EVALUATION OF ECONOMICAL PROFITABILITY OF ASSETS

Marcelo Ap. PELEGRINI
SINAPSIS Inovação em Energia – Brazil
marcelo.pelegrini@sinapsisenergia.com

Ewerton GUARNIER
SINAPSIS Inovação em Energia – Brazil
ewerton.guarnier@sinapsisenergia.com

Sérgio E. TEIXEIRA
AES Eletropaulo - Brazil
sergio.teixeira@aes.com

João Carlos Martins CARVALHO
SINAPSIS Inovação em Energia – Brazil
jcmc@uol.com.br

Carlos Márcio Vieira TAHAN
USP – Brazil
cmvtahan@pea.usp.br

Josimar Oliveira SILVA
USP - Brazil
josimaro@terra.com.br

ABSTRACT

The electricity distribution system in Brazil is regulated by a PRICE CAP model, in which cap prices are imposed to the utilities every four years during the periodic tariff review process, and the prices suffer a tariff readjustment on an annual basis using price indexes. This kind of regulation establishes on each periodic review the revenue considered adequate to both provide electricity services and fairly compensate for the investments done, based on O&M costs modeled for a reference firm and invested capital analyses.

This article intends to present a methodology for the distributors to select investments to expand and/or improve their networks, considering in an aggregated way both technical benefits and regulatory compensations.

INTRODUCTION

The regulatory electricity price is composed of two components: component A, referent to non-manageable costs, is composed of obligations relative to acquisition, transmission, and distribution of energy and are fully transferred to the rates; while component B, referent to manageable costs, compensates the company for operational costs, investments and asset depreciation.

The Brazilian national electric power agency (ANEEL)'s method for the periodic tariff review brings important insight to decision-making, based on technical, economic and financial analyses. The utility should base its decisions on these parameters, such as the reference company used by the regulation agency to determine the fair revenue for the companies and electricity fares.

The Remuneration Base (RB) is calculated considering prudent and convenient investments (at affordable prices and compatible with main goals), as well as assets compromised with the concession of public electrical distribution services. They are evaluated with the method of Depreciated Optimized Replacement Costs and calculated with the Average Value criteria for the real network, with costs and investments optimized.

The Efficient Company model used to determine efficient levels for electricity companies' operational costs intends to simulate conditions a newcomer operator to that electricity market would face, in order to meet the regulator's demands.

Therefore, the utility decision-making process requires an understanding of economic and financial values resulting from RB and Efficient Company models, in order to properly choose the most promising alternative. Its performance is tied to good management of its asset, with parameters such as lifetime and depreciation being considered in the calculations. Efficiency gains from losses reductions, reliability gains and improvement of the voltage profile may contribute to increase revenue, since the difference between regulatory projected costs and effective costs is absorbed as a net profit.

In the context imposed by the Brazilian regime of concessions and regulation, companies analyzing potential works in their systems may therefore encounter tradeoffs between an improvement in technical indicators and expected regulatory compensation from the investment.

REGULATORY COMPENSATION OF ASSETS

There are several possible approaches for asset evaluation, among which:

Depreciated Historical Cost (DHC): Valuates installed assets by its acquisition cost, updating it with market price indexes. Compensation is calculated from the corrected asset value and individual depreciation rates for each type of goods.

Depreciated Optimized Historical Cost (DOHC): Uses the same approach as the DHC method, and also includes valuation of prudent investments, represented by a factor considering the equipment's ability to attend to current and future demands.

Depreciated Reposition Cost (DRC): Valuates assets based on market prices for products on the same level of functionality. The same average depreciation rates are used. This method requires a reference price database for each type of goods.

Depreciated Optimized Replacement Cost (DORC): Uses the same approach as the DRC method, and includes valuation of prudent investments. This is the method chosen by ANEEL to be applied in the Brazilian electrical sector.

Another important variable is the price to be used to evaluate the utility's assets. Two approaches are possible:

Market price: Represents the lowest price among Brazilian electricity distributors for that type of goods. Reflects the "efficient" price of assets.
Average price: Valuates assets based on average prices practiced by all distributors, both efficient and inefficient.

ANEEL uses the second alternative, meaning that distributors may acquire goods below average prices and obtain an operational gain. This method encourages distributors to improve efficiency in acquisition of goods, rewards more effective companies and penalizes ineffective ones.
The compensation is determined through three simple steps, which result in the following values:

a) **New Replacement Value (NRV):** References the value of the new goods, identical or similar to the one in the asset database, obtained with the reference price tables. The final NRV is obtained with the following formula:

$$\mathbf{NRV = ME + COM + AC + IWP}$$

ME: Main equipment value
COM:For each main equipment, there are costs associated to its minor components, determined in percentage of ME.
AC: Additional costs associated to engineering services, auxiliary works, supervision, administration, and others.
IWP: Interest on work in progress, applied to the total value

b) **Used Market Value (UMV):** Value of settled goods, taking its current condition in consideration. It is obtained applying the cumulative asset depreciation (CAD) up to the desired date, using average regulatory depreciation rates, to the NVR.

$$\mathbf{UVM = NRV*(1 - CAD)}$$

c) **Remuneration Base Value (RBV):** Defined applying the concept of prudent investments to the UMV. This concept is translated as the Use Index (UI), which compensates the investment according to its capability factor projected in a 10-year period. It is also known as the net Remuneration Base - RB_{net}.

$$\mathbf{RBV = UMV*UI}$$

Another important variable is the gross RB, which considers the Use Index applied to the NRV, disregarding depreciation.

$$\mathbf{RB_{gross} = NRV*UI}$$

Cost of capital is equal to the sum of capital compensation and depreciation. Investment Remuneration (IR) is equal to the product of the compensation rates (WACC) and the net RB. Depreciation Quota (DQ), is equal to the product of the average depreciation rates (DEP) and the gross RB (RBR_{gross}).

$$\mathbf{IR = RB_{net}*WACC}$$
$$\mathbf{DQ = RB_{gross}*(DEP)}$$

The sum of these two factors, IR and DQ, plus the regulatory operational costs, represents the manageable costs portion of the energy prices.
In the first cycle of periodic tariff review (1PTR), a complete evaluation of asset bases of all distributors was made. In subsequent cycles, ANEEL chose not to completely revise this data, therefore settling the value from the 1TPR. Assets in this database would be updated only using price and depreciation indexes. Assets added or removed after the 1TPR would be evaluated using the methodology described in this article, plus an Incremental Base.
ANEEL wishes to create a database with reference prices to be applied to all distribution companies in the country, but hardships in obtaining the data and implementing the database delayed the project at the very least to the next revisions cycle.

TECHNICAL ANALYSIS METHODOLOGY

This project's central point is the evaluation of alternative investments to satisfy certain technical criteria, in order to find the ones that benefit the company the most from a technical and regulatory point of view. Figure 1 illustrates the evaluation process fluxogram.

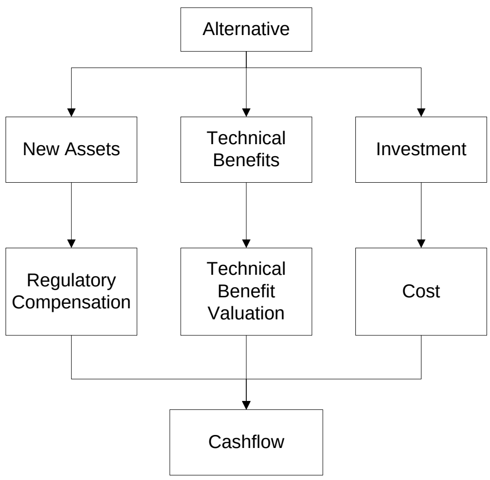

Figure 1 Fluxogram for evaluating alternatives

All phases in the project – technical and financial analyses, investment budgeting – are done separately in the network computer simulation tool SINAPGrid.
This tool uses power flow calculations and electric network simulations to evaluate technical parameters. Power flow

analysis details energy losses and voltage in bars, while simulations determine the network's reliability.
In the SINAPGrid's planning module, several alternatives may be studied, conforming to one or more technical criteria. Each proposed alternative is defined as a set of works and improvements, registered by the used. Those that meet the criteria are ranked in their economic performance.

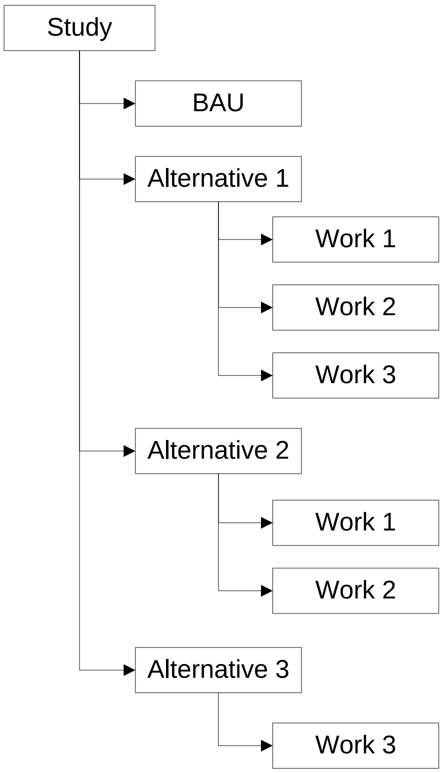

Figura 2. Study Hierarchy

Technical losses

The SINAPGrid technical losses calculation module does an in-depth analysis of this parameter, considering both losses in network stretches and in equipments such as meters.
The calculations are bound to considerations on the consumer market for electricity. Projections for this market must be inserted for each year until the planning horizon, which allows the power flow calculation to determine yearly energy losses until the planning horizon.

Reliability (ENS-Network)

From the network configuration and market information, SINAPGrid calculates continuity indicators SAIDI, SAIFI and the Energy Not Supplied (ENS), which is a component of the total cash flow considered in investment decision-making.

Reliability (ENS-Substation)

Another parameter used in the analysis of alternatives is the ENS-Substation, which translates the risk of not meeting the necessary load and reducing equipment lifecycle into monetary values to be inserted in the cash flow evaluation. The ENS-Substation is determined after a simulation of events in substation transformers, considering expected load growth and using statistical analysis

Voltage level

Yet another important variable is the electric voltage level in the bars, to be translated in adequately valued market variations (kWh); and finally to result in financial values to be added to the decision-making cash flow. Bar voltage information is supplied by SINAPGrid, as shown in Figure 3.

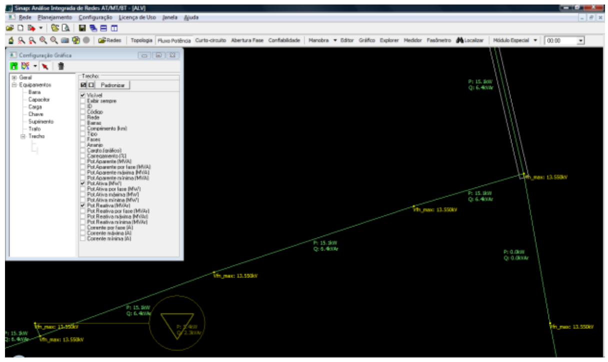

Figure 3. SINAP GRID screenshot displaying bar voltage values

ECONOMICAL EVALUATION METHOD

Each investment alternative, composed by a set of works, is to be analyzed with parameters described previously. Regulatory revenue for the utility's existing assets is also to be considered for each alternative. The set of criteria used is evaluated with calculation of the alternative´s cash flow, as observed in Figure 4.

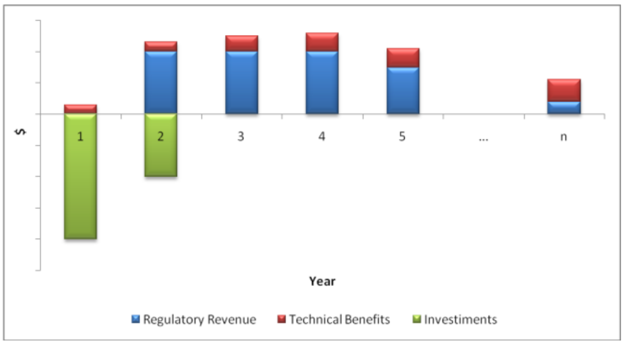

Figure 4. Yearly expected cash flow and components

This cash flow is determined for each year in each revision cycle: 4 cycles have been analyzes, for a total 16 years. Alternatives are compared determining the Internal Return Rate for each of them: the best proposed investment is the one with the best return rate.

CONCLUSION

The tool and the methods developed proved to be efficient and consistent with the electricity distributors' needs. It has been observed that the financial analysis of the investments is incomplete if returns obtained through compensation of the utilities are not taken in consideration, which attests the applicability of this project.
SINAPGrid is currently being used for planning at AES Eletropaulo, an energy distribution utility who serves more than 5,8 million customers in the greatest city of the country.

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