DATA SUPPLY FOR THE PORTUGUESE BRANCH OF IBERIAN ELECTRICITY MARKET

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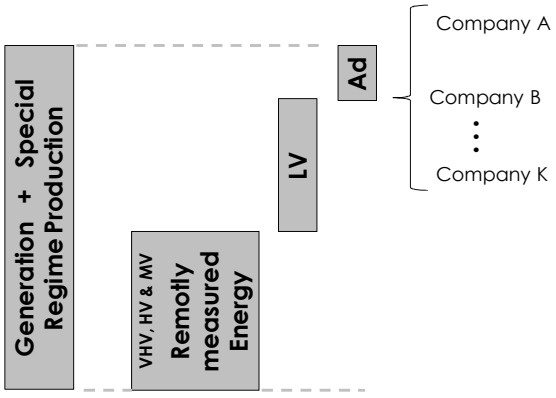
ABSTRACT

With the Iberian electricity market liberalization, data availability on electricity consumption became of the t importance, for the market to operate properly. In Portugal, EDP Distribuição is responsible for providing consumption data for all voltage levels to all the market suppliers, as well as for the market operator itself - REN.

The data supplied by EDP Distribuição consists on the total amount of energy sold by each supplier to its clients regardless of voltage level each client is supplied at. This information is sent both to the supplier as well as for the market operator, which acknowledges the data regarding all the companies operating in the market.

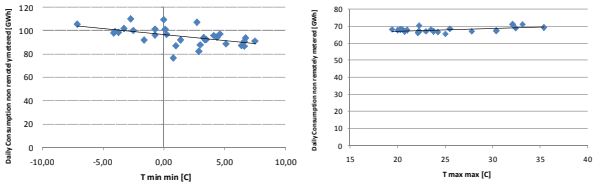
The problem: the amount of energy produced must equal the amount of energy consumed by all the clients at each moment, since electrical energy cannot be stored. As far as the clients connected to the higher voltage levels network (Very High Voltage – VHV 150 to 400kV; High Voltage – HV 60kV and Medium Voltage – MV 6 to 15kV) are concerned, we know exactly the amount of energy consumed, as they are automatically metered, but smaller clients, connected to the low voltage (LV 230V) network, are only metered every 3 months, making it impossible to know exactly the amount of energy consumed per client every 15 minutes. Hence, low voltage consumption is estimated through profiles. Since the energy flowing on the electrical network must be balanced, an adjustment factor is introduced to the LV profiled consumption. This adjustment factor is calculated for every 15 minutes each day.



The adjustment factor works as an auxiliary to distribute the amount of energy consumed by the LV clients which is not considered on the LV profiles (e.g. temperature). This amount of energy must be proportionally divided by all the suppliers with LV clients, considering the number of clients per supplier.
The adjustment procedure is daily applied, so that all the data that has to be sent to the market agents (market operator and suppliers) is as accurate as possible.

In theory, the adjustment factor should be constant and equal to one, but experience has shown that this is not the case. The adjustment factor varies every 15 minutes and from one day to another.

A study was made in order to find out the influence of temperature in this factor, showing that not only the day's temperature is important, but the temperature from the day before also presents an important contribution to this value due to the buildings thermal inertia. This effect is more significant as the temperatures go extreme, either cold or warm.



These studies help us to understand non hourly-metered consumption better, which is extremely important; since EDP Distribuição provides the consumption data that allows the market to operate properly, we have the need to provide the most accurate data possible, at least until smart grids cover the entire area EDP Distribuição operates in.

INTRODUCTION

EDP Distribuição is responsible for providing data on energy consumption, as well as for energy production concerning all the clients connected to the Portuguese Electricity distribution network. With more than 6 million meters installed and the need of having 15 min interval data available per day, for each meter, is a constant challenge.

IBERIAN ELECTRICITY MARKET

In order to realize the relevance of the data supplied by EDP Distribuição to the market agents, it is necessary to be familiar with the market model in which Portugal is included: the Iberian Electricity Market, MIBEL.

The Iberian Electricity Market is a joint initiative from the Portuguese and Spanish governments, which offers the possibility for any consumer in the Iberian zone to acquire electrical energy under a free competition regime, from any producer or supplier, acting either in Portugal or in Spain.

The management of MIBEL's organised markets is based on an interconnected bipolar structure, where the day-ahead and intraday markets are operated by the Spanish division, OMEL, and the organised derivatives market is under the responsibility of the Portuguese division, OMIP. The following paragraphs highlight both the day-ahead and the intraday markets, as well as the importance of consumption data provided by EDP Distribuição in the market operation of retailers.

Day-Ahead Market

The purpose of the day-ahead market, as an integral part of wholesale electricity market, is to handle electricity transactions for the following day, through the presentation of electricity sale and purchase orders by market participants. The market operator includes those orders in a matching procedure that will define the daily programming schedule of the twenty-four consecutive programming hours corresponding to the following day (0:00 to 24:00), after the gate closure time for the reception of orders to the session.

The deadline for the reception of orders by the market operator for day D+1 is 10:00 (CET) of day D. The price in each hour will be equal to the price of the last block of the last generation unit, whose acceptance has been required in order to meet the demand that has been matched.

Intraday Market

Intraday markets cover energy negotiated in market sessions after the day-ahead gate closure time, prior to system operator, SO, real-time balancing interventions. This platform enables market parties to change the first forecasts made in the day-ahead market. In essence, the intraday market follows the same strategy used in the day-ahead market. On one side there are the energy sellers and on the other the energy purchasers. Both of them specify the amount and respective price of energy they want to sell/buy to the market operator. Then, the market operator matches the orders and the price of each intraday session correspond to the last matched selling order. The only dichotomy amongst the day-ahead and the intraday market relies on the number of sessions and respective deadlines. The day-ahead market has a sole session, whereas, the intraday market is divided in six sessions, each one for the same day but with different deadlines, as one may observe in Table I.

Table I: Deadline, schedule horizon and hourly periods of each intraday session.

	Session1	Session2	Session3	Session4	Session5	Session6
Session Closing	17:45	21:45	1:45	4:45	0:45	12:45
Schedule horizon (h)	28	24	20	17	13	9
Hourly periods	21-24	1-24	5-24	8-24	12-24	16-24

Intraday markets are a vital tool for market parties to avoid the generally high costs of the denominated balancing mechanism, which in some cases is perceived as a penalty imposed by the system operator on the purchase price of balancing energy.

Balancing mechanism

Retailers use the data provided by EDP Distribuição to make their forecasts and, consequently, the offers in the different market sessions. As the forecast does not match, generally, what happens in real time, the system operator has to buy/sell the deficit/excess of energy. However, this operation, denominated balancing mechanism, rarely results in a profit for retailers, as can be witnessed in Figure 1.

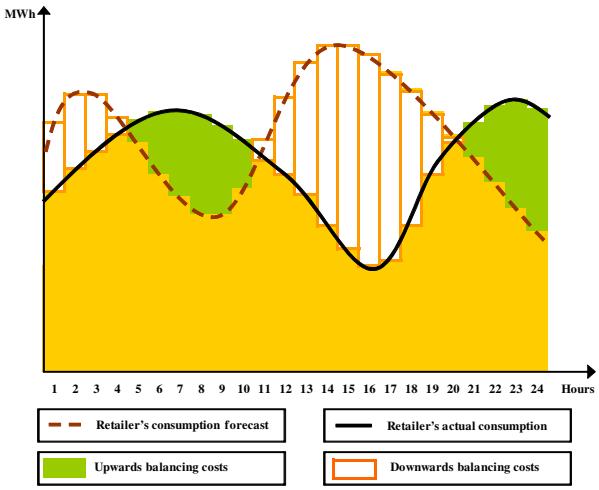


Figure 1 – Application of unbalanced costs (SO's referential).

If the actual consumption of the retailer is lower than forecasted, the system operator will buy that excess at a price which is usually lower than the one of the several market sessions. This penalizes the retailer, because he could have sold that extra energy at a higher price, increasing his financial income. On the opposite, in case the actual consumption of the retailer surpasses the forecast, the system operator will have to compensate that deficit. Typically, the system operator accomplishes that task by buying the shortage of energy to a conventional power plant. However, the retailer is not immune to these costs, as he will have to pay to the SO for the amount of energy he did not schedule at a price that is higher than the price of the different market sessions.

When all is said and done, from the retailers' point of view, the consumption data supplied by EDP Distribuição is crucial to minimize the effects of the balancing mechanism and, consequently, the losses on their financial income. An improvement in the accuracy of the data supplied by EDP Distribuição leads to a better forecast in the market sessions and, subsequently, to a more profitable revenue.

CONSUMPTIONS DATA

Since electrical energy cannot be stored, the system must be always balanced: there cannot be energy in excess or in deficit any moment in time, meaning that the energy produced has to be exactly the same consumed by all the clients connected to the distribution electrical network.

Remotely metered information

For the clients connected to the higher voltage levels (Very High Voltage – VHV 150 to 400kV; High Voltage – HV 60kV and Medium Voltage – MV 1 to 15kV), the amount of energy consumed every 15minutes is known - each of those consumers has a meter installed which stores consumption information every 15minutes; all the information stored in each meter, is daily acknowledged by a central station which communicates with the meter and stores all the data. The communications are processed during the night through a PSTN, GSM or a private network connection, depending on the local conditions of each meter.

Profiled data

Although meters with the ability of being remotely read are more and more present in Low Voltage (LV - 230V) installations, specially in the larger ones (Special Low Voltage – SLV: clients supplied in LV with a subscribed demand over 41,4kVA), most of the low voltage clients are only locally read every three months. In order to solve the lack of information for each 15', load profiles are applied to LV measurements.

LV clients are divided into five categories (Table II), all supplied at 230V, and there is a different load profile applied for each consumer type.

Table II: Low Voltage consumption categories.

	Subscribed Demand [KVA]	Energy [KWh]
SLV	> 41,4	any value
LV A	> 13,8	any value
LV B	<= 13,8	> 7 140
LV C	<= 13,8	<= 7 140
LV PL	Public Lights	any value

Load profiles take into account the seasonality, as might be seen in Figure 2.

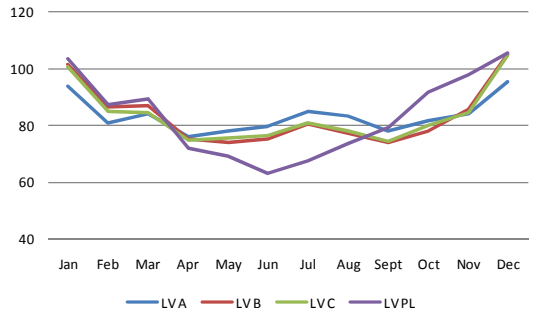


Figure 2 –Monthly LV load profiles in 2010.

DATA SUPPLY

For the market to work properly, all consumption data, as well as all the Special Regime Production data must be supplied to the market operator and to the companies.

Consumption data at all voltage levels are gathered in a single file for each supplier operating in the market. Each file is then sent both to the supplier itself and to the market operator, who receives information concerning all the suppliers. These data are provided on daily-basis and each file contains information for every 15'.

The data supplied per company concerns not only consumption, but includes network losses as well. Unfortunately, an electrical network as big as needed to supply all the consumers in a country is not able to deliver all the energy inflows. There are losses. Losses are higher the lower the voltage level in question, and so there are loss profiles for each voltage level.

For the system to be balanced, as said before, the amount of energy inflows into the distribution network has to match the amount of energy consumed, plus the energy losses of the network.

Network losses are included in the consumption information for all voltage levels.
Despite the load profiles application methods to LV, consumption for all the 15' in a day are hardly balanced with the energy inflows into the distribution network. Those differences are covered through the introduction of an adjustment (Ad in Figure 3).

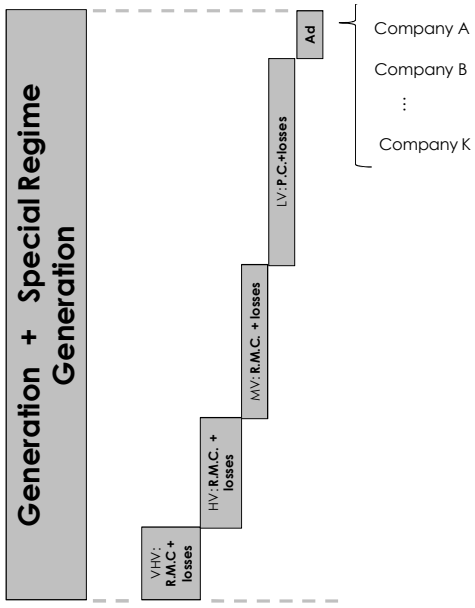


Figure 3 –Total amount of Energy Distribution per tension levels and the adjustment factor.

The adjustment factor represents the energy consumed in

LV which is not included in the profiled LV consumption.

$$Ad = \frac{Gen+SRP-VHV_{wl}-HV_{wl}-MV_{wl}}{LV_{wl}} \quad (1)$$

Where:
Ad – Adjustment Factor;
Gen – Energy inflows in the distribution network;
SRP – Special Regime Production;
VHV_{wl} - Remotely measured very high voltage consumption plus network losses;
HV_{wl} - Remotely measured high voltage consumption plus network losses;
MV_{wl} - Remotely measured medium voltage consumption plus network losses;
LV_{wl} - Profiled low voltage consumption for the four categories plus network losses;

The adjustment factor is calculated for every 15' and, theoretically, is supposed to be equal to 1; however, there are numerous factors that influence this factor, such as the temperature being very different from the expected temperature for a day (information implicit in the LV profiles), the wind and the light.

IMPACT OF TEMPERATURES'

To understand how the temperature variations influence the electrical energy consumption, a study was carried out. LV consumption was analyzed separately from the higher voltage consumption, since different voltage supply imply different types of consumption and therefore different behavior towards temperature. As temperatures go extreme, either cold or warm, their influence on electrical energy consumption becomes clearer. Other fact that arose from this study was the importance of buildings thermal inertia. Besides the importance of the temperature in a given day, the temperature from the day before is also extremely relevant.

As an example, in January 2010, the coldest day in Portugal was the 10th and the day of maximum consumption was the 11th, as highlighted in Figure 4.

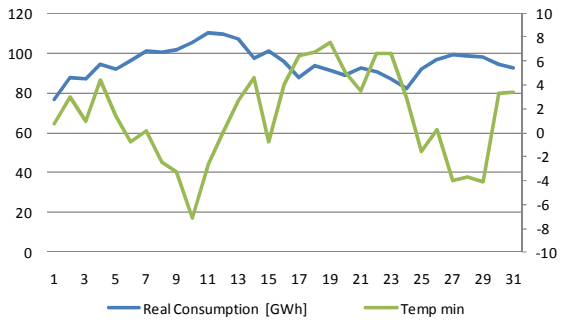


Figure 4 – Real LV consumptions' and temperatures' daily evolution in January 2010.

The scatter diagram highlights the relationship between the variables, as seen in Figure 5.

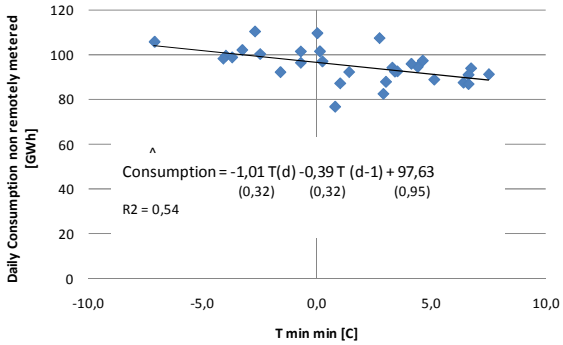


Figure 5 – Real LV consumptions' and temperatures' daily evolution in January 2010.

CONCLUSION

To sum up, the consumption data provided by EDP Distribuição to retailers is vital for their operation in the Iberian electricity market. An upgrading in the accuracy of the data supplied by EDP Distribuição may lead to more precise forecasts from the retailers which will, subsequently, reduce their exposure to the high costs of the balancing mechanism of the system operator and raise their financial income.

There are numerous variables which influence consumption, such as the temperature, and its weight should always be considered when analyzing data.

Until smartmeters are installed in all the clients, LV consumption will have to continue being profiled and the information concerning each client's consumption will not be as accurate as when smartmeters are present in every client.

REFERENCES

T. F. Simão, R. Castro, J. Simão, 2010, "Wind Power Pricing: From Feed-In Tariffs to the Integration in a Competitive Electricity Market"