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Microgrids under perfect control

Controlling and monitoring microgrids in a reliable, cost-optimized, and environmentally friendly manner with the SICAM Microgrid Manager

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One answer to many challenges

To manage the growing complexity and decentralization of the power supply infrastructure, the use of digital information and communication technology is essential. Distribution grids, in particular, are therefore being progressively upgraded with smart technology. In addition to substantially improved open-loop and closed-loop control options for existing grids, this trend has resulted in new possibilities for grid planning and design as well as new business models for utilities and energy traders.

One of the most interesting areas of application for new technologies is microgrids, which are geographically limited low- and medium-voltage structures with their own facilities for generating, distributing, and possible storage of electrical energy. Microgrids can be connected to the supraregional supply grid, or can be run completely independently of this grid, in what is referred to as isolated or island operation.

Independent, efficient, and reliable

Microgrids are characterized by a high degree of independence from what takes place within the supply grid, because they have their own centralized control of the individual systems and the load flow. The advantages are clear: Operation within the microgrid can be rigorously optimized. This allows a high degree of reliability, efficiency, and cost-effectiveness and can significantly reduce the cost of procuring electricity. In many cases, a local district heating grid can also be optimized, which releases further efficiency potential.

Since the outstanding efficiency also saves resources and because a large proportion of the electricity generated locally from renewable sources can be fed into the system, microgrids can also make an important contribution to a more sustainable and more environmentally friendly energy system.

A multitude of application fields

Microgrids are a particularly interesting alternative wherever a stand-alone grid is feasible or even necessary for reasons of geography, infrastructure, or security of supply. In addition to islands and villages in particularly remote regions, other possibilities include large universities, governmental organizations, industrial complexes, shopping centers, and independent grids of local utilities. The high level of availability and power quality as well as the possibility of being able to operate independently of the supply grid make microgrids an interesting alternative wherever security of supply is the top priority – for example, at hospitals or military installations.

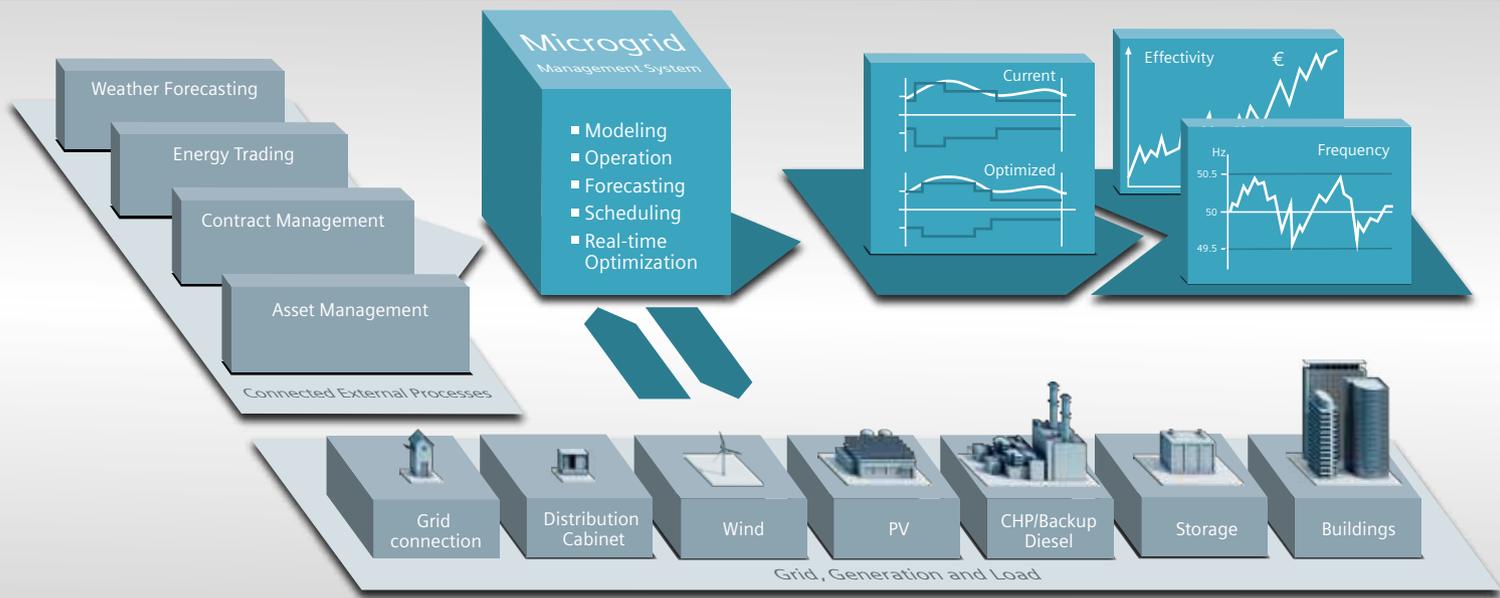
Economic benefits

Economically, microgrids are particularly advantageous in many cases: The integration of renewable sources of energy and energy storage systems into their microgrids allows operators to optimize their energy costs and to market surplus electricity. Furthermore, especially in the case of systems in remote regions, the use of fossil fuels can be reduced significantly and also the costs for transporting these fuels.

However, the intermittent nature of wind- and solar-powered generation calls for intelligent control and reliable load and generation forecasting.

Control is crucial

This is where Siemens' SICAM Microgrid Manager comes into play. It makes smart energy management and the continuous monitoring and control of the grid and all of its components feasible. All operating activities can be scheduled, energy flows can be reliably forecast, and finely tuned generation schedules can be created for all energy resources. Thanks to integrated real-time optimization, the schedule can be flexibly adapted to the actual demand.



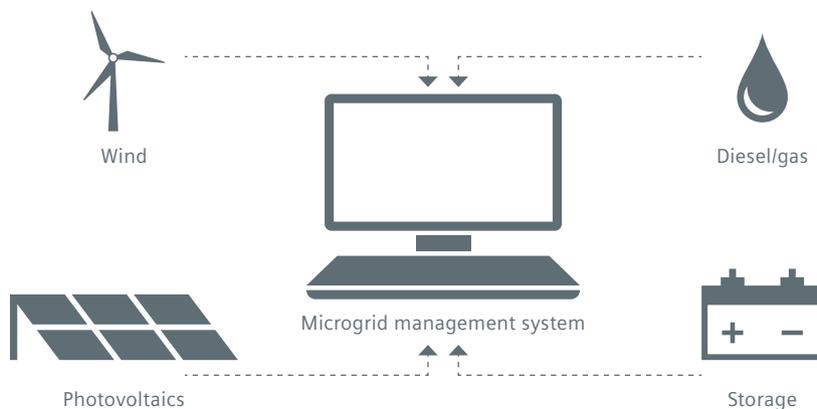
To protect their microgrids from negative influences from higher-level grid instances, operators can even completely decouple their microgrid from the transmission grid. In the resulting isolated grid, the SICAM Microgrid Manager reliably ensures equilibrium between generation and load, even if the proportion of energy from renewable sources is high.

Detailed consultation is vital

In each individual case, however, it is imperative to precisely determine the actual savings potential while taking into consideration all external factors such as customer behavior, load profiles, and geographical conditions. The first step of integrating the SICAM Microgrid Manager into a microgrid is a comprehensive analysis and consultation during which all general conditions are closely examined.

The main benefits of microgrids at a glance

- Cost-effective operation, thanks to extensive optimization possibilities
- Low environmental impact due to resource-efficient operation and possibility of extensive integration of renewable energy
- Highest efficiency of the entire power supply system through the joint optimization of district heating and electricity
- Safeguarding of the power quality and high security of supply



The SICAM Microgrid Manager efficiently and reliably controls all operating resources within a microgrid.



SICAM Microgrid management systems and solutions for the stable and efficient operation of power grids in remote locations



Tailored solutions that help corporations, governmental organizations, municipalities, and universities manage their energy supply optimized for their own use

The features that distinguish the SICAM Microgrid Manager

Powerful, modular, scalable

The Siemens SICAM Microgrid Manager is a comprehensive, highly developed solution for monitoring and controlling microgrids. It consists of intelligent, user-friendly, versatile instruments such as comprehensive SCADA, forecasting, planning, and real-time optimization tools. With it, operators can reliably control and monitor the grid, power generation and storage, and consumption as well as the exchange of energy with higher-level grids. The modular structure and the scalability of the SICAM Microgrid Manager allows operators to precisely tailor it to the specific conditions of each individual microgrid.

Simple operation

One of the SICAM Microgrid Manager's primary features is its intuitive operation. With just a few clicks of a mouse, even complex infrastructures can be mapped. Numerous automated functions support the users, helping them to avoid potential errors. Useful options include grid visualization tools, various alarms, and

SCADA control functions for securing the highest possible supply quality and efficiency.

Green light for sustainability

The SICAM Microgrid Manager accesses a variety of continuously updated parameters – from weather forecasts to current load profiles – in order to ensure a reliable supply. It regulates the use of power generation from fossil fuels in real time as needed and enables the efficient integration of cogeneration plants to minimize the use of fossil fuels. Of course, it also provides the necessary tools for optimum balancing of fluctuating generation capacity within the microgrid.



Scalable microgrid management systems for the highly reliable and cost-efficient operation of industrial power grids



Solutions for the integration of renewables and storage systems in critical environments to increase independence from grid supply in emergency situations

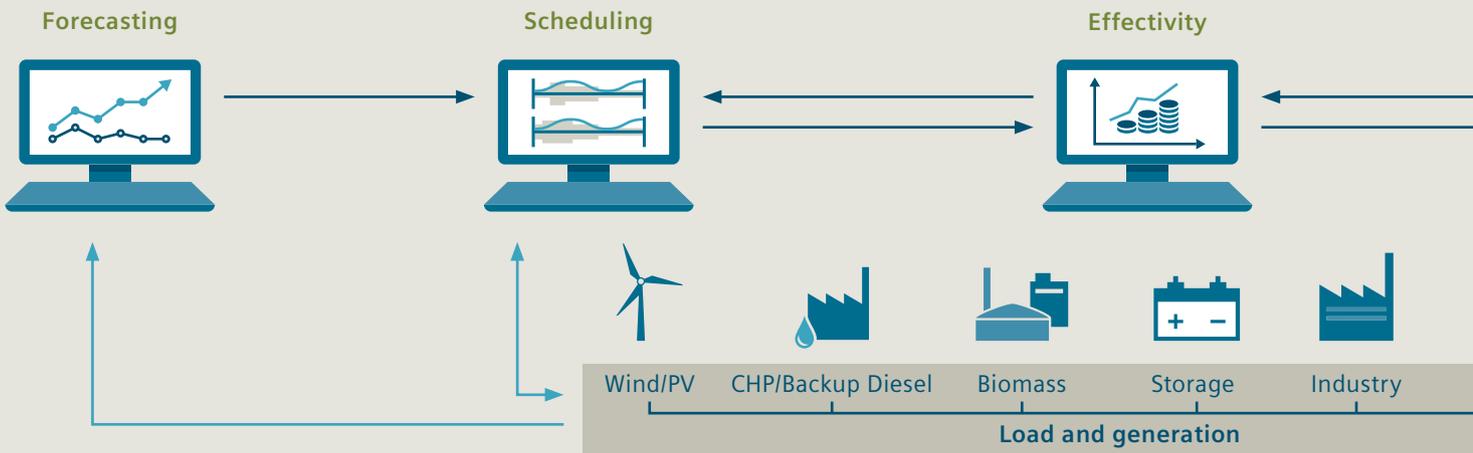
Monitoring and control

Monitoring and controlling the producers and the grid is one of the most important tasks, and this can be done conveniently with the SICAM Microgrid Manager. It visualizes events and structures in an easy-to-understand and user-friendly manner, analyzes energy flows based on present-time as well as historical data, and can integrate a variety of other functions as needed.

Graphical displays of processes facilitate the operation of energy producers, storage systems, and switchgear as well as the transmission of commands to the field, while an event log and individual graphical displays provide an overview of events in the grid. A variety of graphical signals and the topology-oriented color scheme make it easier for operators to find their bearings and draw their attention to important processes and conditions.

The functions at a glance

- Precise control and maximum operational reliability, thanks to clear, easy-to-understand graphical displays and event logs that are accurate to the millisecond
- Logging of all messages, commands, and process values
- IEC 104 and IEC 61850 telecontrol interfaces standard, other interfaces optional
- Automatic voltage control
- Individual assignment of switching authorities, for example, for different voltage levels or producers
- Load/frequency regulation
- Simple expandability via scripting interface



Operational planning and optimization

The Siemens SICAM Microgrid Manager provides extensive, powerful tools for planning generation capacity and load, for planning operation, and for preserving the equilibrium between generation capacity and load during operation. It thus covers all important areas of planning and optimization. All planning and forecasting functions are based on algorithms that are already deployed in the Siemens Decentralized Energy Management System (DEMS®) and have been tried and tested many times over.

Planning of generation capacity and load

The first step toward securing a reliable supply is a reliable assessment and planning of the necessary generation capacity and the expected load. A prerequisite for this is the knowledge of a wide range of fixed and variable parameters – from the available power plant capacity and expected energy demand to changing weather conditions. In addition, the flow of energy is of interest, especially in a microgrid. All in all, a generation plan is required. Depending on the scope of the microgrid, this plan can be very manageable. However, particularly in larger microgrids with a large number of different providers, storage systems, and controllable loads, planning quickly evolves into a challenging task. In order to successfully master this task SICAM MGM supports a fast, easy, and efficient planning.

Operational planning

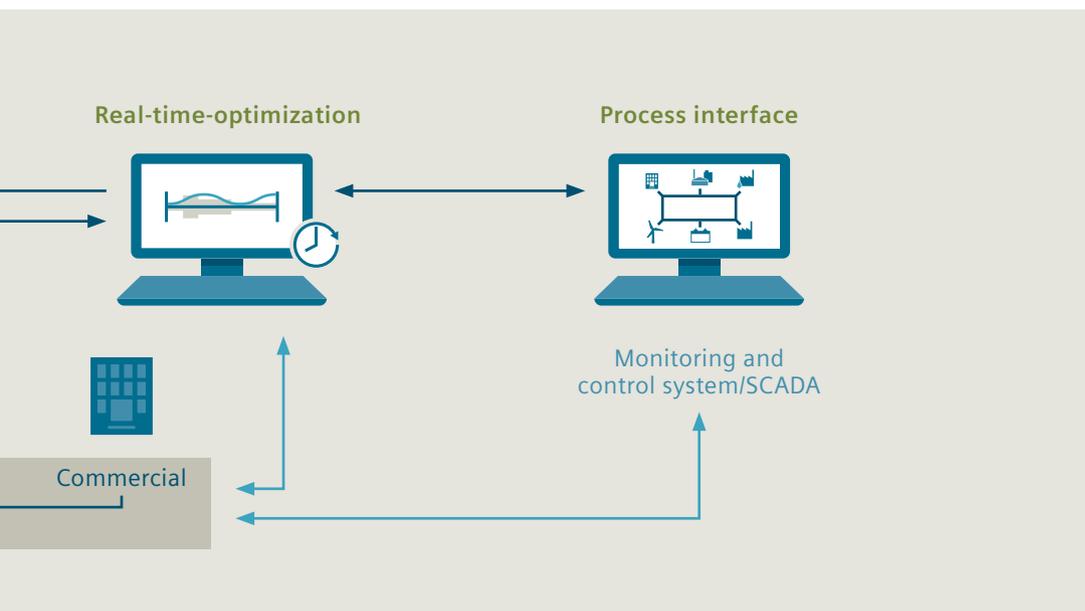
The next step is to ensure that the available energy reaches all consumers in the required quality. Comprehensive short-term planning for all available resources helps reduce operating costs and makes it possible to comply with technical and contractual specifications. The planning requires detailed knowledge of the properties and the exact condition of equipment so that the energy flow can be determined accordingly. Thermal overload of equipment as well as frequency and voltage fluctuations outside of the permissible tolerances must be avoided.

Equilibrium between generation capacity and load

Due to the numerous process variables, even the best planning rarely matches actual operating conditions right down to the last detail. Therefore, the corresponding fine adjustments, based on the latest operating data, must be made during operation to preserve the equilibrium between generation capacity and load. Fossil-fired producers require particular attention – for cost reasons alone.

Secure, cost-optimized, and environmentally friendly operation

The Siemens SICAM Microgrid Manager provides the appropriate tools for automated planning tasks and even plays an active role in the actual operation of the microgrid: The software monitors and controls producers,



Microgrid Management System– Workflow

storage systems, and consumers, and readjusts the generation and grid operation planning in real time as needed. Of course, external conditions are also taken into account, such as changing weather patterns and energy prices. The SICAM Microgrid Manager supports both the most efficient integration possible of cogeneration plants and the economical use of fossil fuels. It thus also contributes to economic efficiency and the creation of maximum added value. The key applications are:

Modeling

Optimum use of a microgrid necessitates precise modeling and parameterization of the interaction of generation, load, and storage, which can be performed quickly, efficiently, and intuitively with the engineering applications in the SICAM Microgrid Manager. A variety of preconfigured routines, comprehensive libraries, validity checks, and tools facilitate work and help avoid errors. The microgrid is mapped precisely, and the equipment can be easily parameterized.

Forecasting

The applications in the SICAM Microgrid Manager create forecasts of energy demand and the available generation capacities of decentralized producers. Configurable forecast periods make reliable preparations possible by providing reserve capacities and developing adequate risk strategies.

Planning

Advanced planning that is as precise as possible is used to reduce generation and operating costs while maximizing the environmental compatibility of the microgrid as a whole. The SICAM Microgrid Manager therefore makes it possible to plan up to a week in advance in 15-minute increments. Real-time mathematical optimization algorithms ensure high planning quality. Variables such as the start-up times and costs of fossil fuel-based producers and available fuel quantities as well as external factors such as fuel and energy prices are taken into account. Autonomous, switchable, and controllable loads are taken into account individually during load control.

Real-time optimization

Deviations from previously calculated energy demand that arise during operation are balanced out as smoothly and cost-effectively as possible through readjustment of providers, storage systems, and controllable loads. This is the best way to comply with previously calculated values and to meet obligations.

The modular, scalable Siemens SICAM Microgrid Manager facilitates comprehensive planning, monitoring, and control of microgrids. Simple and intuitive to operate, it opens up numerous optimization possibilities, thus ensuring cost-effective grid operation.

The possibility of jointly optimizing district heating and energy releases further efficiency potential for the entire Microgrid.



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Siemens AG
Energy Management
Energy Automation
Humboldtstr. 59
90459 Nuremberg, Germany

For more information, please contact our
Customer Support Center.
Tel.: +49 180 524 84 37
Fax: +49 180 524 24 71
(Charges depending on provider)
E-mail: support.ic@siemens.com

Order No. IC1000-G220-A235-X-4A00
Printed in Germany | AL=N ECCN=N
Dispo 6200, SIMC-0000-44268
fb 6271 WÜ WS 09141.0

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