The Business Case

Sweeping privatization and deregulation initiatives have radically altered the competitive landscape of the electric utility business. Deregulation in wholesale power markets has resulted in a tenfold increase in the number of interchange transactions. The combined effects of weather and forced outages have created congestion driving wholesale spot prices to all time highs. Competition is fierce. The pressure for electrical utilities to reduce costs and maximize use of existing assets, while maintaining adequate security margins, has never been greater. In order to thrive in this environment, a reliable and adaptable information technology infrastructure is key.

Since its debut as the first open Energy Management System (EMS) offering in early 1990, the GE Network Solutions XA/21™ system has revolutionized the industry. The established track record of field performance – over one million hours of online operation – and the large installed base offers evidence that the GE Network Solutions reputation for service and technology can be relied upon. GE Network Solutions’ worldwide team of professionals and XA/21™’s modular software and open system architecture combine to enhance total system reliability and facilitate continued compliance with changing industry standards.
Network Solutions

**Improved Decision Support – Information versus data**

XA/21™ presents a consistent real-time view of the entire electrical network to operators and management. The capability to analyze alternate operating strategies based on current or postulated system conditions provides valuable insight into possible courses of action. XA/21™ is designed to ensure that timely, accurate information is available when you need it most.

**Enhanced Operational Security**

As asset utilization levels continue to rise, the importance of system security becomes paramount. Explosive growth in the number of wholesale power trades continually stresses the transfer capability of the transmission grid. As retail wheeling begins to emerge, the sheer number of participants and the volume of trades will be pushed to levels never before seen.

XA/21™ supplies operational staff with a powerful suite of information management tools that allows them to visualize, anticipate, and respond to ever-changing system conditions. Whether through the smooth, reliable management of generated power in response to system disturbances, the vigilant monitoring of system conditions against operating limits, or the development of corrective and preventative strategies, XA/21™ delivers.

**Reduced Operating and Maintenance Costs**

XA/21™ is designed to reduce total operating and maintenance costs, including costs of ownership. XA/21™’s powerful full graphic user interface, in conjunction with its field-proven applications, substantially enhances overall operational efficiency. XA/21™ provides the potential to consolidate existing control centers, resulting in significant savings. Alternatively, existing control center locations and communication facilities can be integrated, allowing for the sharing of data and leveraging a common support infrastructure.

Fuel cost is far and away a generating company’s single largest operating expense. XA/21™ helps to minimize fuel and fuel related O&M costs while satisfying unit, plant, and system level operating constraints as well as contractual and regulatory constraints, such as limited availability fuels and emission levels. XA/21™ also can provide reduced transmission losses through the use of available reactive compensation and voltage controls. By providing an up to date, accurate picture of current system conditions relative to operational constraints, XA/21™ can help to maximize the utilization of existing assets, allowing costly capital expenditures to be deferred.
With Easy Navigation
XA/21™ is easy to use and is designed to industry standards, minimizing the training time required for the end user. The User Interface was designed with the operator in mind, minimizing the number of steps required to access information and perform control room operations. Many navigational aids and options are available so you can choose the method most comfortable.

By Providing Scalability and Flexibility
With XA/21™, it is possible to operate the same XA/21™ software on a small or large system. From single-computer development systems which operate all functions and applications of the XA/21™ EMS to installed customer systems ranging in architecture from three computers to over 70 computers in a single XA/21™ EMS, GE Network Solutions can fit the operational needs facing you today, tomorrow, and beyond. System expansions can be accomplished as an online function, providing the flexibility to grow and advance the system at the pace your operational needs may dictate.

With Logistical Flexibility
XA/21™ provides many options for the physical system configuration and user access. Options include a centralized control center, remote user workstations and/or master stations in dispersed geographic locations, decentralized control centers, networked PCs, intranet and internet browser access and more. With the increasing need for access to EMS data in today’s utility market, we can provide an EMS that will provide secure access for your entire user community.

With a Knowledge Base
You can maintain the integrity of your online system with the comprehensive semantics and syntactic validation applied by the Knowledge Base. The XA/21™ database system automatically validates data input before allowing it to pass to the online system. Many problems for the dispatcher and overall system operation are avoided by ensuring that data definitions are suitable for use in the online system.

With Online Update Capability for the Database
Add, modify or delete remote terminal units, points and datalink objects. With integrated database editing, changes are made to the system without interruption for the dispatchers or online operations. Just edit and commit to the online system. You even have the ability to reject your changes if they are not suitable.

With Robust Power Systems Applications
GE Network Solutions provides a fully integrated Energy Management System application suite which keeps pace with continually evolving utility market needs and regulations.

How the XA/21™ system will improve your performance
The components of XA/21™

XA/21™ is a high performance distributed control system that provides electric utilities worldwide with the capability to monitor, control, and optimize the operation of geographically-dispersed assets in real-time. Scalable from a single node, non-redundant system upward to geographically-dispersed systems containing dozens of interconnected processing nodes, XA/21™ is a common computing foundation that is fully configurable and can be tailored for specific system functions.

Using XA/21™’s distributed processing architecture, a utility’s enterprise system can be entirely integrated and interfaced. XA/21™ unifies corporate data across the utility’s operational system while providing a single system image with a single point of maintenance.

At the foundation of this architecture are the XA/21™ Data Acquisition and Control, Database, and Graphical User Interface. Together, they provide the basic framework for the day-to-day operation and maintenance of the generation and transmission grid.

Data Acquisition and Control (DAC)

- Acquires measurement data via remote terminal units or data links via a variety of industry standard protocols including the following:
  - DNP 3.0
  - Harris 5000
  - Indactic 33
  - CDC 550 Type 1
  - Conitel 2020
  - IEC 870-5 101
  - NETCON 8830
  - L&N 2020
  - Harris 6000
  - MKT2
  - BETAC
  - CDC 44-500 T2
  - Conitel 3000
  - GETAC 7020
  - GETAC 7024
  - MPS 9000
  - REDAC 70H
  - WISP
  - TG 809
  - TRW 9550
  - Valmet S5
  - ICCP
  - ELCOM 90
  - CDC 44-500 T1

- Validates data for reasonability and communication failures
- Performs checks on process variable limits and executes user-defined calculations
- Determines the quality and integrity of acquired data – based on limits, normal/abnormal states, etc.
- Generates alarms for abnormal data conditions
- Provides remote supervisory control capability
  - Raise/Lower
  - Set Point
  - Contact Closure
Graphical User Interface (GUI)

The XA/21™ graphical user interface allows the operator to visualize the past (with Power VU) as well as the current and future operating states of the system and effect the necessary control action to ensure safe and economic operation. Using high-speed pan and zoom in concert with direct linkages from alarm messages to equipment locations on displays, the operator can navigate large interconnected power system networks with ease. Key features of the XA/21™ GUI include the following:

- Deterministic display response, irrespective of system activity levels
- X Windows displays for consistent user interface regardless of platform
- High-speed pan and zoom
- Automatic display decluttering
- Display definition and maintenance using AutoCAD®
- DXF graphic import capability
- Single set of oneline display definitions for all applications
- Support for projection mapboards
- Secure, controlled access from outside the control room via corporate Intranet and/or Extranet
Network Solutions

Optional Modules for XA/21™
The following optional XA/21™ modules can be enabled, as needed, to form a fully-integrated Energy Management System application suite:

Generation Dispatch and Control (GDC)
XA/21™ Generation Dispatch and Control applications provide closed loop control of generator MW outputs in order to achieve smooth, stable control of system frequency and power interchanges with neighboring utilities. These applications help to minimize fuel and variable O&M costs while observing all unit and system operating constraints, including fuel contract limitations and emissions. The XA/21™ GDC Suite is comprised of the following application modules:

- Automatic Generation Control
- Interchange Scheduling
- Fuel and Emissions Monitoring
- Generation Dispatch
- AGC Performance Monitoring
- Production Costing
- Reserve Monitoring

GridSentinel
GridSentinel™ is a single product that can calculate and dynamically re-calculate your available transmission capacity based upon reservations and confirmations and automatically update or re-offer available capacities after a sell has occurred. The product offers import/export of grid information to a third party spreadsheet through a simple point and click interface.

Power Network Applications (PNA)
XA/21™ Power Network Applications provide the operator with the capability to analyze and optimize the operation of the transmission grid under current and postulated system conditions. Whether directed at the current real-time network or a future planned network, XA/21™ Power Network Applications provide the operator with clear and concise information with respect to system vulnerabilities and opportunities.

Real-time Power Network Applications such as state estimation and contingency analysis are software applications that utilize available telemetered status and analog data to improve the reliability of the transmission grid by alerting the operator to the presence of existing or potential overloads and abnormal voltages. The state estimator in particular can often estimate quantities that are not metered, expanding the operator’s field of vision. The state estimator also improves the overall reliability of the metering system and reduces maintenance costs by detecting sustained measurement errors, estimating replacement values, and alerting utility personnel as to the location of the suspect metering.

Security Constrained Dispatch and Voltage VAr Scheduling modules re-schedule active and reactive power controls (generator MWs, phase shifter angles, interchange MWs and generator terminal voltages, transformer taps, shunt capacitor/reactors) to reduce fuel costs and transmission losses, respectively, while ensuring that the system is operated in a secure fashion.

Study mode Power Network Applications provide the operator with the capability to analyze the security of the electrical network during projected future operating conditions, while considering the effects of scheduled maintenance.

The XA/21™ PNA Suite is comprised of the following applications:

- Parameter Adaptation
- Voltage/VAr Scheduling
- Contingency Analysis
- State Estimator
- Preventative Action
- Contingency Selection
- Network Configurator
- Remedial Action
- Security Constrained Dispatch
- Powerflow
**Unit Commitment/Transaction Evaluation (UC/TE)**

Unit commitment determines the minimum cost operating plan (hourly generator commitment/loading levels and interchange schedules) over the short-term planning horizon (1 to 7 days) while considering a broad range of unit and system operating constraints, including fuel contract limitations and emissions. At the operator’s discretion, the developed plan may be relegated to the Generation Dispatch and Control subsystem for automatic closed loop implementation.

Transaction Evaluation leverages the Unit Commitment case comparison capability to determine the economic and security impacts associated with incremental multi-hour, multi-block energy transactions.

**EnterNet View**

EnterNet View is a web-based product used to share data from one-line and tabular displays over the internet with your company’s management, neighboring utilities, regulatory agencies, and even key customer accounts! Use simple admin tools to grant access to specific displays to each of these groups.

**Load Forecasting**

Load Forecasting determines the best estimate of system load during the short-term planning horizon (hourly for 7 days) based on forecasted weather conditions during this period. As the load forecast is used by unit commitment to derive the minimum cost operating plan, accuracy of the load forecast directly impacts the cost of operation. Key features of the XA/21™ Load Forecasting package include the following:

- Model Identification Based on Piecewise Linear Regression
- Recognition and Accommodation of Non-Typical Days
- After the Fact Analysis of Weather Forecast and Model Error
- Real-time Adaptive Updated of Current Day Forecast, Based on Observed Error

**Dispatcher Training Simulator (DTS)**

The Dispatcher Training Simulator provides an accurate, realistic closed loop digital simulation of the electrical power system, allowing operators to be trained to respond to normal and emergency conditions. As all application software interfacing with the simulation is identical to that on the online system, the simulator is also valuable as a software test bed, allowing both database and software modifications to be validated fully prior to installation on the online system. Key components of the DTS include the following:

- Instructor Interface
  - Simulation Driver
  - External System Simulation
- Detailed Simulation Models
  - Generator
  - Load
  - Frequency
  - Network
  - Relay
- Interchange Scheduling
  - Simulation Event Processor
- AGC
- Absolute Time Events
- Relative Time Events
- Conditional Events
XA/21™ Architecture

Technology
XA/21™ is a completely open and highly configurable energy management solution incorporating the following technologies:

- Distributed Database
- Object Oriented Design
- Relational Database
- Hypertext

Standards
Standards benefit the vendor as well as the customer. XA/21™ is built on a foundation of industry and de-facto standards:

- UNIX®
- POSIX®
- UCA™
- MVME
- DXF graphics exchange format
- TCP/IP-based Networking
- ANSI® C, FORTRAN
- X Windows Systems
- IEC® 870-6 TASE.2
- ELCOM 90

Characteristics
As a result of its adherence to standards and innovative use of technology, the XA/21™ Energy Management System exhibits the following characteristics:

- Inherent Flexibility to Adapt to Changing Business Needs
- Deterministic Responsiveness
- Cost Effective Scalability
- Ease of Integration with Other Systems
- 1 for ‘N’ Functional Sparing
- Secure, Reliable Operation
- High Availability/Fault Tolerance
- Integrity of Data

XA/21™ Hardware Environment

XA/21™ is supported on the following major hardware platforms:

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<thead>
<tr>
<th>Hardware/OS Environment</th>
<th>Client</th>
<th>Server</th>
<th>Front End Processor</th>
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</thead>
<tbody>
<tr>
<td>IBM® AIX6000®</td>
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<tr>
<td>SUN®/Solaris®</td>
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<tr>
<td>Motorola®/AIX</td>
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To find out how a GE Network Solution XA/21™ System can improve the information you use to make decisions, enhance operational security, and reduce costs, just visit our website at www.gepower.com/networksolutions

GE Network Solutions