

Design of a tool for end users AMI (Advanced Measurement Systems)

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Abstract - The present research proposes the design of a visual tool for residential electricity sector users. This tool illustrates the implementation process of the Advanced Metering Infrastructure (AMI) in the Colombian capital and has great potential for application in many other regions of the world.

The project focused on analyzing the different concepts and aspects related to the AMI and its incorporation process defined by the National Government. The role played by the residential end user in this entire implementation chain can be linked to acceptance or rejection.

The degree work is divided into three parts: a description of the problem, a normative and conceptual framework that allows interpreting some concepts related to AMI, a methodology that generally describes the procedure executed for the creation and characterization of the booklet, a review, and validation of its content, and conclusions.

Keywords: Smart Grid, Smart Cities, Smart meters, advanced measurement, primer.

1. Introduction

The development of this work aims to design a booklet for residential users of the electricity sector in order to improve the process of receiving and accepting information about the Advanced Metering Infrastructure (AMI) promptly in the city of Bogotá D.C., taking as reference the regulatory framework of the competent authorities established in Colombia such as the Congress of the Republic of Colombia, the Ministry of Mines and Energy (MME), the Energy and Gas Regulatory Commission (CREG) and others, entities in charge of designing, regulating and establishing the installation parameters of the AMI project.

Thanks to the approach of this objective, research has been carried out on the AMI project; in addition to the regulatory framework, the conceptual framework indicates the origin of this technology with intelligent electrical networks, to then delve deeper into the concept of smart meter, in this at the point of the investigation, the environment, architecture, its components, functionalities within the electrical sector and its benefits can be identified.

Following this, the booklet's characterization contemplates using a survey to characterize the public profile, the layout, and the design, which can be carried out using design software that allows a graphical representation of the information investigated as that obtained through the survey.

Finally, the booklet's content is reviewed and validated, which is complemented by the writing of the conclusions derived from the entire process.

2. Definition of the ami problem

We currently live in an environment flooded with technologies that seek to facilitate access to many services, and users need to be transparent about using these technologies, which is why it is evident every day that many sectors are at the forefront of technological issues. Without the electrical sector being indifferent to the incorporation of technological systems throughout its supply chain [1], it allows activating each of the pillars that structure an imminent path toward progress, advancement, and technological sustainability.

With the increase in industry, population, technological devices, and the trend toward Smart Cities, it is imminent that access to the load and energy consumption profiles of different users will facilitate the management of electrical networks and the energy market. Electricity, likewise, companies that are part of this sector increasingly require operational processes that are efficient and that manage to provide solutions to mitigate difficulties that arise about energy consumption readings.[2]

The influence of the implementation of a Smart Electrical Grid is notable since it is a proposal that integrates new concepts that manage to give a new horizon to the products and services already offered by the electrical industry. These technologies stand out for having greater management capacity. Moreover, the efficiency of services through operational and administrative processes that link each energy stage, from generation, transmission, distribution, and marketing. [3]

In the marketing segment, the user plays an important role. Hence, the use of efficient technologies for collecting consumption data is vital in this process. Therefore, the Colombian government's policies are advancing the implementation of Advanced Metering Infrastructure – AMI [4], to efficiently integrate each user and establish mechanisms that allow them greater access to marketers and control of electrical energy consumption. As well as implementing improvements in the provision of the service in different aspects, from the acquisition of user data, its transport, processing, analysis, and reporting until reaching the point of billing, providing greater productivity in operational, commercial, and financial areas, surveillance, control, and planning. In addition, it provides the end user with a two-way channel of information and opens the gap for new business and competition proposals.

The implementation of AMI has been taking place worldwide through different schemes that meet the same purpose, obtaining potential benefits for measurement systems. Traditional electrical networks are in a constant process of evolution thanks to the linking of new technologies, especially in developed countries[5], such as Australia[6], Spain[7],[8],France[9], Italy [10],Brazil and Mexico [11] the European Union[12], Canada [13] and the United State[14] which include different measures that seek to impact the energy market.

In Colombia, plans are being developed that involve smart meters; several companies [15] have already been carrying out deployments of this type in the country's main cities[16], however, today, there is a feasible proposal to be incorporated into Colombia with a projection until 2030, the Energy and Gas Regulation Commission; CREG [17], the one in charge of proposing regulatory initiatives [18].

Because it is a new issue for the Colombian population, resistance to change in measurement technology is occurring in different socioeconomic strata[19], since, for many users, the benefits that AMI can bring and the potential it would bring in issues are unknown. of efficient use of energy and change of supplier with more competitive kW/h prices. For this reason, this project seeks to generate a guide booklet that tells the user everything related to AMI in an illustrated and easy-to-understand way.

3. Regulatory framework and competent authorities

The implementation of AMI in Colombia requires a normative and regulatory framework willing to indicate the general administration and control policies, which are attached below with the Fig. 1.

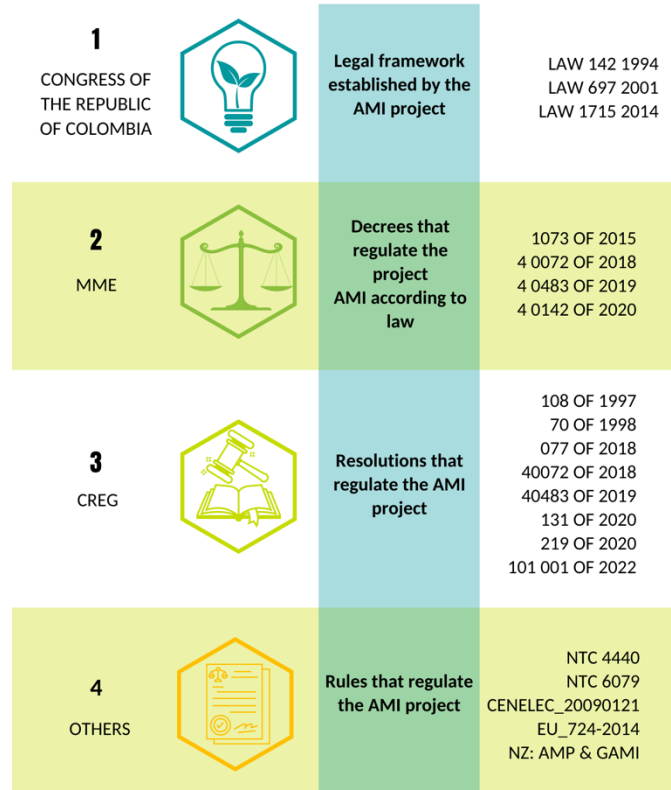


Fig. 1 Regulatory framework and competent authorities of AMI in Colombia

4. Methodology

A sequential development methodology was proposed to allow the proposed objectives to be met systematically. The methodology is divided into three phases, as illustrated in Fig. 2.

The fulfillment of the proposed objectives is developed in the following phases:

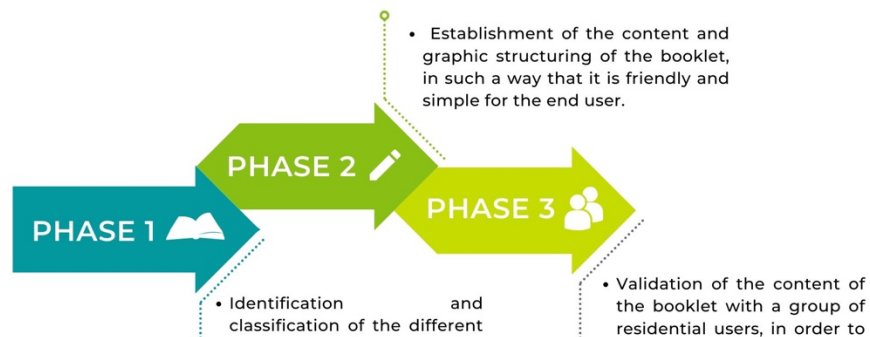


Fig. 2 Diagram of the methodology used

5. Preliminary Aspects Of The Results

The development of the project proposes the definition of some preliminary aspects, which are focused on the initial analysis of topics that allow the target audience to be characterized and, in this way, obtain in a timely and objective manner the perception or expectations that may arise about what the implementation of the AMI project, the Fig. 3 tells us what steps were taken into account to complete this step.

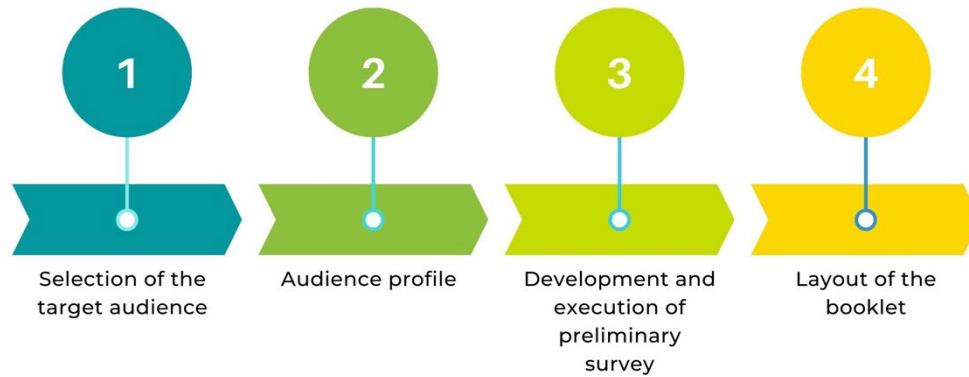


Fig. 3 Diagram indicating preliminary aspects of the results

6. Booklet Design

With the information obtained in the previous sections, we proceeded to define the minimum content of interest to users according to the perception received in the survey and the information defined in the government plan for the implementation of the AMI using the phases that we can evidence in Fig. 4.

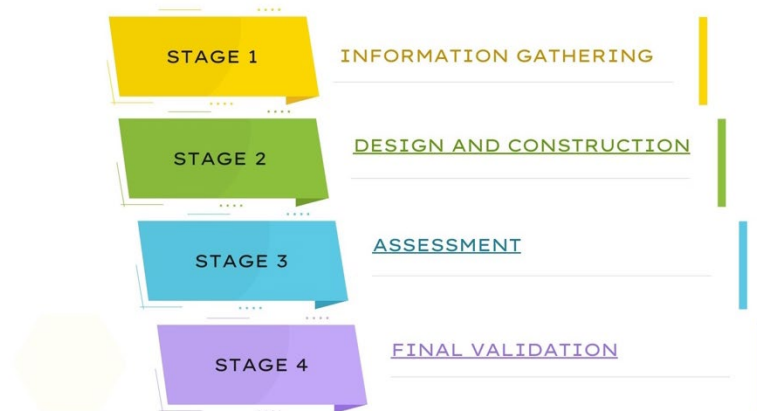


Fig. 4 Phases of booklet design

To facilitate the understanding of the primer, it was divided into five parts, as indicated in Fig. 5, starting with a presentation or preamble. Concepts related to the AMI project were included to facilitate the interpretation of the content. In the third part, there is what is related to the implementation of the AMI project; in the fourth part, there are the benefits for the user, which are shown so that they can demonstrate their benefits; and it ends with the fifth part with answers to frequently asked questions. or concerns that may arise for the user.

In this way, the detailed content of the booklet will be as follows:

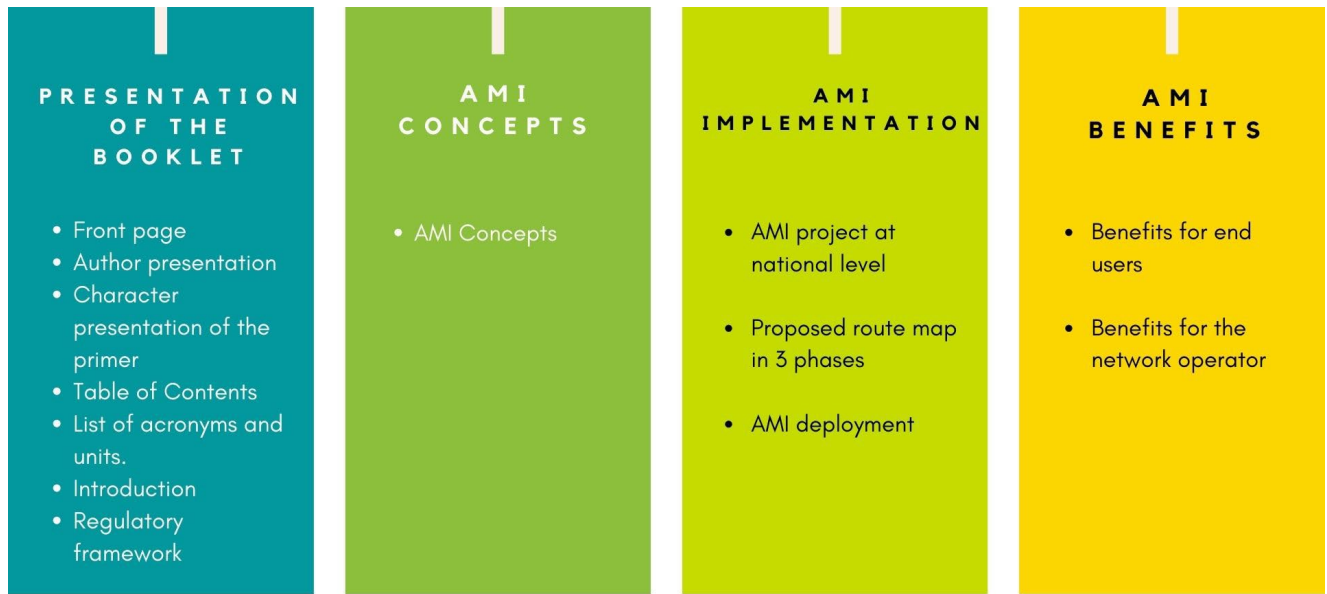


Fig. 5 Layout of the booklet

7. Structure And Diagram Of The Card

For the booklet, he used letter size and a range of colors between yellow, white, gray, and blue, which, according to color psychology in the design, can be appropriately incorporated into the electrical context.

In addition, the character's construction, as shown in Fig. 6, accompanies the reader during reading and generates dynamic spaces and rest between reading. It consists of a transformer as a head, a smart meter as a torso, and various accessories to complement the body.

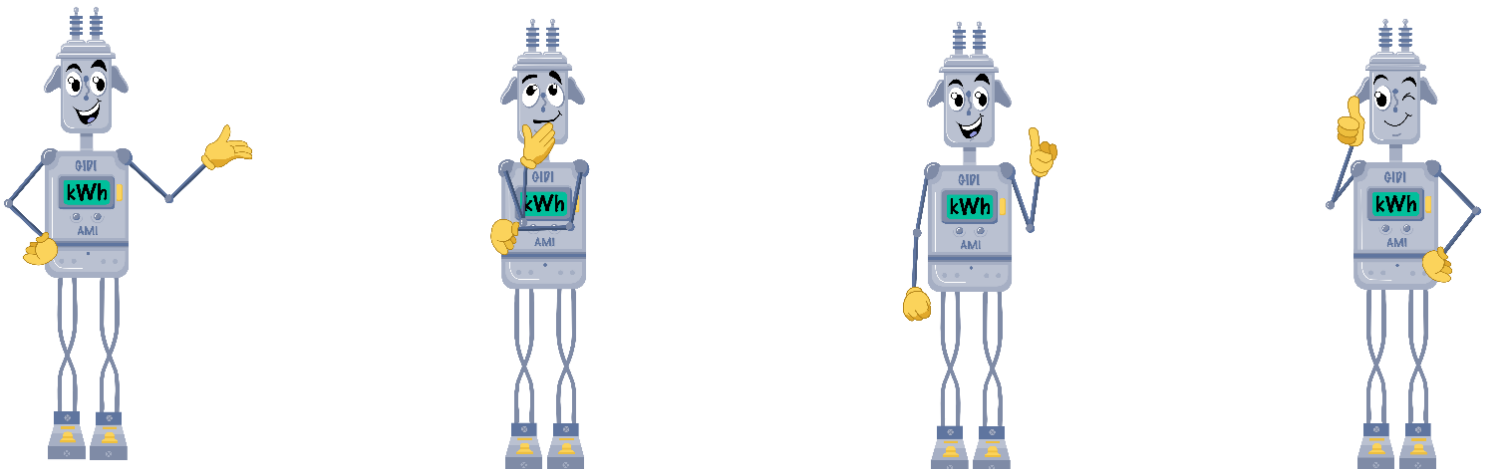


Fig. 6 Character created to accompany the reader

8. Review And Validation Of Content

To begin the final stage of the project Fig. 7 indicates the steps that were carried out to obtain the evaluation of the booklet successfully. It begins with deciding the number of people who will evaluate the booklet. The possible aspects to be evaluated are analyzed to define the most relevant ones later and thus design the questions by agenda. Next, the platform is selected to carry out the survey; after determining the user profile that will fill out the survey, it is disseminated to be answered by the selected profile. Continuing with this process, the information obtained is subtracted, and the content of the final product is refined or improved.

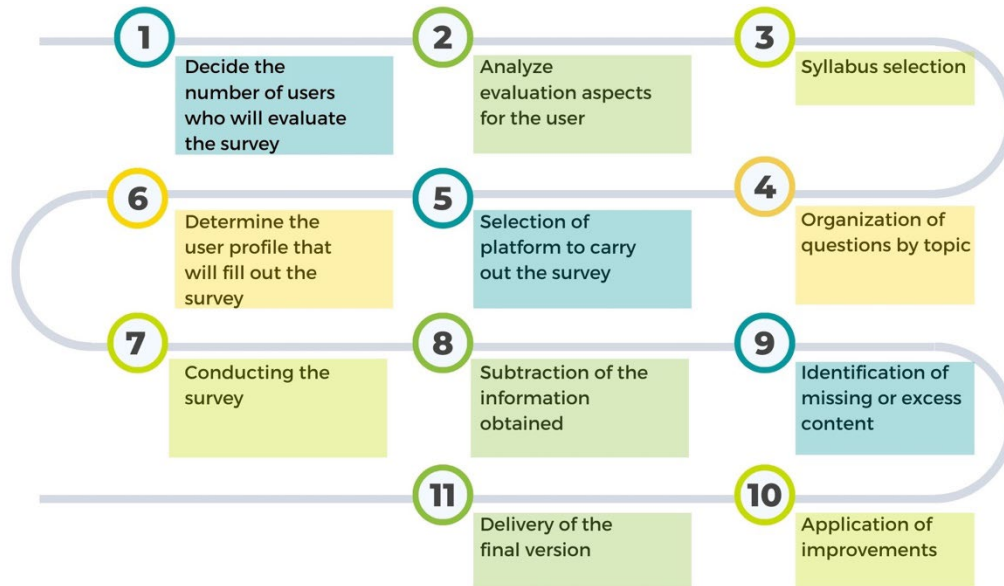


Fig. 7 Diagram on the review and validation of the booklet

9. Conclusions

1. It is advisable to encourage the propagation of this type of guide for all end users, making them even more involved in intelligent electrical metering, including the sectors that were not covered in this degree work, since they also require information about the implementation of these technologies to allow then laying the future foundations for the scheme of an intelligent city.
2. Many users would prefer to avoid managing how they consume energy. However, this situation can change with the state's incentive of AMI benefits to encourage user engagement. It would undoubtedly bring with it a share of demand.
3. The generalities of AMI continue to be in a process of change and adaptation to the Colombian environment; it is necessary to be at the forefront of the guidelines that may emerge from now on.
4. It is necessary to promote education about the culture of energy consumption among the child population. From there, the changes Colombian society needs will be incorporated into other projects in an intelligent city.

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