



The Impact that GIS could have on DOMLEC September 2005

**A document that will seek to justify the full implementation of GIS in
DOMLEC**

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Abstract

The island of Dominica is situated between the island of Guadeloupe and Martinique; it is the most northern and largest island of the windward island, measuring 50 km long by 20 km wide, covering 750 square kilometers. The topography is mountainous and rugged, which in turn contributes to the rich sources of fresh water.

Public electric power for the island of Dominica is generated, transmitted and distributed by Dominica Electricity Supply Company Limited (DOMLEC). The generation comprises a mixture of both hydroelectric and diesel generating plants. These plants supply the load centers over a transmission and distribution system, which operate at 11 kV at 50 Hz.

DOMLEC is the sole utility company involved in the generation distribution and supply of electricity on the island of Dominica and serves approximately 27,000 consumers. Domestic consumption accounts for 49.46% commercial 36.87%, industry 8.83% and public lighting 1.86%.

Introduction

Dominica Electricity Services Limited (DOMLEC) is providing services to approximately 28,000 customers. It is our vision that Geographic Information Systems (GIS) or more recently known as Geographic information Technology (GIT) can become the focal point of DOMLEC operations, not just an Engineering Mapping tool. In a more detailed perspective, GIS will be the technological tool that will help DOMLEC to improve its operation and achieve the overall mission of providing safe, reliable, and cost-effective utility services to the customers it serves in the 21st century. It is our vision that GIS will expand more broadly towards Geographic and facility record keeping systems for all of the company operating functions. More specifically, GIS impact on the company promises great prospects, and requires a great deal of work, and commitment. In conducting an assessment of GIS we recognized that it should fulfill the following major objectives:

- GIS must improve productivity
- GIS must provide a corporate-wide solution to facilities mapping and record-keeping problems, reduce data redundancy and improve corporate data access using PCs
- GIS full implementation must be proven to be cost-justified

- GIS must support the achievement of the following corporate goals:
 - Improve the quality of customer service
 - Lower operating costs
 - Remain competitive in an open access market
 - Improve the integration of corporate data and allow transparent GIS access to data
 - Maintain a stable financial position
 - Maintain system reliability, quality and safety of services and products and improve the utilization of assets
- GIS must provide quick access to current facilities and work-related data for emergency and daily work decision support
- GIS should help DOMLEC avoid certain costs
- GIS must help provide for regulatory compliance
- GIS should demonstrate enough functionality to result in a commitment from DOMLEC in the development of a common GIS that eliminates duplication of work processes and improves communications between all involved in the production of electricity

With respect to the technical resources available to DOMLEC for in the development of GIS, DOMLEC GIS is a windows-based solution which seeks to integrate all the different software. The GIS Software currently exists on five computers which are used for data entry, and processing; it is also installed on another workstation which functions as a server. As part of the tools for recovering data we use Four Trimble sub meter-data loggers for the capturing of accurate information using Global Positioning System (GPS). Corporate-wide access to GIS and other corporate systems is extended via Ethernet and token ring local area networks (LANs) and a fiber-optic wide-area network (WAN).

The main software data provide the company with the GIS basics of land and facility data maintenance, system navigation, mapping, reporting, data query, and job management. Existing custom software includes Terra Sync, Pathfinder, Arcpad, Arcmap; Arcreader, Manifold, Auto Cad; Arc sync; and several data maintenance software. Future plans call for developing trouble call entry, work Management System (WMS), Job design system (JDS), Field Design Systems (FDS), integrated logical models and display applications. The integration with DOMLEC'S SCADA and engineering analysis programs is in the making. All applications done thus far were developed and implemented in-house.

GIS was first introduced to DOMLEC in 1999 as an alternative to account for the Company's external assets, at that time there was not a clear appreciation of the then concept, and the company opted for alternative software "system Grade One".

The company used this software until 2003, then deciding to venture into GIS as an alternative, because of the many limitations which the then software possessed. Recognizing that GIS can be a very expensive alternative and the fact that DOMLEC is a small utility by comparison with other utilities in the Caribbean, careful analysis was made to determine the feasibility of the project.

Because of the standards set forth by the then Engineering Department, together with the corporate wide user, management requirements and financial and strategy business goals were to phase the GIS Project in the following processes:

- Conduct a Feasibility Study
- Implement a Pilot Project
- Full Implementation
- Initial focus on data conversion, data maintenance, and GIS basic functionality
- Implement functionality that addresses key business needs

In this document you will appreciate the impact that GIS will have on DOMLEC; we will seek to highlight the importance of the involvement of all, together with full cooperation from management and executives. It will also be noticed that, in order for GIS to be successful, the plans and processes laid out in this document have to be guided by a comprehensive plan of strategic action, policies, and standards that marshal the overall process, in other word “all must give the necessary support”.

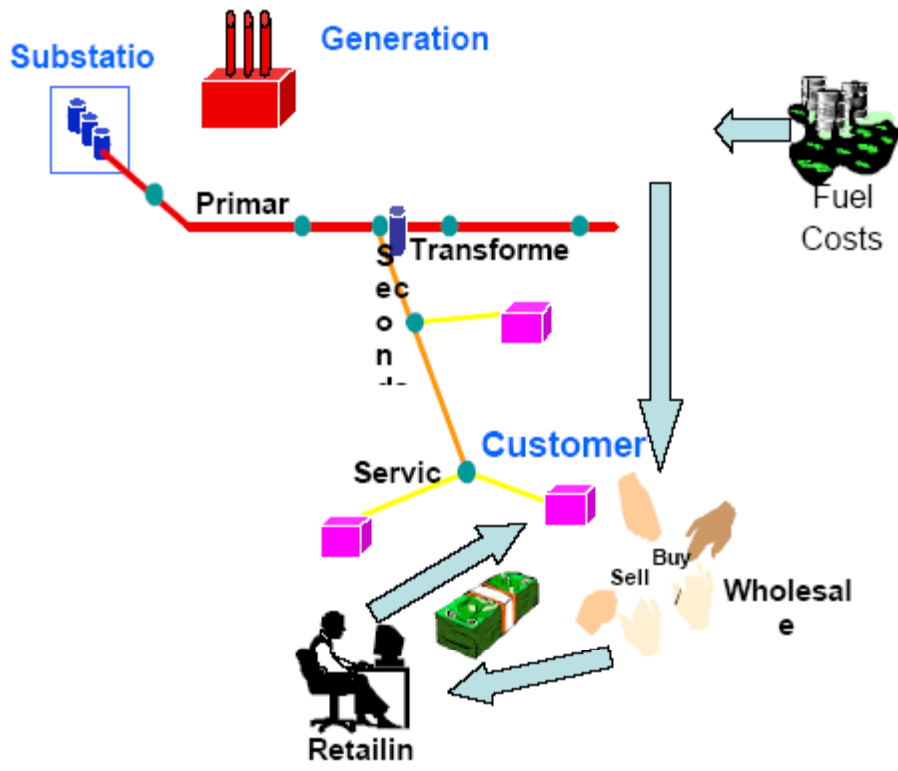


Figure showing the factors which influence the way DOMLEC conducts business

A brief look at DOMLEC

Present situation

DOMLEC is the sole provider of Electric Energy to the Commonwealth of Dominica. It has approximately 28000 customers which are dispersed mainly on the costal parts of the island.

The Company's striving to improve its services has brought about significant changes to the infrastructure; however growth is not as significant as we would have expected.

At present, DOMLEC operates four (4) major departments of which the Chief Engineering department is further divided in four sub-sections. Fig. 1 illustrates the divisions.

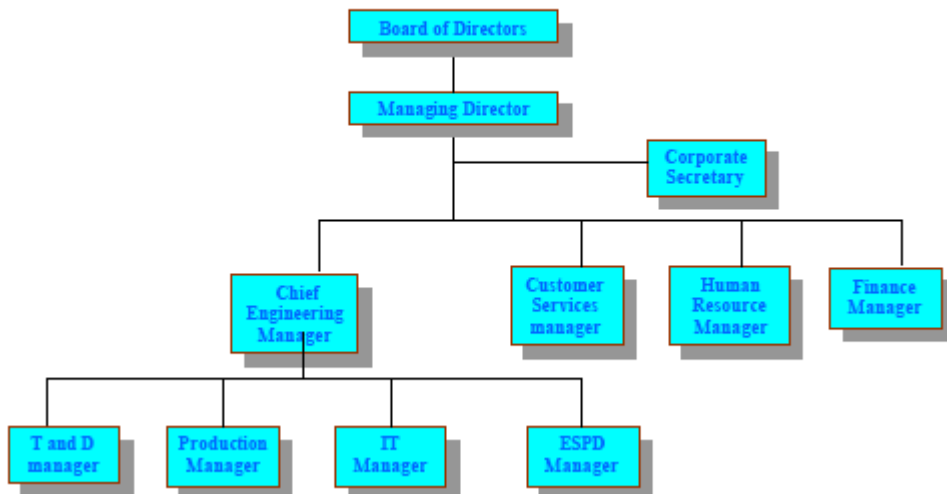


Figure 1 **Organizational Chart of DOMLEC (Executive Level)**

As determined in the introduction, a successful GIS depends on the support of management and the decision makers (board of directors). We have sought to form a group or committee that will be committed to the task at hand and chart and oversee the GIS way forward.

Overview of the departments

Customer Services

Has as its main function the responsibility of credit control and services to customers.

Human resources

- Dealing with employee needs
- Managing all data on personnel (employee) issues.
- Liaising with employees' union
- Training and recruitment of personnel.

Finance and accounting

- Responsible for the Accounting, Accounts payable, Accounts receivable, Budgeting, etc.
- Responsible for Asset Management
- Responsible for Information Systems Management
- among others

Engineering

- Responsible for the operation and maintenance of both Generation and Transmission & Distribution
- Responsible for monitoring and analyzing the entire system
- Planning and recommending future expansions or modifications on the system that result from growth.
- Investigation and implementation of new or innovative technologies

It must be noted that the task of engineering is spread out among four sub departments, namely, Engineering System Planning and Development (ESPD), Transmission and Distribution (T&D), Production (PD), and Information Technology (IT). All the additional departments are separated in different sections.

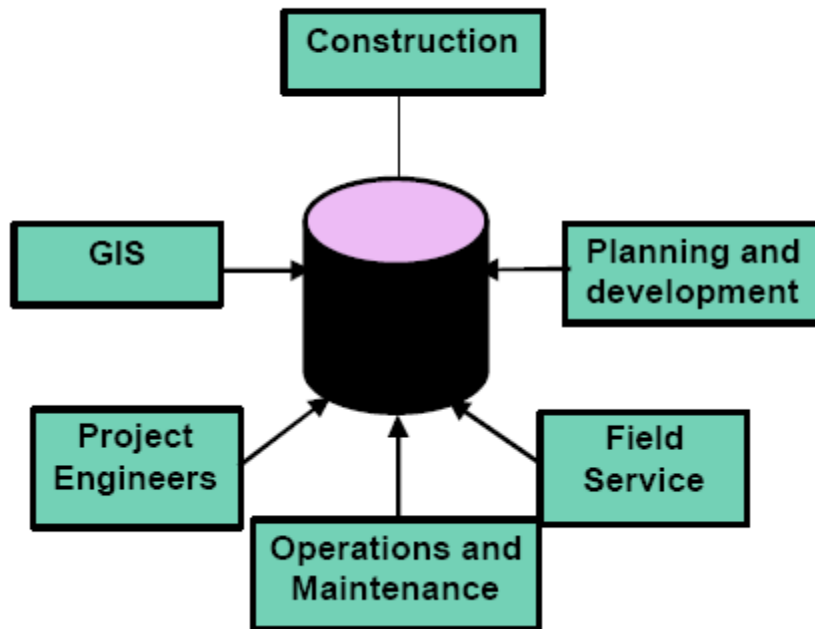


Figure 1 - Illustrating the different Engineering functions together with an example of integration

Problem statement

Although DOMLEC is categorized as a small company in comparison to others in the region, we must recognize that it comprises a complex configuration. The company network is equipped with a number of different electrical devices, such as lines, poles, transformers etc. which need proper management, accountability, and maintenance. Also, DOMLEC serves a diverse and large customer-base, on rugged terrain which in turn makes its operation complex and challenging.

It is true to say that work done in one section or department influences the work done in other departments, hence comes the question of integration - too often we are faced with the “old school” way of doing things. This manner of work allowed only a few persons to have knowledge of the system and its functionality, thereby reducing the efficiency level of the company.

In spite of many efforts to remedy the problems faced in the company, we were still left with problems of communication between departments, and the lack of or limited knowledge of the where-about of the company’s external assets, among others. Therefore, as a result of the many problems and challenges that the company faced, some of which will be highlighted by way of example further into the document, it was necessary to look to GIS. GIS can be the answer to the core problems that plague the efficient operation of DOMLEC.



Figure 2 - GIS addressing communication between departments

The intended Role of GIS

What is GIS? And how does it work?

One might ask, what is GIS? And, how does it work? The answers to the questions are as follows:

GIS is a methodology which facilitates the propagation and display of data from databases on an electronic map.

The GIS maintains a realistic model of a utility's distribution network on a geographic base; it also provides the capability to build connected models of a utility's distribution facilities. A facilities model is a computerized representation of the functional organization of the network. It describes individual facilities in terms of the function they perform, their engineering characteristics, and their relationship to other facilities. This facilities model is typically the nucleus of a large and diverse set of applications the utility can use to support its operations. The electric and other facilities data is captured using a relatively accurate technology called Global Positioning System (GPS) which is a worldwide radio navigation system from a constellation of **24** satellites and their ground stations. In reality *GPS receivers take satellite information and use triangulation to calculate the users exact location.*

Once the data is captured from the field it brought to the office for transfer processing, this process when completed opens a world of opportunities that influences the way see and utilize data. The support of software and computer systems help make the information available to all.

How can GIS contribute?

We have appreciated that GIS is a system that can take a centre stage role in the company's development. As seen in the problem statement, there are many activities that need to be redefined in order for there to be more efficiency.

To begin with, it is imperative that we look at the day to day activities in DOMLEC. DOMLEC has as part of its day to day activities highly specialized activities, which require information from different sources; one such activity is the Planning and Development activities which deals primarily with new layouts and determines whether the system can accommodate changes at specific conditions. For this activity the engineer will need from the different departments historical data, current data, operating scenarios, load condition, consumption patterns, asset details and financial details, among other activities.

As of now it should be clear that in light of the new challenges faced by the utility it had to consider immediate changes in processes, new organizational structure and new technology to achieve operational excellence. These changes were to bring about improved efficiency customer service and customer loyalty.

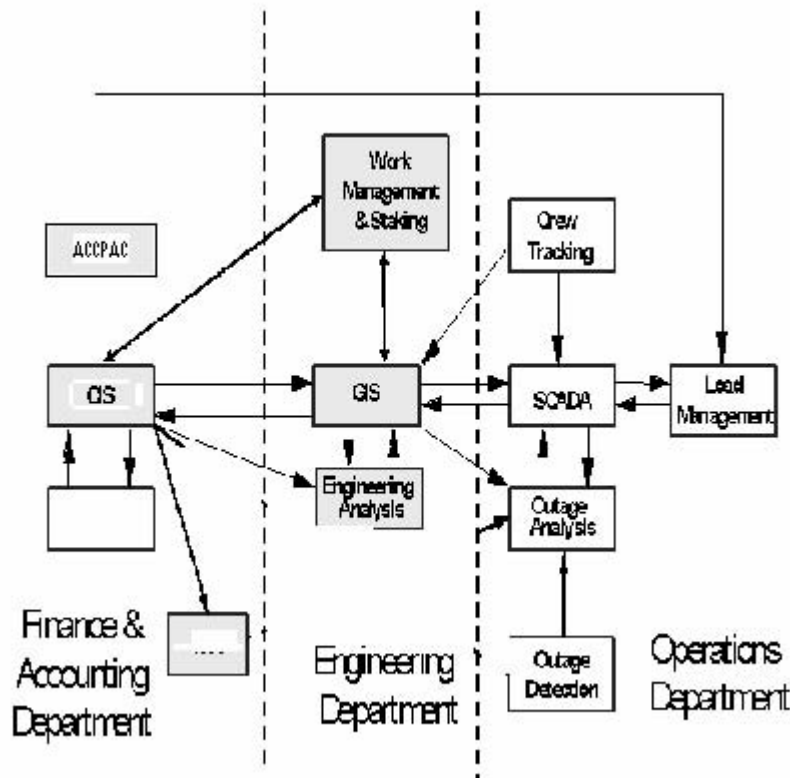


Figure 5 - Some of the processes that GIS can facilitate

GIS offers the tool that can address those issues! It places at our disposal a tool that can integrate with Work management systems (WMS), Asset and Facility management systems (AM/FM), Outage Management Systems (OMS), Trouble Calls, dispatch systems, maintenance Systems, Job design system (JDS),

Supervisory Control and Data Advisory Systems (SCADA) and Corporate Business system such as CIS, financial, material and etc..

Therefore, it is clear that although seemingly big in concept, once implemented GIS will offer large benefits to large parts of the company. In short, GIS opens a world of activities that can be utilized to improve the efficiency of DOMLEC.

The approach we took

The data survey and needs analysis

One of the main driving forces for the implementation of GIS was the fact that the company needed to be able to account for all its assets, and the system used at that time (System Grade ONE) had a number of limitations, some of which are outlined below:

- ✓ There was no way of verifying the integrity of the data
- ✓ The system was fragile in that in there was little technical support
- ✓ Only one or two people had access to the software and an administration pass word was needed to access data
- ✓ Very little knowledge could be obtain about the location of assets
- ✓ Etc.

Recognizing these deficiencies, the then Engineering department had to address the above problems, and come up with a solution, an alternative plan. It is from then that the process to implement GIS at DOMLEC was developed. After extensive research it was recognized that not only could GIS Technology (GIST) solve the then engineering problems, it could also introduce a needed concept in DOMLEC which could bring tremendous benefits.

Needs analysis:

The process to implement GIS at DOMLEC was a phased approach that began with a data survey and needs analysis or feasibility study from 2003. The primary purpose of the Data survey and needs analysis was the following:

- 1) To identify the data sets available
- 2) To gain an understanding of each department's functionality,
- 3) To serve as a starting point for a DOMLEC Data Dictionary.

Coming out of the study we recognized the following:

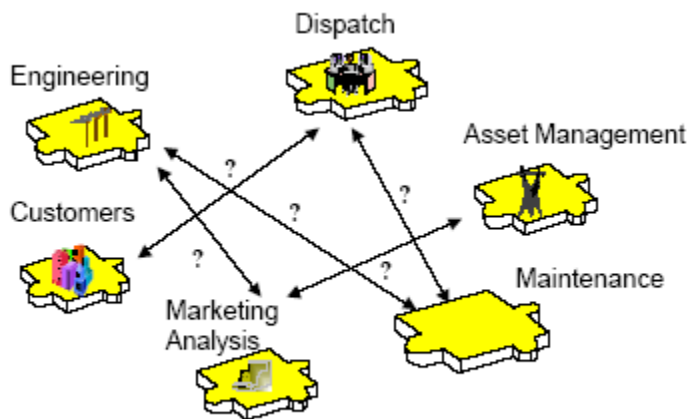
- I. That limited data was available and little information about its status was known
- II. That each department had different needs and they were all related
- III. That a data dictionary would have to address the need of all parties

Based on our finding a business case could be made for undertaking the project; in this business case we would highlight the way business is done without GIS, what specific areas can be improved through the technology, and what benefits can be expected.

After interviews with key people in the company, we conducted a GIS familiarization Presentation. Based on the outcome of this presentation, it was recommended that a committee be put in place to guide the development of GIS in the company. This committee would comprise of key persons in engineering, operations, construction/maintenance, as well as “peripheral user groups” including customer service representatives, accounting personnel and Human Resources.

Let me state that the interview process results in a set of high-level requirements that departments would need for effective operations; it was the general consensus that GIS should seek to address them when it is fully implemented.

The System Integration Question



The Pilot Phase

The decision to use System Grade instead of GIS in 1999 to my understanding was primarily due to the difference in capital investment and the lack of understanding of the functionality and capability of GIS. Our capital situation had not changed, but the corporate expectation was rapidly Changing; rapid and accurate information was needed, while accountability was high on the priority list. It was absolutely necessary to develop the GIS program in a manner that would not impose high capital cost or operational cost. Keeping this in mind a Pilot Project was designed to test the validity of many of the assumptions laid out in the feasibility study and to cut and spread and reduce the cost for development of the GIS program.

The Pilot Project was designed to accomplish the following objectives:

- To capitalize on experience (training of staff)
- To obtain key or base information which were available in Cable and Wireless Dominica Limited
- To minimize the cost of implementation
- To develop and redefine DOMLEC data preparation
- To redefine the data base design by demonstrating functionalities to DOMLEC users and management

After the completion of the pilot project it was necessary to conduct training with a GIS trainer from St. Lucia who was also part of the pilot project; the training included GIS staff and draughtsman surveyor section.

It was recognized at the end of the pilot project that:

- There was a need to develop a data dictionary that would be understood by all involved
- That the gathering of assets was not useful on its own, that there was a need to relate it to other functionalities
- That the Trimble equipment was best suited for DOMLEC application.
- That there exist a need to constantly revise the data due to constant changes on the system.
- That users must have access to the data



Figure 7 illustrates the work done during the pilot project

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GIS Project Status:

Approximately 95% of the HV lines have been mapped, together with about 25% of the LV circuits.

We were able to link the CIS data with the GIS and provide valuable information to a consultant for the UNIDO loss reduction studies, available also is a web-based GIS which give the users the ability to run customer service queries, pole numbers, measure distances and areas among others.

GIS is a useful tool in the identification of all DOMLEC assets such as street lights, Transformers, Switch sites, power station etc. We are now using GIS in the customer estimate, design works, planning, street light identification, and identification of land marks among others.

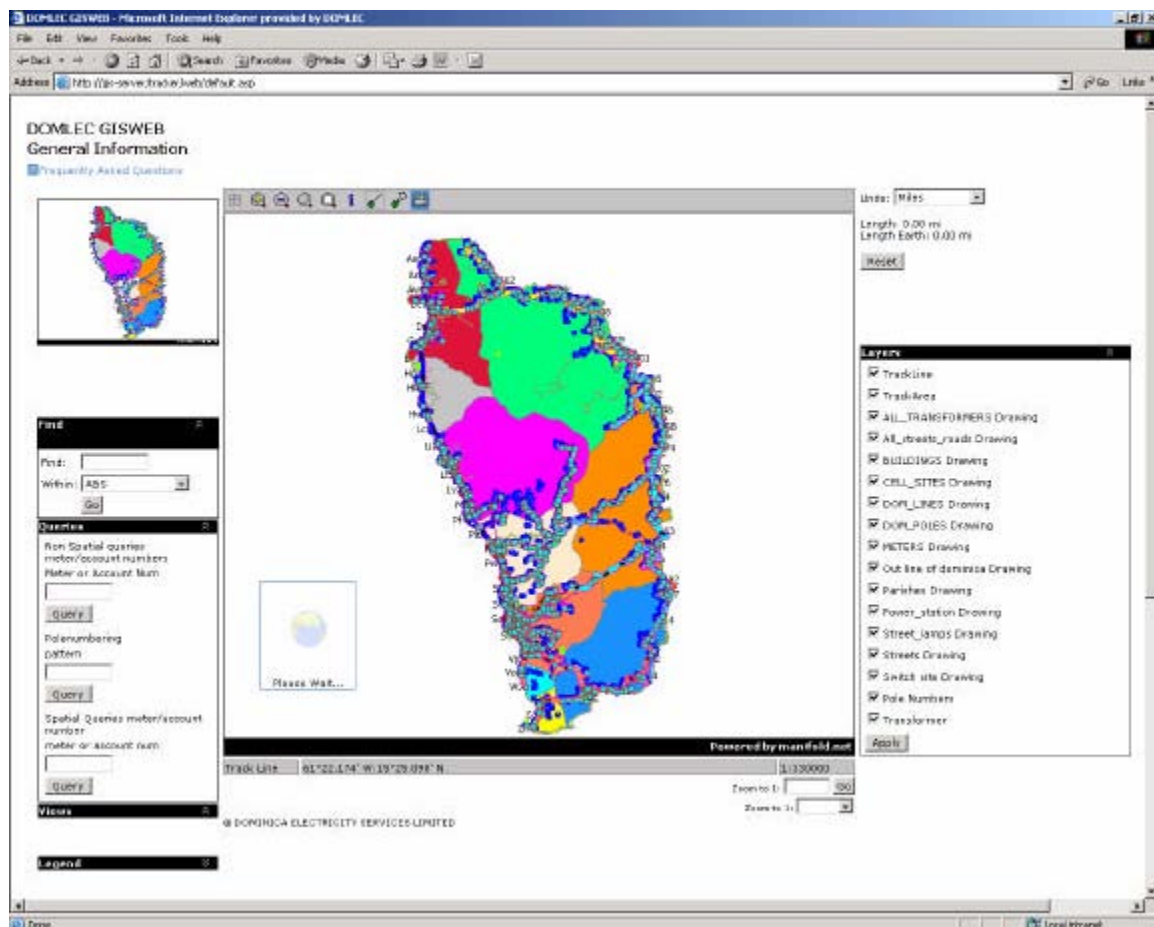


Figure 10 The GIS web-based application

GIS ability to interface with other software's

The ability of GIS to interface with other software is proof that one can put data into the system without duplicates.

The DOMLEC GIS system is seeking to give full integration and interoperability to all of DOMLECS hardware and software.

For the purpose of definition interoperability refers to the ability of software components to integrate, and therefore can enable internal business efficiency and an enhanced end customer experience, which in turn can positively impact customer loyalty. It benefits the bottom line.

Thus far we have been able to link the GIS to the CIS database.

It is intended that all the non-spatial, alphanumeric "business" applications will be integrated into the DOMLEC resource planning; the integration of GIS with the other functions will provide advanced pre-integrated and configurable solutions to improve efficiency and lower the costs of operating a utility's distribution facilities. This intended method of work will serve as an interface for Geofacilities Management System (GMS), Outage Management System (OMS), Work Force Management System (WFMS), and Work Management System (WMS); as well as the corresponding hardware solutions and implementation services

The once difficult to access information will be made available to everyone - from back office to field service - through Web and mobile computing technologies; this will provide rapid analysis and decisions drive optimized processes.

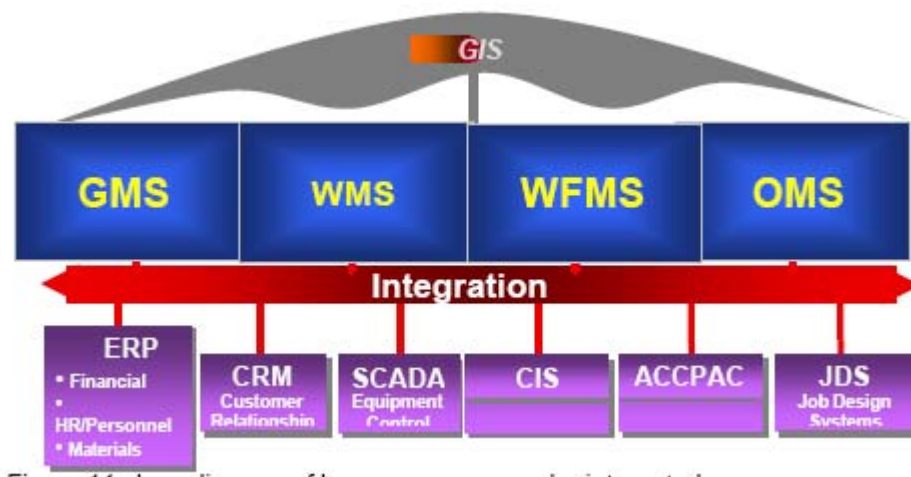


Figure 11 - Diagram of how processes can be integrated

GIS will certainly cut functional expenses!

The corporate impact

In order for GIS to meet its corporate needs we have to consider the people, standards, work tracking, training, advisory teams and risk management. The primary concerns or goals were to improve the quality and level of productivity within DOMLEC. Illustrated below is a diagram of the activities that were considered.

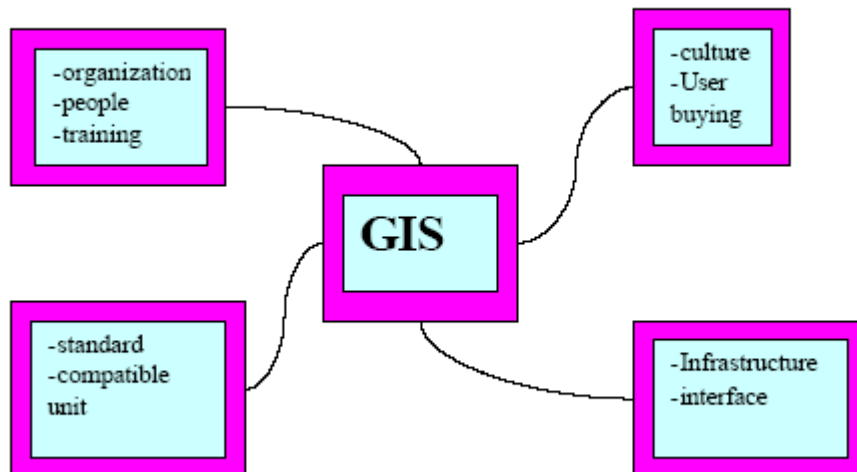


Figure 12 - Topics that were considered

It was stated in the GIS concept presentation that one problem with change is getting people to accept it. GIS once fully implemented will not be a heavy burden but it will require some training and familiarization. Support from the end user is of absolute necessity. There will be training material made available to users, while some training will be conducted; it is hoped that the old users will train the new users.

Further, the implementation of GIS will provide a greater amount of information that will be made available to a larger cross section of the company. The information will help determine productivity, costs of various installations and lead-time on a project. It is expected that much more will be known about the system and its characteristics, its customers and the level of service that DOMLEC provides.

A committee has been established to steer the GIS project; this committee will look at the way forward for GIS. It is expected that the committee will work from there on to develop a working project plan, it will be charged with looking at the resources available to complete the project, and assist in redefining the scope of GIS. We are hoping that most of the work could be done and developed in-house because DOMLEC has the expertise and it will reduce the capital expenditure. The committee may decide on which activities will require an integrator.

Full Implementation

We expect to see the full implementation of DOMLEC GIS in the year 2007. This period set for full implementation is due to the fact that DOMLEC is working to implement GIS on a low cost budget, while integrating all the key functions of the company in the GIS project. We recognize from the pilot project findings that there is a lot that can be done with GIS and we intend to utilize it to the fullest. We have identified the following key functions that will contribute to the successful full implementation of DOMLEC GIS:

- Data acceptance testing - primarily data maintenance and system access / query
- Conduct more familiarization seminars
- Develop a reporting format
- Maintain different record keeping
- Have data backed up regularly
- Write queries that will facilitate each section in DOMLEC in capturing all external data
- Linking of all data
- The numbering of all poles and transformers
- Refine custom applications and interface specification

We expect that by the estimated time for implementation we would have completed all the data collection plus replaced old methods of doing projects with the GIS way (fully integrated)

At present we have been able to map 95% of the primary system and about 25 % of the secondary lines while DOMLEC GIS integration is on the right track. There is a need for developing the other applications, so that for example we can replace existing manual systems with GIS in those areas where data had been accepted. It is our hope that on the full implementation of GIS one will be able to print accurate maps and query information.

The Issue of Reengineering

The GIS will introduce, on its full implementation, a transition from a functional organization organized by departmental process to a matrix organization of integrated functioning of departments. This driven change will influence the business process, i.e. the way day to day business is conducted in the company. For example the DOMLEC GIS project team will define a work flow diagram and project how data and work-flow processes would change with the new GIS technology. Data sharing will no longer be a major issue at DOMLEC, no longer will one man have all the information, it will be information available to all, while keeping the integrity of data.

There will be a need to develop and implement new systems such as Outage Management Systems, Work Management Systems and Job Designs systems. It is expected that the Job Designs system will cut the present time for designs by 50%.

Summary of Functionality

DOMLEC expects to complete full implementation by the end of 2007. This includes all data capturing and the development of the following core GIS functionality:

- On-line access via GIS to customer, meter, and work management information on the server
- PC access to GIS
- Corporate-wide networking infrastructure
- Land and facility data maintenance applications
- Data query and access applications
- System navigation applications
- Work design, work sketch, and work estimating applications
- Batch plotting and address cross reference application
- Miscellaneous other minor applications

Summary of Benefits

Few activities take place within DOMLEC without requiring some knowledge of the transmission and distribution facilities. Therefore, the rapid access and dissemination of this information throughout DOMLEC is of strategic importance to improve customer response and to provide safe, reliable, and effective utility service. GIS is providing the means to economically achieve the corporate-wide accessibility to facility and customer-related information required to efficiently design, build, maintain, and operate DOMLEC'S utility networks. We expect numerous tangible and intangible benefits from GIS implementation of which the primary benefits are as follows:

- Significant quantitative labor productivity enhancements, improved asset utilization, decision support, and cost displacement benefits.

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- Significantly improve the integration of corporate data and systems.
- Facilitate changes in current business processes. GIS is a strategic component of the reengineering of DOMLEC'S business process and of the corporate computing environment.
- Improved geographic and facilities data sharing
- Improved security of maps and facility records by having the digital data backed up on a regular basis.
- The ability to create new understanding and easier access to data
- Improve analytical procedures
- Improve services to customers



GIS Investment Justification

The rigorous economic justification of GIS, is wide and difficult to produce at this moment, however the primary approach to justifying GIS investment within the company is to consider the its contribution to efficiency of services, response to regulatory requirement, and accomplishing the company goals, mission or objective. The GIS Project in DOMLEC will bring about aspects of changes to the company, which will warrant the justifying investment. It will produce firstly, an opportunity for a department or the organization to perform new Data Analysis that is not possible without GIS technology and not comparable with any of the department pre-GIS operations. The above is difficult to express in financial terms (intangible benefits), however the above justification is one of the strongest augments for GIS implementation. Secondly the GIS will range from one single application in the department to an enterprise-wide GIS. As an additional justification we will recognize that the strongest justification will arise from the long term development and implementation of GIS. With respect to who will benefit from GIS technology we can safely point out that it is the user group, the company and the customers. GIS technology would bring forward savings in direct cost (staff time, material, and timely provisions for products now produced manually i.e. estimates) with minimal subjective judgment.

The Impact that GIS could have on DOMLEC September 2005

Cost

Because of the fact that we are still in the development phases of GIS we will only consider the cost for implementation. The cost estimate takes into consideration the following aspects:

- Hardware integration with pre-existing computer infrastructure
- Evaluation, selection, acquisition and installation of software
- Undertake requirements / needs analysis
- Contractual aspect
- Consultancy support
- System customization
- Application portfolio development (and/or customization)
- Interfacing with other data servers and optional systems
- Training, human resource planning, skills development and re-skilling
- Project management
- Etc.

We are looking at full implementation by the END of 2007, and expect to spread the cost over the next two (2) years i.e. 2006 and 2007. It must be noted that the cost reflected in this document is small compared to other GIS implementation projects. This is because we intend to implement most of DOMLEC GIS activities in-house and over a period of time (Two years from now). Represented below is a breakdown of the budgeted activities:

Year	Amount of Money allocated
2006	EC\$XXXXXX.00
2007	EC\$XXXXXX.00