IT starting signal for an energy-efficient future

Lorenz Hilty, Empa scientist and professor of Informatics and Sustainability at the University of Zurich, outlines his vision for intelligently controlled energy consumption. The idea is to use the "ICT for Sustainability" (ICT4S) conference organised by Hilty in February in Zurich as the starting signal.

INTERVIEW: Rainer Klose / PICTURES: Empa

Mr. Hilty, you are currently preparing the ICT4S Conference – the first of its kind. Do we really need another sustainability conference?

Lorenz Hilty: Digitalisation has been rapidly changing society for at least 20 years. However, the awareness that this potential for change could also be used to accelerate sustainable development does not yet exist. For example, could we achieve the energy turnaround with the help of ICT? The basic theory behind this conference is that it won't happen on its own. Advances in ICT will not automatically lead society into a sustainable future. But it is possible to use it for this purpose.

Isn't it true that the debates have gone on independently of each other so far – on the one hand the debate about technological advances in ICT, and on the other hand the sustainability debate?

They are no longer completely isolated. The discussion about "Green IT" has been going on for some years now. People have realised that IT has something to do with protecting the environment and matters concerning energy. We now want to take the topic a step further to the general question of whether we can we achieve a more resourceful and sustainable daily life by means of smarter processes and intelligent control and regulation.

Does this mean that there is more to the concept of "Green IT"? Until now, I have only associated this catchphrase with semiconductor technology, which is less damaging to the environment.

That is where it all began. Some interesting questions were already on the table, such as: how much power is consumed by the Internet? Or: how can we make our entire office communication more energy-efficient? But then the IT industry noticed that we were talking about approx. 2% of global energy consumption. If we wish to achieve something we must think about how to reduce the remaining 98%, such as heating more intelligently or optimising traffic. We must create structures that can provide a new solution for the interaction of information processing, mobility and supply with goods and energy.

Until now is has only been possible to control power consumption at short notice: as soon as a load occurs, someone turns a wheel in the power station and increases output. How can this be changed? How can we anticipate power consumption?

You can look at both sides and carry out "demand shaping", for instance. In order to do this I construct a device in such a way that it can decide for itself: I don't need the energy right now but can instead connect up later. I would thus avoid peak loads and only consume power when there is less demand. The coordination of such devices can be linked with a market mechanism that makes energy expensive when demand is higher – in other words, dynamic energy prices. However, a prerequisite for this is that the shortage signals are made available in the system, in other words introduce new information flows. Such a thing is then known as a "Smart Grid".

How can a "Smart Grid" help to save energy?

The meaning of this approach is only really coming into effect now, because we want to use many more renewable energy sources in the future. Of these sources, only hydroelectricity is easy to control, but is essentially exhausted in Switzerland. In comparison, solar and wind power are difficult to adjust – these have to be "harvested" when they occur. This means that in future there will be bigger fluctuations at the energy supply end, something that would seriously intensify the coordination problem between supply and demand. This is where IT must – and can – help. The system that we need in the future must estimate in advance where energy supply and demand exists, so that the energy flow can be managed accordingly.

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On a personal note…

Lorenz Hilty is a scientist at Empa's "Technology and Society" laboratory and professor of Informatics and Sustainability at the Department of Informatics of the University of Zurich. He develops IT applications that contribute to achieving sustainable development. His research area also includes social discourse by means of new technology.

Are there already precursors to this development?

Yes, particularly in IT. Computer centres require ever-increasing amounts of electricity. The computing load can be shifted by means of Cloud Computing if energy is scarce somewhere in the world. Information is easier to transport around the world than energy nowadays. This means that I can move a calculation task from Europe to Alaska or Australia, for example, if energy from renewable sources is currently available there. And the customer is not even aware of this.

However, it is not just data that is moving around the world but also people and goods. Is it also possible to organise physical transportation in a better way with the help of IT?

Yes, IT-based concepts for this exist as well. For example, people can carry small devices such as smartphones that will identify them and allow them to use transport services. I can get into a taxi or a train. I can hire a car-sharing car or a bike. And all of these mobility options that I can freely combine come at a price. This price can depend on current demand – during a traffic jam I will pay more for using the roads; the tram will cost more during rush hours and the last available bike will cost more to rent. Everyone who can manage it would then avoid travelling at peak times. Even in a system such as this (a type of "Smart Grid" for personal travel) I would need a shortage signal, that would be relayed quickly within the system. I would need skills from the ICT area. Cheap and efficient technologies already exist that can solve these problems.

In this future, people with low incomes such as poor pensioners will have to reschedule their activities for off-peak times and during the night. That leaves the question: is that what society wants?

At our ICT4S conference, the question of desirability will also be raised. We have invited social scientists from countries like Sweden, among others, who are experimenting with "Smart Cities" in an area south of Stockholm. They have already noticed that even the most forward-looking plans are regularly being overtaken by technological developments. This means that governmental planning of such structures is much slower than technical progress. We must therefore create "Smart Cities" as a dynamic system. A "Smart City" must continuously reinvent itself if it wants to function efficiently.

Such a high-speed development may require a different form of government. Can we accomplish this in a democratic society with all of its objection rights?

That could indeed mean that the governance structures would have to be different by allowing more self-organisation, for example. We have contributions at the conference that deal with issues like these.

It hardly sounds like a walk in the park. Are you expecting political opposition?

It is there already. Take the example of "Smart Grids". Anyone who seeks to enforce such a thing will encounter opposition from the power industry, where old monopolies are being defended in some cases. It is socially and economically extremely complex. The only way to move forward in the area is via large-scale experiments and case studies, in my opinion. We can only learn about this new world by means of "trial and error". We have to choose regions where we can experiment – i.e. set up a "Smart Grid" or design a "Smart City". Even if it doesn't bring the expected advantages for the pilot region, experience can be gained. And we can develop a culture around this structure.

How can I convince the population to go along with this?

The idea of "persuasive computing" would be suitable for this task – these are systems that convince people to behave in an energy-saving way, for example. For instance, it would help if you could calculate eco-balances in real time on your mobile phone.

The conference

The conference: The first international "ICT for Sustainability" (ICT4S) conference is taking place at the ETH Zurich from February 14 – 16, 2013. It is all to do with having better control of energy and resource consumption by means of intelligent IT systems and better use of renewable energy sources, and the question of whether goods can be replaced by services. 42 speakers from 27 countries and five continents will be devising the IT use of the future and discussing the effects thereof. The opening of the conference on February 13, is accompanied by a series of public lectures, e.g. a crash course in "Green IT".

Public workshop: On Saturday, February 16, the Swiss Federal Office of Communications (OFCOM) and the Federal Office for Spatial Development (ARE) are organising a public workshop at the ETH Zurich. How can new links be established in Switzerland between today's emerging information society and the desired sustainability? Entry is free of charge. Register at *www.ict4s.org*

Zürich Greenhackathon: The "Zurich Greenhackathon" is taking place in the run-up to the conference on Tuesday, February 12, 2013. The participants are given 24 hours, in which to program software for a purpose that benefits sustainability. Registration and information at *zurich.greenhackathon.com*

Now, is it better to read the news in a printed newspaper or on your iPad? In Zurich, there is already a start-up company that provides cooking recipes for downloading and has calculated a detailed eco-balance for each one. This is a start. After all, psychology tells us that human behaviour can only be influenced by providing information in real time without patronizing. The sooner, the better.

The ICT4S conference is intended to be the starting signal for this type of research. What kind of people will I meet at the conference? What is on the agenda?

On the one hand, we have the classic "Green IT" topics; among all the visions, these must not be forgotten. The question is: how can we reduce the energy requirements of computer centres, and how can we minimise e-waste? Then there will be sessions on the subject of "Smart Cities" and "Smart Buildings". Here we will be discussing our living environment: we will be talking about houses that know when the residents are not at home and control their energy consumption accordingly. In another session, the topic is resource management such as smart water management. However, our conference is of an extremely interdisciplinary nature for a good reason – humanities and social sciences will also be represented. Because it would be naïve to believe that sustainability can only be achieved using technical measures. It is never the technical system alone that has an effect, but the people that use it. //

If you could call up eco-balances on your mobile in real time, it would significantly increase your energy awareness, says Lorenz Hilty. Ecological decisions could thus be made quickly: Should I watch the football match on the plasma TV, or drive to the stadium by car? Does downloading a film in HD use up as much energy as blow-drying your hair?