ASSET MANAGEMENT OF NETWORK COMPONENTS: THE CONCEPT OF RATIONALITY ON DISTRIBUTION UTILITIES.

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ABSTRACT

The criteria of book depreciation value adjusted by condition's factor didn't prove to promote a fair remuneration of the different factors of the power system inducing fudging on the exposure of truth value of the service. A mayor drawback of the current methodologies is that some of these costs vary almost directly with the level of use to which the equipment is allocated. This is not taken into account by the book depreciation methodology.

We propose a methodology based on the conception of "rationality", which had been successfully implemented in four utilities in Argentina

Key words:

Distribution Company, Rationality, Investments, Book Depreciation, Tariff; Electrical System, Utility.

INTRODUCTION

The purpose of this paper is to present a short introduction to an innovative proposal to determine the fair value of each component of a distribution power system based on the criteria of rationality.

Rationality

The rational criteria are based in accordance to reason or logic and attempts to consolidate traditional regulated accounting, with the ability to think, understand and make decisions and a technical adjustment conditions. The main goal of the criteria is consider the fairness of the tariffs while benefiting all the involved parts.

The different parts that the rationality criteria targets are:

- The estate, which should compromise to remunerate the investments in the plant and equipment. The regulators, which represent a subcategory of the estate with the duty to ensure the stability and sustainability of the system. The rationality criteria on estate matters mean to evaluate effectively those investments that are crucially needed in order to benefit all the country, including optimal conditions of quality, security and fair prices.
- The private sector, which will be benefited by the rationality criteria on the system design and by better application of the resources i.e. cost-efficient investment in order to ensure the well functioning and sustainability of the system, without compromising the benefits for the stockholder.
- The network, which should be controlled by regulatory policy´ methods. The rationality criteria is applied in order to provide effective conservation practices, economic values, and a careful analysis of the maintenance, operation, and obsolescence costs.

Rationality also includes the design of the system that set up the value drivers of a cost-effective fair price. This price will benefit all the involved parts.

In a nutshell our methodology is intended to evaluate the current state of the art of the installations taking into account future investments. The criteria of rationality can be implemented without disregarding some current issues as: the quality of the service, reliability, public policy issues, industrial security, and environmental´ policy and to recognize those values in the tariff.

A first step towards the rationality criteria is to calculate the utilities technically and economically adapted to a network. First we need to determine the average service life dispersion and use it to determine the remaining life or to forecast the remaining life for an specific piece of the network.

Once this procedure is done, we define the rationality factor of the network which is applied to determine an annual depreciation´ rate.

Even though we carefully analyzed a variety of proposal's performance-based regulation of electric utilities, we would only consider the once suitable to obtain the cost of capital by the theory of the "new replacement cost" (NRC).

The mentioned methodology is able to be used either if the regulation is "cost plus" rate of return, or "price cap"

ANALYSIS MODEL´ELEMENTS

We had based our study analyzing more than 166 works made, which accumulate the detail of the fixed assets of more than 122 companies of generation, transmission and/or distribution, of 10 countries of Latin America. These countries reach more than 155 power stations of generation with more than 30 thousand MW of nominal power, 84 thousand MVA of transformers, 33 million clients, with approximately 80 GWh of sold energy. The areas covered more than 1.4 million of km2 and approximately 200 thousand km lines of medium and low voltage.

These goods that we had typified according to the main categories of assets are shown in the above table.

Type of good
Installations on Customers
Alarms, control and signal systems
Batteries
Buildings and other constructions
Circuit Breakers and Switches
Communications equipment.
Computer systems
Current and voltage transformers
Equipment grounding
Distributed control, SCADA and RTU
Laboratory and Security materials

Type of good
Land and Land rights
Line and Power transformers
LV and MV Switchgears installations
Meters
Overhead Conductors, and Devices
Poles, towers and fixtures
Protective equipment
Spares and stores and miscellaneous
Station equipment
Structures and Improvements
Underground Cables MV & LV

In order to evaluate the economics' incidence of each group or category on the total of the investment we study the installation of the electrical system that works harmoniously in an integrated form. We use the present values of costs which are standardized by category and type of installation

In our analysis we had identified five key variables which are the targets of the study:

- Operating conditions
- Use level
- Conservation state.
- Level of technological obsolescence
- Level of installation's functionality.

In each case, a numerical graduation of 1 to 5 has been chosen. This graduation reflects the relevance based on the degree of adjustment between the real state that could be observed in each case and the optimal or rational criteria.

Operating conditions:

These are the conditions to configure all or part of a device into a specified state of conditions e.g., voltage, current, power, and the like, in which the specified parameters maintain there stated performance rating

Use level:

It measure the stress of the equipment due to the use. Manufacturers have to make a significant contribution to improving their energy efficiency.

Conservation state.

Conservation state addresses issues related to preservation and maintenance of the goods including repair, material conservation and other preservation techniques.

Guidance principles are establish in order to perform effective, non-damaging repair and to use materials of good quality.

Level of technological obsolescence

Technological obsolescence is the result of the evolution of technology. As new technologies appear, older ones cease to be used. There are many strategies for dealing with technological obsolescence. Maintaining obsolete technologies might be the option only in certain circumstances.
Technology is perceived as a process, product, and a tool to be used in solving real problems related to an identified trouble or issue.

Level of installation´s functionality.

It includes all goods and developments to make the utilities more functionally to the government and customers´ requirements. The concept of "adapted networks" rely on the technical and economical conditions related to the engineering evaluation, the environmental sustainability and the optimal cost
Technology-based are tools including telecommunications, SCADA, RTU and the use of innovative software, the use of non toxic products and the security policies.

Classification of Rationality

The table below shows the matrix analysis of the different categories in order to classify the state of rationality.

The analysis was performed as a table to facilitate the comprehension for the user.

Classification of Rationality	Category of analysis				
	Condition of Operation	Level of Use	State of Conservation	Level of technological obsolescence	Level of functionality of the Installation
1.0 Excellent	Optimal operation	Normal in agreement with its design	Normal conditions for its age	Does not have limitations of use in the long term	High: Without restrictions of design for the service in it utility.
2.0 Very Good	Slight deflection respect to the operatively	Hardly demanded, slight deficit of the design parameters	Acceptable but underneath the standard. Needs several smaller repairs	Moderate, with certain inferiority related to the present state, but maintains it use in the medium term.	Very good. Has some restriction of design for the service of the network and it is apt until the medium term
3.0 Good	Important deflection respect to the operatively	Demanded mainly according to the design parameters	Needs large repairs (overhaul)	Medium. Important deflection related to the present states. Seriously affected use in the medium term	Sufficiently important, design restriction respect to the present states. Only works in the short term
4.0 Fair	Irregular situation that affects it seriously	Not applicable	Needs tasks of reconstruction and/or incorporation of missing parts.	Very significant deflection. Use in the short term becomes inefficient	Very significant design restriction it use in the short term become inefficient
5.0 Bad	Unacceptable. Dangerous situation for the recovery of the good.	Not applicable	Non-recoverable. Repairs are not economically justifiable.	Total deflection. It use make worse the service to the company	Null deflection. It use is not advisable.

Each cell of the previous table, had been measured in economic terms with respect to the new cost of assets evaluating: (i) the costs that would be needed to incur by the electrical operator to mitigate the disadvantages of the goods analyzed (example: by deficient maintenance), or (ii) the inefficiency that exists by overinvestment when the design of the network or it level of obsolescence is not adjusted to the traditional objectives: to guarantee the electrical provision, to guarantee the quality of this provision and to guarantee the less possible cost. If an equipment or part of the network displays an inferior state with respect to the expectable one, it technical value is punished so that in the tariff "the deflection is not awarded".

Based on the precedent categories, the condition of rationality of the goods is determined as follows:

Qualification of Rationality	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0
Condition of rationality of the good	Nor-mal	Acceptable, but with no critical limitation		Fair, with important limitation,			Bad, with important restriction	Without Value. Scrap	

We select the minimum value of each matrix's column to classify rationality. Then we obtain the condition of the rationality

Given all the conditions included in the present work which represents the full study of more than 122 companies, we assume that a factor of rationality of goods will be correctly expressed by a linear equation

F(xi) = axi+b=yi.

Qualification of Rationality	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0
Factor of Rationality	1,0	0.85	0.7	0.55	0.4	0.25	0.10	0.05	0.01

This Factor of Rationality less than or equal to one will multiply the factor that corresponds to the age of the good. For example we considered a good with an age Factor of 0.5 and a qualification of rationality of 2 (Factor of Rationality equal 0.7)

In this case the Depreciation coefficient modified by the Factor of Rationality will be 0.5x0.7 = 0.35.

Next calculations show the Qualification of Rationality

reached about some types of representative goods in four appraisals made in Argentina during 2006. The ratio between goods / NRC show the percentage reached by each category and by type of good for the cases that are separated from the normal condition.
The results are ordered following crescent value of rationality

Rationality	NRC	Description
Number	%	Type of goods
1	9	Conductors
1.2	22	Structures and Improvements
1.8	1	Power distribution transformers
1.9	4	Structures and Improvements
2	14	Circuit Breakers and Switches
2.1	2	Power distribution transformers
2.7	4	Conductors
2.8	4	Structures and Improvements
3	12	Circuit Breakers and Switches
3.2	2.5	Power distribution transformers
3.5	3	Conductors
4	9	Circuit Breakers and Switches
4.3	2	Power distribution transformers
5	1	Circuit Breakers and Switches

The average of all goods in the mentioned four appraisals, are as follow:
The Qualification of Rationality had an impact of additional increment of depreciation coefficient in a range from the 2 to 7 % based on the value of the NRC. This value will increment those calculated by the remaining life.

CONCLUSIONS.

Incentives must be given by the estate to those investments in property, plants and equipment that are coordinated with the schedule planning of the service including optimal conditions of security, quality and price.
A rationality factor had been proposed in line with the optimal value of the electrical goods according to Operating condition, Level of Use, State of Conservation, Level of Technological Obsolescence and Level of Functionality.
The good with this factor will be able to weigh the estimate value of the installation
This parameter corresponds to the Xmin of a model system that is fitted according to a straight line F(xi) = axi+b=yi which allows to determine a matrix table.
In the power network, the criteria of rationality applied to the conservation practices, to the estimation of the degree of obsolescence and age of the good, the restrictions of design or functionality, should allow us to observe the creation or destruction of value of the electrical system with the passage of time. These are value drivers which would allow us to take correct decisions at the time of demanding

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