

GENERAL ELECTRICITY COMPANY OF LIBYA (GECOL)

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Abstract

The paper covers the self-financing, government subsidised, and sole supplier of Libyan electricity – the General Electric Company of Libya (GECOL). Throughout the history of Libya, GECOL has remained strong in its commitment of providing quality distribution of electricity throughout the country. With the entire country's dependence on their operation, GECOL is expected to deliver the highest quality of service possible. However, as the country expanded, the demand for energy expanded as well leaving GECOL with the dilemma of meeting such growing need for electricity.

As of 2006, GECOL declared that the current generation capacity would no longer be sufficient in meeting the needs of the people. Hence, the company initiated GPP in order to establish six additional major power plants to cover the energy demands of Libya for the coming years. However, funding became the major hindrance to the said project leaving GECOL to resort to cost effective quality objectives aimed at: (a) maximising the cost of generation capacity, (b) countering funding constraints brought by technical and non-technical losses, and (c) remaining competitive in customer servicing of company-consumer transactions and communication. In this paper, these three objectives have become the centrepiece of the proposed QM Plan.

Keywords: GECOL, electricity, and General Electric Company

1. Introduction

Since the establishment of GECOL (General Electric Company of Libya) in 1970 up to 2006, the company has shown progressive developments evidenced by the following: (a) the consistent rise of its produced energy from less than 600 GWh in 1970 to 23,993 GWh as of 2007 (Otman&Karlberg, 2007); (b) consistent expansion of generation capacity from 2,630 MW in 2000 to 5015 as of 2009 demonstrating an average annual growth of 8-10% (El-Arroudi, et al., 2009), and (c) along with the rise in generation capacity is the progressive increase in per capita demand from 2,650 KWh in 2000 to 4,158 KWh as of 2007 (Wadi, 2009) showing the results of company initiatives parallel to the needs of the Libyan nation. However, while these figures suggest the parallel coping of energy generation capacity to the demands of consumers, GECOL declared that the stability of supply might only be temporary considering the projections for the 2015 and 2020 peak demands. According to GECOL's projection in cooperation with UNEP, the increase in energy

consumption per capita from 1,493 KWh/c in 1990 to 3,119 KWh/c in 2005 would suggest the rapid increase from the 4,400 MV in 2006 to roughly 8,000 MV in 2020 (GECOL, 2007).

In 2006, GECOL called forth the Generation Power Projects (GPP) to initiate the installation of six major power plants in Libya aimed at (a) increasing generation demand, and (b) reducing generation cost brought by technical and non-technical losses (GECOL, 2010). GECOL acknowledged the rapid increase in demand as a challenge to their operations especially when: (a) GECOL is at the verge of investing and outsourcing US\$ 7.5 billion to compensate the needed construction of major power plants capable of generating the required capacity and reducing generation costs; (b) GECOL is experiencing both technical and non-technical losses at the assessed rate of 17.2% and 23.1% respectively; and (c) GECOL, as the sole supplier of electricity in Libya, must remain competitive in consumer servicing despite the strains of transition, investments. In response to these identified needs and challenges, the paper shall answer the following paper task:

Following the TQM approach in developing and applying *Quality Management* (QM) System, what are the essential steps GECOL should apply via the implementation of a QM Plan in order (a) to maximise cost and improve energy generation capacity, (b) to counter funding constraints brought by technical and non-technical losses, and (c) to remain competitive in customer servicing of company-consumer transactions and communication?

a. Purpose of the paper

Considering the fundamental goal of GECOL in meeting consistently the rising energy demand of the Libyan consumers, this paper asserts the general need for the company to address the three interrelated needs. Thus, the paper shall cover QM Plan associated to the identified three main objectives: (a) to maximise cost effectiveness of energy generation, (b) to counter technical and non-technical losses by conducting loss reduction initiatives, and (c) to remain competitive in customer servicing of company-consumer transactions and communication. The paper aims to apply TQM approach in a QM system through a recommended QM Plan based on QM Standard series centring on the organisational problems identified.

b. Scope and Limitations

With the many issues and challenges faced by the organisation, the paper shall focus on the following interrelated issues: (1) the application of Quality Assurance monitoring on the efficiency of GPP in maintaining cost effectiveness of generation capacity, (2) the incorporation of QM initiatives in setting and monitoring the standards of operation concerning loss monitoring and prevention, (3) the application of QM standards in setting quality standards of servicing despite the funding constraints brought by GPP. The contents of the paper shall be limited to the following: (1) the organisation of GECOL as the focal organisation; (2) Electricity as the primary product being analysed; and (3) GPP as the main project analysed.

c. Sources and Methods of Collecting Information

Sources for collection information shall involve the following: (1) review of official GECOL press releases, publications, and annual reports; (2) scholarly case studies on Libyan public utility management; and (3) review of books covering the GECOL and Libyan utility issues. Methods for collecting the information shall be via scholarly database research, web research, official website publications, and book research.

Established since 1969, GECOL is known as a state-owned utility of the *Great People's Libyan Arab* mainly responsible for the generation, transportation, and distribution of electric power to the entire Libyan nation

(El-Arroudi, et al., 2009). Under the Act No. 17 of 1984 AD, GECOL has been formally established to implement projects in the area of operation and maintenance of electricity networks and power plants, distribution, conversion and transmission lines, distribution centres and electrical control, and management and operation of national desalination plants (GECOL, 2010). As of 2007, GECOL has been considered the sole supplier of electricity mainly to household consumers estimated at 1,129,348 (Mousa, et al., 1998). Since the organisation's founding, the People's Committee became the main public representative to head the company operations; although, as the company operation expanded, *Engineer Omram Ibrahim Abukraa* assumed the position as Chairman of GECOL's People's Committee from 1987 up to 2007 contributing to majority of the company's expansion and to ideals in encouraging utility privatisation (Otman & Karlberg, 2007, p. 322). Later, *AbulgasemUneas* succeeded the latter Chairman in the following year encouraging market-driven approach and the application of best practice processes (Karim, 2009). In terms of organisational structure, GECOL follows a centralised structure with five significant divisions – (1) Finance, (2) Engineering, (3) Administrative, (4) Support, and (5) Technicians. GECOL organises its structure according to the roles and functions of each of their staff (GECOL, 2010).

Generation Power Projects (GPP)

Following the increase in per capita energy consumption from 1,493 KWh/c in 1990 to 3,119 KWh/c in 2005, GECOL has determined a probable doubling of peak load from 4,400 MV in 2006 to roughly 8,000 MV in 2020 (GECOL, 2007). Meanwhile, other groups suggest that near to such peak load (7,960 MV) can be attained in a shorter span of until 2015. GECOL is under pressure of securing approximately 6,300 MW generation capacity from the period of 2006 to 2012 (Wadi, 2009; Otman & Karlberg, 2007); however, as of 2009, the latest GECOL annual report has indicated the rise of peak load from 4,005 in 2006 to 5,282 on 2009, and a rise in generation capacity to 5,279 MV in 2009 (GECOL, 2009).

The project consists of the establishment and/or improvement of seven major power plants with higher installed capacity, particularly: (1) W. Mountain P. Plant with 660 MV (Expected Execution (E. E.) 2005-2007), (2) Tripoli W. Extension I. with 650 MV (E. E. 2004-2006), (3) Benghazi N.C.C.P. with 750 MV (E. E. 2005-2007), (4) Gulf Stem P. Plant with 1,400 MV (E. E. 2004-2007), (5) Zawia C. C. P. Plant with 1,400 MV (E. E. 2005-2007), (6) Musrata Steel P. Plant with 750 MV (E. E. 2007-2012), and (7) Tripoli W. Extension II with 650 MV (E. E. 2008-2012). The goal of the project is to increase generation capacity by at least 5,000 MV for the next five years.



Objective 1: Reducing Generation Cost

Aside from the establishment of major power plants, GPP also include the upgrade from the oil-based energy generation utilised by majority of GECOL power plants as of 2006 to the use of *Combined Cycle*

Technology (CCT) featuring the application of (a) 15% of combined cycle units from steam cycle turbines capable, and (b) 26% units from natural gas turbines to maximise efficiency of generation production (GECOL, 2010). As explained in the study of Pilavachi (2000), CCT significantly reduces the cost of generation production by requiring lesser light fuel input and gas fuel input. In a computation provided by El-Arroudi et al. (2009) using an average rate of consumption of 0.218 m³/MWh for light fuel and 156 m³/MWh for gas, generation production should require around 7,000 m³ costing 602,000 LYD or approximately US\$ 480,000, and 5,000,000 m³ costing 100,000 LYD or \$79,800 respectively if CCT is applied in energy generation systems. Without CCT, the above figures would escalate to roughly 10,500 m³ of light fuel costing 900,000 LYD (\$718,000) and 7.5 million m³ of gas costing 150,000 LYD (\$119,000). Thus, implementing CCT should save generation cost by approximately 300,000 LYD (\$239,000) from light fuel consumption and 50,000 LYD (\$39,900) from gas consumption (El-Arroudi, et al., 2009). As of 2008, GECOL has already converted 50% of its generation consumption to steam generation and 20% to CCT, but the remaining 30% still resorts to gas-based generation.

Objective 2: Loss Reduction Initiatives

The previous Chairman Abukraa estimated the initiative to cause strain in funding, especially with the estimated GPP allocation amounting to a total of US\$ 7.5 billion by the end of 2010 including the \$3.5 billion budget for building eight new steam cycles and natural gas combined cycle power plants for the next five years (GECOL, 2007). One of the initiatives recommended to reduce the strain in funding the above said project is the implementation of loss reduction initiatives mainly by preventing technical (losses acquired from physical loss of electrical equipment) and non-technical losses (related to non-physical losses such as electricity thefts). According to El-Arroudi et al (2009), measured losses as of 2008 reached to 17.2% for technical losses of the whole GECOL grid, and 23.1% for non-technical losses. Reneses et al (2011) have argued in their study that, by preventing energy losses accumulated each year, GECOL can obtain additional budgetary allocations not only for the funding of GPP, but also for potential tariff reductions for the benefit of the consumers.

Objective 3: Improving Customer Servicing

With the pressuring need and time frame for accomplishing GPP, the increasing energy demand, growing per capita consumption, and initiatives by GECOL associated to foreign investments (i.e. investment transactions with U.K., France, etc.), the company must still (a) ensure the growth and improvement in customer servicing, (b) enhance customer feedback and value added mechanisms, and (c) provide for the growing peak load in all sectors, most importantly to the industrial sector in support of the foreign investment requirements.

d. Implication to Dimensions of Quality

Overall, the current initiative of GECOL to sustain energy supply and demand affects the company's principles, views, and dimensions of quality. As part of the company's QM efforts in meeting the projected energy demand of 2020, GECOL has initiated several preparations with GPP as the core project. However, due to the self-financing nature of the organisation and subsidised electricity supply (approximately one-third are subsidised) (Reneses, et al., 2011), incremental projects, such as GPP, would require greater assistance from external forces, mainly from the government and foreign investors. In fact, based on the 2007 report on energy consumption by category of use, the general services (government) consumed the highest at 41%, residential consumption at 31.6%, the agricultural sector at 15.7%, commercial consumption at 8%, and industrial consumption at 4.7% (Wadi, 2009). Hence, QM initiatives of GECOL must focus on maintaining continuous improvement approach for ensuring the sustainability not only of energy

consumption for its consumers, but also the funding for the GPP initiative without compromising the quality of rendered services in the process.

Despite these challenges, GECOL, as part of quality planning in specifying needed operational processes and resources, initiated means to convince foreign investors on the electrical capacity of the nation in supporting industrial developments and commercial projects, which would in turn allow alternative funding sources for the company. Reneses (2011) considered GECOL's GPP as an initiative to encourage shift from electricity subsidy to privatisation from foreign companies to meet the targeted 2020 demand. Overall, GECOL efforts shall affect the following dimensions of quality:

- *Accuracy*: GECOL must ensure the reliability of their energy supply and demand forecasts, targeted generation capacity committed to investors and precision of budgetary allocations for the long-term project of GPP.
- *Accessibility*: GECOL must ensure all information is available to all company divisions and external participating offices to ensure coordination and timeliness of all the activities concerning the initiative.
- *Timeliness*: GECOL must ensure that their five-year target for the additional generation capacity is following an established E. E. and activity schedule. In addition, all data concerning the developments and updates must always be current to ensure coordination and proper conveyance of dynamic information.
- *Security*: GECOL must ensure that their targets and expectations will remain dependable throughout the long-term course of GPP, especially with the involvement of crucial external forces that provide for the budgetary sustenance of the said project.

ELEMENTS OF QUALITY

e. Key Characteristics and Properties of Organisation's Products

The main commodity offered by GECOL is electricity derived mainly from natural gas; although, with GPP in place, 2008 data showed derivation of electricity from CTT technology and steam cycle. Subsidised by the Libyan Government, GECOL as of 2006 was supplying peak load of 4,005 MW from installed generation capacity of 5,440 MW to compensate per capita consumption of 3,693 KWh (GECOL, 2007). Meanwhile, based on the latest publication made by the company, peak load in 2009 reached 5,282 MW, while installed generation capacity stepped in to only 5,279 (GECOL, 2009). Currently, generation quality is challenged by the technical and non-technical losses costing the company reductions of 17.2% and 23.1% respectively.

f. Customer Servicing, Needs, Feedback and Value Analysis

As of 2009, the top five consumer categories supplied by GECOL are the following: (1) Residential sector comprised of 902,965 units covering 33.24%; (2) Commercial sector with 124,740 units at 18.29%; (3) Agricultural sector with 112,950 at 13.04%; (4) Industrial sector with 55,732 at 11.49%; and (5) Public facilities with 23,008 at 7.01% (GECOL, 2009). According to GECOL, the increase in their consumer profile has been influenced by the general infrastructural and servicing quality improvements from 2005 to 2008 (GECOL, 2010). Although, the company acknowledges the fact that

It is still early to derive conclusion whether or not they can meet consumer needs suggested by the forecast. For instance, the 2009 annual report has already indicated a gap between generational capacity and peak load. As per local customer service and feedback mechanisms, GECOL can be reached through their satellite offices, preferred contact details, and website feedback and suggestion section. However, as per foreign inquirers and potential consumers, the only means of reaching GECOL office is via their non-English website feedback section. Lastly, value analysis of GECOL consumers suggest that: (a) customers are concerned mainly on the stability of their electricity supply; (b) industrial and commercial sectors are concerned in the capacity of the company to provide for their operational energy consumption; and (c) consumers are concerned in the lowering down tariff costs of electricity (Reneses, et al., 2011).

g. Cost of Quality

In terms of cost related to quality, cost of conformance stems from (a) the reduction of generation cost through the implementation of GPP, (b) prevention of technical and non-technical losses through loss reduction initiatives, and (c) accessible collections channel for consumer payments. By implementing GPP, GECOL would reduce their spending on materials necessary for energy generation particularly light fuel and gas. Meanwhile, prevention of losses technically and non-technically would enable the maximisation of energy generation efficiency, which again would lead to operation savings. Lastly, by implementing accessible channels of payment, GECOL would reduce the strain from covering the cost of operation from internal budgets.

On the other hand, cost of non-conformance stems from (a) the loss of potential sales due to the inability of the company to meet the necessary energy demand, (b) the greater and possibly growing losses in technical and non-technical aspects of energy generation process, and (c) cost of delayed payments and follow-up sectors necessary for handling payment irregularities, delays, inconsistencies, and other back works.

h. Achieving Competitive Edge

Key expansions of GECOL in the regions of Tripoli, Benghazi, and Sebha facilitated the substantial growth in the company operations. In 2007, GECOL was already operating the following substations along with their MVA capacity: (a) 2 S.S. (substations) with 400 KV reaching a capacity of 1,600, (b) 70 S.S. with 220 KV reaching to 13,058, (c) 169 S.S. with 66 KV reaching to 3,319, and (d) 321 S.S. with 30 KV reaching 9,280 (Wadi, 2009). Meanwhile, as of 2008, almost majority of the energy sources of the company is already being drawn from steam-based and CTT with only 30% remaining for gas-fuelled generation (GECOL, 2010).

i. Approach to Quality Assurance and Quality Control

As of 2007, the organisation's total workforce accounted to 37,232 comprised of the following job categories: (a) 5,585 engineers, (b) 19,161 technicians, (c) 3,389 staffs handling finance operations, (d) 4,808 handling administrative operations, and (e) 4,289 other employees with specialised positions (Wallace & Wilkinson, 2004, p. 152). Each of the divisions is delegated with the necessary tasks to conduct quality control and assurance in all areas from the technical, electrical, financing, and administrative to specialty operations.

QM systems in each division are interrelated to cover quality in each set of activities, particularly: (a) *engineering* and *technical* divisions ensure stability of power plant operations in terms of its capacity for meeting energy demand, loss prevention, responding to consumer technical concerns, responding to plant concerns, and others; (b) finance operations ensure the timely collection of payments, mode of payments,

channel of payments, subsidy, and consumer billing histories; (c) administrative division covers the internal coordination, decision making, representation, and external links tackling minor to major issues stemming from day-to-day operations (i.e. foreign investment relations, subsidy concerns, etc.); and (d) specialty division covers specialised job functions, third-party linkages, and contractual project handlers hired to facilitate QM innovations and project inputs.

QUALITY MANAGEMENT

j. Addressing Critical Issues via Quality Management System

i. Continuity of Improvement

Methods and requirements for ensuring continuity of improvement are as follows: (a) GPP resource allocations must be consistent especially with the possibility of project extension considering the energy demand forecast for 2020; (b) loss prevention initiatives must be done following scheduled check-ups by the engineering and technical divisions depending on the type of loss requiring the most urgency; and (c) implement schedule quality appraisal of customer servicing from office-, outlet-, and we-accessible feedback mechanisms.

ii. Organisation Culture

By implementing TQM, the requirements/ methods for addressing critical issues in relation with organisational culture are as follows: (a) implement written planning, reporting, and monitoring of GPP-related activities by key people per divisions consistently conveying updates throughout the internal organisation and involved external forces; (b) empower engineering and technical divisions for self-development (i.e. self-training, continuous education, etc.) and self-initiatives improving each personnel's capacity for applicable and efficient decision making in dealing with situations that contribute to technical and non-technical losses; and (c) encourage supportive environment and people-oriented approach in the overall area of customer service aimed at making accessible with ease all channels of communications and transactions with the customers.

iii. Ethics

With GECOL as the sole supplier of electricity throughout Libya, ethical requirements of TQM involve (a) the building of trust and security towards the consumers by providing consistent update of developments and trends in GPP, (b) establishing commitment of quality by reducing losses derived from technical and non-technical identified problems, and (c) securing customer-centred approach in customer servicing.

iv. Values

Methods/ requirements for addressing values in relation with the identified critical issues are as follows: (a) secure consistent update of energy demand versus supply in response to consistently meeting consumer needs during the implementation of GPP, and to the consistent updating of forecast of demand beyond the scope of 2020, especially following a significant rise in the rate of per capita consumption; (b) encourage problem solving attitude among engineers and technicians in response to the varying technical and non-technical problems encountered on a day-to-day basis; and (c) identify with the customer service representatives the value of customer servicing not only as a job function, but more importantly, as a corporate social responsibility, especially being the front-liners of the company.

v. Beliefs

In terms of belief systems in the implementation of TQM, GECOL along with the company divisions and staffs must: (a) consider “everyone” as a customer benefitting from the utility services the company is providing, (b) consider “everyone” is affected by the potential risk of not meeting energy demand, losses, and poor customer service, (c) consider “everyone” must be involved in the process of company innovations, development trends, and initiated projects, such as GPP.

vi. Misconceptions of TQM

In addressing possible misconceptions in the critical issues discussed, this paper recommends the following actions: (a) “It costs too much” – conduct cost analysis of potential savings the company can make by applying loss reduction initiatives and improvement in payment collections; (b) “It is a typical jobsite problem” – make case reports updated, transparent and accessible to the engineers and technicians informing them on the latest variances to jobsite problems currently encountered; and (c) “management will not be interested” – discuss to each front liner division the value of customer feedbacks in moulding and shaping customer servicing in the essence of customer approach philosophy.

5. Conclusion

As a sole supplier of electricity across Libya, GECOL is mainly challenged by the growing demand for electricity. In the attempt of the company to maintain the quality of energy distribution and service, they have initiated GPP to cover the necessary installation of major power plants. The initiative of GECOL is aimed at three quality objectives, namely: (1) reduce energy generation cost to minimise funding strains in GPP; (2) maximise efficiency of energy generation by preventing technical and non-technical losses, and (3) improve collections and consumer access through customer servicing channels. In the process of attaining these objectives, the paper has highlighted the significance of quality and performance management, especially in the attempt of meeting the company’s fundamental goal. Following these, a QM Plan has been developed covering all five divisions of GECOL aimed at securing quality consistency, maintaining open access to communication channels, and application of QM standards based on ISO 9001: 2008. Additionally, the QM Plan has highlighted the different propositions, methods, and quality activities recommended to the organisation in the attempt of meeting the said quality objectives.

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