CUSTOMER PROFILING-BASED OPTIMAL LOAD SHAVING SOLUTION USING EVOLUTIONARY PROGRAMMING TECHNIQUE

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ABSTRACT

Economic growth requires high-energy consumption, which leads to supply shortage problem. The world population growth contributes in significant increase in the energy consumption every day. However, there are a lot of mitigation techniques can be applied in order to manage the energy supply and ensuring each consumers consume enough energy to satisfy their load demand. Customer's load profile or daily load curve for each customer is different from one another. Thus, pre-feasibility study on each load profile is a must to ensure an efficient load optimization process. This thesis presents optimal load clipping and shifting using Evolutionary Programming (EP) technique. The problem formulation is based on the basic load clipping and load shifting knowledge. This process is conducted using the data provide by Malaysian Energy Commission (EC). The study considers several load categories namely the industrial, commercial and domestic loads. Results obtained from the study are beneficial for the basic understanding of load clipping and load shifting knowledge for the society. Evolutionary Programming technique is used to solve the optimization model of load shaving. MATLAB software is needed to put into practice the actual operation of the optimization process to provide the recommended decision, thus, avoiding system peak hour shortage problem in the future.

Keywords - Evolutionary Programming (E.P), load clipping, mutation, load shedding, load shifting, customer load profiling, load shaving optimization. Malaysian Energy commission (EC)

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The electricity demand is uneven during the day and the demand in the peak periods is much higher than the demand in the rest of the day. The supply side is limited by production and transmission and distribution network. It is less expensive to clip or shift peak demand than to expand transmission network to correspond to peak demand [8]. The target of load management is to curtail the demand (kW) of higher cost period to relieve the pressure of the power grid during peak demand period so that the existing infrastructure can be utilized as much as possible and the investment for the new capacity which is both costly and time consuming can be delayed or partially avoided [9].

Demand-Side Management

Load management or demand side management (DSM) has been one of the effective means of load shifting and peak-load shaving. In a system with distributed generations and distributed renewable energy sources, demand response can significantly improve the efficiency of electricity usage and energy saving [8-9]. DSM encompasses "systematic utility and government activities designed to change the amount and/or timing of the customer's use of electricity" for the collective benefit of the society, the utility and its customers. As such, it is an umbrella term that includes several different load shape objectives, including load management (LM), energy efficiency (EE) and electrification [14]. The demand side management or load management has been used as an alternative solution for system operation in past thirty years. An overall review of demand side management is provided in [1], including peak-load shaving, valley filling and load shifting. In [9], load management programs are classified as economic-based programs and stability-based programs. An economic-based program aims to minimize price spikes during peaking demand