Smart Grid Operational Services

Utility Mobile IT Adoption

Utility companies have taken great strides in employing the latest technology to manage their work forces, assets and operations. Many have invested significantly in enterprise asset management (EAM) and outage management software, scheduling tools, remote meter reading systems and proprietary communication networks. These tools have delivered marked improvements in productivity and the quality of many processes, empowering utilities to provide a consistent and reliable product. Yet many utility organizations are looking beyond improving back office operations and seeking other ways to get more done, collaborate better and further the efficiency of their day to day activities.

Why? The reasons are many: Continuing deregulation has made the utilities industry more price competitive. The transmission and distribution infrastructure is aging and is in some instances well past its planned service life. The workforce is aging as well, and qualified people are increasingly scarce and more expensive to hire. Customers are demanding one hundred percent availability, environmental awareness, accurate billing and quick fault resolution. Government and industry compliance regulations are becoming stricter. All of this, and more, is business as usual for utilities management.

According to the US Department of Energy, 70 percent of the nation's transmission lines and power transformers are now 25 years or older, and 60 percent of circuit breakers are more than 30 years old. This makes preventative maintenance a top priority and creates tight cost pressures for asset management operations.

With a paper based system, a single work order requires an 11-step process that involves at least five employees to print, sort, enter data and perform the actual work. With mobile technology, work orders can be automatically scheduled, distributed to field employees and closed without a single paper document.

To meet these challenges and be better prepared for the unexpected, companies are increasingly adopting mobile solutions as a way to further control costs, improve productivity and make better decisions throughout their organizations.

This report briefly reviews the state of mobile adoption among utilities and outlines several high return mobilization areas for managers to consider. It further discusses criteria for selection of mobile solutions and provides some leading practices for their implementation within the utility industry.

Why Now?

Electric utilities are enabling or deploying mobility mobile because of the technology's two fundamental capabilities to:

Reduce cycle time: Mobile technology allows such repetitive and/or time consuming activities as inspections, repairs, meter readings and installation of equipment to be completed more efficiently. This reduction in process cycle time delivers significant benefits in customer satisfaction, cost reduction and efficiency.

Facilitate the exchange of information: Mobile technology is extremely beneficial to organizations whose data either resides outside of the enterprise or is needed and inaccessible in the field. This bilateral flow of information greatly improves the decision making ability of both field employees and managers back at the office.

As we will discuss later in this report, mobile technology finds many uses in the utility industry, and most of them belong in the above categories.

When we talk about adoption of mobile technology by utilities, it is important to note that this process is happening in two distinct phases. The industry was rather quick to adopt communi-cations and remote office solutions such as wireless e-mail, mainly because they were widely available and delivered a clear set of benefits. The second phase is the adoption of mobile applications designed specifically for the utilities industry. These can bring exponentially larger benefits than general use horizontal tools, and they are quickly gaining acceptance because of changes in the external environment.

First, the utilities industry is facing the dual challenge of aging infrastructure and aging workforce. Over the past decade, most investment was directed toward constructing new facilities to meet demand, rather than to refurbishing existing equipment. According to the US Department of Energy, 70 percent of the nation's transmission lines and power transformers are now 25 years or older, and 60 percent of circuit breakers are more than 30 years old. This makes preventative maintenance a top priority and creates tight cost pressures for asset management operations. By the same token, some industry surveys report that less than 10 percent of utility workers are under the age of 35, and that most utilities will lose an average of 20 percent of their staffs over the next five years, and some will lose up to 40 percent. This trend exacerbates the need to get more done with fewer people, cut costs, transfer knowledge and standardize processes.

Secondly, at the infrastructure level, is the emergence of mobile platforms that can interface with several back-end systems simultaneously and cost effectively deliver intuitive workflow solutions.

Third is the improvement of mobile device technology. Today's handheld mobile units are vastly superior to older devices, which lacked in battery power, memory, processing capacity and support for the multiple networks and peripherals that employees needed in

the field. Current generation ruggedized devices are truly multipurpose tools that can incorporate location based information, bar-coding and RFID, voice applications, signature capture, imaging, printing and pairing with calibration tools in a small, lightweight device that has an outdoor readable screen and can be worn on a belt.

The fourth factor is the improvement of mobile application security, which had previously posed a barrier.

Finally, a drastic shift has occurred in how companies use mobile technology. Previously, the main use of mobile applications has been to get the information "out" into the hands of field personnel. Increasingly, however, companies are placing more importance on the inward flow of information to enterprise applications such as ERP, EAM, CIS and SCM. In the ELP industry, rapid incorporation of information from the field allows companies to optimize power generation, transmission and distribution through improvements in planning, scheduling, inventory management, logistics and other processes. This inward flow of information is nearly impossible to achieve, with any degree of detail or reliability, with horizontal solutions, such as wireless e-mail.

Mobilize What?

Contrary to what many believe, the biggest barrier to mobile adoption isn't the complexity of the mobile technology or tying it to back-end software. According to a study by a leading industry analyst firm, two of the largest challenges that companies have to overcome are proving the business case and selecting areas to mobilize. While the first challenge is rather apparent, the second is less obvious. Yet it is true that many applications of mobile in the utility industry are hard to uncover.

At Capgemini, with multiple live deployments in utilities, we have the benefit of the collective intelligence of the world's leading utility companies behind us. This gives us great confidence in confirming that mobile technology finds its uses in virtually all parts of a utilities provider's value chain. The next several pages of the report will review some of these applications as well as benefits that companies can realize.

Benefits of Mobile Technology

Increase worker productivity

Mobile solutions improve worker productivity by minimizing idle time, unnecessary travel and redundant data entry. Consider the following example that compares a paper based work order process with one that can be achieved with a mobile work management solution.

With a paper based system, a single work order requires an 11-step process that involves at least five employees to print, sort, enter data and perform the actual work. With mobile technology, work orders can be automatically scheduled, distributed to field employees and closed without a single paper document. This cuts out multiple time consuming steps from the process and results in better visibility and supervisory control across the board.

Reduce costs

Replacing a paper based system with a mobile work management solution delivers considerable cost savings. Using mobile technology allows companies to handle increased work volumes without the propor-tionate increases in staffing levels.

For many companies, this can translate into significant savings in hiring, training and salary for new employees. Several other areas benefit from cost savings as well:

- Eliminating the need for data entry and handling of paperwork can reduce administrative expenses and allow companies to retrain administrative staff to perform higher value activities
- Better management of spare parts and tools inventories reduces the organization's costs in handling these items and often completely eliminates excessive shipping charges for emergency parts orders
- Tightened supply chain capabilities, specifically with raw materials forecasting leads to decreased operating costs
- Faster turnarounds by pairing project management software with mobile solutions can save companies millions of dollars in lost revenue and overtime labor costs

Streamline operations

Although some benefits of mobile technology can be easily tied to the organization's bottom line, many others contribute to the company's competitiveness and long term well being less directly. The improved flow of information to and from field employees serves as a key enabler for companies to:

- Improve and accelerate decision making by providing employees with situational data they need to confidently make decisions in the field: Because the data is continuously and consistently updated by the entire team, engineers can be confident that they are making decisions based on trustworthy and up-to-date information.
- Improve visibility into work status: Without mobile technology, the work order status and information captured in the field is often collated only at the end of the shift when all employees return to the office. Extending back-end systems to mobile devices allows managers to have instant knowledge and control of the work that is being done.
- Improve scheduling: Enabled with real time work status and location information for employees, inventory and equipment, supervisors can make vastly better scheduling decisions. The added transparency of operations

The goal behind implementing sophisticated project management, outage management and GIS systems was to improve decision making across the organization, track more information and improve analysis and performance in key areas of the business. It only makes sense then, to extend these capabilities to as many employees as possible and to remove paper as the communication medium between information in the field and in the back-end applications.

Bridging the gap between the field and the office greatly affects a company's ability to react to unexpected events, shortening outage times and allowing engineers to swiftly resolve unforeseen changes in loads and conditions.

ensures that travel times are minimized, that engineers who arrive at job site have the correct qualifications, and that all necessary parts and tools are available at the job site before work begins. This eliminates employee frustration, saves labor and travel hours and ensures that more work gets done every day.

Extend asset life
Multiple operational improvements created by mobile technology allow engineers to do a better job at servicing critical assets. Improved productivity and scheduling provides more time for preventative maintenance of power plants, the transmission network, substations and the distribution infrastructure. In addition, immediate access to historical maintenance and repair records allows technicians to better isolate current and potential problem areas and perform proper and timely service on assets. As a result, first time fix rates improve, and the assets' service life is extended.

Increase responsiveness
Bridging the gap between the field and the office greatly affects a company's ability to react to unexpected events, shortening outage times and allowing engineers to swiftly resolve unforeseen changes in loads and conditions. Adding mobile components to outage management, work management and scheduling/dispatch systems allows system operations to rapidly disseminate large numbers of work orders and instructions in response to an outage or an emergency.

Improve employee satisfaction
When employees have the right tools and resources to do their jobs, their satisfaction invariably improves. After all, staff engineers and technicians are hired for their skills in their crafts, not for their ability to navigate mazes of paperwork and intricacies of forms and procedures. And it certainly adds much to the a standby engineer's stress levels to get out to an unfamiliar outage site, at night and under heavy rain, and not even know where the assignment is without consulting detailed maps in the truck.

Mobile software solutions can give employees improved autonomy and personal control over their work, and they can streamline the inter-departmental cooperation that makes many tasks easier. The results are increased employee morale and decreased absenteeism and turnover.

Enhance safety and security
Mobile solutions promote employees' safety by providing them with the information they need to make competent decisions in the field. For example, if a switch was broken and is being replaced, the entire team benefits from knowing when it goes back online. Similarly, having full access to information about the location and condition of the plant and equipment allows linemen to take necessary precautions upfront.

Reduce regulatory fines and improve compliance
Compliance and reporting for the US Department of Energy, OSHA, and state and industry agencies can strain utilities companies' time and resources. In addition to developing and complying with multiple procedures, companies must readily provide in-depth reports on their operations — facing hefty fines for failure to do so. By capturing information at the point of performance and uploading it directly to back-end systems, companies can quickly create the necessary reports and successfully pass the strictest of audits.

Improve customer service
Mobilizing critical parts of customer account management allows utility companies to be more responsive to customer needs and create higher levels of customer satisfaction. For example, if a company has a policy of terminating

electricity supply to a residence or business when payment is not received on time, the payment status should be updated immediately upon receipt to ensure that the customer can have their power quickly switched back on. Similarly, a customer may be paying his bill in one of the offices when a service representative in the field terminates the customer's electrical supply. With wireless applications, an alert will be automatically issued to the field worker and an unfortunate incident will be avoided.

Maximize the Value of Back-End Systems

Finally, extending core back-end systems to mobile devices helps companies get the most out of their investments in these applications. The goal behind implementing sophisticated project management, outage management and GIS was to improve decision making across the organization, track more information and improve analysis and performance in key areas of the business. It only makes sense then, to extend these capabilities to as many employees as possible and to remove paper as the communication medium between information in the field and in the back-end applications.

Selecting the Right Mobile Solution: Leading Practices

Suppose the areas of the business that should be mobilized have been identified and a strong business case for a mobile deployment can be built. How does a business select a mobile solution that is correct for its needs?

The following section provides a brief overview of areas that must be addressed to arrive at a solution that will meet demands in the short term and the years ahead.

Usability

No matter how brilliant the underlying technology or tangible the business benefits, a mobile solution that is difficult to use, slow or cumbersome to interact with, or prone to errors will inevitably fail. Ease of use and seamless operation is paramount to user adoption and the success of a mobile deployment. Here are some things to keep in mind:

- Intuitive workflow: The mobile application should reflect the way that employees work, not the way that the back-end systems are set up. This includes arranging fields and forms in the order of task progression, using branching logic to only display relevant information and breaking up a single form into several screens, tends to improve usability and shorten training times. Other usability improvements, such as providing several ways to navigate to the needed screen, context sensitive information entry and drop down menus can also help reduce process and data entry errors. The primary goals for a mobile solution are to gather better information and to be more productive. The software should be set up to achieve these objectives.
- Device selection: Selecting the correct device for the job plays a major role in the speed of adoption and the level of worker productivity. For example, using a palm top (instead of a pistol grip) device in scan intensive environments, or using a keyboardless handheld for qualitative observations may significantly reduce productivity and prompt complaints from your workforce. Selecting a rugged, easy to use multipurpose tool with an outdoor readable screen, support for a variety of networks, integrated GPS, and bar-coding/imaging can greatly contribute to ther solution's usability and aid adoption rates.
- Battery life: It is important to pick a device/connectivity/workflow configuration that provides the

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necessary duration of uninterrupted usage for employees. Always-on connectivity and heavy data entry quickly deplete the battery, requiring employees to spot charge the device or carry a spare.

- **Availability:** Good mobile solutions are not completely dependent on connectivity. Although it is extremely beneficial to update information in real time, the behavior of the actual mobile application should not vary with network availability. Always-on approaches tend to be very sensitive to network bandwidth and latency, and can leave employees waiting for screens to refresh instead of performing work. Robust client-based applications that store all pertinent data and business logic on the device offer great advantages in this regard. They are always available and perform faster in all conditions because all screens and data sets reside on the device, and validation rules and business logic can run locally.

Solution Architecture and Integration Capabilities

Few applications deployed by utility companies today are self contained tools that function in isolation on workers' devices. Mobile solutions are generally geared at getting data in or out of back-end systems and therefore, have to be integrated into them to exchange information.

As previously mentioned, the best mobile solutions can instantly integrate with multiple systems to provide employees with all of the information they need as a part of a single application, and to allow workers to simultaneously update several systems based on information captured in the field. Such solutions can significantly improve productivity by simplifying information retrieval and reduce costs by eliminating redundant information entry. In effect, a mobile solution can become the information hub for back-end systems.

Traditional mobile approaches either required each individual system to have a mobile extension or integrated multiple systems before passing the information to the mobile device. Both of these approaches have different but rather significant disadvantages. Having mobile extensions for multiple systems requires separate applications to be deployed and managed on mobile devices, which is expensive and generally does not allow workers to use more than one system at a time. On the other hand, integrating multiple systems before sending information to the mobile solution can help achieve the needed functionality, but it creates a system that is very inflexible. A minor change in business logic or workflow can have the domino effect of having to adjust the entire arrangement, most often by employing expensive on site consultants. In contrast, having a solution that independently interacts with multiple back-end systems and automatically aggregates information for the user makes the mobile application adaptable and eliminates vendor lock in. It also eliminates the time consuming process of rekeying information from one system to another or accessing multiple systems to coordinate a single repair trip.

Technology Capabilities

Another key area to address in deploying a mobile solution is the depth of functionality and technology capabilities that the solution requires. Over engineering a mobile application may diminish performance and usability, and can make the mobile tool difficult and expensive to maintain. However, it is important to ensure that a mobile vendor addresses the following areas to guarantee that a solution is flexible and can meet needs in the long term:

- **Support for diverse device platforms:** Device platforms and operating systems undergo significant upgrades every two to three years, often becoming incompatible with current mobile software. It is important that the chosen vendor support a broad range of devices in order to make the best out of your current hardware investments and to provide flexibility in the future.
- **Support for multiple peripherals:** Although it is unlikely that your core business processes will change dramatically in the coming years, technology has a way of constantly uncovering new ways to streamline existing practices and introduce new efficiencies. GPS, WiFi, RFID, voice, and high megapixel integrated cameras are just few examples of technologies that gained wide acceptance in recent years and transformed many activities in the business world. Selecting a vendor that is quick to integrate such new technology can help companies to remain competitive and efficient.
- **Support for multiple networks:** Great care should be taken to understand when and where employees need wireless connectivity. A mobile solution that supports wireless networks allows the user to configure the software to use different communication methods depending on availability, cost and convenience and to add an extra level of reliability to the solution by allowing the device to switch to a different connectivity method if the primary communications path is broken. Ideally, support for these various networks should be driven by solution intelligence that defines least cost routing or preferred network routing for flexibility and cost management.
- **Security:** Security measures may be available at the enterprise, transport and device levels. Although not all applications should be equally secure, look for a mobile solution that allows one to adjust security measures to accommodate the changes to the security profile over time.

- **Integration with third party mobile applications:** On device integration with other mobile applications is important for companies that already employ or plan to roll out third party software, such as GIS mapping services. When the client side architecture is open, the new mobile application can be configured to exchange information with other mobile software on the device, providing an added measure of integration.

Flexibility and Upgradeability

In addition to technology capabilities, it is important to understand a vendor's application development and software upgrade methodologies. Some critical questions to ask include:

- Can the solution be configured and maintained on site by trained staff or do changes have to be hard coded by the vendor?
- If changes can be made on site, are they easy to make? Can they be made in a GUI environment rather than coding in VB, .NET or C++?
- Can a vendor's development framework be used to inexpensively create custom applications or application modules in the future?
- Do devices need to be brought in from the field for upgrades, or can updates be sent over the network?

The degree to which a future vendor addresses these lifecycle management areas can have a significant impact on the total cost of ownership (TCO) of the mobile solutions.

Durability of a Solution

When choosing a mobile solution, a company must carefully consider the every day demands to its software and hardware components. On the software side, the system should be highly scalable and capable of simultaneously processing multiple transactions.

For example, when the entire workforce of several thousand engineers signs in at the beginning of the shift, the solution should not become sluggish or prone to crashing. On the hardware side, it is critical to understand the rigors of the devices' everyday lives. Notebooks will be dropped and stepped on, handhelds will be left in trucks under damaging sun, screen scratching signatures will be captured 50 times a day, and moisture and dust will be ever present. Although consumer grade devices may be cheaper to buy at the onset, the overall cost of ownership for ruggedized devices can be up to 33 percent lower due to their durability and a strong support network.

Solution Set

Consider the mobility strategy in the long term. Does it include deploying a single application or potentially mobilizing several areas of the business? If so, vendors must be evaluated on the ability to provide ready to deploy applications for multiple areas in the company's value chain. Having such solutions dramatically reduces project times and saves companies significant resources in application development, integration and customization.

In Summary

Utility companies are quickly adopting mobile technology to help drive efficiencies in generation, transmission and distribution of electricity. Whether a company owns several steps of this process or concentrates on a single area, mobile solutions can help to shorten core process times and facilitate the flow of information throughout the enterprise. Several high benefit mobility areas have been outlined in this report, yet the technology presents virtually limitless opportunities to improve employees' workflow, maximize the quality of data in the back-end systems and cut paperwork out of everyday processes.

It is important, however, to carefully weigh costs against benefits in mobile projects. Remember: if a mobile solution does not save time or money, it's a waste of both. Take a holistic approach to scoping out the mobile project and to selecting a long term technology partner. To achieve a high return on investment with a mobile initiative, ensure that mobile tools are easy to use, versatile, durable and scalable. Understand that the solution will evolve over time, both in size and in scope, and it is critical to Sselect a solution that can accommodate this. Think strategically about mobile as a part of the overall IT infrastructure, security profile and back-end system environment.

Finally, seek advice from mobile specialists. Look for comparable companies that have deployed multiple solutions to address similar challenges. Time and money will likely be saved in development, integration and deployment by relying on a set of industry leading practices and knowledge of mobile "gotchas" that can only come from years of experience.

With years of experience and unmatched execution expertise serving over 750 customers, Capgemini assists organizations with mobile workforces who are faced with the challenges of streamlining workflow and improving productivity.

Capgemini delivers quick realization of benefits by offering rapidly deployable mobile solutions built on 100-percent configurable and reliable mobile architectures.

Capgemini provides the fastest path to mobilize enterprise systems. Unlike other mobile solution providers, Capgemini simplifies enterprise wide deployments with a leading strategic architecture for one or more mobile applications while you concentrate on business processes. Capgemini also sets the standard for adapting to rapid change and managing the risks associated with change.

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