Enterprise GIS: Addressing Utilities' Key Performance Indicators

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An ESRI White Paper

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Introduction

Utilities implement enterprise GIS because nearly every key process involves location. Enterprise GIS reduces utility costs, improves decision making, enhances collaboration and communication, and ultimately closes the gaps in the utility's strategic performance targets. This paper will focus on how utilities can use GIS for nearly every aspect of their mission and how the latest developments in GIS fully support the critical activities of utilities.

Each utility company is unique. Each suffers from various natural challenges, from hurricanes to snowstorms to earthquakes to wildfires. Each region has its own regulatory and political environment. Some countries have a single state-owned utility; others have a combination of investor-, state-, and consumer-owned utilities. Some serve wealthy, demanding customers while others serve abjectly poor communities. Some utilities have a single strong union; others have many weaker unions or none at all. Despite these differences, all utilities have the same four critical stakeholders: shareholders, customers, communities, and employees.

Stakeholders

It's common for utilities to craft their performance metrics as a balanced scorecard. The scorecard records the metrics of mission-critical activities. Boards of directors measure executives' performance based on how well the company meets these metrics. The scorecard can be visualized as four quadrants, each quadrant representing one stakeholder. A successful utility attempts to balance its attention to all four areas. If money were no object, that would be easy. Since one of the quadrants of the balanced scorecard is shareholder (financial), it is critical that a utility not spend more than it can afford. Cost-cutting measures, such as staff reductions, elimination of overtime, and reduction in funding for emergency responses, often negatively impact customer service. They also negatively impact employee morale and, more often than not, result in undesirable political and community consequences.

Even though most utilities strive to maintain a healthy balance, some areas of the scorecard may be in a better position than others. For example, a utility may have a good community record, but its service order process is archaic. It may be well managed financially but consistently suffers from frequent outages, especially compared to other utilities in the region that are exposed to the same weather conditions. The ideal situation is to show improvement for all of the stakeholders at the same time. How is this possible? Improving customer service may cost more money. Improving regulatory reporting could stress the employees. Increasing training for employees takes them away from their jobs serving customers.

It is possible by leveraging technology and by cleaning up old legacy processes. Consider this technology and process improvement opportunity: Let's say the utility is falling behind in meeting new requests for service. It has to cancel customer meetings with

contractors. It has to reschedule crews over and over again. Employees get hassled by irate developers and customers. Complaints are piling up from the public utilities commission. Managers are busy writing excuse reports. The company is spending a lot of money on overtime just to keep up with the workload. Each stakeholder is unhappy.

So what's the solution? Add more people? Have people work longer hours? Probably not. Just by organizing the work properly and having ready access to geographic information system (GIS) facility data, utilities can shorten design time, pre-stage material, reduce travel time to projects, and make and meet appointments. Companies have found that by using GIS for intelligent routing of projects, they save 10 to 15 percent on travel time alone. Customers get their service when they expect it, employees feel better about their jobs, and the company spends less on overtime. Complaints to the public utilities commission go down. Executives, managers, and supervisors spend a lot less time explaining why things get so confused.

GIS integrated with utility IT systems, such as enterprise resource planning (ERP), SCADA, and outage management systems, coupled with some process improvement, can positively impact each of the four stakeholders. The following are examples of typical utility metrics:

- Shareholder
  - Total shareholder returns (investor-owned utilities)
  - Reduction or stabilization in rates (municipally owned utilities)
  - Profit redistribution (rural electric co-ops)
- Customer
  - Total time to complete new customer connections
  - Improvement in reliability statistics
  - Communication of when power will be restored
  - Response time to gas leaks
  - Improvement in customer satisfaction surveys
- Community
  - Reduction in hazardous liquid spill notification time
  - Time to settle a rate case
  - Reduction in number of complaints to the local regulatory body
- Employee
  - Reduction in reportable injuries and motor vehicle accidents
  - Increase in employee training
  - Improvement in employee satisfaction

Since GIS can integrate and visualize data so well, it can be used to help utilities maintain balance by dealing with the various drivers they must control.

Shareholder Drivers

Utilities must meet the demands of the shareholder: the investor, the mayor's budget office, the rural electric cooperative board, the state government, the ministry of energy,

the president, the king, or the sultan. The key business driver is, of course, the financial performance of the utility. The simple metric for an investor-owned utility is earnings: Did the utility make or lose money? Other business factors are the cost of service. A utility that makes money but charges high rates will likely be scrutinized, so rates are another key utility metric. Keeping rates low, or at least reasonable, is important.

GIS can be a key enabler for productivity improvements as in the example of implementing crew routing for new customer connections. These impact the bottom line.

Some other key business drivers that are impacted by application of GIS are

- State of the Industry

  Is the country privatizing a state-owned utility? What is the situation regarding deregulation? How will the utility survive unbundling? These are issues where GIS can assist the utility by organizing service areas, rates, tax burdens, facility inventories, and losses.

- Merger and Acquisition

  How will the utility deal with being acquired? Utilities that have an enterprise GIS in place can be more attractive partners since their assets are fully documented. If the acquiring utility has easy access to the proposed acquired utility's condition data from the target company's GIS, it will have the right information to properly valuate the target utility. This will ultimately result in a better merger deal for both companies. Merger activities are expensive. Having ready access to the inventory of the transmission and distribution assets, along with an assessment of the condition of the assets, will save time in the due diligence process, allowing the acquiring utility to fairly assess the value of the acquisition and the acquired utility to earn a fair price for the assets.

- Revenue Protection

  Sadly, people steal electricity. In some countries, utilities collect revenue for only 50 to 60 percent of the power they generate. GIS is an effective tool to communicate areas of significant concern about theft of the commodity.

- Productivity

  Are the crews productive? Do utilities know where their crews are? How much do they cost? GIS, especially mobile GIS, creates enormous opportunities for tracking workforce productivity.

- Production and Energy Supply

  Do utilities have a good process for producing or procuring energy at the lowest cost? GIS can enable utilities to effectively site power generation equipment or even manage the facilities in a large nuclear power plant.

GIS can bring a new focus to financial data by showing views of the relationship between investment and customer satisfaction.

Customer Drivers

Utilities must meet the demands of customers. That means that lines and pipes are maintained, leaks are fixed in a timely fashion, and power failures are few and resolved quickly. Since utilities are capital intensive, good advance planning for expansion is critical. GIS can help by viewing regional demographics in relationship to utility assets.

Other key customer service drivers are

- Billing

  Are bills accurate and timely? GIS can route meter readers and identify areas where meter reading is difficult.

- Asset Management

  Does the utility coordinate maintenance with replacement to avoid service interruption and meet service requests? GIS data is critical for outage determination.

- Design Process

  Are there simple processes in place to manage engineering and design processes to enable good asset management and meet emerging customer load? GIS is the tool of choice for utility service design.

- Configuration Management

  Do utilities know where their assets are and what condition they are in? GIS can assist in prioritizing maintenance work to avoid costly failures and inconvenience to customers.

Community Drivers

Utilities must meet the demands of the larger community, from the local municipality to the federal government. Clearly, if the community views the company as a sloppy neighbor with unsightly plants, political forces for change will come to bear on the utility. Even if a utility is a good investment and has good service, if, for example, it has a reputation as a polluter, the image of the company suffers. How the utility responds in states of emergency will determine how the community views the utility.

Other community drivers are

- Corporate Image

  How is the utility perceived by the regulatory agencies? Regulators positively view utilities that have outstanding access to data. GIS can organize data and visualize that data in a way that really communicates strategically to government and community agencies.

- Aesthetic

  Modern utilities need to be sensitive to how their facilities blend into the landscape of the community. With today's 3D visualization of GIS data, utilities can easily communicate with the community.

- Prudence

  The August 13, 2003, blackout in the northeastern United States underscored the need for a stronger transmission grid. Stronger means more transmission lines. GIS has been shown as an effective tool to communicate about future facilities to community opposition groups and work with them to offer alternatives.

- Community Investment

  The utility infrastructure condition within a community impacts the ability of a community to attract business and wealth. Communities with aged and poorly operating infrastructure will surely decline. GIS can highlight the role that utility infrastructure condition plays in the overall economic health of the community.

GIS gives utilities the tools to display their corporate image to investors, regulators, and other policy makers. GIS enables utilities to communicate and visualize new and proposed facilities to neighborhoods and helps build consensus. GIS can illustrate how the utility handles its community outreach.

Employee Drivers

Utilities must respond to the needs of their employees. Employees may treat customers in the same way as their employers treat them. Even though a utility might have a good shareholder return, low rates, and even a favorable regulatory position, it may not treat its employees well. If employees consistently injure themselves on the job or regularly battle with unhappy customers, employee morale suffers. Poor morale begets poor performance, which lowers customer service satisfaction, shareholder value, and community image. (And unhappy employees can publicize their feelings.)

Other employee drivers are

- Tools

  Does the utility provide the employees with modern tools to do their work, compared to other employers? Utilities that have adopted modern tools like GIS find their employees feel better about their ability to serve their customers. They also feel better about themselves and their future marketability.

- Resources

  Does the utility offer employee resources such as assistance with carpooling or relocation of employees during a consolidation? Some utilities are seeing that GIS can aid in providing employee services including recruiting and helping employees balance work and home life.

- Employee Stress

  Are employees stressed about too much work and too few people doing the job? GIS has been shown to improve productivity and efficiency, reducing backlogs and delays.

- Safety

  Is critical utility information not readily available to employees? Good data about the location and condition of dangerous equipment creates a safer environment for employees. GIS facilitates this by eliminating redundant and often conflicting information and providing up-to-date data and an easy means of gathering that data in a timely way to make good, safe decisions.

- Emergency Response

  Does the company have an understanding of how easy (or not) it is for employees to respond to emergencies? Some forward-thinking utilities integrate their employee profiles with their GIS so that employees who live closest to emergency events can respond quickly.

GIS can play a role in illustrating pockets of unsafe and high crime areas; in helping employees relocate or commute; or by creating mobile workers, working from their homes and vehicles.

Certainly there are many other systems and factors that impact drivers within a utility. The ability to view the utility from a spatial perspective is just one new way to improve the overall value the utility delivers to its shareholders, customers, communities, and employees.

The Balanced Scorecard Defines Metrics

Utilities can creatively apply GIS to all areas of the balanced scorecard. GIS can improve productivity, thus lowering cost. It can provide a common language of communication for better service. It can aid in the documenting and justification of cost of services and rate cases and provide employees with tools to help them do a better job.

GIS is not just about automating utility operating or engineering maps. Although that represents an important first step in creating the underlying spatial information infrastructure of a utility, it is only a start. Most utilities have spent considerable money converting many of their ancient maps from paper, linen, and Mylar® to some digital form. That's the very good news. The bad news is that some utilities have stopped there and do not use that digital data to close the gaps in their mission-critical performance metrics for each of the utility stakeholders. Others have found that the digital data does not have the accuracy, connectivity, or attributes to do much more than automate the mapping process. However, others have leveraged their GIS data to provide wonderful new services to their stakeholders.

Putting GIS to Work on Mission-Critical Activities

Today's environment demands agility. Yet utilities built IT legacy applications and architectures around old business processes unable to meet new demands. Tightly integrated applications and closed and proprietary data structures and protocols handicap collaboration and inhibit communication across many constituencies. No longer can industries rely solely on information contained and controlled within their own enterprises. Mergers amplify lack of agility. Lack of agility inhibits the utility's focus on those things most important to the utility like the critical performance metrics in the balanced scorecard.

It's All about the Web

Agility requires that companies not look at IT as just a collection of systems such as a billing system or a work management system. Rather, they must look at their information resources as a collection of repeatable services. Those are services generated internally or consumed from some outside service. An application, then, is a collection of services that provides a technology solution to a business problem or function. Software design, in fact, has evolved from the development of large applications to the creation of reusable software objects, combined into larger objects and delivered as services. Many of those services can be used in multiple business processes. A key mechanism that provides a delivery mechanism is, of course, the Web.

Geoexploration and Geoservices on the Web

The introduction of seamless viewing of spatial information to the consumer world has ushered in a new era of interacting with geographic information on the Web. A number of vendors have introduced dynamic and continuous content, fast and natural interaction, and easily accessible information, all in a Web-based environment. These developments allow an entirely new audience to use spatial data without needing to learn GIS.

Utilities can view their mission-critical metrics in an easy-to-understand manner. They can, for example, drill down into the detail and see why one division is performing better than another, by visualizing completed maintenance activities or on-schedule or late tree trimming activities. They can view the utility in a common operating model in which the key factors attributes of the balanced scorecard can be visualized.

The GIS industry has embraced this natural form of visualization with the added benefit of providing rich spatial data management, spatial analysis, and geoprocessing. This delivery mechanism opens more opportunity to deliver geoservices, still authored by spatial professionals but delivered in an easy-to-use, fun-to-navigate environment. Geoexploration is becoming as common as the Internet search engine.

New IT Technologies

GIS maturity has increased the demand on the IT infrastructure. Large datasets, expanded analysis, and dynamic visualization are continuously increasing. Faster processing, multicore systems, and increased storage capacity provide the "muscle" needed to keep up. Increased bandwidth, Web services standards, improved mobile technologies, and real-time networks open more opportunities to use GIS in many diverse application areas. GIS software itself has evolved dramatically. It continues to expand and improve, providing new opportunities in new industries and application areas.

The main purpose of GIS in today's modern utilities is not to produce operating maps more quickly or more efficiently. Instead, GIS for many utilities forms one of the key platforms for the utility IT infrastructure. ESRI® product architecture and adherence to open standards have made ESRI products the technology of choice for utilities. The ability to author utility information at the desktop using ArcInfo®, ArcEditor™, ArcView®, and ArcReader™; serve that data through ArcGIS® Server to the enterprise; consume Web services from within and outside the utility; and, finally, use GIS data and functionality utilizing a variety of handheld and portable devices provides the foundation for leveraging the key spatial information that up until recently was buried in engineering maps and records. Products such as ArcGIS Mobile, ArcPad, and ArcGIS Engine put spatial information directly into the hands of the field-workers. ESRI technology disseminates that critical spatial information to the enterprise.

More Tools Enabling New and Improved Geographic Processes

Several advancements have been made in GIS over the years. Most recently, ESRI has focused on integrating time variables, advancing geostatistics, improving gridding capabilities, expanding modeling functions, modeling network allocation, supporting Thiessen polygons, adding multidimensional data support with netCDF native support, and improving tracking functions. These functions, along with improved interoperability, allow utilities to apply spatial technologies to many new opportunities. This technology application means that utilities can better serve the broader range of mission-critical activities. And as rich as these features are on the desktop, their application as Web services broadens their appeal to a huge user base.

Imagery at Your Fingertips

Whether companies are capturing the latest developments on a project site or flipping through historical aerial photos performing change detection, imagery is critical, especially in the utility industry. However, companies are challenged to manage, organize, and serve these large datasets. ArcGIS Image Server is changing this; working with imagery is now easier and faster than ever before. Society is producing more data and enabling faster distribution, with new technologies to publish and process the imagery on the fly. These developments allow companies to perform georeferencing, pan sharpening, mosaicking, orthorectification, and many other processes on an as-needed basis—saving time and storage space.

Server Capabilities, Mobile Technologies, and Interoperability

Developments in server-side technology provide ways to manage and disseminate geographic knowledge broadly. New ways of replicating complex versioned databases have been developed. Complicated processes can be moved to more powerful machines. They can run in batch modes. They can serve information and functionality to users at the desktop, on the Web, or out to mobile devices. Server technology brings spatial information to every part of the business workflow. The expanded capabilities, along with improved interoperabilities and standards, open GIS to more systems and business workflows than ever before. Companies can leverage existing technologies while benefiting from new technologies. This allows organizations to migrate their legacy systems on their own schedule.

Service-Oriented Architectures Bringing GIS to the Enterprise

A service-oriented architecture (SOA) brings it all together. It brings about agility. SOA allows companies to organize around their business units and processes. It provides a framework for applications and data tailored to critical needs and productivity requirements. Business units become service providers and consumers at the same time; they manage their data while consuming others' data. The services architecture leaves the data and processes with the original owners for ongoing maintenance while allowing others to consume the services as needed across the framework. These services can be tasks, workflows, or data. SOA helps distill processes and defines services. These processes and services can then be consumed over the framework using Web services standards such as WSDL; Universal Description, Discovery, and Integration (UDDI); XML; and SOAP.

Hardware, software, and Web technologies will continue to evolve and improve. ESRI continues to strive to take advantage of these improvements in all our products and offerings.

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Summary

GIS has become a mission-critical system for a number of utilities. The evidence is that GIS is integrated into their core IT systems. GIS contributes to the mission of a company. It helps utilities meet their strategic performance objectives. It's not just about mapping anymore. Spatial information has always been important to utilities. Today's modern GIS—built on open standards, Web enabled, and having the ability to serve spatial information and analytics to the enterprise—provides the framework for utilities to dramatically exploit the power of location.

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For more than 35 years, ESRI has been helping people make better decisions through management and analysis of geographic information. A full-service GIS company, ESRI offers a framework for implementing GIS technology and business logic in any organization from personal GIS on the desktop to enterprise-wide GIS servers (including the Web) and mobile devices. ESRI GIS solutions are flexible and can be customized to meet the needs of our users.

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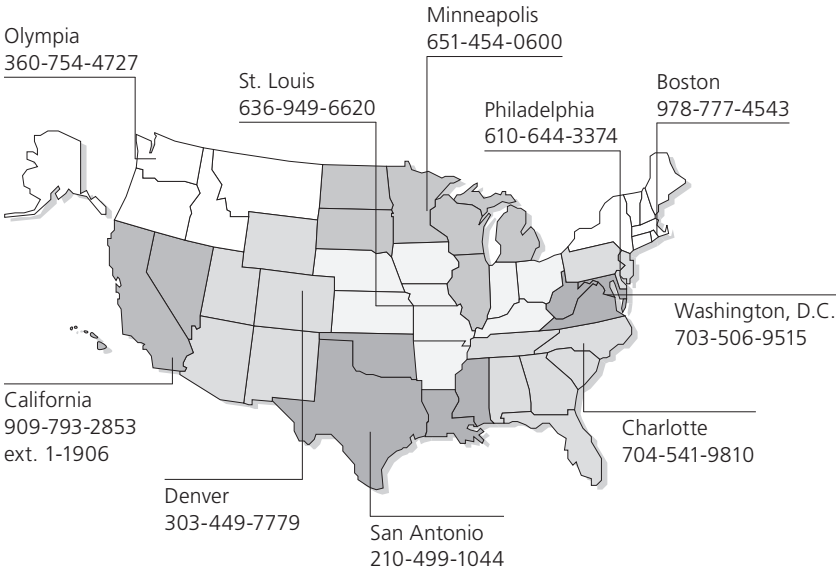

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