International Business Research; Vol. 8, No. 7; 2015
ISSN 1913-9004 E-ISSN 1913-9012
Published by Canadian Center of Science and Education

Improving the Energy Operators Efficiency by Business Process Reengineering in Jordan

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Received: April 21, 2015 Accepted: May 14, 2015 Online Published: June 25, 2015

doi:10.5539/ibr.v8n7p144 URL: http://dx.doi.org/10.5539/ibr.v8n7p144

Abstract

In the early 1990's, the concept of "Business Process Reengineering" (BPR) was first introduced by Michael Hammer and James Champy. Nowadays, many projects aiming a better management focus on better processes, as obtained by reengineering the existing ones, using different techniques. This paper approaches this aspect of the management processes redesign in a field which has been (and still is) highly regulated and ruled by bureaucratic laws: electricity production and distribution. Introducing the corporate management in this field is not always possible but, up to some extent, it is desirable, both because the competition occurred and is growing but also due to the globalization of the energy market. Processes control is necessary for almost all processes run at the level of the energy operators, concerning production, distribution and trading. This paper identifies the most important aspects to be taken into account in order to implement corporate management redesign and especially BPR in the energy sector of Jordan, emphasizing the resemblances and differences between the two cases and offering recommendations for fulfillment of this approach.

Keywords: business process reengineering, electricity production and distribution, management information system, cost optimization, corporate management in state-owned companies

1. Introduction

This paper broadly presents the opportunities for energy operators to implement management reengineering with focus on the production and distribution processes in Jordan. We consider this topic innovative through its energy-efficiency approach and through the new outlook on corporate management in state-owned companies. Therefore, BPR simulation below aims to estimate results on cost optimization, time saving and energy losses reduction in electrical power systems.

Electricity industry in Middle East (ME) is currently facing cost control challenges, both as a result of losses in the supply chain, and because the level of funding in sustainable energy is still low. Therefore, operators often develop strategies to reduce additional investments, produce less and save energy.

Jordanian energy legislation, even as part of ME, doesn't entirely transpose the ME rules and standards. Beside the national targets for efficiency and use of renewables, there is a steady problem of electricity losses, which have been rising as a result of electric power demand increase. Moreover, the Jordanian distribution network faces challenges like a high degree of physical wear, or even damages caused by energy or components robbery. Hence, there is an urgent need for further investment and improvement in terms of energy performance for buildings, while the main policies in the area should be based on the large (industrial) consumer's energy audits. But perhaps the most direct way to improve the competitiveness of national energy field is to redesign the corporate management for each category of actors in the supply chain.

Jordan is making significant progress regarding the national system of renewable energy, while the most substantial investment in the area aims the hydro plants. As well, Jordanian energy policies are focused on greater flexibility, new generation capacities and decrease of consumption. However, important problems, such as an unfavorable energy mix with a high prevalence of lignite, a strong dependence on energy import, poor condition of the energy system and inefficiency in energy production and use, remain in the sector. As contracting party of ME Community, Jordanian needs to prioritize the corporate management for its national electricity operators.

There are many aspects that make classical management techniques no longer sufficient when it comes to new challenges in the global energy system. Given the consumption-based pricing models, speed-to-market and the need of information sharing, one of the most competitive innovations can be the use of BPR, on various management levels. Intensifying global competition combined with volatile economic, regulatory and market conditions means that energy companies have to generate higher performance and greater operational agility, with costs reductions.

As a structure, this paper identifies the main needs in terms of electricity production, distribution and consumption for Jordan, where all these processes are pretty expensive for the stakeholders and slowed down by bureaucratic laws. Subsequently, the article explains the advantages of a redesigned management, employing the cloud computing technique, given the fact that BPR for large utilities producers is currently revealing its first benefits in US and Western Europe. In the end, the paper aims to quantify the differences between the classical, usual corporate management and the one based on reengineering, highlighting the cost optimization effect of the latter. The main purpose is to offer a feasible management alternative for the two countries energy system, starting from their own shortages.

2. Literature Review

2.1 Business Process Reengineering

It is argued by some researchers (for example, van Meel et al., 1994; MacIntosh & Francis, 1997; Mugableh, 2015; Mugableh, 2013 etc.) that there is no commonly agreed definition of BPR. However, Yih-Chang Chen (2001, "Empirical Modelling for Participative Business Process Reengineering") considers BPR a concept which focuses on integrating both business process redesign and deploying IT to support the reengineering work. S. L. Mansar (2007, "Best practices in business process redesign: use and impact") identifies 6 components which must be linked through this technique:

1) The internal or external customers of the BPR;
2) The products (or services) generated by the BPR;
3) The business process;
4) The participants in the business;
5) The information used or created by BPR, and
6) The external environment, other than customers.

2.2 Business Process Management

Process management is a structured approach to performance improvement that centers on the disciplined design and careful execution of a company's end-to-end business processes. Business process automation, often labelled BPM (Business Process Management), is a growing activity, albeit one which tends towards a narrower, IT-centric, context. As M. Hammer (2002, "Process Management and the future of six sigma") noticed, process based interventions, in particular, Six Sigma (Six Sigma provides a way of measuring the variability in a process as it delivers services to an end-user or customer), are becoming more and more popular, although doubts remain as to the durability of such interventions in the absence of a process management framework.

Most people think of BPM as the logical continuation of the interest in business processes that started in the Eighties and reached a crescendo in the mid-Nineties with Six Sigma, Business Process Reengineering, Workflow and ERP software. According to Z. Dabaghkashani (2012, "A Success Model for Business Process Management Implementation"), BPM helps organizations by providing real benefits such as: automation of standard procedures and processes, ability to visualize, simulate and trouble-shoot Business Processes, manage and monitoring the performance of operations and personnel.

2.3 The Practicability in Energy Field

As most of the industries, energy sector is very likely to migrate to management redesign and especially to cloud computing use. We consider that the large number of entities involved in the energy field and power systems–producers, distributors, infrastructure and auxiliary services providers etc.–is the main reason why they should employ process orientation more and more. Currently, national and international operators are looking for ways to optimize costs, reduce losses and process duration, modulate prices or even interact with users/consumers through IT platforms. Watson and Howells (2012, "Energy Informatics: Initial Thoughts on Data and Process Management") observe that there is a need of a new discipline, Energy Informatics, whose goal is to stimulate research in reducing energy consumption through practical solution and power of information systems.

Even if some large energy (electricity) corporations in countries like USA or UK have already virtualized their internal infrastructure, the great majority have yet to implement the full-scale automation in terms of process design and simplification. This is also the case for Romania and FYR of Macedonia, where such system is still incomplete as respects automation of standard procedures and management processes.

3. Methodology

Firstly, it's important to clarify our future working concept, the *smart grid*. It generally refers to a class of technology used in order to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. When talking about energy operators, this communication technology is quite new in process development, despite the fact that they have been used for decades in other industries. There is a wide category of actors in the power system which has begun to use smart grids, from the power plants and distributors, to business and non-business consumers. The table below exposes some of the benefits a smart grid could bring as against a classical one:

Table 1. Traditional grid vs. smart grid in terms of efficiency

	Traditional grid	Smart grid
Communication and control infrastructure	◇ **Technology:** Data transmission along the power grid (for example, unidirectional control of demand) ◇ **Purpose:** Remote (fault) sensing and substation switching ◇ **Metering:** Mainly manual meters	◇ **Technology:** Multidirectional broadband-communications network ◇ **Purpose:** Enabling smart features such as remote performance analysis and automatic remediation, and demand-generation matching ◇ **Metering:** Digital smart meters (active remote-control and remote-readout devices)
Grid and energy-management-software solutions	◇ **Systems support the operation of manual control centers (from network control stations)** • Monitoring and remote-sensing systems • Manual remote controls and switches	◇ **Systems provide "intelligence" that facilitates smart-grid behavior** • Power routing and flow optimization • Pricing for feed-in and consumption
Energy infrastructure	◇ **Power is distributed to customers from central sources and power hubs** • Tree-shaped structure • Slow response to changes	◇ **Power is distributed between central and decentralized elements, sometimes switching the roles of source and consumer** • Mesh-and-ring structure • Fast response to changes
	Run by grid operators	Competition from new players

Source: Boston Consulting Group.

Considering all these classes of benefits, we will detail the energy management approach, with focus on flow optimization, basically because it is the starting point for another advantages, such as cost control, energy saving or fair taxation.

The next evolution of smart grids technology will allow all the actors involved in the power system to control usage, through *demand side management* (DSM). DSM is a set of interconnected and flexible programs which allows customers a greater role in shifting their demand for electricity during peak periods. Overall, operators that develop DSM techniques do it because it also helps them to reduce further investment in generating capacity. Development of energy management programs ensure reduce the pressure on energy resources, including on imports of primary energy resources, improving energy management (through the introduction of energy consumption modern tracking and production processes automating), more efficient use of energy and delaying investments in new power generation capacity.

Types of demand side management include:

- Demand controllers to automatically react to control peak demand.
- Control and cycling of equipment.
- Behavior modification.

- Thermal energy storage (TES) systems such as ice banks for air conditioning.
- Back-up generators.
- Renewable energy integration.

Further, we will explain a gross example of reducing daily peak demand by load leveling using DSM:

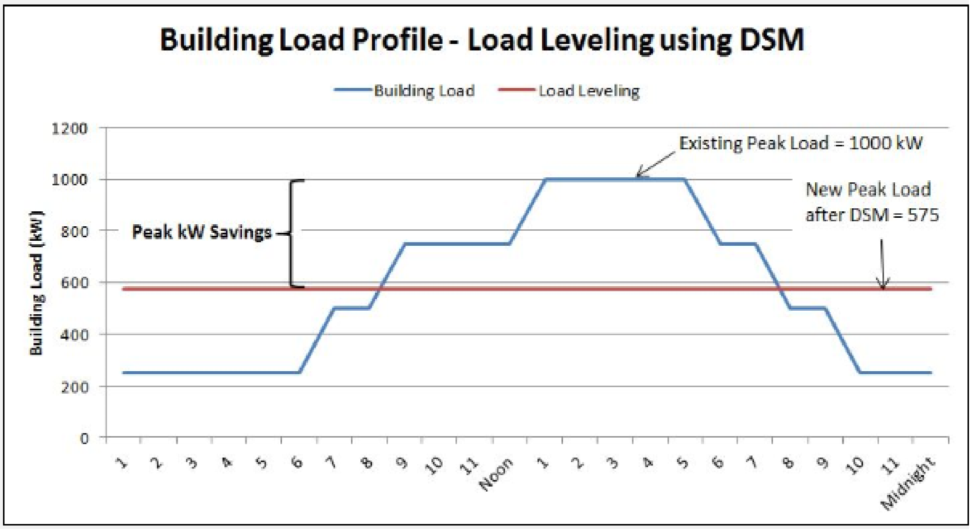

Figure 1. Load leveling using DSM, during one day

The blue line represents total demand / consumption during a whole day and this demand function reaches its maximum value around noon. The red line describes an ideal situation of a constant demand, which may occur as a result of DSM techniques listed above. As one can notice, the peak load decreases from 1000kW to 575kW. Many statistical modulations and even real examples (cases from USA or Australia) have shown that, overall, the electricity consumption doesn't lower, but becomes more balanced. Moreover, the peak load decreases and this can lead to a substantial benefit: the households and business' bills lower (because it costs the utility more to produce power during on-peak hours of high energy demand).

4. Results

Given the fact that Jordan faces similar difficulties in their attempt to boost energy efficiency, we argue that investing in DSM techniques could be lucrative and safe on long term.

Among common issues of both countries there are problems like consumption behavior, the need to upgrade capacities and plants and the fact that, in the past, DSM measures were applied unsystematically. Describing this type of management technique and its consequences can be resumed as Figure 2 shows:

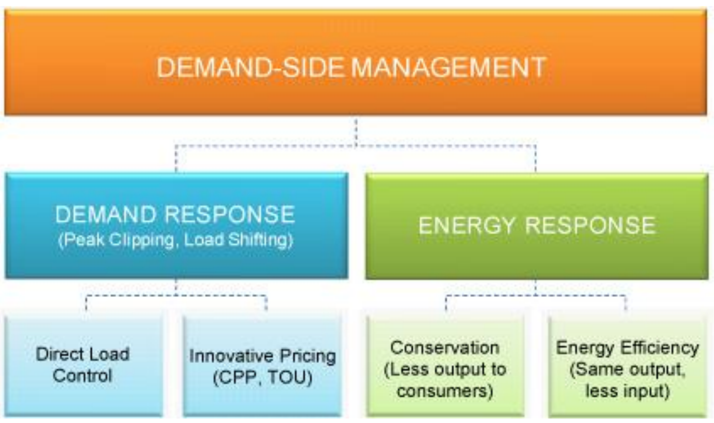

Figure 2. Responses for demand side management

Therefore, DSM has potential benefits on two main coordinates: the economic changes caused by demand and supply variation (demand control, average price decrease on energy market etc.) and the environmental dimension (diminish impact associated with greenhouse gas emissions).

4.1 Brief SW Analysis of DSM Use in Jordan

On the whole, some of the DSM benefits could be:

- Cost reduction: many DSM and energy efficiency efforts have been introduced in the context of integrated resource planning and aimed at reducing total costs of meeting energy demand.
- Environmental and social improvement: energy efficiency and DSM may be pursued to achieve environmental and/or social goals by reducing energy use leading to reduced greenhouse gas emissions.
- Ameliorating problems in the electricity network through reducing demand in ways which maintain system reliability in the immediate term and over the longer term defer the need for network augmentation.
- Improved markets: short-term responses to electricity market conditions (“demand response”), particularly by reducing load during periods of high market prices caused by reduced generation or network capacity.

But there are also some barriers concerning DSM:

- Monopolistic market structure, in Jordan, which might lead to traditional and inefficient tariff structure.
- Lack of proper incentive schemes to consumer on using energy efficient appliances and utility to implement DSM solutions.
- Low awareness among consumers about the efficient use of energy.

4.2 Implementation through BPM

Basically, DSM tools depend, to a large extent, on IT platforms, new generation apps and on cloud computing. Subsequently, management redesign will involve the automation and power of information systems for the following aspects:

- Develop end-use demand forecasting.

- Review cost sharing and viability option.

- (Pilot and large scale) programed selection and design.

- Management and evaluation for the programed.

5. Conclusions

Electrical grid has been facing important challenges regarding quality and quantity to meet the increasing requirements of consumers. Environment friendly and economical generation along with efficient consumption through effective DSM in future smart grids will help in addressing most of these challenges because of integration of advanced information and communication technologies.

Jordan with short tradition in terms of energy efficiency policies and consumers awareness. In the same time, they both have potential for a larger renewables use but need substantial investment to take advantage of it and to reduce the energy imports dependence. For these reasons and not only, techniques such as smart grids and side management are currently worth being applied and could be somehow seen as an “investment to avoid a larger investment”.

To conclude, we argue that IT infrastructure to fulfill this approach is affordable and benefits target many aspects: the local energy market, consumers and energy intensive industries, producers and power plants and also the whole environment. Therefore, DSM and the concept of smart grid, even if difficult to be entirely implemented, are one of the most innovative and productive ways to redesign corporate management in this complex sector.

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