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Cost/benefit analysis of an AMR system to reduce electricity theft and maximize revenues for Électricité du Liban

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Abstract

One of the largest pitfalls for any distribution network is the level of energy losses suffered by the system. These losses fall into two categories: technical and non-technical. Technical losses depend largely on the physical properties of the network, while non-technical losses (sometimes a more significant form of losses) are the result of theft or fraud caused by meter tampering, false reading, illegal connections or unpaid bills. In Lebanon, the levels of total losses are around 50% resulting in an annual deficit of more than 225 million US dollars. Despite the frequent breakdowns of the system and evidently unsustainable financial-losses, political consideration makes the sustained pursuit of electricity thieves low on the list of priorities. To overcome these hurdles, the national electricity company in Lebanon, Électricité du Liban (EDL), studied the possibility of using automatic meter-reading (AMR) technology to modernize electricity metering, billing and collection, minimize fraud and maximize revenues. The results of this study and a cost/benefit analysis of the proposed system are summarized in this paper.

Keywords: Automatic meter-reading; Energy economics and management; Case study

1. Introduction

The distribution of electricity has long been seen as a safe business venture. With secured earnings and a captive market, there appears to be little that could cast a

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shadow over such an investment. However, despite the apparently rosy glow of distribution network finances, the spectre of electricity theft lurks in the shadows of many developing countries, seriously impinging on their fundamental economics [1].

One of the largest pitfalls for any distribution network is the level of energy losses suffered by the system. Distribution losses depend largely on the physical properties of the network, such as conductivity and resistance of the cables, the number of voltage transformations made and the size of the network. The second, and sometimes more significant, form of losses comes under the heading of non-technical losses (i.e. theft and fraud). Several types of non-technical losses exist:

- Fraud (meter tampering, false reading, etc.)
- Theft (illegal network connections)
- Collection (failure to collect monies owed)
- Billing (companies do not know how much electricity has been consumed).

All of these factors are exacerbated by the fact that detection of theft from a distribution network is extremely hard to identify. Essentially the only way to determine the level of losses, both technical and non-technical, is to subtract the level of payment for electricity delivered across the network from the value of power that was generated, the net figure thus produced gives an indication of the total losses. Attempts to determine empirical values for theft are, more often than not, simply estimates based on levels of detection.

As Lebanon was being rebuilt after 20 years of civil war, the national power-company, EDL, started to progressively modernize its infrastructures to meet the growing demand of residential, commercial and industrial customers [2–4]. With new generation and transmission facilities already built, EDL is currently attempting to improve its electricity metering; billing and revenue collection in order to increase revenues and reduce fraud, which accounts for almost 50% of missed revenues today [5].

The objective of this paper is to present a cost/benefit analysis of the proposed system for modernizing the electricity metering, billing and collection processes for EDL customers. Currently, these customers are being metered using a variety of old and new electromechanical meters. The metering process is manual, prone to errors and does not provide EDL with reliable methods to readily check bills, identify problematic customers, and reduce fraud.

Several types of meter-reading systems were investigated for their applicability to Lebanon, including mobile, fixed and power-line carrier systems. The proposed system will ensure that EDL's metering activities would become as advanced as those of modern utilities, reduce fraud and have a reasonable pay-back period. Most importantly, with the proposed system, EDL will regain the confidence of its customers, and would become a highly reputable and revenue-generating organization. The results presented in this paper will show that the proposed modernization project is technically and economically feasible.