ECE697 GC Paper Review:

An Analysis of Peak Demand Reduction Due to Elasticity of Domestic Appliance

Zhefan Lin

This paper studies the potential reduction in peak power to carry out demand by modifying the elastic load components of common household appliances. Such a component can decrease its instantaneous power draw at the expense of increasing its duration of operation with no impact on the appliance's lifetime. Ten types of common appliances are investigated in this paper and the elastic component in these appliances are all illustrated and quantified.

This paper quantifies the relationship between the potential reduction in aggregate peak power and the duration required to complete the operation of appliances in four geographic regions: Ontario, Quebec, France and India. It shows that even with a small extension to the operation duration of appliances, peak demand can be significantly reduced in all four regions both during winter and summer.

They define the notion of appliance elasticity and exploit this property to define an optimization program that appliance loads during demand peaks without overly affecting user comfort. Comprehensive data sets are used to evaluate the potential benefits from our approach in four different regions around the world.

The topic of reducing demands during conditions of peak load, it has been well studied in research literature. Compared with the previous research, this paper has following strength and advantage:

This paper consider penetration rate of 10 common appliances in the four regions. It helps get more accurate result of reduction rate in four different regions. Usage pattern and detailed load profiles are also considered, so it can simulate these appliance usages in reality. They also consider possible adverse impact on appliance components due to reduce in peak power and extent operation duration. In the end of this paper, it gives a policy approach aims to let appliance manufacturers to reduce peak power and require appliance operating in a reduced mode during time of congestion.

The weakness of this paper is shown as following:

It only consider the appliance used in resident home, but it does not show what is the percentage of the power used between home and industry. If the power used by home has relative low percentage compared with industrial used, the significance of peak power reduction in home is small.

The second weakness is that this paper only gives the simulation result about peak power reduction percentage versus different operation extension factor, but it does not show what the best operation extension factor in these four regions. Readers has no idea about what operation extension factor can have a optimized result in aspect of economic and convenience of residence.

The simulation results of these four regions are different; this paper does not give a practical advice regarding to these four different to achieve an optimized peak power reduction. Because residence in these four regions uses different types of appliances, the way to achieve optimized peak power reduction are different.

In order to improve this paper, author should consider the influence on user caused by power reduction. Regarding to different types of appliances, there should be a survey of investigation in users to find out how much operation duration extension time that user can tolerant. Next using these investigation data find out the optimized operation extension factor of ten appliances in four different regions. The precondition of peak power reduction is that the user daily life should not be affected. Having an optimized factor, manufacture can do some practical word to reduce appliance peak power and government can publish some regulator to reduce peak power.

After this paper, there is still a lot of work need to do. For example, if government published regulator to reduce peak power or manufactures modify these types of appliances, to understand whether there are significant gains from these operation, a detailed cost-benefit analysis is necessary.

Assuming the above method is feasible, and manufactures also find solution to modified appliances, but let user change all their current appliance in a short time is not feasible. So in a short time period, in order to control peak power, it is better to investigate more demand response scheme to encourage residence use appliance in valley time rather than peak time.