Gavle Energi (Swedish) electricity distribution tariff

By Herlita Bobadilla Robles, strategy planning, Gavle Energi

1 Background

1.1 **The deregulation** of the electricity market was implemented in Sweden in 1996. The electricity generation, sales and trade were listed on an open market while the electricity network continued to stay as a monopoly. This separation gave customer the possibility to purchase electricity from any trader which created the Nordic power exchange market (NordPool).
For the transmission of the electricity, the network was rearranged into three levels namely: transmission, regional and local distribution.

The transmission grid consists of 220 to 400 kV is owned by the government and is called “the Swedish grid” (Svenska kraftnät); while the regional transmission consists of 70 to 220 kV is owned by a few companies such as Vattenfall (Swedish company), Fortum (Finnish company), EON (German company) and a few others. The local distribution network is the final level in this transmission chain; it operates on a voltage of 0.4 to 70 kV. The local distribution network is owned by various corporations, from Multinational Corporations to municipalities and small cooperative networks. Currently, they are approximately 175 companies (in 1996 there were roughly 220 companies).

Figure 1, Deregulation in Sweden

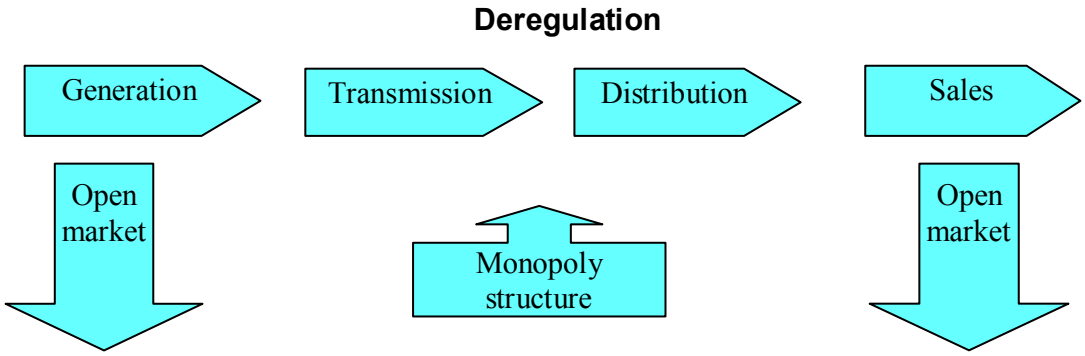
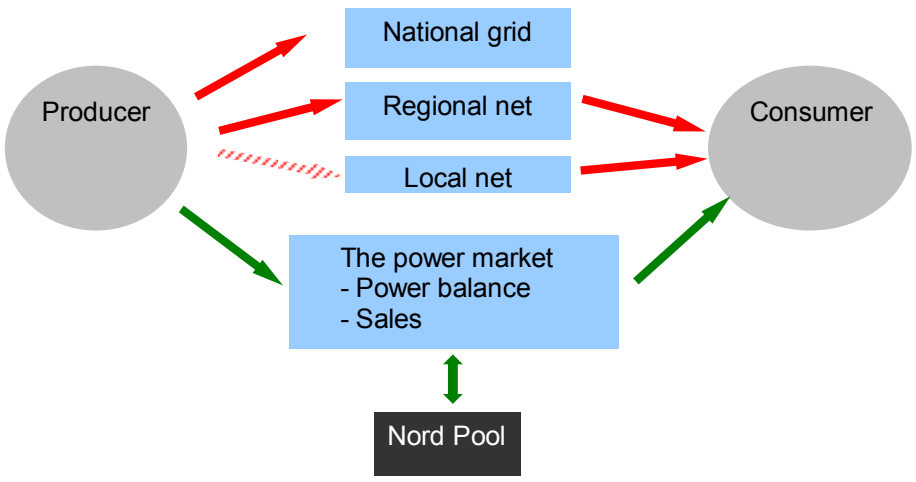


Figure 2, Structure of the electricity market



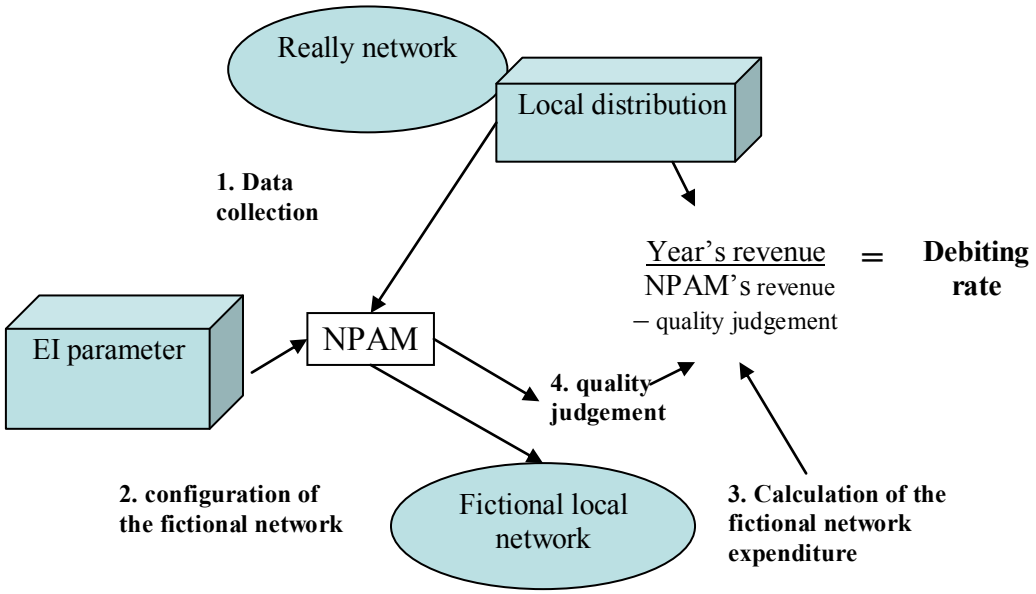
The red line represents the physical transmission and the green lines represent financial transmission.

1.2 ***In order to monitor*** and regulate the local distribution operators, a new regulator authority was established in 1998 called the Swedish Energy agency (Energymyndigheten) which is currently the Energy Markets Inspectorate (EI) that works for energy efficient markets. EI developed the Network Performance Assessment Model (NPAM) and uses it as the main tool for regulation. The first year that the EI utilized NPAM for monitoring and regulating the local distribution operators was in 2004.
The NPAM determines the revenue that the local distribution operator can obtain in the previous year. This model builds a fictional local network based on a set of conditions determined as a standard cost to operate the fictional network during that year, which include the customers' coordinate locations and energy consumption during the monitored year. And from it, it calculates the correct revenue and takes into consideration the distribution network power quality.

The company's reported revenue divided with that of NPAM's calculated revenue, results in a coefficient called "Debiting rate". If the debiting rate is greater than one (1.0) it implies that the distribution operator has over charged the customer.

Several operators have been instructed to return a part of the revenue.

Figure 3, Principle of the NPAM



1.3 ***The new rights of the customer*** have led to the Energy act. The new Act requires monthly measurements and reports of energy consumption to be reported to customers and has resulted in an investment of 80 MSEK (just for Gävle Energy customers). This is due to the major investment of automatic meter reading (AMR) to all consumers.
Several companies has gone beyond what the energy act requires and installed AMR for hourly measurements which provides for the possibility of applying different tariffs, which is based on the fuse size for small commercials and even for domestics consumers

The deregulation and all the new laws have lead to ownership changes of the transmission and distributions grid, resulting in the quantity of local grid being compromised. Many

municipalities and small distribution grids have sold to new multinational companies which currently operate in Sweden.

2. Distribution tariff

2.1 Introductory comments

The financing of the electricity industry is based on the revenue generated from the customers who buy the services.
The global and national demand of a reliable network with very few interruptions, together with the growth of energy consumption has resulted in an increase of investments by the industry for reliable and robust network with better capacity for transmission of electricity.

The increasing costs of energy and in administration resulting from the new requirements of the energy authority have resulted in a rapid increase of prices in the distribution transfer fees.

Fortunately, the factors which affect the pricing of these services are varied and they can be used with different aims in order to reduce the impact on the electricity industry and on the customers.

Although it is a complicated process to calculate the correct tariff for each customer and electricity network, the idea is to have a reasonable fee for the energy distributed and each customer will only be charged for the amount that he/she consumes. It has to be simple to administrate and reasonable on the customer.

At present, the tariffs are generally classified by voltage levels and by fuse size. They are also classified by the nature of the customers' business for example a farmer, commercial businesses, etc.
Other bigger customers such as factories and industries have a tariff based on a demand of maximum use of power (kW) which results in an additional invoice at the end of the year. All these classifications add enormous administrational work and these extra costs are also covered by the tariff..

2.2 Vision for Gävle Energi's tariff

Economical : To make a profit for the owners of the network and have sufficient for future investment.
Technological : To decrease the electricity usage during high demand
Administrative : To decrease the administrative management of billing.
Customers: Each customer will only be charged for the actual usage.
Regulator: The income from the tariff has to be below the regulator's requirement.

2.3 The current tariff of Gävle Energi AB

The tariff is based on the level of voltage connection, measuring electrical parameters and supply size. There are no special tariffs based on the customers' activities.
The main classification is done on voltage levels. High Level Customers (10 kV) and low level customers (0.4 kV).

2.3.1 **High level voltage customers (10kV) .-** they are charged a fixed fee (SEK/year), an unit charge of electricity delivered (ct/kWh), peak demand capacity charge is the average of the three highest peak times of the month (SEK/kW), off peak demand capacity charge is the average of the three highest for that off peak times for the month (SEK/kW) and charge fee (SEK/ kVAr) for the above of the free reactive power level. The free reactive power for those customers is 40% of the active power.

2.3.2 Low level voltage customers (0.4kV) .are subdivided as follows:

2.3.2.1 ***Demand tariff*** .- supply from 80 A. is charged a fixed fee (SEK/year), an unit charge of electricity delivered (ct/kWh), peak demand capacity charge is the average of the three highest peak times of the month (SEK/kW), off peak demand capacity charge is the average of the three highest for that off peak times for the month (SEK/kW) and charge fee (SEK/ kVAr) for the above of the free reactive power level. The free reactive power for this customer is 50% of the active power.

2.3.2.2 ***Demand tariff (63A)*** .- . is charged a fixed fee (SEK/year), an unit charge of electricity delivered (ct/kWh), peak demand capacity charge is the average of the three highest peak times of the month (SEK/kW), off peak demand capacity charge is the average of the three highest for that off peak times for the month (SEK/kW).

2.3.2.3 ***Fuse tariff:***

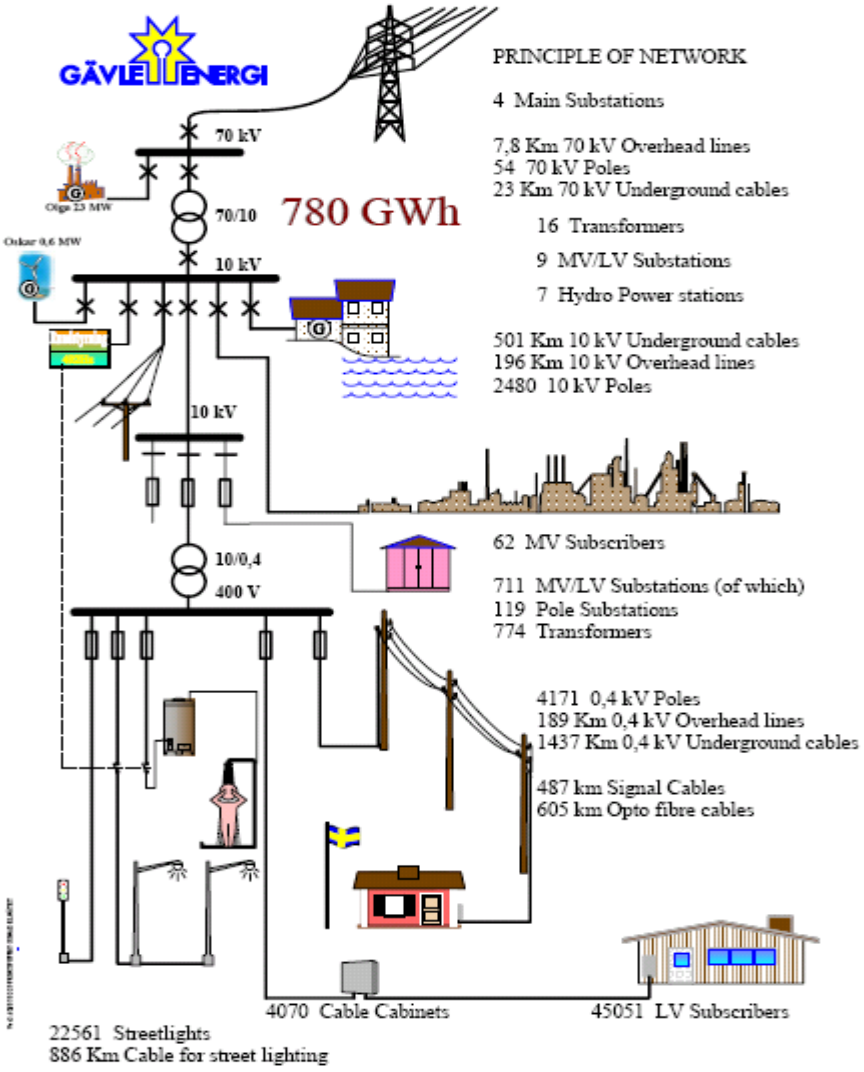
50A .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).
35A .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).
25A .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).
20A .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).
16A .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).

2.3.2.4 **Apartments tariff** .- is charged a fixed fee (SEK/year) and an usage charge fee (ct/kWh).

2.4 The calculation of the tariff

To do a reasonable and impartial tariff calculation, a careful study of every level of the distribution network is made. From the feeding level (70 kV) until the lowest distributed voltage (see figure 4).

Figure 4, Principle of the distribution network



The costs are divided as follows:

2.4.1 Main cost groups:

1. Investment/reinvestment
2. Maintenance
3. Power loss
4. Administration
5. Subscription to regional distribution network
6. Financial cost

2.4.2 Sub cost groups:

Investment/reinvestment

1. Investment/reinvestment high voltage equipment.
2. Investment/reinvestment medium voltage equipment.
3. Investment/reinvestment low voltage equipment.

Maintenance (similar to investment/reinvestment)

1. Maintenance high voltage equipment.
2. Maintenance medium voltage equipment.
3. Maintenance low voltage equipment.

Power loss

1. Power loss in high voltage equipment.
2. Power loss in medium voltage equipment.
3. Power loss in low voltage equipment.

Administration

1. General administration for the company.
2. Administration of customers connecting to high voltage.
3. Administration of customers connecting to low voltage.
4. Administration due to customer segments

Most of the administration expenditure is directly related to a customer group.

Subscription to regional distribution network

For customers' consuming energy (kWh) and power (kW).

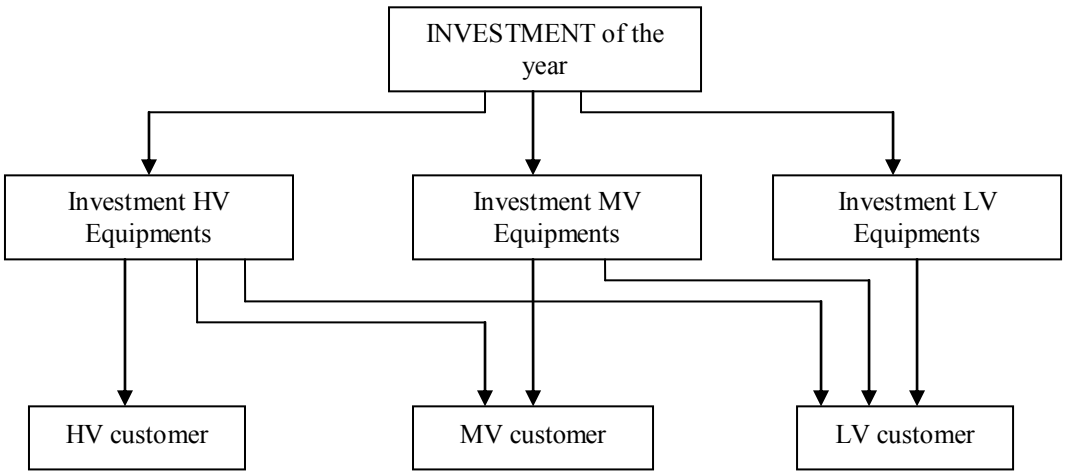
Financial cost.

Similar to investment.

2.4.3 Grouping of expenditure per customer category

Part of the expenditure for the HV (70 kV) and MV (10 kV) equipment has to be split among the MV and LV customers (note we do not have customer at 70 kV) while expenditure for LV equipment is only for LV customers.
Power loss costs are similar but initially we calculate the power loss for each voltage-equipment and split it between no load losses and full-load losses.

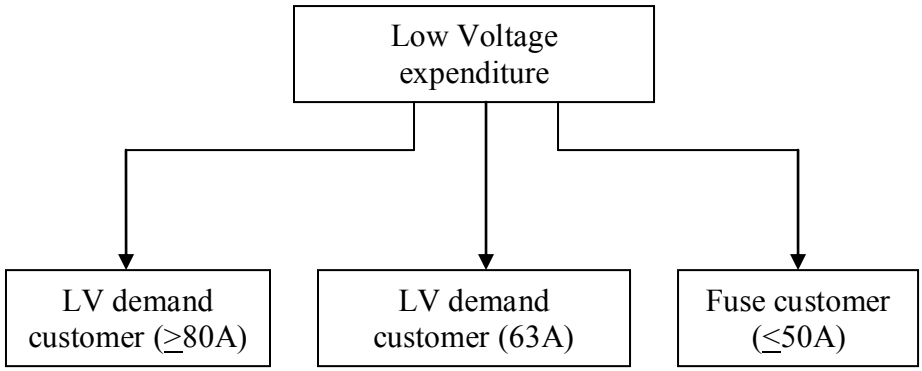
Figure 5, Principle for the investment expenditure between the customers



This allocation principle of expenditure is easy to apply to every cost item.
Adding all these expenditure items would result in the total expenditure per voltage category which needs to be split into the sub categories.
From this level, expenditure resulting from the high voltage customer can be split into different fees.
For GEAB, they are grouped into a fixed fee which is proportional to the administration cost; a fee for the usage power in high demand and one for low demand (which are derived from re- investment, maintenance, the proportional part to the subscription to the regional transmission grid, power loss and financial cost); then the energy fee which is loaded by the proportional quantity of the regional transmission grid and power loss.
To get the correct tariff for the low voltage customer, from this point, we continue splitting the added allocation for the low voltage cost into the sub categories.
This new portion is based on the administration, usage power and energy sub categories consumed. This is similar for the high voltage customer, the difference being that we do not measure the customer usage fuse (supply) tariff but we assume that these customers use 0.9 of the fuse. In this way, we can calculate the power usage and split the expenditure between them (see figure 5).
The next step is to split the allocated amount for the fuse customer into their categories.
Here, we assume that all customers with a certain fuse have the same usage and hence share the cost for that amount of power.
Hence, the expenditure is allocated into each fuse category.

The power cost is split into a fixed fee and energy fee.

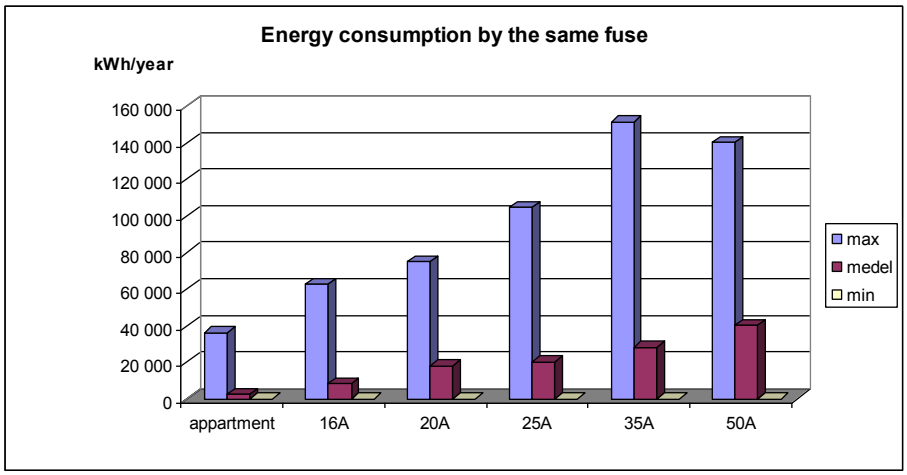
Figure 5, Allocation for LV cost to the different categories



2.5 Future tariff – a reasonable tariff

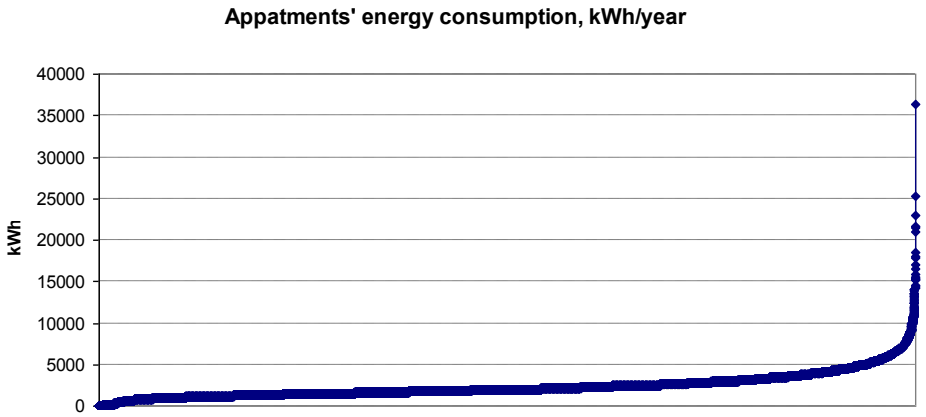
Since the introduction of the new laws to measure the monthly consumption of customers', a reasonable tariff is available.
The current tariff for customer with a fuse tariff imply that customer with the same fuse has to pay as they use 90% of the fuse irrespective if they use that power or not. So same customer are paying for others consumption and some other who uses the entire potential of the fuse are subsiding by those who do not utilize the whole fuse.
The figures 6-9 illustrate the great difference of consumption between customers with the same fuse size.

Figure 6



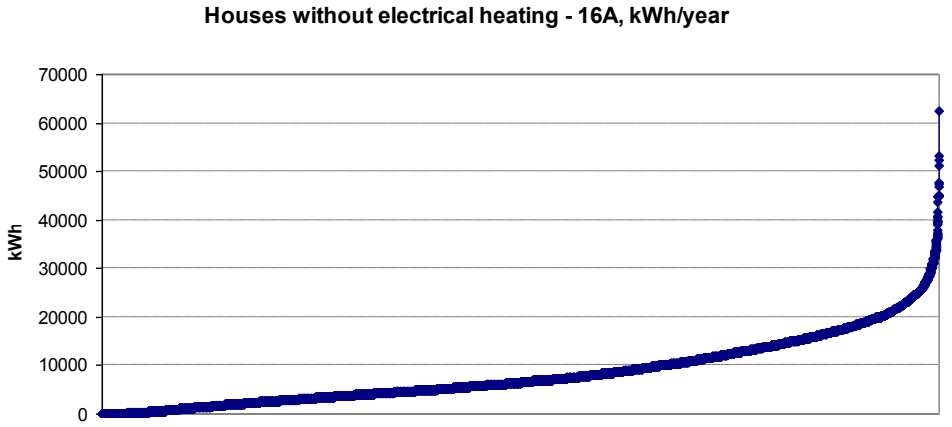
As per the annual meter reading, an apartment consumes from a few kWh/year to 37 000kWh/year

Figure 7



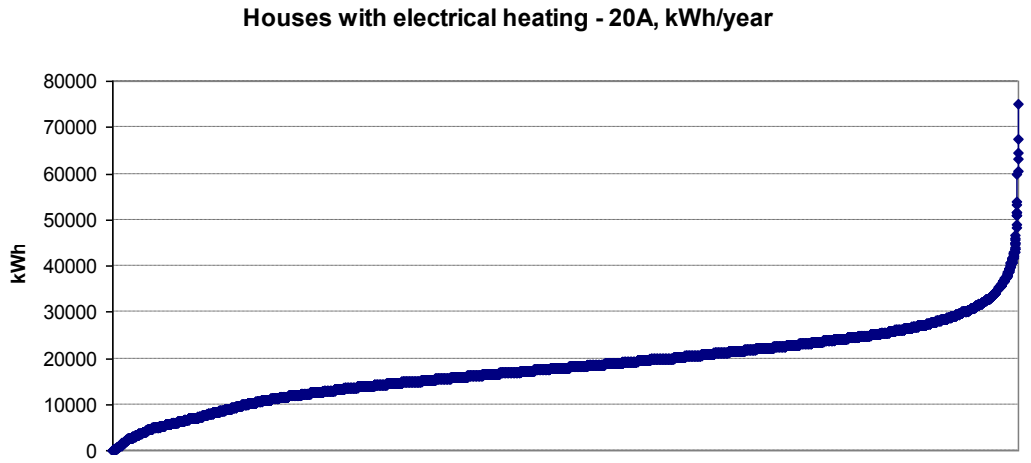
A house without electrical heating consumes between a few kWh/year to 64 000kWh/year

Figure 8



A house with electrical heating consumes between a few kWh/year to 76 000kWh/year

Figure 9



This is the reason the future tariff will be based on the actual usage of power and not on the fuse size.

3. Conclusion

Our challenge will be to teach our customers the difference between energy and power and how they can manage their energy consumption in an effective way. At the same time we believe that with the new tariff, we can reduce the power peaks and the reinvestment in the current network, simultaneously reducing the subscription cost to the regional transmission grid.