

## Biographical Information

Ira Weiss  
IT Manager, Field Force Automation  
Exelon Energy

### Specific Responsibilities

Ira Weiss is the manager of the Field Force Automation group in Exelon's IT Department. He is responsible for wireless applications that support field personnel in Exelon's Energy Delivery Business Unit, which includes both PECO Energy and ComEd. He manages several wireless applications and provides user support for a large customer base. Ira also is responsible for software enhancement requests and requests to scope, develop and implement new systems.

Ira has over 16 years of experience working in the Information Technology field working on software implementations. He has extensive experience implementing large-scale applications that support Electric and Gas Utility field operations and distribution work. Ira has worked at PECO for 11 years in a variety of roles including programmer/analyst, Project Manager and Manager. Ira has had previous experience working for Temple University as a software developer.

### Educational Information

BBA. Computer Science Major - Temple University.

### Professional Memberships

Member, Geospatial Information and Technology Association (GITA)

## BIOGRAPHICAL INFORMATION

Charles Marlin  
Consultant  
Graphic Technologies, Inc.

### Specific Responsibilities

Assist prospective customers in defining their requirements.  
Manage projects.  
Write and implement applications.

### Past Experience

Worked at Intergraph from March 1982 to October 2001, except for a hiatus in 1988-90.  
Held positions of Customer Engineer, Regional Technical Director, Executive Director of the International Graphic Users Group (IGUG), and Executive Manager for Utilities Customer Services.

Taught mathematics at Chattanooga State Technical Community College.

### Educational Information

Bachelor's degree in Mathematics, Harvard College

### Professional Memberships

GITA

# FIELD AUTOMATION AT PECO ENERGY

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## Abstract

PECO Energy, an Exelon Company, has in excess of 400,000 Gas Facility Records that have sketches, which are created in the field, when a gas customer receives a new service or upgrades to their existing service. This new application interfaces with a mainframe based Asset Management System. In the past, when a Gas Facility Record was needed to perform work at a specific address, a hardcopy Gas Facility Record would have to be retrieved via a physical catalog in a central location. Today, these records can be viewed, created or updated over a wireless web connection. The Gas Facility Record is displayed along with information from the Asset Management System. Additionally, there is an option to create or update a sketch, which will be accessible immediately by any technicians working at this location in the future. The asset management system can be automatically updated with the as-built information. This change in the business process has saved hours of drive time for each technician every week. It has transformed the repository of Gas Facility Records from an asset that was expensive to store and retrieve, into a source of information that is easily accessible by all Company personnel. In addition, the value of the Asset Management System has been extended, by sharing of this information with the people who need access to it, and by allowing those performing the work to update the data.

## Introduction

PECO Energy is an electric and natural gas utility subsidiary of Exelon Corporation. PECO serves 1.5 million electric and 460,000 natural gas customers in southeastern Pennsylvania. In 2003, its sales exceeded 36,753 gigawatt hours (gWh) of electricity and 92.3 billion cubic feet of natural gas to residential, business and institutional customers. PECO's energy delivery services generated \$4.38 billion in revenue for Exelon.

## Background

PECO Energy has implemented a new system to track its over 400,000 Gas Facility Records (GFR). This information, once available via hardcopies only, is now accessible remotely to over 170 personnel, many of whom obtain access to it wirelessly while performing fieldwork. The Gas Facility Record system called "GFRQuery" was one of several applications that were deployed to PECO field forces in a project that took nearly 2 years to fully implement. Other applications that were deployed as part of this project included electronic maps, a Gas Valve Database, and a Website to access electric switching routines and other important documents that are required during fieldwork.

The project was initiated as a result of the work of a re-engineering team that was established in the fall of 2000 to evaluate processes related to the Mapping and Document Services department. The team objective was to evaluate and identify process improvement opportunities that could positively impact safety, reliability and productivity while decreasing costs. One of the key recommendations was to provide access to Gas Facility Records and electronic maps for both reactive and maintenance field personnel, using Mobile Data Terminals. This would provide those workers with instant access to maps and Gas Facility data that was required to perform a gas job.

A project was established to implement a small pilot to assess the recommendations and determine the feasibility of expanding the pilot. The pilot was initiated with 8 laptops with wireless capabilities, for a period of 3 months, and set out to measure productivity improvements that could be gained by accessing this information while in the field. The initial functionality was electronic access to electric and gas maps and email. Using the data collected from the pilot, a business case was developed and a recommendation was made to expand the implementation to a larger group. In addition, it was recommended to develop a new application to provide access to Gas Facility Record data.

## Business Processes

Through the efforts of the re-engineering team, it was determined that mapping delivery processes were resulting in many process breakdowns. Examples included safety concerns due to inaccurate maps, escalating damage cases, and difficulty in accessing GFRs and manhole diagrams. The team determined that significant productivity increases could be delivered with the use of laptops for field personnel. Reactive field crews, who required prints and GFR information for emergent work, would have almost instant access to this data, thus eliminating trips back to Service Buildings. This would provide a boost to productivity by reducing windshield time. In addition, emailing of various documents related to a job would further increase productivity.

Another benefit was a reduction in the need for back office support. The old business process required Back Office workers to gather hardcopy GFRs, which included as-built sketches. These would be manually distributed to field workers for Gas Facilities work. Another inefficient back-office activity was the process of updating GFR data from hard copy paper forms that were completed in the field. Entry of the data into PECO's Asset Management system was often delayed by several weeks due to entry backlogs. This was a problem, since the latest data was not readily available to anyone working on those facilities. Another issue was that GFRs were only available at one location in hard copy format. This represented a major risk if there were a disaster at that location and those records were damaged or destroyed. Finally, data accuracy was sometimes compromised by either inaccurate completion of paper forms or inaccurate entry of the data into the system. In some cases, the paper forms may have been either lost or misplaced and never entered into the system.

## Solution

PECO began searching the marketplace for a system to track its Gas Facilities that would address many of the shortcomings of the current processes. When no "Off-the-shelf" product could be found that would meet these needs, PECO entered into an agreement with Graphic Technologies, Inc., to design, develop and implement a new system that would fulfill PECO's needs. The system had some unique requirements that needed to be considered during design. The system would need to be accessible via a wireless mobile data terminal to a field worker. It needed to provide access to the data whether or not the person was in wireless coverage. It would also need to be capable of creating as-built drawings and sending them back to a central database for others to access. Finally, it needed to be interfaced to PECO's Asset Management system to keep this information in sync with all field updates. The solution that PECO required was a "one stop shop" application that included access to textual data, service sketches, and gas maps.

As part of the implementation, all existing GFR sketches, which existed only in paper form, needed to be converted into electronic format so that they would become accessible to the new application. A small scanning team was formed to scan over 400,000 GFRs. This process was very tedious and took in excess of 2 years to complete. To enable the system to be implemented while scanning was in progress, scanning of GFRs was prioritized by geographic area based on the highest traffic areas. This would provide the

greatest immediate benefits while the scanning was occurring. Once all GFR scanning was completed, the full benefits of this system could be achieved.

## Change Management

One of the big challenges with the new technology was Change Management. Many of the workers that were being impacted by the new technology had limited computer skills, which presented a major challenge for both user acceptance and achievement of the expected benefits. Extensive training was required to learn computer basics, even before workers were trained on the new application. Training was provided on the new applications immediately prior to rollout and then planned on an annual basis as part of a re-certification training process. In addition, work processes needed to be re-engineered to incorporate the MDT's and new computer applications. Changes to the processes required a comprehensive change management program in order to obtain worker acceptance. Meetings were held with management early in the project to gain their sponsorship and continued on a periodic basis throughout the rollout. Employee involvement in the project was also a key in helping to ensure a smooth implementation. A user group was established prior to implementation to help identify issues and promote the technology. One representative was selected from each of the impacted business groups to act as a champion for that group. This forum provided valuable insight into how the implementation was going and helped to increase the chances for a successful implementation.

## Field Hardware

Selection of hardware was made based on a combination of factors including system requirements, user requirements, and cost. A decision was made to go with non-rugged full-sized laptops due to the significantly lower cost vs. rugged devices (one-third the cost). An extended warranty was purchased to help mitigate the risk of repair costs due to a harsh environment. The approach of device selection worked well at first but soon resulted in higher than expected failure rates and an increase in troubleshooting resources.

A drawing tablet, including a pen and mouse, was provided to all users to assist in simplifying the field sketching process. The selection of wireless aircards was made based on compatibility with the hardware and wireless network that was selected. CDPD was selected based on best-perceived available coverage and reliability in the PECO service territory.

## System Design

The GFR System was designed as a client server application with an Access database. The Access database stores all textual data, and TIFF files store all field sketches. TIFF files are stored on a file management system residing on a server. The TIFF sketches are stored only on the server, due to the significant number and size of the files. The textual data and gas maps are stored both on the local database and the server database. Windows 2000 laptops run client software and are capable of accessing system data in both standalone and connected mode. While in coverage, the system can access the central database, which resides on a Windows 2000 Web Server, over a public CDPD network. This provides real-time access to the most up to date sketch information. In standalone mode, the system can access all data except for sketches that have not been viewed before. If a field worker knows what sketches he/she requires for a job, they can be viewed while connected and they will remain cached on the MDT. Field workers must bring their laptops into the nearest Service building once every 2 weeks to synchronize the local textual database and gas maps with the central database. This will update their local database with the most recent GFRs. When an individual performs updates while in the field, they can be posted back to the central data repository once they are done with the updates. At that time, all other system users will have access to this information.

The application was developed in several phases so that users could be deployed quickly, begin immediately taking advantage of the benefits, and get accustomed to the new software in small increments. It also provided an opportunity to identify system problems, data problems, and enhancement opportunities along the way, so that they could then be incorporated into a software enhancement release at a later date.

The first phase provided access to view the data on the local database only. It included search facilities that allowed several options for record searches, including sub-string searches, when only partial information is known, such as a street name or geographic area.

The second phase installed a map viewer, which allowed users to seamlessly view Gas Map data and enable them to pan a map in all directions without opening separate map files. To enable this functionality, map data from the GIS system was converted to a format compatible for the viewing software. The viewing software in combination with the GFRQuery, enabled the users to access all Gas data in a single interface.

The third phase added functionality to allow the user to query for data from the web server, rather than being limited to the local Access database. This allowed for all system users to access the latest system updates that were available. At this point, the local database was used as a backup for when the user was out of wireless coverage. The Gas Facilities sketches were also made available for view-only. Gas sketches that were capable of display included both raster and vector drawing formats.

The fourth phase provided the ability to create new records and edit existing records. Updates could then be sent back to the central database for other users to access. When a user is connected through the network, he/she can see any posted data updates by another user immediately. This includes both sketches and textual data

In the fifth and final phase of the project, the GFRQuery application was upgraded to allow the user to update drawings. An interface was also implemented that would allow all the GFR data to be sent to the Asset Management system. This interface also included functionality to synchronize the central GFR database to the Asset Management system. Finally, enhancements and fixes that were identified in the earlier phases were implemented.

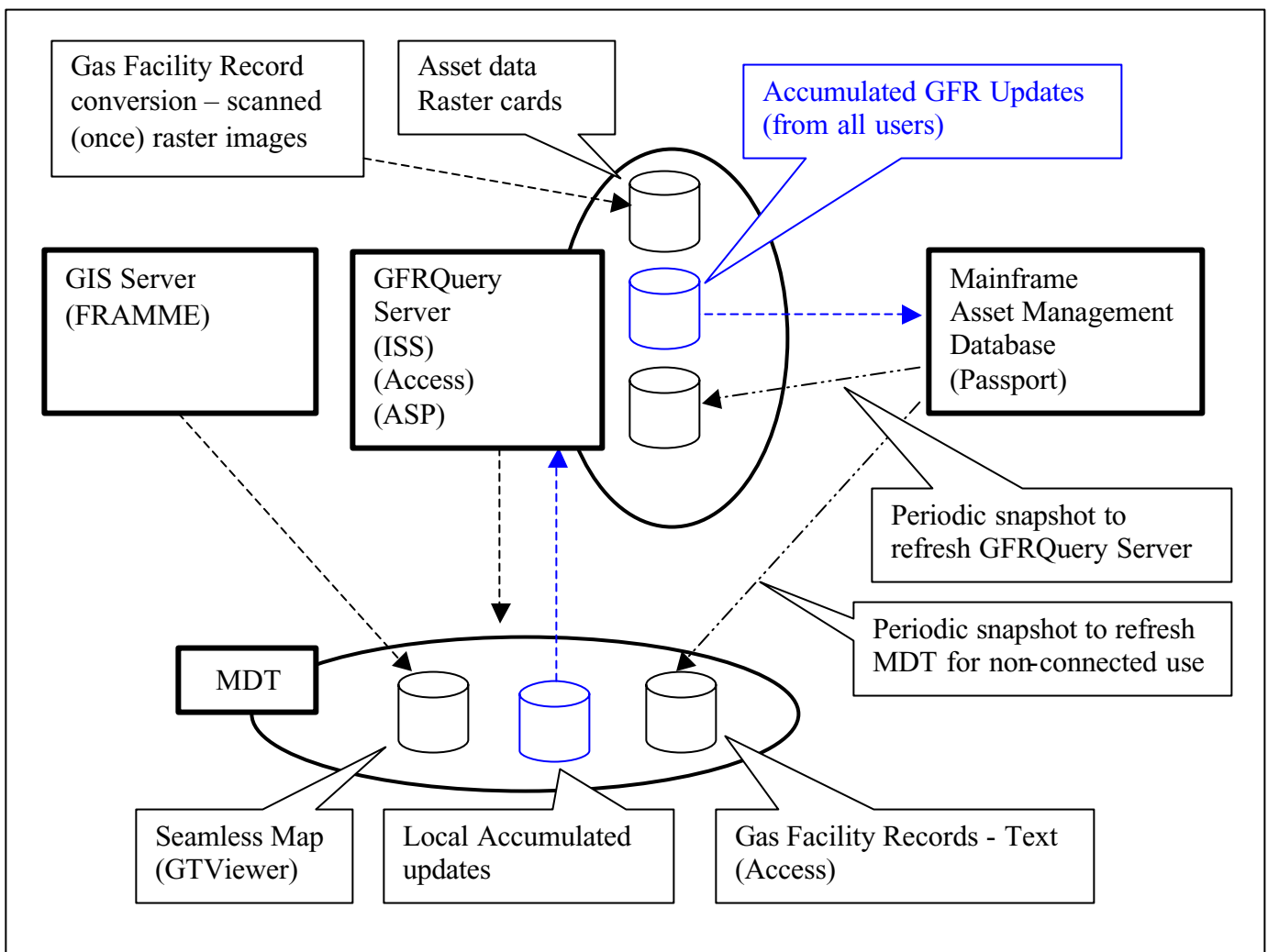


Figure 1: Block diagram for fifth phase.

## Lessons Learned

There were a number of key lessons learned that can be identified and used to improve the chances for future success with an implementation of mobile technologies.

1. Involve field personnel upfront to ensure their buy-in and obtain valuable input from everything from hardware and software selection, to testing and implementation.
2. Be sure not to focus only on upfront implementation costs, but consider ongoing costs for maintenance and support when making development and implementation decisions. Taking shortcuts when developing a project will likely end up costing more when considering TCO.
3. Set up a forum with the end users to identify and work issues, identify improvement opportunities and keep ongoing dialogue with them. This has provided valuable feedback, which has helped to quickly resolve issues and to maximize the benefits of the technology.
4. Document and obtain sign-off on all requirements and specifications before beginning development to help minimize the risk of rework on the back-end. It is crucial that IT and the business have a complete understanding of the system functionality that is required before beginning development.
5. Ensure strong sponsorship from the business to gain commitments for project resources, and support during and after implementation. Without it, the project is doomed for failure.
6. Develop a comprehensive Change Management plan that incorporates thorough user training. It is a good idea to survey your users to better understand their computer literacy before developing your course materials. Classes need to group users with similar experience levels so that those with limited computer skills can receive additional training to develop the basic skills. When introducing a new technology, training needs to be done in small increments with annual retraining to ensure that the maximum business benefits will be realized.
7. Define your new business processes before designing your final solution. Without this, the implementation will not succeed. Technology should not drive the business process; the business process must drive the technology.
8. Wireless coverage gaps need to be considered when designing the business process. No wireless network is 100%, so business processes and the application need to be developed to handle out of coverage situations.

## Summary

PECO is achieving its ROI from its implementation of mobile applications to its Gas and Electric field personnel. Beginning with a small pilot and expanding to over 300 users, these mobile applications have helped improve productivity by providing field personnel with better tools to do their jobs. Electronic maps and Gas Facility Records were two key applications that have helped PECO to achieve the goals that were established with the original business case. Additional benefits above and beyond the original business case were also derived, by providing laptops with wireless capabilities. The key to success

has been a strong change management program that has helped to gain end user acceptance. Without it, this would have been just another technology doomed for failure.