

Electricity consumption and load control possibilities: Residential energy monitoring in Sweden

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1. SYNOPSIS

Some of the main residential electricity consumption factors and the possibilities of controlling them within the Swedish energy market are investigated.

2. ABSTRACT

In a Swedish investigation, various important electricity consumption factors and the ways in which they could be controlled were examined. From this, the possibilities of improving the use and management of electricity for both the residential energy industry and the end-user were found.

All the end-users in the investigation had two-way communicable electricity meters that enabled control and information based experimentation. The study has improved the understanding of the use of electricity within the residential sector and the ways in which to control it.

3. INTRODUCTION

Due to the fluctuating demand for electricity, one major challenge facing the electricity industry is the optimal management of the limited production capacity and how peaks in demand can be met.

If the use of electricity could be governed by the characteristics of the available production capabilities and network characteristics, many of these problems could be significantly alleviated. Such control of the electricity network would therefore provide for the possibilities of switching off certain electrical loads on the users side at a given peak time and shifting this “electrical service” to a less demanding time period. Furthermore, an improved understanding by the end-users themselves on the ways that their usage patterns affects the management of electricity would produce many significant improvements, such as smoother load patterns.

From this, it can be seen that one can approach these electricity problems from two opposing directions – by examining the end-users and trying to direct them towards more energy effective solutions, and by providing control possibilities on the electricity network.

4. CONSUMPTION AND CONTROL

Consumption Factors

The abilities and wishes of the end-user to reduce peak-power demand, by shifting an electrical service to another time, is a significant factor of the users’ characteristics. These characteristics include their actual consumption patterns, household composition and their social and culture attributes, to name but a few. To understand these, investigations were undertaken on end-users’ electricity consumption and a survey was commissioned. These analyses highlighted the affects of important factors such as:

- Time (of year, of season, of day)
- Occupant and building attributes
- Electrical devices (quantities, usage patterns, age, etc)

By using this survey as a basis, an assessment of the abilities to influence residential electricity use was possible for individual consumers.

Direct Control through an Advanced Metering System

As opposed to indirect control through the use of various tariff structures, direct control can be applied via advanced communication electrical systems.

An electricity network suitable to control loading was installed and customers had advanced meters within their homes. These meters allow minute-wise data collection and two-way communication between the residence and their electrical utility.

The installed system can control the household electricity using different techniques, thus providing many options to the system operator. Such possibilities include automated cyclic control, where users can have certain devices that follow a pre-defined switching cycle, and timed control which follows a schedule or electricity tariff.

Control Possibilities of Consumption Factors

From the information gained about the residential electricity user, the variations in the electrical demands and the technical options available through an advanced metering system, research was undertaken with the endeavour to determine:

- Residential Electricity use/demand priorities
 - _ What are the use priorities of the devices and how dynamic are they?
- Load Control potential (apparatus/users perspective)
 - _ What control techniques are available?
 - _ What are the effects on the end-users?
- Electricity use reduction possibilities
 - _ Can the houses' main fuse value be lower?
 - _ What are possible total power reductions?
 - _ How can the users or the utility effect electricity usage through information and/or technology?

5. CONCLUSIONS

Improving the understanding of electricity consumption characteristics within the residential sector and the ways in which to control them, can reduce the ever-present risk of energy shortages and can also provide benefits for the residential customer and the utility from more optimal management of electricity consumption. This research is part of an ongoing project so all the latest results will be shown during the poster presentation at the ECEEE 2001 conference.

6. BIBLIOGRAPHY

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