



Regional Differences in Economic Impacts of Power Outages in Finland

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The value of electric power reliability has been a key question since the advent of liberalisation and unbundling of electric power systems and markets. Before suggesting further investments in infrastructure, planners should know the value of marginal increase power system security and compare it with the cost of interruption events. In addition, increasing awareness of consumer rights encourages authorities to adopt more protective policies. Thus, in some countries such as Finland, Sweden, and the United Kingdom, the durations of single time outage events are capped and in case of exceeding these allowable limits, the Distribution System Operators (DSOs) are obliged to pay compensation to their customers. Therefore, both the authorities which devise these customer compensation plans and the DSOs which face the costs of operation and maintenance and of compensation should be able to understand the true costs of outage events.

We address the problem of estimating customer interruption costs from the DSO perspective. Our study makes use of analytical data shared by 78 Finnish DSOs which provide 99% of the energy to low-voltage customers in Finland. It is crucial to understand the costs of power interruption for planning purposes. Furthermore, protecting customers from long blackouts is another driving factor behind the need of understanding the impacts of power outages and their economic worth. There have been numerous studies targeting this problem, however, the majority of these studies rely on customer surveys, which have been criticized for being biased. We compare two existing approaches and show that a previously proposed macroeconomic model



can be used by the DSOs to quickly and objectively estimate the costs of total direct and indirect impacts of interruption events in their region. However, it is not possible to get customer-specific results using this approach. To understand the value of customer interruptions for industry, service, commercial, residential or agriculture sector, customer surveys are necessary.

Our model makes use of national average income in Finland. Since the income level is higher in southern and western Finland, it might be assume that customer interruption costs per kWh will be higher as well. In fact, this is not the case. According to our calculations, Customer Interruption Cost (CIC) is higher in northern and eastern Finland and it is lowest in southern regions, especially in the Uusimaa region where Helsinki metropolitan area is located. This is a direct result of the share of underground cabling in the distribution network lines. The higher this share, the higher the supply security. In addition, distribution distances are higher in rural areas and these are mainly overhead lines, which pass through forests. Storms cause substantial damage to the distribution system in Nordic countries and falling trees over distribution lines is one of the major reasons for interruption events in Sweden and Finland. We observe that there is an inverse relationship between regional income level and regional CIC in Finland. Therefore, instead of using national average of wages in the macroeconomic model, it is imperative to use average wages in each DSO region.

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