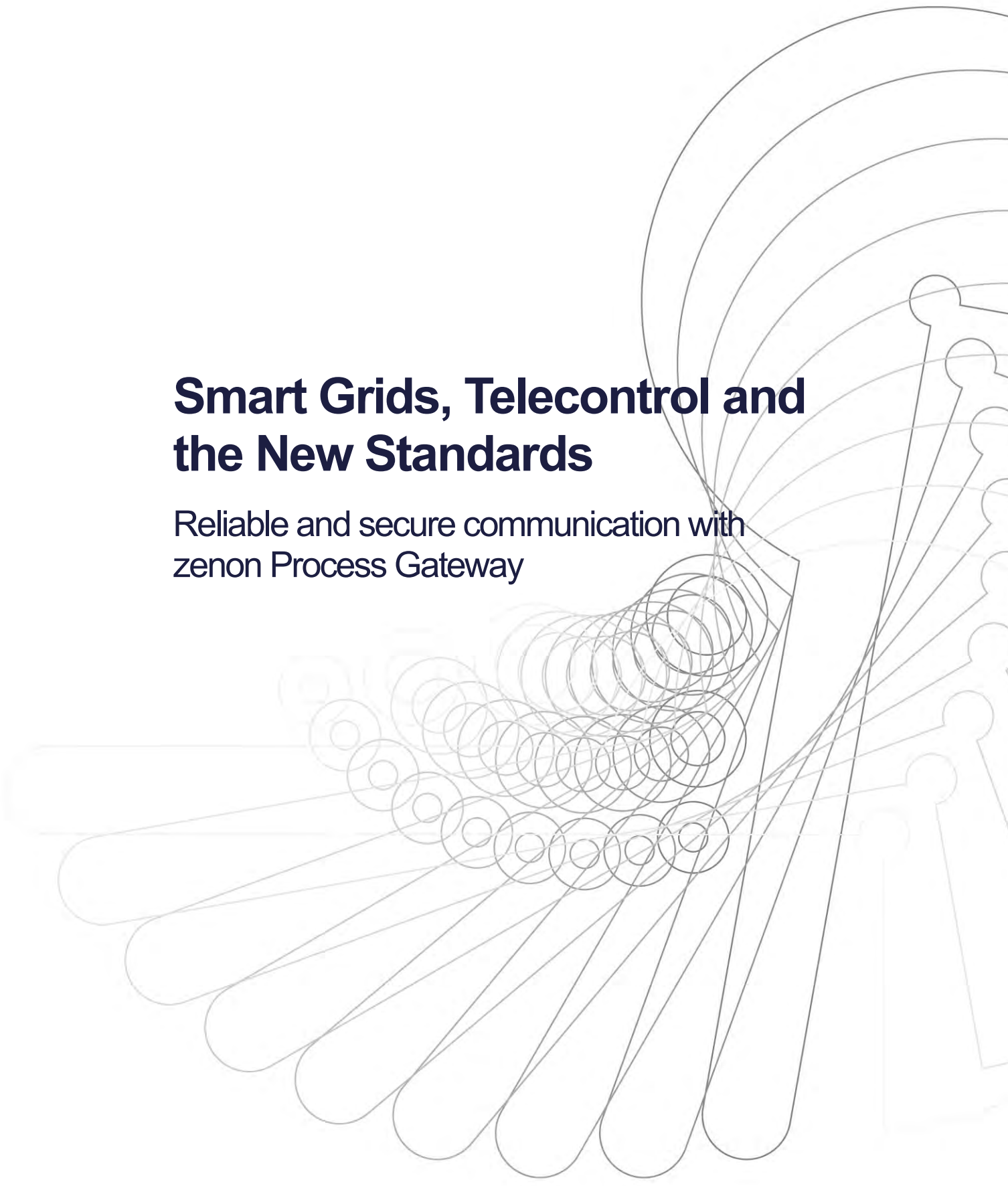
Smart Grids, Telecontrol and the New Standards

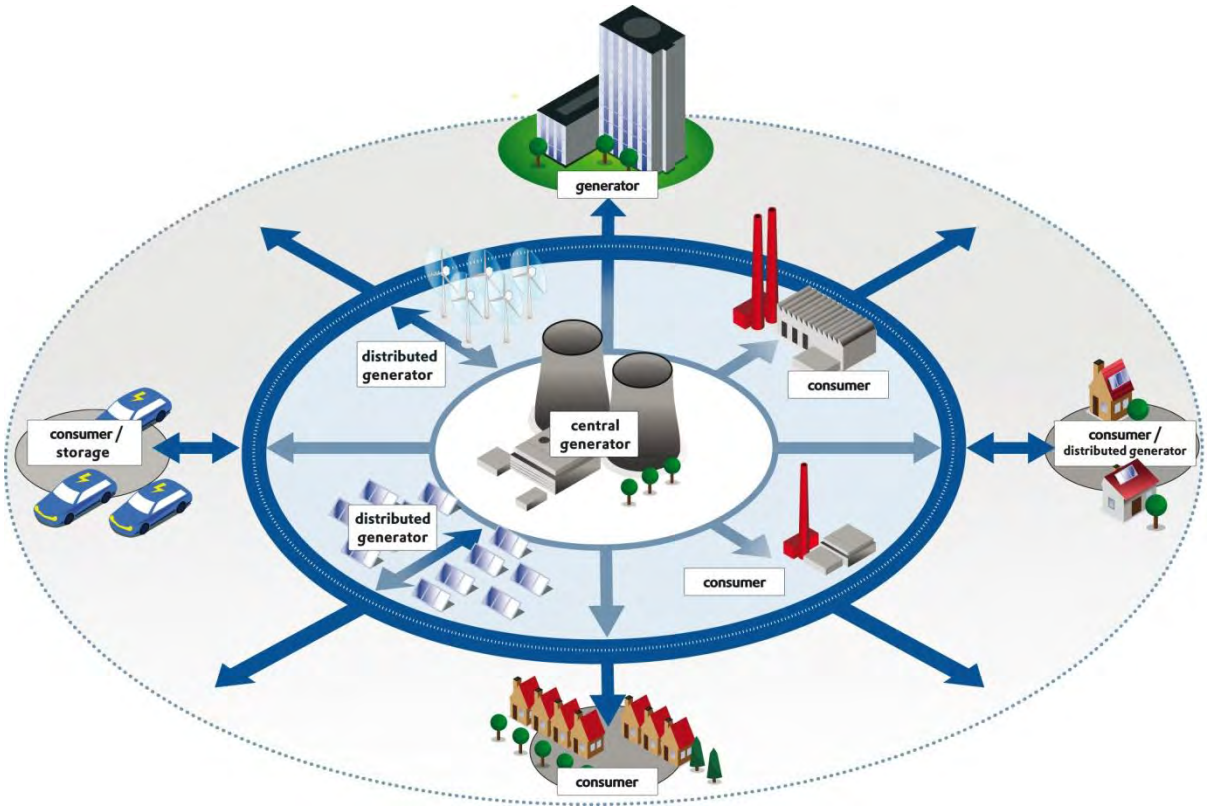
Reliable and secure communication with zenon Process Gateway



zenon®

Smart Grids, Telecontrol and the New Standards
Reliable and secure communication with zenon Process Gateway

After gaining significance in the American market, the concept of a ‚Smart Grid„ is becoming increasingly important to European consumers. Today"s efforts to use energy efficiently require different tasks to be accomplished. Electricity will no longer be simply provided to consumers; consumers are also feeding it back into the grid. Energy highways must be designed for flow in both directions. Energy suppliers will have to integrate many small producers into their power generation.



Decentralized energy generation

The notion of a Smart Grid has evolved in response to the need for decentralized electricity generation. This means that, as well as the many large electricity producers that feed into the grid, many more “small” electricity producers feed into it as well. Small electricity producers could be, for example, private wind power facilities, hydro electric power plants, private biogas facilities, photovoltaic panels (solar cells) on the roof of a large house, or similar. To incorporate these small producers into the grid network, the flow of energy must also flow from the energy producer (e.g. from the generator of a private biogas facility) to the energy company. This is a major challenge for the energy grid, since it must be designed for a two-way flow of energy. Appropriate measures must therefore be taken - for transformers and their protective devices in particular.

Virtual power plants

In an electricity grid, it is important to keep both the frequency and the voltage stable. In Europe the frequency of alternating current is 50 Hz. To maintain stability, the electrical energy must be created at the time when it is required. If demand decreases there could be a surge of energy in the network and the frequency will increase. And vice-versa: if demand for electricity exceeds supply, the frequency decreases.

To achieve an optimum balance, the frequency in the network is continually measured and a corresponding set value, based on the amount of deviation, is sent to the regulating power stations. Due to the integration of many small power stations, ranging from wind power stations to small, private photovoltaic facilities, it becomes increasingly difficult for grid operators to balance out these frequency fluctuations.

An effective technique for the countering of this kind of frequency fluctuation is the use of “clusters”. A cluster is notionally created when several small facilities are grouped together so they can be treated as a single large power plant. In this way, it is also possible to impose set values on them. These clusters are referred to as virtual power plants (VVP).

Smart grid and zenon Energy Edition

So what does Smart Grid actually mean for COPA-DATA and zenon Energy Edition? Large electricity grids must be equipped to handle two-way energy flows. Consequently, it must be possible to monitor and display

these two-way energy flows. This is where zenon Energy Edition comes into its own.

With its topological coloring, via the Automatic Line Coloring (ALC) module, zenon can display the electricity flows as color changes. Even in a topology that includes transformers, an absolutely accurate display of the two-way energy flow is possible.

zenon takes on another important role: it ensures optimum communication. To implement a smart grid, many facilities, such as transformer stations, must be converted and equipped with the most up-to-date devices. In addition to the protection relays being replaced, the entire process control technology often needs to be updated or replaced. The control technology typically includes control units, Intelligent Electronic Devices (IEDs) and a SCADA system. In these facilities, IEC 61850 is usually used as a communication protocol. In the USA, IEC 61850 has already been defined as a Smart Grid standard. However, this is not suitable for onward data transfer to superordinate levels, because it has not been specified for telecontrol applications. For further data transfer within the equipment, zenon users can turn to zenon Process Gateway which makes the use of an RTU (Remote Terminal Unit) unnecessary. The whole functionality equivalent to an RTU is already integrated within zenon, which ensures the software complies with USA smart grid standards.

zenon Process Gateway and Smart Grid

The smart grid standard IEC 61850 is suitable for the substation, but not for telecontrol. By contrast, IEC 60870 and DNP3 are traditional telecontrol protocols. They can be operated in serial communication and in an Ethernet network and have integrated mechanisms for secure transfer. Furthermore, network control stations / load dispatch centers can only be operated using these protocols.

IEC 60870 and DNP3 have further benefits. Let"s look at an example where we need to manage a number of substations in a manufacturing company. Here, two entities must be supplied with data: firstly, the control room system of the manufacturing company and secondly, the control station of the energy supply company. For optimum results in this example, we recommend the use of zenon Process Gateway; however in two separate modes. Communication with the manufacturing company"s control room system would ideally be via OPC and communication to the control station of the energy supply company to be via IEC 60870. With the zenon Process Gateway, several entities can be set up that can communicate diverse data via different protocols.

What does this have to do with the smart grid concept? Smart grid concerns, amongst other things, the provision of data from a substation configured with IEC 61850 to a superordinate level. Efforts are being made to achieve an optimum mapping of data from the substation to the telecontrol protocol (DNP3 or IEC 60870). This initiative is generally known as “harmonization” and “standardization” and is expressed in, for example, the IEC 61850-80 standard. The IEC 61850-80 standard, which is currently only an IEC recommendation, describes how the mapping of IEC 61850 data to data points from DNP3 or IEC 60870 can be achieved. The standard also describes how XML-based configuration files of DNP3 or IEC 60870 can be linked together.

Using zenon Process Gateway, the notion of linking data items from the substation to a telecontrol protocol is already a reality. Any data that zenon receives via IEC 61850 can be transferred to a data point of another protocol and sent on. The zenon Process Gateway sits on the zenon SCADA system and, therefore, has access to all data.

zenon Process Gateway as a “soft RTU”

The zenon Process Gateway can also be referred to as a soft RTU. It offers all the main functions of an RTU – except that it runs on a PC. For maximum reassurance and reliability, it is also possible to run zenon Process Gateway as an RTU on two PCs at the same time giving users the security a redundant system offers.

The advantages of a soft RTU are clear. Engineering is much simpler because the data from the substation is already in the SCADA system and does not need to be routed to an additional device. And: configuration for routing is simple.

Nevertheless, it is important to remember that you are configuring a telecontrol slave. This can mean that a large amount of data must be configured. Because such configurations are often very similar to substations, it is useful to be able to reuse the substation configurations. In zenon Process Gateway this reuse can be carried out via a simple exporting or importing of the configuration in XML format. As a result, laborious configurations can be easily transferred and adapted, or edited directly in the XML file. The engineering effort required is thus reduced immensely.

Load dispatching center systems

There is only a small number of suppliers of large load dispatching center systems. Each control system has its own method for dealing with the acquisition of data. Some control systems require a type of “refresh” of the data transferred via IEC 60870, which is not common with spontaneous data transfer. To accommodate these systems periodic transfer is specified in the IEC 60870 protocol - a function that zenon Process Gateway already supports. With this function, an update, for example of switch settings, is sent to the superordinate load dispatching center. This is necessary because some load dispatching center systems set the status of switches to invalid if they do not regularly receive the current value, even if the value has not changed.

zenon Process Gateway: security configuration

Because zenon Process Gateway runs under Windows, it is possible that it can be ended by users unintentionally. For this reason, zenon Process Gateway can also be operated as an invisible application on the SCADA PC. The user sees what they need to via the normal SCADA application but, in addition to that SCADA application, data is being sent in the background by an additional application the user is not aware of. Using this approach, unintended - or intended - termination of the connection to the load dispatching center can be reliably prevented.

zenon Process Gateway: command processing

Using zenon Process Gateway, a load dispatching center system can also serve the substation, i.e. send switch commands. The commands from the load dispatching center system are mapped to the corresponding command variable of the zenon driver by the Process Gateway. The driver then forwards the command to the corresponding IED (for example, a bay controller), which then switches the primary switching device.

zenon Process Gateway: unlimited file transfer

A SCADA system, such as zenon, must also perform a sort of mailbox function for messages from the field – referred to as “disturbance record evaluation”. A disturbance record is a log file that is made available by a protection relay. Particularly after an event where the protection relay causes a trip, it is often vital to analyze what happened in the seconds before and after it was triggered. A modern protection relay saves all relevant values such as phase voltages and phase currents in a file. After the trip, the file can be transferred to the substation"s SCADA system. It is usually the case that the specialists who analyze these fault logs are not located in the station, but near to the superordinate load dispatcher. It is therefore important to transfer the disturbance record from the substation"s SCADA system into the load dispatcher. This can be done via the file transfer function of the IEC 60870 slave implementation of zenon Process Gateway. Using zenon, files can be transferred throughout the entire system: from the protective device through to the load dispatching center.

Summary

The concept of a Smart Grid is evolving in response to the challenges of modern energy supply. Authorities are in the process of defining the appropriate standards. In the USA, the first steps have already been taken and the subject is now gaining significance in Europe. COPA-DATA provides two congenial programs – zenon Energy Edition and zenon Process Gateway – which equip energy suppliers with all the tools they require to implement Smart Grids and meet modern energy requirements efficiently and safely.

If you would like to find out more about intelligent energy grids, zenon Process Gateway or zenon Energy Edition, please email us at energy@copadata.com.