
“The energy future
won’t happen by itself“

Urs Elber, Managing Director of the Research Focus Area "Energy", explains how the energy supply will change in the years to come and how Empa supports this transformation.

INTERVIEW: Rainer Klose / PICTURES: Empa

About Urs Elber

Urs Elber has been Managing Director of Empa's Research Focus Area "Energy" since September 2014. It is his job to launch new research activities in the energy sector. At the same time, he is Empa's prime contact for partners from industry and academia on matters of energy management, research and planning. In over 20 years of experience, Elber has acquired a profound knowledge of the Swiss telecommunications and energy industries: he ran various hydro, wind, solar and biomass power plants, was CEO of the "Holzenergie" group at the electricity supplier Axpo and still manages the ETH Domain's Competence Center for Energy and Mobility (CCEM) at PSI. He is now looking to pool Empa's expertise in the field of energy research and create closer ties with the sister institutes in the ETH Domain. Elber also puts his money where his mouth is: on the roof of his house in Wangen near Olten, a first-generation photovoltaics system has been working for over 20 years.

Mr Elber, why does Empa's energy research need a managing director?

There are various reasons for the new position: around 40% of all Empa research projects are related to the energy sector, mostly with external partners from research and industry. These include the new demonstration platforms "NEST" and "Future Mobility", where system aspects play a crucial role. Energy research is thus becoming increasingly complex. It is obvious that, the longer the more, we need to think, do research and act in a much wider context than we've done so far – i.e. from the harvest and transportation of energy through its storage and conversion all the way to managing its consumption. Helping to focus on the big picture is part of my job here at Empa. This enables us to generate problem-solving approaches for our energy future in collaboration with all those involved in the process – not just from research.

Sounds like a very integrative, networked undertaking.

Precisely. And there's the societal aspect, too. Specific goals are defined in the Swiss government's Energy Strategy 2050. It is now our job to work out options that help us achieve these objectives. That's why additional public funding was set aside for the coordinated energy research action plan. The options aren't at all restricted to materials research: a new battery here or a better solar cell there won't be enough to solve the energy issue alone. Instead, the answer lies in systemic real-world applications that emerge as a result. Which of these options will win through in the end depends on economic and societal decisions. Ultimately, as citizens, not only do we have to decide which kind of energy we want, but above all which paradigm shift we are prepared to put up with in return. After all, every option will also have its drawbacks.

Can you expand on that? If I put a solar system up on the roof and use it to harvest eco-power – where's the disadvantage?

Firstly, solar panels still have an enormous amount of room for improvement: modules that are even more efficient, cheaper and easier to integrate, production methods with a lower carbon footprint etc. And then, especially in the summertime, when a lot of solar power

>>

is fed into the grid, it is very likely that more solar power is generated than is actually required at that particular point in time. This means that the energy system needs to become a lot more flexible. For instance, we have to develop storage systems, including seasonal ones, to absorb these surpluses. We need to look for new ways.

Such as?

You can never really have "too much" solar energy; you just have to channel the amount that isn't absorbed by the power grid or can't be stored directly into other areas – such as mobility. You can charge electric cars, produce hydrogen for full cell vehicles or, together with the greenhouse gas CO2, make synthetic natural gas from it. We don't need any solar power for heating on during summer – but we can still drive with it and thus substitute more and more imported fossil energy. A second possibility is efficient long-term storage systems. And finally we can manage consumption in such a way that it coincides better with production. So if more and more solar cells are installed on house roofs, it raises these follow-up questions. But not to worry, they can be solved.

Does that mean to say we have already conducted a relatively large amount of research on energy production but neglected the distribution side?

So far, the system was consumption-driven. As much power was produced as necessary. Now we've hit a brick wall with this approach. We have to strike a balance between conventional energies and new ones, such as solar and wind power – which sometimes are available, sometimes not – on the one hand and consumption on the other. This can be achieved by converting it into other forms of energy, centrally or decentrally, or through new sales models, which are geared towards primarily consuming energy when is it available. And the less energy we consume – through efficiency measures, for instance – the smaller the challenge will be.

Electricity and gas networks were invented around 150 years ago. How do these networks need to be renovated to meet the new requirements?

The power grid has a basic problem: it isn't very flexible. Electricity that is fed into it at some point needs to be used somewhere else at the same time. And precisely this kind of network has to make do with more and more non-constant power generators in the future. New technologies will help to expand current transfer networks and to use them more effectively, such as via high-voltage direct current transmission systems and via "Smart Grid". In comparison, the gas grid is very flexible – it can transport far greater amounts of energy in the same space and still store a lot of energy. But we've hardly used these capabilities so far. This begs the question: can I use one network to help solve the problems of the other? We need to find out whether and how we can combine the two worlds.

How can research respond to this challenge? Which research activities should be stepped up? And are there also areas where funding could be reduced?

We certainly shouldn't do any less in basic research. That's where the ideas we seize upon and we can develop further later on are created. But systemic approaches need to be intensified, too. We have to make solutions that work well in the lab – in intensive care, as it were – fit for everyday life. That's not possible in one single step; it takes demonstrators, where lab technologies can be tested on a larger scale and cut their teeth. Only after this step can we put projects into practice together with industry. From the lab "onto the street" in one go is hardly possible in the energy sector.

How do you know what makes sense and what doesn't?

We have to weigh up exactly what the advantages and the drawbacks of a technology are. This is revealed by life-cycle assessments. Often, what might sound good and obvious at first glance actually has negative effects bubbling under the surface. We need to develop computer models that help us estimate the consequences. Models

aren't forecasts, but they give us a certain idea. And the economic reality is just as important as the ecological benefit. We always have to ask ourselves whether and under which conditions a technology or system might actually have a good chance on the market.

Where does Empa come in here?

Several projects are currently on the go at Empa: "Future Mobility", a demonstration platform for sustainable mobility; the test building "NEST"; the "Energy Hub"; and the reconception of the energy supply for the Empa campus. These activities are ideal to combine different research fields in an interdisciplinary, conceptual way. Networked research is hugely important here, both within Empa and with external partners in the ETH Domain, and within the scope of the new Swiss Competence Center for Energy Research (SCCER). My job is to support these activities and interlink them even further.

You mentioned the role of inter-institutional projects. How important is this collaboration?

It's pivotal. In 2006, for instance, with the Competence Center for Energy and Mobility (CCEM), the ETH Domain already recognized that not everyone can do everything in the same depth and that our increasingly complex world calls for more and more systemic considerations. That's why, within the ETH Domain, complementarity is key. Through networking, we minimize – or even exclude – parallel research, which saves both time and money and enables the institutions to focus on their core competencies. There is already a very close collaboration in the energy sector with the Paul Scherrer Institute (PSI) and the other ETH institutions. I see it as my job to push this collaboration further.

Finally, a look to the future: what do the next 35 years hold in terms of energy supply?

My best guess is that we will experience a drastic transformation, quite similar to the one that took place in telecommunications in the last two decades, with paradigm shifts on the part of both suppliers and customers. Back then, there was a state monopolist who owned all the infrastructure and services and supplied the technology all the way to the customer. And today? We have to be careful transferring this model to the energy sector, though. The transformation will happen much more slowly and in a different way because the energy infrastructure is very much geared towards the long term and its effect on the landscape can't be concealed. Nor can we predict exactly what will happen at what point in time. Technical progress will yield numerous new technologies in the next 35 years, the importance of which we can't even fathom yet. Just think back: hardly anyone could imagine a Smartphone back in 1992. We have some exciting times in store for us – and there will be plenty to do for everyone involved. //

Urs Elber at a small Axpo hydropower plant in Kollbrunn/Tösstal, which he used to run.