Assessment of regulatory models for the implementation of intelligent metering systems in the Brazilian distribution system

Regulatory Impact Analysis – RIA nº 1/2025-STD-SFF-STR/ANEEL

Superintendency of Regulation of Electricity Transmission and Distribution Services – STD

Superintendency of Tariff Management and Economic Regulation - STR

Superintendence of Economic, Financial and Market Inspection - SFF

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Summary

Executive Summary

The activity "TRV23-07 - Assessment of measurement systems for energy transition and modernization in the distribution segment" is included in ANEEL's Regulatory Agenda. Briefly, the objective of the activity is to answer two questions: (i) whether there is a need for regulatory intervention by ANEEL regarding the issue of implementing smart metering within the scope of distribution; and (ii) if so, what is the most appropriate form for this intervention.

To answer such questions, this Regulatory Impact Analysis – RIA was prepared by ANEEL, which takes as a reference the study "Evaluation of regulatory models for the implementation of intelligent metering systems in the Brazilian distribution system", produced within the scope of a technical cooperation agreement between ANEEL and the Deutsche Gesellschaft für Internationale Zusammenarbeit – GIZ.

The regulatory problem identified was the existence of possible regulatory barriers to the implementation of smart metering systems in the context of energy transition in Brazil and the specific objectives of the regulatory intervention were established as:

• Improve efficiency in the provision of electricity distribution services;

• Increase consumer awareness and optimize the country's electrical energy resources;

• Empower the consumer;

• Improve the management and dissemination of Distributed Energy Resources – REDs;

• Improve the levels of quality and speed in the transfer of collected information; and

• Implement new regulations with the lowest possible tariff impact and risk for the end consumer.

Three regulatory alternatives were defined, which represent different levels of intervention by the regulator. Briefly, they are:

• Alternative 0: maintenance of the current scenario;

• Alternative 2': prior preparation of a cost-benefit analysis – CBA and a subsequent smart metering implementation plan in case of positive CBA on a discretionary basis by the distributors; and

• Alternative 4': prior preparation of an CBA and a subsequent smart metering implementation plan in the case of a positive CBA on a compulsory basis by the distributors.

In alternatives A2' and A4', minimum functionalities of smart meters are also defined and the digital invoice becomes the standard for consumer units that receive these meters, with the consumer being able to request a return to the physical invoice printing and delivery model.

Regulatory alternatives were compared based on criteria associated with the RIA objectives. The comparative methodology used cost-benefit analysis when the application of the criterion could be done in a quantitative and monetizable way and the Analytic Hierarchy Process – AHP method when the analysis of a criterion could not be quantified (Saaty & Katz, 1990)

After the comparative evaluation, Alternative 4' was recommended as the most appropriate for resolving the regulatory problem by achieving the established objectives. The implementation of this alternative implies the definition of some regulatory topics, such as: minimum functionalities for the smart meter; criteria for preparing CBA by distributors; and criteria for formulating the smart metering implementation plan.

1. Introduction

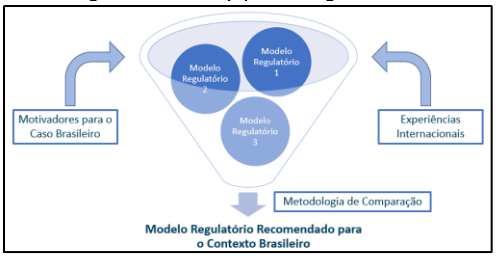
1. As a result of the investigations that took place within the scope of Public Consulation– TS nº 11/2021, whose objective was to discuss proposals for regulatory models for the insertion of Distributed Energy Resources – RED, it was discovered that it was relevant to investigate which function should be performed by the regulator in the process of implementing smart metering systems in the distribution segment. In this context, the activity "TRV23-07 - Assessment of measurement systems for energy transition and modernization in the distribution segment" was included in ANEEL's Regulatory Agenda " (ANEEL, 2024b).

2. In general terms, the objective of this activity is to answer two questions: (i) is there a need for regulatory intervention by ANEEL regarding the issue of implementing smart metering within the scope of distribution? and (ii) if so, what is the most appropriate form for this intervention? To answer these questions, it was decided that a Regulatory Impact Analysis – RIA would be carred out by ANEEL.

3. With the aim of providing subsidies for the preparation of the aforementioned RIA, within the scope of the technical cooperation agreement it has with ANEEL, Deutsche Gesellschaft für Internationale Zusammenarbeit – GIZ was contracted to prepare the study "Evaluation of regulatory models for the implementation of intelligent metering systems in the Brazilian distribution system" (PSR Energy; SIGLASUL, 2023, 2024a, 2024b).

4. In the initial planning, the Superintendency for the Regulation of Electric Energy Transmission and Distribution Services – STD located that the study would be developed along the lines summarized in Figure 1. In summary, considering the motivators for the Brazilian case and based on relevant international experiences, regulatory intervention models were created for the implementation of smart meters in the distribution system. These regulatory approaches were compared using a specific methodology and, in the end, a regulatory approach recommended for the Brazilian context would be specifically.

Figure 1– Study planning scheme



Source: Own preparation.

5. The study was carried out between April 2023 and May 2024 and was divided into three stages:

1. Preliminary Mapping: phase in which the main drivers for Brazil were identified that justified the debate on the regulator's intervention on the issue of implementing smart meters in the distribution segment; regulatory approaches adopted in several jurisdictions to address this topic were mapped; and a set of approaches was selected that would serve as a basis for the construction of regulatory alternatives to be analyzed in Stage 2 (PSR Energy; SIGLASUL, 2024a);

2. Comparison of Alternatives and Selection of the Recommended Alternative: stage in which regulatory alternatives were developed based on the preliminary mappings carried out in Stage 1; the methodology for comparing alternatives was defined and used to produce, in the end, a regulatory approach recommendation for the Brazilian case (PSR Energy; SIGLASUL, 2023); e

3. Description of the Recommended Alternative: final phase in which the ways of implementing and monitoring the alternative recommended in Stage 2 were described, including the survey of regulatory changes necessary for its implementation (PSR Energy; SIGLASUL, 2023).

6. Throughout the study, an executive summary and three reports were produced by the executing consultancies, one relating to each stage. The development of the study was monitored by ANEEL's technical areas through periodic meetings in which the progress of activities was monitored and technical issues relating to the development of the study were discussed. Under the coordination of STD, the Superintendency of Economic, Financial and Market Inspection – SFF monitored the project; the Superintendency of Tariff Management and Economic Regulation – STR; and the Superintendence for Regulation

of Generation Services and the Electricity Market – SGM; and the current Superintendency of Innovation and Energy Transition – STE.

7. However, it is important to clarify that the information, opinions and recommendations contained in the three reports are those provided by the executing consultancies, which were responsible for preparing the contracted study. Thus, in line with the initial objective mentioned above, the study was configured as a source of subsidies to be considered by ANEEL for the development of its regulatory activity, a source that contains information and recommendations that are the responsibility of those carrying out the study.

8. In view of the exposed context, it is important to highlight that the analysis contained in this report is configured as an RIA prepared by ANEEL that aims to update, improve and review some aspects of the RIA initially prepared by the consultancies carrying out the study. Therefore, it is also worth clarifying that at various points in this report only summaries of certain RIA topics may be presented and references may be made to the initial study of the consultancies, in which details of the aforementioned topics can be found.

2. Public Consulation

9. To prepare this RIA, ANEEL carried out several public participation actions. Initially, ANEEL carried out Public Consulation (TS) nº 13/2024 in the period from 15/08/2024 to 12/11/2024, aiming to receive considerations and contributions to improve the study “Evaluation of regulatory models for the implementation of intelligent metering systems in the Brazilian distribution system” within the scope of the activity “TRV23-07 - Assessment of metering systems for energy transition and modernization in the distribution segment”, part of the Regulatory Agenda 2024-2025 from ANEEL.

10. In this TS, the following documents were made available: TECHNICAL NOTE nº67/2024 – STD-SFF-STR-STE-SGM/ANEEL (ANEEL, 2024a); Product 1 - Preliminary Mappings and Selection of Alternatives for Comparison; Product 2 - Comparison and Definition of Alternatives; Product 3 - Description of the Recommended Alternative; Calculation Memory Worksheet.

11. ANEEL then held meetings with consumer representatives, agents in the electrical sector and manufacturers of electricity meters, in order to hear the position of important actors on the topic and to hear the experiences of companies that have advanced with the installation of smart meters in Brazil, even with the current regulation, as shown in Table 1.

Table 1 – Technical meetings held by STD/ANEEL.

Institution	Office	Data	Time
Cemig	260/2025	12/06/2025	15 h - 17 h
CPFL Energia	252/2025	16/06/2025	15 h - 17 h
Enel SP	436/2025	03/09/2025	10 h - 12 h
CONACEN	467/2025	24/09/2025	15 h - 17 h
Copel	482/2025	02/10/2025	15 h - 17 h
Abinee	490/2025	03/10/2025	15 h - 17 h
Landis+Gyr	497/2025	06/10/2025	15 h - 17 h
Equatorial Pará	489/2025	07/10/2025	15 h - 17 h

Fonte: Autoria própria.

12. Furthermore, ANEEL prepared and sent a form to the above distributors, through Forms MS, requesting more up-to-date information on various aspects of the distributor's concession area, such as: number of smart meters - MI installed until 2024 and projected for 2037, by type; MI acquisition and implementation costs; cost of uninstalling conventional meters; communication and software costs; characteristics of installed meters and others.

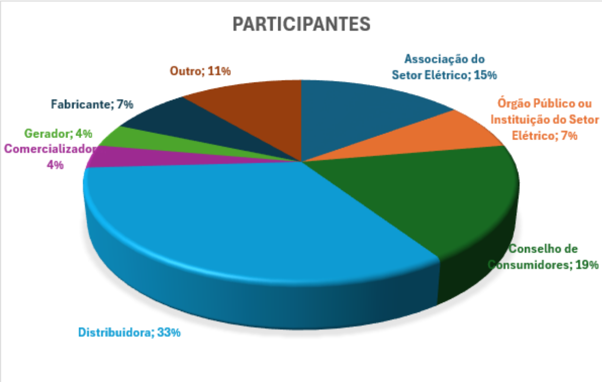
13. This information was used in the calculations that will be presented in the new Cost and Benefit Analysis – CBA, and it will be presented later (ANEEL, 2025).

2.1 Public Consulation nº 9/2024 in numbers

14. TS nº 13/2024 was carried out from 08/15/2024 to 11/12/2024, where 55 questions were presented. This TS received a total of 372 responses, from a total of 27 participants.

15. Figure 2 illustrates the profile of the participants, who represent important sectors of the energy market and other segments of society.

Figure 2 – Distribution of participants of TS nº 13/2024.



Source: Own preparation.

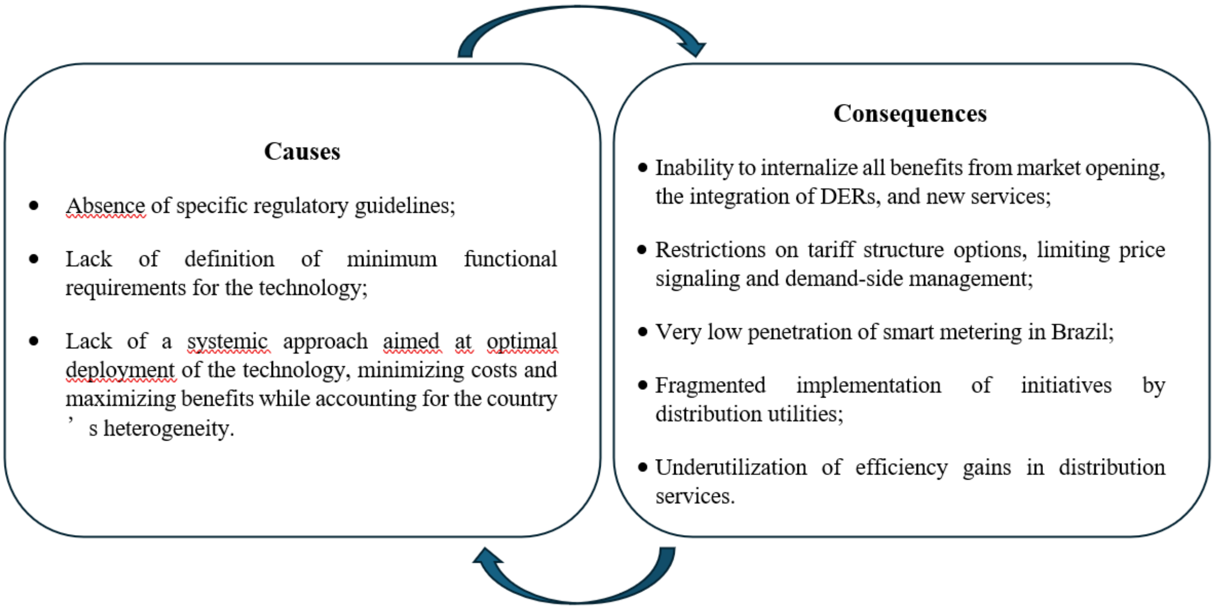
16. From the analysis of the graph above, it can be seen that the 3 segments that contributed most to TS were: distributors, with 33%; consumer councils, with 19%; and electrical sector associations, with 15%; these respondents represented 67% of the total respondents. Also contributing: public bodies or public institutions, meter manufacturers and others.

3. Regulatory Problem

17. According to the study by Consultancies (PSR Energy; SIGLASUL, 2024b), the regulatory problem to be faced by the electricity sector refers to regulatory barriers to the implementation of smart metering systems in the context of energy transition in Brazil.

18. In summary, the Figure 3 presents the diagram of the Regulatory problem, relating it to its causes and consequences.

Figure 3 - Regulatory problem diagram: root causes and consequences.



Source: Report 2 - Comparison of alternatives and definition of the recommended alternative (PSR Energy; SIGLASUL, 2024b).

19. After analyzing the contributions from TS nº 13/2024, it is clear that participants demonstrated general agreement with the definition of the problem as regulatory barriers to the implementation of smart metering, but suggested specific improvements depending on the type of agent:

20. The distributors recognize that the regulatory problem was correctly identified, especially with regard to barriers to the massive implementation of smart metering. The main causes are the lack of specific guidelines, the CAPEX remuneration model based on long tariff cycles and the lack of economic incentives compatible with the reduced useful life of smart meters. The consequences highlighted include low investment attractiveness, risk of project discontinuity and loss of operational efficiency.

21. The ONS reinforces that the regulatory problem was well outlined, but suggests that the issue of the operation of the National Interconnected System (SIN) be explicitly incorporated as a regulatory motivator. The absence of smart metering limits the observability and controllability of Distributed Energy Resources (REDs), negatively impacting system planning and operation.

22. Abraceel assesses that the regulatory problem was well identified, especially with regard to the need to guarantee equality in access to technology. The association defends the adoption of a determinative regulatory model (Alternative 4), with mandatory installation of meters in areas with positive CBA, to prevent only consumers from voluntary distributors from benefiting.

23. ABINEE considers that the regulatory problem has been well defined, but points out that the cost-benefit analysis needs to be improved to better reflect the technical and economic challenges faced by manufacturers. It highlights that the costs of meter components do not tend to fall and that additional regulatory requirements may neutralize economies of scale.

24. The Consumer Councils recognize that the regulatory problem has been correctly identified, especially with regard to the need for guidelines for the implementation of smart metering systems. However, all councils emphasize that the study needs to be improved in terms of assessing tariff impacts and the distribution of costs and benefits between consumers and distributors. There is a recurring concern that the costs of replacing meters are fully passed on to consumers, while the benefits — such as reduced losses and defaults — are concentrated on the distributors. This asymmetry is seen as unfair and potentially harmful to the acceptance of the measure.

25. The points presented regarding the regulatory problem will be considered later, in accordance with the new criteria and alternatives that ANEEL will consider to improve the work in progress.

26. Furthermore, on June 18, 2025, Mistérios das Minas e Energia – MME published Ordinance MME nº 111/2025 (MME, 2025) updated through Ordinance nº 126/2026 – MME (MME, 2026). This Ordinance establishes general guidelines to encourage the gradual digitalization of low-voltage electrical energy distribution networks and services.

27. Still in accordance with this Ordinance, digitalization will aim to promote benefits to electricity consumers, highlighting: innovation, new services, opening the market for low voltage, data transparency, reducing losses and defaults, improving communication between concessionaires and consumers, reasonable tariffs, energy efficiency, network resilience, energy transition, reduction of demand peaks, security, consumer awareness and mechanisms for measuring the performance of concession contracts.

28. Furthermore, this Ordinance established the principles of digitalization: such as isonomic and non-discriminatory management of access to services, transparency in communication and information about interruptions, compliance with technical and safety standards, agility in resolving consumer demands, reasonable tariffs, modernization of the distribution segment and guarantee of control and monitoring mechanisms for the quality and continuity of services.

29. Moreover, the Normative Ordinance No. 111/2025-, MME, defined in the caput of Article 4 A that "Electricity distribution concessionaires must present to Aneel, by February 29, 2028, a cost-benefit analysis - CBA regarding the implementation of smart metering systems for their respective concession areas, without prejudice to the establishment of new CBAs periodically."

30. In addition, the paragraf of 1º the aforementioned article establishes: The preparation of the Cost-Benefit Analysis, referred to in the caput, must observe the following general guidelines: I - identify all costs and benefits directly associated with the implementation of the technology, double counting is prohibited, considering, at a minimum: a) avoided cost of new conventional meters that would be installed; b) reduction of non-technical losses and default; c) reduction of cutting and reclosing costs; d) reduction in costs and reading errors; e) reduction in compensation paid for interruptions; f) cost reduction resulting from economies of scale; g) reduction in technical losses resulting from reduced consumption by consumers with a history of fraud and who have now been regularized; h) cost of the meter and its installation, considering the minimum functionalities provided for in § 6 of art. 4th; i) cost of communication infrastructure and software; j) sunk cost of unamortized meters; k) cost of uninstalling existing meters; l) cost of communicating with consumers; and m) regulatory cost.

31. In other words, the new Normative Ordinance No. 126/2025 did not present any relevant changes, which makes this study in line with the stated objectives.

32. It is important to note that the studies coordinated by ANEEL/GIZ (PSR Energy; SIGLASUL, 2023, 2024a, 2024b) served as the basis for this Ordinance to define the general guidelines, objectives, digitalization principles and minimum functionalities of smart meters.

4. Need for Intervention

33. Smart meters offer important benefits to customers around the world, providing accurate real-time data on: energy consumption to better manage electricity usage and cost savings, automated billing, applying dynamic tariffs and detecting anomalies such as electricity theft, improving consumer control and reliability (Koukouvinos et al., 2025; Völker et al., 2021).

34. Despite these advantages, challenges remain, including data privacy concerns, installation costs, and the need for consumer education to maximize engagement and acceptance of these technologies (Gumz; Fettermann, 2023; Rajaguru Shashiniand Johansson, 2023).

35. According to International Energy Agency (IEA, 2023), "investment in smart grids need to more than double through to 2030 to get on track with the Net Zero Emissions by 2050 (NZE) Scenario, especially in emerging market and developing economies (EMDEs).

36. In the case of Brazil, the implementation of smart metering in Brazil is a fundamental strategy to face the challenges and take advantage of the opportunities arising from the modernization process of the electricity sector.

37. According to Report 2 (PSR Energy; SIGLASUL, 2024b) presented in TS nº 13/2024, the relevance of investing in expanding the number of smart meters in the Brazilian electricity sector can be justified from different perspectives, with the ultimate aim of promoting the modernization of the Brazilian electricity sector. Therefore, here are the motivators:

(i) greater integration and management of REDs: refers to the ability to incorporate, monitor and efficiently operate technologies such as distributed generation, energy storage, electric vehicles and demand response within the electrical distribution system. This involves creating regulatory, technical and operational conditions so that these resources can be connected to the network in a safe, reliable and economical way, allowing the consumer to play a more active role, new services to be developed and system operation to be optimized. The efficient integration of REDs depends on adequate infrastructure, such as smart metering systems, which provide detailed, real-time data, enabling more granular tariffs, better network planning, reduced losses and greater flexibility for the electrical system;

(ii) tariff modernization: this is the process of improving electricity charging models, aiming to overcome the limitations of the traditional monomial volumetric tariff model, which does not adequately reflect the real cost of the service nor encourage the efficient use of energy. Tariff modernization proposes the adoption of more granular tariffs, such as hourly tariffs (TOU), multipart tariffs (binomials or trinomials) and dynamic tariffs, which are only viable with the implementation of smart meters. These new tariff models make it possible to signal more appropriate prices to consumers, promote energy efficiency, reduce cross-subsidies, encourage the adoption of innovative technologies and give consumers a more active role in managing their consumption;

(iii) opening a more transparent market with an adequate price signal: this means creating conditions so that consumers can choose their electricity suppliers freely, with access to clear and detailed information about their consumption and the prices charged. This involves the adoption of more modern measurement systems, such as smart meters, which allow consumption to be recorded at different times and enable the application of tariffs that better reflect the real cost of energy at each moment. In this way, the consumer receives more accurate price signals, being able to adjust their consumption to lower cost times and, thus, save money. Transparency is increased because consumption and billing data are more accessible and reliable, and the appropriate price signal encourages energy efficiency and healthy competition between suppliers, benefiting both consumers and the electrical system as a whole;

(iv) greater efficiency in service provision: refers to the ability of electricity distributors to operate more productively, reducing operational costs, technical and non-technical losses (such as energy theft), defaults and improving the quality of customer service. This is made possible mainly by the adoption of technologies such as smart metering, which allows automating processes such as remote reading, power cutting and reconnection, in addition to enabling faster detection of interruptions and failures in the network. With these innovations, distributors are able to optimize the use of resources, reduce the need for teams to travel, increase assertiveness in inspections and offer more agile responses to consumers, resulting in potentially lower tariffs and higher quality services for society

(v) possibilities for thinking about and implementing new business models: refers to the creation of regulatory, technical and operational conditions so that energy distributors can develop and offer services beyond the traditional supply of electricity. These new business models include, for example, services based on distributed energy resources (REDs), such as distributed generation, energy storage, demand response, energy efficiency services, digital platforms, data integration and even smart city solutions; and

(vi) greater consumer empowerment: means giving the end user of the electricity service more autonomy, information and decision-making capacity over their own consumption. This occurs mainly through the availability of detailed, real-time data on energy use, made possible by technologies such as smart meters. With access to more granular information and rates more suited to their consumption profile, consumers can adopt more efficient habits, choose products and services that best meet their needs and even participate in new business models, such as demand response and distributed generation. Consumer empowerment is also related to the possibility for users to act more actively in the electricity sector, responding to price signals, interacting with distributed energy resources and contributing to the efficiency and sustainability of the electrical system as a whole.

38. In this sense, the regulator's intervention in this matter appears as a key factor in ensuring the harmonization of the transformations that the sector is experiencing, in order to maximize the benefits and reduce costs of these changes, mitigating their risks. As discussed in the Stage 1 (PSR Energy; SIGLASUL, 2023)report of the Consultancy study, the regulator may choose to adopt a more guiding or more determinative regulatory model:

Guidance: greater freedom of decision on the part of distributors when to invest, and as a potential consequence, implementation at a slower pace and lower short-term tariff pressure.

Determinative: ANEEL/MME would need to define how to insert smart metering, considering a deadline, carrying out CBA and criteria for mandatory insertion.

39. As concluded in Stage 1 of the Consultancy study, there was no obligation for ANEEL to intervene in a more decisive manner. However, it is important to highlight that the benefits of smart metering are enhanced with massive insertion and in contiguous areas, which could lead to a more effective approach by the Agency in this regard. Therefore, it is important to evaluate the different ways in which the regulator operates and quantify the costs and benefits brought by each of the alternatives studied, which will be presented later in this RIA.

40. 41. On this point, it is important to highlight the publication of Normative Ordinance nº. 111/2025, which established general guidelines to encourage the gradual digitalization of low-voltage electrical energy distribution networks and services.

41. In this sense, initiatives related to digitalization, the subject of this Ordinance, must comply with Aneel regulations, with priority being given to prior evaluation of the cost-benefit analysis of the smart meter implementation plan by distributors, considering the minimum functionalities of smart meters, among other requirements;

5. Affected Actors or Group

42. Based on the exposure of the regulatory problem, it is possible to identify the main agents affected, directly or indirectly. It should be noted that the degree of impact varies depending on the regulatory alternative adopted, the characteristics of which will be detailed later.

Agents directly impacted:

43. Electricity distribution concessionaires and licensees: these are the main affected agents, especially in scenarios that require the installation of smart meters. The impact tends to be smaller when the installation is a result of consumer initiative or when distributors have the autonomy to develop insertion plans aligned with their business strategy and the economic viability of their concession areas.

44. Consumers connected to the distribution network: the main focus is on low voltage consumers, who will be most affected in scenarios of massive installation of meters.

Indirect impacts:

45. Equipment manufacturers: accelerating the implementation of smart metering, especially in broad adoption scenarios, can generate a significant increase in national demand. This will require a compatible offer, which can stimulate the national industry, increase the participation of agents and promote greater price competitiveness. However, the need to guarantee interoperability between technologies stands out, ensuring integration and communication between systems.

46. Agencies and sectoral entities: ANEEL will be impacted according to the regulatory model adopted. Even in a guiding approach, adjustments will be necessary, such as the definition of minimum functionalities and the review of standards that may currently represent barriers to smart metering. Other agents will also be affected, such as the ONS and the Electric Energy Trading Chamber (CCEE).

6. Legal Basis

47. Legal basis that supports the Agency’s action on the topic addressed:

a) Law nº 8.987, de 1995;
b) Law nº 9.074, de 1995;
c) Law nº 9.427, de 1996;
d) Law nº 10.848, de 2004;
e) Law nº 14.300, de 2022;
f) Decree nº 62.724, de 1968;

g) Decree nº 8.828, de 2016;
h) Decree nº 12.068, de 2024
i) Normative Resolution nº 1000/2021;
j) Normative Resolution nº 1.059/2023;
k) Submodule 2.7 and 2.7A of PRORET – Tariff Regulation Procedures – defines the sharing of revenue obtained from the provision of ancillary activities complementary;
l) Module 7 and Submodule 8.3 of PRORET - Tariff Regulation Procedures – describe the tariff structure for concessionaires and licensees of Distribution
m) PRODIST Module 5 - Electric Energy Distribution Procedures in the National Electric System – defines the minimum requirements for measurement systems used in the distribution system;

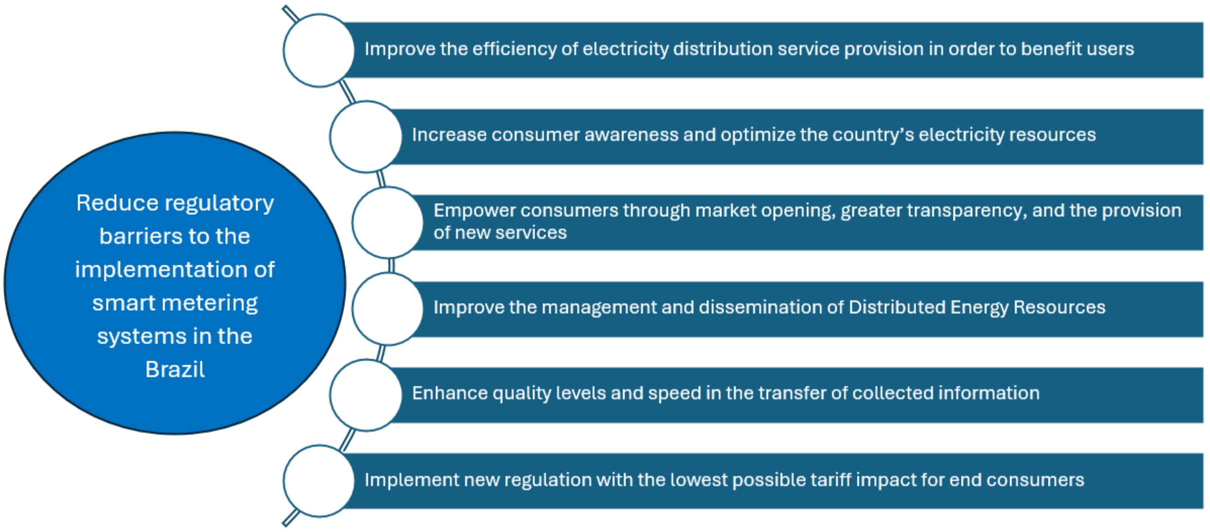
n) Normative Ordinance No. 111, of 2025-MME;

o) Normative Ordinance No. 126, of 2026-MME;

7. Objetivos

48. The objective of this work is to analyze different alternatives to solve the identified regulatory problem, in order to select, in the end, the option that offers the most appropriate regulatory treatment to the topic. To this end, a comparison was made between the available alternatives, considering regulatory criteria. The diagram presented in Figure 4 summarizes both the general objective and the specific objectives of the proposed regulatory action addressed in this study.

Figure 4 - Diagram of objectives and expected results for regulation.



Source: Report 2 - Comparison of alternatives and definition of the recommended alternative (PSR Energy; SIGLASUL, 2024b).

49. In this sense, the central objective of this Regulatory Impact Analysis is to evaluate and reduce possible regulatory barriers to the implementation of smart metering systems in the Brazilian Electricity Sector, precisely the regulatory problem addressed in this RIA Report. Furthermore, the specific objectives are segregated into six main ones, which are intended to be achieved with potential regulatory intervention on the topic of smart metering, namely:

1. Improve efficiency in the provision of the electricity distribution service: it is expected that, with greater granularity of information, distributors will be able to obtain greater efficiency in the provision of the service, resulting in a reduction in operational costs, such as traveling to cut/reconnect, reduced costs with reading, printing and delivery of invoices. Furthermore, more detailed information allows dealerships to locate units with (attempted or existing) fraud.

2. Increase consumer awareness and optimize the country's electrical energy resources: this objective is intensified with the joint insertion of intelligent metering systems and hourly tariffs, enabling consumers to adjust their consumption habits, reducing the average cost perceived by the consumer and generating systemic benefits, such as reducing maximum demand, and at the limit, reducing demand at peak times in the system, resulting, at the limit, in greater quality of supply and postponement of investments by distributors.

3. Empowering the consumer: in the current context, with the insertion of MMGD, electric vehicles, market opening, among others, the consumer starts to play a more active role in relation to their electricity

consumption. Smart metering makes it possible, in many cases, and encourages this greater consumer empowerment, in addition to resulting in a better allocation of risks among agents in the sector.

4. Improve the management and dissemination of REDs: in line with the previous objective, the installation of smart meters is essential to enable new business models for REDs, as it allows the adoption of hourly tariffs and the operation of virtual plants, microgrids, RED ancillary services, energy storage as a reliability provider, among others. Furthermore, smart meters allow real-time monitoring of electrical energy generation and consumption, facilitating the efficient management of electricity and distributed resources, thus contributing to the sustainable energy transition.

5. Improving levels of quality and speed in the transfer of information collected: the quality of information collected by companies and sent to regulators plays a fundamental role in making well-informed decisions, promoting competition and planning and developing the sector. Additionally, smart metering allows for improved communication and, consequently, rapid identification of consumer units without power or areas with voltage below the regulatory limit, resulting in improvements in the quality of services offered by distributors and enabling more effective corrective interventions in less time.

6. Implement new regulations with the lowest possible tariff impact and risk for the end consumer: the expansion of smart metering systems can have non-negligible impacts on the final amount paid by electricity consumers. This objective aims to implement regulation that impacts this value as little as possible and has the lowest risk.

50. In addition to the specific objectives listed above, the following stand out: the calculation of the regulatory cost resulting from the regulator's potential intervention, that is, the consideration of direct financial costs, compliance costs and public administration costs attributed to the implementation of new regulations; and the autonomy of the distributor to decide on its own investments in smart meters, vis-à-vis the public policy decision for the gradual digitalization of networks and the low-voltage electrical energy distribution service (MME, 2025).

8. National and international experience

51. The analysis of international experiences constitutes an essential reference to support regulatory decisions, promoting a more informed and effective approach. Next, the practices adopted by other countries in relation to the implementation of smart energy metering systems will be examined, presenting evidence on successful models and the main challenges faced by different jurisdictions, according to the consultancies. In this way, we seek to support the development of a more efficient regulatory framework for the adoption of these systems in Brazil.

8.1 Selected Countries and Justifications

52. Four countries were selected for in-depth analysis: Chile, Italy, Australia and the United States (California). The choice has similarities with the Brazilian context, such as regulatory regime, level of IM diffusion, socioeconomic profile and technical and regulatory challenges.

- Chile: Price cap regime, multiple distributors, socioeconomic context similar to Brazil. The Chilean experience offers lessons on communicating with the population and managing regulatory crises (Comisión Nacional de Energía, 2013).
- Italy: Pioneer in MI rollouts, with wide dissemination and regulatory recognition of investments. and focus on information efficiency and TOTEX (ENEL, 2023).
- Australia: Significant spread of IM in states such as Victoria. Guidance model charged by retailers or via regulated tariff. Similarities with Brazil in terms of continental dimensions and distributed generation (AEMC, 2022, 2023).
- California (USA): High diffusion of IM (>99%), with strong action from the regulator (CPUC). Implementation of minimum functionalities and requirement of CBAs by distributors. Cost recovery via regulated tariff regulada (CPUC, 2002, 2013).

8.2 Regulatory Models and Financing

53. The international analysis reveals two main models of regulatory intervention for the implementation of smart metering (MI) systems:

- Guisande Model: gives greater freedom to distributors to decide on the time and way to invest. Although it presents lower tariff pressure, it tends to result in slower and more uneven implementation. It is the model currently closest to that adopted in Brazil, as indicated by ANEEL in Technical Note nº 47/2023-SRM/ANEEL.

• Determinative Model: establishes mandatory schedules and minimum technical requirements for smart meters. This model was adopted by countries such as Italy, California (USA) and Victoria (Australia), with significant results in terms of IM diffusion (close to 100%).

54. The choice between models must consider local regulatory drivers, such as market opening, integration of REDs, tariff modernization and consumer empowerment. The absence of firmer regulatory intervention can generate opportunity costs, such as the maintenance of outdated tariff structures and lower efficiency in service provision.

55. The choice of model depends on local characteristics. Cost-Benefit Analysis (CBA) is widely used, usually conducted by regulators or government entities, and serves as the basis for informed decisions.

56. Regarding financing, IM costs are generally passed on to energy tariffs, either through regulated tariffs or additional charges by retailers. The diffusion of IM varies between countries, with some having already completed implementation and others still in the early stages.

8.3 Lessons Learned

57. According to the studies, the highlights of international experiences are presented below:

• Importance of communication and user engagement: the Italian experience has shown that the success of the rollout of smart meters is directly related to the existence of pedagogical and didactic communication plans. Italian consumers were informed about the replacement schedule, features of the new meters and the expected benefits, which generated greater acceptance and active participation in the process. The distributor E-Distribuzione, for example, implemented a robust communication plan, sending informative letters, publicity campaigns and explanatory materials, such as leaflets with frequently asked questions and usage guides.

• Recognition of CAPEX and OPEX for financial viability: the economic viability of the rollout depends on the tariff recognition of investments in measurement and communication infrastructure, including management systems and software. Countries such as Italy and the United Kingdom have adopted regulatory models that clearly recognize CAPEX and OPEX and encourage efficiency through mechanisms such as TOTEX with IQI (Information Quality Incentive).

• Standardization and technical interoperability: the lack of definition of minimum functionalities and interoperability requirements can compromise the functionality of the meters and the integration with other technologies. International experience shows that the regulator must establish general guidelines, without excessive technicality, to ensure that meters are compatible with each other and with existing systems. The lack of standardization can lead to the installation of equipment not recognized by the regulator, generating tariff disallowances and waste of resources.

• Alternative approaches to deployment: in contexts where full rollout is not viable, such as in areas with low population density or limited infrastructure, alternative strategies can be adopted. Australia, for example, implemented smart meters in new consumer units, in cases of replacement due to defect or end of useful life, reaching around 30% diffusion. Experience shows that rates above 50% are only achieved with mandatory approaches or with low margin of choice for users.

• Responsibility and accountability in crisis scenarios: the Chilean case highlighted the importance of clear accountability and communication mechanisms with the population. The lack of transparency regarding the financing of smart meters, which would be paid by consumers themselves via tariff, generated popular dissatisfaction and protests. The absence of an effective containment and communication plan worsened the crisis, leading to the suspension of the rollout. This experience reinforces the need to previously define the responsibilities of the agents involved and ensure that the benefits are clearly communicated to consumers.

8.4 Applications for Brazil

58. International experience demonstrates that the adoption of smart meters can bring significant benefits to the Brazilian electricity sector, such as greater efficiency in service provision, reduction of technical and non-technical losses, tariff modernization and consumer empowerment. However, the diffusion of this technology in Brazil is still incipient, with around 2.5 million consumer units served by smart meters, compared to a universe of almost 90 million. To overcome this scenario, it is essential that the regulator acts to remove any regulatory barriers and create an environment conducive to technological innovation.

59. The current Brazilian regulatory model is guiding, that is, it does not impose mandatory implementation targets, but it can also be an obstacle to the adoption of new technologies. ANEEL, according to Technical Note nº 47/2023-SRM, argues

that the regulatory environment must allow the introduction of innovations, as long as the costs and benefits are balanced between the agents. The adoption of a determinative model, such as that practiced in countries such as Italy and California, would require specific legal provisions, such as Bill No. 2932/2015, which proposes a national schedule for replacing conventional meters with smart meters.

60. To enable the massive implementation of smart meters, it is necessary to review regulatory instruments. Among the main points are the definition of specific guidelines for measurement implementation and the definition of minimum functionalities and interoperability requirements. The publication of Normative Ordinance No. 111/2025 – MME established part of this need, leaving ANEEL to establish additional specific aspects.

61. In addition to regulatory adjustments, it is essential to have a communication and consumer engagement strategy. The Italian experience has shown that the success of the rollout is directly linked to transparency about the benefits and functionalities of smart meters. Distributors should invest in campaigns that explain how meters can improve the quality of service, allow greater control of consumption and enable new tariffs that are more suited to each consumer's usage profile.

62. Finally, the report recommends that the implementation of smart meters be carried out gradually and strategically, prioritizing contiguous areas and specific segments, such as consumers with distributed generation or high load. Carrying out Cost-Benefit Analysis (CBA) must be mandatory to justify investments and guarantee reasonable tariffs. This recommendation was accepted by the MME, which, through Normative Ordinance No. 111/2025, determined that the massive implementation of smart metering be preceded by carrying out CBA.

9. Alternatives

63. Through Ordinance No. 111/2025- MME, of June 18, 2025, general guidelines were established to encourage the gradual digitalization of networks and the low-voltage electrical energy distribution service. In art. 4 of this Ordinance establishes that actions aimed at digitalization, including the implementation of smart meters, must follow ANEEL regulations, which must address certain topics, as per the following excerpt:

> *"Article 4. Initiatives related to digitalization must comply with Aneel regulations, with priority being given to evaluating the implementation of smart meters.*
>
> *§ 1 The regulations referred to in the caput must establish:*
>
> *I - the general guidelines, methodology and rules for the preparation, by distribution concessionaires, of a <u>plan for implementing smart meters</u> in their concession area;*
>
> *II - the minimum requirements for preparing a <u>cost-benefit analysis prior</u> to the plan referred to in item I;*
>
> *(...)". (emphasis added).*

64. The three alternatives considered in this RIA study are presented below:

a) <u>Alternative</u> 0: the same model as the initial RIA remains. In other words, according to Report 2: "According to the current regulatory model, the installation of smart meters is not mandatory for any type of Low Voltage (LV) consumer, nor is there a definition of minimum functionalities or specific guidelines for the massive implementation of this equipment. The distributor may choose to formulate an installation strategy in its concession area. If this is the case, the ownership of this equipment belongs to the distributor and the CAPEX has been recognized in the subsequent tariff review.";

b) <u>Alternative</u> 2': prepared based on Alternative 2 of the initial RIA, including some changes. The distributor must prepare a cost-benefit analysis – CBA and an implementation plan, if the CBA results positive. The general guidelines for the CBA and the plan, as well as the minimum requirements for smart metering, will be defined by ANEEL. There will be no need for approval of the plans by ANEEL, but the distributor **will be able** to move forward with its plan only in the case of a positive CBA, with the distributor making the final decision. All distributors must prepare an initial CBA. Distributors must publicize CBAs and prepared plans, as well as prepare periodic reports on the execution of the plans. The ownership of the smart meters will be held by the distributor and the CAPEX will be remunerated via tariff. Consumers who receive smart metering will now receive their invoice digitally as standard, with the consumer making the final decision on whether to return to a printed invoice.

c) <u>Alternative</u> 4': prepared based on Alternative 4 of the initial RIA, including some changes. The distributor must prepare a cost-benefit analysis – CBA and an implementation plan, if the CBA is positive. The general guidelines for the CBA and the plan, as well as the minimum requirements for smart metering, will be defined by ANEEL. There will be no need for approval of the plans by ANEEL, but the distributor **will be obliged** to move forward with its plan in the case of a positive CBA. All distributors must prepare an initial CBA and periodically carry out new CBAs if they are negative. Distributors must publicize CBAs and prepared plans, as well as prepare periodic reports on the execution of the plans. The ownership of the smart meters will be held by the distributor and the CAPEX will be remunerated via tariff. Consumers who receive smart metering will now receive their invoice digitally as standard, with the consumer making the final decision on whether to return to a printed invoice.

65. Table 2 presents a summary of the characteristics of the three alternatives that will be compared in this revised RIA. As previously mentioned, the design of the revised alternatives was based on the characteristics of the corresponding alternatives from the consultancies' initial RIA, incorporating improvements that resulted from suggestions provided by participants in TS nº 13/2024.

Table 2 - Características dos modelos regulatórios das alternativas.

Critério		**0**	**2'**	**4'**
Initiative	Distributor			
	Consumer			
	Regulator			
Mandatory Cases	New UCs			
	Replacement			
	ToU tariff			
	MMGD			
	ACL migration			
Scope	Scattered			
	Contiguous			
Distributor Ownership Meter				
CAPEX remuneration via Tariff				
Regulatory Guidelines	MI Minimum Requirements			
	CBA criteria			
	Implementation Criteria			
Implementation Criteria	Compulsory Initial CBA Completion			
	Compulsory Periodic CBA Performance			
	Positive CBA Requirement for Implementation			
	Compulsory Implementation when CBA Positive			
	ANEEL Plan Approval			
	Ex-Ante Advertising of the Plan and Ex-Post Reports			
	Opt-Out Digital Invoice			

Source: own elaboration.

10. Methodologies and Comparison of Alternatives

10.1. Methodologies

66. Decree nº. 10,411/2020 (Brasil, 2020) defines rules for Regulatory Impact Analysis (RIA) in federal public administration, covering direct bodies, agencies and foundations. According to this Decree, before creating, modifying or extinguishing rules that affect the general public, it is mandatory to carry out an RIA — except when dealing with urgent, low-impact measures or measures that follow determinations already provided for in higher regulations. RIA involves previously examining the regulatory problem, considering different alternatives and evaluating the impacts, with emphasis on costs and consequences for micro and small businesses.

67. According to art. 7th of this Decree, when preparing the RIA, one of the following specific methodologies will be adopted to assess the reasonableness of the economic impact:

I- multi-criteria analysis;

II - cost-benefit analysis;

III - cost-effectiveness analysis;

IV - cost analysis;

V - risk analysis; or

VI - risk-risk analysis.A escolha da metodologia deve ser justificada e, a partir dela, o comparativo entre as alternativas propostas deve ser apresentado. Cabe destacar também que outra metodologia além das citadas pode ser utilizada, desde que haja uma justificativa do porquê tal metodologia é a mais adequada para a resolução do caso concreto analisado.

68. The choice of methodology must be justified and, based on it, the comparison between the proposed alternatives must be presented. It is also worth noting that another methodology in addition to those mentioned can be used, as long as there is a justification as to why such a methodology is the most appropriate for resolving the specific case analyzed.

10.1.1. Analytic Hierarchy Process - AHP

69. Multicriteria decision support methods (MCDA) emerged to deal with complex problems involving multiple, often conflicting criteria, such as economic, social, environmental and technical aspects. Unlike traditional approaches that consider only one criterion, multi-criteria methods allow you to integrate quantitative and qualitative information, offering a logical structure for organizing preferences and evaluating alternatives. This characteristic is essential in contexts where decisions need to be justified in a transparent and rational way, such as in public management, strategic planning and supplier selection. Among the most used methods, AHP (Analytic Hierarchy Process), PROMETHEE, ELECTRE and TOPSIS stand out, each with specific approaches for hierarchization and analysis of trade-offs between criteria. These methods enable decision-makers to incorporate subjective judgments and objective data, ensuring greater consistency and clarity in the decision-making process (Gomes et al., 2007).

70. Choosing the AHP (Analytic Hierarchy Process) method is advantageous because it offers a structured and transparent approach to solving complex multi-criteria problems. Unlike methods that only aggregate data, AHP allows the problem to be decomposed into a clear hierarchy (objective, criteria and alternatives), facilitating understanding and analysis. Furthermore, it transforms qualitative judgments into quantitative values through pairwise comparisons, ensuring that subjective preferences are incorporated in a rational way. Another strong point is the consistency check, which ensures the coherence of judgments, increasing the reliability of the result. Because it is flexible, intuitive and applicable in different contexts — such as supplier selection, ranking of companies related to service quality (Barbosa et al., 2018), definition of policies or strategic planning —, AHP is a solid choice for those looking for well-founded and auditable decisions.

71. AHP is a decision support method developed by Thomas L. Saaty (Saaty, 1980). It is widely used to solve complex problems that involve multiple criteria, allowing decisions to be made in a structured and rational way. AHP combines qualitative and quantitative aspects, transforming subjective judgments into numerical values that can be analyzed mathematically

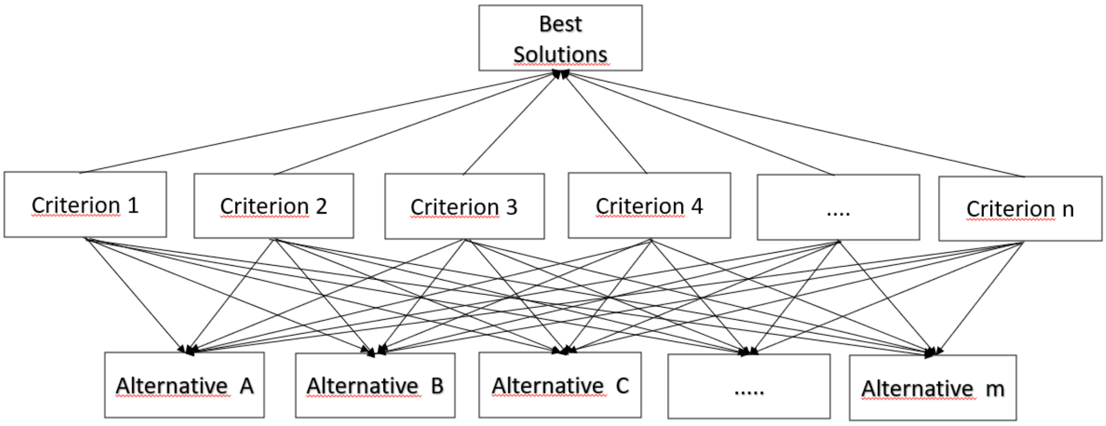
10.1.1.1. Hierarchical Structure

72. The hierarchical structure in the AHP method is one of the fundamental pillars for organizing complex decision problems. It consists of decomposing the problem into levels, allowing a clear and systematic analysis. At the top of the hierarchy is the main objective of the decision (for example, choosing the best supplier). Below are the criteria and sub-criteria, which represent the factors that influence this decision, such as cost, quality and deadline. At the base of the hierarchy are alternatives, which are the options available to choose from. This organization facilitates the visualization of relationships between elements and ensures that all relevant aspects are considered, avoiding omissions and promoting consistency in the decision-making process. Thus, a hierarchical structure can be organized, consisting of three main levels:

- Level 1 – Objective: Defines the purpose of the decision (e.g.: choosing the best supplier).
- Level 2 – Criteria and Sub-Criteria: Represents the factors that influence the decision (e.g. cost, quality, deadline).
- Level 3 – Alternatives: Options available to choose from.

73. This decomposition facilitates understanding of the problem and ensures that all relevant aspects are considered. In other words, the practice of decision-making is linked to the evaluation of alternatives, all of which satisfy a set of intended objectives. The problem is choosing the alternative that best satisfies the total set of objectives. The aim is to obtain numerical weights for alternatives in relation to sub-objectives and for sub-objectives in relation to higher order objectives. The way to logically structure the objectives and sub-objectives of the decision problem under analysis is through hierarchy. Figure 5 shows the hierarchical structure similar to what will be used later in this RIA.

Figure 5 - Hierarchical Structure



Source: (Saaty, 1980), with adaptations.

where: Cn represents the defined criteria (indicators) and Am (alternatives) represents the alternatives defined by the decision makers.

10.1.1.2. Process Steps

74. AHP follows a set of systematic steps. The following presents the main steps in the development and use of a multi-attribute value function. These steps are presented sequentially, but this process is, in practice, iterative (Saaty & Katz, 1990):

Step 1 - Identify the Decision Makers: individual or group of individuals who, directly or indirectly, provide the value judgment that can be used when evaluating the available alternatives, with the aim of identifying the best choice;

Step 2 - Define the Alternatives: sometimes, the alternatives are obvious; in other cases, they need to be defined or reduced to a smaller, more practical list. In the case under study, the alternatives were defined based on the alternatives covered by TS nº 13/2024 and the provisions of MME Ordinance nº 111/2025;

Step 3 - Define the Relevant Criteria for the decision problem: defining alternatives and criteria is an iterative process. New alternatives can suggest new criteria and vice-versa. In this study, the criteria took as a reference those raised by the consultants in TS nº 13/2024, but were defined in a workshop held with the 4 AHP respondents;

Step 4 – Evaluate the Alternatives in Relation to the Criteria: generally, this part of the process is called scoring. At this stage, we seek to quantify the value of each alternative in relation to each criterion. The value scale is not necessarily a linear function or a monotonic function of the scale on which the criterion is naturally measured. Each alternative is compared with another in relation to the superior criterion, using an importance scale of 1 to 9 proposed by Saaty. Furthermore, the consistency of the results is verified, which measures the coherence of the judgments through the Consistency Ratio (CR). Acceptable values indicate that judgments are reliable;

Step 5 – Determine the Relative Importance of the Criteria: in this phase, weights are assigned to the criteria to show their relevance in the decision. This phase consists of assigning weights to the criteria, in order to demonstrate the importance of a criterion for the decision maker. As in the previous step, there are many ways to weight the criteria. The weights, as explained, are trade-off values or marginal rates of substitution. They determine how much of one criterion one is willing to give up in order to improve the performance of another. The weight values relate to the measurement scales used to score the alternatives. In this way, the weights of a criterion involve the psychological concept of importance and the discretionary power of the scale on which the criterion is measured;

Step 6 – Determine the Relative Importance of the Criteria: when using a multi-attribute value function, the value or global score of each alternative is determined;

Step 7 – Sensitivity Analysis: it is important to carry out a sensitivity analysis, especially on the weights of the criteria, in order to understand the resistance of the values of the alternatives to possible changes in the decision maker's preferences;

Step 8 – Recommendations and Presentation of a Report: the analysis carried out must be evaluated together with the information relevant to the decision-making process, with a view to preparing a final recommendation.

10.1.2. Cost-benefit analysis

75. Cost-Benefit Analysis (CBA) is considered the most informative methodology for regulatory decisions, being widely used and recommended by OECD countries. It requires quantifying and monetizing all the costs and benefits of the alternatives analyzed, in order to support the economic justification in the face of regulatory problems.

76. This method aims to evaluate the positive and negative impacts resulting from regulatory interventions. However, there is an inherent difficulty in quantifying and monetizing benefits, especially when they are not commercialized on the market. In these cases, it is necessary to complement the analysis with other methodologies capable of assigning monetary values to benefits, providing an adequate comparison between costs and benefits. The adoption of these methodologies requires the participation of the groups and stakeholders involved, using instruments such as questionnaires, statistical analyses, probability studies, development of models, among other resources.

77. Furthermore, when only a portion of the costs and benefits can be quantified, the analysis can be carried out partially. This type of assessment remains relevant for decision makers as it reduces the scope of issues to be addressed through more subjective and qualitative approaches. In this way, even if an incomplete cost-benefit analysis is developed, it is possible to considerably improve the decision-making process.

78. This methodology also demands attention to the following aspects, in addition to the quantification and monetization of costs and benefits:

- ✓ Presentation of costs and benefits as a cash flow for a pre-defined reference period, with the values discounted to present value;
- ✓ Depreciation of monetary values obtained using a discount rate to compare values at different points in time. Internationally, the tendency is for discount rates to reflect the opportunity cost of the economy as a whole;
- ✓ Consideration of the distributive effects of regulatory alternatives, that is, there must be an understanding of the effects of alternatives on different social groups, considering the gains and losses of different actors affected by the action alternatives;
- ✓ Conducting a sensitivity analysis to confirm that the results will be maintained even with changes in some variable values.

79. Therefore, the cost-benefit analysis must indicate to decision makers the alternative with the greatest economic advantage. The results can be presented as a net benefit (difference between benefits and costs) or as a benefit/cost ratio, where values above 1 show that the benefits exceed the costs. Alternatives can also be classified by net present value (NPV); the option with the highest and most positive NPV is the most recommended.

10.2. Comparison of Alternatives

80. In Report 2, item 3.10, the methodology used by the consultancies for the purpose of comparing regulatory alternatives in the initial RIA is described. In this review, the general structure of the methodology will be maintained, with the application of improvements arising from internal discussions and contributions presented in TS nº 13/2024. The general premise remains: compare regulatory alternatives based on criteria that are associated with the RIA objectives.

81. When the application of a criterion can be done in a quantitative and monetizable way, the cost-benefit analysis method will be used for comparison. In turn, when the analysis of a criterion cannot be quantified, a qualitative methodology will be used to analyze how effective the alternative is in achieving the corresponding objective. Unlike the initial RIA and based on suggestions received in the TS, the method used in the revised RIA will be the Analytic Hierarchy Process – AHP.

82. In Table 3, these criteria are presented and which RIA objectives they are associated with, as well as which regulatory drivers identified in the initial study they are related to.

Table 3– Criteria for comparing alternatives and associated motivators and objectives.

Regulatory Drivers (Report 1, Figure 2)	Objetivos AR (Relatório 2, 10 3)	Criteria for Comparing RIA Alternatives (Report 2, Item 3.11.2)	Comparative Method (Report 2, Table 9)
More efficient service delivery	Improve the efficiency of providing electricity distribution service to form user beneficiaries	Improvement in the efficiency of service provision	Cost-Benefit Analysis/AHP

	Improve the levels of quality and speed in the transfer of collected information	Greater network observability for decision making (Included in revised RIA)	AHP
Consumer empowerment	Empower the consumer through more transparent market opening and provision of new services	Consumer empowerment	AHP
Market opening			
Possibility of new business			
RED integration and management	Improve the management and dissemination of RED and increase consumer awareness and optimize the country's electroenergy resources	Optimize centralized and distributed energy resources (Amended in revised RIA)	AHP
Tariff modernization			
-	Implement new regulations with the lowest possible tariff impact for the end consumer	Short-term tariff impact	AHP
-	-	Regulatory cost	Cost-Benefit Analysis/AHP
-	-	Autonomy for the distributor to decide on its own investments (Included in revised RIA)	AHP

83. In this revised RIA, 6 criteria were listed based on which regulatory alternatives will be compared to analyze their suitability in achieving the objectives of the RIA and, therefore, in resolving the identified regulatory problem. The criteria are as follows:

1. Improvement in the efficiency of service provision: the comparison of alternatives according to this criterion carried out through monetizable cost and benefit items and subsequent use of the result of the cost-benefit analysis as an AHP criterion;

2. Greater observability of the network for decision-making: seeks to qualitatively measure how much the implementation of an alternative contributes to the collection of data on the electrical system through smart meters in order to allow the improvement of network planning and operation actions. This criterion incorporates the criterion proposed by the consultancies of “quality and agility in the transfer of collected information”, as it was understood that they are similar;

3. Consumer empowerment: the same used in the initial RIA and defined in item 3.11.2 of Report 2;

4. Optimization of centralized and distributed energy resources: “improvement in the management and dissemination of REDs” criterion used in the initial RIA and defined in item 3.11.2 of Report 2, but which now incorporates the optimization of the country's electroenergy resources;

5. Short-term tariff impact: the same used in the initial RIA and defined in item 3.11.2 of Report 2;

6. Regulatory cost: the same used in the initial RIA, with the comparison of alternatives according to this criterion carried out through monetizable cost items and subsequent use of the result of the cost-benefit analysis as an AHP criterion;

7. Autonomy of the distributor to decide on its own investments: new criterion adopted in the revised RIA, which seeks to qualitatively measure how much the implementation of an alternative allows the distributor's decision-making autonomy on the application of its available financial resources and investment choices between competing options.

84. The “cost-benefit analysis risk” criterion was excluded because in the revised CBA the new alternatives A2' and A4' were much less volatile than in the consultancies' CBA. Furthermore, in the revised CBA the sensitivity analysis of the results was updated. Furthermore, this RIA presents a specific section on the risks in implementing the chosen altern

11. Results

85. The three regulatory alternatives presented previously were evaluated and compared considering the main objectives of implementing smart meters in Brazil, according to the criteria defined in the previous item. Some of these criteria can be quantified through hypotheses and monetary projections, while others present significant limitations in terms of quantitative and/or financial measurement, both in relation to benefits and implementation costs.

86. Given the multiplicity of criteria adopted and the discussion held in Report 2 of the consultancies, regarding methodologies for measuring economic impact, it was decided to apply the AHP method, which will integrate quantitative and qualitative criteria.

87. In this sense, the Cost-Benefit Analysis will be incorporated into the AHP analysis, with the aim of providing a comprehensive view of the alternatives, considering the complexity of the regulatory topic and the need for integrated strategic assessments that consider all pertinent factors in a balanced way.

11.1. Cost-Benefit Analysis

88. The Cost-Benefit Analysis (CBA) seeks to financially quantify the costs and monetizable benefits of replacing smart meters for each of the alternatives described in section 9. For this, some current and projected information from the electrical system is used, as well as hypotheses are made, always based on data from Brazil or international experience, about the achievement of costs and benefits in each alternative.

89. The information and hypotheses presented by the consultancies in the CBA described in report 2 were evaluated in detail with the aim of, where possible, improving or updating them. In this work, contributions received in Public Consulation (TS) nº 13/2024 were considered.

90. In addition to improving and updating the information used by consultancies, it was also decided to carry out the CBA for each of the 51 Brazilian electricity distribution concessionaires. Thus, the information used in each CBA represents the reality of the concessionaire under analysis. The national CBA uses the sum or weighted average of individual information from the 51 concessionaires.

91. All information used is available in the simulation file attached to this report. In this file it is possible to evaluate or change the CBA of each concessionaire or country.

92. Finally, it is important to highlight that CBA was made from the distributor's perspective. Although in a second moment the benefits and costs are passed on to consumers via tariff mechanisms, in the first moment they are perceived by the distributors.

11.1.1. General Data

93. The basic system characteristics variables used in the cost-benefit analysis, as well as their sources, are presented in Table 4. In all regulatory alternatives evaluated and in all concessionaires, the same values were considered for: the discount rate; the useful life of smart meters; and CBA analysis time. The number of low voltage consumers in Brazil; the annual number of new consumers; the IM penetration rate; and the marginal cost of energy are also the same for the 3 alternatives, but vary between utilities. The numbers presented in the tables in this CBA section refer to the national scenario.

Table 4 - Basic characteristics of the system.

Características básicas do sistema	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Taxa de desconto	8,03%	8,03%	8,03%	% a.a	**Fonte:** WACC Distribuição 2025, depois de impostos
Vida útil dos medidores	13	13	13	anos	**Fonte:** Manual de Controle Patrimonial do Setor Elétrico
Número de consumidores BT	91,48	91,48	91,48	milhões de UCs	**Fonte:** SAMP em 12/2024. Grupo B sem iluminação pública
Novas UCs anuais	1,29	1,29	1,29	milhões de Ucs	**Fonte:** Estimativa baseada em dados passados
Taxa de penetração atual de MI	2,23%	2,23%	2,23%	%	**Fonte:** Resposta das distribuidoras
Custo de compra da energia	239,89	239,89	239,89	R$/MWh	**Fonte:** Processos tarifários de 2024
TUSD fio B	227,58	227,58	227,58	R$/MWh	**Fonte:** Processos tarifários de 2024

94. In relation to what was used by the consultancies, it was decided to change the WACC to the value defined by ANEEL for the year 2025 after taxes, since the payment of taxes is not considered at any point in the analysis. In other words, the net value is adopted, already tax-free.

95. Another item changed in relation to what the consultancies used is the current penetration rate of smart meters. The value responded by distributors that had a large number of smart meters installed in December 2024 was adopted: Enel SP, COPEL and CEMIG. For the other distributors, a value of 0 was considered.

96. Also worth highlighting is the information regarding the TUSD Fio B value of the distributors, which had not been used by the consultancies. This information became important for the new way of valuing the benefit of reducing non-technical losses, as will be described later.

97. Still on this information, and on the cost of purchasing energy, it is highlighted that the value adopted in the national CBA was calculated through the weighted average of the individual values of the cost of purchasing energy and the amount of energy injected into the networks of each concessionaire.

98. The other items, useful life of meters, number of consumer units in group B in December 2024 and the projection of new annual consumer units in group B were collected in the same way carried out by the consultancies, only undergoing updating. The useful life of the meters is currently defined in the electrical sector's asset control manual, the number of consumer units in group B is found in the SAMP and the projection of new annual consumer units in group B results from the application of linear regression in the history of consumer units in group B between 2010 and 2024. The specific information for each concessionaire can be viewed in the “General Data” tab of the simulation file attached to this report.

99. In addition to the current characteristics of the electrical system, according to Table 5, predictions were also defined regarding the percentage of consumer units to have smart meters installed in the period evaluated in the CBA for each alternative analyzed. Note that the same values used by consultancies are being adopted. In fact, no contributions were received on this item of TS No. 13/2024, nor was a well-founded way of updating this data identified. Contributions are expected to be presented in the public consultation regarding this item.

100. In any case, it is important to highlight that more important than the exact value of the percentage of dissemination of smart meters in each alternative are the assumptions that alternative A4´ will lead to more meters installed than A2´, and that alternative A2´ will lead to more meters installed than A0. This is important because the percentages of reduction in non-technical losses, reduction in compensation for DIC transgression and scale gains in costs are greater the more meters are installed.

101. The Table 5 also shows the other hypotheses adopted in the CBA. Contributions are expected in the public consultation on these hypotheses.

Table 5 - Hypotheses adopted in the CBA.

Hipóteses do cenário base	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Previsão de substituição (%)	12,00%	30,00%	40,0%
Percentual de consumidores que optarão pela fatura física	20,00%	20,00%	20,00%
Percentual de redução da PNT (%)	10,0%	20,0%	28,0%
Percentual de redução do consumo com a regularização	30,0%	30,0%	30,0%
Redução na compensação de interrupções (%)	2,5%	5,0%	8,0%
Redução de custos devido à escala (%)	5,0%	10,0%	13,0%
Custo regulatório (mi R$)	0,23	2,73	3,77

102. Regarding the percentage of consumers who will opt for a physical invoice, this is an improvement in relation to the valuation of the benefit of reducing the cost of reading carried out by consultancies. As previously explained, it is proposed in alternatives A2' and A4' that the digital electricity bill be the standard for consumer units that will receive smart metering, with the consumer being able to request a return to the physical bill, at no additional cost. In this scenario, it is understood that there will be greater adoption of digital invoicing, in 80% of consumer units with smart metering. It is understood that this percentage is conservative, since in the current scenario, in which the physical invoice is the standard, there are distributors that reach more than 65% of consumer units with smart metering and adherence to the digital invoice.

103. Therefore, the 20% considered in this hypothesis indicates the percentage of consumers who, having been included in the digital invoice upon receiving smart metering, contact the distributor to request a return to the physical invoice printing and delivery model. This estimation is important so that the benefit can be valued correctly, since the cost of printing and delivering the physical invoice to dispersed consumer units is higher than the current cost of reading, printing in the field and delivering it en masse in densely populated regions.

104. Regarding the percentages of reduction of non-technical losses, a more conservative scenario is adopted than that used by consultancies. It is understood that the scenario considered by the consultancies was well founded, using the experiences of other countries and some national references. However, the contributions presented to TS No. 13/2024 regarding this topic were aligned in pointing out that these percentages represented an optimistic scenario, a view that was corroborated by the statement by the Equatorial group at the meeting held with ANEEL on 10/07/2025. Furthermore, in distributors that already have a large number of smart meters installed, there has not yet been a significant reduction in the percentage of non-technical losses.

105. In any case, it cannot be ignored that by virtue of having anti-tamper alarm and magnetic field sensor functionalities, allowing greater visibility of network configurations and allowing energy balances to be carried out, smart metering has the potential to contribute to the reduction of non-technical losses. Along these lines, distributors Enel SP and Copel indicated greater assertiveness in combating fraud in consumer units with smart metering, which will result in an effective reduction in fraud amounts in the future.

106. Thus, the real percentage of reduction in non-technical losses resulting from the massive installation of smart metering is above 0%, but less than 40%. It is not possible, today, to calculate the exact value before new massive smart metering implementation projects are carried out, since the projects underway today did not have this benefit as their main motivation and are not yet reaping the results of this benefit.

107. On this point, Landis+Gyr received a contribution in TS No. 13/2024 to consider a percentage of installation of smart meters in Centralized Metering Systems equivalent to 10% of the total number of smart meters that will be installed in the period under analysis. Landis+Gyr says that "...Landis+Gyr understands that the 40% reduction in non-technical losses adopted in the base scenario of the study's cost-benefit analysis is reasonable, as long as a percentage of external smart metering installation, or Centralized Metering Systems (CMS) is considered." and that "In view of the above, it is recommended to introduce a percentage of 10% of SMC in the base scenario for alternatives A0, A2 and A4...".

108. It is agreed that the percentage of reduction in non-technical losses adopted by consultancies should not be used without considering the installation of a percentage of meters in external measurement projects, but it is understood that this percentage is not justified in all concession areas. For example, COPEL, Neoenergia Cosern, Equatorial GO and Neoenergia Elektro have a percentage of non-technical losses that do not represent 6% of the low voltage market. On the other hand, Equatorial PA already has 20% of its consumer units used with SMC meters and Energisa RO and Neoenergia PE have non-technical losses that exceed 20% of the low voltage market. Additionally, other distributors, such as Enel RJ and Equatorial CEA, present amounts of non-technical losses that exceed 30% of the market.

109. In this scenario, what would be the optimal percentage of smart meter installation in SMC projects for each utility? As it was impossible to define this percentage, the path was chosen to reduce the percentage of reduction in non-technical losses as a result of the massive implementation of smart meters and to carry out sensitivity analysis to assess the minimum percentage of reduction in these losses necessary for the CBA result to remain positive. The details of this sensitivity analysis are presented in the "CBA Sensitivity Analysis" section.

110. When defining the new percentage, the percentage adopted by the consultancies in alternative 4 for the pessimistic scenario, 28%, was adopted as a starting point. To define the percentage of other alternatives, a proportion was made based on the total number of meters to be installed per alternative. In alternative 0, which considers the installation of smart meters in 12% of group B consumer units, a 10% reduction in non-technical losses was considered. For alternative 2, with 30% of consumer units with smart metering, a percentage reduction in non-technical losses equal to 20% was adopted.

111. Ainda sobre as perdas não técnicas, foi inserida uma nova hipótese, com valor de 30%, relativa à redução do consumo verificada em consumidores com histórico de fraude que passam a ser regularizados após a implantação da medição inteligente. Esse parâmetro indica o total de energia que a distribuidora poderá deixar de comprar em virtude da redução de consumo verificada em consumidores regularizados. Por isso, ele é valorado pelo custo médio de compra da energia.

112. Com a adoção dessa nova abordagem, uma outra parcela, igual a 70% do montante reduzido de perdas não técnicas, deve ser incluída na valoração desse benefício. Essa outra parcela indica o ganho de mercado percebido pela distribuidora em decorrência do faturamento de unidades consumidoras que, antes da regularização, não eram faturadas. Dada sua natureza, essa nova parcela deve ser valorada pela parte da tarifa que remunera a distribuidora, componente Fio B da tarifa de uso dos sistemas de distribuição.

113. As a result, the valuation of the benefit of reducing non-technical losses becomes:

aluation of the reduction in non-technical losses = Amount of reduction in non-technical losses x (30% x average energy purchase cost + 70% x average TUSD Fio B)

114. This is, therefore, a change in the valuation of this benefit in relation to what was considered by the consultancies. This change was motivated by the contribution of Landis+Gyr, which stated that the best way to value this benefit would be the one presented in the Regulatory Result Assessment Report (ARR) nº 001/ANEEL, "Performance of Incentive Regulation in the Electric Energy Distribution segment: Business Development, New Technologies & Energy Efficiency". Landis+Gyr agrees that this is the best way to value this benefit.

115. The percentage of 30% adopted in this hypothesis is based on the information provided by some distributors in their plans to combat non-technical losses, to what was previously considered in reference companies and information available from other processes monitored by ANEEL that dealt with this topic.

116. Regarding the percentage reduction in compensation paid for transgression of the DIC indicator, it was understood that a greater dissemination of smart meters allows greater monitoring of the network, which leads to a greater reduction in service reestablishment times. Thus, a greater reduction in compensation paid under alternative A4´ is adopted in relation to A2´. The reduction percentage for alternative A0 was also changed to maintain the proportion with the other alternatives according to the number of smart meters installed.

117. Still on this item, it is important to highlight that the amount of compensation to which the reduction applies contains the compensation paid for transgression of the DIC, FIC and DMIC indicators in the year 2024 by all distributors. On this point, it is understood that the massive implementation of smart metering has the potential to reduce the time indicators, DIC and DMIC, but does not have the potential to reduce, at least directly, the frequency indicator, FIC. Therefore, the precise way to value this benefit would be to consider the reduction of compensation paid for the transgression of the DIC and DMIC. However, data with this segregation are not available.

118. In any case, the vast majority of compensations arise from the transgression of the DIC and DMIC indicators, with a small part resulting from the transgression of the FIC indicator. Therefore, there is no great inaccuracy in the valuation of this benefit carried out in this CBA.

119. Regarding the percentages of cost reduction due to economies of scale in the purchase and installation of meters and other equipment, Landis+Gyr presented the following statement: "We understand that the cost of the smart meter considered in the cost-benefit analysis is consistent with the minimum functionalities. An observation point is associated with the 25% reduction in the cost of the smart meter with the scale of massive projects. It is reasonable to assume that there will be some gain in scale, however the percentage adopted in the base scenario of the analysis The cost-benefit ratio is quite high, considering that the current costs used are, for the most part, for large-scale projects."

120. 118. In turn, Wasion America contributed in the sense that "...we carefully evaluated the premise of a 25% reduction in the cost of the meter due to economies of scale. Such a scenario is challenging, especially when taking into account that the prices currently charged are already quite competitive and that the electronic components, which represent the majority of the final cost of the meter, already present saturation of gains in scale, in addition, of course, to suffering from exchange rate volatility. For this reason, we understand that such a proposition should be debated in greater depth in the next phases of the discussion, allowing the identification of values that are more in line with what can be practiced."

The Brazilian Association of the Electrical and Electronic Industry said: "Specifically regarding meters, it must be considered that, since the covid19 pandemic, electronic components have not had their prices reduced, mechanical parts and other components have no tendency to reduce costs and new requirements of national regulation, such as the RoHS requirement, act to neutralize economies of scale with increased production.".

121. These contributions are in line with the understanding that the percentages of economies of scale adopted by consultancies were high, representing a very optimistic scenario. As a result, and considering the conservative bias adopted in preparing the CBA, a reduction in the values adopted by consultancies is proposed. However, a higher percentage of scale gain is adopted in alternative A4´ in relation to A2´. It is understood that the more equipment purchased, the more economies of scale you obtain.

122. Finally, regarding the regulatory cost, the same tool adopted by the consultancies was used, with the change that the cost of dedicated personnel (CBA analysis) is not being considered among the costs of public administration. This change arises from the removal of ANEEL's obligation to approve the CBA and the implementation plan for smart meters prepared by the distributors.

123. The Table 6 presents the characteristics of smart meters, installed quantity and cost.

Table 6– Características dos medidores inteligentes.

Características dos medidores inteligentes	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Meta de substituição dos medidores atuais	12,00%	30,00%	40,00%	%	Hipótese
Número de substituições a serem realizadas	**12,75**	**31,87**	**42,49**	milhões de UCs	Cálculo interno
Substituições de UCs atuais	10,73	26,83	35,78	milhões de UCs	Cálculo interno
Substituições de novas UCs	2,02	5,04	6,72	milhões de UCs	Cálculo interno
Custo total do medidor inteligente (CAPEX, instalação, desinstalação e rede AMI) - sem efeito escala	520,99	520,99	520,99	R$	**Fonte:** Média ponderada do valor informado das empresas de acordo com previsão de substituição rspondida por ela no formulário. Mapeado na aba "Parque de Medidores".

124. The number of equipment to be installed, segregated in terms of current UCs and new UCs planned for the period, uses the same method adapted by the consultancies. The average cost of the smart meter results from the responses from distributors Enel SP, CEMIG, CPFL, COPEL and Equatorial PA to the information request form sent by STD, which can be accessed in the "Scenarios" tab of the attached simulation file. The average value results from the application of the simple average of the cost of single-phase, two-phase and three-phase meters reported by the distributors and the quantities of consumer units with single-phase, two-phase and three-phase connections of all group B consumer units in the country.

125. It should be noted that a distributor did not respond to the cost of smart meters. Thus, the final value represents the weighted average cost of the 4 distributors that responded to this item.

126. The Table 7 presents the characteristics of non-smart meters.

Table 7 – Characteristics of non-smart meters.

Características dos medidores não-inteligentes	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo do medidor não inteligentes	192,14	192,14	192,14	R$/medidor	**Fonte:** Cálculo Interno baseado na proporação dos medidores no parque e na resposta das distribuidoras
Vida útil dos medidores não-inteligentes	17,52	17,52	17,52	anos	**Fonte:** Cálculo Interno baseado na proporação dos medidores no parque
Anuidade atuais	20,81	20,81	20,81	R$	Cálculo interno
Anuidade novos convencionais	24,35	24,35	24,35	R$	Cálculo interno

127. The cost of non-smart meters results from the responses sent by distributors to Joint Circular Letter No. 1/2025-STR/SFF/ANEEL, which can be viewed in the “General Data” tab of the attached simulation file. The average value results from the application of the weighted average of the cost of single-phase, two-phase and three-phase meters reported by the distributors and the quantities of consumer units with single-phase, two-phase and three-phase connections from each distributor.

128. The useful life of smart meters and the annual fee for current meters were calculated in the same way as the consultancies. The annual fee for new conventional meters was calculated considering the 13-year useful life of electronic meters.

129. In calculating this benefit, two changes were made in relation to what was done by the consultancies. The first arises from the correction of a small error that was in the consultancy spreadsheet. To calculate the avoided investment, in the last line of the table, the last term was not multiplied by the number of meters, which was corrected in the CBA presented here.

130. The second change made was in the annuity considered in the calculation of the avoided investment. In this CBA, an annual fee calculated based on the 13-year useful life of electronic meters was adopted, understanding that the new non-smart meters that will no longer be installed due to the installation of smart meters are electronic, and not a mix between electromechanical and electronic.

131. These two changes were discussed with the consultants, who agreed with ANEEL's position.

132. The percentage of 100% depreciated meters was calculated in the same way as done by the consultancies, having only been updated. In this CBA, the most recent asset bases present at ANEEL were used. The percentages by company can be viewed in the “GeneralData” tab of the attached simulation spreadsheet.

11.1.2. Benefícios

133. The Table 8 shows the cost avoided by reducing the need for visits (reading and delivering the invoice).

Table 8 – Cost avoided by reducing the need for visits (reading and delivering the invoice).

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo evitado com a redução da necessidade de visitas (leitura e entrega da fatura)	**105**	**263**	**351**	mi R$/ano	Cálculo interno
Custo de leitura	2,22	2,22	2,22	R$/medidor/ano	**Fonte:** Resposta das distribuidoras
Custo total de leitura	339	848	1.131	mi R$/ano	Cálculo interno
Redução no custo de leitura (%)	44%	44%	44%	%	**Fonte:** Resposta das distribuidoras
Custo de entrega da fatura física (consumidores que optarem pela fatura fisica)	16,85	16,85	16,85	R$/medidor/ano	**Fonte:** Resposta das distribuidoras
Custo total de entrega das faturas físicas	214,79	536,96	715,95	mi R$/ano	Cálculo interno
Pecentual de consumidores que optarão pela fatura física	20%	20%	20%	%	Hipótese
Custo evitado com visitas	105	263	351	mi R$/ano	Cálculo interno

134. To calculate this benefit, the cost of issuing and delivering the physical invoice was added to 20% of consumer units that will receive smart metering, as previously presented. Furthermore, the same procedure adopted by the consultancies was adopted.

135. The reading cost value results from the application of the weighted average of the values reported by the distributors in response to Joint Circular Letter No. 1/2025-STR/SFF/ANEEL with the total consumer units of each distributor, which can be viewed in the “General Data” tab of the attached simulation file.

136. The reduction in the cost of reading and the cost of delivering the physical invoice for consumers who wish to switch from the digital invoice model results from the responses from distributors Enel SP, CEMIG, CPFL, COPEL and Equatorial PA to the information request form sent by STD, which can be accessed in the “Scenarios” tab of the attached simulation file.

137. The Table 9 presents the cost avoided with cutting and reconnecting services.

Table 9 - Cost avoided with cutting and reconnecting services.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo evitado com corte e religa	**232,03**	**580,07**	**773,42**	mi R$/ano	Cálculo interno
Número de Suspensões de Fornecimento	22,64	22,64	22,64	mi R$/ano	**Fonte:** Relatório de inadimplência da ANEEL
Número de Cortes	2,72	6,79	9,06	mi R$/ano	Cálculo interno
Número de Religação	2,04	5,10	6,81	mi R$/ano	Cálculo interno
Número de Religações sobre os Clientes Cortados	75%	75%	75%	%	**Fonte:** Resposta das distribuidoras
Custo do Corte ou Religação	53,47	53,47	53,47	R$/Atividade	**Fonte:** Resposta das distribuidoras
Redução do custo de corte e religa	91%	91%	91%	%	**Fonte:** Resposta das distribuidoras
Custo total evitado	232,03	580,07	773,42	mi R$/ano	Cálculo interno

138. This benefit was not considered in the CBA carried out by the consultancies, it arises from a contribution presented by Landis+Gyr within the scope of TS nº 13/2024. It was understood that, in fact, this is a benefit resulting from the implementation of smart metering, which was corroborated in meetings held with distributors. The procedure adopted is exactly the one proposed in this contribution.

139. The number of cuts made by distributors was extracted from the default report released by ANEEL, the data per distributor can be accessed in the "General Data" tab of the attached simulation file. The number of reconnections for disconnected customers, the cost of the disconnection or reconnection service and the percentage of reduction in this cost result from the responses of the distributors Enel SP, CEMIG, CPFL, COPEL and Equatorial PA to the information request form sent by STD, which can be accessed in the "Scenarios" tab of the attached simulation file.

140. The Table 10 presents the cost avoided by reducing Non-Technical Losses.

Table 10 – Cost avoided with the reduction of Non-Technical Losses.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo evitado com a redução das PNT	**130**	**651**	**1.215**	mi R$/ano	Cálculo interno
Perdas não-técnicas sobre mercado BT	16,1%	16,1%	16,1%	%	**Fonte:** https://portalrelatorios.aneel.gov.br/luznatarifa/perdasenergia
Redução da PNT (%)	10,00%	20,00%	28,00%	%	Hipótese
PNT Projetada	14,5%	12,9%	11,6%	%	Cálculo interno
PNT evitada	4.039.588	8.079.175	11.310.845	MWh	**Fonte:** Cálculo interno e https://portalrelatorios.aneel.gov.br/luznatarifa/perdasenergias
Percentual de redução do consumo com a regularização	30,00%	30,00%	30,00%	%	Hipótese
Percentual de aumento do ganho de mercado com a regularização	70,00%	70,00%	70,00%	%	Cálculo interno
Custo evitado por medidor	10	20	29	R$/ano	Cálculo interno

141. To calculate this benefit, changes were made in relation to what was done by the consultancies, as detailed previously when the hypotheses adopted in this CBA were described. The percentage of non-technical losses per distributor can be viewed in the "General Data" tab of the attached simulation file. The national average value results from the application of the weighted average of the non-technical loss percentages for the low voltage market of each distributor.

142. The benefits of cost avoided by modulating consumption and cost avoided by reducing consumption were not considered in this CBA. It was understood that smart metering alone is not capable of generating modulation or reduction in consumption, requiring new tariffs. Furthermore, there was a distributor that detected an increase in consumption by consumers who received smart metering. Furthermore, the withdrawal of these benefits is in line with the conservative bias adopted by ANEEL in preparing the CBA.

143. In any case, it is not unknown that international experience points to these two as important benefits of implementing smart metering. Therefore, it is expected that contributions will be presented in the public consultation on this topic.

144. Still regarding these benefits, they are qualitatively represented in the criterion "improvement in the management and dissemination of REDs and optimization of the country's electrical energy resources" used in the AHP.

145. The Table 11 presents the cost benefit avoided by reducing technical losses.

Table 11 – Cost avoided by reducing technical losses.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo evitado com a redução das perdas técnicas	**2,98**	**14,92**	**27,85**	mi R$/ano	Cálculo interno
Perda técnica (%)	7,37%	7,37%	7,37%	%	**Fonte:** ANEEL. Dados para 2022. Mapeado na aba "Perdas".
Redução do consumo com regularização das perdas não técnicas	30%	30%	30%	10,00%	Referência nos planos de combate a perdas, empresa de referência e outros processos da ANEEL que trataram do tema
Redução da PT devido redução do consumo	0,001	0,002	0,003	MWh/ano/consumidor	Cálculo interno

146. When calculating this benefit, there was a big difference in relation to what was done by the consultancies, since this CBA does not consider a reduction in consumption with the implementation of smart metering. Here, the reduction in technical losses results from the reduction in energy flow resulting from the reduction in consumption of consumers with a history of fraud that are now regularized.

147. The Table 12 presents the cost benefit avoided with the reduction in interruptions.

Table 12 – Cost avoided with reduction in interruptions.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo evitado com a redução em interrupções	**2,73**	**13,64**	**29,10**	mi R$/ano	Cálculo interno
Compensação de continuidade	783,20	783,20	783,20	mi R$	**Fonte:** https://portalrelatorios.aneel.gov.br/indicadoresDistribuicao/compensacoesViolacaoIndicadoresIndividuaisContinuidade
Compensação de continuidade por consumidor	8,56	8,56	8,56	R$/ano	Cálculo interno
Redução da compensação DIC (%)	2,50%	5,00%	8,00%	%	Hipótese
Redução total	2,73	13,64	29,10	mi R$/ano	Cálculo interno

148. The calculation of this benefit differs from what was done by the consultancies in the aspects discussed previously when the hypotheses adopted in this CBA were described.

11.1.3. Custos

149. The Table 13, Table 14, Table 15, Table 16, Table 17 present, respectively, the costs with investments in smart metering, with the installation of smart meters, with the uninstallation of conventional meters, with communication infrastructure and with software infrastructure.

Table 13 – Investment in smart metering.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Investimento em medição inteligente	**389,86**	**923,36**	**1.190,11**	mi R$/ano	Cálculo interno
Percentual do custo total com CAPEX e instalação do MI (%)	49%	49%	49%	%	**Fonte:** Resposta das distribuidoras
Redução devido à escala	5,00%	10,00%	13,00%	%	Hipótese
Custo unitário do medidor	241,31	228,61	220,99	R$/medidor	Cálculo interno
Custo total do medido	3.076,33	7.286,04	9.390,89	mi R$	Cálculo interno

Table 14 – Cost of installing smart meters.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo de instalação medidores inteligentes	**226,57**	**536,61**	**691,64**	mi R$/ano	Cálculo interno
Percentual do custo para instalação do MI (%)	28%	28%	28%	%	**Fonte:** Resposta das distribuidoras
Redução devido à escala	5,00%	10,00%	13,00%	%	Hipótese
Custo unitário de instalação	140,24	132,86	128,43	R$/medidor	Cálculo interno
Custo total de instalação	1.787,81	4.234,29	5.457,52	mi R$	Cálculo interno

Table 15 – Cost of uninstalling conventional meters.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo de desinstalação medidores convencionais	**72,11**	**170,80**	**220,14**	mi R$/ano	Cálculo interno
Percentual do custo total para desinstalação (%)	10,7%	10,7%	10,7%	%	**Fonte:** Resposta das distribuidoras
Redução devido à escala	5,00%	10,00%	13,00%	%	Hipótese
Custo unitário por medidor	53,02	50,23	48,55	R$/medidor	Cálculo interno
Custo total da desinstalação	569,03	1.347,70	1.737,04	mi R$	Cálculo interno

Table 16 – Cost of communication infrastructure.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Infraestrutura de Comunicação	**69,90**	**165,56**	**213,39**	mi R$/ano	Cálculo interno
Percentual do custo total com comunicação	8,7%	8,7%	8,7%	%	**Fonte:** Resposta das distribuidoras
Redução devido à escala	5,00%	10,00%	13,00%	%	Hipótese
Custo unitário em infraestrutura de comunicação	43,27	40,99	39,62	R$/medidor	Cálculo interno
Custo total em intraestrutura de comunicação	551,60	1.306,42	1.683,83	mi R$	Cálculo interno

Table 17 – Cost of software infrastructure.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Infraestrutura de Software	**29,57**	**70,04**	**90,27**	mi R$/ano	Cálculo interno
Percentual do custo total com software	3,7%	3,7%	3,7%	%	**Fonte:** Resposta das distribuidoras
Redução devido à escala	5,00%	10,00%	13,00%	%	Hipótese
Custo unitário em infraestrutura de software	18,30	17,34	16,76	R$/medidor	Cálculo interno
Custo total em intraestrutura de software	233,34	552,64	712,29	mi R$	Cálculo interno

150. The information presented in these tables indicates the total cost of removing the conventional meter from a consumer unit, purchasing and installing the smart meter and installing the entire communication and software infrastructure so that all the functionalities of the smart meter are fully operational. In calculating these costs, the same procedure was adopted as was done by the consultancies, differing only in the percentage of scale, which was previously presented when the hypotheses adopted in this CBA were described.

151. Furthermore, the consultancies did not discuss the cost of software, something that was deemed necessary after meetings with the distributors.

152. The Table 18 presents the sunk cost of the meters to be depreciated.

Table 18 – Cost of meters to be depreciated.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo dos medidores a serem depreciados	**100,73**	**251,83**	**335,77**	mi R$	Cálculo interno
Quantidade de medidores a serem depreciados	5,77	14,43	19,24	medidores	Cálculo interno
Depreciação média dos medidores a serem depreciados	62,22%	62,22%	62,22%	%	**Fonte:** Base de ativos medidores das distribuidoras
Tempo restante de depreciação	6,62	6,62	6,62	anos	Cálculo interno
Custo total dos medidores não depreciados	794,85	1.987,13	2.649,50	mi R$	Cálculo interno

153. The same procedure used by the consultancies was adopted in calculating this cost. There was only an update of the average depreciation of the meters to be depreciated, which was done with the same procedure adopted by the distributors, but with the most recent asset bases of the distributors present at ANEEL.

154. The Table 19 presents the cost of communicating with consumers.

Table 19 – Cost of meters to be depreciated.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo de comunicação com consumidores	**2,00**	**4,99**	**6,66**	mi R$/ano	Cálculo interno
Custo por consumidor em comunicação	1,24	1,24	1,24	R$/medidor	**Fonte:** Resposta das distribuidoras
Custo total de comunicação	15,8	39,4	52,6	mi R$	Cálculo interno

155. To calculate this cost, the same procedure used by the consultancies was adopted. The difference in number occurs only in the cost per consumer, which in this RIA uses the value responded by distributors Enel SP, CEMIG, CPFL, COPEL and

Equatorial PA to the information request form sent by STD, which can be accessed in the "Scenarios" tab of the attached simulation file. Two of these distributors did not respond, so a simple average of the values answered by three distributors was used.

156. The Table 20 presents the regulatory cost.

Table 20 – Regulatory cost.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')	Unidade	
Custo regulatório	0,23	2,73	3,77	mi R$	**Fonte:** Cálculo baseado na Calreg e mapeado na aba "Custos Regulatórios"

157. The calculation of this cost differs from what was done by the consultancies in the aspects discussed previously when the hypotheses adopted in this CBA were described.

11.1.4. Resultado da CBA

158. The Table 21 presents the sum of the present value of all benefits and all costs calculated in the CBA for each alternative.

Table 21 – Sum of the present value of all benefits and all costs calculated in the CBA.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Valor presente dos benefícios	R$ 6.838,67	R$ 19.777,69	R$ 29.258,73
Valor presente dos custos	R$ 7.030,51	R$ 16.775,14	R$ 21.713,36

159. It can be seen from Table 22 that the benefits were greater than the costs in alternatives A2' and A4', indicating that the investment in smart metering is worth it. It is also clear that in alternative 0 the benefits were lower than the costs, which indicates that, in terms of quantitative analysis, not promoting regulatory changes will result in increased costs for distributors and, consequently, for consumers.

160. From the analysis of Table 22, it is also noted that alternative A4´resulted in greater benefits and greater costs than alternative A2´.

161. The Table 22 presents the NPV value and the benefits/costs ratio for each of the alternatives considered in the RIA.

Table 22 - NPV and the benefits/costs ratio for each of the alternatives considered in the RIA.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
VPL	-R$ 191,85	R$ 3.002,55	R$ 7.545,37
Razão B/C	0,97	1,18	1,35

162. It can be seen in Table 23 that alternative A4´ presents the highest values of NPV and benefit/cost ratio among all alternatives, indicating that, in terms of quantitative analysis, this is the best alternative to be followed by ANEEL. It is noted that in this alternative, at the end of 13 years, there will be a net benefit of more than 7.5 billion resulting from the implementation of smart metering and that, in the scenario represented in this alternative, for every R$1 invested in smart metering there is a return of R$1.35 in benefits.

163. On the other hand, it is noted that not promoting regulatory changes, as represented in alternative 0, each R$ 1 invested in smart metering generates only R$ 0.97 in benefit, which indicates that, in fact, regarding quantitative analysis, ANEEL must promote regulatory changes on this topic.

The

164. Figure 6 and Figure 7 present these NPV and benefit/cost ratio results graphically.

Figure 6 – VPL das alternativas.

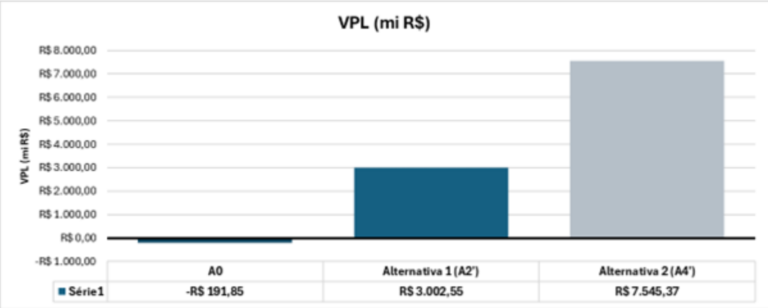
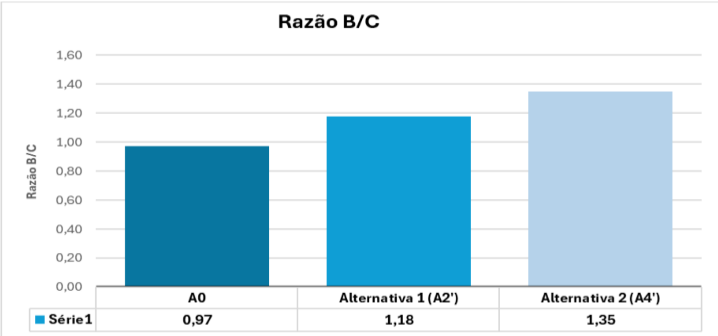


Figure 7 - Razão benefícios/custos das alternativas.



165. The Figure 8 and Figure 9 show the distribution of benefits and costs by alternative.

Figure 8 – Distribution of benefits by alternative.

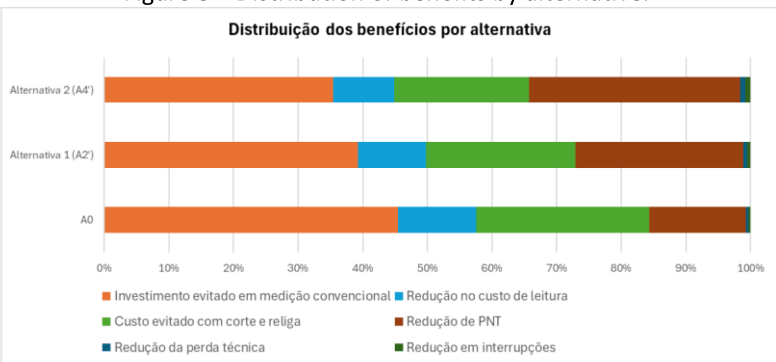


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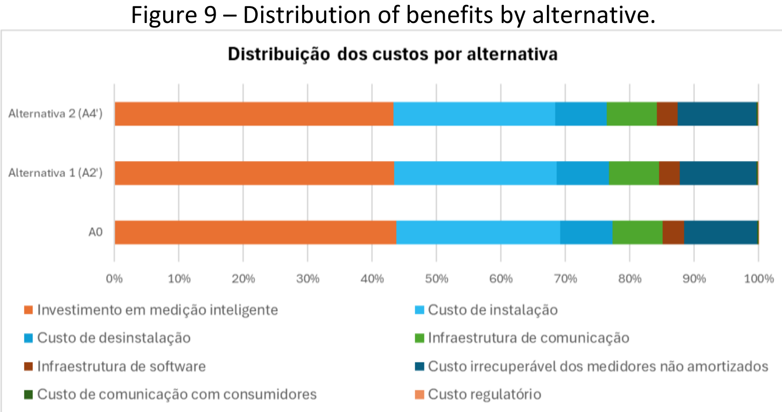
Figure 9 – Distribution of benefits by alternative.



166. It can be seen in Figure 8 that the greatest benefit of CBA comes from the cost avoided with non-intelligent measurement, followed by the reduction of non-technical losses in alternatives A2' and A4'. In alternative A0, the second biggest benefit comes from the reduction in cutting and reconnection costs, followed by the reduction in non-technical losses. In alternatives A2' and A4', the third biggest benefit comes from the reduction in cutting and reconnecting costs.

167. It can be seen in Figure 9 that the highest cost in all alternatives arises from the investment in smart metering, that is, the cost of purchasing the equipment. Next, in all alternatives there is the cost of labor for installing the meters and other

equipment. In third place in all alternatives is the cost of unamortized meters, which represents the cost of removing from the field meters whose depreciation has not yet been completed.

11.1.5. Comparison of results with the CBA of consultancies

11.1.5.1. Benefits

168. The Table 23 and Table 24 present the benefits calculated by the consultancies and those calculated in this CBA, respectively.

Table 23 – Benefits calculated by consultancies.

Benefícios	A0	A1	A2	A3	A4
Investimento evitado em medição convencional	R$ 2.774,21	R$ 1.155,92	R$ 6.935,53	R$ 3.761,30	R$ 9.247,38
Redução no custo de leitura	R$ 402,87	R$ 0,00	R$ 1.258,95	R$ 0,00	R$ 1.678,61
Redução de PNT	R$ 1.488,89	R$ 0,00	R$ 7.444,45	R$ 0,00	R$ 9.925,93
Modulação do consumo	R$ 0,00	R$ 89,07	R$ 1.068,89	R$ 214,76	R$ 1.425,19
Redução de consumo e da perda técnica	R$ 1.790,29	R$ 0,00	R$ 4.475,72	R$ 0,00	R$ 5.967,63
Redução em interrupções	R$ 12,67	R$ 0,00	R$ 63,35	R$ 0,00	R$ 84,47

Table 24 – Benefits calculated in this CBA.

Benefícios	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Investimento evitado em medição convencional	R$ 3.105,27	R$ 7.763,17	R$ 10.350,89
Redução no custo de leitura	R$ 830,13	R$ 2.075,31	R$ 2.767,08
Custo evitado com corte e religa	R$ 1.830,86	R$ 4.577,16	R$ 6.102,87
Redução de PNT	R$ 1.027,33	R$ 5.136,66	R$ 9.588,43
Modulação e redução do consumo	R$ 0,00	R$ 0,00	R$ 0,00
Redução da perda técnica	R$ 23,55	R$ 117,75	R$ 219,79
Redução em interrupções	R$ 21,53	R$ 107,65	R$ 229,66

169. Comparing Table 23 and Table 24, it is noted that the cost benefit avoided with conventional measurement was higher in this CBA than in that carried out by consultancies. This result arises from a greater number of consumer units that will receive smart metering and which, therefore, will not receive conventional metering due to the increase in the number of consumer units in group B since the CBA was carried out by the consultancies. At the same time, the projection of new consumer units in this CBA was greater than what was considered by the consultancies.

170. Furthermore, the number of 100% depreciated meters increased significantly, from 30.5% to 46.2%, indicating a greater number of meters that were already due for replacement. This increase was expected, since the consultancies used the year 2022 as a data reference and this CBA uses the year 2024 as a reference. These two years represent more than 15% of the useful life of electronic meters, which already represent more than 60% of the installed meter park.

171. Two other aspects that influenced these results were the correction of the consultants' spreadsheet and the use of a new annual fee value, which was discussed previously when the hypotheses adopted in this CBA were described.

172. All these effects superseded a lower price for the conventional meter adopted in this CBA, which went from the R$ 216.15 adopted by the consultancies to R$ 192.14.

173. . Focusing on the benefit of reducing reading costs, it is noted that there was also an increase in relation to what was calculated by the distributors. In this case, the main factor that explains the difference is the cost of each reading service, which went from the R$1.06 adopted by consultancies to R$2.22. This increase of over 100% in the cost of each reading service was enough to offset the adoption of physical invoice delivery in 20% of consumer units that will receive smart metering and the adoption of a smaller percentage reduction in reading costs in alternatives A2 and A4, which went from the 50% used by consultancies to 44%.

174. Regarding the reduction of non-technical losses, there has been an increase in the percentage of non-technical losses in the low voltage market since the work carried out by the consultancies, rising from 14.6% to 16.1%. This difference generates a greater potential, in MWh, to reduce these losses, increasing the benefit. On the other hand, the reduction percentages were strongly reduced, especially in alternatives A0 and A2, going from 20% and 40% to 10% and 20%, respectively.Como efeito final, essa diminuição no percentual de redução suplantou o efeito de uma maior quantidade de MWh reduzidos nas alternativas A0 e A2´. Na alternativa A4´, em que a diminuição no percentual de redução foi menor, o efeito final foi de queda no valor desse benefício, mas de maneira menos intensa do que nas outras duas alternativas.

175. Still regarding this benefit, the new calculation method, which considered a total of 70% valued by TUSD Fio B, also led to the final value being lower than that calculated by the consultancies, since this tariff component is lower (R$ 227.58 compared to R$ 244.48) than the energy purchase cost adopted by the consultancies. Strictly speaking, even the energy purchase cost adopted in this CBA, of R$ 239.89, was also lower, but not in the same proportion as the TUSD wire B.

176. With regard to the modulation and reduction of consumption, as previously explained, these benefits were excluded in this CBA.

177. Regarding the reduction of technical losses, the result in this CBA was lower, as a lower percentage of technical losses was considered, 7.37% compared to 17.14%, and also a smaller reduction in consumption per consumer (as already explained, in this CBA the reduction in consumption only occurs in consumers who had a history of fraud and are now regularized).Quanto à redução no pagamento de compensação por transgressão dos indicadores individuais de continuidade, chegou-se um valor maior nessa CBA do que o calculado pelas consultorias, especialmente na alternativa A4´. Esse resultado decorre da adoção de um percentual de redução maior nessa alternativa em relação ao que foi considerado pelas consultorias, a um total pago de compensações maior em 2024 do que em 2022, ano de referência para as consultorias e de uma quantidade maior medidores inteligentes instalados nessa CBA em relação às consultorias.

178. Furthermore, regarding the cost benefit avoided with cutting and reconnecting, it was not considered by the consultants.

179. Finally, it is important to compare the result of the sum of the present value of the benefits calculated by the consultancies and that calculated in this CBA. The Table 25 presents the sum of the present value of all benefits calculated by the consultancies.

Table 25 – Sum of the present value of all benefits calculated by the consultancies.

	A0	A1	A2	A3	A4
Valor presente dos benefícios	R$ 6.468,93	R$ 1.245,00	R$ 21.246,90	R$ 3.976,06	R$ 28.329,20

180. Comparing Table 25 and Table 21, it is clear that in this CBA the benefits of alternatives A0 and A4 were greater than those calculated by the consultancies, while in alternative A2 the benefits were lower. In alternative 0, the result is explained by the adoption of a new benefit, cost avoided with cutting and reconnecting, and by the higher values of the benefits with cost avoided with conventional meters and cost avoided with the reading service, which in this alternative were sufficient to offset the lower values of the benefits of reducing non-technical losses and reducing consumption. A similar situation occurs with alternative A4´.

181. Regarding alternative 2, the value of the new benefit, added to the increase in values in other benefits, was not sufficient to compensate for the reduction in the values of the non-technical loss reduction and consumption reduction benefits. This alternative was especially impacted by the disregard of the consumption modulation benefit. A similar effect occurred with alternative A4', but in that case the drop in the benefit of reducing non-technical losses was much smaller.

182. In percentage terms, alternatives A0 and A4 had benefits 5.7% and 3.3% greater than the results of the consultancies, respectively, while alternative A2 had benefits 6.9% lower than those calculated by the consultancies. Therefore, although there are differences, it can be concluded that they were not very significant.

11.1.5.2. Costs

183. The Table 26 and Table 27 present the costs calculated by the consultancies and those calculated in this CBA, respectively.

Table 26– Costs calculated by consultancies.

Custos	A0	A1	A2	A3	A4
Investimento em medição inteligente	R$ 5.244,85	R$ 2.428,17	R$ 10.926,77	R$ 5.268,84	R$ 14.569,03
Custo de desinstalação	R$ 636,62	R$ 294,73	R$ 1.326,28	R$ 180,03	R$ 1.768,38
Infraestrutura de comunicação	R$ 1.048,97	R$ 485,63	R$ 2.185,35	R$ 1.053,77	R$ 2.913,81
Custo de comunicação com consumidores	R$ 58,17	R$ 24,24	R$ 145,42	R$ 58,43	R$ 193,89
Custo irrecuperável dos medidores não amortizados	R$ 1.350,00	R$ 562,50	R$ 3.374,99	R$ 381,77	R$ 4.499,99
Custo regulatório	R$ 1,53	R$ 1,53	R$ 20,06	R$ 1,53	R$ 28,29

Table 27 – Costs calculated in this CBA.

Custos	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Investimento em medição inteligente	R$ 3.076,33	R$ 7.286,04	R$ 9.390,89
Custo de instalação	R$ 1.787,81	R$ 4.234,29	R$ 5.457,52
Custo de desinstalação	R$ 569,03	R$ 1.347,70	R$ 1.737,04
Infraestrutura de comunicação	R$ 551,60	R$ 1.306,42	R$ 1.683,83
Infraestrutura de software	R$ 233,34	R$ 552,64	R$ 712,29
Custo irrecuperável dos medidores não amortizados	R$ 794,85	R$ 1.987,13	R$ 2.649,50
Custo de comunicação com consumidores	R$ 15,77	R$ 39,41	R$ 52,55
Custo regulatório	R$ 1,79	R$ 21,51	R$ 29,73

184. In order to allow a comparison of the costs of purchasing and installing smart meters and other associated equipment, the Table 28 and Table 29 present in aggregate the costs with investment in smart metering, installation, uninstallation, communication and software calculated by the consultancies and calculated in this CBA, respectively.

Table 28 – Aggregate cost of purchasing and installing smart meters and other equipment calculated by consultancies.

Custos	A0	A1	A2	A3	A4
Custo agregado com compra e instalação dos medidores inteligente e demais equipamentos	R$ 6.930,44	R$ 3.208,54	R$ 14.438,41	R$ 6.502,64	R$ 19.251,21

Table 29 – Added cost of purchasing and installing smart meters and other equipment calculated in this CBA.

Custos	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Custo agregado com compra e instalação dos medidores inteligente e demais equipamentos	R$ 6.218,10	R$ 14.727,09	R$ 18.981,58

185. Comparing Table 28 and Table 29, it is noted that these costs of alternatives A0 and A4 resulted in lower in this CBA than what was calculated by the consultancies. In alternative A2 they were larger. These results are explained by a reduction in the total cost of the installed and operational meter, which went from the R$ 667.92 adopted by the consultancies to the value of R$ 520.99 in this CBA, a drop of 22%, but which was offset by a greater number of meters installed, which increased by 9.6% in all alternatives in this CBA.

186. The percentage results indicate a reduction of 10.3% and 1.5%, respectively, in alternatives A0 and A4´, and an increase of 2.0% in alternative 2. Therefore, in alternatives A2 and A4, the increase in the number of consumers offsets the reduction in costs with the smart meter and other equipment in practically the same proportion. In alternative A0, the reduction in this cost prevails in relation to the increase in the number of consumer units.

187. Turning to Table 27 and Table 28, it is noted that there was a large reduction in the cost of non-amortized meters in all alternatives, which also occurred with the cost of communicating with consumers. As for the regulatory cost, it varied slightly.No caso do custo irrecuperável dos medidores não amortizados, a diferença se justifica pela quantidade maior de medidores 100% amortizados considerados nessa CBA, conforme já apresentados anteriormente. Ou seja, menos equipamentos ainda não 100% amortizados serão retirados de campo em relação ao cenário considerado pelas consultorias.

188. 180. Regarding the cost of communication, the drop is justified by the adoption of a value per consumer in relation to what was considered by the consultancies. Regarding the regulatory cost, the removal of one component of this cost was offset by higher values for the other components.

11.1.5.3. VPL e resultados por consumidor que receberá a medição inteligente

189. Furthermore, it is important to compare the result of the sum of the present value of the costs calculated by the consultancies and that calculated in this CBA. The Table 30 presents the sum of the present value of all costs calculated by the consultancies.

Table 30 – Sum of the present value of all costs calculated by the consultancies.

	A0	A1	A2	A3	A4
Valor presente dos custos	R$ 8.340,13	R$ 3.796,80	R$ 17.978,87	R$ 6.944,38	R$ 23.973,38

190. Comparing Table 30 and Table 21, it is clear that there was a reduction in the NPV of costs in all alternatives, which is explained by the strong reduction in the cost of non-amortized meters.

191. Finally, the Table 31 and Table 32 present the benefits and costs per consumer who will receive smart metering calculated by the consultancies and calculated in this CBA, respectively.

Table 31 – Benefits and costs per consumer who will receive smart metering calculated by consultancies.

	A0	A1	A2	A3	A4
Benefício por consumidor atingido	R$ 556,07	R$ 256,85	R$ 730,55	R$ 340,22	R$ 730,55
Custo por consumidor atingido	R$ 716,91	R$ 783,29	R$ 618,18	R$ 594,22	R$ 618,22

Table 32 – Benefits and costs per consumer who will receive smart metering calculated by consultancies.

	A0	Alternativa 1 (A2')	Alternativa 2 (A4')
Benefício por consumidor atingido	R$ 536,43	R$ 620,55	R$ 688,52
Custo por consumidor atingido	R$ 551,48	R$ 526,34	R$ 510,96

192. Comparing the Table 31 and Table 32, it is noted that both the costs and benefits per consumer who will receive smart metering were reduced in this CBA in relation to the work of the consultancies. The reduction in benefits is explained by the disregard of modulation and reduction in consumption, in addition to the adoption of more conservative percentages in the reduction of non-technical losses, the reduction in the payment of compensation for the transgression of individual continuity indicators and economies of scale. These aspects prevailed over the adoption of the benefit of reducing cutting and reconnecting costs.

193. Regarding costs, the reduction in the costs of smart meters and other equipment and the reduction in the cost of non-amortized meters brought the result to values much lower than those calculated by the consultancies. It can therefore be concluded that these two aspects are the most relevant for the results achieved in this CBA.

194. In effect, the reduction in costs with smart meters and other equipment and the reduction in the cost of non-amortized meters made all alternatives more advantageous, even if lower benefits per consumer were calculated in this CBA. These two aspects more than compensated for the disregard of two benefits and the even more conservative approach adopted in this CBA in relation to consultancies, which indicates that, in terms of quantitative analysis, the time has come for a massive implementation of smart metering.

11.1.6. CBA sensitivity analysis

195. In order to verify the robustness of the results found, the sensitivity analysis carried out by the consultancies was updated, which considered two scenarios – optimistic and pessimistic. In the optimistic scenario, it was considered that the hypotheses related to an increase in benefits would be 30% higher, and the hypotheses related to an increase in costs would be 30% lower. In the pessimistic scenario, these hypotheses were 30% lower and 30% higher, respectively. This analysis can also be simulated in the attached simulation file.

196. The Figure 10 and Figure 11 present the NPV and benefit/cost ratio results, respectively, for the three alternatives of this CBA in the optimistic scenario.

Figure 10 – NPV of the 3 alternatives in the optimistic scenario.

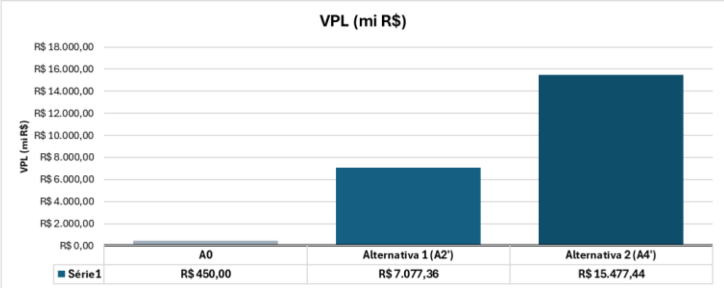
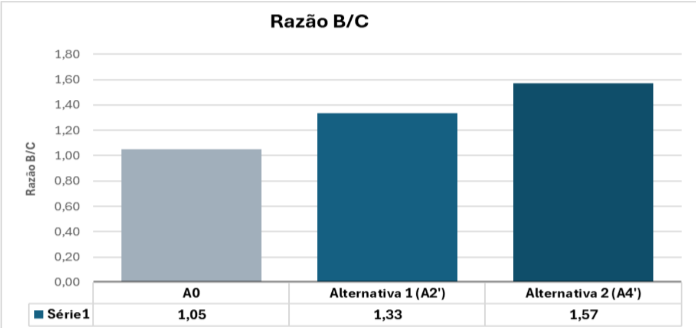


Figure 11 – Benefit/cost ratio of the 3 alternatives in the optimistic scenario.



197. It can be seen in Figure 13 and Figure 14 that in the optimistic scenario all alternatives result in a positive NPV and a benefit/cost ratio greater than 1. Therefore, there is a reversal in alternative 0, which in the neutral scenario had a negative NPV and a benefit/cost ratio lower than 1. In any case, in this scenario, alternative A4´, which starts to present an even more positive result, remains the best choice in the CBA criterion.

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201. Figure 12 and Figure 13 represent the NPV and benefit/cost ratio results, respectively, for the three alternatives of this CBA in the pessimistic scenario. It can be seen in these figures that in the pessimistic scenario, alternatives A2' and A4' remain with a positive NPV result and a benefit/cost ratio greater than 1, while alternative A0 worsens the result achieved in the neutral scenario. Therefore, it appears that alternatives A2 and A4 do not present great volatility in relation to changes

in the CBA input data. Furthermore, alternative A4 remains the most advantageous even in this scenario, which indicates that, in fact, it is the best CBA alternative.

Figure 12 – NPV of the 3 alternatives in the pessimistic scenario.

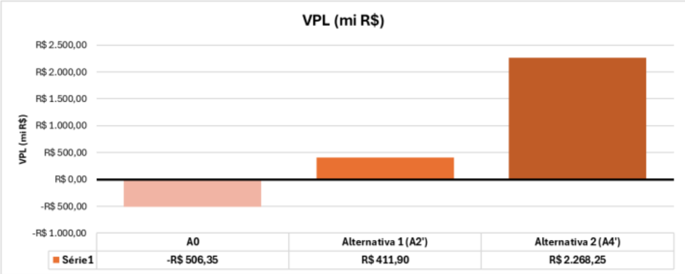
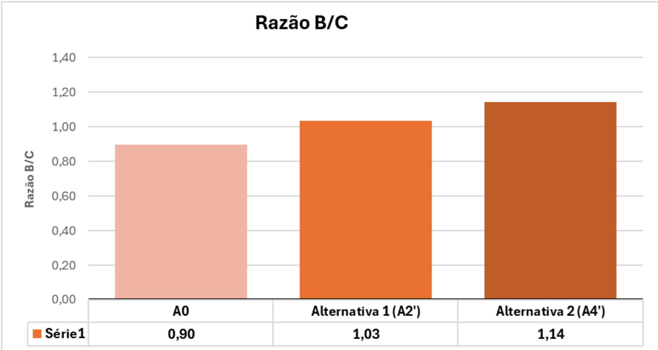


Figure 13 – Benefit/cost ratio of the 3 alternatives in the pessimistic scenario.



202. In order to complement the sensitivity analysis, the price of the smart meter and the percentages of reduction of non-technical losses were varied to assess at what point alternative A4 ceases to be positive. The price of the smart meter strongly impacts the cost, and the aim is to estimate whether a change in the tendency to reduce this price would lead to significant changes in the result presented here. As for non-technical losses, this is a hypothesis that intensely affects one of the main benefits of this CBA.

203. Regarding the cost of the smart meter, if an increase in the value is identified to the point of reaching R$ 730 per installed equipment and with all operational functionalities, alternative A4´ will have a negative NPV and a benefit/cost ratio lower than 1. Therefore, only if there is an increase of more than 40% in this cost would there be a reversal of the scenario in this alternative.

204. With regard to the percentage of reduction in non-technical losses, it can be seen that if the real reduction verified with smart metering is only 6.2%, alternative A4´ starts to have a negative NPV and a benefits/costs ratio lower than 1. Therefore, there must be a reduction of almost 80% in the value adopted in this CBA for this alternative to move to the negative scenarioNa outra ponta, quanto à alternativa A0, caso a redução das perdas não técnicas seja de 12%, 20% maior do que os 10% considerados nessa CBA, essa alternativa passa a ter VPL positivo e razão benefícios/custo maior do que 1. De toda forma, nessa situação as alternativas A2´e A4´ teriam reduções ainda maiores, dado que consideram maior quantidade de medidores instalados, e, assim, a alternativa A4´permaneceria a mais vantajosa na análise quantitativa.

205. These results point to the robustness of alternative A4´, but it is expected that contributions will be presented in the CBA that can improve the analysis presented here.

11.2. AHP Method

206. After choosing the AHP methodology, the method was applied to the regulatory problem: reducing possible regulatory barriers to the implementation of intelligent systems in SEB, with the choice of the most appropriate alternative from a regulatory and technical perspective.

207. Below are the main steps in applying the AHP method. The steps are presented sequentially, however, this process is, in practice, carried out iteratively.

208. The structure of the problem was composed of three levels: at the top, the objective “Choose the Best Alternative”; at the second level, the criteria that would guide the choice; and at the third level, the alternatives.

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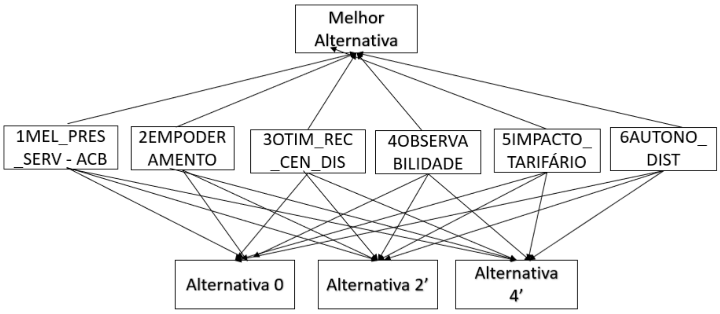
211. Figure 14 presents the hierarchical structure for the problem object of this RIA study.

Figure 14 - Hierarchical structure for the object of this RIA study.



Fonte: Elaboração própria.

212. Based on this structuring of the problem, regulatory alternatives were defined. These alternatives were the result of the original study by the consultancies, the contributions of TS nº 13/2024 and Ordinance 111/2025 – MME, resulting in three alternatives: Alternative 0, Alternative 2' and Alternative 4', already detailed above.

213. The next step was to define the criteria. This process was carried out based on the original study by the consultancies, the contributions of TS nº 13/2024 and Ordinance nº 111/2025. After this definition, the evaluation was carried out, now for the criteria. The chosen criteria are described in section 11.2.

214. With the hierarchy established, the stage of parity comparisons (two by two) between the alternatives began, using the Saaty scale to assign levels of relative importance. This phase allowed calculating the weights of each alternative, reflecting their relevance in the regulatory context.

215. As an example, the decision-makers' assessment is presented in relation to the criterion: Consumer Empowerment. Using Saaty's Fundamental Scale, decision makers evaluated, two by two, the alternatives in relation to this specific criterion, with scores ranging from 1 to 9, being: score 1 for equal importance and score 9 for the absolute importance of one criterion in relation to the other.

216. In case of disagreements between decision makers, a new round of evaluation was carried out, in order to obtain consistency in responses and consensus, in accordance with the Delphi Technique method. The Table 33 presents a comparison, two by two, of the alternatives in relation to the Consumer Empowerment criterion using the AHP method.

Table 33 - Example of evaluating alternatives in relation to the Consumer Empowerment criterion.

Empoderamento do consumidor		PREFERÊNCIA	GRAU DE PREFERÊNCIA
Alternativa 0	Alternativa A2´	Alternativa A2´	5
Alternativa 0	Alternativa A2´	Alternativa A4´	6
Alternativa A4´	Alternativa A4´	Alternativa A4´	3

Fonte: Elaboração própria.

217. This evaluation process was repeated for all criteria, in order to cover the entire hierarchical structure of the problem presented in Figure 16.

218. Then, the same evaluation procedure was carried out, comparing, two by two, each criterion in relation to the main objective: Best Alternative, assigning grades according to its performance.

219. Thus, the process was repeated, in the same way as it was carried out to evaluate the alternatives. Using Saaty's Fundamental Scale, decision makers evaluated, two by two, the criteria in relation to the specified objective, with scores ranging from 1 to 9, being: score 1 for equal importance and score 9 for absolute importance. The Table 34 presents the result of the decision makers' evaluation of the criteria in relation to the main objective: Best Alternative.

Table 34 - Result of evaluation of criteria against the specified objective

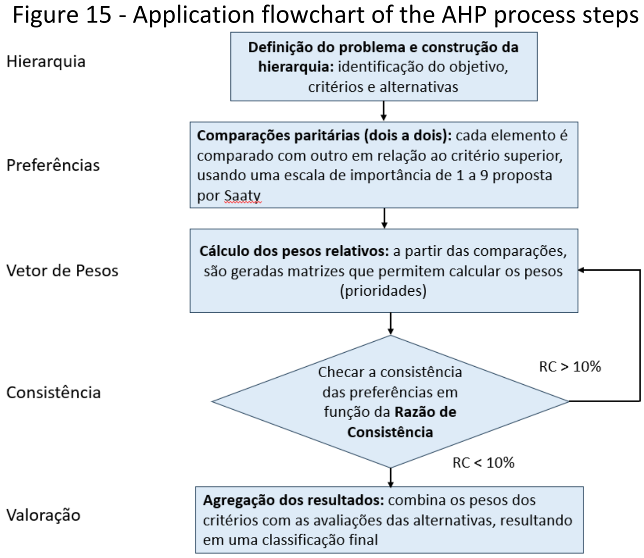
CRITÉRIOS		PREFERÊNCIA	GRAU DE PREFERÊNCIA
Critério 1	Critério 2	Critério 1	3
Critério 1	Critério 3	Critério 1	4
Critério 1	Critério 4	Critério 1	3
Critério 1	Critério 5	Critério 1	3
Critério 1	Critério 6	Critério 1	4
Critério 2	Critério 3	Critério 2	3
Critério 2	Critério 4	Critério 4	3
Critério 2	Critério 5	Critério 5	3
Critério 2	Critério 6	Critério 2	3
Critério 3	Critério 4	Critério 4	2
Critério 3	Critério 5	Critério 5	4
Critério 3	Critério 6	Critério 6	3
Critério 4	Critério 5	Critério 5	3
Critério 4	Critério 6	Critério 4	3
Critério 5	Critério 6	Critério 5	4

Source: Own preparation.

220. It is important to highlight that the coherence of the evaluations carried out by decision-makers can be assessed using the Consistency Ratio – RC in all stages of evaluating the method, presented previously. In this sense, a matrix of consistent subjective judgments is considered when the Consistency Ratio value is less than 0.10. Otherwise, a peer comparison review is recommended.

221. From a practical point of view, in summary, the AHP follows a set of steps, as shown in the flowchart in Figure 15, below:

Figure 15 - Application flowchart of the AHP process steps



Fonte: Elaboração própria

222. After the applicator went through all the steps in the previous flowchart, the following results were obtained for the weights of the criteria and the weight of the alternatives, Figure 18.

Figure 16 – Pesos dos critérios e ordem de preferência das alternativas no método AHP.

	Critério 1	Critério 2	Critério 3	Critério 4	Critério 5	Critério 6
Pesos	0,354	0,117	0,054	0,152	0,245	0,077

ORDEM DE PREFERÊNCIA

	ESCORES	ORDEM
Alternativa 0	0,280	2
Alternativa A2´	0,252	3
Alternativa A4´	0,467	1

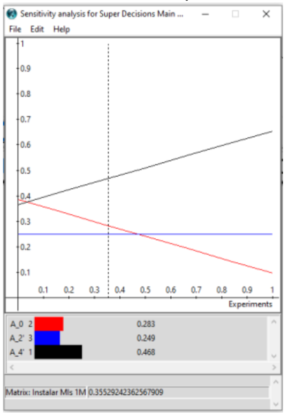
223. It can be seen in Figure 18 that criterion 1, cost-benefit analysis, resulted in the highest weight in the AHP method, with 0.354, followed by criterion 5, short-term tariff impact, with 0.245. As for the results, alternative A4´ came in 1st place, with a weight of 0.467, followed by alternative 0, which had a weight of 0.280. Alternative A2 came in last place, although its weight was very close to alternative A0, with 0.252. These results indicate that, according to the criteria defined in the AHP process, alternative A4' is the option most aligned with the project's objectives and requirements.

11.2.1. AHP Sensitivity Analysis

224. The sensitivity analysis of the results achieved with the AHP method was carried out using the Superdecisions software. The criteria with the greatest weight in the decision were chosen: cost-benefit analysis and short-term tariff impact, and changes in their weights were simulated up to the point of change in the order of recommendation of alternatives.

225. The Figure 17 presents the result of this simulation for the cost-benefit analysis criterion.

Figure 17 - Resultado da análise de sensibilidade para o critério análise de custo-benefício.



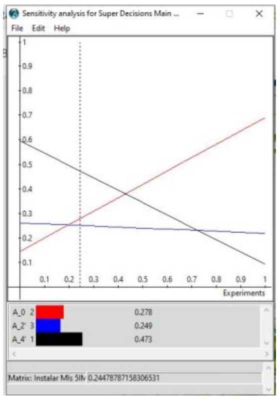
226. Note in Figure 19 that the greater the weight of the cost-benefit analysis, the more alternative A4´ (in black) prevails in relation to the others. In a scenario where the weight of these selections increases, there is also a point, at 0.47, where alternative A2´ (in blue) surpasses alternative A0 (in red).

227. On the other hand, the lower the weight of this recruitment, the lower the dominance of alternative A4´ and the more strength alternative A0 gains. If the weight of this draw reaches 0.03, alternative 0 would be recommended.

228. Therefore, the weight of this selection would have to be reduced by another 90% to change the alternative suggested in the AHP, which highlights the robustness of the result achieved.

229. The Figure 18 presents the result of the sensitivity simulation for the short-term tariff impact.

Figure 18 - Resultado da análise de sensibilidade para o impacto tarifário de curto prazo.



230. It can be seen in Figure 20 that the greater the weight of the short-term tariff impact criterion, the lower the dominance of alternative A4´. If the weight of this criterion reached 0.432, this alternative would no longer be the recommended one, with alternative 0 becoming the dominant one and, therefore, the recommended one. Furthermore, if the criterion weight reached 0.721, alternative A4´ would have the lowest dominance among all alternatives.

231. On the other hand, the lower the weight of this criterion, the greater the dominance of alternative A4'. Furthermore, at the point of 0.195 in the weight of this criterion, alternative A2´ would have more dominance than alternative 0.

232. Based on these results, it is clear that the weight of this criterion should increase from 0.254 to 0.432, 70% higher, so that alternative A4 would no longer be recommended. This result shows that, in fact, this alternative is robust and should be the one recommended by ANEEL.

12. Conclusions

233. The AHP method is an important tool to assist decision making. Its application indicated a preference for the A4´ alternative, with a great advantage over the others. The sensitivity analysis proved the dominance of this alternative in relation to the others and its low volatility in relation to the weights of the main decision-making criteria.

234. After applying the AHP method, a final assessment and definition of the alternative is necessary. Based on the contextualization of the problem presented, with its causes and consequences, it can be stated that the adoption of Alternative A0 will not contribute to the expected advances in the topic. Despite having benefits such as tariff impact and autonomy of distributors, it is clear that leaving the definition of implementation only to the strategic management of distributors can delay several benefits that smart metering can bring to the sector, in addition to not being completely aligned with public policy.

235. Alternatives A2´ and A4´ have practically the same premises, but they differ greatly in the condition of compulsory implementation of smart metering if the CBA has a positive result. This difference, despite seeming simple, translates into a big difference in terms of overall results for society.A implantação de medidores inteligentes está alinhada com as políticas públicas já citadas nesta RIA, com benefícios muitas vezes não capturados nos planejamentos decisórios das próprias distribuidoras.

236. Therefore, the guidelines for carrying out CBA by distributors will not have their full effect if the implementation of meters is not addressed when it proves viable. After all, this is a topic defined as strategic for the country and its advancement should occur whenever it proves beneficial

13. Bibliographic References

AEMC. (2022). *Costs and Benefits of Accelerating the Rollout of Smart Meters AEMC Review of the Regulatory Framework for Metering Services*. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aemc.gov.au/sites/default/files/2022-11/oakley_greenwood_report.pdf

AEMC. (2023). *REVIEW OF THE REGULATORY FRAMEWORK FOR METERING SERVICES*.

ANEEL. (2024a). *NOTA TÉCNICA Nº 67/2024 - STD/SFF/STR/STE/SGM/ANEEL*. https://antigo.aneel.gov.br/web/guest/tomadas-de-subsidios?p_auth=j1j80X2m&p_p_id=participacaopublica_WAR_participacaopublicaportlet&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_p_col_id=column-

2&p_p_col_count=1&_participacaopublica_WAR_participacaopublicaportlet_ideParticipacaoPublica=3869&_participacaopublica_WAR_participacaopublicaportlet_javax.portlet.action=visualizarParticipacaoPublica

ANEEL. (2024b, April 5). *Atividade Regulatória - Cronograma Referencial de Realização das Atividades Regulatórias*. ANEEL. www. aneel.gov.br

ANEEL. (2025). *Nota Técnica Conjunta nº 16/2025-STD-SFF-STR/ANEEL*.

Barbosa, A. de S., Shayani, R. A., & Oliveira, M. A. G. de. (2018). A multi-criteria decision analysis method for regulatory evaluation of electricity distribution service quality. *Utilities Policy*, *53*(June), 38–48. https://doi.org/10.1016/j.jup.2018.06.002

Brasil. (2020, November 30). *Decreto nº 10.411/2020*. DOU. https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2020/decreto/d10411.htm

Comisión Nacional de Energía. (2013). *REDES INTELIGENTES: OPORTUNIDADES DE DESARROLLO Y ESTRATEGIA DE IMPLEMENTACIÓN EN CHILE*. Available: https://www.cne.cl/wp-content/uploads/2016/10/201310-Redes-inteligentes_oportunidadesde- desarrollo-y-estrategia-de-implementaci%C3%B3n-en-Chile.pdf.

CPUC. (2002). *Order Instituting Rulemaking - R.02-06-001*.

CPUC. (2013). *The Benefits of Smart Meters*. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cpuc.ca.gov/-/media/cpuc-website/about-cpuc/documents/transparency-and-reporting/fact_sheets/benefitsofsmartmeters0113.pdf

ENEL. (2023, July). *Controlador do CabeçalhoContatore Open Meter, quando arriverà a casa mia?* Https://Ineuportalgis.Enel.Com/Portal/Apps/Webappviewer/Index.Html?Id=c5cb97af0a1647d48A400ff69c4717ea&mobileBreakPoint=200.

IEA. (2023). *Tracking Clean Energy Progress 2023*. https://www.iea.org/reports/tracking-clean-energy-progress-2023

Koukouvinos, K. G., Koukouvinos, G. K., Chalkiadakis, P., Kaminaris, S. D., Orfanos, V. A., & Rimpas, D. (2025). Evaluating the Performance of Smart Meters: Insights into Energy Management, Dynamic Pricing and Consumer Behavior. *Applied Sciences (Switzerland)*, *15*(2). https://doi.org/10.3390/app15020960

MME. (2025, June 18). *Portaria nº 111/2025 - MME*. DOU. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.gov.br/mme/pt-br/acesso-a-informacao/legislacao/portarias/2025/portaria-normativa-mme-n-111-2025.pdf

MME. (2026, January 28). *Portaria nº 126/2026 - MME*. DOU. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.gov.br/mme/pt-br/acesso-a-informacao/legislacao/portarias/2026/portaria-normativa-mme-n-126-2026.pdf

PSR Energy; SIGLASUL. (2023). *Avaliação de modelos regulatórios para implantação de sistemas de medição inteligentes no sistema de distribuição brasileiro - Relatório 1 - Mapeamentos Preliminares e Seleção de Alternativas*. https://app.powerbi.com/view?r=eyJrIjoiYWJlYzViNGEtZWZlOC00NmY2LTkwMDEtMTI0ODg1ZTM0MmE1Iiw idCI6IjQwZDZmOWI4LWVjYTctNDZhMi05MmQ0LWVhNGU5YzAxNzBlMSIsImMiOjR9.

PSR Energy; SIGLASUL. (2024a). *Avaliação de modelos regulatórios para implantação de sistemas de medição inteligentes no sistema de distribuição brasileiro R3: Descrição da alternativa recomendada*. https://app.powerbi.com/view?r=eyJrIjoiYWJlYzViNGEtZWZlOC00NmY2LTkwMDEtMTI0ODg1ZTM0MmE1Iiw idCI6IjQwZDZmOWI4LWVjYTctNDZhMi05MmQ0LWVhNGU5YzAxNzBlMSIsImMiOjR9.

PSR Energy; SIGLASUL. (2024b). *Avaliação de modelos regulatórios para implantação de sistemas de medição inteligentes no sistema de distribuição brasileiro - Relatório 2 - Comparação das Alternativas e Definição da Alternativa Recomendada*. https://app.powerbi.com/view?r=eyJrIjoiYWJlYzViNGEtZWZlOC00NmY2LTkwMDEtMTI0ODg1ZTM0MmE1Iiw idCI6IjQwZDZmOWI4LWVjYTctNDZhMi05MmQ0LWVhNGU5YzAxNzBlMSIsImMiOjR9.

Saaty, T. L. (1980). The analytic hierarchy Process. In McGraw-Hill (Ed.), *The Analytic Hierarchy Process.* (Vol. 48, Number 1). McGraw-Hill. https://doi.org/10.1016/0377-2217(90)90057-i.

Völker, B., Reinhardt, A., Faustine, A., & Pereira, L. (2021). Watt's up at home? Smart meter data analytics from a consumer-centric perspective. In *Energies* (Vol. 14, Number 3). MDPI AG. https://doi.org/10.3390/en14030719

14. Annex I - Minimum Functionalities of Smart Meters

As discussed in the previous section, alternatives A2´ and A4´ provide for the definition of minimum meter functionalities by ANEEL. This topic is fundamental to deciding the benefits and costs of implementing these meters. It was addressed in the work of the consultancies, which proposed the minimum functionalities presented in Tabela 35.

Tabela 35 - Minimum functionalities proposed by the consultancies.

Categoria	Funcionalidades(1)(2)	Justificativas
Comunicação e controle remotos	**Leitura remota**	Eficiência operacional (redução de custos de leitura e outros custos operacionais), redução em interrupções e compensações
	Corte e religa remotos	
	Last gasp e retorno	
	Programação e parametrização remotas	
	Atualização de *firmware* remota	
	Segurança cibernética	Segurança dos dados trafegados; segurança operacional
Detecção de fraudes	**Alarme *anti-tamper***	Redução de perdas não técnicas; segurança operacional
Interface	**Disponibilização de informações no próprio medidor ou em dispositivo localizado internamente à Unidade Consumidora (UC)**	Facilidade de acesso a informações pelo consumidor; gestão do consumo pelo consumidor; modulação do consumo; redução de consumo e das perdas técnicas correspondentes
	Gestão do consumo por app	
Medição	**Potência e energia ativa bidirecionais(3)**	Faturamento; operação e planejamento da rede
	Potência e energia reativa bidirecionais	Operação e planejamento da rede
	Armazenamento de registros em memória	Uso de dados pelo consumidor e distribuidora
	Intervalo de integralização de 5 min	Padronização; operação e planejamento da rede
Tarifação	**Permitir tarifação pelo horário de uso (*Time-of-Use Tariff* - TOU) com, no mínimo, 4 postos tarifários programáveis**	Previsão para novas modalidades tarifárias/Resposta da Demanda (RD); gestão do consumo pelo consumidor; modulação do consumo; redução de consumo e das perdas técnicas correspondentes

The last gasp and return and bidirectional power and reactive energy functionalities were proposed as recommended, while the other functionalities were proposed as necessary.

In addition to these inputs arising from TS nº 13/2024, another important aspect to be considered when defining the minimum functionalities of meters are the provisions of MME Ordinance nº 111/2025, which in Section III of art. 4th determines:

> *"III - that smart meters may contain, among others, the following functionalities:*
> *a) mechanisms to combat non-technical losses and reduce default, observing the provisions of § 5;*
> *b) preservation of records during power outages for at least 100 (one hundred) hours;*
> *c) time and calendar guarantee system;*
> *d) mass memory, without the need for demand closure; e) recording of active energy, reactive energy and demand;*
> *f) history of energy consumption, in KWh, over the last 12 (twelve) months;*
> *g) remote communication via interface with the Advanced Metering Infrastructure - AMI measurement system; and*

h) record with date and time of the last 15 (fifteen) power interruptions and 15 (fifteen) occurrences of changes made to the meter programming."

Furthermore, during meetings with distributors, ABINEE and Landis+Gyr, the topic of minimum functionalities was discussed. From this debate it is possible to infer that all the functionalities proposed by the consultancies, necessary and recommended, can be defined as minimum and should not increase the price of the meter considered in the CBA, that pre-payment billing can be carried out with the meter suggested by the consultancies as long as the process of controlling credits and enabling consumption is carried out externally to the meter, that allowing parameters to be completed every 5 minutes on the meter does not increase the cost of the equipment too much, but rather that of the communication system, and that is It is necessary to advance the topic of cybersecurity.

Based on all these elements, it is understood that the discussion on the minimum functionalities of smart meters must be carried out at this time, together with the debate on alternatives for ANEEL's action on the topic, that all functionalities proposed by the consultancies, whether necessary or recommended, must be accepted and that the following minimum functionalities must be added:

a) Integration of programmable parameters in the range of 5 to 60min;
b) Internal calculation of DRP and RDC indicators;
c) Magnetic field sensor;
d) Record of the last 100 short and long-term interruptions;
e) Mass memory of at least 37 days of use for 12 channels and amounts paid every 15 minutes;
f) provision of information measured on at least 12 channels through a means that allows the consumer to monitor the meter reading;
g) interface for local acquisition of measured values and mass memory in open format;
h) time synchronization mechanism;
i) power limitation functionality, for social cutting;
j) functionalities that guarantee interoperability
k) possibility of applying prepayment.

It is important to note that meters are not required to have a direct connection to the consumer app, and the distributor can collect the data and make it available later on the consumer app. Item "f" above refers to a display present on the meter for reading at least 12 channels of information by the consumer.

As for the contribution from ONS so that consumption and generation switching and reconnection services can be carried out independently and from COMERC so that it includes specific output for instantaneous measurement of active and reactive power, it is understood that they should not be accepted as they would make the meters too expensive.

Regarding paragraph "f" of item III of art. 4th of Normative Ordinance No. 111/2025- MME, history of energy consumption, in kWh, over the last 12 (twelve) months, it is understood that this history must be included in the distributors to be made available to consumers, as is currently the case, but it must not be stored in the meters, under penalty of a sharp increase in the prices of this equipment.

Regarding cybersecurity, distributors must adopt security requirements at all layers of the solution, must use encryption algorithms and must use physical devices dedicated to protecting cryptographic keys. Furthermore, the processes defined by the distributor must guarantee the integrity of measurement data, the continuity of service provision and the privacy of consumers.

Regarding interoperability, it is not possible to advance specific aspects to be described in the functionalities. It is expected that specific contributions will be presented on this topic in the public consultation that will discuss this RIA.

As for prepayment, it is understood that all credit management and consumption enablement must be allowed to be carried out externally to the meter.