The Role of ICT in Energy Consumption and Energy Efficiency

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Outline

- Aims & Methods of the Study
- Contents of the Study
- Expert Interviews Questionnaire
- Status Report
Main Aims of the Study

1. Provide an overview of
   - ICT energy consumption
   - ICT potential for energy efficiency

2. Second axis: time
   - Current situation
   - Future developments – opportunities and risks

3. Side result: current ICT & EE efforts
   - Initiatives, programmes, projects
   - Mainly EU-funded, but also UN, US, Japan
Progress in Consumption

Moore’s Law

Energy Consumption

Example:
ICT-Related Energy Consumption in Germany

Umweltbundesamt/Borderstep-Institut 2009
Unused Optimization Potentials in Industry

- Process Optimization 20%-25%
- Optimized Logistics 16%
- Integrated Process Chain 30%
- Development of New Products 10%-40%
- Intelligent Motor Drives 20%-40%

Manufacturing in total: 25%-30%

## Optimization Potentials (Energy)

<table>
<thead>
<tr>
<th>Sector</th>
<th>in % of sector energy consumption</th>
<th>in % of overall energy consumption</th>
</tr>
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<tbody>
<tr>
<td>Manufacturing</td>
<td>25%-30%</td>
<td>7%-8.4%</td>
</tr>
<tr>
<td>Transport</td>
<td>26%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Buildings</td>
<td>5%-15%</td>
<td>2%-6%</td>
</tr>
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Methods

- State of the art
  - EMPA’s know-how
  - Extensive literature coverage

- Peek into the future
  - Literature
  - Expert interviews

- Existing programmes & projects
  - EMPA’s know-how
  - Research
Life Cycle Assessment (LCA) is an ISO-standardized methodology to assess the overall environmental impact of providing one functional unit with a given product system.
**Life-Cycle Assessment of a PC**

Desktop PC produced in China in 2005, used and recycled in Switzerland.

Contents

1. Basic Definitions and Scope of the Study
2. Relevance of ICT-Related Energy Consumption and Energy Efficiency
3. State of the Art
4. Future Potential – Results of Expert Interviews
5. National and International Research Programmes
6. Involved Organisations and Research Institutes
7. List of Experts
1 Basic Definitions and Scope of Study

- Information and Communication Technologies
  - Existing Definitions
  - Inherent Complexity of the Task
  - Types of ICT Considered in this Study

- Energy Consumption
  - General Definition
  - ICT-Related Energy Consumption

- Energy Efficiency
  - General Definition
  - ICT-Related Energy Efficiency

- Scope and Methodology of the Study
  - Selection of Literature
  - Expert Interviews
2 Motivation (Relevance of...)

- Importance of Sustainability Research in this Field
  - Outstanding Opportunities and Risks
  - Relative Importance of ICT Compared with other Technologies

- Scientific Interest in this Field
  - Emergence of “ICT and Sustainability” as Research Field
  - Issues of Scientific Methodology

- Economic Importance of the Field
  - Private-Sector Initiatives
  - Estimates of Macro-Economic Relevance

- Political Relevance of the Field
  - National Initiatives/Policies
  - EU Initiatives/Policies
  - UN Initiatives/Policies
3 State of the Art

- Conceptual Framework
- EU-Funded Projects Contributing to the Field
- Measuring ICT-Related Energy Consumption
  - Approaches Based on Direct Energy Consumption
  - The Link between Energy Consumption and CO2 Emissions
  - LCA-Based Methods and Results
  - From Micro- to Macro-Level
3 State of the Art (cont)

- Estimating ICT-Related Energy Efficiency
  - Direct Comparison of Virtual and Physical Meetings
  - Direct Comparison of Electronic and Print Media
  - Direct Comparison of ICT-Controlled All-Electric Cars with Conventional Cars
  - ICT-Related Energy Efficiency Potentials in Power Consumption and Distribution Including Demand-Side management

- Macro-Level Estimates of the Impact of ICT on Energy Efficiency in Specific Sectors
- Macro-Level Estimates of the Impact of ICT on Energy Efficiency at the National Level
- Macro-Level Estimates of the Impact of ICT on Energy Efficiency at the Global Level
4 Future – Results of Expert Interviews

- Reducing ICT-Related Energy Consumption
  - Potential of Technical and Organisational Measures
  - Expected Rebound-Effects
- Unleashing ICT-Related Energy Efficiency Potentials
- Future Research Demand and Relative Importance of Specific Research Fields
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Expert Interviews – 3 Topics

- **What is ICT?**
  - Servers
  - Network infrastructure – e.g., optic fibers
  - End-user devices – e.g., TV sets, set-top boxes, peripherals

- **ICT-Related Energy Consumption**
  - Development until 2020
    - Evolution along nowadays‘ parameters
    - Energy reduction measures consequently followed
  - .. for the above-listed classes of products
Expert Interviews – 3 Topics (cont)

- ICT for Energy Efficiency
  - Which energy saving potential (2020) have the topics
    - smart electricity grids
    - buildings and neighbourhoods
    - transport and mobility
    - logistics incl. supply-chain-management
    - manufacturing
    - telepresence and remote work
  - Which other sectors?
  - Peak into a more distant future (2050) – energy efficient society. How has this been attained?
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