# Change of thought, not adaption

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Abstract:

How can we accomplish the transition to a sustainable information society? Not by making technologies more environmentally friendly, but by utilizing them to completely reinvent industrial society.

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# Change of thought, not adaptation

**How can we accomplish the transition to a sustainable information society? Not by making technologies more environmentally friendly, but by utilizing them to completely reinvent industrial society.**

BY PROFESSOR LORENZ M. HILTY

▶▶ Discussion of climate change and the environment is now focusing on the IT sector. Central issues are power consumption and electronic waste. Yet social issues—such as working conditions at supplier plants in China or Thailand—have also been raised. IT manufacturers have responded and have been involved in a variety of projects for some time. Google and Intel launched a "Climate Savers" initiative, designed to improve the energy efficiency of PCs and servers. The "Green Grid" alliance of AMD, Cisco, Dell, Fujitsu Siemens Computers, Intel, HP, IBM, Microsoft, Sun and others aims to reduce power consumption at computing centers. Furthermore, the EU has regulated recycling through the WEEE (Waste Electrical and Electronic Equipment) Directive. The UN's StEP initiative (Solving the E-waste Problem) goes even further by declaring war on electronic scrap worldwide.

Let us suppose that these measures are realized optimally. In that case, the percentage of power consumed by IT in Germany would not rise from today's 3 percent to the 5 percent forecast for the year 2010, but instead—an optimistic assumption—it would remain more or less at the same level, in spite of the increase in performance. In addition, we would have reached the prescribed mandatory recycling ratio of 75 percent, and would be reclaiming valuable raw materials from electronic scrap.

### Increasing the productivity of resources

These measures are important, but will not matter in terms of avoiding emissions of greenhouse gases. Here the overall environmental burden is dominated by other areas: construction, heating, cooling and also mobility. To provide some background: Electricity accounts for only about a third of the energy consumed by all industries and households—the other two-thirds comprise combustible fuels. Thus, the 3 percent of electricity consumption for operating IT corresponds to just 1 percent of energy consumption overall. This 1 percent is certainly a serious factor, but we should reflect on ways of utilizing IT to reduce the remaining 99 percent as well.

If IT is to contribute to solving the climate change problem, we must consider it an enabling technology for bringing about an information society that achieves a breakthrough in terms of the productivity of resources—a breakthrough comparable to the one that industrialization once achieved in labor productivity. For example, in open-pit, brown-coal mines, 50,000 times more coal can be extracted today than in pre-industrial times. Because this model of progress—based on moving greater volume with the help of machines—has been so successful, it still continues to influence our thinking patterns.

Today, we need a comparable step forward, with the goal of generating more benefit per unit of non-renewable resources. Here it is not enough just to optimize individual processes. Indeed, it is more an issue of how we are meeting human needs on the basis of limited natural resources. Or to put it differently, it is a matter of the overall effectiveness of the entire system of production, consumption and disposal. This system would have to learn to make do with a reduced level of the flow of non-renewable resources, while maintaining the same standard of living.

Unfortunately, we have not been very successful in decoupling our value creation from the flow of materials in recent years—in spite of the wide propagation of IT. Switzerland provides a good example of this. Since 1981, the direct material input to industry has been hovering around a level of about 14 tons per inhabitant per year. Three-quarters of this represents non-renewable raw materials. As the economy grew by 40 percent over the same period, we might be inclined to assume an increase in the productivity of resources (a higher standard of living with the same material input). But appearances are deceiving: The

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fact that the material input has not risen must be attributed above all to the increased level of imports. The products imported have consumed a large volume of resources in the countries where they were manufactured. One kilo of imported materials today causes an average of three kilos of resources consumed in other countries.

So how can we manage the transition to a sustainable information society? We must make intelligent use of IT in areas where the flow of energy and materials is at its highest: that is to say in buildings (construction, heating and cooling systems), in connection with mobility (manufacture and operation of vehicles and transport infrastructure) and in farming. In order to improve the productivity of resources, there are seven areas where the use of IT promises the most potential (see box below). Even a modest effect of this kind would far surpass the inherent consumption factor of the IT utilized.

The last point relates to the IT industry itself. If it also intends to improve the productivity of its own resources, the most effective measure in the long term will be to refrain from using toxic materials in IT equipment, because they hamper the recovery of materials. To take just one example: All the desktop PCs–81 million of them–produced in China in 2005 consume 18,000 gigawatt-hours of energy annually. Due to production methods, however, they carry an "energy backpack" of indirect energy costs amounting to 54,000 gigawatt-hours. About a third of this was consumed by obtaining the materials they contain, above all the metals. Therefore, recycling IT equipment makes sense from an environmental point of view. According to an Empa study, it is many times more environmentally efficient to recycle metallic raw materials from electronic waste than to extract the same materials from ore.

However, it is the toxic ingredients contained in electronic scrap that represent the biggest obstacle for economically successful recycling. In the case of industrial recycling, for example, the extraction of contaminants causes high expenditures, for it can hardly be automated. Only constructive measures can ensure that recycling works in the framework of market-based conditions.

### PERSONALITY

Lorenz M. Hilty is head of the Technology and Society Lab at Empa, a Swiss materials science and technology research institution, and also teaches at the universities of St. Gallen and Zurich. An IT specialist with a postdoctoral lecturing qualification, he was a professor of computer science at the University of Applied Sciences Northwestern Switzerland from 1998 to 2005. At the same time, he led the research program "Sustainability in the Information Society" for the ETH Council. Empa is currently collaborating with Tsinghua University in China and the International Institute for Sustainable Development in Canada on a project dedicated to studying the environmental impact of the global value-creation chains for electronic products.

The future belongs to producers willing to assume responsibility for their materials. In every industry there will be an increasing insistence that the value of the materials be maintained throughout the product lifecycle. IT is the key to a kind of progress that aims to derive more benefit from fewer materials and less energy. It must be said, however, that so far we have been turning this key in the wrong direction. Instead of using IT in such a way as to save non-renewable resources, we have generally been utilizing it to merely quicken the pace of mass turnover.

## Pioneering role for IT

There are two things we must do in order to turn the key in the right direction: First of all, use IT systematically in such a way as to increase the productivity of resources, and secondly, increase the productivity of resources in the IT sector itself. This means not just adhering to Moore's Law, but also taking responsibility for the use of materials in a globalized economy. In the long term, this is a challenge that all sectors of industry will have to face–and here the IT sector is able to play a pioneering role.

### SEVEN AREAS WHERE IT CAN CONTRIBUTE TO CLIMATE PROTECTION

- Context-sensitive heat management (heating, cooling, ventilation) in buildings and perhaps also in the area of clothing (wearables)
- Virtual environments that reduce the need for surrounding building space
- Service replaces material flow: sell services instead of short-lived products, and produce them with the help of long-lived materials
- Efficient, virtual teamwork, which makes some of the travel for meetings unnecessary
- Promotion of lightweight electrical vehicles
- Precision farming to minimize fertilizers and pesticides in agriculture
- Avoidance of toxic materials in hardware production, in order to facilitate recycling of valuable materials

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