Model-Driven Real-Time Solutions for Power Systems

SCADA & Monitoring
Power Management
Generation Management
Transmission Energy Management
Distribution Management
Microgrid Master Controller
Intelligent Load Shedding
Substation Automation
Model-Driven Enterprise Solution

Fully integrated suite of software products that provides mission critical power management solutions.

**Modeling**
Simulation, Design, Sizing, Evaluation, Analysis, & Planning, to Real-Time Model-Based Monitoring, Event Playback, Predictive Analysis, Control, Optimization, Automation & Situational Intelligence,

**Operation**
ETAP® Real-Time™ power system enterprise solution can maximize the entire production process, reduce losses, and increase profits through continuous monitoring, simulation, and optimization of the system.

**Operations**

The ability to seamlessly integrate process information with electrical system constraints is essential to a reliable operation. Virtual testing of operator actions (predicting system response) prior to implementation can reveal potential problems, hence reducing human errors and the risk of service interruptions. ETAP assists operators in making informed and logical decisions to reduce operating costs and improve system reliability.

**Maintenance**

Real-time maintenance alerts and assessments of system components ensures just-in-time predictive maintenance of critical plant equipment. Mean-time-to-repair and mean-time-to-failure rates are calculated to evaluate the network and equipment online reliability indices. This translates into cost reduction and prevention of expensive unplanned shutdowns.

**Engineering**

As the world leader in power system engineering analysis tools, ETAP integrates with data acquisition devices to provide actual system operating conditions for the purpose of real-time simulation. ETAP takes the guesswork out of system analysis.

**Financial**

ETAP can interface with accounting and billing systems to provide up-to-the minute energy usage and fuel cost information, while providing recommendation and prediction scenarios to minimize peak power consumption and eliminate tariff penalties.

**Planning**

System planners can improve performance of production scheduling, thus increasing the system capacity using adaptive planning tools provided by ETAP’s trending and prediction functions.
Model-driven monitoring provides an intuitive real-time visualization and analyses platform via intelligent graphical user interface, one-line diagram, geospatial view, and digital dashboards.

**Network Topology Builder**
Network Topology Builder is a user-friendly environment for creating and managing the network database used for schematic network visualization and is the foundation of real-time applications.

**SCADA Integrator**
Enables quick creation of standardized and reusable templates, efficient system integration and rapid deployment across the entire organization.

**Native Communication Protocols**
Operates seamlessly with third-party hardware, DCS, or data collection systems regardless of manufacturer and models. ETAP supports all standard network protocols including MMS, ModBus, DNP, IEC 61850, IEC 60870, ICCP, NetBeui, T103, NetDDE, UCA, IPX/SPX, and TCP/IP via OPC interface.

**Visualization & Dashboards**
SCADA Human Machine Interfaces (HMI) provides a modern graphical dashboard with electrical intelligence and situational awareness. Smart visualization views, combined with predictive analytics, enable the system dispatcher to effectively view and analyze key performance indicators.

**Web & Mobile Views**
Access design, analysis, and operational data from anywhere via the world-wide-web. The application is capable of connecting to a single or multiple ETAP Real-Time Servers and workstations. Online and simulation applications can be connected to user friendly web HMI’s to monitor and analyze the system on-the-go.
State Estimation & Load Allocation
State-of-the-art techniques are used to provide dependable and fast convergence of state estimation for unobservable subsystems. It includes essential tools for model validation such a comparison between telemetered data, estimated values, and power flow results at any instance in time.

Energy Accounting
Energy Accounting provides detailed energy consumption and cost analysis. Reports are generated based on energy tariffs and electrical power market exchange information. ETAP tracks and creates energy billing reports based on user-definable energy cost functions and energy tariffs.

Data Trending
Data Trending is a user-friendly and flexible trending application that supports real-time as well as archived data trending.

Alarming & Notification
Alarming & Notification management system prioritizes events via graphical and tabular views. Model-driven SCADA enables early detection and announcement of problems, including non-telemetered devices, before a critical failure takes place.

Event Logging
Data acquired from the monitoring equipment is recorded to provide an event log of all activities in the system. The event log provides a complete history of the power system’s operation when played back. Important facts such as sequence of equipment operation and maintenance records can be easily retrieved. History can be tabulated or viewed graphically on an hourly, daily, monthly, or yearly basis. Detailed, continuous data can be displayed with time increments down to the nearest millisecond. Events can be browsed and printed on-demand.
Power Management

**Predictive Simulation**
Predictive Simulation is a powerful set of analytical modules that allows prediction of system behavior in response to operator actions and events using real-time and archived data. With Predictive Simulation, not only can you perform analysis using real-time system parameters and online system model, you can also simulate “what if” scenarios and predict an outcome before system actions are taken.

**Preventive Simulation**
Preventive analytical modules provide automated alarms and warnings to the operator based on events that may potentially occur such as generator outages, contingencies, and suggest remedial actions.

**Benefits**
- Accurate analysis with actual operating values
- Improve system planning & design
- Recognize & correct potential hidden problems
- Prevent system interruption
- Determine under-utilization of system resources
- Identify the cause of operation problems
- Accelerate engineer & operator training
- Virtual test of operator / controller actions
- Validate system settings

Power Management includes powerful analytical tools that allows for detection of system behavior in response to operator actions and events via the use of real-time and archived data.
Operator Training Simulator

OTS provides an environment that is effective for operator training and assistance. Operator training is accelerated using dynamic graphical simulation of the power system. This makes training an ongoing process. The ability to simulate the sequence-of-operation using real-time data is of fundamental importance in order to avoid inadvertent plant outages caused by human error, equipment overload, etc.

Simulation Modules

- Load Flow
- Short-Circuit
- Arc Flash
- Device Coordination & Selectivity
- Sequence-of-Operation
- Motor Acceleration
- Harmonics
- Transient Stability
- Reliability Assessment
- Optimal Power Flow

Event Playback

Event Playback is especially useful for root cause and effect investigations, improvement of system operations, exploration of alternative actions, and replay of What-if scenarios. ETAP can be configured to provide a complete picture of the electrical system from the stored data. The operator can explore the effects of alternative actions at any point of recorded data.

Graphical Display of System Response & Alerts

1. Get Online Data
2. Close a Circuit Breaker
3. Predict System Behavior & Response
Generation Management System is used to monitor, control, and optimize the performance of generation and transmission systems. GMS provides system balance and optimization changes to meet network security, economic, operational, regulation, and environmental requirements.

**Automatic Generation Control**
Automatic Generation Control is a multi-area supervisory control that utilizes real-time data to regulate generation levels in order to maintain system frequency and power exchanges with neighboring areas at scheduled values.

**Reserve Management**
Reserve Management continuously monitors system operating capacity and dynamically calculates the system generation versus load forecast balance to ensure protection against contingency losses.

**Interchange Scheduling**
Interchange Scheduling provides the capability to schedule energy transfer from one control area to another while considering wheeling, scheduling ancillary services, and financial tracking of energy transactions. Dedicated for electricity power exchange and scheduling, Interchange Scheduling incorporates energy scheduling, transaction management, and energy cost analysis / reporting.
**Economic Dispatch**
Economic Dispatch allocates changing generation demand of a power system amongst controllable generator units to achieve optimum area economy. As part of the generation management system, Economic Dispatch software utilizes advanced optimal power flow algorithms in order to determine the optimal generation pattern, while maintaining adequate reserve margins.

**Unit Commitment**
Unit Commitment finds the least-cost dispatch of available generation resources such as nuclear, thermal, and renewables, to meet the electrical load. Unit Commitment includes constraints such as minimum stable operating levels, ramp rates, unit maintenance periods and requirements, scheduled and forced outage information, etc.
Energy Management System applications are designed to reduce energy consumption, increase electrical system reliability, improve equipment utilization, and predict system performance, as well as optimize energy usage.

**Network Security Analysis**
Network Security Analysis system is ideal for online security analysis, situational awareness support, operations planning and offline engineering studies. Capabilities include, Network Topology Processor, Contingency Analysis, Short Circuit Analysis, Voltage Stability, etc.

**Economic Dispatch**
Allows for steady-state real-time optimization, enabling energy consumers to automate the operation of their power system, reduce system losses, and reduce peak load consumption. Economic Dispatch provides guidelines for optimal electrical system operation in order to meet power requirements, steam requirements, and minimize fuel cost per generator. Energy producers can improve power exchange, and maximize security.

**Equipment Outage Scheduling**
Schedule outages including generators, transmission lines, transformers, breakers, switches, loads, and compensation devices. In addition to outages or unavailability of components, equipment derating can also be scheduled due to maintenance such as transformer fan maintenance, generator derating due to cooling limitations, etc. Outages are not limited to just power system components, but may be physical equipment such as computer system maintenance.

**CIM Interface**
Allows for physical or abstract representation of the power system model as objects, attributes and their associations. CIM interface allows for bi-directional transfer of data from ETAP to other vendor systems.
Microgrid Master Controller allows for design, modeling, detailed analysis, islanding detection, optimization and automated control of Microgrids used for offices, retail parks, industrial facilities, data centers, campuses, offshore facilities, ships, etc.

**Generation Optimization**
Supervisory control that utilizes real-time data to regulate generation levels in order to maintain power exchanges with neighboring areas at scheduled values. The program can automatically detect loss of grid and switch control strategies to regulate voltage and frequency in an islanded condition. Optimization algorithms consider system constraints and multiple objectives such as minimizing energy costs, renewable energy availability, fuel costs, etc.

**Energy Storage Management**
ETAP can compensate for voltage and frequency fluctuations associated with switching of large power electric load in microgrid applications. Microgrid Master Controller is used to manage power control strategies and improve overall power quality by regulating both active and reactive power produced or consumed.

**Generation & Load Forecasting**
Generation and Load Forecasting is an ideal tool for microgrid users and utilities to reliably and accurately forecast future short term loading and generation especially from inconsistent sources such as wind and solar.

**Demand Side Management**
DSM delivers a more reliable and economical operation, while maintaining the power system’s operational integrity. Evaluate energy-reducing strategies such as moving on-peak usage to off-peak periods or shifting from one rate schedule to another to improve the bottom line.
Advanced Distribution Management System (ADMS) is an integrated electrical system design and real-time power distribution management system. ETAP ADMS provides the necessary mission critical applications to efficiently, reliably and securely manage, control, visualize, and optimize distribution networks.

Intelligent Geospatial Diagram
Intelligent Geospatial Diagram is a user-friendly environment for creating, visualizing and managing geospatial network databases. It is also the foundation for real-time applications. It allows for direct import of electrical data from a GIS database and dynamically creates equivalent feeders/reduced networks, while maintaining a complete geospatial view of the distribution system.

Distribution Network Applications
DNA is a powerful set of analytical modules that allows the prediction of unbalanced system behavior in response to operator actions and events using real-time and archived data.

- Unbalanced Load Flow
- Unbalanced Short-Circuit
- Arc Flash
- Device Coordination & Selectivity
- Sequence-of-Operation
- Motor Acceleration
- Harmonics
- Reliability Assessment
- Optimal Power Flow
- Switching Optimization
**State Estimation & Load Allocation**

State Estimation combined with Load Allocation provides intuitive, intelligent, and integrated real-time monitoring and estimation of unbalanced distribution systems including unobservable subsystems.

**Fault Location, Isolation, Service Restoration**

FLISR provides assistance to the DMS operator by identifying one or more probable locations of the fault in the network and proposing the fault isolation switching actions to be taken in order to clear that fault. Further, FLISR proposes switching plans to restore the supply for unaffected parts of the faulted feeder. The plans are presented to the DMS operator for analysis and execution.

**Switching Management**

Switching Sequence / Work Order Management allows the dispatcher to build, simulate, and verify a complete switching program using a fully graphical user interface and execute the approved switching programs in one step, while maintaining compliance with safety and security procedures.

**Short-Term Load Forecasting**

Load Forecasting reliably predicts and trends system loading based on algorithms that adaptively correlate multiple input variables, such as weather conditions, as part of an accurate load forecast.

**Outage Management Interface**

Reserve Management continuously monitors system operating capacity and dynamically calculates the system generation versus load forecast balance, to ensure protection against contingency losses.

**Volt / Var Optimization & Control**

VVOC monitors real-time voltages, watts and vars from LTCs, regulators, capacitors, voltage sensors, and additional monitoring points, such as customer meters. VVOC includes an optimization engine to meet a utility’s desired power factor and voltage targets and resolve any conflicts.

**Balance Feeders & Minimize Loss**

ETAP can automatically determine the optimal system configuration to achieve multiple user-specified objectives using switching optimization algorithm. It provides optimal status of existing switching devices and suggests locations for new tie open points in the system. It can be used by the design or operation engineers to minimize system real losses and reduce or eliminate abnormal operating conditions.
Intelligent Load Shedding (ILS) provides optimal, fast load shedding based on actual operating conditions of the system, including type and location of the disturbances. ILS dynamically determines the best load shedding priority in a fraction of a second.

**Load Preservation**
Load Preservation first calculates the minimum required power to be shed for each subsystem and accordingly selects the optimal combination of loads that will satisfy the requirements.

**Load Restoration**
Load Restoration monitors system operating conditions after a load shedding event and restores loads while maintaining system stability and reliability.

**Load Shedding Validation**
Load Shedding Validation evaluates and confirms load shedding decisions in real-time mode. ILS integrates with the ETAP Transient Stability Analysis module to simulate and verify the load shedding requirements and recommendations before system commissioning.

**Faster than Real-Time**
ILS dynamically manages the stability of the system to respond faster to disturbances.
Intelligent Substation is a management application packaged as a focused product for substation automation. iSub provides protection, control, automation, monitoring, and communication capabilities as a part of a comprehensive substation solution.

**Substation Automation**
Substation Automation utilizes intelligent analysis processes to dynamically manage the monitored data for substation level and central system evaluation.

**Switching Management**
Switching Management allows the dispatcher to build, simulate, and verify a complete switching program using a fully graphical user interface and execute the approved switching programs in one step while maintaining compliance with safety and security procedures.

**Load Management**
Load Management evaluates and implements energy-reducing strategies such as peak load shifting, load start inhibition, and shedding of non-critical loads to reduce energy cost.
Quality Assurance Commitment
ETAP is Verified and Validated (V&V) against field results, real system measurements, established programs, and hand calculations to ensure its technical accuracy. Each release of ETAP undergoes a complete V&V process using thousands of test cases for each and every calculation module. ETAP Quality Assurance program is specifically dedicated to meeting the requirements of:

ASME NQA-1 CAN / CSA-Q396.1.2 ANSI / IEEE 730.1 ANSI N45.2.2

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