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TARIFF STRUCTURE

10.2017

// Challenges of the current retail price structure

Electricity tariffs need to accomplish two basic goals: convey information that helps customers and investors make efficient economic decisions about their consumption and investments, and ensure that regulated costs are recovered. Currently, electricity rates often fall short in delivering both these targets.

To better understand the distortions related with the electricity tariff, it is useful to clarify some concepts about its structure. The electricity retail price, as it is reflected to final consumers, is comprised by two main parts:

/ **Variable or Volumetric** | Part of the bill that directly depends on the amount of electricity consumed (price is usually quoted in €/kWh)

/ **Fixed** | Part that is independent of the amount of consumed electricity. It could depend on the contracted power (€/kW or €/kVA) or it could be a simple fee for each electricity contract (€/month)

In parallel, the costs that are behind the electricity tariff can be divided in two main categories:

/ **Third-party access (TPA)** | Includes network costs (transmission and distribution), as well as policy support costs (ex: renewables overcosts, capacity remuneration mechanisms, tariff deficits, and most taxes and levies). Most of the costs included in the TPA charge is fixed, which means that they do not change with the amount of electricity consumed. It is also important to note that this component of the tariff is regulated, meaning that all retailers need to pay the same amount for each kWh of electricity sold (within the same voltage level and contracted power) and then transpose this cost to the final consumer.

/ **Energy** | Includes mainly the price of electricity in the wholesale market, which in turn reflects the variable cost of generating power, as well as other costs such as ancillary services and retailer margin. These costs are mostly variable, meaning that they vary with the consumed volume. Furthermore, each liberalized retailer is free to establish the value for this component of the retail tariff.

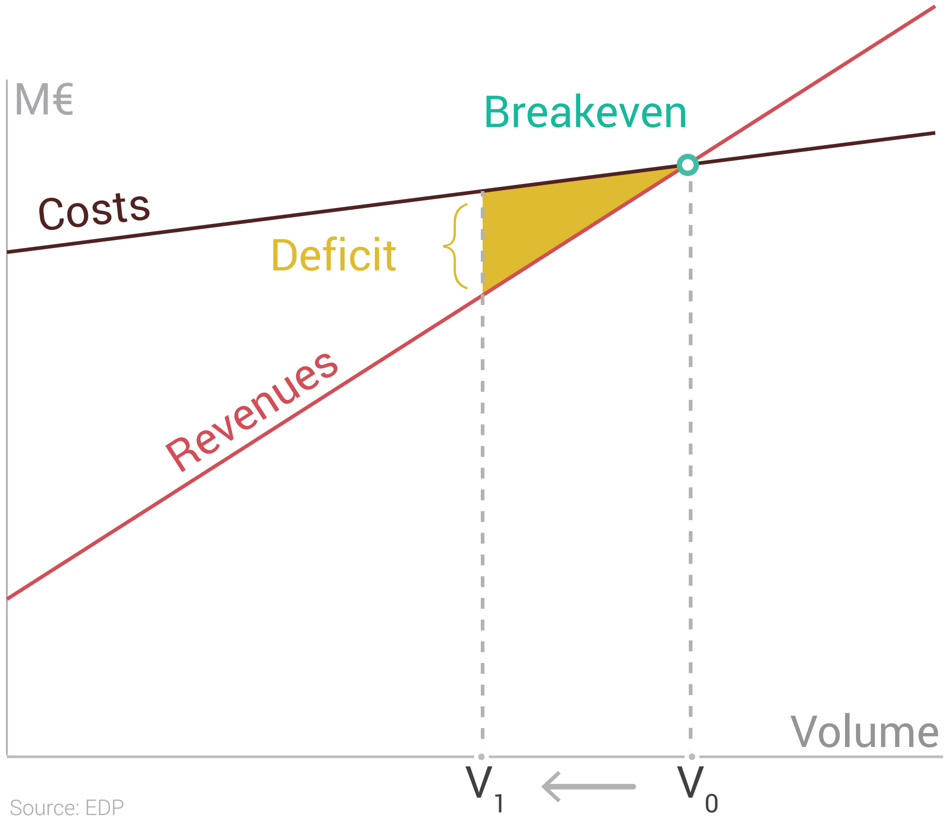
There is no direct relationship between the structure of costs in the power sector and the structure of the electricity tariff to the final consumer. For instance, in Portugal, while near 90% of the sector's revenues are collected through the volumetric charges on the electricity bill, only about 30% of the costs of the Portuguese power system are variable.

This mismatch between the structure of costs and revenues of the power sector occurs in all Member States, although at different magnitudes. Despite the fact that this misalignment has always existed, the rift has been increasing significantly in the last years. One of the main reasons for this is the strong increase in low-carbon generation in the system, which not only increases total fixed costs in the system, but also replaces technologies with high variable costs.
This misalignment is not only economic inefficient, as it provides the wrong price signals, but also contributes to widen social inequality. The main distortions that arise from this price to cost mismatch are:

1/ A tariff deficit is generated when an unforeseen demand reduction occurs
Given the fact that fixed costs are charged through a variable retail tariff, a deficit of revenues will occur in a context of demand contraction (Figure 1). For instance, in the case of Portugal, a demand fall of 5% would generate a ~150M€ deficit due to uncollected TPA charges, with no changes in the system costs. In other words, a demand increase of 5% would be roughly equivalent to avoid increasing the TPA tariff by 5%.

// System costs and revenues collected from retail tariff as a function of electricity consumption (conceptual)

Figure 1



Source: EDP

2/ Clients with higher load factors are subsidizing those with lower load factors

For the same level of contracted power, clients that have higher consumption are subsidizing those with lower demand. In other words, the subsidizing client is paying a higher electricity bill than the costs that the system had to incur to satisfy his demand, thus subsidizing those clients whose electricity bill is not enough to cover its respective costs. That happens because the tariff is designed so that the average client pays its share of the costs.

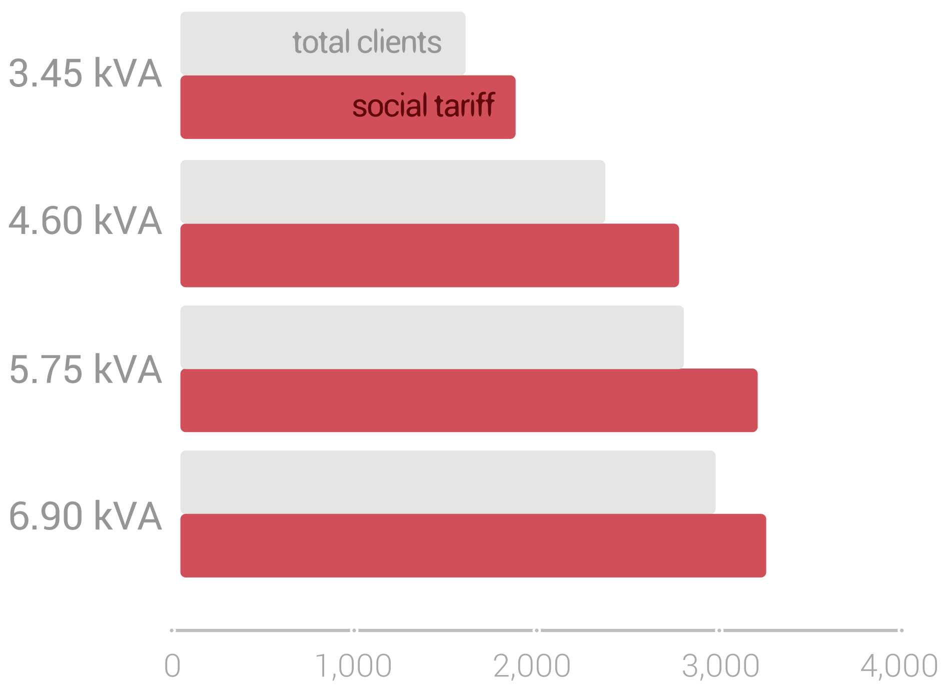
This cross-subsidization is potentially highly regressive. That is because electricity contracts for clients with higher income (such as second houses, garages, etc) are the ones being subsidized, since they usually have low consumption for the level of contracted power.

Furthermore, data of EDP Comercial customers reveals that clients with social tariff have higher demand levels than the rest of clients, for each level of contracted power (Figure 2). Although this result may seem counter-intuitive at first glance, several explanation factors could apply: clients with social tariff spend more time at home (e.g., unemployed, retired, etc.), have higher number of people per home, have better dimensioned their contracted power... Another relevant explanation is that, as seen before, the rest of portfolio includes installations that have low consumption, such as second houses, garages, etc.
Therefore, a cost-reflexive electricity tariff structure would contribute to improve social justice.

// AVERAGE ANNUAL CONSUMPTION OF EDP COMERCIAL'S CLIENTS BY LEVEL OF CONTRACTED POWER

kWh, 2016

Figure 2



Source: EDP Comercial

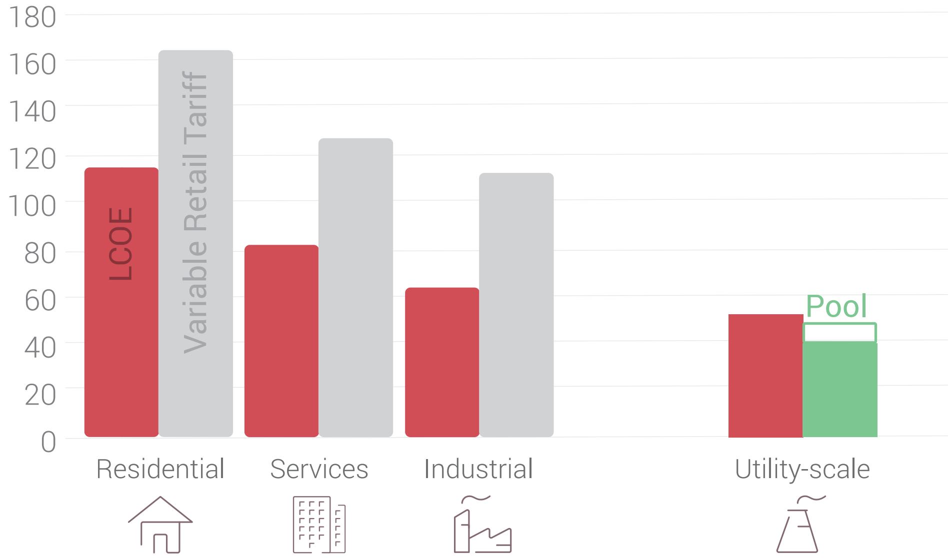
3/ Wrong signal to electrification, energy efficiency and distributed generation investments

The current retail tariff structure over-incentivizes the investment in technologies that reduce grid demand, namely solar PV for self-consumption. That is because the savings that clients obtain from these investments result from avoiding the variable retail tariff which, as we have seen, are much higher than the avoided costs for the power system.

// SOLAR LCOE vs SAVINGS BY SEGMENT IN PORTUGAL[1]

'17 €/MWh, 2017

Figure 3



1 Prices exclude VAT; WACC 6,5% real; CAPEX considered: 1530 €/kW (Residential), 1200 €/kW (Commercial), 1000 €/kW (Industrial), 710 €/kW (Utility-scale); 1100h levelized eq. hours for residential clients, 1450h for C&I and 1800h for Utility-scale; O&M=10 €/kW for industrial, 20 €/kW for services and 25 €/kW for Utility-scale; Regulated tariffs assumed: Residential simple tariff <10.35kVA, Commercial tariff refers to BTE for long uses at 'horas de cheio', Industrial tariff refers to MT at 'horas de cheio'

Source: EDP

Additionally, investing in distributed PV is rational from an individual perspective, since savings from the variable retail tariff are higher than the levelized cost of solar. However, from the system perspective, this investment is inefficient, because it effectively does not reduce the fixed costs that are charged in the variable tariff (only energy acquisition cost is avoided). Furthermore, investments in distributed resources have a higher cost to society than centralized ones, which are more competitive due to scale gains (Figure 3).

This overincentive to distributed solar PV also raises concerns regarding social justice, since these investments are made by those with higher income, who then “free-ride” the payment of the fixed costs of the system, despite the fact that they continue benefiting from the same service from the grid namely in terms of backup, and leaving a higher bill for the clients who cannot invest in PV. This is usually referred to the consumer divide effect.

In parallel, the current retail tariff penalizes electrification, since higher demand levels are overcharged. If the price of electricity was cost-reflexive, then the variable tariff would be much lower, in detriment of the fixed component. This lower marginal cost of consuming electricity would thus promote the electrification of other demand uses, such as electric vehicles and heat pumps. As electric technologies have usually higher efficiencies than the non-electric alternatives (typically fossil fuel based alternative), this incentive to electrification would thus be promoting energy efficiency and decarbonization. Electrification contributes to the decarbonization goal not only because electric technologies have usually higher efficiencies, but also because electricity is the sector where it is more cost-effective to implement in large scale low-carbon generation technologies.

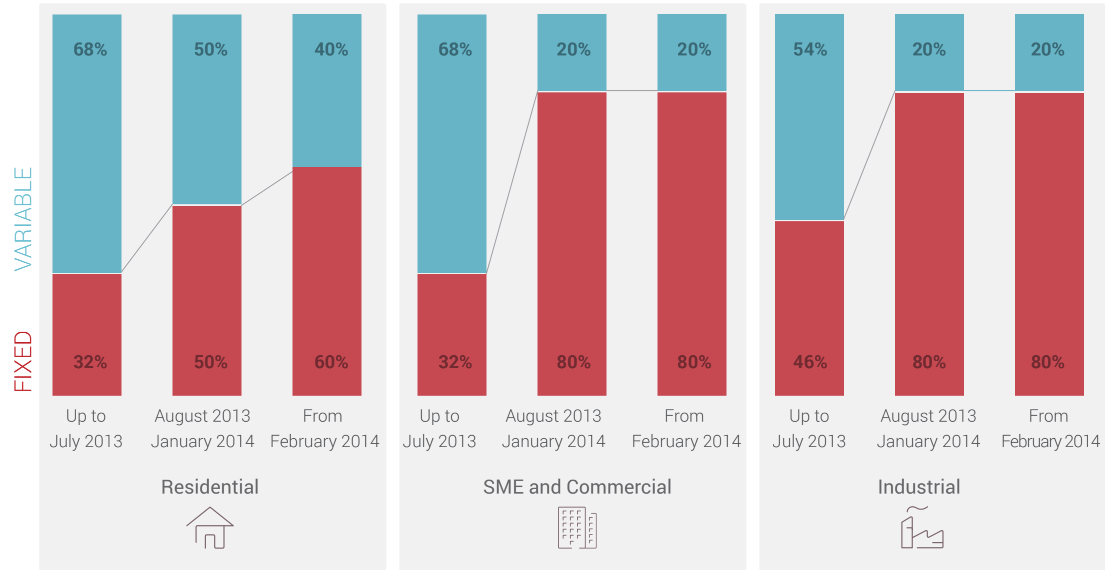
Finally, a tariff structure that promotes the electrification of demand could lead to a decrease in the electricity tariff, due to the effect of diluting the fixed costs by a higher basis of consumption.

// How to correct these distortions?

The most precise way to fix the retail tariff is by changing the structure of the TPA tariff, which currently is mostly charged in the variable tariff, despite its intrinsic costs being mostly fixed. In this way, the structural cause of misalignment is corrected, and so are the distortions caused by that.
This was the case of Spain, where relevant changes in the structure of the TPA tariffs were made between 2013 and 2014 (Figure 4).

EVOLUTION OF THE SPANISH ACCESS TARIFF STRUCTURE

Figure 4



Source: Iberdrola , "Cost reflective distribution tariffs in Spain", Jan 2015

Some countries (e.g., Germany, Spain, Portugal and some states in the US) have adopted specific measures for owners of PV for self-consumption. Although this correction targets only one of the above mentioned distortions, it is the one which has perhaps the biggest potential to shift demand away from the grid in the short-term, thus causing major problems regarding the economic sustainability of the power sector.

By increasing the share of the fixed component of the tariff (as occurred in Spain), it would automatically provide the correct price signal for the investment in solar for self-consumption, and also in other technologies, such as electric vehicles and heat pumps.

This electricity tariff design is compatible with the design of time-of-use rates, which are tariffs where the price varies with the time of the day and/or with the season, and that could apply to both energy and power consumed.

This would improve overall efficiency of the sector, as the final consumer would have incentives to reduce demand at the hours when the system is under stress, and also to consume more (eg, charge electric vehicles) during the periods of renewables surpluses (when the marginal cost is zero).

In the long-term, as the underlying costs of the power sector become more and more fixed, one can envision the adoption of a flat tariff, where customers pay a fixed value, independently of the energy consumed. Some retailers in Germany, the US and Australia, for instance, already offer this type of plan to their customers. This is not unique, as the very same tariff transition had already happened in the telecoms sector a decade ago, when the tariff structure was also mostly volumetric (€/minute), while nowadays is mostly fixed (€/month).

The mechanisms proposed in this document would obey to the main principles of retail tariff structure design, as it is cost-reflexive, enables cost recovery of prudent utility investments and purchases, ensures competition and follows the cost causality principle. In this way, it is possible to ensure the economic sustainability of the electricity sector, while contributing to the improvement of social justice and to the achievement of the decarbonization goals.