Benchmark regulation and efficiency of electricity distribution: strengths and weaknesses

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Abstract- **A growing challenge in the restructuring of the electrical sector, where competition is introduced in the generation area, is to achieve equivalent efficiencies in the electrical distribution service, an activity that develops in a monopolistic environment. Chile has had an experience of over 20 years of applying benchmark price regulation to its distribution companies. This summary discusses the strengths and weaknesses of the Chilean benchmark scheme .**

I. INTRODUCTION

Electrical distribution companies, being network industries, aim to the transport and distribution of electric power from specific points in high or medium voltage lines to end consumers at appropriate voltage levels for industrial and residential usage. This activity is organized in public service utilities that obtain power supply through contracts with generators.

During the last two decades, many countries and geographical areas of the world have made drastic transformations in their electrical sectors, both in terms of segmentation and privatization of state monopolies. Because of these transformations, a big change in the role of the State has been witnessed. The State has transformed itself from a producer and enterprise-owner agent into an agent that regulates those stages of the electrical sector that become natural monopolies, such as electrical distribution. The challenge is to stimulate an efficient service in distribution, similar to that that would be achieved in a competitive environment [5].

To regulate electrical distribution, most Latin-American countries that have started this transformation have adopted a "benchmark" scheme, using the concept of an efficient company that is a company that is adapted to demand and that operates under an optimal investment and operations plan. Under this scheme, to force companies to be efficient, the regulator fixes prices according to the costs of an efficient company, designed from square one and without considering actual companies. The actual company will get a normal profitability only if it is capable of emulating the efficient company, reducing its operating and investment expenditure, thus minimizing the present value of its costs. In general, this regulation has implied a reduction trend in distribution tariffs.

This paper assesses the 20 year experience of Chile in applying benchmark price regulation to its distribution companies. It discusses the strengths and weaknesses of the Chilean benchmark scheme.

II. THE DISTRIBUTION ACTIVITY

The distribution activity is characterized by the constant investments to be made to render good services and to achieve the various scale economies that can be attained by companies when developing their facilities and their management and operation. Although economies of scale add up efficiency, they also make the revenues generated through a marginal cost tariff not to be enough to cover these companies' total costs. Likewise, the strong inter-dependence of investments and the long capital-recovery period give origin to a costs function that is clearly under-additive for the relevant demand range. This takes to conclude that it is more socially efficient to have a single company instead of several companies operating in a same geographical area. In this manner, and as it is a matter of guaranteeing maximum coverage, with the highest quality and least price possible, single distribution companies are justified and they are allowed to operate as a natural monopoly.

Within this framework, since there is no market competition, the primary goal of any regulatory scheme is to provide the appropriate incentives to companies to force them to be efficient and through an adequate price signal, to make them to be able to transfer, in the long term, part of their benefits to the users given their efficient investment and operating policies [4]. Based on these principles, the regulation of natural monopolies is made through different approaches [1, 2].

Regarding costs associated to the activity that is intended to be remunerated, they are associated to the network exploitation, maintenance and expansion components. They can be grouped into the items indicated in Fig. 1.

III. DISTRIBUTION REGULATION CHALLENGES

The tariff regulation is a very complex and demanding process, considering:

•The need to adequately identify and value the different components

•The need to fairly and transparently weight the influence of factors such as network type – rural or urban – overhead or underground lines, and the type and density of consumption present in the company's activity

•The convenience of emitting signals to encourage the adoption of more efficient behaviors by the companies performing in the concession areas

These challenges have been treated differently in regulations, some using rate of return and price cap methods, or in the case of Chile, and other countries in South and Central America, adopted a "benchmark" scheme, using the concept of comparison with an efficient company. All methods serve the same final objective, but the context in which they were created

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where different, making them more suitable than others depending on the general environment of the country. In the case of Chile, benchmark methodologies were appropriated twenty years ago when Chile was a fast developing country, and still is, with high needs of investment across all economic sectors, which demanded high investment rates in energy markets. Benchmark methodology provided clear signals of investment and stability for recently privatized utilities, and forced for efficiency.

In Chile, where the next tariff process is due to commence in early 2008, a reform to the distribution regulatory model is currently been discussed, the Government assessing other price cap schemes.

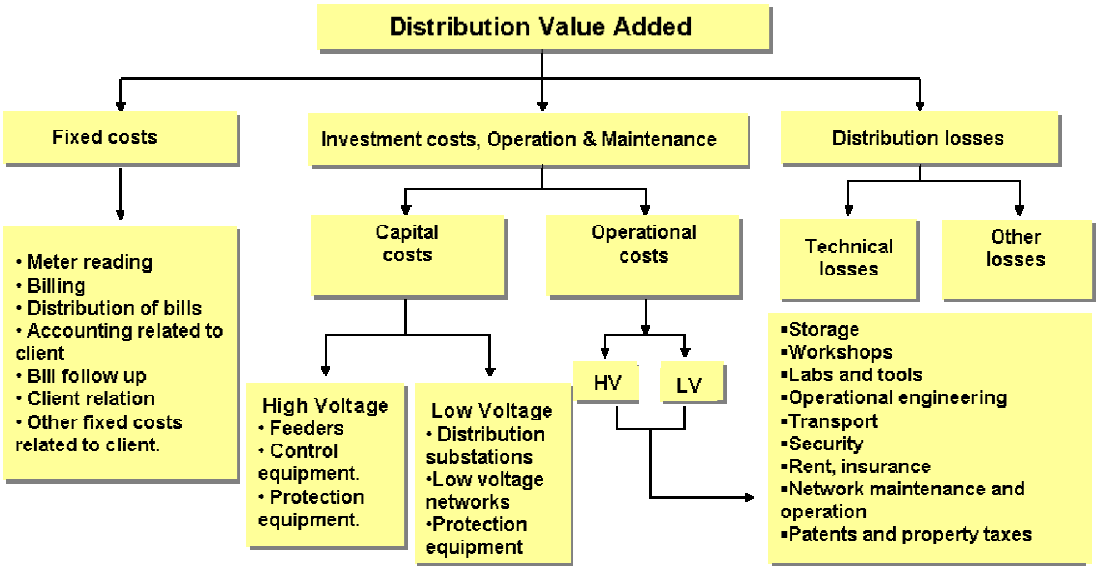

Figure 1.- Cost components of the distribution activity

IV. THE BENCHMARK IN ACTION

There have been 20 years of experience in Chile in applying benchmark price regulation to its distribution companies. As Fig. 2 illustrates for the low voltage segment of the largest Chilean distribution company, the remuneration of the distribution business has followed a downward pattern, with an overall reduction of 44% since 1984.

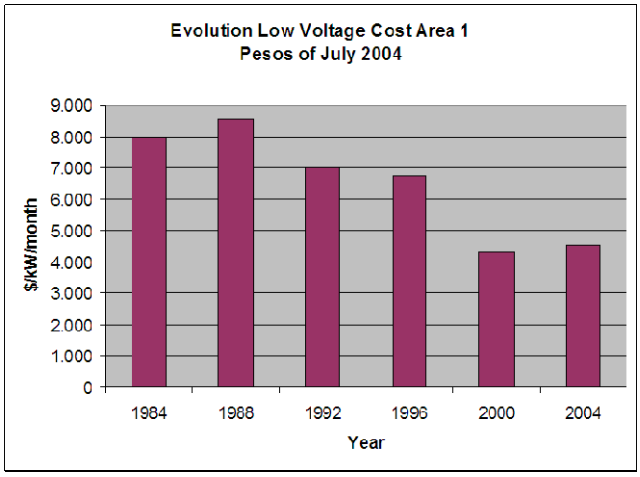

Figure 2.- Costs recognized for low voltage distribution

Nonetheless the cost reductions, returns for the distribution companies have been very favorable concentrating between 10 % and 20%, as can be seen in Figure 3. This solely fact is what leads to question if fairness has been achieved and if there has been or not an adequate transfer of benefits to the final consumers, given the distribution companies efficient investment and operating policies.

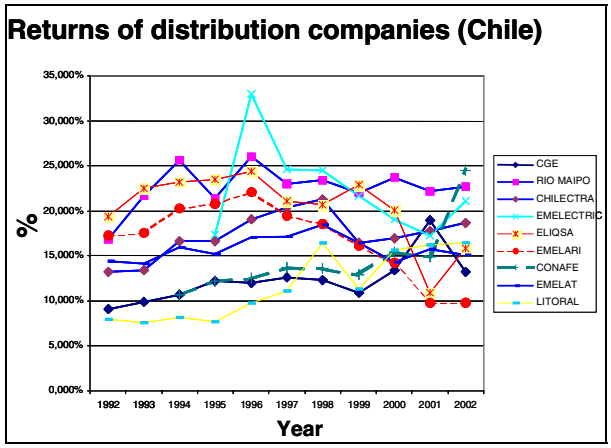

Figure 3.- Return of distribution companies in Chile

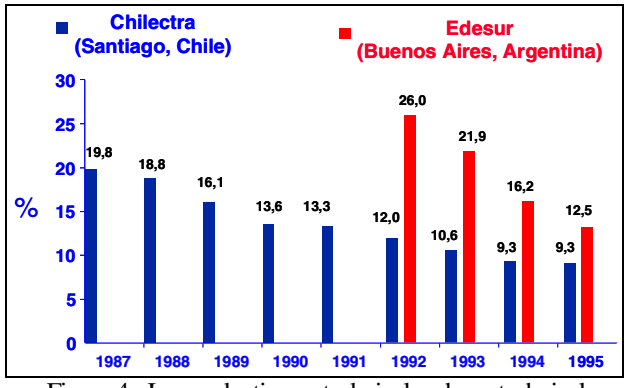

Figure 4.- Loss reductions – technical and non technical

It is clear that distribution companies have been able to gain efficiency through out the time, reflecting the clear incentives of the benchmark methodology. Reductions of technical and non technical losses are shown in Fig. 4. Reduction of losses has been achieved over time, reducing them more than 50 % in less than ten years.

V. THE BENCHMARK CHALLENGES

The benchmark process has faced different difficulties over the years, with conflicts arising over interpretation between the regulator and the companies involved. While the regulator aims at reducing tariffs as much as possible, the companies aim at increasing their revenues. Some of the areas of conflict are described.

a) Technologies

The use of an efficient model company requires designing a distribution company from square one, in which it is possible to evaluate different technological alternatives that not necessarily are in use by the concessionary company, leaving aside the historical practices. In this sense, the evaluation of conductor technologies is a matter of permanent discussion, for example, the use of copper versus aluminum, the determination of distribution voltage, the range for optimal use of the conductors and the compared length of networks of low and high voltage. The studies show that the model company installs practically the same amount of network of low voltage, but with a greater transport capacity, mainly correlated with the street layout, and installs a high voltage network of smaller length, conditioned by the optimization of the secondary transformers.

In relation to secondary transformers, the total installations are evaluated, considering both location and capacity. The studies show that the model company installs a smaller number of transformers of greater capacity and better located, which nevertheless results in a greater total installed capacity with a lower cost than the concessionary company, essentially due to economies of scale.

b) Management

Certainly an area that causes conflict in the building of the model company bears relation to the design of the organization and infrastructure necessary to administer, operate and maintain the distribution network of the company. Aspects such as organization design and the number of workers, level of outsourcing of functions, such as maintenance or commercial areas, are permanently discussed and subject to different views between the regulator and the distribution companies.

c) Economies of scale and prices

With the objective to determine the value of the efficient model company, it is necessary to have studies of market prices of the necessary items for the installation and operation of the distribution network, as well as studies of wages for the employees of the model company. There is a permanent discussion on different issues, such as the concept of market price, given the difficulty to obtain price references of specific equipment, which often forces to use actual information from the company, and the level of wages adapted for the distribution company, which is generally obtained from a survey of prices and benchmark with other companies.

Another subject of discussion the price to consider for commodities at the time of the study, such as steel, copper and aluminum, the discussion arising in relation to the model being valued at a cost that does not correspond to the one historically incurred by the monopoly. Possibly, it can mean a sub valuation of the company, if the commodities at the time of the fixation correspond to historical lower of prices, or viceversa.

d) Municipal rights

Municipal rights have to be paid for the construction of new infrastructure when public roads are used, rights which are related to the ground occupation for the construction. Although these rights have not necessarily been paid historically by the companies, they are costs that any new entrant must assume. For this reason, these costs are recognized in the model company, principle that is consequent with the objective to simulate the competition produced by a new entrant. This is an important difference with other models of tarification, like rate of return or price cap regulations, and has been very controversial in past processes.

In general, the benchmark process needs to follow general guidelines that may also be difficult to achieve.

For example, it is very important to assure regulator independency from monopoly pressure, and avoid regulator capture. This is a key issue in any of the schemes that have been formulated to tariff the distribution segment. The benchmark model exacerbates conflictive interests between regulator and monopoly. On another hand there is always the risk that the regulator could manipulate the model company with other objectives, such as political interests to lower rates.

Also it is very important to consider reliability and quality of supply, especially since the model company has to necessarily comply with current reliability and quality regulations, same as the existing distribution companies. Therefore, there has to be a consistency between the standards of quality and reliability that are required and the level of income set by the resultant tariff.

Currently there are other concerns related with the procedures for the tariff fixation in Chile. For example, the law requires that when the model company is to be calculated, two independent studies must be done, one by the distribution company and a second one done by the National Energy Commission. The results of these two studies must be averaged considering a weight of two thirds for the government and one third for the distribution company. This mechanism obviously has the perverse incentive to raise the values of the study in one hand and in the other to reduce it to minimum, leading to a speculative game. Alternatives mechanisms are currently being revised to replace it.

Certainly another limitation that is present in the process are the asymmetries of information in the knowledge of the consumer needs and the consumer load characteristics. In Chile there has been little done on load characterization and if

the distribution companies have anything, there is nothing that forces them to provide it to third parties.

VI. CONCLUSIONS

The Chilean experience with a benchmark scheme to determine distribution rates, using the particular concept of an efficient company that is adapted to demand and that operates under an optimal investment and operations plan, has resulted in a sustained evidence of efficiency, though clear incentives for cost reductions, and attraction to investors, given adequate returns to investment capital.

Nonetheless, greater fairness in efficiency sharing is an objective that although it is partially achieved, should be revised, in order to allow a larger transfer of benefits of the scheme to end users.

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VIII. BIOGRAPHIES

Hugh Rudnick, IEEE Fellow, is a professor of electrical engineering at Pontificia Universidad Catolica de Chile. He graduated from University of Chile, later obtaining his M.Sc. and Ph.D. from Victoria University of Manchester, UK. His research and teaching activities focus on the economic operation, planning and regulation of electric power systems. He has been a consultant with utilities and regulators in Latin America, the United Nations and the World Bank.

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