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DYNAMIC ENERGY PRICING IN COMBINATION WITH DEMAND SIDE MANAGEMENT

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ARTICLE INFORMATION	ABSTRACT
<p>Published March 2019</p> <p>Key words: indexed tariffs, demand side management, wholesale electricity market</p>	<p>In recent times, the implementation of the dynamic pricing in the electricity supply is getting more and more attention. The dynamic (= indexed to the wholesale electricity price) tariffs are characterized by its changeable nature on the hourly basis, depending on the price at which there is being sold the electricity in the wholesale market. The implementation of the Indexed Tariffs works well in combination with Demand Side Management resulting in the significant savings in the electricity bill when the major part of loads are shifted from the peak hours to off-peak hours.</p> <p>Thus, in the inteGRIDy project, one of the global goals of PH Energia is to analyse the impact of electricity cost variations on the capability of Demand Response implementation. More specifically, it would be tested in the Lisbon Pilot Project in order to provide energy demand flexibility (the change of EVs and ice tanks charging profile) and the subsequent savings in the electricity bill.</p>
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Introduction

In recent times, the implementation of the dynamic pricing in the electricity supply is getting more and more attention. With the evolution of the energy sector, the dynamic (indexed to the wholesale electricity price) tariffs appeared in order to bring monetary value for the final energy consumer as well to achieve the objectives stipulated by policies such as increase of the reliability of the electrical system and promotion of energy production from the renewable energy sources.

It is also expected that the final consumers would be more encouraged to reduce the energy consumption as peak hours or to adjust its consumption profile in accordance with the energy costs, meaning to transfer the loads to the more profitable periods when the energy prices are lower.

In the framework of inteGRIDy project, PH Energia that is known for its strong knowledge and experience in business and academic fields, is working on the development of new business models implementing the dynamic pricing in the electricity tariffs coupled with the Demand Response techniques.

Indexed Energy Tariff implementation

The indexed tariffs are characterized by its changeable nature on the hourly basis, depending on the price at which there is being sold the electricity in the wholesale

market. Thus, the final energy customer would have hourly different price for the energy he consumes. As a result, it may happen that in some months he would pay less for each kWh of the consumed energy when compared to the fixed tariffs. However, it may also happen that in a determined month, when the electricity price in the wholesale market rises significantly, the customer would be obliged to pay more.

PH Energia has developed a formula for the indexed energy tariff calculation:

$$PE_{(h)} = P NAT_{(h)} + (P_{OMIE_{(h)}} + CGS_{(h)}) \times (1 + Losses_{(h)}) + K$$

Where:

$PE_{(h)}$ Energy price for a certain hour (€/kWh);

$P NAT_{(h)}$ = Hourly Network Access Tariff published by ERSE (€/kWh);

$P_{OMIE_{(h)}}$ Hourly electricity cost in the OMIE daily market – Portugal (in €/kWh);

$CGS_{(h)}$ = Hourly Cost of the Management System (0.0028 €/kWh);

$Losses_{(h)}$ = Hourly losses coefficients for the corresponding time period published by ERSE (in %);

K = Fixed value corresponding to the spread of the energy trader (in €/kWh).

It is important to bear in mind that in the wholesale market, there may be wide variations in the electricity price, as it happened for example in September 2018, when the electricity price on 17th of September at 21:00 was 81,82 €/MWh and on 24th of September at 06:00 it decreased until 50,42 €/MWh. This instability in the electricity price may happen due to several reasons, including climate. For example, in April 2018 the

major part of the energy was produced from renewable energy sources, with hydro and wind energy among the main ones, contributing for a low energy cost (42 EUR/MWh) ¹. Therefore, the lack of abundant precipitation and wind, coupled with the high energy demand may result in the significant increase of the electricity wholesale price. From the perspective of the indexed tariffs implementation, it is possible to group the years in “good” year and a “bad” year. A good year is characterized by medium temperatures and high precipitation, resulting in dams



being filled with water, whereas the bad year is characterized by high temperatures and low precipitation, resulting in the dams being empty.

Figure 1. OMIE wholesale electricity prices evolution in 2016, 2017 & 2018 (Source: OMIE)

As it is possible to observe from the Fig. 1, the year 2016 that was characterized by high renewable energy production (hydro energy and wind energy) could be the most profitable, when compared to 2017 and 2018, since the market electricity price was low. The year 2018 can be characterized as a “bad year”,

since the wholesale electricity prices reached shocking values.

In order to make the implementation of the indexed tariffs economically feasible at any time, PH Energia is going to combine the Indexed tariffs with Demand Response through the Electrical Vehicles and Ice tanks charging profile management.

Indexed Tariff in combination with Demand Side Management

The implementation of the Indexed Energy Tariff (Real-Time Pricing) is very interesting for studying the loads flexibility and Demand Side Management². With the application of these tariffs, it is expected that the energy customers would be informed about the electricity prices, and would be encouraged to reduce their energy consumption at peak hours or to shift the biggest loads to the off-peak hours, in order to reduce their electricity bill.

According to our analysis of the electricity wholesale prices in 2018, due to the high wholesale electricity prices, there was no advantageous environment for the Indexed Tariff implementation. For this reason, PH Energia proposes the idea to implement the indexed tariffs in combination with Demand Side Management to attribute the bigger loads to the low prices tariff times. It would be achieved by using the ice tanks to store cold and scheduling the EV charging periods to match low price periods of the

¹ <http://www.omel.es/pt/inicio>

² <https://www.sciencedirect.com/science/article/abs/pii/S03043894154E>

dynamic tariff in order to reduce the charging in peak hours and increase its charging in off-peak hours, replacing the existing fixed-tariff system.

Conclusions

According to the preliminary simulations realized by PH Energia, the implementation of the Indexed Tariffs

would work well in combination with Demand Response techniques.

The goal of PH Energia is to give a significant contribution to the business model development for the Portuguese Pilot which would permit to lower the electricity costs of the Lisbon Municipality Building using our knowledge and experience in Indexed Tariff Implementation and study the possibility of its combination with loads shifting.

About PH Energia Lda.

S'imples
energia

PH Energia, Lda is an electricity retailer company that is aimed to provide market energy solutions to consumer, commercial and industrial applications. It makes use of the experienced and knowledgeable team in the energy sector, in both business and academic field, to develop and integrate both services and products that present a valuable proposal. Through brand Energia Simples, PH Energia sells energy in the Portuguese market, residential, business and industrial sectors. With an innovative, digital and straightforward approach to the customer service, based on openness and trust, the company offers one-to-one advice and support to every customer. PH Energia also introduced market indexed tariffs, charging over the daily energy market price a transparent spread, in each month, to the domestic segment. Fully committed to the environment and efficiency PH Energia invests in a push market strategy that looks forward to market micro-production centres using solar energy and technology that monitors and processes information, providing efficient, economically and environmentally, in all segments.

Since the beginning of its commercial activity, Energia Simples has grown significantly from 11,8 GWh of the sold energy and 94 customers in May 2015 to 1012 GWh and 15 000 clients in December 2018, holding the 7th place both in sold energy and number of customers.

Information about the authors

Aleksandra Krivoglazova is a Project Manager working in PH Energia specialized in Smart Grids, Energy Efficiency & Environmental Sustainability

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