

## DISTRIBUTION REPAYMENT REGULATION ANALYSIS IN SEVERAL POWER MARKETS DEREGULATED

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### ABSTRACT

*Electrical energy distribution repayment models applied in several countries has been also the aim of regulatory changes and critics. This article describes repayment models of electrical energy distribution in economies with liberalized power markets, and it also describes the advantages and problems that they have presented according to the point of view of companies and regulators, becoming a comparison of the different present regulations. The objective is to obtain the parameters that, in this type of economies, should be considered to formulate repaying model which agrees with the requirements of the present and future of the electrical sector.*

### INTRODUCTION

The opening of power markets along with significant changes which have happened in the electrical sector (privatization, dismemberment, distributed generation, aspects of communication in networks etc.), the promulgation of norms on the part of the regulatory agencies in several countries has been required. The result has been the establishment of dynamic, regulatory frames, needed for the operation of the power sector in several countries.

For the establishment of these regulatory frames and for being a highly dynamic sector, different rules have been and will be modified according to the regulator wishes who must answer to different panoramas: economic, social, technological, etc.

Distribution of the electrical energy has also been affected by changes in the electrical sector. As an example of these changes it can be mentioned the separation of the old electrical companies in different businesses, as well as the inclusion of the distributed generation in the distribution network. In presence of this panorama, regulators had to

promulgate rules that guarantee that the activity is not in danger as well as to guarantee their development under quality and optimized criteria to the utilities and clients.

### INTERNATIONAL EXPERIENCES IN ELECTRICAL ENERGY DISTRIBUTION REMUNERATION

To be briefly mentioned next the most characteristic aspects of regulation schemes in several European and American countries that went through process of new structures in local energy markets.

### SPAIN AS A MODEL OF REMUNERATION OF ELECTRICAL ENERGY.

Electrical energy regulation in Spain establishes a system based in the concepts of “Reference Net” and its remuneration is based on the employment of “Unit Reference Prices” that are used for the calculation of distributor’s remuneration.

The model calculates the remuneration for each area considering the best net necessary to feed it with a minimum of quality supply standards. The model uses criterions of electrical planning (minimums of the inversion binomial + losses) for determined quality deliveries (tension fall and number of interruptions for client).

The remuneration for distribution Spanish law has, among others, these features:

- Characterizes the areas of distribution following their natural shape (client location and their power demand, environmental outer conditions, transportation net location and quality of power supply required).
- Determines and valuates in replacement cost the physical units that compose the net, including meters//testers//probes.

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- Establishes maintenance costs both preventive and corrective.
- Values net operation costs taking as a reference the distributed surface, the environmental determining factors, quality supply conditions and the location of the charge.
- Establishes the variables of power and energy as fundamental parameters for the sizing of nets.
- Considers technical losses level in the areas, searching for improving their reduction.
- Allows establishing incentives to quality supply, considering it in the reference net design (number of interruptions) and also fix operation costs (interruption length).
- Considers other necessary costs for activities such as "Public way occupation Tax" or "Flight, ground and subsoil Tax" that companies must pay to councils.

By the reference net the electrical system is analyzed through demand clusters with different characteristics, creating several modules: industrial estates, urban net (> 350 housings), rural net (< 350 housings), MT rural net, distribution and transportation red (supply to substations HT/MT). The considered costs are classified as follows:

		<u>Air lines</u>
		Subsoil lines
		Substations
		Extra HT/HT
		and HT/MT
	Investment costs	Transformation
		Centres and
		level chambers
		Manoeuvre
		office
		Maintenance
		Preventive
DISTRIBUTION	Exploitation costs	Maintenance
NET COSTS		Corrective
		Maintenance
		Operation
	Commercialization	
	costs	
	Other costs	

The model processes unit costs depending on reference net for each area and also includes differential aspects that influence the costs, such as ice, saltiness, rainfall, keraunic level, woodless, compensations for pass rights and plotting, differential costs for person (considering the region) and big city costs.

The regulatory Spanish regime has the detail of fixing a unique tariff for any user from national territory, that's why the model of the retribution net for distribution of electrical energy hereby presented concludes a mechanism of sharing and costs consideration among companies

### ENGLAND

The anglosaxon regulation model for electrical energy distribution is based on companies' efficiency analysis, considering aspects such as quality supply, including also aspects related to customer care, companies profitability in the foreseen of their sustainability for the long period and the annual remuneration allowed.

The English model is considered as the starter of the regulation via incentives, that's because it is used as a parameter to incentive the attitude of the enterprises, the settlement to the so called efficiency coefficient (or "x" coefficient), through which the regulator determines periodically the tariff level for the basket of products that are lent to companies.

A different characteristic of this model is that tariff revisions start from the existing tariff and they introduce modifies with the annual efficiency coefficients for the new tariff period.

This characteristic owns inside a continuousness concept, both for the enterprise operation and also for the tariff sign for the public; this is a different concept from the methodological models offered by Latin-American.

Pragmatically, in the UK, are analyzed all the relevant aspect of enterprises fulfilment and reduction or rises are proposed, finally discussed via consult documents in which those interested can give their opinion, from public or private sector.

Basic concepts that make the incomes for the efficient operation are similar to those that other models use: expenditures (capex) and operation and maintenance costs (opex).

The former represent the remuneration of the actives with the item of valuable and used, in rent ability conditions determined by the acknowledgement beforehand the cost of the capital opportunity. The latter can be recognised considering comparative analysis among companies (yardstick competition), using efficiency factors ("x" factor)

as a parametrical tool to settle the efficiency horizons that the regulator establishes.

## CHILE AND PERU.

These models present similar regulatory characteristics in the determination of the annual input needed for the distribution activity, in the scheme of incentivating the efficiency in the supply.

Both countries establish the remuneration of the actives by means of the calculation of the NVR (New Value of Replacement) and they classify electrical systems into sectors or topic areas of distribution. These are shaped by similar characteristics such as: geographical location of the charge, charge density, technical characteristics and the average energy consumption, among others.

For the setting of electrical tariffs, the Electrical Permissions law, in the case of Peru and similarly to Chile, establishes that the AVD (Added Value of Distribution) has to be calculated for each defined typical sector, taking as a reference a model enterprise. The AVD includes costs that are associated to the user, standard losses of distribution system, standard investment costs, operation and maintenance. As investment cost is considered up to annual NVR, considering its useful life and a tax of actualization also fixed by the law.

In the tariff fixing process, the NVR is useful in order to set the investment cost of a "efficient model enterprise" so that a real enterprise should challenge the ideal model enterprise, in a comparative way. That's why in the calculation of the NVR are considered different fittings to the real net, related to: change in technology, costs fittings, installation modifies and the elimination of not needed plants. En Chile actives from real net are considered.

The fixing model tariff in Chile is very similar to the one in Peru. For the calculation of AVD the criterion used is the typical areas one. Concerning costs optimization, in Chile are also used parameters related to the costs of a model enterprise. Nevertheless, there are differences in the used methodology to determine the NVR for the distribution nets. In the case of Chile it's considered the system of real remuneration, to which there are no adaptations. Moreover, energy losses are readapted on every regulation following recorded values. On the other side, Peru has a programme for the reduction of recognized losses that estimates to arrive to 12 the levels of standard energy losses.

Furthermore in Peru it's calculated the AVD in which is added the investment cost determined by NVR and other recognized costs according to parameters corresponding to a model enterprise. The only thing that is taken from reality in this calculation, is the demand of the sectors and the physical area of the enterprise.

Once the NVR is determined, in the peruan model, an AVD costs study is performed with the aim of verifying the TIR that efficient investments would have, considering a set of distribution enterprises for a typical sector. This test is not performed for each enterprise but for a set of them. The test consists in developing a cash flow in which it's searched the recuperation of the efficient investment of the whole net distribution enterprises, for a period of 25 years. The incomes are calculated like those who would have been obtained if, to the amount of supplies in the previous fiscal year, the basic prices would be applied. The peruan Government is able to evaluate and verify these costs, because the latter have to be correspondent to international standard values, applicables to the mean.

Finally, the law for Electrical Concedes indicates if TIR is between 8% and 16%, calculated AVD is definitive.

In Chile the AVD values of distribution are calculated above a real annual profitability of 10% of the considered investment, with a value of replacement. Studies are performed independently by enterprises and the National Energy Committee over typical areas, the invoices are praised in the proportion of 1/3 and 2/3 to obtain in final value. Final value should give that tasks applied to the set of distribution enterprises will result with profitability between 6% and 14%. If this shouldn't happen, necessary settlements should be done, either by fault or excess.

## ITALY

Distribution regulation in Italy uses average costs for the calculation of remuneration. As in Spain, there is a total distribution cost of distribution itself in medium and low voltage considering total amount, this last being fixed by the regulatory authority.

As in Spain it's considered a total distribution cost that is imposed by the regulatory authority and this latter also calculates the average value of electrical infrastructure. This is the value given to the enterprise.

In the calculation are also taken into account efficiency parameters that are related with the number of clients, the number of clients per kilometre, the average domestic power, the percentage of clients in rural areas and the distance of clients to the distribution line.

## FRANCE

The process of opening the regulation system has been limited, in this scenario sell tariff of electricity to no qualified clients that includes the remuneration of distribution, are fixed by a law by the government and the committee for the electricity regulation. The evolution of the tariff considers variations of defrayed costs, in order to

feed no eligible clients, for the cost of investment, benefits or searched productivity, and also the evolution of fuel costs.

Operators communicate any information regarding their costs, their accountings and the adaptations due to the structure of the tariff. This information is transmitted at the same time to the Minister of Economy, to the Minister of Energy and to the Electricity Regulatory Committee.

Economy and Energy Ministers present to the committee the preview of tariff evolution for selling electricity to non eligible clients. Energy tariffs to non eligible clients include the value that correspond to the actual supplied power and, in case of need, the invoicing of reactive energy. The operator communicates to every client the request of it. The amount that corresponds to tariffs in use for public nets it's identified by the invoices of non eligible clients since the 1st of July 2002.

When a non eligible clients experiments an interruption due to a fail of public nets of transport or distribution, there is a discount in the tariff. Only interruptions longer than six hours determine the discount. The discount is determined as a proportion of the length of the interruption of supply, a 2% of the annual incomes mentioned in the anterior paragraph.

An important innovation of this contract is the settlement formula to remuneration. In present contracts remuneration follows sell tariffs evolution of electricity, those are lowering constantly since many years and should be lower in the forthcoming years. The new buy contract previews that remuneration of producers will be made on the basis of an index that will reflect the costs evolution for the development of the electrical system. This index considers the work cost per hour of wage earner of mechanical and electrical sector and the index of products price and services.

## UNITED KINGDOM

Distribution is regulated in order to protect consumers from natural monopoly. Inside of each 14 areas, the dealer has a virtual monopoly in distribution of electricity, but due to the establish cost for the infrastructure necessary for the distribution device, transformers, wires, systems and control meters, it would be economically inefficient try and develop competitive alternative nets.

Ofgem considers that even if without competitive markets, regulation by incentives, for instance controlling prices, is the best mean to protect interests of consumers. A limit for the prices is a limit for the amount of incomes that a distributor can receive from clients. This encourages companies to search for efficiency in order to improve

benefits and clients benefits of these improvements in following audits.

Ofgem also supervises that distributors accomplish with the conditions of licence and makes that requirements are fulfilled against any fault by distributors. At present, prices controls of distributors are fixed each five years.

In recent decades, Great Britain confides almost only in electricity generated by big plants. Traditional electrical plants are connected with the national transmission high tension system. According to this, distribution nets, the piece of a lower tension in the system, have been considered has an electricity that was delivered in one direction, from the transmission net to clients households. Nevertheless, structural changes, for instance the advanced growth of distributed generation, gave to the government the opportunity to consider the new role of distribution nets so that it would be possible to switch to smaller generators connected to local greed in order to give more electricity.

## CONCLUSIONS

In the following table are the main conclusions.

Is necessary to have new retribution methodologies for the new changes in the electric distribution sector.

New methodologies must have criteria as distributed regulation and security supply.

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CONCLUSIONS

	CENTRALIZED REGULATED SYSTEM	LIBERIZED POWER SYSTEM 1st GENERATION	LIBERIZED POWER SYSTEM 2nd GENERATION	LIBERIZED POWER SYSTEM 3rd GENERATION
DESCRIPTION	INTEGRATED BUSINESS, NATIONAL COMPANIES, LITTLE OR NULL PRIVATE PARTICIPATION	VERTICAL DISINTEGRATION. PRIVATE PARTICIPATION, REGULATED AND NOT REGULATED MARKETS COEXISTING IN DIFFERENT CONDITIONS.	PRIVATE PARTICIPATION. MARKETS SECONDARY. REGULATION OVERTURNED TO THE ESTABLISHMENT OF GAME RULES, QUALITY OF ENERGY POWER	GREATER PRIVATE PARTICIPATION. MORE IMPORTANT TO DEREGULATE THAN TO REGULATE. PREOCCUPATION BY THE SECURITY OF THE PROVISION AND THE DISTRIBUTED GENERATION
REGULATION STATUS	LITTLE IMPORTANCE FOR THE DISTRIBUTION REPAYMENT: A SINGLE BUSINESS: THEREFORE THE YIELD PROBLEM ASSUMES THE PROPRIETOR OF ALL THE COMPANY (MOST OF CASES THE NATION)	THE PREOCCUPATION FOR THE BUSINESS OF THE DISTRIBUTION BEGINS. BASIC MECHANISMS OF REPAYMENT: COSTS OF SERVICE RETRIBUTION, IRR.	REGULATION BY INCENTIVES: PRICE CAP. REVENUE CAP. YARDSTICK COMPETITION. INVOLVES PARAMETERS OF THE REGULATORY INCENTIVES CALCULATION	EVOLUTION OF THE REGULATION BY INCENTIVES TO NEW REPAYING MODELS EVEN DEVELOPING. NEW METHODOLOGIES THAT INCLUDE NEW FACTORS OF CALCULATION ARE REQUIRED
COUNTRY	FRANCE	ITALY	PERU CHILE ENGLAND UNITED KINGDOM SPAIN	