A Shift in Power

A German energy provider shows how digital solutions can optimize the use of solar and wind power.

Text Sven Heitkamp **Photo** Marco Prosch

Germany is in the midst of an energy transition. Millions of wind turbines and solar panels will be replacing the country's coal and nuclear power stations over the next 30 years. In eastern Germany, this energy transition has already been largely completed: this is where more and more often, higher levels of renewable power are being generated and fed into the grid by businesses and private households than are being consumed. "We've already realized the energy transition in numerical terms," says Dr. Adolf Schweer, CTO of eastern Germany's largest regional grid operator, Mitteldeutsche Netzgesellschaft Strom mbh—or "Mitnetz Strom" for short—a subsidiary of enviaM. "Other regions are only facing these challenges now," he adds. The region south of Berlin has an abundance of sun and wind but comparatively few residents and little industry. These factors have enabled it to achieve the energy mix that Germany as a whole intends to attain over the next few decades.

An "Internet of Energy" will regulate the power

Yet what will the world of electrical power look like in the future? An Internet of Energy is one of the answers. To date, the few large-scale coal and nuclear power stations have been regulated centrally. But now millions of decentralized wind turbines and solar systems also need to be controlled. The power grid will have to balance far greater fluctuations and maintain supply both in peak periods and during lulls in demand. This is why the enviaM Group —enviaM stands for envia Mitteldeutsche Energie AG—is upgrading digital communication networks at the same time as it is expanding the grid. This will allow it to coordinate data from energy producers and consumers. One example is the introduction of smart meters that help digitalize electrical systems, integrate them into data networks, and control them remotely.

These intelligent devices are being installed for hundreds of thousands of customers in order to create greater transparency for consumers, suppliers, and grid operators. "In the future, we'll also need to know what potential is available in which locations and at which times," says enviaM CEO Tim Hartmann. "An Internet of Energy will enable us to harmonize supply and demand in the best possible way—even in slack periods, when the sun and wind cannot generate any power." In addition, transformer stations are being retrofitted so they can automatically compensate for fluctuations in the levels of sun and wind, and be controlled remotely. New distribution nodes transport surplus green energy out of the region using national high-voltage grids. Power previously flowed only from the large-scale power stations to the regions through high-voltage lines. With the advent of renewable energy, it now also flows in the opposite direction, from the regions into the major power grids.

Households as power plants

But that's not all. The role of power customers is changing as well. They are becoming energy producers themselves, and their apartments, houses, factories, and electric vehicles are turning into energy storage facilities. "Customers with solar panels on their roofs, energy storage units in their basements, and electric cars in their garages can operate independently of their providers and feed power into the system—and only draw energy at Christmas time, for example," says Hartmann. "That's what we're working toward." For instance, energy management systems for homeowners can regulate household energy flow in the best possible way by analyzing production and consumption data around the clock, displaying it on apps, and even taking weather forecasts into account.

The mobility sector is changing at the same time. Top executives of the enviaM Group expect all new cars to have electric drives as of 2030. A growing number of electric scooters will also need power. "We anticipate the addition of more than 60 million new elements to the power grid by 2050," says CTO Schweer. "These will include electric cars, electric heating systems, and storage systems."

Special weather-based bargains

Electric cars are an example of what intelligent grids can do. If several cars on a single residential street are charged at the same time after work, this could cause conventional grids to crash. And yet if the grid is regulated by allowing cars and charging stations to communicate with each other and coordinate the order in which all the vehicles are charged over the course of the night, most current capacities are sufficient. "The grids are not being overloaded," says Hartmann. "On the contrary, the system has enormous reserves." Overloads affect only isolated locations at certain times. But monetary incentives would encourage consumers to avoid these peak times. Examples already exist: in one test, owners of electric cars selected the less expensive charging option in nine out of ten cases even when it was not immediately available. Hartmann therefore believes that electric power will not become a luxury item; instead, its price will be far more dependent on when, where, and for what it is used. The first price models are already reflecting this.

It is quite possible that smart watches will display messages at times when windy weather conditions make it especially economical to charge vehicles. An intelligently controlled grid would then help avoid having to invest enormous amounts of money into grid expansion with copper cables. "Efficiency and pioneering investments will be key factors for grid operators in Germany," says Dr. Matthias Tewes, Senior Partner at Porsche Consulting. Mitnetz Strom has therefore worked with Porsche Consulting to become one of the first German grid operators to ensure better utilization of its technical systems. "Together with the Porsche consultants, we have applied tried-and-tested approaches from industry to our grid business. We have become leaner, more automated—and more digital," says Schweer.

Creating links with the transportation and heating sectors

EnviaM CEO Hartmann is also calling for a change in thinking on the part of policymakers. Grid operators need to be compensated for using intelligent technology that makes laying miles of new copper cables unnecessary. In addition, Hartmann is advocating that the energy transition not be viewed only in terms of electricity, but also as a transition that affects heating and transportation. "Let's make green energy available for heating and transportation in areas where we're still using fossil fuels," he says. After all, the transportation and heating sectors currently consume around 80 percent of the energy produced in Germany—and general demand for electricity only around 20 percent. The real key to a productive use of renewable energy lies in linking it to the heating and transportation sectors, which to date have largely been operated and analyzed independently of each other. Coordinating these sectors, says Hartmann, would also lead to a marked reduction in CO_2 emissions. And that, after all, is what the energy transition is actually aiming for.

Green power pioneers: **Dr. Adolf Schweer** (left), CTO of Mitnetz Strom, and **Tim Hartmann,** CEO of the enviaM energy provider, at the Taucha substation near Leipzig. There is already more green power in the grid than the region consumes.