

/vision

From energy user to energy producer

>>technical innovations bring about change in the energy market

Many different pictures have been painted of the electricity network of tomorrow. Recently, there has been a great deal of discussion about decentralised generation of electricity, and electric cars frequently make the headlines. In order to make this possible, a smart energy grid is required. This shows that there has been a great deal of development in the energy market within a short time. But where are these developments taking us?

Electricity plays a major role in our society, and it is only going to increase in importance, for example, with the rise of electric cars. The supply of fossil fuels is finite, so eventually, we will be forced to switch to engines powered by alternative fuel sources such as electricity. However, the electrical grid will have to be adapted in order to prevent overloading when everybody gets home from work and plugs their car into the mains! All of these car batteries offer an enormous amount of capacity in which temporary electricity surpluses can be stored, although the electrical grid must be adapted to handle this. After all, electricity follows the path of least resistance. The electricity travels through the network in one direction only: from the power station to the end user. A smart electricity grid sends the power in whatever direction is required: from the power station to your plug, from a solar panel to a regional power station or from a CHP boiler to the battery of your electric car. This way, if there is a shortage of electricity or the network is in danger of overloading, then you can power your house via electric-car batteries or electricity that is generated and stored regionally. In this way, electric-car batteries become part of the electricity grid.

Smart grids: everyone has their own vision

This is just one of the many visions of a 'smart grid': the name given to the electricity grid of the future. However, nobody can say exactly what a smart grid will actually entail. Everybody has their

own interpretation. For a distribution network operator, the smart grid will be a tool for realising more efficient use of the network. This will prevent major investment in the laying of new cables. Electricity suppliers produce electricity and sell it to the client. For these companies, the smart grid offers extra opportunities to sell electricity to clients, for example, via car-recharge points. It will also mean that energy consumers will also increasingly become energy providers by means of solar panels, CHP boilers etc. This group also has its own vision of the smart grid.

Energy management

The managers of the electricity grid will have to anticipate the increasing fluctuations in supply and demand. The rise of electric cars, cogeneration, batteries, solar panels and CHP boilers will necessitate drastic changes to the electrical grid and the way it is managed, as electricity will be heading in all directions! Furthermore, wind and solar energy ensures that the range of electricity on offer is very varied. When the supply is too great, the grid can overload, with the regional transformer being the first to fail. A battery may help to reduce the burden on these regional stations.

This is exactly the idea that is being tested in the Dutch city of Etten-Leur, where eighty houses equipped with solar panels generate 200 kWh per day. In addition to the panels, an enormous battery has been installed to measure whether or not surplus electricity has been produced. The battery serves as a buffer: it can store surplus power generated by the solar panels, and if regional demand for electricity at peak hours is greater than the distribution network operator is capable of supplying, then the battery can step in to make up the deficit. Furthermore, residents can programme their smart washing machines to only operate if enough power has been generated by their solar panels. Etten-Leur therefore has a regional smart grid.

Traffic management in the electrical network

The programming of appliances to depend on the capacity of the electrical grid is almost like ramp metering on motorways. This draws comparisons between the electrical network and the road network, and makes the goal of grid management the same light as that of traffic management: to ensure that demand and capacity remain in balance.

One important factor is the ability to predict the demand for electricity. Distribution network operators currently use models that estimate the power consumption of each 24-hour period. However, in a smart grid, with decentralised generation and hungry power-guzzlers such as electric cars, a much more accurate method of prediction will be required, especially if the number of electric cars rises. However, the measurement and management equipment necessary to do so is not yet available. This equipment will be provided in the form of an ICT network running parallel with the electricity network, intrinsically combining the two in order to anticipate all energy-related developments.

Internet of energy

This gives rise to comparisons with another vast network: the Internet. This similarity has been recognised by the EU, a fact demonstrated by the EU research programme 'Internet of Energy', which Technolution is participating in. This initiative is investigating whether the European energy network can be set up in a way similar to the Internet: as a flexible network with links between energy producers, suppliers and users that allow the exchange of information about energy consumption, supplies, production and costs within a secure network. An Internet of energy would also require adjustments to current equipment. These would require additional devices to enable remote measurement and management. As part of the EU project, the consortium is striving to create standards for the connection of domestic electrical equipment to the network. These connections will enable measurement of energy consumption or the number of kilowatt hours generated by solar panels. This gives consumers insight into the energy consumption/production of every device, which in turn makes them more aware of their behaviour and the effect that it has on both the environment and their bank balance. This is another vision of the smart grid.

Role of the government

The government can encourage initiatives by granting subsidies. One example of this is the Stichting E-laad (the E-Charge Foundation) in The Netherlands, which involves distribution network operators setting up charging points for electric cars. The EU subsidises research projects aimed at creating a European market. This allows the creation of European standards, enabling European businesses to develop the knowledge themselves rather than being dependent on other standards.

However, legislation is a much more important factor. By granting concessions, the government is able to set environmental standards for regional and group transport. Municipal governments can give incentives to the logistics sector by establishing urban green zones within which shops must be supplied by electric delivery vehicles. This will cut down on both noise and air pollution. Many businesses have already anticipated these trends, working with electric lorries and vans which inductively recharge at the parking areas and unloading points.

First life cycle of smart grid

As you can see, the exact structure of the smart grid is not yet clear. What is certain is that it will link three markets: energy, transport and finance. These are markets in which Technolution has an extensive amount of professional knowledge and expertise. The smart grid is currently in the exploratory phase. No standards are yet in place, although they are on the way. This is the time to build prototypes, test concepts and investigate the best structure for the smart grid.

