

A Linear Programming Model for Minimizing U.S. Oil Consumption

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SUMMARY

This paper describes applications of a new model which can be used to help minimize oil consumption by electric utilities in the U.S. The model can be employed to determine the theoretical upper bound on oil savings against which performance can be measured. It can also be used to identify oil conservation options on an hourly basis. In conjunction with other models it can be used to determine system additions and contractual changes necessary for exercising these options. Further, the results can be verified by inspection. Test results using actual hourly data for the Eastern Interconnected System indicate that significant oil savings, over and above those already achieved by electricity transfers, may be realizable.

INTRODUCTION

The minimization of oil consumption in the U.S. to reduce dependence on imported oil is a national priority. The electric utilities' average daily oil use of 1.5 million barrels per day accounts for roughly 8.3% of the 18 million barrels per day of oil used in the U.S. [1]. Hence reduction in the use of oil by electric utilities has significant effects on the total oil used in the U.S., on the balance of payments, and therefore on inflation. The electric utility industry is aware of this, and has been making efforts to reduce its oil consumption. Under the auspices of the newly merged National Electric Reliability Council and North

American Power Systems Interconnection Committee, the Operating Representatives Northeast Systems (ORNS) have surveyed the interchanges taking place to replace oil generation with non-oil generation. Table 1 presents results for the week May 10 - May 16, 1979. The ORNS results indicate 22.7% non-oil capacity apparently available, and all but 3.5% of practically available non-oil capacity utilized to displace oil during that week. These results indicate only a small margin for improvement toward further reduction of oil consumption.

The reduction of oil use is also a major goal of the U.S. Department of Energy (DOE). The Office of Utility Systems, within DOE, has established a center in Washington, DC, to monitor oil displaced by electricity transfers. Congress and the President's Commission on Coal have indicated the need for an independent assessment of the situation by DOE. The model developed will provide an independent and verifiable theoretical upper bound on oil savings against which performance can be measured, and with which options can be identified.

The following sections of this paper describe the problem and the crude but effective model developed to address this problem. Sample results using hourly load and generation data for three 24-hour periods are also presented.

PROBLEM DEFINITION

The minimization of oil consumed by electric utilities through the utilization of available non-oil generating capacity is subject to a variety of constraints. Among these are: (1) satisfaction of the demand for electric energy, (2) transmission, breaker, current transformer, etc., limitations on energy transfers, (3)

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