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## Sectoral e-Business Watch Workshop: ICT and e-Business Implications for Energy Consumption

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### 1 Summary

#### Background

The relation between ICT use and energy consumption is the focus of a Sectoral e-Business Watch study in 2008. The study uses econometric modelling and company case studies to come to a better understanding of this relation. Research up to now recognises that the power of ICT can help control and reduce energy use in existing processes. But it is not clear to what extent savings might be offset by increased energy use by the ICT capital stock itself. Overall there can be an *income* effect (economic boost and **more** energy consumption through increased ICT use) or a *substitution* effect (changes in structure and capital stock towards higher productivity and **lower** energy consumption).

This workshop gathered experts from the various sectors involved to hear and discuss the initial results of the study. Participants provided feedback and made suggestions that could be taken on board in current when completing the study.

The final study results will be presented to the Sectoral e-Business Watch Conference to be held in Brussels on 19 and 20 May 2008.

#### Programme

The workshop was opened by **Hasan Alkas** (EC, DG ENTR), who gave an overview of the SeBW programme, emphasising its importance as a tool for formulating both overall and sectoral industrial policy at EU level. He also underlined the importance of the ICT sector for the European economy, both as a production sector in its own right, and as an element in the overall business chain. He stressed that Europe had to focus on quality in the fiercely competitive global ICT market.

**Reinhard Madlener** (RWTH Aachen University) then presented the preliminary results of the empirical research on the impact of ICT on energy consumption. Some first comments on these results to date were made by **Martin Wörter** (ETHZ - Swiss Federal Institute of Technology, Zurich). Next **Reinhard Madlener** provided a summary of three case studies of the way selected companies are using ICT to measure, understand and reduce energy consumption. **Maher Chebbo** of SAP responded to the case studies and provided an overview of current and upcoming ICT priorities for the energy industry and its consumers. This was followed by a discussion of the findings, during which a number of suggestions were made for areas to be considered in the future.

## 2 Main Points Presented and Discussed

### ICT impact on energy consumption: desk & empirical research

**Reinhard Madlener** started by outlining [previous research](#) on this topic. While there have been countless studies on the links between ICT and growth or between energy consumption and growth, the relationship between ICT and energy consumption remains largely unexplored, at least from an economic point of view. Three relevant economic studies have approached the topic from different angles. A French study (Collard et al., 2005) suggests that information technology tends to increase electricity intensity of production, while communications technology in general reduces intensity. The “CT” impact is greater than the “IT” impact. A Japanese study (Takase and Murota, 2004) concludes that increasing IT lowers CO<sub>2</sub> intensity, but energy consumption may go up or down, depending on whether the income effect or the substitution effect dominates. A South Korean study (Cho et al., 2007) found that ICT investment promotes substitution away from labour and towards electricity. The outcome differs from sector to sector, with energy consumption going down in manufacturing, but going up in the services sector.

Two other economic studies were mentioned. A study by Laitner (2003) suggests that the issue is clouded by the sheer complexity of the information society, and that a focus on direct energy requirements alone may not be the right angle to take. However, he does conclude that small reductions in energy intensity can be brought about by a range of interrelated trends. A Japanese study on projected intensified ICT use in Japan (Ishida and Yanagisawa, 2003) suggests that it would be possible to prevent an increase in energy consumption only if ICT-induced economic growth were capped.

The objective of the [empirical research](#) was to present the relationship between energy (electricity) use and ICT capital stock. Electricity consumption data was taken from EUROSTAT, while the EU KLEMS database provided a range of input factors (ICT capital stock, energy, material, service, labour and non-ICT capital), which could be combined to measure a production function for different industries. Data had been taken for eight countries (the only ones where figures were available in the EU KLEMS database over a sufficiently long time-frame, 1980-2004), and covered five sectors that are among the areas of focus within the SeBW project overall (metals, chemicals, transport and logistics, financial intermediation and retail).

Mr Madlener stressed that work was not yet at the stage where clear answers could be provided. Work is still ongoing on the models to be used to combine this data in the way that best represents the relationship between energy and ICT investment and use. He also stressed that the sectoral data used is aggregate data from national statistics offices, which can only provide a broad picture. Nevertheless, when using this data, descriptive analysis showed some interesting trends, and also some unexplained departures from trends (e.g. for Italy and the UK), while model-based analysis showed greatly varying output elasticities with respect to different input factors across the sectors studied so far (metals, chemicals). ICT also brings with it a number of structural changes and new behavioural patterns that make it difficult to assess the overall impact on energy intensity or consumption.

**Martin Wörter** commented on the data choice and models used, suggesting that the results could consider growth rates over time, and productivity. He also suggested looking in more depth into the relationships between human capital and ICT capital – are there implications for training and qualifications? – and the reasons why the research had identified departures from the trends.

**Georg Erber** (DIW Berlin) commented that different sectors had different levels of substitution (e.g. ICT substitution for other input factors in the banking sector was far greater than in the chemicals industry). Also there was a need to look at “embedded” ICT – an increasing range of goods such as cars have a high ICT content (e.g. micro-processors in the engine system) that would not show up in the data on ICT capital stock.

**Bernard Aebischer** (ETHZ - Swiss Federal Institute of Technology, Zurich) agreed and suggested that there was a need for a clear definition of what was included in the term “ICT capital stock”.

**Petteri Repo** (National Consumer Research Centre, Helsinki) stressed the need to use long-range data and learning from bad experiences as well as good practice. New areas of activity are not always put into practice and impact is therefore only visible in the data over a longer period.

### Company case studies

Mr Madlener presented the results of three case studies, involving companies who had turned to ICT as a means of measuring, understanding, and ultimately cutting, their energy use.

- § **Erdemir** is Turkey’s largest iron and steel producer, and accounts for 1.7% of Turkey’s entire energy consumption. The company used IT applications to bring together all its control systems under one switch, and to provide an on-screen Plant Information System as a means of monitoring energy consumption. This has resulted in energy savings of up to 5%, and an early-warning system for any anomalies (e.g. pressurised air leakages) within the production system.
- § Irish food producer **Jacob Fruitfield** set up an Energy Monitoring System to tackle deficiencies identified in an energy audit. The system has helped reduce gas consumption by 9%, provided better understanding of consumption patterns, and has instilled greater energy awareness among staff.
- § **Coop**, Switzerland’s second-largest retailer, set up an Energy Management System in an attempt to reduce electricity and heat consumption, and to meet its commitments under national climate policy. The system combines data collection from its 950 food retail stores with a comprehensive building management system, which makes sure that target values for temperature and consumption of fuel, electricity and water are met. It also oversees the recovery of energy from the cooling system, which has reduced heat energy demand by some 60%.

**Maher Chebbo** commented that the best results were achieved when technical and production ICT systems were clearly linked to ICT systems for business development. He suggested that company case studies could be set against a sort of maturity matrix, to show how far advanced a company is in its field with respect to the use of ICT. He pointed to advances in ICT systems for managing energy data, and for managing energy use itself. SAP energy applications bring together energy use from across a company to create a portfolio, so that energy use overall can be measured. Here, standardisation of ICT can play an important role – for example, common interfaces can make systems leaner and more automated.

### ICT and energy efficiency: the advent of smart grids

**Mr Chebbo** went on to consider the IT challenges presented by trends in the energy sector – trends set by a changing regulatory, market, competition, consumer and investment climate. Liberalisation of the energy sector means that traditional vertically-integrated energy companies have been split into chains of producers or suppliers, each with very different ICT profiles and needs.

ICT will need to provide a number of answers to the joint challenge of the EU’s 20-20-20 goals for energy and the need for large-scale investment in the EU’s power infrastructure. He pointed to the ongoing development of electronic smart grids that would allow for much better understanding of energy needs. They would employ two-way communication, allowing for targeted responses and tariffs to meet users’ needs, and for a much more flexible management of power supply.

### Recommendations

It was suggested to use the company case studies as a source of anecdotal evidence to support and/or clarify the econometric study results. **Gabriella Cattaneo** (IDC EMEA) remarked that many utility companies were leading the way in the use of ICT to pursue energy efficiency. She pointed out that other operators might not be so motivated, or that the decision-makers for IT were not necessarily considering investments with an energy-conscious outlook. Perhaps there is a role here for policy-

makers to provide the incentives. Energy service companies (ESCOs) are also playing an increasingly important role here.

It was agreed in general that there was a need for a mentality change – but also that climate change policy and marginal cost energy pricing were two push factors already driving this change.

**John Doyle** (EC, DG INFSO) suggested that support for ICT was just one of many ways of tackling energy efficiency, and that overall we should be looking how to separate economic growth from growth in energy consumption as part of the EU's overall move towards the knowledge-based society.

Further more specific recommendations for the remaining work on the study were made in the Advisory Board meeting that followed the workshop.

### 3 Conclusions

This project's research on the link between ICT and energy intensity is now drawing conclusions. It has identified some key trends based on the data available. These trends are different depending on the sector being considered.

There is a need to make the main findings and limitations of the research clearer, and to ensure that final conclusions are in an adequate form fed in to policy-makers. It may be that these conclusions are specific to certain industry sectors, rather than relevant across the board.

Mr Madlener recognised that – at a later stage and subject to data availability – a clearer picture could be drawn up through the use of micro data in the econometric modelling. Also, wider use of the existing data set could be considered for up to 13 EU countries, though this data covers only a much shorter time-frame (+/- 1995 – 2004).

### 4 Further information

Further information, including the agenda and proceedings, are available at the Sectoral e-Business Watch Web site ([www.ebusiness-watch.org](http://www.ebusiness-watch.org)) in the "eBiz Events" section.

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#### About the Sectoral e-Business W@tch

The "Sectoral e-Business Watch" ([www.ebusiness-watch.org](http://www.ebusiness-watch.org)) is based on a Framework Contract (No. ENTR/2006-019) and Specific Contract (No. SI2.451854) between the European Commission, Enterprise and Industry Directorate General, and empirica GmbH. The implementation of the contract involves, besides empirica GmbH, the following main service providers: Altran Group, Databank, DIW Berlin, GOPA-Cartermill, IDC EMEA, Ipsos GmbH and Rambøll Management.

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