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IS QUALITY REALLY REGULATED OR JUST GIVEN?

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Abstract

In the last two decades, unbundling, liberalization and privatization have considerably modified the structure of the electricity supply industry. The need to set up adequate frameworks for regulating the unbundled network sectors in the restructured electricity market and the discontent with traditional regulation systems like the rate of return system has led regulators to implement schemes such as price-caps and yardstick competition. To supply Quality Service is the main goal of the electricity distribution sector, but the diversity and characteristics of the distribution networks pose a huge problem of regulation to be studied. The quality of electricity is not considered, at least not correctly, by the economic regulation models (traditional, incentive or benchmarking) of the electricity distribution sector. The incentive and competition schemes provide strong incentives for efficiency, unlike the traditional regulation. However, these systems mostly focus on cost reduction; thus, the quality of the offered services is at risk. Economically speaking, a decrease in quality is equivalent to a higher price. Both price and quality are highly appreciated by customers; therefore regulators are increasingly interested to assure an inclusion of both aspects within the regulation system. On the other hand, the absence of a precise and operational definition of electrical quality in distribution raises the issue of how to establish the production costs of a certain level of quality, and also which are the logical, economical and technical bases of definition of the quality standards and the related penalties being used or to be implemented.

This paper surveys the literature and models of Quality Regulation. We first present the function and role of the electrical distribution activity, and why the electricity distribution quality is relevant. Second, we define Quality in the context of electricity distribution services. Third, we look how the quality is considered in some of the classic and latest regulatory models used in electricity distribution (rate-of-return regulation, price-cap regulation and yardstick competition). Also, we discuss the main problems of these regulatory models and the need to include quality regulation under the new regulation schemes.

Finally we draw some conclusions. Depending on the regulation model, the Quality of Electricity is simply left to the will of the distributor (rate or return), or is imposed by a command & control regulation (price-cap). If not it is hardly comparable due to the heterogeneity of the Distribution Networks (yardstick competition). Therefore, the absence of robust incentive quality regulation and the lack of a precise definition of electrical quality in distribution highlight the interest to invest in better mechanisms of incentive regulation of Electric Quality in Distribution.

Introduction

The main task of distribution activity is transporting electrical energy from the transmission or sub-transmission networks to the points of consumption, in the suitable conditions of quality, i.e. supply Quality Service to the consumers. Waveform characteristics of the electrical energy are very important, as is the capacity of the distribution network whether or not to supply the electricity, as well as the treatment of the consumer himself.

Distribution is not only a natural monopoly, thus being targeted for regulation, but is also an intense capital business that includes diverse activities, within very heterogeneous conditions. However, in spite of the obvious relevance of the quality of service for the consumers, the distribution activity is regulated but the quality is not in the heart of the regulatory models.

Strangely, the regulation remains targeted on the fee of the infrastructure, reduction of costs and economic efficiency of the firms; even the technical side of the quality is poorly treated by the regulatory schemes. The technical value of the quality is given generally by minimum standards or awaited ranks. The economic value of the quality is given by the minimum cost of the investments to guarantee a quality goal. Against this background, the existence of technical standards of quality without economic endorsement is current practice. Consequently, the existence of penalties for non respect of these standards without economic endorsement is current practice too. Political agreements, between the actors, emulating economic optimums and technical optimums seem to be the norm.

Having presented the function and role of the electrical distribution activity, and why it is relevant to the electricity distribution quality, we can define Quality in the context of electricity distribution services. Later we survey the literature and models of Quality Regulation, looking at how the quality is considered in some of the classics and latest regulatory models used in electricity distribution (rate-of-return regulation, price-cap regulation and yardstick competition). As well, we discuss the mains problems of these regulatory models and the need to include quality regulation under the new regulation schemes. Finally we draw some conclusions.

Definition of Electrical Quality

Outage of supply of the electrical service, i.e. the unavailability of the provision, is probably the most well-known or visible element for the consumers of electrical quality. It is absolutely comprehensible then that the continuity of supply is the driving force in most of the technical-economic discussions related to quality. Nevertheless, usually, economists have in mind the transport system behavior when they speak of quality. But it is an error to confuse reliability in transport with that in distribution. The strongest argument for this is the security of supply, because most current failures are related to infrastructure failures and not to the lack of the balance between production and consumption. However, for electricity distribution, it is also a mistake to think that quality is limited to reliability because it is common to make a distinction between three different quality dimensions: commercial quality that is related with the costumer's treatment, power quality that takes into account about disturbances to the voltage waveform, and reliability that consider the security and availability of distribution network to supply the electricity service (Ajodhia 2006). It is noted that electricity distribution companies have different services and cost structures to fulfill the aforementioned services.

Firstly, Commercial Quality is related to individual agreements between the electricity distribution company and their consumers, as in all commerce in general. I.e. reception of the customers, to respond to problems and complaints, (re)connection of new consumers, installation of measuring equipment, billing and meter readings, etc. Commercial Quality does not depend on planning or maintenance departments' of the distribution firm, usually there is a service specialized on that. On the other hand, Commercial Quality has neither a relation with the natural monopoly of the sector nor with the infrastructure of the network.

Secondly, Power Quality, sometimes called voltage quality, covers a variety of disturbances with the voltage waveform. The relevant technical phenomena are variations in frequency, fluctuations in voltage magnitude (flickers), short-duration voltage variations (dips, swells, and short interruptions), long-duration voltage variations (voltage regulation), transients (temporarily transient over-voltages), and waveform distortion (harmonics). Each one of these disturbances has its own unit of measurement and can be relatively easily measured. Voltage Regulation is, by far, the most important quality feature in Power Quality. Many of the disturbances measured in Power Quality are caused by the clients or come from the Transmission Network.

The third quality dimension is Reliability, which is a measure for the ability of the network to continuously meet the demand from consumers. Network reliability can be divided into two main elements namely adequacy and security. Adequacy relates to the availability of sufficient network capacity to ensure supply of electricity to consumers in the long run. That is, no interruptions occur under normal operating and demand conditions. Security relates to the ability of the network to - given that it is adequately designed - withstand disturbances i.e. consumers do not experience an interruption in the electricity service. The reliability theory is not limited to unavailability, unlike what many authors believe, it possesses a complete array of individual and systemic indicators that allow quantifying the phenomena related to adequacy and security.

Often, Energy Economists does not define what "Electrical quality" is. For example, Paul Joskow (2006) assumes that a certain kind of electrical quality is present. In another case Joskow ignore all technical characteristics, and focuses only on the Reliability dimension of Electricity Distribution Quality (Joskow 2004). Between Electrical Power Engineers, at the end, quality is mainly understood as a "hybrid feature" given by the "Voltage Regulation" and the "Continuity of the Supply" (Raineri 1996 and Rudnick 2000).

Regulating the Quality

Rate-of-return regulation was dominant in many countries for years. However, with the introduction of the regulation, often following the privatization of nationalized industries, some countries have adopted other systems, such as price-cap regulation and revenue-cap regulation, and later benchmarking, which are seen as having better incentive properties. The quality problems resulting from the change towards price-cap regulation or benchmarking, today increase the attention for quality regulation (Ajodhia 2006).

Traditional regulation (rate of return) and quality

Rate-of-return regulation is a system for setting the prices charged by regulated monopolies. The central idea is that monopoly firms should be required to charge the price that would prevail in a competitive market, which is equal to efficient costs of production plus a market-determined rate of return on capital. Rate-of-return regulation has been criticized because it encourages cost-padding, and because, if the allowable rate is set to high, it encourages the adoption of an inefficiently high capital-labor ratio. This is called the Averch-Johnson effect.

Kahn (1970) said that the supplying company have the primary responsibility for quality of service and that the service standards are often much more difficult to specify by the promulgation of rules, reason why regulatory agencies have focused their attention on the price. Kahn suggests that the perceived difficulties of regulating quality have been the reason for regulators to "leave quality to the firms". The natural tendency to oversupply quality under rate-of-return regulation, by the Averch-Johnson effect, makes that if the fair rate-of-return is set higher than the firm's costs of capital, then quality levels will automatically tend to be high. This way, regulators recognize the relevance of quality, but at the same time did not see an explicit need for quality regulation, i.e. the quality it is not directly regulated but established by the distributor. For Spence (1975), rate-of-return regulation can be considered as a substitute for quality regulation.

However, overcapitalization does not necessarily mean that quality is at optimal level. Under the rate-of-return regulation an oversupply of quality can be supposed, i.e. a quality level higher than the optimum. This would be equivalent to additional costs, therefore to a higher price; in other words, consumers will be paying too much for a too high quality level (Kahn 2002). From a theoretical point of view, quality would only be optimal if its production costs and its consumers' demand would be marginally equal.

No empirical proof in France or Italy allows supporting this concern about oversupply of quality. But different empirical studies that use US data, with too high reliability standards, to compare the costs of supplying higher system reliability against the benefits of doing so. The results show that, at given existing reliability levels, the former is substantially higher than the latter (Adojhia 2006). E.g. the reliability in New York State should be reduced by a factor five to arrive at optimal levels. The aforementioned studies seem to confirm the view that rate-of-return regulation not only resulted in low productivity but also led to inefficiently high quality levels in the electricity industry.

Incentive regulation (price–cap) and quality

Price-cap regulation is designed to give incentives to efficiency and therefore reduce spending levels, it also known as "CPI – X", after the basic formula employed to set price caps. This takes the rate of inflation, measured by the Consumer Price Index and subtracts expected efficiency savings X. The system is intended to provide incentives for efficiency savings, as any savings above the predicted rate X can be passed on to shareholders, at least until the price caps are next reviewed. A key part of the system is that the rate X is based not only a firm's past performance, but on the performance of other firms in the industry: X is intended to be a proxy for a competitive market, in industries which are natural monopolies. Price-cap regulation has been criticized because that cost reductions may be achieved through adverse quality reductions. Spence (1975) and Sheshinski (1976) already showed that where price is fixed or taken as given, the monopoly firm will always set quality too low.

The relationship between price-cap regulation and the reliability of supply of a monopolist is studied by Fraser (1994). He suggest that when the firm is allowed to transfer to the consumers a proportion of increasing costs that is enough to maintain the expected profits of the firm, then reliability will be increased. But, practically, this would correspond to rate of return regulation. If the firm is forced to absorb the increasing costs in detriment of its level of expected profits, the answer of the firm will be to reduce to the minimum the loss of expected profit by decreasing the reliability. This way, the protection of the consumers against the increase of the cost will be at expense of reliability. For Fraser, the X-factor represents the authorized degree to transfer to the consumers any specific cost increases of the firm as higher prices. For that reason, if the X-factor is set too high and the firm cannot reach the regulatory objectives of cost, to maintain sufficient benefits the strategic reaction of the firm will be to lower the reliability: « don't touch my profit ». In the same way, Weisman (2002 and 2005) shows that the regulated firm's incentive to invest in service quality increases with the level of the price-cap, also that the incentive to reduce investment in quality can be mitigated by the regulated firm's participation in complementary competitive markets. Because, a poor quality reputation of the monopoly can negatively affect sales in the competitive markets.

Unfortunately, there are only a few studies for the electricity industry available that collected empirical evidence of quality effects under price-cap regulation. Ter-Martirosyan (2003) studies the effects of price-cap regulation on reliability in 78 electricity firms from 23 states of the US during the period 1993 – 1999. She argues that price-cap regulation has a negative impact on quality if no quality safeguards are established. She maintains that price-cap regulation immediately affects the cost structure of the firm, while the consequence on the quality potential of the existing equipment is a long-term effect. Therefore related changes in reliability may not be noticed in the short run. However, enforcement of quality standards appears to reduce the negative impact on quality under price-cap regulation. Her analyze confirms that quality standards help to mitigate this problem. Then, Ter-Martirosyan studies firms' reductions in spending with and without quality standards. She finds that spending levels have fallen in both cases, which supposes more efficiency from the firms. However, the firms with quality standards have reduced less their costs than those without. Since 1993, spending levels for firms with quality standards decreased by 17%, while for firms without quality standards this reduction has been ~ 37%. This important difference supports the concern that price-cap regulation without quality safeguards produce bad incentives to under-spend on quality, then problem of quality degradation. However, it does not tell how define optimal quality level and tends to keep standards existing before price-caps reform as the best benchmarking. It establishes price-capping as a defacto "Quality Floor" method where quality existing under Cost Plus regulation is used as optimal quality.

Regulation by yardstick competition (benchmarking) and quality

In the yardstick competition mechanism, the regulation of monopolistic activities is determined through the comparison (benchmarking) of costs and performance of similar companies or mirror companies or the reduced comparison of heterogeneous companies corrected for differences (Rudnick 2000). I.e. under yardstick competition individual companies' prices are made dependent to the relative performance of others. This is done by setting prices equal to the "yardstick", which can be the mean costs of all companies. Companies that are able to perform better than the average generate' profits, while those who do not, suffer losses. The cost reduction effort of individual companies results in lower mean costs and ultimately in lower prices for customers. Under such a framework efficiency is revealed through the virtual competition process. Yardstick competition is a method to overcome the information problems faced by the regulator (Ajodhia 2002 and 2006). Yardstick competition has been criticized because it requires a complex implementation. Weyman-Jones (1995) raises three problems: commitment, collusion and comparability. For electricity network regulation, the problem of comparison is by far the most difficult. Given the scope of our paper, the commitment and collusion problems are beyond our research horizon. As yardstick competition for price regulation has already proven to be difficult, including reliability elements into yardstick competition is an even more challenging issue. It can be meaningless to simply calculate mean costs as each individual company' costs may be driven by a series of company-specific factors. Clearly, the ability to generate a valid yardstick is a necessary precondition for yardstick competition to be successful. Failing to consider each company-specific factors would generate a blind yardstick which benefits some companies while disadvantaging others. This increases unpredictability and ultimately reduces effectiveness of the system. When reliability is included in the comparison, the issue gets even more complicated as factors beyond the companies' control can influence the level of reliability.

Under yardstick competition, if the costs' production functions are enough homogeneous a sound benchmarking can be done, but if the costs' production functions are heterogeneous the comparisons between firms become difficult. Glachant (2006) say that under yardstick competition, the problem is to relate the costs to the quality, i.e., even if with parametric and non-parametric methods of benchmarking we can make comparisons of homogeneous or heterogeneous costs' production functions, we do not know how these one influence the level of quality for each firm. Costs give us the economic structure of the network (number of transformers, lines' length, consumption limits, etc.) but not the electrical structure of the network (topology). Networks can have equivalent economic structures with a strongly different topology. The economic structure is a too fuzzy approximation of the electrical structure; nevertheless the quality is done by the electrical structure and particular contingencies.

The level of quality depends on the technical reasons as the precise location of the client, the topology of the network, the age of each component of the network, etc. Consequently, the electrical quality is hardly uniform, as currently established in standards. Then, if the quality is locally produced by both the economic structure and the electrical structure of the network, plus unavoidable hazards introducing troubles, the incentive policies must take into account this segmentation as well as the differentiation of quality levels.

Conclusions

Regarding the regulatory process of the electricity distribution sector, a main deficiency refers to the Regulator policies; the latter focuses mainly on the control of the price as indicator of the success of the adopted model, and like instrument to influence the financial balance of the companies. On the contrary, the Regulator brings less attention to the correct regulation of the individual activity and to the main goal of the distribution that is the supply of Quality Service. The second deficiency talks about the lack of a precise definition of electrical quality in electricity distribution. The regulation of Quality in the electricity distribution sector is a really huge issue for regulation.

Depending on the regulation model, the Quality of Electricity Distribution is simply left to the will of the distributor (case of the rate or return regulation), or is administratively imposed by a command & control regulation (case of the price-cap regulation), or if not, is hardly comparable due to the heterogeneity of the Distribution Networks (case of the yardstick competition).

The models of economic regulation of the electricity distribution do not consider, or do not consider correctly, the quality of electricity. Currently, it is considered that the regulation system for distribution can be tremendously improved. Therefore, the absence of robust incentive quality regulation of electrical quality in distribution highlights the interest to establish mechanisms of economic incentive regulation for Electrical Quality in Distribution.

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