Automate  
Control  
Optimize

Real-Time Solutions 
for Power Systems

System Monitoring  
Predictive Simulation  
Energy Management System  
Intelligent Load Shedding  
Intelligent Substation
Power System Enterprise Solution

ETAP is the most comprehensive analysis platform for the design, simulation, operation, control, optimization, and automation of generation, transmission, distribution, and industrial power systems.
Customize ETAP to fit your needs, from small to large power systems

ETAP Enterprise Suite provides one solution for your power system design, analysis, and operation needs. ETAP offers a comprehensive suite of analysis modules that can be configured to suit your specific requirements. This modular approach allows you to expand your ETAP system as needed.

Featured in this brochure
ETAP Real-Time™
Power, Precision, Performance

Intelligent Power Management System for Operators, Managers, & Engineers

ETAP Real-Time extends the traditional data acquisition systems to an intelligent and power management solution for operators, dispatchers, engineers, and decision makers. Its modular applications can be tailored to fit the needs of each company, from small to large power systems. Industrial facilities, transmission, and distribution companies, generation owners, and vertically integrated utilities can all benefit from the features and functionality of ETAP Real-Time.

ETAP’s robust and proven analysis algorithms combined with portable and flexible foundation provides a highly available real-time system, comprehensive modeling environment, operator-friendly user interface, and state-of-the-art energy management applications.
ETAP Enterprise Solution for real-time power management systems is a fully integrated suite of software products that provides intelligent power monitoring, energy management, system optimization and automation, and real-time prediction applications.
Power System Monitoring & Simulation (PSMS) applications allow operators, engineers, and managers to make better and more informed decisions in the critical aspects of their business.

**Advanced Monitoring**
Advanced Monitoring provides intuitive, intelligent, and integrated real-time monitoring via a state-of-the-art interface.

**Energy Accounting**
Energy Accounting provides detailed energy consumption and cost analysis. Reports are generated based on energy tariffs and electrical power market exchange information.

**Predictive Simulation**
Predictive Simulation is a powerful set of analytical modules that allows the prediction of system behavior in response to operator actions and events using real-time and archived data.

**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.

**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.
Energy Management System (EMS) applications are designed to reduce energy consumption, increase electrical system reliability, improve equipment utilization, predict system performance as well as optimize energy usage.

**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.

**Economic Dispatch**
Economic Dispatch allocates changing generation demand of a power system amongst controllable generator units to achieve optimum area economy.

**Supervisory Control**
Supervisory Control performs steady-state real-time optimization allowing energy consumers to automate the operation of their power system, reduce system losses, and reduce peak load consumption. Energy producers can improve power exchange and maximize security.

**Interchange Scheduling**
Interchange Scheduling manages electrical transaction schedules and dispatches tradings that results from market activities related to the buying and selling of energy.

**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.
Intelligent Load Shedding (ILS) is the smartest and fastest proven method of its kind on the market. ILS provides optimal, fast load shedding based on actual operating condition 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.
Intelligent Substation (iSub) is a state-of-the-art 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.
Enterprise Solution

ETAP Power System Enterprise Solution can maximize the entire production process, reduce losses, and increase profits through continuous monitoring, simulation, and optimization of the system.

As a component of the Enterprise Resource Planning (ERP) system, ETAP optimizes the exchange of information between diverse tiers of an organization while channeling domain sensitive information.
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 insures 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 condition for the purpose of real-time simulation. ETAP takes the guesswork out of system analysis.

Financial
ETAP interfaces with existing 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.
Real-Time Benefits

Features & Benefits
- Advanced monitoring, simulation, & control
- Predict system response to operator actions
- Fast, optimal, & intelligent load shedding & restoration
- System optimization & automation
- Demand-Side Management
- Intelligent one-line diagrams
- Multi-dimensional database
- Time domain event playback with simulation capability
- Integrated alarm, warning, & acknowledgement
- Client-server configuration
- Built-in redundancy & automatic fail over

Operators
- Advanced alarm management
- Flexible graphical monitoring
- Multiple access levels
- Multi-console monitoring
- Built-in redundancy & automatic fail over
- Substation automation
- Train & assist operators
- Preserve critical loads
- Reduce downtime
- Improve operator usability & confidence
- Avoid time-of-use penalties

Managers
- Reliable & accurate plant data
- Single platform – reduced maintenance & support
- Optimize operation & increase reliability
- Minimize operating costs
- Evaluate cost allocation
- Provide data accessibility
- Improve energy conservation

Engineers
- Cause & effect investigation
- What If analysis
- Minimize system losses
- Extend equipment lifetime
- Expand capabilities as site requirements change
- Inherent handling of large scale systems
- Developed under ETAP QA Program
Realized Savings

Short-Term Savings
ETAP saves energy costs due to the overall system optimization and power loss reductions. Depending on the size of the facility, the expected average savings can be thousands of dollars per MVA of load per year. Savings can be considerably higher for systems that have abnormal losses, circulation power, or energy cost penalties. The informed decision-making is achieved through:

- Prevention of human errors by predicting the system behavior based on the operator actions or disturbances
- Increased system knowledge by utilizing up-to-date status of the system operating conditions
- Short-term savings are also achieved by operators and engineers gaining experience with the power system operation and reaction.

Long-Term Savings
ETAP can provide a major reduction in the equipment capitalization cost by increasing equipment lifetime. Ongoing savings are achieved by continuously operating at a near-to-optimal condition and preventing possible system overload situations.

Intelligent Load Shedding (ILS) will save you money by dynamically minimizing required load shedding, hence reducing system downtime. ETAP ILS load preservation system translates to savings of millions of dollars in lost revenues, equipment repairs, and penalties.
Power System Monitoring & Simulation (PSMS) is at the heart of the ETAP Real-Time management application. PSMS is the smart choice for both large and small electrical utility systems, generation plants, industrial sites, manufacturing facilities, and off-shore oil platforms. PSMS can determine the appropriate system response to a variety of changes and disturbances by using electrical and physical parameters, loading and generation levels, network topology, and control logics. In addition, PSMS can determine the source of potential problems and advise corrective actions to avoid interruptions.

Features
- Multi-console with multi-screen monitoring
- Graphical monitoring via ETAP one-line diagram
- Visual monitoring via Man-Machine Interface (MMI)
- Alarm annunciation with graphical interface
- Alert of equipment out-of-range violations
- Monitoring of electrical & non-electrical parameters
- Pseudo measurements (override measured data)
- OPC interface layer
- User-access levels
- Continuous real-time monitoring
- On-demand data retrieval
- Data reconciliation & consistency check
- Bad data detection & correction
- Alarm management & processing
- Energy cost monitoring & accounting
- Real-time load forecasting & trending
Advanced Monitoring

Intelligent Graphical User Interface
State Estimator & Load Distributor
Process & Performance Monitoring
Alarm & Notification Management

Provides intuitive and integrated real-time monitoring via an intelligent graphical user interface, one-line diagram, and digital dashboards. Monitoring functions include checking the condition of the network, estimating missing system states, detecting network abnormalities, trending metered values, and annunciating alarms based on operating conditions and status changes.

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.

- Intelligent one-line diagram
- Multi-level nesting of sub-systems
- Multi-color symbols
- Interfaces management switching device
- Unique multi-dimensional database

Advanced State Estimation

- State estimation of non-observable subsystems
- Comparison of measured vs. estimated values
- Dependable & fast convergence solution
- Minimum system measurements requirement
- State-of-the-art estimation techniques
- Data consistency checking
- Bad data & error detection
- Load distribution

PSMS can track and record unusual activities with event logging and alarming tools. This provision allows for early detection and announcement of problems before a critical failure takes place.

Changes in system information are displayed graphically and logged. The calculated results are compared with metered parameters to provide pop-up alarms for equipment with missing and out-of-range data.

- Annunciate local & system-wide alarms
- Warnings based on equipment ratings
- Alarm priority setting & event triggering
- Annunciate out-of-range measurements
- Graphical, tabulated, & audible annunciation
- Predict abnormal conditions & critical failures

etap.com
Advanced Monitoring

Process & Performance Monitoring
The operator interface provides graphical and tabular views of the network to allow the operators and dispatchers to make quick, accurate, and proactive decisions while performing critical tasks.

ETAP’s embedded visualization tools, intelligent one-line diagram, and customizable notification views combined with prediction and simulation modules improve situation awareness by enabling the dispatcher to effectively and efficiently manage vast portions of the system.

Dashboards
Dashboards allow visualization of the data in user-definable formats. Dashboards assist in the assessment of a situation in real-time basis per measurement tag or for an entire set of inputs.

Instantly view and analyze key performance indicators and process data such as gas, water, oxygen, nitrogen, and air networks.

GIS Map Interface
The GIS map interface automatically generates electrical one-line diagrams with the corresponding geographical maps of power generation, transmission, and distribution systems.

Electrical system data is synchronized from GIS into ETAP thereby maintaining the relationship between them.

The results are displayed on one-line diagrams and geographical maps providing a seamless view of the power system within ETAP.

Monitoring & Control Templates
- Thin client application for monitoring & control
- Customizable web-based interfaces & technology
- Human Machine Interface (HMI) template library
- Web-based customizable HMI:
  - SCADA views
  - WPF dashboards
  - Trending & forecasting
  - Alarms & warnings
  - Control & supervision
  - Energy consumption monitoring
  - Reporting & logging
  - Geographical monitoring view

OPC Unified Architecture (UA)
- UA Server
  - Monitoring consoles’ communication via WAN
  - Thin client applications using WPF
  - Secured access control
  - Interface to OPC UA & DA clients
Energy Accounting tools provide online cost and usage comparison against on-site generation, power exchange allocation, and spinning reserves while providing power consumption and pricing profiles for reporting purposes.
Predictive Simulation

Simulate Circuit Breaker Operation
Identify Potential Operating Problems
Simulate Motor Starting & Load Change
Predict Operating Time of Protective Devices

Predictive Simulation is a powerful analytical tool that allows for detection of system behavior in response to operator actions and events via the use of real-time and archived data.

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

Features
- Full spectrum AC & DC analyses
- Emulate response of protective devices
- Evaluate protection & control actions
- Get online data on-demand
- Retrieve archived data for system analysis
- One-touch simulation
- View & analyze initial & post-disturbance actions
- Intelligent interactive graphical user interface
- Online simulation alerts
- Automatic scenario simulation using Project Wizard

Benefits
- Accurate analysis with actual operating values
- Virtual operation of power systems
- Improve system planning & design
- Recognize & correct potential hidden problems
- Avoid “unforeseen” errors
- 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
Predict System Response Based on Operator Actions
Perform “What If” Operating Scenarios
Simulate Real-Time & Archived Data
Operator Assistance & Training

Operator Training Simulator

System operators and engineers must have instant access to online information and analysis tools that allow them to predict an outcome before system actions are taken. The ability to simulate the sequence-of-operation using real-time data is of fundamental importance. Predictive simulation can avoid inadvertent plant outages caused by human error, equipment overload, etc.

Predictive simulation provides an environment that is effective for operator training and assistance. Compared to traditional training methods, operator training is accelerated using dynamic graphical simulation of the power system. This makes training an ongoing process.

1. Get Online Data
2. Close a Circuit Breaker
3. Predict System Behavior & Response

Graphical Display of System Response & Alerts
Event Playback

Replay Archived Historian Data
Investigate Cause & Effect
Explore Alternative Actions
Replay “What If” Scenarios

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 Event Playback capabilities translate into reduction of maintenance costs and prevention of costly shutdowns. ETAP can be configured to provide a complete picture of the electrical system from the stored data. This includes playback of previously recorded monitored data, calculated system parameters, sequence of events, and message log.

Event Log
Additionally, the event log can be synchronized and displayed while the playback is in progress. This allows the operator to determine, at a specific time, what events were occurring in the power system, what was being reported to the operator, and what operator action resulted, if any.

Playback Historian
The Event Playback mode provides seamless retrieval of data from the ETAP historian for any events from any ETAP console. The playback data is stored in an ODBC / SQL database and can be transferred to any user with the appropriate authorization.

Playback Console
The system operator can control playbacks to re-run at original or accelerated speeds, single-step, fast-forward, or rewind through the message log. Playback resolution is operator controlled and determined by the scan rate of field devices. Since full simulation capabilities are available to the system operator at any point during the replay, the operator can explore the effects of alternative actions at any point of recorded data.
Load Forecasting is an ideal tool for industrial users as well as utilities to reliably and accurately forecast future short term loading in the system. A good forecast has a direct and significant impact on costly generating unit startups and shutdowns, energy purchases, and manages system demand as well as scheduling system upgrades based on predicted load growth.

**Features**
- Predict loading up to seven days ahead
- Forecast multiple load areas per individual meters
- User-adjustable weather variables & load profiles
- Revise forecasts based on loading & weather conditions
- Pattern & load profile libraries
- Import & export historical forecast data
- Unlimited forecast views

**Data Trending**
ETAP Data Trending is a user-friendly and flexible trending application that supports real-time as well as archived data trending.
- View up to 20 trends in one window
- Create & view unlimited trend windows
- Auto-scale trends & auto-center plots
- Movable cross-hair for reading data values
- Zooming, scrolling backward / forward in time
- Choose background, grid, & plot styles
- Overlap different time frames in a single view

**Adaptive Forecasting**
ETAP Load Forecasting utilizes sophisticated algorithms to correlate multiple input variables such as predicted weather conditions along with historical data such as meter point loading and weather conditions to construct a forecast model.
ETAP Energy Management System (EMS) is a suite of applications used to monitor, control, and optimize the performance of generation and transmission systems. This intelligent energy management system is designed to reduce energy consumption, improve the utilization of the system, increase reliability, and predict electrical system performance as well as optimize energy usage to reduce cost. EMS applications use real-time data such as frequency, actual generation, tie-line load flows, and plant units’ controller status to provide system changes.

**Features**

- Automatic steady-state optimization control
- Auto control overload, over/under voltage, etc.
- Auto control LTCs, circuit breakers, relays, etc.
- Chain of logic controls & action validations
- Generation averaging (load sharing)
- Minimize MW & Mvar losses
- Minimize power factor penalties
- Intelligent inhibitive & permissive controls
- Maximize voltage security index
- Energy cost assessment
- Supervisory & advisory control
- User-friendly logics & macros
- Control system simulator
- Peak shaving
- Optimize spin reserve
- Intelligent generation control
- Fuel cost optimization
- Economic dynamic dispatch

**System Optimization & Automation**

**Automatic Control**

**Control System Simulator**
Automatic Generation Control

Automatic Generation Control (AGC) calculates the required parameters or changes to optimize the operation of generation units. The application uses real-time data such as frequency, actual generation, tie-line load flows, and plant units’ controller status to provide generation changes. AGC also calculates the parameters required to control the load frequency and provides the required data on demand to maintain frequency and power interchanges with neighboring systems at scheduled values.

Features

- Minimize Area Control Error (ACE)
- Maintain frequency at the scheduled value
- Operate system with adequate security & economy
- Maintain net power interchanges
- Maintain economical power allocation
- Share MW and MVAR proportionally amongst various generation units
- Multiple pre-configured automatic generator control modes

AGC is fully integrated with Economic Dispatch and Interchange Scheduling hence automatically ensuring that generation adjustments are scheduled in the most economical fashion. AGC provides guidelines for optimal electrical system operation to meet power requirements, steam requirements, and minimize fuel cost per generator. This process significantly minimizes the complexities of the decision process.
Economic Dispatch

Minimize Fuel Costs
Optimal Energy Costs
Fast Solution
Robust Algorithms

Economic Dispatch (ED) allocates generation changes of a power system among generator units to achieve optimum area economy. ED provides guidelines for optimal electrical system operation in order to meet power requirements, steam requirements, and minimize fuel costs per generator.

ED utilizes advanced optimal power flow algorithms in order to determine the optimal generation pattern while maintaining adequate reserve margins. Generation levels of individual units are calculated and dispatched in order to meet the load demand at minimal costs. Consideration is given to the fact that the cost of generation is not proportional to the generation level, systems are geographically spread out, and transmission losses are dependent on the generation pattern.

Features
- Generation constraints to maintain adequate online reserves
- Transmission line congestion limits to prevent overloads
- Incremental heat rate characteristics for each generation unit
- Detailed nonlinear cost function modeling

Generating Cost  Generation Dispatch
Supervisory Control allows the operator to apply objectives and constraints to achieve an optimal operation of the system. In this mode, recommendations are implemented based on the predefined set of objectives. ETAP utilizes optimal power flow algorithms and user-defined logics to determine the best operating settings for the system.

Optimization can be used to assist energy consumers to automatically operate the system and minimize system losses, reduce peak load consumption, or minimize control adjustment. For energy producers or co-generators, system optimization can be set to minimize generation fuel cost, optimize system operation, and maximize system security.

The appropriate application of system optimization leads to a more reliable and economical operation, while maintaining system voltages and equipment loading within the required range and constraints. System optimization provides intelligent load flow solutions to minimize system operating costs and maximize system performance while maximizing the value of your energy investment.

**Control System Simulator**

Control System Simulator is an automated testing tool for control and instrumentation systems. This is achieved through customizable mapping of control device settings (governor, exciter, etc.) within ETAP and continuously simulating the system response.

- Evaluate control system settings
- Reduce control system commissioning time
- Design more efficient & robust controls
- Operator training for emergency situations
- User-defined dynamic models
Interchange Scheduling

Interchange Scheduling (IS) 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, IS incorporates energy scheduling, transaction management, and energy cost analysis and reporting.

Features

- Create detailed “Buy” & “Sell” transaction schedules
- Detailed energy transaction reports for user-specified period of time
- Evaluate energy cost per location (regions, areas, zones) for multiple transactions
- Extensive tariff builder
- Transaction management tools
- Energy cost analysis & reporting with user-definable formats
- Graphical & tabular energy cost & transaction views

ETAP IS provides a user interface that allows for creation of energy transactions for each location. This interface allows the user to specify separate contracts for each location and assign multiple non-overlapping schedules to each location. Interchange Area Control Error (ACE) is provided to the Automation Generation Control (AGC) calculation from the IS application.
Reliable operation of an isolated or interconnected power system requires adequate generating capacity to be available at all times while maintaining the scheduled frequency in order to avoid loss of firm loads following system contingencies.

As a part of the Generation Management and Scheduling system, Reserve Management assists the system operator to continuously monitor dynamic parameters that determine the control area’s minimum reserve requirements.

Reserve Management maintains a constant vigil over required system reserves including “regulating reserve” (spinning reserve immediately responsive to automatic generation control commands), “contingency reserve” (spinning and non-spinning reserve sufficient to reduce Area Control Error to NERC performance requirements within 10 minutes), “additional reserve for interruptible imports” (reserve that can be made effective within 10 minutes), and “additional reserve for on-demand obligations” to other entities or control areas. Notification is issued whenever the available reserve in a class falls below the corresponding required value.

Features

- Identify system-wide reserve capacity requirements
- Monitor & maintain regulating, contingency, interruptible imports, & on-demand reserves
- Easily replace generating capacity & energy lost due to forced outages
- Compensate for curtailment of interruptible imports from other areas
- Ensure reliable system operation

Monitor & Manage Power Reserves & Maintain Reliability
Intelligent Load Shedding (ILS) provides optimal, fast load shedding for electrical disturbances and loss of generation. ILS calculates the minimum required MW to be shed for each subsystem according to the type and location of the disturbance, actual operating generation, spin reserve, loading, configuration, load distribution, and priority. ILS then selects the best combination of loads (CBs) that will satisfy this requirement. All of this is executed in less than a few milliseconds after a disturbance occurs in the system for transient events or after user-defined time delay for steady-state overload conditions.

**Benefits**

- Eliminate unnecessary load shedding
- Reduction of downtime for critical loads
- Reduction of spinning reserve requirements
- Reliable load preservation system
- Fast response to disturbances
- Operator alerts for marginal operating conditions
- Display required minimum MW & selected loads
- Trigger & time dependent load shedding
- User-definable control logics & macros
- User-definable system triggers
- Operator-friendly interface
- Display operating & recommended spin reserve
- VFD load reduction control
- System islanding logic
- Display monitored data on the one-line diagram
- Predict system response after load shed
- Log & view load shedding actions & recommendations
- Unlimited load shedding schedules
- User-defined load priority & groups
- Option to simulate & test ILS recommendations

**ILS**

Intelligent Load Shedding

**Fast Load Shedding**

**Optimal Load Preservation**

**Overload Curtailment**

ILS can dynamically manage the stability of your system to respond faster to disturbances.
Shed Less Load with ILS

The longer it takes to shed load during a disturbance, the more load that must ultimately be shed. Because of the intelligence and speed of ILS, the actual amount of load that is shed is far less than that of using the conventional methods such as frequency relay and logic controller schemes.

Unlimited Load Schedules

ILS provides an unlimited number of load schedules for the operators to select from. This flexibility of emergency load reduction produces the ultimate in system flexibility during upset or emergency conditions. Each load schedule can be defined with different load priority tables, load groups, options, calculation method, etc. This is necessary for different operating cycles of the system where load priority may not be the same. With ILS, the operator can switch load schedules with minimum effort.
**Load Restoration**

Restart Inhibition  
Logical Load Sequencer  
Load Restoration Priority

**Intelligent Restoration**

The Load Restoration application minimizes the duration of an outage following a disturbance by automatically restoring power to the available portions of the system while maintaining fault isolation without exceeding the capacities of alternate power sources and routes.

Restoration qualification feature evaluates the ability to restore loads by monitoring and comparing the following parameters:

- System frequency
- Available spinning reserve
- Starting voltages
- Operating voltages
- User-defined logic
- Alternate source detection
- System configuration status
- Interlock & switching sequence logics

Operator notification and acknowledgement provides the means that allow the dispatcher to restart the loads. Armed with Switching Management, loads can be restarted step-by-step or in one action. Where the restarting is determined to be invalid or unsafe, ETAP automatically inhibits the restart and provides the system operator with an indication that the load cannot be started.

**Minimize System Maintenance**

A key feature of ILS is the ability to globally update and customize the load shedding logic, change load priorities, and add / remove loads from the system without the need to reprogram individual PLC controllers at the substation level.
Simulate Load Shedding Scenarios

With the simulator, ILS recommendations can be tested and analyzed before taking the system online. Steady-state and transient conditions can be simulated to analyze ILS system response.

The following conditions and triggers can be simulated:

- Loss of generation
- Under-frequency
- Mechanical failures
- Steam pressure decay
- Other conditions leading to load shed

Steady-state and dynamic system response can be confirmed and analyzed using ETAP simulation capabilities such as Load Flow and Transient Stability. The ILS simulator utilizes both simulated and real-time operating data. It is the perfect tool for predicting the system response and load shedding actions for What If scenarios or upon modifications to the existing load shedding schemes, load additions, and interlock modifications. After ILS logic is approved with the appropriate access level, the controller can easily update the server without taking the system online or interrupting server operation.
iSub is an integrated substation for new and retrofit installation powered by ETAP. iSub provides protection, control, automation, monitoring, and communication capabilities as a part of a comprehensive substation solution.

iSub is the brain of the substation that interfaces with its peers to adapt and respond to dynamically hanging system conditions. Since iSub is built on the ETAP platform, it can seamlessly interface with ETAP. This built-in expansion capability allows you to utilize the advanced capabilities of ETAP as a distributed control system for electrical power systems with all the ETAP Real-Time software functionalities.

**Features**
- Automatic supervision of interlocks
- Graphical presentations of safety procedures
- Local & global alarm & warnings
- Detect fault location - useful for distribution systems
- Equipment diagnostics
- Intelligent interlocking system
- Diagnostics of disturbances
- Automation with supervisory & advisory control
- Substation control via operator
- Enforce complex logic for device protection & coordination
- Programmable Logic Editor with online compiling & execution
- Automatic generation of switching sequences
- Enterprise-wide view of system via intelligent one-line diagram
- Automated retrieval of all data from the substation
- Security control with multiple access levels
- Supporting third party SCADA technology

**Benefits**
- Minimizes outages
- Reduces operating & maintenance costs
- Enhance information management
- Improve productivity
- Improve asset management

**Protection, Control, Automation, Monitoring, & Communication**
iSub technology picks up where other substation automation solutions fall short. ETAP’s intelligent analysis processes are utilized to manage the collected data for the purpose of system monitoring, evaluation, and automation. The embedded Programmable Logic Editor provides a user-friendly interface to create almost any substation automation application. iSub collects data from digital devices in the substation, regardless of device protocol or data format.

**Automation Applications**

- Automatic Voltage Control
- Synchronism
- Tap Position Monitoring
- Load & Bus Transfer
- Load Curtailment
- Capacitor Control Algorithm
- Substation Maintenance Mode
- Sequence of Event Recorder
- Fault Detection

**Features**

- Predictive maintenance through analysis of operating conditions
- Sophisticated built-in control & protection algorithms
- Enables integration of protection systems
- Provides remote data retrieval & setting capability
- Common database
- Web-enabled design
Switching Management

Switching Sequence Management
Safety & Security Procedures
Interlock Logic Evaluator
Switching Plan Validation

Switching Management allows the dispatcher to build a complete switching program using a graphical user interface and execute the switching plan all in one step. The switching sequence contains a list of switching devices and time of execution for circuit breakers, load disconnects, and ground disconnects. Before any switching sequence is executed, ETAP verifies whether the sequence is compliant with safety switching procedures and requests confirmation during execution of each step before proceeding to the next step in order to avoid inadvertent switching.

The switching application may be configured for automatic transfer of bus loads on double-ended bus configurations, thus replacing step-by-step manual switching. Switching sequences can be ranked based on de-energized time, non-delivered energy, and the order of switching allowing easy comparison between different variations of the plan.

Features

- User-friendly switching plan builder
- Point & click selection of switching device from the one-line diagrams
- Graphical display of selected switching devices
- Multi-level switching request approval
- Assignment of user-definable & interlock logic per each switching device
- Checking of selected switching plans against forbidden or potentially hazardous actions
- Unlimited switching plans each with an unlimited number of switching actions
- Switching order reports include switching mode, start / stop time, & nature of work
- Simulate & evaluate switching plans in all states prior to execution
Demand-Side Management

Demand-Side Management (DSM) produces a more reliable and economical operation, while maintaining the power system’s operational integrity. Evaluate efficiency and determine where energy-reducing strategies such as moving on-peak usage into off-peak periods or shifting from one rate schedule to another could help to improve the bottom line.

DSM identifies costly variations in electrical load profiles by determining if and when peak demand usage occurs in a facility. Since demand can often vary hourly, daily, or monthly, specific utility surcharges can be reduced or eliminated by pinpointing the source and length of the peak demand usage.

DSM can be configured to shed non-critical loads during situations where peak electrical demand threatens to increase your electrical bill and reduce the operating profit of your facility.

Intelligent Load Management

Intelligent Load Management (ILM) assists in implementing control strategies to avoid situations where an unforeseen peak demand period might “ratchet” into an expensive electrical surcharge for the balance of the month. ILM automatically performs an orderly cycle-down of the system during electrical disturbances in order to prevent costly material losses as well as reducing unsafe operating situations.

Benefits

- Reduce energy costs
- Reduce peak MWh costs
- Reduce Mvar & power factor penalties
- Improve system operation & stability
- Increase equipment life
- Increase system capacity
- Shared decision making process

Time-of-Use Load Shifting
ETAP Real-Time employs an open and extremely flexible architecture that allows seamless communication with almost any data acquisition system, while providing a hardware-independent platform.

### Features
- Seamless integration
- Robust client / server architecture
- Multi-redundant system
- Scalable modular design
- OPC interface
- ODBC / SQL compliant database
- Enterprise-wide access
- Microsoft® Windows® platform
- Multi-tiered user access management
- ISO 9001 A3147 certified
- Hardware independent

### Web-Based Interface
ETAP thin client HMI operates within a fully distributed web based client/server architecture. Unlimited and customizable ETAP thin clients may be used to retrieve and display information using a web browser, WPF based HMI’s, etc. ETAP thin clients offer advanced visualization and rich user experience to the client location with minimum footprint.

### Protocols
There is a wide variety of network adapters available to support networking of applications. ETAP supports all standard network protocols including MMS, ModBus, DNP, IEC61850, IEC60870, ICCP, NetBeui, T103, NetDDE, UCA, IPX/SPX, and TCP/IP via OPC (OLE for Process Control) interface. OPC Server provides a standard communication interface to any OPC client without the need for direct interface with the device native protocols.

### Open Database
For the system topology, ETAP organizes and accesses its database using the Open Database Connectivity (ODBC) allowing the use of any database format for which an ODBC driver is available, such as Microsoft Access, Microsoft SQL Server, and Oracle®. ETAP users can integrate their data into the ETAP database using commercially available Database Management Systems (DBMS), or ETAP can integrate its data into any existing database.

### 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.

### User Access Management
ETAP relies on two tiers of user access control to provide program security. The first level is provided by the operating system under which ETAP is running. The second level of access control is provided by assigning multiple access level permissions to an authorized user.
Extremely Flexible Architecture with Seamless Communication

Client-Server Configuration

Developed for Microsoft Windows, the ETAP Real-Time Server is a true multi-client-server configuration. The ETAP Real-Time Server is a central processing unit that manages the communication between the system and ETAP consoles. Data is collected by the Real-Time Server from intelligent electronic devices and data acquisition systems.

ETAP Consoles display system data, alarms, warnings, and other pertinent system information while providing access to archive data for historical analysis. Simulation can be conducted from each console to predict system behavior. Additionally, consoles can be configured for dedicated tasks such as generator control and system automation.

High Availability

System availability is crucial to the reliable operation of a power management system. In addition to hardware redundancy and fail-safe software features, ETAP Real-Time offers redundant client-server setup. Two levels of system redundancy are offered:

Centralized Redundancy

Centralized redundant architecture employs an active server with multiple standby servers. Upon failure of the primary active server, a standby server is promoted to the active state allowing for a seamless fail over scheme. Should the failed server recover, the newly promoted active server remains as the primary system server.

Distributed Redundancy

Distributed redundant architecture is similar to that of the centralized redundant scheme with the additional capability to independently manage multiple systems. This scheme supports communication loss as well as physical isolation of multiple sites resulting in islanded systems. In such cases, a standby server at each location will automatically be promoted to an active state and resume managing its local system independently. After reestablishing the connection between the multiple sites, the system is returned back to the normal state with one active server resuming the management of the multiple sites.
ETAP integrators provide turnkey solutions to tie your existing data acquisition system and metering equipment to ETAP Real-Time applications.

Integration Services
- Integration strategy
- System modeling & development
- Architecture & technology consulting
- Technology pre-study & piloting
- Enterprise systems connectivity
- Metering hardware evaluation
- Monitoring & control system design
- Factory Acceptance Testing (FAT)
- Site Acceptance Testing (SAT)
- Visibility studies & system analysis
- Tag database interface implementation
- Logic controller programming
- ETAP engineering certification
- Operator training
- Hardware installation
- Project management
- Technical support

Training Services
Hands-on workshops provide the skills, knowledge, and techniques necessary to become proficient in setup, installation, operation, and maintenance of ETAP Real-Time. The purpose of a workshop is to develop a thorough understanding of ETAP Real-Time applications and the integration process. The workshops are tailored for operators, electrical engineers, and managers who are engaged or interested in power system monitoring, simulation, control, and management.

A certified training program is also offered to system integrators including a comprehensive training on the use of ETAP software products as well as instructions to integrate the system with third party products.
The power and versatility of ETAP combined with the vast knowledge and experience of ETAP partners orchestrates the system integration process while guaranteeing a successful implementation of your system automation project.

ETAP’s modular design makes for an easy implementation, allowing for a hassle-free upgrade path. It starts with the system model of your electric network. Next, the ETAP Real-Time server is installed to access online equipment status and metered data. Then, bring your power system to life and capture the benefits of ETAP’s intelligent monitoring, real-time simulator, and event playback capabilities. Add optimization and control capabilities and harness the power of ETAP Real-Time through the use of advanced features, such as Energy Management System and Intelligent Load Shedding applications.

Operation Technology, Inc.
ETAP Group of Companies

Operation Technology, Inc. is the designer and developer of ETAP, the most comprehensive analysis platform for the design, simulation, operation, monitoring, control, optimization, and automation of power systems. ETAP is the industry leader used worldwide in all types and sizes of power systems, including generation, transmission, distribution, and industrial systems such as oil and gas, manufacturing, steel, cement, mining, data centers, nuclear facilities, transportation, smart grid solutions, renewable energy, and more. Visit etap.com for more information.

ETAP Automation is an Operation Technology company that provides sales, support, and technical training of ETAP software and specializes in value-added power system engineering, consulting, analysis, and automation for the implementation of ETAP Real-Time Power Management System. Visit etapautomation.com for more information.
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:

- ISO 9001:2008
- 10 CFR 50 Appendix B
- 10 CFR Part 21
- 10 CFR Part 50.55
- ANSI/ASME N45.2
- ASME NQA-1
- CAN / CSA-Q396.1.2
- ANSI / IEEE 730.1
- ANSI N45.2.2

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