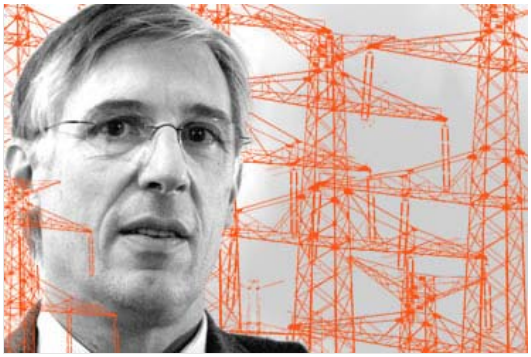
"Before 2015 a household will profitably cover half of its consumption from the roof without feeding into the grid"

Solarplaza interviews Ruggero Schleicher-Tappeser, a freelance renewable energy consultant and energy grid expert advising governments, industry associations, foundations, NGOs and single companies on strategies to enable the transation towards a fully renewable energy system.



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Ruggero Schleicher-Tappeser is working as freelance consultant for renewable energies and sustainable strategies in Berlin since 2008. Born in 1952, he grew up in Italy. After his degree in physics at the University of Bern/Switzerland, he first worked as journalist and consultant on energy issues and was member of the board of directors of the Swiss Energy Foundation since 1976. Later, he turned to research on technology policy, regional development and European environmental and transport policies. For fifteen years he was founder and director of the EURES Institute for Regional Studies in Europe in Freiburg/Germany. More recently he served as Acting Secretary General of the Alpine Convention, an international treaty for the sustainable development of the Alpine area, with offices in Innsbruck, Bolzano and Chambéry. Back as consultant in the energy debate, today he mainly focuses on renewable energies and photovoltaics: foundation process of IRENA, European Alliance for 100% Renewable Energy, foundations, industry, associations.

What are your current activities and is your position?
Working as a freelance consultant on energy strategies in Berlin, I advise governments, industry associations, foundations, NGOs and single companies on strategies in the transition towards a fully renewable energy system. In particular, I focus on photovoltaics, captive power generation, distribution networks and the regulatory changes required for coping with large shares of fluctuating renewable power generation.

In your opinion, do energy utilities have to worry about more and more customers going solar? Do you see a tsunami of new PV installations in the coming five years in Germany?
A strong growth in PV installations for captive power generation in services, small industries and private homes seems inevitable as power from the roof is already more than 25 percent cheaper than power from the grid and will probably cost less than half in two or three years' time. Starting a bit later, there will also be a boom in smart controls and batteries helping to shift power consumption into the sunshine hours. Politics are losing control over the growth rate. Whether utilities need to worry about this depends on their business model: large conventional power plants are already today earning much less – not only because renewables already provide about one quarter of the total power generation in Germany, but mainly because PV covers the consumption peak at noon, driving down the prices at the power exchange during the hours in which previously most money was earned.

How will massive solar application impact their business? What are their major challenges? Why should utilities embrace solar application and how can they benefit from this?
Up to now, the large majority of renewable generating capacity is owned by individuals or new entrants in the market, not by the utilities. If this trend continues, it will further reduce the market share of traditional power generators. The growth in captive power generation, moreover, reduces the amount of electricity flowing through public grids and hence through the business of power traders. Under the present tariff structure and market architecture, this would raise the costs for conventional power customers, as they have to carry the main burden of maintaining the public system – especially when prosumers, who produce for their own consumption needs, can still rely on high-load backup capacities in the grid. Optimising their increasingly flexible private systems in

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the present environment, they may produce additional load or feed-in peaks. Not for protecting the business of conventional utilities, but for protecting the conventional customers, tariff structures and market, architecture must be changed in such a way that the growing private flexibility contributes to the stability of the grid.

How should energy utilities adapt their business model? How can they market solar-based power offers to end customers?

The conventional electricity system was based on centralised top-down control, managing a limited number of large power stations so as to cover varying consumption on the lower levels of the system. Integrating large shares of fluctuating distributed generation and increasingly flexible prosumers into the electricity system will require changing the control logic. To a certain extent, control functions and responsibilities have to shift from the top level down to lower levels of the system. Flexible reaction to specific local conditions will be needed. That implies many changes: in regulation, in technology, in business models, in personal skills.

"Control functions and responsibilities have to shift from the top level down to lower levels of the system"

The landscape of different kinds of utilities is very varied in Germany; municipal utilities and smaller distributors have always coexisted with the four large ones who dominated the market. European market liberalisation and the call for a separation of generation, grid operation and trade activities, has further added to the multitude of roles and different interests. While in the regulatory debate, there is an ongoing major fight about the future distribution of roles, there are considerable margins for developing new approaches already today. Captive power generation requires new business models and new co-operations. The electricity market is getting much more complex; it will also grow by integrating growing shares of heat supply and mobility. Assisting the new prosumers to play an active role in the energy system is a new task for utilities. Most changes will happen at the prosumer and community level. We see a growing number of municipal utilities developing very innovative approaches. But most of the more than 800 distribution companies will need significant help from larger structures to manage the transition.

We should be aware of the extraordinary challenge all of us are confronted with: innovation cycles of renewables are five to ten times shorter than those of traditional energy technologies; the speed of change overthrows all planning and decision-making mechanisms in the power sector, in politics, and among the users of the system. Semiconductor technologies have arrived at price levels which have led to a triple technological revolution of the power sector: Firstly, mass-produced tiny photovoltaic cells directly convert solar radiation into electricity at any location, and consequently the centralisation of power generation is becoming increasingly obsolete. Secondly, semiconductor-based power electronics open new opportunities for managing power grids, drastically reducing the need for large, mostly idle, capacities. Thirdly, cheap distributed ICT intelligence allows for differentiated management of all resources, by flexibly responding to needs and opportunities of millions of actors in the system. A possible drastic fall in battery prices might add a fourth driver for rapid change.

"Innovation cycles of renewables are five to ten times shorter than those of traditional energy technologies"

What is your vision on how energy utilities should charge the use of (solar) energy and grid connection in the future? How will this impact solar energy application?

If we want to influence consumption and production of energy with market mechanisms rather than with strict rules or direct external control, tariffs must reflect offer and demand and also available grid capacities. Compared to today, much stronger incentives are needed for reducing peaks of relatively short duration in consumption and feed-in. Feed-in and consumption tariffs should therefore be much more dependent on power levels (kilowatts) than they are today, rather than just on the energy volume (kilowatt-hours). Moreover, tariffs will need to change over time and also be dependent on the location, since offer, demand and available grid capacities vary locally if grid capacities are not expanded dramatically. This will require some kind of local electricity markets – still a taboo in the German discussion but openly demanded by the Danish electricity industry.

What kind of platform will be available or is required to support, host and control millions of PV systems? What types of (new) aggregators might emerge? How can we maintain grid stability with millions of residential PV systems?

This will depend on the adopted control logic and market architecture. The larger utilities in particular favour centralised control systems. A hot debate is who will have access to consumer data. I would favour a far-reaching autonomy of the prosumer or PV plant owner whose interchange with the grid is governed by basic rules and differentiated tariffs. Active distribution system operators will need to maintain system stability in their specific areas. Besides trading energy and power with different time horizons and at different locations, ancillary services, such as voltage and frequency control and different kinds of reserve power, will need to be provided over a new architecture of rules, bilateral agreements or trade on transparent markets. Platforms will be needed for trading and exchanging

data.

Does Germany need further expansion of the low-, medium- and high-voltage grids in order to support distributed solar PV application?
Without question, the additional flexibility needs of fluctuating renewable power will require additions to the existing grid – strongly depending on the future geographical pattern of generation. Moreover, it will be necessary to invest in more flexible and automatic management of the grids. The required overall capacity, however, will depend on the evolution of the geographical pattern of power production, on the adopted control logic, on improvements in demand response and on the evolution of storage prices. A significant drop in storage prices could even lead to a reduction of required grid capacity. Long-term planning is increasingly difficult. We will need significantly more sophisticated scenarios, which enable the right decisions to be taken at the right point in time.

What and how will other related developments (smart grid, storage, electric transportation) impact and drive solar energy application, in your opinion?
I already emphasised the importance of making grids smarter and of storage. The impact of electric transportation, again, will very much depend on the adopted control approach. Large shares of electric vehicles will increase the pressure to make distribution grids smarter. Electric vehicles are large, but manageable additional loads which might even function as storage systems. Appropriately managed, they can represent a huge flexibility resource in the system. PV can directly take advantage of this flexibility by integrating charging stations into local energy management systems.

In your opinion, will solar energy storage be required in the German market in the next five years? Do you see solar with energy storage becoming cheaper than grid connection in Germany five years from now?
We will see a boom much earlier. Even at present prices of lead-acid cells, before 2015 a private household will be able to profitably cover nearly half of its consumption from the roof without feeding into the grid. Battery price forecasts from the automobile industry predict even faster development. Locating the batteries in private homes may not be the optimal solution from an overall system point of view. But people will just do it because it makes sense for them. Politics and utilities will lose control over growth rates of private PV systems.

"Before 2015 a private household will be able to profitably cover nearly half of its consumption from the roof without feeding into the grid."

Looking into your crystal ball, three years from now, what will have surprised us in terms of the position of the energy utilities, when we look back?
We will wonder why they didn't understand the wave that was coming; why they did not make more of an effort to learn from other industries such as the IT or automobile industries, about how to manage multi-level systems and how to involve customers into the system. Just as the European PV industry four years ago did not acknowledge that they would urgently need to cooperate with other industries in order to be able to offer more complex energy systems – and they have paid a high price for sticking to the business model that helped them to grow during the previous years.

If you were in charge in the government, what should be done as soon as possible to realise a smooth energy transition in Germany?
Refrain from measures undermining trust in public commitments, such as retroactive changes in feed-in remuneration or postponement of payments, as proposed by the Environment Minister.
Ensure equitable burden-sharing by all consumers, including industry.
Reduce costly plans and support for offshore wind. Ensure sufficient feed-in tariffs for onshore wind.
Develop incentives for locating PV and wind power plants of all sizes near to consumption centres.

Focus transmission grid expansion on a small number of projects that are obviously necessary.
Revise funding rules for distribution grid investments so as to favour smart technologies. Encourage distribution system operators to experiment with new approaches.
Ensure easy market access for storage and demand response. Clarify and facilitate electricity sale to tenants and neighbours. Restructure the commercialisation mechanisms for renewable power.

Develop a vision for a multi-level electricity system organised bottom-up, respecting the principle of subsidiarity. Develop a market architecture allowing for differentiated tariffs in space and time. This will require intense cooperation with the EU and other EU countries. We will need a new operational market architecture within five years.

Interested in more expert visions on the future of solar and the energy grid? Join the "Solar & Utility 2.0: Solar Serving the Grid" webinar on 24 April. More information: http://solar2.eu/

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