# UPDATING THE SECURITY OF SUPPLY LEVEL IN THE FINNISH ELECTRICITY DISTRIBUTION SYSTEMS - A REAL LIFE CASE OF CHANGING THE LEGISLATION FROM THE VIEWPOINT OF THE MINISTRY

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## *ABSTRACT*

*This paper describes a law drafting process for amending the Electricity Market Act that was undertaken in the Finnish Ministry of Employment and the Economy during the year 2012. The goal of the process was to upgrade the performance standards for the security of supply in the Finnish electricity distribution systems.*

*The outcome of this paper is two-fold: first we describe a real life case of drafting the legislation concerning the electricity network security of supply levels in Finland and secondly we shed light on the historical reasons and different limitations, which affected the final bill. We also present the main content of the bill in respect of the new network security of supply levels and other improvements in the Finnish distribution system operator's prepardness against the main climatic threats and in their performance during emergency situations.*

## INTRODUCTION

Civil servants have a central role in the legislative process in drafting the proposals for the Minister, the Cabinet and the Parliament. However, the viewpoint and the contribution of civil servants in law drafting is not widely documented, at least not on questions related to the electricity market or regulation of electricity distribution system operators (DSOs). A pure technical aspect of the electricity networks, the electricity network regulation itself and the adaptation of the DSOs to the regulation, on the contrary, is well documented (see e.g. Brekke et all. [1] and Kinnunen [2]).

### Finnish distribution system operators and the nature conditions in which they operate

In Finland, there are 85 electricity DSOs which differ from each other's much in size of the distribution area, number of customers and also in geographical and nature conditions of the distribution area. The total length of the medium voltage (MV) network in Finland is 138 000 km of which estimated over 70 % is overhead lines situated in forests and are thus exposed to storms and snow. The average underground cabling degree in MV networks is 12 % and in low voltage (LV) networks 38 %. Of all the DSOs, 30 % have a MV underground cabling degree less than 5 % and only 23 % have the underground cabling degree over 30 %.

The network security of supply level in Finland is generally speaking good. Figure 1 show the average interruption time for electricity distribution customers in Finland in the past 15 years. In Figure 1 the "City area" has underground cabling degree over 30 % and "Rural area" less than 30 %. The share of the Finnish electricity distribution customers in "City area" is 42 % and in "Rural area" 58 %. In normal years the average aggregate interruption time for the network customer is little over 100 minutes. However, in serious storms the average distribution network, equipped mostly with overhead power lines, can have a much higher interruption figures and cannot guarantee acceptable and low enough interruption time.

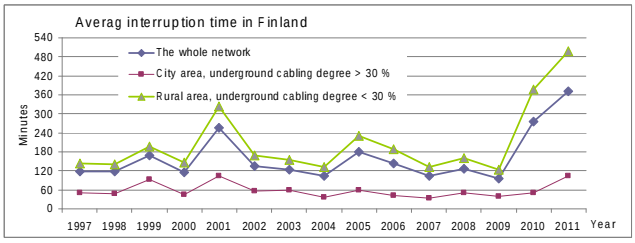


Figure 1. An average interruption time for a Finnish electricity distribution network customer in 1997-2011. [3]

### Review of legislation on interruptions in Finland

Before the storms in 2011, the legislation in Finland concerning the electricity network security of supply was rather general and it lacked the exact time limits for the longest allowed interruptions. The Electricity Market Act contained sections on obligation to develop the network and on standard compensations due to long interruptions. The obligation to develop the network is rather general in nature [4]. Based on it, it is not easy for the regulator, who is responsible for supervising the violations against the act, to set exact rules or limits for the long interruptions. The Ministry has already in 2006 looked further into setting time limits for long interruptions but was not prepared enough to actually do so. The main reason for the hesitation was that in 2006 there was not enough detailed information for example on the economic influences of such time limits.

On the other hand, the Ministry's activity in 2006 opened the discussion on this subject and promoted research, which the civil servants benefited in 2012 when the proposal was actually made. In addition, the need for some kind of limits for interruptions has become clearer after the storms in 2010 and

2011 and thus it was now much easier than earlier to get the political support for the proposed time limits.

Figure 2 shows the basic steps of the legislation process in Finland. The colored boxes are the ones that are in major focus of this paper and the biggest attention is given to the civil servants' contribution to the legislative process.

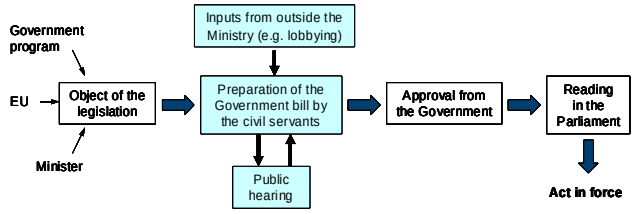


Figure 2. The basic diagram of the legislative process in Finland.

This paper is organised as follows: First we describe the event that led off the legislative process in Finland, namely the two serious storms after the Christmas in 2011. Then we will describe how the legislative process in the Ministry was organised and give details of the boundary conditions based on which the new bill was drafted and list the actual amendments concerning the security of supply in the bill. We conclude by discussing the consequences, which the bill is expected to have for the different parties.

## CASE WINTER STORMS IN 2011 IN FINLAND

On 26th and 27th of December in 2011 two heavy storms, named Tapani and Hannu, rushed one after another through south-west and south of Finland. At that time, the ground was not frozen in southern part of Finland and therefore the storm and the hard wind caused many trees to fall down destroying large amounts of MV electricity distribution overhead lines in rural areas and rural communities. The storms caused wide spread and partly long lasting interruptions for the electricity end users. Also, many functions of the society, for example telecommunication and data communication, were disturbed by these interruptions. The situation after the storms, in respect of the amount of households without electricity and the length of interruption time, was rather exceptional in Finland.

All together around 17 % of all the electricity end users in the MV and LV networks in Finland (570 000 households) experienced interruptions and at the most difficult moment around 9 % of all the elctricity end users were out of electricity at the same time [5]. The average interruption time (in the whole country) was over 6 hours, standard deviation of interruption time was 9,5 hours and the longest reported interruptions were 15 days long. The repair of the network damages was delayed as there simply were not enough skilled personnel available to do the job.

According to the Electricity Market Act the DSOs must pay standard compensation to a customer if the interruption time has exceeded 12 hours. The amount of compensation grows in relation to the length of the interruption. At this moment a customer is entitled to a maximum compensation of 700 € after 120 hours interruption. The aggregate amount of standard compensation payed for the customers and the share of all the network customers who have received standard compenstion are shown in Table 1.

Table 1. The share of network customers (connection points) who have received standard compensation and the amount of standard compensation in 2005-2011. [3]

| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| The % of the customers who have got standard compensation | 1,56 | 1,37 | 0,24 | 0,58 | 0,71 | 3,39 | 11,1 |
| Total ammount of the standard compensation payed for the customers, millions of Euros | 2,62 | 2,75 | 0,36 | 0,83 | 1,42 | 10,12 | 46,79 |

## THE LEGISLATIVE PROCESS OF UPDATING THE ELECTRICITY NETWORK SECURITY OF SUPPLY IN FINLAND

Long and wide spread interruptions in 2011 called a large public attention and caused debate of acceptable time limits for electricity interruptions in Finland. The Cabinet discussed about the storms and interruptions already only three days after the first storm in 2011.

The Minister of Economy was up to the situation and very active in starting the measures to improve the security of supply in electricity networks for the future cases. A little over a week after the storms, the Ministry's Energy Department was ordered by the Minister to make proposals on how to improve the current network security of supply level. The commision from the Minister involved the Energy Department to 1) Improve customer information in severe interruptions, 2) Contribute to increase the degree of underground cabling: to make an estimation of the costs to install enough cables to secure the critical areas of the network and also to check the current (standard) compensation legislation as well as to make a proposal to amend it in such a way that it encourages the network operators to speed up underground cable installations., 3) Contribute to amending the Highways Act of 2005 in order to facilitate underground cable installations, 4) Organise a negotiation with network operators to hear their experiences of the storms.

### Ministry's proposal to improve network security of supply and to ease the affects of the power interruptions

To answer the Minister's commission the Ministry's Energy Department published its memorandum on March 2012 with different proposals to improve the network security of supply. The Ministry's proposal addressed the problem in a

comprehensive manner and included three main points [6]:
**1)** it proposed two separate time frames for the longest allowed interruptions (as a dimensioning criteria) in the distribution systems: 6 hours for the detailed planned areas like cities, towns and communities and either 24 or 36 hours for all the other areas.
**2)** it provided different means for the distribution system operators to reach these time limits, e. g. by introducing changes in legislation to ease the possibilities to install underground cables.
**3)** it improved the ways to supervise that the distribution system operators will take necessary actions to actually reach the time frames.

Setting the time limits for the longest allowed interruptions was the primary measure to improve the network security of supply. The proposal also contained couple of other measures, which supported the primary measure and helped the network operators to improve their security of supply level, for example 1) an obligatory development plan for each network operator, which shows by which measures they are going to fulfill the time limits, 2) an obligatory preparedness plan for the network operators, which includes an information on how the operator has planned to organise the repairing of the network after the storms, 3) ease the possibilities to build underground cables on the side of the roads (this requires an amendment of the Highways Act). In addition to these measures, the proposal also suggested ammendments to the standard compensation scheme, for example a raise the maximum compensation level proportionally up to 2000 €/year.

Next step was to start the hearing process in where the different stakeholders were given the opportunity to express their opinions on the Ministry's proposal. Some statements reguired even stricter time frames than was proposed but mainly the given statements were positive and supported the Ministry's proposal.

### Challenges in choosing the time limits for the longest allowed interruptions

The Ministry's proposal stated that the distribution network must be designed, built and maintained in such a way that if the network will be damaged due to a storm or snow, the electricity interruption must not exceed 6 hours in detailed planned areas and either 24 or 36 hours in other areas[1]. These time limits must be met proportionally in 15 years period.

The challenge in choosing the time limits was to be able to set the limits so that they are strict enough to fullfill the needs of the society at large and expectations of the electricity end users but also loose enough to not to put too heavy burden for the DSOs and finaly to their customers in a form of electricity distribution charges.

**Different time limits for different parts of the network**
To set a time limit for 6 hours for detailed planned areas and 24/36 hours for all the other areas will to some extend help to deal with the fact that the network security of supply level varies between different areas in Finland. 6 hours time limit will in practise require 100 % underground cabling degree and it is reasonable to require it only in densely populated areas like cities. We consulted the Finnish Environment Institute about the different methods to choose different areas for the different time limits. From few alternative possibilities we chose the city plan area as a criteria to separate areas of 6 hour time limit from the areas of 24/36 hour time limit. City plan area was chosen because it is recognised and widely used also in other purposes and therefore easy to take in use.

Even though the DSOs can pick their own measures to reach the time limits, the better network security of supply level is desired the higher underground cabling degree is required. On the other hand, high underground cabling degree means new investments and increase in distribution charges. Quite simply, in defining the longest allowed interruptions as a dimensioning criterias, the question is a comparison between network security of supply level and network charges. However high security of supply level would be desired by the society, the real test for the time limits will be faced when the politicians have to accept the estimated costs of this action.

## INFLUENCES OF THE PROPOSED TIME LIMITS TO THE INTERRUPTIONS

From the beginning it was clear that the current average underground cabling degree is not high enough in order to meet the allowed time limits for interruptions and that the electricity distribution charges are going to rise due to the network investments.

### The effect to the electricity charges

The evaluation of the influences that the Ministry ordered from the Lappeenranta University of Technology [7] provided the following estimations. In order to meet the time limits of 6 and 36 hours, it would require a total investments of 3 500 million € in to the Finnish electricity distribution networks. With time limits of 6 and 24 hours the investments would reach 5 100 million €. The required investments will realize within the same time frame of 15 year that the network operators have to meet the time limits for interruptions. The total investment of 3 500 or 5 100 million € means an average increase of 8-10 % or 11-14 % respectively in total electricity charges including the price of electricity, electricity distribution and taxes. At the moment, the total price of electricity for houesholds is around 15 cents/kWh (and 12,3 cents/kWh for households with electric heating). These average price estimations vary much depending on the distribution operator.

1 At the time of writing this paper the final bill is still under preparation and we can not reveal which one of the time limits 24 or 36 hours is actually chosen.

For example, for the electricity end user with electric heating and consumption of 18 000 kWh/year, the average rise of the electricity costs will be (with 36 hours time limit) 176-220 or (with 24 hours time limit) 242-308 €/year. The numbers can be higher or lower depending of the network operator. It is good to remember that these costs will realize not immediately but in 15 years of time.

### How much will the electricity network security of supply improve?

According to [7]. To meet the time limits of 6 and 36 hours in rural areas, requires underground cabling degree of 40-75 % in MV networks and 40-90 % in LV networks. The corresponding figures for 6 and 24 hours are 60-80 % in MV networks and 50-90 % in LV networks. The wide variation is caused by the very different operation conditions of the network operators. If the underground cabling degree in MV network is arroud 50 %, around 70-80 % of the electricity end users are secured against the storms and snow. In that case the reamaining (20-30 %) of the end users still meet the 24/36 hours time limit. This means that only a very small amount of the end users should have the longest allowed 24/36 hours interruption time and all the other electricity end users have a much shorter interruptions even in very serious storms. This would be a remarkable improvement compared to the current situation.

## CONCLUSIONS AND DISCUSSION

The two serious storms and the following wide spread and long lasting interruptions at the end of the year 2011 were the starting point of amending the electricity network security of supply in the Finnish electricity distribution systems. From the beginning, there was a strong political support for amending the current legislation and setting the time limits for the longest allowed interruptions in Finland.

The process will culminate in late February or early March 2013 to a Government Bill, which will introduce time limits for the longest allowed interruptions, 6 hours for the city plan areas and 24/36 hours for all the other areas. The DSOs must meet these time limits in 15 years' time.

The new time limits for long interruptions will cause significant changes and investments to the distribution networks. Because of the investments, there will also be an increase in electricity end users' distribution charges.

As more and more society's services are going to be delivered through tele- and data communication, it is very important that these services are available at all times and therefore also the network security of supply must meet the new performance standards.

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