ICT for Energy Efficiency
Ad-hoc Consultation
Group Report

October 2008

Note:

ICT for Energy Efficiency

Group Report (Draft 7)

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Introduction

BACKGROUND

On 13 May 2008, the European Commission adopted a Communication "Addressing the Challenge of Energy Efficiency Through Information and Communication Technologies" (COM(2008)241). That Communication called for a Consultation and Partnership Process on ICTs for Energy Efficiency.

DG-Information Society and Media initiated that consultation process in May 2008. It took the form of an open on-line Public consultation, (20th May – 21st July) and the convening of an Ad-Hoc Advisory Group during the period June-Sept 2008. This is the report of that Advisory Group.

GROUP ORGANISATION

The Advisory Group members include the main bodies representing ICT providers, industry associations, end-users including regional and city groups as well as leading academics.

DG-Information Society and Media facilitated the meetings and an independent rapporteur was appointed to compile this report.

The report aims to bring out the common themes and makes a number of recommendations.

A full list of members is given in Annex I

APPROACH

The Advisory Group met on the 25th June, 24th July and 25th September 2008. Terms of Reference were circulated in advance of the June meeting and agreed there.

The Advisory Group was assisted by 6 groups addressing specific themes: Smart Grids, Buildings, Road transport, Lighting and Photonics, Manufacturing, and Restructuring.

The Advisory Group included at least one representative from each of these consultation groups.

The 6 consultation groups met between the meetings of the Advisory Group and provided their individual reports in early August.

Position papers were also submitted by Group Members:

- WWF "A Global Strategy for the 1st Billion Tonnes of CO_2 with ICT"
- Electra "20 Solutions for Growth and Investment to 2020 and Beyond"
- The Climate Group/ GeSI Report on "SMART2020: Enabling the low carbon economy in the information age"
- The EICTA report: "High tech low carbon"
- Gartner: Green IT – The new industry shockwave, 2007
- EICTA (Position Paper on Addressing the Challenge of Energy Efficiency Through Information and Communication Technologies, Brussels 23/7/2008)

- AeA Europe (Position Paper for Energy Efficiency 18/7/2008).

Information from the consultation group reports, the industry association position papers and the individual comments of the members were compiled by the rapporteur to form this Ad-hoc Advisory Group report. This report is not intended as a summary of the individual documents, these are appended in full in Annexes II to IX., rather this report aims to bring out the common themes from the various reports and make a number of comprehensive recommendations for consideration by the relevant stakeholders .

GENERAL CONTEXT

THE STARTING POINT OF THE CONSULTATION

The Advisory Group is acutely aware of the issues and opportunities faced by the European Union in transforming to a low carbon economy and society. We are agreed that there are political, business and social imperatives to achieve the transformation required in energy use in order to address the issue of climate change. We are of the view that this must be achieved within a strict timeframe and that such transformation can only be achieved both with EU policy support and a framework for co-operation and innovation across all the stakeholders..

We are also agreed that the European Union must take a leading role in the global transformation required in attitude, approach and application of ICT in the service of energy efficiency, environmental improvement and the resource intensity of all aspects of socio economic activity.

The Advisory Group started from the view that ICT has the potential to play a very significant part to play in achieving these objectives both through action by the ICT industry sector itself and more significantly as an enabler of the major business and social changes required to make the transformation to a low carbon economy and society. The way in which this might be achieved is presented in the following sections.

In addition to COM(2008)241, under which the Advisory Group was convened, we are aware of the main policy and advisory inputs which precede this consultation. In particular we note the Commission's Action Plan for Energy Efficiency COM(2006)545 and the specific target of a 20% reduction in EU energy consumption by 2020 as a step towards greater changes in the 2050 timeframe.

THE ISSUES ADDRESSED

The nature and scale of the climate change issue has been well stated in many reports and it is not necessary for us to restate it here. We do agree that ICT has a major role to play in tackling this problem. We also agree that to realise this potential that measures need to be taken to initiate, support and accelerate the process. We therefore focus in this report on advising the Commission on particular substantive and coordinated actions which we consider necessary to realise the required socio economic and environmental benefits.

Quoting from our terms of reference, we aim, in this report to:

- Provide and assess current data on the impacts (positive and negative) of ICT on energy efficiency and energy end use
- Identify opportunities for accelerating the re-structuring and dematerialisation potential of ICTs across the economy and society as a whole
- Identify the opportunities for partnerships, voluntary agreements and or specific regulatory measures that might accelerate the targeted deployment and uptake of ICT products and services to accelerate the transition to a *sustainable information society* and evaluate their possible effects
- Recommend other possible actions, including RTD roadmaps and priorities, awareness raising and sharing of best practices.

THE ROLE OF ICT

The group believes that ICT can play a major role in initiating and enabling the EU to reach its energy and environmental targets. Our estimates vary from 50% to 125% of the total 20% GHG reduction required by 2020. (Smart 2020 report, AeA and EICTA position papers).

The group recognized that ICT can be an enabler for economic growth and/or higher energy efficiency but that there are likely to be complex policy trade-offs for policy, business and individuals as stakeholders.

To help address this, the group recognized that ICT has to be viewed, developed, deployed and supported within a known and understood framework. Investment decisions in new technology have to be carefully examined on a case by case basis and seek to balance the optimal speed of technological change and the speed of diffusion for the proposed technology.

In parallel there is an urgent need for more research in the area of optimal technological change and technological diffusion involving multi-discipilinary cooperation between engineers, social scientists and end users in order to detect the true potential and benefits of various forms of ICT driven innovations for a more energy efficient society.This will require extensive cross-disciplinary and cross-sectoral approach for an enhanced holistic view of ICT for EE

“Faster the better" is not necessarily the optimal rule for action or policy programmes / recommendations. Forced technical progress (e.g. by subsidization) may lead to new and undesirable technological lock-in as newer and still better technologies rapidly emerge. An example of this may occur in relation to the first generation long life efficient lighting and the emergence of super efficient LED lighting unless the process is carefully managed at a policy, business and consumer level.

It was also recognised by the group that Information and Communication Technology (ICT) might have different (relative) impacts on energy consumption, and may indeed even increase it. To help avoid this, analyses and recommendations related to IT (Information technology) should be separated from CT (Communications Technologies), and broad ICT generalizations avoided unless quantified, qualified and explained.

Once available to the market the simple ownership of ICT capital is not enough.. It must be supplied and supported with appropriate software (e.g. in the form of energy measurement, accounting and management systems) and human skills in order to maximise the use of ICT capital in a manner designed to manage energy intensity downwards and productivity upwards.(e.g. through ongoing training, eduction, knowledge transfer,baselining, measuring, monitoring, control, optimization, simulations, reviews and business model innovation).

The group recognised that this process must lead to reductions in absolute levels of (fossil) energy consumption and not energy efficiency gains per se. In order to do these actions envisaged, we must explicitly address the issues related to the rebound and /or induction effects[1] both within the remit of the EU but also in the supply domains it influences, trades and interacts with.
Cross-disciplinary and cross-sectoral approach for an enhanced holistic view of ICT for EE

The available reductions which can be achieved through ICT have been categorised in the following way in other reports:

- **ICT s own footprint**
  Reduction of the energy consumed directly by ICT equipment in manufacture, use and disposal and in the delivery of ICT services;
  e.g.: Reduced power consumption in data centres, telecoms equipment and services,

[1] more units of energy efficient ICT in use and/or new purposes of use - leading to higher overall energy consumption

PCs and increased energy efficient computing due to increased availability of multi-core processors

    - **Process efficiencies and change in other sectors**
      Reduction in energy and material consumed in all other sectors, enabled through the application of new technologies.
      eg: Reduced power consumption in buildings, manufacturing, power transmission, transport, intelligent supply chain etc through the use of ICT solutions.

- **"Restructuring" through innovation and behaviour change**
  Saving material and energy by using ICT to restructure the social and economic activity model. (eg: teleworking , e-government, e-energy, digitisation, dematerialisation, business model innovation).

We agree that this categorisation encompasses the opportunity for ICT in enabling energy efficiency.

We have examined each of the categories in terms of:

- Available data on the potential impact (pre-existing knowledge)
- Potential to improve (through Research, Development or Deployment)
- Obstacles impeding the realisation of full potential
- Actions which can be taken to accelerate achievement of potential

ICT'S OWN CARBON FOOTPRINT

This aspect was not directly addressed by any of the 6 consultation groups. This section is therefore mainly based on the inputs from EICTA and AeA as well as individual member contributions. Data points are mainly taken from the SMART2020 and Gartner Group reports. The Advisory Group recognises that many of the policy measures developed to improve the energy efficiency of ICT equipment are within the competence of other DGs within the Commission, such as DG Energy and DG Environment.

Explicit coordination and cross alignment of policy creation, management and implementation has been recognised as a key prerequisite to generate leadership, build confidence and initiate rapid uptake and support by businesses and consumers for EU initiatives.

AVAILABLE DATA

Previous reports show that the use of ICT equipment in the delivery of services in Europe represents about 1.75% of green-house gas (GHG) emissions in Europe. A further 0.25% of GHG emissions are due to the production of ICT and consumer electronic equipment (also known as embedded carbon in ICT equipment). In other regions of the world the usage vs production ratios vary but the overall total is roughly consistent at 2% of total emissions, ie a global total of 0.5 GtCO2e[2] . We concur with these findings

The energy efficiency of individual devices is improving. Major ICT corporations are investing in Research and Technology Developments that are making ongoing and significant efficiency increases a market reality, in areas such as server power consumption, the increased use of multi-core processors at ever decreasing nanometre sizes and the shift toward LCD displays. Some users are deploying more efficient systems and services and making significant strides in introducing more sustainable and energy efficient practices.

However, as the range and penetration of devices and services increases, the overall energy use is growing at a much faster rate than technological development and deployment can offset . According to the Smart2020 report the footprint of the ICT industry is set to rise to 1.4 GtCO2e in 2020[3]; ie a 280% increase at global level, largely due to the expected increased take-up of ICT in developing economies.The group recognised and emphasised that addressing this rebound effect is critical to the success of reduction strategies in the areas of material and energy intensity and environmental impact.

POTENTIAL TO IMPROVE

There are three main ways in which the above situation could be improved upon:.

a) Increase the rate of development and diffusion of the most energy efficient equipment, components and systems available;

b) Encourage the market diffusion of more efficient systems, best practice and usage patterns.

c) Change the economic and social model to make best use of ICT to enable energy efficiency.

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[2] Gartner: Green IT – The new industry shockwave, 2007

[3] SMART 2020: Enabling the low carbon economy in the information age

Item (c) above fits under the heading of restructuring and we will deal with that later, however, in terms of quantifying the problem and the potential solutions, we believe it is necessary to decouple this from the measurement of the overall ICT footprint.

Clearly there are restructuring measures which can be taken which, while reducing global emissions would require deployment of additional ICT resources. We need to be cognisant of this when considering the overall picture. There are also some potential rebound and systemic effects which may carry the risk of an increase in energy efficiency without a corresponding decrease in overall energy consumption.

Obstacles impeding the rate of development and deployment of more efficient ICT

History shows that the rate of development of technology is largely driven by market forces. As energy costs rise the rate of development will continue to rise and energy efficiency becomes an important value proposition driving the market. Energy pricing however is variable and can negatively impact efficiency drives when prices fall. To ensure consistency of effort by stakeholders appropriate and timely regulatory actions to support the pace of innovation and change in the ICT sector and which incentivise the use of most energy efficient equipment (for example, commitment to encourage purchasing of most energy efficient IT equipment) is required.

In parallel there is an urgent need for more research in the area of optimal technological change and technological diffusion using a multi-disciplinary cooperation between engineers and social scientists in order to detect the true potential and benefits of various forms of ICT for society.

There is a lack of coherence at user level in terms of demanding best practice. Sustainable procurement policies exist in some member states, and the practice of 'choice editing' by governments, retailers and manufacturers has helped drive sustainable consumption. However there is a lack of standardisation and consumer awareness of efficiency ratings is patchy at best.

The current economic climate is likely, at least in the short term, to place greater emphasis on controlling capital expenditure and away from whole life cycle costs. Where a current system is inefficient, the step-function capital cost of a more efficient system is likely to be an obstacle. The business case for energy efficiency has not yet been cascaded down to individual purchase decisions. EU public policy aimed at supporting ICT’s enablement of energy efficiency should aim to change this.

ACTIONS TO ACCELERATE REDUCTION IN ICT INDUSTRY'S OWN CARBON FOOTPRINT

- Increase visibility and end user awareness of the efficiencies which can be achieved through the appropriate use of ICT and consequential changes in user behaviour.
- Use policy instruments to continue to enable and drive the adoption of best practice and the setting of minimum energy efficiency criteria and to incentivize going beyond legal minimum requirements.
- Improve standardisation and quantification of energy efficiency criteria in government procurement decisions to ensure that public procurement leads the way in setting an example for selecting the most energy efficient ICT
- more research in the area of optimal technological change and technological diffusion using a multi-disciplinary cooperation between engineers and social scientists in order to detect the true potential and benefits of various forms of ICT for society.

GREATER EFFICIENCIES ENABLED THROUGH THE USE OF ICT IN OTHER SECTORS

The potential energy efficiencies which can be achieved through the use of ICT was explored in detail by 5 of the consultation groups, ie Smart Grids , Buildings, Road transport, Lighting and Photonics and Manufacturing.

SMART ELECTRICAL GRIDS

Available Data

Energy generation and distribution uses one third of all primary energy. Electricity generation could be made more efficient by 40% and its transport and distribution by 10%. ICT could make not only the management of power grids more efficient but also facilitate the integration of renewable energy sources.

Heating, cooling and lighting of buildings account for more than 40% of European energy consumption. The introduction of real-time updates on their energy consumption stimulates consumer behavioural changes. In Finland, this smart metering encouraged consumers to reduce energy consumption by 7%. According to the French regulator, CRE, the implementation of Smart Metering would decrease residential consumption by (up to) 5% and decrease CO_2 emissions by (up to) 5%.

The integration of ICT tools for management of distribution and the smart meters at the consumer location with telecommunications networks forming an intelligent network capable of supporting distributed generation plant is generally known as an Active Distribution Networks and Advanced Metering Infrastructure within Smart Grids.

ICT enablement of the Smart Grid should be supported so that it can enable smarter grids via such things as two way communications between grid operators and customers; pervasive control systems through substation, distribution and feeder automation; and, decision support systems to increase predictive reliability.

Potential to increase energy efficiency through the use Smart Grids

SmartGrids were the largest opportunity found in the Smart 2020 study and that report concludes that they could globally reduce emissions by 2.03 GtCO2e , worth $124.6 billion; up to a 15% reduction of BAU emissions could be achieved in 2020 (7.8 GtCO2e) could be achieved (~ €553 billion in energy and fuel saved and an additional €91 billion in carbon saved, total of €644 billion savings).

The potential for ICT to reduce carbon emissions through SmartGrids technology could be substantial – some 2.03 GtCO2e by 2020 (~14% of Total Power sector emissions in 2020 - accounted for 24% of global emissions in 2002 and could be responsible for 14.26 GtCO2e in 2020).

The Smart Distribution Networks Group report in Annex IV cites several studies which highlight this potential, such as:

Norway (Research project) : Market Based Demand Response Project (2005-2008) performed by SINTEF Energy Research with the Norwegian TSO (Statnett) as responsible partner on behalf of the Research Council. During the pilot project, the customers with the new power product reduced their consumption by 24.5% in quarter 1 of 2006, while customers with spot price power products and standard power products increased their consumption by 10.4% and 7.7% respectively in the same period.

Denmark: DONG Energy, using Demand Side Management, achieved 25%-50% reduction in Non Delivered Energy, 35% reduction in fault search time and up to 90% reduction in Network Reinforcement costs

Britain : For residential and small businesses, the benefit from radical reform would lead to 3.4% in Energy/capacity savings and 1% carbon savings (British Gas cost benefit – undertaken for British Gas by Frontier Economics).

US: At Olympic Peninsula, Smart metering reduced power use 15 % during key peak hours over 12 months and 50% over a “significant” period and consumers saved 10% on their bills (U.S. Pacific Northwest National Lab).

Canada: At Ontario Canada, Time of Use and targeted contracts and tariffs achieved 6% average energy conservation effect and Critical Peak load shifting (summer) of 5.7% and 25.4% (indicative).

For Commercial and Industrial Customers: Real Time Pricing effect on lighting and air conditioning systems achieved cost and demand reduction up to 42% during peak hours (Lawrence Berkeley Labs Pilot). Integrated Demand-Response Platform for lighting in an industrial facility enabled 20-30 % shedding during peak usage and 50 % on second-shift and weekends (Boeing study). Incorporating demand response into the US market with dynamic pricing would lead to $10 to $15 billion savings per year (IEA).

According to the Demand Response Management report (CG-Vaasa ett-Enerdata), €50bn in avoided investment related to peak generation capacity and T&D (~150 Medium sized gas power plants) and €25bn annual savings in electricity bills for customers (~annual residential electricity consumption of Finland's 5 million inhabitant) and 202 TWh of annual energy savings (~Total residential consumption in Spain and Germany), 100 million tons of CO2 emission reductions annually (~50% of the 2020 target).

Obstacles impeding the rate of deployment of Smart Grids

There is a need for greater visibility and communication of the potential benefits of Smart Grids for customers, producers, equipment & technology suppliers and distributors of energy as an overall strong business case to make the huge transformation in the Electricity Networks required by 2020 and beyond.

There are standardisation issues in ICT in general, for instance in the overall communication between Households and the Network and Service operators in a Liberalized unbundled European market. This covers Home Appliances, Smart Metering and Concentrators communication standards with Customer Information Systems, Field Services Systems, Home Area Networks, Local Area Networks, Wide Area Networks and overall interoperability across the value chain. Unification and Synchronization of Data Exchange when Utilities or Metering Operators are offering Electricity, Gas and Water meters and when they need to be independent of Meter vendors ("plug and play") become mandatory.

There is a need for more research and development in the area of consumer demand side and demand response management, based on real time consumptions and customer behaviour models per customer segment and per geography ("one size doesn't fit all", but a limited number of categories could be defined).

There is a need as well for research and development in the area of infrastructure readiness related to the integration of a large scale number of Distributed Generation and Renewable Energy Resources, in Power Electronics and intelligent algorithms embedded in the future Smarter Networks.

Large consumers require integration with their own operational platforms and financial systems to manage the overall energy consumption within their overall company expenses.

Small and medium consumers require greater real-time visibility of usage and costs to influence consumption, ready to run automated energy saving solutions, advice on changes to be implemented and benefits expected and a “Single Stop Shop” to plan, fund and realize the changes.

Whilst there communication issues, there are great opportunities regarding the creation of business cases for Smart Grid investment, replacement of aging infrastructure and more Network and Consumers active participation. However, these can be made more complex by the number of owners/stakeholders in the total energy value chain ie power generators, power transmission operators, distribution operators, retailers, traders, metering operators, technology and service providers, consumers, regulators, etc, and the unique national structure of the value chain in different countries.

Actions to Accelerate the Deployment of Smart Grids

The consultation group provided a list of 31 recommendations under 6 categories.

I. ICT Studies, Business Cases, Surveys, Projects best practices, Go to Market requirements:

- European funded project : Build a European Standard business case for Smart Metering comprising best practices from existing projects
- Library of case studies across diversity of business customers (schools, grocery, stores, retail stores, private sector office buildings, warehouses, etc) to being more visibility to Utilities about Demand-Response (EU project)
- Assistance in developing energy management capabilities for end users
- Create ICT enabled energy efficiency standard indicators
- Comprehensive survey of European Demand-Response pilots (EU survey)

II. Customer Information and Communications enablement (Smart Metering)

- European Regulation :
  - Time of Use Metering and Billing (real consumption) mandatory in Europe
  - Large scale penetration of Smart Metering to reach 100% penetration in 2015
  - Incentives for investments
- Standardization
  - European harmonization and standardization group to be setup : Interoperability open standards between metering suppliers and end-to-end from customers to Utilities
- Telecom and Utilities
  - Setup joint cooperation between Utilities and Telecommunications
  - Setup up a publicly available infrastructure for smart metering (versus PLC and GPRS) (European project)

III. Demand Side and Demand Response Management and Real Time Pricing

- Standardization
  - Automated Demand-Response Communication Standards for C&I buildings
- Incentives

    - Develop innovative incentives and business models to share benefits on Demand-Response across various stakeholders
  - R&D
    - Technical feasibility of distributed, autonomous load control

IV. Home Energy management device (internet like box)

  - Metering or Home Equipment manufacturers : Collecting real time consumption of household appliances and connected to the Smart Meters (European project)

V. Readiness of Infrastructure Network to connect Large scale DG and RES

  - European project: Research innovative technologies for minimizing network losses and improving network stability (Key Performance Indicators : FACTS, WAMS,
  - European project: large scale connection of DG and RES to the Grid by 2020 (considering 20 to 50 % renewable capacity connected to the Grid)

VI. ICT readiness for Electric Powered transport (eg PHEV)

  - Car Manufacturers and European Green Car Programs: Promote the deployment of PHEV
  - European RES Programs: Promote renewable energy programs around cars
  - European Regulation: Push the creation of a consumption-billing infrastructure for electric cars and of Time of use rate plans as incentive for PHEV
  - Change the regulatory framework to allow pan-European ubiquitous micro-payments and engage Telecoms and Banking

By implementing these recommendations, significant energy savings can be achieved. The extent of the savings will depend on the successful combination of smart processes (like Demand response) and smart technologies (like Smart Meters).

These best practices and experiences from European and non-European regions based on specific technologies and processes targeting energy savings lead us to assume positive outcomes, for instance:

- Peak load shaving on specific periods : up to 50% reduction
- Consumer energy consumption reduction : up to 25%
- Network losses reduction: up to 50% reduction in the current losses which account for 2%-8% of total losses in general.

PHOTONICS AND LIGHTING

Available Data

ALMOST 20% OF THE ELECTRICITY CONSUMPTION WORLDWIDE IS USED FOR LIGHTING. IF TODAY THE BEST ALTERNATIVES AVAILABLE WERE TO BE APPLIED IN ALL INSTALLATIONS AN ENERGY SAVING OF 30% IS ENVISIONED.

Potential to Improve

Solid-state light sources, i.e. light-emitting diodes (LED) and organic light emitting diodes (OLED), may in the future outperform almost all other light sources in terms of efficiency and thus provide a saving potential of about 50% of the electrical energy used for lighting. If the advanced LED technology is combined with intelligent light management system, which will control the light output according to ambient lighting conditions or people's presence, another 20% can be saved – in sum 70%. By realising those solutions, huge benefits could be achieved:

- From an environmental perspective more than 1000 Mt of carbon dioxide can be saved per year on a global level
- The economy will be boosted by increasing Europe's industrial position in lamp, luminaire and driving electronics, jointly employing 150,000 people today
- Each year more than 300 billion euro can be saved on the global energy bill
- Society at large will profit from more visual comfort by superior light solutions and from less light pollution
- Energy efficient light technologies will provide significant individual savings

Obstacles impeding the rate of deployment of energy efficient lighting

- High performance technology is not available yet to its full extent and slow market adaptation and acceptance limit the realisation of these intelligent LED solutions.
- Lack of public awareness of scale of benefits and cost effectiveness in terms of cost of ownership
- Consumer resistance due to investment in first generation "long life" bulbs
- Poor public perception due to quality of lighting achieved in early implementations
- Inconsistent metrics, codes, and standards
- Lack of compatibility of new formats to existing stock of luminaires

Actions to Accelerate the Deployment of energy efficient lighting

The faster market share can be gained, the sooner people can profit from their benefits and the sooner the burden of increasing energy cost can be eased. Rapid market penetration is critical to business returns and reductions in overall energy intensity. In order to accelerate both the consultation group proposes the following measures:

- Member states and local authorities should provide fiscal incentives for intelligent energy efficient lighting technologies

- The Commission and member states should support large pilot actions to demonstrate the benefits of intelligent SSL lighting technology, to study its acceptance and to determine its economical cost.
- The Commission and member states should call for and increase their support for research on SSL targeting both indoor & outdoor applications, especially addressing high quality white LED sources with improved efficiency
- The Commission should extend its present research focus beyond photonic components, i.e. LEDs and sensors, to the ambient intelligent lighting solutions, system integration at present being hardly addressed in European project.
- The Commission should reconsider the clear split between research programmes in FP7 on one side and real-life demonstration programmes in CIP on the other side; research and demonstration in this case should run in parallel, in order to shorten the learning cycles
- The Commission should set minimum performance requirements for lighting systems under the regulation for Energy using products (EuP). These requirements should be tuned to the application and should be adapted to on a regular basis in order to reflect the actual state of technology.
- Industry must cooperate on open standards and norms in order to guarantee interoperability of the future lighting solutions and backward compatibility with existing luminaire stock. This effort should extend itself beyond the lighting domain and cover interfacing with building and power management systems.

MANUFACTURING INDUSTRY

Available Data

Europe has a share of 18% in 2006 of the global energy consumption (10.9 billion toe) [Infineon].

World electricity generation will almost double, from 16.4 million GWh in 2004 to 30.1 million GWh in 2030. That is an increase of 2.4% annually[Infineon].

Energy consumption in Europe (EU-27) was 1.168 MT Oil-Equivalent in 2005. The distribution was: industry 28%, traffic 31% and others 41%[Chryssolouris].

Keeping manufacturing industries strong is essential for Europe's sustainable growth and welfare. In turn, the European manufacturing industries can contribute to reaching European policy and G8 targets.

Potential to Improve

The potential to increase the energy and material efficiency in mechanical, thermal and chemical processes and production systems are estimated to be as high as at 25-30% [Neugebauer]:

The Smart Manufacturing Group Report lists potential/target improvements in efficiency for the following three types of manufacturing:

- Discrete Part Manufacturing
  - Process optimization 25-30%
  - Optimised Logistics 16%
  - Integrated Process Chain 30%
  - Development of New Products 10-40%
  - Intelligent Motor Drives 20-40%
  - Alignment with best performers 15%

- Semiconductor Manufacturing (targets)
  - Greenhouse gas emissions 33% by 2010
  - Energy consumption 40% by 2010

- Process industry
  - Cement industry 27,5% since 1990
  - Steel, alignment with best performers 10-15%

The Smart2020 and ELECTRA reports highlight the level of inefficiency in motor system control. Up to 88% of the world's motor drives are not electronically controlled making them up to 50% less efficient compared to an electronically controlled equivalent. Up to 50% of these inefficient motor drives could be retrofitted.

Obstacles impeding the rate of improvement in energy efficiency in manufacturing

- Lack of reliable and coherent data with respect to energy efficiency.
  Eurostat provides interesting data, but they do not reflect the needs of the sectors

with respect to energy efficiency. The data are only rarely comparable between industries.

- Lack of visibility of best practices
  Best practices is a means where companies benchmark to find out how problems are solved in other companies or industries.

- Lack of standards
  There is a lack of energy management standards against which manufacturing companies can be measured and certified ie compared to the framework of standards covering quality management or safety management.

Actions to Accelerate the Deployment of Smart Manufacturing

Information on energy consumption and the carbon footprint throughout the manufacturing supply chain should be collected and made available

Certification schemes for companies based on a standardized approach

Energy labelling from products(today) to processes(tomorrow)

Some prominent pilot projects demonstrating the symbiosis between ICT and manufacturing should be started

In the long run, R&D for the development of new ICT to support simulation, modelling, large scale(wireless) monitoring and control would be an essential contribution to further reduce the carbon footprint of manufacturing.

TRANSPORT AND LOGISTICS

Available Data

Worldwide the overall transport sector is responsible for almost half of the annual oil consumption and about one third of the total global energy consumption. Road transport accounts for almost 70% of this. Concerning CO2 emissions from road transport, the statistical average is around 17% but ranges from between 10% and 22% depending on the scope of the analysis.

Potential to improve energy efficiency of transport

The energy efficiency in the transport and logistics sector can be improved by the deployment of the ICT systems such as:

- Traffic Management & Control
- Navigation & Guidance,
- Access & Demand Management,
- Eco-Driving & Support,
- Freight Logistics & Fleet Management,
- Higher penetration of in-vehicle safety devices to avoid accidents and related congestion.

The Electra report estimates savings of 26% of transport energy use through the deployment of such systems.

Elements that can contribute to such CO2 savings include:

- Improving driver efficiency
    - Help travellers find the most eco-friendly route & transport mode choice
    - Support drivers to acquire and adopt eco-driving techniques.
- Increasing fuel efficiency by making traffic flow more smoothly
    - Collecting real-time information about traffic and environment conditions, incidents
    - Improved traffic flow through infrastructure measures like traffic light synchronization, variable message signs, and dynamic route guidance (RTTI); demand management, and access control;
- Direct and control access to critical zones of high potential pollution by constantly measuring traffic density, structure of traffic and air quality
- Smoother driving using safety systems such as adaptive cruise control (ACC), stop-and-go assistance, vehicle-to-X communication (e.g. interactive traffic control, local danger warning)

Obstacles Impeding the Rate of Improvement in Energy Efficiency in Transport and Logistics

- Lack of reliable data
- National cabotage laws impeding efficient supply chain logistics
- Need to retrofit existing vehicles
- Speed not energy efficiency is the main KPI for commercial transport
- Lack of cost benefit tools for environmental analysis of transport investments

Actions to Accelerate the Deployment Transport and Logistics Energy Solutions

- Development of alternative consistent scenarios on global and European energy consumption and related emissions for all modes of transport
- Initiation of studies to carefully quantify, evaluate and appraise the potential impact of ICT/ITS applications on fuel consumption and emissions with emphasis both on intelligent infrastructure and advanced vehicle safety technologies
- Introduction of European and global standards for selected ITS - technologies when appropriate
- Publication of a best practice guide for municipalities on energy efficient traffic management solutions and work with industry on a list of “eco-innovations”

EC and Member State action points:

- Support deployment of such ICT technologies and services where saving potential has already been proven including monitoring & measurement systems
- Development and implementation of area traffic management strategies optimized for environmental criteria including mobile data collection, real-time traffic and travel information, parking management and energy-optimized dynamic traffic control involving all relevant stakeholders (integrated approach)
- Harmonization of the approach to environment-friendly and energy-efficient mobility in order to ensure interoperability and economies of scale
- Optimization of traffic flow management & control to achieve less traffic delays and congestion by up to 40% with equivalent energy savings by investing in intelligent infrastructure like VMS (variable message signs), Urban Traffic Control centers and speed management
- Promotion of individual use of dynamic navigation systems to save mileage (up to 16%) and journey time (up to 18%) while avoiding environmentally sensitive areas
- Work with industry to set up a cooperative infrastructure to allow vehicle-to-vehicle and vehicle-to-infrastructure communication

Industry action points:

- Develop products and services (R&D) to improve traffic management like provision of better real-time traffic information (floating car data), ADAS (Advanced Driver Assistant Systems), intelligent infrastructure products (VMS, Traffic Light Synchronization, satellite based road user charging), digital maps with safety and eco information, help to change driver behavior (eco-driving feedback systems) and provide interconnection of different traffic modes (multi-modality)
- Management of multi-interfaces and security
- Applying an integrated approach e.g. PPP and stakeholder co-operations

BUILDINGS

Available Data

More than 40% of the energy consumption in Europe is due to heating and lighting operations within buildings. Moreover, buildings are the largest source of CO2 emissions in the EU.

The majority of energy consumption is due to space and water heating within households, although the share of consumption of lighting and appliances is rising over time (this situation is similar within the service sector although the share of lighting and appliance consumption is higher than in households due to greater utilisation of ICT equipment).

According to Smart2020, the worldwide energy consumption for buildings will grow by 45% from 2002 to 2025 – where buildings account for about 40% of energy demand with 33% in commercial buildings and even 67% in residential buildings.

Potential to Improve

The Smart Buildings Group Report (Annex V) identifies five areas where there is potential to improve energy efficiency through the use of ICT.

Design and Simulation Tools

When new buildings are built, designers can apply ICT tools to plan buildings that minimize energy consumption – e.g. simulating and optimizing envelope measures and passive solar heating techniques – achieving significant improvements in buildings' energy performance by providing monitors and sensors throughout that can help more accurately measure usage, system status and equipment conditions as well as: full price information, dynamic tariff and demand response and allowing more energy efficient customer choices, value adder services and more integrated demand side automation..

Studies undertaken in Europe highlighted that designers can achieve significant improvements in building's energy performance if they apply ICT tools to plan buildings that minimize energy consumption – e.g. simulating and optimizing envelope measures and passive solar heating techniques - designers can achieve significant improvements in building's energy performance.

In moderately cold climates, such as the ones of Central Europe, for example, specific heating needs can in principle be reduced from over 200 kWh/m2/year to less than 15 kWh/m2/year[4].

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[4] The potential global CO2 reductions from ICT use. Identifying and assessing the opportunities to reduce the first billion tonnes of CO2 – from WWF (World Wide Fund).

Interoperability /Standards

Most building control systems today are based on localised microprocessors with hardwired sensors controlling single functions. It is not unusual to have separate controllers for heating, cooling air conditioning etc. There are significant opportunities for efficiency but most are lost due to lack of integration and compatibility. The most appropriate solution would be one single control system, governing all HVAC, lighting and other electrical applications, and related sub-systems installed in a building. The main barrier to this logical solution is the fact that the different sub-systems are manufactured and often installed and even operated by different companies.

Building automation

In the area of home automation, which is primarily perceived as improving life quality (e.g. more comfortable, safer homes), ICT has the potential to contribute to energy efficiency through the use of improved control and management systems based on smart appliances and communication networks.

Smart metering

Smart metering enables more accurate measurement of consumption via the use of advanced meters which are connected to a central unit through a communications network, improving data collection for billing purposes. The benefits of smart metering were examined in detail in the grids report. Their benefit from the consumer perspective is reiterated in the buildings report. Smart metering provides information on consumption patterns contributing to more sustainable consumption and energy savings.

User-awareness tools

The provision of intuitive feedback to users on real time energy consumption has significant potential to change behaviour on energy-intensive systems usage. Different studies have shown that a reduction of 5-15% of energy consumption could be achieved through the implementation of this measure.

Obstacles impeding Achievement of Potential Efficiencies in Buildings

The Buildings consultation group have identified the following list of barriers to

be overcome:

- Lack of (common) agreement of what sustainable and energy-efficient buildings are;
- Incompatibility between different control systems and sensors
- Lack of real-time energy measurement and management tools of energy consumption
- Lack of intuitive user energy consumption awareness tools
- Lack of incentives for architects, builders, developers and owners to invest in smart building technology from which they will not benefit or payback periods are too long;
- A lack of skilled technicians to handle complex Building Management System (BMS) design and operation
- Each building is unique - difficulty in applying common standards for efficiency and operations;
- Lack of incentives for energy companies to sell less energy and encourage efficiency among customers.
- Long building renewal cycles

Actions to Accelerate the Deployment of Energy Efficient Solutions in Buildings

- Standardisation of sensor and BMS interfaces
- Development of standard business models
- A comprehensive and systemic view needs to consider future construction including life-cycle aspects (of buildings materials, design, and demolition), use (including on-site power generation and its interface with the electric grid), and location (in terms of urban densities and access to employment and services)
- Currently the EU has in place several directives that affect energy efficiency in buildings, both looking at appliances (Eco-design of Energy Using Products Directive, EuP) and the energy performance of the building as a whole (Energy Performance in Buildings Directive, EPBD). The latter is scheduled to be recast with a proposal coming from the European Commission by the end of 2008. This recast should strengthen the energy efficiency requirements for new and renovated buildings including considerations on the potential of ICT enabled energy efficiency.
- The recast EPBD should include a clause on best-performing component refurbishment/replacement: It should be a mandatory requirement that, when refurbishment or replacement of components takes place, the opportunity to maximise the energy efficiency potential should always be taken.
- Additionally, the EPBD mandates inspections on heating and cooling equipment. Such inspections should be made to cover the entire HVAC system and installation – including looking at ICT enabled potentials in systems management and controls.

Restructuring

Restructuring is defined by the group as the transition to and establishment of a transformed economy and society that enhances present and future social well being, increases business efficiency and viability whilst reducing the lifecycle material, energy and environmental cost of goods and services through the adoption of new processes and behaviours.

In their report the restructuring group examines the key challenges, opportunities, responsibilities and preferred outcomes achievable through the transformation of both the processes and outcomes of production and consumption. The group looked at what was achievable through focusing the three main stakeholders (political, business and social) and on the establishment of production and consumption frameworks that do more with less.

Transformation of this order cannot be easily modelled and trials of sufficient scale have yet to be established. Empirical data for the efficiencies which could be obtained are not readily available. Whilst the challenges are well known, the opportunities and actions to achieve them are less evident and poorly explored. The restructuring consultation group report does not therefore follow the same form as the other group reports in terms of examining existing data, opportunities to improve etc.

Essentially what emerged is a comprehensive view of what is possible, what is required and what is dependent on restructuring. Its implications are clear: there are real and rapid opportunities available for efficiency today that pre-position Europe for enhanced, environmentally positive prosperity and renewed competitive advantage tomorrow.

These advantages will not be realised without the mobilisation of society and changes in individual and corporate behaviour. People need information, "enablement tools" and, above all, leadership.

The group recognise that the European Union has already or is in the process of creating key strategic restructuring enablers in:

- Telecommunications (Mobile costs, data transfer, market enablement)
- Open systems, open standards & interoperable requirements
- Competitive and alternative energy infrastructure and supply
- Key product and service efficiency standards and regulations
- Key Financial management infrastructures and standards
- Consumer protection and enhanced rights
- Carbon trading infrastructure, sector inclusion and management
- Research and development initiatives and financing

Obstacles Impeding the Transition to an Energy Efficient Economy

The restructuring group have identified an extensive set of constraints. The key constraints, which are common to the other group conclusions, are:

- The lack of a an integrated strategic plan or model from which to understand and plan initiatives
- The lack of ICT tools for consistent data measurement, integration, visibility and use across stakeholders to measure strategic and tactical progress against such a plan.
- The small scale of prior initiatives, pilots, tests and "roll-outs"
- The lack of leadership and first mover advantage
- The poor integration of environmental measurement and consideration in the core of business planning
- The lack of innovation in business models, management skill sets and consumer education.
- The lack of long term efficiency and environmental education in all stakeholder groups

Actions to Accelerate the Transition to an Energy Efficient Economy

Restructuring of the EU economy is required to maintain competitiveness, social progress and environmental improvement.

Failure on any of these dimensions would fundamentally undermine EU, national, business and individual well being.

ICT is however just a part of the challenge the EU faces in transitioning to an energy efficient economy. ICT operates within an economic, social and political framework. All these influence and are influenced by changes in ICT based enabling technologies, techniques and usage behaviours.

Each dimension identified has challenges and opportunities. The restructuring group has identified a number of actions that can help address the challenges whilst assisting in the identification and exploitation of the opportunities.

- Creation of an integrated 360° strategic plan and model that is centrally managed, coordinated and communicated within and across the stakeholders
- Creation of a knowledge base to capture and accelerate the diffusion of knowledge and best demonstrated practices within and between stakeholders.
- The identification, deployment and evolution of future scoped ICT based tools for the consistent and dynamic measurement of environmental impact of stakeholder activities.
- A focus on rapid large scale urban and regional deployments of present and future ICT based enablers of energy efficiency and environmental management applications at all levels of metropolitan activity.
- Research and availability of advanced business models to encourage and drive innovation and business changes.
- Implementation of life long and management career development educational programs in all stakeholder groups
- Rewards and incentives to encourage the emergence of leaders in all stakeholder groups
- Acceleration of cross stakeholder cooperation, knowledge sharing and innovation

- Acceleration of EU and global efficiency and environmental standards creation and implementation across the stakeholders and global supply network servicing the EU.

The Restructuring Group recommends two main actions to support this transition

1. The use of using ICT tools to dynamically measure the 360° carbon footprint of stakeholders

2. The establishment of large scale, coordinated and multi city "roll-outs" for carbon footprint measurement, energy efficiency and improved services supported by ICT tools.

These two actions can together be used to orient and drive the required transition and:

- Encourage and enable the use of partnerships of leaders both in the community and business to deploy ICT to facilitate systemic GHG emissions measurement and reduction and a major contribution to the 2020 targets.

- Establish a platform for measuring and informing citizens, service providers and organisations about the carbon footprint of all activities of a city's life….in the appropriate format: real time energy information for the consumer and business, and detailed cost centre attribution for city managers.

- Ensure that a city's own ICT infrastructure has the minimal possible carbon footprint.

- Facilitate ICT/Digital infrastructures for a City to enable low carbon activities and more importantly to address systemic carbon efficiencies - for example linking congestion charging with real time public transport information and telecentre availability.

- Encourage and promote low carbon activities through real time carbon trading systems.

- Create city specific Green Digital Partnerships (businesses large and small, service providers, public sector, financial services, universities) that will own and deliver on a Green Digital Plan.

AD-HOC ADVISORY GROUP CONCLUSIONS AND RECOMMENDATIONS

The Advisory Group concludes that the ICT is a key enabler to support the achievement of the EU energy efficiency targets. ICT is already making and can continue to make a significant impact by reducing its own carbon footprint thereby providing leadership. More significantly, ICT can enable energy efficiencies in other sectors and ICT is fundamental to support the necessary transformation to a low carbon economy and society. This will not, however be achieved without action and appropriate policy support.

The Groups recommendations can be subdivided into

- Recommendations for support of RTD in ICT for Energy Efficiency where it is considered that normal market forces will not deliver technologies and solutions in time

- Recommendations for particular actions to support innovation in ICT for Energy Efficiency and to drive the process and behavioural changes required to meet the challenges we face.

RECOMMENDATIONS FOR SUPPORT FOR RTD IN ICT FOR ENERGY EFFICIENCY

6.1.1 Accurate Modelling of the value chain, Simulations, Real-time Monitoring Measurement and Management of Energy Efficiency based on Decision Support Systems

The theme of real-time monitoring and measurement was raised in several groups. In many cases it is the missing element which prevents the realisation of full energy efficiency potential. “What you cannot measure you cannot control.”

The Restructuring Group specifically proposes the dynamic measurement of carbon footprints using ICT tools. Without dynamic measurement and real time reward for reductions the consumer is not fully engaged in the process and the demand for energy efficiency is suppressed.

Smart Grids, traffic management, building management, enterprise management and industrial automation systems all require real time monitoring and measurement in order to function as closed loop systems and achieve maximum efficiency.

There is for example a clear link between smarter grids and smarter buildings via creating conditions for better two way communication by providing monitors and sensors throughout buildings that can help more accurately measure usage, system status and equipment conditions as well as: full price information, dynamic tariff and demand response and allowing more energy efficient customer choices, value added services and more integrated demand side automation

The use of closed loop control systems in large industrial process is well established. The extension of this concept to the large scale management of energy usage in corporations, SMEs and at the consumer level poses an enormous challenge. This will require:

- the development of standardised low cost embedded measurement and control devices for use at individual appliance level
- the development of energy management software tools and their integration into enterprise management systems
- the establishment of new codes of practice and governance for efficient energy usage

Market forces alone will not enable the development of these technologies in time to meet the targets which have been set for energy efficiency.
In addition, modelling and simulation tools for solution designers can achieve significant improvements in energy efficient planning and designing operations such as in buildings, grids and lighting areas - e.g. simulating and optimizing envelope measures and passive solar heating techniques.

Recommendations

- The EU RTD programmes should support the development of standardised low cost, communications capable, embedded measurement and control devices for use at individual appliance level

- The EU RTD programmes should support the development of ICT based Enterprise management systems to provide businesses with standards based business integration and modelling capability for energy efficiency data, provide consistent and comparable EU wide audit capability and reporting for stakeholder visibility and governance purposes.

- The EU RTD programmes should support the development of the ICT Modelling, simulation, and optimisation tools and applications required to support and manage efficient energy consumption as detailed in the individual group reports.

6.1.2 Cross-disciplinary and cross-sectoral approach for an enhanced holistic view of ICT for Energy Efficiency

The EU RTD programmes should support the development of multi-disciplinary and cross-sectoral RTD activities, in order to allow the future development of mutualised and global approaches and ICT-based infrastructures encompassing a hilistic view on Energy

Efficiency, and integrating complementaries and synergies among "energy-starving" industrial domains. By 2015, global concertation between industry sectors should deliver seamless and pervasive knowledge and business resources at disposal of the European networks of actors from various industrial sectors in order to rapidly set-up, efficiently manage and effectively operate different forms of Energy-Efficient strategies at Urban, district or regional levels.
A cross collaboration between these sectors has to be organised, at the common interfaces between them – the table below is an initial draw of already identified strong links between the six individual groups addressing specific themes*:*

Smart Manufacturing	• Link with embodied energy in buildings and building materials. It is considered that about 10%[5] of all CO_2 emissions globally comes from the production of building materials. In particular steel, concrete (cement), bricks and glass require very high production temperatures that can only be reached today by the burning of fossil fuels. Knowledge from Smart Manufacturing is of high interest here so s to take into account these constraints in future buildings. • Processes in the Construction sector largely involve a complex supply chain – improvement from Smart Manufacturing considering Construction supply chain constraints will have impact in terms of reduction of CO_2 emissions.
Smart Electric Grids	• Need for improvement in Smart Metering, including within the Built environment, and customers' communication / awareness. • Home Energy Controlling box (Internet box). • Development of ICT-based NMS (Neighborhood *Management Systems*), considering future positive-energy buildings as potential active nodes (supply of energy) in future Smart Electric Grids.
Lighting & Photonic	• It is considered that about 12%[6] of energy consumption in buildings is due to lighting. This figure increases in the non-residential building sector. • Smart integration of new lighting technology (high performance technology) and devices (e.g. intelligent LED solutions) in Smart Buildings.
Smart Mobility	• Smart integration of Buildings & Networks in Energy efficient Urban monitoring • Integration of ICT tools for the design phase of buildings and urban developments
Re-Structuring	• New business cases and new (ICT-based) business models • Establishment of common (integrated) platform for measuring and

[5] Roughly estimated figure – to be confirmed in the future.

[6] Bertoldi, P.; Atanasiu, B. (2007). Electricity Consumption and Efficiency Trends in the Enlarged European Union –Status report 2006. Technical Report Series EUR 22753 EN. Ispra: EC-JRC, Institute for Environment and Sustainability, p. 6

	informing citizens, service providers and organisations about the carbon footprint of all activities of, e.g. a city's life.

6.1.3 Large-scale pilots and living labs for ICT impact on energy efficiency assessment

The EU RTD programmes should support the development of new research infrastructures including large-scale pilots and living labs with a clear European dimension, that will:

- Advance the field of user centred research,
- Test, evaluate and improve innovations for the different areas from an integrated approach,
- Foster societal needs such as sustainability and quality of life,
- Stimulate competitiveness of European industry.

One key advantage of this approach over other simulation setups is that products can be evaluated in a real-life environment, over a prolonged period of time. This way, researchers and product developers can achieve a deeper understanding and uncover valuable insights about how people interact with products, leading to the development of better products, with real benefits for consumers and society in general and a better chance of succeeding in the market..

In addition, this will bring the opportunity of achieving real impact assessment of ICT tools for Smart Electrical Grids, Smart Lighting, Smart Manufacturing, Smart Mobility and Smart Buildings could interact in a holistic demonstration environment.

6.2.2 Establishing the State of the Art and The Future Roadmap

Until the relatively recent past energy efficiency has had a low profile in the ICT sector and up to now has been viewed wholly in terms of its use of energy and subsequent carbon footprint. Many of the solution elements required already exist. There are initiatives and projects whose results need dissemination in order to highlight the opportunities which exist to provide "quick wins" and demonstrate an early mover advantage.

Recommendations:

- The Member States should support the creation of a single integrated strategic roadmap with milestones to provide guidance, clarity and focus for member states, businesses and consumers.

- The Member States should initiate the collection, maintenance and publication of best practice technical, initiative, policy, process and innovation across the stakeholders and their activities. This would lead to the creation of a single on-line knowledge database, to collect manage and maintain up to date details of existing technologies, support solutions, deployed initiatives, results, emerging business models and best demonstrated practices related to energy efficiency and environmental impact management..

6.2.3 Driving Restructuring

The restructuring group have defined the outcomes desired from restructuring, they have identified the constraints and proposed a number of short, medium and long term enabler. Restructuring will only succeed if the pull factors are sufficient, however, in view of the complexity of the issues and the risk of unwanted rebound effects there is a need for a coherent driving force at the policy level. There is also a need for co-ordination of the necessary partnerships between the various actors, e.g. cities, utilities and consumers

<u>Recommendations</u>

- The creation within the European Commission and national government a coordination function where policies that focus on the opportunities for ICT and Energy Efficiency can be cross aligned and coordinated. This should also ensure a more holistic and coordinated approach to legislation/policy initiatives such as the Ecodesign directive, Energy Efficiency Buildings Directive, Sustainable Consumption and Production Policy, Green Public Procurement, Emission Trading Scheme, and the Energy Efficiency Action Plan.

- Develop Impact Assessments guidelines by which DG INFSO can evaluate the potential energy savings through the use of ICT solutions for any new proposed piece of legislation that passes Interservice consultation. This is of particular importance in the area of the energy, transport, eGovernment, eHealth, eEnergy security, justice and border control.

  Develop Impact Assessments guidelines, in line with policy Impact assessment procedures, by which any stakeholder can evaluate the potential energy savings through the use of ICT solutions for any new initiative they undertake.

6.2.3 SHOWING THE WAY – CITY/REGIONAL ACTION

Business cases are difficult to make. There are many issues around scale, cross-sectoral and cross-border co-operation to be resolved. There is a need for a replicable framework for action on a large scale, e.g. city wide or regional. Once this is established and the benefits demonstrated it can be rapidly rolled out throughout the community.

Recommendation:

- EU funds should be made available support and highlight a series of city / region led actions to test, measure and promote energy efficiency initiatives thereby encouraging partnerships that build awareness and leadership. They should be cross-sectoral and, at least in some cases, should be cross-border .

  In particular these actions should:

  - Enable – Facilitate the ICT infrastructure required for low carbon activities
  - Measure – Generate real time, online emissions information for households and businesses, through integration of IT-enabled energy measurement systems
  - Manage – Deliver emissions trading and neighbourhood action plans for households and businesses via online platforms that enable collective, community activity
    ICT as a source of emissions
  - Minimise – Lower public sector emissions through take-up of green options for high impact IT activities
  - Monitor – Encourage Independent annual green IT audits, publicly available to evaluate effectiveness of green IT delivery for both the public and private sector
    Innovation in use of ICT to reduce emissions
  - Share – Disseminate learning and best practice from projects across government, business and citizens, through online platforms.

Concrete examples:

The development of regions and cities energy losses visibility (like Google Earth for Energy losses per building and individual consumption benchmarking with average street, city, country's neighbourhoud consumption.

The development of an electronic transactional marketplace connecting households, service providers, energy providers and financing bodies (the "ebay" of households renovations to execute projects saving households' energy)

6.2.4Leading by example

The scale and complexity of the challenge has led to a leadership vacuum. Champions risk isolation, no first mover advantage is yet seen in the political, business or social domains.

Recommendations

- The Commission should lead by example and introduce some of the restructuring/ dematerialisation solutions, such as workplace transformation, printing on demand, and advanced teleconferencing systems. The Commission could start with leading by example and installing advanced video conferencing facilities in their major Missions throughout the world to facilitate face-to-face communication and reduce international travel.

6.2.5 Visibility and Awareness Building

Awareness of the issues and of the potential opportunities and solutions is low, particularly among consumers, small business and regional / local government. There is not enough awareness of good news stories or examples of best practice. There is a need for concerted awareness creation activity and leadership. .

Recommendations:

- The Member States should support the development of open platforms and communities to share knowledge, online tools and publish best practice guides for energy efficiency in specific sectors eg cities, transport authorities etc

- The Commission should publish best practice guides for energy efficiency in specific sectors eg cities, transport authorities etc

6.2.6 Technical Standards and Interoperability

All of the Groups made reference to standards issues.

- At the Technical Level
  e.g. sensors, smart meters, lighting elements
- At the system interoperability level
  e.g. traffic management systems, load management to building management financial management, to etc,
- At the measurement and reporting level
  e.g. Inconsistent metrics, labelling, carbon equivalences etc

Recommendations:

- The European Standards bodies should establish new codes of standard practice and governance for efficient energy usage across the EU.

- The Commission recommends the establishment and ongoing management of an ICT based inventory of standards in order to facilitate and drive increased efficiency in the development, management, uptake and integration of standards by business.
- The Commission recommends the development of an ICT enabled energy efficiency certification process for products, processes and services in support of business efficiency and consumer education.
- The Commission recommends the development and mandated use of standard product level machine readable energy efficiency labelling in order to establish energy efficiency as a visible competitive business advantage and a purchase influencer for consumers.

6.2.7 Financial Issues based on overall Finance modelling of "net" Energy cost / savings

Several constraints were highlighted relating to investment decisions in ICT for Energy Efficiency ie;

- Difficulty in making business cases where investor / developer is not beneficiary
- Long replacement cycle, eg power infrastructure
- Short term ROI expectations
- Fragmented sources of investment with no overall co-ordination
- Initial cost more significant than lifetime cost in constrained capital market
- True costs of material and energy overhead of products not clearly known

<u>Recommendations:</u>

- Sample standard business case models should be developed or ICT investment, including total cost of ownership and carbon accounting elements.
- Modelling of throuseholds sesivitivity around people change, price of Energy, subsidies allocation, end-consumer savings and Energy recycling.
- Develop guidance and tools under the Commission's "Better public procurement for the environment" initiative. Cost of energy should be a mandatory criterion in evaluating total cost of ownership of ICT.
- The Commission and the Member States should develop a system of financial incentives which reduce the ROI for ICT supported energy efficiency projects. Such incentives can include tax reductions for such projects, supportive capital depreciation rules, cheap credits, mortgages that fund energy efficiency, and co-financing. Such incentives would help to remove some of the hurdles to uptake energy efficiency technology, in particular in areas related to infrastructure and construction.

- The Commission should encourage the public sector to follow 'forward commitment procurement' to stimulate sustainable product innovation.

- Enabling of carbon credits or energy efficiency credits trading, to enhance the economic incentive for sectors which are not regulated by carbon caps to reduce their energy use, such as through investing in ICT-enabled solutions.

6.2.8Education and Training

There is a need for additional action in the area of education and training in the areas where ICT can enable energy efficiency. This is required to increase awareness of the issues, solutions and opportunities. This is needed in the schools ,in technical training and in business education

<u>Recommendations:</u>

The Commission and Member States should develop education policies which ensure that:

- Environmental awareness is part of all educational programs at all ages
- Schools take a holistic approach to energy efficiency act as community champions and make use of available tools to reduce energy consumption, this could include:
    - Online books instead of hard copies
    - School construction planning should make use of GIS tools to ensure that locations optimise travel time
    - Car pooling for school use supported by school websites
    - Overhead measurement projects as part of KPI for schools
    - Children given home measurement projects for home work
    - Product impact analysis and usage behaviour projects for children
- In business administration education environmental awareness must be raised to the same level as financial and business governance. The use of ICT in the management of energy efficiency should be a standard module for business graduates. This is considered key to the emergence of champions within business.
- Energy efficiency and the use of ICT to measure and manage energy usage should be integrated in technical training and certification of practitioners.(e.g. architects, designers, manufacturing engineers etc)
- Publicly Accessible Education (as simple as possible like for “dummys”) and continuous up-to-date knwoledge transfer (for example to freelance workers at hourseholds)

Annex I

List of Members of The Ad-Hoc Advisory Group