

# EFFECTS OF DEREGULATION ON ELECTRICITY DISTRIBUTION: A REVIEW OF DISTRIBUTION REMUNERATION SCHEMES

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## ABSTRACT

In this paper, aspects related to the remuneration of distribution activity are treated, structuring the contents into two main points.

In the first one, since there are several theoretical schemes for regulating distribution activity remuneration, the most important ones are presented, analysing, from a regulatory perspective, the advantages and inconveniences of each one.

The remuneration schemes analysed are:

- Cost plus regulation
- Sliding scale regulation
- Price cap regulation
- Revenue cap
- Yardstick competition
- Model Company
- Performance based ratemaking

Afterwards, in a second point, different international experiences are revised showing the regulatory schemes used for distribution

remuneration in several countries with its electricity sector fully liberalised or in ways of achieving it.

The countries analysed are:

- USA: California
- United Kingdom
- Chile
- Argentina
- Norway
- Spain

It can be concluded that as the process of electric sector liberalization advances, distribution activity remuneration passes from being fulfilled through cost fixing schemes, like cost plus regulation or sliding scale regulation, to being fulfilled through incentive based schemes, like price cap regulation or yardstick competition.

The actual tendency in those countries more advanced in electric sector liberalization is the introduction of the most possible efficiency in distribution activity using incentive based remuneration schemes more and more sophisticated, like Performance Based Ratemaking scheme used in California.

# EFFECTS OF DEREGULATION ON ELECTRICITY DISTRIBUTION: A REVIEW OF DISTRIBUTION REMUNERATION SCHEMES

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## 1. INTRODUCTION

Since not many years ago, Electric Power Systems all around the world are engaged in a privatisation, restructuring and deregulation process with the aim of improving their efficiency and obtaining competitive electricity prices.

This process of liberalization, begun in Chile in the 80's, is actually extending all around the world since more and more countries are adopting it, not only for the restructuring of their Electric Power System but, in general, for all the energy sector.

The organisation model generally used for deregulating the electricity sector consists in a vertical disintegration of the different activities, separating those suited for free competition (generation and retailing) from those that must be realised under a regime of regulated monopoly (transmission and distribution).

Distribution activity, because of its inherent natural monopoly nature, comes inside this second group of activities. This does not mean that, because the activity must still be regulated, there is not going to be any changes since, with the aim of improving its efficiency, the activity's regulatory framework undergoes deep modifications.

Thus, measures like third party access, separation between network and retail business, and a new remuneration scheme are introduced.

It is in this last measure where this paper comes. Thus, aspects related to the remuneration of distribution activity are treated, structuring the contents into two main points.

In the first one, since there are several theoretical schemes for regulating distribution activity remuneration, the most important ones are presented, analysing from a regulatory perspective the advantages and inconveniences of each one.

Afterward, in a second point, different international experiences are revised showing the regulatory schemes used for distribution remuneration in several countries with its electricity sector fully liberalised or in ways of achieving it.

## 2. THEORETICAL REMUNERATION SCHEMES

The goal that must achieve every remuneration scheme is the fixing of the revenue the distribution company has to perceive as a compensation for providing a service in a monopoly way. This revenue requirement has to be fair and enough to keep an adequate level of service. It must assure financial stability for the company, and also that customers pay only for the service they get without contributing to finance excessive profits for the company. It is with this consideration that the advantages and inconveniences of each remuneration scheme must be evaluated.

From a theoretical point of view there are multiple schemes that can be applied to regulate the remuneration of distribution companies. In this point the performance of the more generally used ones is briefly explained, from the basic ones based on cost fixing to the modern ones based on incentives, showing their advantages and inconveniences from a practical application point of view.

### 2.1. Cost plus regulation

This scheme takes into account the traditional rate of return and cost of service regulation schemes.

With this scheme, distribution companies are allowed to levy the cost of service to their customers and also they are granted a fair rate of return on their capital invested. Each year, or each remuneration review period considered, the regulator determines, in a negotiation process with the distribution company, the costs necessary to provide the service and the rate of return allowed on the investment.

The advantage of this scheme from a regulatory point of view is that it assures the adequacy of the distribution service, as the revenue is enough to cover the costs keeping the benefits of the distribution company within adequate levels.

On the contrary, this scheme has been considerably criticised because it does not provide incentives to reduce costs. Moreover, if the

scheme is wrongly applied, it can lead to over investment when the rate of return allowed is higher than the cost of capital in financial markets. This effect occurs simply because the regulator cannot react immediately to changes on market conditions.

## 2.2. Sliding scale regulation

It is a scheme design to penalize or reward the distribution company for its performance.

It is based on a cost plus regulation scheme where the fundamental concept of cost recovery remains unchanged but the rate of return on the capital invested is subjected to performance risk, variations in actual operating costs influence the actual rate of return.

The difference between regulated rate of return (fixed by the regulator) and the real one, due to the distribution company performance, can induce losses or profits. These cost saving or overruns are shared between customers and company shareholders using a sharing mechanism.

In this way, if the real rate of return is greater than the allowed one a fraction of the profits will remain within the company and another fraction will be reimbursed to the customers through tariff reductions. On the contrary, a fraction of the losses will be transferred to the customers through tariff increments.

This scheme is one of the first ones designed to incentive the performance of the distribution company but the problem is that the incentive is diluted. Moreover, the scheme operates appropriately only when the economic conditions are static. When inflation is high or in situations of great technological innovation, the performance of the scheme becomes corrupted.

## 2.3. Price cap regulation

The scheme operates imposing a restrain on the rate of increase of prices charged by the distribution company for providing the service.

The average revenue per unit distributed in relevant year  $n$  ( $p_n$ ) is established by bringing up to date the one for the year  $n-1$  ( $p_{n-1}$ ) with the inflation ( $RPI$ ) and a productivity requirement ( $x$ ). In a general form:

$$P_n = P_{n-1} \cdot \left( 1 + \frac{RPI - X}{100} \right)$$

Therefore, the annual remuneration received by the distribution company (average revenue per unit \* distributed energy) consists on two terms: a fixed one that is adjusted yearly with inflation and a variable one that depends on an efficiency factor that the regulator adjusts in terms of the productivity improvements of the distribution company.

Besides the adjustment by the factor  $IPC-X$ , there exist advanced price cap mechanisms that take into account additional adjustment factors that consider energy efficiency (losses reduction), etc.

Price cap regulation has the advantage that, once the cap is fixed, the revenue received by the distribution company is separated from its costs so a strong incentive exists for the company to improve its efficiency over the level fixed in the scheme.

On the contrary, this scheme only fixes prices, that is to say, it does not take into account the nature of the investment, and so it must be complemented with network design and operational standards to assure investments comply with security and quality requirements.

## 2.4. Revenue cap regulation

Revenue cap scheme is an incentive based scheme that operates in a similar way than the Price cap one but, instead of restraining prices, it limits the revenue of the distribution company.

Thus, during a time period expanding normally to 5 years, the revenue allowed yearly to the distribution company ( $I_n$ ) is established by bringing up to date the one for the year  $n-1$  ( $I_{n-1}$ ) with the inflation ( $RPI$ ) adjusted by a productivity requirement ( $X$ ) and the variations in the energy distributed ( $\Delta D$ ). In a general form:

$$I_n = I_{n-1} \cdot \left( 1 + \frac{RPI - X}{100} \right) \cdot (1 + \Delta D)$$

The revenue cap formula can include additional factors to take into account energy efficiency or other performance indicators.

As for the price cap scheme, the revenue cap scheme incentives the distribution company to manage the service with economic efficiency so the company can have additional profits if achieves

a productivity performance greater than the one allowed in the formula

## 2.5. Yardstick competition regulation

This scheme can be applied in Power Systems with various distribution companies of similar characteristics and is based on a regulation by comparison.

The scheme uses a database of costs and other characteristics of the companies to establish comparison among them using advanced statistical techniques.

The regulator promotes efficiency in the management and operation of the companies fixing the remuneration of each company as a function decreasing with its own cost and increasing with the average cost of the other ones.

This scheme has the advantage that it is not necessary to know the real costs of each company as it is based on comparisons among them. In this way, there is no incentive to conceal the real costs.

On the contrary, taking this scheme to practice is more complicated than with other incentive schemes as the statistical techniques used need a lot of variables to correlate the service provided by each company with the characteristics of their markets (topography, climate, demography, etc.)

## 2.6. Model company regulation

The performance of this scheme is based on the design of a model company (a distribution network) completely adapted to the market it has to serve. The remuneration of the distribution company is established during a time period (usually 5 years) using the costs of the model company as a reference.

The remuneration is revised annually using one of the schemes explained before until the next regulatory period starts with a review of the model company to take into account the evolution of the market during the regulatory period.

With this scheme it is possible to incorporate an explicit level of losses and quality of service, so it is easy to reward or penalise the fulfilment of the company with the levels required by the regulator.

On the contrary, the scheme has the same problems of complexity as the yardstick scheme as

it requires a lot of information, which is not always available, or can be wrong.

## 2.7. Performance based ratemaking regulation

Performance Based Ratemaking scheme (PBR) represents one step further in the introduction of efficiency in the management and operation of the distribution company in contrast with traditional incentive based schemes as price cap or revenue cap regulation.

The scheme is based on a revenue cap scheme used to establish the revenue of the distribution company during the regulatory period (usually 5 years). Additionally, the scheme uses a shared earnings mechanism to cast excessive profits or losses among distribution customers and shareholders.

Moreover, the revenue is adjusted with factors that take into account the changes in the revenue of the company caused by variables in which the company has no control (regulatory change, etc).

At last, the remuneration is also affected by penalisation or rewards according with the quality of service performance and with the comparison of the evolution of the company average rate with the national average rate.

This scheme takes into account the advantages of other incentive schemes minimizing its inconveniences. Its main advantage is that it strongly promotes efficiency in the technical and economical management of the company as risks are shared among customers and shareholders.

## 3. INTERNATIONAL EXPERIENCES

### 3.1. USA: California

Electricity is distributed in California by several public and private companies of which only 7 private companies distribute 75% of the energy. Each company operates as a monopoly in a geographical area.

With AB 1890 legislation, the remuneration received by each distribution company has changed from a cost of service regulation scheme to a PBR one that establishes the revenue requirement of each company.

This new scheme is going to be introduced by April 2002. Until then, the companies have been

required to freeze the tariffs charged to their industrial and large commercial customers to the levels they had in 1996 and reduce a 10% the tariffs charged to small commercial and residential customers.

### **3.2. United Kingdom**

From an organisational point of view, the UK has three different power systems: England and Wales, Scotland and Northern Ireland.

Electricity in England and Wales is distributed by 12 Regional Electricity Companies (REC) that operate under licence in a geographical area. The remuneration received by these companies through tariffs and network charges is regulated by a price cap scheme.

During a regulatory period of 4 years, the rates charged by each company for the use of its network can not increase annually more than RPI-X per cent after making an adjustment to reduce energy losses.

In the Scottish system, electricity is distributed by two vertically integrated companies under licence in a geographical area. As in the English system, the scheme used is a price cap one.

In Northern Ireland the electricity is distributed by a vertical integrated utility that operates under a monopoly regime. The remuneration for the distribution activity is established using a cost plus regulation scheme. The regulator (OFREG) considers that the scheme used is inefficient and has started a process to change it.

### **3.3. Chile**

Electricity is distributed in Chile by nearly 40 private companies that operate under licence in a geographical area.

The remuneration of the companies is established using the long run marginal cost of a model company adapted to each market. This cost is used to calculate the Distribution Aggregated Value (DAV), this is, the tariff charged by the distributor to its customers for the use of its network.

DAV is calculated by the regulator and by the companies and the DAV approved is made of two thirds of the value calculated by the regulator and one third of the one calculated by the company.

DAV includes the cost of energy losses and a return on the investment calculated every 4 years for a model company that distributes in a similar location to similar clients. The return on the investment obtained by the company must be between 6% and 14%, if it is outside this band, the VAD is adjusted.

### **3.4. Norway**

Electricity is distributed in Norway by public and private companies that operate as regional monopoly. Most of the companies are public and vertically integrated.

Until 1997, the scheme used to establish the remuneration of the companies was a cost plus regulation one, that is to say, they had recognized an operation and maintenance cost and an investment cost as well as a fair rate of return on the capital invested.

Since 1997, with the aim of improve the efficiency of the distribution activity a new revenue cap scheme was introduced. During 5 years, the formula established actualises the annual revenue requirement with the inflation and a productivity requirement. The productivity requirement of each company is established using a yardstick competition scheme.

Additionally, there is a limit in the annual benefits the distribution company can obtain, they must be in a band of lower limit 2% and upper limit 15%.

### **3.5. Spain**

Most of the electricity distributed in Spain (around 98%) is made by 4 private companies that operate in a geographical area under monopoly regime.

Until 1998, the scheme used to remunerate the companies for its distribution activity was a cost plus regulation scheme but since then, as new legislation was passed the scheme used is a mix of the revenue cap and the model company scheme.

The remuneration for the entire distribution activity, the activity of the four companies, is established using a revenue cap scheme.

Once the global remuneration is fixed, the remuneration of each company is calculated using a model company scheme. This model is used to obtain the percentage that, of the global remuneration, belongs to each one of the four companies.

At present, this model is in review.

#### 4. CONCLUSIONS

In this paper a review about distribution activity remuneration has been made from a theoretical point of view and from a practical one.

For that, the theoretical basis of the most generally used schemes for distribution remuneration is explained, showing the advantages and inconveniences stated by its practical implementation.

Also, the way these schemes are taken into practice is shown explaining the distribution remuneration schemes used in several countries with their electric sectors liberalised or in a process of liberalisation.

It can be concluded that as the process of electric sector liberalization advances, distribution activity remuneration passes from being fulfilled through cost fixing schemes, like cost plus regulation or sliding scale regulation, to being fulfilled through incentive based schemes, like price cap regulation or yardstick competition.

The actual tendency in those countries more advanced in electric sector liberalization is the introduction of the most possible efficiency in distribution activity using incentive based remuneration schemes more and more sophisticated, like performance based ratemaking used in California.

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