

Scenario Analysis of Future Load Profile of Sri Lanka Considering Demand Side Management Initiatives

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Abstract—As a result of technology development, expansion of industries and improvement of living standards, the electricity demand increases rapidly. It is the responsibility of the utility to supply uninterrupted, reliable and good quality power to customers. Basically, it is the balancing of supply against the demand. Building new power plants to match the supply to increasing demand may not always be economically viable. The trend now is to control the demand with demand management initiatives. This study evaluates the reasons for changes in day peak and night peak in the electricity load profile, to study the feasibility of making the load profile smoother using Demand Side Management (DSM) initiatives. After analyzing several types of customer categories, it was identified that Chilled Water Storage (CWS) systems and Electrical Vehicles (EV) can make a significant change in the load curve. By constructing storage tanks to store chilled water during the off-peak tariff period, and using the stored chilled water to meet the peak-time cooling demand will reduce the demand at peak time. A mathematical model was developed for demand forecasting, incorporating DSM.

I. INTRODUCTION

Generation, Transmission and Distribution licensees, regulated by the Public Utilities Commission of Sri Lanka (PUCSL) perform their respective functions. CEB is the only transmission licensee, and CEB, Independent Power Producers (IPPs) and Small Power Producers (SPPs) are the main generation licensees. The transmission licensee dispatches power plants, buys electricity from power plants and sells electricity to distribution licensees.

Five distribution licenses have been issued and four of them are owned by CEB and the other license is owned by Lanka Electricity Company (LECO). The five Distribution Licensees (DLs) own and operate the relevant distribution networks and supply services to customers.

The five DLs are different in terms of their customer base and volume of sales. All DLs sell at the Uniform National Tariff (UNT). If the Bulk Supply Tariffs (BST) for the sale of electricity by the TL to DLs is fixed, then DLs would be required to sell electricity to their customers at non-uniform rates.

The demand for electricity initiates at the customer end the utility, has and the System Operator (CEB) has to match this demand with the supply. Since demand increases, the utility has to dispatch higher cost power plants to match demand. Since the power plants are dispatched in the order of ascending marginal cost, energy from the plants that come online to meet the system peak is the most expensive. In addition, the utility has to possess adequate capacity to meet the varying peak demand, which requires the utility to pay for ongoing availability of peaking plants that may only be dispatched for a few hours per day or month. The sharp evening peak justifies the analysis and implementation of Demand Side Management (DSM) in the country.

The shape of the Sri Lankan load profile has changed significantly over the past two decades. Simply we can identify that the increase in electricity use is the core reason for the change in the shape of load profile. However, there are some other possible reasons as well which require further. Study.

- Increase in demand for electricity
- Changes in demand patterns of different consumer categories
- Economic growth of the country and structure of the economy

The normalized load profile for some selected years is shown in Fig. 1.