

# Optimizing the Performance of Smart Grid Technologies

Location Intelligence Improves Service and Reduces Costs  
in Advanced Customer-to-Network Relationship Management

WHITEPAPER:  
UTILITY

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### ABSTRACT

LOCATION INTELLIGENCE IN SMART GRID SOLUTIONS PROVIDES UTILITY COMPANIES WITH REAL-TIME DECISION SUPPORT SYSTEMS THAT CAN HELP PLAN, MANAGE, PREDICT AND MAKE DECISIONS WITH GREATER ACCURACY—AT LOWER COSTS. IN THE END, LOCATION-BASED TECHNOLOGIES WILL HELP UTILITIES UNLOCK THE VALUE OF FACILITY, LAND-BASE, CUSTOMER AND ENVIRONMENT DATA TO ENABLE THE SMART GRID, HELP ENSURE A BETTER LEVEL OF SERVICE AND BUILD PROFITABLE CUSTOMER RELATIONSHIPS.

## ADOPTION OF LI HELPS OPTIMIZE SMART GRID PERFORMANCE FOR MAXIMUM SERVICE AND OPERATIONAL EFFICIENCY.

Utilities are increasing investments in Smart Grid technologies and smart metering projects. This is being driven by the rising demand for electricity (particularly in developing economies), aging T&D infrastructure in developed countries, emissions and climate change mandates, and the need for real-time visibility of energy supply and demand to optimize both service reliability and cost. Government regulations and incentives are contributing to this rising investment. Interest in alternative energy sources and Smart Grid infrastructure in numerous countries around the globe is another contributing factor.

In North America alone, the U.S. Department of Energy is providing \$3.4 billion in stimulus grants for Smart Grid projects. This represents the largest single energy-grid modernization investment in U.S. history.

### Smart Grid Technologies 101

A Smart Grid is made up of many technologies that work together in an integrated solution to improve overall utility performance. Smart Grids provide a clearer, more detailed and more actionable view of the utility's service area from the enterprise level right down to that of the individual customer. Using this view, utilities can optimize the performance and management of electric transmission and distribution networks, thereby improving service reliability, reducing costs and increasing energy efficiency.

The components of a Smart Grid include technologies such as smart meters that provide advanced measurement of energy usage, integrated communications systems, sensors, distribution management systems, supervisory control and data acquisition (SCADA) and advanced

metering infrastructure (AMI). The intended sum of these parts is a Smart Grid solution that provides real-time decision support systems. These systems can analyze the network, determine the current state and condition of the utility's system and predict what may happen over time. In the event of a disrupting incident, the systems respond accordingly by communicating the state of the system from the sensor network to both the utility and the customers.

### Location Intelligence in Advanced CRM Solutions

With so much interest in these "smart" technologies, it is important to understand what they are, how they work and how to optimize their performance for maximum customer service and operational efficiency. In particular, understanding how important location intelligence can be in making Smart Grid technologies even smarter is essential to getting the most out of these enterprise-level investments.

For utility companies, the adoption of location intelligence in advanced customer relationship management (CRM) solutions can aid Smart Grid technologies and reduce cost-to-serve in very specific ways:

- Provide a standardized and validated enterprise-wide view of customer information—including accurate customer locations in relation to the electric utility system
- Maintain true spatial accuracy, alignment and integrity between the spatial referenced data overlays such as land base data, network data and customer data
- Enable geographical visualization of the electric utility system's relationships, connections and patterns
- Display the real-time status of the grid on an interactive map—and highlight where the system status is changing

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### CASE IN POINT:

#### ADDRESS-POINT INTERPOLATION FOR GREATER ACCURACY

Advanced geocoding technologies now use address-point interpolation to improve upon regular street-segment interpolation. An address-point user dictionary inserts point data that enables addresses to be geocoded at the correct property location rather than just to the approximate location on a street segment. With this level of specificity, property records and accurate parcel boundary definitions can then provide both important ownership information and an accurate geographical representation of the connection between the customer and the electric network.

The map below shows a customer location at 762 4th St., Niagara Falls, NY. An accurate point level geocode of the

customer's address is represented by the green push pin on the map, along with property boundaries, and connectivity to the Smart Grid network represented by the red lines. The map also displays the location of other geocoding precision matches to demonstrate the difference in geocoding precision for every address that is entered. The blue pushpin represents the street segment interpolated location, which places the address three properties to the south of the actual property. The yellow pushpin represents the zip9 location.

As you can see, address-point interpolation markedly improves site accuracy.



## UTILITIES NEED AN ACCURATE GEOGRAPHICAL REPRESENTATION OF THE CONNECTION BETWEEN CUSTOMERS AND THE ELECTRIC NETWORK.

- Provide enterprise risk management (ERM) and real-time analytics for system restoration, storm tracking and security monitoring
- Enhance market-driven network planning with spatial analysis to help determine the most cost-effective and profitable design of the Smart Grid
- Increase the efficiency of customer service on-boarding

### Enterprise Wide View of Customers with Accurate Customer Locations

Integrated communications systems such as CRM solutions help utilities perform critical tasks related to the acquisition, development, service and retention of their customers. In order for a Smart Grid system to provide and apply the consistent, single view of a utility's customers across an enterprise CRM, complete and accurate customer information is crucial.

An address quality system is needed to accurately locate customers geographically and in relation to the electric network in order to accurately represent those customers as connections to the electric grid. Only then can the Smart Grid optimize the automation of system management and restoration to improve reliability, reduce costs, drive energy efficiency and empower consumers. This is one of the areas that location intelligence comes into play.

Location intelligence can help improve the quality and specificity of customer addresses, which in turn improves effectiveness in billing and cash flow, service delivery and customer relationships. Location intelligence solutions enable address cleansing and geocoding (assigning a latitude and longitude to an address), support address validation, postal certification, standardization, correction and geocoding both in batches and/or real-time as data is being entered into customer care and billing systems.

Location intelligence is also a key component in many enterprise information management (EIM) strategies.

Data quality plays an important role in service optimization, network planning, customer service and operations. Utilities must have an enterprise data quality system that enables them to leverage the most up-to-date, accurate and complete view of customers across the organization.

Location intelligence based, customer data quality and integration technologies improve the completeness, validity, consistency, timeliness and accuracy of customer data. These technologies can auto-correct data-entry errors by employees and customers and other inconsistencies that otherwise contribute to data-quality problems.

Overall, they support the execution of five best practices in quality-assurance processes. Having customer data that is accurate, complete and up-to-date enables utilities to better understand their customers, provide a better level of service and reduce cost-to-serve.

#### Location intelligence supports best practices across all stages of data-quality management:

- Data Profiling
- Data Governance
- Back-End Cleanup
- Interactive Processes
- Maintenance

The most advanced location intelligence enterprise data quality systems are based on a service-oriented architecture (SOA) and provide a graphic-rule editor interface. With these systems, utility employees do not have to write any code to customize business processes to their specific needs. Systems are designed for quickly addressing issues of data quality and such problems as reconciliation errors and

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reporting incompatibilities. This bolsters confidence in the accuracy and reliability of Smart Grid performance. In turn, this enables the utilities that use these systems to better promote energy-saving choices for consumers and foster the growth of renewable energy sources.

System capabilities are another important consideration. Data no longer has to be sent from vendor to vendor for different quality improvements and content enhancements. A single, smart location intelligence system can perform an entire range of tasks:

- Name Parsing
- Name Standardization
- Name Validation
- Unique Entity Identification
- Address Cleansing
- Geocoding
- Data Consolidation
- Geography Code Assignment
- Tax Jurisdiction Assignment

### Maintain True Spatial Accuracy, Alignment and Integrity Between Land Base, Network Facility and Customer Data

Powerful location intelligence/geographic information system (GIS) software enables utilities to map the accurate location of network assets in relation to a land base and customers through their completed engineering life cycle model, from point of conception to retirement. This is a particularly important capability for Smart Grid systems that automatically control the electric distribution system. These automated systems require true spatial accuracy and alignment as well as integrity between spatial-referenced data overlays such as land base network facility and customer data.

These tools are also invaluable in correcting older facility maps to make them GPS-compliant and align them with newer and more geographically-accurate land base maps. Without advanced tools to automate the realignment of the facility data to an accurate land base, this process can be time-consuming and labor intensive. However, location intelligence/GIS spatial data-management systems can store, manage and serve the geographic objects and all the historic and real-time data about the system assets from Smart Grid meters and sensors. This makes managing corrections easier and enables utilities to more effectively optimize core Smart Grid components when their network assets are accurately mapped, stored and maintained.

### Enable Geographical Visualization of the Electric Utility System's Relationships, Connections and Patterns

Comprehensive location information systems (LIS) are the source for network asset and land-base geographic information. LIS solutions are integrated into such core utility systems as:

- Outage management
- Distribution management
- Workforce management
- Customer service
- Enterprise asset management (EAM)
- Network planning
- Advanced metering infrastructure (AMI) enabled billing
- CRM systems

LIS mapping and spatial analysis capabilities can be accessed using desktop applications, Web-based applications and mobile-device applications via secure client-user interfaces. Web 2.0 geospatial "mash up" map tiling frameworks, such as MapInfo® Stratus™, Microsoft Bing Maps, and Google Earth solutions are among the latest implementation frameworks that can be used to view, analyze and manage geographically based

## INTEGRITY OF SPATIAL-REFERENCED DATA OVERLAYS LIKE LAND BASE, NETWORK FACILITY AND CUSTOMER DATA IS CRITICAL.

network-asset and customer information and the relationships that exist between them. Even more powerful geospatial capabilities can be integrated into these frameworks from advanced LIS/GIS platforms.

The most advanced platforms provide the ability to fully illustrate and analyze the relationships, connections and patterns in the Smart Grid, thereby enabling utility company leaders to make better planning and operational decisions for their customers. They also provide a powerful means for visualizing and analyzing the spatio-temporal trends of the Smart Grid system metrics over time.

### Monitoring and Tracking System Performance in Real Time

Most electric utility systems today are able to determine little about the health of the system outside of the main supply substations. Most distribution transformers are not monitored and can fail if they rise beyond capacity. And most outage management system (OMS) solutions reactively determine outage locations using prediction engines based on consumer phone calls and network models.

The Smart Grid, however, can enable a more-advanced integrated outage management system and distribution management system (OMS/DMS) to analyze and optimize network performance and identify, respond to and resolve power outages quickly with significantly less impact to customers.

Integrating such advanced technologies as location intelligence and automated meter reading (AMR) with OMS/DMS and workforce management systems can enable the automatic pinging of customer meters to quickly detect if and where there is an outage. Location intelligence linear referencing and dynamic segmentation capabilities found in web-based mapping application development tools and solutions can be used to even more accurately determine the location of a fault by measuring the optical distance along the fiber. Such a system can show a real-time view of location-dependent critical network elements on an interactive map and automatically highlight where status is changing. This system will communicate real-time network status, network quality and trouble tickets issued to service and support representatives across the organization. This in turn can significantly improve outage response times and enhance customer service.

### ENABLING YOUR DATA GEOGRAPHICALLY



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### KEY BENEFITS OF WEB 2.0 GEOSPATIAL SOLUTIONS

- Accurate and aesthetically appealing land-base maps with easy data refreshes
- Hundreds of terabytes of aerial and satellite imagery for better spatial context
- Map tiling to enable caching land-base and network assets for superior map display performance and interactivity
- Desktop user experience over the Web through Flash, Silverlight and JavaScripts, OpenLayers, Mash-Ups and Ajax for partial-page updates
- The ability to use any combination of pre-rendered map tiles, dynamic data feeds (e.g., point data) and web map service (WMS) image servers to create composite maps and deliver real-time and customized information and analysis for individual users
- Flexible standards-based location intelligence web services service-oriented architectures (SOAs)
- Flexible map tiling frameworks client-side JavaScript application programming interfaces (APIs) that enable quick and easy integration of rich web-based geographic capabilities into client applications

Using location intelligence capabilities, the entire network and its status can be viewed at any moment to instantly identify developing problems, locate the nearest repair crew, and reroute repair personnel to exactly where the outage is located. This is made possible by easily visualized, actionable intelligence from the sensor network and the smart meters about outages, restoration, load, events, voltage, current, equipment failures and other potential issues detected along the distribution network.

### Enterprise Risk Management and Real-Time Analytics for System Restoration, Storm Tracking and Security Monitoring

The DMS provides the automated engine to analyze and optimize the distribution network using location intelligence. The Smart Grid will optimize distribution based on easily visualized, actionable information from thousands of sensors and the smart meters after an abnormal event to prevent equipment failure and outages. The Smart Grid will also take preventive measures to mitigate risk based on current and historical intelligence about load and the condition of network components, such as transformers. Smart Grid algorithms that incorporate spatial analysis will be part of a decision support system that can help determine risk and potential customer impact and recommend preventive measures.

Electric utility providers also need to assess, understand and mitigate the effects of many different types of risk, including weather, crime, terrorism, political, financial and regulatory related risk.

By integrating real-time weather monitoring system (WMS) web service feeds into their location intelligence system capable OMS/DMS, utilities can view weather occurrences in real time in conjunction with their network assets,

## ACCURATELY MAPPING, STORING AND MAINTAINING NETWORK ASSETS CAN OPTIMIZE CORE SMART GRID COMPONENTS.

their customers, and their repair crews and supplies to see what is actually happening at their asset locations. Real-time and projected hurricane paths can be mapped and analyzed to show the probability and estimated magnitude of hurricanes in relation to electric systems and customers. And utilities can make better decisions regarding the management of both large-scale and localized weather disruptions.

Data on both historic and current weather, wild fire, earthquake, political and crime risk is also available for enterprise risk analysis. This data can be analyzed using location intelligence for long-term planning to better understand the potential risk:

- By better understanding the potential for loss or interruption based on historical knowledge of wild fires, earthquake fault lines and zones, and weather data on previous hurricanes, hail storms, wind events and tornados, utilities can better anticipate the effects of new events
- Crime risk data can be analyzed to locate the safest areas for company assets and ensure employee safety and security
- Using location intelligence, electric utility providers can access data that models the risk of terrorism to create action plans or establish “what-if” contingency plans

Overall, access to such vital data helps providers make important decisions on:

- Re-allocating assets/resources, controlling liabilities and securing network infrastructures to prevent potential outages
- Establishing priorities for service restoration

- Determining optimal locations for new assets to minimize structural and employee risk

Underground electric utility lines are prevalent, and digging can disrupt critical utility services and result in personal liability, expensive repairs, costly delays, potential injuries and property/environmental damage. Location intelligence based call-before-you-dig (CBYD) systems enable utilities to greatly increase the efficiency and effectiveness of underground plant protection.

In these systems, dig requests are interactively geocoded and a spatial query determines whether the geocoded dig location is within a safe distance from any underground facilities. More advanced geocoding technologies use address point interpolation to pinpoint the dig location. Property records and accurate parcel boundary definitions enable advanced location intelligence based systems to identify which, if any, part of the property at the specified address is within proximity of harm, as well as provide ownership information. This safety verification results in reduced expenses for operations and CBYD-center overhead, lower risks of fiber cuts and more satisfied customers.

### Building a Smarter Grid

Location intelligence provides the tools to help determine the most cost-effective and profitable design of the Smart Grid. It models alternative builds-out as driven by customer needs:

- Location intelligence helps to determine the optimal location for such Smart Grid components as new communication backbones, repeaters and sensors. Thematic mapping can be used to visualize the geographic patterns of market potential in relation to the grid.

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- Location intelligence based predictive-analytic models can be used in customer profiling and segmentation solutions to predict which energy consumers are likely to pay for renewable energy and fund renewable energy sources. These solutions can integrate relevant service provider and third-party data and determine the drivers and patterns of green adoption within customer and prospect data. Scoring algorithms can be included in the models that score customers and/or prospects on the propensity to adopt alternative energy.

Optimization depends heavily on the relationships between existing location based infrastructure, customers, land base and environmental factors. Location intelligence provides an effective means to help see where network investments are needed and determine how much capital is required for build-outs.

### Increasing the Efficiency of Customer On-Boarding

Location intelligence capabilities can be integrated in Smart Grid advanced metering infrastructure (AMI) to enable billing to improve to improve customer on-boarding.

With location intelligence, the Smart Grid can determine all the pertinent information required for successful service activation at the customer's location. It can also correlate customer sites with network service offerings and provide near real-time spatial-enabled decision support. The on-boarding process involves customer information cleansing, standardization and geocoding; customer identity verification and fraud protection; tax jurisdiction assignment; and utility information assignment. These capabilities are integrated into front-end onboarding processes, including CRM applications and web sites and are implemented using customized rules that are published as Web-services using modern service-oriented architectures.

Enterprise tax management (ETM) systems can be integrated in AMI-enabled billing systems to assign more accurate sales and use tax to cover franchise fees for each customer. To produce more accurate sales and use tax determinations for customer billing processes, advanced ETM systems use address standardization and address-point geocoding coupled with special tax district and municipal boundary datasets. They can assign tax jurisdictions on a batch basis and/or real-time as data is being entered into customer care and billing systems.

### Summing It Up: The Case for Location Intelligence

Location intelligence in Smart Grid solutions provide utilities with real-time decision support systems that help plan, manage, predict and make decisions with greater accuracy—at lower costs. Today, location-based technologies can help utilities unlock the value of facility, land-base, customer and environment data to enable the Smart Grid to ensure a better level of service and build more profitable customer relationships.

Utility companies new to Smart Grid technology should make location intelligence a must-have component of their Smart Grid implementation—and utility companies who have already invested in Smart Grid technology should take a close look at how location intelligence can make their Smart Grid more efficient, accurate and effective in improving operations.

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FOR THE PAST 25 YEARS, LEADERS IN THE UTILITY INDUSTRY HAVE GROWN PROFITS USING OUR SOFTWARE AND SERVICES TO LOCATE, CONNECT AND COMMUNICATE WITH CUSTOMERS. TO LEARN MORE ABOUT EMERGING TRENDS, CALL 1.800.327.8627 OR VISIT [WWW.PBINSIGHT.COM](http://WWW.PBINSIGHT.COM).

## WITH LI, THE SMART GRID CAN DETERMINE ALL PERTINENT INFORMATION REQUIRED FOR SUCCESSFUL SERVICE ACTIVATIONS.

Every day, electric utilities must acquire customers more effectively, find hidden market potential, maximize ROI, boost retention rates, optimize networks and deploy new revenue generating services—all while relentlessly cutting costs. This becomes increasingly challenging with today's technology advances, greater dependence on the Internet and growing customer expectations for more personalized service.

At Pitney Bowes Business Insight, we offer solutions to help you meet these demands. Our solutions focus on three main areas:

- Serving the customer
- Streamlining operations
- Reducing enterprise risk

These solutions allow us to help you meet customer expectations, reduce costs and flourish in an increasingly competitive business environment, while locating, connecting and communicating with your most important asset: your customers.

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FOR MORE INFORMATION VISIT [WWW.PBINSIGHT.COM](http://WWW.PBINSIGHT.COM) OR CALL  
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