induce fundamental and long lasting changes in business and society: new lifestyles, products and services, new business models, ways of working and market structures. The challenge is now to ensure that further evolution is directed towards energy-efficient growth and the realisation of a sustainable information society[15]. If ICT sector can manage its own energy footprint and enable the reduction in the often complex systems in the energy-using sectors, it can ultimately facilitate a major **behavioural change** in the whole economy.

> The key obstacles preventing a structural and behavioural change in the short to medium term are similar to those described above for the ICT sector itself and for other energy using sectors:

Lack of awareness, visibility and information about energy use: Citizens, businesses, cities and public administrations need access to ubiquitous, systematic and near real time information about the magnitude, sources and efficiency profiles of their energy use to be able

[15] IMRWolrd Global eIntelligence report: Thinking about the e-green myth. http://www.imrworld.org/product.php?id=121&brand_id=&brand=&cat_id=68

to make energy efficient choices. However, such access is not generally available. This results in a lack of "empowerment" to act.

In the case of *citizens*, real time feedback alone to consumers on their rate of energy consumption has been shown to lead to dramatic behaviour changes[16]. The introduction of smart metering would not only provide real-time information to consumers but also the possibility of enabling better management and control of electricity consumption by users and suppliers. However, smart metering is still a rarity in the EU, which is partly due to the interoperability problems and lack of common functional specifications mentioned earlier.

Public administrations at all levels generally do not have a systematic overview of their own energy consumption and carbon footprint. Cities, for example, represent more than 75% of total energy use and are extremely complex and multi-dimensional physical, social and economic structures. Local government authorities have the means to directly influence their own consumption and that of those businesses and households located on their administrative territory. These include the public buildings and public spaces constructions, renovations, and in many cases, public utility networks transportation systems. The energy efficiency imperative now makes it necessary to adopt a systemic approach to all aspects of urban planning, operations and service provision. Energy use patterns and profiles are not currently visible to users and decision makers because sophisticated simulation, planning and footprinting tools are not systematically used.

Limited use of green public procurement: “GreenIT“ strategies and procurement criteria have been developed by some Member States and several EU policy instruments call for mobilising public procurement. However, they focus on national administration level. Mandatory Public Procurement criteria would still apply only to certain equipment types. There is however significant potential for green public procurement also at the regional and local level and in big private businesses.

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16 HEAT (Household Energy Awareness Technologies) Project, Finnish Environment Institute, and others

Hierarchy of problems and causes/obstacles:

Note: The obstacles are not matching the problems in a one-to-one relationship; it is the various combinations of them which lead to the observable problems

ICT sector and its own energy use

Limited use of ICT solutions in major energy using sectors

Untapped potential of ICT for energy efficiency in the economy at large

OBSTACLES

Weak co-ordination and partnerships in the ICT sector and across sectors

Lack of awareness, visibility and information about energy use

Upfront investment and principle agent problems

Absence of commonly agreed measurement, quantification and management methodologies and tools, particularly for complex systems; greenwashing

Interoperability and standards, risk of lock-in

Limited use of green public procurement

3.2. Problem focus of this Impact Assessment

This proposal on its own cannot eliminate all the above mentioned problems; it is intended to be enabling in its objectives and actions and fully complementary to other EU and Member State policies in areas such environment energy, climate, industry, research and innovation policies.

There are problems which this initiative cannot directly address, such as certain investment and "agency" problems. These are nevertheless alluded to both for completeness sake and because there is evidence[17] that creating greater transparency in respect of energy usage leads to improvements in these two areas.

The key problem that this impact assessment will address is the lack of awareness of, information on and visibility of energy use across all sectors of society coupled with inadequate measurement and quantification capabilities in respect of energy use. This is the area where ICT can provide its most useful contribution not only in the ICT sector itself but also in other sectors of the EU economy. The impact assessment will also attempt to address the related issue of fragmentation and under-development of partnership initiatives between the ICT sector and other sectors and thus indirectly address the problem of technology fear, slow innovation adoption and interoperability.

3.3. Existing policy responses to challenges

It is important to recognise that the existing regulatory and non-regulatory measures at the EU and Member State level undoubtedly contribute to a more energy efficient economy but the ICT sector, through application of innovative ICT solutions for measurement and management of energy consumption, can facilitate and accelerate that change. In that sense, the current initiative is *complementary* to the existing policies.

The complementarities and synergies are further explained in more detail with regard to concrete initiatives:

The Action Plan for Energy Efficiency[18], the Energy Services Directive[19], the proposal for the Liberalisation Directive[20] and the Directive on energy security[21] all emphasize the importance of transparency regarding consumer energy usage. Member States, however, have considerable latitude in implementation. The last Communication on energy efficiency[22] clearly states that there is a real risk of falling short of the global target of 20% energy savings by 2020. Furthermore, none of these instruments requires any "intelligence" to be added to the metering or monitoring of energy usage.

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17 OECD

18 COM(2006)545 Communication Action Plan for Energy Efficiency: Realising the Potential

19 Directive 2006/32/ECof the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services

20 Proposal for a directive amending the Directive 2003/54/EC concerning common rules for the internal market in electricity, COM (2007) 528

21 Directive 2005/89/EC of the European Parliament and of the Council of 18 January 2006 concerning measures to safeguard security of electricity supply and infrastructure investment

22 COM (2008) 772 Communication Energy Efficiency: delivering the 20% target

Eco-Design of Energy-using Products Directive, the eSTAR[23] initiative and other existing voluntary initiatives by the ICT sector are extremely valuable initiatives and address, inter alia, certain ICT products. However, the main technology focus of this impact assessment is on system-level energy savings as opposed to single products or components. The systemic view and the attempt to tackle the problem of real-time and visible measurement of energy use are clearly complementary to what these initiatives and legislative frameworks are already doing at the level of individual products. For example, the Eco-Design Directive and the Energy Labelling Directive will increase energy efficiency of products such as light bulbs, electric equipment in stand-by mode, street and office-lighting equipment, etc. However, the overall energy use or consumption reduction depends also on how these individual pieces of equipment are used in a system (households, businesses, cities, etc.) The problem definition of this impact assessment argues that ICT can help tackle this particular part of energy use by providing the necessary measurement tools.

Energy Performance of Buildings Directive is not explicit about ICT's role and any enhancement that the present initiative can bring is clearly complementary. Again, this Directive provides a framework for concrete measures and requirements concerning new buildings and buildings that undergo major renovation (energy performance certificates, regular inspection of heating and air-conditioning systems, etc.). ICT can facilitate implementation of this directive and enable even further cuts in energy consumption of the current buildings stock e.g. through embedded intelligence and networked controls, ICT systems enhancing heating, ventilation and air-conditioning, and integrated building management systems.

Sustainable Consumption and Production Action Plan's[24] overarching objective of empowerment for better choices, continuous improvement through innovation and stimulation of demand. This activity promotes consumer empowerment through inter alia energy and resource-efficient consumer products, mandatory labelling under the revised Ecodesign directive, incentives and public procurement and the creation of a “Retail Forum” to improve large retailers’ environmental performance, promote the purchase of greener products and better inform consumers. ICT can be a key enabler in realising these ambitious goals. A second major priority of the Sustainable Production and Consumption and Sustainable Industrial Policy Action Plan is *promoting leaner production* where additional ICT contributions will be particularly important in areas such as: developing targets and *tools* to monitor, benchmark and promote energy efficient production, the analysis and modelling of barriers to the expansion of eco-innovations and to their full uptake by other sectors and not least in facilitating and promoting environmental performance in SMEs through customized advice.

The EU Green Public Procurement (GPP) framework is a continuous platform for exchange including mandatory eSTAR criteria for public procurement of office equipment. The latter focuses on the equipment level and on the equipment's own energy use. The framework includes national administrations only.

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[23] The European Programme Energy Star (eSTAR): A Regulation that requires EU institutions and central Member State government authorities to use energy efficiency criteria no less demanding than those defined in the ENERGY STAR (US) programme when purchasing office equipment: www.eu-energystar.org

[24] COM(2008) 397/3 Communication from the Commission on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan

3.4. Justification for EU intervention – subsidiarity and EU added value

The challenges are cross cutting, trans-border and indeed global: the energy efficiency issue is one of the main planks in the EUs climate and energy strategy to 2020 and is at the top of the political agenda. There is a growing understanding that the problem is urgent and that all means need to be mobilised and mobilised quickly to reverse recent energy consumption and emissions trends.

Problems persist in all Member States: Even in the Member States that have made the most progress and individual efforts in support of the energy efficiency goals, the market is visibly not remedying the obstacles identified fast enough. Under these conditions, common efforts at the European level are necessary and can facilitate the emergence of the framework conditions for economies to integrate energy efficient solutions in production processes and business and consumer consumption patterns.

Multi-stakeholder action needed: The problems identified cannot be remedied by the EU or Member States alone; not only does cross border action need to be stimulated but industry, cities and civil society has to become engaged as well.

Leadership: It is acknowledged that international institutions have a role to play in providing independent platforms for exchange for stakeholders and assuming the crucial leadership role. In the current context there have been explicit calls from industry for EU leadership.

Economies of scale and scope: European co-ordination could offer synergies between actions at Member State and regional levels. As shown by the evaluation[25] of the National Energy Efficiency Action Plans, there are significant variations among Member States in preparedness and ability to take action. Therefore, sharing replicable solutions and building on each others' work and experience can be beneficial. The need for sharing best practices and reflecting on and possibly undertaking common measures has been confirmed by the representatives of the Member States participating in the i2010 High-level group, which provides a forum for open co-ordination of the Member States Information Society policies.

Internal Market: Commonly agreed methods in some areas (e.g. metrics for efficiency or calculation of carbon footprints for comparability among Member States) and standards (for reducing equipment cost and enhancing interoperability) would increase the transparency of cross-border flows of products and services.

ICT solutions will not only improve energy efficiency, they will also stimulate the development of a large leading-edge market for ICT enabled energy-efficiency technologies and software that will foster the competitiveness of European industry and create new business opportunities. Therefore providing public incentives and the right framework conditions for the take-up of innovative ICT enabled energy efficiency technologies will be of the utmost importance and will ultimately support the core strategic goals of European industrial, environmental and research policy.

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25 http://www.energy-efficiency-watch.org/fileadmin/eew_documents/Documents/Results/EEW_Press_Release_1_-_June_2008.pdf

4. OBJECTIVES

Global and specific objectives

The measures considered in this impact assessment are a complimentary contribution to the broader objectives of the EU in the area of energy and climate, notably to contribute to energy security and a 20-30% reduction in green-house gas emissions by an improvement in energy efficiency by 20% by 2020.

Therefore, measures are intended to leverage ICT in order to contribute to the Action Plan for Energy Efficiency and the Sustainable Consumption and Production Action Plan through wider and faster take-up of ICT-based innovations both within the ICT sector itself, in other major energy-using activities and through taking the first steps (measurement and awareness) in enabling a structural shift to an energy-efficient, low-carbon information society.

- The global objective can be translated into three specific objectives tackling the key areas where progress can be made. The following three specific objectives have been identified:

  Address energy use and emissions reductions in the ICT sector itself

  Address the potential of ICT for energy efficiency across major energy using sectors

  Encourage an enduring shift in the behaviour of consumers, businesses and communities

  The section below provides more detail on each of these objectives, linking them back to relevant sections in the problem definition and splitting them further into more detailed operational objectives.

4.1. Operational objectives

- **Address energy use and emissions reductions in the ICT Sector itself**

As explained in the problem definition, the ICT sector is projected to growth further in the future and has therefore a specific interest in managing and controlling its own energy and carbon footprint. Moreover, given the innovation and technological capability of the ICT sector, it is well placed to show leadership to other sectors and use the ICT-based tools and solutions in its own business operations. The operational objectives in this area would therefore be as follows:

- Support and reinforce industry-led initiatives aiming at establishing common **energy efficiency measurement methods, metrics,** benchmarks and improved energy-efficiency in the complex ICT systems – including supply chain activity.

- Encourage industry in the **ICT sector** to reduce its own energy use and carbon emissions

Address the potential of ICT for energy efficiency in major energy using sectors

Businesses in all sectors of the economy need to start becoming aware of the need to visualise, measure and quantify energy cost and deploy the tools that provide them with precise energy consumption information. These calculations form the basis for better management of energy and are the pre-condition for running automation tools and simulation design software. The operational objectives under this heading therefore focus on tackling those problems:

- Encourage ICT solutions providers in partnering with energy using sectors in order to provide solutions based on commonly adopted methodologies.

- Promote the use of measuring, management, control, design and reporting ICT tools in major energy using sectors

Encourage an enduring shift in the behaviour consumers, businesses and communities

Energy efficiency has started to become an issue beyond the political and can be a key trigger for behavioural change for businesses and citizen. Awareness needs to be developed of ICT's potential role to support and enable this change: change in awareness leading to change in behaviour. Pioneer, regional and local authorities and cities could take the first step to engage in this process:

Encourage regional and local authorities and innovative **city initiatives** where ICT innovations could play a lead role in exploiting the possibilities to track, control and manage energy usage.

Strengthen the demand side for ICT for energy efficiency innovations

Advance the deployment of ICT solutions for citizens such that they reflect information about actual energy consumption and costs including real time energy use visibility

4.2. Consistency with other EU policies and objectives

The operational objectives are intended to be complementary to and consistent with the Union's Climate and Energy policy, the Sustainable Development Strategy (SDS) and Lisbon goals. They are in the mainstream of Information Society Policy generally and especially the mission to encourage the widespread availability and accessibility of ICT-based services, *especially those that have the greatest impact on the quality of life of the citizens.*

The operational objectives contribute both in terms of the economic stimulus and environmental commitments entered into by the Member States in the conclusions of the December 2008 European Council. The objectives are essentially "enabling". Consistency of these operational objectives with other EU policies and objectives has been checked with other services of the Commission (DG TREN, DG ENTR). As presented in Section 2.4, the objectives of the current initiative are complementary to those of the other EU policies.

5. POLICY OPTIONS

Four broad policy options have been considered. They are described below and are compared in section 5. They represent different approaches and also different policy instruments. One of these approaches is chosen as a preferred one at the end of section 5 and analysed and assessed in more detail in section 6. To this end, sub-options within the preferred option are identified. Because the effectiveness of the broad options and also sub-options depends on the degree of engagement of the business community and civil society, the description includes an indication of the support expressed for their key elements in the Consultation process.

5.1. Option 1: Status-quo (no further EU action)

This option is the reference against which others are compared. It assumes no further measures, either within existing EU intervention frameworks, by business or civil society beyond those taken up to early 2009. As presented in Section 2.3 of this impact assessment, there are number of policy interventions already in place or proposed in the area of energy efficiency. These mostly focus on individual products, components or equipment but not specifically on some of the problems identified in this impact assessment. It is assumed in this option that these initiatives will continue and that the relevant EU directives will be updated as planned in the latest review of the Action Plan for Energy Efficiency and the Sustainable Consumption and Production Action Plan.

In addition to the policy interventions already in place or proposed, there are a number of voluntary agreements and commitments ongoing driven by various industry groups and associations as well as regional, local city and even international initiatives. These voluntary initiatives are listed below:

Voluntary initiatives in the ICT sector:

- Climate savers computing initiative (Intel, HP and others)[26]
- GeSI – Global eSustainability Initiative[27]
- AeA, American Electronic Association "Helping the EU achieve its 20% targets"
- EICTA, European Information and Communications Technology Association "High Tech, Low Carbon Economy"[28]
- BASDA and AFDEL (business application software developers associations in the UK and France) "green charter" initiatives
- Cisco and others "Connected Urban Development"
- Besides these voluntary initiatives by different industry groups, concrete commitments of some individual companies in the ICT sector exist, as documented in the Smart2020 study. Annex V of this impact assessment presents these individual commitments.

Voluntary initiatives at the regional, local and city level:

- The Eurocities declaration on climate change
- The Covenant of Mayors
- The UK Greenshift and the French TIC 21 initiatives

Measures have been already taken within the i2010 policy framework and the EU programmes for research to support the realisation of energy efficiency gains through ICT-based innovations. For example the ENERGYSAFE project in the 6th Framework Programme as well as other research actions in the IST Thematic priority have contributed to opening

[26] Started by Intel and Google, but now with a much wider participation. Participants in the Climate Savers Computing Initiative, computer and component manufacturers commit to producing products that meet specified power-efficiency targets, and corporate participants commit to purchasing power-efficient computing products.

[27] GeSI is a global partnership of ICT companies that promotes technologies for a sustainable development.

[28] http://www.eicta.org/index.php?id=32&id_article=223

opportunities for greater energy efficiency in buildings and lighting. In the 7th Framework Programme, the ARTEMIS JTI[29] has a priority research topic within its work-programme on embedded systems to support energy efficiency in buildings. The ICT Policy Support Programme[30] launched an EU-wide thematic network to exchange experiences in deployment of ICT-based innovations for energy efficiency and to build partnerships for ICT-enabled energy efficiency in cities and regions.

The OECD, EPC, CEPS have all prioritised ICT for energy efficiency in their work from 2008 onwards. The ITU, CEN, CENELEC are also increasingly focused on the area. Development of Member State initiatives has been patchy – with some more advanced Member States having adopted explicit policies[31], but with the general picture one of slow progress.

5.2. Option 2: Stronger collaboration and partnership within existing frameworks - highlighted in a second Communication

- A second policy option could be to use existing policy and intervention frameworks to strengthen collaboration between Member States and local authorities, and partnerships between different business sectors and in Public-private partnerships. This could be highlighted in a further Communication**.** The focus would be on strengthening research, and building on the opportunities for pre-commercial public procurement within the i2010 policy framework. The margin for leveraging significant *new partnerships* or extending influence beyond current constituents would be relatively limited.

- The main existing frameworks at the EU level where partnerships and collaboration can be further strengthened include in particular:

- The ICT Thematic Priority in the Framework Programme and the ICT Policy Support Programme (ICT PSP) within the Competitiveness and Innovation Programme (CIP):

  - Across the sectors of application and for real-time monitoring of energy-use, provisions could be made in the 7th FP and in the ICT PSP of the CIP to establish interoperation protocols for networked systems of ICT-enabled energy-use monitoring and management, and to support large-scale demonstrations and the exchanges of best practices across the EU.

  - For energy use and carbon reporting, the RTD and CIP frameworks could be used to develop consensus on codes of practice for wide-scale use of ICT systems for monitoring and reporting energy-use in companies (including SMEs) and public administrations.

  - The CIP programme could be further exploited to access local and regional authorities and promote ICT tools to improve energy efficiency.

  - To reinforce and co-ordinate industry-led initiatives for improved energy-efficiency in complex ICT systems and services, RTD on “future networks” and on “next

[29] https://artemisia-association.org/

[30] within the new Competitiveness and Innovation Programme

[31] The Netherlands has undertaken to reduce emissions from the sector by 20% by 2020 using 2005 as the baseline year.

generation components" for ICT systems have been identified as key themes for the ICT thematic priority in the 7th FP in 2009-10. A stronger focus on energy-efficiency could be developed within these themes and perhaps even more broadly.

- The i2010 policy framework:

  - The i2010 framework could bring together all three parties in partnership at the EU-level perhaps under a new Flagship initiative to strengthen partnerships for ICT-enabled structural change towards more energy-efficient cities and regions, and facilitate exchanges of best practice.

  - Research support could be used to develop consensus on protocols for energy-use monitoring at city and regional-level, and to demonstrate ICT-based strategic-planning and monitoring tools for consistent energy-use tracking and reporting.

5.3. Option 3: Commission Recommendation on mobilising ICT to facilitate the transition to an energy-efficient, low-carbon economy

A third option would be to go beyond the co-ordination possibilities of existing policy, research and innovation frameworks to identify a number of actions, possibly in the form of recommendations addressed to a wider range of key stakeholders including notably the ICT sector and major energy-using sectors, as well as public authorities in the Member States at various levels of government (regional local). The Recommendation would also identify supporting measures which the Commission can put in place in order to facilitate the implementation of the recommendations and leverage the impact of the stakeholders' initiatives. These supporting measures would be highlighted in an accompanying Communication.

Under this option, the Commission would propose to address stakeholders in the three key areas identified in the problem definition:

- A set of recommendations addressed to the ICT sector in order to measure, control and manage its own energy footprint and encourage it to take a leading role in developing energy efficient solutions.

- A set of recommendations addressed to the ICT sector to establish partnerships with other major energy-using sectors, i.e. buildings and lighting, manufacturing, logistics and transport and electrical power grids. Recommendations would focus on those issues where quick gains could be achieved first to exploit their exemplary value. They would encourage partnership building across sectors and with the ICT sector and stimulate adoption of common measurement, control and management tools for energy use.

- A set of recommendations to catalyze a wider structural change in the economy at large; i.e. beyond the ICT sector and other major energy using sectors. Recommendations would be primarily addressed to Member States and to their local and regional authorities. The key idea would be to help "empower" the public and private actors, notably public administrations at all levels as well as citizens and businesses, to allow them to make informed choices about their energy use and management and to provide them with the tools to measure and control their energy consumption.

The accompanying Communication would address the following issues:

- Use of regional funds for measures supporting energy efficiency and sustainability. As regional funds can be used for ICT infrastructures, innovation and energy efficiency, the Commission, in collaboration with the Committee of Regions and other stakeholders, would complement the recommendations to the local and regional authorities with practical guidance on how they can better exploit ICT to reach better energy efficiency.

- Support for broadband infrastructures. The Recovery Plan approved by the European Council in December 2008 includes a major budgetary stimulus for development of broadband infrastructures which will open up opportunities to connect communities and innovative businesses.

- Support the implementation of the recommended measures. The Commission would act as a facilitator of discussions and partnership building among the relevant sector associations. An independent review group would be put in place to assess progress, recommend actions and advise on future initiatives.

In more concrete terms, as explained in the Explanatory Memorandum that accompanies the Recommendation, the Commission will kick-start the process and will assist in the setting-up of the ICT for energy efficiency Steering Group.

Further to this, the Commission will:

– Facilitate and contribute to improved collaboration between public and private stakeholders, where necessary, to reach the required objectives;
– Ensure the monitoring and follow-up of the Recommendation as well as the assessment of the progress of the sectors involved against the recommended measures and any relevant targets set;
– Explore the possibilities of creating a European web portal that will serve as an open information and communication platform for the exchange of best practices, knowledge and experience on the use of ICT for energy efficiency purposes.

The Commission will make the review exercise proposed in the Recommendation in 2012 and publish its results.

In addition, the Commission will continue to propose that related research be financially supported via its various programmes.

5.4. Option 4: Regulatory or legislative measures

There have been no calls for option 4: a regulatory approach to achieve the objectives. A regulatory approach would inevitably impose a greater cost and administrative burden, notably on SMEs, and could unhelpfully constrain developments in a highly innovative field.

Beyond the regulatory measures already undertaken or planned by the Commission, as detailed in previous sections, there is only limited room for further legislation for the following reasons:

- Not all the objectives can be achieved by regulation (it is not possible to regulate the establishment of partnerships), therefore, this option cannot be a standalone option and would have to be complemented by additional measures.

- Certain aspects of standardisation and/or openness of systems could be mandated for some specific industrial tools and application areas. However, and in accordance with the Commission's general standardisation policy whereby this task is devolved where possible to industry and standards organisations, this is not an option to be considered in the immediate future. In the long term, however, if no visible progress has been made, this option could be reconsidered.

- The philosophy of this initiative is to draw the attention to the systemic view of energy efficiency and ICT's potential enabling role as opposed to mandating or regulating for product or equipment level energy efficiency improvements. As every sector, system and context is different, regulation cannot be generalised.

- Many of the above mentioned markets are still immature and regulation could interfere with potentially favourable technological and market developments by constraining them.

- Any legislative action initiated now would be too slow to impact the market; at least 1 year for legislative process and another 2 for transposition.

- Finally, attempting to make ICT systems for energy efficiency mandatory in Member States' public procurement would (if successful) likely lead to the undesirable result of depriving Member States of the flexibility of a case by case assessment. Pre-commercial public procurement and lead markets are opportunities and the task is to enable Member States, cities and regions to best make use of these instruments.

Option 4 has not been considered practical or appropriate at this stage and is therefore discarded and not assessed further.

5.5. Summary of main elements of Options 1, 2 and 3

Option 1	Option 2	Option 3
Existing legislation at the EU and national level and legislative proposals and initiatives in the pipeline Voluntary industry initiatives in the ICT sector No or very limited partnerships across sectors Some regional and local/city voluntary initiatives Continuation of initiatives under the FP and CIP	Strengthened focus on energy efficiency in the Framework Programme and the CIP (large-scale pilots, exchange of best practice, codes of practice) Closer partnership of business, regions and governments under a new i2010 flagship	Recommendation to the ICT industry to agree on common methodologies and tools for measuring and controlling their own energy footprint and improving its overall energy efficiency Recommendations to the ICT industry to establish partnerships with key energy using sectors to encourage partnership building and across sectors and with the ICT sector and to stimulate adoption of common measurement, control and management tools for energy use Recommendations to Member States and their regional and local authorities to monitor, manage and

		control their own energy use, and use ICT tools to support 'energy-efficient' decision making Accompanying Commission measures highlighted in a Communication

6. ANALYSIS OF POTENTIAL IMPACTS AND COMPARISON OF OPTIONS

6.1. Assessment of Option 1: No further action at the EU level

With respect to the policy interventions already in place or proposed at the EU level, it is reasonable to assume – in line with the assessment made in their respective impact assessments – that they will strongly contribute to improvements in energy efficiency and more specifically to the global energy saving target of 20% by 2020. However, there is a risk that the full potential of significant energy efficiency benefits will not be realised because, as noted earlier:

– The enabling nature of ICT is not explicitly recognised, nor is there any specific commitment from the ICT sector itself (apart from the individual commitments outlined in Section 4.1) to contribute to measurement and reduction of energy consumption.

With respect to the voluntary commitments and existing voluntary initiatives both in the ICT sector and across sectors, regions and cities, these certainly represent a positive sign and can usefully complement the initiatives of the Commission, Member States and other public authorities. However, it can be reasonably assumed that a number of key problems will remain:

– Coordination: while a number of initiatives led by industry associations and civil society groups have emerged, each of them tends to be rather homogenous in their stakeholder participation. As pointed out in the problem section, cross disciplinary (engineers, users) and cross industrial (ICT and other industries) dialogue and cooperation constitute an absolute requirement. However, in the absence of an entity, above these interest groups, perceived as a fair broker promoting this dialogue it is very likely that each group pursues its own agenda and actual progress remains limited with significant risks of "free-riding". The relative success of Energy STAR and the European eSTAR programme[52] is due, in considerable part, to the legislative backing that prompted its subsequent near universal adoption.

– Piecemeal: The more stakeholder groups are being formed the more the approach becomes piecemeal. This is not a drawback for specific subtasks or problems to be solved, however the absence of a common strategic view and agreed goal setting (e.g. "collective green target setting") renders these initiatives less effective. In an explicit recognition of this shortcoming there have been calls from these groups for leadership[32].

[32] European Information and Communications Technology Association – EICTA, American Electronics Association – AeA, Global eSustainability Initiative - GeSI

– Economies of scale and scope: Worthy initiatives at the European and worldwide level need coordination to share information, experience and best practice in order to build on each others' work and not duplicate efforts.

Cost of implementation

For Option 1, the additional cost of implementation is zero as no new measures are proposed under this option. However, with respect to the *opportunity costs of "not doing anything additional at this stage*", these costs are not equal to zero and can be potentially relatively significant. They are certainly very difficult to quantify and attribute at this point in time (also due to the lack of proper measurement) but the basic assumption is that if energy efficiency gains are realised too slowly with respect to the global target, this will likely entail additional costs at a later point in time – this applies as much to individuals and businesses as it does to nations. Annex VI provides concrete figures of percentage added effort required year on year for delays[33].

In conclusion, the current initiatives – whether in the form of existing policy instruments or voluntary initiatives by different actors – will improve energy efficiency but do not sufficiently address the key problems outlined in this impact assessment and present a risk that their implementation on the ground will be rather slow and piecemeal with respect to the global 2020 energy efficiency target of 20%.

6.2. Assessment of Option 2: Stronger collaboration and partnership within existing frameworks

One advantage of Option 2 is that the frameworks for support to collaboration in RTD and in CIP Pilot projects to demonstrate ICT-based innovations already exist, and there is already substantial stakeholder participation in some actions. These frameworks are already used to a limited extent to support innovations in energy efficiency, and a stronger focus on this goal can be proposed beyond the current workprogramme of 2009-2010.

The disadvantages of option 2 are that the CIP pilot projects are more short term focussed and rather limited in scale and scope, while the collaboration in RTD will only be of value for the next generations of technologies which could be available beyond 2015. They are unsuitable to generate the momentum to develop and sustain the cross-sectoral collaboration required to deliver ambitious targets of energy efficiency endorsed by a significant number of market actors and other stakeholders.

The operational objectives also concern market deployment initiatives and require the participation of non-research organisations. Indeed they require the broadest possible stakeholder participation. The Commission could take a role of coordinator; however resources would not allow working intensively with several sectors, cities and public administrations at the same time. Therefore, this exercise would remain very limited in scale and scope. However valuable a framework i2010 has proven to be in interactions with Member States and existing constituents, it is restricted in its time horizon. As the objectives have been considered beyond 2010, continuity of structures and institutional arrangements is key to their realisation.

[33] Annex VI provided by the IMR World e-Business Intelligence Ltd illustrates what would be the cost to business of delaying efforts to reduce energy usage, given the 20% energy efficiency target by 2020.

Cost of implementation

For Option 2, the additional cost of implementation would be insignificant and would essentially include the cost of co-ordinating stakeholders within the new i2010 flagship initiative, the cost of organising the energy efficiency awards and other actions for increased visibility of the results of research undertaken in the energy efficiency area, such as conferences, publications, etc. The increased focus of the RTD and CIP frameworks on energy efficiency would not mean that new and additional EU budgetary resources would have to be found in the current programming period. It might however mean that at least some resources available for the current programming period would have to be shifted from other priorities within the programmes and that the future work programmes would have to put more emphasis on this field. This can be challenging and politically difficult to realise because these decisions are taken separately and follow their own specific comitology procedures and it is impossible for this impact assessment to pre-empt their outcomes. With respect to the opportunity costs referred to under Option 1, these would be somewhat reduced in comparison to Option 1 as pilot initiatives and large scale research projects will progressively be implemented but there is still a risk of solutions not being readily available on a mass scale in the short to medium term.

In summary; the operational objectives can only be partly accommodated within the existing frameworks.

6.3. Assessment of Option 3: Recommendations on partnership initiatives, interoperability and best practices

The advantages of Option 3 are that the scope of recommendations could more accurately reflect the operational objectives as developed in section 3. Recommendations would encourage those stakeholders that are ready and willing to institute change i.e. provide a stronger political signal and visibility for those willing to take up the challenge. It is assumed that the range of such 'volunteer' organisations or sectors will rapidly expand once there is more visibility for initiatives and more awareness and knowledge about the cost and energy saving potential of certain ICTs, not to mention consumer pressure. In comparison with Option 2, the clear political signal represented in the use of the Recommendation instrument and consequent higher visibility could be expected to better catalyse the objective of accelerating change in the timeframe envisaged.

By focusing on co-ordination, partnership building and deployment of ICT tools, Option 3 can be implemented faster than Option 2, given the readiness of several major stakeholders to act upon Commission recommendations. The need to accelerate change has been identified as the key challenge for this initiative and Option 3 scores better than other alternatives in this respect, as it offers a potential for faster and more flexible implementation while addressing a wider spectrum of stakeholders beyond the existing collaboration frameworks.

In summary, Option 3 can:

– Address a wider spectrum of organisations

– Catalyze on the fact that the consultation has indicated the readiness of several major stakeholder groups to take initiatives within a policy framework at EU-level.

– Reinforce various business-led and city-regional partnership initiatives that exist, provide a strong political signal and more visibility.

– Enable systemic effects and improvements in energy efficiency at the system level to be addressed.

– Ensure faster implementation in comparison to Option 2

Option 3 does carry risk in terms of the achievement of the objectives: i.e. as much is left to industry or individual cities and regions with a limited role for the Commission in terms of coordination and agenda setting, the extent to which the problems will be remedied is still subject to uncertainty. This risk in achieving the first step operational objectives could delay the ultimate longer term objectives. Nevertheless, the risk can be mitigated by an adequate evaluation and monitoring system and by the involvement of the Commission as a facilitator in the partnership and consensus building processes.

Cost of implementation

Option 3 presents certain difficulties in assessment of the costs that can be attributed to it. Firstly, there is a cost of co-ordination, building partnerships across sectors and agreeing on the common methodologies and tools for measurement, exchanging best practice, etc. This cost is relatively insignificant and certainly manageable for the parties involved. Secondly, there is the cost of the ICT tools themselves: smart meters, energy accounting software, automation tools, measurement and quantification tools, ICT tools for optimisation of energy consumption (embedded intelligence), etc. The indicative cost of some of these potential investments is investigated and illustrated in Annex IV. Thirdly, there is a certain amount of up-front cost in restructuring and/or behavioural change that will have to occur if energy consumption is to be reduced in any significant way. This cost can be potentially significant in some cases but also partly or even entirely offset by the benefit of using less energy (and therefore paying lower energy bills). Nevertheless, it is important to note that this Option is in the spirit of the general policy on climate change and energy and particularly in the spirit of the 2020 global targets agreed by the EU. The Recommendation is meant to facilitate achievement of those targets and is not at the origin of those targets. It would, therefore, be incorrect to attribute the cost of restructuring to the Recommendation itself.

6.4. Comparison of Options

Comparison of options and their impacts will be carried out in two steps:

- In the first steps, broad policy options outline in Section 4 (Option 1, 2 and 3) will be assessed against a set of predefined criteria. This general assessment will take into account also the suitability of the different policy instruments (no change, Communication, Recommendation) for achieving the objectives. A preferred policy option will be identified as a result of the comparison of the three main options.
- In the second step, the content of the preferred policy instrument will be defined in more detail and assessed again against a set of criteria and against the policy objectives defined in Section 3.

The assessment criteria

The extent to which the global, specific and operational objectives materialise depends mainly on the degree of commitment of the business community and civil society: i.e. how many industry players in how many sectors, how many cities and public administrations commit to take action. The scope and strength of commitment of stakeholders are therefore very important criteria of success of this initiative. The preferred option should be enabling and catalyzing change rather than imposing it through regulatory measures at this stage.

It is also important to note that the criterion of "speed of implementation" is crucial to the success of any proposed actions/measures. If the actions are to contribute to the 2020 energy efficiency goals and complement the Commission Action Plan for Energy Efficiency in a useful and timely manner, it is important that there is a strong potential to achieve the operational objectives in a relatively short term.

The criterion "cost of implementation" also forms an integral part of the assessment of options to avoid disproportionate implementation costs of any measures that would be proposed.

- Options 2, 3 are therefore assessed in comparison with Option 1 in terms of:
- Strength and Scale of commitment by the ICT sector, businesses, regions and cities
- Speed of implementation
- Cost of implementation
- Risks/uncertainties with respect to implementation of the options and expected impacts

A summary of the assessments of the two main policy options considered using Option 1 as a baseline is given in the table below. Options are assessed against the five above-mentioned criteria.

	Policy Option 2 *Stronger collaboration and partnership within existing frameworks*	**Policy Option 3** *Recommendations on partnership initiatives, interoperability and best practices – in addition to Option 2*
Strength	+ Strong commitments. However low visibility and hence relatively weak political impetus for projects	++ Industry and specific regional and city organisations have called for recommendations in the consultation process as the "signal" that would enable widespread mobilisation of the ICT sector, its clients and partners (present and prospective)
Scale	0 ICT-sector partnerships with cities and regions have already been initiated, however, the reach is inevitably smaller and there is a clear lack of co-ordination, visibility and critical mass	++ A number of business groups appear ready to act immediately on Commission Recommendations, and could be ready with large-scale deployments within 12-24 months "GreenIT City" groups also appear ready to act on Commission Recommendations, and could be ready with political commitments within 6 months and large-scale deployment within 12-24 months
Speed of implementation	0/+ Slow paced steady progress New RTD initiatives initiated by Calls for proposals in 2009-10 would not be operational until 2010-2011, and would not deliver prototype solutions and consensus on interoperation protocols until 2012-2013.	++ Faster implementation and uptake due to greater flexibility in implementation and several industry groups, cities and MS working in parallel.

Risk	- Small scale but some risk involved in uncertainty related to the comitology procedures for the future priorities and budgetary allocations for the FP and CIP	- Less control for the Commission. However, the Commission would still be involved as a facilitator and coordinator and monitor progress
Cost of implementation	0/- Insignificant	- Voluntary agreements will impose co-ordination costs on participants, but under their control. The recommendation can indirectly cause cost for some "late movers" in some sectors and public administrations in the acquisition and implementation of ICT tools.

Conclusion

As the assessment shows, Option 1 already involves improvement in energy efficiency as a result of the existing or proposed policies and voluntary initiatives. However, the assessment also points out significant shortcomings and reasons why it is reasonable to assume that Option 1 by itself will not sufficiently tackle the problems and achieve the objectives, or at least not in the given timeframe.

With respect to Option 2, there is no doubt that research effort and contribution of public funds to research and deployment of energy efficient technologies should continue and should be even intensified to the extent possible. However, given the urgency and nature of the issues at stake, the EU and MS research funding alone cannot solve the problem. Option 2 is therefore not a preferred option. Not because it is an approach that should not be pursued at all but because a more holistic approach involving wider range of stakeholders and realisable in the short term is available.

Therefore, Option 3 can be identified as the preferred option. It scores positively against the assessment criteria for scale and strength of commitment and speed of implementation. In comparison to Option 2, it is certainly a more ambitious approach which addresses a wider range of stakeholders.

7. SUB-OPTIONS UNDER THE PREFERRED POLICY INSTRUMENT

7.1. Description of Sub-options

The assessment in Section 5 identified Recommendation as a preferred instrument for this specific intervention and described the content of the Recommendation in broad terms: it would address a wider stakeholder base, it would be focused on issues that can be implemented in a short to medium-term, it would focus on the three main areas outlined in the problem definition and it would be accompanied by supporting Commission actions outlined in a Communication. This section presents a list of concrete recommendations that could be envisaged, assesses and compares them and draws a final set of recommendations that could best achieve the given objectives.

The following specific recommendations could be envisaged to seek better energy efficiency in the ICT industry:

1. The Commission could recommend that the ICT industry agree on establishing common methodologies and tools for the energy efficiency of systems and networks and make those comprehensive, transparent and verifiable.

2. The Commission would recommend that the ICT industry develop roadmaps by 2010 for the reduction of its energy use and carbon emissions and commit itself to ambitious and transparent targets for this reduction.

3. The Commission could recommend a specific quantitative target for reducing energy consumption and carbon emissions in the ICT sector. This target would be set by the Commission and would be in line with the global 2020 energy efficiency target.

4. Given the international nature of the ICT industry and the often complex supply chain relationships, the Commission could recommend that the ICT industry collaborate with international suppliers in order to develop new energy efficiency and carbon reduction strategies and make sure that existing EU and international frameworks are taken into account.

The following specific recommendations could be considered to promote partnerships between the ICT- sector and energy-using sectors:

5. The recommendation could choose to focus only on some of the key energy using sectors where major savings could be realised in the short-term and where a strong commitment of stakeholders has been already signalled during the consultation process. This would be the case of the buildings and construction and the logistics sectors. The Commission would recommend that the ICT sector forms partnerships with these sectors so that their tools are based on common methodological approaches for measurement and reporting of energy consumption, already being prescribed under the Directive on the Energy Performance of Buildings[34] and the Freight and Logistics Action Plan[35].

6. A recommendation could be made to the electricity sector to accelerate investment in automated customer communications and accelerate the roll-out of smart metering and real time energy consumption displays to households.

7. The Commission could recommend that Member States agree on common functional specifications and a timeframe for the roll-out of smart metering

8. As in the case of the ICT sector, the Commission could set a specific quantitative target for these sectors in order to reduce their own energy consumption and carbon footprint.

The following recommendations could be envisaged in order to encourage a shift in behaviour of consumers, businesses and communities in the economy at large:

9. A recommendation could be made that companies, using ICT tools, should track, identify and reveal to the consumer the total energy and carbon footprints of product end to end.

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34 Directive 2002/91EC; www.buildingsplatform.org

35 COM (2007) 607 final

10. A recommendation could be made that retailers and others deploy machine-readable energy labelling systems to enable citizens to make low-carbon choices in their daily lives.

11. Cities, utilities and other intermediaries could be called upon to ensure that European citizens are offered the possibility of having monthly bills reflecting their actual consumption of energy.

12. The Commission could recommend that cities and regions through the aegis of Member State regional and public authorities take the lead in establishing multi-sector partnerships to adopt a systemic view of their operations and deploy ICT systems to monitor, manage and control energy usage[36].

13. It could be recommended to Member States and their public administrations, as well as regions and cities, to exert greater demand-side pressure through "GreenIT" public procurement. The Commission would assist local and regional authorities in their efforts to leverage the green public procurement practices by producing a toolbox with information, sources and methodologies.

7.2. Assessment of Sub-options

Options for individual recommendations will be first assessed in terms of their expected benefits, costs and risks/uncertainties related to their implementation:

Options	Benefits	Costs	Risk of non-compliance
ICT sector			
1	Building partnerships within the ICT industry common measurement tools lower risk of "greenwashing"	Low cost of establishing voluntary agreements and codes of conduct	Low; many stakeholders have already asked for some leadership from the Commission
2	Concrete commitments for energy savings based on commonly agreed methodologies and targets Lower energy consumption and carbon emissions from the ICT sector in the short- to mid-term Lower energy bills for ICT industry and for ICT users (businesses and individuals)	Cost of adapting the ICT processes, products and services Cost of restructuring/reengineering partly or entirely offset by the market appeal of more energy efficient products and services, which will be significant in a scenario of increasing energy prices	Some companies may be unable or reluctant to make the investments required to comply with ambitious targets
3	Benefits from concrete energy savings if ICT sector implements the targets Easier to establish intermediate energy efficiency gains in line with the global 2020 targets and monitor the progress towards these targets	Potentially high cost for some sectors within the ICT industry where the targets were too ambitious. Cost of monitoring and enforcement.	Imposed targets, not agreed by the industry, therefore high risk of non-compliance. Risk of "regulatory failure" (setting targets when the quantification and measurement issue is not solved yet)

36 The DEHEMS RTD project provides one example including the city of Manchester

4	Strengthened international co-operation in the area of energy efficiency, increased potential to achieve more savings throughout the whole supply chain	Cost of building partnerships and developing strategies. Costs of restructuring supply chain required to achieve the intended energy efficiency gains	Relatively low, given the high degree of interdependence within the supply chain of the ICT industry.
ICT and Energy-using sectors			
5	Strong commitments, visibility and leadership from stakeholders who already showed willingness to act upon the recommendation. New partnerships between the ICT sector and other sectors. Common measurement and quantification capabilities	Low and manageable. For most stakeholders in these sectors the cost will be lower than the benefits (e.g. better managed energy use in logistics means direct savings of operational costs)	Low risk of non-compliance as these sectors indicated readiness to act upon the recommendations
6	Potential to deliver high visibility and real opportunities for encouraging behavioural change and better management of energy but in mid- to long-term perspective	Involves up-front costs and is likely to be difficult to implement technically in a short term without commonly defined specifications and standards	High risk of non-compliance; not feasible at the early stage of energy markets liberalisation where there is uncertainty with respect to the evolution of the energy markets
7	Less ambitious than Option 6 but creates the necessary conditions for roll-out of smart meters. Enabling rather than "command and control" approach	Low cost	Relatively low risk of non-compliance but depends on Member States and the progress must be monitored
8	Highly ambitious but difficult to realise the benefits of energy savings without common methodologies and ICT tools in place to enable those savings	High up-front costs for some stakeholders in some sectors may be disproportionate	High risk of non-compliance. Risk of "regulatory failure" (setting targets when the quantification and measurement issue is not solved yet and very different sectors are involved)
Economy at large			
9	Better information for the consumer, high visibility and traceability of energy consumption and carbon footprint	Difficult to implement on a mass scale in the short term. High cost of determining the total energy and carbon footprint for some products and services	High risk of non-compliance (with the exception of a few first movers who are already doing it)
10	Highly ambitious. Similar to Option 11, high visibility empowering consumers to make informed choices. A strong political signal for the first movers and existing voluntary initiatives.	Similar to Option 11; involves cost of labelling	High risk of non-compliance, can be implemented only when common methodologies and tools are in place and energy and carbon foot-printing is carried out on a

			mass scale.
11	Increased visibility and an opportunity for consumers and businesses to better manage their energy consumption	Increased costs for energy providers; a detailed impact assessment of concrete implications would need to be carried out, a review of energy legislation may be necessary	High risk of non-compliance
12	Opportunities for new partnerships. Common tools for energy measurement and management of energy consumption for cities, regions and public administrations. Opportunity to identify new energy savings within the complex systems	Cost of developing energy efficient strategies and implementing ICT tools, cost of energy accounting. Relatively low and manageable.	High commitment from first movers and most progressive cities. Risk of some reluctance and budget constraints for slow adopters.
13	Systematic green procurement at the regional and local level would bring significant positive impacts in terms of a more systemic approach to energy use in the public sector, more energy savings and increased accountability	No additional cost or very limited cost of implementation	Depends on implementation in individual MS. Risk of non-compliance can be lowered by providing a clear guidance and reinforced monitoring

It is apparent from the table above that the recommendations differ in the level of their ambition, the costs involved and risks and uncertainties related to possible non-compliance. Some recommendations would be highly beneficial from the perspective of the consumer or the overall energy efficiency target but would involve high costs for some businesses in the short term or would be difficult to implement because common methodologies and measurement tools are not yet in place.

7.3. Comparison of Sub-options

In order to summarize the assessment and compare the 13 possible sub-options for concrete recommendations, the following five criteria are used:

– **Potential for energy savings –** for most measures, concrete energy savings represent an indirect but desired effect/result of their implementation. They depend on many factors including the commitment of stakeholders and costs of implementation. Therefore, this criterion assesses only the potential for energy savings, other things being equal.

– **Speed of implementation –** expected speed of putting the measure in practice. A measure which can be implemented within two years would score high.

– **Cost of implementation –** the precise cost is in some cases difficult to identify. This cost therefore includes the direct cost of a measure (e.g. the cost of building partnerships and developing the tools) and indirect cost that can be reasonably attributed to the measure (e.g. cost of some restructuring needed to meet a specific quantitative target for a sector)

– **Risks/uncertainties –** as mentioned above, these are related to the risk of non-compliance and reluctance of the stakeholders to commit

– **Overall effectiveness** – the extent to which each sub-option achieves the objectives outlined in Section 3. This is a summarizing criterion which takes into account the results of the previous four criteria. For example, if the potential for energy savings of an option is high but the cost is high as well and there is a high risk of non-compliance, the option would score "low" in this criterion.

The table below summarizes the main results of the assessment:

Options	**Energy savings potential**	**Speed of implementation**	**Cost of implementation**	**Risks/Uncertainties**	**Overall effectiveness**
1. Common methodologies and tools in the ICT sector	high	medium to high	low	low	**high**
2. Roadmaps for energy use reduction to be presented by the sector	high	high	low to medium	medium	**high**
3. Quantitative targets for energy use reduction	high	medium	medium to high	high	**low**
4. International collaboration within the supply chains	medium	high	low	low	**medium to high**
5. Focus on logistics, buildings and smart meters, adoption of common tools	high	high	low	low	**high**
6. Accelerate investment and roll-out of smart meters in the electricity sector	high	low	high	high	**medium**
7. Common functional specifications and a timeframe for the roll-out of smart metering	medium to high	medium	low	low	**medium to high**
8. Quantitative targets for key energy using sectors	high	low	high	high	**low**
9. Track, identify and reveal energy and carbon footprint of products and services	medium	low	medium to high	medium to high	**low**
10. Machine-readable energy labelling systems	medium to high	low	high	high	**low**
11. Billing on a monthly basis	medium to high	low	medium to high	high	**low**
12. Partnership of cities and regions with ICT to deploy ICT tools and disclose their energy use	high	medium to high	low to medium	low	**high**
13. Encourage green IT procurement at regional and local level	high	high	low	medium	**high**

The comparative table reveals that the overall effectiveness of some recommendations is low for various reasons: some of them represent a more "command and control" approach (e.g. setting detailed quantitative targets for sectors) which would be difficult for many actors to comply with at this stage, some of them are premature at this stage or relatively costly to implement and therefore carrying a higher risk of non-compliance.

As noted earlier, Option 3 is conceived as a platform for building new partnerships, developing common tools and catalyzing change, rather than imposing strict targets. It is therefore assumed that sub-options of a more “enabling” nature with limited cost of implementation and some stakeholder commitment will be more likely to achieve the objectives in the short term. It can be therefore concluded from the assessment and comparison that sub-options 3, 6, 8, 9, 10 and 11 should not be pursued as part of the Recommendation at this stage. The retained sub-options 1, 2, 4, 5, 7, 12 and 13 would then form the preferred policy option for a Recommendation, together with the accompanying measures outlined in section 4.3.

The proposed orientation is largely in line with the views expressed in the public consultation. Indeed more than 90% of the respondents agree on the need for a coordination actor capable of setting the agenda, facilitating the discussion amongst the relevant stakeholders and actively promoting concrete collaboration on these matters. Their response also states that the Commission is well placed to play this coordinator / facilitator role in a very effective manner.

8. EVALUATION AND MONITORING

The preferred option does carry a certain risk of non-realisation irrespective of how committed certain sectors, cities and businesses appear to be. In order to assess the progress in implementation and the need for further or stronger measures for the achievement of the strategic objectives, monitoring will start immediately and a comprehensive evaluation will carried out in 2012.

The Commission will be in charge of monitoring progress and providing a report on the implementation and impacts of the Recommendation. Member States will be asked to inform the Commission of actions taken in response to the Recommendation within 12months.

The link between ICT-use and energy-efficiency improvements across the economy, either in specific areas of energy-use, or in structural change is too complex for aggregate measures of energy-efficiency to be used as indicators of the effectiveness of the measures considered. It is therefore proposed *to base the evaluation and monitoring on the operational objectives* in the specific areas of focus.

Special attention will be paid to assessing progress in the three main areas addressed i.e.:

- The extent to which the ICT Sector has engaged in addressing energy use and emissions reductions and in particular progress in benchmarking, strategy elaboration and implementation

- The development of partnerships and uptake of ICT for energy efficiency in the major energy using sectors addressed

- Evidence of ICT's contribution to energy efficiency emerging in the strategic thinking and tactical implementation in the behaviour of consumers, businesses and communities.

- Specific indicators will include the following:

- - The letter of intent by the ICT sector associations to agree on common methodologies and metrology tools, received within 6 months of adoption of the recommendation

- - Status of standardisation activities with respect to the common methodologies and metrology tools in the ICT sector and in other sectors
- - Common functional specifications for smart meters by 2011
- - Roadmaps containing highly ambitious, quantitative targets for increasing energy efficiency presented by the ICT sector by 2010
- - Common measurement and reporting formats for energy consumption and carbon emissions of the processes and services presented by the logistics sector by 2012
- - ICT solutions in the buildings and construction sector commonly adopted in partnership with the ICT sector

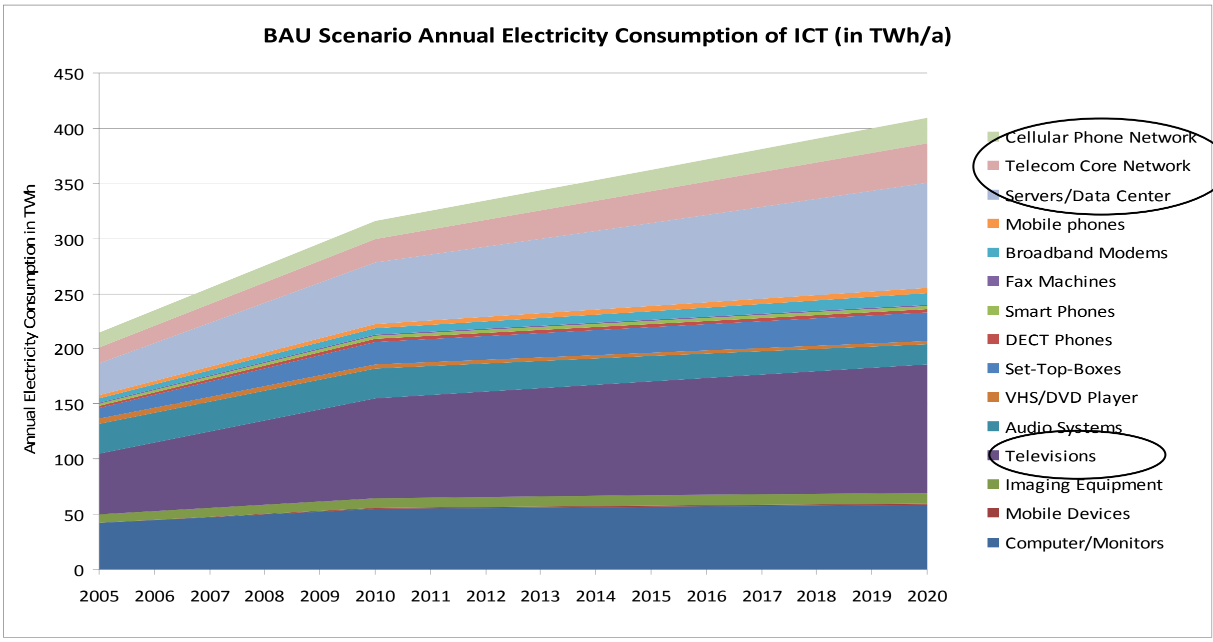
Annex I

Extended Analysis of Energy use of ICT equipment and services

ICT equipment and infrastructures use electricity as their primary form of energy, and represent some 8% of the total electricity consumption in EU 27. Equipment, such as PCs, mobile phones and the communications infrastructures with data-centres used about 3.5% (97 TWh/a) of electrical power in the EU in 2005[2]. In addition, to this, consumer electronics, notably TVs and HiFis also used about 4.5 % (120 TWh/a) of electrical power, and are increasingly networked through communications infrastructures.

Together, these classes of equipment were responsible for about 2% of green-house gas emissions: about ¼ from production and ¾ from use. This estimate is consistent with others[37]. Worldwide, the ICT equipment and service-footprint is estimated to be about 1150 TWh/a (also representing about 2% of GHG emissions).

In future, ICT systems become more pervasive, performance levels continue to rise and energy intensive applications to proliferate. Thus, despite continuing improvements in energy-efficiency of individual equipment, their total energy use is growing, as is their share of the total: 10.9% of EU 27 electricity consumption in 2020 will be consumed by ICT.



Energy-efficiency appears to be still sub-optimal for three reasons: Energy costs have been a small part of the "total cost of ownership" of ICT equipment, infrastructure and data centres (although for the latter energy-costs are now becoming comparable with equipment costs); Energy-use depends on how equipment is used as well as on the intrinsic energy-efficiency (users have often not taken advantage of energy-saving features), and energy-use in complex

37 Gartner: Green IT – The new industry shockwave, 2007; the SMART2020 report: www.smart2020.org, and the report of the Energy Servers consortium, October 2007.

systems, such as data-centres, is a combination of heating/cooling, lighting and facility-design – beyond the competence of any single supplier.

8.1.1. Opportunities and obstacles

ICT equipment and services can certainly be more energy efficient: Competitive pressures, technology innovations and market changes[38], voluntary agreements[39] and initiatives[40] are already improving energy-efficiency. Mobile telephones have become 100-times more energy-efficient in the last 20 years, and the energy-use of base stations has been cut by over 70% from 2001 to 2006. The average standby-power consumption of a TV has been cut from 6W in 1995, to 2.5W in 2007, and "best-in-class" is now 0.3W[41]. These trends are reinforced by new targets of 0.5 or 1W by 2010 adopted under the eco-Design of energy-using Products Directive[42].

Demand-side pressure for greater energy-efficiency is also growing. The dominance of energy-efficiency characteristics in advertising for ICT systems demonstrates the strength of customer interest. Public administrations are now major purchasers: Energy-use by ICT-systems for e-Government and public administration is now a significant part of the energy-footprint of Governments. Several Member States have developed "Green IT" procurement strategies[43] and Regulation (EC) No 106/2008 of the European Parliament and of the Council of 15 January 2008 on a Community energy efficiency labelling programme for office equipment makes the use of the underlying requirements of the (voluntary) Energy Star label, mandatory for central government authorities and Community Institutions in public procurement contracts falling within the scope of the Public Procurement Directives.

There are some indications that in the short-term, some easily implemented solutions can have very positive results on the given institutions's consumption while sending the right signal to the ICT sector.

The Implementation of the EMAS scheme by DG DIGIT at the European Commission, for the purpose of the procurement of PCs used commission-wide is one such example. Since 2006, procurement procedures evaluate offers based on the technical performance vs cost where cost is no longer the cost of purchase alone but the Total Cost of Ownership (TCO) (cost of purchase + cost of energy consumption) of the equipments. Prior to this, the trend towards higher performance at lower prices had led to a trend towards more energy consuming PCs at every new batch purchased. The two purchase procedures launched since the introduction of the TCO criteria have led to the acquisition of PCs with energy consumption similar to the levels of 2002 and almost half the consumption of those purchased through the last procedure prior to the use of CTO.

38 For example, the shift from PCs to laptops, and from CRT to LCD displays

39 For example the Energy Star initiative supported by the EU and USA.

40 For example the "Climate savers Computing initiative" : www.climatesaverscomputing.org

41 High-tech: Low Carbon. The role of the European digital technology industry in tackling climate change: Report by the European ICT Association (EICTA), April 2008. www.eicta.org

42 Member States endorse Commission proposal to reduce standby electricity consumption http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1117&format=HTML&aged=0&language=EN&guiLanguage=en

43 Notably Sweden, Denmark, Norway and the UK: www.oecd.org/sti/ict/green-ict and http://green-broadband.blogspot.com/2008/05/webcast-of-oecd-workshop-icts-and.html

It is difficult to estimate the extent to which these efficiency improvements will be off-set by more pervasive use and higher performance requirements by 2020: There are major uncertainties about the likely growth in use, and energy-impacts of higher-capacity broadband infrastructure and data centres. In the EU, upgrading to higher-speed broadband access, higher capacity data centres and larger-screen TVs are likely to be the major drivers of higher energy-use[44]: On current trends, total energy use could grow to over 400 TWh/a by 2020: about 10.5% of projected increased electrical power consumption in 2020. However, one study estimates that, with some additional measures[45], energy use could be limited to less than 300 TWh/a in 2020, still under 8% of EU electrical power-use.

At the global-level, the ICT energy consumption is expected to triple to over 3000 TWh/a by 2020, representing about 3% of total GHG emissions in 2020. This increase is mainly driven by higher usage in India and China, and higher-capacity data-centres[46].

The major obstacles to faster improvement in energy-efficiency of ICT equipment and services appear to be:

- The speed of energy efficiency improvement on the device level: Though many improve on energy efficiency, this tendency is not yet ubiquitous. In particular, a system-based view as opposed to component and device based view is often lacking.

- Sub-optimal use of public procurement to act as leverage and create a forceful demand side and a critical mass: Beyond energy efficiency criteria for individual devices and equipment, public procurement should first of all adopt a systemic view in order to spot and avoid rebound effects[47]. It can be also tool to provide wide scale acceptance and spread of technologies, be it particularly energy efficient ones or state-of-the-art ones though the tool of pre-commercial IT[48] procurement.

- Limited user awareness and slow behaviour change. The vast majority of users, for example, are unaware that their desk-top computers come loaded with energy saving features that simply need to be enabled. Informatics support teams and indeed purchasing departments are still ignorant of the steps that could be taken to improve an organisations IT infrastructure efficiency as well as performance.

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[44] the BioIntelligence study

[45] "Virtualisation", consolidation and re-location of datacentres; strengthened voluntary initiatives and codes of conduct; Green Public procurement and more focused RTD

[46] SMART2020 report

[47] Are those when energy efficiency improvement does not translate in aggregate saving but energy usage is transferred elsewhere.

[48] COM(2007) 799

Annex II

Analysis of ICT-enabled improvements in existing key energy-using activities

8.1.2. *Buildings and lighting*

Buildings use about 40% of energy and represent a similar proportion of carbon-emissions. More than 50% of energy used in buildings is electrical power. The majority of energy consumption is due to space and water heating within households[49].

Recent research[50] has shown that ICT-systems can improve the control and management of heating, ventilation, air conditioning, lighting, and other energy-hungry devices. Recent developments in nanotechnology (e.g. windows, surfaces), sensor/actuator technology, wireless communication technology, and data processing and control offer new opportunities to embed networked ICT sensors and controls. This assessment addresses three main areas of opportunity:

- Heating, ventilation and cooling (HVAC) and water-heating represents over 40% of residential electrical power use. However, there are now numerous commercial systems with smart ICT-based monitors and controllers. In conjunction with new boiler, pumps, heaters, radiators, and insulation, it is estimated that ICT-systems can enhance the effectiveness of HVAC systems, with savings of 15-25% in residential property and 20-30% in commercial buildings[51]. The SMART2020 report indicates that better building design, management and automation could enable savings of about 15% in energy-use in North America. Additional savings may arise from spin-off technologies such as electronically-controlled “mirror-films” on windows[17].

- Lighting represents about 14% of EU electrical power use in the EU[52] and about 19% globally[53]. Most domestic lighting still uses incandescent bulbs, with poor energy-efficiency (12-15 lm/W) and short lives (1,000 hours). Compact fluorescent bulbs have higher efficiencies (60-100 lm/W) and much longer lives (10,000 hours). Solid-state lighting[54] is now becoming commercially available as a spin-off from the ICT sector: It has efficiencies of 60-110 lm/W, with very long life (10,000-50,000 hours) and could cut energy use by a further 30-50% compared with compact fluorescent bulbs. Measures already proposed[55] could already reduce lighting-energy-use by 25-30%. Recent studies suggest that ICT-based occupation and natural-light monitors, smart-lighting systems could cut energy use by a further 25-30% by 2020[56].

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49 http://www.odyssee-indicators.org

50 Emerging Trend Update 3. The Role of ICT as Enabler for Energy Efficiency EPIS Work Package 1 – Deliverable 1.3 ETU. JRC

51 The lower estimates from the BioIntelligence report, p 150-153; the upper estimates from the Electra report, but with a wider range of technology-measures.

52 Estimated at 13.8% of electrical power use in residential buildings by BioIntelligence (p.164)

53 International Energy Agency : Light's labours lost, 2006: www.iea.org/Textbase/npsum/Light2006SUM.pdf

54 Inorganic (LED) and organic light-emitting diodes (OLED) systems

55 in the Framework of the eco-design and Energy-using Products Directive - 2005/32/EC on the eco-design of Energy-using Products (EuP)

56 bioIntelligence

Use of electrical equipment (notably washing machines, dishwashers, refrigerators and ICT/consumer electronics) represents about 40% of electrical power use in homes in the EU. Their energy efficiency is addressed in the Directives on energy and end-use efficiency and energy-services, and energy-labelling of household products. The Intelligent energy-Europe Programme accelerating uptake and promotion of energy-efficiency. Embedded ICT processors in such equipment already make a significant contribution to improved efficiency. Embedded intelligence and networked controls could enable further improvements. Cloud computing could, by helping to improve the efficiency of IT solutions, lead to electricity savings in computing activity of up to 80%[57].

The combination of these innovations, even on current trends, could probably enable energy-savings in residential and commercial buildings of about 450 TWh/a by 2020. *An accelerated eco-strategy could possibly generate saving of up to 2000 TWh/a[58], about 50% of projected electrical power use in buildings by 2020.*

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There appear to be specific obstacles to the realisation of these opportunities: Firstly, there is a need for real-time energy-use visualization. "Smart Building Management Systems" rely on embedded intelligence and communications. However, sensors are still only in preliminary deployment; connection models & protocols[59] need harmonisation and standardisation, and there is no standardisation of communication between proprietary platforms & networks. There is a lack of a systems-based view of buildings[60].

Additionally, there is a lack of incentives for architects, builders, developers and owners to invest in smart building technology from which they will not benefit, and an unclear business case and absence of business models supporting/promoting investments on energy efficiency: energy consumption is a small part of building cost structure, yet building automation costs can be high and payback periods are often long.

The buildings sector is slow to adopt new technology – a 20-25-year cycle for residential units and a 15-year cycle for commercial buildings is typical. In case of lighting technologies alone, the turnover rate in somewhat higher, though still low: some 15 years in case of commercial building lighting (the biggest consumer).

The LED technology is well known[61], however, there seems to be a low awareness of their use in combination with ICT control systems.

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57 Frankfurter Allgemeine Zeitung, Verlagsbeilage Klimaschutz, p. 17

58 BioIntelligence. In fact the accelerated "eco-strategy" is essentially confined to assuming increased consumer information to promote "vale efficiency" and life cycle costs of product purchases, Europe wide adoption of green public procurement, extension of the Energy Star and EUP regeims to all products and the "development of financial incentives to foster green products". It is not therefore, in any sense, rigorously modelled.

59 NFC - Near Field Communication, Bluetooth, Wi-Fi, RFID, ZigBee, Z-Wave, en Ocean, PLC, etc

60 In most cases, separate controllers are used for solar thermal, space heating and cooling, or the air-conditioning system, without exchanging information. This leads to sub-optimal energy flow, comfort and cost.

61 ChangeWave Energy Efficiency Report, 2008: 37% of companies identified LED as the easiest way to cut back on energy usage.

There is a perception bias, especially in case of consumers who are often deterred by the initial higher investment and where purchase decisions do rarely rely on life cycle cost and saving assessment.

8.1.3. Manufacturing industry

Manufacturing contributes 22% to Europe's GDP and is responsible for 17-18 % of primary energy use [EC Green Paper, ELECTRA]. The consultation has identified energy-use and opportunities for savings in four sectors: discrete manufacturing, semiconductor manufacturing, process industries and services. *Total energy-saving in manufacturing could be up to 25% by 2020 [Neugebauer]* The Commission's Energy Efficiency Communication][Electra].

ICT could play a significant role in motor-systems and industrial-process optimisation [SMART2020]. Motors use about 70% of the electrical power in industry: However, 88% of the motor drives are not electronically controlled. Some 50% could be equipped with variable speed drives and save up to 50% of energy-used [Electra]. More efficient use of compressed air presents opportunities for energy savings of 10-50% [COMPR AIR]: Research suggests that an awareness-raising programme involving information, decision-making and measurement guidelines could reduce electricity consumption by almost 17 %. In the electronic sector, the World Semiconductor Council has set a target to reduce normalised electricity consumption by 30% from 2001 to 2010 [EECA ESIA]. In process industries, "in-silico" simulation and process optimisation could revolutionise the way the chemical industries operate in the next 20 years [Wohlleben]. Model-based catalysis could lead to efficiency gains of up to 50%. Model-based synthesis concepts could lead to efficiency gains of up to 20%, and process modelling could lead to energy efficiency improvements of around 5%.

The main obstacle to the realisation of these opportunities appears to be the lack of real-time information on energy-use: To optimise and operate an efficient factory, energy has to be measured locally and in real time. Developments in microelectronics and embedded systems make it possible for networked embedded devices to provide real time feedback. Embedded, smart components and systems, sensor/actuator networks and control algorithms can exchange data between the automation system and the enterprise resource planning system. Advanced systems are needed to monitor the state of production, the health of the plant, and life-cycle information. Advanced scheduling algorithms can reduce the time required to re-tool or re-arrange production lines, and ICT-driven optimised production planning could allow scheduling of energy intensive tasks to avoid high impact peak loads. One major food processor has realised 9% energy-savings by setting up an energy-monitoring system[62].

In addition, machine tools are a major energy-user. However, energy efficiency of machine tools remains largely un-documented. The machine tool sector, which is typically characterised by SMEs, lacks the incentives and expertise to significantly improve the energy efficiency performance. Coordinated action is needed at machine level, systems level and infrastructure level. The end-users of machine tools cannot themselves upgrade to variable speed controls, since the motors are embedded in equipment. They also lack information about energy-use in motor systems, and wireless networks to interconnect equipment and plant-management systems are not yet standardised.

[62] Jacob Fruitfield, Ireland: Annual report for 2007

8.1.4. *Transport and logistics*

Transport systems represent about 30% of energy end-use, and numerous opportunities exist for improvements in energy-efficiency and rationalisation of transport logistics: More efficient vehicles, road telematics for route guidance, traffic control and road-charging; better fleet management; more efficient traffic lights, and systems to encourage eco-driving. Efficiencies in transport and logistics could deliver savings of nearly 500 TWh/a (equivalent to cutting emissions by 200 MtCO2e) in the EU alone, and over 3000 TWh/a (or 1.5GtCO2e) worldwide63. The Electra report estimates potential savings at about xx TWh/a, equivalent to 26% of transport energy-use by 2020. Another option could be to rationalise travelling, it is estimated that if businesses in Europe were to replace only 20% of all business trips by video conferencing, we could save more than 22 million tons of CO2 per year[64]. In relation to manufacturing activities, it has been estimated that ICT-optimised logistics could also enable a 16% reduction in transport emissions and a 27% reduction in storage emissions globally [SMART2020]. These improvements can be made through software to improve the design of transport routes and networks, route optimisation and inventory reduction.

The specific obstacles to realisation of these opportunities are the fragmentation of the market, the lack of standards and the lack of systems for freight exchange and a lack of data and the complexity of logistical systems[65].

8.1.5. *Electrical power grids*

Energy generation and distribution uses one third of all primary energy. The architecture and management of energy distribution and transmission relies on a technology that is currently 120 years old. Deploying networked ICT could make not only the management of power grids more efficient and reliable but also facilitate the integration of renewable energy sources.. A “smart Grid” is a set of electronic meters, software and other tools which, once connected trough the internet or into a network allows power to be provided and shared more efficiently, reducing the need for peak capacity, and allowing two-way, real-time communication with customers. ICT can help reducing distribution and transport losses, which average 7-8% in Europe66. ICT-systems in “Smart Grids” have been identified in numerous studies as an opportunity for efficiency improvements and FP5 and FP6 projects dedicate considerable resources to them.

A key element in Smart Grids is the *Smart meter at the energy-user’s location*. Smart Meters provide the customer with real-time display of energy-use, link to an onsite Energy Management Systems, and via a communication network to the energy company for monitoring and billing (Automated Meter Reading, AMR). However, smart meters also offer customers more accurate real-time bills; information that could encourage investment in energy efficiency; lower costs through reduced peak consumption and increased security of supply.

In most European countries, energy consumption is still measured with induction meters that can only measure the cumulative consumption. The EU directive on energy end-use efficiency and energy services, however, requires the installation of individualised meters that can

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63 SMART2020

64 SMART 2020: Enabling the low carbon economy in the information age, a report by The Climate Group on behalf of the Global eSustainability Initiative (GeSI), p. 30 et seq.

65 Logistics: sustainability champion or laggard? ELUPEG: www.supplychain-consulting.com

66 www. Leonardo-energy.org

inform end-users about their actual energy consumption. Some initiatives have already been taken by some Member States and companies. Amongst others[67] the up to now largest and widest scale example is in Italy. From 2000 to 2005 Enel deployed smart meters to its entire customer base of 30 million. Meters included a Power-line Communicator transmitting data to an interface to existing IP-networks. However, most meters were read via a GSM link because this network has the broadest coverage. in 2006, also the Dutch ministry of economic affairs decided to replace all electricity and gas meters by automated meter-reading systems.

Real-time feedback to users has shown reductions of 5-25% of energy consumption[68]. Trials in Finland and the US have shown reductions of 6-7% in energy-use. In the US Olympic Peninsula project[69], active participants reduced power-use by 15 percent during key peak hours. Consumers saved approximately 10 percent on their electricity bills. In the pilot project of the Norwegian SINTEF Energy Research institute, the customers reduced their consumption by 24.5%. In Britain, for residential and small businesses, smart metering was estimated to lead to 3.4% in energy savings and 1% carbon savings. The trials in Canada in 2006/07 indicated a 6% average energy conservation effect and critical Peak load shifting (summer) by 5.7% - 25.4%[70]. *According to the Smart 2020 report, Smart grid technologies could reduce global carbon emissions by 3.9% by 2020 (2.03 GtCO2e) and save $124.6 billion.*

There are other advantages of “smart metering”: According to the French regulator, the implementation of smart metering could increase supplier switch capability by factor 10, decrease non-technical losses by 50%, and decrease residential consumption and CO2 emissions by 5%. The UK Government BERR report[71] indicates smart metering solutions can provide more accurate billing of customers; improved energy network management; the facilitation of energy efficiency measures; improved customer services, and reduction in costs of pre-payment meters. IBM conducted an international survey[72] of 1900 households highlighting also the attitude changes smart metering induces in people vis-à-vis energy efficiency.

Only a combination of technologies can deliver large-sale smart metering: Embedded computer systems in smart meters and appliances, connected by broadband access; Power Line Communications, optical fibres or wireless technologies[73]. Various protocols[74] can provide connectivity in the customer premises. However, all these combinations and options will need to interoperate, and common standards are still needed for the Smart meter communications interface.

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67 http://maps.google.com/maps/ms?ie=UTF8&hl=en&msa=0&msid=115519311058367534348.0000011362ac6d7d21187&ll=53.956086,14.677734&spn=23.864566,77.519531&z=4&om=1

68 The Effectiveness Of Feedback On Energy Consumption. A Review For Defra Of The Literature On Metering, Billing And Direct Displays. Sarah Darby, April 2006

69 http://gridwise.pnl.gov/docs/op_project_final_report_pnnl17167.pdf

70 http://www.oeb.gov.on.ca/documents/cases/EB-2004-0205/smartpricepilot/OSPP%20Final%20Report%20-%20Final070726.pdf

71 Impact Assessment of Smart Metering Roll Out for Domestic and Small Businesses, April 2008

72 http://www-03.ibm.com/industries/utilities/doc/content/landingdtw/3165578119.html?g_type=pspot

73 For example: GSM/GPRS. 3G, Wimax etc

74 For example: CAT5, WiFi, Bluetooth, Zigbee, and Homeplug etc

The Measuring Instruments Directive[75] regulates metering products through technical standards for 'essential requirements' including accuracy, durability, and security. It allows compliant goods to be awarded the 'CE marking', giving them free movement throughout the European Community. The Commission has recently issued a standardisation mandate[76] for utility meters.

In addition, a key obstacle is the rapid technology change in communication technologies. The "smart meter" business case will be built on a long term view, maybe 10 – 15 years whilst communication technologies are changing very rapidly and may have a much shorter lifecycle. Furthermore, establishing an entirely smart grid is also very investment intensive, however, a gradual approach can be applied and investment in smart elements needs to be assessed.

[75] Directive 2004/22/EC of the European Parliament and of the Council on measuring instruments

[76] Standardisation mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability

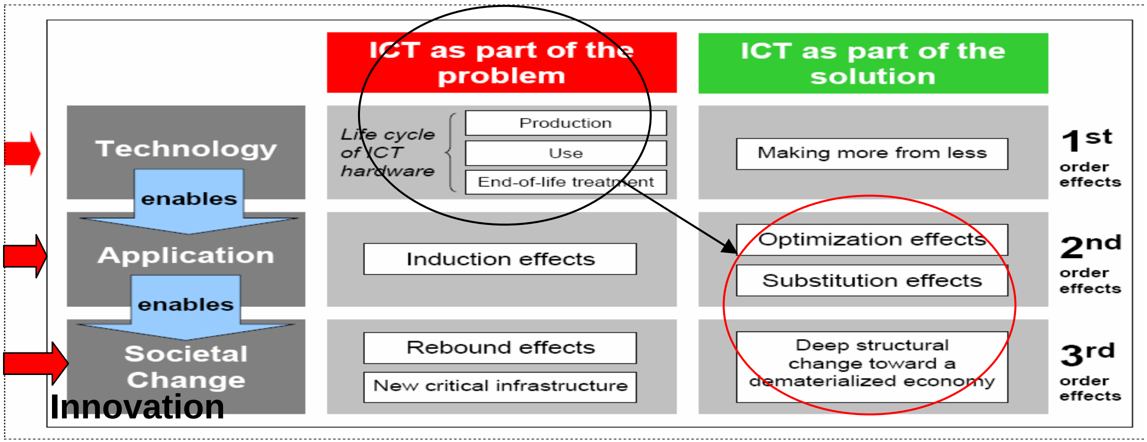
Annex III

Examples of ICT-enabled Structural Change enabled improvements in efficiency

Quoting from Prof L Hilty[77] "The long-term availability of ICT services may enable and foster a transition to a less material-intensive economy in two ways:

Firstly, by helping us to monitor and understand the processes in the environment much better; this will hopefully lead to a higher level of awareness and more effective governance of our interaction with the environment, i.e. the mass and energy flows between society and ecosystems at the local, regional and global levels (environmental information processing);

Secondly, by establishing business models and life styles in which production and consumption is dematerialized, i.e. value creation is based on creating structures and almost decoupled from mass and energy turnover, while consumption is focused on services and almost decoupled from traditional ownership of physical goods (structural dematerialization).. What is needed from the standpoint of sustainability is a deep structural change which would make the above mentioned substitution effects into an essential feature of the economy. In an economy that has been dematerialized in this way, value-added would depend a lot more than it does today on the creation of structures and not on the churning of material and energy."



Conceptual framework for ICT and Sustainability developed by Prof. Hilty at EMPA

Dematerialisation and virtualisation have already had direct impacts on the utilisation of energy; through reducing the energy costs related physical manufacturing (replacement by on-line goods or services) or reducing transaction costs (e.g. travel).

The SMART2020 report indicates that replacing energy-intensive activities (such as physical products and meetings) with low-energy alternatives (such as eCommerce, eGovernment and video-conferencing) could save about 1000 TWh/a by 2020 worldwide; about 1-2% of energy-use (equivalent to about 500 MtCO2e emissions), comparable with the footprint of ICT use. The largest savings identified to date come from wider use of telework, saving up to 500 TWh/a by reduced commuting and office-space. Tele-and video-conferencing could also

77 Information Technology and Sustainability - Essays on the Relationship between ICT and Sustainable Development, Hilty 2008

replace 5-20% of global business travel. For the EU, the estimate of about 1% savings by 2020 (BioIntelligence) is comparable and consistent with other sources[78].

In 2007, 54% of EU27 citizens (16-74) had internet access at home, and over 50% of Europeans now use some on-line Internet services. Over 75% of businesses, 65% of schools and 45% of doctors have broadband connections. Over 80% of basic Government services are available on-line. Between 2000 and 2008 Internet usage has grown in Europe (EU 27) by 340%.[79]

Importantly, ICT and the associated "e-economy" or "e-business" sector is by far the fastest growing sector of the economy: the ICT sector as a whole grew from 5.8% of GDP in 2002 to 7.3% in 2007, and may grow to nearly 9% by 2020[80]. eCommerce has grown to over 19% of retail turnover in the UK in 2008 and is projected to grow to over 40% by 2020[81]. One way to accelerate the shift to a less energy-intensive and low-carbon economy may be to accelerate the growth of on-line services,[82] though the extent to which this would have positive effects depends on the success in improving the energy-efficiency of the ICT tools themselves, covered in the previous section.

78 Wider use of telework and videoconferencing could reduce GHG emissions by about 50 MtCO2e/a by 2010 Saving the climate at the speed of light : WWF/ETNO 2006; and WWF/HP 2008

79 http://www.internetworldstats.com/stats4.htm

80 www.globalinsight.com

81 IMRG figures, reported inuSwitch.com, August 2008

82 Heiskanen et al., 2001; Hilty and Ruddy, 2002, Bohn et al., 2002

Annex IV

Some Investment Figures

1. "Smart Meters"

- Before quantifying "gross cost" of smart meters it is as well to consider the understanding of "smart".

- A simple "energy use display" which can be carried around a house or business premises and communicated wirelessly to a "non invasive" sensor clipped to the incoming electricity power lines can cost less than 30 Euros. It has no other function that to alert (or keep visible to) the user the fluctuations in his power usage i.e. there is no additional functionality. However this "visibility" element is clearly non-negligible and can represent the biggest element in inducing "behavioural change", and savings that are well superior to the 30 euros.

- The latest and most functional smart meters which are actually integral to the power delivery system allow for bi-directional communication, audible warnings of peak load (and charging) times and feed-in enabling for "consumers" who also generate.

- Prices for these meters run to about 100 Euros per customer – but the enablement of some of the associated services obviously requires some additional investment by the provider.

- The emergence of the "ultimate" smart meter will undoubtedly be tied to the emergence of a fully liberalised energy market. Such a meter would need to be not only smart but be capable of switching between energy "service providers" both for supply and generation purposes and would therefore need to be "non-proprietary and open".

- The Business Case varies according to the competitive situation in a given Member State and according to the functionality of the 'smart' meter. According a the study performed by Capgemini[83] which differentiated 3 scenarios with 3 different levels of metering functionalities, the investment was globally profitable, with a rate of return between 8 and 22 percent on average over 5 years. In all 3 cases, the **consumer was the greatest beneficiary** of the investment, while in the first two cases (where the meter has restricted functionality) the standalone pay-off for the distributor was negative. A Dutch study[84] came to a similar conclusion; the investment would have a positive net present value.

83 Comparatif international des systèmes de télé-relève ou de télégestion et étude technico-économique visant à évaluer les conditions d'une migration du parc actuel des compeurs, Capgemini, 8 March, 2007

84 Hans-Paul Siderius, Aldo Dijkstra: Smart metering for households: Cost and Benefits for the Netherlands

Annex V

ICT Sector - Reduction Target Issues

The Smart 2020 Study, Annex 4 illustrates the existing commitments made by a selection of businesses in the sector to make reduction in their GHG emissions or energy consumption.

This illustration shows a wide diversity in targets, baseline dates and target dates for achievement. This diversity fundamentally complicates the ability to measure against the EU baseline. It also illustrates that many ICT businesses are not, currently, on target to achieving a 20/20/20 reduction. This inconsistency complicates carbon accounting, standards and measurement issues.

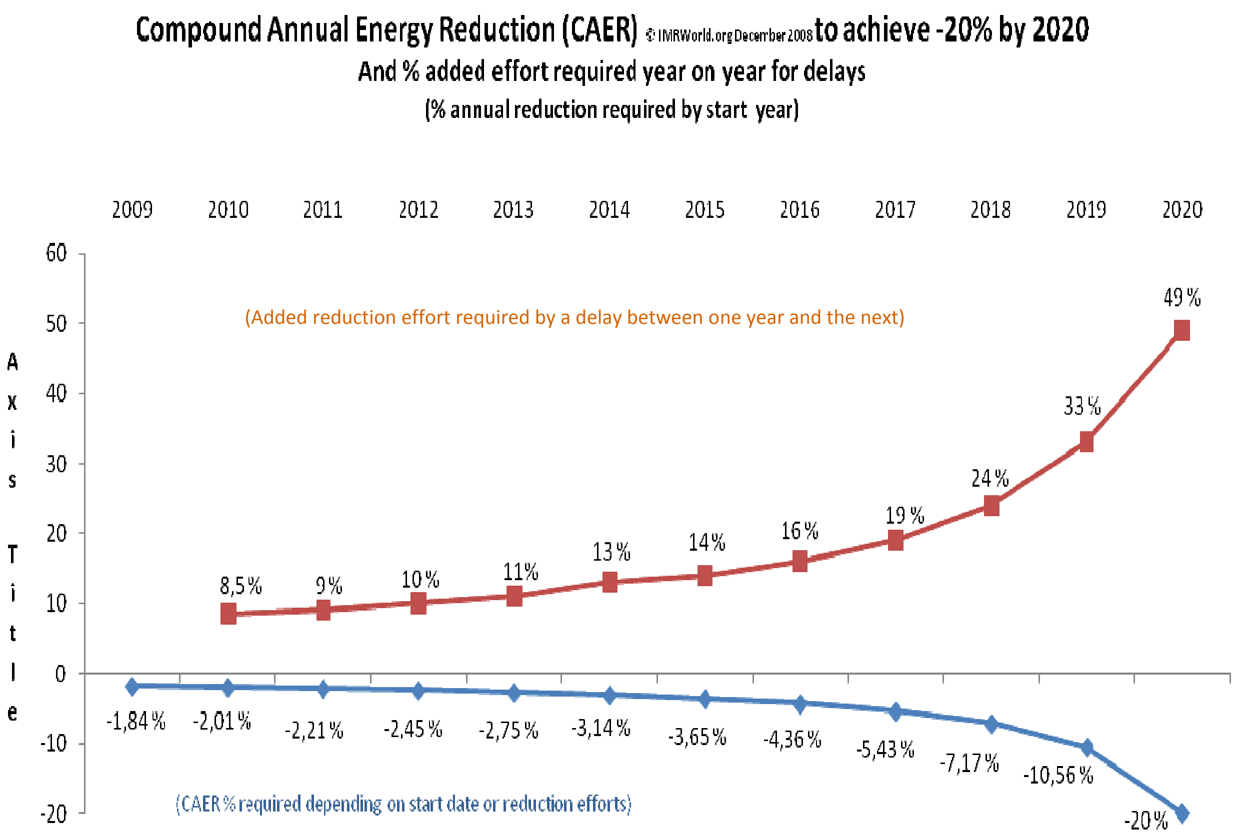
Companies	Target reduction %	Baseline* date	Target date	Comment
BT	80	1996	2020	CO_2 emissions
Vodafone Plc	50	2006	2020	CO_2 emissions
Telecom Italia	30	2007	2008	Increase in energy efficiency only
HP	25	2005	2010	Energy consumption and GHG emissions for operations and products
Deutsche telecom	20	2006	2020	CO_2 emissions
Ericsson	20	2006	2008	(Energy reduction only)
France Telecom	20	2006	2020	CO_2 emissions
Intel	20	2007	2012	Carbon footprint
Sun Microsystems	20	2002	2012	US CO2 only
Bell Canada	15	?	2012	GHG emissions
Dell	15	?	2012	Operational carbon intensity
Alcatel–Lucent	10	2007	2010	CO_2 emissions of facilities
Motorola	6	2000	2010	CO_2 emissions
Nokia	6	2006	2012	Energy consumption of offices and sites
EU	20	1990	2020	
US Interim	To 1990 level	1990	2020	
US Long term	80	2020	2050	

* The Baseline is the year in relation to which the reduction/improvement target is set.

Source: Appendix 4/75; Appendix 4: Company commitments of publication SMART 2020: Enabling the low carbon economy in the information age. A report by The Climate Group on behalf of the Global eSustainability Initiative (GeSI), GeSI (www.gesi.org) is an international strategic partnership of ICT companies and industry associations and EPA Climate Change Leaders Partnership website: http://www.epa.gov/climateleaders/partners/index.html

Annex VI

The Cost to Business of Delaying Efforts to Reduce Energy Usage



- If business is set a 20% reduction target the following Compound Annual Energy Reduction (CAER) rates are what we would expect to see reported depending on the start date of their efforts.
- CAER is a cumulative measure (eg it is a % reduction on the level the year before and is therefore an increasing effort measure over time)
- This means that a business starting its effort in 2009 must report a 1.84% or better CAER year after year to hit target.
- This removes the need to set quantitative or methodological targets as the CAER covers effort not specifics.
- Interestingly the baseline date (1990? 2006?) is actually unimportant as the rates above ensure that effort to a set target reduction rate is being measured against effort start date to a set target percentage.
- This makes reporting far less problematic and allows a measurable reduction standard to be used to set targets across any business or sector