



**SIEMENS**

*Ingenuity for life*

## Intelligent control center technology – Spectrum Power™

The Smart Grid – Constant Energy in a World  
of Constant Change

[siemens.com/spectrum-power](http://siemens.com/spectrum-power)

# Energy management for a new era...

## Decentralization and Digitalization

Our energy system today is completely different to how it was twenty years ago. There have been staggering advances in generation and distribution technology, in the economic viability of renewables and storage as well as in energy efficiency. Furthermore, the market is driven by constantly changing political regulations. New market models and players are entering the stage in addition to a strong desire to keep our planet clean and safe.

The new emerging energy systems are characterized by:

- A fundamental change of the power generation infrastructure from relatively few, “centrally” located, huge power plants to myriads of small, distributed, and mostly independently operated power generation or energy conversion facilities. This leads to a far-reaching change in the energy systems worldwide. Grids must be able to deal with this new environment without compromising reliability, efficiency, and affordability.
- Digitalization is now found in everything from appliances for the home to the most complex power systems. Our real world is taking on a digital dimension wherever one looks. Digitalization also creates growing consumer demand for improved service and ever-more convenient access. Technologies such as the cloud, digital simulation, data analytics, automation, and the Internet of Things – all driven by exponentially expanding computing power – are bringing new opportunities, new challenges, and new threats.

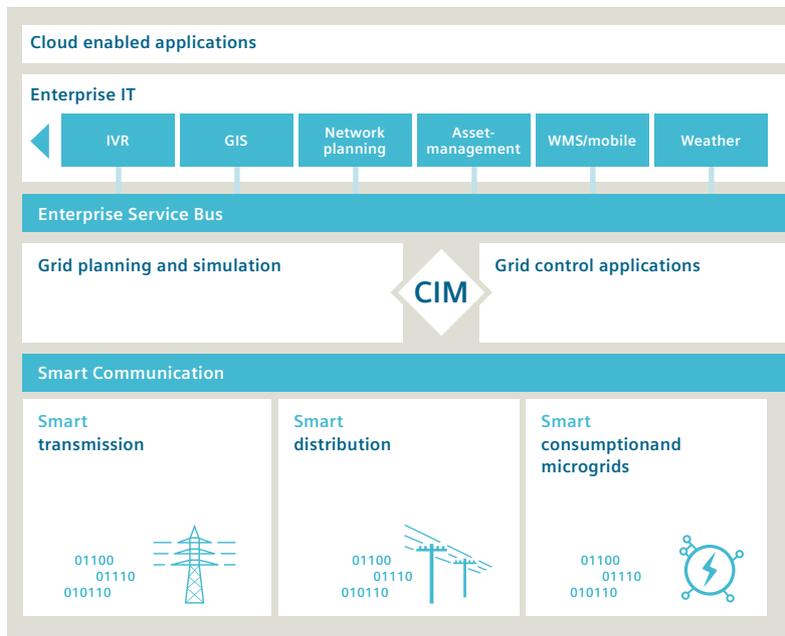
Decentralization is driving digitalization and vice versa. Utilities need to adapt their technological base as well as their business processes to the new requirements in the energy sector. This includes the seamless integration of renewable energy and distributed power generation, a high degree of adaptability, unprecedented sustainability, and the right level of asset protection, to conduct their business efficiently and sustainably – today and in the future.

Our complete offering is designed with the emerging energy systems Siemens in mind:

- Digitally enabled convergence of information technology and operating technology and real-time customer interactions via digital channels
- Device, grid, and market operations embedded in a single, unique architecture
- Open, adaptable, manageable, standards-based ecosystem
- Distributed grid intelligence for more efficiency and reliability

Our comprehensive expertise is the basis for the unique value we can add. We combine 160 years of experience and comprehensive know-how in the efficient generation, transmission, distribution, and application of electrical energy with unrivaled world market leadership in automation, industrial communication, and control. No other company can provide such comprehensive end-to-end portfolio and expertise.

Digital Grid masterplan architecture for a smooth transition to an Utility 4.0



# ... with Agility in Energy

## Managing the power challenge

Agility is the key to keeping any power supply system efficient, reliable, and sustainable in a world that spins ever faster. Spectrum Power is the Siemens advanced grid control platform fully integrated in the Siemens digital grid masterplan architecture.

Spectrum Power links power systems of any size and volume/extent into an easily and centrally controlled grid/energy network, enabling a reliable overview and fast assessments. Information can be accessed remotely anytime, anywhere – making it the perfect tool for flexible and efficient network control.

Power system operators need a solution that ensures a high level of energy reliability and the lowering of costs, fast fault detection based on smart meter information, network-wide volt/VAR optimization and blackout prevention measures, on-time delivery, controlled budget, expert risk management, and sustainable, environmentally friendly products and solutions.

In short, they will need the technology, intelligence and adaptability that define Siemens Spectrum Power.

Siemens Spectrum Power helps power network managers make the right decision at the right moment. It allows for faster and situationally adapted reactions to changing demands and boosts the overall efficiency of systems.

The future of energy management is here. Siemens Spectrum Power.

## Spectrum Power™: Designed to ensure:

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Easy integration with IT infrastructure
- 

Optimized workflows through seamless integration of grid control and smart grid applications
- 

Comprehensive cyber protection
- 

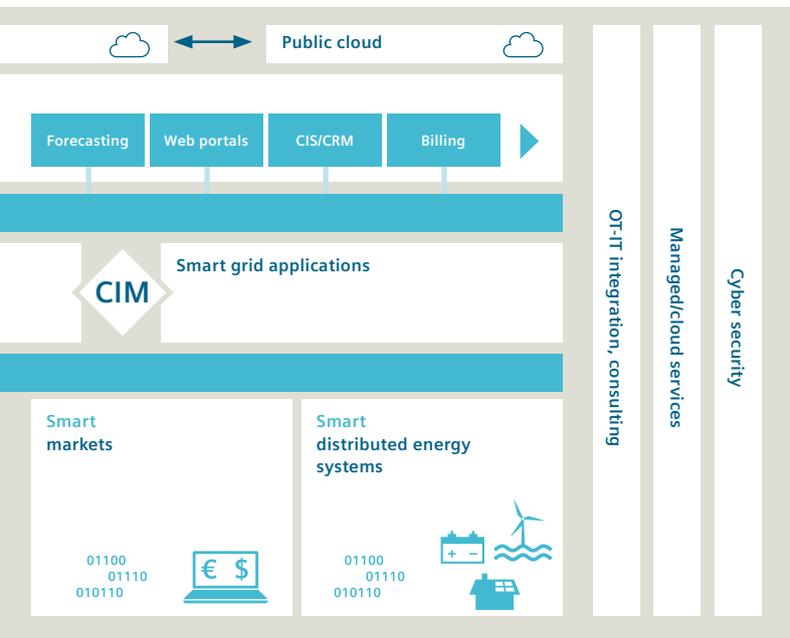
Secure integration of more and more renewable generation
- 

High network stability and prevention of blackouts
- 

Optimal asset utilization with minimal network load and loss
- 

Shorter outage restoration times
- 

Increased reliability of supply and reduced operational costs





## A suite solution ...

**Whether for transmission, distribution, and generation companies, or for multi-utilities, independent system operators, or industrial and infrastructure companies; grid control systems from Siemens meet extremely diverse demands.**

The systems range from the smallest all-in-one solutions right up to multi-server systems using virtualization for higher cost efficiency. In each case, the solution is tailored to the client's requirements, drawing on the modular range of tried-and-tested products and services.

Spectrum Power can either be implemented on premise or can run in the cloud.

### **Long-standing experience – comprehensive portfolio**

Spectrum Power is the product of many decades of experience, and the over 3,000 grid control systems installed worldwide by Siemens in that time pay testament to its success. Almost as impressive is the wide range of requirements fulfilled by these systems.

### **Full service – full control**

Siemens will train client personnel – either on-site or at dedicated educational centers. In addition, a global service network – including remote diagnosis and remote access – ensures optimum systems availability.

- The benefits of unsurpassed experience
- Leading the way in energy automation and digitalization
- 160 years of experience in power engineering
- Support in over 90 countries
- Over 1,600 network control systems currently installed worldwide
- Vertical integration through standardization (IEC, CIM)
- Powerful products, applications and solutions with clear-cut migration and innovation strategies



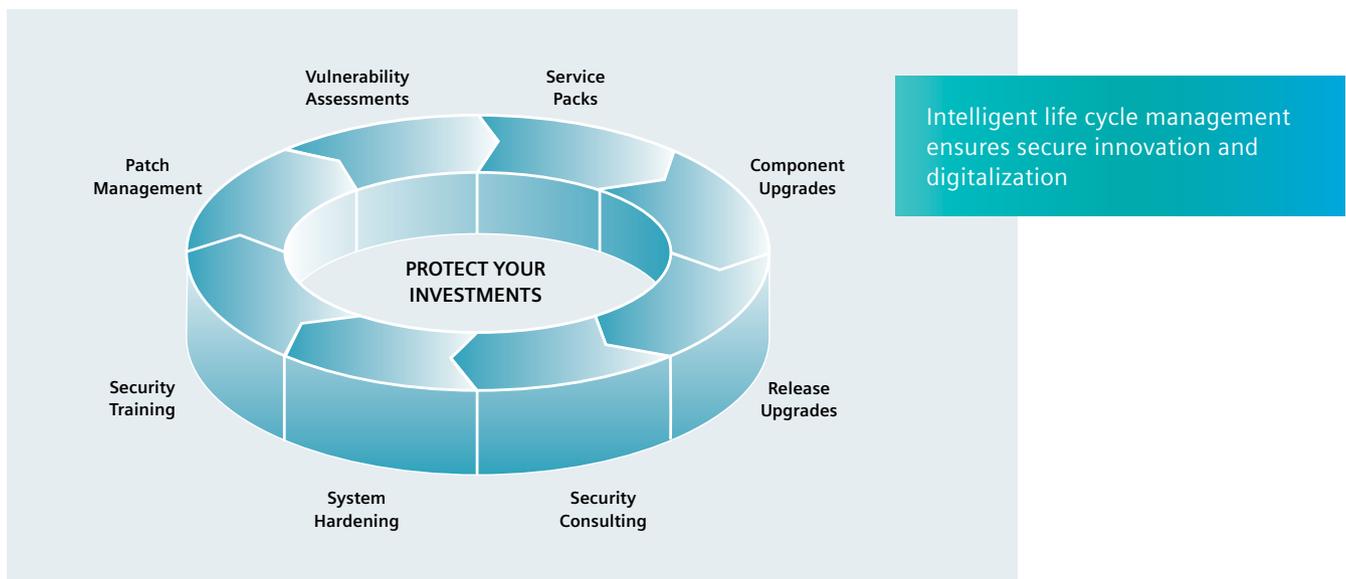
## ... for a safe power supply

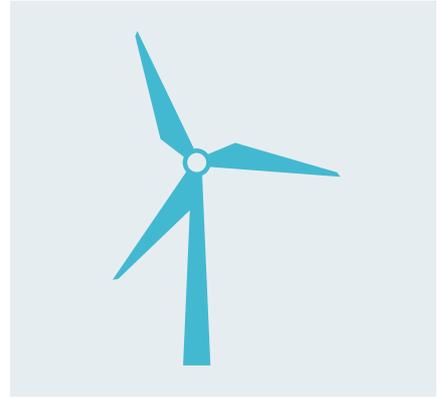
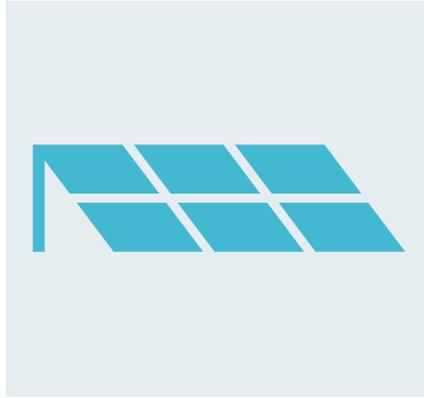
### Global presence – local expertise

A whole multitude of factors need to be considered when designing a grid control system. This is why – thanks to its presence in more than 90 countries – Siemens ensures that the specific, local requirements of each project are known and perfectly understood. Customers from all over the world can depend not only on the company's expertise, but also on a broad range of services that ensures reliable grid operation around the clock.

### Innovation leader – loyal partner

Investing in an advanced network control system means increasing long-term competitiveness and profitability. With its fast and secure innovation cycles, Siemens is constantly in line with new technologies and market needs. That's why Siemens remains a reliable partner throughout the entire life cycle of the system. This covers everything from professional consulting on projects of any size to the configuration, installation and commissioning of the system and its individual components.





## ... for continuous innovation

**As the name implies, Spectrum Power covers all aspects of energy management. Drawing on its unique and comprehensive range of solutions based on proven and innovative components, Siemens is able to configure the network control system as a tailored solution.**

Spectrum Power provides basic components for SCADA, communications, and data modeling for control and monitoring systems. Application suites can be added to optimize network and generation management for all areas of energy management.

In addition to its functional flexibility, the hardware can be configured for small- and large-scale systems. An all-in-one system, for example, can be gradually expanded at any time – all the way up to a redundant multi-server system. Redundant configurations deliver the highest level of reliability, ensuring dependable network management around the clock. Spectrum Power naturally uses the latest and most powerful hardware on the market, combined with best-in-class operating systems, such as Linux and Microsoft Windows.

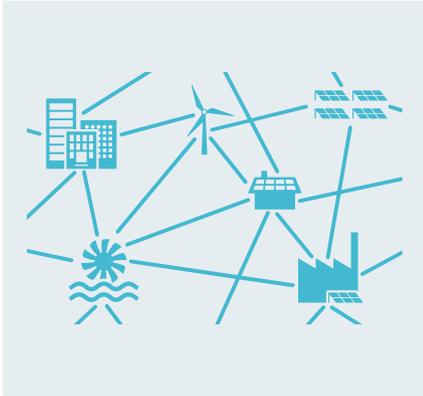
### ... for safe investments and reliable operation

The data in any network control system needs to be retained, regardless of how technologies and platforms may develop in the future. That's why the Spectrum Power product family relies on internationally valid standards – from data modeling based on CIM™ or „CIM-based data modeling to communications standards such as IEC 101 and 104, DNP, ICCP and OPC. Due to these open interfaces, all existing data can be seamlessly migrated to Spectrum Power as needed, ensuring the system is ready for the powerful technologies of the future – while protecting existing investments.

### ... for IT interoperability

Thanks to its service-oriented architecture (SOA) Framework, Spectrum Power is able to make use of other IT systems within the power system – which in turn can access the services of the network control system. Standardized process, interface and messaging specifications based on IEC 61968 and IEC 61970 standards ensure trouble-free data exchange between the systems.

Spectrum Power thus becomes an integral part of the heterogeneous IT systems landscape and the operational processes – optimizing both the power supply and communications.



Energy usage is never static. Smart management of peak and off-peak supply can affect everything from budgets to blackouts.

## ... for secure operation

### ... for secure integration of distributed energy

Grid management is facing challenges like an unclear, fluctuating direction of load flow and, more and more often, critical voltage violations. Spectrum Power offers various solutions to ensure reliable power supply.

The integrated Active Network Management ANM delivers reliable voltage regulation, helps to avoid expensive overload situations, reliably informs about the load flow direction and supplies up-to-date load values.

Fully integrated day ahead congestion forecast supports determining preventive remedial actions based on advanced forecast technology using magnifold schedules from diverse sources.

And benefiting from the Siemens integrated platform approach for grid control and grid applications, Spectrum Power can get valuable information from smart meters for higher forecast accuracy. The Siemens EnergyIP grid application platform provides various analytics applications such as Load Forecasting, which excels in providing granular low-voltage distribution level forecasts based on the AMI data of millions of service points under full consideration of the grid hierarchy.

### ... for cyber security

A major goal of Spectrum Power is to provide features and services that maximize customers' security while complying with all relevant regulatory regimes.

With its Spectrum Power Security Service, Siemens tracks security bulletins published by third-party vendors and other industry sources, installs and tests available security fixes on the current release of Spectrum Power systems and components, and communicates all results and known issues to its customers.

Recognizing that cyber security requires an ongoing commitment, Siemens provides a comprehensive patch management service including patch notification, basic patch testing, and optional custom services such as extended testing and on-site installation.

In addition, Siemens provides a range of security consulting services, on-site security evaluations, and training. A global service network is available to assist Spectrum Power owners through secure remote diagnosis and problem resolution.

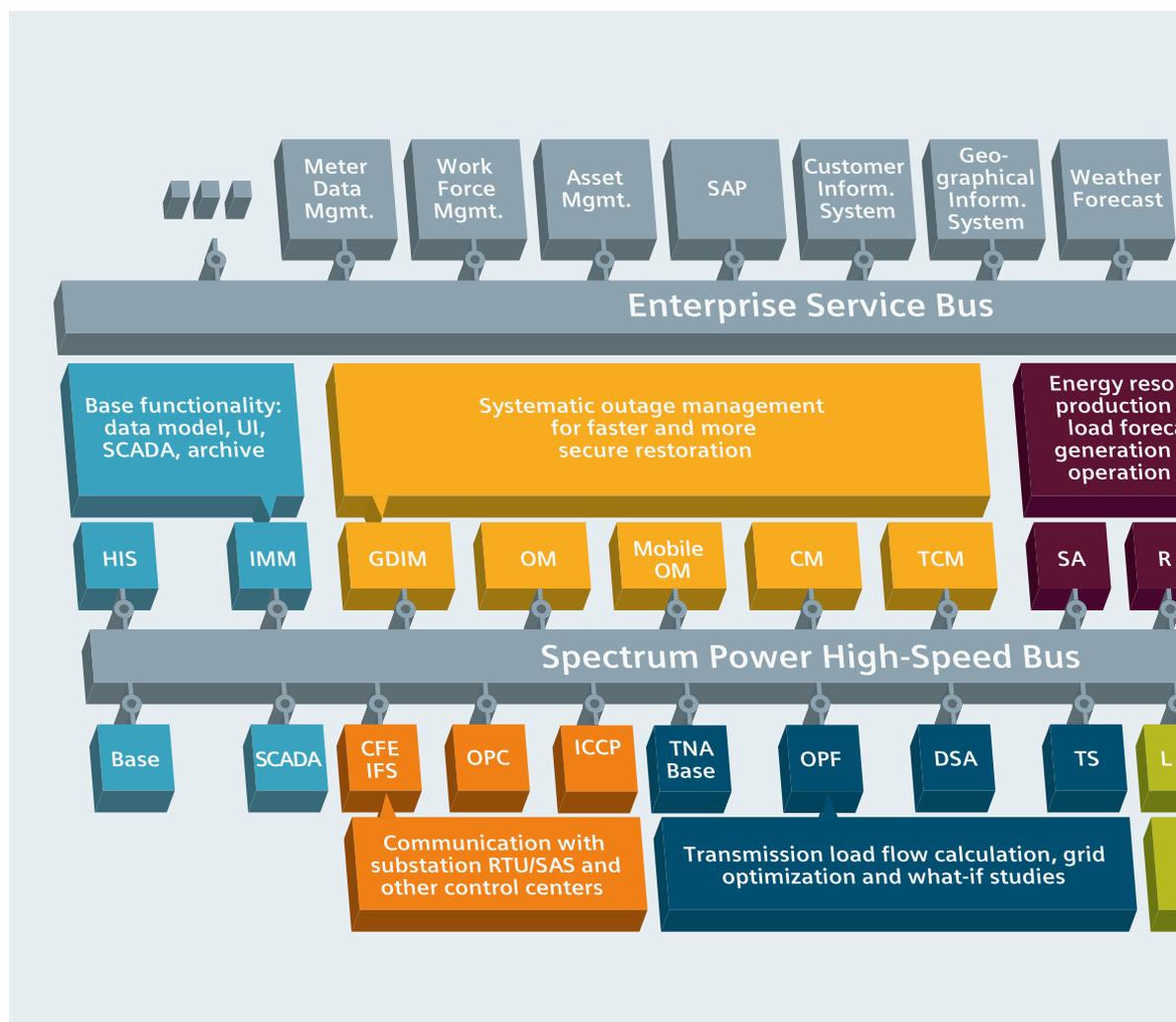
### ... for reduced costs and higher network availability

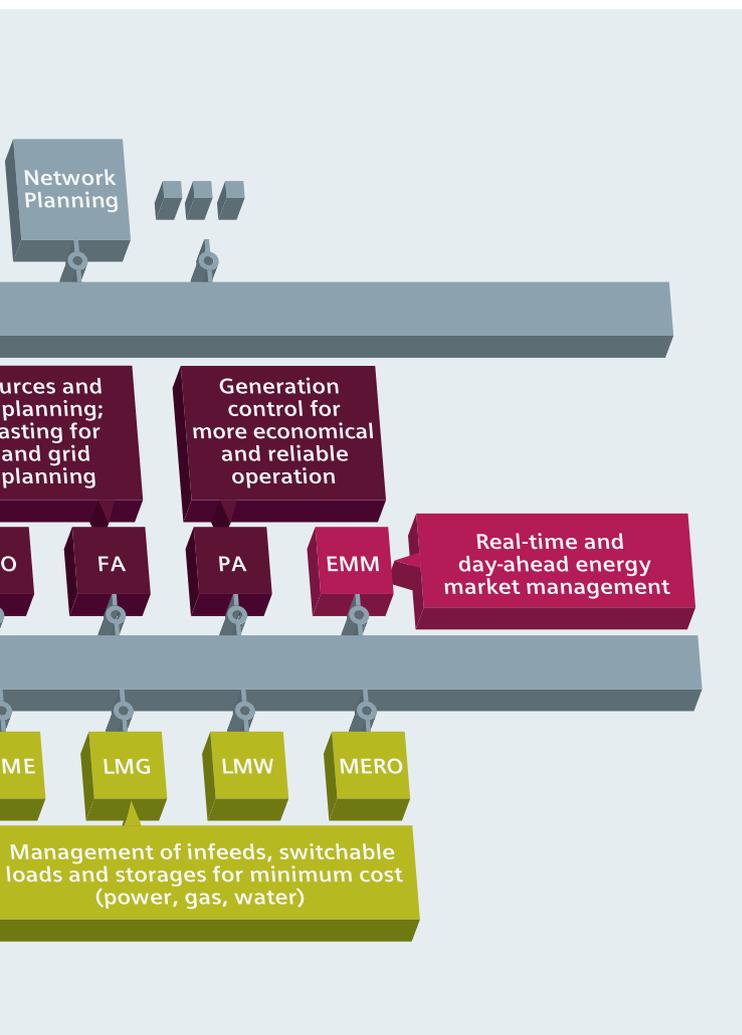
Spectrum Power contributes to a reduction in both maintenance and operating costs, ensuring an economically efficient network. This is achieved by way of an improved assessment of the network status and an optimized utilization of resources.

Better management enables planned maintenance to be performed with a minimum of downtime. Similarly, unplanned disturbances and outages are quickly remedied by applications for fast fault localization and isolation. Moreover, the automation of switching sequences helps restore power as quickly as possible. Finally, a simulation mode allows the impact of planned actions on the network to be analyzed without affecting real-time operations.

# Spectrum Power: Open and scalable for multiple needs

Service-oriented architecture (SOA) and a powerful set of applications: supports you today and scales for the uncertainties of tomorrow.





IFS	Independent Frontend System
CFE	Communication Front End
CMS	Crew Management System
DNA	Distribution Network Applications
DSA	Dynamic Stability Analysis
EMM	Energy Market Management
FA	Forecasting Applications
GIS	Geographical Information System
HIS	Historical Information System
ICCP	Inter-Control-Center Communication Protocol
IMM	Information Model Manager
LME	Load Management Electricity
LMG	Load Management Gas
LMW	Load Management Water
MERO	Multi-Energy Resource Optimization
OPF	Optimal Power Flow
PA	Power Applications
RO	Resource Optimization
SA	Scheduling Applications
TCS	Trouble Call System
TNA	Transmission Network Applications
TS	Training Simulator

# Smart Grid challenges and Spectrum Power solutions

Grid control systems from Siemens meet every demand. We offer solutions for transmission and distribution, for municipalities or multiutilities and the industry, for energy generation, portfolio optimization, rail electrification, and market management. Whatever you need, Spectrum Power has the solution.



## Transmission grid operators

- have to cope with fundamental load flow changes due to energy market liberalization
- are under pressure to overstretch existing equipment
- face ever increasing interconnection of transmission grids
- have to integrate an increasing share of intermittent energy sources

## Spectrum Power

- provides ready-to-implement measures to prevent or remedy dangerous situations
- ensures reliable supply, efficient use of generation resources and reduced transmission losses
- models the utilities grid as part of a wider interconnected transmission grid and provides better transmission forecast functionality
- reduces the risk of blackouts with QuickStab, SIGUARD® PDP, and SIGUARD® DSA. These provide current and anticipatory monitoring of power system stability and support in evaluation of preventive measures



## Distribution grid operators

- have to cope with fundamental load flow changes due to increased distributed generation (e.g. wind, PV)
- have to adapt to significant changes in observability due to the advent of smart meters
- face increasing pressure for higher reliability of supply despite higher network volatility

## Spectrum Power ADMS

- is best in class in both SCADA and OMS outage management
- ensures higher system reliability and shorter restoration times after unplanned outages
- offers optimal asset utilization with minimal network load and losses
- sets the benchmark with integrated Active Network Management ANM to foster renewable generation and keep the voltage within the limits
- provides intuitive awareness of complex grid situations down to the LV grid



## Multi-utilities

- face increasing uncertainties due to energy market liberalization
- have to deal with increasing pressure towards sustainability and value orientation in line with environmental/climate protection
- need to guarantee the reliable and safe supply of power, gas, heating/cooling and water

## Spectrum Power

- offers reliable forecast and after-the-fact analysis applications for multiple commodities including leakage detection and reservoir management
- ensures optimal use of dispatchable loads and smart management of renewable generation
- minimizes operational costs while increasing supply stability and quality
- efficiently enables the merging of multiple legacy control centers into a single unified platform



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### Power producers and traders

- are challenged by the growing complexity of generating bids on futures and spot markets
- encounter more and more players due to the rise of renewable energy
- have to increase profitability on energy markets and ancillary services markets

### Spectrum Power jROS

#### (Joint Resource Optimization & Scheduler)

- facilitates faster decisions on energy exchanges and for bilateral trading
- optimizes generation schedules
- is prepared for stochastic optimization to cope with increased renewable power generation
- includes unit commitment, hydrothermal coordination, and medium-term optimization of power trading
- boosts profitability on the energy markets through cost savings in generation and precise information for trading



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### Rail operators

- must find answers for the transportation of a rapidly growing population in and between modern cities
- have to guarantee the smooth and reliable operation of traction power supply and station facilities
- are facing increasing economic pressure

- Spectrum Power
- provides for increased stability and quality of energy supply and maximum security, safety, and quality standards
- includes intelligent interlocking and switching procedure management with process element disposal locking
- features network model & state estimator, closed-loop optimization of load distribution and reactive power flow, and helps rail operators prepare their systems to withstand contingencies
- assures minimized operational and contractual costs



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### Energy market operators

- need to balance highly complex and diverse interests
- have to organize reliable energy supply and low energy prices for the public
- have to optimize investments and increase operational efficiency for market players
- must coordinate grid security while providing highly available market operations

### Spectrum Power Energy Market Management (EMM)

- incorporates the latest market-clearing technology in a set of modular, high-performance components and engines
- helps lower market prices, optimize business processes and heighten grid reliability
- includes the market-clearing engine based on the Security Constrained Unit Commitment software and can be used in multiple structures such as day-ahead or real-time market



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### Industry & infrastructure

- are under pressure to always meet the demand for energy
- have to ensure reliable supply around the clock
- face mounting cost pressure

### Spectrum Power

- ensures a secure power supply for airports, industrial estates, and industries such as mining, pulp & paper, oil & gas, chemicals and steel, guaranteeing maximum production output
- features standardized, robust, secure, easy-to-use technology
- includes smart data engineering for reduced TCO
- allows existing energy contracts to be optimally exploited through switchable load and power generation
- includes standard interfaces such as OPC for complete access to the world of industrial automation



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