

# Executive Summary

**T**HIS YEAR MARKS THE SEVENTH YEAR FOR THE ANNUAL *Geospatial Technology Report*, the only study to independently survey technology users for detailed project information across the full spectrum of GIT uses. GITA's Industry Trends Analysis Group originally intended this study to be a tool for information exchange and for education of GITA's membership. By 2005 it has grown far beyond these simple goals.

There is significant new detail in this year's report. The survey asked for 2005 budget information for most expense categories, resulting in a valuable data set of current as well as cumulative spending patterns. There is new information regarding data-sharing capabilities, including types of relational database management systems used. Respondents were also asked whether data maintenance is performed in individual departments or consolidated into one department, with a further question about the data level at which departments have responsibility. This year, in addition to the popular top 10 applications and top 10 technologies lists, information was collected on the top three issues companies are facing. A section of questions on mobile technology was also added.

In addition to more detailed information about how geospatial information technology is being used, the analysis provides historical perspective. By reviewing up to six years of archived survey data, it is possible to examine how trends are developing. GIT and related technologies affect operations today and will continue to do so into the future. As the technology and its role in business operations evolve, the *Geospatial Technology Report* will help users and developers of GIT have a better understanding of how the technology is being used and what value there is in the many applications and interfaces that geospatial data enable.

Reflecting the expanded membership base of GITA, the report now provides detailed information for six unique types of GIT users, with continuing data on electric, gas, pipeline, telecommunications, water, and public sector users. Look for an increased GITA focus on public sector users in the future corresponding to this fast-growing segment of GITA's membership and accompanying the growth in demand for e-government solutions requiring geospatial data.

As GITA's membership and participant bases continue to increase, the study grows in size and statistical reliability for use in various market research and industry analysis applications. This year, study participation increased from 204 to 294 responses, further broadening the spectrum of users and improving the statistical reliability of the cumulative survey responses.

With a record number of surveys received, this year continues the tradition of increasing the participant base while reaching out to new user groups. Last year saw a dramatic increase in membership and participation from water, wastewater, and stormwater utilities. This makes the second year that other public sector users are presented separately from the utility-managing organizations. In the past, people may have perceived GITA as having a focus on electric and gas utilities. This is no longer true, as the new public sector category has more survey participation than that from electric and gas utilities combined.

**Table E.1. Statistical Summary of Study Participants**

Sector/General Info	Electric	Gas	Pipeline	Public	Telecom	Water
Survey Participants	80	23	21	108	19	43
Low Meters/Customers	5,000	250	10	10	4	100
High Meters/Customers	5,680,000	3,000,000	500,000	36,000,000	50,000,000	8,300,000
Low Square Miles	10	26	550	6	100	10
High Square Miles	329,924	150,000	60,000	1,000,000	50,000	500,000

## Implementation Approaches

Since its beginning, this report has examined the implementation approaches used by member organizations. In an enterprise approach to implementation, geospatial data are stored in a corporate data repository, and applications support a wide range of corporate business processes and interfaces. In a departmental approach, geospatial data and applications are undertaken at a departmental level, such as land and right-of-way data management, maps and records, engineering, and operations. A service organization approach involves a specific GIS group within the company, which provides GIS services on demand to various users in the organization—and sometimes outside the organization.

Enterprise deployments have remained somewhat steady across all industries, as have the percentage of departmental and service approaches. Comparing this year's implementation approaches with last year's shows a slight (7%) increase in enterprise approach when all markets are totaled. However, pipeline companies show a significant decrease while telecoms show a strong increase. A relatively consistent development across all industries is that more mature organizations are building solutions that fit their existing business process rather than trying to make technical changes and organizational changes simultaneously.

**Table E.2. 2004–2003 Implementation Approaches of Study Participants**

### 2004

Approach	Electric	Gas	Pipeline	Public	Telecom	Water
Enterprise	61%	75%	48%	60%	58%	45%
Departmental	30%	21%	29%	37%	37%	41%
Service Group	9%	4%	24%	13%	5%	14%

### 2003

Approach	Electric	Gas	Pipeline	Public	Telecom	Water
Enterprise	51%	68%	60%	66%	42%	53%
Departmental	38%	27%	20%	22%	58%	35%
Service Group	11%	5%	20%	12%	0%	12%

This year's survey also asked how organizations perform data maintenance. About 60% of respondents indicated their data are maintained by a single department, with the remaining 40% indicating maintenance is done by individual user groups or departments.

## Top 10 Applications and Technologies

The ratings feature of the top 10 applications and technologies in each GIS discipline continues to be one of the most popular aspects of this report. Examination of the ratings in each sector may reveal that the effect of developments such as Web services are first recognized by users in their technology list, with the related applications following.

The year provides an additional top list, the top three issues faced by each company. As no past lists were available to guide respondents' choices, results covered a very wide range of issues. Frequently mentioned topics were budget constraints, quality control, data maintenance, data sharing, and regulatory compliance.

## Hardware and Software

This year, each section of the report includes a breakdown of software vendors by number of projects as well as full-use seats and view-only seats. The ability to analyze information about the number of customers (projects) with actual deployed seats is valuable in getting a balanced picture of market penetration through the survey sample. Technological advances in Web distribution for view-only seats is making it difficult for users to accurately estimate these seats as well as making the full- and view-only statistics a bit of a moving target.

Comparing full-use software seats for all industries with last year's full-use seats shows increases for

Autodesk, Bentley, and MapInfo; a decrease for GE Energy; and ESRI and Intergraph holding steady. Although there is much talk in the industry about the maturity and usability of the new Microsoft MapPoint platform, it has not yet shown up on the survey as a named platform. The same goes for the new Oracle 10G databases.

## Multiplatform GIS Implementations

The survey asked participants who were using more than a single GIS platform if and how they were sharing data between the various systems. A variety of factors influences the decision to operate heterogeneous GISs, including the lower cost of entry from a software perspective and the advancement of “open GIS” via data standards. From OGIS to MultiSpeak, PODS and more, the ability to exchange data across platforms is enabling users to buy the application that is right for the job, even if it means running more than a single GIS platform.

Slightly over 60% of all participants were using more than a single platform, and about two-thirds of those were sharing data between systems. Although Safe Software’s Feature Manipulation Engine (FME) was named most often as the third-party application for data sharing, a growing number of those polled said they were using functionality native to their selected GIS and did not require additional software to move data back and forth. This development heralds what some industry analysts refer to as a change from a geo-centric to an integration-centric basis for competition in the industry.

This year’s survey asked which relational database management system companies use. About half of the responses use Oracle, about one-fourth use SQL Server, and about one-fifth use Access.

**Table E.3. 2004–2003 GIS Platform Vendors by Number of Full-Use Seats**

### 2004

Vendors	Electric	Gas	Pipeline	Public	Telecom	Water
Autodesk	21%	3%	31%	13%	8%	21%
Bentley	14%	9%	9%	6%	6%	25%
ESRI	15%	20%	27%	73%	4%	30%
GE Power	43%	45%	>1%	>1%	>1%	2%
Intergraph	7%	17%	29%	5%	54%	7%
MapInfo	>1%	0%	0%	1%	27%	4%
Others	>1%	6%	3%	1%	>1%	11%

### 2003

Vendors	Electric	Gas	Pipeline	Public	Telecom	Water
Autodesk	23%	3%	0%	21%	11%	27%
Bentley	8%	9%	2%	5%	12%	2%
ESRI	33%	20%	12%	58%	2%	41%
GE Power	30%	45%	67%	4%	1%	16%
Intergraph	5%	17%	18%	6%	67%	7%
MapInfo	>1%	>1%	>1%	4%	>1%	>1%
Others	>1%	6%	1%	2%	6%	6%

## Hardware Manufacturers and Operating Systems

Each industry section has detailed information on hardware manufacturers categorized by full-use and view-only workstations. The sections also have detailed information on server use, including hardware manufacturer and operating system.

Microsoft Windows continues to dominate and grow across all industry segments, with many workstation users migrating to XP Professional. UNIX-based operating systems (AIX, Solaris, etc.) on the server side have continued to decline, replaced most often by NT. However, Linux has carved out a small toehold, with a few public-sector implementations.

For the first time there is information on use of GIS-dedicated mobile computers, including number of field units in use, operating systems, and method of communication.

## Project Costs

This year, the survey has broken down project costs in three ways. New this year is a category for 2005 budget information for most cost categories, providing valuable information regarding upcoming

spending patterns. Expanded categories provide levels of detail for software and applications, hardware only (servers and workstations), data, and implementation services. The data category is further broken down to describe facilities and land base data in terms of conversion and data purchase, detailing commercial-off-the-shelf (COTS) data and data purchased from noncommercial sources.

Availability of the new 2005 budget information presents some startling contrasts in spending patterns. Although electric utilities had the greatest total reported spending on COTS data, the public sector followed close behind. However, electric utilities have relatively sparse 2005 budgets for COTS data, with 2005 levels well under 10% of total COTS spending. By contrast, the public sector has very large 2005 budgets for COTS data, with 2005 aggregated budgets representing as much as 88% of total spending for new COTS data. This may simply indicate that the public sector has recently embraced the use of COTS data. Pipeline responses also indicate large 2005 budgets for COTS data, with aggregated 2005 budgets showing as much as 48% of total spending for new COTS data. All user types are moving to a new land-base accuracy paradigm, using varying accuracy levels based on the density of population and distribution network for specific geographic areas.

## Using Consultants and Conversion Vendors

Who used a consultant and who figured it out on their own? Most consulting firms will probably admit that business is slow, but it's not because work has stopped. The number of respondents who indicated "none" as their implementation consultant and/or vendor for land base and facilities conversion is increasing. This appears to be driven by economics, as well as the progress that software vendors have made in the ease of implementation, complemented by increased participation in peer-to-peer networking taking place over the Internet and at conferences around the country. For those who did seek outside help, the vendors identified are more likely to be

engaged for specific development tasks than for overall project planning.

There are many economic drivers, especially the federal government shifting more responsibilities to state and local governments. So far, it's doing this without the accompanying funding, which is making budgets tighter than ever.

## Land Base Management

Business drivers for GIT implementation vary according to the disciplines described in this report. Most utilities implement GIT to manage a large network of geographically dispersed distribution or collection facilities. They focus on the data directly related to those networks—whether they are pipes or wires—and the related equipment. More utilities are recognizing that the land base data empower the GIS to physically locate the assets and enable effective applications. This is resulting in a trend of increased sophistication in utility land base data.

Public sector GIS users are more focused on the land fabric itself, along with a variety of non-utility land features, including cadastral (property, easements, right of way, and tax and boundary data), planimetric (man-made visible features such as streets, curbs, paved surfaces, and fences), topographic (elevations, viewsheds, and hydrology), and demographics (data about population makeup, fire hazards, retail locations, traffic counts, crime statistics, known offenders, etc.). Accordingly, this is the sector indicating greatest aggregated spending on land base, closely followed by the electric sector. As with expenses for COTS data, the two sectors differ sharply in 2005 budget percentages. Public sector has high 2005 budgets as a percentage of total land base expenditures, 22% of total expenses for new data purchase, and 47% of total expenses for maintenance. This is somewhat skewed by several very large projects, but is still a good indicator of public sector land base spending. By contrast, electric utility 2005 budgets are very low, with 3% of total expenditures going for new land base data and 5% of total expenditures going for maintenance.

## Land Base Accuracy

A primary factor in the cost of land base data is the level of positional accuracy. Participants were generally unwilling to spend their GIT project budget on 6-inch levels of accuracy, with the public sector providing a dramatic exception. The public sector percentages for the new fine-resolution land base are increments of land areas from many companies (there are no single large contributions skewing the data). Telecoms have persisted in a recent shift toward 2-foot accuracy, significant given that they were once satisfied with data at the +/- 40 feet to 50 feet levels. Table E.4 shows that GIS users are varying their land base accuracy levels based on geography, density of population, and their distribution networks.

## Land Base Sophistication

Although including raster data to complement vector data is widespread among this year's survey participants, there is a continued decrease in those relying on raster data alone. The gas utility sector showed greatest use of vector-only land base (46%), followed by electric at 34%, and telecom at 26%. The drive to automate processes and integrate redundant systems across the enterprise helps cost-justify more intelligent and sophisticated landbase qualities such as connected street centerline networks and seamless coordinate systems. It also helps cost-justify the use of commercially available raster imagery as a backdrop. Improved land bases enable operational and customer service departments to realize more benefits. When dispatch and SCADA use the same land base as engineering and construction, the organizations can improve their bottom line.

**Table E.4. 2004–2003 Land Base Accuracy by Industry Sector**

### 2004

Accuracy	Electric	Gas	Pipeline	Public	Telecom	Water
+/- 6 inches	7%	7%	1%	34%	1%	7%
+/- 2 feet	9%	13%	2%	19%	47%	39%
+/- 5 feet	8%	23%	7%	5%	15%	3%
+/- 10 feet	25%	27%	7%	4%	22%	48%
+/- 50 feet	52%	30%	82%	37%	14%	3%

### 2003

Accuracy	Electric	Gas	Pipeline	Public	Telecom	Water
+/- 6 inches	2%	0%	0%	1%	0%	2%
+/- 2 feet	3%	18%	0%	2%	57%	30%
+/- 5 feet	6%	11%	20%	26%	29%	12%
+/- 10 feet	35%	12%	20%	5%	13%	54%
+/- 50 feet	53%	58%	60%	66%	2%	2%

## Land Base Maintenance Cycle

Although the shift this year in land base maintenance is slight, the trend toward longer maintenance cycles across all disciplines continues. Updating the GIS land base data on a continuous basis is a costly undertaking, and many organizations defer this activity to control costs. This year's report provides an analysis of trends in maintenance cycles in each vertical market sector.

## Facilities Management

The primary business driver for implementing GIS at utilities is automation of the many activities surrounding the design, engineering, construction, operation, and maintenance of their facility networks. The majority of costs are incurred with activities ranging from initial conversion of the network data to ongoing maintenance and distribution of the data. The primary benefits or returns on investment (ROI) are realized through implementing user applications in these areas.

**Table E.5. Facilities Conversion**

Conversion	Electric	Gas	Pipeline	Public	Telecom	Water
100% Complete	61%	52%	14%	11%	37%	33%
In-House	39%	30%	29%	63%	31%	42%

Conversion vendors can testify that business is down from years past. This decrease is due to either utilities responding to the survey being finished with facility conversion, or they are doing it in house rather than using a vendor. Overall sophistication of the facilities data model has been increasing in areas where benefits can be realized and decreasing in areas where it proves more cost effective to integrate with legacy or new lower-cost systems. The tools available to users for data input are becoming easier to use and availability of budget dollars for outsourcing is decreasing, resulting in more in-house efforts. Using raster imagery in conjunction with vector facility data is low in cost, deferring some conversion costs to an incremental approach.

## Facilities Maintenance

As with land base maintenance cycles, utilities must examine this costly effort for facilities data maintenance and schedule appropriately. The biggest changes from last year's data show a significant decrease in frequency of maintenance by gas utilities and an increase in frequency by electric utilities and the public sector.

**Table E.6. Facilities Maintenance Cycle by Industry**

Cycle	Electric	Gas	Pipeline	Public	Telecom	Water
Daily	12%	4%	10%	4%	11%	7%
Weekly	40%	17%	5%	17%	37%	18%
Monthly	29%	46%	33%	11%	31%	41%
Longer	19%	33%	52%	68%	21%	34%

## Facilities Applications

Prioritizing areas for GIS application implementation is a major concern to strategic planners so that the system can begin to realize return on investment as soon as possible. Planners recognize high return areas, so system data conversion and application development costs are scheduled and incurred based on rollout to these groups.

This section of the report examines the level of penetration of various application areas, thus identifying those recognized as high-value and high-ROI. Sorting responses by application lifecycle (implemented, developed, designed, or nothing) helps readers see whether the designed project was prioritized for rollout and look ahead to where

development activities have increased, signaling increases in implementations in upcoming years.

## Maps and Views

Before it was commonly referred to as GIS, the technology began as automated mapping and was then expanded to include facilities management (AM/FM). Starting with the premise that a digital map was easier to update than redrawing a paper map, generating various maps and views was and remains the number one application area for GIS. As with last year's indication of steady levels of implementation in this mature application area, there is little indication of change other than slight overall increases in implementation in the water sector. There are a significant number of design- and development-stage projects in the telecom, public, and gas sectors, which should result in a jump in implementations by next year's survey.

## Operations and Maintenance

Last year, most applications associated with this area reported a lower than 50% implementation rate in any industry. This year shows little change, with small increases in duct occupancy management and one-call at telecommunications companies, one-call at gas utilities, and pole inspections at electric utilities. There are also several areas with a large percentage of projects in design or development, including valve and manhole inspection and maintenance applications at water utilities and applications relating leaks to mains for gas utilities.

## Engineering Work Order

Generally recognized as the logical, single point-of-entry for new facilities data across most industries in a post-conversion implementation, increases here correspond with the high top 10 ratings for mobile computing and pen-based systems in utilities as they increase work sketch and as-built applications. Electric, gas, and telecom companies have very strong percentages of implementations in most or all application areas in this category. Water utilities have a solid percentage of projects in design or development for compatible units and work

sketches, indicating this sector is gradually making a move into the work order area.

## **Distribution and Field Automation**

Telecommunications and electric utilities have many projects using database access capabilities, while gas and electric companies have implemented many field viewers and are using CD-ROM capabilities extensively. There are a significant number of projects in the development or design stages, including GPS capabilities for water, gas, and telecoms, wireless capabilities for water, Web distribution for the public sector, and red-lining for telecommunications.

## **Miscellaneous Systems**

Among the lowest implementation percentages across all sectors, miscellaneous systems include applications that are considered part of corporate marketing and financial systems, such as customer targeting, business geographics, competitive analysis, and tax applications. Most segments are low and decreasing, perhaps because the required functionality is more cost-effective to implement on other linked systems. Tax polygon reporting was implemented extensively by public sector and gas utilities. Gas utilities also have implemented a good number of customer target marketing and business geographics projects. Telecommunications has a number of business geographics projects in development and design, while gas utilities have customer target marketing projects in development and design.

## **Facilities Interfaces**

Interfacing GIS facilities data with other corporate systems involves sending facilities data out to other systems, importing data into the GIS from other systems, or both. The concept that systems that create or maintain specific data types are the best source of data for other systems that can use the data is not new—it eliminates redundant data entry and maintenance and reduces the potential for discrepancies between systems used for decision support. Information technology operates at a higher level of efficiency when users of various types share data rather than re-create them, and as data become

more homogeneous and readily shared, this activity should increase in many of these areas.

## **Engineering Network Analysis**

Interfaces with load flow, load analysis, and load balancing applications are up for electric utilities, as are load flow and pressure analysis for gas companies. This indicates a decision to leave these mission-critical application areas on their separate systems, rather than develop applications for them on the GIS platform. Water companies have implemented many flow analysis projects and have a significant number of projects in design or development for pressure analysis and valve area isolation analysis. Although engineering network analysis implementations are very low in the public sector, there are a good number of hydrologic flow model projects in design or development.

## **Work and Materials Management**

Electric utilities have the greatest percentage of implementations in this category, averaging just under 50%. Telecommunications companies also have a good number of implementations, followed by gas companies. Although water implementations are low, this sector has a significant number of design or development projects for work management while telecoms have many design and development projects for materials management. Note the potential for real construction cost savings, as design engineers are enabled with “what-if ” scenarios for optimizing designs from the labor and materials cost side.

## **CIS/Trouble/Outage**

Electric utilities are the sector with the greatest percentage of implementations in this area, particularly for window or link with GIS, trouble call analysis, voice response unit, and outage analysis. Telecommunication companies also have a fair number of applications, including window or link with GIS, trouble call analysis, incidences display, computer-aided dispatch, and outage analysis. Areas with substantial design or development projects include windows or link with GIS and outage analysis for gas utilities, trouble call analysis for water utilities, and outage analysis for electric utilities.

## Miscellaneous Systems

Interfaces here include financial, human resources, SCADA, workflow automation, forecasting and planning, and document management. The greatest percentage of SCADA/EMS/distribution automation implementations are found at electric utilities, followed by water and then gas utilities. Telecom companies have a high implementation of document management systems. Telecoms have a high percentage of forecasting/planning projects in the design and development stage, and the public sector has a high percentage of workflow automation projects in the design and development stage.

## Acknowledgement of Report Participants

GITA thanks the people and organizations that participated in this survey. Their willingness to share

information has made the publication of this report possible. Overall, GITA received 294 survey responses, up substantially from last year's 204 responses. Some companies submitted more than one survey if they were involved in more than one type of utility, for instance electric and gas, or gas distribution and gas transmission (pipeline). These were carefully qualified, sorted, and included by market segment.

GITA respects the participants' desire for confidentiality with regard to dissemination of project-specific data. This acknowledgement section is the only place in which the report associates a company name with any data supplied via the survey. The report presents all other data only in summary by industry sector, and it does not identify them with a specific user participant.

Electric Participants	Number of Customers	Year Started
ADROITEC Information System Ltd., New Delhi, India	67,400	2004
Alliant Energy, Madison, Wis.	940,000	1992
Bangor Hydro, Bangor, Maine	110,000	1994
BC Hydro, Burnaby, British Columbia, Canada	1.6 million	1990
Boone Electric Co-op, Columbia, Mo.	24,678	1994
Cambridge & North Dumgries Hydro, Cambridge, Ontario, Canada	45,000	1993
CenterPoint Energy, Houston, Texas	4 million	1990
Central Lincoln PUD, Newport, Ore.	34,000	1993
Central Vermont Public Service, Rutland, Vt.	148,000	1994
Central Virginia Electric Cooperative, Lovingston, Va.	29,000	1999
Chelan County PUD, Wenatchee, Wash.	70,000	1992
Chugach Electric, Anchorage, Alaska	350,000	1994
City of Concord Electric Systems, Concord, N.C.	51,000	1998
City of Medicine Hat Electric Utility, Medicine Hat, Alberta, Canada	25,400	1990
City of Naperville, Naperville, Ill.	130,000	2000
City Water Light and Power, Springfield, Ill.	66,500	2001
Cleco Corporation, Pineville, La.	250,000	1972
Commonwealth Edison, Bartlett, Ill.	3.2 million	1994
Conectiv, Newark, Del.	3 million	1998
Consumers Energy, Grand Rapids, Mich.	2 million	2004
COPEL—Companhia Paranaense de Energia, Curitiba, Paraná, Brazil	9.5 million	1995
Cumberland Electric Membership Corp., Clarksville, Tenn.	79,000	1995
Dawson Public Power District, Lexington, Neb.	22,000	2004
Duke Power Company, Charlotte, N.C.	2.2 million	1997
EDP – Energias de Portugal, Lisboa, Portugal	10 million	1994
El Paso Electric Company, El Paso, Texas	300,000	2004
Enelven Distribuidora (Eneldis), Maracaibo, Zulia, Venezuela	550,000	2000
ENMAX Power Corporation, Calgary, Alberta, Canada	360,000	1991
Eugene Water & Electric Board, Eugene, Ore.	138,000	1998
Florida Power & Light, Juno Beach, Fla.	8 million	1985
Fortis Alberta, Calgary, Alberta, Canada	400,000	1986
Franklin County Public Utility District #1, Pasco, Wash.	20,450	1996



<b>Electric Participants (continued)</b>	<b>Number of Customers</b>	<b>Year Started</b>
Georgia Transmission Corporation, Tucker, Ga.	(39 cooperatives)	2000
Great Lakes Energy, Boyne City, Mich.	119,000	1992
Greenville Utilities, Greenville, N.C.	52,415	1997
Hart EMC, Hartwell, Ga.	30,000	1995
Huntsville Utilities, Huntsville, Ala.	140,000	1985
Idaho Power, Boise, Idaho	400,000	2001
Intermountain REA, Sedalia, Colo.	118,000	1989
Israel Electric Co., Tel Aviv, Israel	5 million	1994
Kansas City Power & Light, Kansas City, Mo.	N/A	1992
Ketchikan Public Utilities, Ketchikan, Alaska	5,000	2003
La Plata Electric Association, Durango, Colo.	26,000	1994
Lansing Board of Water and Light, Lansing, Mich.	97,448	1997
Lewis County PUD #1, Chenalis, Wash.	29,660	1997
Lincoln Electric System, Lincoln, Neb.	250,000	1985
MidAmerican Energy, Rock Island, Ill.	690,000	1992
Middle Tennessee EMC, Murfreesboro, Tenn.	160,000	1996
Murray City Power, Murray, Utah	35,000	1991
Nevada Power Company, Las Vegas, Nev.	650,000	1998
North Carolina Electric Membership Corp., Raleigh, N.C.	(27 cooperatives)	N/A
Northeast Utilities Service Company, Selden, Conn.	2 million	2002
OGE Energy Corp, Oklahoma City, Okla.	720,000	1994
Orange and Rockland Utilities, Spring Valley, N.Y.	250,000	1991
Orangeburg Department of Public Utilities, Orangeburg, S.C.	23,000	2002
PowerNet Limited, Ivercargill, Southland, New Zealand	64,000	1995
PSE&G, Newark, N.J.	2.5 million	1999
PUD No. 1 of Clallam County, Port Angeles, Wash.	26,000	2001
PUD No. 1 of Klickitat County, Goldendale, Wash.	10,500	1998
Riverside Public Utilities, Riverside, Calif.	100,000	1991
SAIC/Entergy, New Orleans, La.	2.6 million	1990
SaskPower, Regina, Saskatchewan, Canada	434,000	1996
Snohomish County PUD No. 1, Everett, Wash.	290,000	1991
SRP (Salt River Project), Phoenix, Ariz.	830,000	1980
Tampa Electric Company, Tampa, Fla.	686,000	2000
Thunder Bay Hydro Electricity Distribution Inc., Thunder Bay, Ontario, Canada	43,000	1994
Toronto Hydro Corporation, Toronto, Ontario, Canada	2.4 million	2000
Truckee Donner PUD, Truckee, Calif.	46,000	2000
Tucson Electric Power, Tucson, Ariz.	600,000	1998
Wallingford Electric Division, Wallingford, Conn.	23,000	1989
We Energies, Waukesha, Wis.	1.1 million	1983
Wisconsin Public Service Corporation, Green Bay, Wis.	408,000	1984

<b>Gas Participants</b>	<b>Number of Customers</b>	<b>Year Started</b>
AGL Resources, Atlanta, Ga.	2.2 million	N/A
Alliant Energy, Madison, Wis.	404,000	1992
Bahiagas—Cia de Gas de Bahia, Bahia, Brazil	N/A	2003
CenterPoint Energy, Houston, Texas	3 million	2000
City of Palo Alto, Palo Alto, Calif.	23,416	1989
City of Tallahassee, Tallahassee, Fla.	24,000	1990
DTE Energy Gas/MichCon, Detroit, Mich.	1.2 million	1989
Gaz Métropolitain, Montréal, Québec, Canada	153,527	1985
Laclede Gas Company, St. Louis, Mo.	630,000	2003
MidAmerican Energy, Rock Island, Ill.	661,000	1992
New England Gas Company, Providence, R.I.	280,000	1998
NiSource, Inc.—Energy Distribution, Columbus, Ohio	2.5 million	1990
NSTAR Gas, Southboro, Mass.	250,000	1988
Orange and Rockland Utilities, Spring Valley, N.Y.	185,000	1991
Piedmont Natural Gas, Charlotte, N.C.	950,000	2001
Questar Regulated Services, Salt Lake City, Utah	780,000	1982

<b>Gas Participants (continued)</b>	<b>Number of Customers</b>	<b>Year Started</b>
SEMCO ENERGY Gas Company, Port Huron, Mich.	265,000	1996
Terasen Gas, Surrey, British Columbia, Canada	862,000	1990
UGI Utilities, Inc., Reading, Pa.	270,000	1998
Unisource Energy Services, Flagstaff, Ariz.	135,000	1995
We Energies, Waukesha, Wis.	1 million	1995
Wisconsin Public Service Corporation, Green Bay, Wis.	296,000	1999
Xcel Energy, Denver, Colo.	1.5 million	1993

<b>Pipeline Participants</b>	<b>Number of Transmission Miles</b>	<b>Year Started</b>
Ameren Corporation, St. Louis, Mo.	550 miles	1993
BP Canada Energy Company, Calgary, Alberta, Canada	4,971 km	2000
BP Pipelines NA, Warrenville, Ill.	120,000 miles	N/A
ChevronTexaco Pipeline Co., Houston, Texas	12,000 miles	1989
Dow Pipeline, Port Lavaca, Texas	3,200 miles	2000
El Paso Corp., Houston, Texas	60,000 miles	1985
Enbridge Pipelines Inc., Edmonton, Alberta, Canada	4,640 km	1999
Energy Resources Management, Houston, Texas	0 miles	2002
Enterprise Products, Houston, Texas	26,000 miles	1990
ExxonMobil Pipeline Company, Houston, Texas	11,700 miles	N/A
Panhandle Energy, Houston, Texas	11,000 miles	2000
Petris Technology, Houston, Texas	N/A	1999
Petro IT Pvt. Ltd. New Delhi, India	1,000 km	N/A
Sunoco Logistics, Honey Brook, Pa.	3,800 miles	1996
Telus, North Vancouver, British Columbia, Canada	1,800 km	N/A
Valero Energy Corporation, San Antonio, Texas	5,000 miles	1995
Williams Gas Pipeline-Northwest, Salt Lake City, Utah	5,000 miles	1985
Woodaicals, Seoul, South Korea	3,000 miles	N/A

<b>Telecom Participants</b>	<b>Number of Customers</b>	<b>Year Started</b>
AGL Resources, Atlanta, Ga.	1.8 million	2001
Allstream, Calgary, Alberta, Canada	n/a	1997
Alltel, Hudson, Ohio	n/a	1988
Bell Canada, Toronto, Ontario, Canada	17 million	1985
Bezeq The Israel Telecom Corp, Ramat Gan, Israel	3 million	1990
Enghouse Systems Limited, Markham, Ontario, Canada	N/A	1984
Frankfort Plant Board, Frankfort, Ky.	2,500	1982
Level 3 Communications, Broomfield, Colo.	N/A	1998
Manitoba Telecom Services, Winnipeg, Manitoba, Canada	700,000	2003
Matáv, Budapest, Hungary	2.3 million	1992
PCCW – Cascade Limited, Kowloon, Hong Kong	3.5 million	1991
Ponderosa Telephone Co., O'Neals, Calif.	10,000	1992
Reliance Digital World, Navi Mumbai, Maharashtra, India	9 million	2000
Ricoh Corporation, San Bernardino, CA	4	N/A
Sprint, Overland Park, Kan.	50 million	1986
SR Telecom, Montreal, Quebec, Canada	N/A	N/A
Telcordia Technologies, Huntsville, Ala.	N/A	1996
Telus Geomatics, Edmonton, Alberta, Canada	4 million	1997
WeDo Consulting, Lisboa, Portugal	3 million	2000

<b>Water Participants</b>	<b>Number of Customers</b>	<b>Year Started</b>
AECS, Damascus, Syria	N/A	1998
Boston Water & Sewer Commission, Boston, Mass.	1 million	1997
Cincinnati Water Works, Cincinnati, Ohio	860,000	1994
City of Englewood, Englewood, Colo.	32,500	1995
City of Everett, Everett, Wash.	97,000	1991
City of Mesa, Mesa, Ariz.	430,000	1997
City of Niagara Falls Canada, Niagara Falls, Ontario, Canada	80,000	1998
City of Palo Alto, Palo Alto, Calif.	62,000	1989
City of Scottsdale Water Resources, Scottsdale, Ariz.	215,000	1992
City of South Bend, South Bend, Ind.	107,000	1996
Clayton Group Services, Crystal Lake, Ill.	100,000	2004
Denver Wastewater, Denver, Colo.	600,000	1990
Denver Water, Denver, Colo.	1.1 million	1985
Eastern Municipal Water District, Perris, Calif.	500,000	1989
EPCOR, Edmonton, Alberta, Canada	999,800	1978
Eugene Water & Electric, Eugene, Ore.	140,000	1994
Huntsville Utilities, Huntsville, Ala.	180,000	1990
IntelliCAD Service S.R.I., Bucharest, Romania	2 million	N/A
Lehigh County Authority, Allentown, Pa.	30,000	2000
Madison Water Utility, Madison, Wis.	215,000	1994
Meshek & Associates, Sand Springs, Okla.	25,000	2001
Murray City, Murray, Utah	45,000	1995
New York City Dept. of Environmental Protection, New York, N.Y.	8.3 million	N/A
Newport News Waterworks, Newport News, Va.	400,000	1986
Northeast Ohio Regional Sewer District, Cleveland, Ohio	1 million	2000
North Wales Water Authority, North Wales, Pa.	(7 municipalities)	2001
Ocean County Utilities Authority, Bayville, N.J.	600,000	2001
Orlando Utilities Commission, Orlando, Fla.	190,000	2001
Pasadena Water, Pasadena, Calif.	160,000	2002
Potlatch Corporation, Boardman, Ore.	100	1995
SAMCO, Fishers, Ind.	36,000	1994
Sammamish Plateau Water and Sewer District, Sammamish, Wash.	43,000	1998
Spokane City Water, Spokane, Wash.	147,000	1999
Stockholm Water Co., Stockholm, Sweden	1.1 million	1997
St. Paul Regional Water Services, St. Paul, Minn.	447,487	1994
Texarkana Water Utility, Texarkana, Texas	61,000	1996
Turkish Petroleum Corp., Esentepe, Ankara, Turkey	300	2001
Truckee Donner PUD, Truckee, Calif.	20,000	2000
WCWD, Richmond, Calif.	92,000	2002
Western Arkansas Planning & Development District, Fort Smith, Ark.	200,000	2001
Wisconsin Rapids Water Works & Lighting, Wisconsin Rapids, Wis.	18,000	2001

<b>Public Sector Participants</b>	<b>Number of Customers</b>	<b>Year Started</b>
Army Corps of Engineers, Vicksburg, Miss.	1,200	1994
Butler County, Hamilton, Ohio	8	1980
Caldwell County Government, Lenoir, N.C.	74,000	1994
California Resources Agency, Sacramento, Calif.	36 million	1995
Center for Urban Transportation Research, Tampa, Fla.	17 million	1994
City of Arlington, Arlington, Texas	358,215	1990
City and County of Denver Environmental Health, Denver, Colo.	500,000	1995
City of Beaverton, Beaverton, Ore.	80,000	1985
City of Bloomington, Bloomington, Minn.	90,000	1998
City of Bowling Green, Bowling Green, Ky.	50,000	1988
City of Brampton, Brampton, Ontario, Canada	375,000	1980
City of Burlington, Burlington, N.C.	45,000	2000
City of Carson, Carson, Calif.	90,000	1995
City of Chula Vista, Chula Vista, Calif.	200,000	1985

Public Sector Participants (continued)	Number of Customers	Year Started
City of Cleveland Heights, Cleveland Heights, Ohio	50,000	1997
City of Dallas, Dallas, Texas	1 million	1992
City of Des Moines, Des Moines, Iowa	200,000	1992
City of Duluth, Duluth, Minn.	86,000	1994
City of Fargo Engineering, Fargo, N.D.	100,000	1980
City of Fort Wayne, Fort Wayne, Ind.	230,000	1998
City of Fredericton, Fredericton, New Brunswick, Canada	50,000	1991
City of Indianapolis, Indianapolis, Ind.	860,454	1987
City of Kingston, Kingston, Ontario, Canada	120,000	1994
City of Kitchener, Kitchener, Ontario, Canada	190,000	1993
City of Leduc, Leduc, Alberta, Canada	17,000	1990
City of McKinney, McKinney, Texas	85,000	1999
City of Merced, Merced, Calif.	67,000	1998
City of Mesa, Mesa, Ariz.	446,110	1992
City of Montrose, Montrose, Colo.	14,000	1989
City of Newington, Newington, Conn.	30,000	1999
City of Norwalk, Norwalk, Conn.	83,000	1992
City of Pana, Pana, Ill.	7,000	N/A
City of Pensacola, Pensacola, Fla.	50,000	1997
City of Ponca City, Ponca City, Okla.	26,000	1998
City of Red Deer, Red Deer, Alberta, Canada	76,000	1990
City of Renton, Renton, Wash.	49,000	1985
City of Richmond, Richmond, Ind.	300	1990
City of Roseville, Roseville, Minn.	34,000	1990
City of Santa Clarita, City of Santa Clarita, Calif.	155,000	1998
City of Sidney, Sidney, Neb.	3,500	1980
City of Stockbridge, Stockbridge, Ga.	18,000	2001
City of Tempe, Tempe, Ariz.	100,000	1985
City of Toronto, Toronto, Ontario, Canada	2.5 million	1999
City of Virginia Beach Public Utilities Engineering, Virginia Beach, Va.	500,000	1980
City of Welland, Welland, Ontario, Canada	48,000	2001
City of West Lafayette, West Lafayette, Ind.	26,000	1999
Citywide, Melbourne, Victoria, Australia	2 million	2000
Clear Creek County Government, Georgetown, Colo.	9,300	1987
Comm. Of Massachusetts Dept. of Conservation and Rec., Boston, Mass.	5.5 million	1980
Delaware Office of State Planning Coordination, Dover, Del.	850,000	1998
DeSoto County, Harnando, Miss.	125,000	2000
DHS/FEMA Region 10, Gig Harbor, Wash.	11 million	1995
El Dorado County Department of Agriculture, Placerville, Calif.	200,000	1997
Ellis Environmental Group, Newberry, Fla.	N/A	1999
Finance-IS, Woodland, Calif.	53,000	1997
Franklin County GIS, Pasco, Wash.	56,000	1992
Henry County, Cambridge, Ill.	51,000	2001
Highlands Ranch Metro Districts, Centennial, Colo.	60,000	1998
JCCAL, Birmingham, Ala.	260,000	1990
King County GIS Center, Seattle, Wash.	1.7 million	1990
Lafayette Consolidated Government, Lafayette, La.	200,000	1999
Livingston County IT/GIS Division, Howell, Mich.	160,000	1999
Maricopa County Assessor, Phoenix, Ariz.	3.4 million	1993
Maricopa County Elections Department, Phoenix, Ariz.	3.4 million	1996
Marion County Auditor's Office, Marion, Ohio	62,274	1999
Mercer County, Princeton, W.Va.	62,000	1995
Ministry of Work & Housing, Bahrain	1,500	N/A
MMSD, Milwaukee, Wis.	500,000	1970
National Capital Planning Commission, Washington, D.C.	70	1995
National Energy Board, Calgary, Alberta, Canada	N/A	2003
National Geospatial Intelligence Agency, Bethesda, Md.	1,000	1996
New Mexico Environment Dept., White Rock, N.M.	N/A	1995
New York Presbyterian Hospital EMS, New York, N.Y.	8 million	N/A

<b>Public Sector Participants (continued)</b>	<b>Number of Customers</b>	<b>Year Started</b>
NKAPC, Fort Mitchell, Ky.	300,000	1989
NKIDHD, Edgewood, Ky.	360,000	2003
Northern Kentucky Area Planning Commission, Fort Mitchell, Ky.	300,000	1985
Ohio EPA, Gahanna, Ohio	200	1996
OKI Mapping Systems, Camarillo, Calif.	1	2004
Polis Center, Indianapolis, Ind.	N/A	N/A
Port of Seattle, Seattle, Wash.	N/A	1986
Region of Durham, Whitby, Ontario, Canada	550,000	1997
Robeson County Tax Administration, Lumberton, N.C.	125,000	1994
Santa Barbara CAG, Santa Barbara, Calif.	400,000	2000
Santa Fe County, Santa Fe, N.M.	300,000	1997
Sedgwick Associates, Houston, Texas	10	1995
Seminole County Florida, Sanford, Fla.	400,000	1989
SPC, Pittsburgh, Pa.	2.6 million	1993
St. Clair County Metro. Planning, Port Huron, Mich.	31	N/A
Strategic Consulting International, Tulsa, Okla.	100,000	1998
Sundsta-Alvkullegymnasiet, Karlstad, Värmland, Sweden	200	1995
Tioga County, Wellsboro, Pa.	47,000	2001
T.M.A. Gujrat, Gujrat, Pakistan	65	N/A
Town of Falmouth, Falmouth, Mass.	34,000	1996
Town of Stockbridge, Stockbridge, Mass.	1900	1999
Town of Tewksbury, Tewksbury, Mass.	30,000	1999
Universal Map, Williamstown, Mich.	N/A	2000
U.S. Air Force, Colorado Springs, Colo.	3,000	1990
U.S. Geological Survey, Reston, Va.	N/A	N/A
U.S. Space and Rocket Center, Huntsville, Ala.	4.5 million	2000
Village of Schaumburg, Schaumburg, Conn.	80,000	1993
Yuma County, Wray, Colo.	9,000	2002