

Improvement of Surveillance Process Applied to Continuity Indicators of the Energy Distributors

Thiago Pedroso, Thales Sousa

Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas, CEP: 09210-580, Santo André/SP, Brazil

Email: thales.sousa@ufabc.edu.br

Abstract— *The National Electric Energy Agency (ANEEL), created in 1996, is responsible for regulating and supervising the Brazilian electricity sector. In case of non-compliance with the current regulation, the ANEEL initiates the instruction of the punitive process and may apply a punishment to the regulated agent. In this context, to improve the current regulation, an additional form of penalty is proposed, which takes into account the amount of sanctions applied to continuity indicator inspections in the last four years when defining the new limits of continuity indicators. In this way, the distributors with the highest number of penalties will have their limits reduced, that is, they will be more penalized. To analyze the improvement proposed the electrical assemblies belonging to the concession area of a small distributor was considered.*

Keywords— *Electricity distribution, Surveillance, Continuity indicators, Regulatory agency.*

I. INTRODUCTION

In 1996 the federal government created the National Electric Energy Agency (ANEEL) with the purpose of regulating and supervising the Brazilian Electricity Sector [1].

In this sense, since the characteristics of the Brazilian states are heterogeneous, it became necessary to create state agencies to expand ANEEL's activities, and they act according to local particularities, based on the observation of integrated state policies and performance of distributors [2]. For an efficient process of supervision and regulation of the electric sector, the state agencies depend on the financial independence, the autonomy, the technical capacity and the State participation [3].

In addition, in order for electricity distribution services to be adequately provided, the supervision carried out by the Agency verifies compliance with the concession contract and the legislation in force by the respective concessionaire, observing the evolution of safety, regularity and continuity standards, which translate the quality of the customer service.

Among the items inspected by regulatory agencies and object of this article will be considered the "Individual

and Collective Continuity Indicators". From the inspection process, when the agent (distributor) does not follow the current regulation, it may be penalized. On the other hand, this penalty does not always result in the improvement of the continuity indicator.

In this way, it is proposed to improve the current regulation, which takes into account the amount of sanctions applied in the inspections of indicators of continuity in the last four years, at the time of defining the new limits of the indicators of continuity. In this way, distributors with a higher number of sanctions will have their limits reduced.

II. BRAZILIAN ELECTRICITY SECTOR SURVEILLANCE

According to Law 8,987, 1995, the inspection of the service may be done through a technical body of the Granting Authority or by an entity with which it has been contracted, and periodically, as provided for in a regulatory standard, by a commission composed of representatives of the Granting Authority, the concessionaire and the consumers.

Therefore the ANEEL functions are related to the regulation and supervision of the provision of electricity generation, transmission and distribution services and the State Regulatory Agencies have been delegated a regulatory action regarding the provision of electricity distribution services [4].

In a first stage, the federal and state agencies aim to educate and guide the agents of the electricity sector regarding compliance with the legislation in force and the concession contracts. In a second stage, the inspection action, in accordance with the regulatory norms and the respective concession agreements and authorizing acts, may result in penalties for agents of the electric sector, as provided in Article 2 of ANEEL Normative Resolution no. 63/2004. This act also provides for the cumulativeness, aggravation or mitigation of these penalties [5].

Among these actions is the inspection of electric energy services, whose purpose is to verify the compliance of the obligations established to the agents in

the acts of grants and in regulatory devices, to ensure that the customer service is given in standards of quality, time and security, compatible with the requirements appropriate to the purpose of the services [6].

III. STAGES OF SUPERVISION OF DISTRIBUTION SERVICES

In a context of Responsive Regulation, ANEEL is based on a strategic vision seeking to graduate surveillance actions with a focus on prevention using Analytical Intelligence to verify and validate the data.

According to ANEEL [7], the Inspection of Electricity Services is composed of four stages (Monitoring, Analysis, Monitoring and Supervisory Actions).

Failures are identified in the Monitoring, Analysis and Monitoring stages and if they are not corrected, the notification and monitoring step will start and may result in an eventual punishment [7].

The inspection process within a regulatory agency is presented in the flowchart illustrated by Fig. 1. In the control process, no deadlines are set for each stage, thus being at the discretion of the regulatory agency [8].

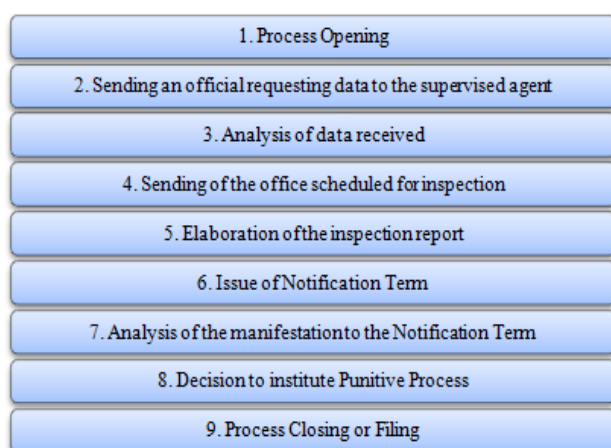


Fig.1: Steps of the inspection process within a regulatory agency. Source: Authors.

IV. TYPES OF SURVEILLANCE

ANEEL together with the State Agencies inspect the following topics in the electricity distribution sector: Technical, Commercial, Low Income, Assets, Universalization, Teleservice, Voltage Level and supervision of continuity indicators [9].

The inspection of the Continuity Indicators aims to determine the continuity of the electric power supply to the consumer units in their aspects of duration and frequency, and can be defined as [10]:

- Collective Indicators: calculated by grouping consumer units served by a distribution substation as shown in Table 1. In this case, the indicators are monitored and are not subject to penalties.

Table.1: Collective Indicators.

DEC - Equivalent Duration of Interruption per Consumer Unit measured in hours
FEC - Equivalent Frequency of Interruptions per Consumer Unit, which measures the number of times of power outages

- Individual Indicators: calculated for each consumer unit, as shown in Table 2. In this case, the determination of the penalty is automatic and the compensation resulting from the transgression is directly reimbursed in the electric energy bill.

Table.2: Individual Indicators.

DIC - Duration of Individual Interruption per Consuming Unit, or by point of connection, expressed in hours and hundredths of hours
FIC - Frequency of Individual Interruption per Consumer Unit, or per connection point, expressed in number of interruptions
DMIC - Maximum Continuous Individual Interruption Duration per Consuming Unit, or per connection point, expressed in hours and hundredths of hours
DICRI - Duration of Individual Interruption occurring on a Critical Day by Consumer Unit, or by point of connection, expressed in hours and hundredths of hours

According to the Electricity Distribution Procedure in the National Electrical System - PRODIST, Module 8, Section 8.2, revision 9, to establish the limits of the continuity indicators, the distributors must send to ANEEL their BDGD (Data Base Geographic Information System) as established in Module 6 (Required Information and Obligations), from which the physical and electrical attributes of its consumer units will be extracted [11].

V. PUNITIVE ADMINISTRATIVE PROCESS

After the inspection process has been completed, if there is evidence of non-compliance, a punitive administrative proceeding is initiated. According to Moreira Pinto [12], "The fine is the main instrument that the State uses to punish and, above all, to prevent new anti-competitive conduct."

The Normative Resolution of ANEEL no. 63/2004 approves procedures to regulate the imposition of penalties on concessionaires, permit holders, authorized agents and other agents of electric power installations and services, as well as on entities responsible for operating the system, for the sale of electric energy and for the management of resources from sectoral charges. According to art. 2 of the Normative Resolution of

ANEEL no. 63/2004, electric sector agents are subject to the following penalties [13]:

- I. Advertence;
- II. Fine;
- III. Construction interruption;
- IV. Installation Interdict;
- V. Temporary suspension of participation in bids to obtain new concessions, permits or authorizations, as well as being prevented from contracting with ANEEL and receiving authorization for electric energy services and installations;
- VI. Authorization revocation;
- VII. Administrative intervention;
- VIII. Expiry of the concession or permission.

In the event of the occurrence of more than one infraction, the penalties corresponding to each will be applied simultaneously and cumulatively [13].

VI THE APPLICATION OF REN N° 63/2004 IN THE DOSIMETRY OF FINES

ANEEL has sought to establish clear parameters for the application of Resolution No. 63/2004. In this sense, Technical Note No. 39/2010-SFE / ANEEL defined Equation (1) to calculate the amount of fines [13].

$$M=(0,5*G+0,2*D+0,2*V+0,1*S)*A*MaxGrupo*r*Fat \quad (1)$$

Where,

M: fine, in *reais* (R\$);

G: Severity (%);

D: Damages to the consumer services (%);

V: Advantages to the Distributor resulted from the infraction (%);

S: Sanctions in the last 4 years (%);

A: Scope (%);

r: reincidence ($r = 1$ ou $r = 1,5$);

MaxGrupo: maximum value of the respective group (%);

Fat: company revenues in the last 12 months, in *reais* (R\$).

Regarding the parameter "reincidence" (r), ANEEL followed the one described in REN 63/2004. The "scope" (A) is used by the audit agencies to establish the relationship between the quantity of non-conforming items of the inspection sample and the total quantity of items in that sample. The definition of the parameters "severity", "damages" and "advantages" is done case by case subjectively, according to Technical Note 39/2010 [13].

VII PROPOSED ADJUSTMENT

As previously mentioned, ANEEL is responsible for defining the limits of the indicators of continuity of the Brazilian distributors and uses some criteria to obtain and

inspect them. However, the oversight and sanctions currently considered are not achieving the desired outcome with regard to the improvement of continuity indicators [14].

In this sense, in order to present a constant improvement in the continuity indicators, an adjustment is proposed in the process of applying the sanctions used by the regulatory / supervisory body.

In this way, it is proposed that each new process of defining the limits of the DEC and FEC continuity indicators be taken into account the total number of administrative sanctions related to the topic applied in the last 4 years. Thus, the total of sanctions applied will directly impact on the percentage reduction of the values of said indicators, as proposed in Table 3.

Table.3: Percentage of Reduction in the Limit of Continuity Indicator.

Amount of sanctions in the last 4 years	1	2	3	4 or more
Indicator reduction percentage	5%	10%	20 %	30%

The values proposed in Table III were defined based on the evaluation of the percentage of reduction in the final result of the continuity indicator, always seeking harmony between the regulatory body and the regulated agent. The Fig. 2 illustrates the steps of proposed adjustment.

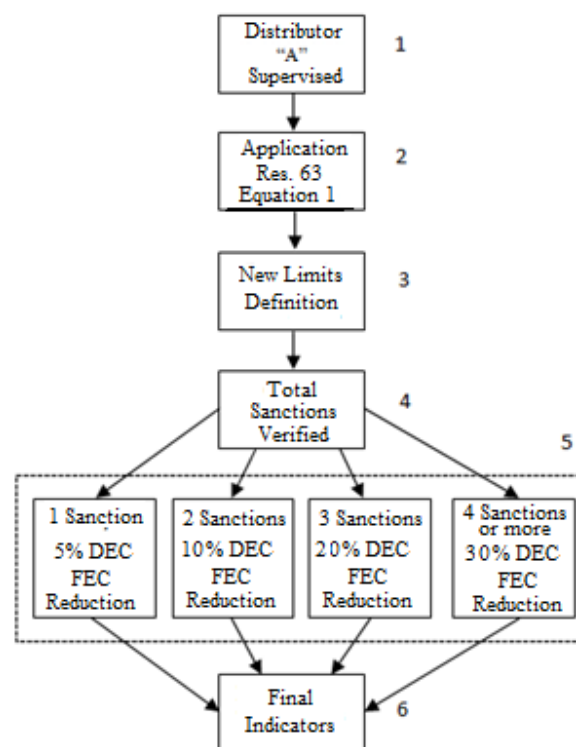


Fig. 2: Diagram of the adjustment proposal for the inspection process. Source: Authors.

VIII. RESULTS

To exemplify the proposed methodology, a small distributor that has only two electrical assemblies was considered. In this way, Table 4 illustrates the limits of DEC and FEC defined by ANEEL in the period from 2009 to 2012 to this distributor.

For the period from 2009 to 2012, it was considered that the distributor was inspected only once, in 2010, and it was penalized. In this sense, applying the proposed criterion, the distributor will have a 5% reduction in the new values of the DEC and FEC limits of their consumer unit sets.

Table.4: DEC and FEC limits defined by ANEEL to the surveillance period.

GROU PS	DEC (hours)				FEC (number of interruptions)			
	20 09	20 10	20 11	201 2	20 09	20 10	20 11	20 12
Group 1	13	12	12	11	14	13	12	11
Group 2	16	15	14	13	17	16	15	14

The Table 5 presents the new values of DEC and FEC calculated by ANEEL to the next period (2013 a 2016) without the proposed adjustment.

Table.5: DEC and FEC limits defined by ANEEL to the next period without consider the application of proposed adjustment.

GROU PS	DEC (hours)				FEC (number of interruptions)			
	201 3	201 4	201 5	201 6	201 3	201 4	201 5	201 6
Group 1	11	10	10	9	11	11	10	9
Group 2	13	12	12	11	14	13	12	11

The Table 6 presents the new values of DEC and FEC calculated by ANEEL to the next period (2013 a 2016) considering the proposed adjustment.

Table.6: DEC and FEC limits defined by ANEEL to the next period considering the application of proposed adjustment.

GROU PS	DEC (hours)				FEC (number of interruptions)			
	201 3	201 4	201 5	201 6	201 3	201 4	201 5	201 6
Group 1	10. 5	9.5	9.5	8.6	10. 5	10. 5	9.5	8.6
Group 2	12. 4	11. 4	11. 4	10. 5	13. 3	12. 4	11. 4	10. 5

The test carried out showed that the proposed methodology resulted in the reduction of continuity indicators. This was expected and fundamental to improve the quality of the electricity distribution system.

The reduction of the limits of the indicators of continuity in the set of consumer units is negative to the distributor since it becomes more difficult to meet the goal stipulated by the regulator.

It should be noted that audited distributors that do not present non-conformities will not be punished and consequently will not suffer a reduction in the limits of their consumer units. In this way, the regulated agent is expected to seek continuous improvement and full compliance with the current regulation.

IX. CONCLUSIONS

ANEEL is responsible for regulating and supervising the Brazilian electricity sector. To meet the different characteristics of the Brazilian states, ANEEL decentralized the activities of inspection of the distribution to state agencies. In this sense, the Normative Resolution of ANEEL no. 63/2004 approved the procedures to regulate the imposition of penalties to the distributors, having as main penalties applied the warnings and the fines.

Even with constant monitoring, the indicators of continuity have not presented the expected improvement, showing the need for evolution in the process of applying the sanctions employed by the regulatory agency.

Thus, in order to improve existing regulations, an improvement was made to the current regulations, which take into account the amount of sanctions applied in the monitoring of continuity indicators in the last four years, at the moment of defining the new limits of continuity indicators for consumer units. In this case, distributors with a higher number of sanctions will have their limits reduced, that is, they will be more penalized.

It was analyzed the concession of a small distributor and after the application of the penalty, a reduction in the limits of the continuity indicators, DEC and FEC, of the consumer units was observed.

In this sense, by reducing the limits of continuity indicators, it is expected that the regulated agent will make the necessary efforts to comply with the current regulations.

X. ACKNOWLEDGEMENTS

The authors gratefully acknowledge Federal University of ABC and Sao Paulo State Sanitation and Energy Regulatory Agency (ARSESP) for supporting the work.

REFERENCES

- [1] E. L. Ramalho (2003), “Abrangência e Eficácia da Descentralização das Atividades De Regulação e Fiscalização no Setor de Energia Elétrica: Estudo de Caso CSPE”. Tese (Doutorado). Faculdade de Engenharia Mecânica da Universidade Estadual de Campinas, Campinas (in portuguese).
- [2] A. S. Aragão (2002), “Agências Reguladoras e a Evolução do Direito Administrativo Econômico”. Rio de Janeiro: Forense (in portuguese).
- [3] M. M. Santos (2014), “Regulação Descentralizada - Um Estudo à Luz dos Setores de Energia e Gás Natural”. Dissertação (Mestrado). Faculdade de Direito da Universidade de São Paulo, São Paulo (in portuguese).
- [4] BRASIL. Lei nº 8987, de 13 de fevereiro de 1995. Presidência da República - Casa Civil - Subchefia para Assuntos Jurídicos, Artigos 1 - 47. Legislação Federal, 1995. Available: http://www.planalto.gov.br/ccivil_03/Leis/L8987compilada.htm. [Accessed: 15/11/ 2018] (in portuguese).
- [5] BRASIL. Lei nº 9427, de 26 de dezembro de 1996. Presidência da República - Casa Civil - Subchefia para Assuntos Jurídicos, Artigos 1 - 35. Legislação Federal, 1996. Available: http://www.planalto.gov.br/ccivil_03/leis/19427cons.htm. [Accessed: 15/11/ 2018] (in portuguese).
- [6] ANEEL. “Manual de Fiscalização”. Brasília - DF, 2004. Available: http://www2.aneel.gov.br/arquivos/PDF/Manual_de_Fiscaliza%C3%A7%C3%A3o_SFG.pdf. [Accessed: 12/11/ 2018] (in portuguese).
- [7] ANEEL. “Fiscalização do Serviço Público de Energia Elétrica”. Available: <http://www.aneel.gov.br/fiscalizacao-do-setor-eletrico>. [Accessed: 12/11/ 2018] (in portuguese).
- [8] ANEEL. Agência Nacional de Energia Elétrica. “Entenda a Fiscalização da Distribuição”. Available: http://www.aneel.gov.br/fiscalizacao-da-distribuicao-conteudos/-/asset_publisher/. [Accessed: 10/11/ 2018] (in portuguese).
- [9] ANEEL. “Procedimento de Fiscalização da Apuração dos Indicadores da Qualidade do Serviço”. 105p. Brasília, 2014. Available: <http://www.aneel.gov.br/documents/656808/15076882/Procedimento+de+Fiscaliza%C3%A7%C3%A3o+da+Apura%C3%A7%C3%A3o+rv1+20-6-014.pdf/b830a522-a64e-41a0-8d60-73ff0451fb4e?version=1.0>. [Accessed: 10/11/2018] (in portuguese).
- [10] ANEEL. “Controle das Fiscalizações - Sistema de Gestão de Fiscalização”. Available: <https://sigefis.aneel.gov.br/>. [Accessed: 20/03/2018] (in portuguese).
- [11] ANEEL. “Procedimentos de Distribuição de Energia Elétrica no Sistema Elétrico Nacional. Módulo 8 - Qualidade da Energia Elétrica”. Available: http://www.aneel.gov.br/documents/656827/14866914/M%C3%B3dulo8_Revis%C3%A3o_9_LIMPO.pdf/d689590a-231d-b8ad-b354-bd6e0a4cd401. [Accessed: 20/03/2018] (in portuguese).
- [12] G. M. Pinto (2010), “A Dosimetria das Multas Impostas em Resposta às Infrações Contra a Ordem Econômica: Uma Análise da Lei de Defesa da Concorrência e de Sua Aplicação pelo CADE”. Monografia de Graduação, Universidade de São Paulo, São Paulo (in portuguese).
- [13] ANEEL. “Resolução Nº 63 de 12 de maio de 2004. Artigos 1-41”. Resolução Federal, 2004. Available: http://www.aneel.gov.br/documents/655816/14689417/Resolu%C3%A7%C3%A3o+Normativa+Aneel+63+2004_ren2004063.pdf/b202aa21-a235-4d02-9b1d-1d1547cdec37. [Accessed: 20/03/201 8] (in portuguese).
- [14] ARSESP. “Relatório Anual da ARSESP”. Available: <http://www.arsesp.sp.gov.br/SitePages/relatorio-anual-arsesp.aspx>. [Accessed: 20/03/2018] (in portuguese).