Power and Energy Management

March 14, 2007
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The objective of today’s presentation is to provide information on Enterprise Energy Management (EEM) Solutions that:

- **Reduce energy costs**
- **Improve system reliability**
Outline

- Introduction
- Why Monitor Power?
- Power Quality
- Hardware and Software solutions
- Enterprise Energy Management (EEM)
  - What is ION EEM
  - Features & Technology
Introduction

- Langford & Associates – agents for PowerLogic and ION meters and software.
- Represent related products
  - Protective relays, power conditioners, reference standards, etc.
<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Focus</th>
<th>Skills</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria, BC</td>
<td>Revenue &amp; Mid-High end Metering/Control</td>
<td>Hardware, Software &amp; Solutions</td>
<td>235</td>
</tr>
<tr>
<td>Lavergne, TN</td>
<td>Mid-High end Metering/Control</td>
<td>Hardware, Software &amp; Solutions</td>
<td>100</td>
</tr>
<tr>
<td>Meylan, FR</td>
<td>Low-end metering &amp; MV Protection Relays</td>
<td>Hardware, Software, Network Protection, Entry level Meters</td>
<td>125</td>
</tr>
</tbody>
</table>
We provide enterprise energy management (EEM) systems for energy suppliers, service providers, and large energy consumers worldwide.

Head office: Victoria, Canada

Engineered Solutions Group Main office: Nashville
Outline

- Introduction
- Why Monitor Power?
- Power Quality
- Hardware and Software solutions
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  - What is ION EEM
  - Features & Technology
The Need

- There are three fundamental problems facing energy consumers and suppliers:

  Enterprises lack the information and control systems to buy and use energy efficiently.
  Enterprises require a level of power quality and reliability that the grid alone generally cannot deliver.
  The price charged for electricity in real-time bears no relation to its cost, quality or value.
Our Solutions

Enterprise wide energy management (EEM) solutions provide:

EEM Solutions provide energy consumers the information and control they need to use and purchase energy more efficiently.

Provide monitoring and control solutions that help deliver high-quality power to mission critical loads.

Supply real-time revenue metering and power quality monitoring which can facilitate market-based pricing of electricity.
How can energy management save $$

- **Electrical System Management and maintenance**
  - Provide operations personnel tools to manage systems as effectively and reliably as possible.

- **Energy Cost Control**
  - Provide financial tools to management for improving energy efficiency and operations.

- **Education and awareness**
  - Improve corporate awareness to develop a culture of conservation within the organization.
Electrical System Management & maintenance

- Improve system reliability and efficiency
  - Understand and manage loads for system protection, control and management;
  - Identify PQ issues that affect production/maintenance;
  - Avoid interruptions and downtime with preventive alarming;
  - Develop long-term load profiles for planning;
  - Track and monitor energy changes over time;
  - Reduce capital costs by optimizing the use of existing equipment, and avoiding over-design of new systems.
Electrical System Management & maintenance

- Monitoring and control of emergency power (generators and systems) during outages
- Fast response due to power related problems
  - Power quality analysis of critical loads (elevators, UPS, life safety systems);
  - Increased tenant retention with improved electrical system reliability.
- Develop best practices
What can an Energy Management system do? Technical

- Real time tracking of the utility electricity price (HOEP) and forecast price.
- Send alarm signals to control systems or operators to:
  - Shed load,
  - Turn on a generator, etc.
- Emergency plan
  - Monitor load/generation if there is a power outage.
- Interface with other meters for all utilities:
  - Hydro; Gas; Steam; Water
- Reporting of green-house gas emissions, etc.
Energy Cost Control

- Prepare accurate invoices to different users and departments within an organization.
- Real time tracking of the utility electricity price (HOEP) and forecast price.
- Monitor the performance of energy contracts or performance contracts.
- Forecasting of energy costs and verification of actual vs. budget.
- Utility invoice verification and tracking.
Energy Cost Control

- Interface with other meters for all utilities:
  - Hydro; Gas; Steam; Water;
  - Import weather data (degree days) into system for tracking.

- Benchmarking and development of KPIs to compare energy consumption with other facilities.
  - Energy/ft²; Energy/m³ water treated.

- Send alarm signals to building automation systems or operators for energy management load shedding, etc.
What can an Energy Management system do?

**Financial**

- **Benchmarking and development of KPIs**
  - Energy/ft<sup>2</sup> ; $$ / occupancy.
  - Energy based on temperature / occupancy; compare energy consumption performance.

- **Billing:**
  - Utility invoice verification and tracking
  - Preparing invoices to different tenants.
  - Forecasting of energy costs over a medium term.
  - Energy contracts
  - Budgeting of energy costs and verification of actual vs. budget.

- **Import weather data (degree days) into system for tracking energy vs. weather.**
Ontario’s Electricity Market

- Cost of energy in Ontario is expected to rise
  - Shortages of generation and transmission capacity.
  - Natural gas prices are rising.
- Power Quality reliability is deteriorating as utilities are not paid for high levels of reliability
- Numerous energy brokers offering energy contracts.
  - Who is providing a good deal?
  - Is it wise to lock into an energy contract?
Education and awareness

- Develop education and energy awareness programs.
  - Promote a culture of conservation
  - Use power information to develop energy efficiency and maintenance programs
  - Demand Response (DR) and Demand Side Management (DSM) programs
- Set targets and reporting benchmarks such as greenhouse gas emissions and 1-tonne challenge.
Applies to the MUSH Sector
Must develop mandatory conservation plans including:
- Significant energy-consuming operations;
- Summary of annual energy consumption;
- Description of current and proposed measures to conserve energy;
- Progress and achievements in energy conservation;
- Energy conservation and energy efficiency in their acquisition of goods and services.
LEED (Leadership in Energy and Environmental Design)

- A standard for measuring building sustainability that was developed in the U.S. and adapted in Canada to reflect Canadian climates.
- The rating system recognizes leading edge buildings that incorporate design, construction and operational practices that combine healthy, high quality and high-performance advantages with reduced environmental impacts.
- One of the five principal LEED’s categorizes is Optimize Energy Performance, Enhanced Commissioning, and Enhanced Metering.
- Must establish an operational baseline,
- On-going monitoring is required to determine whether targets to meet certification goals have been attained and whether or not they are maintained over time.
LEED Building Ratings

- Leadership in Energy and Environmental Design
- Green Building Rating System is a standard developed by the US Building Council for developing high-performance, sustainable buildings.
  - define "green building" by establishing a common standard of measurement
  - promote integrated, whole-building design practices
  - recognize environmental leadership in the building industry
- LEED standards are currently available or under development for many aspects such as:
  - New commercial construction and major renovation;
  - Existing Building operations
One major requirement of a LEED building is the requirement to baseline the total energy consumption and maintain or improve on the energy efficiency target.

- Monitoring = benchmarking.

www.usgbc.org
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Deregulation has fostered:
- increased competition between suppliers,
- creation of new energy service offerings and
- a heightened awareness of power quality issues.

Increasingly complex energy supply contracts
- contractual obligations for minimum levels of power quality ...
- driving a need for “Performance-based PQ Monitoring”.

30,000 Foot Perspective
What is Performance-based PQ Monitoring?

- Contract specifies compliance conditions that must be met.
  - Conditions may be imposed on supplier, consumer, both.
  - Conditions often based on a recognised standard.
- Must monitor whether the compliance conditions are met.
  - Initial indication = Pass/Fail - not a detailed report!
  - Secondary indication = the detailed PQ info
- Failure to comply with the conditions must be recorded and reported.
Increasing demands on metering infrastructure

- Metering “supply availability” (# of 9s PQ)
- Metering internationally recognized PQ criteria such as Harmonics, Sags/Swells, Flicker, Transients, etc.
- Metering PQ pass/fail criteria in Real Time
- Power Providers and Power Consumers see a need for “Performance-based” Metering ... usually just prior to the date the market is scheduled to open.
Historically, power metering has been an Engineers tool.

Historically, revenue metering has been a utility business tool ("cash register").

Performance Metering is a supplier/consumer tool

- dispute mitigation / a Lawyers tool!

Most plants have the ION revenue meters – so use them to their fullest capabilities.
What is Power Quality?

- Definitions vary ...
  - “Any power problem manifested in voltage, current, or frequency deviations & that results in mis-operation or failure of customer equipment.”

- Financial impact of PQ is the key ...
  - “The quality of power received is unacceptably poor if it causes an adverse financial impact on the supplier or the consumer.”
What is Power Quality?

- **Power Quality = Voltage Quality**
  - Utility has no control over current drawn by load.
  - Problems “spread” on the voltage waveform.
  - Any deviations in magnitude, waveshape, or frequency of supplied voltage.
What is Power Quality?

Classification of PQ Events

- **Temporary Conditions**
  - Long Term Voltage Variation (> 1 minute)
  - Sags and Swells (0.5 cycle - 1 minute)
  - Flicker
  - Transients (<0.5 cycle)

- **Steady-State Conditions**
  - Harmonics
  - Notching (steady-state transients)
  - Voltage and Frequency Stability
What is Power Quality?

- Surge
- Capacitor Switching
- Notching
- Harmonics (Distortion)
- Sag
- Interruption

Continuous
Switch Mode Power Supply

- Computer PS – 3\textsuperscript{rd}, 5\textsuperscript{th} and 7\textsuperscript{th} harmonics
DC Motor Drive

- DC Motor Drive – Very high 5th harmonic
Sources of PQ Disturbances

- Some disturbances are preventable, others are not...
  - Lightning, wildlife in transformers
  - Utility line or capacitor bank switching
  - Transformer tap changes
  - Variable Frequency drives
  - Computer power supplies, electronic ballasts and other non-linear loads
  - Wiring
Factors contribute to PQ Problems?

Power quality is not new.
- Improper wiring, poor grounding (high neutral currents, etc.)
- Transformer magnetizing current (harmonics).
- Utility line or capacitor switching induced transients.

Increasing use of power electronics.
- Variable speed drives.
- Computer Equipment (switching power supplies).
- Process control equipment.
- Inverters; electronic ballasts and other non-linear loads.

These and other factors have an adverse impact on PQ in the distribution network including high neutral currents, circulating currents, ground faults.
Effects of Power Quality Problems

- Damage to equipment
- Excessive transformer / machine heating
- Unintentional tripping of sensitive devices
- Resonance (capacitor banks)
- $ Down-time
- $ Loss of productivity
- $ Material waste
- $ Financial Loss
There are different ways to measure PQ events, especially with digital metering.

There are *many* different ways to characterize PQ events.

As PQ becomes more important to more people, some common ground must be found ==> Standards.

Power quality standards will come into widespread use in the next few years.
**Power Quality Standards**

- **ITI (CBEMA) Curve**
  - *Guideline* for power supply design
  - Updated in 1996

From IEEE Std 446
IEEE 519: Steady-state Harmonic Control
- Defines utility and customer responsibilities.
- Control of harmonics at point of common coupling.

IEEE 1159: Power Quality
- Flicker
  - IEEE 1453 (120V / 60Hz)
  - IEC 61000-4-15 (240V / 50Hz)

SEMI
- Power supply for semiconductor industry.
Power Quality Standards

EN50160

- Developed by European utilities for voltage supply standard in distribution networks.
- Covers many PQ problem areas
  - Voltage variation
  - Frequency
  - Harmonics/Interharmonics
  - Flicker
  - Mains Signaling
- Uses a statistical approach (5%=8.4 hours)

<table>
<thead>
<tr>
<th>Measurement Component</th>
<th>Statistical Evaluation</th>
<th>Thresholds</th>
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</thead>
<tbody>
<tr>
<td>Power Frequency</td>
<td>95% of the time in 1 week 100% of the time in 1 week</td>
<td>50Hz ± 1% 50Hz ± 4% to 6%</td>
</tr>
<tr>
<td>Supply Magnitude</td>
<td>95% of the time in 1 week</td>
<td>Un ± 10%</td>
</tr>
<tr>
<td>Flicker</td>
<td>95% of the time in 1 week</td>
<td>Plt ≤ 1</td>
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</table>
Types of PQ monitoring equipment

- Hand-held multi-functional meters
  - Fluke
- Portable PQ analyzers
  - Reliable Power Meters, BMI, ACE
- Permanently installed Performance Metering
  (Revenue Meters that measure PQ in accordance with international standards).
  - ION meters
Traditional Applications for PQ monitoring

- Repeated equipment failure: drive, UPS, PLC failure or breaker trip that cannot be explained.
- Load surveys and harmonic studies within a manufacturing facility or building;
  - Can be part of standard maintenance
- On-line energy management and PQ monitoring system for continuous monitoring.
  - Includes meters, communications and software
  - Advanced PQ meters on important loads
Equipment Requirements

- Real-time voltage and current measurements
- Harmonics, PF and trending
- High speed sampling rates for sag/swell and transient detection
  - Simultaneous Voltage and current waveform recording
- Neutral and ground voltage and current sensing inputs
  - Ground faults and circulating currents
- Software
- Communications
Advantages of PQ monitoring

- Reduce the cost of poor power quality
  - Unnecessary down time due to equipment failures,
  - Wear on equipment – harmonics or low voltage,
  - Increased maintenance as a result
- Isolate sources of transients, sags and harmonics that may damage Variable Speed Drives (VFDs), UPS, transformers, PLCs, computers, etc.;
- Correlate sequences of events to reduce troubleshooting time for preventative maintenance.
- Harmonic studies within building or plant
- Installation of harmonic filters, etc.
Performance Metering

- **Revenue Metering:**
  - Billing.
  - Cost allocation.
  - Load profiling.

- **Power Quality Metering:**
  - Harmonics, Flicker.
  - Sags/Swells, Transients.
  - Data logging, Disturbance/Fault Waveform Recording

- **Communications and I/O**
  - Integrate to existing or new BAS, SCADA monitoring systems
  - Alarming and SOE.

- **Reporting Tools**
Monitor load profile to establish energy procurement strategies under deregulation; rate comparison or to catch utility billing errors.

Include PQ in supply contract with energy supplier.

On-board recording for remote, long term monitoring

Departmental cost allocation
Performance Metering (PQ)

- Permanently installed (continuous) monitoring:
  - Captures event immediately instead of waiting until after problem occurs
  - Avoiding visits to install portable recorders
  - Fast response to understanding problems
  - Can automatically alert personnel of disturbances
  - Immediate pass/fail notification
- System reliability indices (number of 9’s up time)
- Facilitates post event analysis to determine the probable event cause
- Establish baseline of system PQ characteristics and identify trends.
Performance Metering (Communications)

- Has real-time communications capability - I.e. send PQ info to one or more locations without the need to send someone into the field.
- Integrate meter with existing SCADA, DCS, EMS or energy purchasing system.
- Meters and Monitoring software now have full browser support for multi-user access (web enabled).
- For permanently installed systems:
  - Open, non-proprietary system that can use standard communications, protocols and interface with others.
  - Support for trending, alarms, and system wide-monitoring
Performance Metering (reporting)

- Must have reporting and data-analysis tools.
- Reporting tools for detailed PQ analysis
  - Local analysis to determine the severity of the PQ event; reduces the amount of data that must be retrieved, reviewed and managed.
  - Make informed decisions re. preventative actions to avoid repeat occurrences
- Each vendor provides software that can be used with their monitoring hardware.
  - Should be flexible and easily programmed – to allow programming of alarm points, recording intervals, data retrieval, etc.
How can improved metering save $$?

- Identify PQ issues that affect production/maintenance
  - Track and monitor energy changes over time;
  - Voltage regulation, phase balances, harmonics, faults, etc.
  - Avoid interruptions and downtime with preventive alarming
- Reduce capital costs by optimizing the use of existing equipment, and avoiding over-design of new systems
  - Use power information to develop energy efficiency and maintenance programs
Types of PQ services being offered.

- Specialized PQ monitoring service organizations.
  - Traditional: site visit and prepare report
- Service Bureaus: performance (permanent) monitoring
  - Bureau provides PQ reports and alarms to customer
  - Monthly fee; No capital cost for user.
  - Internet / Web based services
- Some utilities now considering offering PQ services over Internet to customers.
  - Utilities offering performance metering to their customers.
Digital economy requires high-9’s power

Digital economy is driving requirement for high-nines power

Assuring high-nines power requires networked monitoring & control devices

Digital economy provides the enabling Internet communications
Disturbance Protection

- Certain equipment is prone to failure during a power disturbance.
  - Downtime is expensive
- OmniVerter Active Voltage Conditioner
- Boosts voltage during a sag or power problem
- Active Device - Not a UPS
  - Low Maintenance
  - High Efficiency
  - Option for outage ride-through
Performance Metering ..Real-time

Revenue-class PQ Analyzer

Wholesale Consumer

End-use Consumer

Independent Power Producer

Co-Generation

Generator

Generator

Metering Points
Internet-based PQ monitoring by Utilities, Energy Service Providers, Consumers

ESCO / Utility

Customer 1

Customer 2

Customer 3

terminal server

Internet

CDPD modem

Alarms!

Energy

Energy & PQ

Real-time Revenue & PQ Information

ION
Power Quality

Several PQ Standards are now in place.
- Allow us all to speak the same language.
- Make sure your measurement tools are accredited to these standards.

Increase of non-linear loads, deregulation and higher performance requirements by building and production managers are making power quality and energy management more important and prevalent.

Performance Metering
- Provide 24 / 7 tools for benchmarking and managing PQ on your electrical system.
- Improve system reliability and reduce operation and maintenance costs.
References

**Electrical Power Systems Quality**, Dugan, McGranaghan, Beaty (McGraw Hill)

**IEEE Std 519**: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

**IEEE Orange Book (Std 446)**: Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications

**EN50160**: Voltage Characteristics of Electricity Supplied by Public Distribution Systems

**UNIPEDE Measurement Guide for Voltage Characteristics**
(application guide for EN50160)

**IEEE Std 1159**: Monitoring Electric Power Quality
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Hardware Products

Features

- Real-time Power & Energy
- ANSI C12.20
- Sag/Swell detection
- Transient detection
- Direct Ethernet Access
- High Speed Metering
- Revenue Accuracy
- Waveform Capture
- Automatic Alarming & Control
- Trend Logging
- Energy Pulsing
- Status Monitoring
- Digital Comms
- Advanced Control

$
ION Enterprise

- Flexible and easily programmed
- Trending and alarms
- Non-proprietary, open system
  - User configurable, multiple system support
- Interface with other programs
  - Modbus
  - DDE link capabilities
  - ODBC Database format
  - OPC
Communications to existing DCS / SCADA

- Getting meter data back to the user!
- Many different technologies:
  - RS485 / 232 / Ethernet / modem / satellite / radio
  - Protocols supported DNP3.0, Modbus, TCP/IP, etc.
  - Pulse (DO) and analogue outputs (4-20mA)
  - database connectivity - SQL & ODBC
  - Software: DDE link / OPC Server / .XML / FTP download
- The best solution depends on what is practical and most reliable for the installation.
Communications Flexibility

- Simultaneous Connections,
- Multiple Protocols Standard on Meters,
- Each Communication Port Optically Isolated
Leverage Existing Infrastructure

Use existing infrastructure to achieve maximum value.

Combine resources from operations, information technology (IT) and management to meet the objectives as cost-effectively as possible.

In many plants there typically exists some or all of the following:

- **Communications**
  - Corporate network (LAN / WAN) or telephone lines

- **Instrumentation**
  - Digital or pulse-based meters and relays on switchgear and MCCs
  - Generator control panels

- **Process control systems**
  - DCS, SCADA or BAS that can be integrated to other applications
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Enterprise Energy Management

- Provides an enterprise level view of energy consumption;
  - encompassing differing utility types,
  - differing data source types,
  - differing geographical locations,
- Direct purpose being to quantify the costs of energy and relate them to everyday business processes;
- And improve system reliability.
Basic Value Proposition

- Improve operation of facilities with real-time monitoring and alarming integrated with existing systems.
- Offers a unique ability to provide a fully integrated look at all levels of your business.
EEM for Multiple Facilities

- Reports
- EEM for Multiple Facilities
- Electricity
- Water & Gas
- Power Quality

- ODBC
- Normalize data wrt
  - Weather
  - Flows / treatable water
  - Population
  - other parameters

- Energy Cost Analysis
  - Plant capacity
  - Storage capacity
  - Budgets
  - Environmental regulations
  - other parameters

- Corporate Database
- Internet
- Utility Tariffs
- HOEP pricing
- Weather Info

- Plant #1
- Remote Site
- Building A
- Building B

- Ethernet/VPN

- Reports

- Ethernet/VPN
Enterprise Energy Management

- Provides an enterprise level view of energy consumption;
  - encompassing differing utility types,
  - differing data source types,
  - and possibly differing geographical locations,
- Direct purpose being to quantify the costs of energy and relate them to everyday business processes;
- And improve system reliability.
Key Benefits of Enterprise Energy Management (EEM)

- ION EEM allows you to:
  - Translate real-time and historical data into actionable information
  - Proactively reduce energy-related business risks
  - Control energy costs
  - Unite energy management and business strategies
  - Gather, cleanses and integrate info from disparate systems
  - Easily add capabilities as you need them
Energy Cost Analysis

- Monitor and evaluate energy consumption and costs
- View data in whatever format best suits your needs
- Normalize energy usage data for variables such as weather and square footage
- Use easy drill-down analysis functions to present increasing levels of detail
- Process system data to prepare budgets for individual departments or processes, track budget projections with actuals, and use historical data to identify production, usage and cost trends
Energy Cost Control

- Implement a comprehensive demand control scheme, with automatic load shedding, peak shaving, base loading and on-site generation
- Maximize ROI and simplify data collection by interfacing legacy systems with ION EEM
- Reduce business risks with information and analyses that can be used to produce cost and risk reduction strategies
- Create reports that can be distributed in paper, email or HTML format
Benchmarking, Baselining and Forecasting

- Benchmark facility conditions
- Carry out comparisons between locations to identify best practices
- Create baselines to track conditions within a single facility
- Compare results over time to measure the effectiveness of retrofits, upgrades, etc.
- Use normalization routines to remove independent variables to ensure accuracy
- Model future results, then alter variables to gauge dependencies and see possible outcomes of different scenarios
Energy Procurement & Bill Verification

- Procure energy at the best rate by using utility tariff and usage data to compare options
- Use a real-time pricing feed to monitor and calculate spot market rates
- Ensure your supplier complies with contract terms
- Avoid penalty charges for utility-initiated events
- Validate utility bills by running accurate shadow bills for comparison
Real-time Monitoring

- Determine the condition of all your energy assets in real time
- Use instant data access to correlate ongoing activities with logged trends to help you better fulfill core needs
- Configure schedule- or event-driven alerts on any combination of trends, events or costs to ensure quick and efficient response to any condition
Power Quality Analysis

- Conduct complex power quality analyses: steady state, waveform and voltage variation
- Benchmark power quality to industry standards
- Improve productivity with electrical system analysis
- Produce automated power quality reports
System Expansion Planning

- Design the right power distribution system capacity to meet but not exceed the needs of a new facility, retrofit or expansion.
- Automatically generate load profiles to reveal hidden capacity and increase forecast accuracy.
- Increase efficiency by safely maximizing your electric network capacity while avoiding unnecessary expansion costs.
- Compare energy usage to equipment specs to determine whether maintenance or replacement is required before capital expenses are incurred.
Reporting

- Produce aggregated load profile, cost allocation, power quality, and forecast reports

- Generate composite reports which include charts, tables, images, hyperlinks, other reports and data from other enterprise systems

- Distribute event- or schedule-driven reports via paper, email or web
Alarm Notification and Management

- System can push alarms in real time to your desktop, pager or email
- Customize alarms and assign staff to specific events with sign-off responsibilities
- Analyze historical alarm trends to reduce incidents and associated costs
ION EEM Architecture

Data Sources

- Scalable
  - Large number of users
  - Large quantity of devices and data

Web Browsers

- Interoperability
- MS .Net, no legacy code
- Distributed component architecture

ION Database Archiver

Central ION Database

VEE Routines

Web Server

Data Warehouse

- Rate Engine
- Load Aggregation Module
- Cost Allocation Module
- Web Reporting System
- Security
- Alerting

Web Browsers
ION® EEM Software Overview

"Operations Software"
- Meter config
- Energy, power, demand
- Power quality analysis
- Alarms, control
- Load profiles, pq reports

ION® EEM Software
"Economic Dashboard"
- Economic performance reporting
- Fast decision-making tool, eg., buy vs. generate
- Cost allocation
- Simulations
- Bill verification

Database
- Relay, meter data, 3rd party real-time data

Data Warehouse
- PQDIF, COMTRADE, HHF
- Weather, HOEP

web browser

ION
SMS
iFix

ION
Database

Data Warehouse

Enterprise (ERP)
Technical Description

- Designed to support real-time monitoring within a data warehousing architecture
- Built on SQL Server 2000 with a scaleable Microsoft .NET framework
- Includes core components and advanced modules:

<table>
<thead>
<tr>
<th>Core Components</th>
<th>Advanced Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Quality Module</td>
<td>Billing Module</td>
</tr>
<tr>
<td>Trend Analysis Module</td>
<td>Power Quality Analysis Module</td>
</tr>
<tr>
<td>Web-Based Dashboard</td>
<td>Modeling Module</td>
</tr>
<tr>
<td>User Administration</td>
<td>Alarms and Events Module</td>
</tr>
<tr>
<td>Real-time Diagrams</td>
<td>Integration Modules</td>
</tr>
</tbody>
</table>
Core Components: Data Quality Module

- Provides comprehensive validation, editing and estimation (VEE) functions
- Eliminates processing delays and reduces manual validation tasks
- Accepts data from many different types of systems (WAGES)
- Automatically corrects for gaps, nulls, time jitter, and duplicates
- Adheres to utility standards
- Issues automatic notifications to users when predefined limits have been exceeded
- Accepts customized validation methodologies
- Uses utility standards to compensate for missing data and calculate revenue-accurate bills
- Audits, tracks and versions all data quality changes
Core Components: Trend Analysis Module

- Reports on the complex relationships between energy drivers
- Enables the comparison of values over different time ranges, like days of the week, seasons, production shifts, production lines, time of day, or time-of-use period
- Aggregates and compares different energy cost centers, such as geographical regions, buildings and load types (for example, lighting versus HVAC), as well as suppliers
- Displays measured parameters including usage, demand, voltage, harmonics, transients, status, temperature, and real-time prices
- Allows you to organize physical and virtual data sources into multiple hierarchical views
- Clarifies the complex inter-relationships between energy loads and achieving business goals
Optional Modules: Modeling Module

- Use benchmarking to accurately compare one facility, process or production line to another by removing independent variables such as temperature, square footage or production units.
- Benchmark using standardized rating systems like EnergyStar and ASHRAE.
- Use baselining to compare an individual facility, process or production line to itself at different times by removing independent variables.
- Use forecasting to model future results. Change variables to gauge dependencies and see possible effects.
- Include key details on equipment, buildings or other assets, such as rated load, performance/efficiency ratings, age, total/leasable space, occupancy rates, etc.
Monitoring

- Display KPIs, trends, tables, real-time data, power quality indicators, external web pages and alerts all in one easy-to-use dashboard
- Customize graphics for facility views, status indicators, and more
Your Session has Expired. Please login again.

Username: [Blank]
Password: [Blank]

Login
Basic Profiling

Display Type: Chart Grid

Select time range:
- Relative
- Fixed

Start Date: 1/1/2003
End Date: 1/31/2003

Start Time: 12:00:00 AM
End Time: 11:59:00 PM

Select a hierarchy:
- Electrical Oneline

Select a node:
- Company
- East
- Boston Facility
- Chicago Facility
- Florida Plant
- NY Facility
- VA Facility
- West
- Dallas Facility
- Denver Plant
- Nebraska Plant
- San Diego Plant
- Seattle Plant

Select a quantity:
- Air
- Billing
- Electric
- Demand Power
- Energy
- Apparent
- Reactive
- Real
- kWh Del-Rec
- Power
- Power Factor
- Gas
- Steam
- Water
- Weather
“If you cannot measure it ... if you cannot express it in quantitative terms, then you your knowledge is of a meager and insignificant kind”. (Lord Kelvin).

i.e. Without accurate and up-to-date information, based on accepted industry standards, then you are reduced to “offering an opinion”.

Summary
A dedicated Enterprise Energy Management Solution will:

**Reduce energy costs**

and

**Improve system reliability**