DEMS – Decentralized Energy Management System
The intelligent way to manage distributed energy resources and virtual power plants

Intelligent integration of distributed supply structures

Ready for change in the power supply

Over the next few years, the number of distributed generating units in use – such as wind, photovoltaic, biomass, combined heat, and power stations – increases dramatically. This shift is being driven by the need to reduce environmental pollution, avoid resource depletion and increase energy efficiency, as well as by the growing deregulation and liberalization of the market. This makes the task of intelligently harmonizing generation, loads, and storage even more challenging.

In virtual power plants, a large number of distributed units are networked virtually in a plant cluster as one operational unit. This calls for a smart control solution that enables the virtual generating units to be deployed as economically and ecologically as possible.

Fully exploiting the potential of virtual power plants

DEMS® (Decentralized Energy Management System) from Siemens helps combine distributed power plants of any size into a virtual power plant. In doing so, the system takes into account all interconnections between electricity, thermal and cooling energy, gas, and other energy sources. Using diverse data such as load forecasts, current electricity prices, and weather forecasts, the system compiles a coordinated dispatch plan for all units, which can be rapidly adapted through real-time optimization.

Siemens' DEMS is therefore the key to deploying distributed generating units, storage systems, and loads, while ensuring optimal operating costs. It plays an important role in reducing environmental pollution and resource depletion, integrating distributed energy resources into the energy markets, and enabling the marketing of available flexibility.

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The complete spectrum for your virtual power plant

Forecasting

DEMS creates a forecast for both renewable energy generation and the electrical and thermal loads – depending on variables such as the type of day, the time, weather conditions and characteristics of the power plant. With parameterizable forecast bandwidths, you can determine the reserve and risk strategies for plant operation in advance. Depending on the confidence intervals chosen, the width of the forecasting band varies and, as a result, so does the amount of reserve power that needs to be kept available in the schedule. Usage for the following day and week can be continuously optimized using this forecast.

Scheduling

Short-term scheduling for all planned resources helps minimize operating costs in accordance with the general technical conditions and terms of the contracts. This is implemented with a 15-minute resolution, up to a week in advance. DEMS uses modern mathematical optimization algorithms that ensure high quality of the schedules. These precalculated dispatch plans minimize generation and operating costs. Naturally, DEMS takes both economical and ecological aspects into consideration.

DEMS provides you with everything you need for energy-related operations in a virtual power plant: load forecasting and renewable power generation, the ability to formulate dispatch plans for optimized scheduling, and fast updating with real-time optimization.
The optimized dispatch plan for thermal power plants includes power-up costs, maximum output ramps, minimum operating and shutdown times, fuel quantity limits, and energy limits as well as time-dependent fuel prices.

When it comes to energy demands, dispatch planning differentiates between three types of loads: independent loads, switchable loads, and controllable loads. Storage systems are managed according to specific requirements.

Complex energy delivery and purchase contracts with power-zoned energy prices are taken into account, as are time-dependent tariff structures, power bands, and energy limits.

**Real-time optimization**

Based on the dispatch plan, any deviations that occur during operation are distributed cyclically, at minimum cost, among generators and storage as well as loads that can be influenced. This enables the planned value to be met and external stipulations related to purchase, supply, or corresponding agreements to be fulfilled.

**Process connection**

DEMS is directly linked to your processes, using automation technology, and can communicate in real time with the lower-level automation systems. This means that operator control and monitoring functions as well as customer-specific additions can be easily implemented. DEMS relies on standardized communications, e.g. according to IEC 60870-5-104, and high-performance software interfaces for its interactions with other IT systems.

Relevant data is saved manually or automatically while DEMS is in operation.
The DEMS Designer – for intuitive modeling

Modeling an entire energy network at the click of a mouse

In order to enable a distributed integrated energy network to leverage its full potential, the complex interactions between energy, loads, and storage must be modeled and parameterized for the energy management system – quickly, efficiently, and intuitively. DEMS Designer satisfies these requirements.

Intuitive prompting enables the user to model all relevant energy and material flows after just a short period of familiarization. Potential connections between the elements are automatically displayed so that all plants and parameters can be virtually linked with total precision by dragging and dropping.

Thanks to the comprehensive library of tools and components, a variety of different types of distributed units can be modeled. This allows all functions, including the process connection, to be easily parameterized. Questions can be quickly clarified using help texts and explanations, while the validation and plausibility check function helps ensure the consistency of input data. After modeling, the topological display is imported into DEMS and is fully functional.

In summary, with the DEMS Designer you create a coherent data model of your energy system that is used in all DEMS applications – quickly, efficiently, and clearly.

Comprehensive recording of operating resources

DEMS Designer supports all elements of the distributed energy management system:

- Purchase and supply contracts, such as electricity, primary energy, and reserves
- Controllable, switchable, and noncontrollable loads, including electric, thermal, and gas
- Power plants, such as biomass cogeneration plants, wind turbines, and photovoltaic systems
- Storage systems, such as electrical and thermal

Even more user-friendly: With the new DEMS Designer, you can model the entire energy system using a drag and drop user interface – a simple, intuitive, and highly efficient solution.