DIGITALLY TRANSFORMING UTILITIES

A COMPREHENSIVE GIS

Electric and Gas Utilities

esri | THE SCIENCE OF WHERE

Introduction

Overcoming the challenges being faced by utilities today seems overwhelming at times. However, utility issues and solutions have one thing in common: location. It's hard to think of a utility process that ignores location. Around the globe, utilities use maps. Why? Utilities work better using location intelligence.

Most utilities use geographic information system (GIS) technology as a foundation for mapping. However, limiting GIS use to the digital replacement of paper maps is a profound underutilization—a lost advantage to address new challenges.

ArcGIS® software is an extensive information system that enables new results—solutions that devour underutilized data, harness analytics, and run on any device. Engaging apps tailored to each user's role transform utilities.

Contents

CoServ, one of the nation's largest co-op utilities, uses location intelligence to digitally transform its organization.

Thriving in a Changing Industry

The electric and gas industries are in motion. Utilities face changes in every area of their business. They work hard to adapt to and leverage digital technology. Yet they often face tomorrow's challenges with yesterday's methods.

In the struggle to remain relevant and thrive, utilities look to advanced technologies and ArcGIS.

Organizations choose ArcGIS to make better maps because location is central to utility assets, customers, and employees. But ArcGIS is more than mapmaking technology. It is a comprehensive enterprise system. It integrates all kinds of data and performs advanced analytics. It also makes those results conveniently available to everyone.

GIS catalyzes the improvements utilities desperately seek today and will be seeking tomorrow.
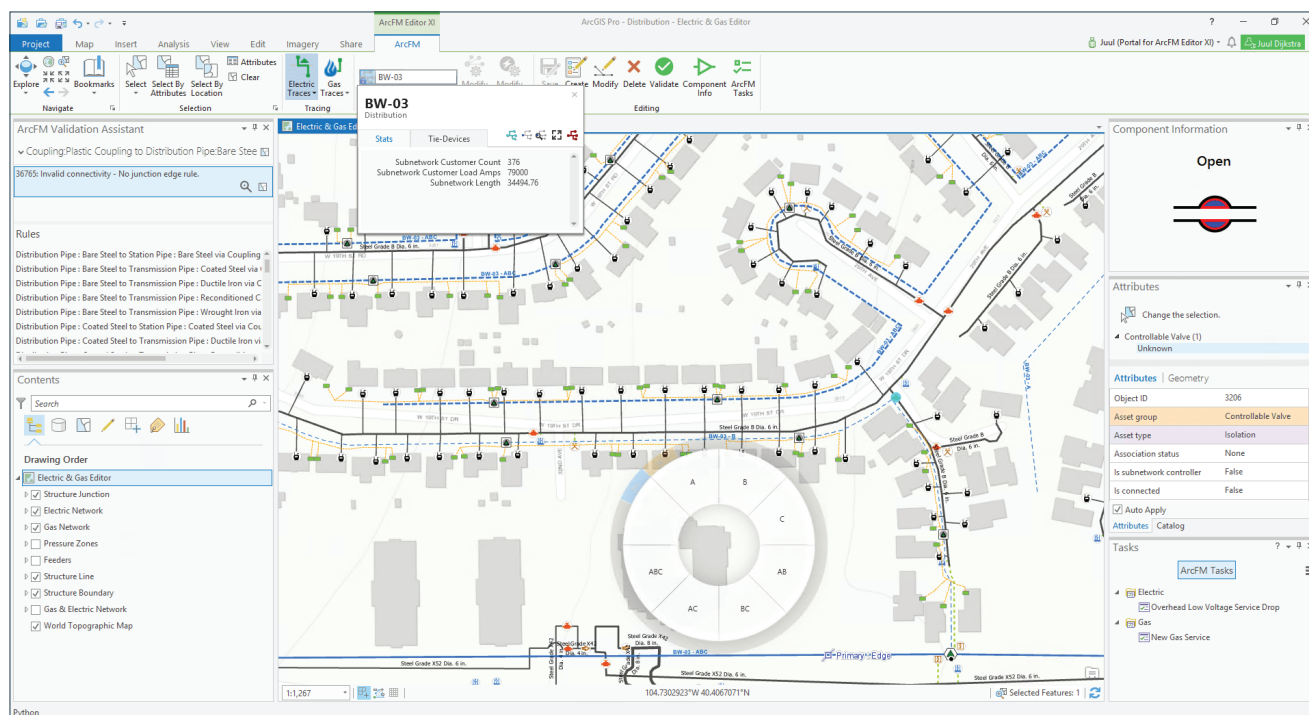
The Language of Location

Utilities have made substantial investments in technology to address business problems. Yet these solutions have largely automated manual processes, reinforcing silos with suboptimal results. Today's problems require next-level improvements. These improvements demand a better understanding of network behavior and customer expectations.

Utilities' issues and solutions have one thing in common—location:

- Where are outages occurring?
- Where is the network vulnerable?
- Where are customers behaving differently?

Location yields perspective—most utility processes revolve around where they occur. Managers, employees, and customers have a common need to know what is happening, when it's happening, and where.

Employees from different departments speak their own lingo and have the following problems:

- Their data is different from other departments'.
- They struggle to understand each other.
- They need a common language to work together.

That language is location. A map turns huge datasets into colorful pictures, quickly revealing the underlying business meaning. ArcGIS is a location intelligence system. It provides an understanding of patterns and situations. ArcGIS provides the enterprise infrastructure for location-aware business solutions.

"Location provides the framework to absorb new ideas and accomplish true transformation."

—Pat Hohl,
Director, Electric Utility Solutions, Esri

Mature Systems Deliver Business Value

In the 1990s, Carnegie Mellon University looked at the maturity curve of digital systems. Geoffrey Moore, author of *Crossing the Chasm*, and IBM popularized an approach based on this research. The model proposed a digital progression from systems of record to systems of engagement and then to systems of insight. This marked a clear path to information technology maturity and more significant business value.

As energy providers pivot around the industry trends, they apply the best business tools to accelerate their progress. Leading utilities use the power of location to accomplish this. A comprehensive GIS supports their need to accomplish the following:

- Migrate to a real-world model of their assets, building a more robust system of record

- Liberate information for all stakeholders— internal and external—creating a dependable system of engagement

- Capitalize on analytics, growing a system of insight

"Digital disruption is forcing all enterprises to make big changes."

—Geoffrey Moore
Crossing the Chasm

System of Record
Data Management and Integration

System of Engagement
Sharing, Collaboration, and Dissemination

System of Insight
Analytics, Models, and Data Exploration
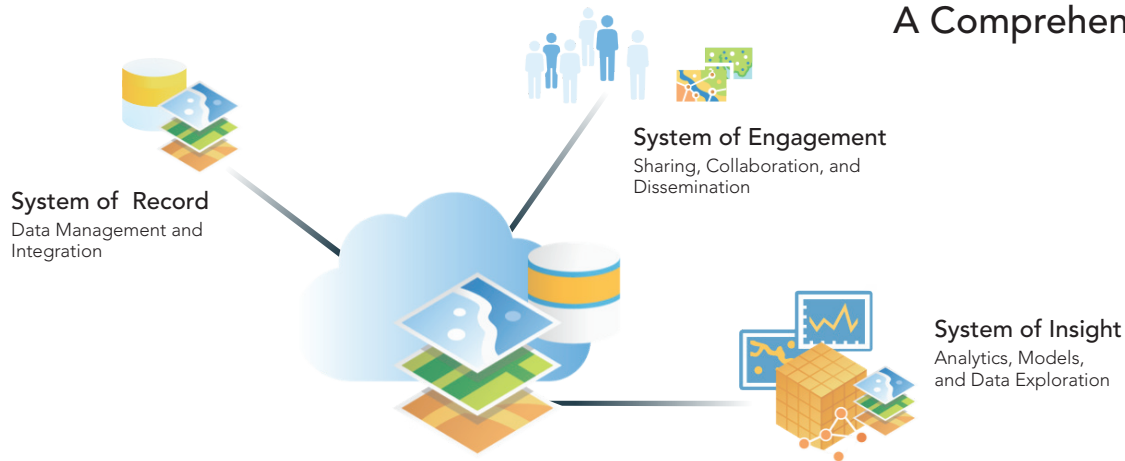
A Comprehensive GIS—More Than Making Maps

Changes in the utility environment and the explosion of data demand vastly better ways of managing, examining, and communicating utility information.

ArcGIS is a comprehensive GIS. Comprehensive means it contains all the elements needed to overcome utility challenges, not just make conventional maps faster. ArcGIS maintains key information, analyzing it and distributing it to everyone who needs business intelligence.

ArcGIS does things traditional mapping GIS can't touch. It employs an unparalleled data model and consumes most any form of external data. The rich data supports out-of-the-box analytics and the latest artificial intelligence (AI) and machine learning tools. The results are easily exploited with engaging apps personalized to each user's role. They provide focused capabilities and align with how people work today.

These capabilities create a seamless experience when using the following systems needed to thrive:

- System of record—Data management and integration

- System of engagement—Sharing, collaboration, and dissemination

- System of insight—Analytics, models, and data exploration

The energy industry requires new digital tools that show a comprehensive picture and provide powerful insights—including exceptional visualization—on any device, anywhere, at any time. As the requirements for GIS have evolved, so has ArcGIS. It delivers the power to increase the effectiveness in every corner of the utility.

> "Having the GIS enterprise approach actually makes me sleep a little better at night. We're not scrambling to chase down information. It is networked, it is mobile, and we can get access to it."
>
> —Jimmie Cho
> Chief Operating Officer, SoCalGas

SoCalGas, the nation's largest gas utility uses ArcGIS to respond quickly to pipeline emergencies.

System of Record

How Complete Is Your Data?

As utilities moved to automated mapping, they began to see the strategic value of digital facility data. They harnessed the basic mapping data for other applications like system analysis. Soon, shortcomings in the data designed for mapping became self-evident, such as utility lines that looked fine on paper but in actuality lacked correct network connectivity.

Despite the data flaws, utilities began to view GIS as a system of record, particularly for the location of assets. A system of record is the authoritative source for a data element—the place where that element is systematically maintained.

In this data-driven world, advanced systems, digitally savvy customers, and the modern workforce all mandate better data inputs. Many utilities look forward to a strategic investment in new capabilities—a system of record that goes further!

In response, Esri has designed a new data foundation—a network optimized specifically for utilities. ArcGIS Utility Network adds new capabilities.

A utility network fully represents today's complex energy networks, sustaining powerful analytics and real-time modeling. It's fast and scalable. But it goes even further by delivering its capabilities to engineering staff and extending them across the organization and into the field.

Case Study

Moving to ArcGIS Utility Network allowed South Jersey Industries (SJI) to consolidate its assets into a single authoritative system of record. Previously, asset data was managed through multiple applications including GIS and several asset-tracking databases. In some cases, a single asset was represented differently in each system. Leak information, which was once tracked only in GIS, was also being managed in a separate, nonspatial database. Utility Network provided SJI with a single source of truth, which was, in turn, integrated with other enterprise systems.

Read the full case study.

"The next 5 years will bring more change to utilities than the previous 50 have."

Esri, *The Business Value of the Utility Network*

System of Engagement

How Many Are Actually Using Your Data?

To make a system of record more valuable, the information must be shared, allowing everyone to access and understand it. To be most useful, a system of record needs a system of engagement. The ArcGIS system of engagement manages and promotes user collaboration and interaction.

Engagement starts with communication—connecting people in real time, using location-aware devices. It's a move to empower employees,

customers, and regulators with the information they need. ArcGIS gives all users live access to the appropriate information captured in the system of record.

Mobile workers easily update maps while they work, naturally reinforcing the system of record. Moreover, those updates become available immediately, without the delay of transcribing notes scribbled on paper.

Case Study
Given Muscat Electricity Distribution Company's (MEDC) culture of innovation, management directed the GIS team to create a new mobility-based inspection process. Using ArcGIS, the project removed the problems mobile workers had experienced. MEDC was also able to get better insight into the health of its assets. For example, MEDC was able to discover that transformers installed in 2007 were more prone to leaking, so MEDC began analyzing the location of each of them. This initiated targeted inspections of transformers based on their tendencies to leak.

Read the full case study.

"I used to inspect 10 to 15 substations daily, but now with smart transformation, I can inspect more than 30 per day."

—Mahmood Al Qassabi, MEDC

System of Engagement (continued)

How Many Are Actually Using Your Data?

Executives monitor dashboards that track real-time events and key performance indicators, making decisions at a glance.

Customers get maps from the web. They see the progress of projects in their neighborhood or report a streetlight that is out. When customers mention "wire down" or "gas odor" on social media, the utility immediately gleans the information, improving safety and response.

Using GIS this way is easy, productive, and fun, thanks to a whole suite of out-of-the-box apps that run anywhere. They support intelligent mapping, field data collection, location tracking, routing, spatial analytics, and situational awareness.

Case Study

Gainesville Regional Utilities (GRU) installed ArcGIS Field Maps to improve the company's meter assignments critical to outage management.

Field staff immediately recognized how the mobile app reduced their workload and made them more productive. Handling the information electronically reduced the time required to update critical business systems, saving many work hours per year.

Read the full case study.

"Taking a cue from social media, once a change is made by anyone, those changes are visible to all."

—Bill Meehan,
Empowering Electric and Gas Utilities with GIS

System of Insight

What Is Your Data Telling You?

A system of insight enables discovery—creating new understanding. Incremental improvements create slightly better processes. Breakthroughs require new knowledge. They require seeing things differently—discovering insights that are not visible using conventional means.

Analytics allows the discovery of secrets in data and the evaluation of trends.

A system of insight dramatically magnifies business value. It explores the diverse data maintained in the system of record and derived from the system of engagement.

The ArcGIS system of insight adds information gained from outside sources over the web—weather, traffic, and vehicle location services. It takes in real-time data from Internet of Things (IoT) sensors collaborating with other operational systems such as SCADA, AMI, and ADMS. Exploiting complex data requires state-of-the-art data science tools. ArcGIS delivers exciting analytical capabilities such as spatial analysis, machine learning, big data analytics, and image processing.

Business intelligence comes from examining raw data through the lens of location. The powerful analytic features in ArcGIS release more significant insights. They uncover relationships that simple reporting cannot find. They detect patterns and correlations. Data-driven predictions form the foundation of decision-making based on following business rules logic:

- Where will solar be added next?
- Where are the greatest risks to resiliency?
- What factors are affecting asset performance and longevity?

This is actionable business intelligence.

Case Study

Dubai Electric and Water Authority (DEWA) determined that a lack of convenient information was limiting the adoption of solar panels. Analyzing each project's potential was taking too long and costing too much. DEWA utilized the powerful analytic capabilities of ArcGIS to rate the suitability of any potential location. The ArcGIS deployment is helping DEWA reach its renewable energy goals by providing timely information, eliminating barriers, and improving solar energy adoption.

"Customers were able to estimate potential electricity production and savings on electricity charges by installing solar panels."

—Manal Ahmed Salem Alshamlan,
Senior Manager, DEWA

A Comprehensive GIS Supports Your Needs

ArcGIS is a comprehensive GIS. Systems of record, engagement, and insight provide a mature information system that creates real business value across the utility enterprise.

Safety and Compliance

Ensuring public and employee safety is job one. Where are the unsafe conditions that threaten people, property, and the environment? Knowledge of the hazards improves safety performance and compliance.

Customer Engagement

Digital consumers expect current information in seconds. They want an engaging and personalized experience worthy of a valued utility customer. ArcGIS relates information to the customer's location and puts it in their hands.

Asset Management

Many forward-thinking utilities want enterprise asset management and GIS to be fully interoperable. They must consider the location of many more nonutility distributed energy assets. They want to find trends to fine-tune their asset decision-making process.

Operations Management

Utility operations management demands the best use of resources. Efficiently managing spare-parts locations, routing vehicles, and moving to job sites can be a challenge. Lack of optimization increases operating and capital expenditures. It lengthens restoration time and response to environmental disasters. GIS provides the tools to effectively manage operations.

Design and Engineering

Utility designers need innovative tools and methods for effective utility network management. Reliable information sharpens the focus of every project and reduces risks. A single source of accurate design information comes from a modern GIS, which provides a solid data and communication foundation to model utility networks. This enables utilities to succeed with repeatable solutions to engineering problems. The modern capabilities of ArcGIS reinforce excellence for utility design and engineering.

The Geographic Approach

Getting the most out of the comprehensive GIS requires a new way of thinking. It demands a way of problem-solving that integrates all the information that is available to a utility. This process is called *the geographic approach*. Whether engineering, facility, real-time, network, or environmental data, the information is science based. GIS and the geographic approach bring this information together and help utilities understand—and predict.

The geographic approach sets up a framework for action, applying all of this knowledge in meaningful ways directly into a utility's workflows. Since the vast majority of work involves location, GIS enables this approach. It allows utilities to measure things in very focused ways, make maps, visualize conditions, and help people understand and predict the future. This approach also provides an environment where engineers and planners can design using this geographic understanding and make better decisions supporting various kinds of actions.

The geographic approach is all about a process—not just a technology but a framework—for widely applying geographic knowledge. It starts with data collected from various sources and assessing that information leveraging visualization and maps. But it doesn't stop there. As noted above, the analysis and modeling help predict what may happen, such as where gas leaks might occur or where customer satisfaction might wane.

In addition, the geographic approach leads to projects being planned holistically using geodesign, helping utilities understand the long-term impacts and consequences of their plans and make adjustments if necessary.

The geographic approach leads to comprehensive understanding and science-based decision-making.

"Understanding precedes action."

—Jack Dangermond, Cofounder and President of Esri

Esri Geospatial Infrastructure Supports the Geographic Approach

Geospatial Infrastructure

GIS is increasingly becoming interconnected between the desktop, the cloud, enterprise servers, apps, and portals. This ecosystem of interconnected components is about streamlining collaboration.

This ecosystem is called *geospatial infrastructure*. It enables and supports the geographic approach. It is the sum of all the parts coming together as new technology, for which portals provide support. It helps utilities organize and integrate the distributed services to bring people together.

A New Pattern

Multiple services brought together is a new pattern for GIS. It's not just a database with some tools and apps—it also provides a way to bring information together very quickly. And this data is made available supporting a whole new generation of powerful desktop technology as well as the massive deployment of GIS occurring in mobile technology.

This new pattern provides the framework for comprehensive situational awareness. This is extremely important for utilities since they have distributed assets, employees, events, and customers. Knowing where each is; where there are vulnerabilities; and, most importantly, what action the utilities must take at any given time is critical.

Enabling New Capabilities

The geospatial infrastructure enables spatial analytics. This includes spatiotemporal analysis; robust interactive visual analysis; and graph analysis, which involves geospatial artificial intelligence (GeoAI), a new family of tools used for looking at relationship patterns. GeoAI and other intelligent tools allow access to vast collections of big data and raster analytics in the cloud.

Manage Big Data

The geospatial infrastructure helps manage big data. Today, GIS desktop and web environments can access the massive data collection occurring with data lakes and warehouses. This innovation creates a whole new form of understanding.

Remote Sensing and Imagery

Advances in imagery and remote sensing, ranging from image maps to oriented imagery and motion video and multispectral analysis, are part of the geospatial infrastructure. GeoAI enables these massive point clouds to visualize, analyze, and extract features. These capabilities let utilities take these pictures and images and create massive amounts of timely information right inside GIS.

Digital Twins

The emergence of 3D digital twins, connecting immersive experiences with game engines, builds additional capability into the geospatial infrastructure. These allow utilities to see, understand, share, and act differently.

Extending Corporate Systems

A properly configured geospatial infrastructure makes it simple to embed GIS capabilities inside of other major IT systems. Examples include work management, customer information systems, and network analysis, all to support knowledge workers.

GIS Hubs

A GIS hub brings communities together to organize information and initiatives and form teams. For example, all players must coordinate action when a major emergency occurs, such as a wildfire, earthquake, flood, or extreme wind event. Those players include utilities, first responders, governments, the media, and residents. GIS hubs provide the means to do that.

A Basis for Solutions

GIS is much more than a technology for making maps—it is a basis for solutions. As a result, utilities worldwide are making strategic investments in location-aware information capabilities as a foundation for business refinements, modernization, and customer engagement.

Truly comprehensive models of utility systems are based on Esri utility network models. These models enable smooth data compilation and compelling analytics. When solutions are visualized clearly and shared widely, they make it possible to thrive in a changing industry.

Esri's location intelligence system is a comprehensive GIS for utilities. ArcGIS helps you work better and smarter—advancing your operations, design and engineering, safety and compliance, asset management, and customer experience efforts.

Empower transformation through innovation.

To learn more, visit our site:
esri.com/en-us/industries/utilities

ArcGIS is a comprehensive GIS—the strategic investment that every utility needs to make to move the utility forward.

About Esri

Esri, the global market leader in GIS software, offers the most powerful mapping and spatial analytics technology available. Since 1969, Esri has helped customers unlock the full potential of data to improve operational and business results. Today, Esri software is deployed in more than 350,000 organizations including the world's largest cities, most national governments, 75 percent of Fortune 500 companies, and more than 7,000 colleges and universities. Esri engineers the most advanced solutions for digital transformation, the Internet of Things (IoT), and location analytics to inform the most authoritative maps in the world.

For more information,
go to esri.com/en-us/industries/utilities.

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