Evolution of the Smart Grid

Presented by: Jeff Tolnar
Chief Technical Officer
BPL Global
Agenda

**BPL Global overview**

**Industry Overview**
- What are the global challenges of today’s grid
- Open discussion about specifics of Middle Eastern grids

**General industry responses to challenges**
- Open discussion about specifics of Middle Eastern responses

**BPL Global’s solution responses to challenges**
- Strategic viewpoint
- Technology solutions

**Questions and Answers**

**Detailed Technology Discussion as time permits**
Vision and Mission

Vision
Transforming Energy Efficiency and Reliability

Mission
To lead the transformation of energy efficiency and reliability through integrated solutions that significantly improve the operation and economics of energy networks throughout the world
Company Overview

**BPLG develops and deploys software applications and technology solutions to enhance the efficiency and reliability of utility networks**

- Solutions control, manage and monitor demand and distributed capacity, improve service reliability and optimize the overall cost structure

**Founded in 2004 with headquarters in Pittsburgh PA, US**

**Regional Offices:**
- Le Mans France – Europe
- Kuwait City – Middle East
- South Africa - Africa
- Sao Paulo Brazil – Latin America
- Beijing China - Asia

**Leading the transformation of the electric network**

- Offer fully integrated Smart Grid solutions from the substation to and through the customer premises.
- Deployed our 1,000th transformer monitor and deployed over 10,000 premises energy controllers and sensors
- Manage, monitor and control more than 530MW of power
The Evolution of the Smart Grid Market
The existing power grid is increasingly operating at its limit, facing shortcomings in capacity, reliability, operational capability, security and power quality.

The world of the Electric Utility will change dramatically over the next decade

- Technology must change
- The grid must change
- Utility operational paradigms must change
- Customers must change
Global issues facing the Electric Utility

Growing demand and constrained supply

Economic cost of natural resources for energy production are increasing

Aging infrastructure stresses networks and causes high technical losses and outages

Regulatory forces are driving alternative energy sources and new technologies

Information technology is inadequate to keep up with growing information needs to manage demand and curb operational losses
Challenges affect all aspects of energy delivery

**Capacity & Supply**
- Central Supply costs increasing
- New generation challenges
- Distributed energy resource are expensive

**Reliability & Operations**
- Asset are aging
- Faults are increasing due to increased stress and age
- Operational losses are high
- Technical losses are high

**Demand Side Management**
- Demand is increasing beyond supply capacity
- Metering infrastructure is inadequate for data needs
- Growth is where supply is not

**Information Technology**
- Systems not prepared for emerging applications
- Limited network management capability
- Inadequate communications
The Challenges
Challenges in the Middle East

Supply Demand Imbalance

- Projected demand growth of 10% per year for electricity and 8% per year for desalination
- Estimated 60,000MW of new capacity - representing 80 per cent of current installed capacity - will be required by 2015
- Desalination capacity will need to double to over 5 billion gallons a day
- Energy intensity of households, services sector & industries is 2 times higher than EU standards, driving energy efficiency projects.

Smart Grid communications

- Fiber often in place to substations but little communications beyond
- High licensing costs for Wireless implementations
- GSM/GPRS networks perform unpredictably and at times poor

Massive Investments Required

(1) MEED - Middle East Business Intelligence
(2) International Energy Agency
Economics for Plant Construction

The index shows the cost of new power plant construction increased 27 percent in 12 months and 19 percent in the most recent six months, reaching a level 130 percent higher than in 2000.

Power Capital Costs Index (PCCI) introduced at the CERAWeek 2008 conference.
The average age of transformers ~ 40 Years

Transformer explosions increase every year...

...as they near the end of their design lives.

Sergi – "Transformer Explosions in the United States"

# Renewables are gaining traction

Planned Nameplate Capacity Additions from New Generators, by Energy Source, 2007 through 2011  
(Megawatts)

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Coal[1]</td>
<td>1,679</td>
<td>920</td>
<td>12,611</td>
<td>6,839</td>
<td>7,649</td>
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<tr>
<td>Petroleum[2]</td>
<td>255</td>
<td>1</td>
<td>835</td>
<td>50</td>
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<tr>
<td>Natural Gas</td>
<td>9,891</td>
<td>12,896</td>
<td>11,050</td>
<td>7,569</td>
<td>4,622</td>
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<tr>
<td>Nuclear</td>
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<td>Hydroelectric</td>
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<tr>
<td>Conventional</td>
<td>13</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Other Renewables[4]</td>
<td>5,714</td>
<td>2,032</td>
<td>350</td>
<td>217</td>
<td>56</td>
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<tr>
<td>Pumped Storage</td>
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<tr>
<td>Other[5]</td>
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<td>165</td>
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<tr>
<td>Total</td>
<td>17,552</td>
<td>16,432</td>
<td>25,617</td>
<td>14,675</td>
<td>12,833</td>
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[2] Distillate fuel oil (all diesel and fuel oils), residual fuel oil, jet fuel, kerosene, petroleum coke, and waste oil.  

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."
Potential of Renewables

Potential of renewable energy sources is more than 18 times current global primary energy use and several times higher than projected energy use in 2100.

<table>
<thead>
<tr>
<th>The Renewable Energy Resource Base (Exajoules per year)</th>
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<tr>
<td>Resource</td>
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<tr>
<td>Hydropower</td>
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<td>Biomass energy</td>
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<td>Wind energy</td>
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<td>Solar energy</td>
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<td>Geothermal energy</td>
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<tr>
<td>Ocean energy</td>
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<tr>
<td>Total</td>
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</table>

- Current use is in primary energy equivalent.
- The theoretical potential indicates the amount of energy theoretically available for energy purposes, such as, in the case of solar energy, the amount of incoming radiation at the earth's surface.
- The technical potential is a more practical estimate of how much could be put to human use by considering conversion efficiencies of the available technology and available land area. To give an idea of the constraints, the estimate for solar energy assumes that 1% of the world's unused land surface is used for solar power.

Source: World Energy Assessment 2001[65]
Fossil emissions versus Renewable costs

Other challenges with Renewables

- Solar – cost, intermittency, and efficiency
- Wind – siting, and intermittency
- Efficiency – micro-benefits, operational challenges
The Solution
## Transforming the Electric Network

### Grid 1.0
- Designed 50 years ago, pre-computers, pre-telecom
- Centralized carbon-based power generation
- Limited or no communication
- Analog electrical devices
- Vulnerable to natural disasters and attack with single points of failure
- Business model designed to build more generation to meet unlimited growth in demand

### Grid 2.0
- Designed for next 50 years, leverages computers and telecom
- Distributed clean generation and storage
- 2-way real-time communication
- Digital electronic devices
- Resistant to natural disasters and attack with multiple power flows
- Business model designed to improve distribution reliability and efficiency, optimizing supply and demand
**Present Utility Actions**

*Determining what Smart/Modern Grid means to them*

*Evaluation and deployment of (primarily as point solutions)*

- Smart meters
- Distributed Energy Resources and storage
- GCC Transmission Interconnection
- Demand management systems
- Operational IT systems
- Advanced sensors

*Building business cases*

*Evaluating regulatory\market approaches for funding*
Need Holistic Resolution

- Operations Center
- Centralized Generation
- Transmission Grid
- Distributed Renewable Generation & Storage
- Distribution Grid
- Residential and C&I Demand

- Substation Automation
  - Improve productivity and reliability
- Distributed Energy Resource Management
  - Optimize underutilized renewable generation and storage resources
- Distribution Reliability
  - Protect & extend asset life
- Demand Management
  - Meet demand growth for ~1/3 the cost of new generation

Communications, Asset Monitoring & Management, Fault Location

Software Solutions

- Distribution Reliability
- Protect & extend asset life

Better Power Lines
Technology must take into consideration all aspects of supply, demand, reliability and information technology

- Integrate to legacy systems and emerging applications
- Provide a total solution from generation to the customer premise
- Provide alternatives to building central generation
- Reduce emissions and enhance environmental benefits
- Incrementally build to a smart grid enabled CLN Power Plant™
Steps to a Smart Grid

Determine the issues, categorize them and prioritize

Take one step at a time
  – Focus on the present but always walk towards the future

The Smart Grid and CLN Power Plant are built from the bottom up
  – Device integration to mine the data
  – Communications and systems to gather, monitor and manage the data
  – Information aggregation to enable management and control decisions
  – Application collaboration in order to maximize the return on investment
  – Develop operational and market interfaces to automate management and controls

Strategically use all existing systems and data in every step of the way
BPL Global’s Solution
BPLG’s Strategic View

- BPLG creates monitoring & control interfaces to the edge of the electrical distribution grid.
- BPLG coordinates the capture, transport, archiving and interrelationship of data through pervasive networking.
- Solutions are enabled with the intelligence to analyze and model the data it has captured.
- The linkage harmonizes all aspects of energy delivery and consumption into a unified management system.
BPLG Value Proposition

We view smart grid solutions as most compelling when they address the entire energy delivery value chain

- This vision directs a solutions approach utilizing a software platform with vertical applications that can cross collaborate with each other
  - Cross collaboration of vertical applications can automate responses in the electric network to enhance reliability and efficiency
  - This vision provides a competitive advantage over other companies in the sector providing single point solutions
- This approach reflects the holistic and interdependent nature of how utilities currently manage their electrical grids

Market Dynamics

- Utilities will focus investments in smart grid solutions on those areas where they have the most need and best ROI
BPLG Differentiators

**BPL Global solves specific problems of electric utilities through software-based solutions**

- Applications are ROI-driven
- Ability to cross-collaborate between applications
- Solutions are standards based, software driven and hardware independent enabling ease of integration to existing utility hardware and legacy software

**Protected Technology**

- Substation IP
- Solution IP
- Premise IP

Four patents approved  Three patents filed  One Patent approved

One patent filed  18 Copyright applications
The definition of Smart Grid requires grid operations and, secondarily, can include back office operations.

**Utility Operations**

- IBM, SAP, Oracle, Microsoft, Cisco
- Middleware and Applications
- Meter Data Mgmt, Billing, CRM

**Grid Operations**

- Substation
- Distribution Grid
- Distributed Renewable Generation & Storage
- Distribution Grid
- Residential and C&I Demand

**Back-Office Operations**

- Premises
  - Gridpoint, Microsoft, Google, GE
  - Web Portals, Energy Mgmt.
BPLG’s Enterprise Solution

Power SG Foundation is the enterprise class software platform that provides all operating functionality and services needed for Power SG applications to operate stand alone or in conjunction with other operating platforms.

- Empowers the utility with the ability to manage, monitor and control critical components of the electric network through the integration of BPLG’s vertical solutions.

<table>
<thead>
<tr>
<th>Value Proposition</th>
<th>Benefits to Utility</th>
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<tbody>
<tr>
<td>Supports targeted applications from substation to the customer premise</td>
<td>Delivers the true value of smart grid investments vs. unrelated, disconnected point solutions</td>
</tr>
<tr>
<td>Cross-collaboration between applications anywhere on your grid</td>
<td>The grid is an interconnected system and smart grid solutions can now be applied the same way</td>
</tr>
<tr>
<td>Legacy system integration</td>
<td>Power SG solutions can leverage existing utility systems for faster, cost effective deployment</td>
</tr>
<tr>
<td>A single, open enterprise class software platform</td>
<td>Obsolescence eliminated</td>
</tr>
</tbody>
</table>
Power SG Solution

*Power SG Foundation includes a set of base services which Applications use to perform their function*

- The Foundation architecture enables applications to use any or all services, operate independently or collaborate with other applications.
Existing Solutions – Generation to the Premises

- Power SG Foundation
- Integrated Distributed Energy Resources (IDER)
- Substation Automation
- Transformer Monitoring
- Asset Utilization and Distributed Energy Resource Management
- Rapid Fault Locator
- Demand Response / Demand Management
- Building Energy Efficiency
- AMI Integration and Loss Detection (Energy Theft)
- Network Monitoring and Management
OPEN DISCUSSION
AND
QUESTIONS
Power SG Foundation
Power SG Foundation

Product Description

- Power SG Foundation is the core operating software that provides all operating functionality and services needed for Power SG applications to operate stand alone or in conjunction with other operating platforms.
- Foundation uses three fundamental building blocks: Presentation, Processing and Mediation.

Value Proposition

- Distributed Service Oriented Architecture via Messaging.
- Broad based scale – large to very small.
- Easily integrate hardware devices, new applications, and legacy systems.
- Flexibly choose hosting platform and messaging technology.
- Agility, Time to Market, Hardware & Software independent, Modularity, Reusability, Loose Coupling, Interoperability.
Power SG Solution

Power SG Foundation includes a set of base services which Applications use to perform their function.

- The Foundation architecture enables applications to use any or all services, operate independently or collaborate with other applications.
INTEGRATED DISTRIBUTED ENERGY RESOURCE (DER)
Integrated Distributed Energy Resource (IDER)

Product Description

- IDER coordinates capacity and load in order to meet reliability and efficiency requirements of the distribution system within defined areas. Areas can be as large as operating regions or as small as substations, circuits or individual customer premises. The IDER offering is being jointly developed with First Energy and other customer input.

Value Proposition

- Manage the energy delivery system based on the changing conditions of the grid, whether normal, emergency or critical
- Initiate granular, targeted load control to desired area / circuit to enhance operational reliability
- Integrate and fully manage distributed renewables and energy storage devices to shift peak demand, improve energy efficiency and reliability of distribution system
- BPLG’s IDER application is the first of its kind that fully integrates distributed supply, storage, and load as collaborative resources within a definable area
Power SG Integrated DER – Status Indications

- Actual load in use for defined local area fed from meters, sensors, SCADA, etc.
- Actual load available for shed in defined local area fed from Demand Disp module
- Available resources (supply, storage, load) identified in each defined local area
- Projected state condition of local area fed by rules engine and alarm manager
- Projected operating condition based upon historical data from data warehouse and forecasts
Create resource specific programs to enact load shed, discharge battery, and/or turn on distributed supply.

Load shed action has lowered peaks to nearly required levels.

Remaining sheddable load indicated to determine available operating margin.

Battery discharged to compensate for remainder of peak period.

State condition returned to Normal mode due to actions taken.
# IDER Use Cases

<table>
<thead>
<tr>
<th>Use Case</th>
<th>IDER</th>
<th>SSA</th>
<th>Added Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Load Optimization</strong></td>
<td>End user load control and energy storage management</td>
<td>Connectivity and data access to substation metering</td>
<td><strong>Improved load optimization</strong></td>
</tr>
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<td>The ability to confirm load shed not only at the end user level but aggregate load shed at the substation level</td>
</tr>
<tr>
<td><strong>Power Quality</strong></td>
<td>End user voltage level information</td>
<td>Connectivity to substation assets such as load tap changer and capacitor banks</td>
<td><strong>Improved voltage management</strong></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>See voltage level gradients over the entire feeder and adjust substation LTC and capacitor banks to optimize voltage levels at end users.</td>
</tr>
<tr>
<td><strong>Asset Management</strong></td>
<td>End user load control and feeder storage management</td>
<td>Substation asset condition assessment such as transformers</td>
<td><strong>Improved Asset Management</strong></td>
</tr>
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<td><strong>Improved System Reliability</strong></td>
</tr>
<tr>
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<td></td>
<td>The ability to shed load granularity for operational reasons such as transformer overload or asset condition problems.</td>
</tr>
<tr>
<td><strong>Grid Efficiency</strong></td>
<td>End user power factor measurement, control and feeder storage management</td>
<td>Substation level power factor measurement and control of assets including capacitor banks</td>
<td><strong>Improved Power Factor Management</strong></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>View power factor from substation to end user. Multiple levers to optimize power factor including: End user inductive loads, Feeder storage devices, Substation devices</td>
</tr>
</tbody>
</table>
Substation Automation
Substation Automation (SSA)

Product Description

- Provides complete monitoring, control and management of substation assets and intelligent devices.

- SSA is the collection and consolidation of data from Intelligent Electronic Devices (IEDs) within a substation. The SSA product line includes hardware and software that provides a system bridge between Power SG and all substation assets.

Value Proposition

- The SSA system has the ability to process data from disparate manufacturers' IEDs and supports any IED communications protocol

- Reduce O&M costs, improves customer satisfaction through reduced outage time, offsets reduction in staffing

- Vendor agnostic approach, first hand experience, broader integration to other distribution assets through Power SG
Substation Automation (SSA) Product Family

- Substation Integration / Automation
- Transformer Monitor TMx DGA
- Transformer Monitor Temperature Management System
- Transformer Bushing Monitor System
Substation Automation (SSA) Design

275,000 substations worldwide of 30kV+

- Only 12% of utility substations are fully automated
- Some s/s have 1000’s of points/IED’s
- 80% of IED’s are protective relays
- Other IED’s: High res meters, LTC’s, Cap banks, etc.
Substation Automation Solution

**Broad and deep experience**

- 140 years of combined technical expertise
- Deployed over 320 SSA systems
- HW and SW solution involves over 25 man-years of development
- Largest IED driver library in the industry

**SCADA EXPERIENCE:**

- DNP, L&G, Con itel, Val met, CDC, IEC, others (20 total)

**IED PROTOCOL KNOWLEDGE:**

- GE, SEL, Ariva, PML, Schlumberger, Siemens, Beckwith, ABB, Cooper, JEM, GEC, PSI, others (85 total with 200+ versions)
Why Automate Substations

Improved Reliability and Cost Reduction

- **PEPCO**
  - $4.5Mil investment automating 700 distribution feeders in 100 substations saved $8.0M annually by remotely controlling 1500 feeder capacitor banks
  - All relays are now SCADA controlled and outages are minimized during storm conditions (Many industrial clients have outage penalty clauses)

- **LADWP**
  - Load history on multiple feeders enables safe and proper reaction when a transformer on one feeder fails. Decision can be made quickly if one other feeder can take on extra load or if more feeders needs to be utilized as well therefore reducing overall outage magnitude
Why Automate Substations

Improved Operating and Maintenance Efficiencies and Lower Maintenance Costs

- **LADWP**
  - Capacitor bank short circuit was tracked down in 4 days due to SA data. Former process would have taken up to 4 months.
  - Substation ground fault source was determined in hours due to SA data. Former process would have taken days.
  - SCADA system integrity improved enabling faster decisions on customer outages.

- **PEPCO**
  - Maintenance management systems from Maximo and EPRI now receive smart relay data automatically. Large reduction in maintenance response times.
Transformer Monitoring
Transformer Monitoring

All Transformers fail!

The Question is HOW (catastrophically or not) and WHEN (probability of failure)

USA, near Phoenix
Transformer failures can be devastating

- 520 MVA GSU Transformer
- $6.0 million replacement cost
- $0.5 million environmental cleanup
- $1.5 million/day spot market buy
- $18 million loss in eight days!!
- 24 months replacement time
Factors Leading to Transformer Failures

William H. Bartley, P.E.
The Hartford Steam Boiler Inspection and Insurance Co.

- Lightning
- Through Faults
- Insulation Deterioration
- Inadequate Maintenance
- Moisture
- Loose Connections
- Workmanship
- Overloading
- All Others

- Fortunately, most failures can be prevented with proper condition assessment.
Monitoring of Gases in Transformers

Gas originates from many places:

- Conductor paper insulation
- Mineral insulating oil
- Pressboard barriers
- Other materials

Gas generation is related to high material temperatures (150°C to 1,000°C)

Gases are symptoms of:

- Poor design or construction
- Too much electrical stress
- Too much thermal stress
- Too many short circuits
- Overall poor condition
Transformer Monitoring

Product Description

- BPLG’s Transformer Monitoring solutions monitor and control the most expensive and critical assets in the substation – the power transformers. Anchoring the line is our TM8/TM3 online Dissolved Gas Analysis (DGA) monitors.

Value Proposition

- Avoid transformer failures (No transformer has ever failed with our system attached)
- Lower Maintenance Costs (Enables a condition based maintenance strategy)
- Defer Capital Expenditures (Extend transformer life)
- Four patents in place and one patent pending
- Near real-time information on the internal state of the power transformer
- Lab quality DGA analysis of all 8 IEEE/IEC fault gases, condition based assessment, correlates fault gases to transformer load, identifies most critical transformer fault types, provides insight into fault diagnostics.
- Highly accurate, fast, advanced correlation and fault diagnostics
- Largest installed base of multi-gas monitors worldwide
DGA Capabilities at the Transformer

Data is collected via automated, closed-loop GC

- Leverages accepted science
- No risk of human intervention
- Repeatable sampling technique
- No atmospheric exposure

Data collected up to hourly

- Faster, more precise determination of trends & events
- Important in characterizing size and frequency of faults
- Visibility to dynamic behavior of gases related to loading

All 8 fault gases + moisture are monitored and correlated with oil temperature and load
## Fault Gas Indications TM-8/TM-3

<table>
<thead>
<tr>
<th></th>
<th>H₂</th>
<th>CO</th>
<th>CO₂</th>
<th>CH₄</th>
<th>C₂H₂</th>
<th>C₂H₄</th>
<th>C₂H₆</th>
<th>O₂</th>
<th>H₂O</th>
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</thead>
<tbody>
<tr>
<td>Cellulose</td>
<td>✔</td>
<td>✔</td>
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<td>Mineral oil</td>
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<td>Leaks in oil</td>
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<td>Thermal faults -</td>
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TM-3
Case Study #12 Analysis

The Duval Triangle is a DGA tool included in the IEC 60599 Gas Guide.

Rogers Ratios are included in IEEE 57.104 Gas Guide (similar to Basic Gas Ratios in IEC-60599)

- Both the Duval Triangle and Rogers Ratio analysis shows the fault condition is in T2 indicating a thermal problem getting worse in the range of 300°C to 700°C
- Combustible gas levels were rising very quickly, exceeding preset rate of change limits. Transformer load reduction began approximately 32 hours after levels began to change and was fully de-energized within approximately 52 hours
- Root cause; Overheating of LV crimped connections caused by the combination of high eddy losses in the crimps & over-insulation + poor oil circulation in crimped bundled areas
Case Study #12 result

North American nuclear power plant taken off-line within 52 hours of alarm by Serveron Transformer Monitor
Rapid Fault Locator
**Rapid Fault Locator**

**Product Description**

- Part of the Reliability Suite within the PowerSG portfolio that offers fine-grained power distribution monitoring.
- Uses multiple Power SG modules including an advanced rules engine and grid based sensors to identify, alarm and trigger responses to asset and circuit conditions that have surpassed thresholds set by system operator.

**Value Proposition**

- Any device that is “seen” by Power SG can be used as a sensor by the rules engine.
- Captures and executes user-defined business rules over large amounts of data flowing in from the power line instrumentation. Observes patterns of exceptions in the data and creates notifications for specialized handling.
- Events can be used for email alerts, topological correlations, or other device control tasks when integrated with other Power SG applications.
- Flexible rules engine easily customized by the energy operator.
Rapid Fault Locator

Rules Engine

Establish Rules

Fault Notification

Alarm Manager

Corrective Action

Fault Identification

Device Tracker

PSG Applications

Impact Assessment

Network Mgmt & Mon
Demand Management

Product Description

- Enables the energy operator to shape demand through precise direct load control in residential, business and multi dwelling unit facilities.

Value Proposition

- Solution patent submitted in March 2007
- Real time control and aggregation of small loads with specific attributes allows for granular management of energy delivery system
- Prioritized management by load attributes allows load to be dispatched in support of greatest network need or market opportunity
- System manages premises temperature to customer specified thresholds without the cost or burden of thermostat replacements
- Verifiable load shed; does not require thermostat or meter replacement
- Demand is a resource and collaborates with other Power SG solutions
BPL Global Deployed Demand Dispatch

- Enabled through a two-way communication wireless mesh network or through a premise gateway
- Any load within the premise that can be measured and controlled can be included in the Demand Dispatch program
**Demand Dispatch Dashboard**

- Measures actual load in real time for all devices under management.
- Indicates load available for shed by considering individual service level agreements.
- Manages load shed at precisely the desired levels for the entire duration of the shed event.
- Indicates types of load being shed.
- Indicates load shed targets and monitors real time status of load shed event.
Building Energy Efficiency Solutions
EasyGreen®
**Building Energy Efficiency**

**Product Description**

- Real-time monitoring and analysis of electric use, hot water consumption, indoor and outdoor air temperature provides a live view of the total energy envelope and resource consumption for each building and each unit within it. Includes control capability for those devices that are controllable.

**Value Proposition**

- Real-time usage monitoring for detection of losses and abnormal consumption
- Customizable usage and cost thresholds to trigger alarms
- Historical views of consumption provide up to date analysis of total, average, aggregated usage and identifies any deviations from normal consumption patterns
- Support multiple in premise devices, sensors and communications technologies
- Hosted end to end service
- Integration with all other Power SG solutions and in building communications
Building Energy Efficiency

Vendor independent solution - devices, sensors and comms

Monitor, manage and control at multiple levels – city, building, unit, room

- Electricity Use
- Hot and Cold Water consumption
- Temperature (Indoor, Outdoor-monitor only)
- HVAC and many others

Roll up energy and water resources to city wide demand, IDER and water management programs
AMI Integrator and Theft Detection
AMI Integrator & Theft Detection

Product Description

- Integration with metering and 3rd party communications systems for non-critical load management and import of 3rd party AMI system data to other Power SG™ application suites.

Value Proposition

- Enables utilities to identify energy theft (non-technical loss) at a very granular level
- Turns meter into an outage sensors for Network mgmt & fault location
- Granular restoration during Islanding, etc.
- Firms meter assets by leveraging all other Power SG applications
Integrated AMI Data Enhances Applications

Any Power SG Application can make use of meter data

- Display Meter details through NMM
- Shed meter based load or devices through Demand Dispatch
- Utilize meters as sensors via RFL
- Identify Energy Theft through theft detection reports
- Firm meter assets with renewables using IDER
- Show alarms, events, location though alarm manager
Overview

**BPL Global (“BPLG”) can assist in managing and controlling energy consumption in commercial and industrial facilities**

- By leveraging BPLG’s **PowerSG™ enerVIEW™** technology, plant managers can:
  - improve operating results by visualizing and managing energy consumption
  - reduce energy consumption by 10 - 20%, on average, by focusing on industrial equipment, HVAC, lighting and distributed resources

**BPLG’s applications target on-site generation, energy storage and plant energy assets**

- **PowerSG™ enerVIEW™** monitors and control assets within plants and implements demand management (load management based on priorities and order)

**BPLG is currently monitoring and controlling 475 megawatts of commercial and industrial load**
enerVIEW™ has connected to....

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<th>Power Meters</th>
<th>Control &amp; Energy Systems</th>
<th>Engines</th>
<th>Microturbines</th>
<th>Data Collectors</th>
<th>Solar Systems</th>
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**CENTRYwcc – The Plant Level Gateway**

- **Eight Discrete Inputs**
  - Meter Pulse Inputs

- **Secure VPN Connection**

- **Eight Discrete Outputs**
  - Addressable Individually

**CENTRYwcc**

- **Advanced Meters**
- **LAN Access**
- **Electrical Distribution Monitoring**

**Plant Systems:**
- Lighting
- HVAC
- Hot Water
- Steam
- Process Equip.

**Plant Systems:**
- **Plant Instrumentation**
- **Energy Distrib. Systems**
- **Plant DCS & EMS Interface**

77
enerVIEW™ Delivers Value

Value

A 10% to 20% reduction in energy consumption and reduced down time.

Benefit

The user benefits from increased visibility and control of energy systems; allowing continuous commissioning, optimized operation and increased reliability.

Action

Action is based on the information. New energy saving technologies can be tested and verified using real-world baseline data.

Information

The data is analyzed and or modeled, it is then presented in a manner that is meaningful to the operator.

Data

Operating data is captured from energy consuming and producing equipment across the enterprise.
Site Overview Screen From Actual Deployment

- Boiler System
- Chiller Systems
- Cooling Towers
- Compressed Air System
- Purified Water
- Potable Water
- Treated Water
- Wastewater Treatment
Communications
Communications network for successful Smart Grid deployment

3 area networks within the Smart Grid communications scheme:

- **The Home Area Network**: The short range network providing communications between devices installed inside the customer premises.

- **The Access Network**: The mid-range distance network providing communications in the LV grid area; typically between MV/LV transformers and homes.

- **The Aggregation Network**: Aggregates communication paths and data streams from the various Access Networks up to the utility computation site and provides communication with the utility System Information.
Communication network for successful SmartGrid deployment

Differentiators of BPL Global’s solution:

For each area network, BPLG is able to implement various technologies while offering centralized control and monitoring at the utility operation center.

For each area network and depending on the field constraints as well as the targeted services, BPLG elects the most suitable combination of communication protocols and technologies.
Network Expertise Diagnostic

Modules include provisioning, monitoring, trouble ticketing

Broadband Services Diagnostic

- High Speed Data
- VoIP
- Cable infrastructure

Manages multiple technologies

- Backbone, IP Cable, Power Line, Wireless, FTTH Diagnostics
BPLG Superior and Adaptative solution

Example of hybrid design that makes use of different access technologies while offering aggregation at the utility location for centralized storage and computation.
Network Monitoring and Management
Network Monitoring & Management

Product Description

- Power SG Network Monitoring & Management is the presentation component of all utility applications using PSG Foundation. Not sold as standalone application – bundled with Foundation
- Power SG Network Expertise Monitors all forms of communications systems (e.g. wireless, fiber, DSL, cable, BPL, PLC) through an organically developed NMS network management system

Value Proposition

- Manages multiple communications technologies, protocol independent
- GIS and Logical view capable
- Enhanced communications diagnostics
- Low cost, ease of integration, includes enhanced diagnostics for BPL
Power SG Network Monitoring & Management

Multi-Driver Network Management System
- Designed for SNMP v3, DNP3, ModBus, & any proprietary

GIS Integration
- Map grid sensors directly onto grid map via lat/long coordinates
- WMS Server Compatible v1.1.1

Map Zoom/Drill down
Polling & Trap Based Outage Determination and Isolation
Visual Outage Indication