etap
Thinking Power

Dynamics & Transients

Transient Stability

Generator Start-Up

Wind Turbine Generator

User-defined Dynamic Model

Parameter Estimation

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 to your power system design, analysis, and operation needs. ETAP offers a comprehensive suite of analysis modules that can be configured to suit your specific needs. This modular approach allows you to purchase only the modules you need.

Featured in this brochure

Cable Systems
Cable Sizing - Phase
Cable Sizing - Grounding/PE
Cable Ampacity
Electric Shock Calculation
Underground Thermal Analysis
Cable Pulling

Base Package
Cable Ampacity & Sizing
Transmission Line Constants
Report Manager
Project Management Wizards
Output Report Comparator
Multi-Dimensional Database
Libraries

Distribution
Unbalanced Load Flow
Optimal Power Flow
Transformer Tap Optimization
Switching Sequence Mgmt.
Reliability Assessment
Optimal Capacitor Placement
GIS View

Star Protective Devices
Protection Coordination & Selectivity
Sequence-of-Operation
Relay Test Set Interface

Intelligent Load Shedding
Adaptive Load Shedding
Automatic Islanding
Load Preservation & Management
System Restoration & Control
Load Shedding Validation

Data Exchange
DataX
MS Access® & Excel®
CAD Interface
e-DPP® Interface
SmartPlant® Interface
Third-Party Software

Transmission Line
Line Constants
Line Ampacity
Mutual Coupling
Sag & Tension
HV DC Transmission Link

Arc Flash
AC Arc Flash
DC Arc Flash
Result Analyzer
Sequence Viewer

Monitoring & Simulation
Real-Time Monitoring
State Estimation
Energy Accounting
Predictive Simulation
Event Playback
Load Forecasting

Ground Grid Systems
Finite Element Method
IEEE 80 Method
IEEE 665 Method

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Network Analysis
Short Circuit – ANSI
Short Circuit – IEC
Load Flow
Motor Acceleration

Energy Management System
Automatic Generation Control
Economic Dispatch
Supervisory Control
Interchange Scheduling
Reserve Management

Panel Systems
ANSI Panel
IEC Panel
Code Factors
Schedule Reports

User-defined Dynamic Modeling
Graphical Logic Editor
Transfer Function Blocks
Import/Export to Simulink®
Excitor/Governor/Stabalizer
Generic Load

Intelligent Substation
Substation Automation
Switching Management
Load Management
Smart Grid
Micro Grid

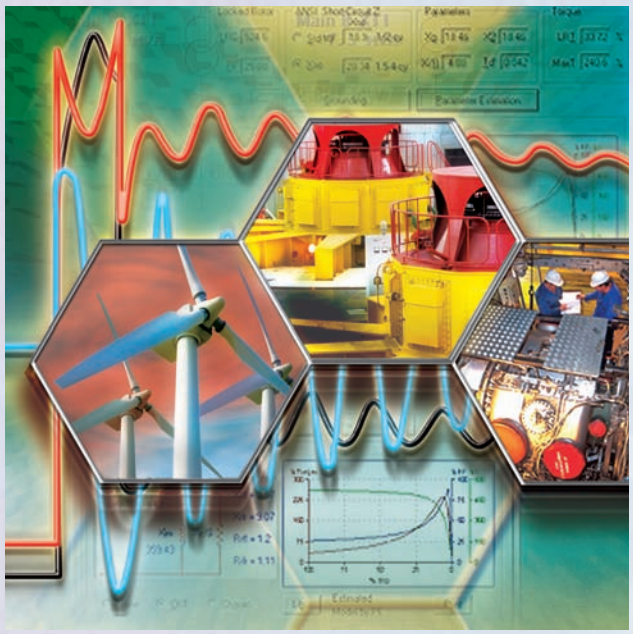
Renewable Energy
Wind Turbine Generator
Wind Farm
Photovoltaic Array

Power Quality
Harmonic Load Flow
Frequency Scan
Harmonic Filters

DC Systems
Load Flow
Short-Circuit
Control System Diagram
Battery Discharge
Battery Sizing

Dynamics & Transients

Stability and Operability



The most advanced Unbalanced Load Flow program

A robust and efficient power flow solution method must be able to model special features of distribution systems with sufficient accuracy. With ETAP's Unbalanced Load Flow module, you can easily model your unbalanced system with detailed representation of component unsymmetrical characteristics. Accurate and reliable results are available describing your system's unbalanced operating conditions. Automatic alarm/warning and advanced features such as automatic line constant calculation make it the most advanced Unbalanced Load Flow program available today.

Transient Stability

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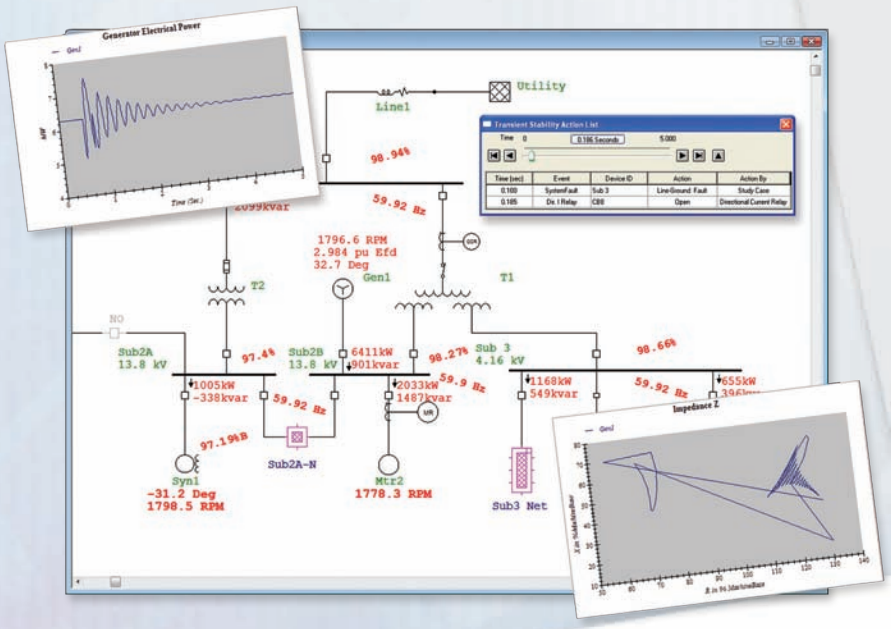
Dynamic Response



Accelerate Multiple Motors: Start multiple motors using unlimited sequence of events

Transient Stability

The Transient Stability module enables engineers to accurately model power system dynamics and simulate system disturbances and events. Typical transient stability studies include identifying critical fault clearing time, motor dynamic acceleration/re-acceleration, load shedding schedule, fast bus transfer timing, excitation/AVR system parameter tuning, governor parameter tuning, voltage/frequency response and stability, and generator start-up. You can split a system or combine multiple subsystems, simulate automatic relay actions and associated circuit breaker operations, accelerate or re-accelerate motors. Combined with enhanced plotting and graphical results, engineers can truly use this module to master power system stability studies.

Key Features

- Complete synchronous & induction machine models
- Comprehensive excitation system models
- Comprehensive governor-turbine models
- Power System Stabilizer (PSS) models
- Compatibility with User-Defined Dynamic Models (UDM)
- Unlimited sequence of events & actions
- Typical & common disturbances & operations
- Automatic relay actions based on settings & system responses
- Short-time & long-time simulation
- Variable total simulation time & simulation step
- Variable frequency drive dynamic modeling
- 3-phase & line-to-ground fault actions
- Auto synch-check action
- Embedded Newton-Raphson & Accelerated Gauss Siedel methods for initial load flow
- Faster calculation time by skipping tabular plots
- Transient simulation action line-to-ground fault

Reporting

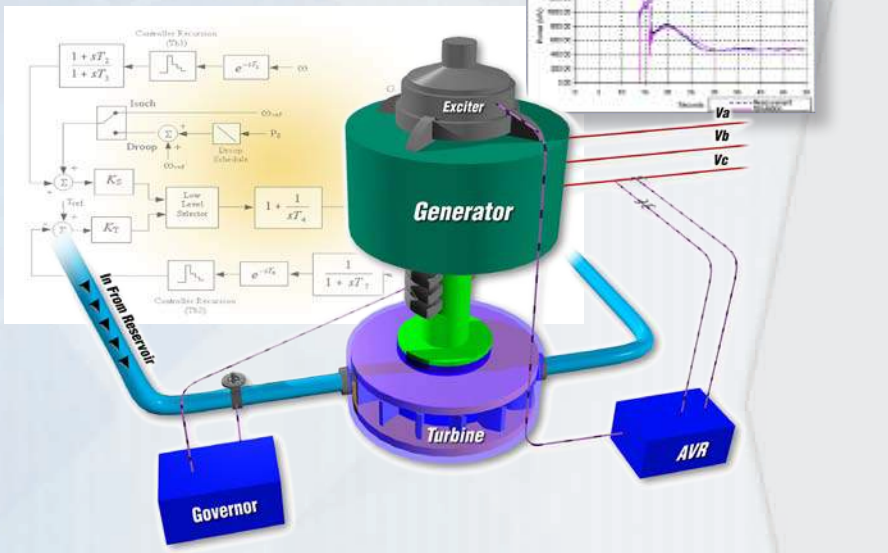
- Plots, one-line display, & text reports
- Synchronous generator & motor rotor angle & speed
- Synchronous generator & motor voltage & current
- Synchronous generator & motor mechanical & electrical power
- Exciter voltage & current
- Induction motor slip & torque
- Induction motor V/Hz plot
- Motor current & terminal voltage
- Motor mechanical & electrical power
- Machine terminal impedance
- Branch power & current flow
- Bus frequency, voltage, volts/hertz, & more
- Bus volts/hertz vector difference
- Superimpose plots
- Time-varying graphical one-line display of results
- One-line playback with list of events
- Customize output reports using Crystal Reports®

Capabilities

- IEEE standard synchronous machine equivalent, transient & subtransient models
- Synchronous machine round rotor & salient pole models
- Induction machine single-cage & double-cage dynamic models
- Special frequency-dependent synchronous machine, induction machine & network models
- IEEE type exciter/AVR models
- IEEE type turbine/governor models
- MFR specific exciter & turbine/governor models
- Power system stabilizers (PSS)
- Motor mechanical load models
- Machine torsion effect models
- User-Defined excitor, governor & PSS models (optional)
- User-Defined wind turbine generator models
- User-Defined generic load models
- Variable frequency drive, frequency, voltage & V/Hz starting
- Variable frequency drive, frequency & voltage control
- Model UPS parallel operation
- Model photovoltaic power panel
- Simulate unlimited system disturbances & operations
- Apply/clear faults
- 3-phase & L-G faults
- Segment (fractional) faults for cables & transmission lines
- Operate circuit breakers & switches
- Generator/load rejection
- Impact & ramp loading
- Generator & power grid voltage impact & ramp change
- Governor isochronous/droop switching
- Change generator operating modes
- Reference machine switching

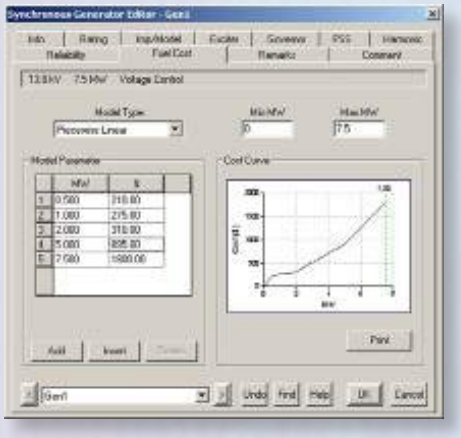
Generator Start-Up

Using full frequency-dependent machine and network models, the Generator Start-Up module analyzes cold-state starting of generators under normal and emergency conditions. The entire generator start-up process is modeled, including automatic control relay simulation and the dynamic behavior of exciters/AVRs, governors, turbines, and Power System Stabilizers (PSS). You can simulate the starting of generators, connection of generators to the network before reaching synchronizing speed, acceleration of motors, action of MOVs, and operation circuit breakers.



Key Features

- Cold-state generator starting
- Load generators prior to synchronous speed
- Frequency-dependent machine models
- Frequency-dependent network models
- An expansion to the Transient Stability module
- Utilizes user-defined dynamic models



Flexible Operations

- Parameter correction due to saturation effects
- Initial field flashing circuit & switching time
- Special dynamic turbine actions during start-up
- Detailed & user-programmable speed-governor system control
- System switching actions controlled by relay settings
- Variety of relay controls (Volt, Hz, V/Hz, dHz/dt)
- Motor acceleration at under-voltage & under-frequency conditions

Capabilities

- Quick recovery of power to critical loads
- Determine optimum loading time
- Schedule of loading sequence
- Analysis of generator & motor starting behavior
- Analysis of governor & AVR starting behavior
- Diesel generator starting for critical applications
- Analysis of power recovery to critical loads when power grid connection is lost
- Cold-state starting of stand-by generator under normal & emergency conditions
- Motor acceleration & rejection
- Simulate relay actions automatically during analysis

Dynamic Models

- Exciters
- Automatic Voltage Regulators (AVR)
- Governors
- Turbines
- Power System Stabilizers (PSS) speed-governor system control
- System switching actions controlled by relay settings

Wind Turbine Generator

The Wind Turbine Generator (WTG) module allows you to design and monitor wind farms via a highly flexible graphic interface optimized for both steady-state and dynamic simulation. The WTG module is fully integrated with all ETAP calculation modules such as Load Flow, Short circuit, Transient Stability, Harmonic Analysis, Protective Device Coordination, and ETAP Real-Time. User-defined actions may be added to simulate disturbances like wind variation and relay operations. It also predicts the dynamic response of each individual wind turbine generator. Analysis results may be utilized to analyze alternative turbine placement, tuning of control parameters, selection and placement of protective devices, and sizing associated equipment.

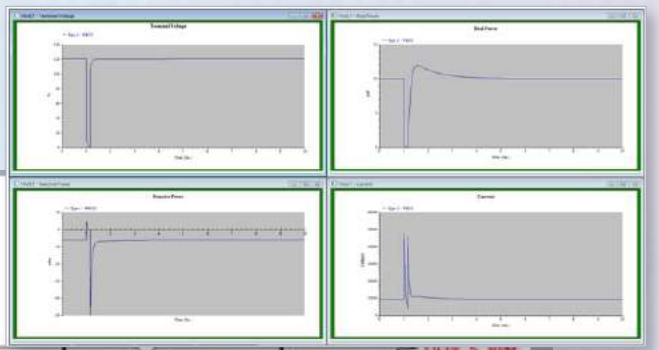
The ETAP WTG module comes to market with proven utility. It is currently being used for real-time monitoring of power exchange between wind turbines and the power grid at the third largest wind farm in the United States.

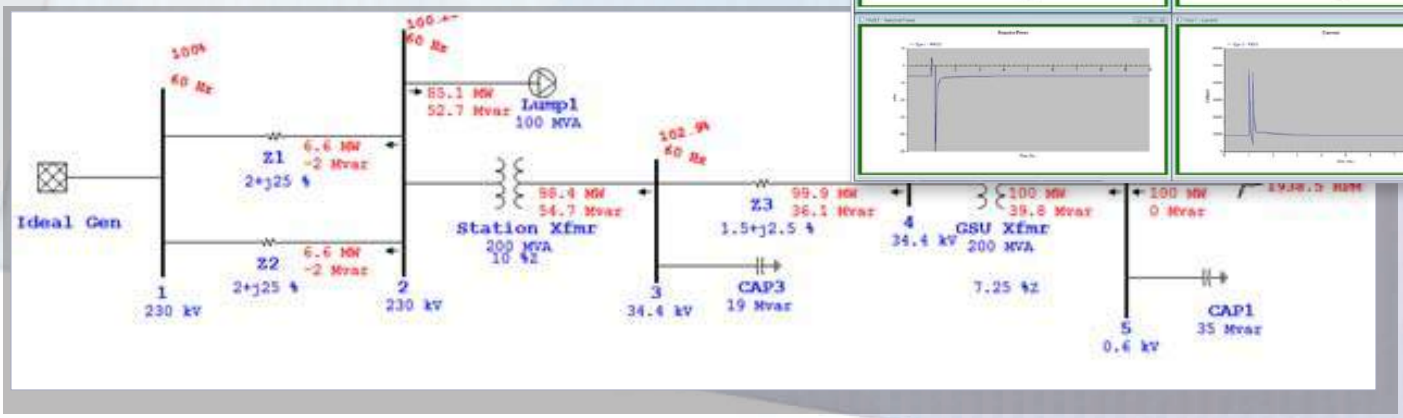
Model Types

- Model type 1, 2, 3, & 4 wind turbine generators

Key Features

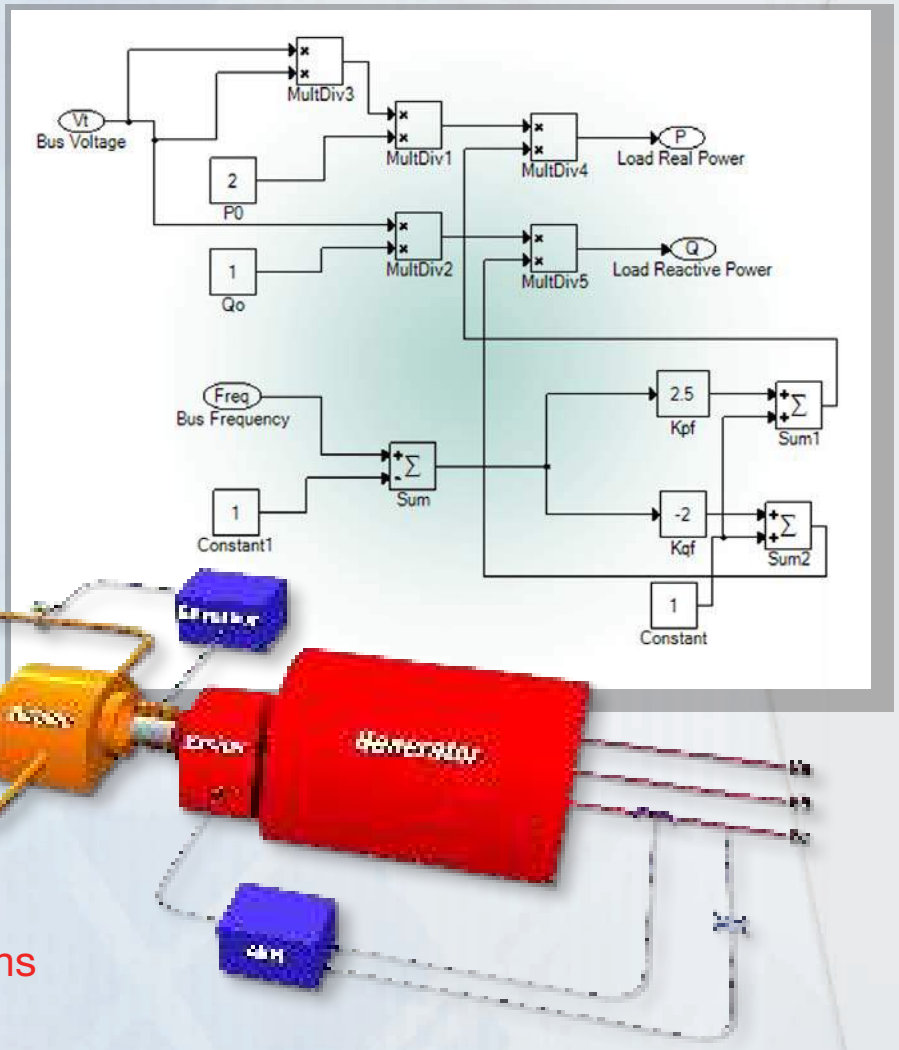
- Ability to model unlimited wind turbine generators individually or in groups
- Detailed modeling of turbine dynamics including aerodynamics & power coefficients
- Model doubly-fed induction generators with pitch & converter controller characteristics
- Simulate transient wind conditions with ramp, gust, & noise disturbances & calculate dynamic impact on wind machines
- Create multiple wind categories for predictive “what if” studies & scenarios
- Perform transient stability analysis with individual or zone-based disturbances
- Perform system integration studies





User-Defined Dynamic Model

User-Defined Dynamic Models (UDM) can be used to model or customize complex machine control system. This module allows you to build control block diagrams needed to simulate the behavior of machines in Transient Stability and Generator Start-Up simulations. UDM provides independant self-testing via load rejection, load acceptance, and terminal bus faults for validation of models and their dynamic behavior.



Key Features

- Library of pre-built models
- Customize existing UDM models
- Wide variety of blocks for building models
- Import Simulink models
- Various model testing methods
- Real-time compiling & linking of model
- Dynamic model builder in ETAP
- Fast & accurate model initialization

Capabilities

- Transient stability analysis
- Generator start-up analysis
- Motor acceleration analysis
- Synchronous motor startup
- Frequency-dependent models
- Bus voltage support mode
- User defined wind turbine models for transient studies
- User defined generic load model for transient studies

Create Custom Block Diagrams

- Automatic Voltage Regulators (AVR)
- Power System Stabilizers (PSS)
- Exciters
- Turbines
- Governors
- Wind turbine generators (WTG)
- Generic load model

Pre-Built Control Block Diagrams

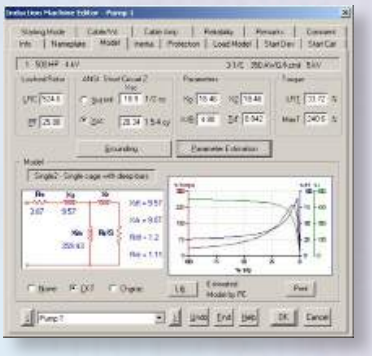
- IEEE type exciter models
- IEEE type governor models
- IEEE type PSS models
- Manufacturer specific models
- Frequency-dependent models
- Wind turbine generators (WTG)
- Generic load model

Independent Self-Testing

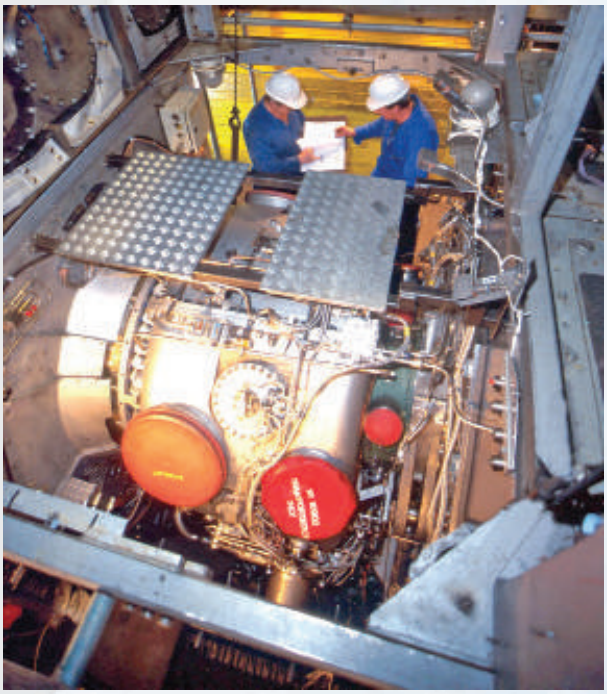
- Terminal bus faults
- Load rejection
- Load acceptance

Parameter Estimation

The ETAP Parameter Estimation program calculates equivalent circuit model parameters for machines at starting condition. The calculation is based on advanced mathematical estimation and curve fitting techniques, which require only the machine performance characteristic data.



The estimated model together with its parameters can be used to represent the machine dynamics during motor starting and transient stability studies. Machine characteristic curves based on the estimated model are automatically updated into the corresponding motor editor. Additional key machine characteristic and nameplate data are automatically calculated based upon the estimated model.



Key Features

- Unbalanced power flow
- Single-phase & unbalanced 3-phase modeling
- Unbalanced & nonlinear load modeling
- Phase & sequence voltage, current, & power
- Voltage & current unbalance factors
- Transmission line coupling
- Automatic device evaluation

Capabilities

- Single-phase, two-phase (2W & 3W), three-phase (3W & 4W)
- Unbalanced loads & branches
- Machine internal sequence impedances
- Machine/transformer various grounding types
- Modeling of transformer winding connections
- Transmission line coupling between phases of one line & multiple lines
- Loads of constant power, constant impedance & constant current
- Generic load as function of voltage & frequency
- Generator governors with isochronous or droop mode
- Generator exciters with AVR or Mvar/PF control
- Transformer load tap changers (LTC/regulators)
- Phase-shifting transformers

Reporting

- Individual phase & sequence voltage, current, & power
- Voltage drops, losses, power flows, power factor, voltage/current unbalance factors, etc.
- Input data, detailed load flows, & summaries
- State-of-the-art graphic display of results
- Export reports to your favorite word processing program
- Graphically display device evaluation results
- Graphically display buses with marginal or critical under/over voltage
- Export one-line diagrams including results to third party CAD systems
- Alert view to display critical & marginal limit violations

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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:

A3147

ISO 9001:2009	10 CFR 21	ASME NQA-1	CAN/CSA-Q396.1.2
10 CFR 50 Appendix B	ANSI/ASME N45.2	ANSI/IEEE 730.1	ANSI N45.22

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