Scope for Effective Energy Conservation Practices in the Information and Communication Technology Industry :
A Time Series Examination of a Case from the Sri Lankan Corporate Sector

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Introduction

The Information and Communication Technology (ICT) industry is considered to be relatively "environmentally friendly", for the fact that it does not discharge any significant amounts of effluents or emissions to the environment. Therefore, the industry is categorised among the relatively cleaner economic activities. However, it is known that the ICT industry is a significant demand-puller for energy, particularly electricity, and hence contributes indirectly towards carbon dioxide emissions at the source of electricity generation. In the global context, the ICT industry accounts for approximately 2% of the total carbon dioxide emissions to the atmosphere, which is closer to that of the aviation sector. With increased awareness of the problems of global warming and adverse environmental impacts on consumers, major ICT firms in the global context are taking steps to minimise their carbon foot print. In this attempt, they are not only greening their own operations, but also looking for companies having less carbon emissions when deciding to outsource their operations. Leading ICT Companies operating from Sri Lanka are thereby encouraged, if not compelled by these market trends, to go "green", for they are largely dependent on sub-contracts and outsourced tasks assigned by European or American partners. They intend to stand out among industry peers and to be a competitive force in the global IT services market.

The present case study is about Virtusa Incorporated, one such leading ICT company operating an office in Sri Lanka, which has resorted to electricity saving strategies over a period of time, and has taken steps to bring about a green revenue stream to its operations.

Methodology

Electricity saving strategies adopted by the Company and the timing of such strategies coming into force have been identified by a research project. Monthly data on the company's electricity consumption corresponding to the period of study covering the

conservation effort have also been gathered. An econometric time series analysis was used to appraise the effectiveness of each conservation strategy, and to arrive at conclusions, particularly with a view to drawing lessons for other similar companies intending to resort to such conservation strategies.

The average electricity consumption per day in each month was tested against the deterministic variables standing for each of the conservation measures, as well as against the average number of active employees at work per day within the same period. Different forms of relationships were tested, and the acceptability of the model was determined based on the conformity of results to the theoretical concepts depicted by the signs of coefficients, as well as on satisfactory model estimation parameters. The model was repetitively estimated with different combinations of independent variables in order to arrive at the most appropriate estimation of co-integrating vectors with acceptable statistical parameters, plausible coefficients and correct signs of explanatory variables.

Results and Conclusions

Machine switching off, CRT replacement, and introduction of CFL bulbs indicated a negative and significant relationship with the electricity consumption in different models examined, hence indicating their correct direction of conservation impact. The dummy variable representing power management strategies, such as computer screen saving action, did not have any significant impact on electricity conservation in the presence of other explanatory variables, and hence was simply dropped.

The model with best explanatory power, and with the maximum number of conservation oriented variables bearing correct direction of impact could only retain machine switching off and CRT replacement as strategies. In this model, the variables at first differences were stationary or integrated with order one, $I(1)$, according to Augmented Dickey-Fuller (ADF) test results. Johansen and Juselius (1990) Multivariate Cointegration test results revealed the presence of a single cointegrating vector in this model, meaning that the variables retained would be linked together in achieving steady state equilibrium in the long run.

The Long-run equation of this combination of variables indicated that the electricity consumption, as naturally expected, was directly and significantly correlated to the

number of employees at work. Among other variables, only the CRT replacement and machine switching off effort stood out as significant, indicating the impact on conservation through reduced energy consumption by computers switched on as well as through switching off of machines when they are not in use. The causal relationship examined through the Toda and Yamamoto (1995) Granger test also indicated the existence of a unidirectional causality to the energy consumption from the number of employees at work as well as from machine switching off effort. Hence, it can be concluded that a lesser human resource intensive operation or greater labour productivity, and systematic switching off of computers when not in use, would have significant conservation effect on electricity in this Company. However, the Granger test could not establish causality from CRT replacement effort towards reduced electricity consumption of the company.

This time series analytical exercise has interestingly brought strong evidence for having a declining trend of electricity consumption over time, quite independent of the identified and tested determinant variables. This is further substantiated by the fact that a "time" variable, if introduced, would become dominant with a highly significant negative coefficient, though such inclusion would weaken the acceptability of models examined in terms of the correct direction of influence of some of the explanatory variables. This evidence suggests that there could be an entirely different determinant of the pattern of electricity consumption not captured by data in the present study. This could well be associated with air-conditioning control by the management, pertaining to which the data were not made available for this study.

It can thus be concluded that ICT companies could look forward to going green by strategically positioning their conservation measures. Most energy intensive usages need to be focused, such as the number of active work stations, the computers being switched on with no operators working with them, and the energy consumption by operating computers. Along the same lines, air-conditioning could also be a major candidate for electricity conservation. The conservation impact of controlling relatively minor applications of electrical energy, such as screen saving, would be relatively small.

Key words: Electricity Consumption, Energy Conservation, ICT

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Hydrogeological Characteristics in the Geothermal Springs in Sri Lanka
(A case study of the Madunagala and Kinniya geothermal springs)

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Geothermal springs are the natural springs that contain hot water. Hydro geothermal systems link the global lithosphere, hydrological and atmospheric cycles of the environment. Generally three important factors control the generation of hot springs, including heat sources, ground water and reservoir rocks. The major process of thermal water is the meteoric water that brings the heat from the interior to the surface through a permeable path or aquifer. The main heat source is from magmas within the crust that intrude to shallower levels from unstable areas such as active volcanic belts or fault zones