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## Siemens ENEAS solutions for distribution automation

Cost-effective, reliable, safe

Answers for infrastructure and cities.



## An integrated approach covering the full spectrum of energy automation

### Always a step ahead with ENEAS solutions from Siemens

Comprehensive and highly efficient system solutions in all areas of energy automation based on proven Siemens products – that's the idea behind Siemens ENEAS (Efficient Network and Energy Automation Systems). This integrated system offers compelling benefits in all areas of application:

- Efficiency thanks to low costs throughout the entire life cycle
- Sustainability due to extensive performance reserves and open interfaces
- An ideal technical basis for the smart grids of the future
- A high degree of safety and reliability which only a proven business partner can provide

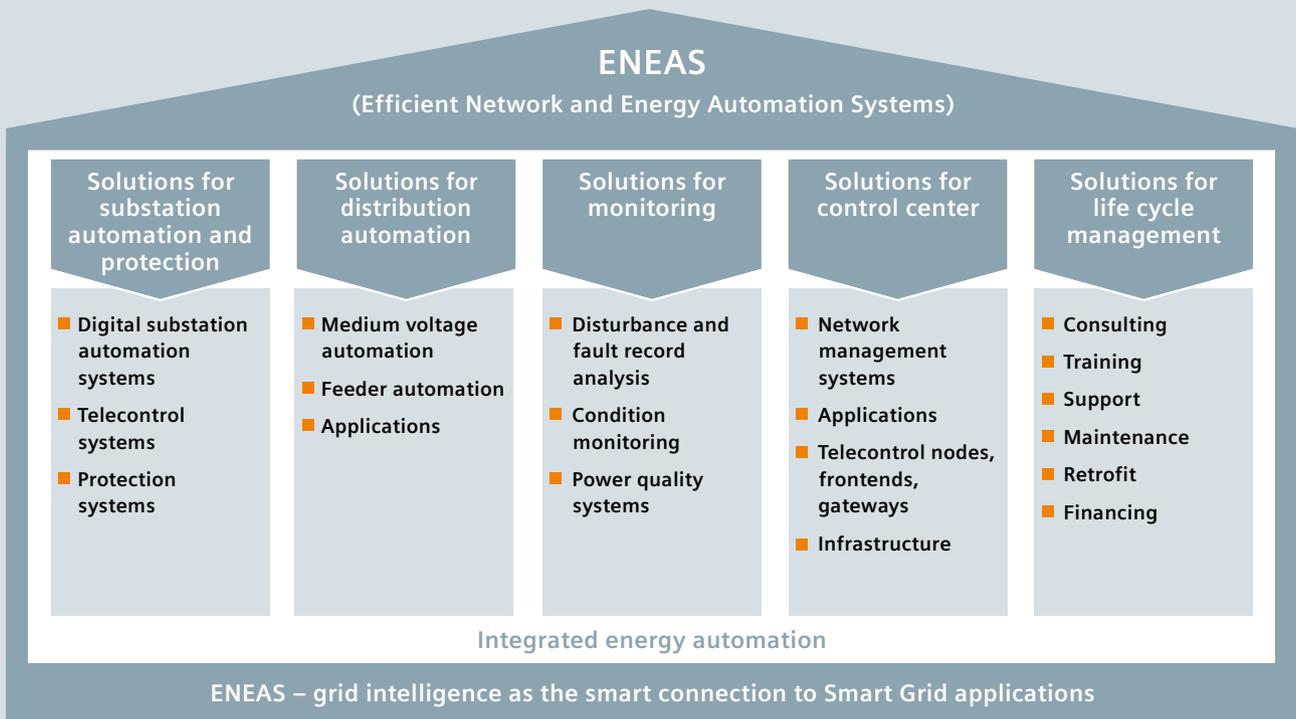
### Optimize costs with distribution automation based on ENEAS solutions

As an interface between medium and low voltages, distribution automation permits the complete monitoring and automation of all controllable devices.

The three tasks of distribution automation are to:

- Optimize the cost of operating and maintaining the primary technology
- Improve supply safety and voltage quality
- Quickly adapt to changes in the distribution grid caused, for instance, by the addition of renewable energy from local providers

Siemens ENEAS solutions for distribution automation have been proven in the field and are based on time-tested Siemens equipment. The result is the highly reliable and cost-effective automation of local network stations.



Siemens ENEAS solutions cover the entire spectrum of energy automation and stand for efficient project engineering, reliable safety functions, unlimited communication, and compatibility with international standards. They are the basis for intelligent transmission and distribution networks.

### Reliability as a factor of success

Today's customers expect a highly reliable and safe supply of energy from their power grids, and their demands are steadily increasing. That is why both utilities and customers are focusing their attention more and more on the quality of distribution networks.

The safe and reliable supply of energy depends mainly on the distribution networks, with several technical and organizational factors playing an important part. Supply safety is generally quantified by two indicators: SAIDI (non-availability) as a measure of the likelihood that a customer will be affected by a supply interruption at any one time. SAIFI indicates the interruption frequency, i.e. how often a customer is affected by a supply interruption per year on average.

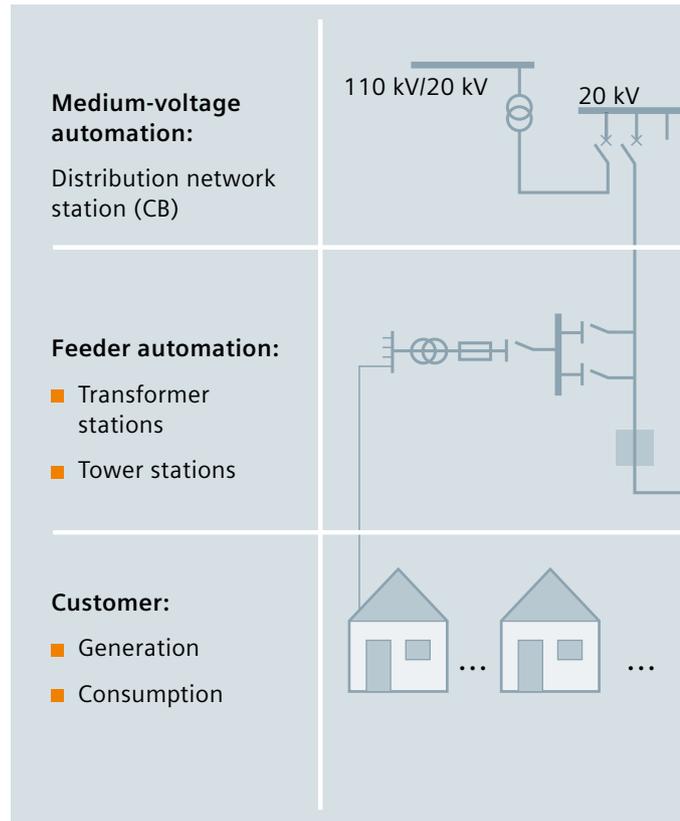
More and more energy supply agreements between utilities and customers include explicit provisions on network quality, with SAIDI and SAIFI being just as important as other network quality indicators. Moreover, in liberalized markets, regulators typically require the utilities to document the reliability of networks or define explicit performance targets – some countries even impose penalties for non-compliance. This makes network quality an increas-

ingly important factor for the economic success of utilities. Siemens ENEAS solutions for distribution automation are a cost-efficient means to provide maximum safety – as a basis for sustainable success.

### Added value with new solutions

Network operators gain a number of benefits from automating their complete distribution networks – most importantly, reduced operating costs, better grid utilization, and reduced fines. New applications such as fault detection, voltage and reactive power compensation as well as measurements of network quality also support the efficient operation of distribution networks.

# Full control of all aspects of distribution networks



## Efficiency is the key

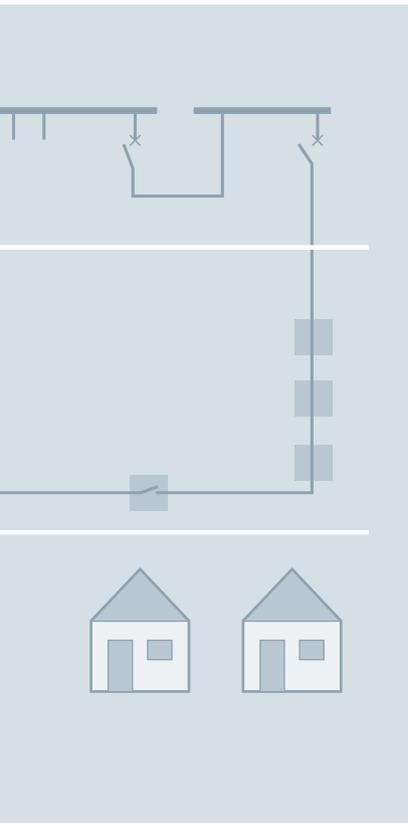
In view of increasing cost pressure in liberalized markets, investment decisions have to strike a balance between technical benefits and economic feasibility. However, regardless of whether a specific situation focuses on minimizing costs or meeting legal or regulatory requirements, distribution automation always has to be cost-effective. With ENEAS solutions from Siemens, costs can be calculated, and the economic value can be demonstrated up-front.

The development of individual solutions requires a reliable evaluation of supply safety. Apart from the faults which vary with different types of lines, interruption frequency and interruption length are crucial factors. The more frequent and longer an interruption, the more severe are its consequences. The use of highly reliable components with short switching times addresses this issue and helps increase supply safety.

### The right solution for every network

The different types of networks, from a simple line to open ring networks and networks with remote stations, and their topologies display different fault and failure behaviors and require customized automation concepts. Decisions on whether to use local fault indicators or remote data diagnostics, load interrupter switches or circuit breakers, the selection of suitable drives for remote switching and possibly even a self-healing configuration have to be taken early on during the planning phase. The ENEAS solutions for distribution automation offer a high degree of flexibility and numerous design options.

Apart from general regulatory requirements, a particular solution approach is determined primarily by specific customer requirements. With proper planning, distribution automation results in quantifiable improvements of supply safety, such as noticeably fewer and shorter interruptions. These improvements are objectively verifiable, and their economic value can be calculated in advance using a target-actual comparison.



#### Benefits at a glance:

- Increased distribution network reliability
- Improved distribution network operation and maintenance
- Fast disturbance analysis and fault location
- Monitoring for aging infrastructure and targeted investments
- Improved distribution network quality and avoiding the negative impact of industry and local energy generation on network quality
- Integrating decentralized energy generation in the distribution networks
- Transparency regarding power flow
- Active load balancing and rearrangement when operating distribution networks
- Use of state-of-the-art technology for communication nodes with broadband infrastructure
- Introduction of electrical mobility
- Integration of smart electric meters

#### Ready to face complex challenges

The energy landscape is currently undergoing fundamental and fast-paced changes. The rapid increase in the number of local energy providers requires completely new approaches to network integration; at the same time, it has an enormous impact on the power flow in power grids and on network stability. The smart networks which are just emerging offer completely new communication structures and will multiply the available data.

Distribution automation based on Siemens ENEAS solutions will meet these challenges reliably and cost-effectively. It offers complete control of the whole system, considerably improved stability, and consistent network quality, both under routine operating conditions and during maintenance activities and malfunctions. This is made possible primarily by a transparent power flow and the option of controlling loads.

Greatly improved fault analysis and precise fault location functions permit the efficient deployment of service technicians. Development and parameterization as well as the option of changing and updating the configuration are simplified. Based on condition data, maintenance times can be reduced and maintenance schedules can be aligned with specific status conditions. And finally, the data acquired by smart meters can be integrated and utilized leading to new business models based on smart networks.

# Added supply safety and reliability for medium-voltage networks



## Medium-voltage automation

Medium-voltage automation as part of an ENEAS solution for distribution automation can be accomplished either at the field or at the station level. It is based on interconnected communication between all system components according to the IEC standard.

### Automating telecontrol technology

The implementation of telecontrol technology is the stepping stone to medium-voltage automation. This technology clearly demonstrates the primary advantage of Siemens protective and control devices: centralized and one-time configuration and parameterization. Object-oriented work with central engineering systems saves time and prevents errors since there are no duplicate entries. The cost of automating telecontrol technology at the field level is relatively low. It mainly requires direct data transfer to the control room for monitoring and control purposes.

### Substation automation

Substation automation can be seamlessly integrated into existing telecontrol systems, with appropriate migration concepts facilitating the transition. Medium-voltage automation at the station level is characterized by decentralized peripherals interacting via bus communication, a high degree of integrated protection technology as well as extensive automation and visualization. It permits full monitoring and control of the station and consistent network quality, both during routine operations and in exceptional situations.

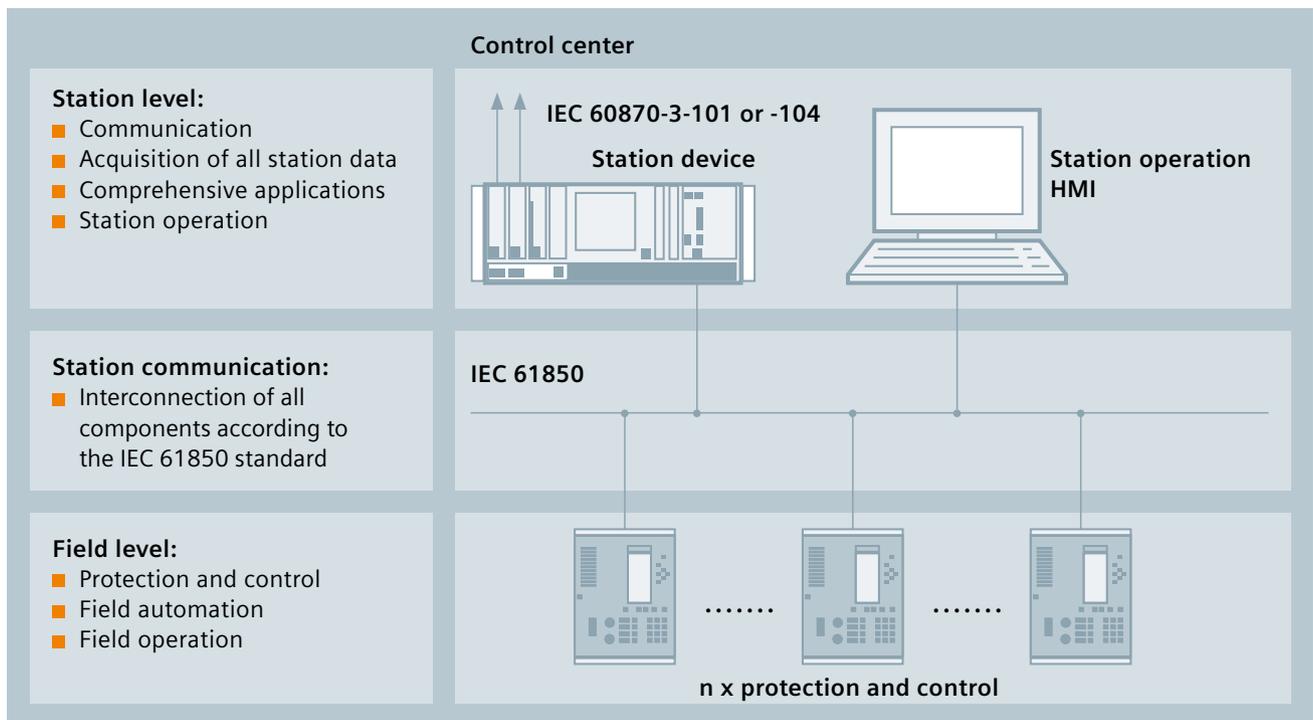
ENEAS solutions for distribution automation include a large number of proven configurations and functions for substation automation. Substation automation ensures reliable operations and has the potential of improving documentation and life cycle management as well as allowing migration concepts to safeguard investments already made. Another advantage is its fast and easy implementation.



**Benefits at a glance:**

- Fast system engineering due to error-free data entry
- Consistent implementation of the required functions both for the telecontrol system and digital substation automation
- Easy upgrade to substation automation using the existing telecontrol system
- Use of protocols according to international standards and protocols of third-party manufacturers
- Secure long-term investments due to the transfer of parameters during migration and seamless change between system generations

Diagram of an automated substation





## Distinct advantages from comprehensive automation and monitoring

### Feeder automation

When controlling and monitoring distribution networks, time is of the essence, especially when it comes to reducing interruption times. That is why feeder automation based on Siemens ENEAS solutions goes to where the action is: directly in the field. This makes it possible to respond quickly, precisely, and reliably to all events and changes in the distribution network. It also improves network quality and permits the active control of bidirectional power flows – an important requirement for the integration of decentralized energy providers and electrical vehicles. And smart meters can also be included in feeder automation.

#### Cable network automation

Siemens ENEAS solutions for the automation of cable networks, particularly ring main units (RMUs), are based on compact remote telemetry units (RTUs) which can be easily parameterized with an object-oriented tool for display and control functions. For safety reasons, these devices are equipped with a separate power supply. They can be integrated in substations or placed in external housings. Communication is largely wireless.

#### Overhead line automation

Overhead lines are completely exposed to the environment. They pose a relatively high interruption risk for the distribution network and a special challenge for automation.

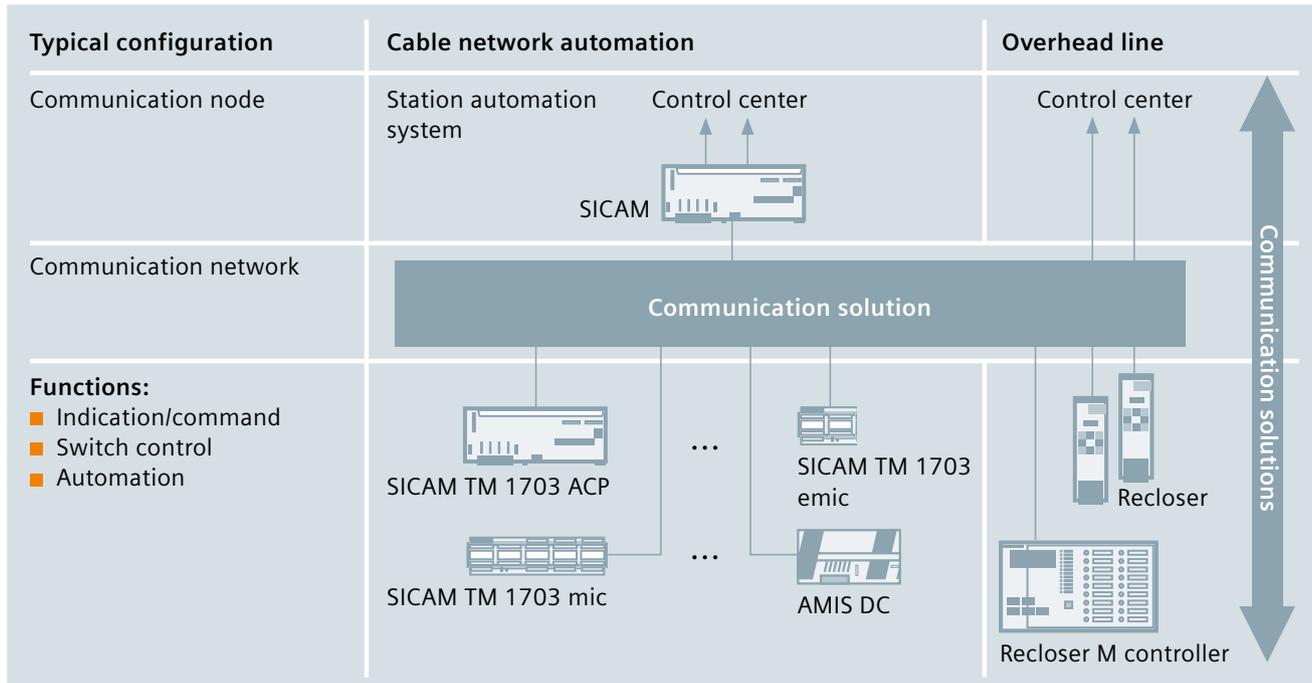
Pole-mounted disconnectors are configured as load disconnectors with restart action to reliably isolate temporary as well as permanent disturbances. Automated reclosers, on the other hand, have a circuit breaker and automatically reconnect the line again in case of a disturbance to avoid triggering an interruption caused by a very brief disturbance. With automatic self-healing functions based on IEC 61850 and GOOSE-compliant peer-to-peer communication, line faults can be located and corrected making the energy system safer and more reliable.

**Benefits at a glance:**

- Self-healing high-speed solution based on IEC 61850 and GOOSE, which means minimum downtimes thanks to fault detection, isolation, and service restoration (FDIR) as well as self-resolving logic
- Maximum selectivity and expert system for fault isolation and repair
- Scalable protective functions of proven and reliable SIPROTEC devices
- Optimizing life cycle and operating costs because of reduced labor and travel time for troubleshooting
- Improved monitoring with online information
- Various communication options from serial to LAN and WLAN



**Feeder automation for cable and overhead line networks**



# Efficient solutions for current and future challenges



## Applications

Siemens ENEAS solutions for distribution automation offer network operators a number of technical and economic benefits. They are also clearly more economical than solutions which are geared solely to the primary technology. Studies\* have shown that implementing an automation solution in a distribution network can have a significant influence on supply safety. Complete automation of the network including autonomous circuit breakers or load disconnectors can lower the important SAIDI and SAIFI indicators to just a few percent of the values usually seen in non-automated networks.

### Targeted automation of distribution networks saves costs

Since most distribution networks are not yet highly automated, distribution automation based on Siemens ENEAS solutions can usually realize substantial cost savings while optimizing performance. Even the automation of individual ring main units can yield noticeable savings. With detailed analyses of the existing network, the most efficient starting points in the network can be identified.

### Smart distribution networks as part of smart grids

The range of functions of distribution automation with Siemens ENEAS solutions and the implementation of suitable communication solutions make distribution networks fit for integration in smart grids. This creates synergies which reach far beyond the distribution network.

Distribution automation with Siemens ENEAS solutions covers all fault detection, isolation, and repair functions within a network segment. The greatest benefits can be achieved when circuit breakers are automated together with their related protective functions. The network segments can be operated completely automatically using local self-healing functions, remotely controlled with SCADA, or manually operated by operators inside the station. With remote control, switching operations for reconfiguring the network can be carried out centrally from the control room.

With Siemens ENEAS solutions for distribution automation, communication between the individual field devices and with higher instances is based entirely on the modern communications standards IEC 61850 and IEC 60870-3-104. This Ethernet-based communication enables real-time messages, self-healing functions of the network, and error detection within seconds.

\*CIRED 2011, paper 1117, Distribution Automation – Impact on System Availability in Distribution Networks – SIEMENS AG, Germany.



**Benefits at a glance:**

- Free scalability of the desired solution, from simple monitoring all the way to a “self-healing” distribution network
- Smart automation concepts for a more reliable energy system which can be implemented centrally or locally
- Minimized downtimes through automatic fault detection, isolation, and service restoration (FDIR)
- Improved network quality with continuous monitoring
- Optimization of life cycle and operating costs thanks to reduced labor requirements for troubleshooting

**Distribution automation with Siemens ENEAS solutions:  
possible network monitoring and automation functions**

	Monitoring	Automation
Medium voltage	<ul style="list-style-type: none"> <li>■ Fault indication</li> <li>■ Fault location</li> <li>■ Monitoring of power quality</li> <li>■ Detecting isolated operation</li> <li>■ Monitoring primary equipment</li> </ul>	<ul style="list-style-type: none"> <li>■ Fault location</li> <li>■ Supply restoration</li> <li>■ Voltage and reactive power compensation</li> <li>■ Coordinating decentralized energy resources &gt;100 kWh</li> </ul>
Low voltage	<ul style="list-style-type: none"> <li>■ Monitoring of power quality</li> <li>■ Detecting islanded operation</li> </ul>	<ul style="list-style-type: none"> <li>■ Protection of low voltage cables and overhead lines</li> <li>■ Control of distribution transformers</li> <li>■ Energy-efficient control of decentralized providers</li> </ul>

ENEAS system solutions for distribution automation allow the flexible adaptation of supply systems to the increasing demand for energy. They also provide efficient and cost-effective answers to the fundamental changes in the energy infrastructure.

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Order No. IC1000-G220-A118-X-4A00  
Printed in Germany, AL=N ECCN=N  
Dispo 6200, c4bs No. 693  
fb 4873 WÜ WS 05122.0

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