

ICT-ensure



Materials Science & Technology

The Role of ICT in Energy Consumption and Energy Efficiency

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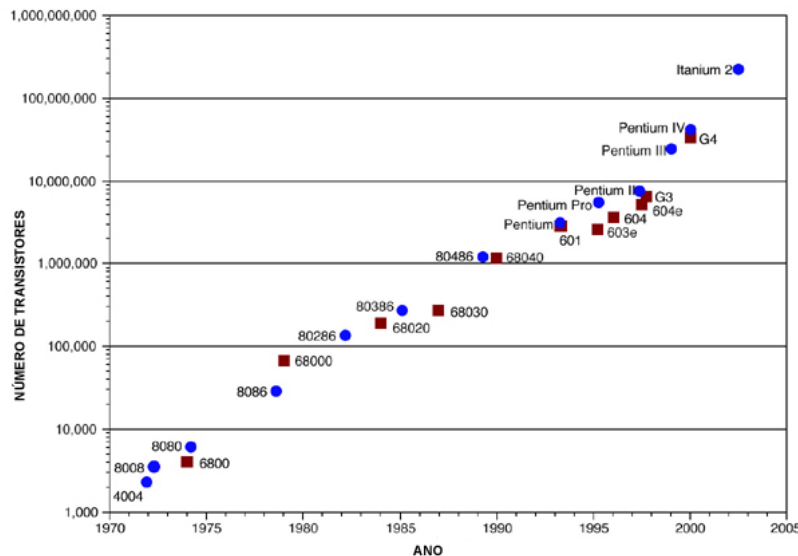
Outline

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

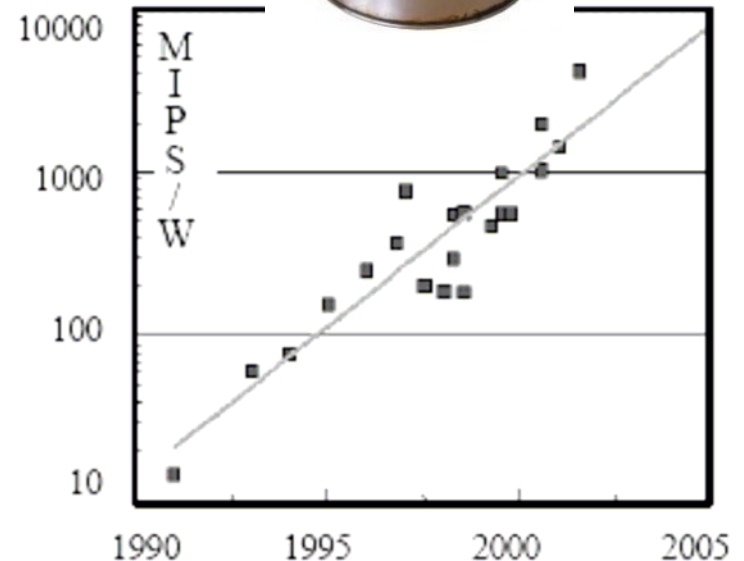
Main Aims of the Study

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



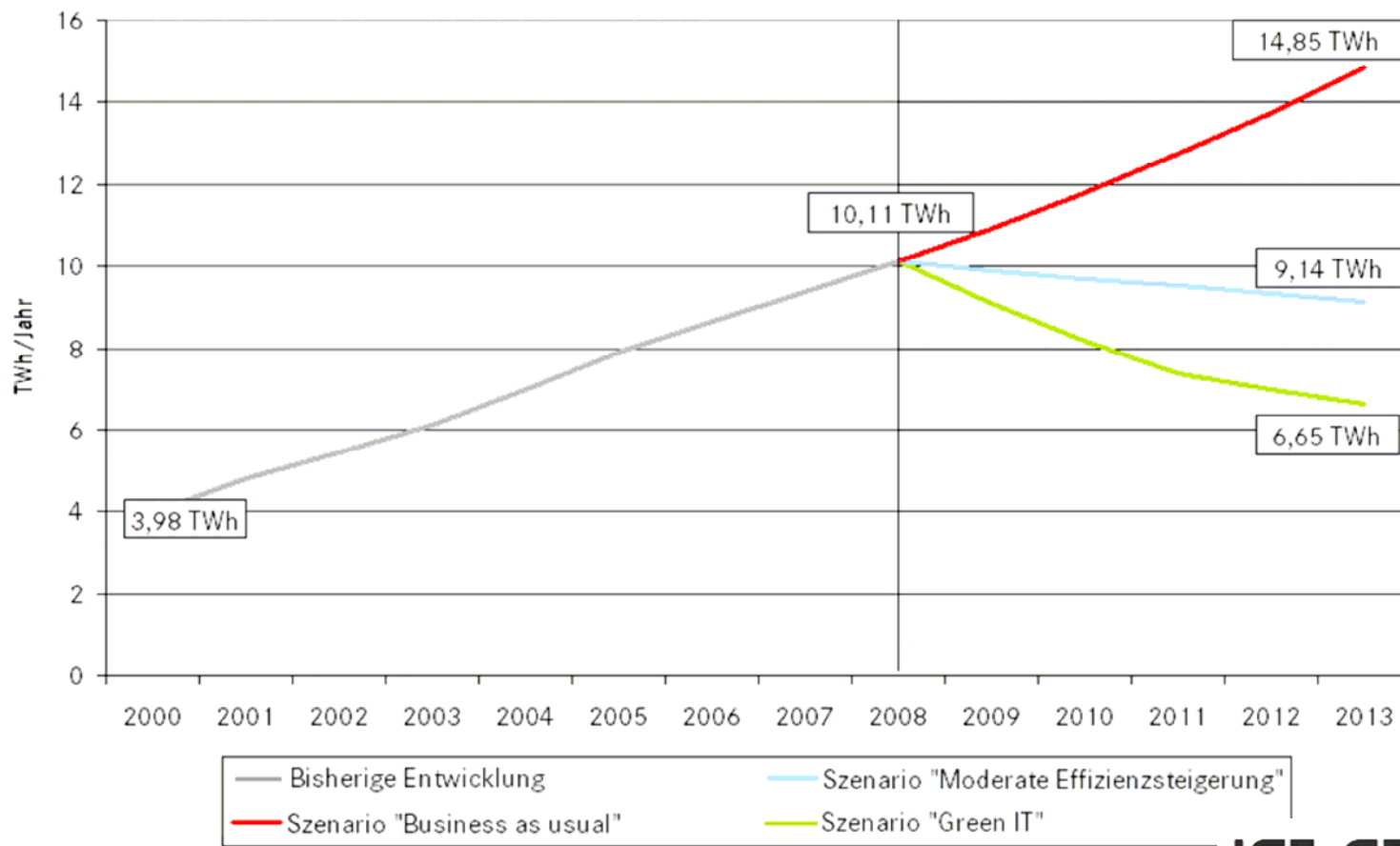
Moore's Law



Energy Consumption

Mattern, F.: Die technische Basis für das Internet der Dinge. in: Fleisch, E.; Mattern, F. (Hrsg.): Das Internet der Dinge. Springer 2005, pp. 39-66

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%

specific energy savings

Ad-hoc Advisory Group „ICT for Energy Efficiency“ of the European Commission DG INFSO, Final Report, 2008

Optimization Potentials (Energy)

| | in % of sector energy consumption | in % of overall energy consumption |
|---------------|-----------------------------------|------------------------------------|
| Manufacturing | 25%-30% | 7%-8.4% |
| Transport | 26% | 8.1% |
| Buildings | 5%-15% | 2%-6% |

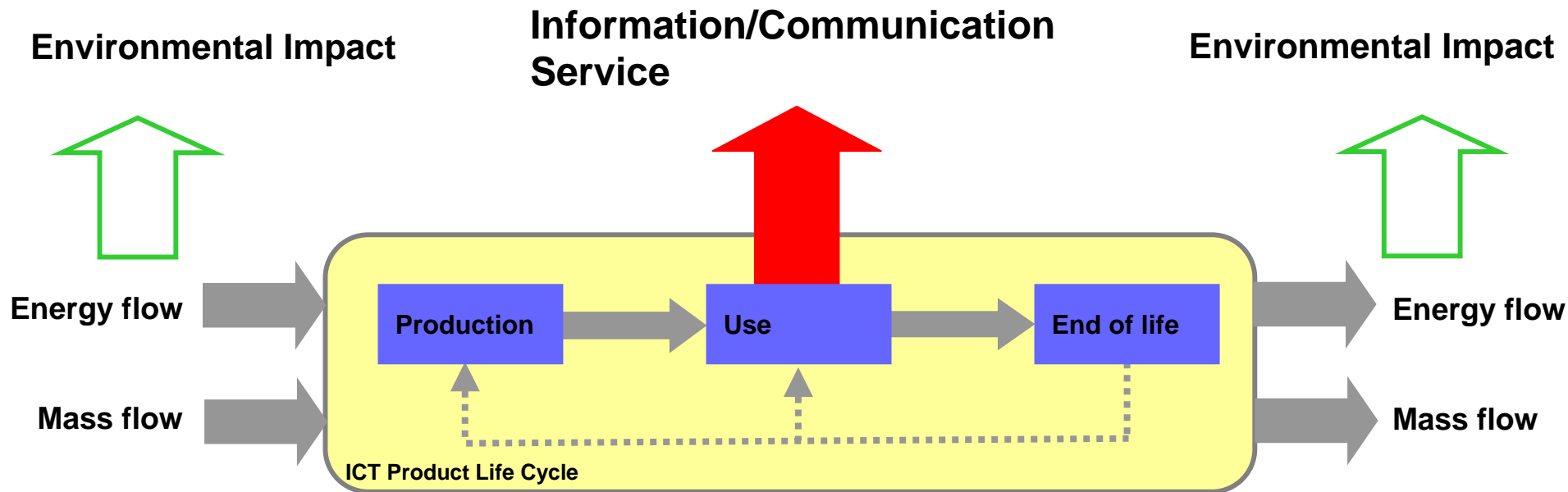
Ad-hoc Advisory Group „ICT for Energy Efficiency“ of the European Commission DG INFSO, 2008

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

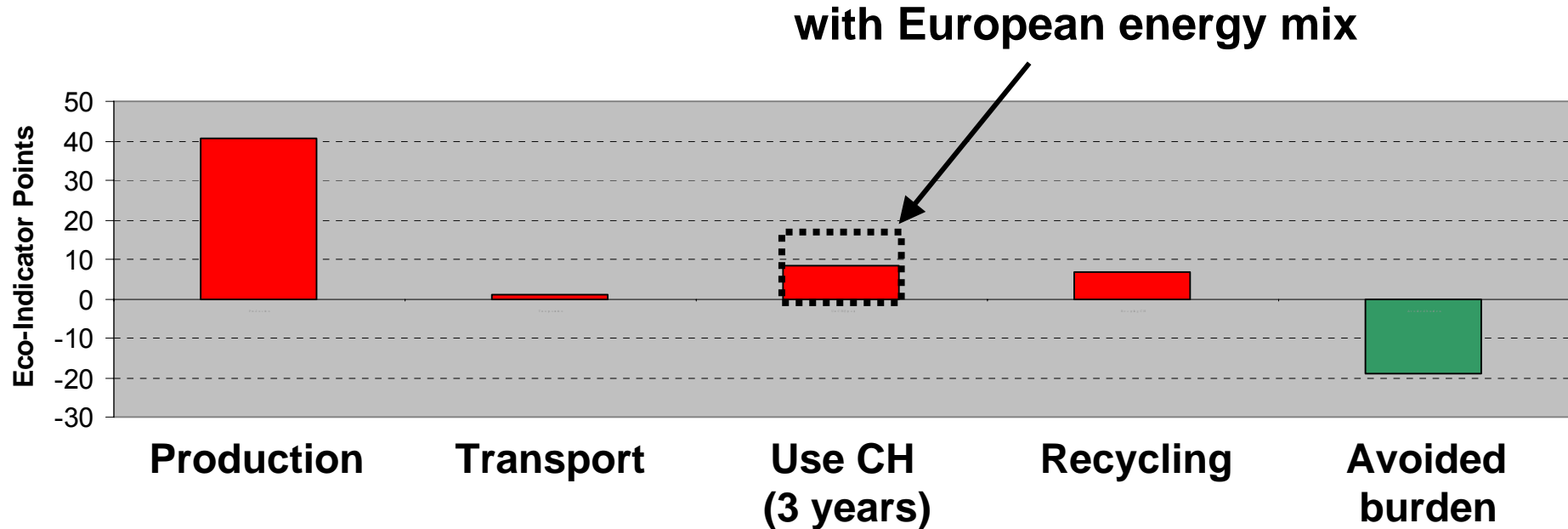


Life Cycle Assessment (LCA)



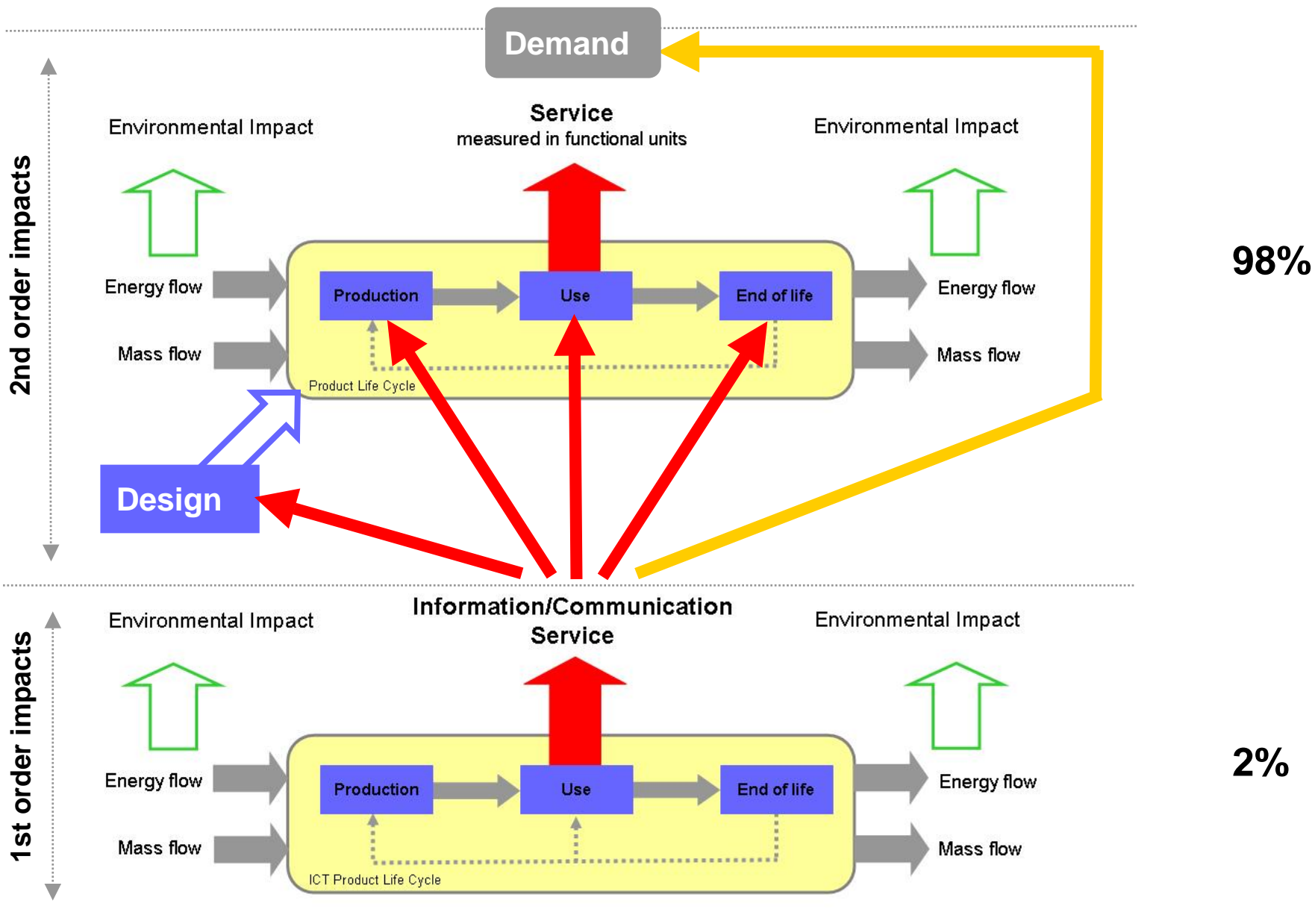
Life Cycle Assessment (LCA) is an ISO-standardized methodology to assess the overall environmental impact of **providing one functional unit** with a given product system.

Life-Cycle Assessment of a PC



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

Eugster, M., Hischier, R., Huabo, D.: Key Environmental Impacts of the Chinese EEE-Industry – A Life Cycle Assessment Study. Empa and Tsinghua University, St.Gallen and Beijing (2007)



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?

Děkuji

