

## Registration Information

**Title:** A Fundamental Utility Restoration and Evolution Using GIS

**Authors' Names:** Bernard Pertot / Bilal A. Hassan

**Paper Number:** 2107

**Organization:** EDL / Khatib and Alami

**Address:** P.O.Box: 14-6203

**City / Code:** Beirut 1105 2100

**Country:** Lebanon

**Fax:** (961) 1 564366

**Telephone:** (961) 1 564366(7)

**E-mail:** [bpertot@yahoo.com](mailto:bpertot@yahoo.com)  
[bahassan@kacec.com](mailto:bahassan@kacec.com)

**Application:** Electricity and Communication

**Software:** ArcView and other developed applications

## **Abstract**

With the growing demand to back Electricity of Lebanon (EDL) in its struggle to crack down illegal network connections, collect its outstanding bills, and fight mal-administration. The GIS Distribution Operation Support (GISEL-DOS) project has succeeded in making the quantum leap for this worn out sector.

The GIS-based Energy Correlation studies on the electrical network have highlighted the vicinities with high losses and guided inspection crews. The assistance in dispatching audit and disconnection teams has resulted in a startling hike of returns. The integration and deployment of the Utility-GIS and Customer Management System (CMS) developed applications have enforced regulations, furnished optimum decisions, and improved performance.

GISEL-DOS project resulted in improving EDL image as an organization pioneering in Information Technology, and provided an added value for its asset management. The GIS system has become a paramount mean for EDL to provide better customer services, and boost revenues.

## **Introduction**

Ravaged by seventeen years of civil war, Electricité Du Liban (EDL) initiated an ambitious plan to rebuild its utilities. A part of its reconstruction plan is to implement a new Geographic Information System in Beirut called GISEL to model and manage its electric infrastructure.

The latest one of consecutive GISEL projects was the GISEL Distribution Operation Support (GISEL-DOS) for Municipal Beirut Distribution Division. GISEL-DOS was found invaluable for evaluating system reliability and capacity, tracking down power losses due to pirated electricity and defective metering equipment, and managing revenues collection.

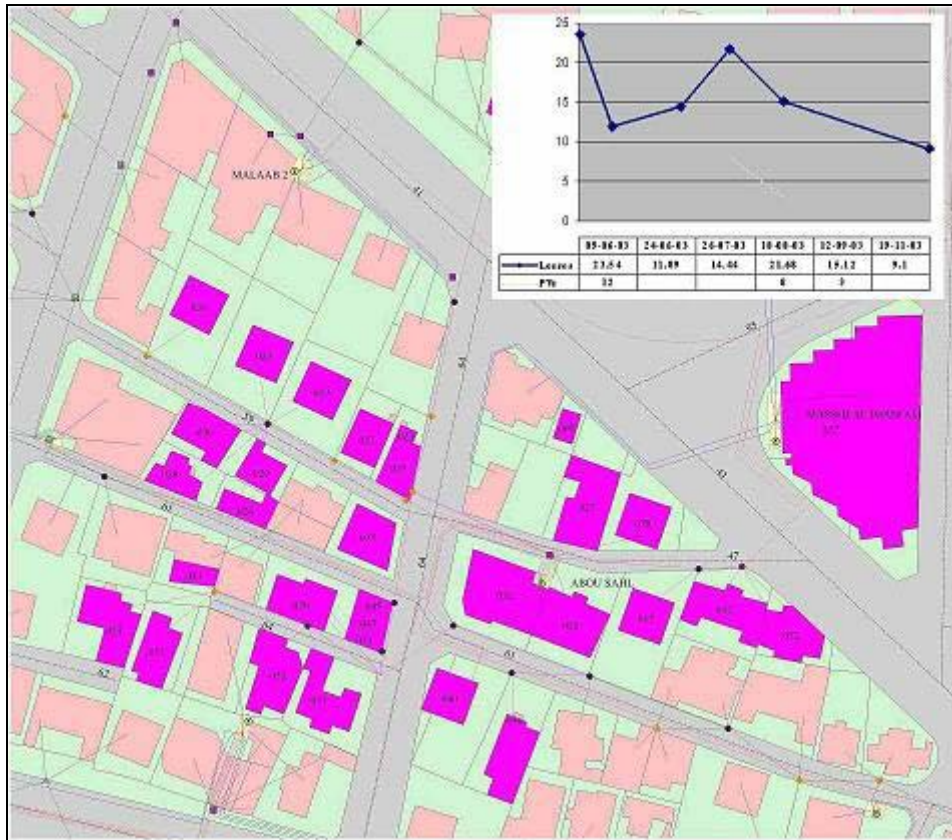
## **GISEL-DOS Roles**

GISEL-DOS assisted in conquering The challenges EDL have faced, that included cracking down illegal power tapping, handling the collection of its outstanding bills, managing field crews, solving customers queries, and tracking the flow of energy from the transmission level (Primary Substations) to the distribution level (customers).

## **Energy Correlation**

The challenge to reduce technical and non-technical losses, to acceptable international standards, was tackled through the implementation of Energy Correlation (EC) studies based on the GISEL database. The EC studies consist of two levels: the primary feeders vs. distribution transformers, and the distribution transformers vs. end customers:

1. Issue Energy Correlation between primary feeders and distribution transformers with the intent to highlight the candidate distribution transformers
2. The energy Correlation between the distribution transformers and the end-customers are done by carefully comparing the billed kWh usage to the actual usage, in order to detect the non technical losses on the distribution network
3. After locating the network spots with non technical losses, violation removal teams were dispatched to these areas to eliminate illegal network connections and take appropriate actions against violators
4. To reduce the potential of recurring network violations, following up and monitoring of transformers under EC studies is of vital importance

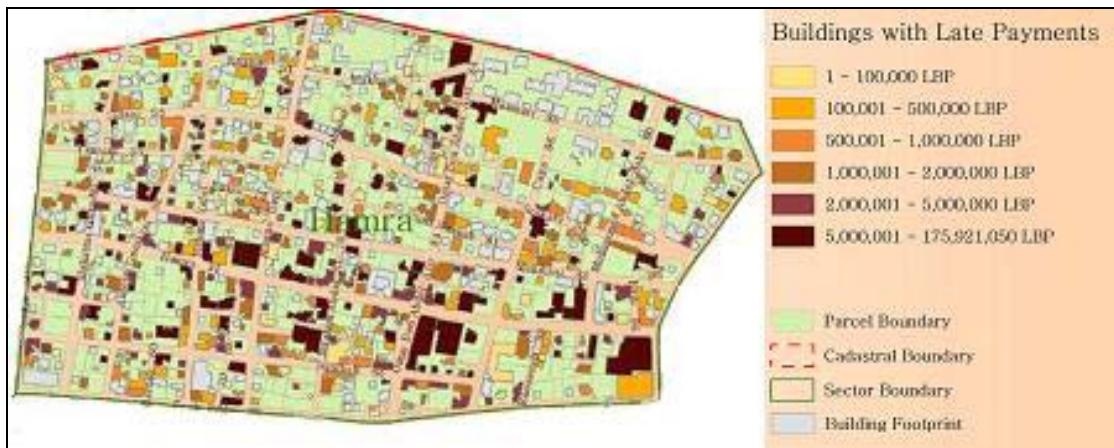


**Figure 1: Tracking losses for a single distribution transformer**

The outcome of the EC studies have resulted in tremendous decrease in non-technical losses, that reached around 10% of the total energy delivered to Municipal Beirut (Value around one Million dollars per month).

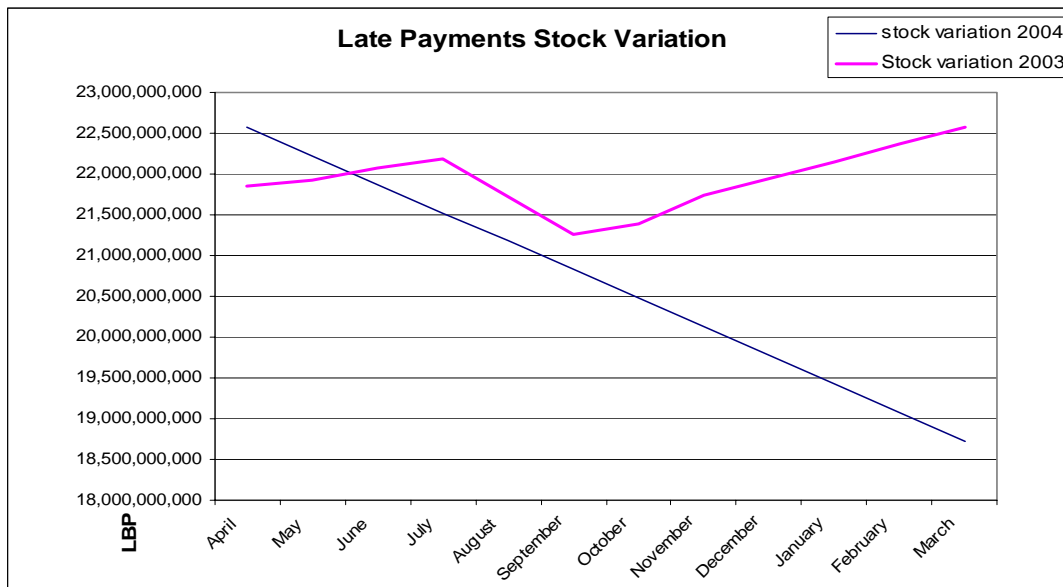
### **Bills Collection**

A major difficulty EDL faced was in the administration of its collections, which led to an accumulation of unpaid bills. To tackle this growing issue, GISEL-DOS team developed the GIS based disconnection application, which is a tool for grouping and organizing the disconnection orders based on geographic, jobs volume and outstanding bills constraints. The application is capable of screening the sites with maximum disconnection orders in minimum geographic areas. It's also capable of tracing the buildings with towering figures of unpaid bills and spotting the zones with highest amounts, which assists EDL in managing the collection of the disconnection orders and unpaid bills.



**Figure 2: Late payments distribution in buildings for a specific sector**

The contribution of GISEL-DOS project was measured in a major boost in the collection of accumulated bills and in reducing the stock of unsettled payments.



**Figure 3: Unpaid Bills Stock variation 2003 vs. 2004**

## Assets Collection

GISEL-DOS project contributed in the collection of unused EDL assets. A solid example was the assemblage of redundant electric meters in Beirut buildings in a fast and least costly manner, where field teams were dispatched to collect those meters based on the total number of available meters in a single building and/or a designated sector.

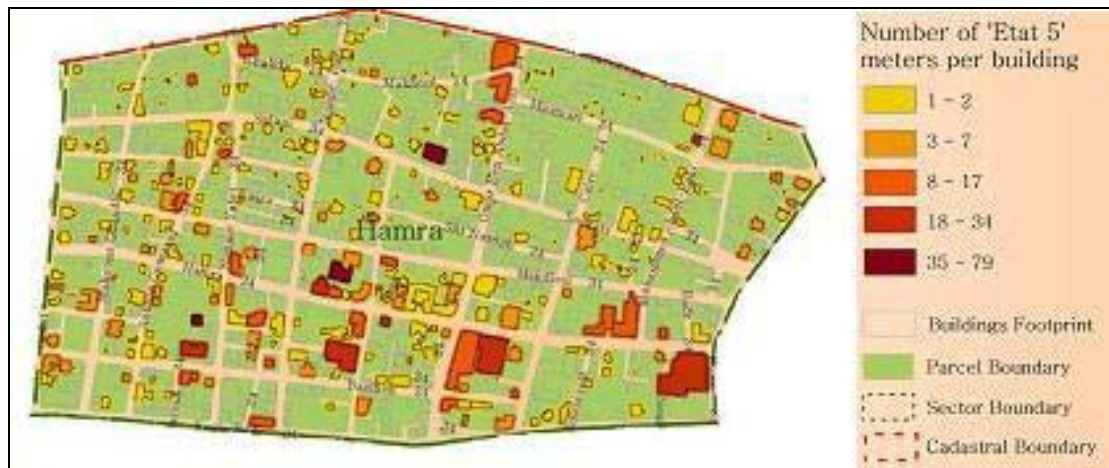


Figure 4: Unused meters distribution in a specific sector

## Customer Management System

The insecurity of information and loss of paperwork transactions within departments is another chaos EDL management faced. To embark upon this dilemma, EDL was raised from conventional paperwork to digital era by the development of the Customer Management System (CMS) and integrating it with the GIS.

The developed CMS is an integrated system for managing and tracking customers' activities within Municipal Beirut Distribution Division. The CMS automated the transactions flow by means of allowing the managers to audit the transactions electronically in a clear and user-friendly environment.



**Figure 5: GIS integrated CMS application; old Vs. new transaction**

The CMS tracks the transactions using oracle archiving that enforces regulations, provides optimum knowledge-base decisions and improve performance. It reduces the potential for mal-administration and liability through establishing a systematic and standardized way of achieving work.

Furthermore, the CMS provides visual workflow search methods to trace the location of a transaction; it visualizes the Business Processes (BP)s involved and how a certain customer application is progressing from one stage to another with animation and coloring features.

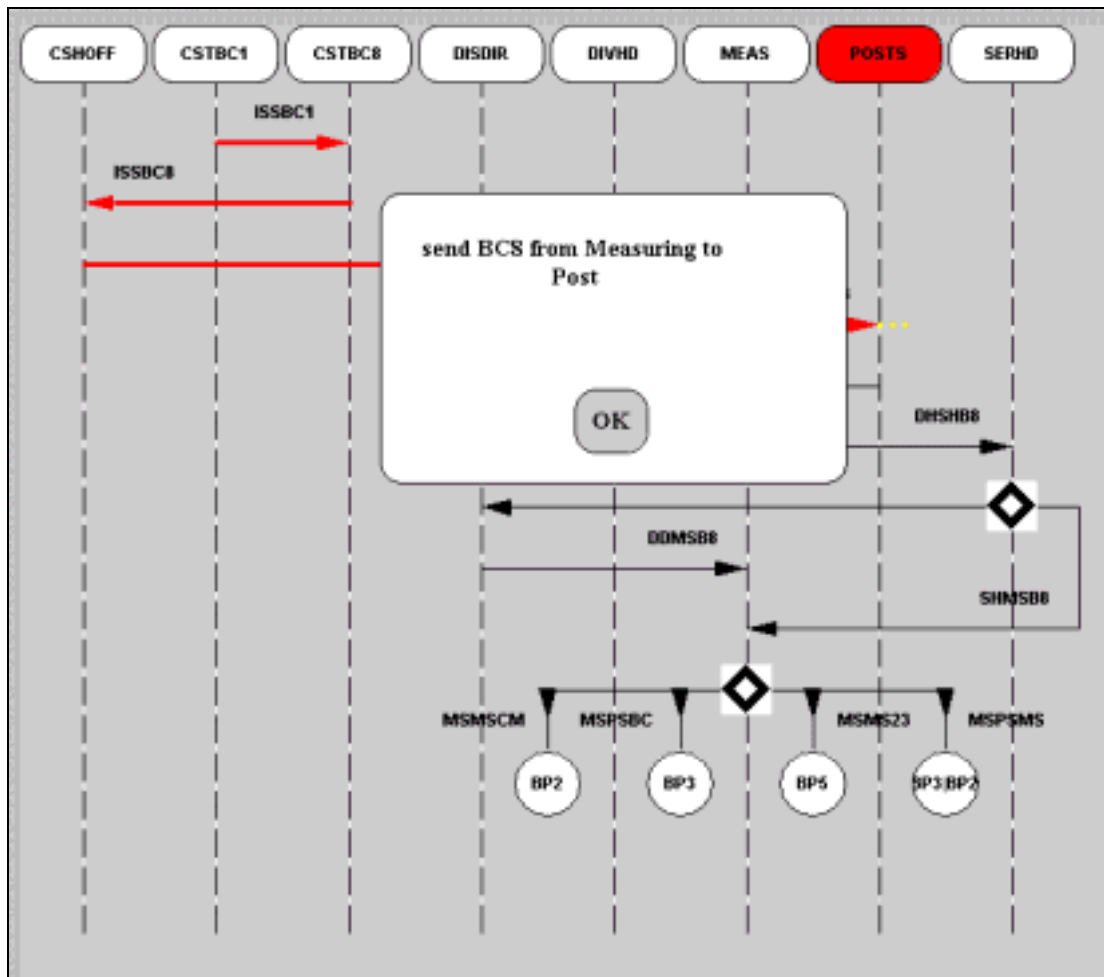


Figure 6: CMS sample of Visual Work Flow

## Network Planning

GISE-DOS project assists EDL with the ability to take adequate decisions in connecting new customers (or new buildings) to the electric distribution grid, or in reinforcing an existing connection by the deployment and operation of the GIS Facility Siting Application (FS).

The FS application offers the physical modality of the optimal electric connection for the customers hooked on the 'low voltage' network. It simplifies and fastens the managerial and engineering decisions in the utility and consequently rapidly complies to its customer needs.

The FS decreases the man-hours spent on processing customers' applications, and eliminates job misconducts that the surveyors may carry out in assigning distances and cables lengths. It also reduces the survey hassles and saves time by providing the needed maps along with the electrical networks, potential transformers, and other required data.



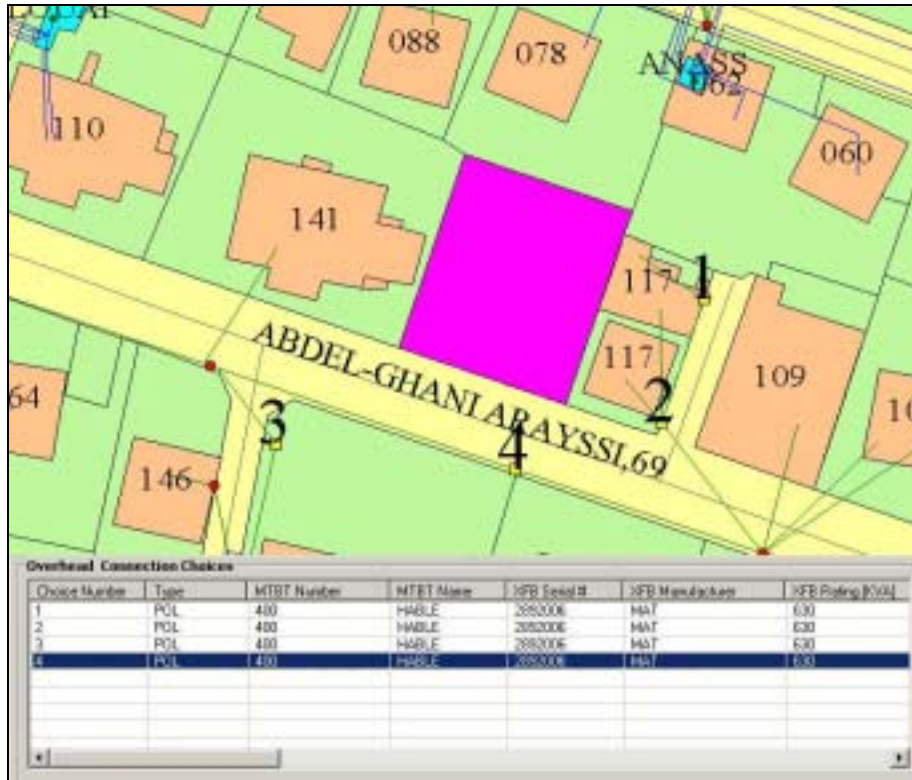


Figure 7: New building overhead connection FS scenarios

## Outage Management

In the absence of a Supervisory Control and Data acquisition (SCADA) and real-time monitoring, GISEL-DOS team implemented an outage management for the City of Beirut called the GIS Trouble Call System (TCS).

The TCS uses customer calls received at the Hotline call center and the online integration with the distribution network Switching system, and the GIS maps to locate the outage devices & their probable causes. Accordingly the repair crews are directed, with all adequate data, to the incidents' sites, and provide field's actual incidents and repairs feedback.

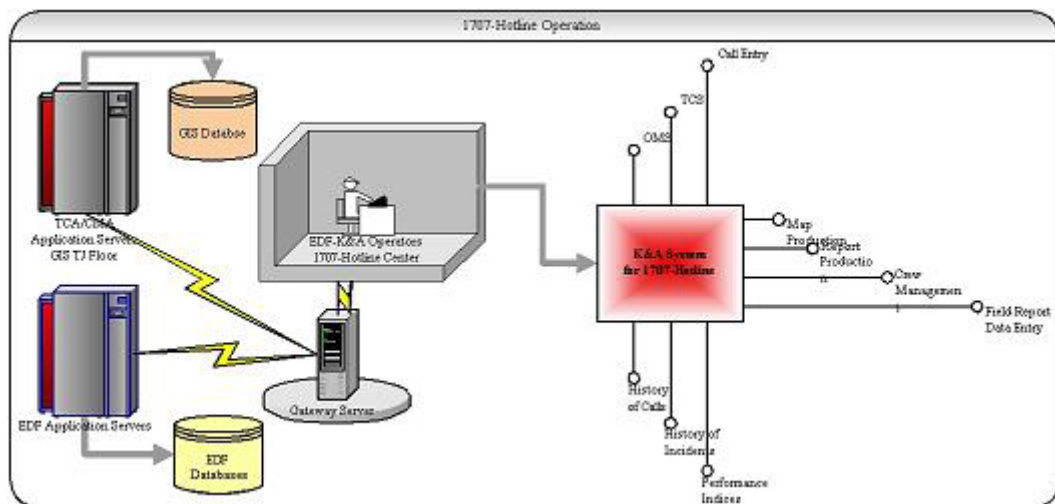


Figure 8: Operation in the Hotline Center

The TCS provides EDL management with historical & reliability indices reports, to add asset to their decisions in their daily network maintenance. Furthermore, the TCS assists EDL in maintenance cost savings, providing fast responses and in managing the interruption/restoration on the electrical network.



Figure 9: A sample Outage report and map

## Distribution Network Management

In the absence of a distribution control center, the switching maneuvers in EDL were done manually and biased by the dispatchers' knowledge of the network connectivity and the carried load.

GISEL-DOS project supplied EDL's Distribution Operation Center with the Switching/Power Flow application to study network loads and faults and to improve switching operations on the medium tension network. It presents various switching scenarios with spatial and traditional schematic maps to aid the dispatchers in performing their maneuvers rapidly and accurately.

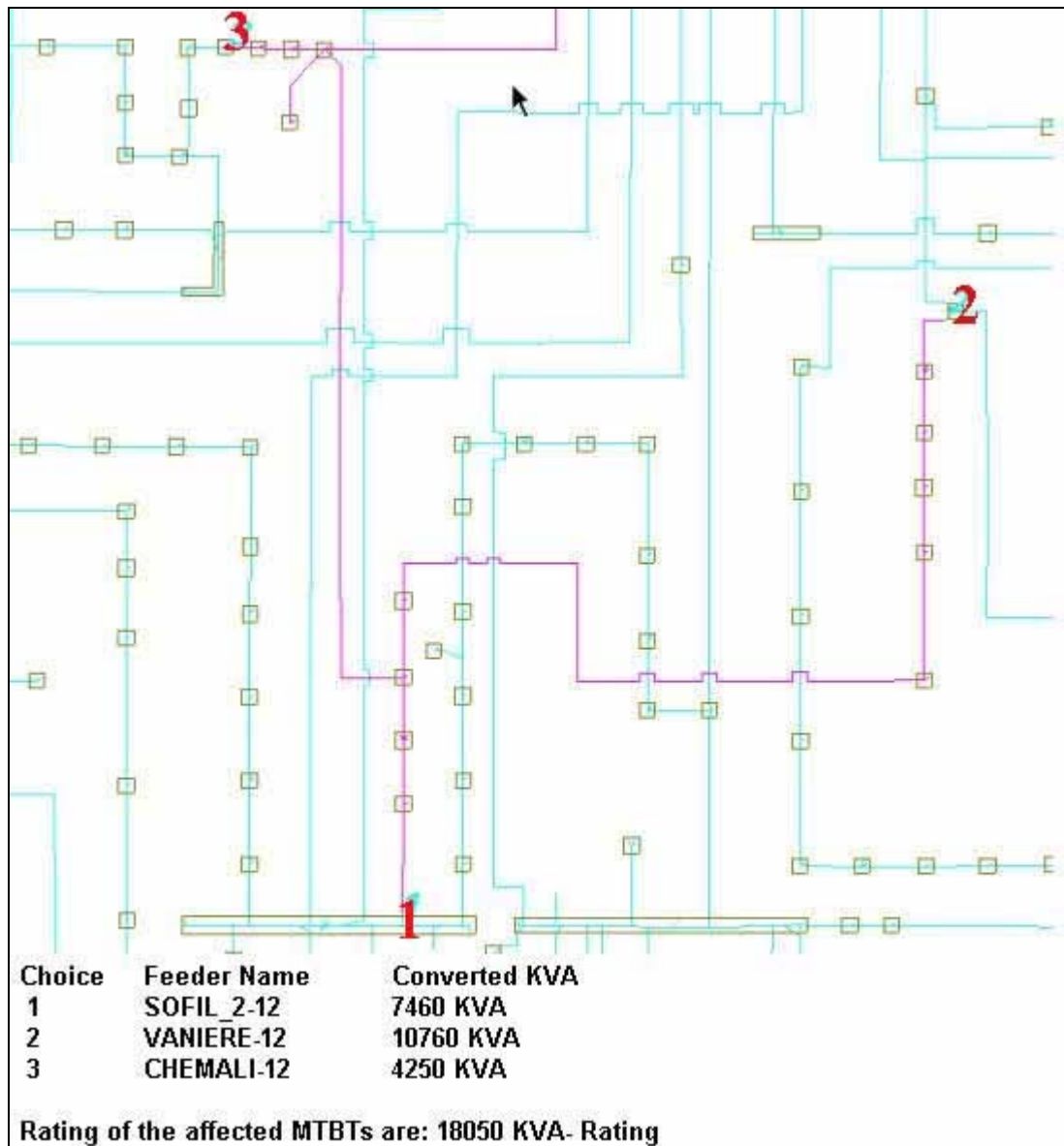


Figure 10: Re-routing power feeding scenarios

### Collector Routing

In the absence of Automatic Reading (AMR), EDL meter readings and bills collections routes (Tournées) were designed few decades ago, and were not refined despite the major demographic and urban changes that have occurred.



**Figure 11: A sample of old Collector' Tournée by sector**

In order to improve and reorganize this situation efficiently and effectively, the Tournée application was sought. The quest of the Tournée application is to come up with improved scenarios for the bill collection, based on different criteria.

The new Tournées were planned in a way that uniformly distribute the total amount of money to be collected in each Tournée, the number of bills to be collected, and the geographic extent.

## **EDL Benefits**

Many benefits had been attained from project GISEL-DOS. It is important to note that some benefits are tangible while others are intangible and realized in the longer term of the life of project GISEL.

1. The GISEL-DOS enterprise service delivery provides significant reduction in the operation and maintenance costs, provides substantial improvements in service reliability and level of customer service
2. Project "GISEL-DOS" has become the driver leading to boost EDL revenues collections, to fight maladministration, and to improve productivity.
3. The Knowledge-Based Organization based on the geographic information systems (GIS) technologies allowed EDL to process, input, manipulate, update, track and share complex and geographically

referenced information swiftly and correctly among the different 'Services / Authorities' within EDL.

4. The EDL operation started relying on modern scientific methods rather than guesswork and it bases its operations on verified data rather than assumptions, thus applying the Fact-Based management principles. Facility Siting, Trouble Call System, Switching, and CMA are vacant examples.
5. Powerful visual statistical tools are available to EDL to organize geographically referenced data and draw inferences. This allows EDL to simulate the real world electric power system of Lebanon on its computer screens on real time basis.
6. All Services within EDL are able to obtain up-to-date information, comparisons, insight into changing inferences and trends.

The cumulative benefits of the above points allows EDL to provide much better services to its customers with less cost and higher returns.

## **Summary**

As a result of GISEL projects, EDL personnel have direct access to all the geographic and the customer data needed to plan their activities efficiently. Also, the project has improved the EDL image as an organization pioneering in Information Technology, and provided an added value for its asset management in any future privatization arrangements. The GIS and CMS systems have become paramount means for EDL to provide better customer services, and enhance its revenues.

## **Acknowledgements**

We would like to confirm our gratitude Mr. Kamal Hayek, Chairman of the Board and Director General of EDL, on his perspicacity, wisdom and conceited administration.

Also our appreciation to the management of Khatib and Alami for their superior performance and operation.

## **References**

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