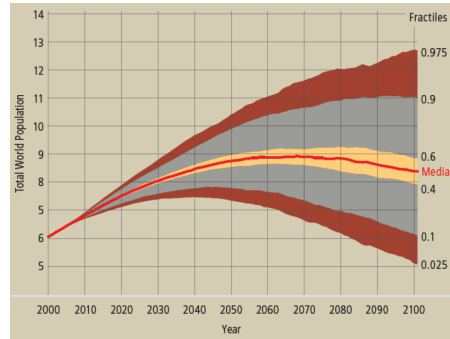




FROM ENVIRONMENTAL INFORMATICS TO SUSTAINABILITY INFORMATICS?

Lorenz M. Hilty
University of Zurich *and*
Technology and Society Lab, Empa
Switzerland

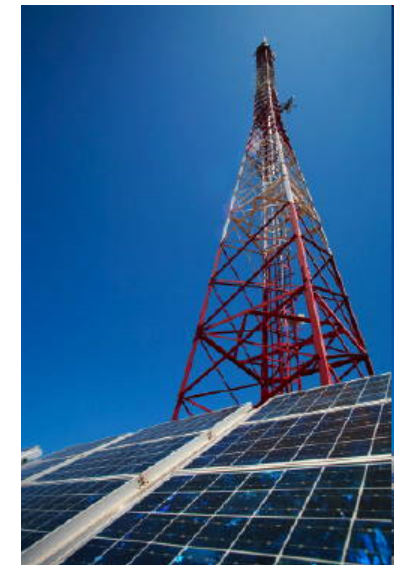
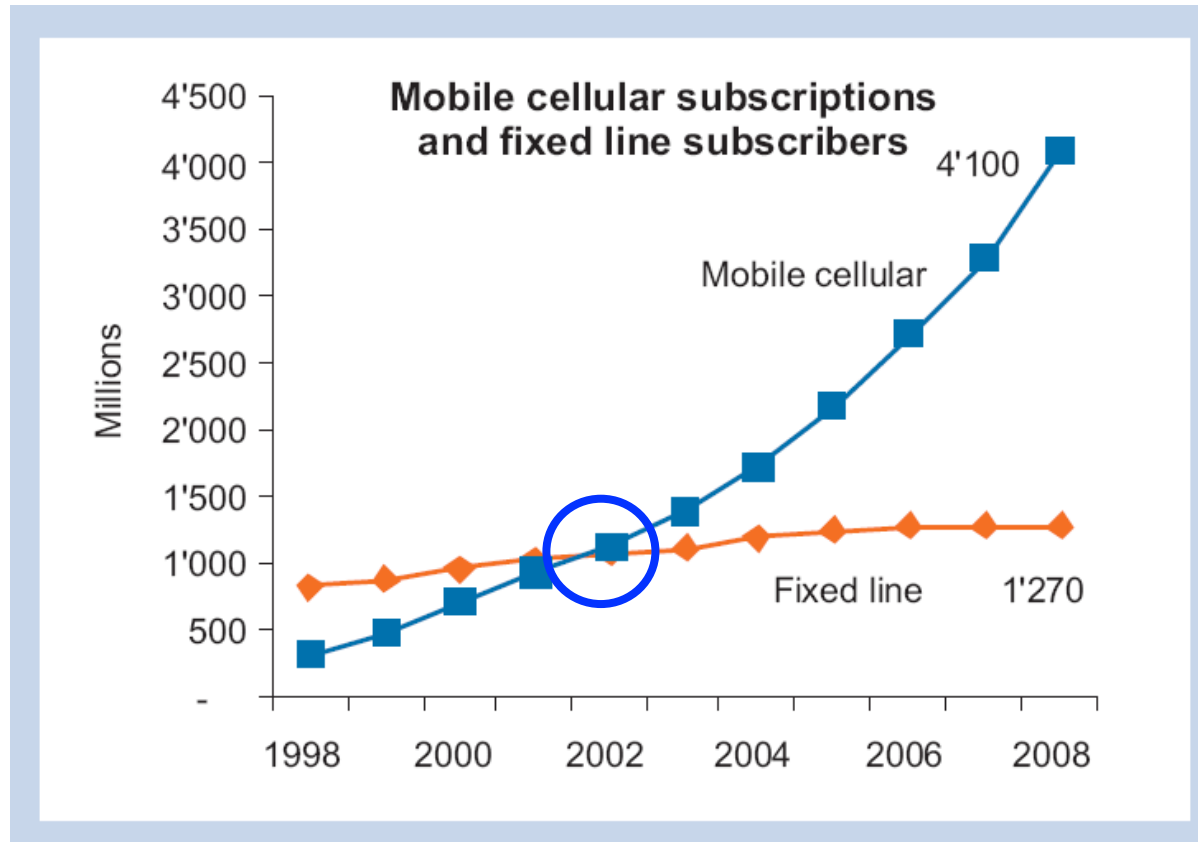


University of Zurich
Department of Informatics



1
Materials Science & Technology

More mobile than fixed-line phones



Source: ITU, 2009



2010-10-06

Lorenz M. Hilty, Empa/University of Zurich

Source: Ericsson, 2009

More Microprocessors than People

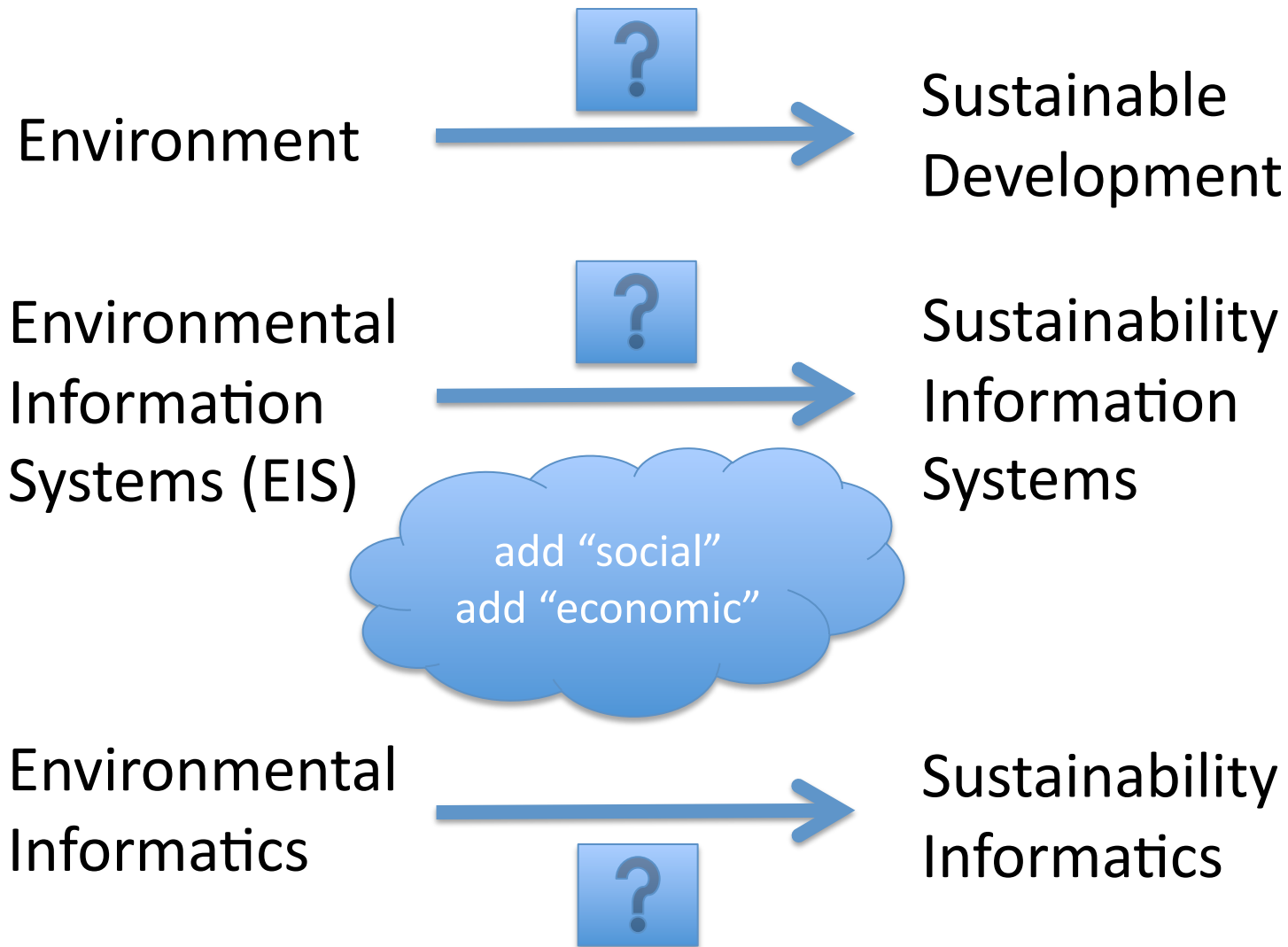
- Between 2008 and 2014, the number of personal computers in use world-wide is expected to double from 1 to 2 Billion.
 - At least 98% (some experts estimate more) of all microprocessors produced today are not for personal computers.
- ➔ There are 50-100 Billion Microprocessors in the world.

Overview

1. From Environment to Sustainability – Some Critical Remarks
2. The Landscape of Research and Development
3. Combining Application Development and Impact Assessment – A Case Study

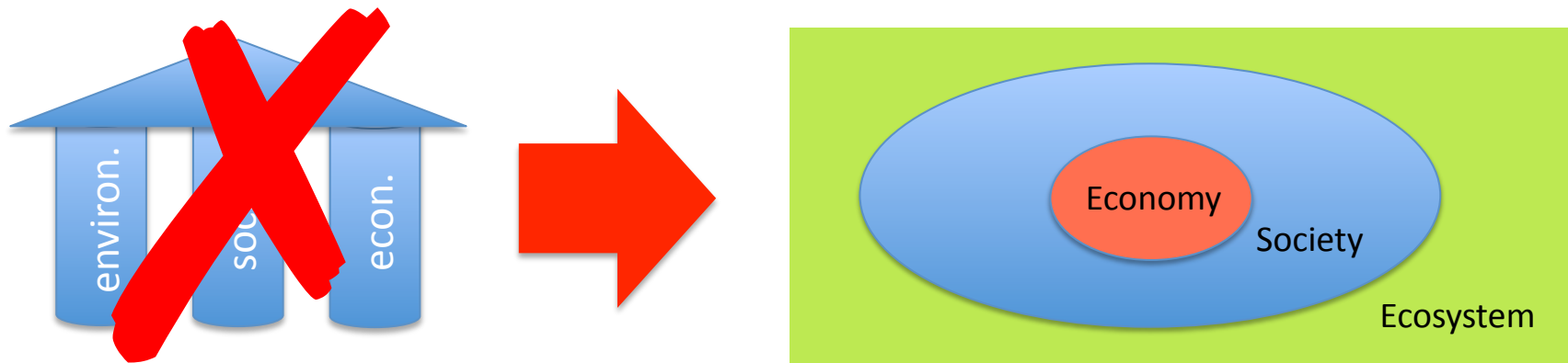
Overview

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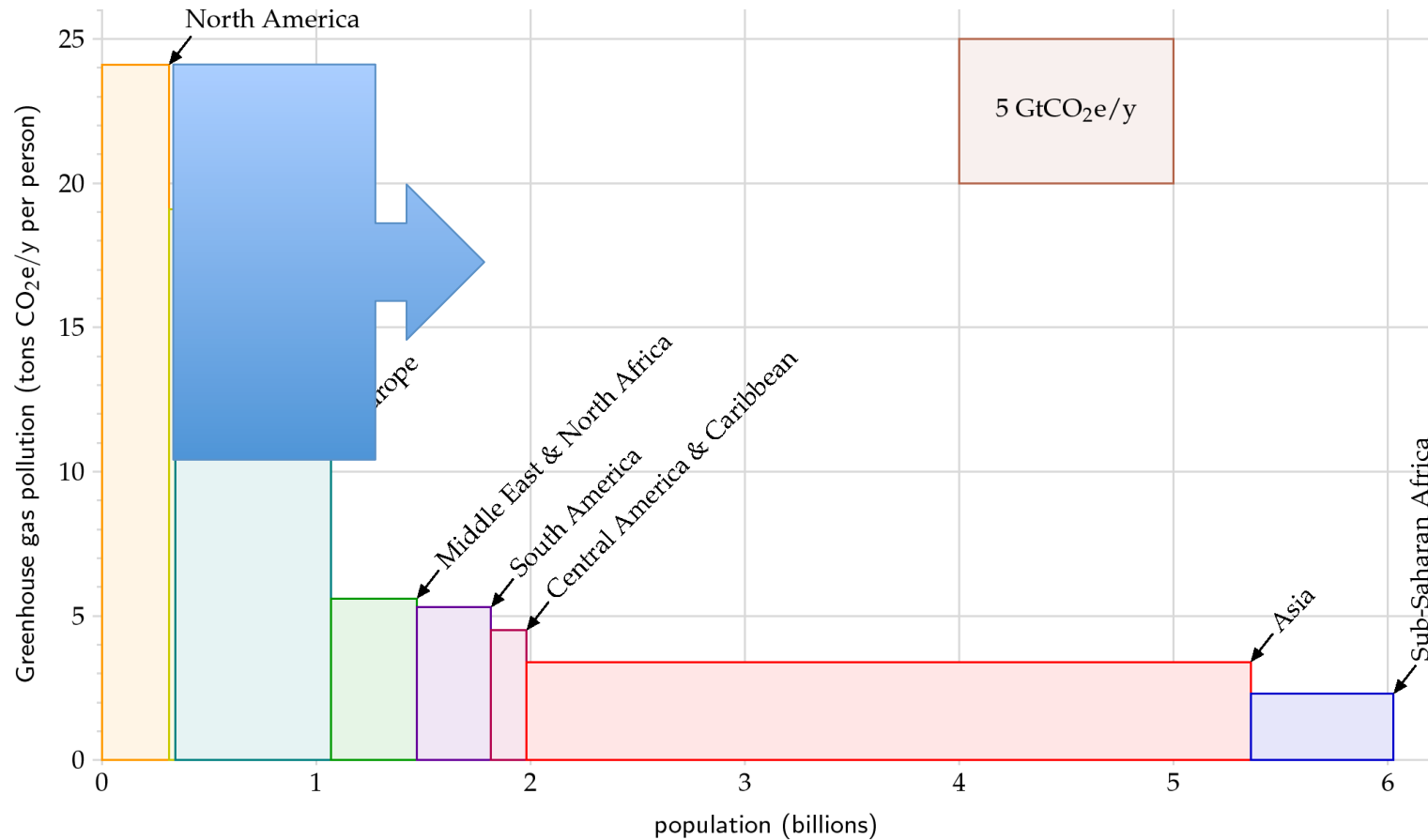
Two reasons why this will not work

1. The three-pillar-model of sustainable development is based on a misconception:



2. “Environment” is descriptive,
“Sustainability” is normative.
→ Can a field of study be based on a normative concept?

Example: CO₂ Emissions per Person



Is it sustainable to export the North-American or the European lifestyle?

Data source: International Energy Agency (IEA): CO₂ Emissions from Fuel Combustion. Edition 2009 (data for 2007).

Chart: David MacKay: Sustainable Energy: Without the Hot Air, UIT Cambridge

The Ethical Dilemma Behind Sustainability

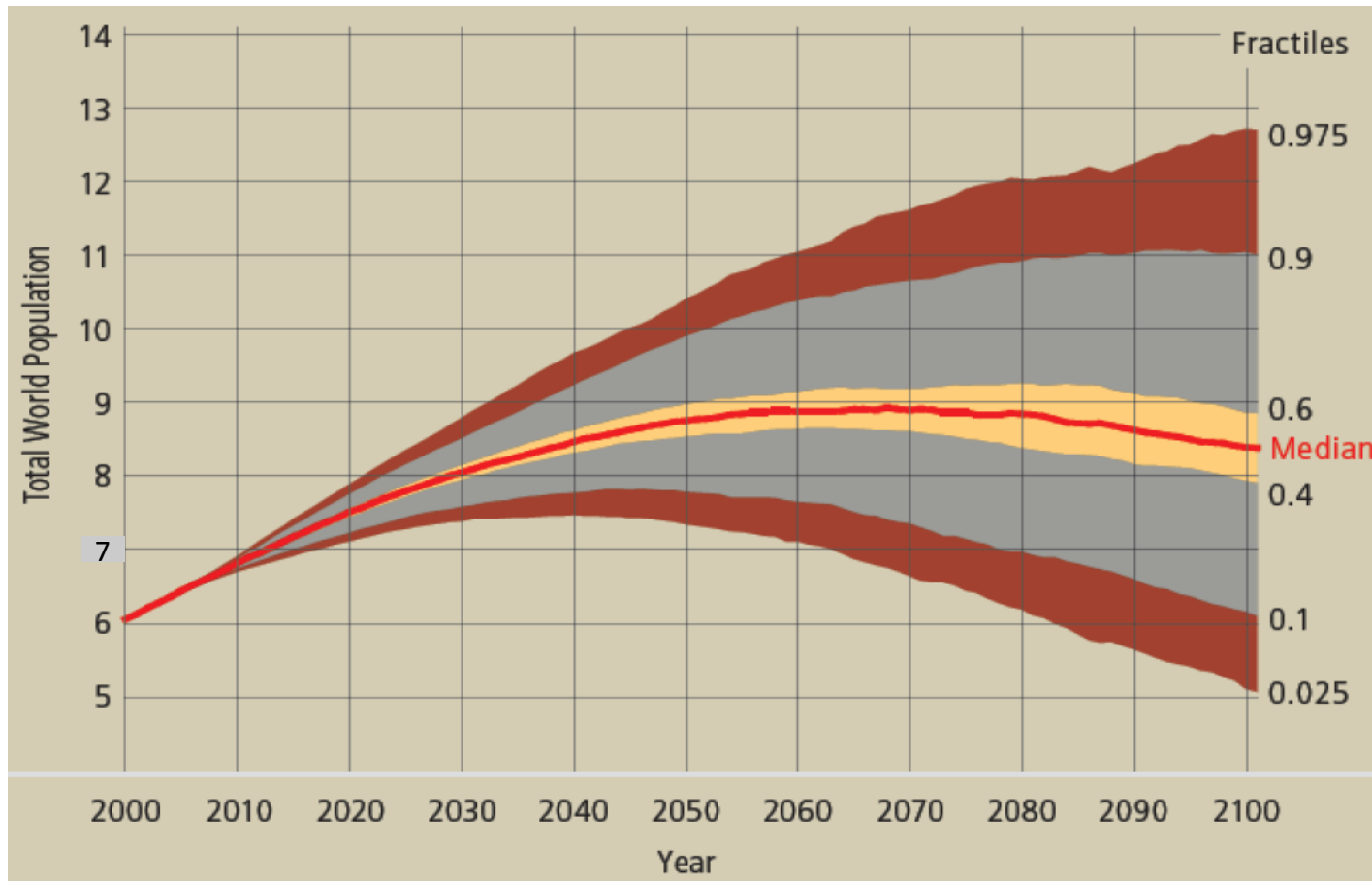
Sustainable Development is a type of development „that meets

- the needs of the present without compromising
- the ability of future generations to meet their own needs.“



World Commission for Environment and Development, 1987 („Brundtland Commission“)

World Population Development

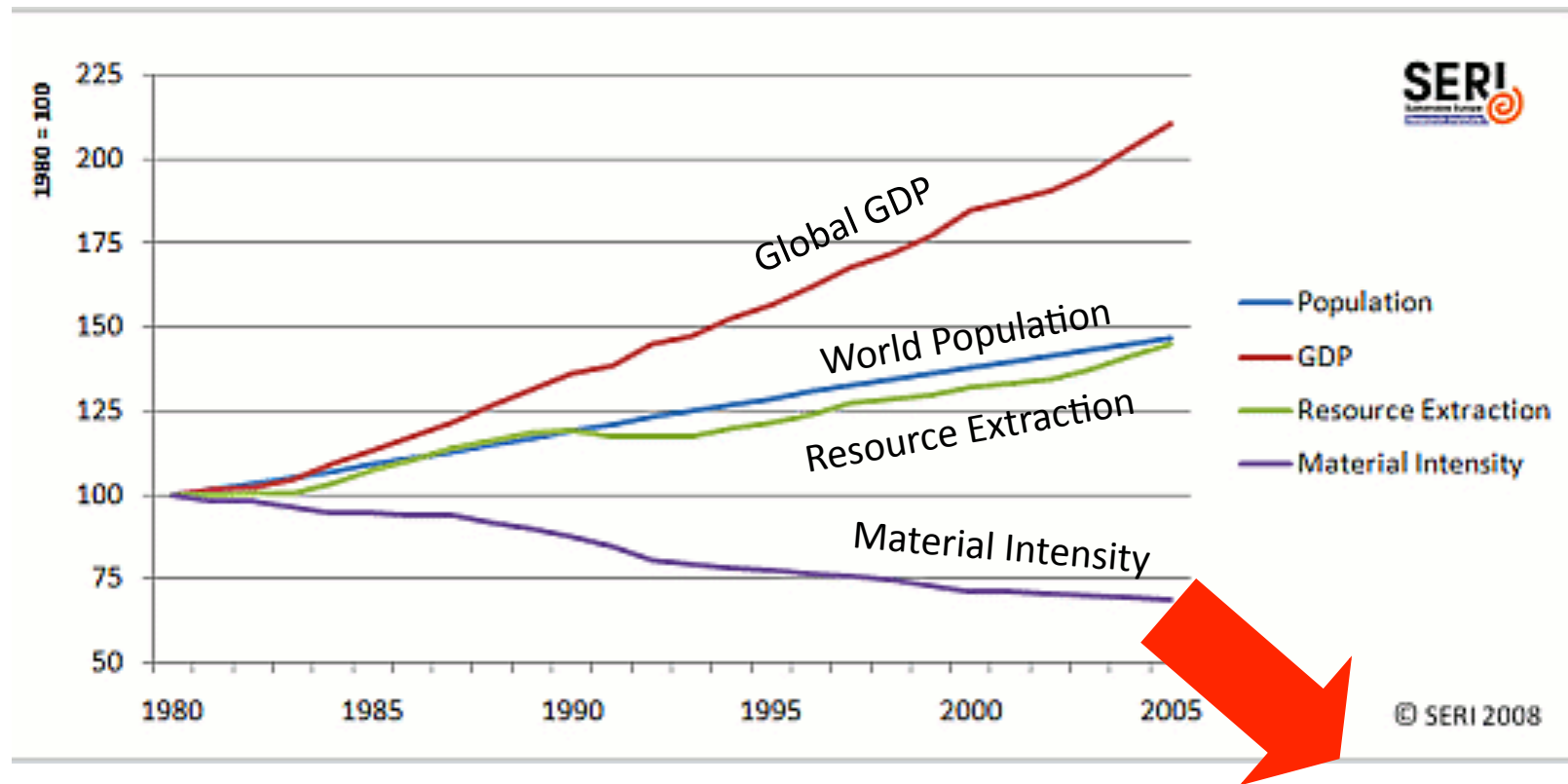


Scenarios of total world population by IIASA

Source: Wolfgang Lutz, 2009 (World Resources Forum, Davos)

The Idea of Decoupling

(GDP from resource extraction)



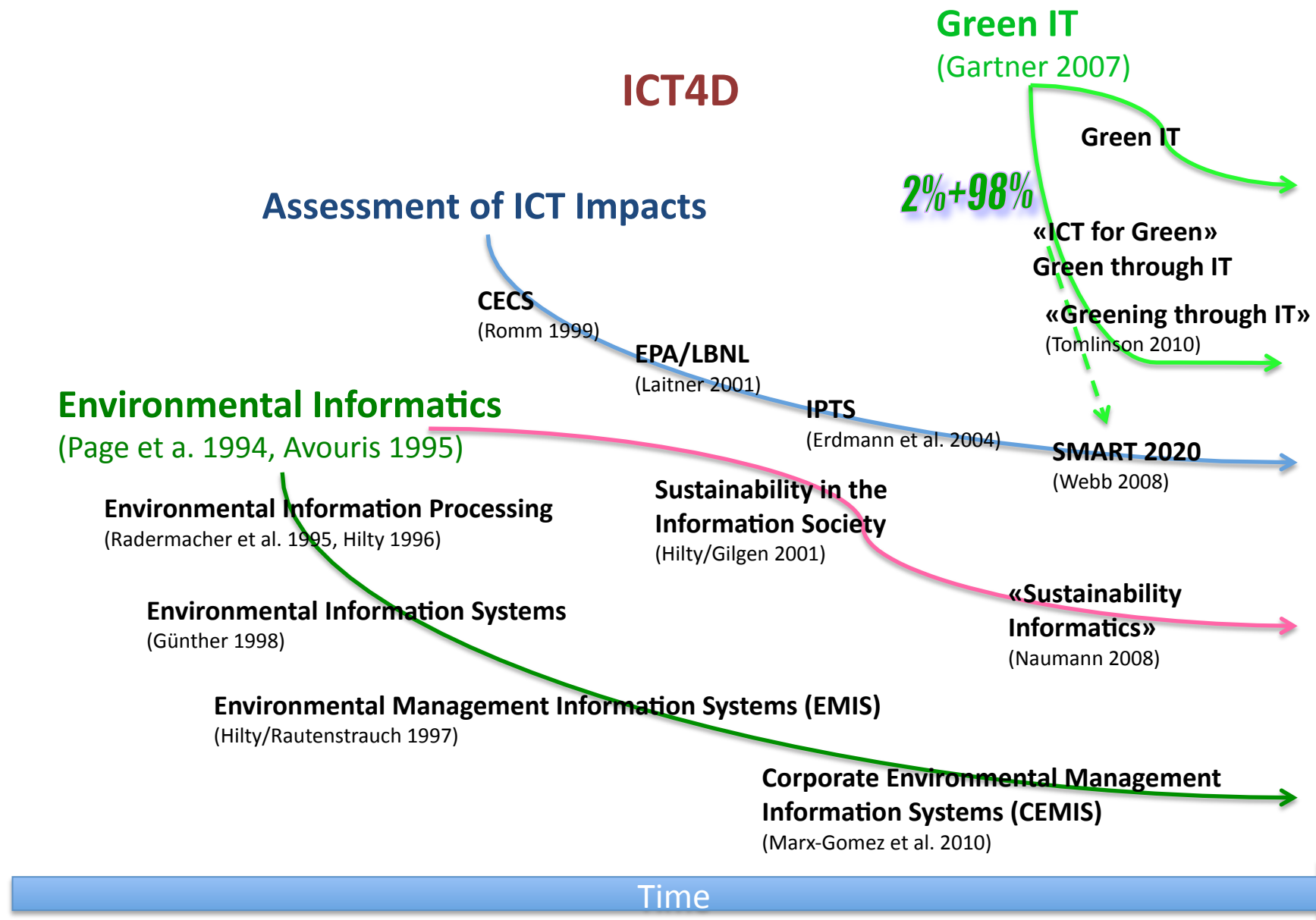
$$\text{Material Intensity} = \frac{\text{Resource Extraction}}{\text{GDP}}$$

Dematerialization

Overview

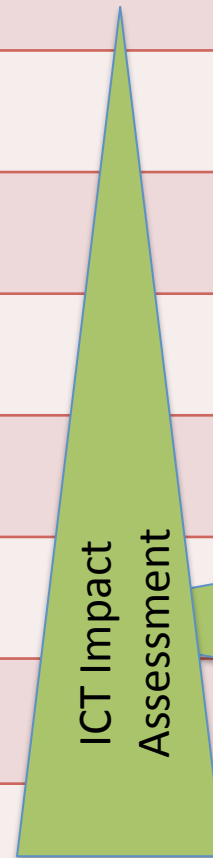
1. From Environment to Sustainability – Some Critical Remarks
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Trends in the study of ICT and environment / sustainability



Understanding ICT effects to use them to support sustainable development

Classification of ICT effects		Analysis (of ICT in application context)	Synthesis (of ICT or application context)
3 rd -order effects = systemic effects (dynamic reactions to application effects)	by dynamics of technology interpretation		
	by political dynamics		
	by market dynamics (e.g. structural change)		ICT4D
2 nd -order effects = application effects (effects of the application of ICT)	on accessibility of knowledge and awareness		
	on political decision-making and policy implementation		Environmental Informatics EIS/EMIS
	on production and con- sumption processes		Green through IT ICT for Green
1 st -order effects supply effects (effects of supplying ICT services)	of software via hardware demand and use		
	of hardware production, use, disposal		Green IT



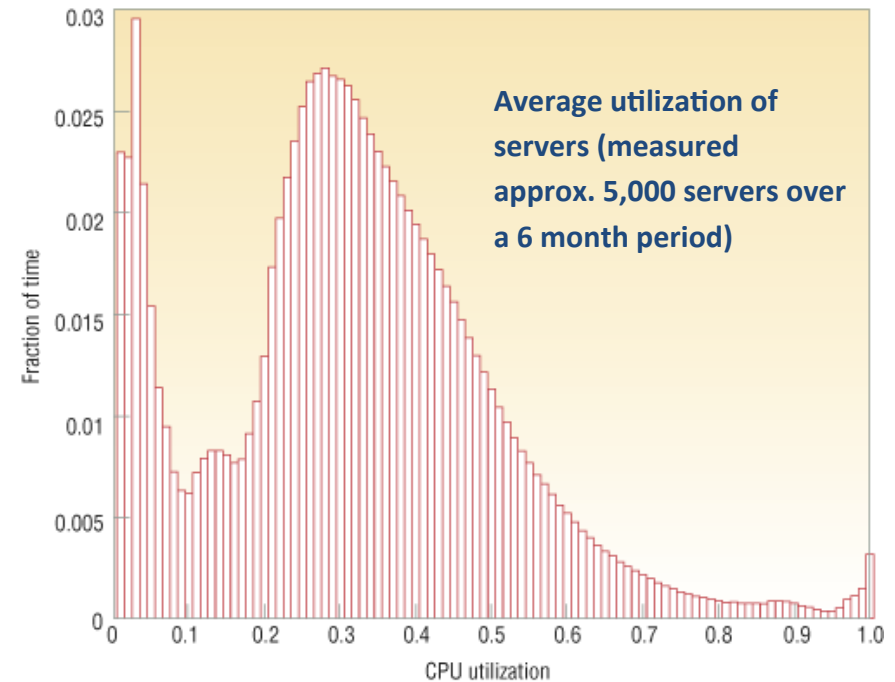
ICT4D = ICT for Development
 EIS = Environmental Information Systems
 EMIS = Environmental Management Information Systems (usually corporate)

Example of a Green IT Approach: Energy-Proportional Computing



Half of the energy consumption
between 0 and 10% load.

Source: The Green Grid, 2009, p. 8



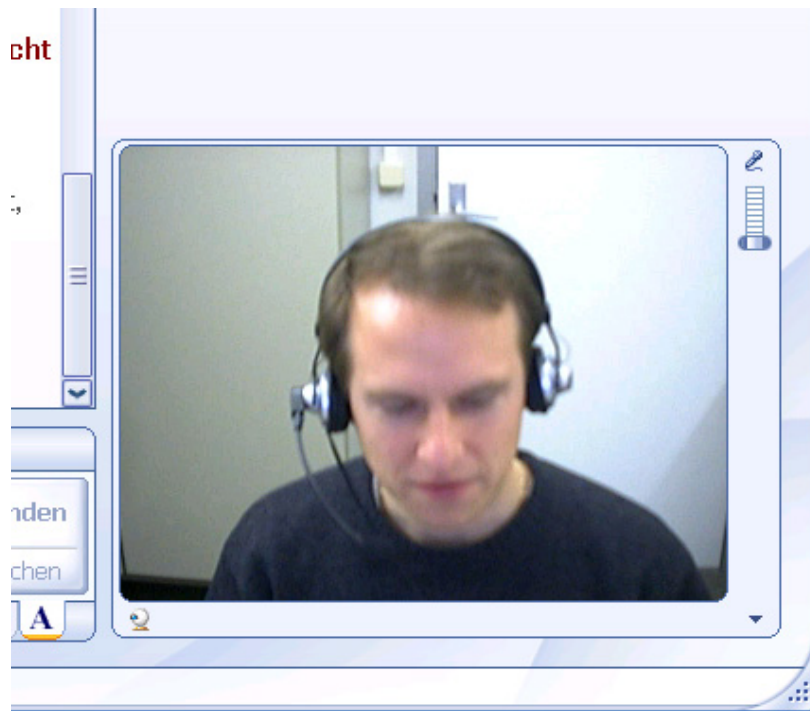
Utilization of Google Servers: most
of the time around 30%.

Source: Barroso, L.; Hölzle, U.: The Case for Energy-Proportional Computing. IEEE Computer, Dec. 2007

Overview

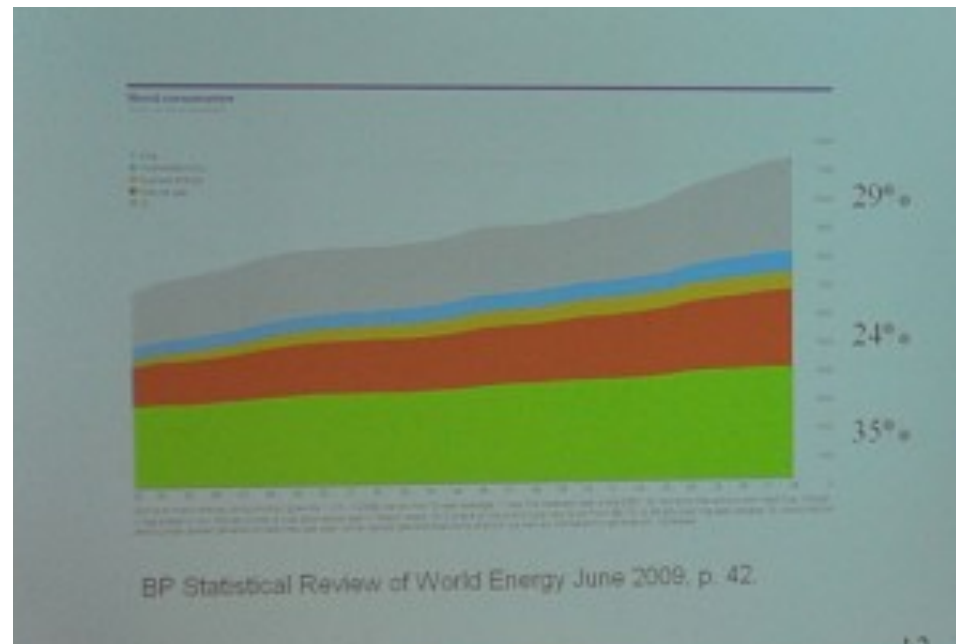
1. From Environment to Sustainability – Some Critical Remarks
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Videoconferencing – some reasons why it doesn't work



the virtual squint

Videoconferencing – some reasons why it doesn't work



(mis)understanding pointing gestures

The World Resources Forum on two Continents



www.worldresourcesforum.org
in Davos (Switzerland) and Nagoya (Japan)

2010-10-06

Lorenz M. Hilty, Empa/University of Zurich



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Remote Audience can be Viewed in Full HD



www.worldresourcesforum.org in Davos (Switzerland) and Nagoya (Japan)

2010-10-06

Lorenz M. Hilty, Empa/University of Zurich

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Remote speaker are really „present“ in the room due to Full-HD quality transmission and Full-HD projection



Some Speakers at the World Resources Forum 2009



Ashok Khosla
Co-President of the Club of Rome



Friedrich Schmidt-Bleek
Factor 10 Institute



Dennis Meadows
„The Limits to Growth“



Ernst Ulrich v. Weizsäcker
UNEP Resource Panel

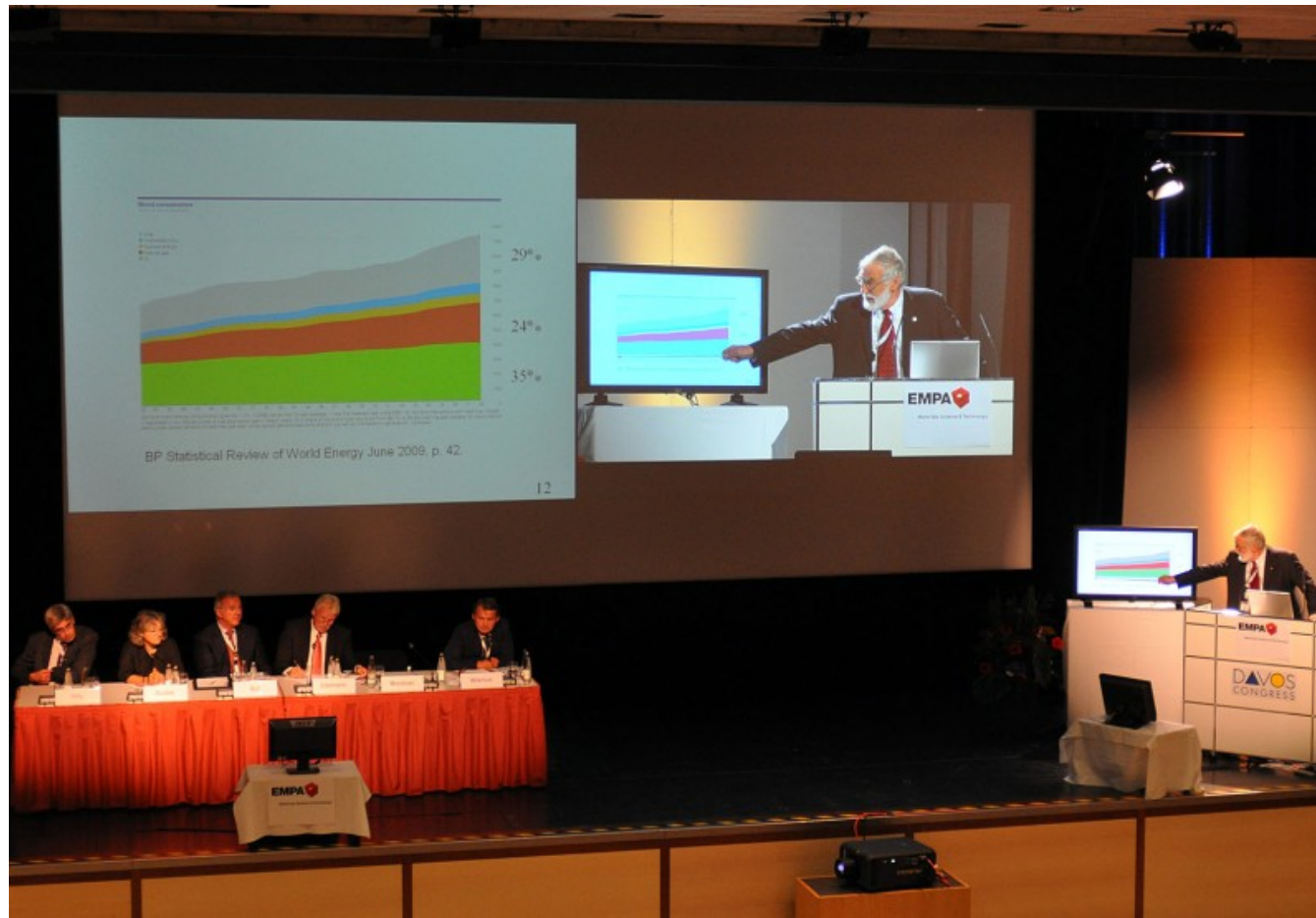
Speaker Has Eye Contact to Remote Audience



Taking Remote questions



Pointing on Content



Informal Communication at TelePresence Hotspots



2010-10-06

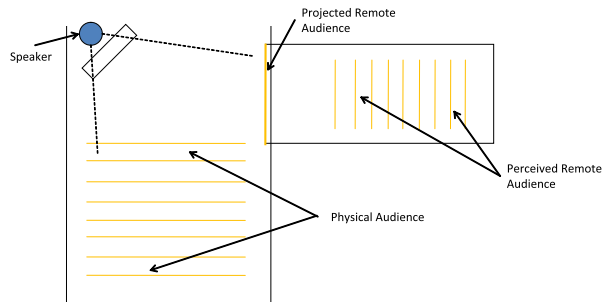
Lorenz M. Hilty, Empa/University of Zurich

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Additional TelePresence Points for Small Workshops



Lessons Learned: Details are important



www.worldresourcesforum.org
in Davos (Schweiz) and Nagoya (Japan)

2010-10-06

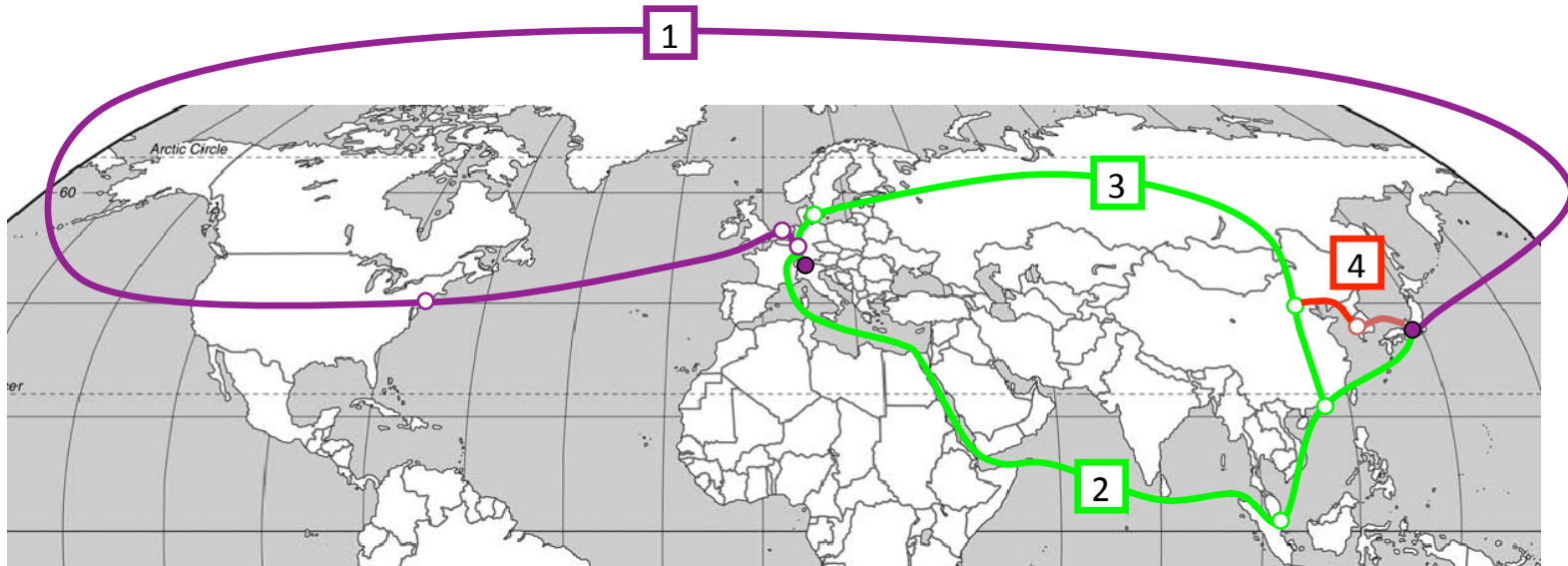
Lorenz M. Hilty, Empa/University of Zurich



SWITCH
Serving Swiss Universities

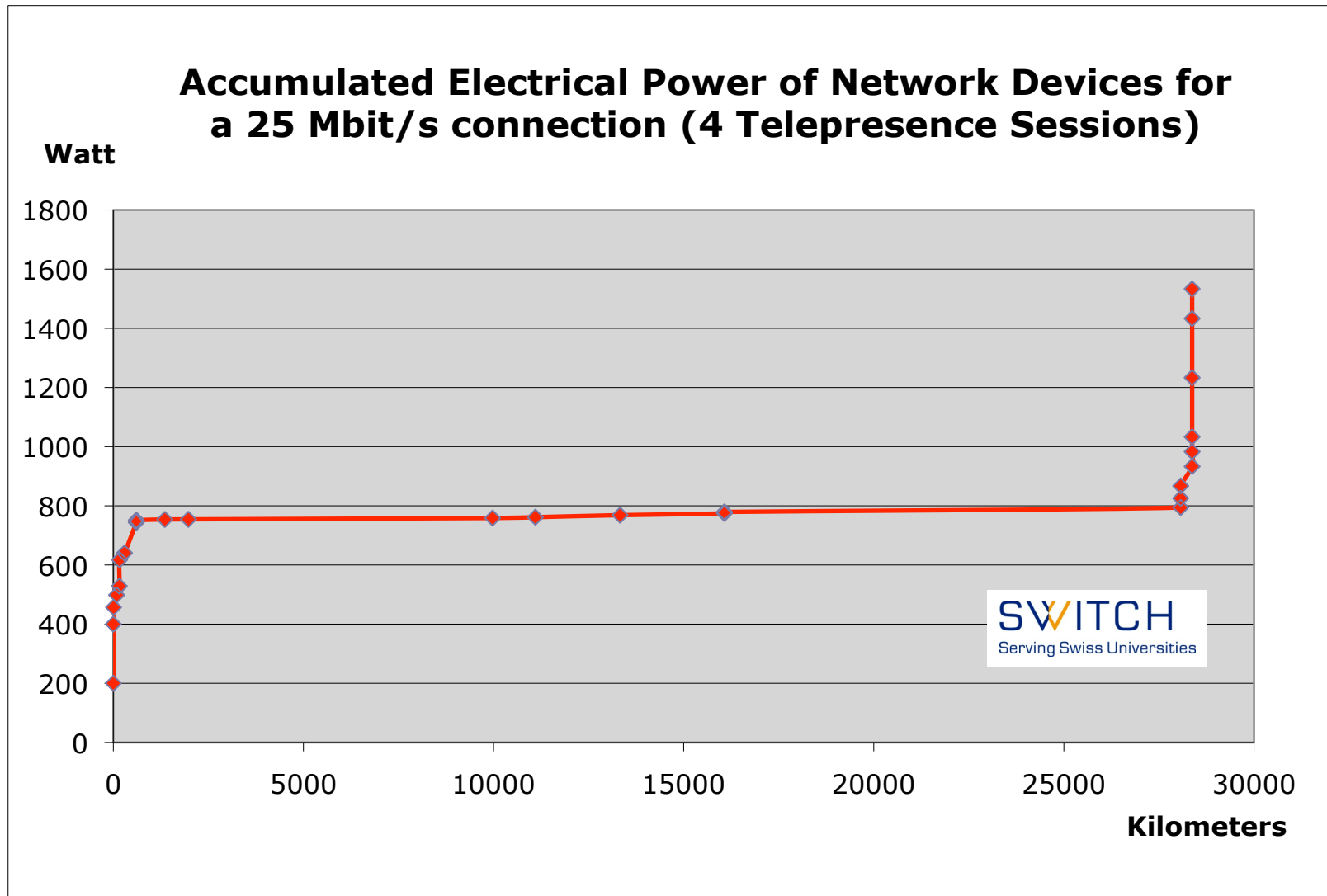
28

Internet Route Davos-Nagoya



1. Geant-Internet2-Transpac2: RTT 295 ms ~30'000 km
2. Geant-TEIN/SEA-ME-WE: RTT 325 ms ~33'000 km
3. Geant-TEIN/Transsib: RTT 270 ms ~27'000 km – estimated
4. Geant-TEIN/Transsib-**direct**: RTT 230 ms, ~23'000 km
was not available

Electrical Power used for an intercontinental Internet Connection



Preliminary data! Final data will be published in a paper by Vlad Coroama, Ernst Heiri, Frank Horn, Lorenz M. Hilty (2011)

Energy used per participant and in total

real case



kWh/participant	Davos only	Nagoya only	Twin Conference
Travel to venue	2360	3491	1067.000
Equipment Davos	0	0	0.147
Equipment Nagoya	0	0	0.153
Internet transmission (25 Mbit/s * 3 days * 5h/day)	0	0	0.056
Total	2360	3491	1067.356

kWh (all participants)	Davos only	Nagoya only	Twin Conference
Travel to venue	1'057'240	830'748	566'700
Equipment Davos	0	0	78
Equipment Nagoya	0	0	81
Internet transmission (25 Mbit/s * 3 days * 5h/day)	0	0	30
Total	1'057'240	830'748	566'889

Participants	448	238	531
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Preliminary data! Final data will be published in a paper by
Vlad Coroama, Ernst Heiri, Frank Horn, Lorenz M. Hilty (2011)

CO₂ Emissions Caused by Travel and Videoconferencing

kg CO ₂ /participant	Davos only	Nagoya only	Twin Conference
Travel to venue	525	796	224.000
Equipment Davos	0	0	0.003
Equipment Nagoya	0	0	0.083
Internet transmission (25 Mbit/s * 3 days * 5h/day)	0	0	0.016
Total	525	796	224.102

t CO ₂ (all participants)	Davos only	Nagoya only	Twin Conference
Travel to venue	235.01	189.35	118.950
Equipment Davos	0	0	0.002
Equipment Nagoya	0	0	0.044
Internet transmission (25 Mbit/s * 3 days * 5h/day)	0	0	0.009
Total	235.01	189.35	119.005

Participants	448	238	531
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Preliminary data! Final data will be published in a paper by
Vlad Coroama, Ernst Heiri, Frank Horn, Lorenz M. Hilty (2011)

Conclusions

1. Contributing to sustainable development by ICT means: trying to use a powerful technology to trigger radical changes.
2. We should combine the creation of ICT applications with the assessment of their sustainability impacts to start a process of true improvement.



Thank you for your attention!

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Further Reading

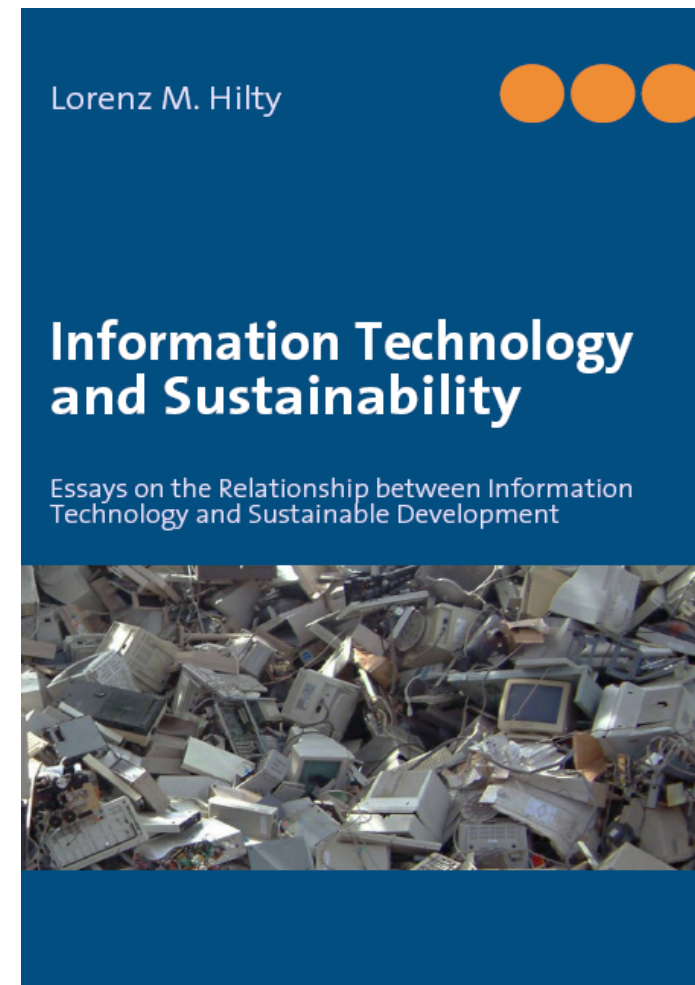
Lorenz M. Hilty: Information Technology and Sustainability. Books on Demand, Norderstedt, Germany 2008.

ISBN: 978-3-8370-1970-4

<http://www.amazon.de/dp/3837019705>

Other publications by Lorenz M. Hilty:

<http://publicationslist.org/lorenz.hilty>



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About the Author



Lorenz Hilty is Head of the Technology and Society Lab at Empa, the Swiss Federal Laboratories for Materials Science and Technology, and Professor of Informatics and Sustainability at the Department of Informatics at the University of Zurich.

He published fundamental work on Environmental Informatics and related fields. His current research interests include the assessment of ICT with regard to sustainability, applications in the contexts of environment or development, as well as methods and principles that lead to sustainable solutions.

<http://www.ifl.uzh.ch/iands/en>